TEST REPORT

EMISSION TEST PROGRAM
EPA ICR FOR PETROLEUM REFINERIES
FCCU 500 STACK

BP PRODUCTS NORTH AMERICA, INC.
WHITING, INDIANA

PREPARED FOR:

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REPORT CERTIFICATION

STATEMENT OF CONFORMANCE AND TEST REPORT CERTIFICATION

I certify, to the best of my knowledge, that this test program was conducted in a manner conforming to the criteria set forth in ASTM D 7036-04: Standard Practice for Competence of Air Emission Testing Bodies, and that project management and supervision of all project related activities were performed by qualified individuals as defined by this practice.

I further certify that this test report and all attachments were prepared under my direction or supervision in accordance with the ARI Environmental, Inc. quality management system designed to ensure that qualified personnel gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed the sampling and analysis relating to this performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate and complete.

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ARI Environmental, Inc.

Hank Taylor, QI
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ARI Environmental, Inc.

SECTIONONE Introduction and Summary

ARI Environmental, Inc. (ARI) was retained by BP Products North America, Inc. (BP) to conduct an emission test program at their refinery located in Whiting, Indiana.

The testing program was conducted in response to the USEPA Section 114 Information Collection Request (ICR) for Petroleum Refineries and was performed on the FCCU 500 stack on June 7 through 15 and August 2, 2011. The test program was conducted pursuant to the sampling and analytical procedures presented in the Test Protocol (ARI Project No. 566-27 Revision 1) dated May 23, 2011.

The specific pollutants, test run duration and units of measure that were determined are presented in Table 1-1. The parameters and associated test methods are presented in Table 1-2.

Under the direct supervision of Mr. Steve Flaherty, ARI's test team consisted of Messrs. Rob Burton, Terrence Davis, Ryan Lyons, Ryan Mahoney, Alex Reyes, Nathan Sekulic and Dr. Steven Yuchs. Ms. Cheryl Joyal of BP provided coordination of the test program with refinery operations.

The results of the test program are presented in Section 4. The calculation summaries, field data, analytical data, ARI reference method monitoring data, calibration data, process data and test program qualifications are included in the appendices.

TABLE 1-1. POLLUTANTS, TEST RUN DURATION AND UNITS OF MEASURE

Group[1]	Pollutants	Test Run Duration (hours)[2]	Units of Measure
A	Speciated Volatile Organic Hazardous Air Pollutants (HAP)	1	lb/hr, µg/dscm
	Speciated Semi-Volatile Organic HAP	3	lb/hr, µg/dscm
	Aldehydes	1	lb/hr, µg/dscm
	Total Hydrocarbons (THC)	1	lb/hr, ppmv db
	Methane, Ethane	1	lb/hr, ppmv db
	Carbon Monoxide (CO)[3]	1	lb/hr, ppmv db
B	Dioxins and Furans (D/F), Polychlorinated Biphenyls (PCB)	4	lb/hr, pg/dscm
E	Hydrogen Chloride (HCl), Chlorine (Cl_2), Hydrogen Fluoride (HF)	2	lb/hr, mg/dscm
	Hydrogen Cyanide (HCN)	1	lb/hr, µg/dscm
D	Mercury (Hg)	3	lb/hr, µg/dscm
	Hexavalent Chromium (Cr^{+6})	1[4]	lb/hr, mg/dscm
	Other Metals[5]	3	lb/hr, mg/dscm
	Particulate Matter (PM), PM under 2.5 microns ($PM_{2.5}$) (filterable)	2	lb/hr, gr/dscf
	$PM_{2.5}$ (condensable)	2	lb/hr, gr/dscf
	Ammonia (NH_3)	1	lb/hr, ppmv db
	Nitrogen Oxides (NO_x)[3]	2	lb/hr, ppmv db
	Sulfur Dioxide (SO_2)[3]	2	lb/hr, ppmv db
A, B, E, D	Flow Oxygen (O_2), Carbon Dioxide (CO_2) Moisture	Conducted simultaneously with the sampling in each group	acfm, scfm, dscfm % volume db % volume

[1]Simultaneous sampling was conducted for all pollutants in each group.
[2]Three test runs were conducted for each pollutant.
[3]BP's continuous emission monitoring system (CEMS) was used.
[4]Test run duration reduced to 48 minutes based upon preliminary sampling run data indicating that a pH above 8.5 could be maintained in the sampling train first impinger for a period not to exceed 48 minutes using 8N KOH absorbing solution.
[5]Metals include antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), nickel (Ni) and selenium (Se).

TABLE 1-2. POLLUTANTS AND TEST METHODS

Group	Pollutants	Test Methods (Recommended)	Isokinetic Sampling
A	Speciated Volatile Organic HAP	USEPA Method 18	No
	Speciated Semi-Volatile Organic HAP	SW-846 Method 0010 with SW-846 Method 8270C/D analytical finish	Yes
	Aldehydes	USEPA Method 320 with validation	No
	THC	USEPA Method 25A	No
	Methane, Ethane	USEPA Method 18	No
B	D/F, PCB	USEPA Method 23	Yes
E	HCl, Cl_2, HF	USEPA Method 26	No
	HCN	USEPA Method 320 with validation	No
D	Hg	ASTM D6784-02 (Ontario-Hydro Method)	Yes
	Cr^{+6}	SW-846 Method 0061	Yes
	Metals	USEPA Method 29	Yes
	PM, $PM_{2.5}$	USEPA Methods 5, 201A/202	Yes
	NH_3	USEPA Method 320 with validation	No

SECTION TWO Testing and Analytical Procedures

2.1 OVERVIEW

ARI conducted an emission test program on the FCCU 500 stack at the BP Whiting Refinery located in Whiting, Indiana. Testing was conducted in response to the USEPA Section 114 ICR for Petroleum Refineries. Three (3) test runs were conducted at the FCCU 500 stack for all pollutants. The test run durations are shown in Table 1-1. The test methods are summarized in Table 1-2.

2.2 METHODOLOGY

Test methods followed the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Appendix A, USEPA Methods 1-4, 5, 18, 23, 25A, 26 and 29; 40 CFR 51, Appendix M, USEPA Methods 201A, 202 and 205; 40 CFR 63, Appendix A, USEPA Methods 301, 308 and 320; USEPA SW-846 Methods 0010, 0061 and 8270C/D; ASTM Methods D6348-03 - Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy and D6784-02 - Ontario-Hydro Method; and the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods.

2.2.1 Sampling Location (USEPA Method 1)

The sampling point locations for the determination of gas velocity and volume flow rate were determined following the procedural requirements as detailed in USEPA Method 1. Sampling was conducted at the FCCU 500 stack in the two (2) sampling ports provided in the 108-inch I.D. stack. The sample ports were located approximately 720 inches (6.7 duct diameters) upstream and 1,368 inches downstream (12.7 duct diameters) from the nearest flow disturbances. Twelve (12) traverse points were used to sample the cross-sectional area of the stack.

2.2.2 Flue Gas Volumetric Flow Rate (USEPA Method 2)

Gas velocity and volumetric flow rate were determined following USEPA Method 2. Velocity head measurements were performed using a Type S pitot tube and Dwyer inclined 0 – 10-in. water manometer. Temperature measurements were conducted using a Chromel-Alumel thermocouple connected to a digital direct read-out potentiometer.

2.2.3 Oxygen and Carbon Dioxide (USEPA Method 3A)

O_2 and CO_2 concentrations were determined following USEPA Method 3A procedures using ARI's Servomex, Inc. Model 1440C combination paramagnetic O_2 and non-dispersive infrared CO_2 analyzer.

As shown in Figure 2-1, ARI's sampling system consisted of a stainless steel probe with in-stack filter followed by a calibration tee assembly. The probe system was connected to a heated Teflon sampling line that transported the gas sample through an ice-cooled condenser and an electronic chiller to remove moisture. The dry sample gas was then transported to a manifold system by a Teflon lined sample pump and Teflon sample line. The manifold was connected with sample gas intake lines for ARI's O_2 and CO_2 analyzers.

SECTIONTWO Testing and Analytical Procedures

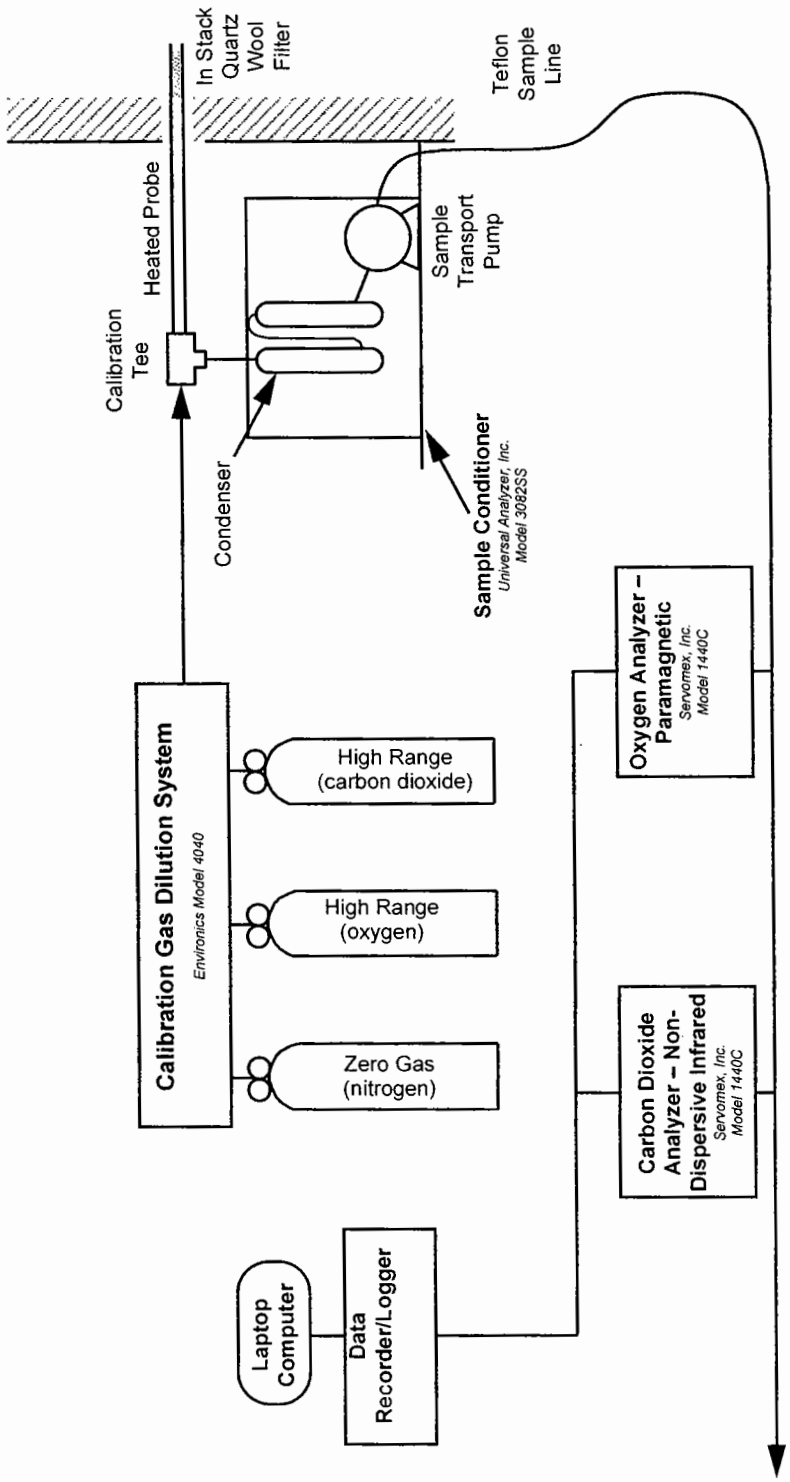

FIGURE 2-1. ARI REFERENCE METHOD O_2 AND CO_2 SAMPLING SYSTEM

ARI's monitors were calibrated with applicable zero, mid-range and high-range gases as specified in the applicable USEPA methods. The calibration gases were generated from Protocol 1 calibration gases using an Environics Model 4040 Gas Dilution System. The gases met the calibration gas protocols as specified in USEPA Method 7E, Section 7.1.

Response time, calibration error and measurement system bias tests were performed prior to testing and a pre/post calibration drift test was conducted after each test repetition on each monitor.

The monitor data were collected at 15-second intervals and one-minute averages were calculated by ARI's data acquisition system consisting of an Omega OMB-DAQ-56 data acquisition module connected to a computer for digital data archiving and data reduction.

2.2.4 Flue Gas Moisture Content (USEPA Method 4)

The stack gas moisture content was determined following USEPA Method 4. This method was performed as part of the pollutant sampling trains. Moisture was collected in a series of chilled impingers containing methodology specific liquids and silica gel. A dry gas meter to determine the sample volume followed the impingers. The amount of volume gain in the condensate impingers and weight gain in the silica gel impinger were used to calculate the moisture content.

2.2.5 Particulate Matter (USEPA Method 5)

PM sampling was conducted in accordance with USEPA Method 5 and combined with the USEPA Method 29 metals sampling using an Apex Instruments, Inc. sampling train (Figure 2-2).

2.2.5.1 Sampling Apparatus

Assembled by ARI personnel, the sampling train consisted of the following:

Nozzle - Borosilicate glass with sharp, tapered leading edge.

Probe - Borosilicate glass with a heating system capable of maintaining a probe exit temperature of 320°F ±25°F.

Pitot Tube - Type-S, attached to probe for monitoring stack gas velocity.

Filter Media - A 4-in. quartz-fiber filter that met the requirements of Method 5.

Filter Holder - Borosilicate glass with a 4-in. Teflon frit filter support and a Viton O-ring gasket. The holder design provides a positive seal against leakage from the outside or around the filter. The filter holder was heated to 320°F ±25°F during sampling. A thermocouple was placed in the back-half of the filter holder for direct measurement of the sample stream temperature.

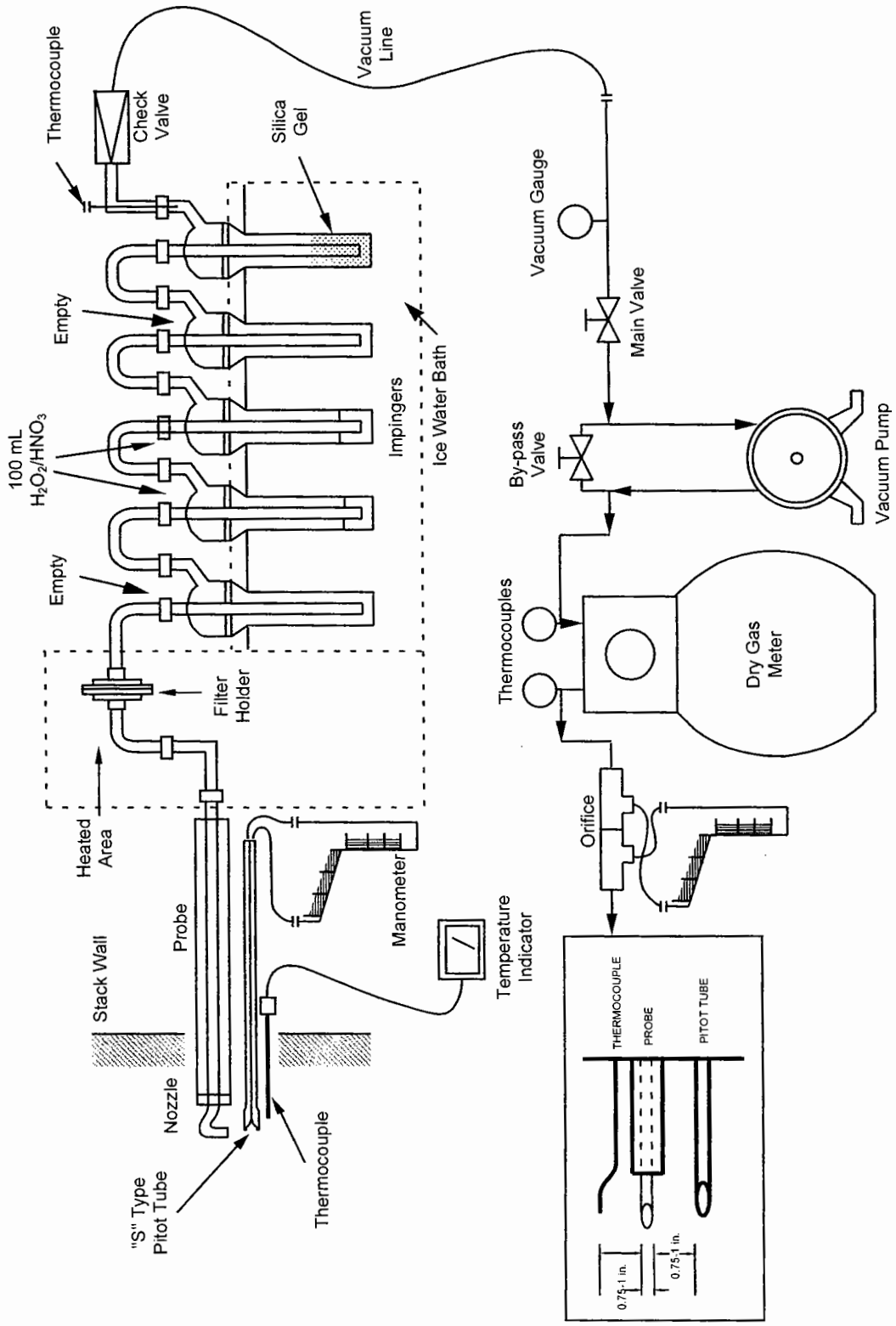

FIGURE 2-2. USEPA METHODS 5/29 COMBINED SAMPLING TRAIN

Draft Gauge - Inclined manometer with a readability of 0.01-in. H_2O in the 0- to 1-in. range and 0.1-in. H_2O in the 1-in. to 10-in. range.

Impingers - Five impingers connected in series with glass ball joints. The first impinger was empty with a shortened stem, the second and third impingers contained 100 milliliters (mL) of dilute nitric acid/hydrogen peroxide mixture, the fourth impinger was empty and the fifth impinger contained approximately 200 grams of silica gel.

Metering System - Apex Model 522. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with ±2 percent accuracy, and related equipment as required to maintain an isokinetic sampling rate and to determine sample volume.

Barometer - Mercury barometer capable of measuring atmospheric pressure to within ±0.1-in. Hg.

2.2.5.2 Sampling Procedures

After the minimum number of traverse points was selected, the stack pressure, temperature, moisture and range of velocity head were measured according to procedures described in USEPA Methods 1 through 4.

The sampling train was leak-checked at the sampling site by plugging the inlet to the nozzle and pulling a vacuum of 15-in. Hg. Leak rates of less than 0.02 ft^3/min at a vacuum of 15-in. Hg were recorded in all cases. At the completion of each test run, the sampling train was again leak-checked by the same procedure, but at the highest vacuum attained during the test run. Both pre- and post-test leak checks of the pitot tube were made for each test run. Ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at less than 68°F.

During sampling, stack gas and sampling train data were recorded at specified intervals. Isokinetic sampling rates were set throughout the sampling period with the aid of a programmable calculator.

2.2.5.3 Sample Recovery Procedures

After sampling was completed and the final leak checks were performed, the filter and probe (front-half) were disconnected from the impinger train and moved carefully from the test site to the recovery area. The sample fractions were recovered as follows:

Container 1 - The filter holder was sealed.

Container 2 - Loose particulate and acetone washings from all sample-exposed surfaces prior to the filter were placed in a glass bottle, sealed and labeled. Particulate was removed from the probe with the aid of a brush and acetone rinsing. The liquid level was marked after the container was sealed.

Container 3 - A minimum of 200 mL of acetone was taken for the blank analysis. The blank was obtained and treated in a similar manner as the contents of Container 2.

2.2.5.4 Analytical Procedures

The analytical procedures followed those described in USEPA Method 5.

Container 1 - The filter and any loose PM from this sample container were placed in a tared glass weighing dish, placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg.

Container 2 - The acetone washings were transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure. The contents were then placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg.

Container 3 - The acetone blank was transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure. The contents were then placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg.

The term "constant weight" means a difference of no more than 0.5 mg or 1 percent of the total weight less tare weight, whichever is greater between two consecutive readings, with no less than 6 hours of desiccation between weighings.

2.2.6 Methane and Ethane (USEPA Method 18)

Methane and ethane were measured in conjunction with the THC (USEPA Method 25A) procedures. Tedlar bag samples were collected concurrently and analyzed by calibration procedures described in USEPA Method 18. One bag sample was collected in conjunction with each USEPA SW-846 Method 0010 semi-volatile sample run described in Subsection 2.2.17.

Specifically, the concentrations were measured by flame ionization detection with separation by gas chromatography (GC-FID). The GC-FID was calibrated by triplicate injections of cylinder gas standards to calculate a 4-point calibration curve.

2.2.7 Speciated Volatile Organic HAP (USEPA Method 18)

Volatile organic HAP sampling and analysis were conducted following the Method 18 Midget Impinger Method approved by the USEPA and referenced on the Refinery ICR Website (FAQ Test-029) as an alternate method to determine the stack gas concentrations and emission rates of target volatile analytes listed in Table 1.3 of Component 4 of the ICR. This method utilizes a midget impinger train with chilled ultrapure grade methanol as the volatiles collection media. Co-located sampling trains were performed as a duplicate determination of emissions. Therefore, the reported concentrations and mass emission rates were calculated as the average of the paired sampling trains.

SECTIONTWO Testing and Analytical Procedures

The test consisted of three one-hour sampling runs and was conducted simultaneously with the semi-volatile organic HAP sampling. Each sampling run was conducted following USEPA Method 18 criteria for sorbent train sampling which requires that two co-located sampling trains be operated simultaneously. The co-located trains were spiked with both "labeled" and "native spikes" covering a specific list of recovery surrogates included in the refinery ICR Component 4 document. The labeled spikes were in the form of isotopologues that consisted of replacing the hydrogen atoms with deuterium (heavy hydrogen) isotope. The deuterated compounds can be differentiated from that of the naturally existing compounds by mass spectroscopy analytical detection and measurement. Respective recoveries for each deuterated compound can be calculated for each sample train without effect on the measurement of the flue gas native (naturally occurring) compounds. The purpose of this spiking was to determine the recovery efficiencies of each compound and to demonstrate the quality of the measurement data. The recovery surrogates that were spiked into the co-located trains included the following:

Labeled Spikes Plus the Corresponding Deuterium Count (added to each of the co-located trains):

1,3-Butadiene-d6	2,2,4-Trimethylpentane-d18
Pentane-d12	2-Nitropropane-d6
MTBE-d12	1,2-Dibromoethane-d4
n-Hexane-d14	Ethylbenzene-d10
Acrylonitrile-d3	Styrene-d8
Benzene-d6	Nitrobenzene-d5

Native Spikes (added to only one of the co-located trains):

Acrolein
Acetonitrile
Toluene
Trichloroethene
Methyl *iso*-Butyl Ketone

2.2.7.1 Sampling Apparatus

Each of the two co-located sampling trains consisted of the following components (see Figure 2-3):

Probe - Heated stainless steel probe with borosilicate glass liner.

Coil Condenser - Borosilicate glass condenser to cool the sample gas stream prior to entering the impinger train.

Impinger Train - Five borosilicate glass midget impingers with the first impinger acting as a moisture and condensable knockout and fitted with a shortened impinger tip. The second, third and fourth impingers each contained an ultrapure grade (purge and trap grade) of methanol (10-20 mL each) with each impinger fitted with a tapered insert. The fifth impinger contained approximately 25 grams of silica gel to remove the final traces of moisture from the gas sample.

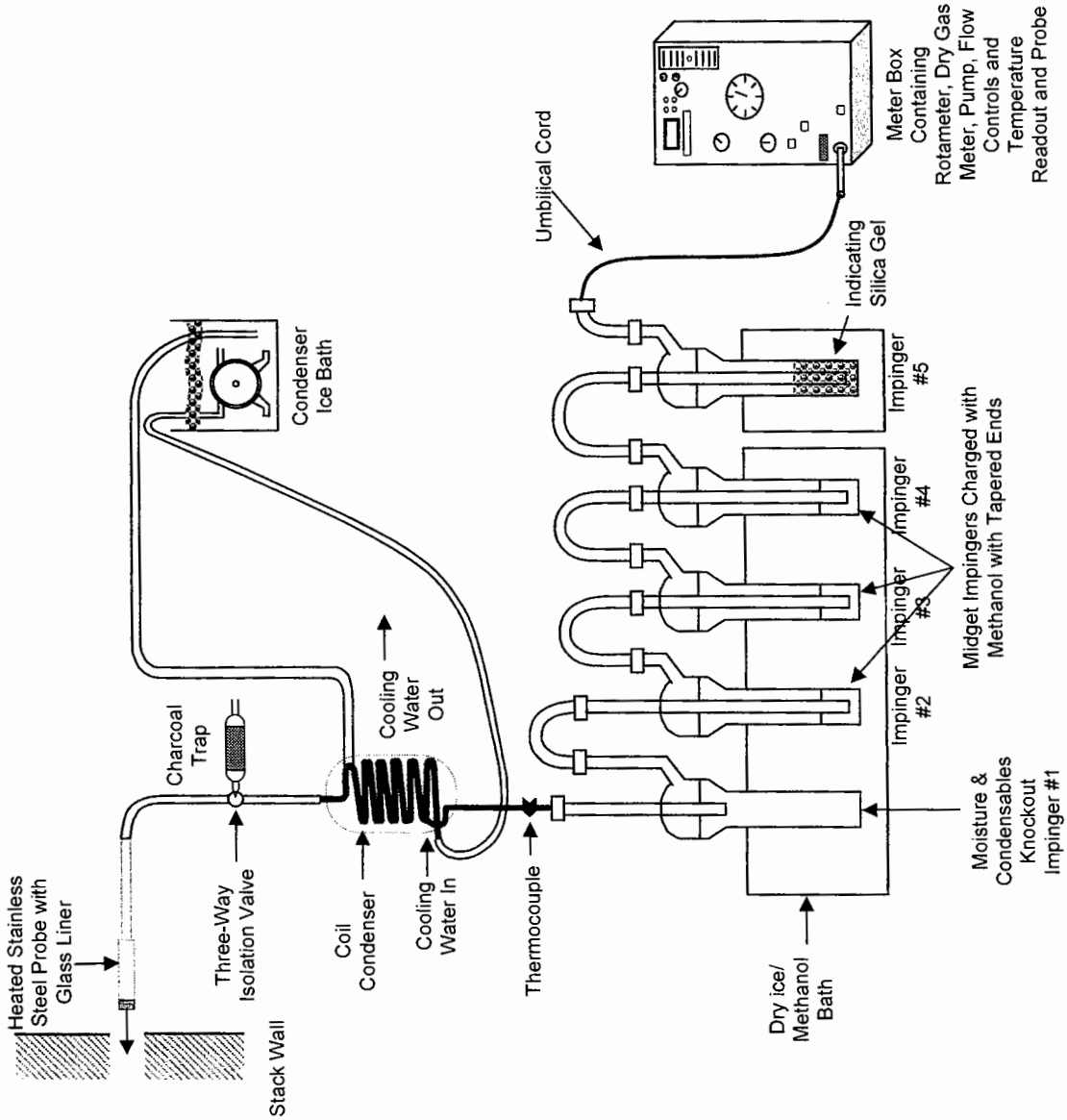

FIGURE 2-3. USEPA METHOD 18 MIDGET IMPINGER TRAIN

Meter Console - A VOST type meter console was used to control the sampling rate through the impinger train and monitor the temperature of the sampling train components. The meter console itself contained a dry gas meter to measure the volume of gas sampled. The gas meter had an accuracy of ±1%.

2.2.7.2 Sampling Procedures

Sampling Train Glassware Preparation

The sampling train glassware was pre-cleaned, thoroughly rinsed with ultrapure grade methanol, baked in an oven at 100°C for two hours, cooled, sealed and stored separately from other reagents and other equipment to avoid contamination prior to assembly of the sampling train.

Recovery Surrogate Spiking of Impinger Train

The co-located sampling trains were assembled prior to charging the impingers with methanol. The co-located trains were both field spiked with the "labeled" spikes and one of the co-located trains was also spiked with the "native" spikes using the surrogate recovery standards prepared by the analytical laboratory. The contents of the prepared spikes were charged directly into impinger #2 of the sampling train which contained pre-chilled purge and trap grade methanol.

Sampling Train Operation

A leak check of the sampling train was performed before and after each sampling run at near 10 inches of mercury and was performed such that exposure of sampling train components to possible ambient air contaminants was avoided.

Following the leak check and prior to sampling, the sampling probe was heated to a temperature to prevent the condensation of organics and water vapor (280° to 302°F). The first four impingers of the sampling train were placed into a dry ice/methanol water bath and allowed to cool the impinger absorbing solutions prior to the start of sampling. Under these conditions, the target analytes of interest were efficiently trapped and dissolved in the methanol and stability of the samples was assured prior to analysis. Ice water circulated through the pre-impinger coil condenser to ensure that the first knockout impinger effectively collected sample gas condensate and low boiling organic components.

The probe was introduced into the stack and located either close to the centroid or greater than 3-feet from the inner wall of the stack cross-sectional plane. Sampling was conducted at a constant rate of 0.25 liter/minute during each sampling run to collect a nominal 15 L sample volume. Sampling train flow rate, temperature and gas volume data were recorded at five-minute intervals throughout each sampling run. Following completion of the test run, the sampling train was leak checked following the pretest leak check procedure.

2.2.7.3 Sample Recovery Procedures

Sample recovery from each of the co-located sampling trains was conducted as follows:

Container No. 1 - The contents of midget impingers #1 and #2 were combined, rinsed with a small quantity of methanol, and placed in a labeled 40 mL VOA vial. The probe, coil condenser and connecting glassware and tubing to the first impinger were rinsed with three small volumes of methanol and added to the Container No. 1 (VOA vial). The vial was labeled as Method 18 1st and 2nd Methanol Impinger Composite.

Container No. 2 - The contents of midget impinger #3 and rinse were placed in a separate 40 mL VOA vial and labeled as Method 18 3rd Methanol Impinger. This fraction was analyzed separately from the first fraction.

Container No. 3 - The contents of midget impinger #4 and rinse were placed in a separate 40 mL VOA vial and labeled as Method 18 4th Methanol Impinger. This fraction was analyzed separately from the other fractions.

Following sample recovery, ultrapure methanol was added to the sample vials to reduce the headspace and the vials were then placed in separate sealable poly bags and stored in coolers on dry ice prior to and during shipment of all samples to the analytical laboratory.

Blank Train and Trip Blanks (Quality Control Samples)

A train blank set of Method 18 samples and a methanol trip blank were collected one time during each source location.

During one of the sampling runs, a complete blank train was set up in the same manner as the sample trains. The methanol remained in the identical train for the same length of time as the duration of the sampling run. Beginning and end leak checks were performed and the probe was heated to temperature. The blank train samples were recovered in the same manner as those for the stack sampling runs.

Additionally, once for each test, a field spike was prepared for each of the two spiking standards (native and labeled spikes) by adding the contents of each spiking ampoule to a VOA vial containing 5 to 10 mL of purge and trap grade methanol. The ampoule was not rinsed. The vial was then filled with additional methanol to reduce headspace. These field spikes were QC samples to provide additional baseline data for the recovery study.

2.2.7.4 Analytical Procedures

Analysis of the collected stack run samples, one methanol trip blank sample, and the two spike QC samples for one source were performed by ALS Environmental Laboratories following SW-846 Methods 8260B employing purge and trap GC/MS procedures.

Sample volumes of the methanol sorbent for the purge and trap analysis procedure were adjusted in order to achieve a low end target analysis concentration in the stack gas stream of 0.1 ppmv.

2.2.8 Polychlorinated Dibenzo-P-Dioxins, Polychlorinated Dibenzofurans and Polychlorinated Biphenyls (USEPA Method 23)

D/F and PCB were collected in accordance with USEPA Method 23. Specifically, testing consisted of isokinetically extracting a sample of the stack gas through a modified Method 5 (MM5) sampling train, modified to include a cooling condenser and a resin trap between the filter holder and the first impinger. See Figure 2-4.

Samples collected and analyzed included the filter (Container #1); probe, nozzle, connecting front-half glassware, back-half glassware and coil condenser, acetone and methylene chloride rinse (Container #2); probe, nozzle, connecting front-half glassware, back-half glassware and coil condenser and toluene rinse (Container #3); and the resin trap, which was capped, labeled and covered with aluminum foil immediately at the conclusion of testing for transport to the laboratory for analysis. The impinger gains were measured and used in isokinetic calculations.

The MM5 train was assembled and leak-checked before sampling commenced. A minimum of 3 dry standard cubic meters of stack gas was sampled isokinetically and collected in a heated sample probe and heated filter (front half catch) and a chiller and sorbent trap containing XAD-2 resin (back half catch) during each sampling run. At the end of each test run, the sampling train was disassembled, and all train samples were collected.

The major components are described below:

a) Nozzle - Borosilicate glass with sharp tapered leading edge.

b) Probe - Type 316 stainless steel with borosilicate glass liner and attached pitot tube and stack temperature thermocouple.

c) Apex Sample Box - Containing borosilicate glass filter holder, quartz fiber filter, a water jacketed sample chiller, sorbent trap containing XAD-2 resin, five Greenburg-Smith impingers and the connecting glassware.

The sample adsorbent traps and filters were cleaned and prepared using USEPA Method 23 procedures. ARI's laboratory cleaned all Method 23 sampling train glassware to pesticide analytical requirements using procedures outlined in Section 3A of the "Manual of Analytical Methods for the Analysis of Pesticide in Human and Environmental Samples".

The sample traps were spiked with 100 µl of 100 picograms per µl of surrogate standards per USEPA Method 23 procedures. Five surrogate compounds were added to the resin in the adsorbent sampling cartridge before the sample was collected. The surrogate recoveries were measured relative to the internal standards and were a measure of collection efficiency; they were not used to measure native PCDD's and PCDF's. All recoveries were between 70 and 130 percent. Poor recoveries for the surrogate may be an indication of breakthrough in the sampling train.

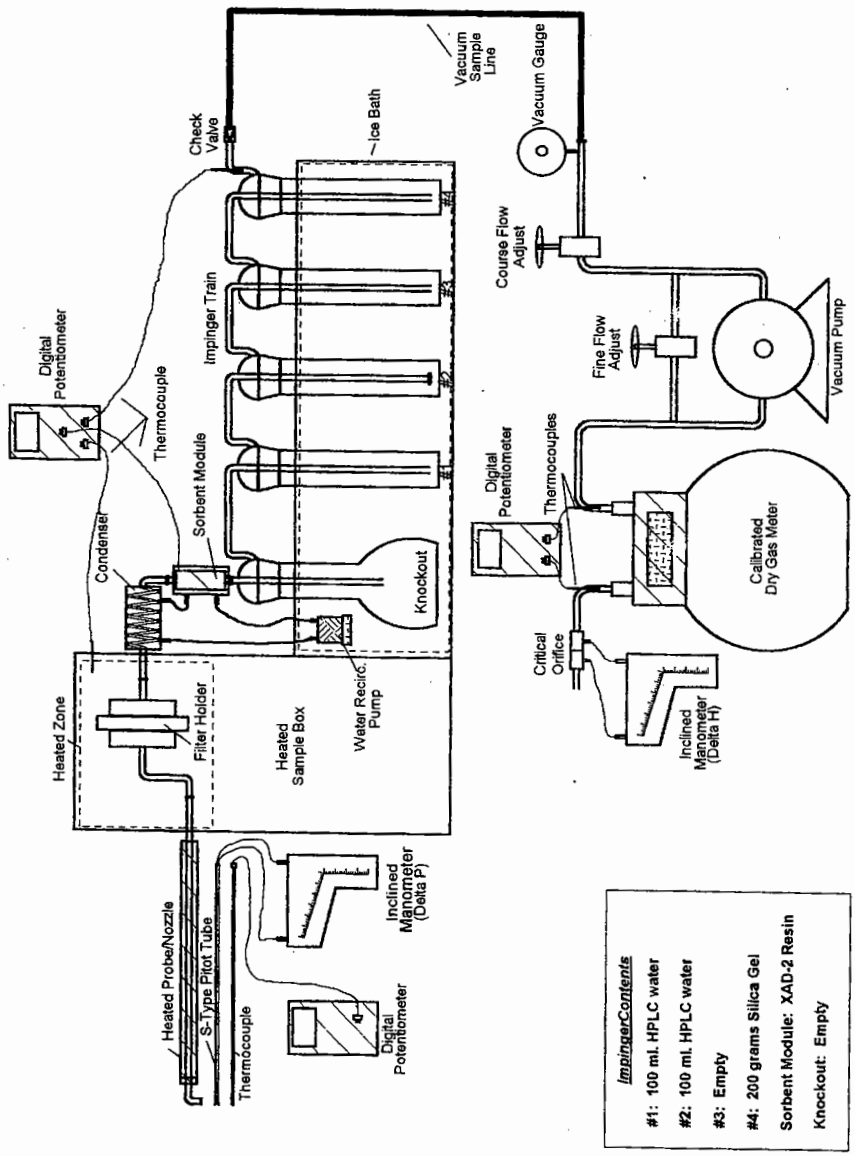

FIGURE 2-4. USEPA METHOD 23 SAMPLING TRAIN

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The sample train was assembled as follows:

a) A glass nozzle was selected and attached to the probe.

b) A pre-cleaned quartz fiber filter was placed in the filter holder and its number recorded on the data sheets.

c) The water jacketed sample chiller and sorbent trap containing 25 to 40 grams of XAD-2 resin were placed in series after the filter holder.

The back half of the train consisted of five impingers. The first impinger (knock-out) was assembled empty. The second and third impingers contained 100 mL of deionized distilled water. The fourth impinger was assembled empty. The fifth impinger contained 200 grams of silica gel.

The sampling train was assembled at the sampling location.

Sampling began by positioning the probe and sampling nozzle at the first sampling point in the first sample port. Sampling started and the sampling rate adjusted to maintain an isokinetic sampling rate. The sorbent traps were kept below 68°F to ensure that the XAD resin stayed efficient during the testing.

At the completion of each test run, a final leak test was performed on the sampling system.

The train was then moved carefully from the test site to the recovery area. The probe wash, filter, solvent traps and impinger contents were recovered in strict adherence to USEPA Method 23 protocols.

The samples were recovered, sealed, labeled and levels marked. The traps were wrapped in aluminum foil and stored on ice in a storage chest.

After all chain of custody forms were completed, the samples were transported on ice via ground transportation to the laboratory for analysis. All samples were extracted within 30 days of collection and analyzed within 45 days of extraction.

An elaborate spiking program was applied to the MM5 trains that allowed for complete assessment of the sampling and analytical effort regarding the overall method accuracy. Spiked compounds were placed on the components of the train at the different stages of the sampling and analytical program so that the efficiency of the method's performance could be measured quantitatively. By assuming that these compounds have chemical characteristics that are identical to the target compounds, the overall method efficiency could be assessed. Four types of spiking materials were applied to the MM5 train samples. These types are defined as follows:

- Sampling Surrogate Spikes - These compounds are spiked directly onto the XAD-2 resin at the laboratory during resin tube preparation and prior to any field handling or sampling. The final recovery of these compounds gives the most comprehensive indication that the determination of native compounds using the MM5 methodology is accurate. Good recovery of these compounds reflects the XAD-2 resin's ability to capture and retain the various isomers of dioxins and furans.

- Isotope Dilution Internal Standard Spikes - These compounds are placed directly onto the sample just prior to the preparation and extraction steps. The final recovery efficiency of these compounds reflects the overall accuracy of the sample's laboratory handling and analysis. Accordingly, these compounds are used to generate data that indicate the relative accuracy of the analytical methods.

- Recovery Standards - These compounds are applied to the sample extracts just before the extracts are introduced onto the GC/MS instrument injection ports. These compounds are precisely applied at this step in the analytical scheme and provide the actual relative response factors that are used to calculate analyte concentrations.

- Matrix Spike Compounds (back-half and spiked resin blanks only) - These compounds are spiked onto a separately prepared aliquot of the MM5 train back half condensate sample or XAD-2 resin before analysis. The spiked aliquots are then analyzed, and the spike recovery is calculated. Recovery of these spikes provides an independent indicator of method accuracy relative to the sample matrix.

Table 2-1 lists the specific isomers that were used to spike the MM5 train and the quantities that were applied.

One field blank was obtained for the test. The blank train was assembled and charged with all required reagents in a fashion that was identical to that of the actual sample train. This blank train was heated and leak-checked in the same manner as the actual train, placed near the base of the stack, and sealed for the duration of one sampling run. Upon completion, the blank train samples were recovered applying the same procedures used to collect actual train samples. These blank train samples were analyzed for D/F isomers using the same handling and analysis procedures performed on the actual sampling trains. The results of the blank train samples indicate any possible contamination introduced to the samples by contaminated reagents, improper preparation or handling techniques, or contamination problems due to impure reagents.

One laboratory blank was analyzed for the test program.

During the laboratory sample analysis, all samples were combined and then extracted before the GC/MS analysis. The front half rinses were reduced in volume using a Kundera-Danish concentrator apparatus, followed by a nitrogen blow down. The toluene back-half rinse was concentrated in a rotary evaporator. The concentrates were combined, with a total mixture volume of 1-2 mL. The XAD and filter were placed in a Soxhlet extraction apparatus and refluxed with methylene chloride, followed by a subsequent extraction with toluene. These solvents were also reduced in volume as described above. Both extracts were combined, spikes added, and analyzed by GC/MS using Method 23 criteria.

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TABLE 2-1. USEPA METHOD 23 SPIKE COMPOUNDS AND QUANTITY SPIKED

Spike Type	Quantity Spiked
Sampling Surrogate Spikes (applied to XAD-2 before field sampling)	
Dioxin or Furan	
$^{37}Cl_4$-2,3,7,8-Tetrachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-1,2,3,4,7,8-Hexachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-2,3,4,7,8-Pentachlorodibenzofuran	10 ηg
$^{13}C_{12}$-1,2,3,4,7,8-Hexachlorodibenzofuran	10 ηg
Isotope Dilution Internal Standard Spikes and Surrogate Recovery Compounds (applied to each train half before sample preparation)	
Dioxin or Furan	
$^{13}C_{12}$-2,3,7,8-Tetrachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-1,2,3,7,8-Pentachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-1,2,3,6,7,8-Hexachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-1,2,3,4,6,7,8-Heptachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-1,2,3,4,6,7,8,9-Octachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-2,3,7,8-Tetrachlorodibenzofuran	10 ηg
$^{13}C_{12}$-1,2,3,7,8-Pentachlorodibenzofuran	10 ηg
$^{13}C_{12}$-1,2,3,6,7,8-Hexachlorodibenzofuran	10 ηg
$^{13}C_{12}$-1,2,3,4,6,7,8-Heptachlorodibenzofuran	10 ηg
Dioxin and Furan Recovery Standards (applied to extracts prior to sample injection)	
Dioxin and Furan	
$^{13}C_{12}$-1,2,3,4-Tetrachlorodibenzodioxin	10 ηg
$^{13}C_{12}$-1,2,3,7,8,9-Hexachlorodibenzodioxin	10 ηg

Notes: ηg = Nanogram

The peak areas for the two ions monitored for each analyte were summed to yield the total response for each analyte. Each internal standard was used to quantify the indigenous PCDD's or PCDF's in its homologous series. For example, the $^{13}C_{12}$-2,3,7,8-tetra chlorinated dibenzodioxin was used to calculate the concentrations of all other tetra chlorinated isomers. Recoveries of the tetra- and penta- internal standards were calculated using the $^{13}C_{12}$-1,2,3,4-TCDD. Recoveries of the hexa- through octa- internal standards were calculated using $^{13}C_{12}$-1,2,3,7,8,9-HxCDD.

Recoveries of the surrogate standards were calculated using the corresponding homolog from the internal standard. When no peak was detected, the noise level, as measured by the intensity of the noise in a clear zone of the chromatogram, was used to calculate the detection limit.

The individual tetra through octa isomers were added together to calculate the total PCDD's and PCDF's in each sample.

2.2.9 Total Hydrocarbons (USEPA Method 25A)

THC sampling was conducted in accordance with USEPA Method 25A using a VIG Industries hydrocarbon analyzer equipped with a heated FID.

The sample delivery system consisted of a stainless steel probe, filter and calibration tee (on the end of the probe) connected to a heated 250ºF Teflon sampling line. The sampling lines connected directly into the analyzers located in ARI's monitoring trailer. The THC analyzer is internally heated to keep the sample gas stream above its dew point (see Figure 2-5).

The analyzer was calibrated with applicable zero, low-range, mid-range and high-range gases as specified in USEPA Method 25A. The calibration gases were generated from Protocol 1 calibration standards using an Environics Model 4040 Gas Dilution System. The dilution system was verified on-site in strict accordance with USEPA Method 205. The gases met the calibration gas protocols specified in USEPA Method 7E, Section 7.1.

A calibration error test and measurement system bias test were performed prior to testing and a post calibration drift test was done on the monitor. The average zero and calibration drift values were used to correct the raw monitor data for each respective test run.

The monitor's data was collected at 15-second intervals by ARI's data acquisition system which consisted of an Omega OMB-DAQ-56 datalogger connected to a computer for digital data archiving and data reduction. DaqViewXL and Excel spreadsheet computer software were used for calculation of emission rates.

2.2.10 Hydrogen Chloride, Chlorine and Hydrogen Fluoride (USEPA Method 26)

HCl, Cl_2 and HF sampling was conducted following USEPA Method 26. USEPA Method 26 was conducted non-isokinetically with the sample gas extracted at a constant rate throughout each test run.

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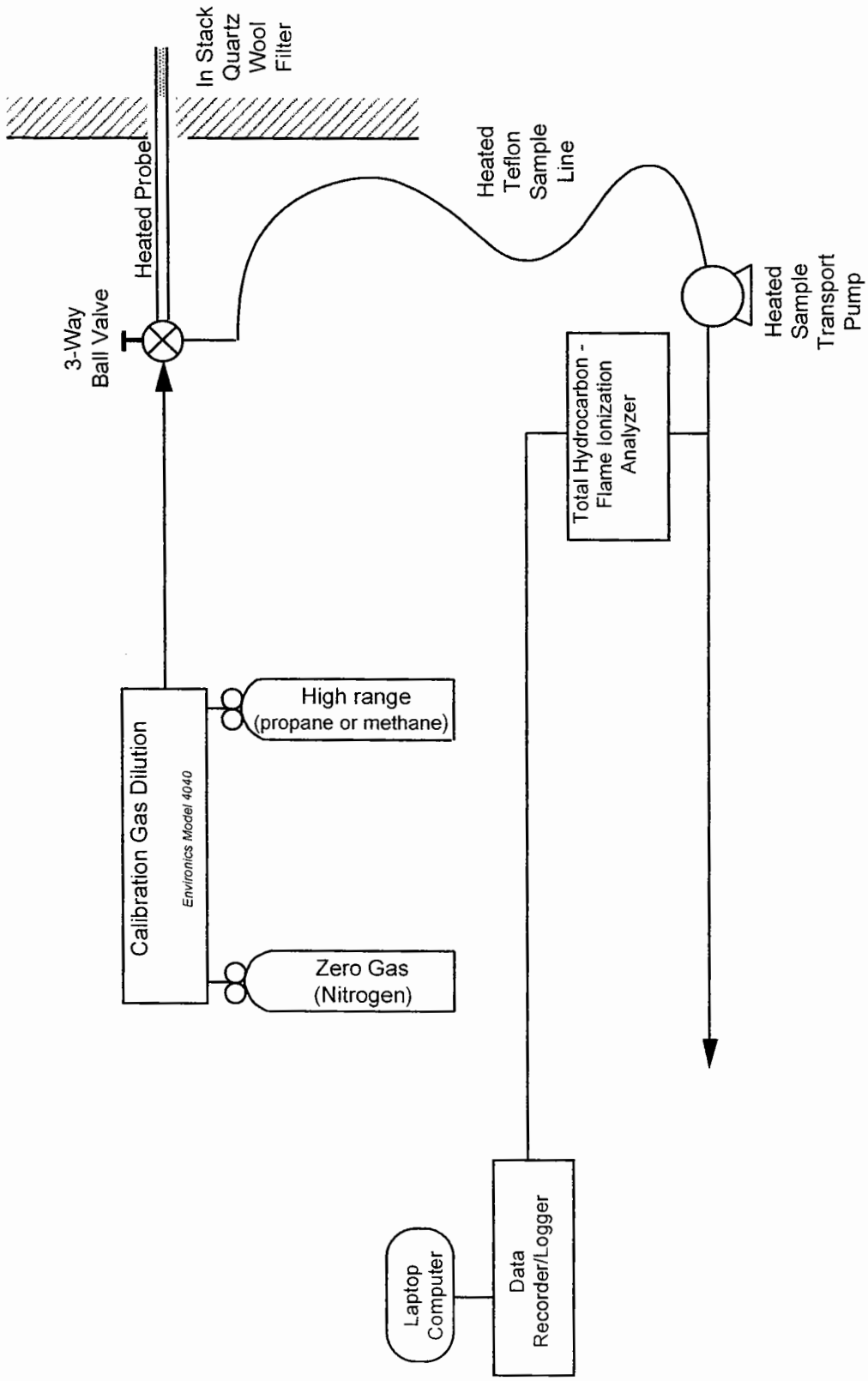

FIGURE 2-5. USEPA METHOD 25A - THC SAMPLING SYSTEM

Sample gas was withdrawn through a heated glass lined sample probe and heated Teflon filter followed by a series of chilled impingers. The front half of the sampling train consisted of a heated glass lined probe and heated sample box containing a Teflon filter. The back half of the train consisted of five impingers. The first and second impingers (Greenburg-Smith) each contained 100 mL of 0.1N H_2SO_4, the third and fourth impingers contained 0.1N NaOH and the fifth impinger contained 200 grams of silica gel. See Figure 2-6.

At the conclusion of each test run, after the final leak check was performed, the following clean-up procedure was conducted:

1. The contents of impingers 1 and 2 were measured for volume and then placed in Container 1. The impingers were then rinsed with deionized distilled water and the contents placed in this container. The total volume was then measured and the liquid level marked on the outside of the bottle.

2. The contents of impingers 3 and 4 were measured for moisture and placed in Container 2. The impingers were then rinsed with deionized distilled water and the contents placed in this container. The total volume was then measured and the liquid level marked on the outside of the bottle.

3. The contents of impinger 5 were placed in Container 3 for subsequent weighing to the nearest gram.

4. A 200 mL reagent blank of the 0.1N H_2SO_4 was placed in Container 4.

At ARI's laboratory, analysis of the samples was performed in accordance with USEPA Method 26 using ion chromatography techniques.

2.2.11 Metals (USEPA Method 29)

Sampling and analysis for the following metals were performed in accordance with USEPA Method 29 using an Apex Instruments, Inc. sampling train:

Antimony (Sb)	Cobalt (Co)
Arsenic (As)	Lead (Pb)
Beryllium (Be)	Manganese (Mn)
Cadmium (Cd)	Nickel (Ni)
Chromium (Cr)	Selenium (Se)

The samples were withdrawn from the exhaust stack and collected in a heated sample probe, heated filter (front-half catch) and a series of ice cooled impingers containing an acid/peroxide solution (back-half catch).

2.2.11.1 Sampling Apparatus

As shown in Figure 2-2, the metals sampling train was an Apex Instruments Method 5/29 sampling train. Assembled by ARI personnel, the sampling train consisted of the following:

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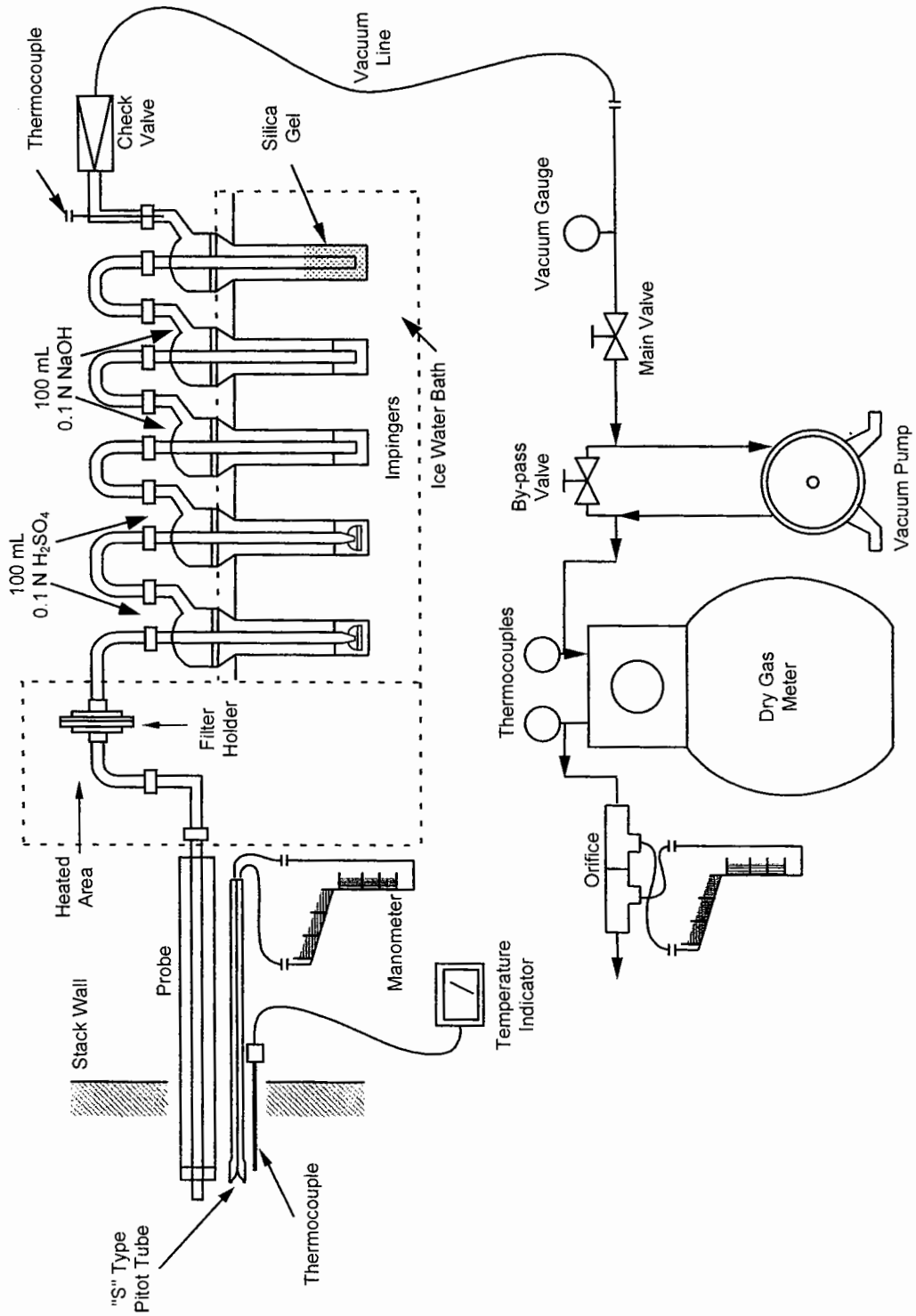


FIGURE 2-6. USEPA METHOD 26 SAMPLING TRAIN

Nozzle - Borosilicate glass with sharp, tapered leading edge.

Probe - Borosilicate glass with a heating system capable of maintaining a probe exit temperature of 248°F ±25°F.

Pitot Tube - Type-S, attached to probe for monitoring stack gas velocity.

Filter Media – A 4-in. quartz-fiber filter that met the requirements of Method 29.

Filter Holder - Borosilicate glass with a 4-in. Teflon frit filter support and a Viton O-ring gasket. The holder design provided a positive seal against leakage from the outside or around the filter. The filter holder was heated to 320°F ±25°F during sampling. A thermocouple was placed in the back-half of the filter holder for direct measurement of the sample stream temperature.

Draft Gauge - Inclined manometer with a readability of 0.01-in. H_2O in the 0- to 1-in. range and 0.1-in. H_2O in the 1-in. to 10-in. range.

Impingers – Five impingers connected in series with glass ball joints. The first impinger was empty with a shortened stem, the second and third impingers contained 100 milliliters (mL) of dilute nitric acid/hydrogen peroxide mixture, the fourth impinger was empty, and the fifth impinger contained approximately 200 grams of silica gel.

Metering System - Apex Model 522. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with ±2 percent accuracy, and related equipment as required to maintain an isokinetic sampling rate and to determine sample volume.

Barometer - Mercury barometer capable of measuring atmospheric pressure to within ±0.1-in. Hg.

2.2.11.2 Sampling Procedures

After the minimum number of traverse points was selected, the stack pressure, temperature, moisture and range of velocity head were measured according to procedures described in USEPA Methods 1 through 4.

The sampling train was leak-checked at the sampling site by plugging the inlet to the nozzle and pulling a vacuum of 15-in. Hg. Leak rates of less than 0.02 ft^3/min at a vacuum of 15-in. Hg were recorded in all cases. At the completion of each test run, the sampling train was again leak-checked by the same procedure, but at the highest vacuum attained during the test run. Both pre- and post-test leak checks of the pitot tube were made for each test run. Ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at less than 68°F.

During sampling, stack gas and sampling train data were recorded at specified intervals. Isokinetic sampling rates were set throughout the sampling period with the aid of a programmable calculator.

2.2.11.3 Sample Recovery Procedures

After sampling was completed and the final leak checks were performed, the sampling train was moved carefully from the test site to the recovery area.

The sample fractions were as follows:

Container 1 - The filter was removed from the filter holder and placed in a clean Petri dish and labeled.

Container 2 - A brush and acetone were used to clean the probe and other fittings as required. The washings from the inner surfaces of the nozzle and upstream portions of the filter holder were collected in a bottle and labeled.

Container 3 - A brush and 0.1 N nitric acid (HNO_3) were then used to rinse the probe and other fittings as required. The washings from the inner surfaces of the nozzle and upstream portions of the filter holder were collected in a bottle and labeled. The liquid level was marked after the container was sealed.

Container 4 - The contents of impingers 1, 2 and 3 were placed in a graduated cylinder to measure the total volume collected then rinsed with 0.1N HNO_3, then transferred to a bottle and labeled. The contents of impinger 4 were placed in a graduated cylinder to measure the total volume.

Container 5 - The contents of impinger 5 were transferred to a clean bottle and labeled. The weight of the silica gel was then determined. The difference between this final weight and the initial weight was the total moisture collected by the silica gel.

2.2.11.4 Analytical Procedures

Containers #1, #2, #3 and #4 and associated blanks were transported to the laboratory and analyzed for metals by ICAP in accordance with USEPA Method 29.

2.2.12 $PM_{2.5}$ and Condensable PM (USEPA Methods 201A and 202)

Sampling was conducted in accordance with USEPA Methods 201A and 202 using an Apex Instruments, Inc. particulate sampling train (see Figure 2-7). The back half impinger catch was analyzed for condensable particulate matter (CPM) in accordance with USEPA Method 202 procedures.

$PM_{2.5}$ was determined using the procedures of USEPA Method 201A. Sampling was conducted at a constant rate in order to achieve the 2.5 microns cut-rate of the cyclone separator. Dwell times at each sample point were calculated based on the stack gas velocity and gas meter temperature.

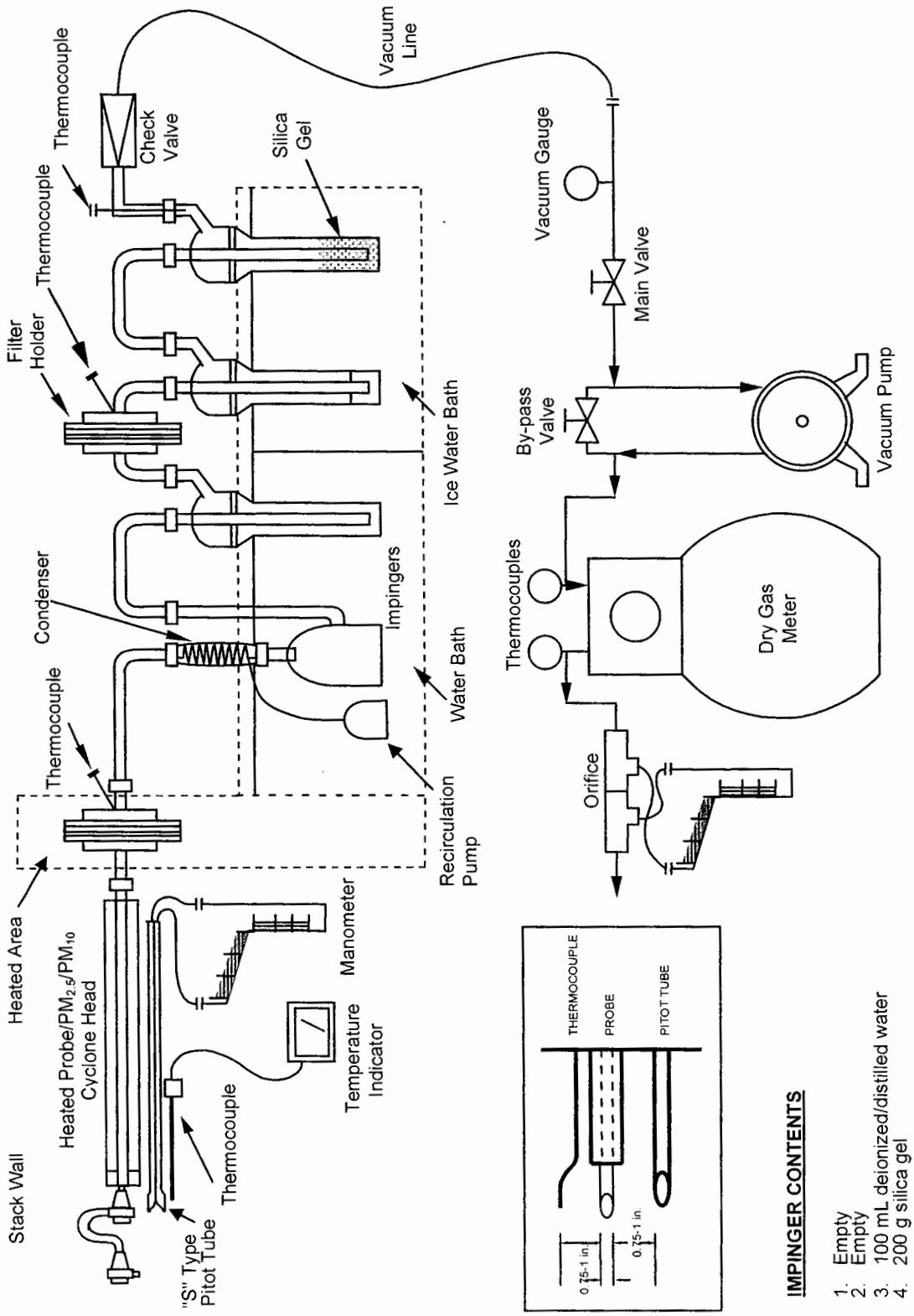


FIGURE 2-7. USEPA METHODS 201A/202 PARTICULATE MATTER SAMPLING TRAIN

2.2.12.1 Sampling Apparatus

Assembled by ARI personnel, the sampling train consisted of the following:

Cyclone Separator - Apex Instruments, 316 stainless steel design - 2.5 micron cut-rate.

Cyclone Nozzle - Stainless steel - integrated with cyclone, sized to attain $PM_{2.5}$ cut-rate.

Probe - Borosilicate glass with a heating system capable of maintaining a probe exit temperature of 248°F.

Pitot Tube - Type-S, attached to probe for monitoring stack gas velocity.

Heated Filter Holder - Borosilicate glass with a 4-in. Teflon frit filter support and a silicone rubber gasket. The holder design provides a positive seal against leakage from the outside or around the filter. The filter holder was heated to 248°F ±25°F during sampling. A thermocouple was placed in the back half of the filter support in direct contact with the sample stream. A quartz fiber filter that met the requirements of USEPA Method 5 was used.

Ambient Filter Holder - Unheated borosilicate glass with a 4-in. Teflon frit filter support, Teflon filter and a silicone rubber gasket. A thermocouple was placed in the back half of the filter holder to measure sample gas temperature by direct contact with the sample stream. Temperature was maintained between 65 and 85°F. A Teflon filter disc was placed in the filter holder.

Draft Gauge - Inclined manometer with a readability of 0.01-in. H_2O in the 0- to 10-in. range.

Condenser - Glass, coil type with compatible fittings.

Impingers - Four (4) impingers connected in series with glass ball joints. The first impinger was of the Greenburg-Smith design but with a shortened stem to act as a moisture knockout. The second, third and fourth impingers were of the Greenburg-Smith design, but modified by replacing the standard tip with a ½-in.-i.d. glass tube extending to within ½-in. of the bottom of the impinger flask. The second and third impingers were connected using the ambient filter holder.

Metering System - Apex Model 522. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with ±2 percent accuracy, and related equipment as required to maintain an isokinetic sampling rate and to determine sample volume.

Barometer - Mercury barometer capable of measuring atmospheric pressure to within ±0.1-in. Hg.

2.2.12.2 Sampling Procedures

After the minimum number of traverse points were selected, the stack pressure, temperature, moisture and range of velocity head were measured according to procedures described in USEPA Methods 1 through 4. The first and second impingers were initially empty. The third impinger contained 100 mL of deionized/distilled water. The fourth impinger contained 200 to 300 grams of silica gel.

The impingers were placed in a container that had two compartments. The first two impingers were placed in the first compartment and the third and fourth impingers were placed in the second compartment. The first compartment contained water that was circulated through the condenser to reduce the sample gas to between 65 and 85°F at the exit of the ambient filter. The second compartment contained ice water to reduce the sample gas to ≤68°F upon exiting the last impinger. Both temperatures were recorded at each traverse point interval throughout each test run.

The sampling train was leak-checked at the sampling site by plugging the inlet to the nozzle and pulling a vacuum of 15-in. Hg. Leak rates of less than 0.02 ft^3/min at a vacuum of 15-in. Hg are considered acceptable. At the completion of each test run, the sampling train was again leak-checked by the same procedure, but at the highest vacuum attained during the test run. Both pre- and post-test leak checks of the pitot tube were made for each test run. Ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at less than 68°F.

During sampling, stack gas and sampling train data were recorded at specified intervals. Isokinetic sampling rates were set throughout the sampling period with the aid of a programmable calculator.

2.2.12.3 Sample Recovery Procedures

After sampling was completed, a post-test nitrogen purge was conducted with the impingers still on ice at the meter ΔH@ for 60 minutes. Before the purge step began, the short stem of the first impinger was replaced with a long stem that was within ½-inch of the bottom of the impinger. If the stem did not extend below the water level in the impinger by 1 cm, then a measured amount of degassed, deionized, distilled water was added to adjust the level.

Method 201A

The sample fractions were recovered as follows:

Container 1 - The heated filter was removed from the holder and placed in a Petri dish.

Container 2 - Loose particulate and acetone washings from all sample-exposed surfaces including the exit tube of the $PM_{2.5}$ cyclone prior to the filter were placed in a glass bottle, sealed and labeled. Particulate was removed from the probe with the aid of a brush and acetone rinsing. The liquid level was marked after the container was sealed. The cyclone and nozzle catch were not recovered.

Container 3 – 150 mL of acetone was taken for blank analysis. The blank was obtained and treated in a similar manner as the contents of Container 2.

Method 202

The sample fractions were recovered as follows:

Container 1 – The contents from the first two impingers were placed into a glass container. The impingers (including the short stem), connecting glassware and front-half of the ambient filter were quantitatively rinsed twice with distilled/deionized water and the rinse was added to this container. The liquid level was marked after the container was sealed.

Container 2 – The first two impingers (including the short stem), connecting glassware and front half of the ambient filter were rinsed with acetone followed by two rinses with hexane and placed in a glass container. The liquid level was marked after the container was sealed.

Container 3 – The ambient filter was removed and placed in a Petri dish.

Containers 4 & 5 – 150 mL of distilled/deionized water and hexane were taken for blank analysis. The blanks were obtained and treated in a similar manner as the contents of Containers 1, 2 and 3.

The contents of the third impinger were weighed and the contents discarded. The contents of the fourth impinger (silica gel) were weighed to the nearest gram.

2.2.12.4 Analytical Procedures

Method 201A

The analytical procedures followed those described in USEPA Method 201A.

Container 1 (≤$PM_{2.5}$ micrometer filterable particulate) - The filter and any loose particulate were transferred from the sample container to a tared glass weighing dish and desiccated for 24 hours in a desiccator containing anhydrous calcium sulfate or indicating silica gel. The filter was weighed to a constant weight and the results were reported to the nearest 0.1 mg.

Container 2 (≤$PM_{2.5}$ micrometers acetone rinse of the exit tube of the cyclone and front half of the filter holder) - The acetone washings were transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure. The contents were then placed in a dessicator for 24 hours and weighed to a constant weight to the nearest 0.1 mg.

Container 3 - The acetone blank was transferred to a tared beaker and evaporated to approximately 10 mL at ambient temperature and pressure in a fume hood, transferred to a pre-weighed tin and evaporated to dryness at ambient temperature and pressure in a fume hood, placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg.

Method 202

The analytical procedures followed those described in USEPA Method 202.

Container 1 – The liquid in this container was measured volumetrically and placed into a separatory funnel. Approximately 30 mL of hexane was added, mixed well and the lower organic phase drained off. This procedure was repeated twice, leaving a small amount of the organic/hexane phase in the separatory funnel each time to yield approximately 90 mL of organic extract. This organic extract was combined with Container 4. The aqueous fraction from Container 3 was transferred to a tared beaker and evaporated in an oven at 105°C to no less than 10 mL and allowed to air dry at ambient temperature. The residue was then redissolved in 100 mL of water and titrated with 0.1N NH_4OH to a pH of 7.0. The aqueous phase was then evaporated in an oven at 105°C to approximately 10 mL, transferred to a pre-weighed tin and evaporated to dryness in a fume hood at ambient temperature and pressure, placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg. The gain in mass represents the inorganic PM collected in the sampling train back half.

Container 2 – The contents of this container were combined with the organic extract from Container 1, placed in a tared beaker and evaporated at ambient temperature and pressure in a fume hood to not less than 10 mL. The beaker contents were then transferred to a pre-weighed tin, evaporated to dryness at ambient temperature and pressure in a fume hood, placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg. The gain in mass represents the organic PM collected in the sampling train back half.

Container 3 - The ambient filter was folded in quarters and placed into a 50 mL extraction tube. Sufficient deionized/distilled water was used to cover the filter. The extraction tube was placed in a sonication bath and the water soluble material was extracted for a minimum of 2 minutes. The aqueous extract was combined with the contents of Container 3. This step was completed a total of three times. After completion of the aqueous extraction, the filter was covered with a sufficient amount of hexane. The extraction tube was then placed in a sonication bath and the organic material was extracted for a minimum of 2 minutes. The organic extract was combined with the contents of Container 4. This step was completed a total of three times. The procedures for Container 3 were completed prior to any procedures for Containers 1 and 2.

Container 4 - The water blank was transferred to a tared beaker and evaporated to approximately 10 mL in an oven at 105°C, transferred to a pre-weighed tin and evaporated to dryness at ambient temperature and pressure in a fume hood, placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg.

Container 5 - The hexane blank was transferred to a tared beaker and evaporated to approximately 10 mL at ambient temperature and pressure in a fume hood, transferred to a pre-weighed tin and evaporated to dryness at ambient temperature and pressure in a fume hood, placed in a desiccator for 24 hours and weighed to a constant weight to the nearest 0.1 mg.

The term "constant weight" means a difference of no more than 0.5 mg or 1 percent of the total weight less tare weight, whichever is greater between two consecutive readings, with no less than 6 hours of desiccation between weighings.

2.2.13 Gas Dilution System Verification (USEPA Method 205)

All applicable calibration gases were certified by USEPA Protocol 1 procedures. All diluted calibration standards were prepared using an Environics Model 4040 Gas Dilution System that was verified by a field evaluation prior to testing following the requirements of USEPA Method 205 (40 CFR 51, Appendix M).

ARI's Servomex Model 1440C O_2 analyzer was initially calibrated following USEPA Method 3A procedures. After the calibration procedure was complete, diluted low and mid-range standards and a mid-range EPA Protocol 1 standard were alternately introduced in triplicate and an average instrument response was calculated for each standard. No single response differed by more than $\pm$2% from the average response for each standard. The difference between the instrument average and the predicted concentration was less than $\pm$2% for each diluted standard. The difference between the certified gas concentration and the average instrument response for the mid-range EPA Protocol 1 standard was less than $\pm$2%.

2.2.14 Methanol Determination (USEPA Methods 308/18)

Methanol concentration and emission rate were determined following the basic principles of USEPA Method 308. Since the refinery ICR volatile organic HAP sampling requirements include surrogate spiking and recovery determination, the USEPA Method 308 test procedure included the addition of a co-located sampling train spiked with the target analyte (methanol) and operated simultaneously with the stack gas sampling train. This satisfies the ICR volatile organic HAP surrogate spiking and recovery requirement.

2.2.14.1 Sampling Apparatus

As shown in Figure 2-8, each of the co-located sampling trains consisted of the following components:

Probe - Heated stainless steel or borosilicate glass lined probe.

Teflon Tube - Connecting the probe to the absorbing solution/condensate impinger.

Impinger - Borosilicate glass impinger with tapered insert to collect moisture and condensable organics.

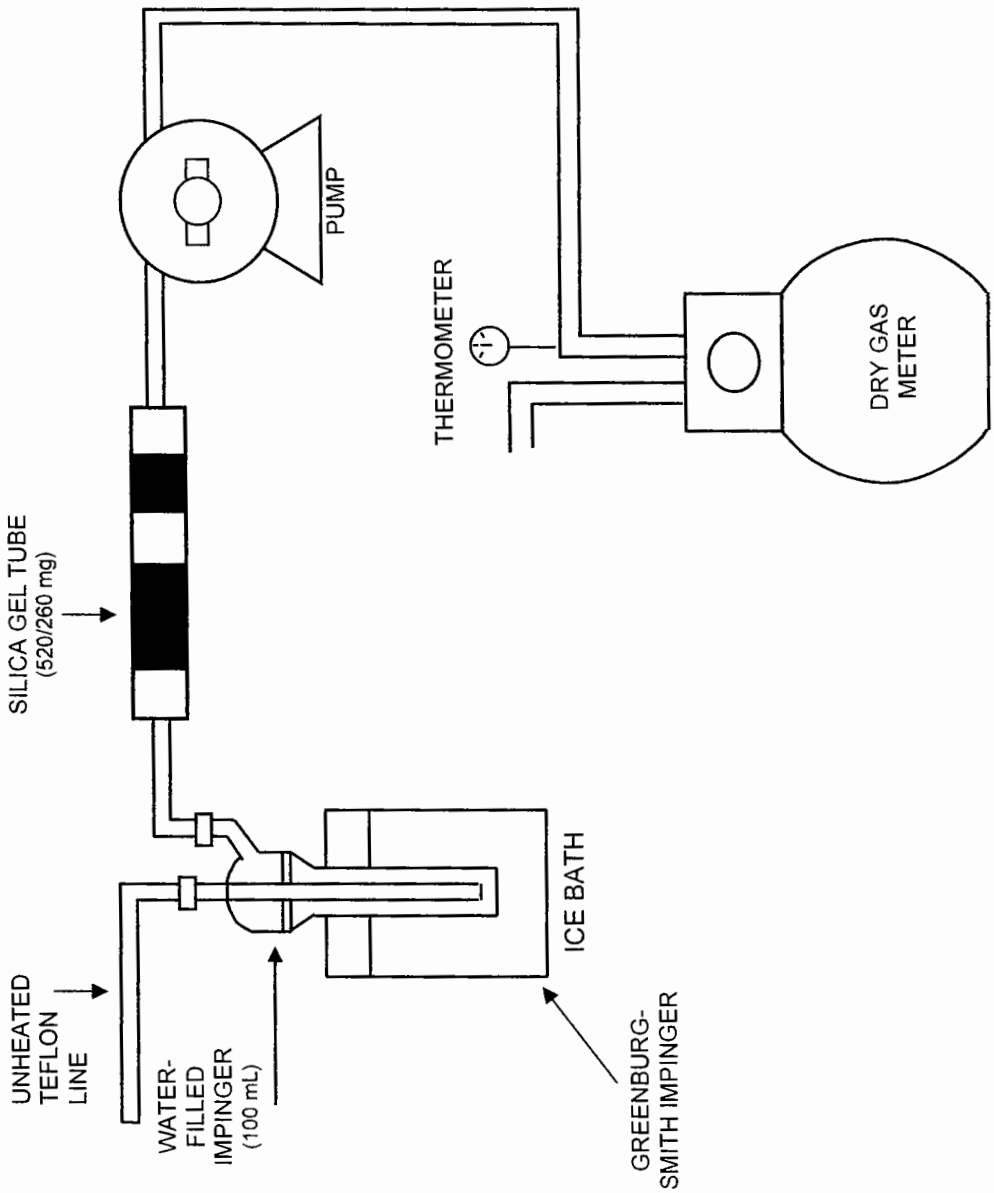


FIGURE 2-8. USEPA METHOD 18/308 SAMPLING TRAIN (METHANOL ONLY)

Sorbent Tube - Two section silica gel trap to collect non-condensable methanol fraction.

Pump - To transport gas sample through sampling train.

Needle Valve - To control gas sample flow rate through the sampling train.

Meter Console - A VOST type meter console was used to control the sampling rate through the impinger train and monitored the temperature of the sampling train components. The meter console itself contained a dry gas meter to measure the volume of gas sampled. The gas meter has an accuracy of ± 1%.

The unspiked sampling train included one midget impinger charged with 20 mL of ultrapure deionized water.

The spiked train included one midget impinger charged with 20 mL of laboratory prepared spiking solution for the recovery determination. The spiked train also included a two-section silica gel sorbent tube spiked with a known mass of ultra pure methanol into the first section for the recovery determination.

2.2.14.2 Sampling Procedures

Prior to the start of sampling, each of the sampling trains was leak checked at 10 inches of Hg. Acceptable leak rate is ≤ 2% of the average sampling rate. Following the leak check, the impinger was immersed in an ice water bath and the sample probe was positioned in the centroid of the stack. The sample probe was purged and sampling began with the sample rate adjusted to a selected flow rate in the range of 200 to 1000 mL/minute (dependent upon the methanol concentration in the stack and the detection limit required). Sample train flow rate and temperature data were recorded at five-minute intervals throughout the duration of the run. Following completion of the run, a post test leak check was performed in the same manner as that conducted prior to the start of the run.

2.2.14.3 Sample Recovery Procedures

Sample recovery from each of the two co-located trains was conducted as follows:

Container #1 - The impinger absorbing solution and water rinse of the impinger and upstream sample tubing were stored in a labeled and sealed 40 mL VOA vial and stored in a cooler with ice packs.

Silica Gel Sorbent Tube - The sorbent tube was capped, labeled, and stored in a cooler with cold packs.

Blanks - A methanol field blank and a sorbent tube blank were collected once for each source tested.

2.2.14.4 Analytical Procedures

At ARI's laboratory, the collected samples were analyzed using an SRI Model 8610 gas chromatograph equipped with a FID following USEPA Method 308 procedures to determine the methanol concentration.

Calibration of the gas chromatograph was performed using methanol standards prepared in the desorbing solution matrix. The samples were analyzed and target analyte recoveries were determined to meet the QA recovery requirements set forth in USEPA Method 18.

2.2.15 FTIR Single Instrument Spiking Validation (USEPA Method 301/320)

A USEPA Method 301 spiking study was performed to validate the use of FTIR techniques to accurately measure the specific compound concentrations (aldehydes, HCN and NH_3).

The results of the validation study were used to determine if the FTIR procedures are valid for this type of stationary source. USEPA Method 320 allows the validation of FTIR-based measurements by a pair wise comparison between the results of a single FTIR system.

Sequential measurements were made of "native" (or unspiked) concentrations and dynamically spiked concentrations to provide a calculable change in analyte concentrations i.e. "method of additions analysis". Twelve independent measurements were made for native and spiked samples.

The means of the spiked results and calculated spiked levels provide a bias estimate for the FTIR measurements. A t-test was applied to the 12 differences in the values of these paired measurements to determine whether the bias was significant. If the results of the validation study indicate an accuracy of $\leq \pm 2\%$ for each compound, no bias correction factor is needed.

All of the statistical criteria in the method were met.

2.2.16 Specific Compound Determination using FTIR Spectroscopy (USEPA Method 320)

Sampling was conducted using FTIR instrumentation following the principles of USEPA Method 320 and ASTM Method D6348-03.

An MKS Model MultiGas 2030 FTIR was used to measure the specific compound concentrations.

The MultiGas 2030 analyzer is composed of a 2102 process FTIR spectrometer, a high optical throughput sampling cell, analysis software and a quantitative spectral library. The analyzer collects high resolution spectra in the mid infrared spectral region (400 to 4,000 cm^{-1}), which are analyzed using the quantitative spectral library. This provides an accurate, highly sensitive measurement of gases and vapors.

SECTION TWO Testing and Analytical Procedures

As shown in Figure 2-9, the sample delivery system consisted of a stainless steel sampling probe, 3-way ball valve, Teflon sampling line, fast loop bypass pump, dilution system and sample manifold. The gas sample was continuously extracted from the source at approximately 8 liters per minute.

It should be noted that the main principles and calibration procedures of USEPA Method 320 were followed. USEPA Method 320 specifies a number of analytical uncertainty parameters that the analyst may calculate to characterize the FTIR system performance. To calculate the minimum detectable concentration (MDC) values for the target compounds, the MDC2 calculation specified in Equation A2.4 of ASTM Standard D-6348-03, "Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface FTIR Spectroscopy" was used. This calculation provides a more realistic and conservative estimate than those listed in USEPA Method 320.

The MKS software also calculates the analytical error of the FTIR measurement which includes the root mean standard deviation (RMSD). The concentration uncertainty reported by MKS is called the standard error of estimated concentration (SEC) and is also known as the marginal standard deviation. The uncertainties in the concentration are proportional to the square root of the sums of the squares of the residual. After the residual spectrum is obtained, which is called R, the error variance for the case of a single reference spectrum is calculated by the software.

Independent calculations of optical path length were not performed because the instrument has a fixed path of 5.11 meters. A signal to noise ratio test (S/N) was performed using MKS software to verify instrument performance.

Independent calculations of RMSD, individual fractional uncertainty (FU), overall fractional uncertainty (OFU), minimum instrumental line width (MIL), and fractional error (FE) for separate analytical regions were not performed due to the advancement of software technologies which factors these statistics in the operation of the FTIR and within the development of the calibration curves. The data was stored on the computer disk and also backed up to CD media.

Measured performance parameters were signal to noise tests, noise equivalent absorbance (NEA), detector linearity, background spectra, potential interferents, and cell and system leakage.

Quality assurance procedures included baseline measurement with ultra high purity nitrogen, measurement of a calibration transfer standard (~100 ppm ethylene), direct analyte calibration measurements and measurements to determine baseline shift. SF_6 was also used as a tracer gas in the calibration gases to evaluate dilution ratios and verify the sample delivery system integrity.

The general FTIR field sampling procedure was as follows:

SECTIONTWO Testing and Analytical Procedures

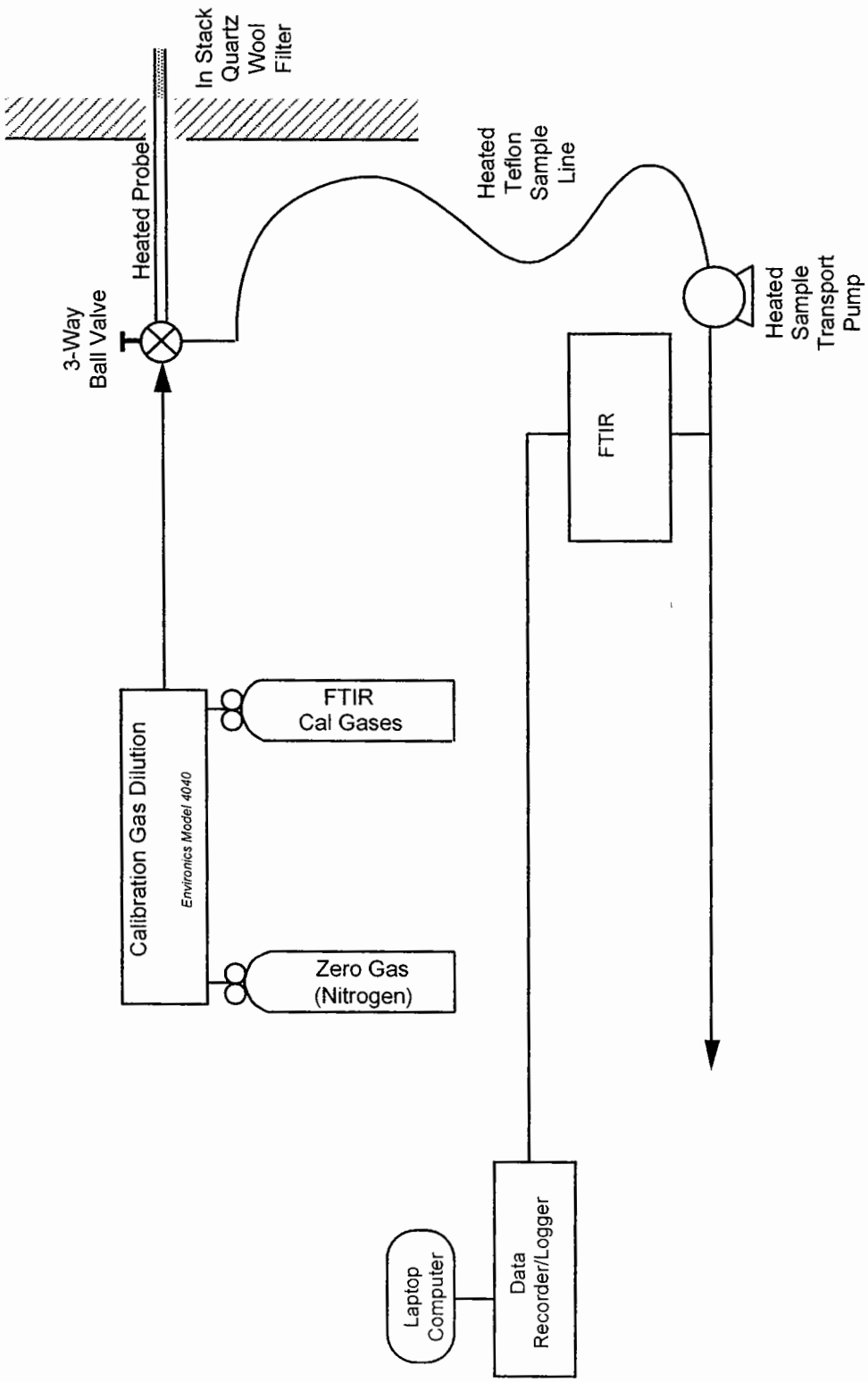


FIGURE 2-9. FTIR SAMPLING SYSTEM

PRE-TEST AND METHOD 301 VALIDATION

1) Background spectrum
   - Evaluate diagnostics of the instrumentation
2) Baseline (cylinder UHP-N_2 for zero check)
   - Determine the level of background noise
   - Observe spectrum for baseline tilt, i.e., indicates vibrations/perturbations affecting instrument
3) Calibration transfer standard (cylinder 100 ppm ethylene for span check)
   - Determine level of response to evaluate the spectral response and stability of the instrument
   - Create a field reference spectrum
4) Baseline evaluation
   - Note baseline flush/clean out FTIR sample cell
   - Observe spectrum for baseline tilt
5) Collection of spectra stack gas
   - Determine stack gas analyte concentrations
6) Measurement of analyte calibration gas and analyte spike
   - The spike recovery must be ±30% and consist of >90% stack gas
7) Method 320/301 validation of 12 spiked and 12 unspiked samples and statistical analysis.

TEST – Run 1, 2 and 3 (repeat each run)

1) Baseline determination
2) Measurement of calibration transfer standard
3) Collect sequential spectra of stack gas
4) Baseline determination
5) Measurement of calibration transfer standard

POST-TEST

1) Baseline determination
2) Measurement of calibration transfer standard (i.e. span check)
3) Measurement of analyte calibration gas (optional)

2.2.17 Mercury (ASTM D6784-02 – Ontario Hydro Method)

Total Hg was determined following the test procedures as detailed in ASTM Method D6784-02 (Ontario Hydro Method).

2.2.17.1 Sampling Apparatus

Assembled by ARI personnel, the sampling train consisted of the following (see Figure 2-10):

Nozzle - Borosilicate glass with sharp, tapered leading edge.

Probe - Borosilicate glass with a heating system capable of maintaining a probe exit temperature to within ±27°F of the flue gas temperature and no less than 248°F.

Pitot Tube - Type-S, attached to probe for monitoring stack gas velocity.

Filter Holder - Borosilicate glass with a 4-in. Teflon frit filter support and a Viton O-ring gasket. The holder design provided a positive seal against leakage from the outside or around the filter. The filter holder was heated to within ±27°F of the flue gas temperature and no less than 248°F during sampling. A thermocouple was placed in the back-half of the filter holder for direct measurement of the sample stream temperature.

Draft Gauge - Inclined manometer with a readability of 0.01-in. H_2O in the 0- to 1-in. range and 0.1-in. H_2O in the 1-in. to 10-in. range.

Impingers – Eight impingers connected in series with glass ball joints. The first, second, fourth, fifth, sixth and eighth impingers were of the Greenburg-Smith design, but modified by replacing the standard tip with a ½-in.-i.d. glass tube extending to within ½-in. of the bottom of the impinger flask. The third and seventh impingers were of the Greenburg-Smith design with standard tips. The first, second and third impingers contained 100 mL of an aqueous 1 N potassium chloride (KCl) solution. The fourth impinger contained 100 mL of an aqueous solution of 5% HNO_3 and 10% hydrogen peroxide (H_2O_2). The fifth, sixth and seventh impingers each contained 100 mL of an aqueous solution of 4% potassium permanganate ($KMnO_4$) and 10% sulfuric acid (H_2SO_4). The last impinger contained 200 g of silica gel.

Metering System - Apex Model 522. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with ±2 percent accuracy, and related equipment as required to maintain an isokinetic sampling rate and to determine sample volume.

Barometer - Mercury barometer capable of measuring atmospheric pressure to within ±0.1-in. Hg.

2.2.17.2 Sampling Procedures

After the minimum number of traverse points was selected, the stack pressure, temperature, moisture, and range of velocity head were measured according to procedures described in USEPA Methods 1 through 4.

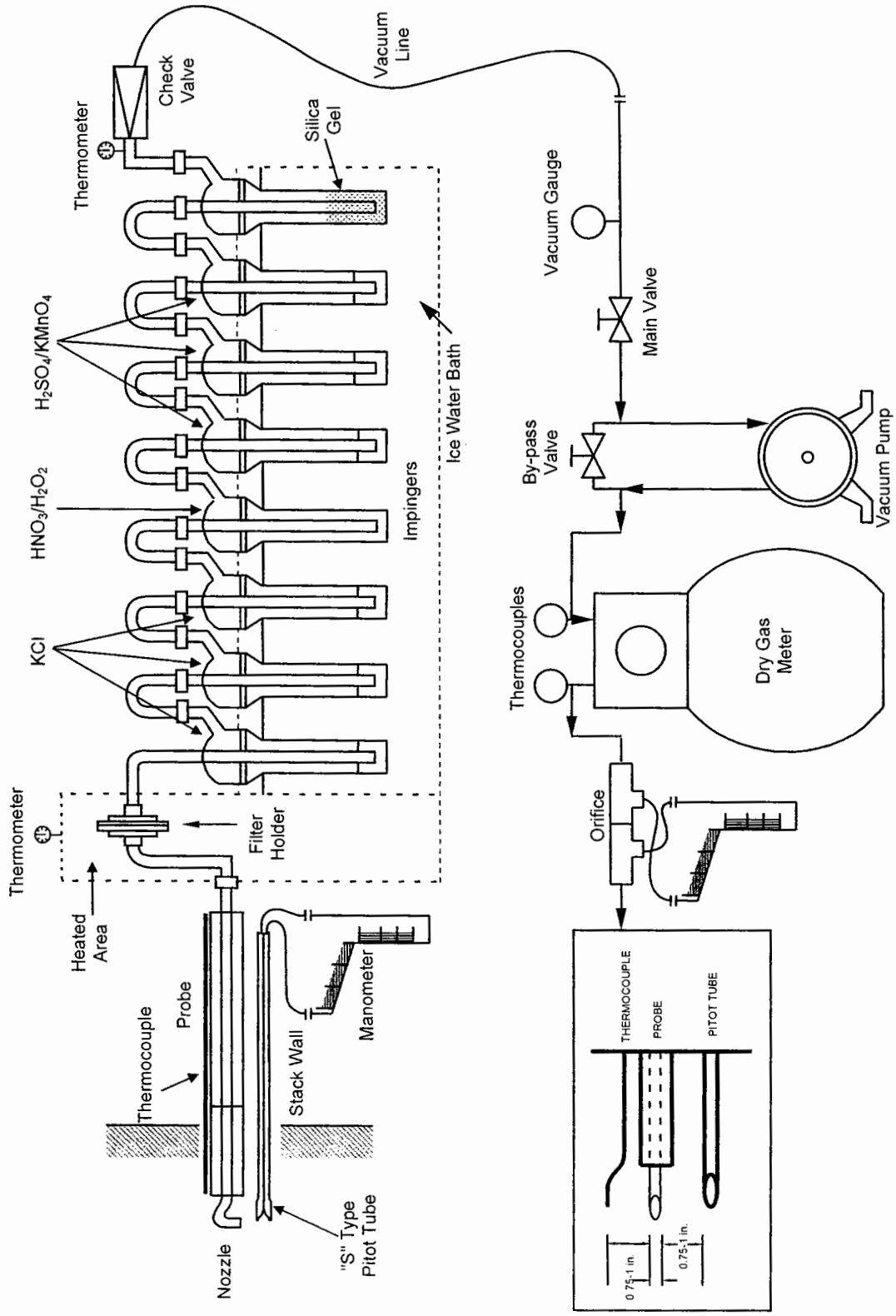


FIGURE 2-10. ASTM METHOD D6784-02 (ONTARIO HYDRO METHOD) MERCURY SAMPLING TRAIN

Prior to final sampling train assembly, the weight of each impinger was recorded. The sampling train was leak-checked at the sampling site by plugging the inlet to the nozzle and pulling a vacuum of 15-in. Hg. Leak rates of less than 0.02 ft^3/min at a vacuum of 15-in. Hg were recorded in all cases. At the completion of each run, the sampling train was again leak-checked by the same procedure, but at the highest vacuum attained during the test run. Both pre- and post-test leak checks of the pitot tube were made for each test run. Ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at less than 68°F.

During sampling, stack gas and sampling train data were recorded at specified intervals. Isokinetic sampling rates were set throughout the sampling period with the aid of a programmable calculator.

2.2.17.3 Sample Recovery Procedures

After sampling was completed and the final leak checks were performed, the filter and probe (front-half) were disconnected from the impinger train and moved carefully from the test site to the recovery area.

The sample fractions were recovered as follows:

Container 1 - The filter was removed and placed in a petri dish.

Container 2 - Loose particulate and 0.1 N HNO_3 washings from all sample-exposed surfaces prior to the filter were placed in a glass bottle, sealed, and labeled. Particulate was removed from the probe with the aid of a brush and 0.1 N HNO_3 rinsing. The liquid level was marked after the container was sealed.

Container 3 – Impingers 1, 2 and 3 were weighed to the nearest 0.5 g. The filter support, back half and connecting glassware were rinsed with 0.1 N HNO_3 and placed in a glass bottle. Small amounts of 5% $KMnO_4$ solution were added very slowly to each impinger and gently mixed until a purple color was obtained and remained for 15 minutes. The contents of each impinger were then added to Container 3. The impingers and connecting glassware were then rinsed with 10% HNO_3 and the rinses were added to Container 3. If the solution was clear, a small amount of 5% $KMnO_4$ solution was added until a pink or slightly purple color remained for 90 minutes. A final rinse of the impingers and glassware was conducted with 0.1 N HNO_3 and added to Container 3. The liquid level was marked after the container was sealed.

Container 4 – The contents of impinger 4 were placed in a glass bottle. The impinger and connecting glassware were rinsed a minimum of two times with 0.1 N HNO_3 and added to Container 4.

Container 5 – Impingers 5, 6 and 7 were weighed to the nearest 0.5 g. The contents of each impinger were placed in a glass bottle. The impingers and connecting glassware were rinsed a minimum of two times with 0.1 N HNO_3 and added to Container 5. A third rinse was conducted using 0.1 N HNO_3 and several drops of 10% hydroxylamine solution and added to Container 5. If the solution was clear, a small amount of H_2SO_4/$KMnO_4$

solution was added until a pink or slightly purple color was obtained. The solution was preserved by adding 1 mL of 5% dichromate solution to Container 5. A final rinse of the impingers and glassware was conducted with 0.1 N HNO_3 and added to Container 5. The liquid level was marked after the container was sealed.

Container 6 - The contents of the eighth impinger were weighed to the nearest gram and discarded.

Containers 7, 8, 9 & 10 – 50 mL each of 0.1 N HNO_3, 1 N KCl, 5% HNO_3/10% H_2O_2 and H_2SO_4/$KMnO_4$ were taken for blank analysis.

Container 11 - 100 mL of hydroxylamine solution was taken for blank analysis.

2.2.17.4 Analytical Procedures

The samples were transported to the laboratory and analyzed for Hg by cold-vapor atomic absorption (CVAAS) in accordance with ASTM Method D6784-02.

2.2.18 Speciated Semi-Volatile Organic HAP (SW-846 Method 0010)

Sampling in accordance with SW-846 Method 0010 was conducted for the following target analytes:

Acenaphthene	Cresol (mixed isomers)	Fluorene
Acenaphthylene	Chrysene	Indeno(1,2,3-cd)pyrene
Aniline	Dibenz[a,h]anthracene	Isophorone
Anthracene	Dibenzofuran	3-Methylcholanthrene
Benzidine	Dibenzo(a,e)pyrene	2-Methylnaphthalene
Benz[a]anthracene	3,3-Dimethoxybenzidine	Naphthalene
Benzo[b]fluoranthene	Dimethylaminobenzene	Perylene
Benzo[k]fluoranthene	7,12-Dimethylbenz(a)anthracene	Phenanthrene
Benzo[g,h,i]perylene	3,3-Dimethylbenzidine	Phenol
Benzo[a]pyrene	α, α -Dimethylphenethylamine	1,4-Phenylenediamine
Benzo[e]pyrene	2,4-Dimethylphenol	Pyrene
Biphenyl	Fluoranthene	o-Toluidine

The samples were withdrawn isokinetically from the stack location through a heated particulate filter followed by a condenser, a XAD-2 resin sorbent trap and a series of chilled impingers.

2.2.18.1 Sampling Apparatus

The sampling train was an Apex Instruments Modified Method 5 sampling train (see Figure 2-11). The major components are described below:

Nozzle - Borosilicate glass with sharp tapered leading edge.

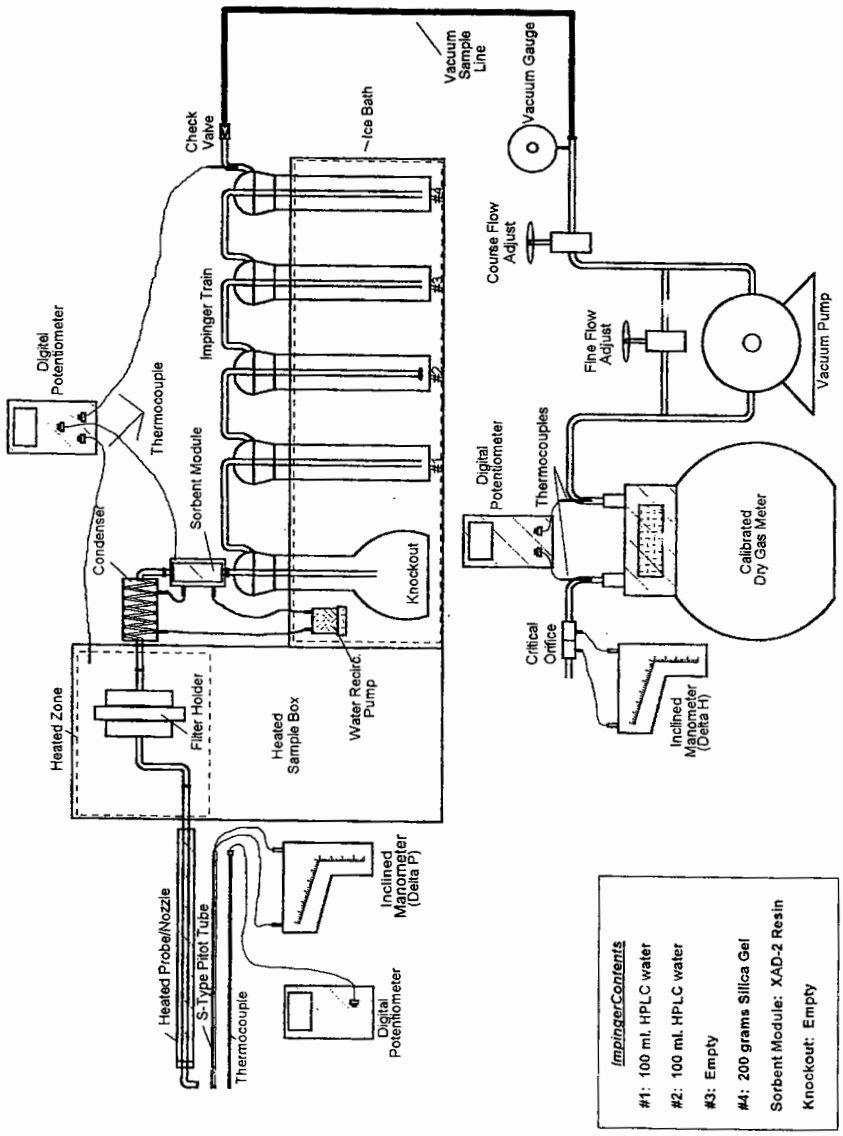


FIGURE 2-11. SW-846 METHOD 0010 SAMPLING TRAIN

Probe – Stainless steel with borosilicate glass liner and attached pitot tube and stack temperature thermocouple.

Apex Sample Box - Borosilicate glass filter holder, quartz fiber filter, a water jacketed sample chiller, a sorbent trap containing XAD-2 resin, five Greenburg-Smith impingers and the connecting glassware.

Apex Control Module – (per USEPA Method 5 specifications) pump, heat controllers and inclined-vertical oil gauge manometer.

The sample adsorbent traps and filters were cleaned and prepared by the laboratory following SW-846 Method 0010 procedures. ARI cleaned all sampling train glassware to pesticide analytical requirements using procedures outlined in Section 3A of the "Manual of Analytical Methods for the Analysis of Pesticide in Human and Environmental Samples".

The sample train was assembled as follows:

1. A glass nozzle was selected and attached to the probe.

2. A pre-weighed, pre-cleaned quartz fiber filter was placed in the filter holder and its number recorded on the data sheets.

3. The water jacket sample condenser and sorbent trap containing 50 grams of XAD-2 resin were placed in series after the filter holder.

4. The back half of the train consisted of five impingers. The first impinger was assembled empty. The second and third impingers contained 100 mL of HPLC grade water. The fourth impinger was assembled empty. The fifth impinger contained 200 grams of silica gel.

5. The sampling train was assembled on-site in ARI's monitoring trailer.

2.2.18.2 Sampling Procedures

The sampling train was leak checked prior to sampling using the following procedures:

1. The pump was started.

2. The course flow adjustment valve was opened.

3. Flow through the dry gas meter was checked.

4. The probe inlet was plugged.

5. The fine flow adjustment valve was adjusted so that the vacuum gauge read 15 in. Hg.

6. If the flow exceeded .02 ACFM, the pump was shut off and all connections were rechecked for tightness and the leak test procedure was repeated until acceptable results were obtained.

The pitot tube assembly was leak checked using the following procedures:

1. A positive (or negative) pressure of greater than 3 inches of water was created in the pitot line to be checked.

2. The line was plugged to hold the pressure, and the manometer was monitored to watch for any change in the reading.

3. If the reading changed, the system was rechecked for leaks and the leak check procedure was repeated until no leaks were present.

Crushed ice was added to the impinger compartment and the sample case was moved into position outside the first port to be sampled. When the filter holder assembly was properly heated, the nozzle was uncapped and the probe introduced into the stack to the first sampling point. The dry gas meter reading was recorded and sampling started. At each point, a pitot reading was made and the sampling rate adjusted using calculations based on preliminary temperature, pressure and estimated moisture. The sorbent trap was maintained below 68°F to insure XAD collection efficiency during testing. When sampling at the last point in the port was complete, the pump was turned off and the probe was carefully removed from that port.

A final leak test was performed on the sampling train, as previously described. The umbilical cord was disconnected, and the sample case and probe were then disassembled.

2.2.18.3 Sample Recovery Procedures

Upon completion of each test run and final leak check, the following sampling train clean-up procedure was performed:

Container 1 - The filter was removed from its holder and was placed and sealed in a glass Petri dish.

Container 2 - All loose particulate matter and rinse washings from all sample-exposed surfaces preceding the filter paper were placed in this container and sealed. The probe, nozzle and connecting heated Teflon line were scrubbed with a stiff Teflon brush and rinsed with a 1 to 1 (1:1) mixture of methanol and methylene chloride. The final level of liquid was marked on the bottle.

Container 3 - The contents of impingers 1, 2, 3 and 4 were measured for volume and then placed in Container 3. The total volume was measured to the closest ±1 mL and the liquid level was marked on the outside of the bottle.

Container 4 - The silica gel from impinger 5 was placed in Container 4.

Containers 5 & 6 - The sorbent traps were sealed with Teflon tape and glass end caps. The traps were refrigerated in ARI's monitoring trailer.

Blanks - During testing, a methanol/methylene chloride blank, DI water blank, XAD-2 resin blank and glass fiber filter blank were collected and placed into respective glass bottles with Teflon lined lids for analysis.

2.2.18.4 Analytical Procedures

After all chain of custody forms were completed, the samples were shipped to the laboratory for analysis in accordance with SW-846 Method 0010 and 8270C or D. The samples were stored in ice chests containing cold packs.

2.2.19 Hexavalent Chromium (SW-846 Method 0061)

The chromium sample was extracted isokinetically from the source using a recirculatory sampling train in accordance with SW-846 Method 0061. The chromium was collected in a solution containing 8N (due to CO_2 content of gas stream) potassium hydroxide (KOH).

2.2.19.1 Sampling Apparatus

The recirculatory sampling train (see Figure 2-12) was assembled by ARI. The major components are described below:

Probe Nozzle – Borosilicate glass with a sharp, tapered leading edge.

Teflon Aspirator – Teflon aspirator capable of recirculating absorbing reagent at 50 mL/ min. while operating at 0.75 cfm.

Teflon Sample Line – Teflon, 3/8" ID to connect aspirator to first Teflon impinger.

Teflon Recirculation Line – Teflon, ¼" OD and 1/8" ID to connect first impinger to aspirator.

Impingers - Five impingers connected in series with Teflon tubes and fittings. The first four impingers were Teflon and the fifth was a Greenburg-Smith impinger modified by replacing the tip with a ½-inch glass tube extending to ½-inch from the bottom of the flask. The first impinger contained 150 mL of 8N KOH solution. The second and third impingers each contained 75 mL of 8N KOH solution. The fourth impinger was empty and served as a knockout impinger to trap solution carried over from the previous impingers. The fifth impinger contained 200 g of silica gel.

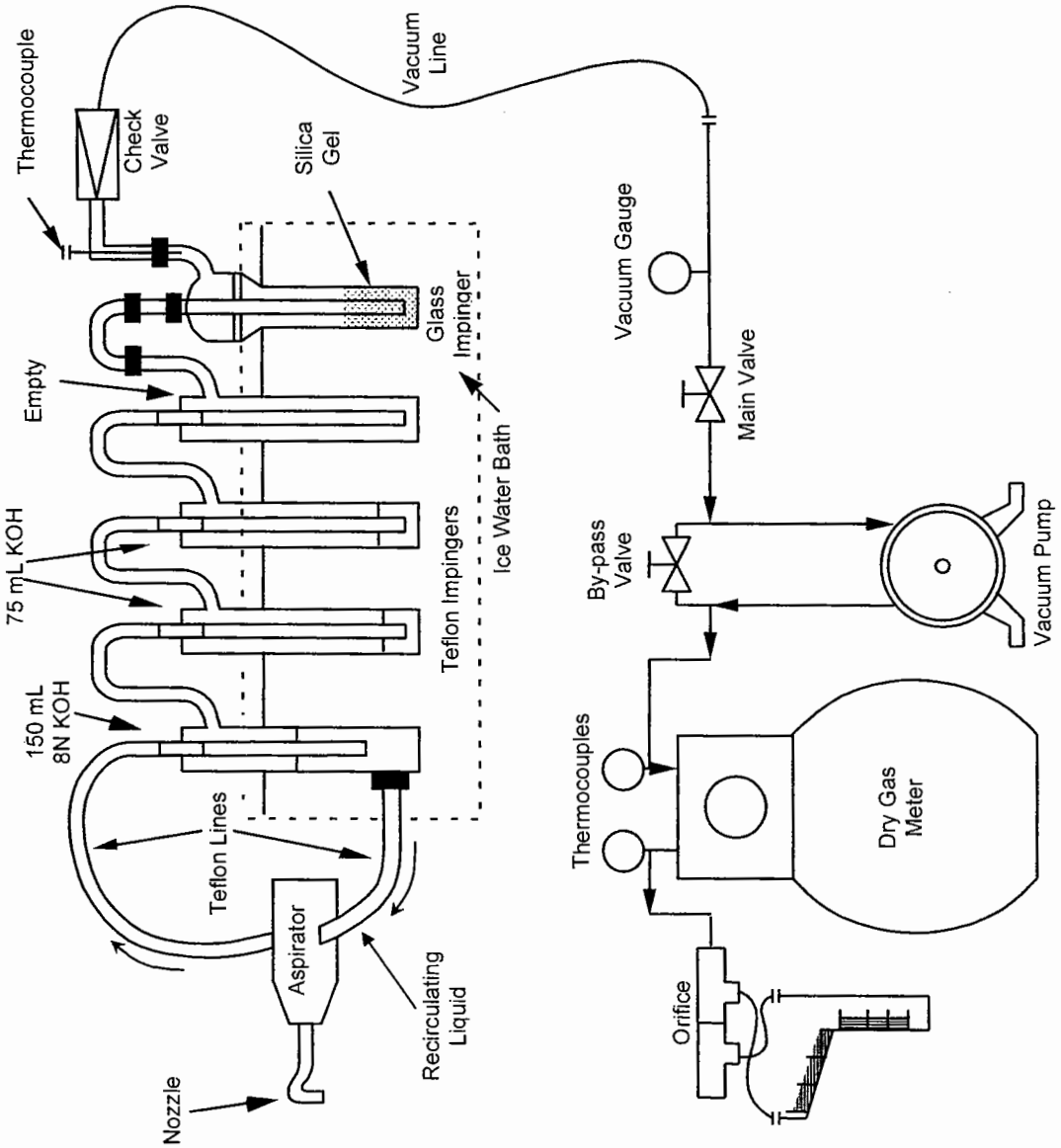


FIGURE 2-12. SW-846 METHOD 0061 SAMPLING TRAIN

Metering System - Apex Model 522. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with ±2 percent accuracy, and related equipment as required to maintain an isokinetic sampling rate and to determine sample volume.

Barometer - Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within ±0.1 in. Hg.

2.2.19.2 Sampling Procedures

All sample train components from the glass nozzle to the silica gel impinger and sample containers were cleaned prior to sampling in hot soapy water designed for laboratory cleaning of glassware. Next, the components and containers were rinsed three times with tap water, followed by three additional rinses with reagent water. Then the components and containers were soaked in 10% (v/v) HNO_3 solution for a minimum of 4 hours, rinsed three times with reagent water, and allowed to air dry. All openings where contamination can occur were covered with Parafilm, or equivalent, until the sampling train was assembled for sampling.

The sampling train was leak-checked at the sampling site by plugging the inlet to the nozzle and pulling a vacuum of 15 in. Hg. Leak rates of less than 0.02 ft^3/min at a vacuum of 15 in. Hg were recorded in all cases. At the completion of each test run, the sampling train was again leak-checked by the same procedure, but at the highest vacuum attained during the test run.

Ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at less than 68°F.

At the end of each sampling run, the pH of the first impinger was determined. If the pH of the solution was less than 8.5, the solution was discarded.

2.2.19.3 Sample Recovery Procedures

After sampling was completed, a post-test nitrogen purge was conducted with the impingers still on ice for 30 minutes. The following sampling train clean-up procedure was performed:

Container 1 – The contents of the first three impingers were placed in a polyethylene sample container and measured volumetrically to within 1 mL. The inside of the glass nozzle, aspirator, sample and recirculation lines, impingers and connecting tubing were rinsed four times with reagent water and added to Container 1.

Container 2 – The entire train assembly (from the nozzle to the fourth impinger) was rinsed three times with 0.1 N HNO_3 and the rinses were placed in a polyethylene sample container. The liquid level was marked after the container was sealed.

Container 3 - The silica gel from impinger 5 was placed in Container 3.

Containers 4, 5 & 6 - During testing, a KOH blank, reagent water blank and 0.1 N HNO_3 blank were collected and placed into respective polyethylene sample containers for analysis. The liquid level was marked after the container was sealed.

2.2.19.4 Analytical Procedures

After all chain of custody forms were completed, the samples were shipped to the laboratory for analysis in accordance with SW-846 Method 0061 and 7199 by ion chromatography coupled with a post column reactor (IC/PCR).

SECTION THREE Process Description

The FCCU 500, constructed in 1945, is identified as Unit ID 230 and rated at 115,000 barrels per day. This facility converts hydrocarbons that boil above 500°F into lower molecular weight products, which include gasoline and LPG. The cracking takes place as the gas oil and catalyst stream mix in the reactor. This process results in the catalyst being coated with coke, which is subsequently burned off in a regenerator.

SECTIONFOUR Test Results

The test results are presented in Table 4-1 through 4-18.

The calculation summaries, field data, analytical data, FTIR and reference method monitoring data, calibration data, process data and test program qualifications are included in the appendices as detailed in the Table of Contents.

DISCUSSION

Volatile Organic HAPs

Data presented for the volatile organic HAPs (see Tables 4-7 and 4-8) should be qualified with the following observances:

1. Concentrations of acetone in the Test Run No. 1 sample and methanol in Test Run Nos. 1, 2 and 3 samples appear as artifacts of cross-method contamination. Elevated levels of these compounds should not be considered characteristic of the FCCU atmospheric emissions. This is further corroborated by the results of the USEPA Method 25A test runs presented in Table 4-9 confirming total non-methane hydrocarbons concentration in the stack is less than 1 ppmv.

2. Based upon the cross-method contamination levels of methanol found in the Method 308/18 co-located sampling trains, recovery values for the spiked train could not accurately be determined.

3. The laboratory reported inconsistencies with the recovery of nitrobenzene-d5 and subsequent quantification of native nitrobenzene. The purge and trap analysis suffered from run to run carry-over and there was no clear evidence of nitrobenzene in the samples. The detection limits for nitrobenzene were raised because of the uncertainty of low level data. Nitrobenzene data is also available from the SVOC data presented in Appendix C.

4. The spiked and unspiked sampling trains for Test Run Nos. 2 and 3 appeared to be contaminated with high levels of dichloromethane, which is a common field use sample recovery and laboratory solvent. The quantities detected in the samples were severe enough to cause interferences from acrolein, acetonitrile, carbon disulfide, acrylonitrile and hexane region of the GC/MS instrumental run.

5. Recoveries of 1,3-butadiene-d5 (a labeled spike for both co-located trains) were lower than anticipated although this analyte was not identified in the source above the MDL.

Semi-Volatile HAPs

High laboratory control sample recovery on acenapthelene (above the target control limit of 50-100%) indicated a potential for high bias on the sample data for this target analyte.

Dioxins/Furans/PCBs

USEPA Method 23 test results for Test Run No. 1 conducted on June 7, 2011 indicated high and possibly suspect stack gas concentration values for D/F and PCB. Contamination of the Run No. 1 sampling train components and/or collection media during the sampling, sample recovery or extraction/analysis procedures is a possible root cause of these results, but cannot be confirmed. The method blank analysis did not indicate evidence of collection media contamination. It should be noted that the Run No. 1 test results, although suspect, were included in calculating the three-run average concentrations and emission rates for the Method 23 analytes. Test Run Nos. 2 and 3 both indicated considerably lower and more consistent results compared to Run No. 1.

$PM_{2.5}$

Based upon review of the analytical results for the original three $PM_{2.5}$ test runs, it was determined that contamination was apparent in the CPM organic fractions for Test Run Nos. 2 and 3. The condensable organic fractions of these sample runs measured uncharacteristically high values, emitted a strong odor and were yellow in color. Experience has proven that this contamination is a result of the adhesive from high temperature glass fiber electrical tape bleeding into the sample collection stream. Although leakage rates of these samples were within specifications, it is ARI's theory that there was a clean break or crack of the glass-lined probe that would seal itself under vacuum and open up at normal sampling conditions. The probe, however, was found to pass all pre-test and post-test leak checks. Based upon the apparent contamination, these sample runs could not be considered indicative of the actual FCCU emission rate data for $PM_{2.5}$, including CPM, and were excluded from their respective data set. Therefore, two additional $PM_{2.5}$/CPM test runs were conducted on August 2, 2011 to complete a valid data set.

SECTIONFOUR Test Results

TABLE 4-1. FCCU 500 STACK D/F CONCENTRATION TEST RESULTS SUMMARY

RUN NO. :	M23-1	M23-2	M23-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	12:57 - 17:36	08:55 - 13:24	14:15 - 18:28	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.852	99.736	102.547	94.378
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.40	17.70	18.00	17.70
Oxygen, av. % vol	1.60	1.60	1.60	1.60
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Total Dioxins collected, nanograms	10.50	2.33	1.97	4.93
Total Furans collected, nanograms	153.00	5.55	7.59	55.38
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total Dioxins and Furans				
Concentration, pg/dscm				
2,3,7,8-TCDD	**2.7406**	< 0.4783	< 0.4076	< 1.2088
Total TCDD	**48.0257**	**2.5453**	**2.6901**	**17.7537**
1,2,3,7,8-PeCDD	**4.5677**	< 0.5193	< 0.5256	< 1.8709
Total PeCDD	**39.9344**	**1.1392**	**1.5706**	**14.2147**
1,2,3,4,7,8-HxCDD	**1.7827**	< 0.5132	< 0.3787	< 0.8915
1,2,3,6,7,8-HxCDD	**3.8107**	< 0.5481	< 0.3932	< 1.5840
1,2,3,7,8,9-HxCDD	**5.4812**	< 0.5563	**0.3911**	< 2.1429
Total HxCDD	**28.1890**	**1.3691**	**3.9523**	**11.1702**
1,2,3,4,6,7,8-HpCDD	**14.1728**	**0.9545**	**1.2830**	**5.4701**
Total HpCDD	**22.0031**	**1.5293**	**3.4971**	**9.0098**
Total OCDD	**17.5659**	**4.9880**	**5.1525**	**9.2355**
2,3,7,8-TCDF	**20.1238**	**0.4208**	**0.3207**	**6.9551**
Total TCDF	**553.3393**	**2.9764**	**6.6838**	**187.6665**
1,2,3,7,8-PeCDF	**37.5853**	< 0.4495	**0.3890**	< 12.8080
2,3,4,7,8-PeCDF	**19.8889**	< 0.4146	**0.3559**	< 6.8865
Total PeCDF	**224.4678**	**0.8888**	**1.1112**	**75.4893**
1,2,3,4,7,8-HxCDF	**19.5496**	**0.2278**	**0.4904**	**6.7560**
1,2,3,6,7,8-HxCDF	**23.2559**	< 0.2566	**0.5628**	< 8.0251
2,3,4,6,7,8-HxCDF	**12.9461**	< 0.2381	< 0.1955	< 4.4599
1,2,3,7,8,9-HxCDF	**32.3651**	< 0.3100	< 0.2504	< 10.9752
Total HxCDF	**151.6463**	**0.7205**	**1.3078**	**51.2249**
1,2,3,4,6,7,8-HpCDF	**19.7323**	< 0.4660	**0.9332**	< 7.0438
1,2,3,4,7,8,9-HpCDF	**45.1546**	< 0.6774	< 0.4573	< 15.4298
Total HpCDF	**84.8280**	< 0.5604	**0.9332**	< 28.7739
Total OCDF	**40.7174**	< 1.0879	**0.7698**	< 14.1917
TOTAL	1,473.8741*	< 24.8354	< 35.0030	< 511.2375

*See Discussion of Test Results: Page 4-2.

SECTIONFOUR Test Results

TABLE 4-2. FCCU 500 STACK D/F EMISSION RATE TEST RESULTS SUMMARY

RUN NO. :	M23-1	M23-2	M23-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	12:57 - 17:36	08:55 - 13:24	14:15 - 18:28	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.852	99.736	102.547	94.378
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.40	17.70	18.00	17.70
Oxygen, av. % vol	1.60	1.60	1.60	1.60
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Total Dioxins collected, nanograms	10.50	2.33	1.97	4.93
Total Furans collected, nanograms	153.00	5.55	7.59	55.38
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total Dioxins and Furans				
Mass Emission, lb/hr				
2,3,7,8-TCDD	**1.3350E-09**	< 3.0125E-10	< 2.5267E-10	< 6.2964E-10
Total TCDD	**2.3394E-08**	**1.6032E-09**	**1.6673E-09**	**8.8883E-09**
1,2,3,7,8-PeCDD	**2.2250E-09**	< 3.2710E-10	< 3.2577E-10	< 9.5930E-10
Total PeCDD	**1.9453E-08**	**7.1756E-10**	**9.7347E-10**	**7.0480E-09**
1,2,3,4,7,8-HxCDD	**8.6839E-10**	< 3.2322E-10	< 2.3471E-10	< 4.7544E-10
1,2,3,6,7,8-HxCDD	**1.8563E-09**	< 3.4520E-10	< 2.4369E-10	< 8.1506E-10
1,2,3,7,8,9-HxCDD	**2.6700E-09**	< 3.5038E-10	**2.4241E-10**	< 1.0876E-09
Total HxCDD	**1.3732E-08**	**8.6236E-10**	**2.4497E-09**	**5.6812E-09**
1,2,3,4,6,7,8-HpCDD	**6.9039E-09**	**6.0120E-10**	**7.9520E-10**	**2.7668E-09**
Total HpCDD	**1.0718E-08**	**9.6321E-10**	**2.1675E-09**	**4.6163E-09**
Total OCDD	**8.5568E-09**	**3.1417E-09**	**3.1936E-09**	**4.9640E-09**
2,3,7,8-TCDF	**9.8028E-09**	**2.6504E-10**	**1.9880E-10**	**3.4222E-09**
Total TCDF	**2.6954E-07**	**1.8747E-09**	**4.1427E-09**	**9.1854E-08**
1,2,3,7,8-PeCDF	**1.8309E-08**	< 2.8314E-10	**2.4112E-10**	< 6.2776E-09
2,3,4,7,8-PeCDF	**9.6883E-09**	< 2.6117E-10	**2.2060E-10**	< 3.3900E-09
Total PeCDF	**1.0934E-07**	< 5.5983E-10	**6.8874E-10**	< 3.6864E-08
1,2,3,4,7,8-HxCDF	**9.5231E-09**	**1.4351E-10**	**3.0397E-10**	**3.3235E-09**
1,2,3,6,7,8-HxCDF	**1.1328E-08**	< 1.6161E-10	**3.4886E-10**	< 3.9463E-09
2,3,4,6,7,8-HxCDF	**6.3063E-09**	< 1.4998E-10	< 1.2120E-10	< 2.1925E-09
1,2,3,7,8,9-HxCDF	**1.5766E-08**	< 1.9523E-10	< 1.5519E-10	< 5.3721E-09
Total HxCDF	**7.3870E-08**	**4.5381E-10**	**8.1059E-10**	**2.5045E-08**
1,2,3,4,6,7,8-HpCDF	**9.6121E-09**	< 2.9349E-10	**5.7844E-10**	< 3.4947E-09
1,2,3,4,7,8,9-HpCDF	**2.1996E-08**	< 4.2666E-10	< 2.8345E-10	< 7.5686E-09
Total HpCDF	**4.1322E-08**	< 3.5296E-10	**5.7844E-10**	< 1.4084E-08
Total OCDF	**1.9834E-08**	< 6.8524E-10	**4.7712E-10**	< 6.9989E-09
TOTAL	**6.1644E-07***	< 1.5643E-08	< 2.1695E-08	< 2.5177E-07

*See Discussion of Test Results: Page 4-2.

TABLE 4-3. FCCU 500 STACK PCB CONCENTRATION TEST RESULTS SUMMARY

RUN NO. :	M23-1	M23-2	M23-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	12:57 - 17:36	08:55 - 13:24	14:15 - 18:28	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total PCB Emissions				
Concentration, pg/dscm				
PCB-77 33'44'-TeCB	135.7	14.8	18.5	56.4
PCB-81 344'5-TeCB	18.7	1.1	2.1	7.3
PCB-105 233'44'-PeCB	281.9	30.6	44.5	119.0
PCB-114 2344'5-PeCB	24.6	3.1	3.6	10.5
PCB-118 23'44'5-PeCB	777.8	88.7	125.0	330.5
PCB-123 2'344'5-PeCB	75.7	8.7	13.1	32.5
PCB-126 33'44'5-PeCB	18.2	1.0	1.1	6.8
PCB-156 233'44'5-HxCB	32.1	4.7	6.3	14.4
PCB-157 233'44'5'-HxCB	9.4	1.2	1.6	4.0
PCB-167 23'44'55'-HxCB	28.2	2.9	3.3	11.5
PCB-169 33'44'55'-HxCB	4.7	0.3	0.6	1.9
PCB-189 233'44'55'-HpCB	14.8	0.8	0.8	5.5
Total PCB	**1,421.9***	**157.9**	**220.4**	**600.0**

*See Discussion of Test Results: Page 4-2.

TABLE 4-4. FCCU 500 STACK PCB EMISSION RATE TEST RESULTS SUMMARY

RUN NO. :	M23-1	M23-2	M23-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	12:57 - 17:36	08:55 - 13:24	14:15 - 18:28	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total PCB Emissions				
Emission Rate, lb/hr				
PCB-77 33'44'-TeCB	6.6115E-08	9.3347E-09	1.1479E-08	2.8976E-08
PCB-81 344'5-TeCB	9.1035E-09	6.9170E-10	1.2723E-09	3.6892E-09
PCB-105 233'44'-PeCB	1.3732E-07	1.9264E-08	2.7575E-08	6.1385E-08
PCB-114 2344'5-PeCB	1.2002E-08	1.9523E-09	2.2573E-09	5.4040E-09
PCB-118 23'44'5-PeCB	3.7889E-07	5.5853E-08	7.7467E-08	1.7074E-07
PCB-123 2'344'5-PeCB	3.6872E-08	5.4819E-09	8.1059E-09	1.6820E-08
PCB-126 33'44'5-PeCB	8.8873E-09	6.2059E-10	6.7207E-10	3.3933E-09
PCB-156 233'44'5-HxCB	1.5639E-08	2.9737E-09	3.8990E-09	7.5038E-09
PCB-157 233'44'5'-HxCB	4.5772E-09	7.3954E-10	9.6321E-10	2.0933E-09
PCB-167 23'44'55'-HxCB	1.3732E-08	1.8488E-09	2.0649E-09	5.8818E-09
PCB-169 33'44'55'-HxCB	2.2886E-09	1.8618E-10	3.5271E-10	9.4249E-10
PCB-189 233'44'55'-HpCB	7.2218E-09	4.9777E-10	4.6942E-10	2.7296E-09
Total PCB	**6.9264E-07***	**9.9445E-08**	**1.3658E-07**	**3.0955E-07**

*See Discussion of Test Results: Page 4-2.

TABLE 4-5. FCCU 500 STACK SVOC CONCENTRATION TEST RESULTS SUMMARY

RUN NO. :	0010-1	0010-2	0010-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	13:27 - 17:36	09:25 - 13:24	14:45 - 18:13	Average
SVOC Sample Parameters				
Time, min	180	180	180	
Volume, dscm	3.290	3.491	3.308	
Volume, dscf	116.182	123.267	116.795	
Isokinetic rate, %	105.9	109.1	105.0	
Concentration - µg/dscm				
Acenaphthene	**0.05440**	**0.00544**	**0.01363**	**0.02449**
Acenaphthylene	**0.02553**	**0.01160**	**0.00623**	**0.01445**
Aniline	< 0.56225	< 0.52993	< 0.55930	< 0.55050
Anthracene	**0.00559**	**0.00148**	**0.00195**	**0.00301**
Benzidine	**11.54897**	**10.88511**	**11.48836**	**11.30748**
Benzo[a]anthracene	< 0.00282	< 0.00115	< 0.00121	< 0.00173
Benzo[b]fluoranthene	< 0.00477	< 0.00146	< 0.00121	< 0.00248
Benzo[k]fluoranthene	< 0.00307	< 0.00115	< 0.00121	< 0.00181
Benzo[g,h,i]perylene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
Benzo[a]pyrene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
Benzo[e]pyrene	< 0.00939	< 0.00115	< 0.00121	< 0.00392
Biphenyl	**5.13625**	**0.73331**	**0.44139**	**2.10365**
Cresols	< 2.35538	< 2.21999	< 2.34302	< 2.30613
Chrysene	**0.01036**	**0.00367**	**0.00180**	**0.00528**
Dibenz[a,h]anthracene	< 0.00180	< 0.00115	< 0.00121	< 0.00138
Dibenzofuran	< 0.69902	< 0.65884	< 0.69535	< 0.68440
Dibenzo(a,e)pyrene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
3,3'-Dimethoxybenzidine	< 8.81369	< 8.30706	< 8.76743	< 8.62939
Dimethylaminobenzene	< 0.60784	< 0.57290	< 0.60465	< 0.59513
7,12-Dimethylbenz(a)anthracene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
3,3'-Dimethylbenzidine	< 8.81369	< 8.30706	< 8.76743	< 8.62939
a,a-Dimethylphenethylamine	< 3.64704	< 3.43740	< 3.62790	< 3.57078
2,4-Dimethylphenol	< 0.79019	< 0.74477	< 0.78605	< 0.77367
Fluoranthene	**0.03677**	**0.01212**	**0.00523**	**0.01804**
Fluorene	**0.06413**	**0.01467**	**0.01572**	**0.03150**
Indeno(1,2,3-cd)pyrene	< 0.00272	< 0.00115	< 0.00121	< 0.00169
Isophorone	< 0.68382	< 0.64451	< 0.68023	< 0.66952
3-Methylcholanthrene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
2-Methylnaphthalene	**2.43136**	**0.16328**	**0.60163**	**1.06542**
Naphthalene	**0.96647**	**0.35233**	**0.42023**	**0.57968**
Perylene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
Phenanthrene	**0.17627**	**0.05901**	**0.04081**	**0.09203**
Phenol	**2.99361**	**2.47779**	**2.35814**	**2.60985**
1,4-Phenylenediamine	< 5.47056	< 5.15611	< 5.44185	< 5.35617
Pyrene	**0.04073**	**0.01063**	**0.00580**	**0.01905**
o-Toluidine	< 1.51960	< 1.43225	< 1.51163	< 1.48783

TABLE 4-6. FCCU 500 STACK SVOC EMISSION RATE TEST RESULTS SUMMARY

RUN NO. :	0010-1	0010-2	0010-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	13:27 - 17:36	09:25 - 13:24	14:45 - 18:13	Average
SVOC Sample Parameters				
Time, min	180	180	180	
Volume, dscm	3.290	3.491	3.308	
Volume, dscf	116.182	123.267	116.795	
Isokinetic rate, %	105.9	109.1	105.0	
Emission Rate - lb/hr x 10^{-5}				
Acenaphthene	**2.993**	**0.309**	**0.761**	**1.354**
Acenaphthylene	**1.405**	**0.658**	**0.348**	**0.803**
Aniline	< 30.935	< 30.046	< 31.218	< 30.733
Anthracene	**0.308**	**0.084**	**0.109**	**0.167**
Benzidine	< 635.428	< 617.167	< 641.226	< 631.274
Benzo[a]anthracene	< 0.155	< 0.065	< 0.067	< 0.096
Benzo[b]fluoranthene	< 0.263	< 0.083	< 0.067	< 0.138
Benzo[k]fluoranthene	< 0.169	< 0.065	< 0.067	< 0.100
Benzo[g,h,i]perylene	< 0.067	< 0.065	< 0.067	< 0.066
Benzo[a]pyrene	< 0.067	< 0.065	< 0.067	0.066
Benzo[e]pyrene	< 0.517	< 0.065	< 0.067	< 0.216
Biphenyl	**282.598**	**41.578**	**24.637**	**116.271**
Cresols	< 129.594	< 125.870	< 130.776	< 128.747
Chrysene	**0.570**	**0.208**	**0.100**	**0.293**
Dibenz[a,h]anthracene	< 0.099	< 0.065	< 0.067	< 0.077
Dibenzofuran	< 38.460	< 37.355	< 38.811	< 38.209
Dibenzo(a,e)pyrene	< 0.067	< 0.065	< 0.067	< 0.066
3,3'-Dimethoxybenzidine	< 484.932	< 470.996	< 489.357	< 481.762
Dimethylaminobenzene	< 33.444	< 32.482	< 33.749	< 33.225
7,12-Dimethylbenz(a)anthracene	< 0.067	< 0.065	< 0.067	< 0.066
3,3'-Dimethylbenzidine	< 484.932	< 470.996	< 489.357	< 481.762
a,a-Dimethylphenethylamine	< 200.662	< 194.895	< 202.493	< 199.350
2,4-Dimethylphenol	< 43.477	< 42.227	< 43.873	< 43.192
Fluoranthene	**2.023**	**0.687**	**0.292**	**1.001**
Fluorene	**3.528**	**0.832**	**0.877**	**1.746**
Indeno(1,2,3-cd)pyrene	< 0.150	< 0.065	< 0.067	< 0.094
Isophorone	< 37.624	< 36.543	< 37.967	< 37.378
3-Methylcholanthrene	< 0.067	< 0.065	< 0.067	0.0664
2-Methylnaphthalene	**133.774**	**9.258**	**33.580**	**58.871**
Naphthalene	**53.175**	**19.977**	**23.455**	**32.202**
Perylene	< 0.067	< 0.065	< 0.067	0.0664
Phenanthrene	**9.699**	**3.346**	**2.278**	**5.107**
Phenol	**164.710**	**140.487**	**131.620**	**145.606**
1,4-Phenylenediamine	< 300.992	< 292.342	< 303.739	< 299.024
Pyrene	**2.241**	**0.603**	**0.324**	**1.056**
o-Toluidine	< 83.609	< 81.206	< 84.372	< 83.062

TABLE 4-7. FCCU 500 STACK VOLATILE ORGANIC HAP TEST RESULTS SUMMARY

RUN NO. :	18-1	18-2	18-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	14:04 - 15:24	12:04 - 13:24	17:08 - 18:28	Average
Stack Gas Parameters				
Temperature, av. °F	544.1	543.4	544.5	544.0
Velocity, av. ft/sec	89.145	94.180	91.874	91.733
Volume flow, acfm	340,270	359,487	350,687	350,148
Volume flow, scfm	174,139	184,688	179,970	179,599
Volume flow, dscfm	146,649	151,324	148,967	148,980
Volume flow, scfh	10,448,358	11,081,285	10,798,203	10,775,949
Volume flow, dscfh	8,798,924	9,079,436	8,938,046	8,938,802
Moisture, av. % vol	15.79	18.07	17.23	17.03
CO_2, av. % vol, db	18.0	17.7	18.0	17.9
O_2, av. % vol, db	1.5	1.6	1.6	1.6

RUN NO. :	18-1		18-2		18-3		Average	
Compound	VOC Concentration (µg/dscm)	VOC Emission Rate (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission Rate (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission Rate (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission Rate (lb/hr)
Acetone	6,900	3.791	NA	NA	NA	NA	6,900	3.791
Acetonitrile	< 218	< 0.120	NA	NA	NA	NA	< 218	< 0.120
Acrolein	< 218	< 0.120	NA	NA	NA	NA	< 218	< 0.120
Acrylonitrile	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Benzene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
1,3-Butadiene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Carbon disulfide	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Chlorobenzene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Cumene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
1,2-Dibromoethane	< 216	< 0.119	< 228	< 0.129	321	0.179	< 255	< 0.142
Ethylbenzene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Hexane	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Methyl isobutyl ketone	< 218	< 0.120	< 233	< 0.132	< 212	< 0.119	< 221	< 0.123
Methyl t-butyl ether	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Methylene chloride	< 218	< 0.120	NA	NA	NA	NA	< 218	< 0.120
Nitrobenzene	< 1,081	< 0.594	< 1,259	< 0.714	< 1,044	< 0.582	< 1128	< 0.630
2-Nitropropane	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Pentane	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Styrene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Tetrachloroethene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Toluene	< 218	< 0.120	< 233	< 0.132	< 212	< 0.119	< 221	< 0.123
Trichloroethene	< 218	< 0.120	< 233	< 0.132	< 212	< 0.119	< 221	< 0.123
2,2,4 Trimethyl pentane	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Xylenes	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122

NA = Data not available

TABLE 4-8. FCCU 500 STACK METHANOL TEST RESULTS SUMMARY

RUN NO. :	Methanol - 1	Methanol - 2	Methanol - 3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	14:04 - 15:04	12:04 - 13:04	17:08 - 18:08	Average
Stack Gas Parameters				
Temperature, av. °F	544.1	543.4	544.5	544.0
Velocity, av. ft/sec	89.145	94.180	91.874	91.733
Volume flow, acfm	340,270	359,487	350,687	350,148
Volume flow, scfm	174,139	184,688	179,970	179,599
Volume flow, dscfm	146,649	151,324	148,967	148,980
Volume flow, scfh	10,448,358	11,081,285	10,798,203	10,775,949
Volume flow, dscfh	8,798,924	9,079,436	8,938,046	8,938,802
Moisture, av. % vol	15.79	18.07	17.23	17.03
CO_2, av. % vol, db	18.0	17.7	18.0	17.9
O_2, av. % vol, db	1.5	1.6	1.6	1.6
Spiked Train Parameters				
Time, min	60	60	60	
Volume, std liters	15.851	16.500	14.599	
Volume, dscf	0.560	0.583	0.515	
Unspiked Train Parameters				
Time, min	60	60	60	
Volume, std liters	14.207	13.458	14.862	
Volume, dscf	0.502	0.475	0.525	
Methanol Data				
Spike Recovered (R), fractional	2.552	0.414	0.000	
Concentration				
ppbv db	63,534[a]	131,336[a]	0[b]	64,957[a,c]
mg/dscm	84,629[a]	174,944[a]	0[b]	86,524[a,c]
lb/dscf x 10^{-6}	5.2838[a]	10.9225[a]	0.0000[b]	5.4021[a,c]
Emission Rate				
lb/hr	46.491[a]	99.170[a]	0.000[b]	48.554[a,c]

[a]Test results are attributed to cross-method contamination between the Method 308/18 sampling train for methanol and the Method 18 chilled impinger sampling train for volatile HAP. These methanol results should be considered invalid based upon Method 25A test results indicating stack total non-methane hydrocarbon concentration is less than 1 ppmv dry basis. Further confirmation that stack methanol concentration is less than 1 ppmv is supported by Method 320 FTIR test data.

[b]Test results reported as "zero" based upon unspiked train methanol concentration exceeding the spiked train concentration resulting in an unrealistic spike recovery value.

[c]The average for the three runs includes the Run 3 zero value.

TABLE 4-9. FCCU 500 STACK THC, METHANE AND ETHANE TEST RESULTS SUMMARY

RUN NO. :	1	2	3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	13:27 - 14:27	09:25 - 10:25	14:45 - 15:45	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
THC (as Propane)				
Concentration				
ppmv db	1.56	0.58	0.44	0.86
Emission Rate				
lb/hr	1.40	0.67	0.50	0.85
Methane				
Concentration				
ppmv db	< 0.18	< 0.18	< 0.18	< 0.18
Emission Rate				
lb/hr	< 0.06	< 0.09	< 0.07	< 0.07
Ethane				
Concentration				
ppmv db	< 0.10	< 0.10	< 0.10	< 0.10
Emission Rate				
lb/hr	< 0.06	< 0.09	< 0.08	< 0.08

TABLE 4-10. FCCU 500 STACK USEPA METHOD 301/320 VALIDATION STUDY RESULTS SUMMARY

Compound	Test Date	Stack Gas % of Dynamic Spiking	Ss Spiked Result RSD	Su Unspiked Result RSD	Instrument Accuracy (%)	Average Spike Recovery (%)	CF Value	Calculated Bias Value	Student t-Test Value	Pass Method 301 Validation
Acetaldehyde	6/7/2011	92.2	3.1	22.4	2.23	97.77	1.07	0.51	2.005	Yes
Formaldehyde	6/7/2011	96.1	6.1	29.3	1.55	98.45	1.02	0.09	0.354	Yes
Hydrogen Cyanide	6/7/2011	90.9	4.3	32.8	3.62	96.38	0.95	-0.49	1.223	Yes
Ammonia	6/9/2011	90.7	7.0	38.6	3.23	96.77	0.93	-0.69	1.069	Yes
Acceptance Criteria		**> 90%**	**< 50%**	**< 50%**	**< 20 %**	**70 - 130%**	**0.7 < CF < 1.3**	**-----**	**< 2.201**	**-----**

TABLE 4-11. FCCU 500 STACK ALDEHYDES TEST RESULTS SUMMARY

RUN NO. :	1	2	3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	12:58 - 14:58	09:30 - 10:30	14:15 - 16:15	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Acetaldehyde				
Concentration				
ppmv wb	0.34	0.86	0.73	0.64
µg/dscm	754.78	1,828.88	1,620.82	1,401.49
Emission rate				
lb/hr	0.37	1.15	1.00	0.84
Formaldehyde				
Concentration				
ppmv wb	0.21	0.31	0.20	0.24
µg/dscm	317.81	449.42	302.73	356.65
Emission rate				
lb/hr	0.15	0.28	0.19	0.21
Propanal				
Concentration				
ppmv wb	0.21	0.27	0.19	0.22
µg/dscm	614.67	757.06	556.22	642.65
Emission rate				
lb/hr	0.30	0.48	0.34	0.37

TABLE 4-12. FCCU 500 STACK HCl, HF AND Cl_2 TEST RESULTS SUMMARY

RUN NO. :	FCCU-26-1	FCCU-26-2	FCCU-26-3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	15:56 - 17:56	9:17 - 11:17	14:15 - 16:15	Average
Stack Gas Parameters				
Temperature, av. °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.07	100.79	103.04	94.63
Volume flow, acfm	305,641	384,704	393,295	361,214
Volume flow, scfh	9,366,385	11,838,020	12,093,315	11,099,240
Volume flow, dscfh	8,143,430	9,641,561	9,721,839	9,168,943
Moisture, av. % vol	13.06	18.55	19.61	17.07
CO_2, av. % vol, db	17.30	17.70	18.00	17.67
O_2, av. % vol, db	1.60	1.50	1.50	1.53
Sample Data				
Time, min	120.0	120.0	120.0	120.0
Volume, dscf	70.396	72.916	71.493	71.602
Volume, dscm	1.994	2.065	2.025	2.028
Hydrogen Chloride (HCl)				
Concentration				
ppmv db	0.39	0.33	0.50	0.41
mg/dscm	0.000472	0.000401	0.000613	0.000495
lb/dscf x 10^{-6}	0.0368	0.0312	0.0477	0.0386
Emission rate				
lb/hr	0.299	0.301	0.464	0.355
Chlorine (Cl_2)				
Concentration				
ppmv db	0.02	0.02	0.05	0.03
mg/dscm	0.000052	0.000054	0.000108	0.000071
lb/dscf x 10^{-6}	0.0040	0.0042	0.0084	0.0055
Emission rate				
lb/hr	0.033	0.041	0.082	0.052
Hydrogen Fluoride (HF)				
Concentration				
ppmv db	0.03	0.03	0.02	0.03
mg/dscm	0.000023	0.000018	0.000017	0.000019
lb/dscf x 10^{-6}	0.0018	0.0014	0.0013	0.0015
Emission rate				
lb/hr	0.015	0.014	0.013	0.014

TABLE 4-13. FCCU 500 STACK HCN TEST RESULTS SUMMARY

RUN NO. :	1	2	3	
TEST DATE :	6/7/2011	6/8/2011	6/8/2011	
TEST TIME :	12:58 - 14:58	09:30 - 10:30	14:15 - 16:15	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Hydrogen Cyanide				
Concentration				
ppmv wb	0.76	0.57	0.50	0.61
microgram/dscm	1,035.27	743.81	681.21	820.10
Emission rate				
lb/hr	0.50	0.47	0.42	0.46

TABLE 4-14. FCCU 500 STACK $PM_{2.5}$ AND CPM TEST RESULTS SUMMARY

RUN NO. :	202-1	202-4	202-5	
TEST DATE :	6/9/2011	8/2/2011	8/2/2011	
TEST TIME :	15:10 - 19:32	08:20 - 12:32	13:30 - 17:31	Average
Stack Gas Parameters				
Temperature, °F	554.2	560.9	559.2	557.6
Velocity, av. ft/sec	113.0	104.7	104.7	108.8
Volumetric flow, acfm	431,345	399,470	401,659	415,407
Volumetric flow, scfm	218,384	202,521	203,136	210,453
Volumetric flow, dscfh	10,804,595	9,973,200	10,032,939	10,388,898
Moisture, av. % vol	17.5	17.9	17.7	17.7
Carbon Dioxide, av. % vol	18.0	17.8	17.9	17.9
Oxygen, av. % vol	2.0	1.8	1.6	1.9
$PM_{2.5}$ Sample				
Time, min	243.5	240.3	235.0	239.6
Volume, dscf	75.319	78.194	74.785	76.100
Filterable $PM_{2.5}$, mg	64.0	37.5	29.6	43.7
Condensable $PM_{2.5}$, mg	49.3	16.7	27.7	31.2
Total $PM_{2.5}$, mg	113.3	54.1	57.3	74.9
Isokinetic Ratio, %	103.8	97.6	94.9	98.8
D_{50} Cutpoint, µm	2.74	2.58	2.65	2.66
Filterable $PM_{2.5}$				
Concentration				
grains/dscf	0.0131	0.0074	0.0051	0.0085
x 10^{-6} lb/dscf	1.874	1.056	0.872	1.268
Emission Rate				
lb/hr	20.253	10.535	8.750	13.180
Condensable $PM_{2.5}$				
Concentration				
grains/dscf	0.0101	0.0033	0.0057	0.0064
x 10^{-6} lb/dscf	1.443	0.470	0.817	0.910
Emission Rate				
lb/hr	15.594	4.683	8.194	9.490
Total $PM_{2.5}$				
Concentration				
grains/dscf	0.0232	0.0107	0.0118	0.0152
x 10^{-6} lb/dscf	3.318	1.526	1.689	2.177
Emission Rate				
lb/hr	35.847	15.218	16.944	22.670

TABLE 4-15. FCCU 500 STACK PM AND METALS TEST RESULTS SUMMARY

RUN NO. :	5/29 - 1	5/29 - 2	5/29 - 3	
TEST DATE :	6/9/2011	6/10/2011	6/10/2011	
TEST TIME :	15:40 - 19:00	8:35 - 11:48	13:57 - 17:09	Average
Stack Gas Parameters				
Temperature, av. °F	558.0	561.0	562.8	560.6
Velocity, av. ft/sec	117.315	118.319	118.017	117.884
Volume flow, acfm	447,796	451,629	450,476	449,967
Volume flow, acmm	12,680.1	12,788.6	12,755.93	12,741.52
Volume flow, scfm	225,868	226,741	225,764	226,124
Volume flow, dscfm	192,839	188,030	186,866	189,245
Volume flow, dscmm	5,460.55	5,324.36	5,291.40	5,358.77
Volume flow, dscfh	11,570,354	11,281,791	11,211,958	11,354,701
Moisture, av. % vol	14.62	17.07	17.23	16.31
CO_2, av. % vol, db	18.30	18.40	18.50	18.40
O_2, av. % vol, db	1.60	1.40	1.40	1.47
Metals Sample				
Time, min	180.0	180.0	180.0	180.0
Volume, dscf	143.567	142.688	142.367	142.874
Volume, dscm	4.066	4.041	4.032	4.046
Isokinetic Ratio, %	101.5	103.5	103.9	103.0
Antimony (Sb)				
Concentration				
lb/dscf x 10^{-9}	0.0175	0.0297	0.0354	0.0275
mg/dscm	0.0003	0.0005	0.0006	0.0004
Emission rate				
lb/hr x 10^{-4}	2.024	3.352	3.971	3.115
Arsenic (As)				
Concentration				
lb/dscf x 10^{-9}	< 0.0184	< 0.0185	< 0.0186	< 0.0185
mg/dscm	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Emission rate				
lb/hr x 10^{-4}	< 2.132	< 2.092	< 2.083	< 2.102
Beryllium (Be)				
Concentration				
lb/dscf x 10^{-9}	< 0.0046	< 0.0046	< 0.0047	< 0.0046
mg/dscm	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Emission rate				
lb/hr x 10^{-4}	< 0.533	< 0.523	< 0.521	< 0.526
Cadmium (Cd)				
Concentration				
lb/dscf x 10^{-9}	0.0773	0.0710	0.1674	0.1052
mg/dscm	0.0012	0.0011	0.0027	0.0017
Emission rate				
lb/hr x 10^{-4}	8.939	8.008	18.768	11.905
Chromium (Cr)				
Concentration				
lb/dscf x 10^{-9}	0.1666	0.2522	0.2271	0.2153
mg/dscm	0.0027	0.0040	0.0036	0.0034
Emission rate				
lb/hr x 10^{-4}	19.281	28.451	25.456	24.396

TABLE 4-15 (CONTINUED). FCCU 500 STACK PM AND METALS TEST RESULTS SUMMARY

RUN NO. :	5/29 - 1	5/29 - 2	5/29 - 3	
TEST DATE :	6/9/2011	6/10/2011	6/10/2011	
TEST TIME :	15:40 - 19:00	8:35 - 11:48	13:57 - 17:09	Average
Lead (Pb)				
Concentration				
lb/dscf x 10^{-9}	0.3001	0.2483	0.2730	0.2738
mg/dscm	0.0048	0.0040	0.0044	0.0044
Emission rate				
lb/hr x 10^{-4}	34.717	28.012	30.609	31.113
Manganese (Mn)				
Concentration				
lb/dscf x 10^{-9}	0.0920	0.0666	0.0912	0.0833
mg/dscm	0.0015	0.0011	0.0015	0.0013
Emission rate				
lb/hr x 10^{-4}	10.641	7.511	10.225	9.459
Nickel (Ni)				
Concentration				
lb/dscf x 10^{-9}	0.2160	0.3697	0.2949	0.2935
mg/dscm	0.0035	0.0059	0.0047	0.0047
Emission rate				
lb/hr x 10^{-4}	24.990	41.704	33.066	33.253
Selenium (Se)				
Concentration				
lb/dscf x 10^{-9}	< 0.0461	< 0.0464	< 0.0465	< 0.0463
mg/dscm	< 0.0007	< 0.0007	< 0.0007	< 0.0007
Emission rate				
lb/hr x 10^{-4}	< 5.330	< 5.229	< 5.209	< 5.256
Cobalt (Co)				
Concentration				
lb/dscf x 10^{-9}	0.0392	0.0304	0.0197	0.0298
mg/dscm	0.0006	0.0005	0.0003	0.0005
Emission rate				
lb/hr x 10^{-4}	4.531	3.434	2.208	3.391
Filterable PM				
Filterable PM collected, mg	107.80	126.15	130.10	
Concentration				
gr/dscf	0.0116	0.0136	0.0141	0.0131
lb/dscf x 10^{-6}	1.6557	1.9494	2.0150	1.8734
mg/dscm	26.517	31.222	32.272	30.004
Emission rate				
lb/hr	19.151	21.986	22.585	21.240

TABLE 4-16. FCCU 500 STACK MERCURY TEST RESULTS SUMMARY

RUN NO. :	OH-1	OH-2	OH-3	
TEST DATE :	6/13/2011	6/13/2011	6/14/2011	
TEST TIME :	09:50 - 13:25	14:15 - 17:22	08:20 - 11:26	Average
Stack Gas Parameters				
Temperature, °F	560.8	560.6	561.1	560.8
Velocity, av. ft/sec	114.9	115.2	114.3	114.8
Volumetric flow, acfm	438,412	439,564	436,366	438,114
Volumetric flow, scfm	222,044	222,671	220,565	221,760
Volumetric flow, dscfh	11,071,954	10,942,543	10,917,819	10,977,439
Moisture, av. % vol	16.89	18.10	17.50	17.50
Carbon Dioxide, av. % vol	18.40	18.40	18.10	18.30
Oxygen, av. % vol	1.50	1.50	1.40	1.47
Metals Sample				
Time, min	180.0	180.0	180.0	
Volume, dscf	139.698	140.137	138.854	
Isokinetic Ratio, %	103.2	104.8	104.1	
Mercury Emissions				
Mercury-particle bound				
Mass, µg	<0.065	<0.059	<0.065	<0.063
Concentration				
µg/dscm	<0.016	<0.015	<0.017	<0.016
lb/dscf x 10^{-9}	<0.001	<0.001	<0.001	<0.001
Emission Rate				
lb/hr x 10^{-4}	<0.1136	<0.1016	<0.1127	<0.1093
Mercury-oxidized				
Mass, µg	0.849	0.073	0.246	0.389
Concentration				
µg/dscm	0.215	0.018	0.063	0.098
lb/dscf x 10^{-9}	0.013	0.001	0.004	0.006
Emission Rate				
lb/hr x 10^{-4}	1.4834	0.1250	0.4264	0.6783
Mercury-elemental				
Mass, µg	<1.299	<0.361	<0.389	<0.683
Concentration				
µg/dscm	<0.328	<0.091	<0.099	<0.173
lb/dscf x 10^{-9}	<0.020	<0.006	<0.006	<0.011
Emission Rate				
lb/hr x 10^{-4}	<2.2697	<0.6214	<0.6743	<1.1885
Mercury-total				
Mass, µg	<2.213	<0.493	<0.700	<1.135
Concentration				
µg/dscm	<0.559	<0.124	<0.178	<0.287
lb/dscf x 10^{-9}	<0.035	<0.008	<0.011	<0.018
Emission Rate				
lb/hr x 10^{-4}	<3.8667	<0.8480	<1.2134	<1.9760

SECTIONFOUR Test Results

TABLE 4-17. FCCU 500 STACK HEXAVALENT CHROMIUM TEST RESULTS SUMMARY

RUN NO. :	0061-1	0061-2	0061-3	
TEST DATE :	6/13/2011	6/13/2011	6/14/2011	
TEST TIME :	11:18 - 12:14	14:58 - 16:46	09:06 - 10:24	Average
Stack Gas Parameters				
Temperature, av. °F	557.2	558.9	559.1	558.4
Velocity, av. ft/sec	110.28	113.00	114.10	112.46
Volume flow, acfm	420,948	431,341	435,518	429,269
Volume flow, scfh	12,837,174	13,135,465	13,234,132	13,068,923
Volume flow, dscfh	10,628,836	10,961,677	11,067,593	10,886,035
Moisture, av. % vol	17.20	16.55	16.37	16.71
CO_2, av. % vol, db	18.50	18.50	18.10	18.37
O_2, av. % vol, db	1.40	1.50	1.30	1.40
Hex Chrome Sample				
Time, min	48.0	48.0	48.0	
Volume, dscf	33.756	35.010	34.866	
Volume, dscm	0.956	0.992	0.987	
Isokinetic Ratio, %	95.4	96.0	94.6	
Hexavalent Chromium				
Concentration				
lb/dscf x 10^{-6}	< 0.0008	< 0.0008	< 0.0008	< 0.0008
µg/dscm	< 0.0098	< 0.0100	< 0.0101	< 0.0100
Emission rate				
lb/hr	< 0.008	< 0.008	< 0.009	< 0.008

TABLE 4-18. FCCU 500 STACK NH_3 TEST RESULTS SUMMARY

RUN NO. :	1	2	3	
TEST DATE :	6/9/2011	6/10/2011	6/10/2011	
TEST TIME :	15:53 - 17:53	08:16 - 11:16	13:29 - 15:29	Average
Stack Gas Parameters				
Temperature, °F	558.0	561.0	562.8	560.6
Velocity, av. ft/sec	117.315	118.319	118.017	117.884
Volumetric flow, acfm	447,796	451,629	450,476	449,967
Volumetric flow, scfm	225,868	226,741	225,764	226,124
Volumetric flow, dscfh	11,570,354	11,281,791	11,211,958	11,354,701
Moisture, av. % vol	14.6	17.1	17.2	16.3
Carbon Dioxide, av. % vol	18.3	18.4	18.5	18.4
Oxygen, av. % vol	1.6	1.4	1.4	1.5
Ammonia				
Concentration				
ppmv wb	0.51	0.92	0.82	0.75
µg/dscm	422.85	785.32	701.29	636.49
Emission rate				
lb/hr	0.31	0.55	0.49	0.45

APPENDIX A Calculation Summaries

SUMMARY OF TEST RESULTS

TABLE	Dioxin and Furan Results			
COMPANY	BP			
LOCATION	Whiting, IN			
SOURCE	FCCU 500 Exhaust			
RUN NO	M23-1	M23-2	M23-3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	1257-1736	0855-1324	1415-1828	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.40	17.70	18.00	17.70
Oxygen, av. % vol	1.60	1.60	1.60	1.60
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Total Dioxins collected, nanograms	10.50	2.33	1.97	4.93
Total Furans collected, nanograms	153.00	5.55	7.59	55.38
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total Dioxins and Furans Emissions				
Concentration, pg/dscm				
2,3,7,8-TCDD	**2.7406**	< 0.4783	< 0.4076	< 1.2088
Total TCDD	**48.0257**	**2.5453**	**2.6901**	**17.7537**
1,2,3,7,8-PeCDD	**4.5677**	< 0.5193	< 0.5256	< 1.8709
Total PeCDD	**39.9344**	**1.1392**	**1.5706**	**14.2147**
1,2,3,4,7,8-HxCDD	**1.7827**	< 0.5132	< 0.3787	< 0.8915
1,2,3,6,7,8-HxCDD	**3.8107**	< 0.5481	< 0.3932	< 1.5840
1,2,3,7,8,9-HxCDD	**5.4812**	< 0.5563	**0.3911**	< 2.1429
Total HxCDD	**28.1890**	**1.3691**	**3.9523**	**11.1702**
1,2,3,4,6,7,8-HpCDD	**14.1728**	**0.9545**	**1.2830**	**5.4701**
Total HpCDD	**22.0031**	**1.5293**	**3.4971**	**9.0098**
Total OCDD	**17.5659**	**4.9880**	**5.1525**	**9.2355**
2,3,7,8-TCDF	**20.1238**	**0.4208**	**0.3207**	**6.9551**
Total TCDF	**553.3393**	**2.9764**	**6.6838**	**187.6665**
1,2,3,7,8-PeCDF	**37.5853**	< 0.4495	**0.3890**	< 12.8080
2,3,4,7,8-PeCDF	**19.8889**	< 0.4146	**0.3559**	< 6.8865
Total PeCDF	**224.4678**	**0.8888**	**1.1112**	**75.4893**
1,2,3,4,7,8-HxCDF	**19.5496**	**0.2278**	**0.4904**	**6.7560**
1,2,3,6,7,8-HxCDF	**23.2559**	< 0.2566	**0.5628**	< 8.0251
2,3,4,6,7,8-HxCDF	**12.9461**	< 0.2381	< 0.1955	< 4.4599
1,2,3,7,8,9-HxCDF	**32.3651**	< 0.3100	< 0.2504	< 10.9752
Total HxCDF	**151.6463**	**0.7205**	**1.3078**	**51.2249**
1,2,3,4,6,7,8-HpCDF	**19.7323**	< 0.4660	**0.9332**	< 7.0438
1,2,3,4,7,8,9-HpCDF	**45.1546**	< 0.6774	< 0.4573	< 15.4298
Total HpCDF	**84.8280**	< 0.5604	**0.9332**	< 28.7739
Total OCDF	**40.7174**	< 1.0879	**0.7698**	< 14.1917
TOTAL	1,473.8741	< 24.8354	< 35.0030	< 511.2375

SUMMARY OF TEST RESULTS

COMPANY	BP			
LOCATION	Whiting, IN			
SOURCE	FCCU 500 Exhaust			
RUN NO	M23-1	M23-2	M23-3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	1257-1736	0855-1324	1415-1828	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.40	17.70	18.00	17.70
Oxygen, av. % vol	1.60	1.60	1.60	1.60
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Total Dioxins collected, nanograms	10.50	2.33	1.97	4.93
Total Furans collected, nanograms	153.00	5.55	7.59	55.38
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total Dioxins and Furans Emissions				
Mass Emission, lb/hr				
2,3,7,8-TCDD	**1.3350E-09**	< 3.0125E-10	< 2.5267E-10	< 6.2964E-10
Total TCDD	**2.3394E-08**	**1.6032E-09**	**1.6673E-09**	**8.8883E-09**
1,2,3,7,8-PeCDD	**2.2250E-09**	< 3.2710E-10	< 3.2577E-10	< 9.5930E-10
Total PeCDD	**1.9453E-08**	**7.1756E-10**	**9.7347E-10**	**7.0480E-09**
1,2,3,4,7,8-HxCDD	**8.6839E-10**	< 3.2322E-10	< 2.3471E-10	< 4.7544E-10
1,2,3,6,7,8-HxCDD	**1.8563E-09**	< 3.4520E-10	< 2.4369E-10	< 8.1506E-10
1,2,3,7,8,9-HxCDD	**2.6700E-09**	< 3.5038E-10	**2.4241E-10**	< 1.0876E-09
Total HxCDD	**1.3732E-08**	**8.6236E-10**	**2.4497E-09**	**5.6812E-09**
1,2,3,4,6,7,8-HpCDD	**6.9039E-09**	**6.0120E-10**	**7.9520E-10**	**2.7668E-09**
Total HpCDD	**1.0718E-08**	**9.6321E-10**	**2.1675E-09**	**4.6163E-09**
Total OCDD	**8.5568E-09**	**3.1417E-09**	**3.1936E-09**	**4.9640E-09**
2,3,7,8-TCDF	**9.8028E-09**	**2.6504E-10**	**1.9880E-10**	**3.4222E-09**
Total TCDF	**2.6954E-07**	**1.8747E-09**	**4.1427E-09**	**9.1854E-08**
1,2,3,7,8-PeCDF	**1.8309E-08**	< 2.8314E-10	**2.4112E-10**	< 6.2776E-09
2,3,4,7,8-PeCDF	**9.6883E-09**	< 2.6117E-10	**2.2060E-10**	< 3.3900E-09
Total PeCDF	**1.0934E-07**	< 5.5983E-10	**6.8874E-10**	< 3.6864E-08
1,2,3,4,7,8-HxCDF	**9.5231E-09**	**1.4351E-10**	**3.0397E-10**	**3.3235E-09**
1,2,3,6,7,8-HxCDF	**1.1328E-08**	< 1.6161E-10	**3.4886E-10**	< 3.9463E-09
2,3,4,6,7,8-HxCDF	**6.3063E-09**	< 1.4998E-10	< 1.2120E-10	< 2.1925E-09
1,2,3,7,8,9-HxCDF	**1.5766E-08**	< 1.9523E-10	< 1.5519E-10	< 5.3721E-09
Total HxCDF	**7.3870E-08**	**4.5381E-10**	**8.1059E-10**	**2.5045E-08**
1,2,3,4,6,7,8-HpCDF	**9.6121E-09**	< 2.9349E-10	**5.7844E-10**	< 3.4947E-09
1,2,3,4,7,8,9-HpCDF	**2.1996E-08**	< 4.2666E-10	< 2.8345E-10	< 7.5686E-09
Total HpCDF	**4.1322E-08**	< 3.5296E-10	**5.7844E-10**	< 1.4084E-08
Total OCDF	**1.9834E-08**	< 6.8524E-10	**4.7712E-10**	< 6.9989E-09
TOTAL	**6.1644E-07**	< 1.5643E-08	< 2.1695E-08	< 2.5177E-07

Dioxins and Furans Calculation Summary

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/7/2011
TEST RUN NO. : M23-1

SAMPLE VOLUME : 135.283 **dscf**
SAMPLE VOLUME : 3.831 **dscm**
GAS FLOW RATE : 7,800,598 **dscfh**

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	STACK GAS CONCENTRATION (lb/dscf)	STACK GAS CONCENTRATION (picogram/dscm)	EMISSION RATE (lb/hr)
2,3,7,8-TCDD	10.5	1.7114E-16	2.7	1.3350E-09
Total TCDD	184.0	2.9991E-15	48.0	2.3394E-08
1,2,3,7,8-PeCDD	17.5	2.8524E-16	4.6	2.2250E-09
Total PeCDD	153.0	2.4938E-15	39.9	1.9453E-08
1,2,3,4,7,8-HxCDD	6.8	1.1132E-16	1.8	8.6839E-10
1,2,3,6,7,8-HxCDD	14.6	2.3797E-16	3.8	1.8563E-09
1,2,3,7,8,9-HxCDD	21.0	3.4228E-16	5.5	2.6700E-09
Total HxCDD	108.0	1.7603E-15	28.2	1.3732E-08
1,2,3,4,6,7,8-HpCDD	54.3	8.8505E-16	14.2	6.9039E-09
Total HpCDD	84.3	1.3740E-15	22.0	1.0718E-08
Total OCDD	67.3	1.0969E-15	17.6	8.5568E-09
2,3,7,8-TCDF	77.1	1.2567E-15	20.1	9.8028E-09
Total TCDF	2,120.0	3.4554E-14	553.3	2.6954E-07
1,2,3,7,8-PeCDF	144.0	2.3471E-15	37.6	1.8309E-08
2,3,4,7,8-PeCDF	76.2	1.2420E-15	19.9	9.6883E-09
Total PeCDF	860.0	1.4017E-14	224.5	1.0934E-07
1,2,3,4,7,8-HxCDF	74.9	1.2208E-15	19.5	9.5231E-09
1,2,3,6,7,8-HxCDF	89.1	1.4523E-15	23.3	1.1328E-08
2,3,4,6,7,8-HxCDF	49.6	8.0844E-16	12.9	6.3063E-09
1,2,3,7,8,9-HxCDF	124.0	2.0211E-15	32.4	1.5766E-08
Total HxCDF	581.0	9.4698E-15	151.6	7.3870E-08
1,2,3,4,6,7,8-HpCDF	75.6	1.2322E-15	19.7	9.6121E-09
1,2,3,4,7,8,9-HpCDF	173.0	2.8198E-15	45.2	2.1996E-08
Total HpCDF	325.0	5.2972E-15	84.8	4.1322E-08
Total OCDF	156.0	2.5427E-15	40.7	1.9834E-08
TOTAL	4,848.4	7.9025E-14	1,265.5	6.1644E-07

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NO: M23-1

INPUT

V_m:	146.721	**ft^3**	**Q_s:**	7,800,598	**dscfh**
γ FACTOR:	1.010		**T_s:**	546.1	**°F**
P_{bar}:	29.20	**in. Hg**	**Θ:**	240	**minutes**
ΔH:	1.23	**in. H_2O**	**V_s:**	80.852	**fps**
T_m:	106.2	**°F**	**P_s:**	29.12	**in. Hg**
HCl in sample:	0.00	**µg**	**V_{lc}:**	610.5	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 135.283 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 106.42 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 240 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011

BAROMETRIC:	29.2 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.40 **% by volume**
STACK TEMP:	546.1 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.0243 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.85	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.60	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.0243	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 546.1 °F + 460	=	1,006.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.12	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	80.852	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	308,616	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	157,626 9,457,572	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	130,010 7,800,598	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NUMBER: M23-1

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	146.721 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	106.2 **°F**
STACK TEMP:	546.1 **°F**	**LIQUID COLL:**	610.5 **milliliters**
SQ.RT ΔP:	1.0243 **in.H_2O**	**CO_2:**	17.40 **% by volume**
ΔH:	1.23 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 135.283 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 28.736 \text{ scf}$$

V_{lc} = 610.5 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1752$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.6 °K
P = 739.6 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1752

Dioxins and Furans Calculation Summary

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : M23-2

SAMPLE VOLUME : 172.019 **dscf**
SAMPLE VOLUME : 4.872 **dscm**
GAS FLOW RATE : 10,086,284 **dscfh**

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	STACK GAS CONCENTRATION (lb/dscf)	STACK GAS CONCENTRATION (picogram/dscm)	EMISSION RATE (lb/hr)
2,3,7,8-TCDD	< 2.3	< 2.9867E-17	< 0.5	< 3.0125E-10
Total TCDD	**12.4**	**1.5895E-16**	**2.5**	**1.6032E-09**
1,2,3,7,8-PeCDD	< 2.5	< 3.2431E-17	< 0.5	< 3.2710E-10
Total PeCDD	**5.6**	**7.1142E-17**	**1.1**	**7.1756E-10**
1,2,3,4,7,8-HxCDD	< 2.5	< 3.2046E-17	< 0.5	< 3.2322E-10
1,2,3,6,7,8-HxCDD	< 2.7	< 3.4225E-17	< 0.5	< 3.4520E-10
1,2,3,7,8,9-HxCDD	< 2.7	< 3.4738E-17	< 0.6	< 3.5038E-10
Total HxCDD	**6.7**	**8.5499E-17**	**1.4**	**8.6236E-10**
1,2,3,4,6,7,8-HpCDD	**4.7**	**5.9605E-17**	**1.0**	**6.0120E-10**
Total HpCDD	**7.5**	**9.5497E-17**	**1.5**	**9.6321E-10**
Total OCDD	**24.3**	**3.1149E-16**	**5.0**	**3.1417E-09**
2,3,7,8-TCDF	**2.1**	**2.6278E-17**	**0.4**	**2.6504E-10**
Total TCDF	**14.5**	**1.8587E-16**	**3.0**	**1.8747E-09**
1,2,3,7,8-PeCDF	< 2.2	< 2.8072E-17	< 0.4	< 2.8314E-10
2,3,4,7,8-PeCDF	< 2.0	< 2.5893E-17	< 0.4	< 2.6117E-10
Total PeCDF	**4.3**	**5.5504E-17**	**0.9**	**5.5983E-10**
1,2,3,4,7,8-HxCDF	**1.1**	**1.4228E-17**	**0.2**	**1.4351E-10**
1,2,3,6,7,8-HxCDF	< 1.3	< 1.6023E-17	< 0.3	< 1.6161E-10
2,3,4,6,7,8-HxCDF	< 1.2	< 1.4869E-17	< 0.2	< 1.4998E-10
1,2,3,7,8,9-HxCDF	< 1.5	< 1.9356E-17	< 0.3	< 1.9523E-10
Total HxCDF	**3.5**	**4.4993E-17**	**0.7**	**4.5381E-10**
1,2,3,4,6,7,8-HpCDF	< 2.3	< 2.9098E-17	< 0.5	< 2.9349E-10
1,2,3,4,7,8,9-HpCDF	< 3.3	< 4.2301E-17	< 0.7	< 4.2666E-10
Total HpCDF	< 2.7	< 3.4994E-17	< 0.6	< 3.5296E-10
Total OCDF	< 5.3	< 6.7937E-17	< 1.1	< 6.8524E-10
TOTAL	**45.2**	**5.7913E-16**	**9.3**	**5.8413E-09**

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NO: M23-2

INPUT

V_m:	184.315	ft^3	Q_s:	10,086,284	**dscfh**
γ **FACTOR:**	1.010		T_s:	545.4	°F
P_{bar}:	29.30	**in. Hg**	Θ:	240	**minutes**
ΔH:	1.88	**in. H_2O**	V_s:	99.736	**fps**
T_m:	102.2	°F	P_s:	29.22	**in. Hg**
HCl in sample:	0.00	µg	V_{lc}:	590.0	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 172.019 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 104.65 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.70 **% by volume**
STACK TEMP:	545.4 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.2773 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.90	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	29.10	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.2773	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 545.4 °F + 460	=	1,005.4	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.22	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	99.736	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	380,695	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	195,244 11,714,650	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	168,105 10,086,284	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-2

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.315 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	102.2 **°F**
STACK TEMP:	545.4 **°F**	**LIQUID COLL:**	590.0 **milliliters**
SQ.RT ΔP:	1.2773 **in.H_2O**	**CO_2:**	17.70 **% by volume**
ΔH:	1.88 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 172.019 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 27.771 \text{ scf}$$

V_{lc} = 590.0 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1390$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.2 °K
P = 742.2 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1390

Dioxins and Furans Calculation Summary

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : M23-3

SAMPLE VOLUME : 170.639 **dscf**
SAMPLE VOLUME : 4.833 **dscm**
GAS FLOW RATE : 9,925,468 **dscfh**

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	STACK GAS CONCENTRATION (lb/dscf)	STACK GAS CONCENTRATION (picogram/dscm)	EMISSION RATE (lb/hr)
2,3,7,8-TCDD	< 2.0	< 2.5456E-17	< 0.4	< 2.5267E-10
Total TCDD	13.0	1.6799E-16	2.7	1.6673E-09
1,2,3,7,8-PeCDD	< 2.5	< 3.2822E-17	< 0.5	< 3.2577E-10
Total PeCDD	7.6	9.8078E-17	1.6	9.7347E-10
1,2,3,4,7,8-HxCDD	< 1.8	< 2.3647E-17	< 0.4	< 2.3471E-10
1,2,3,6,7,8-HxCDD	< 1.9	< 2.4552E-17	< 0.4	< 2.4369E-10
1,2,3,7,8,9-HxCDD	1.9	2.4423E-17	0.4	2.4241E-10
Total HxCDD	19.1	2.4681E-16	4.0	2.4497E-09
1,2,3,4,6,7,8-HpCDD	6.2	8.0117E-17	1.3	7.9520E-10
Total HpCDD	16.9	2.1838E-16	3.5	2.1675E-09
Total OCDD	24.9	3.2176E-16	5.2	3.1936E-09
2,3,7,8-TCDF	1.6	2.0029E-17	0.3	1.9880E-10
Total TCDF	32.3	4.1738E-16	6.7	4.1427E-09
1,2,3,7,8-PeCDF	1.9	2.4293E-17	0.4	2.4112E-10
2,3,4,7,8-PeCDF	1.7	2.2226E-17	0.4	2.2060E-10
Total PeCDF	5.4	6.9391E-17	1.1	6.8874E-10
1,2,3,4,7,8-HxCDF	2.4	3.0625E-17	0.5	3.0397E-10
1,2,3,6,7,8-HxCDF	2.7	3.5148E-17	0.6	3.4886E-10
2,3,4,6,7,8-HxCDF	< 0.9	< 1.2211E-17	< 0.2	< 1.2120E-10
1,2,3,7,8,9-HxCDF	< 1.2	< 1.5636E-17	< 0.3	< 1.5519E-10
Total HxCDF	6.3	8.1667E-17	1.3	8.1059E-10
1,2,3,4,6,7,8-HpCDF	4.5	5.8278E-17	0.9	5.7844E-10
1,2,3,4,7,8,9-HpCDF	< 2.2	< 2.8558E-17	< 0.5	< 2.8345E-10
Total HpCDF	4.5	5.8278E-17	0.9	5.7844E-10
Total OCDF	3.7	4.8070E-17	0.8	4.7712E-10
TOTAL	**69.8**	**9.0177E-16**	**14.4**	**8.9504E-09**

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NO: M23-3

INPUT

V_m:	184.495	**ft^3**	**Q_s:**	9,925,468	**dscfh**
γ FACTOR:	1.010		**T_s:**	545.9	**°F**
P_{bar}:	29.30	**in. Hg**	**Θ:**	240	**minutes**
ΔH:	1.88	**in. H_2O**	**V_s:**	102.547	**fps**
T_m:	107.3	**°F**	**P_s:**	29.21	**in. Hg**
HCl in sample:	0.00	**µg**	**V_{lc}:**	770.8	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 170.639 **dscf**

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)}$$

= 105.50 **% I**

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.2 **in.H_2O**	**CO_2:**	18.00 **% by volume**
STACK TEMP:	545.9 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.3031 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.94	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.67	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.3031	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
T_s = 545.9 °F + 460	=	1,005.9	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.21	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	102.547	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	391,426	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	200,597 12,035,842	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	165,424 9,925,468	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-3

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.495 **ft^3**
STATIC PRES:	-1.20 **in.H_2O**	**METER TEMP:**	107.3 **°F**
STACK TEMP:	545.9 **°F**	**LIQUID COLL:**	770.8 **milliliters**
SQ.RT ΔP:	1.3031 **in.H_2O**	**CO_2:**	18.00 **% by volume**
ΔH:	1.88 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 170.639 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 36.282 \text{ scf}$$

V_{lc} = 770.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1753$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.5 °K
P = 742.0 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1753

USEPA METHOD 23 LABORATORY DATA

Company: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram) Raw lab data			
Run	**M23-1**	**M23-2**	**M23-3**	**Blank**
2,3,7,8-TCDD	10.50	2.33	1.97	1.77 DL
1,2,3,7,8-PeCDD	17.50	2.53	2.54	2.14 DL
1,2,3,4,7,8-HxCDD	6.83	2.50	1.83	2.02 DL
1,2,3,6,7,8-HxCDD	14.60	2.67	1.90	1.95 DL
1,2,3,7,8,9-HxCDD	21.00	2.71	1.9	2.14 DL
1,2,3,4,6,7,8-HpCDD	54.30	4.7	6.2	2.19 DL
TCDD	184.00	12.4	13.0	**12.10**
PeCDD	153.00	5.6	7.6	2.14 DL
HxCDD	108.00	6.7	19.1	2.03 DL
HpCDD	84.30	7.5	16.9	2.19 DL
OCDD	67.30	24.3	24.9	4.82 DL
TOTAL DIOXIN (AS TCDD)	**596.60**	**56.4**	**81.5**	**9.04**
2,3,7,8-TCDF	77.10	2.1	1.6	1.53 DL
1,2,3,7,8-PeCDF	144.00	2.19	1.9	1.47 DL
2,3,4,7,8-PeCDF	76.20	2.02	1.7	1.44 DL
1,2,3,4,7,8-HxCDF	74.90	1.1	2.4	0.97 DL
1,2,3,6,7,8-HxCDF	89.10	1.25	2.7	0.96 DL
2,3,4,6,7,8-HxCDF	49.60	1.16	0.95	0.84 DL
1,2,3,7,8,9-HxCDF	124.00	1.51	1.21	1.13 DL
1,2,3,4,6,7,8-HpCDF	75.60	2.27	4.5	1.24 DL
1,2,3,4,7,8,9-HpCDF	173.00	3.30	2.21	1.90 DL
TCDF	2,120.00	14.5	32.3	1.53 DL
PeCDF	860.00	4.3	5.4	1.45 DL
HxCDF	581.00	3.5	6.3	0.97 DL
HpCDF	325.00	2.73	4.5	1.54 DL
OCDF	156.00	5.30	3.7	4.82 DL
TOTAL FURAN (AS TCDF)	**4,042.00**	**30.4**	**52.2**	**10.30**

SUMMARY OF TEST RESULTS

COMPANY	BP			
LOCATION	Whiting, IN			
SOURCE	FCCU 500 Exhaust			
RUN NO	M23-1	M23-2	M23-3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	1257-1736	0855-1324	1415-1828	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total PCB Emissions				
Concentration, pg/dscm				
PCB-77 33'44'-TeCB	135.7	14.8	18.5	56.4
PCB-81 344'5-TeCB	18.7	1.1	2.1	7.3
PCB-105 233'44'-PeCB	281.9	30.6	44.5	119.0
PCB-114 2344'5-PeCB	24.6	3.1	3.6	10.5
PCB-118 23'44'5-PeCB	777.8	88.7	125.0	330.5
PCB-123 2'344'5-PeCB	75.7	8.7	13.1	32.5
PCB-126 33'44'5-PeCB	18.2	1.0	1.1	6.8
PCB-156 233'44'5-HxCB	32.1	4.7	6.3	14.4
PCB-157 233'44'5'-HxCB	9.4	1.2	1.6	4.0
PCB-167 23'44'55'-HxCB	28.2	2.9	3.3	11.5
PCB-169 33'44'55'-HxCB	4.7	0.3	0.6	1.9
PCB-189 233'44'55'-HpCB	14.8	0.8	0.8	5.5
Total PCB	**1,421.9**	**157.9**	**220.4**	**600.0**

SUMMARY OF TEST RESULTS

COMPANY	BP			
LOCATION	Whiting, IN			
SOURCE	FCCU 500 Exhaust			
RUN NO	M23-1	M23-2	M23-3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	1257-1736	0855-1324	1415-1828	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Sample Parameters				
Time, min	240.0	240.0	240.0	240.0
Volume, dscf	135.283	172.019	170.639	159.313
Volume, dscm	3.831	4.872	4.833	4.512
Isokinetic Ratio, %	106.4	104.7	105.5	105.5
Total PCB Emissions				
Emission Rate, lb/hr				
PCB-77 33'44'-TeCB	6.6115E-08	9.3347E-09	1.1479E-08	2.8976E-08
PCB-81 344'5-TeCB	9.1035E-09	6.9170E-10	1.2723E-09	3.6892E-09
PCB-105 233'44'-PeCB	1.3732E-07	1.9264E-08	2.7575E-08	6.1385E-08
PCB-114 2344'5-PeCB	1.2002E-08	1.9523E-09	2.2573E-09	5.4040E-09
PCB-118 23'44'5-PeCB	3.7889E-07	5.5853E-08	7.7467E-08	1.7074E-07
PCB-123 2'344'5-PeCB	3.6872E-08	5.4819E-09	8.1059E-09	1.6820E-08
PCB-126 33'44'5-PeCB	8.8873E-09	6.2059E-10	6.7207E-10	3.3933E-09
PCB-156 233'44'5-HxCB	1.5639E-08	2.9737E-09	3.8990E-09	7.5038E-09
PCB-157 233'44'5'-HxCB	4.5772E-09	7.3954E-10	9.6321E-10	2.0933E-09
PCB-167 23'44'55'-HxCB	1.3732E-08	1.8488E-09	2.0649E-09	5.8818E-09
PCB-169 33'44'55'-HxCB	2.2886E-09	1.8618E-10	3.5271E-10	9.4249E-10
PCB-189 233'44'55'-HpCB	7.2218E-09	4.9777E-10	4.6942E-10	2.7296E-09
Total PCB	**6.9264E-07**	**9.9445E-08**	**1.3658E-07**	**3.0955E-07**

TOTAL PCB EMISSIONS

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/7/2011
TEST RUN NO. : M23-1

SAMPLE VOLUME : 135.283 **dscf**
SAMPLE VOLUME : 3.831 **dscm**
GAS FLOW RATE : 7,800,598 **dscfh**

PCB Group	TOTAL SAMPLE MASS (picogram)	STACK GAS CONCENTRATION (lb/dscf)	STACK GAS CONCENTRATION (picogram/dscm)	EMISSION RATE (lb/hr)
PCB-77 33'44'-TeCB	520.0	8.4756E-15	135.7	6.6115E-08
PCB-81 344'5-TeCB	71.6	1.1670E-15	18.7	9.1035E-09
PCB-105 233'44'-PeCB	1,080.0	1.7603E-14	281.9	1.3732E-07
PCB-114 2344'5-PeCB	94.4	1.5386E-15	24.6	1.2002E-08
PCB-118 23'44'5-PeCB	2,980.0	4.8572E-14	777.8	3.7889E-07
PCB-123 2'344'5-PeCB	290.0	4.7268E-15	75.7	3.6872E-08
PCB-126 33'44'5-PeCB	69.9	1.1393E-15	18.2	8.8873E-09
PCB-156 233'44'5-HxCB	123.0	2.0048E-15	32.1	1.5639E-08
PCB-157 233'44'5'-HxCB	36.0	5.8677E-16	9.4	4.5772E-09
PCB-167 23'44'55'-HxCB	108.0	1.7603E-15	28.2	1.3732E-08
PCB-169 33'44'55'-HxCB	18.0	2.9339E-16	4.7	2.2886E-09
PCB-189 233'44'55'-HpCB	56.8	9.2580E-16	14.8	7.2218E-09
Total PCB	**5,447.7**	**8.8793E-14**	**1,421.9**	**6.9264E-07**

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NO: M23-1

INPUT

V_m:	146.721	**ft^3**	**Q_s:**	7,800,598	**dscfh**
γ FACTOR:	1.010		**T_s:**	546.1	**°F**
P_{bar}:	29.20	**in. Hg**	**Θ:**	240	**minutes**
ΔH:	1.23	**in. H_2O**	**V_s:**	80.852	**fps**
T_m:	106.2	**°F**	**P_s:**	29.12	**in. Hg**
HCl in sample:	0.00	**µg**	**V_{lc}:**	610.5	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 135.283 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 106.42 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 240 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011

BAROMETRIC:	29.2 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.40 **% by volume**
STACK TEMP:	546.1 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.0243 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.85	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.60	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.0243	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 546.1 °F + 460	=	1,006.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.12	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	80.852	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	308,616	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	157,626 9,457,572	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	130,010 7,800,598	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NUMBER: M23-1

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	146.721 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	106.2 **°F**
STACK TEMP:	546.1 **°F**	**LIQUID COLL:**	610.5 **milliliters**
SQ.RT ΔP:	1.0243 **in.H_2O**	**CO_2:**	17.40 **% by volume**
ΔH:	1.23 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 135.283 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 28.736 \text{ scf}$$

V_{lc} = 610.5 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1752$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.6 °K
P = 739.6 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1752

TOTAL PCB EMISSIONS

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : M23-2

SAMPLE VOLUME : 172.019 **dscf**
SAMPLE VOLUME : 4.872 **dscm**
GAS FLOW RATE : 10,086,284 **dscfh**

PCB Group	TOTAL SAMPLE MASS (picogram)	STACK GAS CONCENTRATION (lb/dscf)	STACK GAS CONCENTRATION (picogram/dscm)	EMISSION RATE (lb/hr)
PCB-77 33'44'-TeCB	72.200	9.2549E-16	14.8	9.3347E-09
PCB-81 344'5-TeCB	5.350	6.8578E-17	1.1	6.9170E-10
PCB-105 233'44'-PeCB	149.000	1.9099E-15	30.6	1.9264E-08
PCB-114 2344'5-PeCB	15.100	1.9356E-16	3.1	1.9523E-09
PCB-118 23'44'5-PeCB	432.000	5.5375E-15	88.7	5.5853E-08
PCB-123 2'344'5-PeCB	42.400	5.4350E-16	8.7	5.4819E-09
PCB-126 33'44'5-PeCB	4.800	6.1528E-17	1.0	6.2059E-10
PCB-156 233'44'5-HxCB	23.000	2.9482E-16	4.7	2.9737E-09
PCB-157 233'44'5'-HxCB	5.720	7.3321E-17	1.2	7.3954E-10
PCB-167 23'44'55'-HxCB	14.300	1.8330E-16	2.9	1.8488E-09
PCB-169 33'44'55'-HxCB	1.440	1.8458E-17	0.3	1.8618E-10
PCB-189 233'44'55'-HpCB	3.850	4.9351E-17	0.8	4.9777E-10
Total PCB	**769.2**	**9.8594E-15**	**157.9**	**9.9445E-08**

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NO: M23-2

INPUT

V_m:	184.315	**ft^3**	**Q_s:**	10,086,284	**dscfh**
γ FACTOR:	1.010		**T_s:**	545.4	**°F**
P_{bar}:	29.30	**in. Hg**	**Θ:**	240	**minutes**
ΔH:	1.88	**in. H_2O**	**V_s:**	99.736	**fps**
T_m:	102.2	**°F**	**P_s:**	29.22	**in. Hg**
HCl in sample:	0.00	**µg**	**V_{lc}:**	590.0	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 172.019 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 104.65 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.70 **% by volume**
STACK TEMP:	545.4 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.2773 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.90	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	29.10	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.2773	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
T_s = 545.4 °F + 460	=	1,005.4	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.22	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	99.736	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	380,695	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	195,244 11,714,650	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	168,105 10,086,284	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-2

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.315 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	102.2 **°F**
STACK TEMP:	545.4 **°F**	**LIQUID COLL:**	590.0 **milliliters**
SQ.RT ΔP:	1.2773 **in.H_2O**	**CO_2:**	17.70 **% by volume**
ΔH:	1.88 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 172.019 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 27.771 \text{ scf}$$

V_{lc} = 590.0 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1390$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.2 °K
P = 742.2 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1390

TOTAL PCB EMISSIONS

COMPANY :	BP
LOCATION :	Whiting, IN
SOURCE :	FCCU 500 Exhaust
TEST DATE :	6/8/2011
TEST RUN NO. :	M23-3

SAMPLE VOLUME :	170.639	**dscf**
SAMPLE VOLUME :	4.833	**dscm**
GAS FLOW RATE :	9,925,468	**dscfh**

PCB Group	TOTAL SAMPLE MASS (picogram)	STACK GAS CONCENTRATION (lb/dscf)	STACK GAS CONCENTRATION (picogram/dscm)	EMISSION RATE (lb/hr)
PCB-77 33'44'-TeCB	89.5	1.1565E-15	18.5	1.1479E-08
PCB-81 344'5-TeCB	9.9	1.2819E-16	2.1	1.2723E-09
PCB-105 233'44'-PeCB	215.0	2.7782E-15	44.5	2.7575E-08
PCB-114 2344'5-PeCB	17.6	2.2743E-16	3.6	2.2573E-09
PCB-118 23'44'5-PeCB	604.0	7.8049E-15	125.0	7.7467E-08
PCB-123 2'344'5-PeCB	63.2	8.1667E-16	13.1	8.1059E-09
PCB-126 33'44'5-PeCB	5.2	6.7712E-17	1.1	6.7207E-10
PCB-156 233'44'5-HxCB	30.4	3.9283E-16	6.3	3.8990E-09
PCB-157 233'44'5'-HxCB	7.5	9.7045E-17	1.6	9.6321E-10
PCB-167 23'44'55'-HxCB	16.1	2.0804E-16	3.3	2.0649E-09
PCB-169 33'44'55'-HxCB	2.8	3.5536E-17	0.6	3.5271E-10
PCB-189 233'44'55'-HpCB	3.7	4.7295E-17	0.8	4.6942E-10
Total PCB	**1,064.9**	**1.3760E-14**	**220.4**	**1.3658E-07**

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NO: M23-3

INPUT

V_m:	184.495	**ft^3**	**Q_s:**	9,925,468	**dscfh**
γ FACTOR:	1.010		**T_s:**	545.9	**°F**
P_{bar}:	29.30	**in. Hg**	**Θ:**	240	**minutes**
ΔH:	1.88	**in. H_2O**	**V_s:**	102.547	**fps**
T_m:	107.3	**°F**	**P_s:**	29.21	**in. Hg**
HCl in sample:	0.00	**µg**	**V_{lc}:**	770.8	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 170.639 **dscf**

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)}$$

= 105.50 **% I**

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.2 **in.H_2O**	**CO_2:**	18.00 **% by volume**
STACK TEMP:	545.9 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.3031 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.94	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.67	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.3031	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 545.9 °F + 460	=	1,005.9	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.21	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	102.547	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	391,426	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	200,597 12,035,842	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	165,424 9,925,468	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-3

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.495 **ft^3**
STATIC PRES:	-1.20 **in.H_2O**	**METER TEMP:**	107.3 **°F**
STACK TEMP:	545.9 **°F**	**LIQUID COLL:**	770.8 **milliliters**
SQ.RT ΔP:	1.3031 **in.H_2O**	**CO_2:**	18.00 **% by volume**
ΔH:	1.88 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 170.639 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 36.282 \text{ scf}$$

V_{lc} = 770.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1753$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.5 °K
P = 742.0 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1753

PCB LABORATORY DATA

Company: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust

PCB COMPOUND	TOTAL SAMPLE MASS (picogram) Not corrected for blank value			
Run	**M23-1**	**M23-2**	**M23-3**	**Blank**
PCB-77 33'44'-TeCB	520.0	72.2	89.5	6.4
PCB-81 344'5-TeCB	71.6	5.4	9.9	0.5
PCB-105 233'44'-PeCB	1,080.0	149.0	215.0	9.0
PCB-114 2344'5-PeCB	94.4	15.1	17.6	0.9
PCB-118 23'44'5-PeCB	2,980.0	432.0	604.0	18.3
PCB-123 2'344'5-PeCB	290.0	42.4	63.2	0.9
PCB-126 33'44'5-PeCB	69.9	4.8	5.2	1.4
PCB-156 233'44'5-HxCB	123.0	23.0	30.4	1.1
PCB-157 233'44'5'-HxCB	36.0	5.7	7.5	0.7
PCB-167 23'44'55'-HxCB	108.0	14.3	16.1	0.5
PCB-169 33'44'55'-HxCB	18.0	1.4	2.8	0.9
PCB-189 233'44'55'-HpCB	56.8	3.9	3.7	1.4

SUMMARY OF TEST RESULTS

COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust
SAMPLE	SVOC

RUN NO	0010-1	0010-2	0010-3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	13:27 - 17:36	09:25 - 13:24	14:45 - 18:13	Average
SVOC Sample Parameters				
Time, min	180	180	180	
Volume, dscm	3.290	3.491	3.308	
Volume, dscf	116.182	123.267	116.795	
Isokinetic rate, %	105.9	109.1	105.0	
Concentration - µg/dscm				
Acenaphthene	**0.05440**	**0.00544**	**0.01363**	**0.02449**
Acenaphthylene	**0.02553**	**0.01160**	**0.00623**	**0.01445**
Aniline	< 0.56225	< 0.52993	< 0.55930	< 0.55050
Anthracene	**0.00559**	**0.00148**	**0.00195**	**0.00301**
Benzidine	**11.54897**	**10.88511**	**11.48836**	**11.30748**
Benzo[a]anthracene	< 0.00282	< 0.00115	< 0.00121	< 0.00173
Benzo[b]fluoranthene	< 0.00477	< 0.00146	< 0.00121	< 0.00248
Benzo[k]fluoranthene	< 0.00307	< 0.00115	< 0.00121	< 0.00181
Benzo[g,h,i]perylene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
Benzo[a]pyrene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
Benzo[e]pyrene	< 0.00939	< 0.00115	< 0.00121	< 0.00392
Biphenyl	**5.13625**	**0.73331**	**0.44139**	**2.10365**
Cresols	< 2.35538	< 2.21999	< 2.34302	< 2.30613
Chrysene	**0.01036**	**0.00367**	**0.00180**	**0.00528**
Dibenz[a,h]anthracene	< 0.00180	< 0.00115	< 0.00121	< 0.00138
Dibenzofuran	< 0.69902	< 0.65884	< 0.69535	< 0.68440
Dibenzo(a,e)pyrene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
3,3'-Dimethoxybenzidine	< 8.81369	< 8.30706	< 8.76743	< 8.62939
Dimethylaminobenzene	< 0.60784	< 0.57290	< 0.60465	< 0.59513
7,12-Dimethylbenz(a)anthracene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
3,3'-Dimethylbenzidine	< 8.81369	< 8.30706	< 8.76743	< 8.62939
a,a-Dimethylphenethylamine	< 3.64704	< 3.43740	< 3.62790	< 3.57078
2,4-Dimethylphenol	< 0.79019	< 0.74477	< 0.78605	< 0.77367
Fluoranthene	**0.03677**	**0.01212**	**0.00523**	**0.01804**
Fluorene	**0.06413**	**0.01467**	**0.01572**	**0.03150**
Indeno(1,2,3-cd)pyrene	< 0.00272	< 0.00115	< 0.00121	< 0.00169
Isophorone	< 0.68382	< 0.64451	< 0.68023	< 0.66952
3-Methylcholanthrene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
2-Methylnaphthalene	**2.43136**	**0.16328**	**0.60163**	**1.06542**
Naphthalene	**0.96647**	**0.35233**	**0.42023**	**0.57968**
Perylene	< 0.00122	< 0.00115	< 0.00121	< 0.00119
Phenanthrene	**0.17627**	**0.05901**	**0.04081**	**0.09203**
Phenol	**2.99361**	**2.47779**	**2.35814**	**2.60985**
1,4-Phenylenediamine	< 5.47056	< 5.15611	< 5.44185	< 5.35617
Pyrene	**0.04073**	**0.01063**	**0.00580**	**0.01905**
o-Toluidine	< 1.51960	< 1.43225	< 1.51163	< 1.48783

SUMMARY OF TEST RESULTS

COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust
SAMPLE	SVOC

RUN NO	0010-1	0010-2	0010-3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	13:27 - 17:36	09:25 - 13:24	14:45 - 18:13	Average
SVOC Sample Parameters				
Time, min	180	180	180	
Volume, dscm	3.290	3.491	3.308	
Volume, dscf	116.182	123.267	116.795	
Isokinetic rate, %	105.9	109.1	105.0	
Emission Rate - lb/hr x 10^{-5}				
Acenaphthene	**2.993**	**0.309**	**0.761**	**1.354**
Acenaphthylene	**1.405**	**0.658**	**0.348**	**0.803**
Aniline	< 30.935	< 30.046	< 31.218	< 30.733
Anthracene	**0.308**	**0.084**	**0.109**	**0.167**
Benzidine	< 635.428	< 617.167	< 641.226	< 631.274
Benzo[a]anthracene	< 0.155	< 0.065	< 0.067	< 0.096
Benzo[b]fluoranthene	< 0.263	< 0.083	< 0.067	< 0.138
Benzo[k]fluoranthene	< 0.169	< 0.065	< 0.067	< 0.100
Benzo[g,h,i]perylene	< 0.067	< 0.065	< 0.067	< 0.066
Benzo[a]pyrene	< 0.067	< 0.065	< 0.067	0.066
Benzo[e]pyrene	< 0.517	< 0.065	< 0.067	< 0.216
Biphenyl	**282.598**	**41.578**	**24.637**	**116.271**
Cresols	< 129.594	< 125.870	< 130.776	< 128.747
Chrysene	**0.570**	**0.208**	**0.100**	**0.293**
Dibenz[a,h]anthracene	< 0.099	< 0.065	< 0.067	< 0.077
Dibenzofuran	< 38.460	< 37.355	< 38.811	< 38.209
Dibenzo(a,e)pyrene	< 0.067	< 0.065	< 0.067	< 0.066
3,3'-Dimethoxybenzidine	< 484.932	< 470.996	< 489.357	< 481.762
Dimethylaminobenzene	< 33.444	< 32.482	< 33.749	< 33.225
7,12-Dimethylbenz(a)anthracene	< 0.067	< 0.065	< 0.067	< 0.066
3,3'-Dimethylbenzidine	< 484.932	< 470.996	< 489.357	< 481.762
a,a-Dimethylphenethylamine	< 200.662	< 194.895	< 202.493	< 199.350
2,4-Dimethylphenol	< 43.477	< 42.227	< 43.873	< 43.192
Fluoranthene	**2.023**	**0.687**	**0.292**	**1.001**
Fluorene	**3.528**	**0.832**	**0.877**	**1.746**
Indeno(1,2,3-cd)pyrene	< 0.150	< 0.065	< 0.067	< 0.094
Isophorone	< 37.624	< 36.543	< 37.967	< 37.378
3-Methylcholanthrene	< 0.067	< 0.065	< 0.067	0.0664
2-Methylnaphthalene	**133.774**	**9.258**	**33.580**	**58.871**
Naphthalene	**53.175**	**19.977**	**23.455**	**32.202**
Perylene	< 0.067	< 0.065	< 0.067	0.0664
Phenanthrene	**9.699**	**3.346**	**2.278**	**5.107**
Phenol	**164.710**	**140.487**	**131.620**	**145.606**
1,4-Phenylenediamine	< 300.992	< 292.342	< 303.739	< 299.024
Pyrene	**2.241**	**0.603**	**0.324**	**1.056**
o-Toluidine	< 83.609	< 81.206	< 84.372	< 83.062

SUMMARY OF TEST RESULTS

COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust
SAMPLE	SVOC

RUN NO	0010-1	0010-2	0010-3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	13:27 - 17:36	09:25 - 13:24	14:45 - 18:13	Average
SVOC Sample Parameters				
Time, min	180	180	180	
Volume, dscm	3.290	3.491	3.308	
Volume, dscf	116.182	123.267	116.795	
Isokinetic rate, %	105.9	109.1	105.0	
Concentration - ppb db				
Acenaphthene	**0.00849**	**0.00085**	**0.00213**	**0.00382**
Acenaphthylene	**0.00404**	**0.00183**	**0.00098**	**0.00228**
Aniline	< 0.14525	< 0.13690	< 0.14448	< 0.14221
Anthracene	**0.00075**	**0.00020**	**0.00026**	**0.00041**
Benzidine	**1.50808**	**1.42139**	**1.50016**	**1.47654**
Benzo[a]anthracene	< 0.00030	< 0.00012	< 0.00013	< 0.00018
Benzo[b]fluoranthene	< 0.00045	< 0.00014	< 0.00012	< 0.00024
Benzo[k]fluoranthene	< 0.00029	< 0.00011	< 0.00012	< 0.00017
Benzo[g,h,i]perylene	< 0.00011	< 0.00010	< 0.00011	< 0.00010
Benzo[a]pyrene	< 0.00012	< 0.00011	< 0.00012	< 0.00011
Benzo[e]pyrene	< 0.00090	< 0.00011	< 0.00012	< 0.00037
Biphenyl	**0.80131**	**0.11440**	**0.06886**	**0.32819**
Cresols	< 0.52401	< 0.49389	< 0.52126	< 0.51305
Chrysene	**0.00109**	**0.00039**	**0.00019**	**0.00056**
Dibenz[a,h]anthracene	< 0.00016	< 0.00010	< 0.00010	< 0.00012
Dibenzofuran	< 0.09999	< 0.09424	< 0.09946	< 0.09790
Dibenzo(a,e)pyrene	< 0.00010	< 0.00009	< 0.00010	< 0.00009
3,3'-Dimethoxybenzidine	< 0.86799	< 0.81810	< 0.86344	< 0.84984
Dimethylaminobenzene	< 0.06491	< 0.06118	< 0.06457	< 0.06355
7,12-Dimethylbenz(a)anthracene	< 0.00011	< 0.00011	< 0.00011	< 0.00011
3,3'-Dimethylbenzidine	< 0.99883	< 0.94142	< 0.99359	< 0.97795
a,a-Dimethylphenethylamine	< 0.58796	< 0.55417	< 0.58488	< 0.57567
2,4-Dimethylphenol	< 0.15561	< 0.14666	< 0.15479	< 0.15235
Fluoranthene	**0.00437**	**0.00144**	**0.00062**	**0.00215**
Fluorene	**0.00928**	**0.00212**	**0.00228**	**0.00456**
Indeno(1,2,3-cd)pyrene	< 0.00024	< 0.00010	< 0.00011	< 0.00015
Isophorone	< 0.11903	< 0.11219	< 0.11841	< 0.11654
3-Methylcholanthrene	< 0.00011	< 0.00010	< 0.00011	< 0.00011
2-Methylnaphthalene	**0.41135**	**0.02762**	**0.10179**	**0.18025**
Naphthalene	**0.18141**	**0.06614**	**0.07888**	**0.10881**
Perylene	< 0.00012	< 0.00011	< 0.00012	< 0.00011
Phenanthrene	**0.02379**	**0.00797**	**0.00551**	**0.01242**
Phenol	**0.76529**	**0.63342**	**0.60283**	**0.66718**
1,4-Phenylenediamine	< 1.21751	< 1.14752	< 1.21112	< 1.19205
Pyrene	**0.00484**	**0.00126**	**0.00069**	**0.00227**
o-Toluidine	< 0.34113	< 0.32152	< 0.33934	< 0.33400

SVOC CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/7/2011
TEST RUN NO. : 0010-1

SAMPLE VOLUME : 116.182 **dscf**
SAMPLE VOLUME : 3.290 **dscm**
GAS FLOW RATE : 8,810,743 **dscfh**
STACK O_2 CONTENT : 1.60 **%**

VOST COMPOUND	TOTAL SAMPLE MASS (microgram)	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10^{-6})	STACK GAS CONCENTRATION (µg/dscm)	STACK GAS CONCENTRATION (ppb)	EMISSION RATE (lb/hr)
Acenaphthene	0.179	154.21	0.00000340	0.0544	0.0085	0.00002993
Acenaphthylene	0.084	152.19	0.00000159	0.0255	0.0040	0.00001405
Aniline	< 1.85000	93.13	< 0.00003511	< 0.5623	< 0.1452	< 0.00030935
Anthracene	0.0184	178.23	0.00000035	0.0056	0.0008	0.00000308
Benzidine	38.0000	184.24	0.00072120	11.5490	1.5081	0.00635428
Benzo[a]anthracene	< 0.00928	228.29	< 0.00000018	< 0.0028	< 0.0003	< 0.00000155
Benzo[b]fluoranthene	< 0.0157	252.31	< 0.00000030	< 0.0048	< 0.0005	< 0.00000263
Benzo[k]fluoranthene	< 0.0101	252.31	< 0.00000019	< 0.0031	< 0.0003	< 0.00000169
Benzo[g,h,i]perylene	< 0.004	276.33	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Benzo[a]pyrene	< 0.004	252.31	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Benzo[e]pyrene	< 0.0309	252.31	< 0.00000059	< 0.0094	< 0.0009	< 0.00000517
Biphenyl	16.9	154.21	0.00032074	5.1363	0.8013	0.00282598
Cresols	< 7.75000	108.14	< 0.00014709	< 2.3554	< 0.5240	< 0.00129594
Chrysene	0.0341	228.28	0.00000065	0.0104	0.0011	0.00000570
Dibenz[a,h]anthracene	< 0.00592	278.35	< 0.00000011	< 0.0018	< 0.0002	< 0.00000099
Dibenzofuran	< 2.3000	168.19	< 0.00004365	< 0.6990	< 0.1000	< 0.00038460
Dibenzo(a,e)pyrene	< 0.004	302.37	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
3,3'-Dimethoxybenzidine	< 29.000	244.29	< 0.00055039	< 8.8137	< 0.8680	< 0.00484932
Dimethylaminobenzene	< 2.000	225.29	< 0.00003796	< 0.6078	< 0.0649	< 0.00033444
7,12-Dimethylbenz(a)anthracene	< 0.004	256.34	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
3,3'-Dimethylbenzidine	< 29.000	212.29	< 0.00055039	< 8.8137	< 0.9988	< 0.00484932
a,a-Dimethylphenethylamine	< 12.000	149.23	< 0.00022775	< 3.6470	< 0.5880	< 0.00200662
2,4-Dimethylphenol	< 2.6000	122.17	< 0.00004935	< 0.7902	< 0.1556	< 0.00043477
Fluoranthene	0.121	202.26	0.00000230	0.0368	0.0044	0.00002023
Fluorene	0.211	166.22	0.00000400	0.0641	0.0093	0.00003528
Indeno(1,2,3-cd)pyrene	< 0.00896	276.33	< 0.00000017	< 0.0027	< 0.0002	< 0.00000150
Isophorone	< 2.25000	138.21	< 0.00004270	< 0.6838	< 0.1190	< 0.00037624
3-Methylcholanthrene	< 0.004	268.35	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
2-Methylnaphthalene	8.00	142.20	0.00015183	2.4314	0.4114	0.00133774
Naphthalene	3.18	128.17	0.00006035	0.9665	0.1814	0.00053175
Perylene	< 0.004	252.31	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Phenanthrene	< 0.580	178.23	< 0.00001101	< 0.1763	< 0.0238	< 0.00009699
Phenol	9.85000	94.11	0.00018694	2.9936	0.7653	0.00164710
1,4-Phenylenediamine	< 18.000	108.10	< 0.00034162	< 5.4706	< 1.2175	< 0.00300992
Pyrene	< 0.134	202.25	< 0.00000254	< 0.0407	< 0.0048	< 0.00002241
o-Toluidine	< 5.000	107.17	< 0.00009489	< 1.5196	< 0.3411	< 0.00083609

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 0010-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011

BAROMETRIC:	29.2 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.40 **% by volume**
STACK TEMP:	544.1 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.1364 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.848	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.820	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.1364	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 544.1 °F + 460	=	1,004.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.12	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	89.265	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	340,727	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	174,373.2 10,462,393	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	146,845.7 8,810,743	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NUMBER: 0010-1

γ FACTOR:	0.991	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	129.150 **ft^3**
STATIC PRES:	-1.100 **in.H_2O**	**METER TEMP:**	109.9 **°F**
STACK TEMP:	544.1 **°F**	**LIQUID COLL:**	462.7 **milliliters**
SQ.RT ΔP:	1.1364 **in.H_2O**	**CO_2:**	17.40 **% by volume**
ΔH:	1.57 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 116.182 \text{ dscf}$$

γ = 0.991

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 21.779 \text{ scf}$$

V_{lc} = 462.7 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1579$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7260$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1579

METHOD 0010 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NO: 0010-1

INPUT

V_m:	129.150	**ft^3**	**Q_s:**	8,810,743	**dscfh**
γ FACTOR:	0.991		**T_s:**	544.1	**°F**
P_{bar}:	29.20	**in. Hg**	**Θ:**	180	**minutes**
ΔH:	1.57	**in. H_2O**	**V_s:**	89.265	**fps**
T_m:	109.9	**°F**	**P_s:**	29.12	**in. Hg**
			V_{lc}:	462.7	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 116.182 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 105.94 \text{ \% I}$$

A_n = 0.00026398 ft^2 Runtime (θ) = 180 minutes

SVOC CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : 0010-2

SAMPLE VOLUME : 123.267 **dscf**
SAMPLE VOLUME : 3.491 **dscm**
GAS FLOW RATE : 9,079,436 **dscfh**
STACK O_2 CONTENT : 1.60 **%**

VOST COMPOUND	TOTAL SAMPLE MASS (microgram)	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10^{-6})	STACK GAS CONCENTRATION (µg/dscm)	STACK GAS CONCENTRATION (ppb)	EMISSION RATE (lb/hr)
Acenaphthene	0.019	154.21	0.00000034	0.0054	0.0008	0.00000309
Acenaphthylene	0.0405	152.19	0.00000072	0.0116	0.0018	0.00000658
Aniline	< 1.85000	93.13	< 0.00003309	< 0.5299	< 0.1369	< 0.00030046
Anthracene	0.00516	178.23	0.00000009	0.0015	0.0002	0.00000084
Benzidine	< 38.0000	184.24	0.00067974	10.8851	1.4214	0.00617167
Benzo[a]anthracene	< 0.004	228.29	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Benzo[b]fluoranthene	< 0.005	252.31	< 0.00000009	< 0.0015	< 0.0001	< 0.00000083
Benzo[k]fluoranthene	< 0.004	252.31	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Benzo[g,h,i]perylene	< 0.004	276.33	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Benzo[a]pyrene	< 0.004	252.31	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Benzo[e]pyrene	< 0.004	252.31	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Biphenyl	2.56	154.21	0.00004579	0.7333	0.1144	0.00041578
Cresols	< 7.75000	108.14	< 0.00013863	< 2.2200	< 0.4939	< 0.00125870
Chrysene	0.0128	228.28	0.00000023	0.0037	0.0004	0.00000208
Dibenz[a,h]anthracene	< 0.004	278.35	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Dibenzofuran	< 2.3000	168.19	< 0.00004114	< 0.6588	< 0.0942	< 0.00037355
Dibenzo(a,e)pyrene	< 0.004	302.37	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
3,3'-Dimethoxybenzidine	< 29.000	244.29	< 0.00051875	< 8.3071	< 0.8181	< 0.00470996
Dimethylaminobenzene	< 2.000	225.29	< 0.00003578	< 0.5729	< 0.0612	< 0.00032482
7,12-Dimethylbenz(a)anthracene	< 0.004	256.34	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
3,3'-Dimethylbenzidine	< 29.000	212.29	< 0.00051875	< 8.3071	< 0.9414	< 0.00470996
a,a-Dimethylphenethylamine	< 12.000	149.23	< 0.00021466	< 3.4374	< 0.5542	< 0.00194895
2,4-Dimethylphenol	< 2.6000	122.17	< 0.00004651	< 0.7448	< 0.1467	< 0.00042227
Fluoranthene	0.0423	202.26	0.00000076	0.0121	0.0014	0.00000687
Fluorene	0.0512	166.22	0.00000092	0.0147	0.0021	0.00000832
Indeno(1,2,3-cd)pyrene	< 0.004	276.33	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Isophorone	< 2.25000	138.21	< 0.00004025	< 0.6445	< 0.1122	< 0.00036543
3-Methylcholanthrene	<0.004	268.35	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
2-Methylnaphthalene	0.57	142.20	0.00001020	0.1633	0.0276	0.00009258
Naphthalene	1.23	128.17	0.00002200	0.3523	0.0661	0.00019977
Perylene	<0.004	252.31	< 0.00000007	< 0.0011	< 0.0001	< 0.00000065
Phenanthrene	0.206	178.23	0.00000368	0.0590	0.0080	0.00003346
Phenol	8.65000	94.11	0.00015473	2.4778	0.6334	0.00140487
1,4-Phenylenediamine	< 18.000	108.10	< 0.00032198	< 5.1561	< 1.1475	< 0.00292342
Pyrene	0.0371	202.25	0.00000066	0.0106	0.0013	0.00000603
o-Toluidine	< 5.000	107.17	< 0.00008944	< 1.4323	< 0.3215	< 0.00081206

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 0010-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.2 **in.H_2O**	**CO_2:**	17.70 **% by volume**
STACK TEMP:	543.4 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.196 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.90	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.57	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.1960	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 543.4 °F + 460	=	1,003.4	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.21	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	94.180	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	359,487	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	184,688.1 11,081,285	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	151,323.9 9,079,436	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: 0010-2

γ FACTOR:	0.991	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	135.045 **ft^3**
STATIC PRES:	-1.200 **in.H_2O**	**METER TEMP:**	103.8 **°F**
STACK TEMP:	543.4 **°F**	**LIQUID COLL:**	577.4 **milliliters**
SQ.RT ΔP:	1.1960 **in.H_2O**	**CO_2:**	17.70 **% by volume**
ΔH:	1.73 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 123.267 \text{ dscf}$$

γ = 0.991

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 27.178 \text{ scf}$$

V_{lc} = 577.4 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1807$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7237$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1807

METHOD 0010 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NO: 0010-2

INPUT

V_m:	135.045	ft^3	Q_s:	9,079,436	**dscfh**
γ **FACTOR:**	0.991		T_s:	543.4	°F
P_{bar}:	29.30	**in. Hg**	Θ:	180	**minutes**
ΔH:	1.73	**in. H_2O**	V_s:	94.180	**fps**
T_m:	103.8	°F	P_s:	29.21	**in. Hg**
			V_{lc}:	577.4	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units** (29.92 in. Hg, 68 °F)

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 123.267 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 109.07 \text{ \% I}$$

A_n = 0.00026398 ft^2 Runtime (θ) = 60 minutes

SVOC CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : 0010-3

SAMPLE VOLUME : 116.795 **dscf**
SAMPLE VOLUME : 3.308 **dscm**
GAS FLOW RATE : 8,938,046 **dscfh**
STACK O_2 CONTENT : 1.60 **%**

VOST COMPOUND	TOTAL SAMPLE MASS (microgram)	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10^{-6})	STACK GAS CONCENTRATION (µg/dscm)	STACK GAS CONCENTRATION (ppb)	EMISSION RATE (lb/hr)
Acenaphthene	0.0451	154.21	0.00000085	0.0136	0.0021	0.00000761
Acenaphthylene	0.0206	152.19	0.00000039	0.0062	0.0010	0.00000348
Aniline	< 1.85000	< 93.13	< 0.00003493	< 0.5593	< 0.1445	< 0.00031218
Anthracene	0.00644	178.23	0.00000012	0.0019	0.0003	0.00000109
Benzidine	< 38.0000	< 184.24	< 0.00071741	< 11.4884	< 1.5002	< 0.00641226
Benzo[a]anthracene	< 0.004	< 228.29	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Benzo[b]fluoranthene	< 0.004	< 252.31	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Benzo[k]fluoranthene	< 0.004	< 252.31	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Benzo[g,h,i]perylene	< 0.004	< 276.33	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Benzo[a]pyrene	< 0.004	< 252.31	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Benzo[e]pyrene	< 0.004	< 252.31	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Biphenyl	1.46	154.21	0.00002756	0.4414	0.0689	0.00024637
Cresols	< 7.75000	< 108.14	< 0.00014631	< 2.3430	< 0.5213	< 0.00130776
Chrysene	0.0059	228.28	0.00000011	0.0018	0.0002	0.00000100
Dibenz[a,h]anthracene	< 0.004	< 278.35	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Dibenzofuran	< 2.3000	< 168.19	< 0.00004342	< 0.6953	< 0.0995	< 0.00038811
Dibenzo(a,e)pyrene	< 0.004	< 302.37	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
3,3'-Dimethoxybenzidine	< 29.000	< 244.29	< 0.00054750	< 8.7674	< 0.8634	< 0.00489357
Dimethylaminobenzene	< 2.000	< 225.29	< 0.00003776	< 0.6047	< 0.0646	< 0.00033749
7,12-Dimethylbenz(a)anthracene	< 0.004	< 256.34	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
3,3'-Dimethylbenzidine	< 29.000	< 212.29	< 0.00054750	< 8.7674	< 0.9936	< 0.00489357
a,a-Dimethylphenethylamine	< 12.000	< 149.23	< 0.00022655	< 3.6279	< 0.5849	< 0.00202493
2,4-Dimethylphenol	< 2.6000	< 122.17	< 0.00004909	< 0.7860	< 0.1548	< 0.00043873
Fluoranthene	0.0173	202.26	0.00000033	0.0052	0.0006	0.00000292
Fluorene	0.0520	166.22	0.00000098	0.0157	0.0023	0.00000877
Indeno(1,2,3-cd)pyrene	< 0.0040	< 276.33	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Isophorone	< 2.25000	< 138.21	< 0.00004248	< 0.6802	< 0.1184	< 0.00037967
3-Methylcholanthrene	<0.004	< 268.35	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
2-Methylnaphthalene	1.99	142.20	0.00003757	0.6016	0.1018	0.00033580
Naphthalene	1.39	128.17	0.00002624	0.4202	0.0789	0.00023455
Perylene	<0.004	< 252.31	< 0.00000008	< 0.0012	< 0.0001	< 0.00000067
Phenanthrene	0.135	178.23	0.00000255	0.0408	0.0055	0.00002278
Phenol	7.80000	94.11	0.00014726	2.3581	0.6028	0.00131620
1,4-Phenylenediamine	< 18.000	< 108.10	< 0.00033983	< 5.4419	< 1.2111	< 0.00303739
Pyrene	0.0192	202.25	0.00000036	0.0058	0.0007	0.00000324
o-Toluidine	< 5.000	< 107.17	< 0.00009440	< 1.5116	< 0.3393	< 0.00084372

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 0010-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.2 **in.H_2O**	**CO_2:**	18.00 **% by volume**
STACK TEMP:	544.5 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.1691 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.94	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.71	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.1691	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 544.5 °F + 460	=	1,004.5	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.21	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	91.874	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	350,687	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	179,970.1 10,798,203	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	148,967.4 8,938,046	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: 0010-3

γ FACTOR:	0.991	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	128.605 **ft^3**
STATIC PRES:	-1.200 **in.H_2O**	**METER TEMP:**	106.4 **°F**
STACK TEMP:	544.5 **°F**	**LIQUID COLL:**	516.4 **milliliters**
SQ.RT ΔP:	1.1691 **in.H_2O**	**CO_2:**	18.00 **% by volume**
ΔH:	1.54 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 116.795 \text{ dscf}$$

γ = 0.991

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 24.307 \text{ scf}$$

V_{lc} = 516.4 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1723$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7237$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1723

METHOD 0010 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NO: 0010-3

INPUT

V_m:	128.605	ft^3	Q_s:	8,938,046	**dscfh**
γ **FACTOR:**	0.991		T_s:	544.5	°F
P_{bar}:	29.30	**in. Hg**	Θ:	180	**minutes**
ΔH:	1.54	**in.** H_2O	V_s:	91.874	**fps**
T_m:	106.4	°F	P_s:	29.21	**in. Hg**
			V_{lc}:	516.4	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 116.795 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 104.98 \text{ \% I}$$

A_n = 0.00026398 ft^2 Runtime (θ) = 60 minutes

SUMMARY OF VOLATILE HAPS TEST RESULTS

COMPANY	BP			
LOCATION	Whiting, IN			
SOURCE	FCCU 500 Exhaust			
RUN NO	18-1	18-2	18-3	
TEST TIME	14:04-15:24	12:04-13:24	17:08-18:28	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	Average
Stack Gas Parameters				
Temperature, av. °F	544.1	543.4	544.5	544.0
Velocity, av. ft/sec	89.145	94.180	91.874	91.733
Volume flow, acfm	340,270	359,487	350,687	350,148
Volume flow, scfm	174,139	184,688	179,970	179,599
Volume flow, dscfm	146,649	151,324	148,967	148,980
Volume flow, scfh	10,448,358	11,081,285	10,798,203	10,775,949
Volume flow, dscfh	8,798,924	9,079,436	8,938,046	8,938,802
Moisture, av. % vol	15.79	18.07	17.23	17.03
CO_2, av. % vol, db	18.0	17.7	18.0	17.9
O_2, av. % vol, db	1.5	1.6	1.6	1.6

Run Numbers	18-1		18-2		18-3		Average	
Compound	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)
Acetone	6,900	3.791	NA	NA	NA	NA	6,900	3.791
Acetonitrile	< 218	< 0.120	NA	NA	NA	NA	< 218	< 0.120
Acrolein	< 218	< 0.120	NA	NA	NA	NA	< 218	< 0.120
Acrylonitrile	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Benzene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
1,3-Butadiene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Carbon disulfide	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Chlorobenzene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Cumene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
1,2-Dibromoethane	< 216	< 0.119	< 228	< 0.129	321	0.179	< 255	< 0.142
Ethylbenzene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Hexane	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Methyl isobutyl ketone	< 218	< 0.120	< 233	< 0.132	< 212	< 0.119	< 221	< 0.123
Methyl t-butyl ether	< 216	< 0.119	NA	NA	NA	NA	< 216	< 0.119
Methylene chloride	< 218	< 0.120	NA	NA	NA	NA	< 218	< 0.120
Nitrobenzene	< 1,081	< 0.594	< 1,259	< 0.714	< 1,044	< 0.582	< 1128	< 0.630
2-Nitropropane	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Pentane	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Styrene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Tetrachloroethene	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Toluene	< 218	< 0.120	< 233	< 0.132	< 212	< 0.119	< 221	< 0.123
Trichloroethene	< 218	< 0.120	< 233	< 0.132	< 212	< 0.119	< 221	< 0.123
2,2,4 Trimethyl pentane	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122
Xylenes	< 216	< 0.119	< 228	< 0.129	< 209	< 0.116	< 218	< 0.122

Volatile Organic HAPs Laboratory Data Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/7/2011
Run No: 18-1

Compound	Molecular Weight	Sample Train A Analysis (M_u) (micrograms)	% Recovery	Sample Train B Analysis (M_u) (micrograms)	% Recovery
Acetone	58.08	158.0		116	
Acetonitrile	41.05	< 4.3		3953	63
Acrolein	56.06	< 4.3		4896	83
Acrylonitrile	53.06	< 4.3	113	< 4.3	70
Benzene	78.11	< 4.3	78	< 4.3	83
1,3-Butadiene	54.09	< 4.3	77	< 4.3	59
Carbon disulfide	76.14	< 4.3		< 4.3	
Chlorobenzene	112.56	< 4.3		< 4.3	
Cumene	120.19	< 4.3		< 4.3	
1,2-Dibromoethane	187.86	< 4.3	87	< 4.3	80
Ethylbenzene	106.17	< 4.3	74	< 4.3	84
Hexane	86.18	< 4.3	75	< 4.3	64
Methyl isobutyl ketone	100.16	< 4.3		4017	122
Methyl t-butyl ether	88.15	< 4.3	90	< 4.3	71
Methylene chloride	84.93	< 4.3		1076	
Nitrobenzene	123.06	< 21.5	269	< 21.5	74
2-Nitropropane	89.09	< 4.3	119	< 4.3	84
Pentane	72.15	< 4.3	96	< 4.3	73
Styrene	104.15	< 4.3	75	< 4.3	76
Tetrachloroethene	165.83	< 4.3		< 4.3	
Toluene	92.14	< 4.3		1445	114
Trichloroethene	131.39	< 4.3		2653	122
2,2,4 Trimethyl pentane	114.23	< 4.3	80	< 4.3	82
Xylenes	106.16	< 4.3		< 4.3	

Volatile Organic HAPs Laboratory Data Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/8/2011
Run No: 18-2

Compound	Molecular Weight	Sample Train A Analysis (M_u) (micrograms)	% Recovery	Sample Train B Analysis (M_u) (micrograms)	% Recovery
Acetone	58.08	NA		NA	
Acetonitrile	41.05	NA		NA	96
Acrolein	56.06	NA		NA	83
Acrylonitrile	53.06	NA	129	NA	153
Benzene	78.11	< 4.3	100	< 4.3	85
1,3-Butadiene	54.09	< 4.3	51	< 4.3	26
Carbon disulfide	76.14	NA		NA	
Chlorobenzene	112.56	< 4.3		< 4.3	
Cumene	120.19	< 4.3		< 4.3	
1,2-Dibromoethane	187.86	< 4.3	95	< 4.3	82
Ethylbenzene	106.17	< 4.3	102	< 4.3	81
Hexane	86.18	NA	111	NA	77
Methyl isobutyl ketone	100.16	< 4.3		2923	85
Methyl t-butyl ether	88.15	NA	97	NA	95
Methylene chloride	84.93	NA		NA	
Nitrobenzene	123.06	< 21.5	434	26.1	238
2-Nitropropane	89.09	< 4.3	103	< 4.3	85
Pentane	72.15	< 4.3	114	< 4.3	57
Styrene	104.15	< 4.3	96	< 4.3	79
Tetrachloroethene	165.83	< 4.3		< 4.3	
Toluene	92.14	< 4.3		1255	139
Trichloroethene	131.39	< 4.3		2708	173
2,2,4 Trimethyl pentane	114.23	< 4.3	102	< 4.3	72
Xylenes	106.16	< 4.3		< 4.3	

Volatile Organic HAPs Laboratory Data Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/8/2011
Run No: 18-3

Compound	Molecular Weight	Sample Train A Analysis (M_u) (micrograms)	% Recovery	Sample Train B Analysis (M_u) (micrograms)	% Recovery
Acetone	58.08	NA		NA	
Acetonitrile	41.05	NA		NA	63
Acrolein	56.06	NA		NA	48
Acrylonitrile	53.06	NA	75	NA	71
Benzene	78.11	< 4.3	85	< 4.3	88
1,3-Butadiene	54.09	< 4.3		< 4.3	39
Carbon disulfide	76.14	NA		NA	
Chlorobenzene	112.56	< 4.3		< 4.3	
Cumene	120.19	< 4.3		< 4.3	
1,2-Dibromoethane	187.86	< 4.3	83	9.0	82
Ethylbenzene	106.17	< 4.3	89	< 4.3	94
Hexane	86.18	NA	43	NA	73
Methyl isobutyl ketone	100.16	< 4.3		2692.9	79
Methyl t-butyl ether	88.15	NA	49	NA	63
Methylene chloride	84.93	NA		NA	
Nitrobenzene	123.06	< 21.5	121	< 21.5	127
2-Nitropropane	89.09	< 4.3	85	< 4.3	97
Pentane	72.15	< 4.3	61	< 4.3	81
Styrene	104.15	< 4.3	86	< 4.3	90
Tetrachloroethene	165.83	< 4.3		< 4.3	131
Toluene	92.14	< 4.3		1242.4	116
Trichloroethene	131.39	< 4.3		2375.3	
2,2,4 Trimethyl pentane	114.23	< 4.3	79	< 4.3	81
Xylenes	106.16	< 4.3		< 4.3	

VOLATILE ORGANIC HAPS CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
SAMPLE: VolHAPs - Methanol Impingers
TEST DATE: 6/7/2011
RUN NO: 18-1

INPUT

Q_s :	8,798,924 **dscfh**
P_{bar} :	29.20 **in Hg**

	A Train:		*B Train:*
V_m **Spiked:**	22.006 **liters**	V_m **Unspiked:**	21.223 **liters**
V_m **Spiked:**	0.777 **cubic ft**	V_m **Unspiked:**	0.749 **cubic ft**
Y Spiked :	0.997	**Y Sample :**	1.005
T_m **Spiked:**	114.6 **°F**	T_m **Sample:**	88.7 **°F**
ΔH Spiked:	0.59 **in.** H_2O	**ΔH Sample:**	0.59 **in.** H_2O

Volume of sample at standard conditions on dry basis		**English units (29.92 in. Hg 68° F)**	
V_{mstd} Train A (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.696	**dscf**
V_{mstd} Train A ($V_{s\text{-liters}}$) = dscf x 28.32	=	19.705	**std liters**
V_{mstd} Train B (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.708	**dscf**
V_{mstd} Train B ($V_{u\text{-liters}}$) = dscf x 28.32	=	20.060	**std liters**

		A TRAIN					B TRAIN					AVERAGE	
Compound	Molecular Weight	Mass/volume (M_v) (µg/liter)	VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	Mass/volume (M_v) (µg/liter)	VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)
Acetone	58.08	8.0184	5.0062E-07	3,321	8,018	4.4049	5.7826	3.6103E-07	2,395	5,783	3.1767	6,900	3.7908
Acetonitrile	41.05	< 0.2182	< 1.3624E-08	< 128	< 218	< 0.1199						< 218	< 0.1199
Acrolein	56.06	< 0.2182	< 1.3624E-08	< 94	< 218	< 0.1199						< 218	< 0.1199
Acrylonitrile	53.06	< 0.2182	< 1.3624E-08	< 99	< 218	< 0.1199	< 0.2144	1.3383E-08	< 97	< 214	< 0.1178	< 216	< 0.1188
Benzene	78.11	< 0.2182	< 1.3624E-08	< 67	< 218	< 0.1199	< 0.2144	1.3383E-08	< 66	< 214	< 0.1178	< 216	< 0.1188
1,3-Butadiene	54.09	< 0.2182	< 1.3624E-08	< 97	< 218	< 0.1199	< 0.2144	1.3383E-08	< 95	< 214	< 0.1178	< 216	< 0.1188
Carbon disulfide	76.14	< 0.2182	< 1.3624E-08	< 69	< 218	< 0.1199	< 0.2144	1.3383E-08	< 68	< 214	< 0.1178	< 216	< 0.1188
Chlorobenzene	112.56	< 0.2182	< 1.3624E-08	< 47	< 218	< 0.1199	< 0.2144	1.3383E-08	< 46	< 214	< 0.1178	< 216	< 0.1188
Cumene	120.19	< 0.2182	< 1.3624E-08	< 44	< 218	< 0.1199	< 0.2144	1.3383E-08	< 43	< 214	< 0.1178	< 216	< 0.1188
1,2-Dibromoethane	187.86	< 0.2182	< 1.3624E-08	< 28	< 218	< 0.1199	< 0.2144	1.3383E-08	< 27	< 214	< 0.1178	< 216	< 0.1188
Ethylbenzene	106.17	< 0.2182	< 1.3624E-08	< 49	< 218	< 0.1199	< 0.2144	1.3383E-08	< 49	< 214	< 0.1178	< 216	< 0.1188
Hexane	86.18	< 0.2182	< 1.3624E-08	< 61	< 218	< 0.1199	< 0.2144	1.3383E-08	< 60	< 214	< 0.1178	< 216	< 0.1188
Methyl isobutyl ketone	100.16	< 0.2182	< 1.3624E-08	< 52	< 218	< 0.1199						< 218	< 0.1199
Methyl t-butyl ether	88.15	< 0.2182	< 1.3624E-08	< 60	< 218	< 0.1199	< 0.2144	1.3383E-08	< 58	< 214	< 0.1178	< 216	< 0.1188
Methylene chloride	84.93	< 0.2182	< 1.3624E-08	< 62	< 218	< 0.1199	53.6383	3.3488E-06	15,191	53,638	29.4663	< 218	< 0.1199
Nitrobenzene	123.06	< 1.0911	< 6.8122E-08	< 213	< 1,091	< 0.5994	1.0718	6.6915E-08	209	1,072	0.5888	1,081	0.5941
2-Nitropropane	89.09	< 0.2182	< 1.3624E-08	< 59	< 218	< 0.1199	< 0.2144	1.3383E-08	< 58	< 214	< 0.1178	< 216	< 0.1188
Pentane	72.15	< 0.2182	< 1.3624E-08	< 73	< 218	< 0.1199	< 0.2144	1.3383E-08	< 71	< 214	< 0.1178	< 216	< 0.1188
Styrene	104.15	< 0.2182	< 1.3624E-08	< 50	< 218	< 0.1199	< 0.2144	1.3383E-08	< 50	< 214	< 0.1178	< 216	< 0.1188
Tetrachloroethene	165.83	< 0.2182	< 1.3624E-08	< 32	< 218	< 0.1199	< 0.2144	1.3383E-08	< 31	< 214	< 0.1178	< 216	< 0.1188
Toluene	92.14	< 0.2182	< 1.3624E-08	< 57	< 218	< 0.1199						< 218	< 0.1199
Trichloroethene	131.39	< 0.2182	< 1.3624E-08	< 40	< 218	< 0.1199						< 218	< 0.1199
2,2,4 Trimethyl pentane	114.23	< 0.2182	< 1.3624E-08	< 46	< 218	< 0.1199	< 0.2144	1.3383E-08	< 45	< 214	< 0.1178	< 216	< 0.1188
Xylenes	106.16	< 0.2182	< 1.3624E-08	< 49	< 218	< 0.1199	< 0.2144	1.3383E-08	< 49	< 214	< 0.1178	< 216	< 0.1188

VOLATILE ORGANIC HAPS CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
SAMPLE: VolHAPs - Methanol Impingers
TEST DATE: 6/8/2011
RUN NO: 18-2

INPUT

Q_s :	9,079,436 **dscfh**		
P_{bar} :	29.30 **in Hg**		
	A Train:		***B Train:***
V_m **Spiked:**	20.358 **liters**	V_m **Unspiked:**	20.8 **liters**
V_m **Spiked:**	0.719 **cubic ft**	V_m **Unspiked:**	0.734 **cubic ft**
Y Spiked :	0.997	**Y Sample :**	1.005
T_m **Spiked:**	109.0 **°F**	T_m **Sample:**	102.0 **°F**
ΔH Spiked:	0.79 **in.** H_2O	**ΔH Sample:**	0.59 **in.** H_2O

Volume of sample at standard conditions on dry basis		**English units (29.92 in. Hg 68° F)**	
V_{mstd} Train A (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.653	**dscf**
V_{mstd} Train A ($V_{s\text{-liters}}$) = dscf x 28.32	=	18.481	**std liters**
V_{mstd} Train B (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.680	**dscf**
V_{mstd} Train B ($V_{u\text{-liters}}$) = dscf x 28.32	=	19.261	**std liters**

		A TRAIN					B TRAIN					AVERAGE	
Compound	Molecular Weight	Mass/volume (M_v) (µg/liter)	VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	Mass/volume (M_v) (µg/liter)	VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)
Acetone	58.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	41.05	NA	NA	NA	NA	NA						NA	NA
Acrolein	56.06	NA	NA	NA	NA	NA						NA	NA
Acrylonitrile	53.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	78.11	< 0.2327	< 1.4527E-08	< 72	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 69	< 223	< 0.1266	< 228	< 0.1292
1,3-Butadiene	54.09	< 0.2327	< 1.4527E-08	< 103	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 99	< 223	< 0.1266	< 228	< 0.1292
Carbon disulfide	76.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	112.56	< 0.2327	< 1.4527E-08	< 50	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 48	< 223	< 0.1266	< 228	< 0.1292
Cumene	120.19	< 0.2327	< 1.4527E-08	< 47	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 45	< 223	< 0.1266	< 228	< 0.1292
1,2-Dibromoethane	187.86	< 0.2327	< 1.4527E-08	< 30	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 29	< 223	< 0.1266	< 228	< 0.1292
Ethylbenzene	106.17	< 0.2327	< 1.4527E-08	< 53	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 51	< 223	< 0.1266	< 228	< 0.1292
Hexane	86.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	100.16	< 0.2327	< 1.4527E-08	< 56	< 233	< 0.1319						< 233	< 0.1319
Methyl t-butyl ether	88.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	84.93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	123.06	< 1.1634	< 7.2635E-08	< 227	< 1,163	< 0.6595	< 1.3551	< 8.4603E-08	< 265	< 1,355	< 0.7681	< 1259	< 0.7138
2-Nitropropane	89.09	< 0.2327	< 1.4527E-08	< 63	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 60	< 223	< 0.1266	< 228	< 0.1292
Pentane	72.15	< 0.2327	< 1.4527E-08	< 78	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 74	< 223	< 0.1266	< 228	< 0.1292
Styrene	104.15	< 0.2327	< 1.4527E-08	< 54	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 52	< 223	< 0.1266	< 228	< 0.1292
Tetrachloroethene	165.83	< 0.2327	< 1.4527E-08	< 34	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 32	< 223	< 0.1266	< 228	< 0.1292
Toluene	92.14	< 0.2327	< 1.4527E-08	< 61	< 233	< 0.1319						< 233	< 0.1319
Trichloroethene	131.39	< 0.2327	< 1.4527E-08	< 43	< 233	< 0.1319						< 233	< 0.1319
2,2,4 Trimethyl pentane	114.23	< 0.2327	< 1.4527E-08	< 49	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 47	< 223	< 0.1266	< 228	< 0.1292
Xylenes	106.16	< 0.2327	< 1.4527E-08	< 53	< 233	< 0.1319	< 0.2233	< 1.3938E-08	< 51	< 223	< 0.1266	< 228	< 0.1292

VOLATILE ORGANIC HAPS CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
SAMPLE: VolHAPs - Methanol Impingers
TEST DATE: 6/8/2011
RUN NO: 18-3

INPUT

Q_s : 8,938,046 **dscfh**
P_{bar} : 29.30 **in Hg**

A Train:		*B Train:*	
V_m **Spiked:**	22.294 **liters**	V_m **Unspiked:**	22.669 **liters**
V_m **Spiked:**	0.787 **cubic ft**	V_m **Unspiked:**	0.800 **cubic ft**
Y Spiked :	0.997	**Y Sample :**	1.005
T_m **Spiked:**	108.9 **°F**	T_m **Sample:**	102.5 **°F**
ΔH Spiked:	0.79 **in. H_2O**	**ΔH Sample:**	0.59 **in. H_2O**

Volume of sample at standard conditions on dry basis		**English units (29.92 in. Hg 68° F)**	
V_{mstd} Train A (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.715	**dscf**
V_{mstd} Train A ($V_{s\text{-liters}}$) = dscf x 28.32	=	20.242	**std liters**
V_{mstd} Train B (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.741	**dscf**
V_{mstd} Train B ($V_{u\text{-liters}}$) = dscf x 28.32	=	20.973	**std liters**

		A TRAIN					B TRAIN					AVERAGE	
Compound	Molecular Weight	Mass/volume (M_v) (µg/liter)	VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	Mass/volume (M_v) (µg/liter)	VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)
Acetone	58.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	41.05	NA	NA	NA	NA	NA						NA	NA
Acrolein	56.06	NA	NA	NA	NA	NA						NA	NA
Acrylonitrile	53.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	78.11	< 0.2124	< 1.3263E-08	< 65	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 63	< 205	< 0.1144	< 209	< 0.1165
1,3-Butadiene	54.09	< 0.2124	< 1.3263E-08	< 94	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 91	< 205	< 0.1144	< 209	< 0.1165
Carbon disulfide	76.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	112.56	< 0.2124	< 1.3263E-08	< 45	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 44	< 205	< 0.1144	< 209	< 0.1165
Cumene	120.19	< 0.2124	< 1.3263E-08	< 43	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 41	< 205	< 0.1144	< 209	< 0.1165
1,2-Dibromoethane	187.86	< 0.2124	< 1.3263E-08	< 27	< 212	< 0.1185	< 0.4291	< 2.6792E-08	< 55	< 429	< 0.2395	< 321	< 0.1790
Ethylbenzene	106.17	< 0.2124	< 1.3263E-08	< 48	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 46	< 205	< 0.1144	< 209	< 0.1165
Hexane	86.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl isobutyl ketone	100.16	< 0.2124	< 1.3263E-08	< 51	< 212	< 0.1185						< 212	< 0.1185
Methyl t-butyl ether	88.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	84.93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	123.06	< 1.0622	< 6.6316E-08	< 208	< 1,062	< 0.5927	< 1.0251	< 6.4003E-08	< 200	< 1,025	< 0.5721	< 1,044	< 0.5824
2-Nitropropane	89.09	< 0.2124	< 1.3263E-08	< 57	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 55	< 205	< 0.1144	< 209	< 0.1165
Pentane	72.15	< 0.2124	< 1.3263E-08	< 71	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 68	< 205	< 0.1144	< 209	< 0.1165
Styrene	104.15	< 0.2124	< 1.3263E-08	< 49	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 47	< 205	< 0.1144	< 209	< 0.1165
Tetrachloroethene	165.83	< 0.2124	< 1.3263E-08	< 31	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 30	< 205	< 0.1144	< 209	< 0.1165
Toluene	92.14	< 0.2124	< 1.3263E-08	< 55	< 212	< 0.1185						< 212	< 0.1185
Trichloroethene	131.39	< 0.2124	< 1.3263E-08	< 39	< 212	< 0.1185						< 212	< 0.1185
2,2,4 Trimethyl pentane	114.23	< 0.2124	< 1.3263E-08	< 45	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 43	< 205	< 0.1144	< 209	< 0.1165
Xylenes	106.16	< 0.2124	< 1.3263E-08	< 48	< 212	< 0.1185	< 0.2050	< 1.2801E-08	< 46	< 205	< 0.1144	< 209	< 0.1165

SUMMARY OF METHANOL TEST RESULTS

COMPANY	BP			
LOCATION	Whiting, IN			
SOURCE	FCCU 500 Exhaust			
RUN NO	Methanol - 1	Methanol - 2	Methanol - 3	
TEST TIME	14:04-15:04	12:04-13:04	17:08-18:08	Average
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
Stack Gas Parameters				
Temperature, av. °F	544.1	543.4	544.5	544.0
Velocity, av. ft/sec	89.145	94.180	91.874	91.733
Volume flow, acfm	340,270	359,487	350,687	350,148
Volume flow, scfm	174,139	184,688	179,970	179,599
Volume flow, dscfm	146,649	151,324	148,967	148,980
Volume flow, scfh	10,448,358	11,081,285	10,798,203	10,775,949
Volume flow, dscfh	8,798,924	9,079,436	8,938,046	8,938,802
Moisture, av. % vol	15.79	18.07	17.23	17.03
CO_2, av. % vol, db	18.0	17.7	18.0	17.9
O_2, av. % vol, db	1.5	1.6	1.6	1.6
Spiked Train Parameters				
Time, min	60	60	60	
Volume, std liters	15.851	16.500	14.599	
Volume, dscf	0.560	0.583	0.515	
Unspiked Train Parameters				
Time, min	60	60	60	
Volume, std liters	14.207	13.458	14.862	
Volume, dscf	0.502	0.475	0.525	
Methanol Data				
Spike Recovered (R), fractional	2.552	0.414	-0.309	
Concentration				
ppbv db	63,534	131,336	0	64,956
mg/dscm	84,629	174,944	0	86,524
lb/dscf x 10^{-6}	5.28375	10.92248	0	5.40208
Emission Rate				
lb/hr	46.49133	99.16992	0	48.55375

Methanol Laboratory Data Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/7/2011
Run No: Methanol - 1

Compound	Molecular Weight	Spiked Value (S) (micrograms)	Spiked Train Analysis (M_s) (micrograms)	Unspiked Train Analysis (M_u) (micrograms)
Methanol	32.04	317.8	4,234.0	3,068.0

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/8/2011
Run No: Methanol - 2

Compound	Molecular Weight	Spiked Value (S) (micrograms)	Spiked Train Analysis (M_s) (micrograms)	Unspiked Train Analysis (M_u) (micrograms)
Methanol	32.04	317.8	1,327.0	975.0

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/8/2011
Run No: Methanol - 3

Compound	Molecular Weight	Spiked Value (S) (micrograms)	Spiked Train Analysis (M_s) (micrograms)	Unspiked Train Analysis (M_u) (micrograms)
Methanol	32.04	317.8	342.0	448.0

METHANOL CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
SAMPLE: Methanol
TEST DATE: 6/7/2011
RUN NO: Methanol - 1

INPUT

Q_s :	8,798,924 **dscfh**
P_{bar} :	29.20 **in Hg**

Spiked Train:		***Unspiked Train:***	
V_m **Spiked:**	17.462 **liters**	V_m **Unspiked:**	15.447 **liters**
V_m **Spiked:**	0.617 **cubic ft**	V_m **Unspiked:**	0.545 **cubic ft**
Y Spiked :	0.993	**Y Sample :**	1.000
T_m **Spiked:**	104.8 **°F**	T_m **Sample:**	101.1 **°F**
ΔH Spiked:	0.79 **in.** H_2O	**ΔH Sample:**	0.59 **in.** H_2O

Volume of sample at standard conditions on dry basis

		English units (29.92 in. Hg 68° F)	
V_{mstd} Spiked (V_s) = $(17.647)(V_m)(Y_d)(P_{bar}+\Delta H/13.6)/(T_m)$	=	0.560	**dscf**
V_{mstd} Spiked ($V_{s\text{-liters}}$) = dscf x 28.32	=	15.851	**std liters**
V_{mstd} Unspiked (V_u) = $(17.647)(V_m)(Y_d)(P_{bar}+\Delta H/13.6)/(T_m)$	=	0.502	**dscf**
V_{mstd} Unspiked ($V_{u\text{-liters}}$) = dscf x 28.32	=	14.207	**std liters**

Recovery Calculations

$M_v = (M_s/V_{s\text{-liters}}) - (M_u/V_{u\text{-liters}})$

$R = (M_v * V_{s\text{-liters}}) / S$

Stack gas volume flow rate

Q_s = dscfh

Stack VOC emission rate

$Q_s \times C_s$

VOC Concentration

$C_s = 2.2046 \times 10^{-9}$ lb/µg x M_u / V_u

Reported $C_s = C_s / R$

ppb = $C_s * (385.26 \times 10^9 / MW)$

Reported ppb = ppb/R

Compound	Molecular Weight	Mass/volume (M_v) (µg/liter)	Fraction of Spike Recovered R (fractional)	VOC Concentration (lb/dscf)	Reported VOC Concentration (lb/dscf)	VOC Concentration (ppb)	Reported VOC Concentration (ppb)	Reported VOC Concentration (µg/dscm)	Reported VOC Emission (lb/hr)
Methanol	32.04	51.2	2.6	1.3483E-05	5.2838E-06	162,120	63,534	84,629	46.49133

METHANOL CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
SAMPLE: Methanol
TEST DATE: 6/8/2011
RUN NO: Methanol - 2

INPUT

Q_s :	9,079,436 **dscfh**
P_{bar} :	29.85 **in Hg**

Spiked Train:		***Unspiked Train:***	
V_m **Spiked:**	17.653 **liters**	V_m **Unspiked:**	14.314 **liters**
V_m **Spiked:**	0.623 **cubic ft**	V_m **Unspiked:**	0.505 **cubic ft**
Y Spiked :	0.993	**Y Sample :**	1.000
T_m **Spiked:**	101 **°F**	T_m **Sample:**	101.1 **°F**
ΔH Spiked:	0.98 **in. H_2O**	**ΔH Sample:**	0.59 **in. H_2O**

Volume of sample at standard conditions on dry basis		**English units (29.92 in. Hg 68° F)**	
V_{mstd} Spiked (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.583	**dscf**
V_{mstd} Spiked ($V_{s\text{-liters}}$) = dscf x 28.32	=	16.500	**std liters**
V_{mstd} Unspiked (V_u) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.475	**dscf**
V_{mstd} Unspiked ($V_{u\text{-liters}}$) = dscf x 28.32	=	13.458	**std liters**

Recovery Calculations
$M_v = (M_s/V_{s\text{-liters}}) - (M_u/V_{u\text{-liters}})$
$R = (M_v * V_{s\text{-liters}}) / S$

Stack gas volume flow rate
Q_s = dscfh

Stack VOC emission rate
$Q_s \times C_s$

VOC Concentration
$C_s = 2.2046 \times 10^{-9}$ lb/µg x M_u / V_u
Reported $C_s = C_s / R$
ppb = $C_s * (385.26 \times 10^9 / MW)$
Reported ppb = ppb/R

Compound	Molecular Weight	Mass/volume (M_v) (µg/liter)	Fraction of Spike Recovered R (fractional)	VOC Concentration (lb/dscf)	Reported VOC Concentration (lb/dscf)	VOC Concentration (ppb)	Reported VOC Concentration (ppb)	Reported VOC Concentration (µg/dscm)	Reported VOC Emission (lb/hr)
Methanol	32.04	7.98	0.41	4.5234E-06	1.0922E-05	54,390	131,336	174,944	99.16992

METHANOL CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
SAMPLE: Methanol
TEST DATE: 6/8/2011
RUN NO: Methanol - 3

INPUT

Q_s :	8,938,046 **dscfh**
P_{bar} :	29.30 **in Hg**

Spiked Train:		***Unspiked Train:***	
V_m **Spiked:**	15.946 **liters**	V_m **Unspiked:**	16.124 **liters**
V_m **Spiked:**	0.563 **cubic ft**	V_m **Unspiked:**	0.569 **cubic ft**
Y Spiked :	0.993	**Y Sample :**	1.000
T_m **Spiked:**	102.2 **°F**	T_m **Sample:**	101.5 **°F**
ΔH Spiked:	0.98 **in. H_2O**	**ΔH Sample:**	0.39 **in. H_2O**

Volume of sample at standard conditions on dry basis		**English units (29.92 in. Hg 68° F)**	
V_{mstd} Spiked (V_s) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.515	**dscf**
V_{mstd} Spiked ($V_{s\text{-liters}}$) = dscf x 28.32	=	14.599	**std liters**
V_{mstd} Unspiked (V_u) = (17.647)(V_m)(Y_d)(P_{bar}+ΔH/13.6)/(T_m)	=	0.525	**dscf**
V_{mstd} Unspiked ($V_{u\text{-liters}}$) = dscf x 28.32	=	14.862	**std liters**

Recovery Calculations

$M_v = (M_s/V_{s\text{-liters}}) - (M_u/V_{u\text{-liters}})$

$R = (M_v * V_{s\text{-liters}}) / S$

Stack gas volume flow rate

Q_s = dscfh

Stack VOC emission rate

$Q_s \times C_s$

VOC Concentration

$C_s = 2.2046 \times 10^{-9}$ lb/µg x M_u / V_u

Reported $C_s = C_s / R$

ppb = $C_s * (385.26 \times 10^9 / MW)$

Reported ppb = ppb/R

Compound	Molecular Weight	Mass/volume (M_v) (µg/liter)	Fraction of Spike Recovered R (fractional)	VOC Concentration (lb/dscf)	Reported VOC Concentration (lb/dscf)	VOC Concentration (ppb)	Reported VOC Concentration (ppb)	Reported VOC Concentration (µg/dscm)	Reported VOC Emission (lb/hr)
Methanol	32.04	-6.7	-0.31	1.8820E-06	-6.0995E-06	22,629	-73,342	-97,694.2	-54.51728

SUMMARY OF TEST RESULTS

COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust

RUN NO	1	2	3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	1327-1427	0925-1025	1445-1545	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
THC Emissions (as Propane)				
Concentration				
ppmv db	1.56	0.58	0.44	0.86
Emission rate				
lbs/hr	1.40	0.67	0.50	0.85
Methane Emissions				
Concentration				
ppmv db	< 0.18	< 0.18	< 0.18	< 0.18
Emission rate				
lbs/hr	< 0.06	< 0.09	< 0.07	< 0.07
Ethane Emissions				
Concentration				
ppmv db	< 0.10	< 0.10	< 0.10	< 0.10
Emission rate				
lbs/hr	< 0.06	< 0.09	< 0.08	< 0.08

METHANE / ETHANE CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/7/2011
TEST RUN NO. : 1

GAS FLOW RATE : 7,800,598 **dscfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf) x10^{-6}	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v db)	EMISSION RATE (lb/hr)
Methane	16.04	< 0.007	< 120.01	< 0.18	< 0.06
Ethane	30.07	< 0.008	< 124.99	< 0.10	< 0.06

USEPA Method 25-A
Total VOC
Emission Rate Calculation

Company: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Test Date: 6/7/2011
Test Run #: 1
Test Time: 1258-1458

Data Input:

Average CEM reading (as methane):	3.87	**ppmv wb**
Average CEM reading (as propane):	1.29	**ppmv wb**
Average methane concentration:	0.0	**ppmv db**
Stack gas volumetric flow rate (Q_{std}):	7,800,598	**dscfh**
Total VOM molecular weight (MW):	44.10	**lb/lb-mole**
Stack gas moisture content (B_{wo}):	0.1752	**fractional**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Total VOC (as Propane)

$C_{gas(wet)} = \text{CEM reading(C)}$ = **1.29 ppmv wb as propane**

Total VOC (as Propane) Concentration and Emission Rate:

$$C_{gas(dry)} = \frac{C_{gas(wet)}}{(1-B_{wo})}$$ = **1.56 ppmv db as propane**

$$C_{nmgas(dry)} = C_{gas(dry)} - C_{methane(dry)}$$ = **1.56 ppmv db as propane**

$$C_{nmgasVOC-total,lb/dscf} = C_{nmgas(asVOC-Cc)} \times \left(\frac{MW \ \ lb/lb-mole}{385.26 \times 10^6 \ ft^3/lb-mole} \right)$$ = **0.179 x 10^{-6} lbs/dscf VOC as propane**

$$ES_{nmgas\ VOC-total,lb/hr} = \left(E_{nmgasVOC-C,lb/hr}\right) x (Qstd)$$ = **1.40 lb/hr VOC as propane**

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011

BAROMETRIC:	29.2 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.40 **% by volume**
STACK TEMP:	546.1 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.0243 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.85	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.60	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.0243	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 546.1 °F + 460	=	1,006.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.12	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	80.852	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	308,616	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	157,626 9,457,572	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	130,010 7,800,598	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NUMBER: M23-1

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	146.721 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	106.2 **°F**
STACK TEMP:	546.1 **°F**	**LIQUID COLL:**	610.5 **milliliters**
SQ.RT ΔP:	1.0243 **in.H_2O**	**CO_2:**	17.40 **% by volume**
ΔH:	1.23 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 135.283 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 28.736 \text{ scf}$$

V_{lc} = 610.5 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1752$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.6 °K
P = 739.6 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1752

METHANE / ETHANE CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : 2

GAS FLOW RATE : 11,714,610 **dscfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v db)	EMISSION RATE (lb/hr)
Methane	16.04	< 0.007	< 120.01	< 0.18	< 0.09
Ethane	30.07	< 0.008	< 124.99	< 0.10	< 0.09

USEPA Method 25-A
Total VOC
Emission Rate Calculation

Company: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Test Date: 6/8/2011
Test Run #: 2
Test Time: 0855-1055

Data Input:

Average CEM reading (as methane):	1.50	**ppmv wb**
Average CEM reading (as propane):	0.50	**ppmv wb**
Average methane concentration:	0.0	**ppmv db**
Stack gas volumetric flow rate (Q_{std}):	10,086,284	**dscfh**
Total VOM molecular weight (MW):	44.10	**lb/lb-mole**
Stack gas moisture content (B_{wo}):	0.1390	**fractional**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Total VOC (as Propane)

$C_{gas(wet)} = \text{CEM reading(C)}$ = **0.50 ppmv wb as propane**

Total VOC (as Propane) Concentration and Emission Rate:

$$C_{gas(dry)} = \frac{C_{gas(wet)}}{(1-B_{wo})}$$ = **0.58 ppmv db as propane**

$$C_{nmgas(dry)} = C_{gas(dry)} - C_{methane(dry)}$$ = **0.58 ppmv db as propane**

$$C_{nmgasVOC-total,lb/dscf} = C_{nmgas(asVOC-C3)} \times \left(\frac{MW \ \ lb/lb-mole}{385.26 \times 10^6 \ ft^3/lb-mole} \right)$$ = **0.066 x 10^{-6} lbs/dscf VOC as propane**

$$ESnm_{gas\ VOC-total,lb/hr} = (E_{nmgasVOC-C3,lb/hr}) \times (Qstd)$$ = **0.67 lb/hr VOC as propane**

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.70 **% by volume**
STACK TEMP:	545.4 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.2773 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.90	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	29.10	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.2773	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 545.4 °F + 460	=	1,005.4	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.22	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	99.736	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	380,695	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	195,244 11,714,650	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	168,105 10,086,284	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-2

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.315 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	102.2 **°F**
STACK TEMP:	545.4 **°F**	**LIQUID COLL:**	590.0 **milliliters**
SQ.RT ΔP:	1.2773 **in.H_2O**	**CO_2:**	17.70 **% by volume**
ΔH:	1.88 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 172.019 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 27.771 \text{ scf}$$

V_{lc} = 590.0 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1390$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.2 °K
P = 742.2 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1390

METHANE / ETHANE CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : 3

GAS FLOW RATE : 9,925,468 **dscfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v db)	EMISSION RATE (lb/hr)
Methane	16.04	< 0.007	< 120.01	< 0.18	< 0.07
Ethane	30.07	< 0.008	< 124.99	< 0.10	< 0.08

USEPA Method 25-A
Total VOC
Emission Rate Calculation

Company: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Test Date: 6/8/2011
Test Run #: 3
Test Time: 1415-1615

Data Input:

Average CEM reading (as methane):	1.08	**ppmv wb**
Average CEM reading (as propane):	0.36	**ppmv wb**
Average methane concentration:	0.0	**ppmv db**
Stack gas volumetric flow rate (Q_{std}):	9,925,468	**dscfh**
Total VOM molecular weight (MW):	44.10	**lb/lb-mole**
Stack gas moisture content (B_{wo}):	0.1753	**fractional**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Total VOC (as Propane)

$C_{gas(wet)}$ = CEM reading(C) = **0.36 ppmv wb as propane**

Total VOC (as Propane) Concentration and Emission Rate:

$$C_{gas(dry)} = \frac{C_{gas(wet)}}{(1-B_{wo})} = \textbf{0.44 ppmv db as propane}$$

$$C_{nmgas(dry)} = C_{gas(dry)} - C_{methane(dry)} = \textbf{0.44 ppmv db as propane}$$

$$C_{nmgasVOC,lb/dscf} = C_{nmgas(asVOC-C3)} \times \left(\frac{MW \ \ lb/lb-mole}{385.26 \times 10^6 \ ft^3/lb-mole} \right) = \textbf{0.050 x } 10^{-6} \textbf{ lbs/dscf VOC as propane}$$

$$ESnm_{gas\ VOM-total,lb/hr} = (E_{nmgasVOM-C1,lb/hr}) \times (Qstd) \times (MSF) = \textbf{0.50 lb/hr VOC as propane}$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.2 **in.H_2O**	**CO_2:**	18.00 **% by volume**
STACK TEMP:	545.9 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.3031 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.94	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.67	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.3031	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 545.9 °F + 460	=	1,005.9	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.21	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	102.547	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	391,426	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	200,597 12,035,842	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	165,424 9,925,468	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-3

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.495 **ft^3**
STATIC PRES:	-1.20 **in.H_2O**	**METER TEMP:**	107.3 **°F**
STACK TEMP:	545.9 **°F**	**LIQUID COLL:**	770.8 **milliliters**
SQ.RT ΔP:	1.3031 **in.H_2O**	**CO_2:**	18.00 **% by volume**
ΔH:	1.88 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 170.639 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 36.282 \text{ scf}$$

V_{lc} = 770.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1753$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.5 °K
P = 742.0 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1753

SUMMARY OF TEST RESULTS

COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust

RUN NO	1	2	3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	1258-1458	0930-1030	1415-1615	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Hydrogen Cyanide Emissions				
Concentration				
ppmv wb	0.76	0.57	0.50	0.61
microgram/dscm	1,035.27	743.81	681.21	820.10
Emission rate				
lbs/hr	0.50	0.47	0.42	0.46

SUMMARY OF TEST RESULTS

COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust

RUN NO	1	2	3	
TEST DATE	6/7/2011	6/8/2011	6/8/2011	
TEST TIME	1258-1458	0930-1030	1415-1615	Average
Stack Gas Parameters				
Temperature, °F	546.1	545.4	545.9	545.8
Velocity, av. ft/sec	80.9	99.7	102.5	94.4
Volumetric flow, acfm	308,616	380,695	391,426	360,246
Volumetric flow, scfm	157,626	195,244	200,597	184,489
Volumetric flow, dscfh	7,800,598	10,086,284	9,925,468	9,270,783
Moisture, av. % vol	17.5	13.9	17.5	16.3
Carbon Dioxide, av. % vol	17.4	17.7	18.0	17.7
Oxygen, av. % vol	1.6	1.6	1.6	1.6
Acetaldehyde Emissions				
Concentration				
ppmv wb	0.34	0.86	0.73	0.64
microgram/dscm	754.78	1,828.88	1,620.82	1,401.49
Emission rate				
lbs/hr	0.37	1.15	1.00	0.84
Formaldehyde Emissions				
Concentration				
ppmv wb	0.21	0.31	0.20	0.24
microgram/dscm	317.81	449.42	302.73	356.65
Emission rate				
lbs/hr	0.15	0.28	0.19	0.21
Propanal Emissions				
Concentration				
ppmv wb	0.21	0.27	0.19	0.22
microgram/dscm	614.67	757.06	556.22	642.65
Emission rate				
lbs/hr	0.30	0.48	0.34	0.37

FTIR ORGANICS CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/7/2011
TEST RUN NO. : 1

GAS FLOW RATE : 9,457,539 **scfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/scf) $x10^{-6}$	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v wb)	EMISSION RATE (lb/hr)
Formaldehyde	30.03	0.016	0.020	317.8	0.21	0.15
Acetaldehyde	44.05	0.039	0.047	754.8	0.34	0.37
Propanal	58.08	0.032	0.038	614.7	0.21	0.30
HCN	27.03	0.053	0.065	1,035.3	0.76	0.50

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011

BAROMETRIC:	29.2 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.40 **% by volume**
STACK TEMP:	546.1 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.0243 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.85	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.60	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.0243	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 546.1 °F + 460	=	1,006.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.12	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	80.852	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	308,616	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	157,626 9,457,572	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	130,010 7,800,598	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/7/2011
RUN NUMBER: M23-1

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	146.721 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	106.2 **°F**
STACK TEMP:	546.1 **°F**	**LIQUID COLL:**	610.5 **milliliters**
SQ.RT ΔP:	1.0243 **in.H_2O**	**CO_2:**	17.40 **% by volume**
ΔH:	1.23 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 135.283 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 28.736 \text{ scf}$$

V_{lc} = 610.5 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1752$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.6 °K
P = 739.6 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1752

FTIR ORGANICS CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : 2

GAS FLOW RATE : 11,714,610 **scfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/scf) $x10^{-6}$	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v wb)	EMISSION RATE (lb/hr)
Formaldehyde	30.03	0.024	0.028	449.4	0.31	0.28
Acetaldehyde	44.05	0.098	0.114	1,828.9	0.86	1.15
Propanal	58.08	0.041	0.047	757.1	0.27	0.48
HCN	27.03	0.040	0.046	743.8	0.57	0.47

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.1 **in.H_2O**	**CO_2:**	17.70 **% by volume**
STACK TEMP:	545.4 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.2773 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.90	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	29.10	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.2773	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 545.4 °F + 460	=	1,005.4	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.22	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	99.736	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	380,695	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	195,244 11,714,650	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	168,105 10,086,284	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-2

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.315 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	102.2 **°F**
STACK TEMP:	545.4 **°F**	**LIQUID COLL:**	590.0 **milliliters**
SQ.RT ΔP:	1.2773 **in.H_2O**	**CO_2:**	17.70 **% by volume**
ΔH:	1.88 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 172.019 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 27.771 \text{ scf}$$

V_{lc} = 590.0 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1390$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.2 °K
P = 742.2 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1390

FTIR ORGANICS CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/8/2011
TEST RUN NO. : 3

GAS FLOW RATE : 12,035,801 **scfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/scf) $x10^{-6}$	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v wb)	EMISSION RATE (lb/hr)
Formaldehyde	30.03	0.016	0.019	302.7	0.20	0.19
Acetaldehyde	44.05	0.083	0.101	1,620.8	0.73	1.00
Propanal	58.08	0.029	0.035	556.2	0.19	0.34
HCN	27.03	0.035	0.043	681.2	0.50	0.42

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: M23-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011

BAROMETRIC:	29.3 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.2 **in.H_2O**	**CO_2:**	18.00 **% by volume**
STACK TEMP:	545.9 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.3031 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.94	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.67	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.3031	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 545.9 °F + 460	=	1,005.9	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.21	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	102.547	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	391,426	**acfm**
Stack Area = 63.617 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	200,597 12,035,842	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	165,424 9,925,468	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/8/2011
RUN NUMBER: M23-3

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	184.495 **ft^3**
STATIC PRES:	-1.20 **$in.H_2O$**	**METER TEMP:**	107.3 **°F**
STACK TEMP:	545.9 **°F**	**LIQUID COLL:**	770.8 **milliliters**
SQ.RT ΔP:	1.3031 **$in.H_2O$**	**CO_2:**	18.00 **% by volume**
ΔH:	1.88 **$in.H_2O$**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 170.639 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 36.282 \text{ scf}$$

V_{lc} = 770.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1753$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$MF = \frac{\left(10^{\left[8.361 - \left(\frac{1893.5}{T - 27.65}\right)\right]}\right) - 0.5}{P} = 1.0000$$

T = 558.5 °K
P = 742.0 mmHg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1753

Company	: BP				
Location	: Whiting, IN				
Source	: FCCU 500				
Operators	:				
Test Run	:	FCCU-26-1	FCCU-26-2	FCCU-26-3	
Test Date	:	6/7/2011	6/8/2011	6/8/2011	
Test Time	:	15:56 - 17:56	9:17 - 11:17	14:15 - 16:15	Average
STACK GAS					
Temperature, av. °F		546.1	545.4	545.9	545.8
Velocity, av. ft/sec		80.07	100.79	103.04	94.63
Volume flow, acfm		305,640.83	384,704.49	393,295.33	361,213.55
Volume flow, scfh		9,366,385	11,838,020	12,093,315	11,099,240
Volume flow, dscfh		8,143,430	9,641,561	9,721,839	9,168,943
Moisture, av. % vol		13.06	18.55	19.61	17.07
CO_2, av. % vol, db		17.30	17.70	18.00	17.67
O_2, av. % vol, db		1.60	1.50	1.50	1.53
SAMPLE DATA					
Time, min		120.0	120.0	120.0	120.0
Volume, dscf		70.396	72.916	71.493	71.602
Volume, dscm		1.994	2.065	2.025	2.028
HYDROGEN CHLORIDE (HCl)					
Concentration					
ppmv db		0.39	0.33	0.50	0.41
mg/dscm		0.000472	0.000401	0.000613	0.000495
lb/dscf x 10^{-6}		0.0368	0.0312	0.0477	0.0386
Emission rate					
lb/hr		0.299	0.301	0.464	0.355
CHLORINE (Cl_2)					
Concentration					
ppmv db		0.02	0.02	0.05	0.03
mg/dscm		0.000052	0.000054	0.000108	0.000071
lb/dscf x 10^{-6}		0.0040	0.0042	0.0084	0.0055
Emission rate					
lb/hr		0.033	0.041	0.082	0.052
HYDROGEN FLUORIDE (HF)					
Concentration					
ppmv db		0.03	0.03	0.02	0.03
mg/dscm		0.000023	0.000018	0.000017	0.000019
lb/dscf x 10^{-6}		0.0018	0.0014	0.0013	0.0015
Emission rate					
lb/hr		0.015	0.014	0.013	0.014

HYDROGEN CHLORIDE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/7/2011
RUN NO: FCCU-26-1

INPUT

V_m:	78.605	ft^3	Q_s:	8,143,430	**dscfh**
γ **FACTOR:**	0.982		T_s:	546.1	**°F**
P_{bar}:	29.20	**in. Hg**	Θ:	120	**minutes**
ΔH:	1.53		V_s:	80.073	**fps**
T_m:	107.2	**°F**	P_s:	29.12	**in. Hg**
HCl in sample:	1,174	**µg**	V_{lc}:	224.6	**mL**
			$\%O_2$:	1.60	**%**

Volume of Sample at Standard Conditions on a Dry Basis: — **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 70.396 **dscf**

Total µg HCl in sample (M_n) = 1,174 **µg**

Concentration of HCl

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\ lb/\mu g)(M_n)}{V_{mstd}}$$

= 0.0368 **x 10^{-6} lbs/dscf**

$$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\ ft^3/lb-mole}{36.45\ lb/lb-mole} \times 10^6$$

= 0.39 **ppmv db**

$$C_{s(mg/dscm)} = \frac{M_n}{(1000\ \mu g/mg)(V_{mstd})(35.31\ ft^3/m^3)}$$

= 0.000472 **mg/dscm**

HCl Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)}$$

= 0.299402 **lbs/hr**

CHLORINE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/7/2011
RUN NO: FCCU-26-1

INPUT

V_m:	78.605	ft^3	Q_s:	8,143,430	dscfh
γ FACTOR:	0.982		T_s:	546.1	°F
P_{bar}:	29.20	in. Hg	Θ:	120	minutes
ΔH:	1.53		V_s:	80.073	fps
T_m:	107.2	°F	P_s:	29.12	in. Hg
Cl_2 in sample:	129	µg	V_{lc}:	224.6	mL
			$\%O_2$:	1.60	%

Volume of Sample at Standard Conditions on a Dry Basis: — **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 70.396 **dscf**

Total µg Cl_2 in sample (M_n) = 129 µg

Concentration of Cl_2

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\ lb/\mu g)(M_n)}{V_{mstd}}$$

= 0.0040 **x 10^{-6} lbs/dscf**

$$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\ ft^3/lb-mole}{70.096\ lb/lb-mole} \times 10^6$$

= 0.02 **ppmv db**

$$C_{s(mg/dscm)} = \frac{M_n}{(1000\ \mu g/mg)(V_{mstd})(35.31\ ft^3/m^3)}$$

= 0.000052 **mg/dscm**

Cl_2 Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)}$$

= 0.032899 **lbs/hr**

HYDROGEN FLUORIDE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/7/2011
RUN NO: FCCU-26-1

INPUT

V_m:	78.605	ft^3	Q_s:	8,143,430	dscfh
γ FACTOR:	0.982		T_s:	546.1	°F
P_{bar}:	29.20	in. Hg	Θ:	120	minutes
ΔH:	1.53		V_s:	80.073	fps
T_m:	107.2	°F	P_s:	29.12	in. Hg
HF in sample:	58	µg	V_{lc}:	224.6	mL
			$\%O_2$:	1.60	%

Volume of Sample at Standard Conditions on a Dry Basis:	$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$	=	**English Units (29.92 in. Hg, 68 °F)** 70.396 **dscf**
Total µg HF in sample (M_n)		=	58 **µg**
Concentration of HF	$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\, lb/\mu g)(M_n)}{V_{mstd}}$	=	0.0018 **x 10^{-6} lbs/ dscf**
	$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb-mole}{20.01 lb/lb-mole} \times 10^6$	=	0.03 **ppmv db**
	$C_{s(mg/dscm)} = \frac{M_n}{(1000\,\mu g/mg)(V_{mstd})(35.31 ft^3/m^3)}$	=	0.000023 **mg/dscm**
HF Mass Rate:	$E = Q_s \times C'_{s(lb/dscf)}$	=	0.014792 **lbs/hr**

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: FCCU-26-1

SOURCE: FCCU 500
TEST DATE: 6/7/2011

BAROMETRIC:	29.20 **in. Hg**	**STACK DIAM:**	108.0 **inches**
STATIC PRES:	-1.10 **in.H_2O**	**CO_2:**	17.30 **% by volume**
STACK TEMP:	546.1 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.0243 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.83	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	29.16	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.0243	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 546.1 °F + 460	=	1,006.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.12	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	80.073	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	305,640.83	**acfm**
Stack Area = 63.62 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	156,106.42 9,366,385	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	135,723.83 8,143,430	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/7/2011
RUN NUMBER: FCCU-26-1

γ FACTOR:	0.982	**STACK DIAM:**	108.0 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	78.605 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	107.2 **°F**
STACK TEMP:	546.1 **°F**	**LIQUID COLL:**	224.6 **milliliters**
SQ.RT ΔP:	1.0243 **in.H_2O**	**CO_2:**	17.30 **% by volume**
ΔH:	1.53 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 70.396 \text{ dscf}$$

γ = 0.982

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 10.572 \text{ scf}$$

V_{lc} = 224.6 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1306$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7260$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1306

HYDROGEN CHLORIDE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NO: FCCU-26-2

INPUT

V_m:	80.160	**ft^3**	**Q_s:**	9,641,561	**dscfh**
γ FACTOR:	0.982		**T_s:**	545.4	**°F**
P_{bar}:	29.30	**in. Hg**	**Θ:**	120	**minutes**
ΔH:	1.50		**V_s:**	100.786	**fps**
T_m:	100.3	**°F**	**P_s:**	29.22	**in. Hg**
HCl in sample:	1,032	**µg**	**V_{lc}:**	352.9	**mL**
			$\%O_2$:	1.50	**%**

Volume of Sample at Standard Conditions on a Dry Basis: — **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 72.916 **dscf**

Total µg HCl in sample (M_n) = 1,032 **µg**

Concentration of HCl

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\ lb/\mu g)(M_n)}{V_{mstd}}$$

= 0.0312 **x 10^{-6} lbs/dscf**

$$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\ ft^3/lb-mole}{36.45\ lb/lb-mole} \times 10^6$$

= 0.33 **ppmv db**

$$C_{s(mg/dscm)} = \frac{M_n}{(1000\ \mu g/mg)(V_{mstd})(35.31\ ft^3/m^3)}$$

= 0.000401 **mg/dscm**

HCl Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)}$$

= 0.300841 **lbs/hr**

CHLORINE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NO: FCCU-26-2

INPUT

V_m:	80.160	ft^3	Q_s:	9,641,561	dscfh
γ FACTOR:	0.982		T_s:	545.4	°F
P_{bar}:	29.30	in. Hg	Θ:	120	minutes
ΔH:	1.50		V_s:	100.786	fps
T_m:	100.3	°F	P_s:	29.22	in. Hg
Cl_2 in sample:	139	µg	V_{lc}:	352.9	mL
			$\%O_2$:	1.50	%

Volume of Sample at Standard Conditions on a Dry Basis:	$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$	=	**English Units (29.92 in. Hg, 68 °F)** 72.916 **dscf**
Total µg Cl_2 in sample (M_n)		=	139 **µg**
Concentration of Cl_2	$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\ lb/\mu g)(M_n)}{V_{mstd}}$	=	0.0042 **x 10^{-6} lbs/ dscf**
	$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\ ft^3/lb-mole}{70.096\ lb/lb-mole} \times 10^6$	=	0.02 **ppmv db**
	$C_{s(mg/dscm)} = \frac{M_n}{(1000\ \mu g/mg)(V_{mstd})(35.31\ ft^3/m^3)}$	=	0.000054 **mg/dscm**
Cl_2 Mass Rate:	$E = Q_s \times C'_{s(lb/dscf)}$	=	0.040520 **lbs/hr**

HYDROGEN FLUORIDE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NO: FCCU-26-2

INPUT

V_m:	80.160	ft^3	Q_s:	9,641,561	dscfh
γ FACTOR:	0.982		T_s:	545.4	°F
P_{bar}:	29.30	in. Hg	Θ:	120	minutes
ΔH:	1.50		V_s:	100.786	fps
T_m:	100.3	°F	P_s:	29.22	in. Hg
HF in sample:	47	µg	V_{lc}:	352.9	mL
			$\%O_2$:	1.50	%

Volume of Sample at Standard Conditions on a Dry Basis: — **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 72.916 **dscf**

Total µg HF in sample (M_n) = 47 **µg**

Concentration of HF

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\, lb/\mu g)(M_n)}{V_{mstd}}$$

= 0.0014 **x 10^{-6} lbs/ dscf**

$$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\, ft^3/lb-mole}{20.01 lb/lb-mole} \times 10^6$$

= 0.03 **ppmv db**

$$C_{s(mg/dscm)} = \frac{M_n}{(1000\,\mu g/mg)(V_{mstd})(35.31 ft^3/m^3)}$$

= 0.000018 **mg/dscm**

HF Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)}$$

= 0.013701 **lbs/hr**

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: FCCU-26-2

SOURCE: FCCU 500
TEST DATE: 6/8/2011

BAROMETRIC:	29.30 **in. Hg**	**STACK DIAM:**	108.0 **inches**
STATIC PRES:	-1.10 **in.H_2O**	**CO_2:**	17.70 **% by volume**
STACK TEMP:	545.4 **°F**	**O_2:**	1.50 **% by volume**
SQ.RT ΔP:	1.2773 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$ = 30.89 **lb/lb-mole**

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$$ = 28.50 **lb/lb-mole**

PITOT TUBE COEFFICIENT

C_p (from calibration curve or geometric specifications) = 0.84

AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$$ = 1.2773 **in. H_2O**

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

T_s = 545.4 °F + 460 = 1,005.4 **°R**

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$ = 29.22 **in.Hg**

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$ = 100.786 **ft/sec**

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s$$ = 384,704.49 **acfm**

Stack Area = 63.62 ft^2

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis

$$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$$ = 197,300.33 **scfm, wb**
11,838,020 **scfh, wb**

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$ = 160,692.69 **dscfm**
9,641,561 **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NUMBER: FCCU-26-2

γ FACTOR:	0.982	**STACK DIAM:**	108.0 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	80.160 **ft^3**
STATIC PRES:	-1.10 **in.H_2O**	**METER TEMP:**	100.3 **°F**
STACK TEMP:	545.4 **°F**	**LIQUID COLL:**	352.9 **milliliters**
SQ.RT ΔP:	1.2773 **in.H_2O**	**CO_2:**	17.70 **% by volume**
ΔH:	1.50 **in.H_2O**	**O_2:**	1.50 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 72.916 \text{ dscf}$$

γ = 0.982

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 16.611 \text{ scf}$$

V_{lc} = 352.9 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1855$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7235$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1855

HYDROGEN CHLORIDE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NO: FCCU-26-3

INPUT

V_m:	79.690	**ft^3**	**Q_s:**	9,721,839	**dscfh**
γ FACTOR:	0.982		**T_s:**	545.9	**°F**
P_{bar}:	29.30	**in. Hg**	**Θ:**	120	**minutes**
ΔH:	1.50		**V_s:**	103.037	**fps**
T_m:	108.1	**°F**	**P_s:**	29.21	**in. Hg**
HCl in sample:	1,547	**µg**	**V_{lc}:**	370.5	**mL**
			$\%O_2$:	1.50	**%**

Volume of Sample at Standard Conditions on a Dry Basis:	$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$	=	71.493 **dscf**
Total µg HCl in sample (M_n)		=	1,547 **µg**
Concentration of HCl	$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\, lb/\mu g)(M_n)}{V_{mstd}}$	=	0.0477 **x 10^{-6} lbs/ dscf**
	$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\, ft^3/lb-mole}{36.45\, lb/lb-mole} \times 10^6$	=	0.50 **ppmv db**
	$C_{s(mg/dscm)} = \frac{M_n}{(1000\, \mu g/mg)(V_{mstd})(35.31 ft^3/m^3)}$	=	0.000613 **mg/dscm**
HCl Mass Rate:	$E = Q_s \times C'_{s(lb/dscf)}$	=	0.463774 **lbs/hr**

CHLORINE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NO: FCCU-26-3

INPUT

V_m:	79.690	ft^3	Q_s:	9,721,839	dscfh
γ FACTOR:	0.982		T_s:	545.9	°F
P_{bar}:	29.30	in. Hg	Θ:	120	minutes
ΔH:	1.50		V_s:	103.037	fps
T_m:	108.1	°F	P_s:	29.21	in. Hg
Cl_2 in sample:	272	µg	V_{lc}:	370.5	mL
			$\%O_2$:	1.50	%

Volume of Sample at Standard Conditions on a Dry Basis:	$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$	=	**English Units (29.92 in. Hg, 68 °F)** 71.493 **dscf**
Total µg Cl_2 in sample (M_n)		=	272. **µg**
Concentration of Cl_2	$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\ lb/\mu g)(M_n)}{V_{mstd}}$	=	0.0084 **x 10^{-6} lbs/ dscf**
	$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\ ft^3/lb-mole}{70.096\ lb/lb-mole} \times 10^6$	=	0.05 **ppmv db**
	$C_{s(mg/dscm)} = \frac{M_n}{(1000\ \mu g/mg)(V_{mstd})(35.31\ ft^3/m^3)}$	=	0.000108 **mg/dscm**
Cl_2 Mass Rate:	$E = Q_s \times C'_{s(lb/dscf)}$	=	0.081543 **lbs/hr**

HYDROGEN FLUORIDE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NO: FCCU-26-3

INPUT

V_m:	79.690	ft^3	Q_s:	9,721,839	dscfh
γ FACTOR:	0.982		T_s:	545.9	°F
P_{bar}:	29.30	in. Hg	Θ:	120	minutes
ΔH:	1.50		V_s:	103.037	fps
T_m:	108.1	°F	P_s:	29.21	in. Hg
HF in sample:	42	µg	V_{lc}:	370.5	mL
			$\%O_2$:	1.50	%

Volume of Sample at Standard Conditions on a Dry Basis: — **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 71.493 **dscf**

Total µg HF in sample (M_n) = 42 **µg**

Concentration of HF

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9}\ lb/\mu g)(M_n)}{V_{mstd}}$$

= 0.0013 **x 10^{-6} lbs/ dscf**

$$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26\ ft^3/lb-mole}{20.01\ lb/lb-mole} \times 10^6$$

= 0.02 **ppmv db**

$$C_{s(mg/dscm)} = \frac{M_n}{(1000\ \mu g/mg)(V_{mstd})(35.31\ ft^3/m^3)}$$

= 0.000017 **mg/dscm**

HF Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)}$$

= 0.012591 **lbs/hr**

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: FCCU-26-3

SOURCE: FCCU 500
TEST DATE: 6/8/2011

BAROMETRIC:	29.30 **in. Hg**	**STACK DIAM:**	108.0 **inches**
STATIC PRES:	-1.20 **in.H_2O**	**CO_2:**	18.00 **% by volume**
STACK TEMP:	545.9 **°F**	**O_2:**	1.50 **% by volume**
SQ.RT ΔP:	1.3031 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$ = 30.94 **lb/lb-mole**

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$$ = 28.40 **lb/lb-mole**

PITOT TUBE COEFFICIENT

C_p (from calibration curve or geometric specifications) = 0.84

AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$$ = 1.3031 **in. H_2O**

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

T_s = 545.9 °F + 460 = 1,005.9 **°R**

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$ = 29.21 **in.Hg**

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$ = 103.037 **ft/sec**

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s$$ = 393,295.33 **acfm**

Stack Area = 63.62 ft^2

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis

$$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$$ = 201,555.25 **scfm, wb**
12,093,315 **scfh, wb**

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$ = 162,030.66 **dscfm**
9,721,839 **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/8/2011
RUN NUMBER: FCCU-26-3

γ FACTOR:	0.982	**STACK DIAM:**	108.0 **inches**
BAROMETRIC:	29.30 **in. Hg**	**METER VOLUME:**	79.690 **ft^3**
STATIC PRES:	-1.20 **in.H_2O**	**METER TEMP:**	108.1 **°F**
STACK TEMP:	545.9 **°F**	**LIQUID COLL:**	370.5 **milliliters**
SQ.RT ΔP:	1.3031 **in.H_2O**	**CO_2:**	18.00 **% by volume**
ΔH:	1.50 **in.H_2O**	**O_2:**	1.50 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 71.493 \text{ dscf}$$

γ = 0.982

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 17.439 \text{ scf}$$

V_{lc} = 370.5 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1961$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7237$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1961

SUMMARY OF TEST RESULTS

COMPANY	:	BP			
LOCATION	:	Whiting, In			
SOURCE	:	FCCU 500			
RUN NO	:	202-1	202-4	202-5	
TEST DATE	:	6/9/2011	8/2/2011	8/2/2011	
TEST TIME	:	1510-1932	0820-1232	1330-1731	Average
Stack Gas Parameters					
Temperature, ºF		554.2	560.9	559.2	557.6
Velocity, av. ft/sec		113.0	104.7	104.7	108.8
Volumetric flow, acfm		431,345	399,470	401,659	415,407
Volumetric flow, scfm		218,384	202,521	203,136	210,453
Volumetric flow, dscfh		10,804,595	9,973,200	10,032,939	10,388,898
Moisture, av. % vol		17.5	17.9	17.7	17.7
Carbon Dioxide, av. % vol		18.0	17.8	17.9	17.9
Oxygen, av. % vol		2.0	1.8	1.6	1.9
$PM_{2.5}$ Sample					
Time, min		243.5	240.3	235.0	239.58
Volume, dscf		75.319	78.194	74.785	76.10
Filterable PM2.5 particulate, mg		64.0	37.5	29.6	43.7
Condensible PM2.5 particulate, mg		49.3	16.7	27.7	31.2
Total $PM_{2.5}$ particulate, mg		113.3	54.1	57.3	74.9
Isokinetic Ratio, %		103.8	97.6	94.9	98.76
D_{50} Cutpoint, μm		2.74	2.58	2.65	2.66
Filterable $PM_{2.5}$ Emissions					
Concentration					
grains/dscf		0.0131	0.0074	0.0051	0.0085
x 10^{-6} lb/dscf		1.874	1.056	0.872	1.268
Emission Rate					
lb/hr		20.253	10.535	8.750	13.180
Condensible $PM_{2.5}$ Emissions					
Concentration					
grains/dscf		0.0101	0.0033	0.0057	0.0064
x 10^{-6} lb/dscf		1.443	0.470	0.817	0.910
Emission Rate					
lb/hr		15.594	4.683	8.194	9.490
$PM_{2.5}$ Emissions					
Concentration					
grains/dscf		0.0232	0.0107	0.0118	0.0152
x 10^{-6} lb/dscf		3.318	1.526	1.689	2.177
Emission Rate					
lb/hr		35.847	15.218	16.944	22.670

USEPA Method 201A $PM_{2.5}$ Emissions
Particulate Calculation Summary

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 6/9/2011
Run #: 202-1

Data Input

Barometric pressure (P_{bar}):	29.20 inches Hg	Particulate Weight:		
Stack pressure (P_s):	29.10 Inches Hg Abs.	<$PM_{2.5}$ M_1, (Container 1) (Filterable)	42.65	milligrams
Test length (θ):	243.5 minutes			
Sample nozzle diameter (D_n):	0.1390 inches	>$PM_{2.5}$ M3, (Container 3)	55.11	milligrams
Sample nozzle area (A_n):	0.000105 ft^3	<PM2.5 M_1, (Container 4) (Rinse)	21.38	milligrams
Stack temperature (T_s):	554.2 °F	Total $PM_{2.5}$ front half:	64.03	milligrams
Volume metered (Vm_{std}):	75.319 ft^3			
Stack gas velocity (V_s):	113.005 feet/second	Total PM front half	119.14	milligrams
Stack gas volumetric flow (Q_{std}):	10,804,595 dscf/hour	Total $PM_{2.5}$ back half:		
Fractional Moisture content (B_{wo}):	0.1754 %	organics:	2.35	milligrams
		inorganics:	46.95	milligrams
		Total $PM_{2.5}$ weight (M_n):	113.33	milligrams

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Percent Isokinetic:

$$\%Isokinetic = \frac{0.0945 \times Vm_{std} \times (T_s + 460)}{P_s \times V_s \times \theta \times A_n \times (1 - B_{wo})}$$

= **103.8 % isokinetic**

PM_{10}, $PM_{2.5}$, and Total Particulate emission rate (lb/dscf):

$$C_s = \frac{\left(\frac{0.01543 grains}{mg} \times M_n\right)}{V_{mstd}}$$

= **0.0131 filterable PM2.5 gr/dscf**
= **0.0101 condensible PM2.5 gr/dscf**
= **0.0232 total $PM_{2.5}$ gr/dscf**

$$E_p = \frac{\left(\frac{2.205 \times 10^{-6} lb}{mg} \times M_n\right)}{V_{mstd}}$$

= **1.874 x 10^{-6} filterable $PM_{2.5}$ lb/dscf**
= **1.443 x 10^{-6} condensible $PM_{2.5}$ lb/dscf**
= **3.318 x 10^{-6} total $PM_{2.5}$ lb/dscf**

PM_{10}, $PM_{2.5}$, and Total Particulate emission rate:

$$E_p = C'_s \times Q_{std}$$

= **20.253 filterable $PM_{2.5}$ lb/hr**
= **15.594 condensible $PM_{2.5}$ lb/hr**
= **35.847 total $PM_{2.5}$ lb/hr**

USEPA Method 201A $PM_{2.5}$ Emissions
D_{50} Cutpoint Calculation Summary

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 6/9/2011
Run #: 202-1

Data Input

Stack temperature (T_s):	554.2 °F
Fractional Moisture content (B_{ws}):	0.1754 %
Oxygen (O_2):	2.000 %
Stack pressure (P_s):	29.10 Inches Hg Abs.
Volume metered (Vm_{std}):	75.319 dscf
Volume of water vapor (Vw_{std}):	16.023 scf
Molecular weight of gas, wet basis (M_s):	28.687 lb/lb-mole
Test length (θ):	243.5 minutes
D_p:	2.5 microns

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Stack gas viscosity:

$$\mu=-150.3162+\left(13.4622\times\sqrt{(T_s+460)}\right)+\left(3.86153\text{x}10^{6}\times(T_s+460)^{-2}\right)+\left(0.591123\times(\%O_{2,wet})\right)-(91.9723\times B_{ws})+\left(1.51761\text{x}10^{-5}\times B_{ws}\times(T_s+460)^{2}\right)$$

= **269.74 micropoise**

Sample flow rate @ standard conditions:

$$Q_{sSt}=\frac{V_{mstd}}{\theta}$$

= **0.309 dscfm**

Sample flow rate through PM_{10} cyclone:

$$Q_s=\frac{29.92}{528}\times Q_{sSt}\times\left(\frac{1}{(1-B_{ws})}\right)\times\left(\frac{[T_s+460]}{P_s}\right)$$

= **0.741 cfm**

Calculated Reynolds Number

$$N_{re}=8.64\times10^{5}\times\left(\frac{P_s\times M_s}{(T_s+460)}\right)\times\left(\frac{Q_s}{\mu}\right)$$

= **1953**

Cunningham Correction Factor

$$C=1+0.0057193\times\left(\frac{\mu}{P_s\times D_p}\right)\times\left(\left(\frac{[T_s+460]}{M_s}\right)^{0.50}\right)$$

= **1.1261**

Re-Estimated Cunningham Correction Factor

$$C_r=1+0.0057193\times\left(\frac{\mu}{P_s\times D_{50}}\right)\times\left(\left(\frac{[T_s+460]}{M_s}\right)^{0.50}\right)$$

= **1.1152**

D_{50} cutpoint (for Cyclone IV, N_{re} < 3,162):

$$D_{50}=0.0024302\times\left(\left(\frac{\mu}{Q_s}\right)^{1.1791}\right)\times\left(\frac{1}{C}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.6790}$$

= **2.736**

D_{50} cutpoint (for Cyclone IV, N_{re} ≥ 3,162):

$$D_{50}=0.0019723\times\left(\left(\frac{\mu}{Q_s}\right)^{0.8058}\right)\times\left(\frac{1}{C}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.3058}$$

= **0.2815**

$D_{50\text{-}1}$ cutpoint (for Cyclone IV, N_{re} < 3,162):

$$D_{50\text{-}1}=0.0024302\times\left(\left(\frac{\mu}{Q_s}\right)^{1.1791}\right)\times\left(\frac{1}{C_r}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.6790}$$

= **2.750**

$D_{50\text{-}1}$ cutpoint (for Cyclone IV, N_{re} ≥ 3,162):

$$D_{50\text{-}1}=0.0019723\times\left(\left(\frac{\mu}{Q_s}\right)^{0.8058}\right)\times\left(\frac{1}{C_r}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.3058}$$

= **0.2829**

Ratio (Z) Between D_{50} and $D_{50\text{-}1}$:

$$Z=\frac{D_{50\text{-}1}}{D_{50}}$$

= **1.005**

Resultant $PM_{2.5}$ Cutpoint

$0.99 \le Z \le 1.01$, then D_{50}, else $D_{50\text{-}1}$

= **2.736**

USEPA Method 2
Volumetric Flow Rate Sample Calculations (Circular Ducts)

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 6/9/2011
Run #: 202-1

Data Input

Carbon Dioxide (CO_2):	18.0	**%**
Oxygen (O_2):	2.0	**%**
Nitrogen (N_2):	80.0	**%**
Fractional Moisture Content (B_{wo})	0.1754	
Stack Temperature (T_s):	554.2	**°F**
Pitot Coefficient (C_p):	0.84	**dimensionless**
Average square root of ΔP	1.4276	**inches H_2O**
Barometric Pressure (P_{bar}):	29.20	**inches Hg**
Static Pressure (S_t)	-1.40	**inches H_2O**
Stack diameter:	108.00	**inches H_2O**
Stack area (A_s):	63.6172	**ft^2**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Dry molecular weight of stack gas:

$$M_d = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$$ = **30.960 lb/lb-mole**

Molecular weight of stack gas, wet basis:

$$M_s = (M_d \times (1 - B_{ws})) + (18 \times B_{ws})$$ = **28.687 lb/lb-mole**

Absolute stack gas pressure:

$$P_s = P_{bar} + \left(\frac{S_t}{13.6}\right)$$ = **29.097 inches H_2O**

Stack gas velocity:

$$V_s = 85.49 \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{(T_s + 460)}{(P_s \times M_s)}}$$ = **113.005 feet/second**

Stack gas volumetric flow rate:

$$Q_a = A_s \times V_s \times 60$$ = **431,345 acfm**

Stack gas volumetric flow rate, wet basis:

$$Q_{sw} = Q_a \times \left[\left(\frac{528°R}{29.92in.Hg}\right) \times \left(\frac{P_s}{T_s + 460}\right)\right]$$ = **218,384 scfm**

$$Q_{sw} = Q_a \times \left[\left(\frac{528°R}{29.92in.Hg}\right) \times \left(\frac{P_s}{T_s + 460}\right)\right] \times 60$$ = **13,103,045 scfh**

Stack gas volumetric flow rate, dry basis:

$$Q_{std} = Q_{sw} \times (1 - B_{wo})$$ = **180,077 dscfm**

$$Q_{std} = Q_{sw} \times (1 - B_{wo}) \times 60$$ = **10,804,595 dscfh**

USEPA Method 4
Moisture Determination Sample Calculations

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 6/9/2011
Run #: 202-1

Data Input:

Volume metered (V_m):	79.990	**ft^3**
Meter calibration coefficient (Y_d):	0.991	**dimensionless**
Barometric pressure (P_{bar}):	29.20	**inches Hg**
Meter sample rate (ΔH):	0.35	**inches H_2O**
Meter inlet/outlet temperature (T_m):	82.8	**°F**
Volume of moisture collected (V_{lc}):	340.4	**milliliters**
Stack Temperature (T_s):	554.2	**°F**
Static Pressure (St):	-1.4	**inches H_2O**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Volume of sample, dry basis:

$$Vm_{std} = V_m \times Y_d \times \left(\frac{528.0^{\circ}R}{29.92"Hg}\right) \times \left(\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m + 460}\right) = \textbf{75.319 dscf}$$

Volume of water vapor in sample:

$$Vw_{std} = \frac{0.04707 ft^3}{ml} \times V_{lc} = \textbf{16.023 scf}$$

Fractional moisture content of stack gas:

$$B_{wo} = \frac{Vw_{std}}{(Vm_{std} + Vw_{std})} = \textbf{0.1754 } B_{wo}$$

Percent Moisture:

$$\%moisture = B_{wo} \times 100 = \textbf{17.54 \%}$$

Fractional moisture content of stack gas at saturated conditions:

$$T_{s(°K)} = ((T_s - 32) * 0.5556) + 273 = \textbf{563.1 °Kelvin}$$

$$P_{s(mmHg)} = \left(P_{bar} + \frac{S_t}{13.6}\right) \times 25.401 = \textbf{741.71 mm Hg}$$

$$B_{wos} = \frac{\sqrt{\left(10^{\left(A - \left(\frac{B}{(T_{s(°K)} - C)}\right)\right)}\right)}}{P_{s(mmHg)}} = \textbf{90.0973 \%}$$

where:
A= 8.361
B=1893.5
C=27.65

Percent moisture at saturated conditions:

$$\%moisture_{saturated} = B_{wos} \times 100 = \textbf{100.00 \%}$$

Percent moisture used for emissions calculations:

= **17.54 %**

USEPA Method 201A $PM_{2.5}$ Emissions
Particulate Calculation Summary

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-4

Data Input

Barometric pressure (P_{bar}):	29.41 inches Hg	Particulate Weight:		
Stack pressure (P_s):	29.33 Inches Hg Abs.	<$PM_{2.5}$ M_1, (Container 1) (Filterable)	34.80	milligrams
Test length (θ):	240.3 minutes			
Sample nozzle diameter (D_n):	0.1530 inches	>$PM_{2.5}$ M3, (Container 3)	6.21	milligrams
Sample nozzle area (A_n):	0.000128 ft^3	<PM2.5 M_1, (Container 4) (Rinse)	2.66	milligrams
Stack temperature (T_s):	560.9 °F	Total $PM_{2.5}$ front half:	37.46	milligrams
Volume metered (Vm_{std}):	78.194 ft^3			
Stack gas velocity (V_s):	104.655 feet/second	Total PM front half	43.67	milligrams
Stack gas volumetric flow (Q_{std}):	9,973,200 dscf/hour	Total $PM_{2.5}$ back half:		
Fractional Moisture content (B_{wo}):	0.1792 %	organics:	1.55	milligrams
		inorganics:	15.10	milligrams
		Total $PM_{2.5}$ weight (M_n):	54.11	milligrams

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Percent Isokinetic:

$$\%Isokinetic = \frac{0.0945 \times Vm_{std} \times (T_s + 460)}{P_s \times V_s \times \theta \times A_n \times (1 - B_{wo})}$$

= **97.6 % isokinetic**

PM_{10}, $PM_{2.5}$, and Total Particulate emission rate (lb/dscf):

$$C_s = \frac{\left(\frac{0.01543 grains}{mg} \times M_n\right)}{V_{mstd}}$$

= **0.0074 filterable PM2.5 gr/dscf**
= **0.0033 condensible PM2.5 gr/dscf**
= **0.0107 total $PM_{2.5}$ gr/dscf**

$$E_p = \frac{\left(\frac{2.205 \times 10^{-6} lb}{mg} \times M_n\right)}{V_{mstd}}$$

= **1.056 x 10^{-6} filterable $PM_{2.5}$ lb/dscf**
= **0.470 x 10^{-6} condensible $PM_{2.5}$ lb/dscf**
= **1.526 x 10^{-6} total $PM_{2.5}$ lb/dscf**

PM_{10}, $PM_{2.5}$, and Total Particulate emission rate:

$$E_p = C'_s \times Q_{std}$$

= **10.535 filterable $PM_{2.5}$ lb/hr**
= **4.683 condensible $PM_{2.5}$ lb/hr**
= **15.218 total $PM_{2.5}$ lb/hr**

USEPA Method 201A $PM_{2.5}$ Emissions
D_{50} Cutpoint Calculation Summary

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-4

Data Input

Stack temperature (T_s):	560.9 °F
Fractional Moisture content (B_{ws}):	0.1792 %
Oxygen (O_2):	1.800 %
Stack pressure (P_s):	29.33 Inches Hg Abs.
Volume metered (Vm_{std}):	78.194 dscf
Volume of water vapor (Vw_{std}):	17.077 scf
Molecular weight of gas, wet basis (M_s):	28.604 lb/lb-mole
Test length (θ):	240.3 minutes
D_p:	2.5 microns

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Stack gas viscosity:

$$\mu = -150.3162 + \left(13.4622 \times \sqrt{(T_s + 460)}\right) + \left(3.86153 \times 10^{6} \times (T_s + 460)^{-2}\right) + \left(0.591123 \times (\%O_{2,wet})\right) - (91.9723 \times B_{ws}) + \left(1.51761 \times 10^{-5} \times B_{ws} \times (T_s + 460)^{2}\right)$$

= **270.7 micropoise**

Sample flow rate @ standard conditions:

$$Q_{sSt} = \frac{V_{mstd}}{\theta}$$

= **0.325 dscfm**

Sample flow rate through PM_{10} cyclone:

$$Q_s = \frac{29.92}{528} \times Q_{sSt} \times \left(\frac{1}{(1-B_{ws})}\right) \times \left(\frac{[T_s + 460]}{P_s}\right)$$

= **0.782 cfm**

Calculated Reynolds Number

$$N_{re} = 8.64 \times 10^{5} \times \left(\frac{P_s \times M_s}{(T_s + 460)}\right) \times \left(\frac{Q_s}{\mu}\right)$$

= **2051**

Cunningham Correction Factor

$$C = 1 + 0.0057193 \times \left(\frac{\mu}{P_s \times D_p}\right) \times \left(\left(\frac{[T_s + 460]}{M_s}\right)^{0.50}\right)$$

= **1.126**

Re-Estimated Cunningham Correction Factor

$$C_r = 1 + 0.0057193 \times \left(\frac{\mu}{P_s \times D_{50}}\right) \times \left(\left(\frac{[T_s + 460]}{M_s}\right)^{0.50}\right)$$

= **1.122**

D_{50} cutpoint (for Cyclone IV, N_{re} < 3,162):

$$D_{50} = 0.0024302 \times \left(\left(\frac{\mu}{Q_s}\right)^{1.1791}\right) \times \left(\frac{1}{C}\right)^{0.5} \times \left(\frac{(T_s + 460)}{P_s \times M_s}\right)^{0.6790}$$

= **2.581**

D_{50} cutpoint (for Cyclone IV, N_{re} ≥ 3,162):

$$D_{50} = 0.0019723 \times \left(\left(\frac{\mu}{Q_s}\right)^{0.8058}\right) \times \left(\frac{1}{C}\right)^{0.5} \times \left(\frac{(T_s + 460)}{P_s \times M_s}\right)^{0.3058}$$

= **0.2704**

$D_{50\text{-}1}$ cutpoint (for Cyclone IV, N_{re} < 3,162):

$$D_{50\text{-}1} = 0.0024302 \times \left(\left(\frac{\mu}{Q_s}\right)^{1.1791}\right) \times \left(\frac{1}{C_r}\right)^{0.5} \times \left(\frac{(T_s + 460)}{P_s \times M_s}\right)^{0.6790}$$

= **2.585**

$D_{50\text{-}1}$ cutpoint (for Cyclone IV, N_{re} ≥ 3,162):

$$D_{50\text{-}1} = 0.0019723 \times \left(\left(\frac{\mu}{Q_s}\right)^{0.8058}\right) \times \left(\frac{1}{C_r}\right)^{0.5} \times \left(\frac{(T_s + 460)}{P_s \times M_s}\right)^{0.3058}$$

= **0.2709**

Ratio (Z) Between D_{50} and $D_{50\text{-}1}$:

$$Z = \frac{D_{50\text{-}1}}{D_{50}}$$

= **1.002**

Resultant $PM_{2.5}$ Cutpoint

$0.99 \le Z \le 1.01$, then D_{50}, else $D_{50\text{-}1}$ = **2.581**

USEPA Method 2
Volumetric Flow Rate Sample Calculations (Circular Ducts)

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-4

Data Input

Carbon Dioxide (CO_2):	17.8	**%**
Oxygen (O_2):	1.8	**%**
Nitrogen (N_2):	80.4	**%**
Fractional Moisture Content (B_{wo})	0.1792	
Stack Temperature (T_s):	560.9	**°F**
Pitot Coefficient (C_p):	0.84	**dimensionless**
Average square root of ΔP	1.3211	**inches H_2O**
Barometric Pressure (P_{bar}):	29.41	**inches Hg**
Static Pressure (S_t)	-1.10	**inches H_2O**
Stack diameter:	108.00	**inches H_2O**
Stack area (A_s):	63.6172	**ft^2**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Dry molecular weight of stack gas:

$$M_d = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$$ = **30.920 lb/lb-mole**

Molecular weight of stack gas, wet basis:

$$M_s = (M_d \times (1 - B_{ws})) + (18 \times B_{ws})$$ = **28.604 lb/lb-mole**

Absolute stack gas pressure:

$$P_s = P_{bar} + \left(\frac{S_t}{13.6}\right)$$ = **29.329 inches H_2O**

Stack gas velocity:

$$V_s = 85.49 \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{(T_s + 460)}{(P_s \times M_s)}}$$ = **104.655 feet/second**

Stack gas volumetric flow rate:

$$Q_a = A_s \times V_s \times 60$$ = **399,470 acfm**

Stack gas volumetric flow rate, wet basis:

$$Q_{sw} = Q_a \times \left[\left(\frac{528°R}{29.92in.Hg}\right) \times \left(\frac{P_s}{T_s + 460}\right)\right]$$ = **202,521 scfm**

$$Q_{sw} = Q_a \times \left[\left(\frac{528°R}{29.92in.Hg}\right) \times \left(\frac{P_s}{T_s + 460}\right)\right] \times 60$$ = **12,151,280 scfh**

Stack gas volumetric flow rate, dry basis:

$$Q_{std} = Q_{sw} \times (1 - B_{wo})$$ = **166,220 dscfm**

$$Q_{std} = Q_{sw} \times (1 - B_{wo}) \times 60$$ = **9,973,200 dscfh**

USEPA Method 4
Moisture Determination Sample Calculations

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-4

Data Input:

Volume metered (V_m):	84.205 **ft^3**
Meter calibration coefficient (Y_d):	1.006 **dimensionless**
Barometric pressure (P_{bar}):	29.41 **inches Hg**
Meter sample rate (ΔH):	0.32 **inches H_2O**
Meter inlet/outlet temperature (T_m):	102.7 **°F**
Volume of moisture collected (V_{lc}):	362.8 **milliliters**
Stack Temperature (T_s):	560.9 **°F**
Static Pressure (St):	-1.1 **inches H_2O**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Volume of sample, dry basis:

$$Vm_{std}=V_m \times Y_d \times \left(\frac{528.0°R}{29.92"Hg}\right) \times \left(\frac{P_{bar}+\frac{\Delta H}{13.6}}{T_m+460}\right)$$ = **78.194 dscf**

Volume of water vapor in sample:

$$Vw_{std} = \frac{0.04707 ft^3}{ml} \times V_{lc}$$ = **17.077 scf**

Fractional moisture content of stack gas:

$$B_{wo} = \frac{Vw_{std}}{(Vm_{std} + Vw_{std})}$$ = **0.1792 B_{wo}**

Percent Moisture:

$$\%moisture = B_{wo} \times 100$$ = **17.92 %**

Fractional moisture content of stack gas at saturated conditions:

$$T_{s(°K)} = ((T_s - 32) * 0.5556) + 273$$ = **566.9 °Kelvin**

$$P_{s(mmHg)} = \left(P_{bar} + \frac{S_t}{13.6}\right) \times 25.401$$ = **747.04 mm Hg**

$$B_{wos} = \frac{\sqrt{\left(10^{\left(A-\left(\frac{B}{(T_{s(°K)}-C)}\right)\right)}\right)}}{P_{s(mmHg)}}$$

where:
A= 8.361
B=1893.5
C=27.65

= **94.6263 %**

Percent moisture at saturated conditions:

$$\%moisture_{saturated} = B_{wos} \times 100$$ = **100.00 %**

Percent moisture used for emissions calculations:

= **17.92 %**

USEPA Method 201A $PM_{2.5}$ Emissions
Particulate Calculation Summary

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-5

Data Input

Barometric pressure (P_{bar}):	29.29 inches Hg	Particulate Weight:		
Stack pressure (P_s):	29.21 Inches Hg Abs.	<$PM_{2.5}$ M_1, (Container 1) (Filterable)	24.8	milligrams
Test length (θ):	235.0 minutes		0.0	milligrams
Sample nozzle diameter (D_n):	0.1530 inches	>$PM_{2.5}$ M3, (Container 3)	10.1	milligrams
Sample nozzle area (A_n):	0.000128 ft^3	<PM2.5 M_1, (Container 4) (Rinse)	4.8	milligrams
Stack temperature (T_s):	559.2 °F	Total $PM_{2.5}$ front half:	29.6	milligrams
Volume metered (Vm_{std}):	74.785 ft^3		39.7	milligrams
Stack gas velocity (V_s):	105.228 feet/second	Total PM front half	39.7	milligrams
Stack gas volumetric flow (Q_{std}):	10,032,939 dscf/hour	Total $PM_{2.5}$ back half:		
Fractional Moisture content (B_{wo}):	0.1768 %	organics:	1.35	milligrams
		inorganics:	26.35	milligrams
		Total $PM_{2.5}$ weight (M_n):	57.28	milligrams

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Percent Isokinetic:

$$\%Isokinetic = \frac{0.0945 \times Vm_{std} \times (T_s + 460)}{P_s \times V_s \times \theta \times A_n \times (1 - B_{wo})}$$ = **94.9 % isokinetic**

PM_{10}, $PM_{2.5}$, and Total Particulate emission rate (lb/dscf):

$$C_s = \frac{\left(\frac{0.01543 grains}{mg} \times M_n\right)}{V_{mstd}}$$

= **0.0051 filterable PM2.5 gr/dscf**
= **0.0057 condensible PM2.5 gr/dscf**
= **0.0118 total $PM_{2.5}$ gr/dscf**

$$E_p = \frac{\left(\frac{2.205 \times 10^{-6} lb}{mg} \times M_n\right)}{V_{mstd}}$$

= **0.872 x 10^{-3} filterable $PM_{2.5}$ lb/dscf**
= **0.817 x 10^{-3} condensible $PM_{2.5}$ lb/dscf**
= **1.689 x 10^{-3} total $PM_{2.5}$ lb/dscf**

PM_{10}, $PM_{2.5}$, and Total Particulate emission rate (lb/Hr):

$$E_p = C'_s \times Q_{std}$$

= **8.750 filterable $PM_{2.5}$ lb/hr**
= **8.194 condensible $PM_{2.5}$ lb/hr**
= **16.944 total $PM_{2.5}$ lb/hr**

USEPA Method 201A $PM_{2.5}$ Emissions
D_{50} Cutpoint Calculation Summary

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-5

Data Input

Stack temperature (T_s):	559.2 **°F**
Fractional Moisture content (B_{ws}):	0.1768 **%**
Oxygen (O_2):	1.600 **%**
Stack pressure (P_s):	29.21 **Inches Hg Abs.**
Volume metered (Vm_{std}):	74.785 **dscf**
Volume of water vapor (Vw_{std}):	16.065 **scf**
Molecular weight of gas, wet basis (M_s):	28.642 **lb/lb-mole**
Test length (θ):	235.0 **minutes**
D_p:	2.5 **microns**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Stack gas viscosity:

$$\mu=-150.3162+\left(13.4622\times\sqrt{(T_s+460)}\right)+\left(3.86153\text{x}10^{6}\times(T_s+460)^{-2}\right)+\left(0.591123\times(\%O_{2,wet})\right)-(91.9723\times B_{ws})+\left(1.51761\text{x}10^{-5}\times B_{ws}\times(T_s+460)^{2}\right)$$

= **270.5 micropoise**

Sample flow rate @ standard conditions:

$$Q_{sSt}=\frac{V_{mstd}}{\theta}$$

= **0.318 dscfm**

Sample flow rate through PM_{10} cyclone:

$$Q_s=\frac{29.92}{528}\times Q_{sSt}\times\left(\frac{1}{(1-B_{ws})}\right)\times\left(\frac{[T_s+460]}{P_s}\right)$$

= **0.764 cfm**

Calculated Reynolds Number

$$N_{re}=8.64\times10^{5}\times\left(\frac{P_s\times M_s}{(T_s+460)}\right)\times\left(\frac{Q_s}{\mu}\right)$$

= **2004**

Cunningham Correction Factor

$$C=1+0.0057193\times\left(\frac{\mu}{P_s\times D_p}\right)\times\left(\left(\frac{[T_s+460]}{M_s}\right)^{0.50}\right)$$

= **1.126**

Re-Estimated Cunningham Correction Factor

$$C_r=1+0.0057193\times\left(\frac{\mu}{P_s\times D_{50}}\right)\times\left(\left(\frac{[T_s+460]}{M_s}\right)^{0.50}\right)$$

= **1.119**

D_{50} cutpoint (for Cyclone IV, N_{re} < 3,162):

$$D_{50}=0.0024302\times\left(\left(\frac{\mu}{Q_s}\right)^{1.1791}\right)\times\left(\frac{1}{C}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.6790}$$

= **2.650**

D_{50} cutpoint (for Cyclone IV, N_{re} ≥ 3,162):

$$D_{50}=0.0019723\times\left(\left(\frac{\mu}{Q_s}\right)^{0.8058}\right)\times\left(\frac{1}{C}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.3058}$$

= **0.2753**

$D_{50\text{-}1}$ cutpoint (for Cyclone IV, N_{re} < 3,162):

$$D_{50\text{-}1}=0.0024302\times\left(\left(\frac{\mu}{Q_s}\right)^{1.1791}\right)\times\left(\frac{1}{C_r}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.6790}$$

= **2.659**

$D_{50\text{-}1}$ cutpoint (for Cyclone IV, N_{re} ≥ 3,162):

$$D_{50\text{-}1}=0.0019723\times\left(\left(\frac{\mu}{Q_s}\right)^{0.8058}\right)\times\left(\frac{1}{C_r}\right)^{0.5}\times\left(\frac{(T_s+460)}{P_s\times M_s}\right)^{0.3058}$$

= **0.2762**

Ratio (Z) Between D_{50} and $D_{50\text{-}1}$:

$$Z=\frac{D_{50\text{-}1}}{D_{50}}$$

= **1.003**

Resultant $PM_{2.5}$ Cutpoint

$0.99 \le Z \le 1.01$, then D_{50}, else $D_{50\text{-}1}$

= **2.650**

USEPA Method 2
Volumetric Flow Rate Sample Calculations (Circular Ducts)

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-5

Data Input

Carbon Dioxide (CO_2):	17.9	**%**
Oxygen (O_2):	1.6	**%**
Nitrogen (N_2):	80.5	**%**
Fractional Moisture Content (B_{wo})	0.1768	
Stack Temperature (T_s):	559.2	**°F**
Pitot Coefficient (C_p):	0.84	**dimensionless**
Average square root of ΔP	1.3276	**inches H_2O**
Barometric Pressure (P_{bar}):	29.29	**inches Hg**
Static Pressure (S_t)	-1.10	**inches H_2O**
Stack diameter:	108.00	**inches H_2O**
Stack area (A_s):	63.6172	**ft^2**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Dry molecular weight of stack gas:

$$M_d = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$$ = **30.928 lb/lb-mole**

Molecular weight of stack gas, wet basis:

$$M_s = (M_d \times (1 - B_{ws})) + (18 \times B_{ws})$$ = **28.642 lb/lb-mole**

Absolute stack gas pressure:

$$P_s = P_{bar} + \left(\frac{S_t}{13.6}\right)$$ = **29.209 inches H_2O**

Stack gas velocity:

$$V_s = 85.49 \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{(T_s + 460)}{(P_s \times M_s)}}$$ = **105.228 feet/second**

Stack gas volumetric flow rate:

$$Q_a = A_s \times V_s \times 60$$ = **401,659 acfm**

Stack gas volumetric flow rate, wet basis:

$$Q_{sw} = Q_a \times \left[\left(\frac{528°R}{29.92in.Hg}\right) \times \left(\frac{P_s}{T_s + 460}\right)\right]$$ = **203,136 scfm**

$$Q_{sw} = Q_a \times \left[\left(\frac{528°R}{29.92in.Hg}\right) \times \left(\frac{P_s}{T_s + 460}\right)\right] \times 60$$ = **12,188,163 scfh**

Stack gas volumetric flow rate, dry basis:

$$Q_{std} = Q_{sw} \times (1 - B_{wo})$$ = **167,216 dscfm**

$$Q_{std} = Q_{sw} \times (1 - B_{wo}) \times 60$$ = **10,032,939 dscfh**

USEPA Method 4
Moisture Determination Sample Calculations

Client: BP
Location: Whiting, In
Source: FCCU 500
Date: 8/2/2011
Run #: 202-5

Data Input:

Volume metered (V_m):	82.215 **ft^3**
Meter calibration coefficient (Y_d):	1.006 **dimensionless**
Barometric pressure (P_{bar}):	29.29 **inches Hg**
Meter sample rate (ΔH):	0.32 **inches H_2O**
Meter inlet/outlet temperature (T_m):	112.1 **°F**
Volume of moisture collected (V_{lc}):	341.3 **milliliters**
Stack Temperature (T_s):	559.2 **°F**
Static Pressure (St):	-1.1 **inches H_2O**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Volume of sample, dry basis:

$$Vm_{std} = V_m \times Y_d \times \left(\frac{528.0°R}{29.92"Hg}\right) \times \left(\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m + 460}\right) = \textbf{74.785 dscf}$$

Volume of water vapor in sample:

$$Vw_{std} = \frac{0.04707 ft^3}{ml} \times V_{lc} = \textbf{16.065 scf}$$

Fractional moisture content of stack gas:

$$B_{wo} = \frac{Vw_{std}}{(Vm_{std} + Vw_{std})} = \textbf{0.1768 } B_{wo}$$

Percent Moisture:

$$\%moisture = B_{wo} \times 100 = \textbf{17.68 \%}$$

Fractional moisture content of stack gas at saturated conditions:

$$T_{s(°K)} = ((T_s - 32) * 0.5556) + 273 = \textbf{565.9 °Kelvin}$$

$$P_{s(mmHg)} = \left(P_{bar} + \frac{S_t}{13.6}\right) \times 25.401 = \textbf{744.00 mm Hg}$$

$$B_{wos} = \frac{\sqrt{\left(10^{\left(A - \left(\frac{B}{(T_{s(°K)} - C)}\right)\right)}\right)}}{P_{s(mmHg)}} = \textbf{93.6753 \%}$$

where:
A= 8.361
B=1893.5
C=27.65

Percent moisture at saturated conditions:

$$\%moisture_{saturated} = B_{wos} \times 100 = \textbf{100.00 \%}$$

Percent moisture used for emissions calculations:

= **17.68 %**

SUMMARY OF TEST RESULTS

Company	BP
Location	Whiting, IN
Source	FCCU 500

Test Run	5/29 - 1	5/29 - 2	5/29 - 3	
Test Date	6/9/2011	6/10/2011	6/10/2011	
Test Time	15:40 - 19:00	8:35 - 11:48	13:57 - 17:09	Average
Stack Gas Parameters				
Temperature, av. °F	558.0	561.0	562.8	560.6
Velocity, av. ft/sec	117.315	118.319	118.017	117.884
Volume flow, acfm	447,796	451,629	450,476	449,967
Volume flow, acmm	12,680.1	12,788.6	12,755.93	12,741.52
Volume flow, scfm	225,868	226,741	225,764	226,124
Volume flow, dscfm	192,839	188,030	186,866	189,245
Volume flow, dscmm	5,460.55	5,324.36	5,291.40	5,358.77
Volume flow, dscfh	11,570,354	11,281,791	11,211,958	11,354,701
Moisture, av. % vol	14.62	17.07	17.23	16.31
CO_2, av. % vol, db	18.30	18.40	18.50	18.40
O_2, av. % vol, db	1.60	1.40	1.40	1.47
Metals Sample				
Time, min	180.0	180.0	180.0	180.0
Volume, dscf	143.567	142.688	142.367	142.874
Volume, dscm	4.066	4.041	4.032	4.046
Isokinetic Ratio, %	101.5	103.5	103.9	103.0
Antimony (Sb)				
Concentration				
lb/dscf x 10^{-9}	0.01749	0.02971	0.03541	0.02754
mg/dscm	0.000280	0.000476	0.000567	0.000441
Emission rate				
lb/hr x 10^{-4}	2.02370	3.35197	3.97071	3.11546
Arsenic (As)				
Concentration				
lb/dscf x 10^{-9}	< 0.01843	< 0.01854	< 0.01858	< 0.01852
mg/dscm	< 0.00030	< 0.00030	< 0.00030	< 0.00030
Emission rate				
lb/hr x 10^{-4}	< 2.13208	< 2.09171	< 2.08345	< 2.10242
Beryllium (Be)				
Concentration				
lb/dscf x 10^{-9}	< 0.00461	< 0.00464	< 0.00465	< 0.00463
mg/dscm	< 0.00007	< 0.00007	< 0.00007	< 0.00007
Emission rate				
lb/hr x 10^{-4}	< 0.53302	< 0.52293	< 0.52086	< 0.52560
Cadmium (Cd)				
Concentration				
lb/dscf x 10^{-9}	0.07726	0.07098	0.16740	0.10521
mg/dscm	0.001238	0.001137	0.002681	0.001685
Emission rate				
lb/hr x 10^{-4}	8.93876	8.00777	18.76841	11.90498
Chromium (Cr)				
Concentration				
lb/dscf x 10^{-9}	0.16664	0.25218	0.22705	0.21529
mg/dscm	0.002669	0.004040	0.003637	0.003449
Emission rate				
lb/hr x 10^{-4}	19.28115	28.45078	25.45628	24.39607

Lead (Pb)				
Concentration				
lb/dscf x 10^{-9}	0.30006	0.24829	0.27301	0.27378
mg/dscm	0.004807	0.003977	0.004373	0.004386
Emission rate				
lb/hr x 10^{-4}	34.71744	28.01152	30.60935	31.11277
Manganese (Mn)				
Concentration				
lb/dscf x 10^{-9}	0.09197	0.06658	0.09119	0.08325
mg/dscm	0.001473	0.001066	0.001461	0.001333
Emission rate				
lb/hr x 10^{-4}	10.64088	7.51099	10.22453	9.45880
Nickel (Ni)				
Concentration				
lb/dscf x 10^{-9}	0.21598	0.36965	0.29492	0.29352
mg/dscm	0.003460	0.005921	0.004724	0.004702
Emission rate				
lb/hr x 10^{-4}	24.98981	41.70352	33.06609	33.25314
Selenium (Se)				
Concentration				
lb/dscf x 10^{-9}	< 0.04607	< 0.04635	< 0.04646	< 0.04629
mg/dscm	< 0.00074	< 0.00074	< 0.00074	< 0.00074
Emission rate				
lb/hr x 10^{-4}	< 5.33021	< 5.22928	< 5.20862	< 5.25604
Cobalt (Co)				
Concentration				
lb/dscf x 10^{-9}	0.03916	0.03044	0.01970	0.02976
mg/dscm	0.00063	0.00049	0.00032	0.00048
Emission rate				
lb/hr x 10^{-4}	4.53068	3.43389	2.20846	3.39101
Filterable PM collected, mg	107.80	126.15	130.10	
Concentration				
gr/dscf	0.01159	0.01364	0.01410	0.01311
lb/dscf x 10^{-6}	1.65567	1.94944	2.01501	1.87337
mg/dscm	26.517	31.222	32.272	30.004
Emission rate				
lb/hr	19.15050	21.98599	22.58485	21.24045

ARI ENVIRONMENTAL, INC.
USEPA METHOD 5 - FILTERABLE PARTICULATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/9/11
RUN NUMBER: 5/29 - 1

INPUT

V_m:	149.010	ft^3	Q_s:	192,839.2	dscfm
γ FACTOR:	1.010		T_s:	558.0	°F
P_{bar}:	29.20	in.Hg	Runtime:	180.0	minutes
ΔH:	2.22	$in.H_2O$	V_s:	117.315	ft/sec
T_m:	83.2	°F	P_s:	29.10	in.Hg
V_{lc}:	522.4	mL	Noz. diam:	0.218	inches
M_n front:	107.80	mg			
CO_2:	18.30	% by volume			
O_2:	1.60	% by volume			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$ = 143.567 **dscf**

γ = 1.010

VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc}$$ = 24.589 **scf**

FRACTIONAL MOISTURE CONTENT OF STACK GAS

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} \times 100$$ = 14.62 **%**

PARTICULATE CONCENTRATION IN STACK GAS ON A DRY BASIS

$$C_s = (0.01543)\left(\frac{M_n}{V_{mstd}}\right)$$ Filterable = 0.01159 **gr/dscf**

$$C_{s,mg/dscm} = \frac{(M_n)(35.315)}{(V_{mstd})}$$ = 26.517 **mg/dscm**

$$C'_s = (2.205 \times 10^{-6})\left(\frac{M_n}{V_{mstd}}\right)$$ C'_s Filterable = 1.65567 **x 10^{-6} lbs/dscf**

EMISSION RATE

$$pmr = \left(\frac{C_s}{7000}\right)(Q_{std})(60)$$ = 19.15050 **lb/hr**

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)}$$ = 101.52 **% I**

A_n = 0.0002592 ft^2 Runtime = 180 minutes

Metals Laboratory Data Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500
Date: 6/9/2011
Run #: 5/29 - 1

Front Half Metal Calculation

Metal	Detection Limit (micrograms)	FH Sample (M_{fh}) (micrograms)	FH Blank (M_{fhb}) (micrograms)	*I Value* A Value (4 inch filter) (micrograms)	*II Values* 5 % of FH Sample (micrograms)	Lesser value (M_{fhb}) vs 5% (micrograms)	Greater Value *I vs II* (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
Antimony	**0.2**	1.3700	0.3080	**17.590**	0.069	0.069	17.590	0.308	1.0620
Arsenic	**1**	<1.000	<1.000	**17.590**	0.050	0.050	17.590	1.000	0.0000
Beryllium	**0.2**	<0.200	<0.200	**17.590**	0.010	0.010	17.590	0.200	0.0000
Cadmium	**0.1**	0.1210	<0.100	**17.590**	0.006	0.006	17.590	0.100	0.0210
Chromium	**1**	10.5000	2.2200	**17.590**	0.525	0.525	17.590	2.220	8.2800
Lead	**0.5**	12.9000	<0.500	**17.590**	0.645	0.645	17.590	0.500	12.4000
Manganese	**0.5**	3.3700	2.0800	**17.590**	0.169	0.169	17.590	2.080	1.2900
Nickel	**0.2**	12.5000	1.1200	**17.590**	0.625	0.625	17.590	1.120	11.3800
Selenium	**2**	<2.000	<2.000	**17.590**	0.100	0.100	17.590	2.000	0.0000
Cobalt	**0.2**	0.5400	<0.200	**17.590**	0.027	0.027	17.590	0.200	0.3400

Back Half Metal Calculation

Metal	Detection Limit (micrograms)	BH Sample (M_{bh}) (micrograms)	BH Blank (M_{bhb}) (micrograms)	*I Value* (micrograms)	*II Values* 5 % of BH Sample (micrograms)	Lesser value (M_{bh}) vs 5% (micrograms)	Greater Value I vs II (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
Antimony	**0.1**	0.1770	<0.100	**1.000**	0.009	0.009	1.000	0.100	0.0770
Arsenic	**0.2**	<0.200	<0.200	**1.000**	0.010	0.010	1.000	0.200	0.0000
Beryllium	**0.1**	<0.100	<0.100	**1.000**	0.005	0.005	1.000	0.100	0.0000
Cadmium	**0.05**	5.0600	<0.050	**1.000**	0.253	0.253	1.000	0.050	5.0100
Chromium	**0.15**	3.1400	0.5680	**1.000**	0.157	0.157	1.000	0.568	2.5720
Lead	**0.05**	7.3700	0.2300	**1.000**	0.369	0.369	1.000	0.230	7.1400
Manganese	**0.15**	5.4000	0.7010	**1.000**	0.270	0.270	1.000	0.701	4.6990
Nickel	**0.1**	3.2900	0.6050	**1.000**	0.165	0.165	1.000	0.605	2.6850
Selenium	**1**	<1.000	<1.000	**1.000**	0.050	0.050	1.000	1.000	0.0000
Cobalt	**0.1**	2.3100	<0.100	**1.000**	0.116	0.116	1.000	0.100	2.2100

Metal	FH Sample (M_{fh}) (micrograms)	FH Blank (M_{fhb}) (micrograms)	BH Sample (M_{bh}) (micrograms)	BH Blank (M_{bhb}) (micrograms)	Total Metal (M_t) (micrograms)	
Antimony	1.370	0.308	0.177	<0.100	**1.139**	**ADL**
Arsenic	<1.000	<1.000	<0.200	<0.200	**<1.200**	**BDL**
Beryllium	<0.200	<0.200	<0.100	<0.100	**<0.300**	**BDL**
Cadmium	0.121	<0.100	5.060	<0.050	**5.031**	**ADL**
Chromium	10.500	2.220	3.140	0.568	**10.852**	**ADL**
Lead	12.900	<0.500	7.370	0.230	**19.540**	**ADL**
Manganese	3.370	2.080	5.400	0.701	**5.989**	**ADL**
Nickel	12.500	1.120	3.290	0.605	**14.065**	**ADL**
Selenium	<2.000	<2.000	<1.000	<1.000	**<3.000**	**BDL**
Cobalt	0.540	<0.200	2.310	<0.100	**2.550**	**ADL**

$$M_t = (M_{fh} - M_{fhb}) + (M_{bh} - M_{bhb})$$

USEPA Method 29
Metals Emissions Calculation Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500
Date: 6/9/2011
Run #: 5/29 - 1

Test Data Input

Barometric pressure (P_{bar}):	29.20 inches Hg
Stack pressure (P_s):	29.10 Inches Hg Abs.
Test length (θ):	180.0 minutes
Sample nozzle diameter (D_n):	0.2180 inches
Sample nozzle area (A_n):	0.000259 ft^3
Stack temperature (T_s):	558.0 °F
Volume metered (V_{mstd}):	143.567 dscf
Stack gas velocity (V_s):	117.315 ft/sec
Stack gas volumetric flow (Q_{std}):	11,570,354 dscfh
Fractional Moisture content (B_{ws}):	0.1462
Stack Oxygen Content ($\%O_2$):	1.60 %

Metals Laboratory Analysis Weights (M_t)

Antimony (Sb):	1.14 µg	Manganese (Mn):	5.99 µg
Arsenic (As):	1.20 µg		
Beryllium (Be):	0.30 µg	Nickel (Ni):	14.07 µg
Cadmium (Cd):	5.03 µg	Selenium (Se):	3.00 µg
Chromium (Cr):	10.85 µg	Cobalt (Co)	2.55 µg
Lead (Pb):	19.54 µg		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Metals concentration (µg/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.315\,\text{dscf/dscm}}\right)\right]}$$

=	0.280175 µg/dscm	Antimony (Sb)	=	1.473195 µg/dscm	Manganese (Mn)
=	0.295180 µg/dscm	Arsenic (As)	=		
=	0.073795 µg/dscm	Beryllium (Be)	=	3.459758 µg/dscm	Nickel (Ni)
=	1.237543 µg/dscm	Cadmium (Cd)	=	0.737950 µg/dscm	Selenium (Se)
=	2.669413 µg/dscm	Chromium (Cr)	=	0.627258 µg/dscm	Cobalt (Co)
=	4.806517 µg/dscm	Lead (Pb)			

Metals concentration ($x10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046\times10^{-9}\,\text{lb}}{\mu\text{g}}\times M_t\right)}{V_{mstd}}$$

=	0.017490 x 10^{-9} lb/dscf	Antimony (Sb)	=	0.091967	x 10^{-9} lb/dscf Manganese (Mn)
=	0.018427 x 10^{-9} lb/dscf	Arsenic (As)			
=	0.004607 x 10^{-9} lb/dscf	Beryllium (Be)	=	0.215981	x 10^{-9} lb/dscf Nickel (Ni)
=	0.077256 x 10^{-9} lb/dscf	Cadmium (Cd)	=	0.046068	x 10^{-9} lb/dscf Selenium (Se)
=	0.166643 x 10^{-9} lb/dscf	Chromium (Cr)	=	0.039158	x 10^{-9} lb/dscf Cobalt (Co)
=	0.300055 x 10^{-9} lb/dscf	Lead (Pb)			

Metals emission rate ($x10^{-4}$ lb/hr):

$$E_{m,lb/hr} = C'_s \times Q_{std}$$

=	2.023704 x10^{-4} lb/hr	Antimony (Sb)	=	10.640879 x10^{-4} lb/hr	Manganese (Mn)
=	2.132085 x10^{-4} lb/hr	Arsenic (As)			
=	0.533021 x10^{-4} lb/hr	Beryllium (Be)	=	24.989809 x10^{-4} lb/hr	Nickel (Ni)
=	8.938765 x10^{-4} lb/hr	Cadmium (Cd)	=	5.330212 x10^{-4} lb/hr	Selenium (Se)
=	19.281152 x10^{-4} lb/hr	Chromium (Cr)	=	4.530680 x10^{-4} lb/hr	Cobalt (Co)
=	34.717445 x10^{-4} lb/hr	Lead (Pb)			

METHOD 5/29 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/9/2011
RUN NO: 5/29 - 1

INPUT

V_m:	149.010	ft^3	Q_s:	11,570,354	**dscfh**
γ **FACTOR:**	1.010		T_s:	558.0	**°F**
P_{bar}:	29.20	**in. Hg**	Θ:	180.0	**minutes**
ΔH:	2.22	**in. H_2O**	V_s:	117.315	**fps**
T_m:	83.2	**°F**	P_s:	29.10	**in. Hg**
			V_{lc}:	522.4	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 143.567 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 101.52 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 180 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 5/29 - 1

SOURCE: FCCU 500
TEST DATE: 6/9/2011

BAROMETRIC:	29.2 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.30 **% by volume**
STACK TEMP:	558 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.4897 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.99	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	29.09	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4897	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 558.0 °F + 460	=	1,018.0	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.10	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	117.315	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	447,796	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	225,867.8 13,552,067	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	192,839.2 11,570,354	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/9/2011
RUN NUMBER: 5/29 - 1

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	149.010 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	83.2 **°F**
STACK TEMP:	558.0 **°F**	**LIQUID COLL:**	522.4 **milliliters**
SQ.RT ΔP:	1.4897 **in.H_2O**	**CO_2:**	18.30 **% by volume**
ΔH:	2.22 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 143.567 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 24.589 \text{ scf}$$

V_{lc} = 522.4 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1462$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7265$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1462

ARI ENVIRONMENTAL, INC.
USEPA METHOD 5 - FILTERABLE PARTICULATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/11
RUN NUMBER: 5/29 - 2

INPUT

V_m:	148.62	ft^3	Q_s:	188,029.8	dscfm
γ FACTOR:	1.010		T_s:	561.0	°F
P_{bar}:	29.15	in.Hg	Runtime:	180.0	minutes
ΔH:	2.23	$in.H_2O$	V_s:	118.319	ft/sec
T_m:	84.2	°F	P_s:	29.05	in.Hg
V_{lc}:	624.1	mL	Noz. diam:	0.218	inches
M_n front:	126.15	mg			
CO_2:	18.40	% by volume			
O_2:	1.40	% by volume			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$ = 142.688 **dscf**

γ = 1.010

VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc}$$ = 29.376 **scf**

FRACTIONAL MOISTURE CONTENT OF STACK GAS

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} \times 100$$ = 17.07 **%**

PARTICULATE CONCENTRATION IN STACK GAS ON A DRY BASIS

$$C_s = (0.01543)\left(\frac{M_n}{V_{mstd}}\right)$$ Filterable = 0.01364 **gr/dscf**

$$C_{s,mg/dscm} = \frac{(M_n)(35.315)}{(V_{mstd})}$$ = 31.222 **mg/dscm**

$$C'_s = (2.205 \times 10^{-6})\left(\frac{M_n}{V_{mstd}}\right)$$ C'_s Filterable = 1.94944 **x 10^{-6} lbs/dscf**

EMISSION RATE

$$pmr = \left(\frac{C_s}{7000}\right)(Q_{std})(60)$$ = 21.98599 **lbs/hr**

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)}$$ = 103.48 **% I**

A_n = 0.0002592 ft^2 Runtime = 180 minutes

Metals Laboratory Data Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500
Date: 6/10/2011
Run #: 5/29 - 2

Front Half Metal Calculation

Metal	Detection Limit (micrograms)	FH Sample (M_{fh}) (micrograms)	FH Blank (M_{fhb}) (micrograms)	*I Value* *A* Value (4 inch filter) (micrograms)	*II Values* 5 % of FH Sample (micrograms)	Lesser value (M_{fhb}) vs 5% (micrograms)	Greater Value *I vs II* (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
Antimony	**0.2**	2.2100	0.3080	**17.590**	0.111	0.111	17.590	0.308	1.902
Arsenic	**1**	<1.000	<1.000	**17.590**	0.050	0.050	17.590	1.000	0.000
Beryllium	**0.2**	<0.200	<0.200	**17.590**	0.010	0.010	17.590	0.200	0.000
Cadmium	**0.1**	0.1040	<0.100	**17.590**	0.005	0.005	17.590	0.100	0.004
Chromium	**1**	16.9000	2.2200	**17.590**	0.845	0.845	17.590	2.220	14.680
Lead	**0.5**	11.6000	<0.500	**17.590**	0.580	0.580	17.590	0.500	11.100
Manganese	**0.5**	4.3500	2.0800	**17.590**	0.218	0.218	17.590	2.080	2.270
Nickel	**0.2**	20.1000	1.1200	**17.590**	1.005	1.005	17.590	1.120	18.980
Selenium	**2**	<2.000	<2.000	**17.590**	0.100	0.100	17.590	2.000	0.000
Cobalt	**0.2**	1.0600	<0.200	**17.590**	0.053	0.053	17.590	0.200	0.860

Back Half Metal Calculation

Metal	Detection Limit (micrograms)	BH Sample (M_{bh}) (micrograms)	BH Blank (M_{bhb}) (micrograms)	*I Value* (micrograms)	*II Values* 5 % of BH Sample (micrograms)	Lesser value (M_{bh}) vs 5% (micrograms)	Greater Value I vs II (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
Antimony	**0.1**	0.1210	<0.100	**1.000**	0.006	0.006	1.000	0.100	0.021
Arsenic	**0.2**	<0.200	<0.200	**1.000**	0.010	0.010	1.000	0.200	0.000
Beryllium	**0.1**	<0.100	<0.100	**1.000**	0.005	0.005	1.000	0.100	0.000
Cadmium	**0.05**	4.6400	<0.050	**1.000**	0.232	0.232	1.000	0.050	4.590
Chromium	**0.15**	2.2100	0.5680	**1.000**	0.111	0.111	1.000	0.568	1.642
Lead	**0.05**	5.2000	0.2300	**1.000**	0.260	0.260	1.000	0.230	4.970
Manganese	**0.15**	2.7400	0.7010	**1.000**	0.137	0.137	1.000	0.701	2.039
Nickel	**0.1**	5.5500	0.6050	**1.000**	0.278	0.278	1.000	0.605	4.945
Selenium	**1**	<1.000	<1.000	**1.000**	0.050	0.050	1.000	1.000	0.000
Cobalt	**0.1**	1.2100	<0.100	**1.000**	0.061	0.061	1.000	0.100	1.110

Metal	FH Sample (M_{fh}) (micrograms)	FH Blank (M_{fhb}) (micrograms)	BH Sample (M_{bh}) (micrograms)	BH Blank (M_{bhb}) (micrograms)	Total Metal (M_t) (micrograms)	
Antimony	2.210	0.308	0.121	0.100	**1.923**	**ADL**
Arsenic	<1.000	<1.000	<0.200	<0.200	**<1.200**	**BDL**
Beryllium	<0.200	<0.200	<0.100	<0.100	**<0.300**	**BDL**
Cadmium	0.104	<0.100	4.640	<0.050	**4.594**	**ADL**
Chromium	16.900	2.220	2.210	0.568	**16.322**	**ADL**
Lead	11.600	<0.500	5.200	0.230	**16.070**	**ADL**
Manganese	4.350	2.080	2.740	0.701	**4.309**	**ADL**
Nickel	20.100	1.120	5.550	0.605	**23.925**	**ADL**
Selenium	<2.000	<2.000	<1.000	<1.000	**<3.000**	**BDL**
Cobalt	1.060	<0.200	1.210	<0.100	**1.970**	**ADL**

$$M_t = (M_{fh} - M_{fhb}) + (M_{bh} - M_{bhb})$$

USEPA Method 29
Metals Emissions Calculation Summary

Client:	BP
Location:	Whiting, IN
Source:	FCCU 500
Date:	6/10/2011
Run #:	5/29 - 2

Test Data Input

Barometric pressure (P_{bar}):	29.15 inches Hg
Stack pressure (P_s):	29.05 Inches Hg Abs.
Test length (θ):	180.0 minutes
Sample nozzle diameter (D_n):	0.2180 inches
Sample nozzle area (A_n):	0.000259 ft^3
Stack temperature (T_s):	561.0 °F
Volume metered (V_{mstd}):	142.688 dscf
Stack gas velocity (V_s):	118.319 ft/sec
Stack gas volumetric flow (Q_{std}):	11,281,791 dscfh
Fractional Moisture content (B_{ws}):	0.1707
Stack Oxygen Content (%O_2):	1.40 %

Metals Laboratory Analysis Weights (M_t)

Antimony (Sb):	1.92 µg	Manganese (Mn):	4.31 υγ
Arsenic (As):	1.20 µg		
Beryllium (Be):	0.30 µg	Nickel (Ni):	23.93 µg
Cadmium (Cd):	4.59 µg	Selenium (Se):	3.00 µg
Chromium (Cr):	16.32 µg	Cobalt (Co)	1.97 µg
Lead (Pb):	16.07 µg		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Metals concentration (µg/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.315\,\text{dscf/dscm}}\right)\right]}$$

=	0.475939 µg/dscm	Antimony (Sb)	=	1.066470 µg/dscm	Manganese (Mn)
=	0.296998 µg/dscm	Arsenic (As)	=		
=	0.074249 µg/dscm	Beryllium (Be)	=	5.921396 µg/dscm	Nickel (Ni)
=	1.137007 µg/dscm	Cadmium (Cd)	=	0.742495 µg/dscm	Selenium (Se)
=	4.039666 µg/dscm	Chromium (Cr)	=	0.487572 µg/dscm	Cobalt (Co)
=	3.977297 µg/dscm	Lead (Pb)			

Metals concentration ($x10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046\times10^{-9}\,\text{lb}}{\mu\text{g}}\times M_t\right)}{V_{mstd}}$$

=	0.029711 x 10^{-9} lb/dscf	Antimony (Sb)	=	0.066576	x 10^{-9} lb/dscf Manganese (Mn)
=	0.018541 x 10^{-9} lb/dscf	Arsenic (As)			
=	0.004635 x 10^{-9} lb/dscf	Beryllium (Be)	=	0.369653	x 10^{-9} lb/dscf Nickel (Ni)
=	0.070980 x 10^{-9} lb/dscf	Cadmium (Cd)	=	0.046352	x 10^{-9} lb/dscf Selenium (Se)
=	0.252183 x 10^{-9} lb/dscf	Chromium (Cr)	=	0.030437	x 10^{-9} lb/dscf Cobalt (Co)
=	0.248290 x 10^{-9} lb/dscf	Lead (Pb)			

Metals emission rate ($x10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

=	3.351969 x10^{-4} lb/hr	Antimony (Sb)	=	7.510991 x10^{-4} lb/hr	Manganese (Mn)
=	2.091713 x10^{-4} lb/hr	Arsenic (As)			
=	0.522928 x10^{-4} lb/hr	Beryllium (Be)	=	41.703520 x10^{-4} lb/hr	Nickel (Ni)
=	8.007773 x10^{-4} lb/hr	Cadmium (Cd)	=	5.229282 x10^{-4} lb/hr	Selenium (Se)
=	28.450778 x10^{-4} lb/hr	Chromium (Cr)	=	3.433895 x10^{-4} lb/hr	Cobalt (Co)
=	28.011518 x10^{-4} lb/hr	Lead (Pb)			

METHOD 5/29 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/2011
RUN NO: 5/29 - 2

INPUT

V_m:	148.620	ft^3	Q_s:	11,281,791	**dscfh**
γ **FACTOR:**	1.010		T_s:	561.0	**°F**
P_{bar}:	29.15	**in. Hg**	Θ:	180.0	**minutes**
ΔH:	2.23	**in. H_2O**	V_s:	118.319	**fps**
T_m:	84.2	**°F**	P_s:	29.05	**in. Hg**
			V_{lc}:	624.1	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 142.688 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.48 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 180 minutes

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/2011
RUN NUMBER: 5/29 - 2

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.15 **in. Hg**	**METER VOLUME:**	148.620 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	84.2 **°F**
STACK TEMP:	561.0 **°F**	**LIQUID COLL:**	624.1 **milliliters**
SQ.RT ΔP:	1.4909 **in.H_2O**	**CO_2:**	18.40 **% by volume**
ΔH:	2.23 **in.H_2O**	**O_2:**	1.40 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 142.688 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 29.376 \text{ scf}$$

V_{lc} = 624.1 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1707$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7278$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1707

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 5/29 - 2

SOURCE: FCCU 500
TEST DATE: 6/10/2011

BAROMETRIC:	29.15 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.40 **% by volume**
STACK TEMP:	561 **°F**	**O_2:**	1.40 **% by volume**
SQ.RT ΔP:	1.4909 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	31.00	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.78	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4909	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 561.0 °F + 460	=	1,021.0	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.05	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	118.319	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	451,629	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	226,741.2 13,604,471	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	188,029.8 11,281,791	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
USEPA METHOD 5 - FILTERABLE PARTICULATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/11
RUN NUMBER: 5/29 - 3

INPUT

V_m:	150.01	ft^3	Q_s:	186,866.0	dscfm
γ FACTOR:	1.010		T_s:	562.8	°F
P_{bar}:	29.15	in.Hg	Runtime:	180.0	minutes
ΔH:	2.21	$in.H_2O$	V_s:	118.017	ft/sec
T_m:	90.5	°F	P_s:	29.05	in.Hg
V_{lc}:	629.6	mL	Noz. diam:	0.218	inches
M_n front:	130.10	mg			
CO_2:	18.50	% by volume			
O_2:	1.40	% by volume			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 142.367 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 29.635 \text{ scf}$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} \times 100 = 17.23 \%$$

PARTICULATE CONCENTRATION IN STACK GAS ON A DRY BASIS

$$C_s = (0.01543)\left(\frac{M_n}{V_{mstd}}\right)$$ Filterable = 0.01410 gr/dscf

$$C_{s,mg/dscm} = \frac{(M_n)(35.315)}{(V_{mstd})} = 32.272 \text{ mg/dscm}$$

$$C'_s = (2.205 \times 10^{-6})\left(\frac{M_n}{V_{mstd}}\right)$$ C'$_s$ Filterable = 2.01501 x 10^{-6} lbs/dscf

EMISSION RATE

$$pmr = \left(\frac{C_s}{7000}\right)(Q_{std})(60) = 22.58485 \text{ lbs/hr}$$

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.89 \%I$$

A_n = 0.0002592 ft^2 Runtime = 180 minutes

Metals Laboratory Data Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500
Date: 6/10/2011
Run #: 5/29 - 3

Front Half Metal Calculation

Metal	Detection Limit (micrograms)	FH Sample (M_{fh}) (micrograms)	FH Blank (M_{fhb}) (micrograms)	*I Value* *A* Value (4 inch filter) (micrograms)	*II Values* 5 % of FH Sample (micrograms)	Lesser value (M_{fhb}) vs 5% (micrograms)	Greater Value *I vs II* (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
Antimony	**0.2**	2.5700	0.3080	**17.590**	0.129	0.129	17.590	0.308	2.262
Arsenic	**1**	<1.000	<1.000	**17.590**	0.050	0.050	17.590	1.000	0.000
Beryllium	**0.2**	<0.200	<0.200	**17.590**	0.010	0.010	17.590	0.200	0.000
Cadmium	**0.1**	5.4800	<0.100	**17.590**	0.274	0.274	17.590	0.100	5.380
Chromium	**1**	15.7000	2.2200	**17.590**	0.785	0.785	17.590	2.220	13.480
Lead	**0.5**	9.7600	<0.500	**17.590**	0.488	0.488	17.590	0.500	9.260
Manganese	**0.5**	4.1500	2.0800	**17.590**	0.208	0.208	17.590	2.080	2.070
Nickel	**0.2**	17.2000	1.1200	**17.590**	0.860	0.860	17.590	1.120	16.080
Selenium	**2**	<2.000	<2.000	**17.590**	0.100	0.100	17.590	2.000	0.000
Cobalt	**0.2**	0.9140	<0.200	**17.590**	0.046	0.046	17.590	0.200	0.714

Back Half Metal Calculation

Metal	Detection Limit (micrograms)	BH Sample (M_{bh}) (micrograms)	BH Blank (M_{bhb}) (micrograms)	*I Value* (micrograms)	*II Values* 5 % of BH Sample (micrograms)	Lesser value (M_{bh}) vs 5% (micrograms)	Greater Value I vs II (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
Antimony	**0.1**	0.1250	<0.100	**1.000**	0.006	0.006	1.000	0.100	0.025
Arsenic	**0.2**	<0.200	<0.200	**1.000**	0.010	0.010	1.000	0.200	0.000
Beryllium	**0.1**	<0.100	<0.100	**1.000**	0.005	0.005	1.000	0.100	0.000
Cadmium	**0.05**	5.4800	<0.050	**1.000**	0.274	0.274	1.000	0.050	5.430
Chromium	**0.15**	1.7500	0.5680	**1.000**	0.088	0.088	1.000	0.568	1.182
Lead	**0.05**	8.6000	0.2300	**1.000**	0.430	0.430	1.000	0.230	8.370
Manganese	**0.15**	4.5200	0.7010	**1.000**	0.226	0.226	1.000	0.701	3.819
Nickel	**0.1**	3.5700	0.6050	**1.000**	0.179	0.179	1.000	0.605	2.965
Selenium	**1**	<1.000	<1.000	**1.000**	0.050	0.050	1.000	1.000	0.000
Cobalt	**0.1**	0.6580	<0.100	**1.000**	0.033	0.033	1.000	0.100	0.558

Metal	FH Sample (M_{fh}) (micrograms)	FH Blank (M_{fhb}) (micrograms)	BH Sample (M_{bh}) (micrograms)	BH Blank (M_{bhb}) (micrograms)	Total Metal (M_t) (micrograms)	
Antimony	2.570	0.308	0.125	<0.100	**2.287**	**ADL**
Arsenic	<1.000	<1.000	<0.200	<0.200	**<1.200**	**BDL**
Beryllium	<0.200	<0.200	<0.100	<0.100	**<0.300**	**BDL**
Cadmium	5.480	<0.100	5.480	<0.050	**10.810**	**ADL**
Chromium	15.700	2.220	1.750	0.568	**14.662**	**ADL**
Lead	9.760	<0.500	8.600	0.230	**17.630**	**ADL**
Manganese	4.150	2.080	4.520	0.701	**5.889**	**ADL**
Nickel	17.200	1.120	3.570	0.605	**19.045**	**ADL**
Selenium	<2.000	<2.000	<1.000	<1.000	**<3.000**	**BDL**
Cobalt	0.914	<0.200	0.658	<0.100	**1.272**	**ADL**

$$M_t = (M_{fh} - M_{fhb}) + (M_{bh} - M_{bhb})$$

USEPA Method 29
Metals Emissions Calculation Summary

Client: BP
Location: Whiting, IN
Source: FCCU 500
Date: 06/10/11
Run #: 5/29 - 3

Test Data Input

Barometric pressure (P_{bar}):	29.15 inches Hg
Stack pressure (P_s):	29.05 inches Hg Abs.
Test length (θ):	180.0 minutes
Sample nozzle diameter (D_n):	0.2180 inches
Sample nozzle area (A_n):	0.000259 ft^3
Stack temperature (T_s):	562.8 °F
Volume metered (V_{mstd}):	142.367 dscf
Stack gas velocity (V_s):	118.017 ft/sec
Stack gas volumetric flow (Q_{std}):	11,211,958 dscfh
Fractional Moisture content (B_{ws}):	0.1723
Stack Oxygen Content (%O_2):	1.40 %

Metals Laboratory Analysis Weights (M_t)

Antimony (Sb):	2.29 µg	Manganese (Mn):	5.89 υγ
Arsenic (As):	1.20 µg		
Beryllium (Be):	0.30 µg	Nickel (Ni):	19.05 µg
Cadmium (Cd):	10.81 µg	Selenium (Se):	3.00 µg
Chromium (Cr):	14.66 µg	Cobalt (Co)	1.27 µg
Lead (Pb):	17.63 µg		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Metals concentration (µg/dscm):

$$C_s = \frac{M_t}{\left(\frac{V_{mstd}}{35.315\,dscf/dscm}\right)}$$

=	0.567304 µg/dscm	Antimony (Sb)	=	1.460802 µg/dscm	Manganese (Mn)
=	0.297667 µg/dscm	Arsenic (As)	=		
=	0.074417 µg/dscm	Beryllium (Be)	=	4.724227 µg/dscm	Nickel (Ni)
=	2.681485 µg/dscm	Cadmium (Cd)	=	0.744168 µg/dscm	Selenium (Se)
=	3.636997 µg/dscm	Chromium (Cr)	=	0.315527 µg/dscm	Cobalt (Co)
=	4.373227 µg/dscm	Lead (Pb)			

Metals concentration ($x10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046\times10^{-9}\,lb}{\mu g}\times M_t\right)}{V_{mstd}}$$

=	0.035415 x 10^{-9} lb/dscf	Antimony (Sb)	=	0.091193	x 10^{-9} lb/dscf Manganese (Mn)
=	0.018582 x 10^{-9} lb/dscf	Arsenic (As)			
=	0.004646 x 10^{-9} lb/dscf	Beryllium (Be)	=	0.294918	x 10^{-9} lb/dscf Nickel (Ni)
=	0.167396 x 10^{-9} lb/dscf	Cadmium (Cd)	=	0.046456	x 10^{-9} lb/dscf Selenium (Se)
=	0.227046 x 10^{-9} lb/dscf	Chromium (Cr)	=	0.019697	x 10^{-9} lb/dscf Cobalt (Co)
=	0.273006 x 10^{-9} lb/dscf	Lead (Pb)			

Metals emission rate ($x10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

=	3.970708 x10^{-4} lb/hr	Antimony (Sb)	=	10.224530 x10^{-4} lb/hr	Manganese (Mn)
=	2.083450 x10^{-4} lb/hr	Arsenic (As)			
=	0.520862 x10^{-4} lb/hr	Beryllium (Be)	=	33.066085 x10^{-4} lb/hr	Nickel (Ni)
=	18.768411 x10^{-4} lb/hr	Cadmium (Cd)	=	5.208625 x10^{-4} lb/hr	Selenium (Se)
=	25.456285 x10^{-4} lb/hr	Chromium (Cr)	=	2.208457 x10^{-4} lb/hr	Cobalt (Co)
=	30.609350 x10^{-4} lb/hr	Lead (Pb)			

METHOD 5/29 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/2011
RUN NO: 5/29 - 3

INPUT

V_m:	150.010	**ft^3**	**Q_s:**	11,211,958	**dscfh**
γ FACTOR:	1.010		**T_s:**	562.8	**°F**
P_{bar}:	29.15	**in. Hg**	**Θ:**	180.0	**minutes**
ΔH:	2.21	**in. H_2O**	**V_s:**	118.017	**fps**
T_m:	90.5	**°F**	**P_s:**	29.05	**in. Hg**
			V_{lc}:	629.6	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 142.367 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.89 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 180 minutes

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 5/29 - 3

SOURCE: FCCU 500
TEST DATE: 6/10/2011

BAROMETRIC:	29.15 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.50 **% by volume**
STACK TEMP:	562.8 **°F**	**O_2:**	1.40 **% by volume**
SQ.RT ΔP:	1.4856 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	31.02	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.77	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4856	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 562.8 °F + 460	=	1,022.8	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.05	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	118.017	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	450,476	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	225,764.2 13,545,851	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	186,866.0 11,211,958	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/2011
RUN NUMBER: 5/29 - 3

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.15 **in. Hg**	**METER VOLUME:**	150.010 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	90.5 **°F**
STACK TEMP:	562.8 **°F**	**LIQUID COLL:**	629.6 **milliliters**
SQ.RT ΔP:	1.4856 **in.H_2O**	**CO_2:**	18.50 **% by volume**
ΔH:	2.21 **in.H_2O**	**O_2:**	1.40 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 142.367 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 29.635 \text{ scf}$$

V_{lc} = 629.6 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1723$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7278$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1723

SUMMARY OF TEST RESULTS

TABLE	Mercury Summary
COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust

RUN NO	OH-1				OH-2				OH-3			
TEST DATE	6/13/2011				6/13/2011				6/14/2011			
TEST TIME	09:50 - 13:25				14:15 - 17:22				08:20 - 11:26			
Stack Gas Parameters												
Temperature, °F	560.8				560.6				561.1			
Velocity, av. ft/sec	114.9				115.2				114.3			
Volumetric flow, acfm	438,412				439,564				436,366			
Volumetric flow, scfm	222,044				222,671				220,565			
Volumetric flow, dscfh	11,071,954				10,942,543				10,917,819			
Moisture, av. % vol	16.89				18.10				17.50			
Carbon Dioxide, av. % vol	18.40				18.40				18.10			
Oxygen, av. % vol	1.50				1.50				1.40			
Metals Sample												
Time, min	180.0				180.0				180.0			
Volume, dscf	139.698				140.137				138.854			
Isokinetic Ratio, %	103.2				104.8				104.1			
Metals Emissions												
Mercury	**Mass µg**	**Concentration µg/dscm**	**Concentration x 10^{-9} lb/dscf**	**Emission Rate x 10^{-4} lb/hr**	**Mass µg**	**Concentration µg/dscm**	**Concentration x 10^{-9} lb/dscf**	**Emission Rate x 10^{-4} lb/hr**	**Mass µg**	**Concentration µg/dscm**	**Concentration x 10^{-9} lb/dscf**	**Emission Rate x 10^{-4} lb/hr**
Hg-FH (particle bound)	< 0.065	< 0.016	< 0.001	< 0.1136	< 0.059	< 0.015	< 0.001	< 0.1016	< 0.065	< 0.017	< 0.001	< 0.1127
Hg-KCl (oxidized)	0.849	0.215	0.013	1.4834	0.073	0.018	0.001	0.1250	0.246	0.063	0.004	0.4264
Hg-Acid/$KMnO_4$ (elemental)	< 1.299	< 0.328	< 0.020	< 2.2697	< 0.361	< 0.091	< 0.006	< 0.6214	< 0.389	< 0.099	< 0.006	< 0.6743
Hg-Total	< 2.213	< 0.559	< 0.035	< 3.8667	< 0.493	< 0.124	< 0.008	< 0.8480	< 0.700	< 0.178	< 0.011	< 1.2134

Mercury Emissions Calculation Summary
Ontario Hydro (ASTM Method D6784-02)

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/13/2011
Run #: OH-1

Test Data Input		*Metals Laboratory Analysis Weights (Mt)*	
Barometric pressure (P_{bar}):	29.40 inches Hg	Hg-FH (particle bound)	< 0.065 ug
Stack pressure (P_s):	29.30 Inches Hg Abs.	Hg-KCl (oxidized)	0.849 ug
Test length (θ):	180.0 minutes	Hg-Acid/$KMnO_4$ (elemental)	< 1.299 ug
Sample nozzle diameter (D_n):	0.2180 inches	Hg-Total	< 2.213 ug
Sample nozzle area (A_n):	0.000259 ft^3		
Stack temperature (T_s):	560.8 °F		
Volume metered (V_{mstd}):	139.698 dscf		
Stack gas velocity (V_s):	114.857 ft/sec		
Stack gas volumetric flow (Q_{std}):	11,071,954 dscfh		
Fractional Moisture content (B_{ws}):	0.1689 %		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Mercury concentration (ug/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.31 dscf/dscm}\right)\right]}$$

Hg-FH (particle bound)	=	< 0.016 µg/dscm
Hg-KCl (oxidized)	=	0.215 µg/dscm
Hg-Acid/$KMnO_4$ (elemental)	=	< 0.328 µg/dscm
Hg-Total	=	< 0.559 µg/dscm

Mercury concentration (x10^{-9} lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} lb}{\mu g} \times M_t\right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	< 0.001 x 10^{-9} lb/dscf
Hg-KCl (oxidized)	=	0.013 x 10^{-9} lb/dscf
Hg-Acid/$KMnO_4$ (elemental)	=	< 0.020 x 10^{-9} lb/dscf
Hg-Total	=	< 0.035 x 10^{-9} lb/dscf

Mercury emission rate (x10^{-4} lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	< 0.114 x 10^{-4} lb/hr
Hg-KCl (oxidized)	=	1.483 x 10^{-4} lb/hr
Hg-Acid/$KMnO_4$ (elemental)	=	< 2.270 x 10^{-4} lb/hr
Hg-Total	=	< 3.867 x 10^{-4} lb/hr

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: OH-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011

BAROMETRIC:	29.4 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.40 **% by volume**
STACK TEMP:	560.8 **°F**	**O_2:**	1.50 **% by volume**
SQ.RT ΔP:	1.4543 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$ = 31.004 **lb/lb-mole**

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18B_{ws}$$ = 28.807 **lb/lb-mole**

PITOT TUBE COEFFICIENT

C_p (from calibration curve or geometric specifications) = 0.84

AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$$ = 1.4543 **in. H_2O**

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

T_s = 560.8 °F + 460 = 1,020.8 **°R**

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$ = 29.30 **in.Hg**

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$ = 114.857 **ft/sec**

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s$$ = 438,412 **acfm**

Stack Area = **63.617** ft²

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis

$$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$$ = 222,043.7 **scfm, wb**
13,322,622 **scfh, wb**

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$ = 184,532.6 **dscfm**
11,071,954 **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NUMBER: OH-1

γ FACTOR:	1.010	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.40 **in. Hg**	**METER VOLUME:**	143.705 **ft^3**
STATIC PRES:	-1.400 **in.H_2O**	**METER TEMP:**	81.9 **°F**
STACK TEMP:	560.8 **°F**	**LIQUID COLL:**	603.3 **milliliters**
SQ.RT ΔP:	1.4543 **in.H_2O**	**CO_2:**	18.40 **% by volume**
ΔH:	2.12 **in.H_2O**	**O_2:**	1.50 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 139.698 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 28.397 \text{ scf}$$

V_{lc} = 603.3 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1689$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7216$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1689

ASTM D6784-02 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NO: OH-1

INPUT

V_m:	143.705	ft^3	Q_s:	11,071,954	**dscfh**
γ **FACTOR:**	1.010		T_s:	560.8	°F
P_{bar}:	29.40	**in. Hg**	Θ:	180	**minutes**
ΔH:	2.12	**in. H_2O**	V_s:	114.857	**fps**
T_m:	81.9	°F	P_s:	29.30	**in. Hg**
			V_{lc}:	603.3	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 139.698 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.23 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 180 minutes

Mercury Emissions Calculation Summary
Ontario Hydro (ASTM Method D6784-02)

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/13/2011
Run #: OH-2

Test Data Input		*Metals Laboratory Analysis Weights (Mt)*	
Barometric pressure (P_{bar}):	29.40 inches Hg	Hg-FH (particle bound)	< 0.059 ug
Stack pressure (P_s):	29.30 Inches Hg Abs.	Hg-KCl (oxidized)	0.073 ug
Test length (θ):	180.0 minutes	Hg-Acid/$KMnO_4$ (elemental)	< 0.361 ug
Sample nozzle diameter (D_n):	0.2180 inches	Hg-Total	< 0.493 ug
Sample nozzle area (A_n):	0.000259 ft^3		
Stack temperature (T_s):	560.6 °F		
Volume metered (V_{mstd}):	140.137 dscf		
Stack gas velocity (V_s):	115.159 ft/sec		
Stack gas volumetric flow (Q_{std}):	10,942,543 dscfh		
Fractional Moisture content (B_{ws}):	0.1810 %		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Mercury concentration (ug/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.31 dscf/dscm}\right)\right]}$$

Hg-FH (particle bound)	=	**< 0.015 µg/dscm**
Hg-KCl (oxidized)	=	**0.018 µg/dscm**
Hg-Acid/$KMnO_4$ (elemental)	=	**< 0.091 µg/dscm**
Hg-Total	=	**< 0.124 µg/dscm**

Mercury concentration (x10^{-9} lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046\times10^{-9} lb}{\mu g} \times M_t\right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	**< 0.001 x 10^{-9} lb/dscf**
Hg-KCl (oxidized)	=	**0.001 x 10^{-9} lb/dscf**
Hg-Acid/$KMnO_4$ (elemental)	=	**< 0.006 x 10^{-9} lb/dscf**
Hg-Total	=	**< 0.008 x 10^{-9} lb/dscf**

Mercury emission rate (x10^{-4} lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	**< 0.102 x 10^{-4} lb/hr**
Hg-KCl (oxidized)	=	**0.125 x 10^{-4} lb/hr**
Hg-Acid/$KMnO_4$ (elemental)	=	**< 0.621 x 10^{-4} lb/hr**
Hg-Total	=	**< 0.848 x 10^{-4} lb/hr**

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: OH-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011

BAROMETRIC:	29.4 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.40 **% by volume**
STACK TEMP:	560.6 **°F**	**O_2:**	1.50 **% by volume**
SQ.RT ΔP:	1.4543 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	31.00	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.65	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4543	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 560.6 °F + 460	=	1,020.6	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.30	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	115.159	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	439,564	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	222,670.7 13,360,243	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	182,375.7 10,942,543	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NUMBER: OH-2

γ FACTOR:	1.010	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.40 **in. Hg**	**METER VOLUME:**	145.620 **ft^3**
STATIC PRES:	-1.400 **in.H_2O**	**METER TEMP:**	87.4 **°F**
STACK TEMP:	560.6 **°F**	**LIQUID COLL:**	657.8 **milliliters**
SQ.RT ΔP:	1.4543 **in.H_2O**	**CO_2:**	18.40 **% by volume**
ΔH:	2.12 **in.H_2O**	**O_2:**	1.50 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 140.137 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 30.963 \text{ scf}$$

V_{lc} = 657.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1810$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7216$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1810

ASTM D6784-02 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NO: OH-2

INPUT

V_m:	145.620	ft^3	Q_s:	10,942,543	**dscfh**
γ **FACTOR:**	1.010		T_s:	560.6	°F
P_{bar}:	29.40	**in. Hg**	Θ:	180	**minutes**
ΔH:	2.12	**in. H_2O**	V_s:	115.159	**fps**
T_m:	87.4	°F	P_s:	29.30	**in. Hg**
			V_{lc}:	657.8	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 140.137 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 104.78 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

Mercury Emissions Calculation Summary
Ontario Hydro (ASTM Method D6784-02)

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/14/2011
Run #: OH-3

Test Data Input		*Metals Laboratory Analysis Weights (Mt)*	
Barometric pressure (P_{bar}):	29.35 inches Hg	Hg-FH (particle bound)	< 0.065 ug
Stack pressure (P_s):	29.25 Inches Hg Abs.	Hg-KCl (oxidized)	0.246 ug
Test length (θ):	180.0 minutes	Hg-Acid/$KMnO_4$ (elemental)	< 0.389 ug
Sample nozzle diameter (D_n):	0.2180 inches	Hg-Total	< 0.700 ug
Sample nozzle area (A_n):	0.000259 ft^3		
Stack temperature (T_s):	561.1 °F		
Volume metered (V_{mstd}):	138.854 dscf		
Stack gas velocity (V_s):	114.321 ft/sec		
Stack gas volumetric flow (Q_{std}):	10,917,819 dscfh		
Fractional Moisture content (B_{ws}):	0.1750 %		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Mercury concentration (ug/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.31 dscf/dscm}\right)\right]}$$

Hg-FH (particle bound)	=	< 0.017 µg/dscm
Hg-KCl (oxidized)	=	0.063 µg/dscm
Hg-Acid/$KMnO_4$ (elemental)	=	< 0.099 µg/dscm
Hg-Total	=	< 0.178 µg/dscm

Mercury concentration (x10^{-9} lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} lb}{\mu g} \times M_t\right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	< 0.001 x 10^{-9} lb/dscf
Hg-KCl (oxidized)	=	0.004 x 10^{-9} lb/dscf
Hg-Acid/$KMnO_4$ (elemental)	=	< 0.006 x 10^{-9} lb/dscf
Hg-Total	=	< 0.011 x 10^{-9} lb/dscf

Mercury emission rate (x10^{-4} lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	< 0.113 x 10^{-4} lb/hr
Hg-KCl (oxidized)	=	0.426 x 10^{-4} lb/hr
Hg-Acid/$KMnO_4$ (elemental)	=	< 0.674 x 10^{-4} lb/hr
Hg-Total	=	< 1.213 x 10^{-4} lb/hr

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: OH-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011

BAROMETRIC:	29.35 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.10 **% by volume**
STACK TEMP:	561.1 **°F**	**O_2:**	1.40 **% by volume**
SQ.RT ΔP:	1.4430 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.95	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.69	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4430	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 561.1 °F + 460	=	1,021.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.25	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	114.321	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	436,366	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	220,565.2 13,233,912	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	181,963.7 10,917,819	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011
RUN NUMBER: OH-3

γ FACTOR:	1.010	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.35 **in. Hg**	**METER VOLUME:**	144.625 **ft^3**
STATIC PRES:	-1.400 **in.H_2O**	**METER TEMP:**	87.7 **°F**
STACK TEMP:	561.1 **°F**	**LIQUID COLL:**	625.8 **milliliters**
SQ.RT ΔP:	1.4430 **in.H_2O**	**CO_2:**	18.10 **% by volume**
ΔH:	2.08 **in.H_2O**	**O_2:**	1.40 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 138.854 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 29.456 \text{ scf}$$

V_{lc} = 625.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1750$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7228$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1750

ASTM D6784-02 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011
RUN NO: OH-3

INPUT

V_m:	144.625	ft^3	Q_s:	10,917,819	**dscfh**
γ **FACTOR:**	1.010		T_s:	561.1	**°F**
P_{bar}:	29.35	**in. Hg**	Θ:	180	**minutes**
ΔH:	2.08	**in. H_2O**	V_s:	114.321	**fps**
T_m:	87.7	**°F**	P_s:	29.25	**in. Hg**
			V_{lc}:	625.8	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

= 138.854 **dscf**

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)}$$

= 104.06 **% I**

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

SUMMARY OF TEST RESULTS

ABLE	Mercury Summary
COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust

RUN NO	OH-1				OH-2				OH-3			
TEST DATE	6/13/2011				6/13/2011				6/14/2011			
TEST TIME	09:50 - 13:25				14:15 - 17:22				08:20 - 11:26			
Stack Gas Parameters												
Temperature, °F	560.8				560.6				561.1			
Velocity, av. ft/sec	114.9				115.2				114.3			
Volumetric flow, acfm	438,412				439,564				436,366			
Volumetric flow, scfm	222,044				222,671				220,565			
Volumetric flow, dscfh	11,071,954				10,942,543				10,917,819			
Moisture, av. % vol	16.89				18.10				17.50			
Carbon Dioxide, av. % vol	18.40				18.40				18.10			
Oxygen, av. % vol	1.50				1.50				1.40			
Metals Sample												
Time, min	180.0				180.0				180.0			
Volume, dscf	139.698				140.137				138.854			
Isokinetic Ratio, %	103.2				104.8				104.1			
Metals Emissions												
Mercury	Mass µg	Concentration µg/dscm	Concentration x 10^{-9} lb/dscf	Emission Rate x 10^{-4} lb/hr	Mass µg	Concentration µg/dscm	Concentration x 10^{-9} lb/dscf	Emission Rate x 10^{-4} lb/hr	Mass µg	Concentration µg/dscm	Concentration x 10^{-9} lb/dscf	Emission Rate x 10^{-4} lb/hr
Hg-FH (particle bound)	0.00	0.000	0.000	0.000	0.04	0.011	0.001	0.076	0.00	0.000	0.000	0.000
Hg-KCl (oxidized)	0.85	0.215	0.013	1.483	0.07	0.018	0.001	0.125	0.25	0.063	0.004	0.426
Hg-Acid/$KMnO_4$ (elemental)	1.25	0.316	0.020	2.182	0.29	0.072	0.004	0.492	0.34	0.086	0.005	0.588
Hg-Total	2.10	0.530	0.033	3.666	0.40	0.101	0.006	0.693	0.59	0.149	0.009	1.014

Mercury Emissions Calculation Summary
Ontario Hydro (ASTM Method D6784-02)

Client:	BP
Location:	Whiting, IN
Source:	FCCU 500 Exhaust
Date:	6/13/2011
Run #:	OH-1

Test Data Input		***Metals Laboratory Analysis Weights (Mt)***	
Barometric pressure (P_{bar}):	29.40 **inches Hg**	**Hg-FH (particle bound)**	0.00 **ug**
Stack pressure (P_s):	29.30 **inches Hg Abs.**	**Hg-KCl (oxidized)**	0.85 **ug**
Test length (θ):	180.0 **minutes**	**Hg-Acid/$KMnO_4$ (elemental)**	1.25 **ug**
Sample nozzle diameter (D_n):	0.2180 **inches**	**Hg-Total**	2.10 **ug**
Sample nozzle area (A_n):	0.000259 **ft^3**		
Stack temperature (T_s):	560.8 **°F**		
Volume metered (V_{mstd}):	139.698 **dscf**		
Stack gas velocity (V_s):	114.857 **ft/sec**		
Stack gas volumetric flow (Q_{std}):	11,071,954 **dscfh**		
Fractional Moisture content (B_{ws}):	0.1689 **%**		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Mercury concentration (ug/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.31 dscf/dscm}\right)\right]}$$

Hg-FH (particle bound)	=	**0.000 µg/dscm**
Hg-KCl (oxidized)	=	**0.215 µg/dscm**
Hg-Acid/$KMnO_4$ (elemental)	=	**0.316 µg/dscm**
Hg-Total	=	**0.530 µg/dscm**

Mercury concentration (x10^{-9} lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} lb}{\mu g} \times M_t\right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	**0.000 x 10^{-9} lb/dscf**
Hg-KCl (oxidized)	=	**0.013 x 10^{-9} lb/dscf**
Hg-Acid/$KMnO_4$ (elemental)	=	**0.020 x 10^{-9} lb/dscf**
Hg-Total	=	**0.033 x 10^{-9} lb/dscf**

Mercury emission rate (x10^{-4} lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	**0.000 x 10^{-4} lb/hr**
Hg-KCl (oxidized)	=	**1.483 x 10^{-4} lb/hr**
Hg-Acid/$KMnO_4$ (elemental)	=	**2.182 x 10^{-4} lb/hr**
Hg-Total	=	**3.666 x 10^{-4} lb/hr**

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: OH-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011

BAROMETRIC:	29.4 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.40 **% by volume**
STACK TEMP:	560.8 **°F**	**O_2:**	1.50 **% by volume**
SQ.RT ΔP:	1.4543 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	31.004	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.807	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4543	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 560.8 °F + 460	=	1,020.8	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.30	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	114.857	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	438,412	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	222,043.7 13,322,622	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	184,532.6 11,071,954	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NUMBER: OH-1

γ FACTOR:	1.010	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.40 **in. Hg**	**METER VOLUME:**	143.705 **ft^3**
STATIC PRES:	-1.400 **in.H_2O**	**METER TEMP:**	81.9 **°F**
STACK TEMP:	560.8 **°F**	**LIQUID COLL:**	603.3 **milliliters**
SQ.RT ΔP:	1.4543 **in.H_2O**	**CO_2:**	18.40 **% by volume**
ΔH:	2.12 **in.H_2O**	**O_2:**	1.50 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 139.698 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 28.397 \text{ scf}$$

V_{lc} = 603.3 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1689$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7216$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1689

ASTM D6784-02 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NO: OH-1

INPUT

V_m:	143.705	ft^3	Q_s:	11,071,954	**dscfh**
γ **FACTOR:**	1.010		T_s:	560.8	**°F**
P_{bar}:	29.40	**in. Hg**	Θ:	180	**minutes**
ΔH:	2.12	**in. H_2O**	V_s:	114.857	**fps**
T_m:	81.9	**°F**	P_s:	29.30	**in. Hg**
			V_{lc}:	603.3	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 139.698 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.23 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 180 minutes

Mercury Emissions Calculation Summary
Ontario Hydro (ASTM Method D6784-02)

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/13/2011
Run #: OH-2

Test Data Input		*Metals Laboratory Analysis Weights (Mt)*	
Barometric pressure (P_{bar}):	29.40 inches Hg	Hg-FH (particle bound)	0.04 ug
Stack pressure (P_s):	29.30 Inches Hg Abs.	Hg-KCl (oxidized)	0.07 ug
Test length (θ):	180.0 minutes	Hg-Acid/$KMnO_4$ (elemental)	0.29 ug
Sample nozzle diameter (D_n):	0.2180 inches	Hg-Total	0.40 ug
Sample nozzle area (A_n):	0.000259 ft^3		
Stack temperature (T_s):	560.6 °F		
Volume metered (V_{mstd}):	140.137 dscf		
Stack gas velocity (V_s):	115.159 ft/sec		
Stack gas volumetric flow (Q_{std}):	10,942,543 dscfh		
Fractional Moisture content (B_{ws}):	0.1810 %		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Mercury concentration (ug/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.31 dscf/dscm}\right)\right]}$$

Hg-FH (particle bound)	=	0.011 µg/dscm
Hg-KCl (oxidized)	=	0.018 µg/dscm
Hg-Acid/$KMnO_4$ (elemental)	=	0.072 µg/dscm
Hg-Total	=	0.101 µg/dscm

Mercury concentration (x10^{-9} lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} lb}{\mu g} \times M_t\right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	0.001 x 10^{-9} lb/dscf
Hg-KCl (oxidized)	=	0.001 x 10^{-9} lb/dscf
Hg-Acid/$KMnO_4$ (elemental)	=	0.004 x 10^{-9} lb/dscf
Hg-Total	=	0.006 x 10^{-9} lb/dscf

Mercury emission rate (x10^{-4} lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	0.076 x 10^{-4} lb/hr
Hg-KCl (oxidized)	=	0.125 x 10^{-4} lb/hr
Hg-Acid/$KMnO_4$ (elemental)	=	0.492 x 10^{-4} lb/hr
Hg-Total	=	0.693 x 10^{-4} lb/hr

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: OH-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011

BAROMETRIC:	29.4 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.40 **% by volume**
STACK TEMP:	560.6 **°F**	**O_2:**	1.50 **% by volume**
SQ.RT ΔP:	1.4543 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	31.00	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.65	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4543	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 560.6 °F + 460	=	1,020.6	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.30	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	115.159	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	439,564	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	222,670.7 13,360,243	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	182,375.7 10,942,543	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NUMBER: OH-2

γ FACTOR:	1.010	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.40 **in. Hg**	**METER VOLUME:**	145.620 **ft^3**
STATIC PRES:	-1.400 **in.H_2O**	**METER TEMP:**	87.4 **°F**
STACK TEMP:	560.6 **°F**	**LIQUID COLL:**	657.8 **milliliters**
SQ.RT ΔP:	1.4543 **in.H_2O**	**CO_2:**	18.40 **% by volume**
ΔH:	2.12 **in.H_2O**	**O_2:**	1.50 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 140.137 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 30.963 \text{ scf}$$

V_{lc} = 657.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1810$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7216$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1810

ASTM D6784-02 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NO: OH-2

INPUT

V_m:	145.620	ft^3	Q_s:	10,942,543	**dscfh**
γ **FACTOR:**	1.010		T_s:	560.6	**°F**
P_{bar}:	29.40	**in. Hg**	Θ:	180	**minutes**
ΔH:	2.12	**in. H_2O**	V_s:	115.159	**fps**
T_m:	87.4	**°F**	P_s:	29.30	**in. Hg**
			V_{lc}:	657.8	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 140.137 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 104.78 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

Mercury Emissions Calculation Summary
Ontario Hydro (ASTM Method D6784-02)

Client: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust
Date: 6/14/2011
Run #: OH-3

Test Data Input		*Metals Laboratory Analysis Weights (Mt)*	
Barometric pressure (P_{bar}):	29.35 inches Hg	Hg-FH (particle bound)	0.00 ug
Stack pressure (P_s):	29.25 inches Hg Abs.	Hg-KCl (oxidized)	0.25 ug
Test length (θ):	180.0 minutes	Hg-Acid/$KMnO_4$ (elemental)	0.34 ug
Sample nozzle diameter (D_n):	0.2180 inches	Hg-Total	0.59 ug
Sample nozzle area (A_n):	0.000259 ft^3		
Stack temperature (T_s):	561.1 °F		
Volume metered (V_{mstd}):	138.854 dscf		
Stack gas velocity (V_s):	114.321 ft/sec		
Stack gas volumetric flow (Q_{std}):	10,917,819 dscfh		
Fractional Moisture content (B_{ws}):	0.1750 %		

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Mercury concentration (ug/dscm):

$$C_s = \frac{M_t}{\left[\left(\frac{V_{mstd}}{35.31 dscf/dscm}\right)\right]}$$

Hg-FH (particle bound)	=	0.000 µg/dscm
Hg-KCl (oxidized)	=	0.063 µg/dscm
Hg-Acid/$KMnO_4$ (elemental)	=	0.086 µg/dscm
Hg-Total	=	0.149 µg/dscm

Mercury concentration ($x10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} lb}{\mu g} \times M_t\right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	0.000 x 10^{-9} lb/dscf
Hg-KCl (oxidized)	=	0.004 x 10^{-9} lb/dscf
Hg-Acid/$KMnO_4$ (elemental)	=	0.005 x 10^{-9} lb/dscf
Hg-Total	=	0.009 x 10^{-9} lb/dscf

Mercury emission rate ($x10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	0.000 x 10^{-4} lb/hr
Hg-KCl (oxidized)	=	0.426 x 10^{-4} lb/hr
Hg-Acid/$KMnO_4$ (elemental)	=	0.588 x 10^{-4} lb/hr
Hg-Total	=	1.014 x 10^{-4} lb/hr

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: OH-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011

BAROMETRIC:	29.35 **in. Hg**	**STACK DIAM:**	108.000 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.10 **% by volume**
STACK TEMP:	561.1 **°F**	**O_2:**	1.40 **% by volume**
SQ.RT ΔP:	1.4430 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.95	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.69	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4430	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 561.1 °F + 460	=	1,021.1	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.25	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	114.321	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	436,366	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	220,565.2 13,233,912	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	181,963.7 10,917,819	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011
RUN NUMBER: OH-3

γ FACTOR:	1.010	**STACK DIAM:**	108.000 **inches**
BAROMETRIC:	29.35 **in. Hg**	**METER VOLUME:**	144.625 **ft^3**
STATIC PRES:	-1.400 **in.H_2O**	**METER TEMP:**	87.7 **°F**
STACK TEMP:	561.1 **°F**	**LIQUID COLL:**	625.8 **milliliters**
SQ.RT ΔP:	1.4430 **in.H_2O**	**CO_2:**	18.10 **% by volume**
ΔH:	2.08 **in.H_2O**	**O_2:**	1.40 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 138.854 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 29.456 \text{ scf}$$

V_{lc} = 625.8 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1750$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7228$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1750

ASTM D6784-02 ISOKINETIC CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011
RUN NO: OH-3

INPUT

V_m:	144.625	ft^3	Q_s:	10,917,819	**dscfh**
γ **FACTOR:**	1.010		T_s:	561.1	°F
P_{bar}:	29.35	**in. Hg**	Θ:	180	**minutes**
ΔH:	2.08	**in. H_2O**	V_s:	114.321	**fps**
T_m:	87.7	°F	P_s:	29.25	**in. Hg**
			V_{lc}:	625.8	**mL**

Volume of Sample at Standard Conditions on a Dry Basis: **English Units** **(29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 138.854 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 104.06 \text{ \% I}$$

A_n = 0.00025920 ft^2 Runtime (θ) = 60 minutes

Company	: BP				
Location	: Whiting, IN				
Source	: FCCU 500 Exhaust				
Operators	:				
Test Run	:	0061-1	0061-2	0061-3	
Test Date	:	6/13/2011	6/13/2011	6/14/2011	
Test Time	:	11:18-12:14	14:58-16:46	09:06-10:24	Average
STACK GAS					
Temperature, av. °F		557.2	558.9	559.1	558.4
Velocity, av. ft/sec		110.28	113.00	114.10	112.46
Volume flow, acfm		420,947.72	431,340.68	435,518.36	429,268.92
Volume flow, scfh		12,837,174	13,135,465	13,234,132	13,068,923
Volume flow, dscfh		10,628,836	10,961,677	11,067,593	10,886,035
Moisture, av. % vol		17.20	16.55	16.37	16.71
CO_2, av. % vol, db		18.50	18.50	18.10	18.37
O_2, av. % vol, db		1.40	1.50	1.30	1.40
HEX CHROME SAMPLE					
Time, min		48.0	48.0	48.0	
Volume, dscf		33.756	35.010	34.866	
Volume, dscm		0.956	0.992	0.987	
Isokinetic Ratio, %		95.4	96.0	94.6	
HEXAVALENT CHROMIUM					
Concentration					
lb/dscf x 10^{-6}		< 0.0007592	< 0.0007745	< 0.0007872	< 0.0007737
µg/dscm		< 0.009753	< 0.009950	< 0.010113	< 0.009939
Emission rate					
lb/hr		< 0.008070	< 0.008490	< 0.008713	< 0.008424

HEXAVALENT CHROMIUM CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NO: 0061-1

INPUT

V_m:	35.575 **ft³**	**Q_s:**	10,628,836 **dscfh**
γ FACTOR:	0.991	**T_s:**	557.2 **°F**
P_{bar}:	29.40 **in. Hg**	**Θ:**	48.0 **minutes**
ΔH:	1.80	**V_s:**	110.281 **fps**
T_m:	84.3 **°F**	**P_s:**	29.30 **in. Hg**
HexChrome:	< 15 **µg/L**	**V_{lc}:**	149.0 **mL**
Sample Volume:	775 **mL**	**%O_2:**	1.40 **%**
Total Mass of Cr^{+6}:	< 11.6 **µg**		

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 33.756 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 95.4 \text{ \% I}$$

A_n = 0.00026398 ft² Runtime (θ) = 48 minutes

Total µg Hexavalent Chromium in sample (M_n) = <11.6 **µg**

Concentration of Hexavalent Chromium

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} \text{ lb}/\mu\text{g})(M_n)}{V_{mstd}} = < 0.0007592 \text{ x } 10^{-6} \text{ lb/dscf}$$

$$C_{s(\mu g/dscm)} = \frac{M_n}{(V_{mstd})(35.31 \text{ ft}^3/\text{m}^3)} = < 0.009753 \text{ µg/dscm}$$

Hexavalent Chromium Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)} = < 0.008070 \text{ lb/hr}$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 0061-1

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011

BAROMETRIC:	29.40 **in. Hg**	**STACK DIAM:**	108.0 **inches**
STATIC PRES:	-1.40 **in.H_2O**	**CO_2:**	18.50 **% by volume**
STACK TEMP:	557.2 **°F**	**O_2:**	1.40 **% by volume**
SQ.RT ΔP:	1.3981 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$ = 31.02 **lb/lb-mole**

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$$ = 28.78 **lb/lb-mole**

PITOT TUBE COEFFICIENT

C_p (from calibration curve or geometric specifications) = 0.84

AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$$ = 1.3981 **in. H_2O**

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

T_s = 557.2 °F + 460 = 1,017.2 **°R**

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$ = 29.30 **in.Hg**

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$ = 110.281 **ft/sec**

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s$$ = 420,947.72 **acfm**

Stack Area = 63.61725 ft^2

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis

$$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$$ = 213,952.89 **scfm, wb**
12,837,174 **scfh, wb**

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$ = 177,147.26 **dscfm**
10,628,836 **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NUMBER: 0061-1

γ FACTOR:	0.991	**STACK DIAM:**	108.0 **inches**
BAROMETRIC:	29.40 **in. Hg**	**METER VOLUME:**	35.575 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	84.3 **°F**
STACK TEMP:	557.2 **°F**	**LIQUID COLL:**	149.0 **milliliters**
SQ.RT ΔP:	1.3981 **in.H_2O**	**CO_2:**	18.50 **% by volume**
ΔH:	1.80 **in.H_2O**	**O_2:**	1.40 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 33.756 \text{ dscf}$$

γ = 0.991

VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 7.013 \text{ scf}$$

V_{lc} = 149.0 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1720$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7216$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1720

HEXAVALENT CHROMIUM CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NO: 0061-2

INPUT

V_m:	36.950	ft^3	Q_s:	10,961,677	dscfh
γ FACTOR:	0.991		T_s:	558.9	°F
P_{bar}:	29.40	in. Hg	Θ:	48.0	minutes
ΔH:	1.96		V_s:	113.004	fps
T_m:	85.3	°F	P_s:	29.30	in. Hg
HexChrome:	< 15	µg/L	V_{lc}:	147.5	mL
Sample Volume:	820	mL	$\%O_2$:	1.50	%
Total Mass of Cr^{+6}:	< 12.3	µg			

Volume of Sample at Standard Conditions on a Dry Basis:

English Units (29.92 in. Hg, 68 °F)

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 35.010 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 96.0 \text{ \% I}$$

A_n = 0.00026398 ft^2 Runtime (θ) = 48 minutes

Total µg Hexavalent Chromium in sample (M_n) = <12.3 µg

Concentration of Hexavalent Chromium

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} \text{ lb}/\mu g)(M_n)}{V_{mstd}} = < 0.0007745 \text{ x } 10^{-6} \text{ lb/dscf}$$

$$C_{s(\mu g/dscm)} = \frac{M_n}{(V_{mstd})(35.31 ft^3/m^3)} = < 0.009950 \text{ µg/dscm}$$

Hexavalent Chromium Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)} = < 0.008490 \text{ lb/hr}$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 0061-2

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011

BAROMETRIC:	29.40 **in. Hg**	**STACK DIAM:**	108.0 **inches**
STATIC PRES:	-1.30 **in.H_2O**	**CO_2:**	18.50 **% by volume**
STACK TEMP:	558.9 **°F**	**O_2:**	1.50 **% by volume**
SQ.RT ΔP:	1.4338 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$ = 31.02 **lb/lb-mole**

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$$ = 28.87 **lb/lb-mole**

PITOT TUBE COEFFICIENT

C_p (from calibration curve or geometric specifications) = 0.84

AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$$ = 1.4338 **in. H_2O**

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

T_s = 558.9 °F + 460 = 1,018.9 **°R**

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$ = 29.30 **in.Hg**

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$ = 113.004 **ft/sec**

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s$$ = 431,340.68 **acfm**

Stack Area = 63.61725 ft^2

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis

$$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$$ = 218,924.42 **scfm, wb**
13,135,465 **scfh, wb**

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$ = 182,694.61 **dscfm**
10,961,677 **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/13/2011
RUN NUMBER: 0061-2

γ FACTOR:	0.991	**STACK DIAM:**	108.0 **inches**
BAROMETRIC:	29.40 **in. Hg**	**METER VOLUME:**	36.950 **ft^3**
STATIC PRES:	-1.30 **in.H_2O**	**METER TEMP:**	85.3 **°F**
STACK TEMP:	558.9 **°F**	**LIQUID COLL:**	147.5 **milliliters**
SQ.RT ΔP:	1.4338 **in.H_2O**	**CO_2:**	18.50 **% by volume**
ΔH:	1.96 **in.H_2O**	**O_2:**	1.50 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 35.010 \text{ dscf}$$

γ = 0.991

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 6.943 \text{ scf}$$

V_{lc} = 147.5 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1655$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7214$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1655

HEXAVALENT CHROMIUM CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011
RUN NO: 0061-3

INPUT

V_m:	37.195 **ft^3**	**Q_s:**	11,067,593 **dscfh**
γ FACTOR:	0.991	**T_s:**	559.1 **°F**
P_{bar}:	29.35 **in. Hg**	**Θ:**	48.0 **minutes**
ΔH:	1.99	**V_s:**	114.099 **fps**
T_m:	90.3 **°F**	**P_s:**	29.25 **in. Hg**
HexChrome:	< 15 **µg/L**	**V_{lc}:**	145.0 **mL**
Sample Volume:	830 **mL**	**$\%O_2$:**	1.30 **%**
Total Mass of Cr^{+6}:	< 12.5 **µg**		

Volume of Sample at Standard Conditions on a Dry Basis: **English Units (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 34.866 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s)\left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m}\right)(\gamma)\left(P_{bar} + \left(\frac{\Delta H}{13.6}\right)\right)\right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 94.6 \text{ \% I}$$

A_n = 0.00026398 ft^2 Runtime (θ) = 48 minutes

Total µg Hexavalent Chromium in sample (M_n) = <12.5 µg

Concentration of Hexavalent Chromium

$$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} \text{ lb}/\mu\text{g})(M_n)}{V_{mstd}} = < 0.0007872 \text{ x } 10^{-6} \text{ lb/dscf}$$

$$C_{s(\mu g/dscm)} = \frac{M_n}{(V_{mstd})(35.31 ft^3/m^3)} = < 0.010113 \text{ µg/dscm}$$

Hexavalent Chromium Mass Rate:

$$E = Q_s \times C'_{s(lb/dscf)} = < 0.008713 \text{ lb/hr}$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 0061-3

SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011

BAROMETRIC:	29.35 **in. Hg**	**STACK DIAM:**	108.0 **inches**
STATIC PRES:	-1.40 **in.H_2O**	**CO_2:**	18.10 **% by volume**
STACK TEMP:	559.1 **°F**	**O_2:**	1.30 **% by volume**
SQ.RT ΔP:	1.4452 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$ = 30.95 **lb/lb-mole**

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$$ = 28.83 **lb/lb-mole**

PITOT TUBE COEFFICIENT

C_p (from calibration curve or geometric specifications) = 0.84

AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$$ = 1.4452 **in. H_2O**

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

T_s = 559.1 °F + 460 = 1,019.1 **°R**

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$ = 29.25 **in.Hg**

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$ = 114.099 **ft/sec**

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s$$ = 435,518.36 **acfm**

Stack Area = 63.61725 ft^2

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis

$$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$$ = 220,568.86 **scfm, wb**
13,234,132 **scfh, wb**

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$ = 184,459.88 **dscfm**
11,067,593 **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500 Exhaust
TEST DATE: 6/14/2011
RUN NUMBER: 0061-3

γ FACTOR:	0.991	**STACK DIAM:**	108.0 **inches**
BAROMETRIC:	29.35 **in. Hg**	**METER VOLUME:**	37.195 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	90.3 **°F**
STACK TEMP:	559.1 **°F**	**LIQUID COLL:**	145.0 **milliliters**
SQ.RT ΔP:	1.4452 **in.H_2O**	**CO_2:**	18.10 **% by volume**
ΔH:	1.99 **in.H_2O**	**O_2:**	1.30 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 34.866 \text{ dscf}$$

γ = 0.991

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 6.825 \text{ scf}$$

V_{lc} = 145.0 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1637$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7228$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1637

SUMMARY OF TEST RESULTS

COMPANY	BP
LOCATION	Whiting, IN
SOURCE	FCCU 500 Exhaust

RUN NO	1	2	3	
TEST DATE	6/9/2011	6/10/2011	6/10/2011	
TEST TIME	1553-1753	0816-1116	1329-1529	Average
Stack Gas Parameters				
Temperature, °F	558.0	561.0	562.8	560.6
Velocity, av. ft/sec	117.315	118.319	118.017	117.884
Volumetric flow, acfm	447,796	451,629	450,476	449,967
Volumetric flow, scfm	225,868	226,741	225,764	226,124
Volumetric flow, dscfh	11,570,354	11,281,791	11,211,958	11,354,701
Moisture, av. % vol	14.6	17.1	17.2	16.3
Carbon Dioxide, av. % vol	18.3	18.4	18.5	18.4
Oxygen, av. % vol	1.6	1.4	1.4	1.5
Ammonia Emissions				
Concentration				
ppmv wb	0.51	0.92	0.82	0.75
microgram/dscm	422.85	785.32	701.29	636.49
Emission rate				
lbs/hr	0.31	0.55	0.49	0.45

FTIR ORGANICS CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/9/2011
TEST RUN NO. : 1

GAS FLOW RATE : 13,552,067 **scfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/scf) $x10^{-6}$	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v wb)	EMISSION RATE (lb/hr)
Ammonia	17.03	0.023	0.026	422.9	0.51	0.31

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 5/29 - 1

SOURCE: FCCU 500
TEST DATE: 6/9/2011

BAROMETRIC:	29.2 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.30 **% by volume**
STACK TEMP:	558 **°F**	**O_2:**	1.60 **% by volume**
SQ.RT ΔP:	1.4897 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.99	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	29.09	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4897	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 558.0 °F + 460	=	1,018.0	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.10	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	117.315	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	447,796	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	225,867.8 13,552,067	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	192,839.2 11,570,354	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/9/2011
RUN NUMBER: 5/29 - 1

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.20 **in. Hg**	**METER VOLUME:**	149.010 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	83.2 **°F**
STACK TEMP:	558.0 **°F**	**LIQUID COLL:**	522.4 **milliliters**
SQ.RT ΔP:	1.4897 **in.H_2O**	**CO_2:**	18.30 **% by volume**
ΔH:	2.22 **in.H_2O**	**O_2:**	1.60 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 143.567 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 24.589 \text{ scf}$$

V_{lc} = 522.4 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1462$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7265$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1462

FTIR ORGANICS CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/10/2011
TEST RUN NO. : 2

GAS FLOW RATE : 13,604,471 **scfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/scf) $x10^{-6}$	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v wb)	EMISSION RATE (lb/hr)
Ammonia	17.03	0.041	0.049	785.3	0.92	0.55

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 5/29 - 2

SOURCE: FCCU 500
TEST DATE: 6/10/2011

BAROMETRIC:	29.15 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.40 **% by volume**
STACK TEMP:	561 **°F**	**O_2:**	1.40 **% by volume**
SQ.RT ΔP:	1.4909 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$ = 31.00 **lb/lb-mole**

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18B_{ws}$$ = 28.78 **lb/lb-mole**

PITOT TUBE COEFFICIENT

C_p (from calibration curve or geometric specifications) = 0.84

AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$$ = 1.4909 **in. H_2O**

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

T_s = 561.0 °F + 460 = 1,021.0 **°R**

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$ = 29.05 **in.Hg**

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)\left(\text{avg}\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$ = 118.319 **ft/sec**

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s$$ = 451,629 **acfm**

Stack Area = 63.6172 ft^2

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis

$$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$$ = 226,741.2 **scfm, wb**
13,604,471 **scfh, wb**

STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis

$$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$$ = 188,029.8 **dscfm**
11,281,791 **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/2011
RUN NUMBER: 5/29 - 2

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.15 **in. Hg**	**METER VOLUME:**	148.620 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	84.2 **°F**
STACK TEMP:	561.0 **°F**	**LIQUID COLL:**	624.1 **milliliters**
SQ.RT ΔP:	1.4909 **in.H_2O**	**CO_2:**	18.40 **% by volume**
ΔH:	2.23 **in.H_2O**	**O_2:**	1.40 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 142.688 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 29.376 \text{ scf}$$

V_{lc} = 624.1 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1707$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7278$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1707

FTIR ORGANICS CALCULATION SUMMARY

COMPANY : BP
LOCATION : Whiting, IN
SOURCE : FCCU 500 Exhaust
TEST DATE : 6/10/2011
TEST RUN NO. : 3

GAS FLOW RATE : 13,545,851 **scfh**

ORGANIC COMPOUND	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/scf) $x10^{-6}$	STACK GAS CONCENTRATION (lb/dscf) $x10^{-6}$	STACK GAS CONCENTRATION (microgram/dscm)	STACK GAS CONCENTRATION (ppm v wb)	EMISSION RATE (lb/hr)
Ammonia	17.03	0.036	0.044	701.3	0.82	0.49

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
RUN NUMBER: 5/29 - 3

SOURCE: FCCU 500
TEST DATE: 6/10/2011

BAROMETRIC:	29.15 **in. Hg**	**STACK DIAM:**	108.00 **inches**
STATIC PRES:	-1.4 **in.H_2O**	**CO_2:**	18.50 **% by volume**
STACK TEMP:	562.8 **°F**	**O_2:**	1.40 **% by volume**
SQ.RT ΔP:	1.4856 **in.H_2O**		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	31.02	**lb/lb-mole**
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.77	**lb/lb-mole**
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H_2O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n}\sum_{i=1}^{n}\sqrt{\Delta p}$	=	1.4856	**in. H_2O**
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s =$ 562.8 °F + 460	=	1,022.8	**°R**
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.05	**in.Hg**
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	118.017	**ft/sec**
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	450,476	**acfm**
Stack Area = 63.6172 ft^2			
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	225,764.2 13,545,851	**scfm, wb** **scfh, wb**
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	186,866.0 11,211,958	**dscfm** **dscfh**

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: BP
LOCATION: Whiting, IN
SOURCE: FCCU 500
TEST DATE: 6/10/2011
RUN NUMBER: 5/29 - 3

γ FACTOR:	1.010	**STACK DIAM:**	108.00 **inches**
BAROMETRIC:	29.15 **in. Hg**	**METER VOLUME:**	150.010 **ft^3**
STATIC PRES:	-1.40 **in.H_2O**	**METER TEMP:**	90.5 **°F**
STACK TEMP:	562.8 **°F**	**LIQUID COLL:**	629.6 **milliliters**
SQ.RT ΔP:	1.4856 **in.H_2O**	**CO_2:**	18.50 **% by volume**
ΔH:	2.21 **in.H_2O**	**O_2:**	1.40 **% by volume**

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE
@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92}\right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 142.367 \text{ dscf}$$

γ = 1.010

VOLUME OF WATER IN SAMPLE
@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 29.635 \text{ scf}$$

V_{lc} = 629.6 mL

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1723$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.7278$$

S.V.P. = 21.14 in. Hg

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

B_{ws} = 0.1723

APPENDIX B

Field Data

TRAVERSE POINT LOCATIONS FOR CIRCULAR AND RECTANGULAR STACKS AND DUCTS

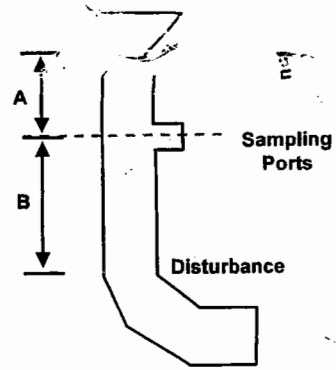
Facility BP - Whiting
Date 6-6-11
Sampling Location FCU 500
Inside of Far Wall to
Outside of Port (Distance C) 117.75 in.
Inside of Near Wall to
Outside of Port (Distance D) 9.75 in
Stack ID (Distance C- Distance D) 108.00 in.
Port Distance Downstream From Disturbance (B) 138.0 in.
Port Distance Upstream From Disturbance (A) ~8 ~96.0 in.
Equivalent Diameters Downstream From Disturbance (B) 12.9 (≥ 2.0)
Equivalent Diameters Upstream From Disturbance (A) ~8.9 (≥ 0.5)
Number of Ports Used 2 Traverse Points / Port 6

Note: Sketch Stack/Ports/Control Device on Back of Form

Equivalent Diameters Downstream From Disturbance (B) =
[Distance B / Stack ID]

Equivalent Diameters Upstream From Disturbance (A) =
[Distance A / Stack ID]

Equivalent Diameter For a Square or Rectangular Stack =
[(2 x L x W) / (L + W)]



Port ID 4 in. (for monorail bracket specs.)
Port Length Outside of Stack N/A in. (for monorail bracket specs.)

1 Port Traverse Point Number	2 Fractional % of Stack I.D. (frac. %)	3 Stack I.D. (inches)	4 Product of Columns 2 and 3 (inches)	5 Port Depth (inches)	6 Traverse Point Location From Outside of Port (Sum of 4 and 5 in inches)
1	0.044	108	4.75	9.75	14.50
2	0.146	↓	15.77	↓	25.52
3	0.296		31.97		41.72
4	0.704		76.03		85.78
5	0.854		92.23		101.98
6	0.956	↓	103.25	↓	113.00
7					
8					
9					
10					
11					
12					

For Stacks / Ducts ≤ 24 inches ID – No traverse point shall be located less than 0.5 inches from stack wall

For Stacks / Ducts > 24 inches ID – No traverse point shall be located less than 1.0 inches from stack wall

QA/QC Check:
Completeness ✓ Legibility ✓ Accuracy ✓ Specifications ✓

Method 1 Calculator Signature/Date R B Bentley 6-6-11

Field Supervisor Signature/Date [signature] 6/7/11

B-1

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

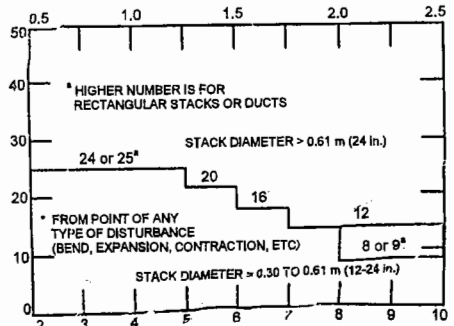
Pts	4	6	8	10	12
1	6.7	4.4	3.2	2.6	2.1
2	25.0	14.6	10.5	8.2	6.7
3	75.0	29.6	19.4	14.6	11.8
4	93.3	70.4	32.3	22.6	17.7
5		85.4	67.7	34.2	25.0
6		95.6	80.6	65.8	35.6
7			89.5	77.4	64.4
8			96.8	85.4	75.0
9				91.8	82.3
10				97.4	88.2
11					93.3
12					97.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS CEMS*

Pts	2	3	4	5	6	7	8	9
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.5
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8
4			87.5	70.0	58.3	50.0	43.8	38.9
5				90.0	75.0	64.3	56.3	50.0
6					91.7	78.6	68.8	61.1
7						92.9	81.3	72.2
8							93.8	83.3
9								94.4

*3 point CEMS RATA traverse point locations (valid for rectangular and round stacks)

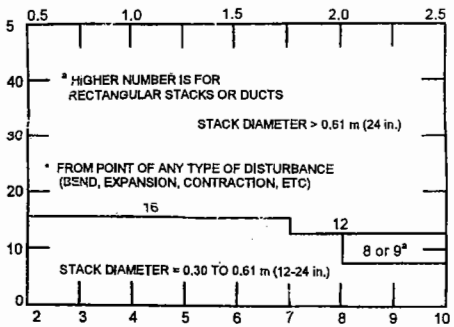
DUCT DIAMETERS UPSTREAM FROM FLOW DISTURBANCE* (DISTANCE A)



DUCT DIAMETERS DOWNSTREAM FROM FLOW DISTURBANCE* (DISTANCE B)

MINIMUM NUMBER OF TRAVERSE POINTS
ISOKINETIC TESTING

DUCT DIAMETERS UPSTREAM FROM FLOW DISTURBANCE* (DISTANCE A)



DUCT DIAMETERS DOWNSTREAM FROM FLOW DISTURBANCE* (DISTANCE B)

MINIMUM NUMBER OF TRAVERSE POINTS
FOR VELOCITY (NON-ISOKINETIC) TRAVERSES

Form FDF 4000.00

ARI ENVIRONMENTAL INC.

SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6-8-11

Nozzle ID: Glass (7/32")

Nozzle Type: Glass

Inspected By: S. Flaherty

Nozzle Clean: (Y) / N

Nozzle Undamaged: (Y) / N

Absent of Nicks or Dents: (Y) / N

Leading Edge Sharp: (Y) / N

Nozzle Diameter			ΔD	D_{avg}
D_1 (inches)	D_2 (inches)	D_3 (inches)	(inches)	(inches)
0.217	0.218	0.219	0.002	0.218

where:

$D_{1, 2, 3}$ = three different nozzle diameter measurements , (inches) ; each diameter must be measured to within 0.001 inches

ΔD = maximum difference between any two diameters, (inches) ; $\Delta D \leq 0.004$ inches

D_{avg} = average of D_1, D_2, and D_3, (inches)

Methods: 23, 5/29 & OH

ARI ENVIRONMENTAL INC.

SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6-8-11

Nozzle ID: 7/32"

Nozzle Type: Glass

Inspected By: SF.

Nozzle Clean: (Y) / N

Nozzle Undamaged: (Y) / N

Absent of Nicks or Dents: (Y) / N

Leading Edge Sharp: (Y) / N

Nozzle Diameter				
D_1 (inches)	D_2 (inches)	D_3 (inches)	ΔD (inches)	D_{avg} (inches)
0.220	0.220	0.219	0.001	0.220

where:

$D_{1,2,3}$ = three different nozzle diameter measurements , (inches) ; each diameter must be measured to within 0.001 inches

ΔD = maximum difference between any two diameters, (inches) ; $\Delta D \leq 0.004$ inches

D_{avg} = average of D_1, D_2, and D_3, (inches)

Methods: 0010 & 0061

SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6-9-11

Nozzle ID: PM2.5 Nozzle #1

Nozzle Type: SS

Inspected By: S.M.F.

Nozzle Clean: (Y)/ N

Nozzle Undamaged: (Y)/ N

Absent of Nicks or Dents: (Y)/ N

Leading Edge Sharp: (Y)/ N

Nozzle Diameter				
D_1 (inches)	D_2 (inches)	D_3 (inches)	ΔD (inches)	D_{avg} (inches)
0.137	0.137	0.137	0.000	0.137

where:

$D_{1, 2, 3}$ = three different nozzle diameter measurements , (inches) ; each diameter must be measured to within 0.001 inches

ΔD = maximum difference between any two diameters, (inches) ; $\Delta D \leq 0.004$ inches

D_{avg} = average of D_1, D_2, and D_3, (inches)

Runs 1-3

6/9-10/11

ARI ENVIRONMENTAL INC.

SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 8-2-11

Nozzle ID: PM2.5 N#2

Nozzle Type: SS

Inspected By: S. Flaherty

Nozzle Clean: (Y) / N

Nozzle Undamaged: (Y) / N

Absent of Nicks or Dents: (Y) / N

Leading Edge Sharp: (Y) / N

Nozzle Diameter				
D_1 (inches)	D_2 (inches)	D_3 (inches)	ΔD (inches)	D_{avg} (inches)
0.153	0.154	0.153	0.001	0.153

where:

$D_{1, 2, 3}$ = three different nozzle diameter measurements , (inches) ; each diameter must be measured to within 0.001 inches

ΔD = maximum difference between any two diameters, (inches) ; $\Delta D \leq 0.004$ inches

D_{avg} = average of D_1, D_2, and D_3, (inches)

Runs 4 & 5 8/2/11

VELOCITY TRAVERSE AND CYCLONIC FLOW VERIFICATION

PLANT BP Whiting
DATE 6-9-3
LOCATION Whiting, IN
SOURCE FCCU 500
STACK ID 108
PROBE #/TC # 354
BAROMETRIC PRESSURE, in. Hg 29.20
OPERATORS RB/RL

SCHEMATIC OF TRAVERSE POINT LAYOUT

RUN NO. Pre 1
STATIC, in. H_2O -1.4
START: 1335 STOP: 1347
PRE-TEST: +/- 0 POST-TEST: +/- 0

TRAVERSE POINT NUMBER	VELOCITY HEAD, ΔP (in. H_2O)	STACK TEMP. (°F)	YAW ANGLE (°)
S 1	2.0	557	6
2	2.2	557	3
3	2.3	557	3
4	2.3	558	0
5	2.0	555	1
6	1.9	553	9
W 1	1.7	551	11
2	1.8	553	4
3	1.9	554	6
4	2.2	554	3
5	2.0	554	1
6	1.7	553	2
AVERAGE			

RUN NO. Pre 2
STATIC, in. H_2O -1.4
START: 1400 STOP: 1408
PRE-TEST: +/- 0 POST-TEST: +/- 0

TRAVERSE POINT NUMBER	VELOCITY HEAD, ΔP (in. H_2O)	STACK TEMP. (°F)	YAW ANGLE (°)
1	2.0	557	
2	2.3	557	
3	2.2	558	
4	2.3	558	
5	2.0	557	
6	1.9	552	
1	1.6	556555	
2	1.8	555	
3	1.8	556	
4	2.0	556	
5	2.2	556	
6	1.7	555	
AVERAGE			

Method 18

B-8

Train A

FIELD DATA SHEET

Plant:	Sylvatica	Meter No.:	703006	Ambient Temperature:	60's
Date:	6/9/14	Y Factor:	0.997	Barometric Pressure:	29.20
Location:	Whiting, IN	Trap Contents:	Methanol	Stack Diameter:	N/A
Source:	FCU 500	USEPA Method:	18	Pre-test Leak Check:	Y 0.000
Run No.:	14-1 ~ Unspike	Compound Analysis:		Post-test Leak Check:	Y 0.000
Operators:	MB	Spike in Trap (Y/N):			
Comments:					

Clock Time	Sampling Time (min)	Meter Pressure ~~mm~~ (~~in.~~ H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature Inlet (°F)	~~Gas Meter Temperature Outlet (°F)~~ Vacuum
1401	0	15 mm	0.25	~~5~~ 0.002	106	0
	5	15	0.25	1.576	108	0
1411	10	15	0.25	~~3~~ 3.204	108	0
	15	15	0.25	4.193	106	0
1421	20	15	0.25	5.421	109	0
	25	15	0.25	6.771	112	0
1431	30	15	0.25	7.523	114	0
	35	15	0.25	9.054	117	0
1441	40	15	0.25	10.464	117	0
	45	15	0.25	11.872	119	0
1451	50	15	0.25	13.286	119	0
	55	15	0.25	15.077	119	0
1501	60	15	0.25	16.901	119	0
	65	15	0.25	18.341	119	0
1511	70	15	0.25	19.469	120	0
	75	15	0.25	20.744	120	0
1521	80			22.006		
		0.59" H_2O			114.6	

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FIELD DATA SHEET

Plant: Wmtm
Date: 6/8/11
Location: Wmtm Pm
Source: FLUSH
Run No.: M/4-2
Operators: NJ
Comments:

Meter No.: 703066
Y Factor: 0.997
~~Trap~~ Trap Contents: Methanol
USEPA Method: 18
Compound Analysis:
Spike in Trap (Y/N):

Ambient Temperature: 90's
Barometric Pressure: 29.30
Stack Diameter: 98
Pre-test Leak Check: Y 0.000
Post-test Leak Check: Y 0.000

Clock Time	Sampling Time (min)	Meter Pressure ~~(in.~~ mm H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature Inlet (°F)	Gas ~~Meter Temperature Outlet~~ Vacuum (°F)
1204	0	20 mm	0.25	0	104	0
	5	20 mm	0.25	1.781	104	0
1214	10	20	0.25	3.341	104	0
	15	20	0.25	4.515	105	0
1224	20	20	0.25	5.930	107	0
	25	20	0.25	7.300	108	0
1234	30	20	0.25	8.722	109	0
	35	20	0.25	10.280	111	0
1244	40	20	0.25	11.895	112	0
	45	20	0.25	13.145	111	0
1254	50	20	0.25	14.446	111	0
	55	20	0.25	15.951	111	0
1304	60	20	0.25	17.333	111	0
	65	20	0.25	18.670	112	0
1314	70	20	0.25	19.994	112	0
	75	20	0.25	21.341	112	0
1324	90			22.610		
		0.79" H_2O			109.0	

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ARI ENVIRONMENTAL INC.

B-1

FIELD DATA SHEET

Plant: Bp Whiting
Date: 6/4/11
Location: Whiting, IN
Source: FCU SW
Run No.: M18-3
Operators: NS
Comments: 703006
YD 0.997

Ambient Temperature: 90's
Barometric Pressure: 29.30
Stack Diameter: 96
Pre-test Leak Check: X 0.000
Post-test Leak Check: Y 0.000
Probe Heater Setting:

Clock Time	Sampling Time (min)	Meter Pressure (mm H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)	Pump Vacuum (in. Hg)
1704	0	20	0.25	0	105	0
	5	20	0.25	1.354	105	0
1718	10	20	0.25	2.877	105	0
	15	20	0.25	4.544	105	0
1724	20	20	0.25	6.261	106	0
	25	20	0.25	7.944	108	0
1738	30	20	0.25	9.546	109	0
	35	20	0.25	11.004	109	0
1748	40	20	0.25	12.245	110	0
	45	20	0.25	13.364	111	0
1754	50	20	0.25	14.733	111	0
	55	20	0.25	16.000	111	0
1804	60	20	0.25	17.269	111	0
	65	20	0.25	18.520	111	0
1814	70	20	0.25	19.297	112	0
	75	20	0.25	21.002	112	0
1824	80			22.294		
		0.79" H_2O			108.9	

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Train B

FIELD DATA SHEET

Plant: BP Whiting
Date: 6/7/11
Location: Whiting, IN
Source: FCCU 300
Run No.: FC-1 - Spike
Operators: MJ
Comments:

Meter No.: 0212027
Y Factor: 1.005
Imp ~~Trap~~ Contents: Methanol
USEPA Method: M 18
Compound Analysis:
Spike in Trap (Y/N):

Ambient Temperature: 90's
Barometric Pressure: 29.26
Stack Diameter: 106.0"
Pre-test Leak Check: Y 0.000
Post-test Leak Check: Y 0.000

Clock Time	Sampling Time (min)	Meter Pressure ~~mm~~ (in. H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature Inlet (°F)	~~Gas Meter Temperature~~ ~~Outlet~~ Vacuum ~~(°F)~~
1404	0	15 mm	0.25	0.000	~~168~~ 102	1
	5	15	0.25	1.185	101	1
1414	10	15	0.25	2.942	101	1
	15	15	0.25	3.044	102	1
1424	20	15	0.25	4.361	104	1
	25	15	0.25	5.793	104	1
1434	30	15	0.25	7.262	105	1
	35	15	0.25	8.1004	107	1
1441	40	15	0.25	10.617	108	1
	45	15	0.25	12.261	108	1
1451	50	15	0.25	14.062	108	1
	55	15	0.25	16.016	106	1
1501	60	15	0.25	17.123	108	1
	65	15	0.25	18.344	108	1
1514	70	15	0.25	19.479	109	1
	75	15	0.25	20.595	109	1
1521	80	↓		21.723		
		15/25.4 = 0.59			105.8	

$L_{in H_2O}$

B-11

ARI ENVIRONMENTAL INC

B-12

FIELD DATA SHEET

Plant: Bp Whiting
Date: 6/8/11
Location: Whiting Dr
Source: FCU 500
Run No.: M18-2-Spike
Operators: [illegible]
Comments:

Meter No.: 02/2027
Y Factor: 1.005
Trap ~~Trap~~ Contents: methanol
USEPA Method: 18
Compound Analysis:
Spike in Trap (Y/N):

Ambient Temperature: 90's
Barometric Pressure: 29.30
Stack Diameter: 98
Pre-test Leak Check: Y 0.000
Post-test Leak Check: Y 0.000

Clock Time	Sampling Time (min)	Meter Pressure mm ~~(in.~~ H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature Inlet (°F)	Gas Meter Temperature Vaccum ~~Outlet~~ (°F)
1204	0	15 mm	0.25	0	99	1
	5	15	0.25	(M) 1.220	99	1
1214	10	15	0.25	2.160	99	1
	15	15	0.25	3.330	100	1
1224	20	15	0.25	4.540	100	1
	25	15	0.25	6.031	100	1
1234	30	15	0.25	7.671	101	1
	35	15	0.25	9.253	103	1
1244	40	15	0.25	10.852	103	1
	45	15	0.25	12.650	103	1
1254	50	15	0.25	14.351	103	1
	55	15	0.25	15.260	104	1
1304	60	15	0.25	16.314	104	1
	65	15	0.25	17.422	104	1
1314	70	15	0.25	18.541	105	1
	75	15	0.25	19.674	105	1
1324	90			20.800		
		0.59 in H_2O			102.0	

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FIELD DATA SHEET

Plant: BP Whiting
Date: 6/8/11
Location: Whiting Inn
Source: FCU 500
Run No.: M18-3-spiked
Operators: NS
Comments: 0212027
Yd 1.005

Ambient Temperature: 90°F
Barometric Pressure: 29.30
Stack Diameter: 98
Pre-test Leak Check: X 0.000
Post-test Leak Check: Y 0.000
Probe Heater Setting:

Clock Time	Sampling Time (min)	Meter Pressure (mm H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)	Pump Vacuum (in. Hg)
1708	0	15	0.25	0	101	1
	5	15	0.25	1.464	101	1
1718	10	15	0.25	3.045	101	1
	15	15	0.25	4.203	101	1
1728	20	15	0.25	5.440	101	1
	25	15	0.25	6.474	101	1
1738	30	15	0.25	8.111	103	1
	35	15	0.25	9.654	104	1
1748	40	15	0.25	10.971	103	1
	45	15	0.25	12.540	103	1
1758	50	15	0.25	14.007	103	1
	55	15	0.25	15.477	103	1
1808	60	15	0.25	17.004	103	1
	65	15	0.25	18.477	104	1
1818	70	15	0.25	19.899	104	1
	75	15	0.25	21.335	104	1
1828	80			22.669		
	80	0.59 in H_2O			102.5	

ARI ENVIRONMENTAL INC.

FIELD DATA SHEET

Plant:	Ky Whitney	Meter No.:	209023	Ambient Temperature:	80°F
Date:	6/7/11	Y Factor:	0.993	Barometric Pressure:	29.20
Location:	Whitney Mn	Trap ~~Trap~~ Contents:	DI	Stack Diameter:	1080
Source:	FW 500	USEPA Method:	308	Pre-Test Leak Check:	Y 0.000
Run No.:	308-1-spike	Compound Analysis:	Methanol	Post-Test Leak Check:	Y 0.000
Operators:	NS	Spike in Trap (Y/N):			
Comments:					

Clock Time	Sampling Time (min)	Meter Pressure mm (~~in.~~ H_2O)	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)
1404	0	20mm	0	0.25	0.000	101
	5	20	0	0.25	1.44	101
1414	10	20	0	0.25	2.85	102
	15	20	0	0.25	3.80	102
1424	20	20	1	0.25	5.230	104
	25	20	1	0.25	6.710	106
1434	30	20	1	0.25	8.240	106
	35	20	1	0.25	9.57	107
1444	40	20	1	0.25	11.24	107
	45	20	1	0.25	13.400	107
1454	50	20	1	0.25	14.650	107
	55	20	1	0.25	16.05	107
1504	60				17.462	
						104.8

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FIELD DATA SHEET

Plant: Op Whitmi
Date: 6/8/11
Location: [illegible]
Source: FCU 500
Run No.: M 308-2 spike
Operators: NJ
Comments: MW209023
YD 0.993

Ambient Temperature: 90's
Barometric Pressure: 29.30
Stack Diameter: 96
Pre-test Leak Check: Y 0.000
Post-test Leak Check: Y 0.000
Probe Heater Setting:

Clock Time	Sampling Time (min)	Meter Pressure (mm H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)	Pump Vacuum (in. Hg)
1204	0	25 mm	0.25	0	99	1
	5	25 mm	0.25	1.165	99	1
1214	10	25	0.25	3.199	99	1
	15	25	0.25	4.687	100	1
1224	20	25	0.25	6.196	100	1
	25	20	0.25	7.720	100	1
1234	30	20	0.25	9.260	101	1
	35	20	0.25	10.662	102	1
1244	40	20	0.25	12.035	103	1
	45	20	0.25	13.075	103	1
1254	50	20	0.25	14.471	103	1
	55	20	0.25	16.113	103	1
1304	60			17.653		
					101.0	

ARI ENVIRONMENTAL INC.

FIELD DATA SHEET

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Plant: Bp Whiting
Date: 6/8/11
Location: Whiting, IN
Source: FCU 500
Run No.: M308-3-Spike
Operators: NS
Comments: 209023
YD 0.993

Ambient Temperature: 90's
Barometric Pressure: - 29.30
Stack Diameter: 98
Pre-test Leak Check: X 0.000
Post-test Leak Check: Y 0.000
Probe Heater Setting:

Clock Time	Sampling Time (min)	Meter Pressure (mm H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)	Pump Vacuum (in. Hg)
1709	0	20	0.25	0	101	1
	5	20	0.25	1.210	101	1
1718	10	20	0.25	2.394	101	1
	15	20	0.25	3.566	101	1
1728	20	25	0.25	4.678	101	1
	35	25	0.25	5.884	103	1
1738	30	25	0.25	7.276	103	1
	35	25	0.25	8.690	103	1
1748	40	25	0.25	10.200	103	1
	45	25	0.25	11.744	103	1
1758	50	25	0.25	13.401	103	1
	55	25	0.25	14.743	103	1
1800	60			15.945		
					102.2	

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FIELD DATA SHEET

Plant:	BP Whiting	**Meter No.:**	S/1024	**Ambient Temperature:**	90's
Date:	7/7/11	**Y Factor:**	1.000	**Barometric Pressure:**	29.70
Location:	Whiting, IN	~~**Trap Contents:**~~	DI	**Stack Diameter:**	100
Source:	FCU 500	**USEPA Method:**	308	**Pre-Test Leak Check:**	Y 0.000
Run No.:	308-1-unspiked	**Compound Analysis:**	methanol	**Post-Test Leak Check:**	Y 0.000
Operators:	NS	**Spike in Trap (Y/N):**			
Comments:	unspiked				

Clock Time	Sampling Time (min)	Meter Pressure mm (in. H_2O)	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)
1404	0	15mm	0	0.25	0.000	38°C
	5	15	0	0.28	1.17	38
1411	10	15	0	0.25	2.36	39
	15	15	0	0.28	3.90	40
1424	20	15	0	0.25	5.21	40
	25	15	0	0.25	6.34	41
1434	30	15	0	0.25	7.66	41
	35	15	0	0.25	9.04	42
1441	40	15	0	0.25	10.04	42
	45	15	0	0.25	~~11.00~~ 11.77	42
1451	50	15	0	0.25	12.67	42
	55	15	0	0.25	14.17	42
1504	60				15.427	
						104.8°F

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ARI ENVIRONMENTAL INC.

B-1

FIELD DATA SHEET

Plant: BP Whiting
Date: 6/8/11
Location: Whiting, IN
Source: FCU 500
Run No.: M308-2
Operators: NS
Comments: meter #S11024
YD 1.000B

Ambient Temperature: 90's
Barometric Pressure: 29.70
Stack Diameter: 98
Pre-test Leak Check: Y 0.000
Post-test Leak Check: Y 0.000
Probe Heater Setting:

Clock Time	Sampling Time (min)	Meter Pressure (mm H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature ~~(°F)~~ °C	Pump Vacuum (in. Hg)
1204	0	15	0.25	0	37	0
	5	15	0.25	1.272	37	0
1214	10	15	0.25	2.445	38	0
	15	15	0.25	3.856	38	0
1224	20	15	0.25	5.105	38	0
	25	15	0.25	6.231	39	0
1234	30	15	0.25	7.490	39	0
	35	15	0.25	8.583	39	0
1244	40	15	0.25	9.825	39	0
	45	15	0.25	11.059	39	0
1254	50	15	0.25	12.031	39	0
	55	15	0.25	13.231	39	0
1304	60			14.314		
					101.1°F	

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FIELD DATA SHEET

Plant: Bp Whiti
Date: 6/4/11
Location: Whiting Th
Source: FCU SW
Run No.: M302-3
Operators: NS
Comments: 91/024
YD 1.0000

Ambient Temperature: 90's
Barometric Pressure: 29.30
Stack Diameter: 96
Pre-test Leak Check: ∅ 0.000
Post-test Leak Check: ∅ 0.000
Probe Heater Setting:

Clock Time	Sampling Time (min)	Meter Pressure (mm H_2O)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature ~~(°F)~~ °C	Pump Vacuum (in. Hg)
1704	0	10	0.25	0	38	0
	5	10	0.25	1.110	38	0
1714	10	10	0.25	2.167	38	0
	15	10	0.25	3.250	38	0
1724	20	10	0.25	4.344	38	0
	25	10	0.25	5.546	39	0
1734	30	10	0.25	6.750	39	0
	35	10	0.25	8.520	39	0
1744	40	10	0.25	9.941	39	0
	45	10	0.25	11.244	39	0
1754	50	10	0.25	13.006	39	0
	55	10	0.25	14.555	39	0
1806	60			16.124		

101.5°F

Method 26

FIELD DATA

A= B=

PLANT	BP	AMBIENT TEMPERATURE	100	PROBE HEATER SETTING	-
DATE	6-7-11	BAROMETRIC PRESSURE	29.20	HEATER BOX SETTING	250
LOCATION	Whiting IN	ASSUMED MOISTURE, %	12	METER $H_{@}$	1.53
OPERATOR	R. Burton	PROBE LENGTH, in.	60	C_p FACTOR	N/A
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	-	Y_d FACTOR	0.982
RUN NO	26-1	STACK DIAMETER, in.	108	PITOT NO.	N/A
SAMPLE BOX NO	APEX	MINUTES PER POINT	120		
METER BOX NO	808023	NUMBER OF POINTS	4		
START TIME	1556	NUMBER OF PORTS	1		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. 'F	PROBE TEMP 'F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1556	Start Point	0	-	-	-	-	1.5	1.53	278.29		106	247	-	-	65	9
		5		546.1			1.5		281.55		106	247			66	9
		10					1.5		284.81		106	248			67	9
		15					1.5		288.06		107	249			67	9
		20					1.5		291.47		107	246			66	9
		25					1.5		294.79		107	247			65	9
		30					1.5		297.91		108	248			66	9
		35					1.5		301.33		108	246			65	9
		40					1.5		304.63		108	250			64	9
		45					1.5		307.87		108	251			64	9
		50					1.5		311.13		109	249			65	9
		55					1.5		314.351		108	248			65	9
1656	End	60					1.5		317.620		108	246			65	9
		65					1.5		320.86		107	249			66	9
		70					1.5		324.12		107	241			67	9
		75					1.5		327.46		106	245			66	9
		80					1.5		330.83		107	247			65	9
		85					1.5		334.10		107	246			66	9
		90					1.5		337.36		107	249			66	9
		95					1.5		340.59		106	248			67	9
		100					1.5		343.90		107	248			66	9
		105					1.5		348.04		108	249			68	9
		110					1.5		350.21		108	251			67	9
		115					1.5		353.50		107	255			66	9
1756		120							356.55							
AVERAGE	1	120 min	-1.1	546.1	-	1.0243	1.5		78.605		107.2				68	≤9

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						224.6

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		17.3	1.6
TRIAL 2		17.3	1.6
TRIAL 3		17.3	1.6
Average		17.3	1.6

LEAK CHECK		
SYSTEM PRE:	20cfm	CFM@15"Hg
POST:	20cfm	CFM@15"Hg
PITOT PRE:		@ > 3"H_2O
POST:		@ > 3"H_2O

FIELD DATA

A=_____ B=_____

B-22

PLANT	BF	AMBIENT TEMPERATURE	~90	PROBE HEATER SETTING	7		
DATE	6-8-11	BAROMETRIC PRESSURE	29.30	HEATER BOX SETTING	250		
LOCATION	White Rock	ASSUMED MOISTURE, %	12	METER $H_{@}$	1.53		
OPERATOR	R. Burton	PROBE LENGTH, in.	60	C_p FACTOR	0.84		
STACK NO.	600 S00	NOZZLE DIAMETER, in.	NA	Y_d FACTOR	0.982		
RUN NO.	26-2	STACK DIAMETER, in.	108	PITOT NO.	—		
SAMPLE BOX NO.	APEX	MINUTES PER POINT	120				
METER BOX NO	8080B	NUMBER OF POINTS	1				
START TIME	917	NUMBER OF PORTS	1				

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	(ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
917		0					1.5	1.53	361.300		96	241			66	8
		5					1.5		364.72		98	249			63	8
		10					1.5		368.14		98	248			62	8
		15					1.5		371.51		98	246			64	8
		20					1.5		374.83		99	248			63	6
		25					1.5		378.11		99	251			65	6
		30					1.5		381.35		99	250			66	8
		35					1.5		384.62		100	251			64	8
		40					1.5		388.01		100	249			63	8
		45					1.5		391.33		100	247			64	8
		50					1.5		394.57		100	247			64	8
		55					1.5		397.75		100	249			65	6
1017		60					1.5		401.05		101	246			64	8
		65					1.5		404.41		101	246			64	8
		70					1.5		407.83		101	247			64	8
		75					1.5		411.10		101	249			64	8
		80					1.5		414.51		101	245			66	8
		85					1.5		417.81		101	249			65	6
		90					1.5		421.13		101	247			65	8
		95					1.5		424.55		101	248			65	8
		100					1.5		427.90		102	246			66	8
		105					1.5		431.16		102	249			66	8
		110					1.5		434.51		103	246			63	6
		115					1.5		437.96		103	241			63	6
1117	2ND	120							441.460							
AVERAGE		120	-1.1	545.4		1.2773	1.5		~~441.460~~ 80.160		1003					

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						352.9

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		17.7	1.5
TRIAL 2		17.7	1.5
TRIAL 3		17.7	1.5
Average		17.7	1.5

LEAK CHECK	
SYSTEM PRE:	2000 CFM@15"Hg
POST:	2000 CFM@15"Hg
PITOT PRE:	_____ @ > 3"H_2O
POST:	@ > 3"H_2O

FIELD DATA

A= B=

PLANT X	6-8-11	AMBIENT TEMPERATURE	~95	PROBE HEATER SETTING	250
DATE	BP	BAROMETRIC PRESSURE	29.30	HEATER BOX SETTING	—
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_{@}$	1.53
OPERATOR	R Burton	PROBE LENGTH, in.	60"	C_p FACTOR	.84
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	—	Y_d FACTOR	0.980
RUN NO	26-3	STACK DIAMETER, in.	108	PITOT NO.	—
SAMPLE BOX NO.	APEX	MINUTES PER POINT	120		
METER BOX NO	611209	NUMBER OF POINTS	1		
START TIME	1415	NUMBER OF PORTS	1		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1419	1	0	-1.2				1.5	1.53	443.040		104	~~1027~~ 250			66	10
	2	5					1.5		446.30		106	251			63	10
	3	10					1.5		449.70		106	253			62	10
	4	15					1.5		453.05		107				61	10
	5	20					1.5		456.41		107				61	10
	6	25					1.5		459.58		107				60	10
	1	30					1.5		463.20		107				60	10
	2	35					1.5		466.53		107				60	10
		40					1.5		469.81		108				60	10
		45					1.5		473.22		108				61	10
		50					1.5		476.67		108				63	10
		55					1.5		479.91		108				64	10
		60					1.5		483.13		108				66	10
		65					1.5		486.51		108				68	10
		70					1.5		489.92		108				67	10
		75					1.5		493.29		108				63	10
		80					1.5		496.69		108				63	10
		85					1.5		499.94		109				63	10
		90					1.5		503.30		109				63	10
		95					1.5		506.63		110				64	10
		100					1.5		509.96		110				64	10
		105					1.5		513.37		110				65	10
		110					1.5		516.95		111				65	10
		115					1.5		519.48		111				65	10
1615		120							522.730							
AVERAGE		120	-1.2	545.9		1.3031	1.5		79.690		108.1				≤66	≤10

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						370.5
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.0	1.5
TRIAL 2		18.0	1.5
TRIAL 3		18.0	1.5
Average		18.0	1.5

LEAK CHECK	
SYSTEM PRE:	Good CFM@15"Hg
POST	Good CFM@15"Hg
PITOT PRE:	@ > 3"H_2O
POST:	@ > 3"H_2O

B-23

IMPINGER RECOVERY DATA SHEET

ARI ENVIRONMENTAL INC.

Company:	BP Whiting	Date Set-up:	6-7-11
Location:	Whiting, IN	Test Date:	6-7-11
Source:	FCCU 500	Date Recovered:	6-7-11
Run No.:	M26-1	USEPA Method:	M26
		Corresponding Filter Wgt:	—
		Filter Container No:	—

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	H_2SO_4	713.8	~~881.7~~ SY	852.7	138.9
2	H_2SO_4	715.1	~~759.2~~ SY	760.1	45.0
3	~~empty~~ NaOH	713.5	~~718.7~~ SY	722.4	8.9
4	NaOH	676.0	~~715.4~~ SY	677.1	1.1
5	SG	792.6	~~866.4~~ SY	823.3	30.7
6					224.6

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP Whiting	**Date Set-up:**	6/7/11
Location:	Whiting, IN	**Test Date:**	6/8/11
Source:	FCV 500 Stack	**Date Recovered:**	
Run No.:	M26-2	**USEPA Method:**	26
		Corresponding Filter Wgt:	
		Filter Container No:	

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	H_2SO_4	625.7	881.1	255.4	
2	H_2SO_4	706.1	759.2	53.1	
3	NaOH	709.6	718.7	9.1	
4	NaOH	709.6	715.4	5.8	
5	Silica	836.9	866.4	29.5	
6				352.9	

IMPINGER RECOVERY DATA SHEET

ARI ENVIRONMENTAL INC.

Company:	BP Whiting	Date Set-up:	6-8-11
Location:	Whiting, IN	Test Date:	6-8-11
Source:	FCCU 500	Date Recovered:	6-8-11
Run No.:	M26-3	USEPA Method:	M26
		Corresponding Filter Wgt:	—
		Filter Container No:	—

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	H_2SO_4	651.2	905.4	254.2	
2	H_2SO_4	710.9	788.6	77.7	
3	NaOH	716.9	723.9	7.0	
4	NaOH	743.3	750.4	7.1	
5	SG	790.7	815.3	24.6	
6				370.5	

Method 23

B-28

FIELD DATA

A=_____ B=_____

PLANT	BP Whiting	AMBIENT TEMPERATURE	~95°F	PROBE HEATER SETTING	~250		
DATE	6-7-11	BAROMETRIC PRESSURE	29.20	HEATER BOX SETTING	~256		
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	12	METER $H_@$	1.88		
OPERATOR	Ryan Yoas	PROBE LENGTH, in.	120"	C_p FACTOR	0.84		
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	0.218	Y_d FACTOR	1.010		
RUN NO.	23-1	STACK DIAMETER, in.	108"	PITOT NO.	354		
SAMPLE BOX NO.	APEX	MINUTES PER POINT	20				
METER BOX NO.	402005	NUMBER OF POINTS	12				
START TIME	1257	NUMBER OF PORTS	2				

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	$\sqrt{\Delta P_S}$	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	Trap AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
1257	1	0	-1.1	546	1.0		1.20	1.16	672.019	—	105	255	254	59	67	5
1317	2	20		546	1.1		1.30	1.27	684.20		106	252	243	55	67	5
1337	3	40		546	1.1		1.30	1.27	696.89		106	252	242	46	65	8
1357	4	60		547	1.1		1.30	1.28	708.95		104	243	239	51	65	10
1417	5	80		547	0.95		1.10	1.10	722.40		105	248	236	53	65	9
1437	6	100		547	0.95		1.10	1.10	734.21		105	243	237	53	66	9
1457/1536	1	120		546	1.20		1.40	1.39	746.60		106	233	260	52	65	11
1556	2	140		545	1.1		1.30	1.28	759.39		106	238	263	49	65	10
1616	3	160		545	1.1		1.30	1.28	771.60		108	247	256	54	64	10
1636	4	180		546	1.1		1.30	1.28	784.30		106	252	257	48	65	10
1656	5	200		546	0.98		1.10	1.14	797.20		108	254	256	50	65	9
1716	6	220		546	0.93		1.10	1.08	807.90		111	254	255	51	65	9
1736		240							818.740							
AVERAGE	12	240	-1.1	546.1	—	1.0243	1.23		146.721	—	106.2	248±25	248±25	168	168	max 11

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL	0	100	100	59		200
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		17.4	1.6
TRIAL 2		17.4	1.6
TRIAL 3		17.4	1.6
Average		17.4	1.6

LEAK CHECK		
SYSTEM PRE:	0.000	CFM@15"Hg
POST:	0.016	CFM@15"Hg
PITOT PRE:	+-5	@>3"H_2O
POST:	N/A	@>3"H_2O

FIELD DATA

A=_____ B=_____

PLANT	BP Whiting	AMBIENT TEMPERATURE	~90	PROBE HEATER SETTING	~250	WEIGHT OF PARTICULATE, mg	
DATE	6-8-11	BAROMETRIC PRESSURE	29.30	HEATER BOX SETTING	~250	Filter No.	
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	12	METER $H_@$	1.88	Sample	
OPERATOR	Ryan Lyons	PROBE LENGTH, in.	120	C_p FACTOR	0.84	Final wt	
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	.218	Y_d FACTOR	1.010	Tare wt	
RUN NO.	23-2	STACK DIAMETER, in.	108	PITOT NO.	3541	Wt. gain	
SAMPLE BOX NO.	APEX	MINUTES PER POINT	20			TOTAL	mg
METER BOX NO.	402005	NUMBER OF POINTS	12				
START TIME	0855	NUMBER OF PORTS	2				

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD $\sqrt{(\Delta P_S)}$	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	Trap AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
0855	1	0	-1.1	546	1.6		1.8	1.82	820.200	—	94	245	252	56	66	5
0915	2	20		544	1.6		1.8	1.83	834.92		96	248	256	54	66	5
0935	3	40		545	1.6		1.8	1.84	850.23		101	250	248	52	66	5
0955	4	60		546	1.8		2.1	2.07	865.03		102	243	244	50	65	7
1015	5	80		546	1.5		1.7	1.73	881.75		102	250	247	50	65	5
1035	6	100		545	1.5		1.7	1.73	896.17		103	231	244	50	65	5
1055/1124	1	120		545	1.6		1.9	1.85	910.66		104	241	245	49	64	6
1144	2	140		544	1.8		2.1	2.08	926.55		103	244	238	52	65	7
1204	3	160		546	1.7		2.0	1.99	942.22		105	265	243	53	63	6
1224	4	180		547	1.8		2.1	2.09	958.37		105	248	249	51	64	7
1244	5	200		545	1.6		1.9	1.85	973.91		105	260	242	52	66	6
1304	6	220		546	1.5		1.7	1.73	989.18		106	261	240	53	65	5
1324		240							1004.515							
		~~260~~														
AVERAGE	12	240		545.4	—	1.2773	1.88	—	184.315	—	102.2	248±25	248±25	68	68	max 7

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL	0	100	100	59		200
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		17.7	1.6
TRIAL 2		17.7	1.6
TRIAL 3		17.7	1.6
Average		17.7	1.6

LEAK CHECK		
SYSTEM PRE:	0.000	CFM@15"Hg
POST:	0.009	CFM@15"Hg
PITOT PRE:	+V	@>3"H_2O
POST:	+V	@>3"H_2O

FIELD DATA

A=_____ B=_____

B-30

PLANT	BP Whiting	AMBIENT TEMPERATURE	~95°F	PROBE HEATER SETTING	~250
DATE	6-8-4	BAROMETRIC PRESSURE	29.30	HEATER BOX SETTING	~250
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	12	METER $H_@$	1.88
OPERATOR	Ryan Hong	PROBE LENGTH, in.	120	C_p FACTOR	0.84
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	0.218	Y_d FACTOR	1.010
RUN NO.	23-3	STACK DIAMETER, in.	108	PITOT NO.	354
SAMPLE BOX NO.	APEX	MINUTES PER POINT	20		
METER BOX NO.	Leo2005	NUMBER OF POINTS	12		
START TIME	1415	NUMBER OF PORTS	2		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD $\sqrt{(\Delta P_S)}$	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1415	1	0	-1.2	545	1.6		1.9	1.85	005.090	—	104	254	240	59	67	4
1425	2	20		548	1.8		2.1	2.08	19.90		106	249	243	57	66	5
1455	3	40		548	1.8		2.1	2.08	35.76		107	254	261	53	65	5
1515	4	60		549	1.8		2.1	2.08	51.95		107	255	242	49	63	5
1535	5	80		546	1.7		2.0	1.96	67.99		106	254	250	48	64	5
1555	6	100		546	1.5		1.6	1.57	84.62		106	251	236	51	65	4
1615/1628	1	120		545	1.5		1.6	1.57	97.99		106	245	250	50	64	4
1648	2	140		545	1.7		1.8	1.78	112.43		109	263	263	53	66	5
1708	3	160		546	1.8		1.9	1.90	127.93		109	265	280	52	64	5
1728	4	180		547	1.8		1.9	1.91	143.33		108	260	228	54	65	5
1748	5	200		547	1.8		1.9	1.91	158.79		109	248	232	53	65	5
1808	6	220		546	1.6		1.7	1.70	174.79		110	250	245	55	66	4
1828		240							189.585							
AVERAGE	12	240	-1.2	545.9		1.3031	1.88		184.495	—	107.3	248±25	248±25	168	168	Max 5

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL	0	100	100	59		200
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.0	1.6
TRIAL 2		18.0	1.6
TRIAL 3		18.0	1.6
Average		18.0	1.6

LEAK CHECK		
SYSTEM PRE:	0.001	CFM@15"Hg
POST:	0.002	CFM@15"Hg
PITOT PRE:	+- √	@>3"H_2O
POST:	+- √	@>3"H_2O

b

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP Whiting	Date Set-up:	6-7-11
Location:	Whiting, In	Test Date:	6-7-11
Source:	FCCU 500	Date Recovered:	6-7-11
Run No.:	M23-1	USEPA Method:	M23
		Corresponding Filter Wgt:	—
		Filter Container No:	—

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1 KO	empty	368.5	956.6	588.1	
2	H_2O	677.2	672.7	-4.5	
3	H_2O	751.5	747.8	-3.7	
4	empty	614.7	621.4	6.7	
5	SG	808.3	832.2	23.9	
6					

Total 610.5g

588.6
-23.9
610.5

IMPINGER RECOVERY DATA SHEET

ARI ENVIRONMENTAL INC.

Company:	BP Whiting	Date Set-up:	6-7-11
Location:		Test Date:	
Source:	FCC 500 Stack	Date Recovered:	
Run No.:	M23-2	USEPA Method:	M23
		Corresponding Filter Wgt:	
		Filter Container No:	

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
4 KO	empty	377.3	926.0	548.7	
2	water	734.4	732.7	-1.7	
3	water	702.8	704.0	1.2	
4	empty	615.9	628.0	12.1	
5	SG	812.5	842.2	29.7	
6					
				Total 590.0 g	

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP Whiting	Date Set-up:	6-8-11
Location:	Whiting, In	Test Date:	6-8-11
Source:	FCCU 520	Date Recovered:	
Run No.:	M23-3	USEPA Method:	M23
		Corresponding Filter Wgt:	—
		Filter Container No:	—

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1 KO	Empty	370.0	1036.5	666.5	
2	H_2O	672.7	722.7	50	
3	H_2O	747.8	753.6	5.8	
4	Empty	615.7	623.7	8.0	
5	SG	927.0	967.5	40.5	
6					
				Total 770.8g	

Method 201A / 202

FIELD DATA

A= ____ B= ____

PLANT	BP	AMBIENT TEMPERATURE	60	PROBE HEATER SETTING	320		
DATE	6-9-11	BAROMETRIC PRESSURE	29.20	HEATER BOX SETTING			
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_{@}$	1.83		
OPERATOR	R Buxton	PROBE LENGTH, in.	120	C_p FACTOR	0.84		
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	0.137	Y_d FACTOR	0.991		
RUN NO.	202-1	STACK DIAMETER, in	108	PITOT NO.	997		
SAMPLE BOX NO	APEX	MINUTES PER POINT	variable				
METER BOX NO.	~~600~~ 11209	NUMBER OF POINTS	12				
START TIME	1510	NUMBER OF PORTS	2				
	Mid-Size						

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_g)	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	CPN Filter AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1510	6	0:00 +	-1.4	554	1.9		0.35	0.35	959.905		75	306	295	67	55	1
	5	14:30 + 2		553	2.2		0.35		965.47		80	311	301	70	49	1
	4	40:30 + 2		553	2.2		0.35		972.92		82	317	305	72	48	1
	3	61:30 + 2		554	2.2		0.35		979.60		84	303	301	68	47	1
	2	83:30 + 20		554	2.0		0.35		985.18		86	331	304	69	46	1
	1	103:30 + 18		553	1.7		0.35		992.31		84	297	269	62	51	1
1710/1730	6	122:00 + 20		555	2.0		0.35		998.11		879	299	300	69	53	1
	5	142:00 + 20		555	2.0		0.35		1005.07		8863	306	314	71	50	1
	4	162:00 + 21:30		555	2.3		0.35		1011.54		84	318	285	72	52	1
	3	183:30 + 20	:30	556	2.1		0.35		1018.43		86	341	266	73	55	1
	2	204:00 + 20	:30	554	2.1		0.35		1025.76		85	336	240	74	54	1
	1	224:30 + 19	:00	554	~~0.1~~ 1.8		0.35		1032.88		86	340	239	77	54	1
1932	END	243:30							1039.895							
Soot Blow 16:41 - 16:45																
AVERAGE	12	243:30	-1.4	554.2		1.4276	0.35		79.990		82.8				568	≤1

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.0	2.0
TRIAL 2		18.0	2.0
TRIAL 3		18.0	2.0
Average		18.0	2.0

LEAK CHECK	
SYSTEM PRE:	0.004 CFM@15"Hg
POST:	0.004 CFM@15"Hg
PITOT PRE:	+/- 02 @ > 3"H_2O
POST:	+/- 00 @ > 3"H_2O

B3

FIELD DATA

ARI ENVIRONMENTAL INC.

A= ____ B= ____

B-36

PLANT	BP	AMBIENT TEMPERATURE	~50	PROBE HEATER SETTING	320
DATE	6-10-11	BAROMETRIC PRESSURE	29.15	HEATER BOX SETTING	320
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_@$	1.83
OPERATOR	R Burton	PROBE LENGTH, in.	120	C_p FACTOR	0.84
STACK NO	FCU500	NOZZLE DIAMETER, in.	0.	Y_d FACTOR	0.991
RUN NO	202-2	STACK DIAMETER, in	108	PITOT NO.	997
SAMPLE BOX NO.	APEX	MINUTES PER POINT	variable		
METER BOX NO	611204	NUMBER OF POINTS	12		
START TIME	0805 min/sec	NUMBER OF PORTS	2		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
	TOTAL	mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE 0.3 ~~(ΔH) in. H_2O~~ SCFM ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE 0.3 ~~(ΔH) in. H_2O~~ SCFM DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	CFM AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
805	6	0:00	-1.4	556	1.8		~~0.53~~	0.325	039.950		69	296	288	65	55	2
	5	18:45+20:15		556	2.1		0.42		46.07		74	329	320	66	53	2
	4	39:00+20:15		555	2.1		0.42		52.31		81	309	322	71	50	2
	3	59:15+20:15		556	2.1		0.42		59.59		88	304	292	72	49	2
	2	79:30+19:45		557	2.0		0.42		66.91		91	326	302	69	46	2
	1	99:15+18:45		558	1.8		0.42		73.82		92	311	285	70	46	2
1003/1018	1	118:00+19:45		559	1.9		0.42		80.19		89	297	327	70	62	2
	2	138:00+19:45		559	2.0		0.42		86.96		91	301	283	70	53	2
	3	157:45+20:45		559	2.2		0.42		93.51		90	304	275	71	55	2
	4	178:30+20:45		558	2.2		0.42		100.17		92	309	281	73	60	2
	5	199:15+20:15		~~558~~ 558	2.1		0.42		106.96		93	311	278	72	59	2
	6	219:30+18:45		558	1.8		0.42		113.40		94	306	290	70	59	2
1218		238:15							120.330							
AVERAGE	12	238.15	-1.4	557.4		1.4162	0.42	0.325	80.380		87.0				≤68	≤2

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.5	1.6
TRIAL 2		18.5	1.6
TRIAL 3		18.5	1.6
Average		18.5	1.6

LEAK CHECK

SYSTEM PRE: <0.001 CFM@15"Hg

POST: <0.001 CFM@15"Hg

PITOT PRE: +/- ok @ > 3"H_2O

POST: +/- ok @ > 3"H_2O

FIELD DATA

A=_____ B=_____

PLANT	BP	AMBIENT TEMPERATURE	~60 F	PROBE HEATER SETTING	320
DATE	6-10-11	BAROMETRIC PRESSURE	29.15	HEATER BOX SETTING	320
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_@$	1.83
OPERATOR	R. Burton	PROBE LENGTH, in.	120	C_p FACTOR	0.84
STACK NO.	FCU	NOZZLE DIAMETER, in.	~~0.37~~ 0.37	Y_d FACTOR	0.991
RUN NO.	202-3	STACK DIAMETER, in	108	PITOT NO.	997
SAMPLE BOX NO.	APEX	MINUTES PER POINT	variable		
METER BOX NO	611209	NUMBER OF POINTS	12		
START TIME	1327	NUMBER OF PORTS	2		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
	TOTAL	mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O CFM ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O CFM DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1327	6	0	-1.3	559	2.1		0.43	0.325	120.620		85	286	280	71	60	4
	5	20:30 21:00		559	2.2		0.43		127.43		89	298	311	72	56	4
	4	41:30 21:00		559	2.2		0.43		133.96		94	316	290	75	58	4
	3	62:30+21:00		559	2.2		0.43		140.51		94	307	280	73	55	4
	2	83:30+20:30		559	2.1		0.43		147.08		95	318	268	72	55	4
	1	104:00+19:30		558	1.9		0.43		153.80		96	321	251	73	61	4
1530/1539	1	123:30+20:00		559	2.0		0.43		159.97		90	312	295	66	57	4
~~1539~~	2	143:30+20:30		559	2.1		0.43		166.55		91	298	311	70	60	4
	3	164:00+21:00		558	2.2		0.43		173.98		91	304	301	72	58	4
	4	185:00 21:00		558	2.2		0.43		181.41		92	311	305	72	55	4
	5	206:00+20:00		558	2.0		0.43		189.02		92	304	315	73	54	4
	6	226:00+18:30		557	1.7		0.43		195.71		93	310	300	72	51	4
1740	END	244:30							202.125							
AVERAGE	12	244:30	-1.3	558.4		1.4395	0.43		81.505		91.8				≤68	≤4

Soot Blow 14:52-14:55

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.4	1.5
TRIAL 2		18.4	1.5
TRIAL 3		18.4	1.5
Average		18.4	1.5

LEAK CHECK	
SYSTEM PRE:	<0.001 cfm CFM@15"Hg
POST:	0.001 cfm CFM@15"Hg
PITOT PRE:	+/- ok @ > 3"H_2O
POST:	+/- ok @ > 3"H_2O

B-3

FIELD DATA

PLANT	BP Whiting	AMBIENT TEMPERATURE	~ 85°F	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	8-2-11	BAROMETRIC PRESSURE	29.41	HEATER BOX SETTING	250	Filter No.	43038
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	17	METER H_a	1.67	Sample	
OPERATOR	Ryan Lyons	PROBE LENGTH, in.	120	C_p FACTOR	0.84	Final wt	
STACK NO.	FCCU 500	NOZZLE DIAMETER, in.	~~0.156~~ 0.153	Y_d FACTOR	1.006	Tare wt	779.7
RUN NO.	202-4	STACK DIAMETER, in.	108	PITOT NO.	354	Wt. gain	
SAMPLE BOX NO.	APEX	MINUTES PER POINT	Variable			TOTAL	mg
METER BOX NO.	81006	NUMBER OF POINTS	12				
START TIME	0820	NUMBER OF PORTS	2				

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_s) °F	VELOCITY HEAD (ΔP_s)		PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	OUTLET (Tm_{out}) °F	FILTER ~~BOX~~ TEMP. °F	PROBE TEMP °F	Backhalf Filter AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
0820	1	0	-1.1	561	1.5		0.32	0.32	945.730	97	97	235	241	82	64	1
	2	18:30		560	1.8		0.32		952.02	103	96	234	245	83	62	1
	3	38:45		561	1.9		0.32		958.98	102	96	240	239	83	58	1
	4	59:45		561	1.9		0.32		966.08	103	96	242	244	82	63	1
	5	80:45		562	1.8		0.32		973.95	105	96	242	242	80	63	1
	6	101:15		562	1.8		0.32		981.68	109	98	245	243	82	62	1
1031:30	1	121:30		561	1.4		0.32		989.14	105	100	242	247	83	62	1
	2	139:30		560	1.9		0.32		995.38	107	101	248	249	81	62	1
	3	160:30		560	1.9		0.32		1002.62	109	102	252	248	82	58	1
	4	181:15		561	1.9		0.32		1009.73	110	103	248	244	80	62	1
	5	202:00		561	1.7		0.32		1016.77	111	104	246	248	81	63	1
	6	221:45		561	1.5		0.32		1023.50	112	105	245	246	79	58	1
1232		240:15							1029.935							
		M·Sec														
AVERAGE	12	240:15	-1.1	560.9	—	1.3211	0.32		84.205	—	102.7	248 ± 25	248 ± 25	65 < X < 85	68	max 1

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	Sgr #4	#5	g
FINAL	707.8	599.5	707.5	833.2		
INITIAL	388.4	590.7	692.3	813.8		
LIQUID COLLECTED	319.4	8.8	15.2	19.4		
TOTAL LIQUID COLLECTED (specify ml or g)						362.8

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1	1350	17.8	1.8
TRIAL 2	1356	17.8	1.8
TRIAL 3	1407	17.8	1.8
Average		17.8	1.8

LEAK CHECK		
SYSTEM PRE:	0.002	CFM@15"Hg
POST:	0.000	CFM@15"Hg
PITOT PRE:	+- √	@ > 3"H_2O
POST:	+- √	@ > 3"H_2O

Purge Start = 13:35 Purge End = 14:35 @ 15lpm HPN (262.8g)

Form FDF 4003.00

FIELD DATA

PLANT	BP Whiting	AMBIENT TEMPERATURE	~85°F	PROBE HEATER SETTING	250		
DATE	8-2-11	BAROMETRIC PRESSURE	29.89	HEATER BOX SETTING	250		
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	17	METER $H_@$	1.67		
OPERATOR	Ryan Lyons	PROBE LENGTH, in.	120	C_p FACTOR	0.84		
STACK NO.	FCCU 500	NOZZLE DIAMETER, in.	0.153	Y_d FACTOR	1.006		
RUN NO.	202-5	STACK DIAMETER, in.	109	PITOT NO.	354		
SAMPLE BOX NO.	APEX	MINUTES PER POINT	Variable				
METER BOX NO.	61006	NUMBER OF POINTS	12				
START TIME	1330	NUMBER OF PORTS	2				

WEIGHT OF PARTICULATE, mg		
Filter No.	43037	
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_s) °F	VELOCITY HEAD (ΔP_s)	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (V_m) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET ($T_{m_{in}}$) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET ($T_{m_{out}}$) °F	FILTER ~~BOX~~ TEMP. °F	PROBE TEMP °F	Backhalf Filter AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
1330	1	0	-1.1	559	1.5		0.33	0.33	30.200	106	105	250	248	80	64	1
	2	18:30		558	1.8		0.33		36.78	115	108	256	249	82	65	1
	3	39:00		559	1.9		0.33		43.94	119	109	249	245	81	64	1
1430	4	60:00		560	1.9		0.33		51.29	117	110	243	240	80	63	1
	5	81:00		560	1.9		0.33		58.61	116	109	245	248	80	62	1
	6	101:15		560	1.6		0.33		65.70	115	109	244	243	81	60	1
1536	1	120:15		559	1.4		0.33		72.22	112	109	244	248	79	58	1
	2	139:30		557	1.9		0.33		78.18	116	109	249	251	80	60	1
	3	157:30		558	1.9		0.33		85.18	116	110	241	249	81	63	1
	4	177:30		560	1.8		0.33		92.25	116	109	254	251	82	65	1
	5	197:00		560	1.8		0.33		99.05	118	110	249	249	80	62	1
	6	216:30		560	1.8		0.33		105.91	118	111	245	248	79	66	1
1731		235:30							112.415							
AVERAGE	12	235:30	-1.1	559.2		1.3276	0.33	0.33	82.215	—	112.1	248±25	248±25	79.5	62.8	Max 1

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL	698.4	594.2	694.8			870.6
INITIAL	381.4	593.7	691.8			849.1
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						341.3

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		17.9	1.6
TRIAL 2		17.9	1.6
TRIAL 3		17.9	1.6
Average		17.9	1.6

LEAK CHECK		
SYSTEM PRE:	0.001	CFM@15"Hg
POST:	0.001	CFM@15"Hg
PITOT PRE:	+√	@>3"H_2O
POST:	+√	@>3"H_2O

Form FDF 4003.00

B-38

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP	**Date Set-up:**	6/6/11
Location:	Whiting IN	**Test Date:**	6/9/11
Source:	FCCU Stack	**Date Recovered:**	6/9/11
Run No.:	201A/202-1	**USEPA Method:**	201A/202
		Corresponding Filter Wgt:	795.5
		Filter Container No:	17585

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	Knockout	373.5	640.9	267.4	
2	Empty	525.2	554.4	29.2	
3	100ml H2O	752.2	774.8	22.6	
4	SG	843.8	865.0	21.2	
5					
6					

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	ZR	**Date Set-up:**	6/9/11
Location:	Whiting, IN	**Test Date:**	6/10/11
Source:	FCCU 500	**Date Recovered:**	6/10/11
Run No.:	201A/202-2	**USEPA Method:**	201A/202
		Corresponding Filter Wgt:	761.8
		Filter Container No:	47/64

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	Knockout	388.2	669.7	281.5	
2	Empty	588.2	595	6.8	
3	100ml DI	712.1	738.6	26.5	
4	SG	811.6	835.8	24.2	
5					
6					
				339.0	

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP	**Date Set-up:**	6/10/11
Location:	Whiting, In	**Test Date:**	6/20/11
Source:	ECCU Sou	**Date Recovered:**	6/10/11
Run No.:	201A/202A3	**USEPA Method:**	201A/202
		Corresponding Filter Wgt:	~~47658~~ 786.5
		Filter Container No:	(P) ~~786.5~~ ~~47658~~

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	Knockout	373.5	669.8	296.3	
2	Empty	527.5	530.3	2.8	
3	100ml DF	773.6	799.1	25.5	
4	Si gel	846.8	867.3	20.5	
5					
6					

Method 5/29

FIELD DATA

A=____ B=____

B-44

PLANT	BP-Whiting	AMBIENT TEMPERATURE	~ 65°F	PROBE HEATER SETTING	~ 320
DATE	6-9-11	BAROMETRIC PRESSURE	29.20	HEATER BOX SETTING	~ 250
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_{@}$	1.88
OPERATOR	Ryan Lyons	PROBE LENGTH, in.	120	C_p FACTOR	0.84
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	.216	Y_d FACTOR	1.010
RUN NO	5/24 - 1	STACK DIAMETER, in	108	PITOT NO.	354
SAMPLE BOX NO	APEX	MINUTES PER POINT	15		
METER BOX NO	402005	NUMBER OF POINTS	12		
START TIME	1540	NUMBER OF PORTS	2		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD $\sqrt{(\Delta P_S)}$	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
1540	1	0	-1.4	558	2.2		2.2	2.18	190.115	—	78	331	259	N/A	46	5
1555	2	15		558	2.2		2.2	2.18	202.43		80	333	256		47	5
1610	3	30		559	2.3		2.3	2.30	214.33		82	335	247		50	5
1625	4	45		559	2.3		2.3	2.30	226.78		83	329	249		51	5
1640	5	60		559	2.4		2.4	2.40	239.50		84	324	255		59	5
1655	6	75		556	2.1		2.1	2.10	252.29		85	330	246		62	5
1710/1730	1	90		557	2.1		2.1	2.10	264.45		82	321	244		51	5
1745	2	105		557	2.3		2.3	2.30	276.53		84	315	239		52	5
1800	3	120		558	2.4		2.4	2.41	288.96		85	324	242		57	5
1815	4	135		559	2.4		2.4	2.41	301.58		85	330	233		61	5
1830	5	150		559	2.0		2.0	2.01	314.98		85	321	229		57	5
1845	6	165		558	1.9		1.9	1.91	327.32		85	327	234		50	5
1900		180							339.125							
AVERAGE	12	180	-1.4	558.0 ✓	1.4879 ✓		2.22 ✓		149.010 ✓	—	83.2 ✓	320±25	248±25	—	468	max 5

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL	0	100	100	199	5g	200
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						522.4

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.3	1.6
TRIAL 2		18.3	1.6
TRIAL 3		18.3	1.6
Average		18.3	1.6

LEAK CHECK		
SYSTEM PRE:	0.000	CFM@15"Hg
POST:	0.001	CFM@15"Hg
PITOT PRE:	+- ✓	@ > 3"H_2O
POST:	+- ✓	@ > 3"H_2O

FIELD DATA

A= _____ B= _____

PLANT	BP Whiting	AMBIENT TEMPERATURE	~70	PROBE HEATER SETTING	~250
DATE	6-10-11	BAROMETRIC PRESSURE	29.15	HEATER BOX SETTING	~320
LOCATION	Whiting/IN	ASSUMED MOISTURE, %	17	METER $H_@$	1.88
OPERATOR	Ryan Lyons	PROBE LENGTH, in.	120	C_p FACTOR	0.84
STACK NO	FCU 500	NOZZLE DIAMETER, in.	.218	Y_d FACTOR	1.010
RUN NO	5129-2	STACK DIAMETER, in	108	PITOT NO.	354
SAMPLE BOX NO	APEX	MINUTES PER POINT	15		
METER BOX NO	407053	NUMBER OF POINTS	12		
START TIME	0835	NUMBER OF PORTS	2		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_s) °F	VELOCITY HEAD (ΔP_s)	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
0835	1	0	-1.4	560	2.0		2.0	1.97	339.430	—	76	321	257	NA	59	5
0850	2	15		560	2.0		2.0	1.97	351.14		81	324	258		60	5
0905	3	30		560	2.3		2.3	2.30	362.71		83	324	254		57	6
0920	4	45		561	2.4		2.4	2.40	375.19		84	319	260		58	6
0935	5	60		561	2.3		2.3	2.30	387.83		85	323	258		57	6
0950	6	75		561	2.1		2.1	2.10	400.43		84	328	256		60	5
1005/1018	1	90		561	2.2		2.2	2.20	412.98		82	321	230		59	5
1033	2	105		560	2.3		2.3	2.30	425.12		84	317	237		57	6
1048	3	120		562	2.4		2.4	2.40	437.81		86	330	240		57	6
1103	4	135		561	2.4		2.4	2.40	450.57		87	325	243		56	6
1118	5	150		563	2.2		2.2	2.20	463.30		88	321	240		57	6
1133	6	165		562	2.1		2.1	2.10	475.99		90	320	242		58	5
1148		180							488.050							
AVERAGE	12	180	-1.4	561.0 ✓	1.4909 ✓		2.23 ✓		148.620	—	84.2 ✓	321±25	248±25	NA	58	max 6

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL	0	100	100	100	59	200
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						624.1

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.4	1.4
TRIAL 2		18.4	1.4
TRIAL 3		18.4	1.4
Average		18.4	1.4

LEAK CHECK		
SYSTEM PRE:	0.000	CFM@15"Hg
POST:	0.000	CFM@15"Hg
PITOT PRE:	+-✓	@ > 3"H_2O
POST:	+-✓	@ > 3"H_2O

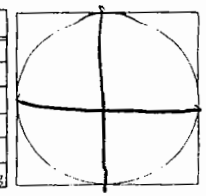
B-15

FIELD DATA

A= _____ B= _____

B-46

PLANT	BP Whiting	AMBIENT TEMPERATURE	~70°F	PROBE HEATER SETTING	~250	WEIGHT OF PARTICULATE, mg	
DATE	6-10-11	BAROMETRIC PRESSURE	29.15	HEATER BOX SETTING	~320	Filter No.	
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_{@}$	1.88	Sample	
OPERATOR	Ryan Yoas	PROBE LENGTH, in.	120	C_p FACTOR	0.84	Final wt	
STACK NO.	FCU500	NOZZLE DIAMETER, in.	.218	Y_d FACTOR	1.010	Tare wt	
RUN NO.	5179-3	STACK DIAMETER, in.	108	PITOT NO.	354	Wt. gain	
SAMPLE BOX NO	APEX	MINUTES PER POINT	15			TOTAL	mg
METER BOX NO	402005	NUMBER OF POINTS	12				
START TIME	1357	NUMBER OF PORTS	2				



CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD $\sqrt{(\Delta P_S)}$	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
1357	1	0	-1.4	563	2.2		2.2	2.18	488.200	—	81	324	238	NA	55	3
1413	2	15		564	2.2		2.2	2.18	500.36		85	323	243		52	3
1428	3	30		564	2.3		2.3	2.29	512.55		85	324	245		56	3
1443	4	45		564	2.2		2.2	2.28	525.56		92	331	256		59	3
1458	5	60		564	2.2		2.2	2.23	537.37		93	328	251		54	3
1513	6	75		563	2.1		2.1	2.12	550.30		95	333	249		52	3
1528/1539	1	90		560	2.0		2.0	2.02	562.45		90	325	239		59	3
1554	2	105		562	2.2		2.2	2.23	574.42		92	329	243		55	3
1609	3	120		562	2.4		2.4	2.43	586.97		93	336	253		52	3
1624	4	135		563	2.4		2.4	2.43	600.14		93	331	244		55	3
1639	5	150		563	2.2		2.2	2.23	613.21		93	333	249		57	3
1654	6	165		562	2.1		2.1	2.12	625.79		94	332	252		59	3
1709 ~~1709~~		180							638.210							
AVERAGE	12	180	-1.4	562.8 ✓		1.4856 ✓	2.21 ✓		150.010 ✓	—	90.5 ✓	330±25	248±25	—	56	MAX 3

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						629.6

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.5	1.4
TRIAL 2		18.5	1.4
TRIAL 3		18.5	1.4
Average		18.5	1.4

LEAK CHECK		
SYSTEM PRE:	0.000	CFM@15"Hg
POST:	0.000	CFM@15"Hg
PITOT PRE:	+ ✓	@ > 3"H_2O
POST:	+ ✓	@ > 3"H_2O

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP	**Date Set-up:**	6-8-11
Location:	Whiting, IN	**Test Date:**	6-9-11
Source:	FCCU 500	**Date Recovered:**	6-9-11
Run No.:	5/29 - 1	**USEPA Method:**	5/29
		Corresponding Filter Wgt:	792.5 mg
		Filter Container No:	47586

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	EMPTY	580.9	828.9	248.0	
1	5% HNO_3/10% H_2O_2	735.4	903.4	168.0	
2	5% HNO_3/10% H_2O_2	690.4	760.4	70.0	
3	Empty	615.1	635.6	20.5	
4	SG	825.0	860.9	35.9	
5					
6				522.4	

IMPINGER RECOVERY DATA SHEET

ARI ENVIRONMENTAL INC.

Company:	BP	Date Set-up:	6/9/11
Location:	Whiting IN	Test Date:	6/9/11
Source:	FCCU SOO	Date Recovered:	
Run No.:	5/29-2	USEPA Method:	5/29
		Corresponding Filter Wgt:	47588
		Filter Container No:	795.0

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	Empty	609.6	872.2	262.6	
2	5% HNO_3/10% H_2O_2	716.9	936.9	220.0	
3	5% HNO_3/10% H_2O_2	721.4	808.0	86.6	
4	Empty	607.3	632.3	25.0	
5	SG	788.3	818.2	29.9	
6				624.10	

IMPINGER RECOVERY DATA SHEET

Company:	BC	**Date Set-up:**	6/10/11
Location:	Whiting, IN	**Test Date:**	6/10/11
Source:	FCCU Stack	**Date Recovered:**	6/10/11
Run No.:	5/29+3	**USEPA Method:**	5/29
		Corresponding Filter Wgt:	791.1
		Filter Container No:	47963

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	Empty	581.2	826.7	245.5	
2	5% HNO_3/a% H_2O_2	767.5	974.1	206.6	
3	5% HNO_3/10% H_2O_2	683.4	799.6	116.2	
4	Empty	619.7	645.0	26.3	
5	SG	920.4	955.4	35.0	
6				629.6	

Ontario Hydro (Hg)

FIELD DATA

A= B=

PLANT	BP whiting	AMBIENT TEMPERATURE	~ 70°F	PROBE HEATER SETTING	~250
DATE	6-13-11	BAROMETRIC PRESSURE	29.40	HEATER BOX SETTING	~250
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	17	METER $H_@$	1.95
OPERATOR	Ryan Yon	PROBE LENGTH, in.	120	C_p FACTOR	0.84
STACK NO	FCU 500	NOZZLE DIAMETER, in.	.218	Y_d FACTOR	1.010
RUN NO	OH-1	STACK DIAMETER, in	108	PITOT NO.	354
SAMPLE BOX NO	APEX	MINUTES PER POINT	15		
METER BOX NO	402405	NUMBER OF POINTS	12		
START TIME	0950	NUMBER OF PORTS	12		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	(ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
0950	1	0	-1.4	560	1.9		1.9	1.86	634.400	—	74	254	260	NA	53	8
1005	2	15		559	2.2		2.2	2.16	649.33		76	255	241		52	9
1020	3	30		561	2.2		2.2	2.18	661.04		80	260	244		53	9
1035	4	45		562	2.3		2.3	2.28	673.22		81	262	239		56	10
1050	5	60		562	2.0		2.0	1.99	686.29		83	259	232		56	10
1105	6	75		562	2.0		2.0	1.99	698.11		85	255	240		58	10
1120/1135	1	90		560	2.1		2.1	2.08	709.95		80	252	233		59	9
1210	2	105		561	2.2		2.2	2.18	721.61		82	251	242		58	10
1225	3	120		561	2.2		2.2	2.18	733.43		84	239	240		60	10
1240	4	135		561	2.2		2.2	2.18	745.91		85	238	241		57	10
1255	5	150		560	2.1		2.1	2.11	758.14		86	261	244		60	9
1310	6	165		560	2.0		2.0	2.01	770.00		87	258	249		62	9
1325		180							782.105							
AVERAGE				560.8	1.4543		2.12		143.705	—	81.9	248±25	248±25	—	468	max 10

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.4	1.5
TRIAL 2		18.4	1.5
TRIAL 3		18.4	1.5
Average		18.4	1.5

~~Meter Exit = 15.6% CO_2~~
2.4% O_2

LEAK CHECK		
SYSTEM PRE:	0.000	CFM@15"Hg
POST:	0.000	CFM@15"Hg
PITOT PRE:	+-5	@ > 3"H_2O
POST:	+-5	@ > 3"H_2O

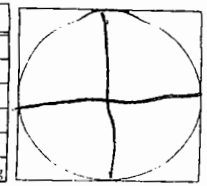
FIELD DATA

A= B=

B-52

PLANT	BP Whiting	AMBIENT TEMPERATURE	~ 70°	PROBE HEATER SETTING	~250		
DATE	6-13-11	BAROMETRIC PRESSURE	29.40	HEATER BOX SETTING	~250		
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	17	METER $H_{@}$	1.88		
OPERATOR	Ryan Lyons	PROBE LENGTH, in.	120	C_p FACTOR	0.84		
STACK NO	Fcu 300	NOZZLE DIAMETER, in.	.318	Y_d FACTOR	1.010		
RUN NO	Out-2	STACK DIAMETER, in	104	PITOT NO	354		
SAMPLE BOX NO	APEX	MINUTES PER POINT	15				
METER BOX NO	402005	NUMBER OF POINTS	12				
START TIME	1415	NUMBER OF PORTS	2				

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg



CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD $\sqrt{(\Delta P_S)}$	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
1415	1	0	-1.4	560	2.1		2.1	2.11	786.085	—	82	251	238	NA	66	7
1430	2	15		559	2.2		2.2	2.21	798.11		84	254	246		56	7
1445	3	30		560	2.2		2.2	2.21	810.32		87	257	244		51	7
1500	4	45		560	2.3		2.3	2.31	822.85		88	261	240		53	8
1515	5	60		560	1.9		1.9	1.91	835.23		89	260	238		57	7
1530	6	75		561	1.9		1.9	1.91	847.09		90	248	239		60	7
1545/1552	1	90		559	2.2		2.2	2.21	858.54		86	240	233		62	7
1607	2	105		561	2.2		2.2	2.21	870.87		87	245	240		51	7
1622	3	120		562	2.2		2.2	2.21	883.13		88	230	235		52	7
1637	4	135		562	2.1		2.1	2.11	895.24		89	244	243		53	7
1652	5	150		562	2.1		2.1	2.11	907.89		89	259	247		50	7
1707	6	165		561	2.0		2.0	2.01	919.94		90	252	249		62	7
1722		180							931.705							
AVERAGE	12	180	-1.4	560.6		1.4543	2.12	—	145.620	—	87.4	248±25	248±25	—	68	max 8

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.4	1.5
TRIAL 2		18.4	1.5
TRIAL 3		18.4	1.5
Average		18.4	1.5

LEAK CHECK		
SYSTEM PRE:	0.005	CFM@15"Hg
POST:	0.003	CFM@15"Hg
PITOT PRE:	+-√	@ > 3"H_2O
POST:	+-√	@ > 3"H_2O

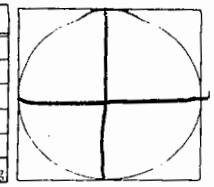
~~Molar Frac = 139.00~~

FIELD DATA

A=_____ B=_____

PLANT	BP Whiting	AMBIENT TEMPERATURE	~70°F	PROBE HEATER SETTING	~250		
DATE	6-14-11	BAROMETRIC PRESSURE	29.35	HEATER BOX SETTING	~250		
LOCATION	Whiting, IN	ASSUMED MOISTURE, %	17	METER $H_@$	1.88		
OPERATOR	Ryan Lyons	PROBE LENGTH, in.	120	C_p FACTOR	0.84		
STACK NO	FCU 500	NOZZLE DIAMETER, in.	.218	Y_d FACTOR	1.010		
RUN NO	OH-3	STACK DIAMETER, in.	109	PITOT NO.	354		
SAMPLE BOX NO.	APEX	MINUTES PER POINT	15				
METER BOX NO	402005	NUMBER OF POINTS	12				
START TIME	0820	NUMBER OF PORTS	2				

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg



CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
0820	1	0	-1.4	563	2.1		2.1	2.08	932.100	—	79	245	231	NA	54	7
0835	2	15		561	2.2		2.2	2.18	943.89		80	243	243		51	8
0850	3	30		562	2.2		2.2	2.19	956.14		83	255	249		51	8
0905	4	45		562	2.2		2.2	2.20	968.79		85	261	241		54	8
0920	5	60		562	2.2		2.2	2.20	980.83		87	261	237		58	8
0935	6	75		561	2.0		2.0	2.01	993.08		88	254	245		57	7
0950/0956	1	90		560	2.0		2.0	2.02	1005,030		89	256	245		52	7
1011	2	105		563	2.1		2.1	2.12	1016.82		90	251	243		51	7
1026	3	120		561	2.1		2.1	2.12	1029.02		91	249	242		57	7
1041	4	135		560	2.0		2.0	2.03	1040.98		92	232	236		55	7
1056	5	150		560	2.0		2.0	2.04	1052.89		93	245	246		59	7
1111	6	165		558	1.9		1.9	1.93	1065.13		95	256	244		60	7
1126		180							1076.725							
AVERAGE	12	180	-1.4	561.1	1.4430		2.08		144.625	—	87.7	248±25	248±25	—	L68	max8

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		18.3	1.4
TRIAL 2		18.1	1.4
TRIAL 3		18.1	1.4
Average		18.1	1.4

LEAK CHECK		
SYSTEM PRE:	0.000	CFM@15"Hg
POST:	0.000	CFM@15"Hg
PITOT PRE:	+- √	@ > 3"H_2O
POST:	+- √	@ > 3"H_2O

OH - 1

B-54

FIELD SAMPLING TRAIN MOISTURE SUMMARY

Company: BP
Location: Whiting, IN
Source: FCCU 500
Test Date: 6/13/11
USEPA Method: Ontario Hydro
Parameter: Hg

Net Gain (mL or g)
603.3 g

Filter # 40703
Tare = 776.9 mg
Final =

Impinger No	Contents	Final Volume (mL)	Initial Volume (mL)	Net Volume Gain (mL)
1	K.O.	901.5	610.5	291.0
2	KCl	920.3	740.5	179.8
3	KCl	823.5	728.2	95.3
4	KCl	767.5	758.0	9.5
5	MT	617.2	614.3	2.9
6	5%/10%	740.2	736.7	3.5
7	$KMnO_4$	730.6	733.3	-2.7
8	$KMnO_4$	797.9	800.1	-2.2
9	$KMnO_4$	730.1	729.4	0.7

Silica Gel	Final Weight (g)	Initial Weight (g)	Net Weight Gain (g)
10	833.4	807.1	26.3

FORM FDF 4006.00

OH-2

FIELD SAMPLING TRAIN MOISTURE SUMMARY

Company: BP
Location: Whiting, IN
Source: FCCU 500
Test Date: 6/13/11
USEPA Method: Ontario Hydro
Parameter: Hg

Net Gain (mL or g)
657.8 g

Filter # 47597
Tare = 796.7mg

Impinger No	Contents	Final Volume (mL)	Initial Volume (mL)	Net Volume Gain (mL)
1	K.O.	904.7	581.4	323.3
2	KCl	941.8	772.9	168.9
3	KCl	760.7	699.6	61.1
4	KCl	857.8	736.8	21.0
5	MT	617.3	611.2	6.1
6	5%/10%	749.8	741.1	8.7
7	$KMnO_4$	746.1	747.5	-1.4
8	$KMnO_4$	711.8	710.4	1.4
9	$KMnO_4$	784.8	750.8	34.0

Silica Gel	Final Weight (g)	Initial Weight (g)	Net Weight Gain (g)
10	859.7	825.0	34.7

FORM FDF 4006.00

B-56

FIELD SAMPLING TRAIN MOISTURE SUMMARY

Company: BP
Location: Whiting, IN
Source: FCCU 500
Test Date: 6/14/11
USEPA Method: Ontario Hydro
Parameter: Hg

Net Gain (mL or g)
625.8 g

Filter # 17591
Tare = 796.8 mg
Final =

Impinger No	Contents	Final Volume (mL)	Initial Volume (mL)	Net Volume Gain (mL)
1	K.O.	964.1	610.4	353.7
2	KCl	922.3	718.9	203.4
3	KCl	737.3	706.9	30.4
4	KCl	711.5	705.3	6.2
5	MT	618.6	615.8	2.8
6	5%/10%	744.4	742.3	2.1
7	$KMnO_4$	677.0	682.7	-5.7
8	$KMnO_4$	758.9	759.3	-0.4
9	$KMnO_4$	716.5	718.5	0.0

Silica Gel	Final Weight (g)	Initial Weight (g)	Net Weight Gain (g)
10	842.9	809.6	33.3

Method 0010

FIELD DATA

1.2

A=____ B=____

B-58

PLANT	BP	AMBIENT TEMPERATURE	100	PROBE HEATER SETTING	250
DATE	6-7-11	BAROMETRIC PRESSURE	29.20	HEATER BOX SETTING	250
LOCATION	Whiting IN	ASSUMED MOISTURE, %	12	METER $H_@$	~~0.~~ 1.83
OPERATOR	R. Burton	PROBE LENGTH, in.	120	C_p FACTOR	0.84
STACK NO.	~~[illegible]~~ FCU 500	NOZZLE DIAMETER, in.	0.220	Y_d FACTOR	0.991
RUN NO	~~23-1~~ 0010-1	STACK DIAMETER, in	108	PITOT NO.	997
SAMPLE BOX NO.	APEX	MINUTES PER POINT	15		
METER BOX NO.	611209	NUMBER OF POINTS	12		
START TIME	1327	NUMBER OF PORTS	2		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
	TOTAL	mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1327	W1	0	-1.1	545	1.3		1.6	1.56	564.900		102	260	271	49	61	6
	2	15		547	1.3		1.6	1.56	575.36		107	265	244	53	65	6
	3	30		545	1.5		1.8	1.80	588.63		111	235	253	50	65	8
	4	45		545	1.4		1.7	1.68	597.85		113	239	252	46	59	8
	5	60		545	1.4		1.7	1.68	608.95		115	234	255	45	60	8
	6	75		543	0.95		1.1	1.13	620.08		115	245	252	44	66	7
1457/1606	IV 1	90		544	1.3		~~1.3~~ 1.6	1.55	629.550		107	239	230	43	63	9
	2	105		543	1.3		1.6	1.55	641.70		108	272	225	45	64	9
	3	120		544	1.4		1.7	1.68	652.98		109	266	226	45	66	9
	4	135		544	1.4		1.7	1.68	663.27		110	262	227	46	65	9
	5	150		543	1.2		1.4	1.43	673.90		111	268	220	45	66	9
	6	165		542	1.1		1.3	1.31	684.83		111	271	218	48	65	9
1736	END	180							694.050							
AVERAGE	12	180	-1.1	544.1		1.1364	1.57		129.150		109.9				≤68	≤9

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		17.4	1.6
TRIAL 2		17.4	1.6
TRIAL 3		17.4	1.6
Average		17.4	1.6

LEAK CHECK

SYSTEM PRE: 0.001 cc CFM@15"Hg

POST: 0.008 cc CFM@15"Hg

PITOT PRE: +/- 02 @ > 3"H_2O

POST: +/- 02 @ > 3"H_2O

FIELD DATA

A= B=

PLANT	BP	AMBIENT TEMPERATURE	~95°	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	6-8-11	BAROMETRIC PRESSURE	29.30	HEATER BOX SETTING	250	Filter No.	
LOCATION	Wyoming IN	ASSUMED MOISTURE, %	12	METER $H_{@}$	1.93	Sample	
OPERATOR	R Burton	PROBE LENGTH, in.	120	C_p FACTOR	0.84	Final wt	
STACK NO	FCU500	NOZZLE DIAMETER, in.	0.220	Y_d FACTOR	0.991	Tare wt	
RUN NO	0010-2	STACK DIAMETER, in	108	PITOT NO	0947	Wt. gain	
SAMPLE BOX NO.	1 OF 4	MINUTES PER POINT	15			TOTAL	mg
METER BOX NO	611209	NUMBER OF POINTS	12				
START TIME	0925	NUMBER OF PORTS	2				

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	(ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
0925	1	0	-1.2	544	1.4		1.7	1.67	695.760		94	271	175	42	68	7
	2	15		544	1.4		1.7	1.67	707.01		95	265	178	43	67	7
	3	30		544	1.5		1.8	1.67	716.86		99	264	176	44	68	7
	4	45		544	1.6		1.9	1.91	729.44		101	262	180	45	63	7
	5	60		543	1.5		1.8	1.79	740.04		102	261	171	44	67	7
	6	75		541	1.1		1.3	1.31	751.11		104	261	188	45	65	6
1045/1154	1	90		544	1.6		1.9	1.91	761.84		99	232	166	46	68	4
	2	105		544	1.7		2.0	2.03	773.16		106	246	169	44	63	8
	3	120		544	1.7		2.0	2.03	786.42		109	247	172	42	65	8
	4	135		544	1.5		1.8	1.74	798.80		111	244	174	43	66	8
	5	150		543	1.3		1.6	1.55	809.96		112	266	178	41	64	8
	6	165		542	0.97		1.2	1.16	821.72		113	270	180	41	64	6
1324	END	180							830.805							
AVERAGE	12	180	-1.2	543.4		1.1960	1.73		135.045		103.8					

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		17.7	1.6
TRIAL 2		17.7	1.6
TRIAL 3		17.7	1.6
Average		17.7	1.6

LEAK CHECK

SYSTEM PRE: <0.001 @ CFM@15"Hg

POST: <0.001 @ CFM@15"Hg

PITOT PRE: +/- 0 @ > 3"H_2O

POST: +/- 0 @ > 3"H_2O

FIELD DATA

B-60

A= B=

PLANT	BP	AMBIENT TEMPERATURE	295	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	6-8-17	BAROMETRIC PRESSURE	29.30	HEATER BOX SETTING	250	Filter No.	
LOCATION	Whiting IN	ASSUMED MOISTURE, %	12 17	METER $H_{@}$	1.83	Sample	
OPERATOR	B Brown	PROBE LENGTH, in.	120	C_p FACTOR	0.84	Final wt	
STACK NO	FCU 500	NOZZLE DIAMETER, in.	0.220	Y_d FACTOR	0.991	Tare wt	
RUN NO	0010-3	STACK DIAMETER, in.	108	PITOT NO	997	Wt. gain	
SAMPLE BOX NO	IP EX	MINUTES PER POINT	15			TOTAL mg	
METER BOX NO	6/1209	NUMBER OF POINTS	12				
START TIME	1445	NUMBER OF PORTS	2				

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	(ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1445	1	0	-1.2	545	1.4		1.7	1.67	831.230		102	226	175	41	67	8
1500	2	15		545	1.4		1.7	1.67	842.29		106	236	173	45	64	8
1515	3	30		545	1.5		1.8	1.79	852.71		107	233	176	44	66	9
1530	4	45		545	1.7		2.0	2.03	862.90		108	235	181	52	68	10
1545	5	60		545	1.5		1.6	1.63	874.96		104	234	182	49	64	9
1600	6	75		543	1.0		1.1	1.08	887.18		108	232	182	50	65	7
1615/1643	1	90		544	1.2		1.3	1.30	898.76		104	230	168	46	67	9
1658	2	105		544	1.2		1.3	1.30	909.64		105	262	168	45	66	9
1713	3	120		545	1.6		1.7	1.73	919.19		106	262	172	45	65	10
1728	4	135		545	1.6		1.7	1.73	930.85		107	263	171	45	67	10
1743	5	150		545	1.3		1.4	1.41	944.02		107	261	165	42	63	7
1758	6	165		544	1.1		1.2	1.14	952.61		108	255	163	43	66	9
1813	END	180							959.835							
AVERAGE	12	180	-1.2	544.5		1.169	1.54		128.605		106.4				68	9.0

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1		1.6	18.0
TRIAL 2		1.6	18.0
TRIAL 3		1.6	18.0
Average		1.6	18.0

LEAK CHECK

SYSTEM PRE: 4.000 CFM@15"Hg

POST: 4.000 CFM@15"Hg

PITOT PRE: +/- 0 @ > 3"H_2O

POST: +/- 0 @ > 3"H_2O

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP Whiting	Date Set-up:	6-7-11
Location:	Whiting, IN	Test Date:	6-7-11
Source:	FCCU 500	Date Recovered:	
Run No.:	0010-1	USEPA Method:	0010
		Corresponding Filter Wgt:	NA
		Filter Container No:	NA

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1 KO	~~351.7~~	351.7	786.3	434.6	
2	H_2O	690.4	688.7	-1.7	
3	H_2O	720.1	720.1	0	
4	empty	626.8	630.5	3.7	
5	SG	823.6	849.7	26.1	
6				~~Total~~ 462.7	

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	~~BP~~ Whiting	Date Set-up:	6-7-11
Location:	Whiting, IN	Test Date:	
Source:	FCCU 500 Stack	Date Recovered:	
Run No.:	M0010-2	USEPA Method:	SW846 0010
		Corresponding Filter Wgt:	—
		Filter Container No:	—

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
~~x~~KO	Empty	383.3	906.1	522.8	
2	Water	690.6	700.3	9.7	
3	Water	730.2	730.6	0.4	
4	Empty	586.8	599.5	12.7	
5	SG	775.3	807.1	31.8	
6				Total 577.4	

IMPINGER RECOVERY DATA SHEET

ENVIRONMENTAL INC.

Company:	BP Whiting	**Date Set-up:**	6-8-11
Location:	Whiting, IN	**Test Date:**	6-8-11
Source:	FCCU SCO	**Date Recovered:**	
Run No.:	0010-3	**USEPA Method:**	0010
		Corresponding Filter Wgt:	—
		Filter Container No:	—

Measurement Method: Weight or Volume

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
* KO	empty	352.7	810.9	458.2	
2	H_2O	692.0	714.3	22.3	
3	H_2O	745.7	752.5	6.8	
4	empty	628.7	632.8	4.1	
5	SG	903.7	928.7	25.0	
6				Total 516.4	

Method ØØ61

FIELD DATA

A= ____ B= ____

PLANT	BP	AMBIENT TEMPERATURE	65	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	6-13-11	BAROMETRIC PRESSURE	29.40	HEATER BOX SETTING	—	Filter No.	
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_{@}$	1.93	Sample	
OPERATOR	R. Burton	PROBE LENGTH, in.	120	C_p FACTOR	0.84	Final wt	
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	0.220	Y_d FACTOR	0.991	Tare wt	
RUN NO.	0061-1	STACK DIAMETER, in	108	PITOT NO.	997	Wt. gain	
SAMPLE BOX NO.	APEX	MINUTES PER POINT	4			TOTAL	mg
METER BOX NO	G11209	NUMBER OF POINTS	12				
START TIME	1118	NUMBER OF PORTS	2				

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) 'F	VELOCITY HEAD (ΔP_S)	(ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) 'F	OUTLET (Tm_{out}) 'F	FILTER EXIT GAS TEMP. 'F	PROBE TEMP 'F	AUXILIARY TEMP. 'F	LAST IMPINGER OUTLET TEMP. 'F	PUMP VACUUM (in. Hg)
1118	1	0	-1.4	557	1.8		1.7	1.66	206.100		79	NA	250	NA	64	2
	2	4		558	2.0		1.8	1.84	208.67		79		234		63	2
	3	8		557	2.2		2.0	2.02	211.37		80		246		62	3
	4	12		558	2.1		1.9	1.93	214.21		83		238		65	2
	5	16		558	2.1		1.9	1.93	217.10		84		235		66	2
	6	20		557	1.7		1.6	1.56	219.92		85		240		62	2
1140/1155	6	24		558	1.7		1.6	1.56	222.19		83		253		64	2
	5	28		558	1.9		1.8	1.77	225.74		84		249		61	2
	4	32		557	2.0		1.8	1.84	228.36		87		242		61	2
	3	36		556	2.1		1.71	1.93	231.50		88		236		60	2
	2	40		556	2.1		1.9	1.93	234.21		89		241		60	2
	1	44		556	1.8		1.7	1.66	237.86		90		240		62	2
1214	END	48							241.675							
AVERAGE	12	48	-1.4	557.2		1.3981	1.80		35.575		84.3				≤68	≥2

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						199.0

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1	1305	18.5	1.4
TRIAL 2	1310	18.5	1.4
TRIAL 3	1315	18.5	1.4
Average		18.5	1.4

Meter Box 15.6% CO_2
2.1% O_2

LEAK CHECK
SYSTEM PRE: 20.001 CFM@15"Hg
POST: 40.000 CFM@15"Hg
PITOT PRE: +/- ok @ > 3"H_2O
POST: +/- ok @ > 3"H_2O

29

FIELD DATA

A= ____ B= ____

B-66

PLANT	BP	AMBIENT TEMPERATURE	70
DATE	6-13-11	BAROMETRIC PRESSURE	29.40
LOCATION	Whiting IN	ASSUMED MOISTURE, %	15
OPERATOR	R. Burton	PROBE LENGTH, in.	120
STACK NO	FCU 500	NOZZLE DIAMETER, in.	0.220
RUN NO.	0061-2	STACK DIAMETER, in	108
BOX NO	APEX	MINUTES PER POINT	4
METER BOX NO	611209	NUMBER OF POINTS	12
START TIME	1458	NUMBER OF PORTS	2

PROBE HEATER SETTING	250		
HEATER BOX SETTING	NA		
METER $H_@$	1.83		
C_p FACTOR	0.84		
Y_d FACTOR	~~0.991~~ 0.997		
PITOT NO.	997		

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL		mg

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	GAS SAMPLE TEMP AT DRY GAS METER OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
1458	1	0	-1.3	558	1.7		1.6	1.59	242.015		79	NA	238	NA	55	4
	2	4		558	2.1		2.0	1.96	244.81		79		234		54	5
	3	8		560	2.2		2.1	2.06	247.86		81		240		54	5
	4	12		562	2.2		2.1	2.06	250.98		83		241		55	5
	5	16		562	2.2		2.1	2.06	254.36		86		243		57	5
	6	20		554	2.0		1.9	1.87	257.15		87		240		54	5
1522/1822	6	24		556	1.9		1.8	1.83	259.98		85		244		56	5
	5	28		558	2.0		1.9	1.87	264.20		86		247		56	5
	4	32		558	2.2		2.1	2.06	266.93		87		245		55	5
	3	36		558	2.1		2.0	1.96	269.45		89		243		56	5
	2	40		557	2.1		2.0	1.96	272.81		90		243		56	6
	1	44		557	2.0		1.9	1.87	276.09		91		244		57	5
1646	End	48							278.965							
AVERAGE	12	48	-1.3	5589		1.4330	1.96		36.950		853				568	≤5

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g) #1	#2	#3	#4	#5	SILICA GEL WEIGHT g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						197.5

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1	1712	18.5	1.5
TRIAL 2	1720	18.5	1.5
TRIAL 3	1726	18.5	1.5
Average		18.5	1.5

Meter Exit = 13.9% CO_2
2.1% O_2

LEAK CHECK	
SYSTEM PRE:	~~0.002~~ CFM@15"Hg
POST:	~~0.002~~ 0.002 CFM@15"Hg
PITOT PRE:	~~+/-~~ ∞ @ > 3"H_2O
POST:	~~+/-~~ ∞ @ > 3"H_2O

FIELD DATA

A= ____ B= ____

PLANT	BP	AMBIENT TEMPERATURE	65	PROBE HEATER SETTING	250		
DATE	6-14-11	BAROMETRIC PRESSURE	29.35	HEATER BOX SETTING	NA		
LOCATION	Whiting IN	ASSUMED MOISTURE, %	17	METER $H_@$	1.83		
OPERATOR	B Burton	PROBE LENGTH, in.	120	C_p FACTOR	0.84		
STACK NO.	FCU 500	NOZZLE DIAMETER, in.	0.250	Y_d FACTOR	0.991		
RUN NO.	0061-3	STACK DIAMETER, in	108	PITOT NO.	997		
SAMPLE BOX NO	APEX	MINUTES PER POINT	4				
METER BOX NO	611209	NUMBER OF POINTS	12				
START TIME	906	NUMBER OF PORTS	2				

WEIGHT OF PARTICULATE, mg		
Filter No.		
Sample		
Final wt		
Tare wt		
Wt. gain		
TOTAL	mg	

CROSS SECTION

CLOCK TIME (Hrs)	TRAVERSE POINT NUMBER	SAMPLING TIME (Θ) min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (T_S) °F	VELOCITY HEAD (ΔP_S)	(ΔP_S)	PRESSURE DIFFERENTIAL ACROSS METER ORIFICE (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft^3	GAS SAMPLE TEMP AT DRY GAS METER INLET (Tm_{in}) °F	OUTLET (Tm_{out}) °F	FILTER EXIT GAS TEMP. °F	PROBE TEMP °F	AUXILIARY TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM (in. Hg)
906	1	0	-1.4	560	1.8		1.7	1.68	280.300		82	NA	231	NA	67	3
	2	4		560	2.0		1.9	1.87	283.11		84		232		56	3
	3	8		560	2.1		2.0	1.97	286.30		86		237		56	3
	4	12		561	2.2		2.1	2.06	289.65		87		240		54	3
	5	16		561	2.2		2.1	2.06	293.02		91		232		55	3
	6	20		560	2.0		1.9	1.87	296.37		93		236		59	3
930/1000	6	24		559	1.8		1.7	1.68	298.58		89		242		63	3
	5	28		559	2.1		2.0	1.96	301.65		91		247		53	4
	4	32		558	2.2		2.1	2.06	304.78		92		246		55	4
	3	36		558	2.3		2.2	2.15	307.99		95		248		58	4
	2	40		557	2.3		2.2	2.15	311.27		96		241		59	4
	1	44		557	2.1		2.0	1.96	314.41		97		240		66	
1024	END	48							317.495							
AVERAGE	12	48	-1.4	559.1		1.4452	1.99		37.195		903				≤68	≤4

VOLUME OR WEIGHT OF LIQUID COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)					SILICA GEL WEIGHT
	#1	#2	#3	#4	#5	g
FINAL						
INITIAL						
LIQUID COLLECTED						
TOTAL LIQUID COLLECTED (specify ml or g)						245.0

ORSAT DATA	TIME	CO_2	O_2
TRIAL 1	1042	18.1	1.3
TRIAL 2	1050	18.0	1.4
TRIAL 3	1100	18.2	1.2
Average		18.1	1.3

Meter Exit = 14.7% CO_2
2.4% O_2

LEAK CHECK	
SYSTEM PRE:	0.010 CFM@15"Hg
POST:	0.010 CFM@15"Hg
PITOT PRE:	+/- 02 @ > 3"H_2O
POST:	+/- 02 @ > 3"H_2O

B-68

FIELD SAMPLING TRAIN MOISTURE SUMMARY

Company: BP
Location: Whiting, In
Source: FCCU-500 Run 2
Test Date: 6/13/11
USEPA Method: 0061
Parameter: Hex Chrome

Net Gain (mL or g)
147.5

Impinger No	Contents	Final Volume (mL)	Initial Volume (mL)	Net Volume Gain (mL)
1	KOH	372	300	72
2	KOH	134	100	34
3	MT	20	0	20
4	SG			
5				
6				
7				
8				

Silica Gel	Final Weight (g)	Initial Weight (g)	Net Weight Gain (g)
	813.3	791.8	21.5

FORM FDF 4006.00

FIELD SAMPLING TRAIN MOISTURE SUMMARY

Company: BP
Location: Whiting, IN
Source: FCCU - 500 Run 1
Test Date: 6/13/11
USEPA Method: 0061
Parameter: Hex Chrom

Net Gain (mL or g)
149.0

Impinger No	Contents	Final Volume (mL)	Initial Volume (mL)	Net Volume Gain (mL)
1	KOH	358	300	58
2	KOH	146	100	46
3	MT	18	0	18
4	SG	813.6	786.6	27.0
5				
6				
7				
8				

Silica Gel	Final Weight (g)	Initial Weight (g)	Net Weight Gain (g)
	813.6	786.6	27.0

FORM FDF 4006.00

B-70

FIELD SAMPLING TRAIN MOISTURE SUMMARY

Company: BP
Location: Whiting, IN
Source: FCCU 502 Run 3
Test Date: 6/14/11
USEPA Method: 0061
Parameter: Hex Chrom

Net Gain (mL or g)
145.0

Impinger No	Contents	Final Volume (mL)	Initial Volume (mL)	Net Volume Gain (mL)
1	1COH	367	300	67
2	1COH	145	100	45
3	MT	14	0	14
4	SG			
5				
6				
7				
8				

Silica Gel	Final Weight (g)	Initial Weight (g)	Net Weight Gain (g)
	808.7	789.9	19.0

FORM FDF 4006.00

APPENDIX C

Analytical Data

August 9, 2011

Laboratory Case Narrative

Client: BP, Whiting, IN
Source(s): FCCU 500 Stack
Sampling Date(s): 8/2/11
Analyses: USEPA Methods 201A and 202
ARI Project #: 08-325

1) Sample Receipt

Fifteen (15) samples were received in good condition on 8/3/2011 and logged in for analysis. All sample receipt criteria were met.

2) Laboratory Analysis

The samples were analyzed following USEPA Methods 201A or 202, as requested.

3) QA/QC

All criteria as specified in USEPA Methods 201A and 202 were met.

4) Discussion

These are final results for your review. Any questions can be directed to Eric Vogt at ARI at (847) 487-1580 x116.

Respectfully submitted,

Eric Vogt
Lab Manager
ARI Environmental, Inc.
Wauconda, IL

C-2

ANALYTICAL SUMMARY

CLIENT: BP Whiting
LOCATION: Whiting, IN
SOURCE: FCCU 500
SAMPLE DATE: 8/2/2011
ANALYSIS: Particulates
METHOD: USEPA Method 201/202

Analyst: J. Ruggaber
Date of Completion: 8/9/2011
Template Control ID: USEPA-M201/202-PARTIC-TEMPLATE-62T-REV1

Identification		Solvent Mass (g)	Tare	WT1	WT2	WT 1 - WT 2 (mg)	Particulate (mg)	Blank Corrected Particulate (mg)
Run 4	FILTER	-	779.7	814.4	814.6	-0.20	34.80	-
	<PM 2.5	141.2	112873.8	112877.2	112877.4	-0.20	3.50	2.66
	>PM 2.5	48.7	115498.2	115504.9	115504.5	0.40	6.50	6.21
Run 5	FILTER	-	778.2	802.9	803.1	-0.20	24.80	-
	<PM 2.5	154.1	120430.7	120436.3	120436.5	-0.20	5.70	4.78
	>PM 2.5	44.7	123890.1	123900.4	123900.6	-0.20	10.40	10.13
Acetone Blank	Blank	142.5	115925.5	115926.2	115926.5	-0.30	0.85	-

Identification		Tare	WT1	WT2	WT 1 - WT 2 (mg)	Condensate (mg)
Run 4	Organic	110068.4	110070.8	110071.1	-0.30	2.55
Run 5	Organic	122026.1	122028.5	122028.4	0.10	2.35
Organic Blank	Organic	115181.6	115182.6	115182.7	-0.10	1.05

Identification		Tare	WT1	WT2	WT 1 - WT 2 (mg)	Condensate (mg)
Run 4	Inorganic	115352.4	115368.7	115368.3	0.40	16.10
Run 5	Inorganic	110074.0	110101.4	110101.3	0.10	27.35
DI Water Blank	Inorganic	114536.8	114537.6	114538.0	-0.40	1.00

Identification		Volume (mL)	Tare	WT1	WT2	WT 1 - WT 2 (mg)	Condensate (mg)	Target Weight (mg)	Accuracy	Pass/Fail
LCS	QC	100	116624.6	116714.3	116714.2	0.10	89.65	95.00	-5.6	PASS

Identification		Org. CPM (mg)	Inorg. CPM (mg)	Total CPM (mg)	Corrected CPM (mg)*
Run 4	TCPM	2.55	16.10	18.65	16.65
Run 5	TCPM	2.35	27.35	29.70	27.70
Blank	TCPM	1.05	1.00	2.05	-

*Since total value of the blanks was > 2.0, a value of 2.0 mg was used for the correction.

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN
FCU 500 Stack

Lab Project #: 08-325
Project Manager: Steve Flaherty
Received: 8/3/2011
Reported: 8/9/2011

Sample ID: < PM 2.5 Acetone PW 202-4
Lab Sample #: 0811001
Date Sampled: 08/02/2011
Field #: 43173

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	08/09/2011	2.66	mg	

Sample ID: < PM 2.5 Acetone PW 202-5
Lab Sample #: 0811002
Date Sampled: 08/02/2011
Field #: 40311

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	08/09/2011	4.78	mg	

Sample ID: > PM 2.5 Head Recovery 202-4
Lab Sample #: 0811003
Date Sampled: 08/02/2011
Field #: 43172

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	08/09/2011	6.21	mg	

Sample ID: > PM 2.5 Head Recovery 202-5
Lab Sample #: 0811004
Date Sampled: 08/02/2011
Field #: 40312

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	08/09/2011	10.13	mg	

Sample ID: 202-4 Container #1
Lab Sample #: 0811005
Date Sampled: 08/02/2011
Field #: 40308

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Inorganic Residue	USEPA Method 202	Joel Ruggaber	08/09/2011	16.10	mg	

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN
FCU 500 Stack

Lab Project #: 08-325
Project Manager: Steve Flaherty
Received: 8/3/2011
Reported: 8/9/2011

Sample ID: 202-5 Container #1
Lab Sample #: 0811006
Date Sampled: 08/02/2011
Field #: 40313

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Inorganic Residue	USEPA Method 202	Joel Ruggaber	08/09/2011	27.35	mg	

Sample ID: 202-4 Container #2
Lab Sample #: 0811007
Date Sampled: 08/02/2011
Field #: 40309

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Organic Residue	USEPA Method 202	Joel Ruggaber	08/09/2011	2.55	mg	

Sample ID: 202-5 Container #2
Lab Sample #: 0811008
Date Sampled: 08/02/2011
Field #: 35961

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Organic Residue	USEPA Method 202	Joel Ruggaber	08/09/2011	2.35	mg	

Sample ID: 202-4 PM filter
Lab Sample #: 0811011
Date Sampled: 08/02/2011
Field #: 43038

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	08/09/2011	34.80	mg	

Sample ID: 202-5 PM filter
Lab Sample #: 0811012
Date Sampled: 08/02/2011
Field #: 43037

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	08/09/2011	24.80	mg	

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN
FCU 500 Stack

Lab Project #: 08-325
Project Manager: Steve Flaherty
Received: 8/3/2011
Reported: 8/9/2011

Sample ID: Blank PW Acetone
Lab Sample #: 0811013
Date Sampled: 08/02/2011
Field #: 43176

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	08/09/2011	0.85	mg	

Sample ID: Blank DI H2O
Lab Sample #: 0811014
Date Sampled: 08/02/2011
Field #: 35962

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Inorganic Residue	USEPA Method 202	Joel Ruggaber	08/09/2011	1.00	mg	

Sample ID: Blank Hexane/Acetone
Lab Sample #: 0811015
Date Sampled: 08/02/2011
Field #: 35971

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Organic Residue	USEPA Method 202	Joel Ruggaber	08/09/2011	1.05	mg	

Notes: UA - Not a NELAC accredited analyte under this method.
NA - Sample not tested for this analyte.
D - Value calculated from dilution.
J - Value less than the low standard but above the Limit of Quantitation (LOQ).

USEPA METHOD 5 TASK SCHEDULE

Client: BP

Location: Whiting, IN

Project Manager: S. Flaherty

Date Sampled: 8/2/11

Lab Project #: 08-325

Spreadsheet Template ID: USEPA-M5-Template-051T-REV1

Analyst: J. Ruggaber

DATE	TIME	EQUIPMENT	TASK
8/3/11	16:00	Desiccator #2	Place labeled beakers in dessicator (store 24 hrs)
8/7/11	13:00	Desiccator #2	Place filters in dessicator (store min. 24 hours)
8/5/11	9:22	Ohaus Adventurer SL balance	Weigh conditioned beakers and record tares
8/5/11 – 8/7/11	-	-	Dry down probe washes in tared beakers
8/7/11	13:00	Desiccator #2	Place beakers in dessicator (store min. 24 hours)
8/8/11	15:34	Ohaus Adventurer SL balance	Beaker weighing #1
8/9/11	10:18	Ohaus Adventurer SL balance	Beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Beaker weighing #4 (min. 6 hrs after weighing #3)
8/8/11	15:34	Ohaus Adventurer SL balance	Filter weighing #1 (min. 24 hrs in dessicator)
8/9/11	10:18	Ohaus Adventurer SL balance	Filter weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Filter weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Filter weighing #4 (min. 6 hrs after weighing #3)
8/9/11	-	-	Prepare report
			Report QA review
			Report distribution

LCS Solution used: Sodium Chloride Solution: 0.0950 g/ 100 mL NaCl in DI water, 8/5/11

USEPA METHOD 202 TASK SCHEDULE

Client: BP

Location: Whiting, IN

Project Manager: S. Flaherty

Date Sampled: 8/2/11

Lab Project #: 08-325

Spreadsheet Template ID: USEPA-M201/202-PARTIC-TEMPLATE-62T-REV1

Analyst: J. Ruggaber

Reagent Information

Hexane Lot #106898, Fisher

Phenolphthalein Solution (if needed): N/A

0.1 N Ammonium Hydroxide Lot # (if needed): N/A

Sodium Chloride Solution: 0.0950 g/ 100 mL NaCl in DI water, 8/5/11

DATE	TIME	EQUIPMENT	TASK
8/3/11	16:00	Desiccator # 1	Label beakers for hexane rinse, imp samples, and LCS sample. Place beakers in dessicator (store 24 hrs).
8/5/11	9:22	Ohaus Adventurer SL balance	Weigh conditioned beakers and record tares.
8/5/11	10:00	-	Sonicate filter in water for at least two minutes. Add the water to the imp contents. Repeat 2 more times.
8/5/11	10:00	-	Sonicate filter in hexane for at least two minutes. Add the hexane to the hexane sample contents. Repeat 2 more times.
8/5/11	-	-	Extract the imp contents with 30 mL of hexane 3 times. Collect all hexane extractions in the labeled and tared hexane beaker. Add the hexane sample to the hexane extractions.
8/5/11	-	-	Drain the water phase into the labeled and tared beaker.
8/5/11-8/6/11	-	-	Evaporate hexane beakers to dryness in a fume hood.
8/5/11	16:46		Transfer 100 mL of the sodium chloride solution into the tared LCS beaker.

8/5/11 – 8/7/11	-	Oven #1	Place the water phase beakers and LCS sample in an oven or hot plate and evaporate to not less than 10 mL. Allow to evaporate to dryness in a fume hood at room temperature.
8/7/11	13:00	Desiccator #2	Place beakers in dessicator (store min. 24 hours)
8/8/11	15:34	Ohaus Adventurer SL Balance	Hexane beaker weighing #1
8/9/11	10:18	Ohaus Adventurer SL Balance	Hexane beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Hexane beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Hexane beaker weighing #4 (min. 6 hrs after weighing #3)
8/8/11	15:34	Ohaus Adventurer SL Balance	Water Phase and LCS beaker weighing #1
8/9/11	10:18	Ohaus Adventurer SL Balance	Water Phase and LCS beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Water Phase and LCS beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Water Phase and LCS beaker weighing #4 (min. 6 hrs after weighing #3)
If Water Phase Beakers achieve constant weight, skip this section			
N/A	N/A	N/A	Redissolve the residue from water phases in 100 mL of DI water. Add approximately 5 drops of phenolphthalein.
N/A	N/A	N/A	Titrate with 0.1 N ammonium hydroxide. Record the amount of ammonium hydroxide used.
N/A	N/A	N/A	Return the water phase beakers to the oven or hot plate and evaporate to not less than 10 mL. Allow to evaporate to dryness in a fume hood at room temperature.
N/A	N/A	N/A	Place beakers in dessicator (store min. 24 hours)
N/A	N/A	N/A	Water Phase beaker weighing #1
N/A	N/A	N/A	Water Phase beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Water Phase beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Water Phase beaker weighing #4 (min. 6 hrs after weighing #3)
End Section			
8/9/11	-	-	Prepare report
			Report QA review
			Report distribution

951 Old Rand Road, Unit 106
Wauconda, Illinois 60084

1710 Preston Road, Unit C
Pasadena, Texas 77503

SAMPLE RECEIPT CHECKLIST

Client Name: BP

Site Location: Whiting, IN

ARI Project Manager: S. Flaherty

Sample Collection Date(s): 8/2/11

Chain-of-Custody Number(s): 6749

Chain-of-Custody Form(s):

Custody release signatures, dates, and times present	Yes	No
Preservation code noted	Yes	No
Project information clearly identified	Yes	No
Sample information clearly identified	Yes	No
Analysis request clearly identified	Yes	No
Report tier level noted	Yes	No

Sample Containers:

Custody seal(s) applied and intact	Yes	No
Quantity of samples match number on COC	Yes	No
Container label ID numbers and descriptions match COC	Yes	No
All containers received in good condition	Yes	No
Liquid levels at marked heights on containers	Yes	No
All container labels are legible	Yes	No
All sample IDs are unique	Yes	No
Samples received in correct type of container	Yes	No
Samples received within the required holding time	Yes	No
Samples received under the required preservation code	Yes	No

Non-Conformances and/or Corrective Actions Applied:
All criteria for sample acceptance met

Samples Received by: Joel Ruggaber (Printed Name) _____ (Signature)

Date and Time Received: 8/4/11 11:46

Form LF0002

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6749

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP	Whiting, IN
Lab Project No. / Client Name		Location
Steve Flaherty		
ARI Project Manager		ARI Sampler Initials
Wauconda, IL		
Analysis Location (Wauconda or Pasadena)	"FCCU 500 Stack"	
ICR		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: USEPA Method 201A (PM2.5 only)	Analysis Request: USEPA Method 202	Comments
43173	8-2-11	≤PM2.5 (Acetone PW) 202-4	1	250W	1	X		
40311	↓	↓ 202-5	1	250W	1	X		
43172		≥PM2.5 (Head Recovery) 202-4	1	250W	1	X		
40312		↓ 202-5	1	250W	1	X		
40308		202-4 Container #1 (Imps + HI Rinses)	1	1000N	1		X	
40313		202-5 ↓ ↓	1	1000N	1		X	
40309		202-4 Container #2 (Organic Rinses)	1	250A	1		X	
X35961		202-5 ↓ ↓	1	250A	1		X	
40310		202-4 Container #3 (CPM Filter)	1	250A	1		X	
35922		202-5 ↓ ↓	1	250A	1		X	
43038		202-4 PM Filter ≤ pm2.5	1	Petri	1	X		
43037		202-5 ↓	1	Petri	1	X		
43176		Blank PW Acetone	1	250W	1	X		
35962		Blank DI H2O	1		1		X	
35971	↓	Blank Hexane (100mls) / Acetone (100mls)	1		1		X	

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments

Requested Analysis Completion Date: 8/10/11

Report Level: Tier I: Engineering / Tier II: Compliance (ICR) / Tier III: QAPP

Route Results Through: S. Flaherty

	(1)	(2)	(3)
Relinquished By	S. Flaherty		
Date / Time	8/3/11 @ 1010 hrs		
Company	ARI		
Received By			
Date / Time	8/4/11 11:46		
Company	ARI		

SHIPMENT: HAND CARRY / FEDX / UPS

Custody Seal Applied: Yes No

Form LF0001

ARI ENVIRONMENTAL, INC.

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

Chain of Custody Record 6749

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP	Whiting, IN
Lab Project No.	Client Name	Location
Steve Flaherty		
ARI Project Manager		ARI Sampler Initials
Wauconda, IL		
Analysis Location (Wauconda or Pasadena)	"FCCU 500 Stack"	
ICR		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: USEPA Method 201A ($PM_{2.5}$ only)	Analysis Request: USEPA Method 202	Analysis Request	Analysis Request	Comments
43173	8-2-11	≤ $PM_{2.5}$ (Acetone PW) 202-4	1	250 W	1	X				
40311	↓	202-5	1	250 W	1	X				
43172		> $PM_{2.5}$ (Head Recovery) 202-4	1	250 W	1	X				
40312		202-5	1	250 W	1	X				
40308		202-4 Container #1 (Impg + DI Rinses)	1	1000 N	1		X			
40313		202-5 ↓ ↓	1	1000 N	1		X			
40309		202-4 Container #2 (Organic Rinses)	1	250 A	1		X			
X35961		202-5 ↓ ↓	1	250 A	1		X			
40310		202-4 Container #3 (CPM Filter)	1	250 A	1		X			
35922		202-5 ↓ ↓	1	250 A	1		X			
43038		202-4 PM Filter & $PM_{2.5}$	1	Petri	1	X				
43037		202-5 ↓	1	Petri	1	X				
43176		Blank PW Acetone	1	250 W	1	X				
35962		Blank DI H_2O	1		1		X			
35971	↓	Blank Hexane (100 mls) / Acetone (100 mls)	1		1		X			

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	S. Flaherty			HAND CARRY
	(1) Date / Time: 8/3/11 @ 1010 Hrs	(2) Date / Time	(3) Date / Time	FEDX
	(1) Company: ARI	(2) Company	(3) Company	UPS
Requested Analysis Completion Date: 8/10/11	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering / Tier II: ICR Compliance / Tier III: QAPP	(1) Date / Time: 8/4/11 11:46	(2) Date / Time	(3) Date / Time	Yes No
Route Results Through: S. Flaherty	(1) Company: ARI	(2) Company	(3) Company	

C-11

Form LF0001

July 23, 2011

Laboratory Case Narrative

Client: BP, Whiting, IN
Source(s): FCCU 500
Sampling Date(s): 6/7 - 6/13/11
Analyses: USEPA Methods 5, 18, 26A & 201A/202
ARI Project #: 08-314

1) Sample Receipt

Fifty-three (53) samples were received in good condition on 6/15/2011 and logged in for analysis. All sample receipt criteria were met.

2) Laboratory Analysis

The samples were analyzed following USEPA Methods 5,18, 26A or 201A/202, as requested. Some samples were sent to DAT Inc. for USEPA Method 29 analysis after USEPA Method 5 particulate analysis was completed.

3) QA/QC

All criteria as specified in USEPA Methods 5, 18, 26A & 201A/202 were met.

4) Discussion

These are final results for your review. Any questions can be directed to Eric Vogt at ARI at (847) 487-1580 x116.

Respectfully submitted,

Eric Vogt
Lab Manager
ARI Environmental, Inc.
Wauconda, IL

ANALYTICAL SUMMARY

CLIENT: BP Whiting
LOCATION: Whiting, IN
SOURCE: FCCU 500
SAMPLE DATE: 6/9/11, 6/10/11, 6/13/11
ANALYSIS: Particulates
METHOD: USEPA Method 201/202

Analyst: J. Ruggaber
Date of Completion: 6/26/2011
Template Control ID: USEPA-M201/202-PARTIC-TEMPLATE-62T-REV1

Identification		Solvent Mass (g)	Tare	WT1	WT2	WT 1 - WT 2 (mg)	% difference	Particulate (mg)	Blank Corrected Particulate (mg)
Run 1	FILTER	-	795.5	838.1	838.2	-0.10	-0.01	42.65	-
	<PM 2.5	157.9	121816.5	121838.5	121838.2	0.30	0.00	21.85	21.38
	>PM 2.5	64.9	111547.5	111602.8	111602.8	0.00	0.00	55.30	55.11
Run 2	FILTER	-	781.1	948.2	949.0	-0.80	-0.08	167.50	-
	<PM 2.5	110.1	111260.8	111305.3	111305.6	-0.30	0.00	44.65	44.33
	>PM 2.5	39.4	105590.2	105613.7	105613.8	-0.10	0.00	23.55	23.43
Run 3	FILTER	-	786.5	844.9	844.8	0.10	0.01	58.35	-
	<PM 2.5	114.9	115102.1	115116.1	115116.4	-0.30	0.00	14.15	13.81
	>PM 2.5	45.6	113150.0	113168.0	113168.0	0.00	0.00	18.00	17.87
Filter Blank	FILTER	-	778.7	781.7	781.4	0.30	0.04	2.85	-
Acetone Blank	Blank	118.7	114039.5	114039.7	114040.0	-0.30	0.00	0.35	-

Identification		Tare	WT1	WT2	WT 1 - WT 2 (mg)	% difference	Condensate (mg)
Run 1	Organic	104018.0	104020.6	104020.8	-0.20	0.00	2.70
Run 2	Organic	114354.8	115038.9	115038.6	0.30	0.00	683.95
Run 3	Organic	115132.3	115504.8	115504.6	0.20	0.00	372.40
Acetone Blank	Organic	114039.5	114039.7	114040.0	-0.30	0.00	0.35
Hexane Blank	Organic	100973.0	100973.0	100973.0	0.00	0.00	0.00

Identification		Tare	WT1	WT2	WT 1 - WT 2 (mg)	% difference	Condensate (mg)
Run 1	Inorganic	111357.5	111404.9	111405.0	-0.10	0.00	47.45
Run 2	Inorganic	113222.5	113313.8	113313.4	0.40	0.00	91.10
Run 3	Inorganic	123790.2	123845.6	123845.1	0.50	0.00	55.15
DI Water Blank	Inorganic	119905.5	119906.0	119906.0	0.00	0.00	0.50

Identification		Volume (mL)	Tare	WT1	WT2	WT 1 - WT 2 (mg)	Condensate (mg)	Target Weight (mg)	Accuracy	Pass/Fail
LCS	QC	100	106900.0	106998.0	106998.2	-0.20	98.10	99.98	-1.9	PASS

CLIENT: BP Whiting
LOCATION: Whiting, IN
SOURCE: FCCU 500
SAMPLE DATE: 6/9/11, 6/10/11, 6/13/11
ANALYSIS: Particulates
METHOD: USEPA Method 201/202
Total Condensable Particulate Matter (TCPM)

Analyst: J. Ruggaber
Date of Completion: 6/26/2011
Template Control ID: USEPA-M201/202-PARTIC-TEMPLATE-62T-REV1

Identification		Org. CPM (mg)	Inorg. CPM (mg)	Total CPM (mg)	Corrected CPM (mg)
Run 1	TCPM	2.70	47.45	50.15	49.30
Run 2	TCPM	683.95	91.10	775.05	774.20
Run 3	TCPM	372.40	55.15	427.55	426.70
Blank	TCPM	0.35	0.50	0.85	-

USEPA METHOD 5 TASK SCHEDULE

(Task schedule being used for Method 201A)

Client: BP

Location: Whiting, IN

Project Manager: S. Flaherty

Date Sampled: 6/9/11, 6/10/11, 6/13/11

Lab Project #: 08-314

Spreadsheet Template ID: USEPA-M201/202-PARTIC-TEMPLATE-62T-REV1

Analyst: J. Ruggaber

DATE	TIME	EQUIPMENT	TASK
6/20/11	11:45	Desiccator #2	Place labeled beakers in dessicator (store 24 hrs)
6/20/11	11:45	Desiccator #1	Place filters in dessicator (store min. 24 hours)
6/21/11	16:46	Ohaus Adventurer SL balance	Weigh conditioned beakers and record tares
6/21/11-6/22/11	-	-	Dry down probe washes in tared beakers
6/22/11	8:30	Desiccator #2	Place beakers in dessicator (store min. 24 hours)
6/23/11	15:51	Ohaus Adventurer SL balance	Beaker weighing #1
6/24/11	9:48	Ohaus Adventurer SL balance	Beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Beaker weighing #4 (min. 6 hrs after weighing #3)
6/23/11	15:56	Ohaus Adventurer SL balance	Filter weighing #1 (min. 24 hrs in dessicator)
6/24/11	10:05	Ohaus Adventurer SL balance	Filter weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	Ohaus Adventurer SL balance	Filter weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Filter weighing #4 (min. 6 hrs after weighing #3)
7/22/11	-	-	Prepare report
			Report QA review
			Report distribution

LCS Solution used: Sodium Chloride Solution: 0.99975 g/L NaCl in DI water, 1/10/11

USEPA METHOD 202 TASK SCHEDULE

Client: BP

Location: Whiting, IN

Project Manager: S. Flaherty

Date Sampled: 6/9/11, 6/10/11, 6/13/11

Lab Project #: 08-314

Spreadsheet Template ID: USEPA-M201/202-PARTIC-TEMPLATE-62T-REV1

Analyst: J. Ruggaber

Reagent Information

Hexane Lot #106898, Fisher

Phenolphthalein Solution (if needed): N/A

0.1 N Ammonium Hydroxide Lot # (if needed): N/A

Sodium Chloride Solution: 0.99975 g/L NaCl in DI water, 1/10/11

DATE	TIME	EQUIPMENT	TASK
6/20/11	11:45	Desiccator # 1	Label beakers for hexane rinse, imp samples, and LCS sample. Place beakers in dessicator (store 24 hrs).
6/21/11	13:19	Ohaus Adventurer SL balance	Weigh conditioned beakers and record tares.
6/21/11	13:25	-	Sonicate filter in water for at least two minutes. Add the water to the imp contents. Repeat 2 more times.
6/21/11	13:45	-	Sonicate filter in hexane for at least two minutes. Add the hexane to the hexane sample contents. Repeat 2 more times.
6/21/11	-	-	Extract the imp contents with 30 mL of hexane 3 times. Collect all hexane extractions in the labeled and tared hexane beaker. Add the hexane sample to the hexane extractions.
6/21/11	-	-	Drain the water phase into the labeled and tared beaker.
6/21/11-6/23/11	-	-	Evaporate hexane beakers to dryness in a fume hood.
6/21/11	16:46		Transfer 100 mL of the sodium chloride solution into the tared LCS beaker.

6/21/11-6/23/11	-	Oven #1	Place the water phase beakers and LCS sample in an oven or hot plate and evaporate to not less than 10 mL. Allow to evaporate to dryness in a fume hood at room temperature.
6/23/11	8:45	Desiccator #2	Place beakers in dessicator (store min. 24 hours)
6/24/11	9:55	Ohaus Adventurer SL Balance	Hexane beaker weighing #1
6/26/11	21:55	Ohaus Adventurer SL Balance	Hexane beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Hexane beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Hexane beaker weighing #4 (min. 6 hrs after weighing #3)
6/24/11	9:55	Ohaus Adventurer SL Balance	Water Phase and LCS beaker weighing #1
6/26/11	21:55	Ohaus Adventurer SL Balance	Water Phase and LCS beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Water Phase and LCS beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Water Phase and LCS beaker weighing #4 (min. 6 hrs after weighing #3)
If Water Phase Beakers achieve constant weight, skip this section			
N/A	N/A	N/A	Redissolve the residue from water phases in 100 mL of DI water. Add approximately 5 drops of phenolphthalein.
N/A	N/A	N/A	Titrate with 0.1 N ammonium hydroxide. Record the amount of ammonium hydroxide used.
N/A	N/A	N/A	Return the water phase beakers to the oven or hot plate and evaporate to not less than 10 mL. Allow to evaporate to dryness in a fume hood at room temperature.
N/A	N/A	N/A	Place beakers in dessicator (store min. 24 hours)
N/A	N/A	N/A	Water Phase beaker weighing #1
N/A	N/A	N/A	Water Phase beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Water Phase beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Water Phase beaker weighing #4 (min. 6 hrs after weighing #3)
End Section			
7/22/11	-	-	Prepare report
			Report QA review
			Report distribution

ANALYTICAL SUMMARY

CLIENT: BP Whiting
LOCATION: Whiting, IN
SAMPLE DATES: 6/9/11, 6/10/11, 6/13/11
ANALYSIS: Particulates
METHOD: USEPA Methods 5

Analyst: J. Ruggaber
Date of Completion: 6/26/11
Template Control ID: USEPA-M5-Template-051T-REV1

Identification		Solvent Mass (g)	Tare	WT1	WT2	WT 1 - WT 2 (mg)	Particulate (mg)	Blank Corrected Particulate (mg)	Total M5 Particulate (mg)
Run 1	FILTER	-	792.5	880.9	880.6	0.30	88.25	-	107.80
	PW	129.9	111603.6	111623.0	111623.3	-0.30	19.55	19.55	-
Run 2	FILTER	-	795.0	904.0	904.1	-0.10	109.05	-	126.15
	PW	101.4	109226.5	109243.4	109243.8	-0.40	17.10	17.10	-
Run 3	FILTER	-	791.1	904.4	904.1	0.30	113.15	-	130.10
	PW	127.0	114209.8	114226.6	114226.9	-0.30	16.95	16.95	-
Acetone Blank	PW	117.6	120635.1	120635.0	120635.0	0.00	<0.10	-	-
Filter Blank	Filter	-	786.8	786.7	786.7	0.00	<0.10	-	-

		Volume	Tare	WT 1	WT 2	WT1 - WT2	Particulate	Target	% Recovery	PASS/FAIL
LCS sample	PW	100.0	106900.0	106998.0	106998.2	-0.20	98.10	99.98	98.12	PASS

USEPA METHOD 5 TASK SCHEDULE

Client: BP

Location: Whiting, IN

Project Manager: S. Flaherty

Date Sampled: 6/9/11, 6/10/11, 6/13/11

Lab Project #: 08-314

Spreadsheet Template ID: USEPA-M5-Template-051T-REV1

Analyst: J. Ruggaber

DATE	TIME	EQUIPMENT	TASK
6/20/11	11:45	Desiccator #2	Place labeled beakers in dessicator (store 24 hrs)
6/20/11	11:45	Desiccator #2	Place filters in dessicator (store min. 24 hours)
6/21/11	17:10	Ohaus Adventurer SL balance	Weigh conditioned beakers and record tares
6/21/11-6/22/11	-	-	Dry down probe washes in tared beakers
6/22/11	8:30	Desiccator #2	Place beakers in dessicator (store min. 24 hours)
6/23/11	15:45	Ohaus Adventurer SL balance	Beaker weighing #1
6/24/11	9:45	Ohaus Adventurer SL balance	Beaker weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Beaker weighing #4 (min. 6 hrs after weighing #3)
6/23/11	15:56	Ohaus Adventurer SL balance	Filter weighing #1 (min. 24 hrs in dessicator)
6/24/11	10:05	Ohaus Adventurer SL balance	Filter weighing #2 (min. 6 hrs after weighing #1)
N/A	N/A	N/A	Filter weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Filter weighing #4 (min. 6 hrs after weighing #3)
7/22/11	-	-	Prepare report
			Report QA review
			Report distribution

LCS Solution used: Sodium Chloride Solution: 0.99975 g/L NaCl in DI water, 1/10/11

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Acetone PW LTPM 2.5 run 1
Lab Sample #: 0611054
Date Sampled: 06/09/2011
Field #: 47376

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	21.38	mg	

Sample ID: Acetone PW LTPM 2.5 run 2
Lab Sample #: 0611056
Date Sampled: 06/10/2011
Field #: 47318

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	44.33	mg	

Sample ID: Acetone PW LTPM 2.5 run 3
Lab Sample #: 0611057
Date Sampled: 06/10/2011
Field #: 47323

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	13.81	mg	

Sample ID: Acetone Head Rinse GT PM 2.5 run 1
Lab Sample #: 0611058
Date Sampled: 06/09/2011
Field #: 31846

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	55.11	mg	

Sample ID: Acetone Head Rinse GT PM 2.5 run 2
Lab Sample #: 0611059
Date Sampled: 06/10/2011
Field #: 47379

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	23.43	mg	

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Acetone Head Rinse GT PM 2.5 run 3 **Date Sampled:** 06/10/2011
Lab Sample #: 0611060 **Field #:** 31875

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	17.87	mg	

Sample ID: CPM Organic run 1 **Date Sampled:** 06/09/2011
Lab Sample #: 0611067 **Field #:** 31863

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Organic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	2.70	mg	

Sample ID: CPM Organic run 2 **Date Sampled:** 06/10/2011
Lab Sample #: 0611068 **Field #:** 31868

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Organic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	683.95	mg	

Sample ID: CPM Organic run 3 **Date Sampled:** 06/10/2011
Lab Sample #: 0611069 **Field #:** 28699

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Organic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	372.40	mg	

Sample ID: Acetone blank **Date Sampled:** 06/13/2011
Lab Sample #: 0611070 **Field #:** 45700

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	0.35	mg	
Organic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	0.35	mg	

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: DI H20 Blank
Lab Sample #: 0611071
Date Sampled: 06/13/2011
Field #: 45701

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Inorganic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	0.50	mg	

Sample ID: Hexane blank
Lab Sample #: 0611072
Date Sampled: 06/13/2011
Field #: 45702

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Organic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	<0.10	mg	

Sample ID: Filter Blank
Lab Sample #: 0611074
Date Sampled: 06/13/2011
Field #: 45832

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	2.85	mg	

Sample ID: Filter run 1
Lab Sample #: 0611078
Date Sampled: 06/09/2011
Field #: 47585

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	42.65	mg	

Sample ID: Filter run 2
Lab Sample #: 0611079
Date Sampled: 06/10/2011
Field #: 47104

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	167.50	mg	

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Filter run 3
Lab Sample #: 0611080
Date Sampled: 06/10/2011
Field #: 47658

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	Method 201A	Joel Ruggaber	06/26/2011	58.35	mg	

Sample ID: Imp contents run 1
Lab Sample #: 0611081
Date Sampled: 06/09/2011
Field #: 31862

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Inorganic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	47.45	mg	

Sample ID: Imp contents run 2
Lab Sample #: 0611082
Date Sampled: 06/10/2011
Field #: 31869

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Inorganic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	91.10	mg	

Sample ID: Imp contents run 3
Lab Sample #: 0611083
Date Sampled: 06/10/2011
Field #: 31866

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Inorganic Residue	USEPA Method 202	Joel Ruggaber	06/26/2011	55.15	mg	

Sample ID: 0.1 N H2SO4 Imp run 1
Lab Sample #: 0611084
Date Sampled: 06/07/2011
Field #: 31982

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Hydrochloric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	1174.0	ug	

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Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Hydrofluoric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	58.0	ug	J

Sample ID: 0.1 N NaOH Imp run 1
Lab Sample #: 0611085
Date Sampled: 06/07/2011
Field #: 30441

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Chlorine	USEPA Method 26 & 26A	Joel Ruggaber	06/30/2011	129.0	ug	

Sample ID: 0.1 N H2SO4 Imp run 2
Lab Sample #: 0611086
Date Sampled: 06/08/2011
Field #: 30442

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Hydrochloric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	1032.0	ug	
Hydrofluoric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	47.0	ug	J

Sample ID: 0.1 N NaOH Imp run 2
Lab Sample #: 0611087
Date Sampled: 06/08/2011
Field #: 30443

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Chlorine	USEPA Method 26 & 26A	Joel Ruggaber	06/30/2011	139.0	ug	

Sample ID: 0.1 N H2SO4 Imp run 3
Lab Sample #: 0611088
Date Sampled: 06/08/2011
Field #: 30444

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Hydrochloric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	1547.0	ug	
Hydrofluoric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	42.0	ug	J

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Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: 0.1 N NaOH Imp run 3 **Date Sampled:** 06/08/2011
Lab Sample #: 0611089 **Field #:** 30446

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Chlorine	USEPA Method 26 & 26A	Joel Ruggaber	06/30/2011	272.0	ug	

Sample ID: 0.1 N H2SO4 Blank **Date Sampled:** 06/08/2011
Lab Sample #: 0611090 **Field #:** 30447

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Hydrochloric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	<234.0	ug	
Hydrofluoric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	<32.0	ug	

Sample ID: 0.1 N NaOH Blank **Date Sampled:** 06/08/2011
Lab Sample #: 0611091 **Field #:** 30448

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Chlorine	USEPA Method 26 & 26A	Joel Ruggaber	06/30/2011	<115.0	ug	

Sample ID: DI H2O Blank **Date Sampled:** 06/08/2011
Lab Sample #: 0611092 **Field #:** 30449

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Hydrochloric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	<234.0	ug	
Hydrofluoric Acid	Method 26 - HF & HCl	Joel Ruggaber	06/30/2011	<32.0	ug	

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Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Method 5 Filter run 1
Lab Sample #: 0611093
Date Sampled: 06/09/2011
Field #: 47586

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	88.25	mg	

Sample ID: Method 5 Filter run 2
Lab Sample #: 0611094
Date Sampled: 06/10/2011
Field #: 47588

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	109.05	mg	

Sample ID: Method 5 Filter run 3
Lab Sample #: 0611095
Date Sampled: 06/10/2011
Field #: 47583

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	113.15	mg	

Sample ID: Method 5 Probe Wash 1
Lab Sample #: 0611096
Date Sampled: 06/09/2011
Field #: 47374

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	19.55	mg	

Sample ID: Method 5 Probe Wash 2
Lab Sample #: 0611097
Date Sampled: 06/10/2011
Field #: 31872

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	17.10	mg	

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Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Method 5 Probe Wash 3
Lab Sample #: 0611098
Date Sampled: 06/10/2011
Field #: 47320

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	16.95	mg	

Sample ID: Method 5 Acetone blank
Lab Sample #: 0611099
Date Sampled: 06/13/2011
Field #: 45708

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	<0.10	mg	

Sample ID: Method 5 filter blank
Lab Sample #: 0611100
Date Sampled: 06/13/2011
Field #: 45639

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Particulate	USEPA Method 5	Joel Ruggaber	06/26/2011	<0.10	mg	

Sample ID: Unspiked Imp run 1
Lab Sample #: 0611101
Date Sampled: 06/07/2011
Field #: 36956

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	2881.0	ppmv	

Sample ID: Unspiked Tube #1 run 1
Lab Sample #: 0611102
Date Sampled: 06/07/2011
Field #: 36957

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	109.0	ppmv	

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Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Unspiked Tube #2 run 1
Lab Sample #: 0611103
Date Sampled: 06/07/2011
Field #: 36958

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	78.0	ppmv	

Sample ID: Spiked Imp run 1
Lab Sample #: 0611104
Date Sampled: 06/07/2011
Field #: 36959

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	3912.0	ppmv	

Sample ID: Spiked Tube #1 run 1
Lab Sample #: 0611105
Date Sampled: 06/07/2011
Field #: 45854

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	123.0	ppmv	

Sample ID: Spiked Tube #2 run 1
Lab Sample #: 0611106
Date Sampled: 06/07/2011
Field #: 45855

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	199.0	ppmv	

Sample ID: Unspiked Imp run 2
Lab Sample #: 0611107
Date Sampled: 06/08/2011
Field #: 45866

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	957.0	ppmv	

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Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Unspiked Tube #1 run 2
Lab Sample #: 0611108
Date Sampled: 06/08/2011
Field #: 45867

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	15.0	ppmv	

Sample ID: Unspiked Tube #2 run 2
Lab Sample #: 0611109
Date Sampled: 06/08/2011
Field #: 45868

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	3.0	ppmv	

Sample ID: Spiked Imp run 2
Lab Sample #: 0611110
Date Sampled: 06/08/2011
Field #: 45869

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	1230.0	ppmv	

Sample ID: Spiked Tube #1 run 2
Lab Sample #: 0611111
Date Sampled: 06/08/2011
Field #: 45870

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	68.0	ppmv	

Sample ID: Spiked Tube #2 run 2
Lab Sample #: 0611112
Date Sampled: 06/08/2011
Field #: 45871

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	29.0	ppmv	

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Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Unspiked Imp run 3
Lab Sample #: 0611113
Date Sampled: 06/08/2011
Field #: 45872

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	410.0	ppmv	

Sample ID: Unspiked Tube #1 run 3
Lab Sample #: 0611114
Date Sampled: 06/08/2011
Field #: 45863

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	24.0	ppmv	

Sample ID: Unspiked Tube #2 run 3
Lab Sample #: 0611115
Date Sampled: 06/08/2011
Field #: 45864

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	14.0	ppmv	

Sample ID: Spiked Imp run 3
Lab Sample #: 0611116
Date Sampled: 06/08/2011
Field #: 45875

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	255.0	ppmv	

Sample ID: Spiked Tube #1 run 3
Lab Sample #: 0611117
Date Sampled: 06/08/2011
Field #: 45862

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	37.0	ppmv	

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: 08-314
Project Manager: Steve Flaherty
Received: 6/17/2011
Reported:

Sample ID: Spiked Tube #2 run 3
Lab Sample #: 0611118
Date Sampled: 06/08/2011
Field #: 45865

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	50.0	ppmv	

Sample ID: H20 Blank
Lab Sample #: 0611119
Date Sampled: 06/08/2011
Field #: 45878

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	<0.2	ppmv	

Sample ID: MeOH Blank
Lab Sample #: 0611120
Date Sampled: 06/08/2011
Field #:

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	15.7	ppmv	

Sample ID: Tube Media blank
Lab Sample #: 0611121
Date Sampled: 06/08/2011
Field #: 45880

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	2.0	ppmv	

Sample ID: Tube Field blank
Lab Sample #: 0611122
Date Sampled: 06/08/2011
Field #: 45881

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methanol	USEPA Method 18	Eric Vogt	07/22/2011	3.3	ppmv	

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN

Lab Project #: **08-314**
Project Manager: **Steve Flaherty**
Received: 6/17/2011
Reported:

Notes: UA - Not a NELAC accredited analyte under this method.
NA - Sample not tested for this analyte.
D - Value calculated from dilution.
J - Value less than the low standard but above the Limit of Quantitation (LOQ).

Methods 201A/202

1 of 2

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6770

ARI ENVIRONMENTAL INC.
951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL INC.
1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY: 08-314	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY		SMF
ARI Project Manager		ARI Sampler Initials
Wauconda		
Analysis Location (Wauconda or Pasadena)		
ICR-Compliance		
Engineering or Compliance Test Samples		

Preservation Code
1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: USEPA Method 201A	USEPA Method 202	~~USEPA Method 5F~~ Not Preserved HMT 7-25-11		Comments
47376	6-9-11	Run 1 - Acetone ProbeWash (PW) < PM2.5	1	250 wide	1	X				
47318	6-10-11	Run 2 - Acetone PW < PM2.5	1	250 wide	1	X				
47323	6-10-11	Run 3 - Acetone PW < PM2.5	1	250 wide	1	X				
31846	6-9-11	Run 1 - Acetone Head Rinse > PM2.5	1	250 wide	1	X				
47379	6-10-11	Run 2 - Acetone Head Rinse > PM2.5	1	250 wide	1	X				
31875	6-10-11	Run 3 - Acetone Head Rinse > PM2.5	1	250 wide	1	X				
31845	6-9-11	Run 1 - ΔI Rinse < PM2.5	1	250 wide	1			X		
47319	6-10-11	Run 2 - ΔI Rinse < PM2.5	1	250 wide	1			X		
47324	6-10-11	Run 3 - ΔI Rinse < PM2.5	1	250 wide	1			X		
31865	6-9-11	Run 1 - ΔI Rinse > PM2.5	1	250 wide	1			X		
31867	6-10-11	Run 2 - ΔI Rinse > PM2.5	1	250 wide	1			X		
31874	6-10-11	Run 3 - ΔI Rinse > PM2.5	1	250 wide	1			X		
31863	6-9-11	Run 1 - CPM Organic Rinses	1	250 amber	1		X			Acetone & Hexane
31868	6-10-11	Run 2 - CPM Organic Rinses	1	250 amber	1		X			Acetone & Hexane
28699	6-10-11	Run 3 - CPM Organic Rinses	1	250 amber	1		X			Acetone & Hexane

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time: 6/15/11 @ 1330	(2) Date / Time	(3) Date / Time	HAND CARRY
	(1) Company: ARI	(2) Company	(3) Company	FEDX
Requested Analysis Completion Date: 7-7-11	(1) Received By	(2) Received By	(3) Received By	UPS
Report Level: Tier I: Engineering; Tier II: ICR Compliance; Tier III: QAPP	(1) Date / Time: 6/16/11 14:30	(2) Date / Time	(3) Date / Time	Custody Seal Applied
Route Results Through: S. Flaherty	(1) Company: ARI	(2) Company	(3) Company	Yes No

Form LF0001

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Methods 201A/202
2 of 2

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6769

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY		
08-314	BP-Whiting	Whiting IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY		SMF
ARI Project Manager		ARI Sampler Initials
Wauconda		
Analysis Location (Wauconda or Pasadena)		
ICR - Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: USEPA Method 201A	Analysis Request: USEPA Method 202			Comments
45700	6-13-11	BLANK - Acetone	1	2D Vial	1	X	X			
45701	6-13-11	BLANK - DI H_2O	1	500 Vial	1		X			
45702	6-13-11	BLANK - Hexane	1	2D Vial	1		X			
45703	6-13-11	BLANK - CPM Filter	1	Petri	1		X			
45832	6-13-11	BLANK - 201A Filter	1	Petri	1	X				
31864	6-9-11	Run 1 - CPM Filter	1	Petri	1		X			
31870	6-10-11	Run 2 - CPM Filter	1	Petri	1		X			
31873	6-10-11	Run 3 - CPM Filter	1	Petri	1		X			
47585	6-9-11	Run 1 - 201A Filter	1	Petri	1	X				
47104	6-10-11	Run 2 - 201A Filter	1	Petri	1	X				
47658	6-10-11	Run 3 - 201A Filter	1	Petri	1	X				
31862	6-9-11	Run 1 - Imp Contents	1	1000mL	1		X			
31869	6-10-11	Run 2 - Imp Contents	1	1000mL	1		X			
31866	6-10-11	Run 3 - Imp Contents	1	1000mL	1		X			

Preservation Code
1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time 6/15/11 @ 1330	(2) Date / Time	(3) Date / Time	(HAND CARRY)
	(1) Company ARI	(2) Company	(3) Company	FEDX
				UPS
Requested Analysis Completion Date: 7-7-11	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering (Tier II: ICR Compliance) Tier III: QAPP	(1) Date / Time 6/16/11 14:30	(2) Date / Time	(3) Date / Time	(Yes) No
Route Results Through: S. Flaherty	(1) Company ARI	(2) Company	(3) Company	

Form LF0001

Methods 5/29

1 of 2

ARI ENVIRONMENTAL, INC.

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

Chain of Custody Record 6783

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY		
08-314	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY		EMF
ARI Project Manager		ARI Sampler Initials
ARI-Wauconda & ALS		
Analysis Location (Wauconda or Pasadena)		
ICR-Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: USEPA Method 5	Analysis Request: USEPA Method 29 (We Hg)	Analysis Request	Analysis Request	Comments
47586	6-9-11	Run 1 - Filter	1	Petri	1	X	X			
47588	6-10-11	Run 2 - Filter	1	Petri	1	X	X			
47583	6-10-11	Run 3 - Filter	1	Petri	1	X	X			
47375	6-9-11	Run 1 - Nitric Rinse	1	500ml	1		X			
47378	6-10-11	Run 2 - Nitric Rinse	1	500ml	1		X			
47321	6-10-11	Run 3 - Nitric Rinse	1	500ml	1		X			
31861	6-9-11	Run 1 - Imp Contents	1	1000ml	1		X			
31871	6-10-11	Run 2 - Imp Contents	1	1000ml	1		X			
47735	6-10-11	Run 3 - Imp Contents	1	1000ml	1		X			
47374	6-9-11	Run 1 - Acetone Probe Wash (PW)	1	250wide	1	X				
31872	6-10-11	Run 2 - Acetone PW	1	250wide	1	X				
47320	6-10-11	Run 3 - Acetone PW	1	250wide	1	X				

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments

Requested Analysis Completion Date: 7-14-11

Report Level: Tier I: Engineering | Tier II: ICR Compliance | Tier III: QAPP

Route Results Through: S. Flaherty (ARI)

	(1)	(2)	(3)
Relinquished By			
Date / Time	6/15/11 @ 1330		
Company	ARI		
Received By			
Date / Time	6/16/11 14:30		
Company	ARI		

SHIPMENT: (HAND CARRY) FEDX UPS

Custody Seal Applied (Yes) No

Form LF0001

C-35

Methods 5/29
2 of 2

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6784

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY		
08-314	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY		SMW
ARI Project Manager		ARI Sampler Initials
ARI-Wauconda & ALS		
Analysis Location (Wauconda or Pasadena)		
ICR-Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: USEPA Methods 5	Analysis Request: USEPA Methods 29 (no Hg)	Analysis Request	Analysis Request	Comments
45707	6-13-11	BLANK-5% Nitric/10% H_2O_2	1	1000 Nalgene	1		X			
45708	6-13-11	BLANK- Acetone	1	Beaker	1	X				
45639	6-13-11	BLANK- Filter	1	Petri	1	X	X			
45641	6-13-11	BLANK- 0.10% Nitric	1	1000 Nalgene	1		X			

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time: 6/15/11 @ 1330	(2) Date / Time	(3) Date / Time	HAND CARRY
	(1) Company: ARI	(2) Company	(3) Company	FEDX
				UPS
Requested Analysis Completion Date: 7-14-11	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering; Tier II: ICR Compliance; Tier III: QAPP	(1) Date / Time: 6/16/11 14:30	(2) Date / Time	(3) Date / Time	Yes / No
Route Results Through: S.Flaherty (ARI)	(1) Company: ARI	(2) Company	(3) Company	

Form LF0001

951 Old Rand Road, Unit 106
Wauconda, Illinois 60084

1710 Preston Road, Unit C
Pasadena, Texas 77503

SAMPLE RECEIPT CHECKLIST

Client Name: BP Whiting

Site Location: Whiting, In

ARI Project Manager: S. Flaherty

Sample Collection Date(s): 6/8/11 - 6/10/11, 6/13/11

Chain-of-Custody Number(s): 6738, 6769, 6770, 6783, 6784

Chain-of-Custody Form(s):

Custody release signatures, dates, and times present	Yes	No
Preservation code noted	Yes	No
Project information clearly identified	Yes	No
Sample information clearly identified	Yes	No
Analysis request clearly identified	Yes	No
Report tier level noted	Yes	No

Sample Containers:

Custody seal(s) applied and intact	Yes	No
Quantity of samples match number on COC	Yes	No
Container label ID numbers and descriptions match COC	Yes	No
All containers received in good condition	Yes	No
Liquid levels at marked heights on containers	Yes	No
All container labels are legible	Yes	No
All sample IDs are unique	Yes	No
Samples received in correct type of container	Yes	No
Samples received within the required holding time	Yes	No
Samples received under the required preservation code	Yes	No

Non-Conformances and/or Corrective Actions Applied:
All criteria for sample acceptance met.

Samples Received by: Joel Ruggaber (Printed Name) _____ (Signature)

Date and Time Received: 6/16/11 14:30

Form LF0002

BP, Whiting, IN, FCCU 500, Methanol, Method 18 - 6/7 - 6/8/11

C-38

Calibration Curve Calculation

Std. (ppm)	Pre Cal 1 (area counts)	Pre Cal 2 (area counts)	Pre Cal 3 (area counts)	Average (area counts)	Post Cal 1 (area counts)	Post Cal 2 (area counts)	Post Cal 3 (area counts)	Average (area counts)	Pre-Post Average (%)	Pre-Post Deviation (%)
2.0	6.47	6.12	6.71	6.43						
5.0	15.90	16.53	16.82	16.42						
10.0	30.69	30.96	31.03	30.89						
24.9	75.15	78.38	78.04	77.19	80.43	79.51	82.26	80.73	78.96	2.2
49.8	135.57	133.48	138.57	135.87						
99.7	282.49	281.57	273.06	279.04						
199.3	542.42	561.22	556.30	553.32						

Sample Concentration Calculations

Location Description	Analysis 1 (area counts)	Analysis 2 (area counts)	Analysis 3 (area counts)	Average (area counts)	concentration (µg/ml)	Volume (mls)	Mass (µg)
Run 1 Imp Unspiked	324.20	320.33	317.63	320.72	115.23	25	2,881
Run 1 Tube 1 No Spike	78.28	71.24	77.20	75.57	27.15	4	109
Run 1 Tube 2 No Spike	58.11	54.45	50.57	54.38	19.54	4	78
Run 1 Imp Spiked	436.72	434.43	435.25	435.47	156.46	25	3,912
Run 1 Tube 1 Spiked	85.85	85.74	84.52	85.37	30.67	4	123
Run 1 Tube 2 Spiked	145.44	136.70	133.20	138.44	49.74	4	199
Run 2 Imp Unspiked	106.61	107.48	105.44	106.51	38.27	25	957
Run 2 Tube 1 No Spike	11.34	10.77	10.07	10.73	3.85	4	15
Run 2 Tube 2 No Spike	2.09	2.14	1.94	2.06	0.74	4	3
Run 2 Imp Spiked	135.61	138.81	136.28	136.90	49.19	25	1,230
Run 2 Tube 1 Spiked	47.68	46.97	46.79	47.15	16.94	4	68
Run 2 Tube 2 Spiked	22.90	19.54	19.07	20.50	7.37	4	29
Run 3 Imp Unspiked	45.95	44.86	46.09	45.63	16.40	25	410
Run 3 Tube 1 No Spike	16.31	15.52	18.49	16.77	6.03	4	24
Run 3 Tube 2 No Spike	9.97	8.55	9.86	9.46	3.40	4	14
Run 3 Imp Spiked	27.95	28.89	28.21	28.35	10.19	25	255
Run 3 Tube 1 Spiked	30.78	19.76	25.89	25.47	9.15	4	37
Run 3 Tube 2 Spiked	36.66	35.74	32.70	35.03	12.59	4	50
Water Blank	<0.46	<0.46	<0.46	<0.46	<0.165	-	-
Spike Imp Solution	42.50	43.94	44.81	43.75	15.72	-	-
3% n-propanol Blank	1.73	1.92	1.99	1.88	0.68	-	-
Field Tube Blank	2.21	2.37	2.21	2.26	0.81	4	3.3
Tube Media Blank	1.37	1.58	1.28	1.41	0.51	4	2.0

Standards Average for Calibration

Conc. Ug/ml	Peak Area	RF	%dev
2.0	6.432	3.2271	7.4
5.0	16.416	3.2945	9.7
10.0	30.892	3.0997	3.2
24.9	77.192	3.0982	3.2
49.8	135.872	2.7284	-9.2
99.7	279.041	2.7999	-6.8
199.3	553.315	2.7760	-7.6
	mean RF-----	3.0034	

BP, Whiting, IN, FCCU 500, Methanol, Method 18 - 6/7 - 6/8/11

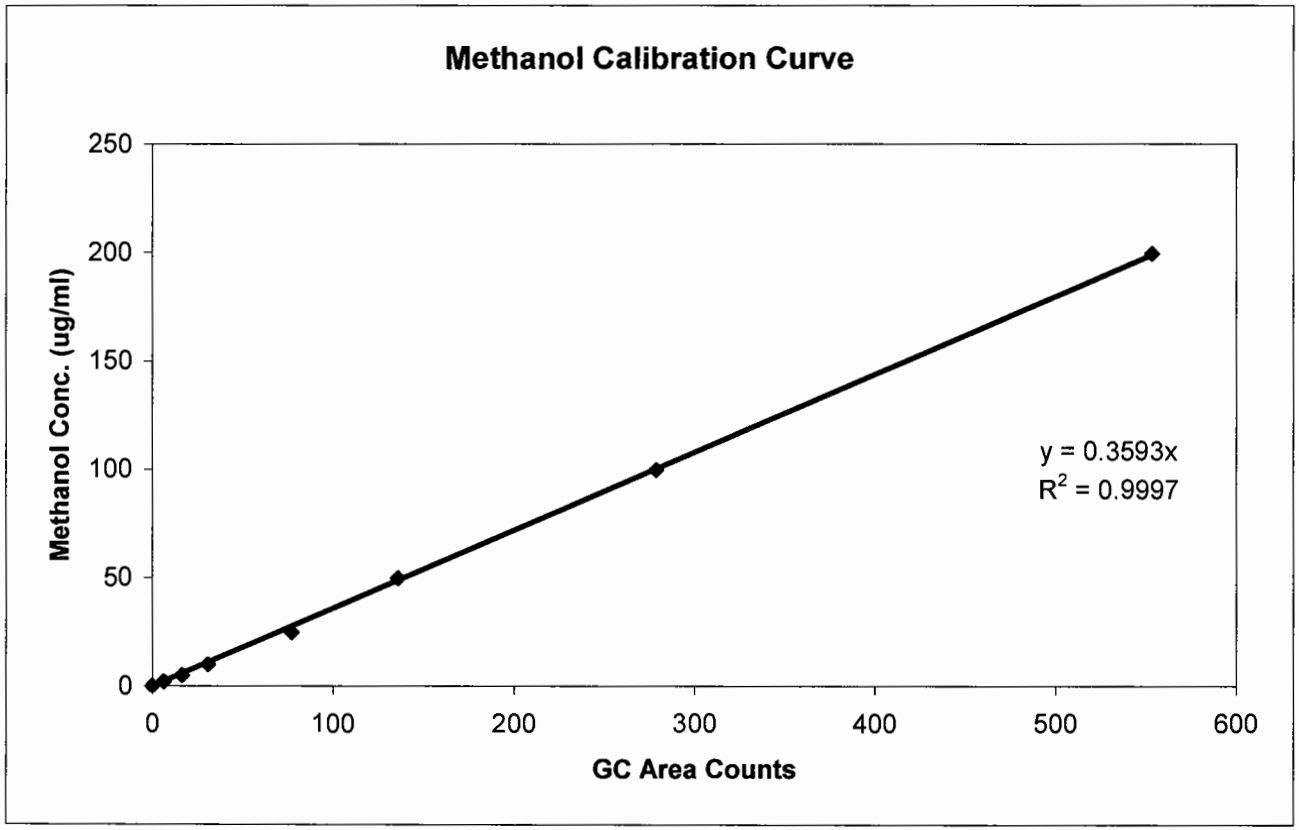
Sample Description	Analysis 1 (area counts)	Analysis 2 (area counts)	Analysis 3 (area counts)	Average (area counts)	concentration (µg/ml)	Certified (µg/ml)	% Difference	Acceptable
Secondary 25 ppm Standard	85.39	83.65	83.92	84.32	30.30	24.92	21.6	Yes

Sample Description	Analysis (area counts)	Pre Cal Average	% Difference
25 ppm Check Standard #56	75.87	77.19	-1.7
25 ppm Check Standard #78	72.93	77.19	-5.5
25 ppm Check Standard #119	78.71	77.19	2.0
25 ppm Check Standard #135	73.70	77.19	-4.5

Spike Amounts (µg): Imps: 316
Tubes: 1.8

Analyst: E. Vogt
Date: 7/22/11

Template Control ID: USEPA-M18-SORBENT-TEMPLATE-64T-REV1



USEPA METHOD 18 , ASTM 1945/1946 TASK SCHEDULE

Client: BP

Location: Whiting, IN

Project Manager: Steve Flaherty

Date Sampled: 6/7 – 6/8/11

Lab Project #: 08-314

Spreadsheet Template ID: USEPA-M18-SORBANT-TEMPLATE-64T-REV1

Analyst: E. Vogt

Reagents

Hydrogen Gas Manufacturer and Lot: Air Liquide Cylinder # K011471

Helium Gas Manufacturer and Lot: Air Liquide Cylinder # IO002919

Air Manufacturer and Lot: ALM042528

Nitrogen Manufacturer and Lot: N/A

Standard Identification

1) 996.6 µg/ml MeOH Stock Standard made from Fisher Purge & Trap Grade Lot #064748

2) 2.0 µg/ml MeOH

3) 5.0 µg/ml MeOH

4) 10.0 µg/ml MeOH

5) 24.9 µg/ml MeOH

6) 49.8 µγ/ml MeOH

7) 99.7 µg/ml MeOH

8) 199.3 µg/ml MeOH

9)_____

Secondary standard: 996.6 µg/ml MeOH Stock Standard made from Fisher Purge & Trap Grade Lot #104737, then diluted to 24.9 µg/ml

DATE	EQUIPMENT	TASK
7/12/11	SRI GC #3	Equilibrate the instrument until a stable baseline is achieved.
7/12 – 7/13/11	SRI GC #3	Inject each compound to be analyzed once. Establish the retention time windows for each compound. Adjust GC conditions if needed to ensure separation.
7/13 – 7/14/11	SRI GC #3	Inject each standard in triplicate. Ensure that each standard agrees within 5% of the mean of the three injections. Plot the standard injection areas against calibration standard concentrations to determine an initial calibration curve.
7/14 – 7/15/11	SRI GC #3	Inject each sample in triplicate.
N/A	SRI GC #3	If necessary, dilute samples if the peak areas are greater than the highest standard and re-inject in triplicate.
7/14 – 7/15/11	SRI GC #3	Inject the midpoint standard and a blank once after every 20 sample injections. Check that the midpoint standard is within 10% of the value generated by the initial calibration curve.
7/15/11	SRI GC #3	Inject each secondary standard in triplicate at the end of the run.
7/21/11		For each analyte, plot the average of the standard injections against calibration standard concentrations to determine a final calibration curve.
7/21/11		Determine the concentrations of each analyte in each sample using the calibration curve.
7/22/11		Prepare report
7/26/11		Report QA review
7/26/11		Report distribution

M308
1 of 2

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6735

C-42

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY		SWF
ARI Project Manager		ARI Sampler Initials
ALS Wauconda		
Analysis Location (Wauconda or Pasadena)		
Compliance - ICR		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: M18 M308-ICR				Comments
36956	6-7-11	Run 1 - Unspiked Imp Contents	1	20ml vial	2	X				
36957	6-7-11	- Tube #1	1	tube	2	X				
36958	6-7-11	- Tube #2	1	tube	2	X				
36959	6-7-11	Run 1 - Spiked Imp Contents	1	20ml	2	X				
45854	6-7-11	- Tube #1 - Spiked	1	tube	2	X				
45855	6-7-11	- Tube #2	1	tube	2	X				
45866	6-8-11	Run 2 - Unspiked Imp Contents	1	20ml	2	X				
45867	6-8-11	- Tube #1	1	tube	2	X				
45868	6-8-11	- Tube #2	1	tube	2	X				
45869	6-8-11	Run 2 - Spiked Imp Contents	1	20ml	2	X				
45870	6-8-11	- Tube #1 - Spiked	1	Tube	2	X				
45871	6-8-11	- Tube #2	1	tube	2	X				
45872	6-8-11	Run 3 - Unspiked Imp Contents	1	20ml	2	X				
45863	6-8-11	- Tube #1	1	tube	2	X				Sample No. 45863
45864	6-8-11	- Tube #2	1	tube	2	X				Sample No. 45864

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time 6/10/11 / 2045	(2) Date / Time	(3) Date / Time	HAND CARRY
	(1) Company ARI	(2) Company	(3) Company	FEDX
Requested Analysis Completion Date: 6-30-11	(1) Received By	(2) Received By	(3) Received By	UPS
Report Level: Tier I: Engineering Tier II: Compliance ICR Tier III: QAPP	(1) Date / Time 6/15/11 14:44	(2) Date / Time	(3) Date / Time	Custody Seal Applied
Route Results Through: S. Flaherty (ARI)	(1) Company ARI	(2) Company	(3) Company	Yes No

Form LF0001

M308
2 of 2

ARI ENVIRONMENTAL, INC.

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

Chain of Custody Record 6736

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY		1 INF
ARI Project Manager		ARI Sampler Initials
ALS not Wauconda		
Analysis Location (Wauconda or Pasadena)		
Compliance - ICR		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: M18 (SVOC) M308-ICR				Comments
45875	6-8-11	Run 3 - Spiked Imp Contents	1	20ml	2	X				
45862	6-8-11	Run 3 - Tube #1 - Spiked	1	tube	2	X				Sample No. 45862
45865	6-8-11	Run 3 - Tube #2 - Spiked	1	tube	2	X				Sample No. 45865
45878	6-8-11	H_2O Blank	1	20ml	2	X				
45879	6-8-11	MeOH Blank	1	20ml	2	X				
45880	6-8-11	Tube - media blank	1	tube	2	X				
45881	6-8-11	Tube - field blank	1	tube	2	X				

Preservation Code
1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments

Requested Analysis Completion Date: 6-30-11

Report Level: Tier I: Engineering; Tier II: ICR (Compliance); Tier III: QAPP

Route Results Through: S. Flaherty (ARI)

	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By
	(1) Date / Time: 6/10/11 2045	(2) Date / Time	(3) Date / Time
	(1) Company: ARI	(2) Company	(3) Company
	(1) Received By	(2) Received By	(3) Received By
	(1) Date / Time: 6/15/11 14:44	(2) Date / Time	(3) Date / Time
	(1) Company: ARI	(2) Company	(3) Company

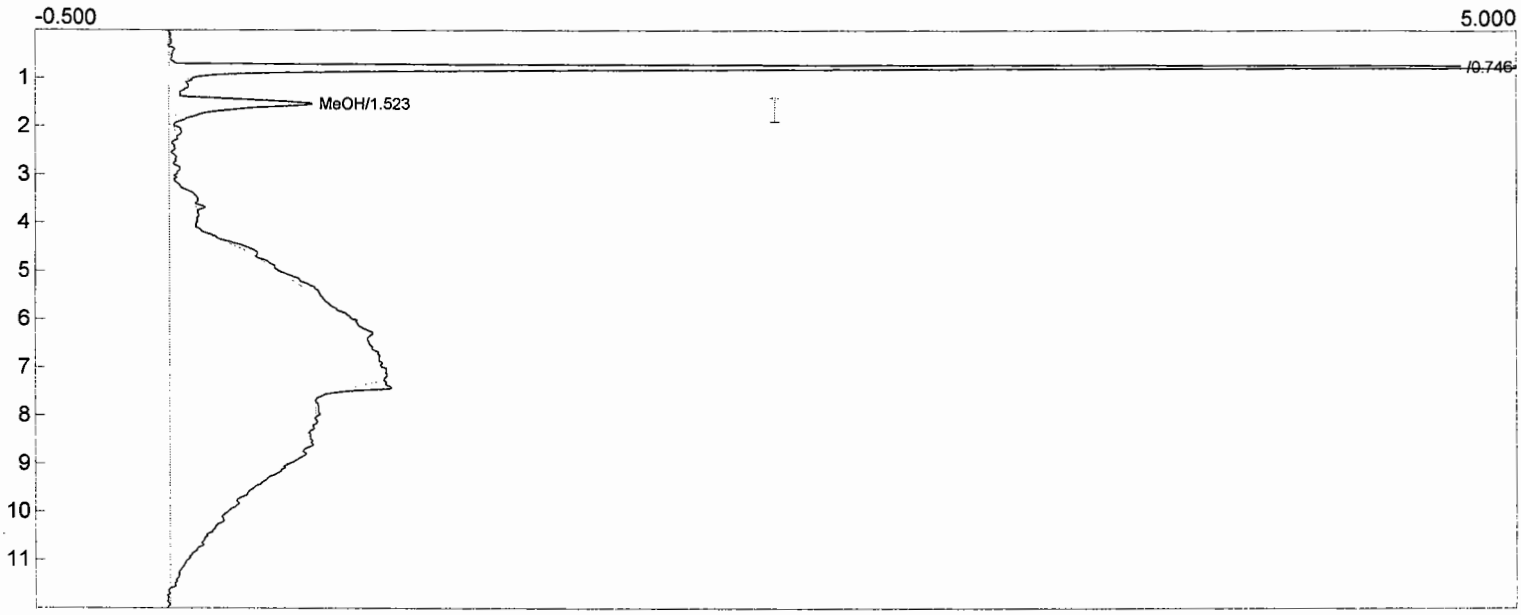
SHIPMENT: (HAND CARRY) FEDX UPS

Custody Seal Applied: Yes No

Form LF0001

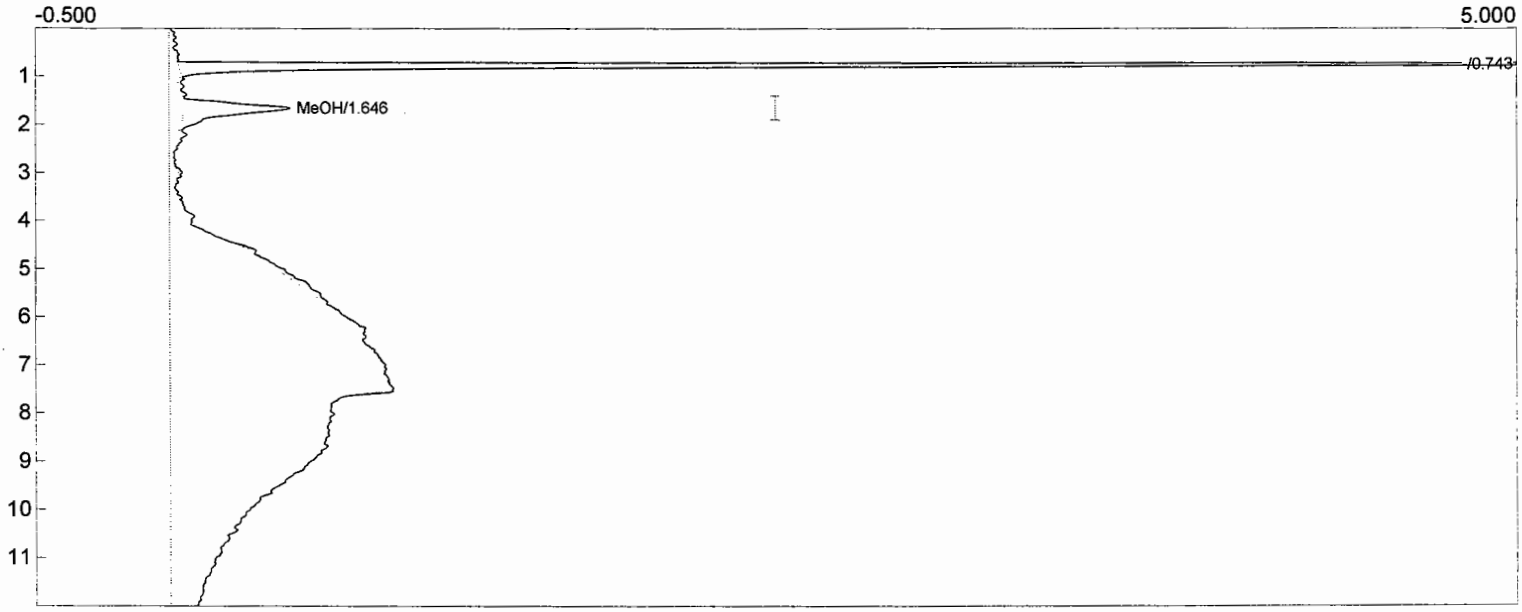
C-43

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 11:41:18
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR07.CHR ()
Sample: 2.0 ppm MeOH - pre
Operator: E. Vogt



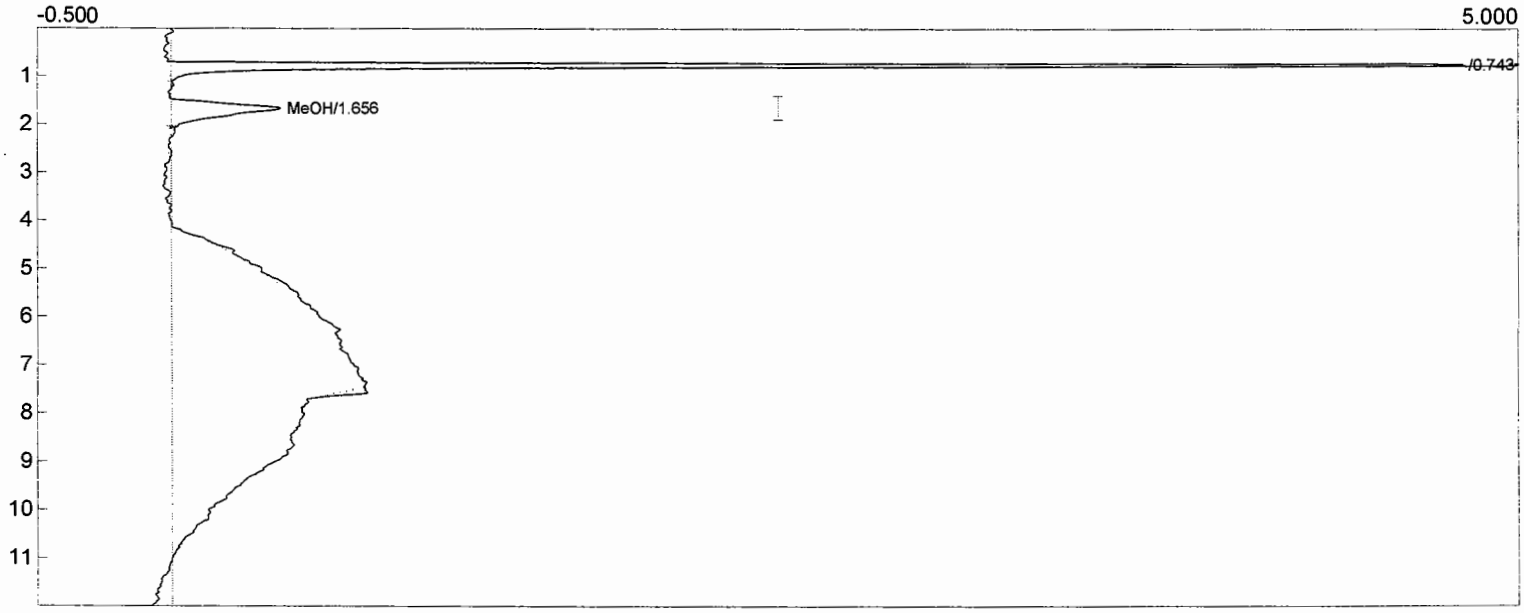
Component	Retention	Area
MeOH	1.523	6.4671
		6.4671

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 12:06:47
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR08.CHR ()
Sample: 2.0 ppm MeOH - pre
Operator: E. Vogt



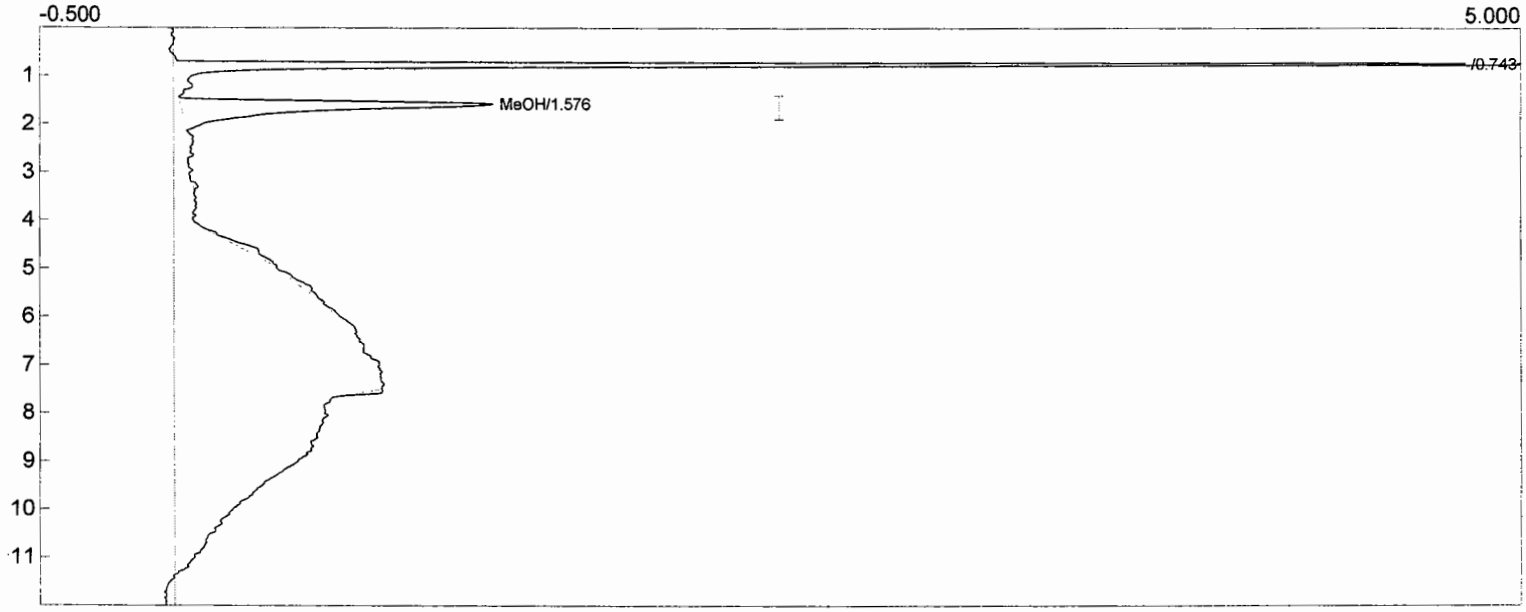
Component	Retention	Area
MeOH	1.646	6.1176
		6.1176

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 12:35:26
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR09.CHR ()
Sample: 2.0 ppm MeOH - pre
Operator: E. Vogt



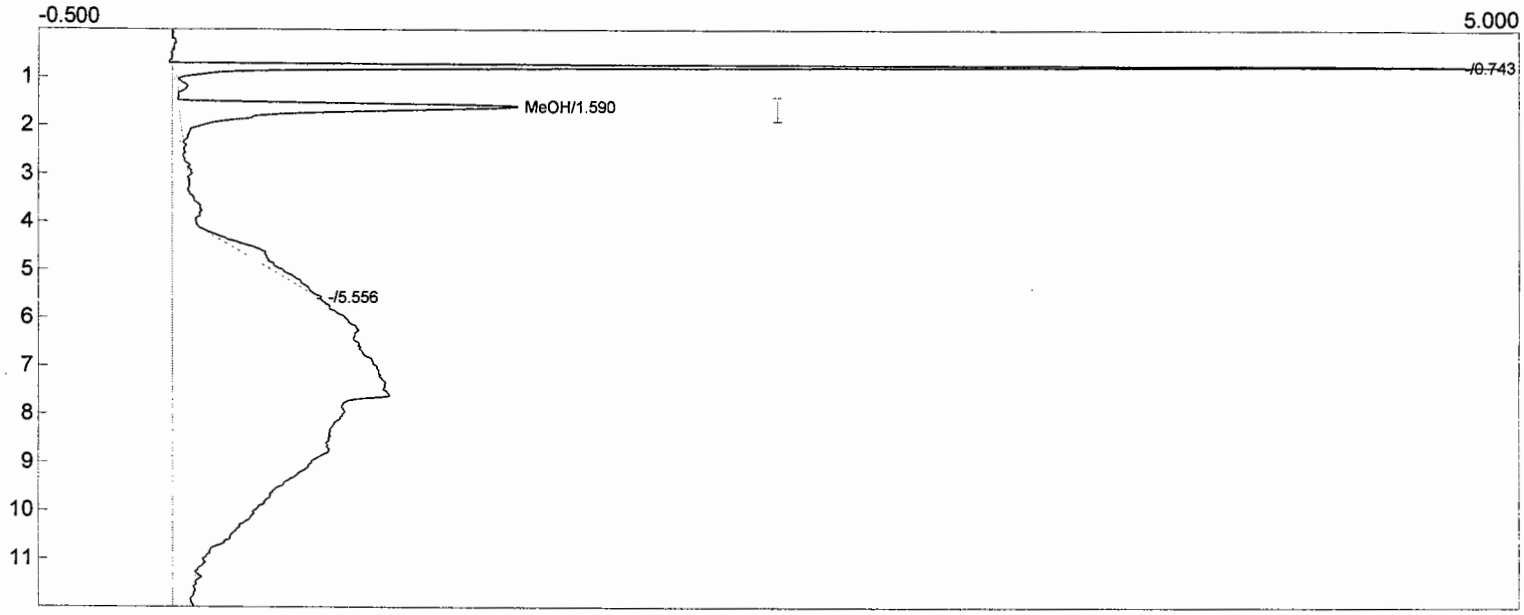
Component	Retention	Area
MeOH	1.656	6.7120
		6.7120

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 13:45:42
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR11.CHR ()
Sample: 5.0 ppm MeOH - pre
Operator: E. Vogt



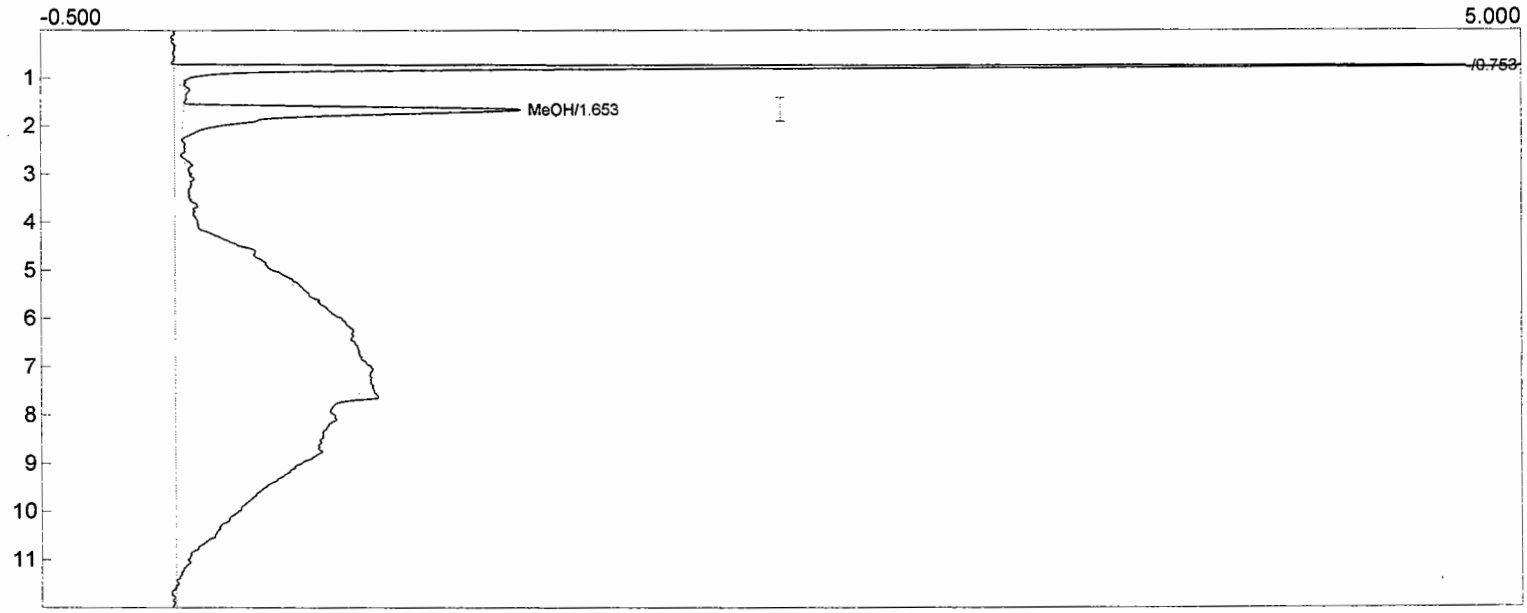
Component	Retention	Area
MeOH	1.576	15.8983
		15.8983

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 14:02:09
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR12.CHR ()
Sample: 5.0 ppm MeOH - pre
Operator: E. Vogt



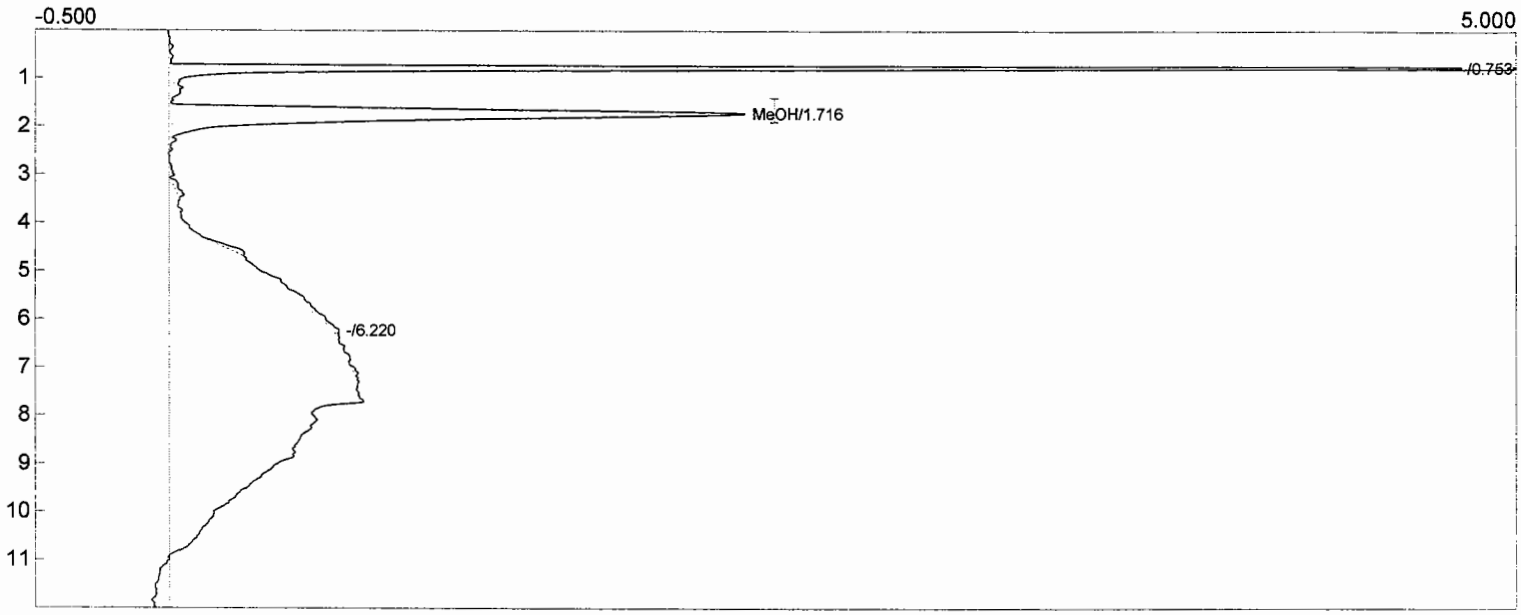
Component	Retention	Area
MeOH	1.590	16.5306
		16.5306

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 14:18:33
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR13.CHR ()
Sample: 5.0 ppm MeOH - pre
Operator: E. Vogt



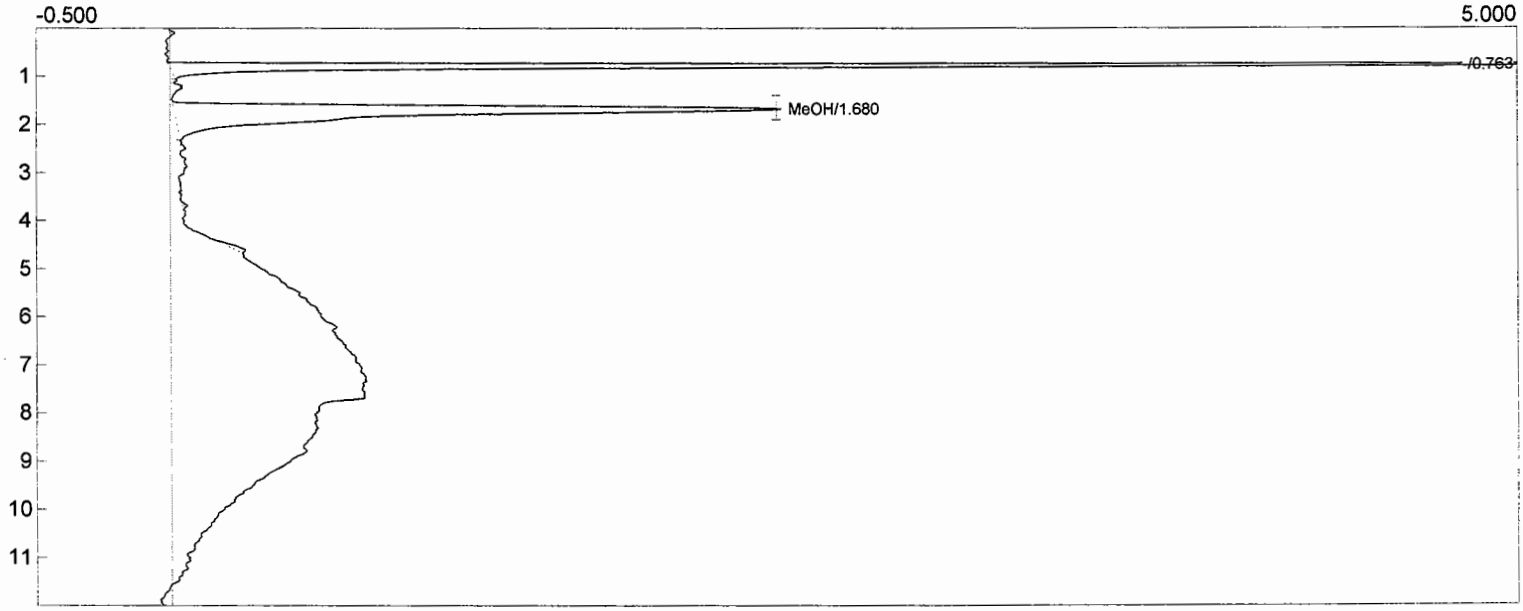
Component	Retention	Area
MeOH	1.653	16.8202
		16.8202

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 14:34:58
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR14.chr ()
Sample: 10.0 ppm MeOH - pre
Operator: E. Vogt



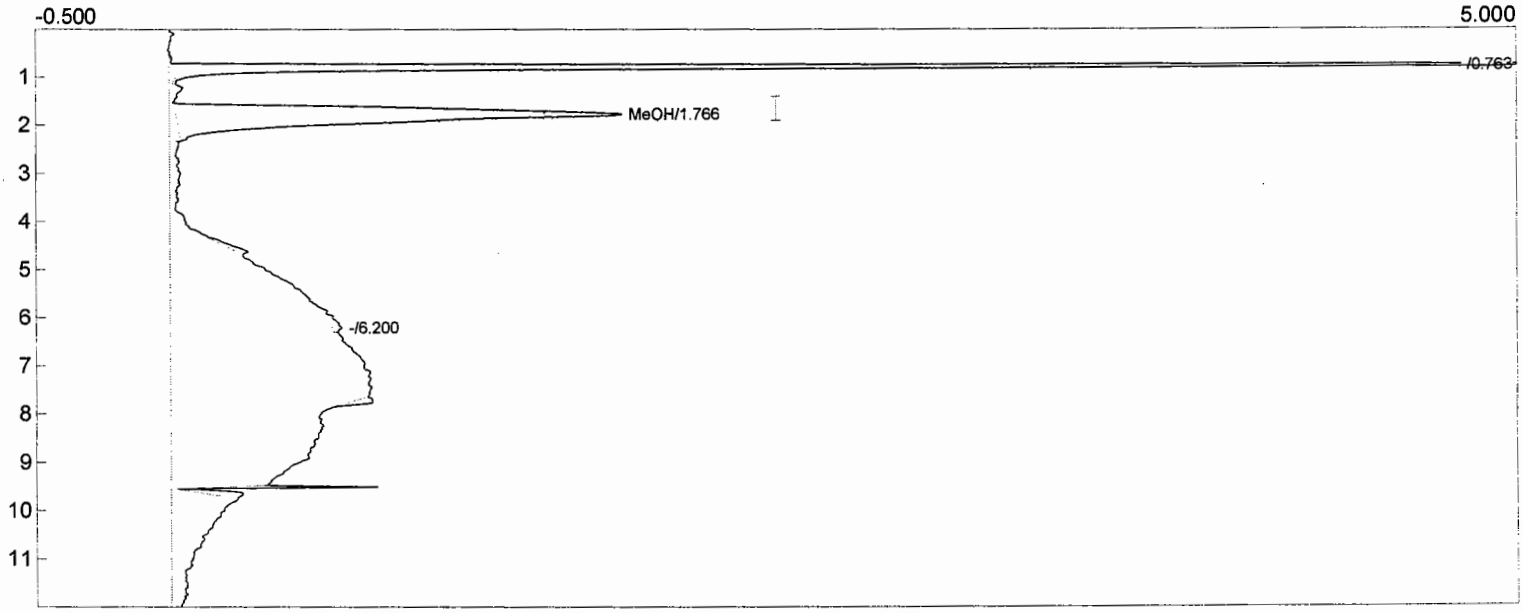
Component	Retention	Area
MeOH	1.716	30.6892
		30.6892

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 14:51:03
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR15.CHR ()
Sample: 10.0 ppm MeOH - pre
Operator: E. Vogt



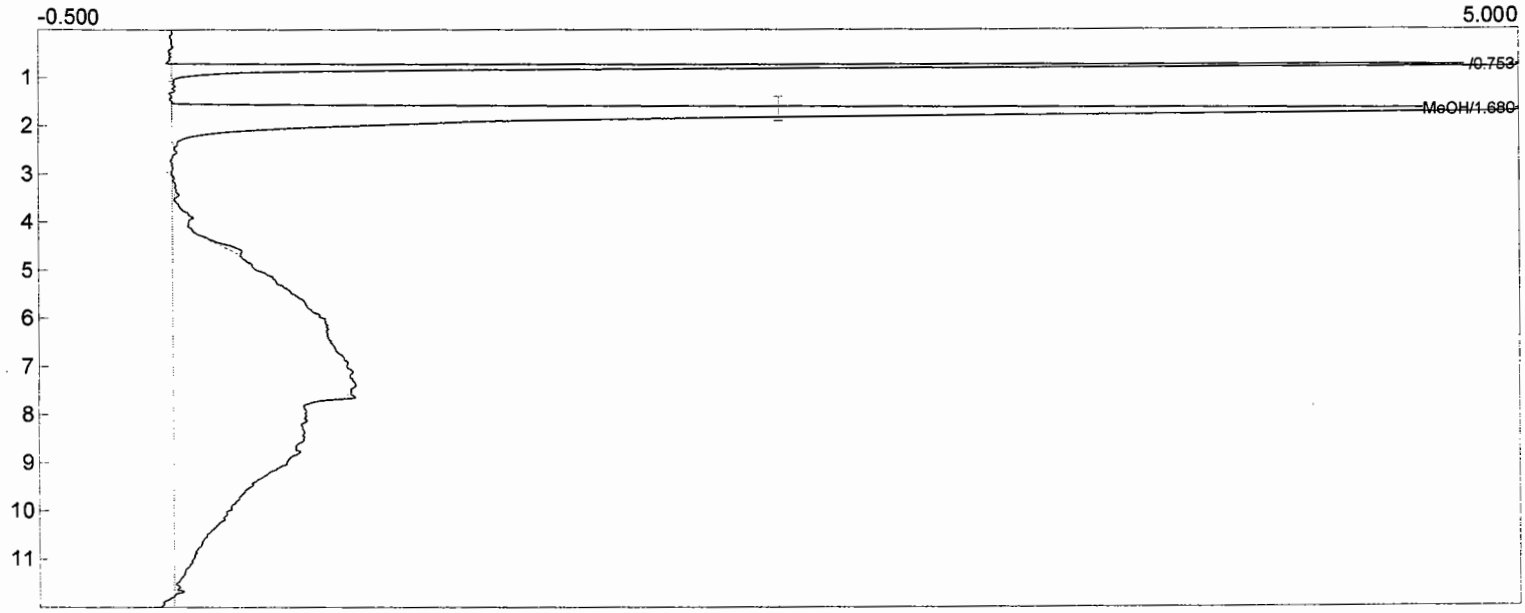
Component	Retention	Area
MeOH	1.680	30.9562
		30.9562

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 15:07:08
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR16.chr ()
Sample: 10.0 ppm MeOH - pre
Operator: E. Vogt



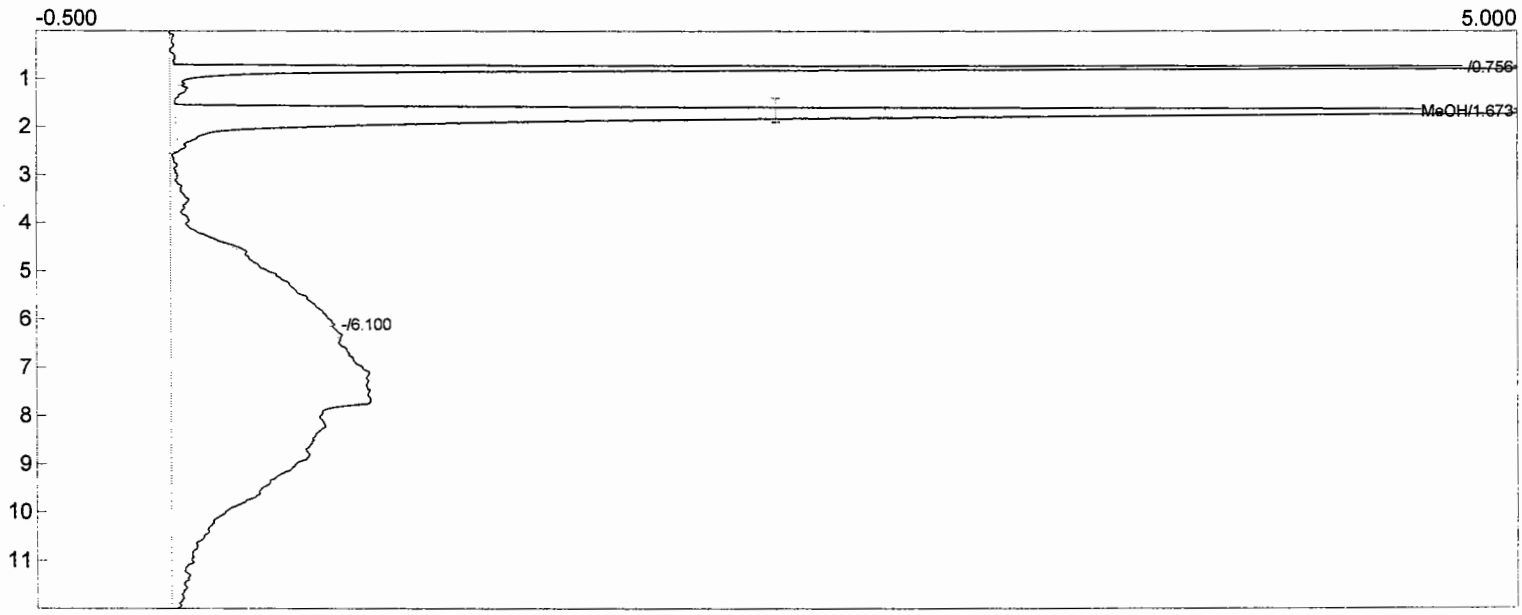
Component	Retention	Area
MeOH	1.766	31.0306
		31.0306

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 15:23:23
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR17.CHR ()
Sample: 25.0 ppm MeOH - pre
Operator: E. Vogt



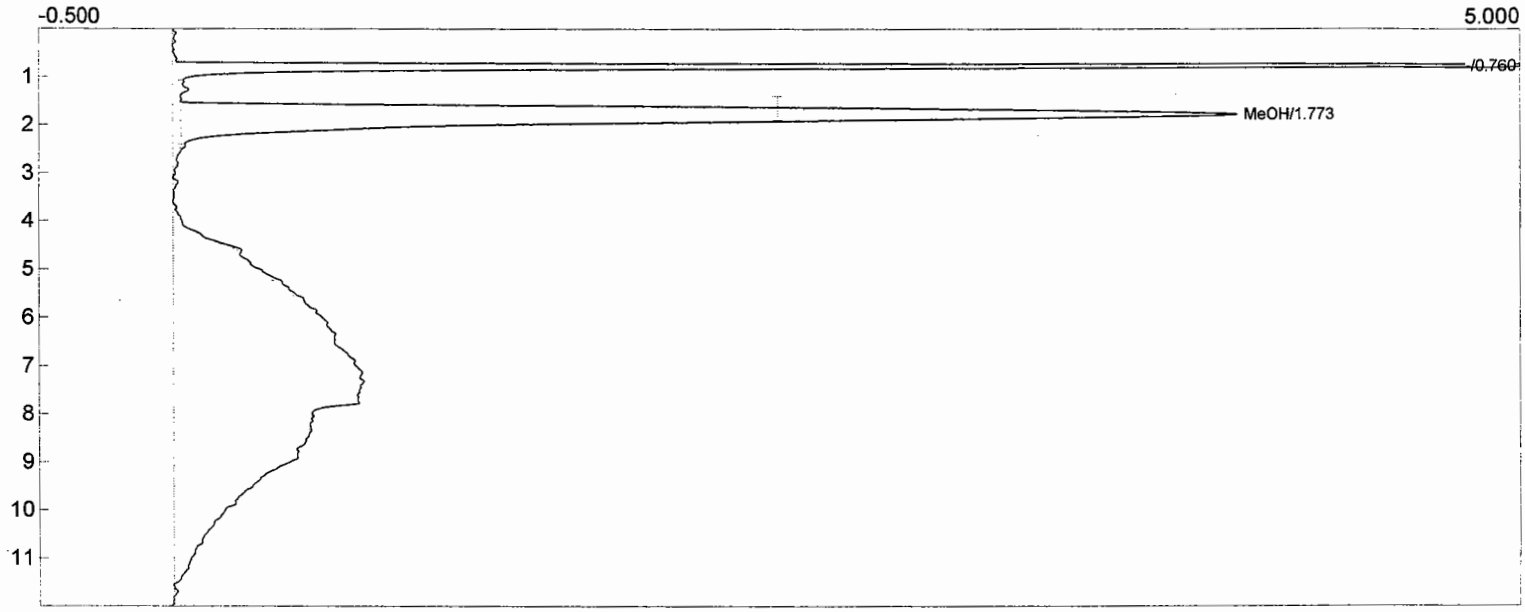
Component	Retention	Area
MeOH	1.680	75.1543
		75.1543

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 15:39:39
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR18.chr ()
Sample: 25.0 ppm MeOH - pre
Operator: E. Vogt



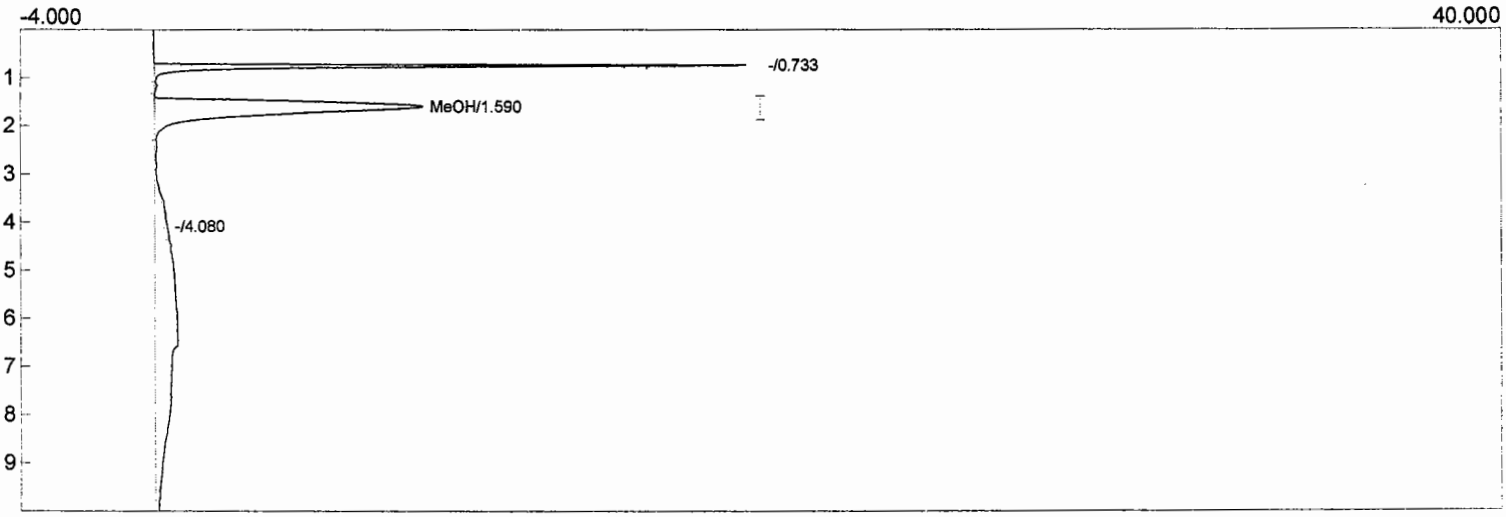
Component	Retention	Area
MeOH	1.673	78.3797
		78.3797

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 15:55:55
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR19.CHR ()
Sample: 25.0 ppm MeOH - pre
Operator: E. Vogt



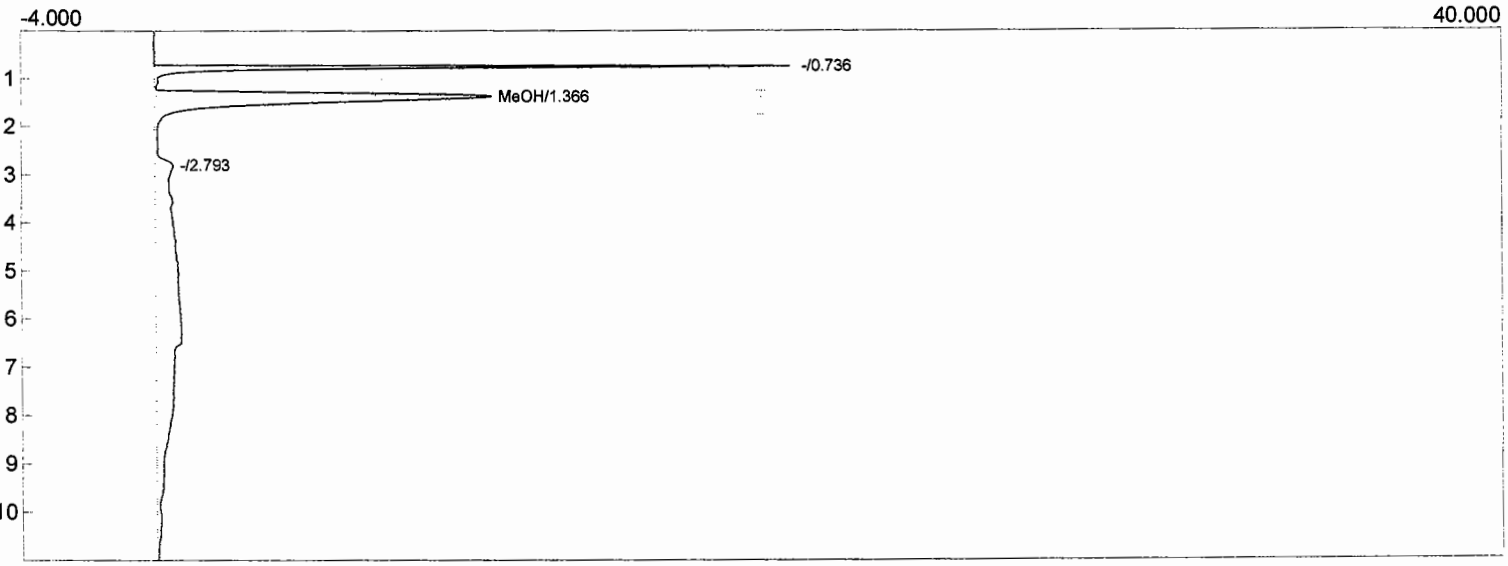
Component	Retention	Area
MeOH	1.773	78.0420
		78.0420

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/13/2011 17:53:10
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR22.chr ()
Sample: 50.0 ppm MeOH - pre
Operator: E. Vogt



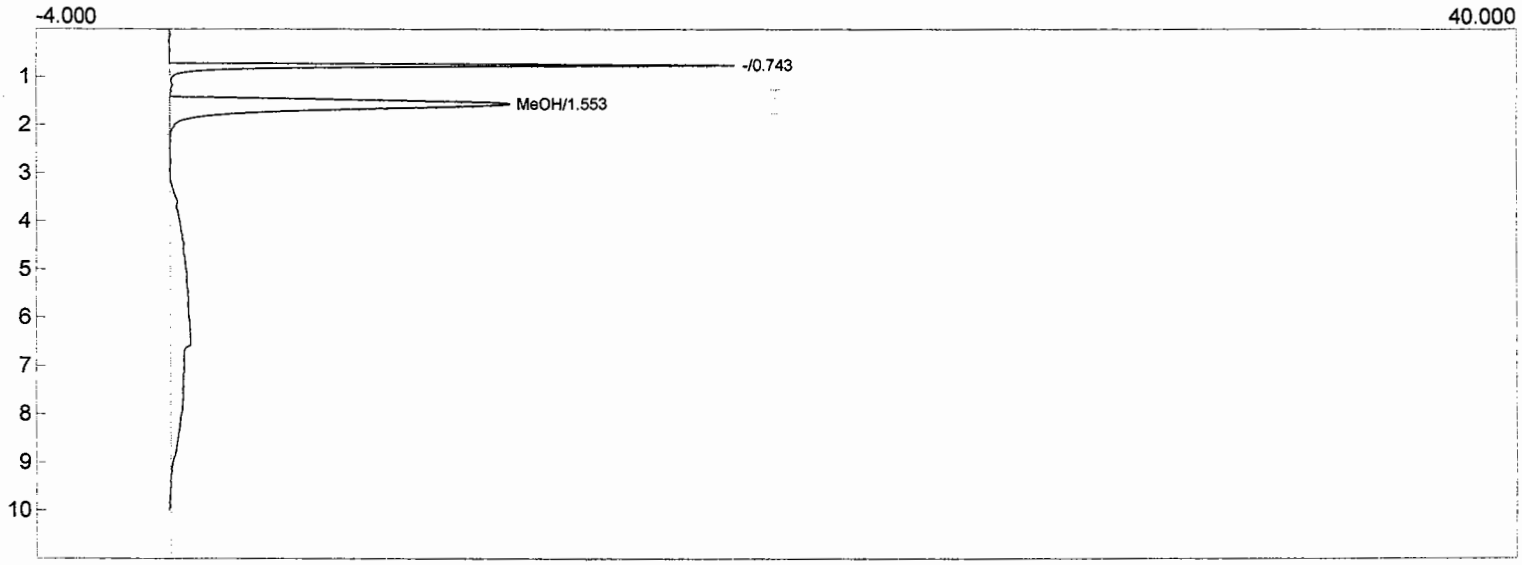
Component	Retention	Area
MeOH	1.590	135.5650
		135.5650

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 08:45:20
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR23.chr ()
Sample: 50.0 ppm MeOH - pre
Operator: E. Vogt



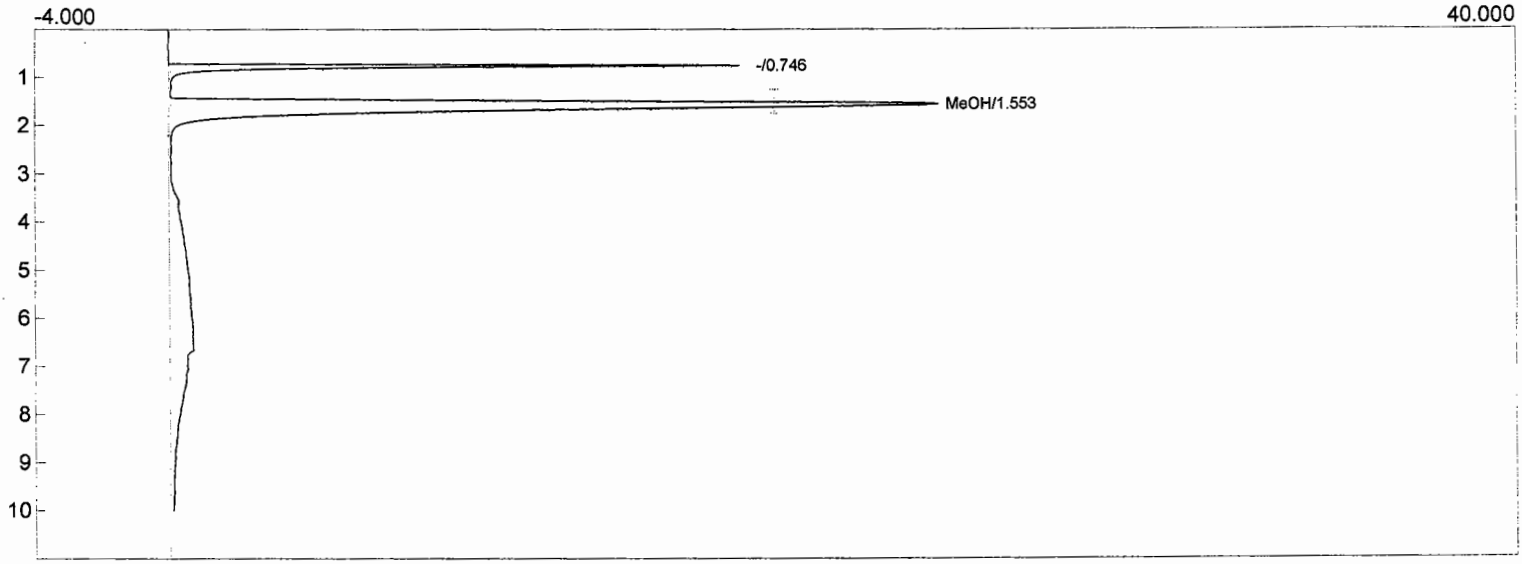
Component	Retention	Area
MeOH	1.366	133.4768
		133.4768

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 09:03:03
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR24.chr ()
Sample: 50.0 ppm MeOH - pre
Operator: E. Vogt



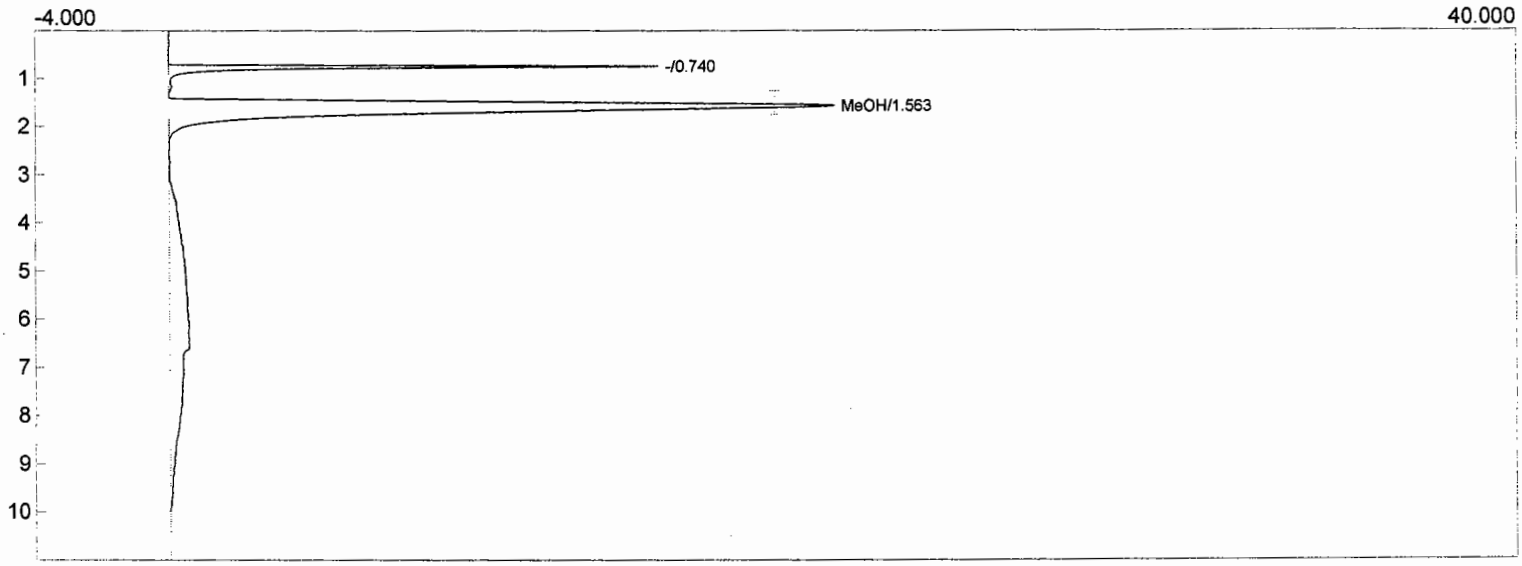
Component	Retention	Area
MeOH	1.553	138.5738
		138.5738

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 09:18:58
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR26.chr ()
Sample: 100.0 ppm MeOH - pre
Operator: E. Vogt



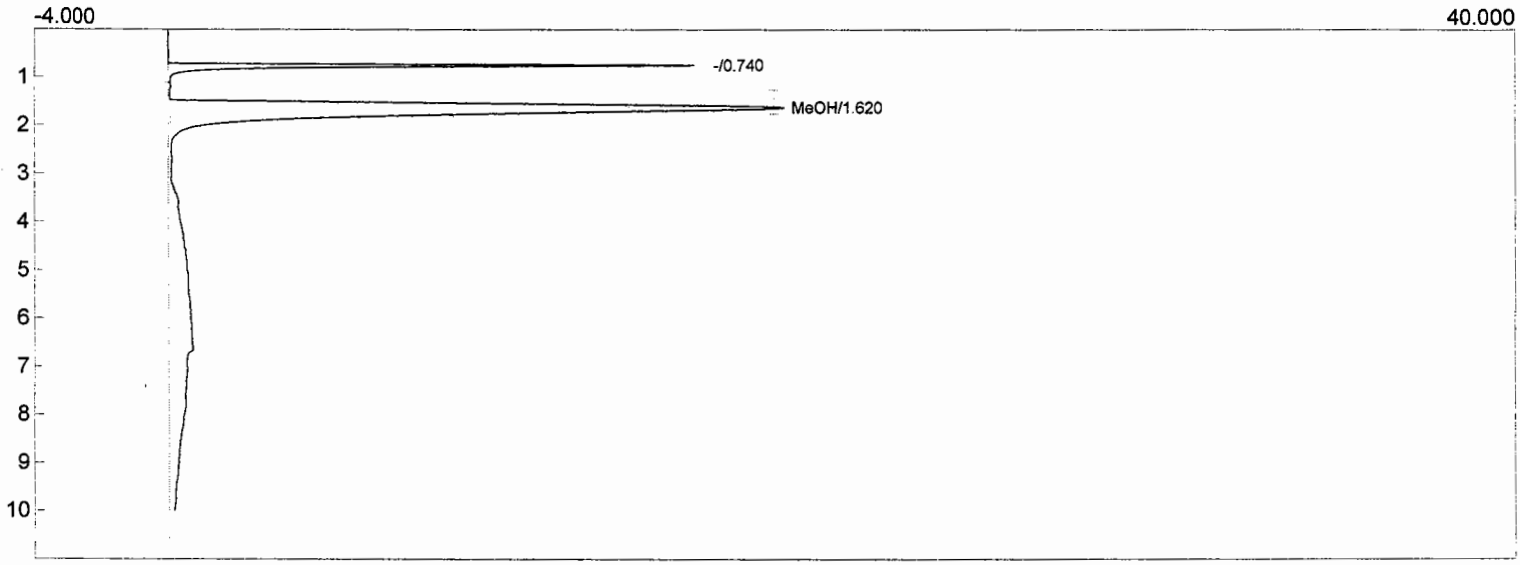
Component	Retention	Area
MeOH	1.553	282.4888
		282.4888

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 09:35:51
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR27.chr ()
Sample: 100.0 ppm MeOH - pre
Operator: E. Vogt



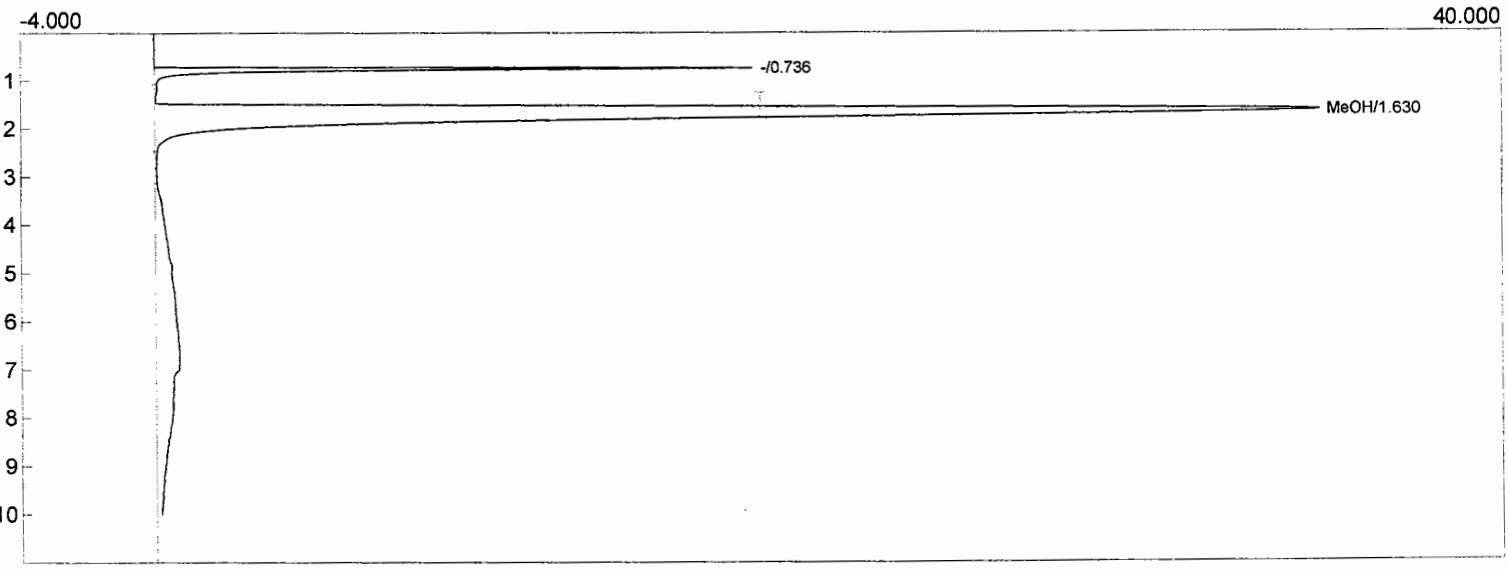
Component	Retention	Area
MeOH	1.563	281.5718
		281.5718

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 09:50:35
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR28.CHR ()
Sample: 100.0 ppm MeOH - pre
Operator: E. Vogt



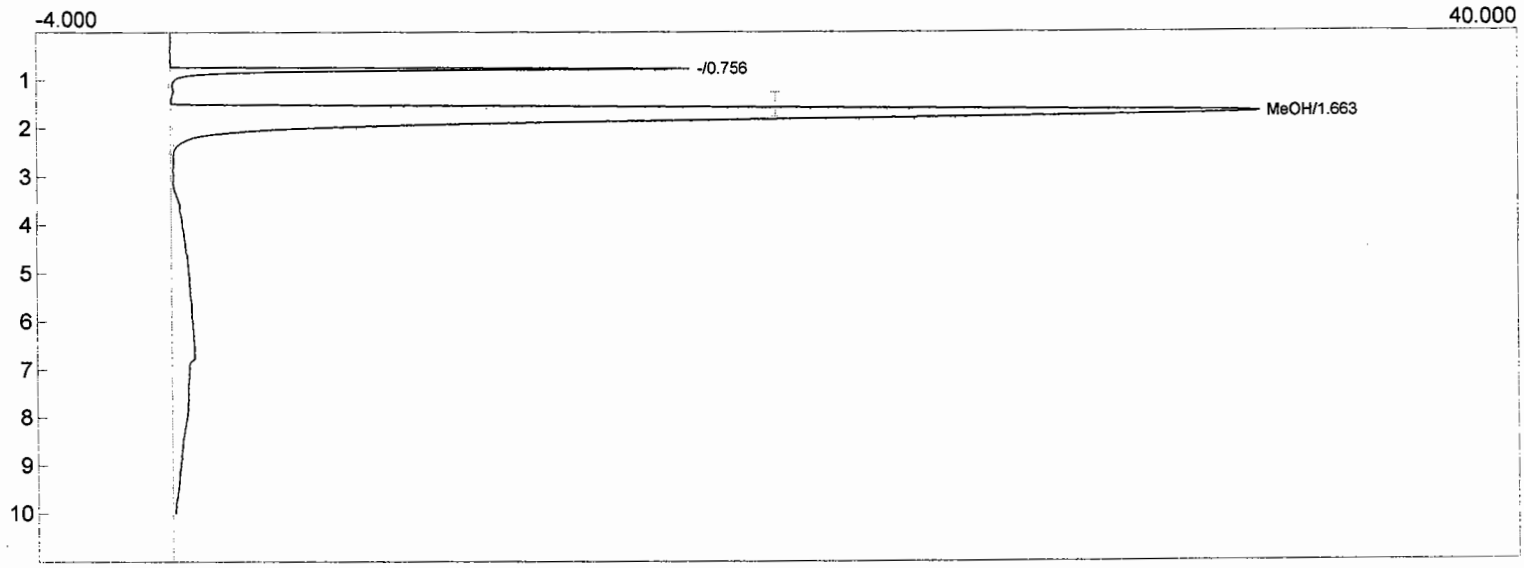
Component	Retention	Area
MeOH	1.620	273.0629
		273.0629

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 10:04:30
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR29.CHR ()
Sample: 200.0 ppm MeOH - pre
Operator: E. Vogt



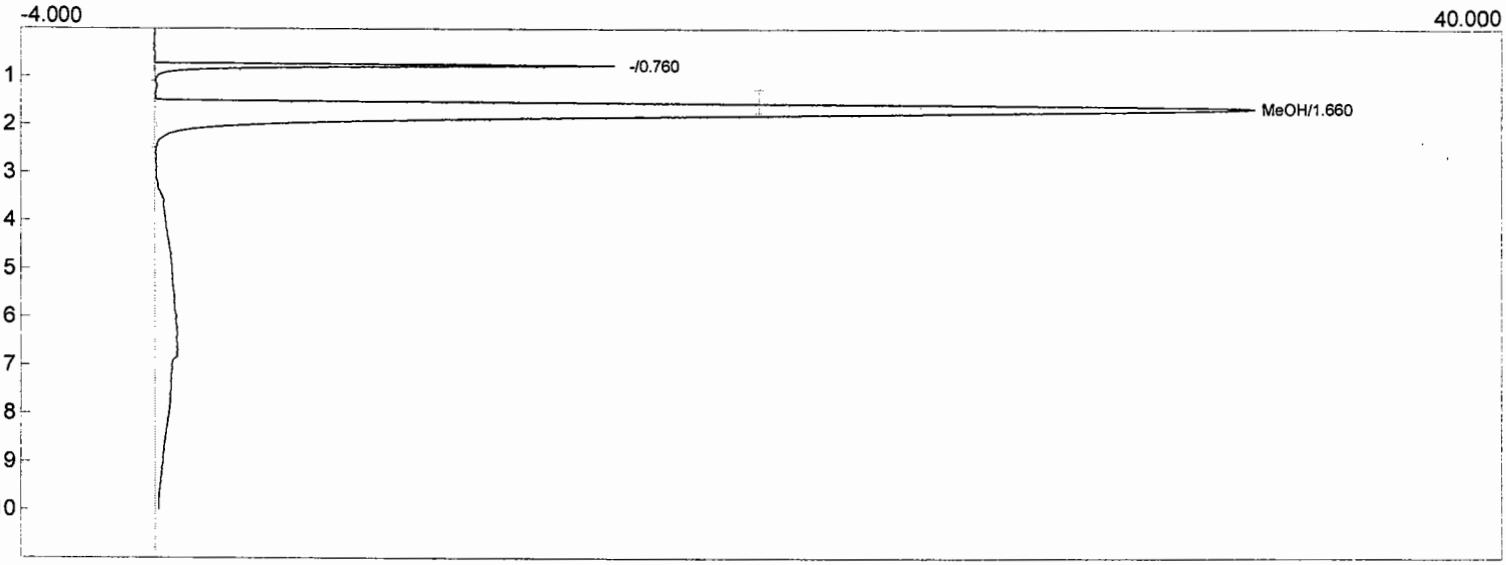
Component	Retention	Area
MeOH	1.630	542.4196
		542.4196

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 10:16:49
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR30.CHR ()
Sample: 200.0 ppm MeOH - pre
Operator: E. Vogt



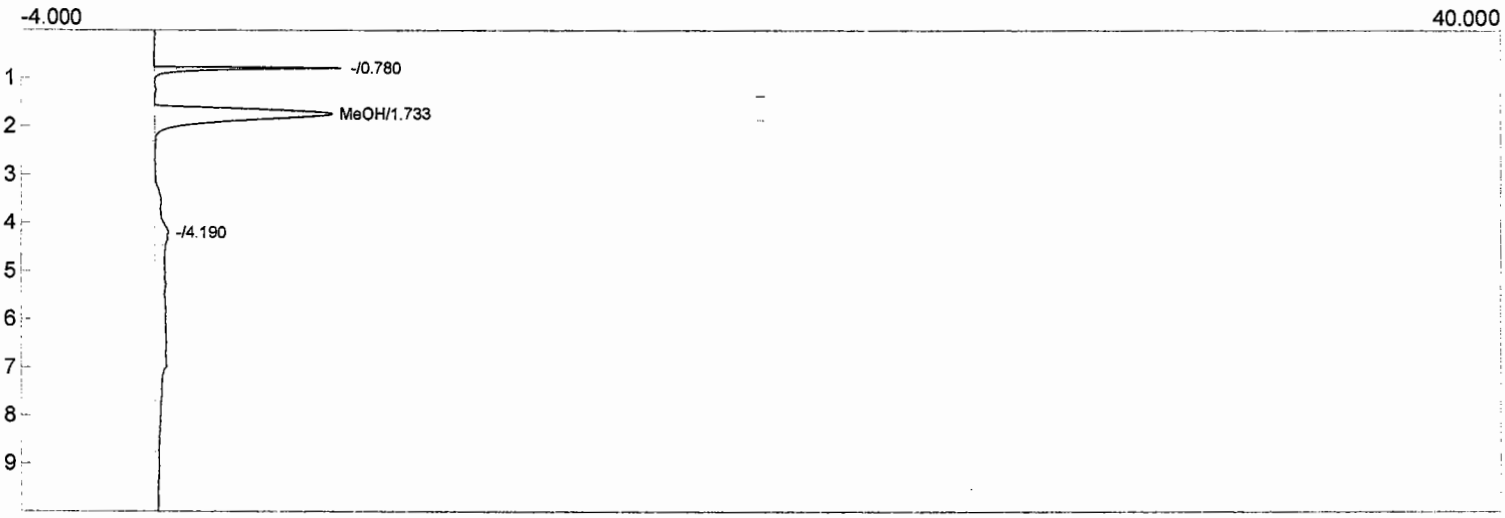
Component	Retention	Area
MeOH	1.663	561.2236
		561.2236

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 10:29:26
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR31.CHR ()
Sample: 200.0 ppm MeOH - pre
Operator: E. Vogt



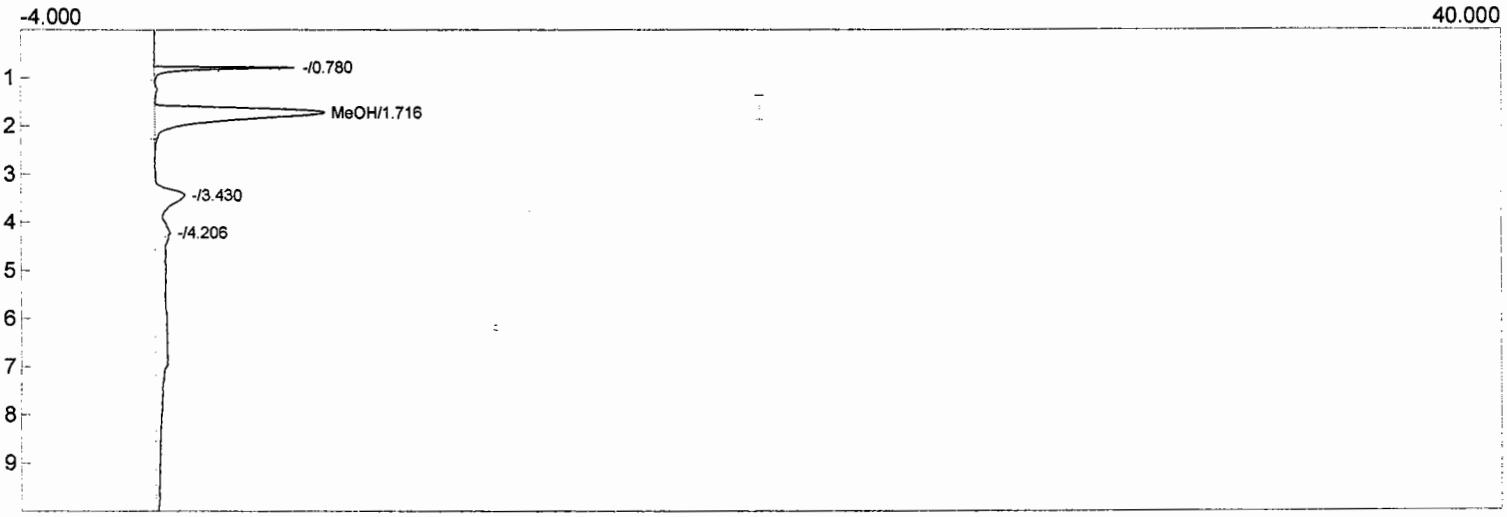
Component	Retention	Area
MeOH	1.660	556.3028
		556.3028

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 20:25:47
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR134.CHR ()
Sample: 25 ppm MeOH Std - post
Operator: E. Vogt



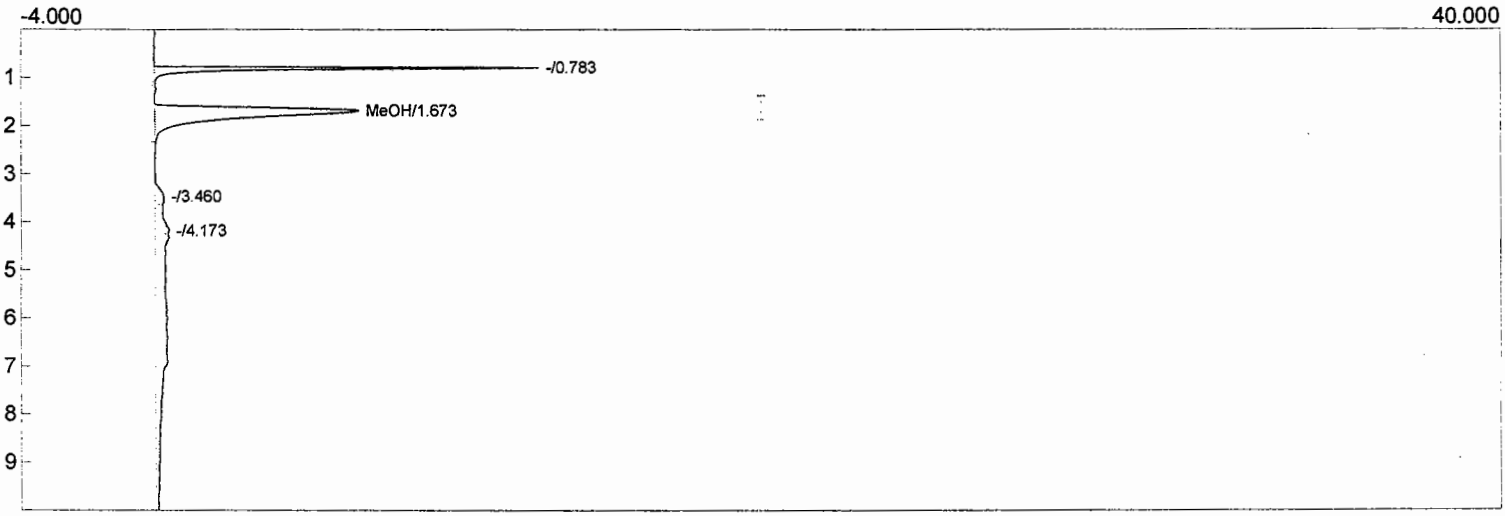
Component	Retention	Area
MeOH	1.733	80.4332
		80.4332

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 20:11:38
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR133.chr ()
Sample: 25 ppm MeOH Std - Post
Operator: E. Vogt



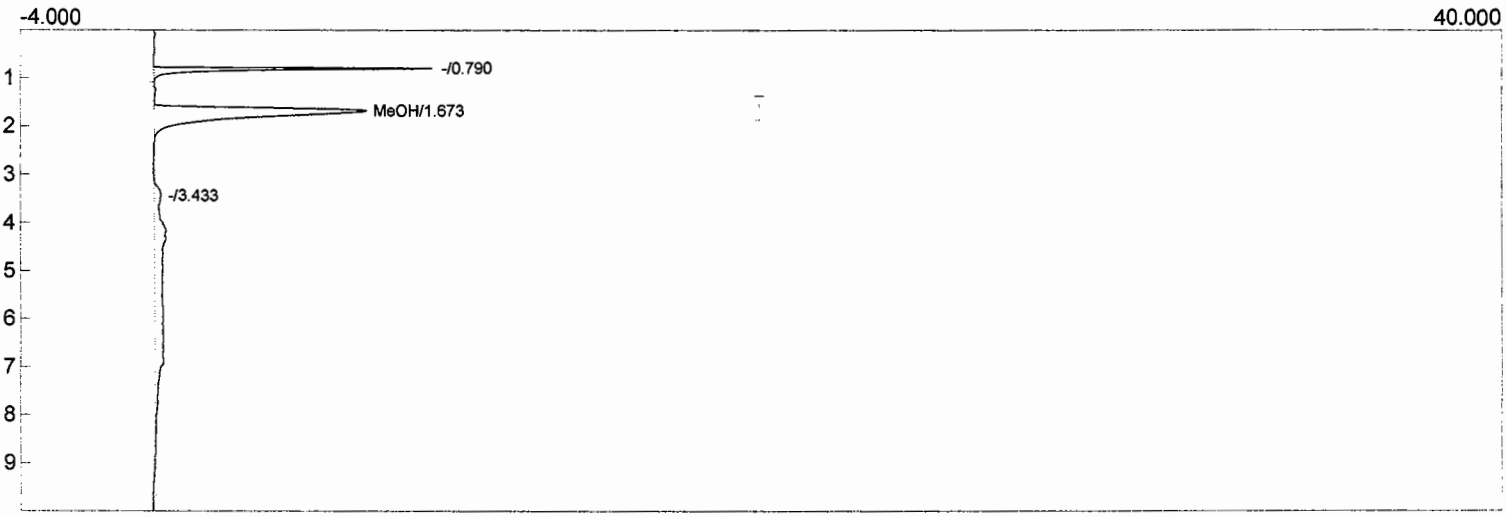
Component	Retention	Area
MeOH	1.716	79.5123
		79.5123

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 19:57:34
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR132.chr ()
Sample: 25 ppm MeOH Std - post
Operator: E. Vogt



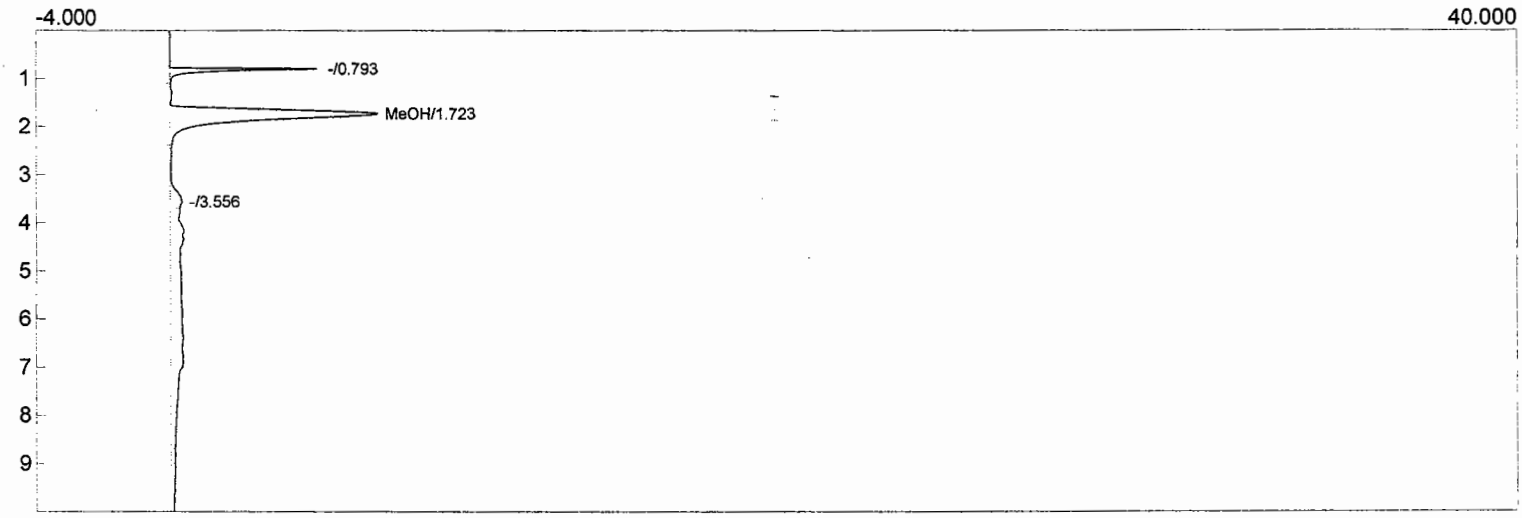
Component	Retention	Area
MeOH	1.673	82.2589
		82.2589

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 19:43:43
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR131.chr ()
Sample: 25 ppm MeOH Std - post
Operator: E. Vogt



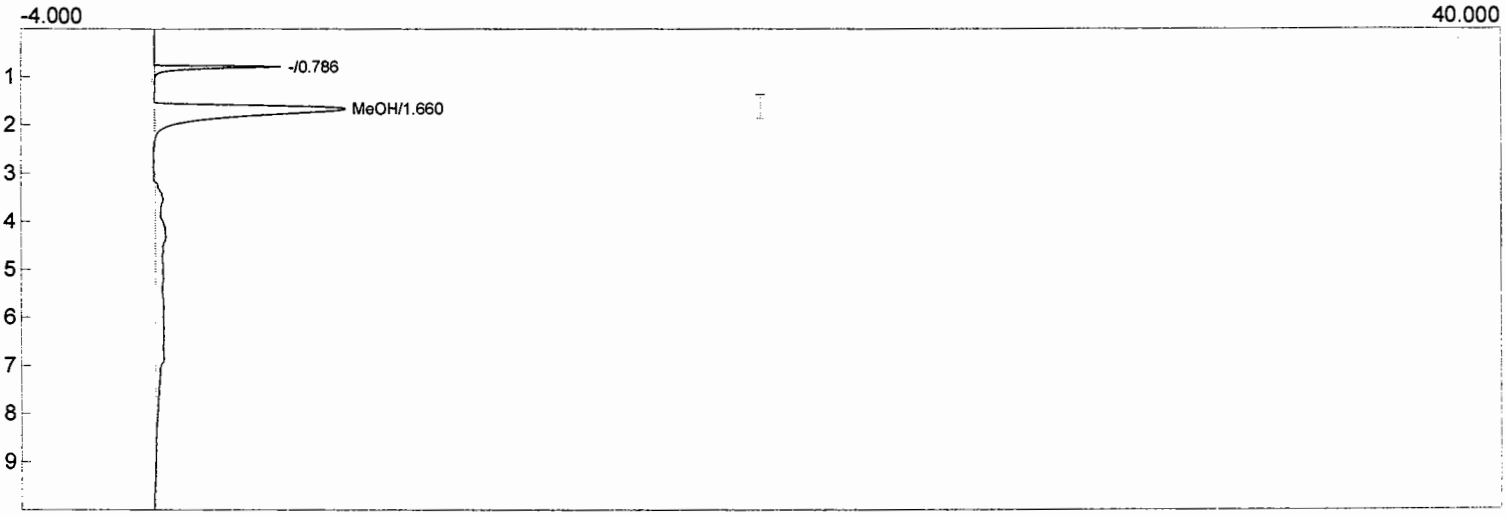
Component	Retention	Area
MeOH	1.673	81.5962
		81.5962

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 19:29:33
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR130.chr ()
Sample: 25 ppm MeOH Secondary Std
Operator: E. Vogt



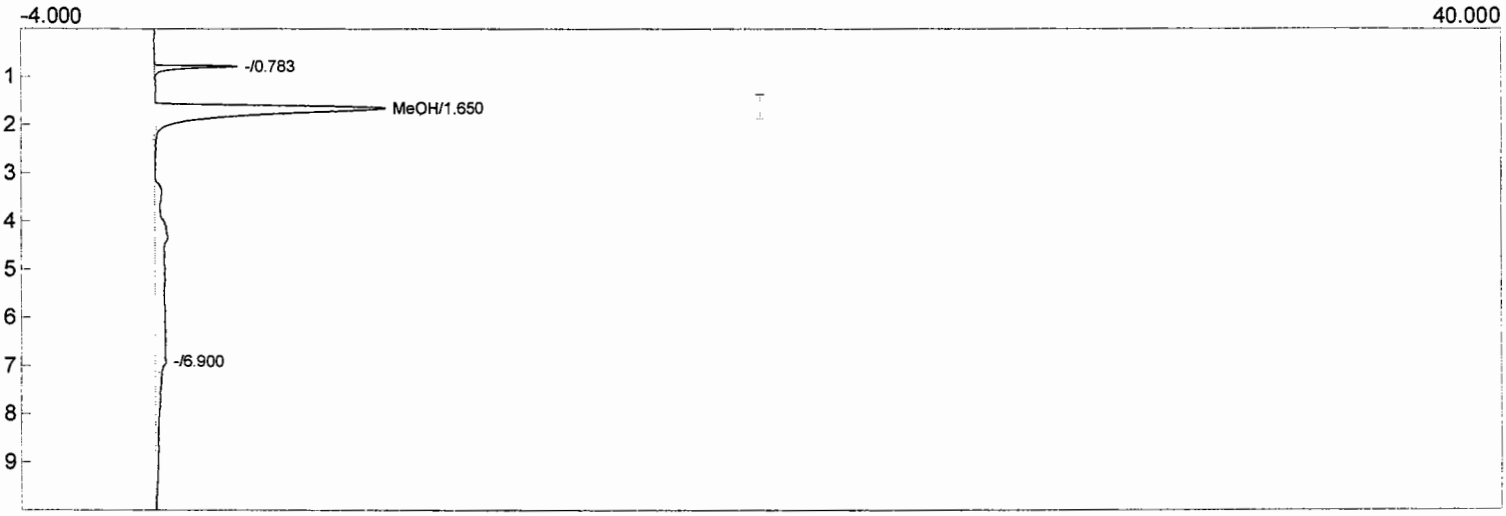
Component	Retention	Area
MeOH	1.723	85.3902
		85.3902

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 19:01:51
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR128.chr ()
Sample: 25 ppm MeOH Secondary Std
Operator: E. Vogt



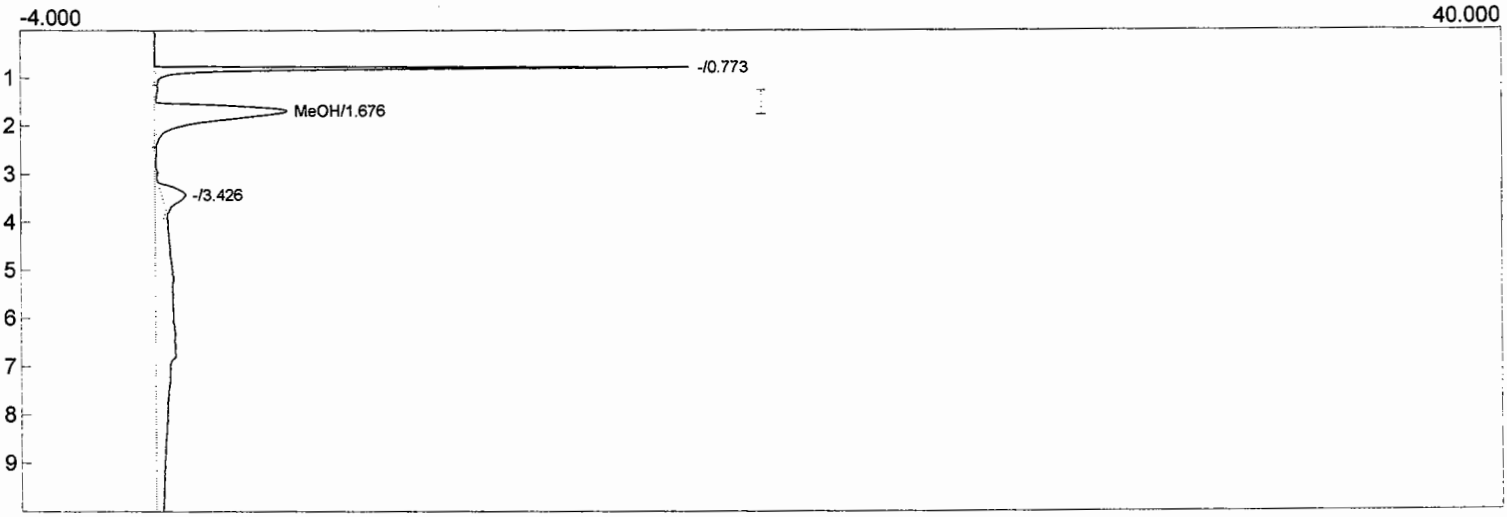
Component	Retention	Area
MeOH	1.660	83.6482
		83.6482

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 18:48:05
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR127.chr ()
Sample: 25 ppm MeOH Secondary Std
Operator: E. Vogt



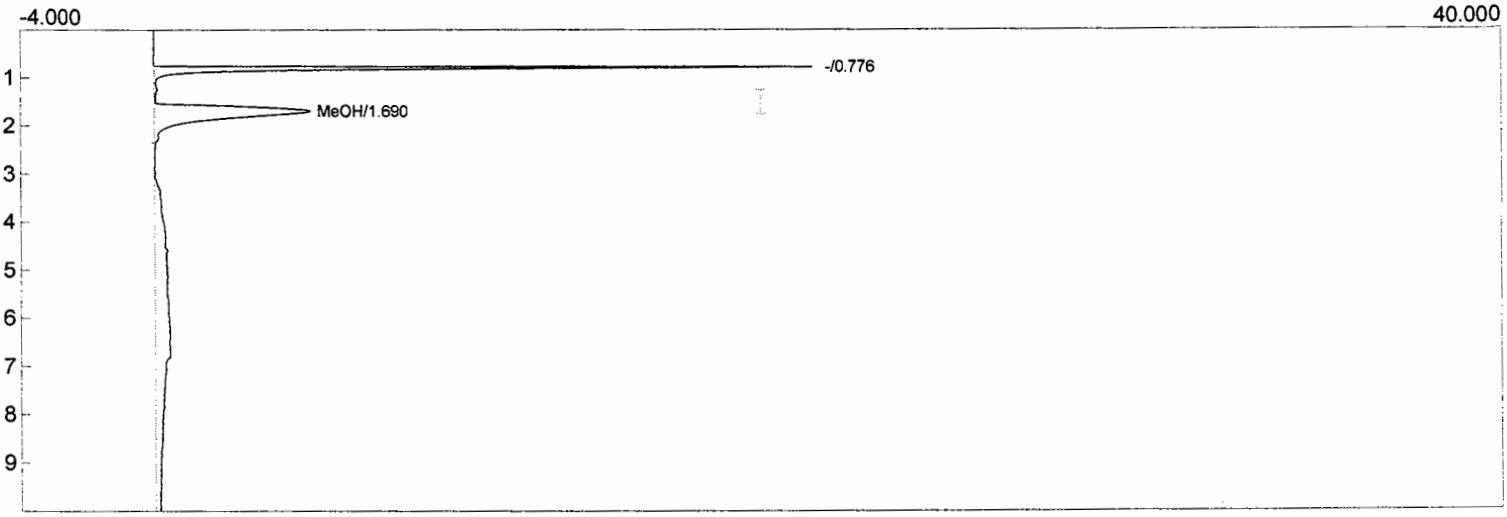
Component	Retention	Area
MeOH	1.650	83.9216
		83.9216

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 16:55:13
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR56.CHR ()
Sample: 25 ppm MeOH check Std.
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



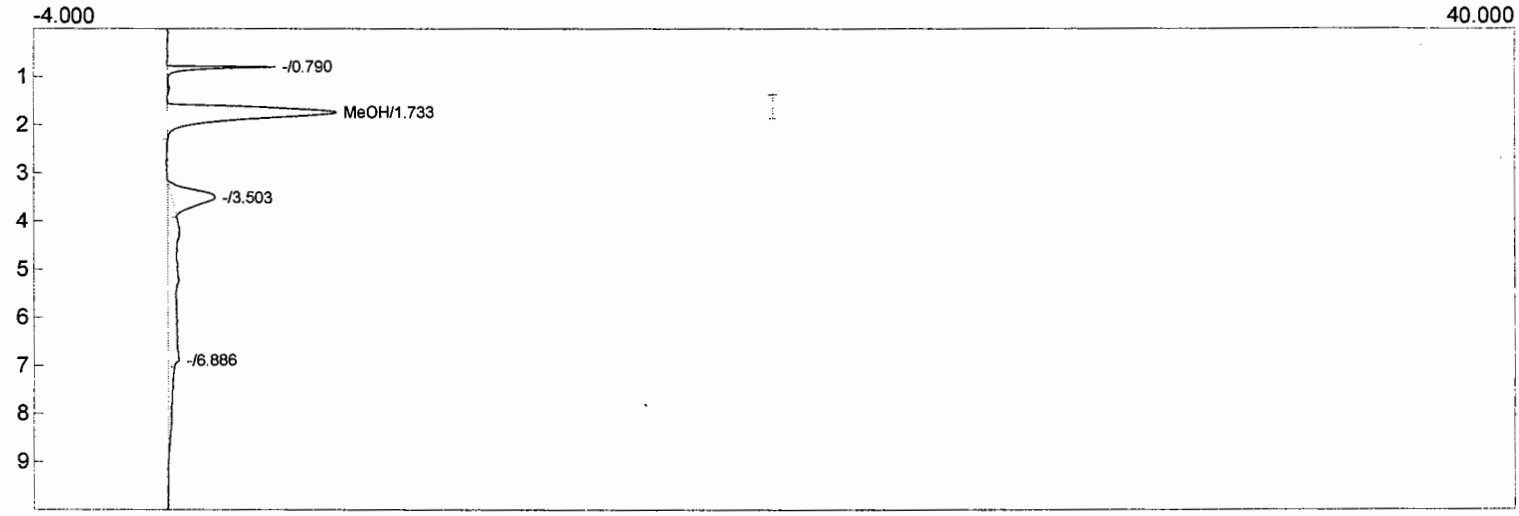
Component	Retention	Area
MeOH	1.676	75.8690
		75.8690

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 22:13:25
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR78.chr ()
Sample: 25 ppm MeOH std. check
Operator: E. Vogt



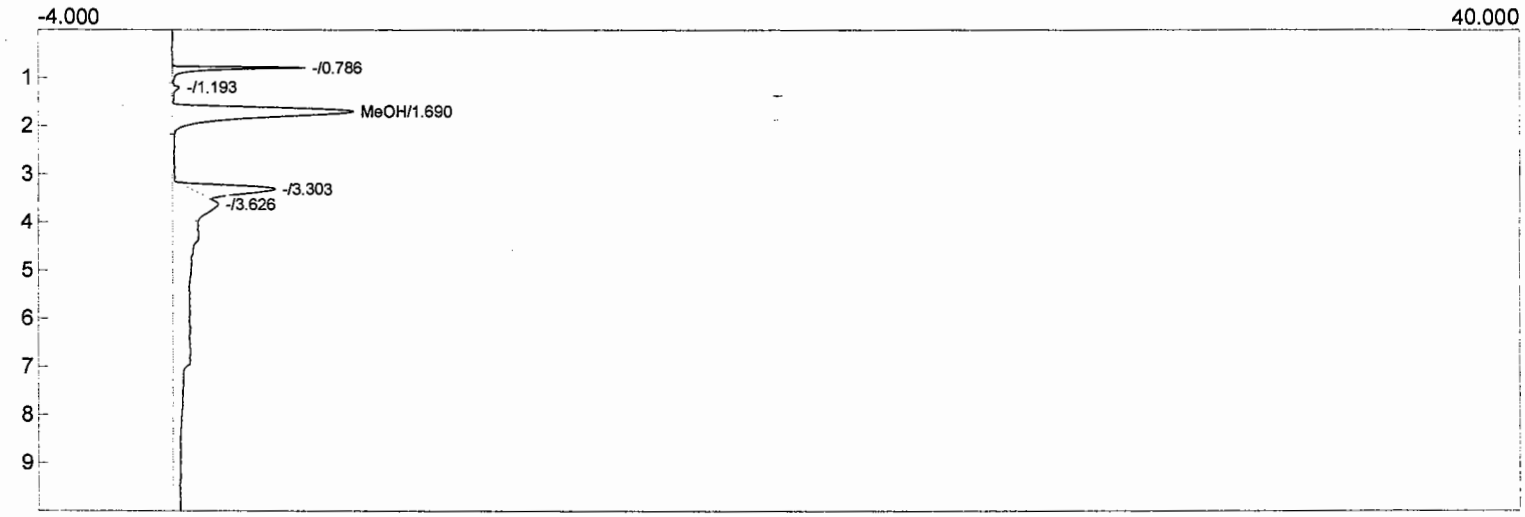
Component	Retention	Area
MeOH	1.690	72.9270
		72.9270

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 16:55:07
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR119.chr ()
Sample: 25 ppm Check Std
Operator: E. Vogt



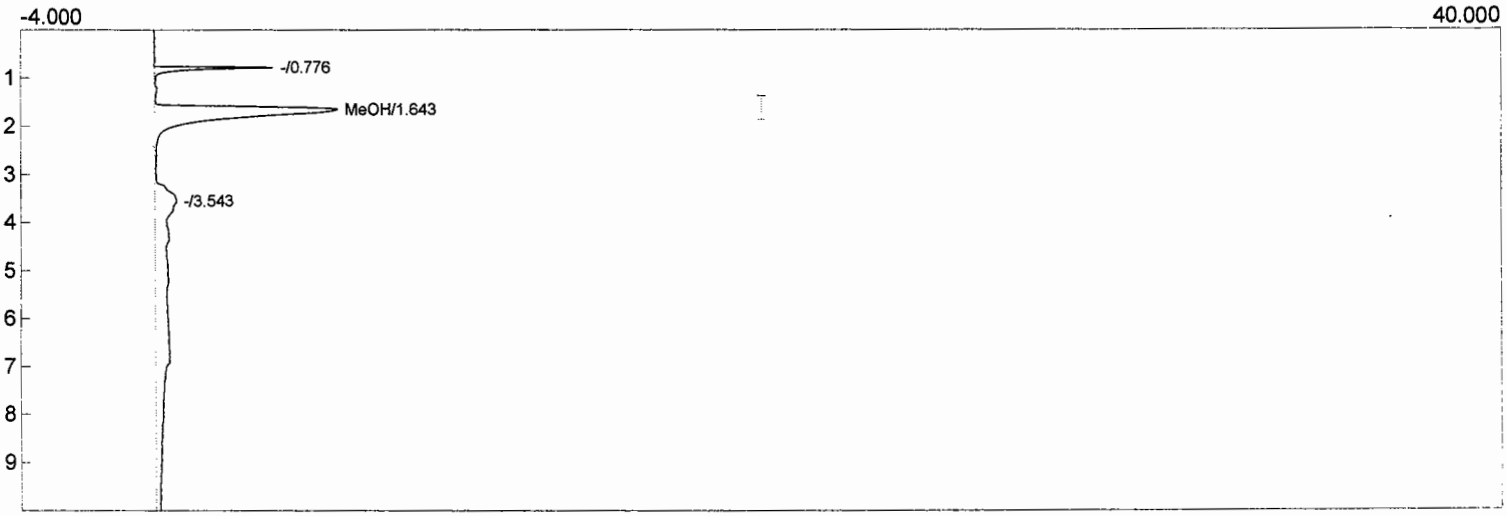
Component	Retention	Area
MeOH	1.733	78.7058
		78.7058

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/18/2011 09:18:20
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR135.CHR ()
Sample: 25 ppm MeOH Std - Check
Operator: E. Vogt



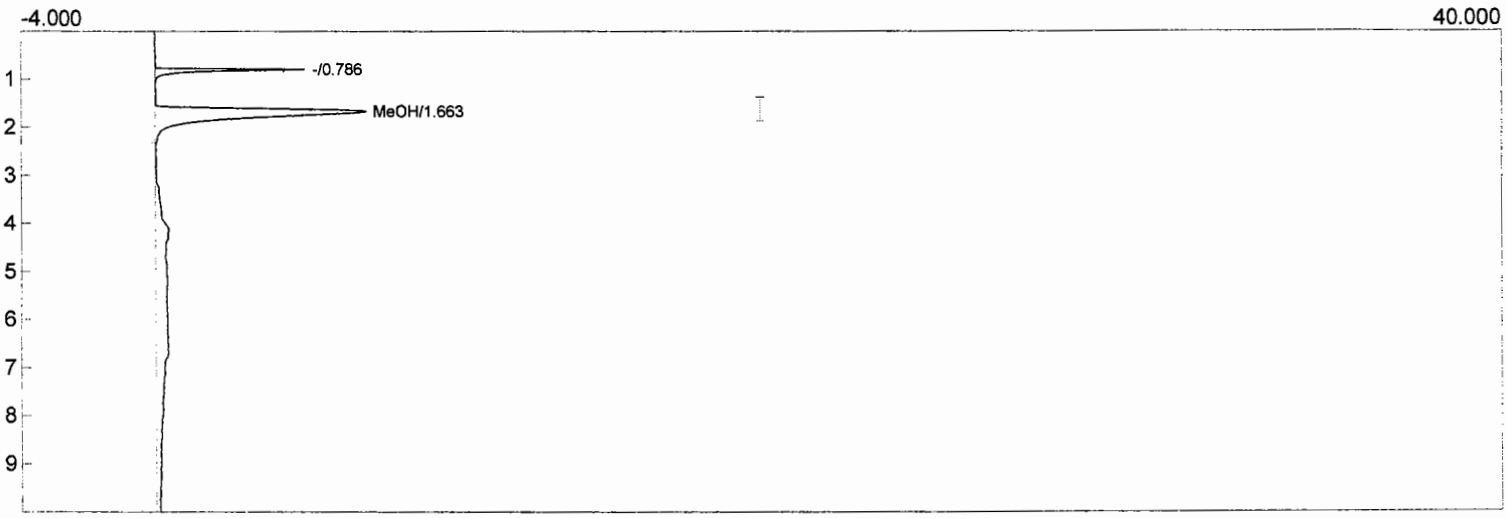
Component	Retention	Area
MeOH	1.690	73.7036
		73.7036

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 17:08:46
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR120.CHR ()
Sample: 25 ppm Check Std
Operator: E. Vogt



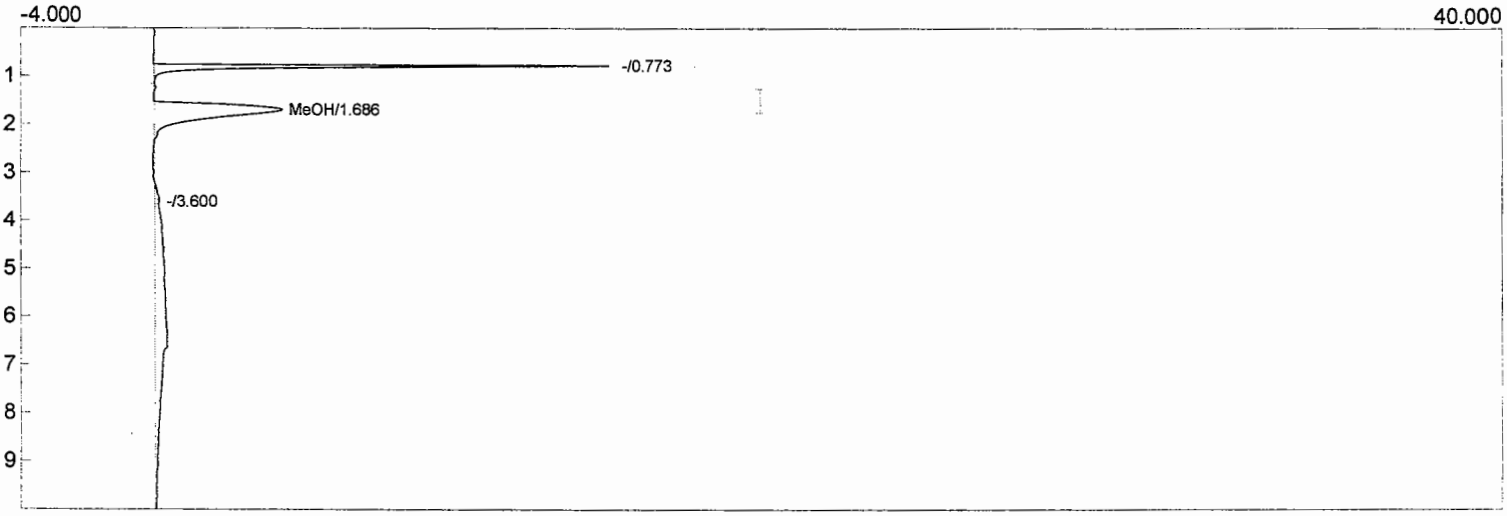
Component	Retention	Area
MeOH	1.643	79.8290
		79.8290

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 19:15:37
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR129.chr ()
Sample: 25 ppm MeOH Secondary Std
Operator: E. Vogt



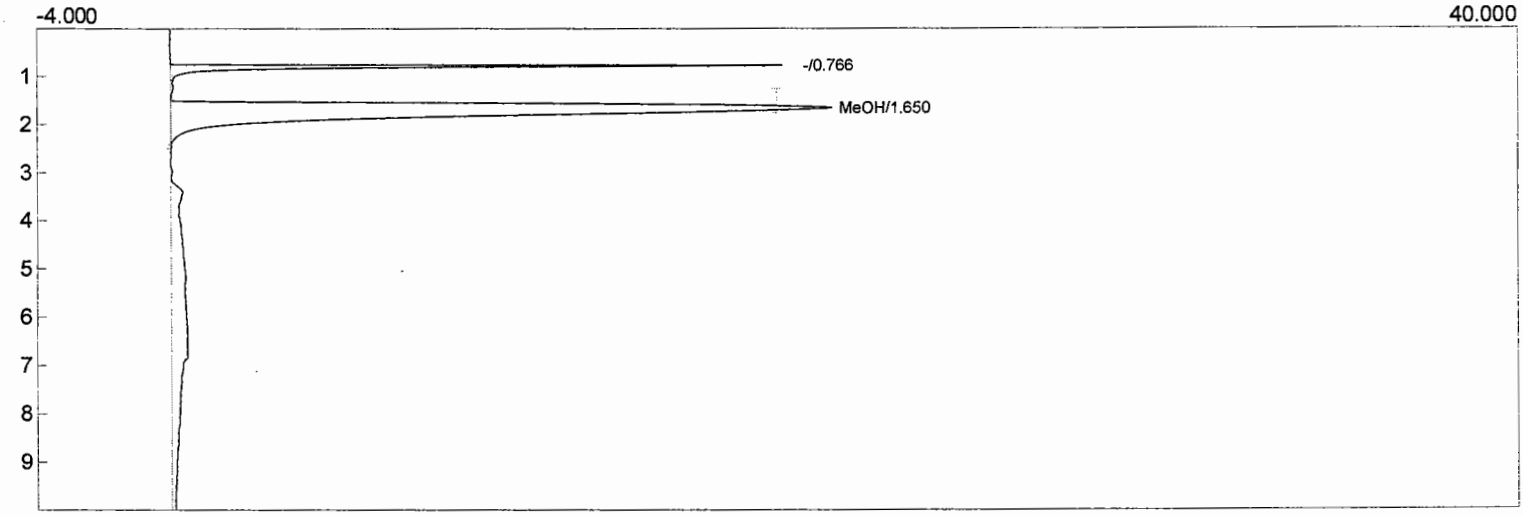
Component	Retention	Area
MeOH	1.663	76.6426
		76.6426

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 21:58:46
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR77.CHR ()
Sample: 25 ppm MeOH std. - Check
Operator: E. Vogt



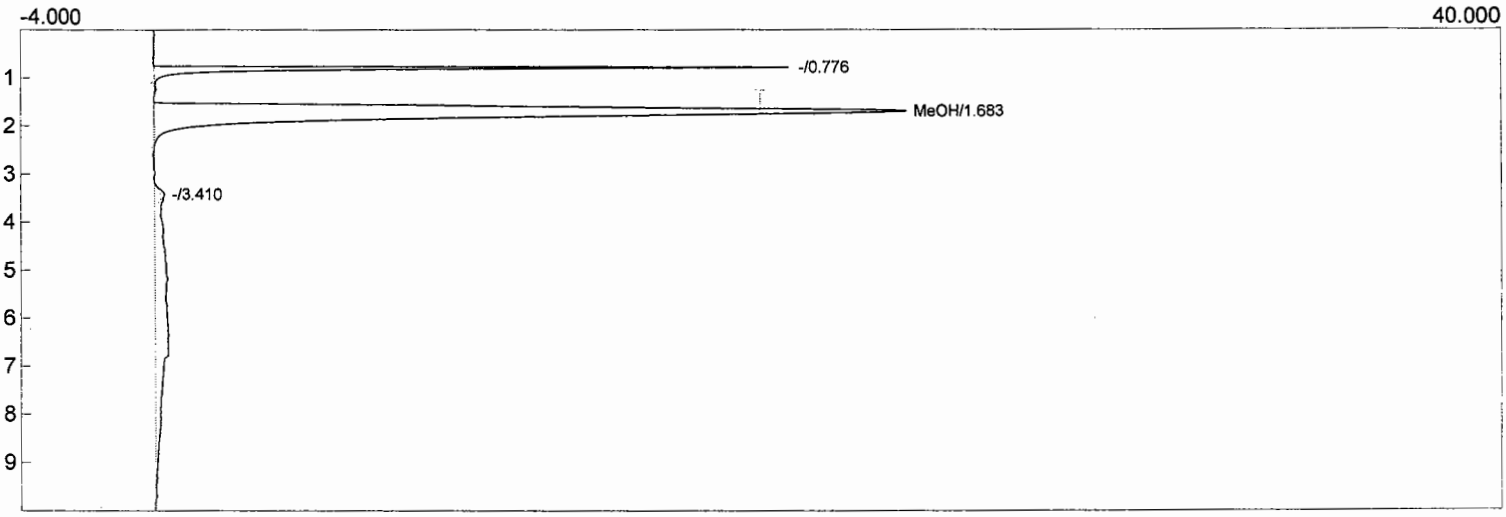
Component	Retention	Area
MeOH	1.686	67.8072
		67.8072

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 17:09:17
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR57.chr ()
Sample: Run 1 Unspiked Imp
Operator: E. Vogt



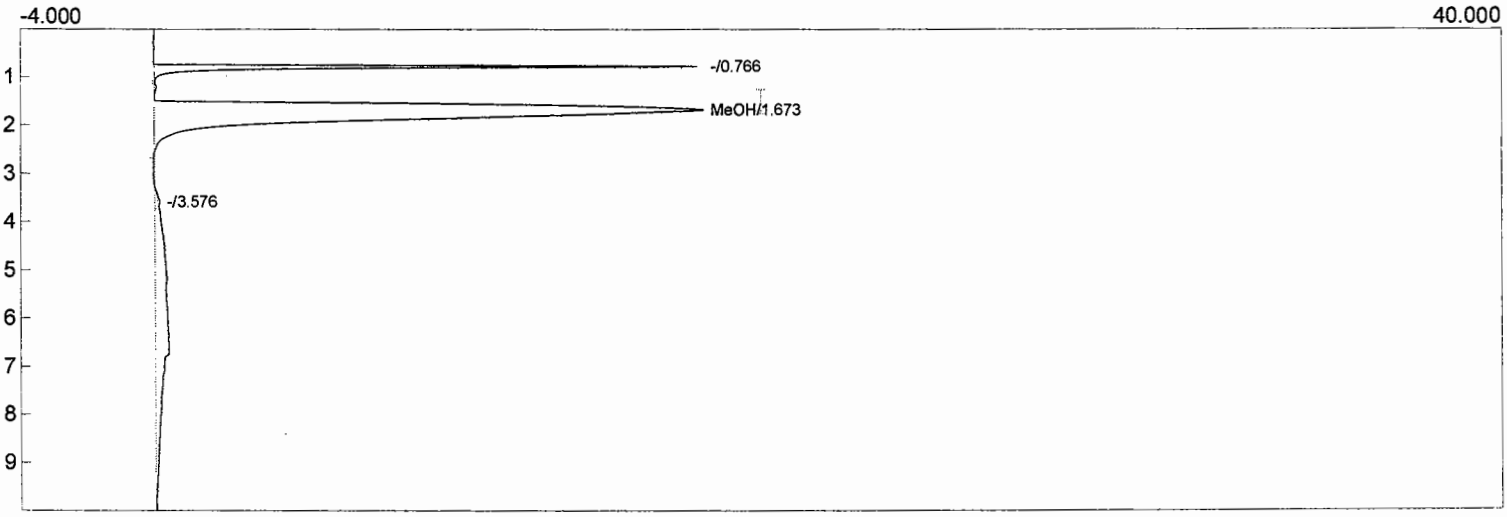
Component	Retention	Area
MeOH	1.650	324.2004
		324.2004

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 17:23:07
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR58.chr ()
Sample: Run 1 Unspiked Imp
Operator: E. Vogt



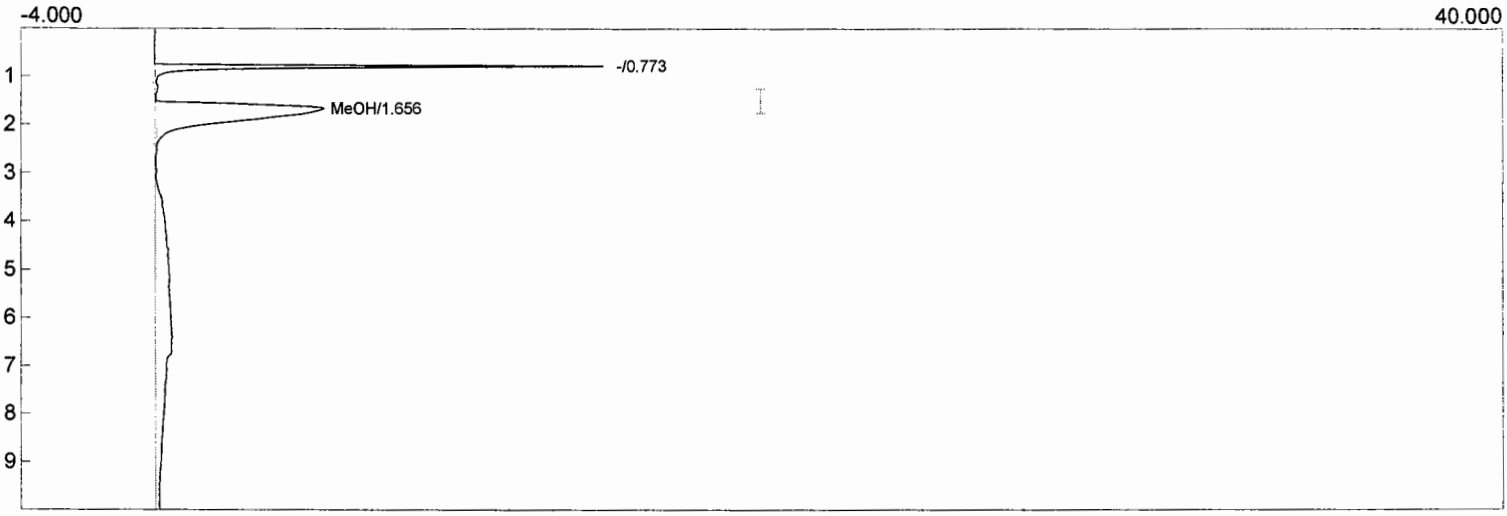
Component	Retention	Area
MeOH	1.683	320.3261
		320.3261

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 17:37:33
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR59.chr ()
Sample: Run 1 Unspiked Imp
Operator: E. Vogt



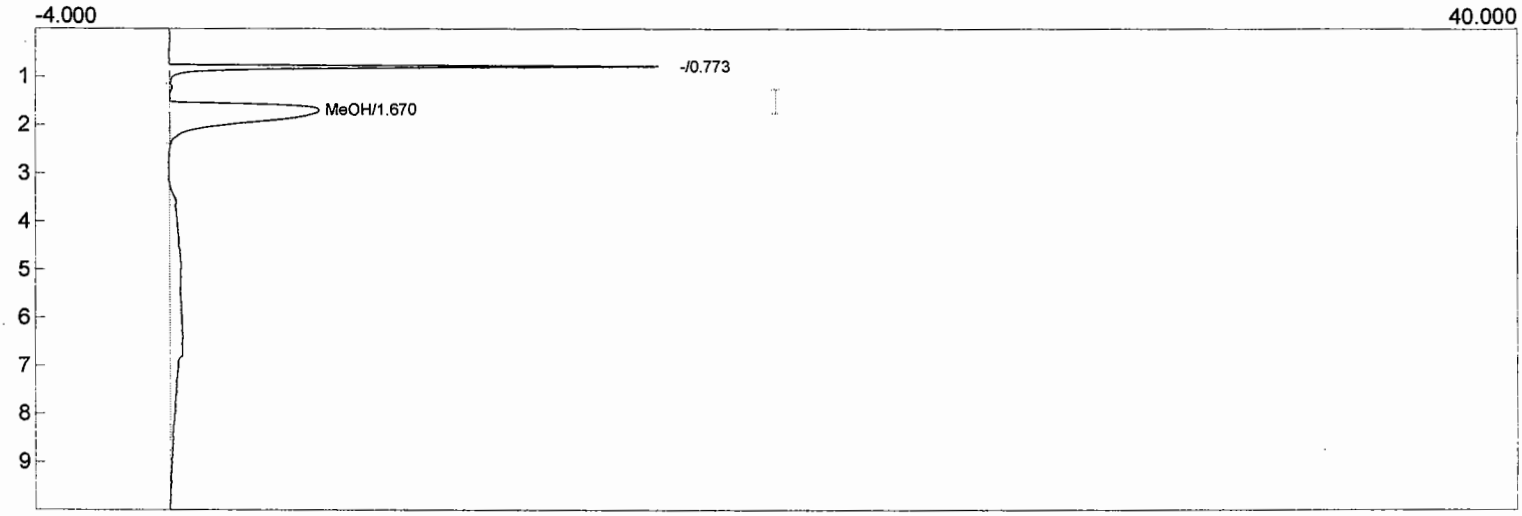
Component	Retention	Area
MeOH	1.673	317.6302
		317.6302

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 18:06:26
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR61.CHR ()
Sample: Run 2 Unspiked Imp
Operator: E. Vogt



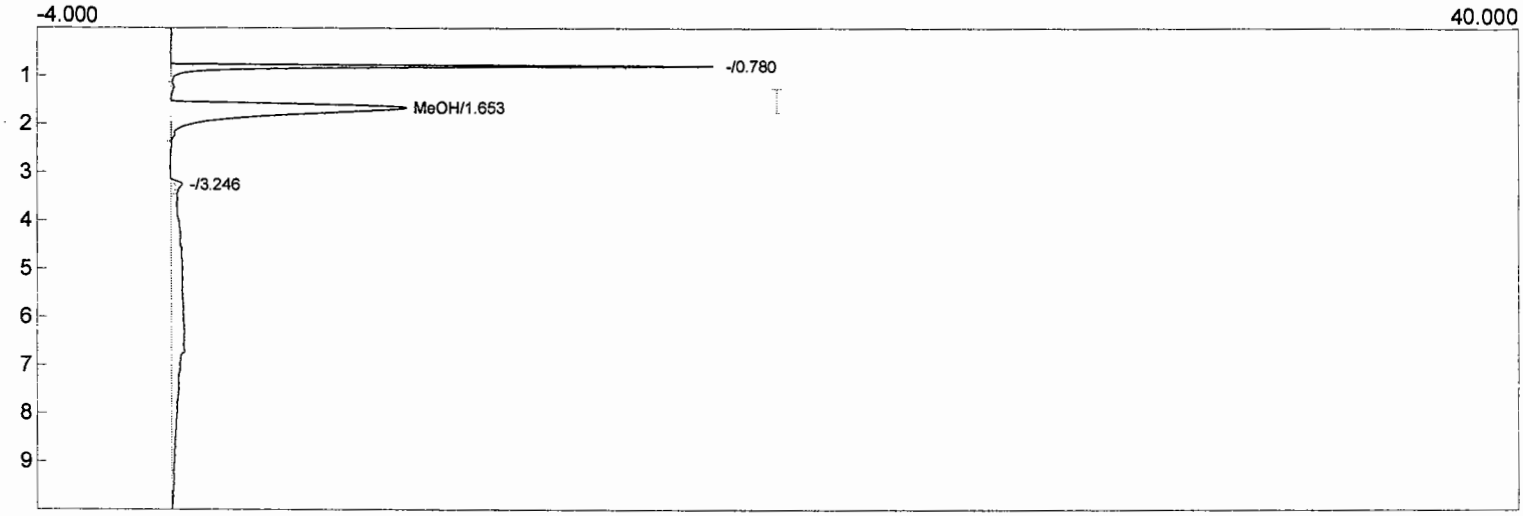
Component	Retention	Area
MeOH	1.656	106.6085
		106.6085

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 18:20:53
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR62.chr ()
Sample: Run 2 Unspiked Imp
Operator: E. Vogt



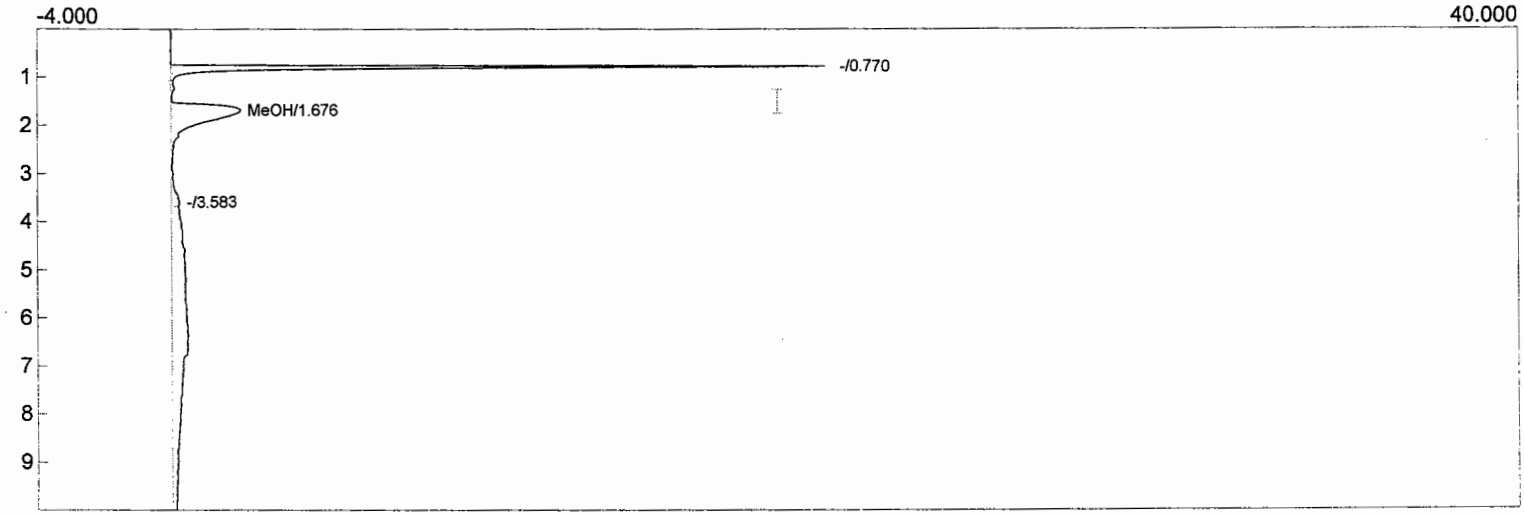
Component	Retention	Area
MeOH	1.670	107.4782
		107.4782

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 18:35:02
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR63.CHR ()
Sample: Run 2 Unspiked Imp
Operator: E. Vogt



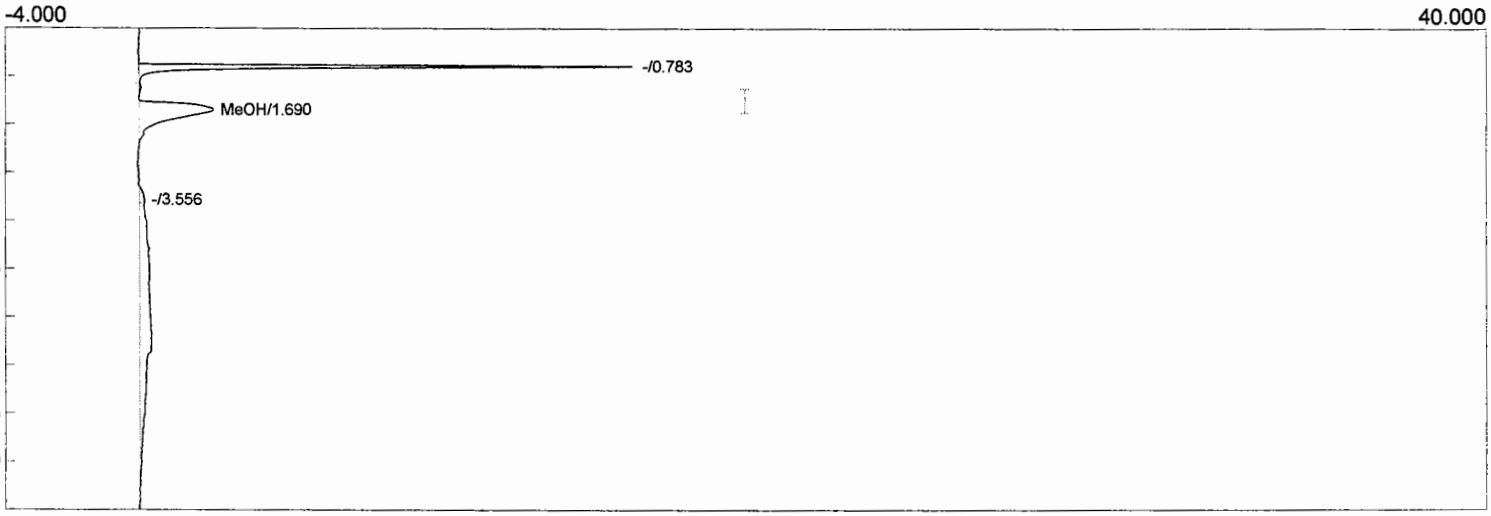
Component	Retention	Area
MeOH	1.653	105.4372
		105.4372

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 19:04:01
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR65.chr ()
Sample: Run 3 Unspiked Imp
Operator: E. Vogt



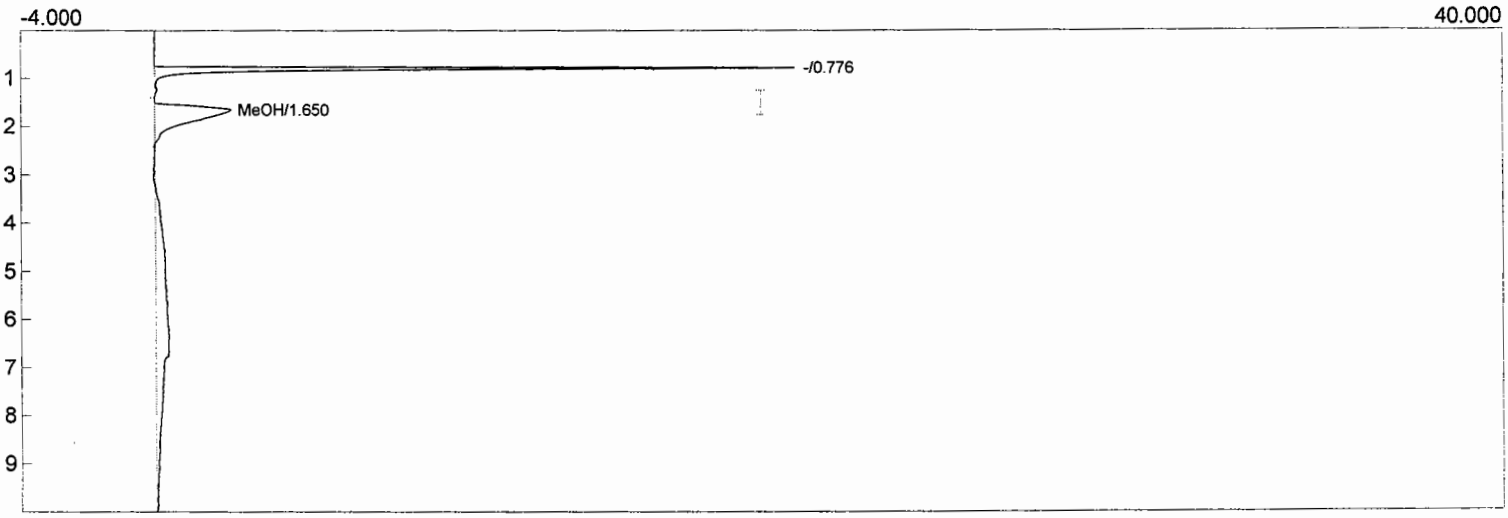
Component	Retention	Area
MeOH	1.676	45.9530
		45.9530

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 19:18:25
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR66.chr ()
Sample: Run 3 Unspiked Imp
Operator: E. Vogt



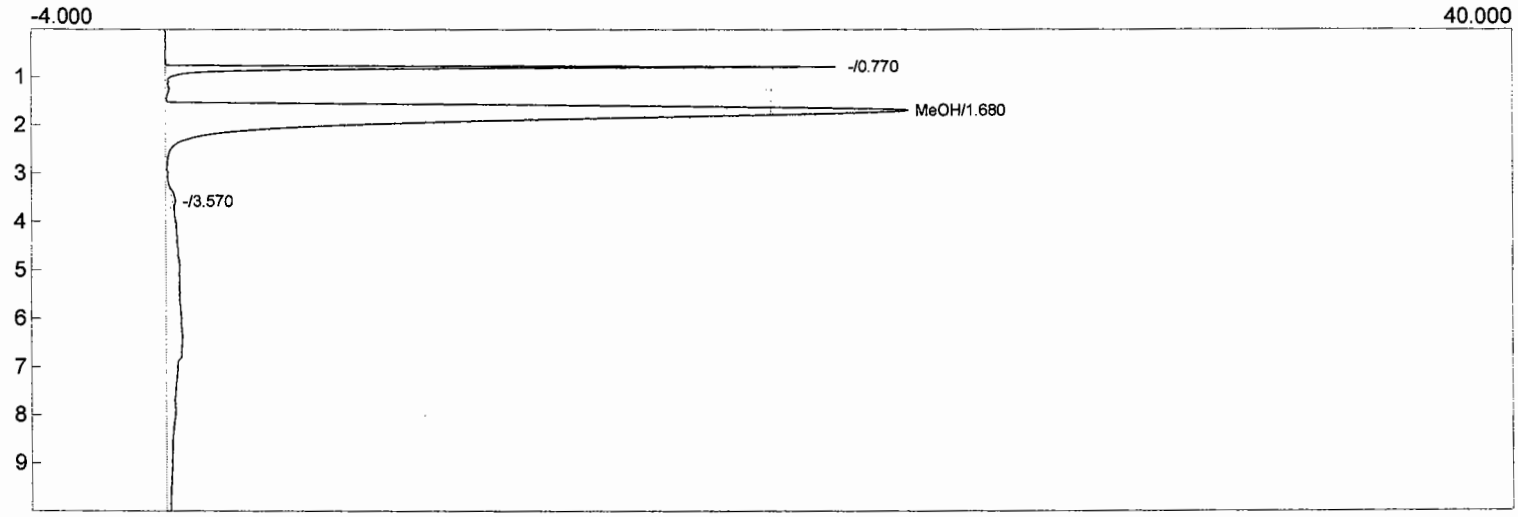
Component	Retention	Area
MeOH	1.690	44.8554
		44.8554

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 19:32:45
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR67.CHR ()
Sample: Run 3 Unspiked Imp
Operator: E. Vogt



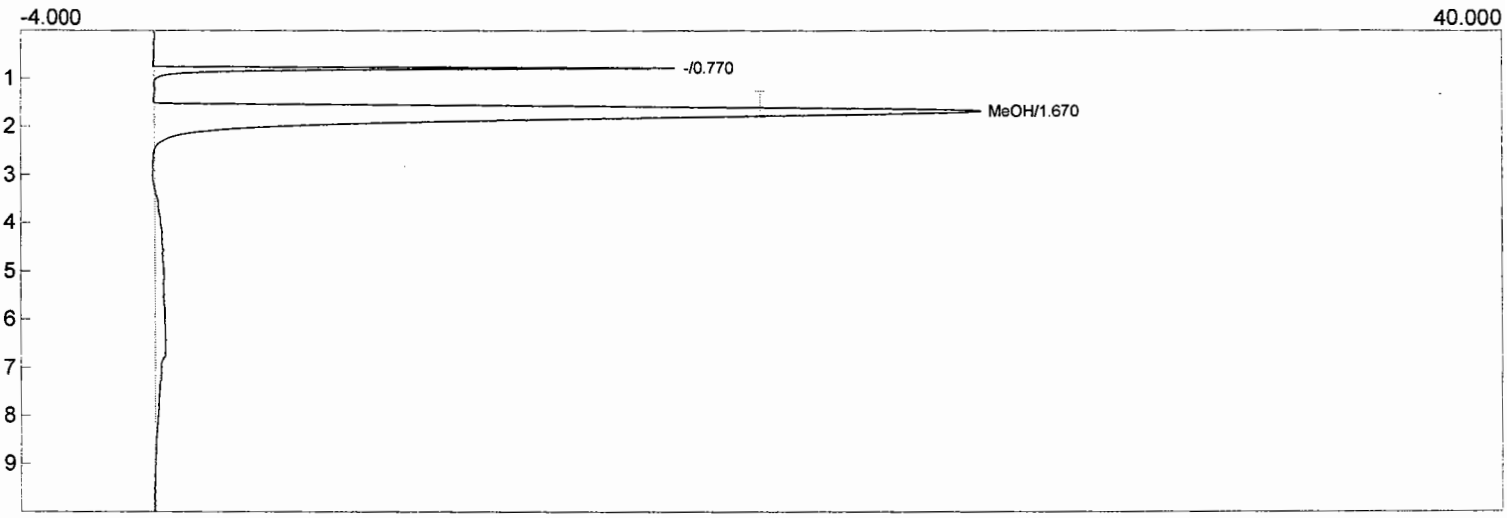
Component	Retention	Area
MeOH	1.650	46.0914
		46.0914

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 20:02:12
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR69.chr ()
Sample: Run 1 Spiked Imp
Operator: E. Vogt



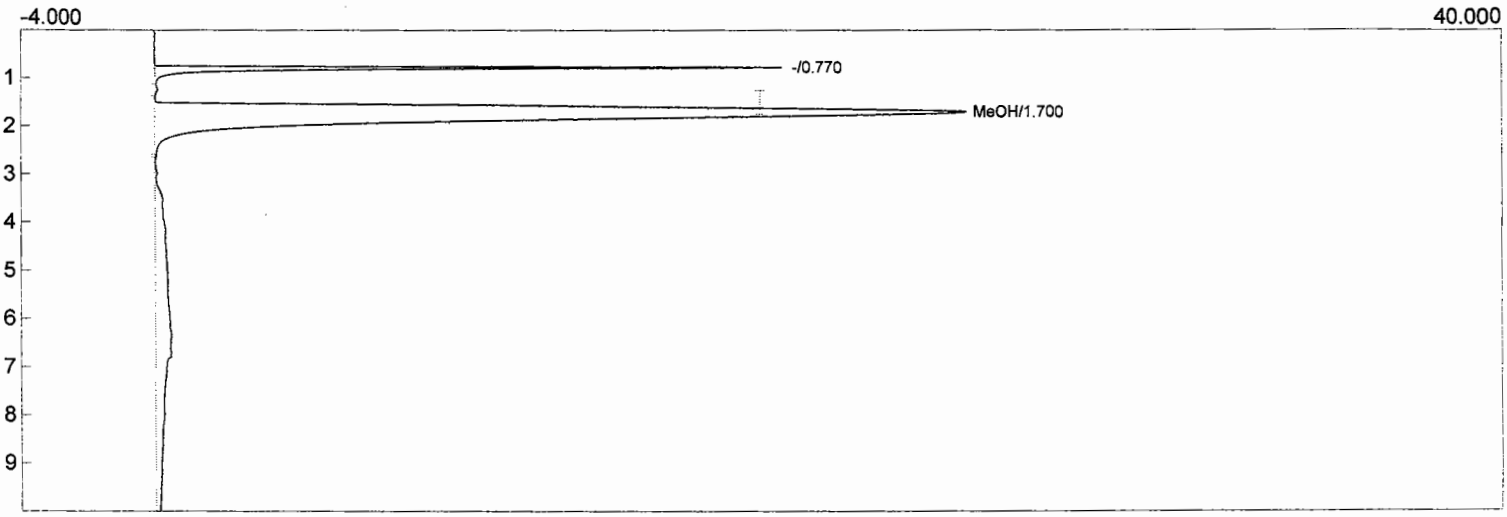
Component	Retention	Area
MeOH	1.680	436.7184
		436.7184

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 20:16:45
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR70.chr ()
Sample: Run 1 Spiked Imp
Operator: E. Vogt



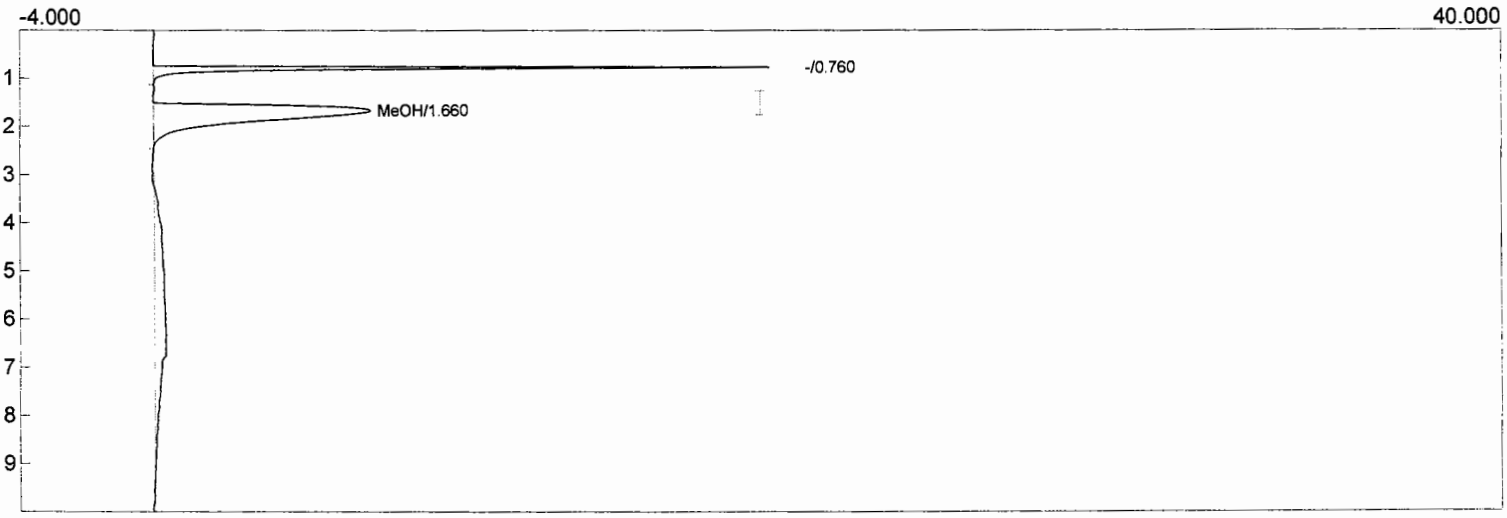
Component	Retention	Area
MeOH	1.670	434.4342
		434.4342

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 20:31:08
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR71.chr ()
Sample: Run 1 Uspiked Imp
Operator: E. Vogt



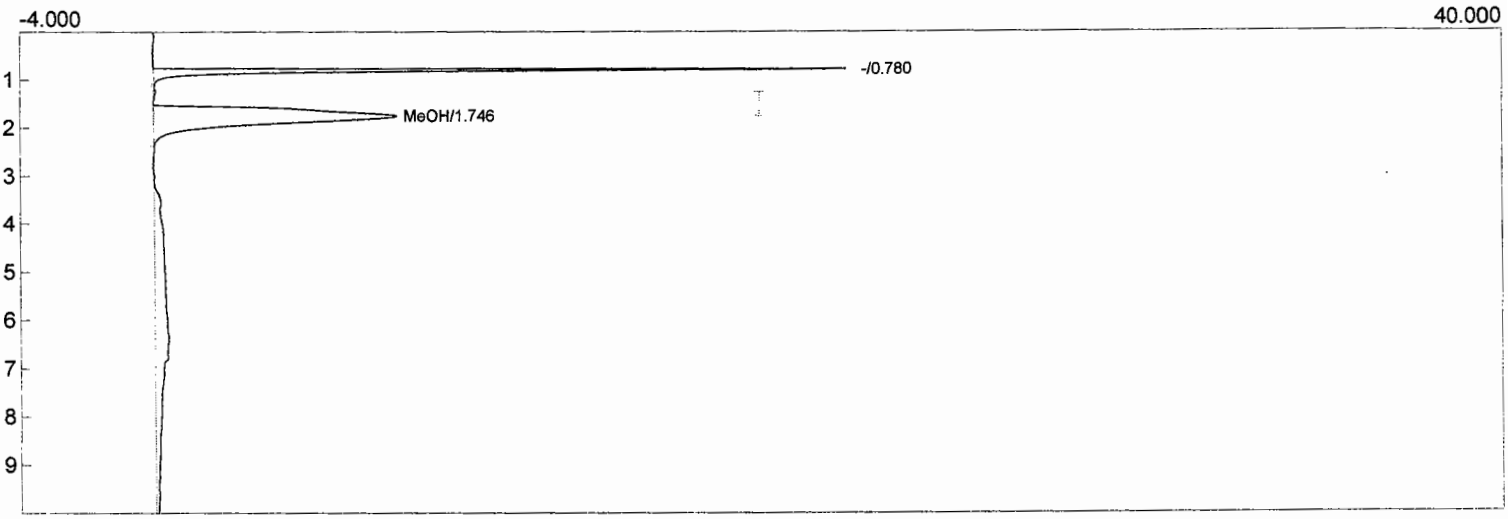
Component	Retention	Area
MeOH	1.700	435.2505
		435.2505

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 21:00:23
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR73.chr ()
Sample: Run 2 Spiked Imp
Operator: E. Vogt



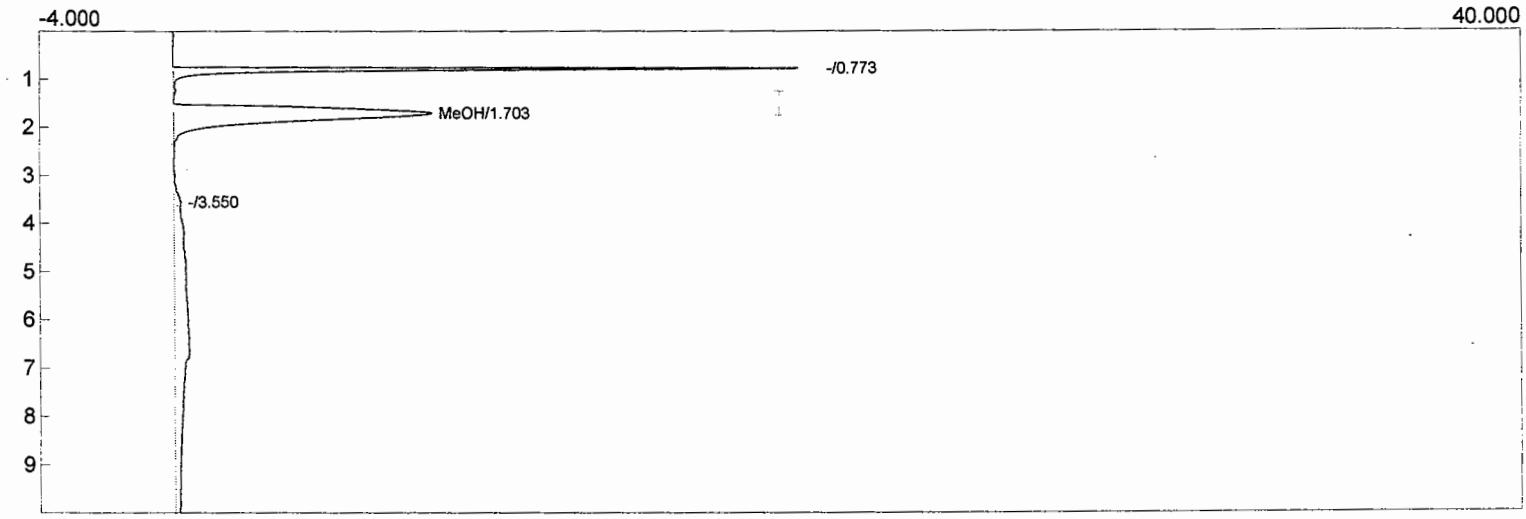
Component	Retention	Area
MeOH	1.660	135.6088
		135.6088

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 21:14:40
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR74.chr ()
Sample: Run 2 Spiked Imp
Operator: E. Vogt



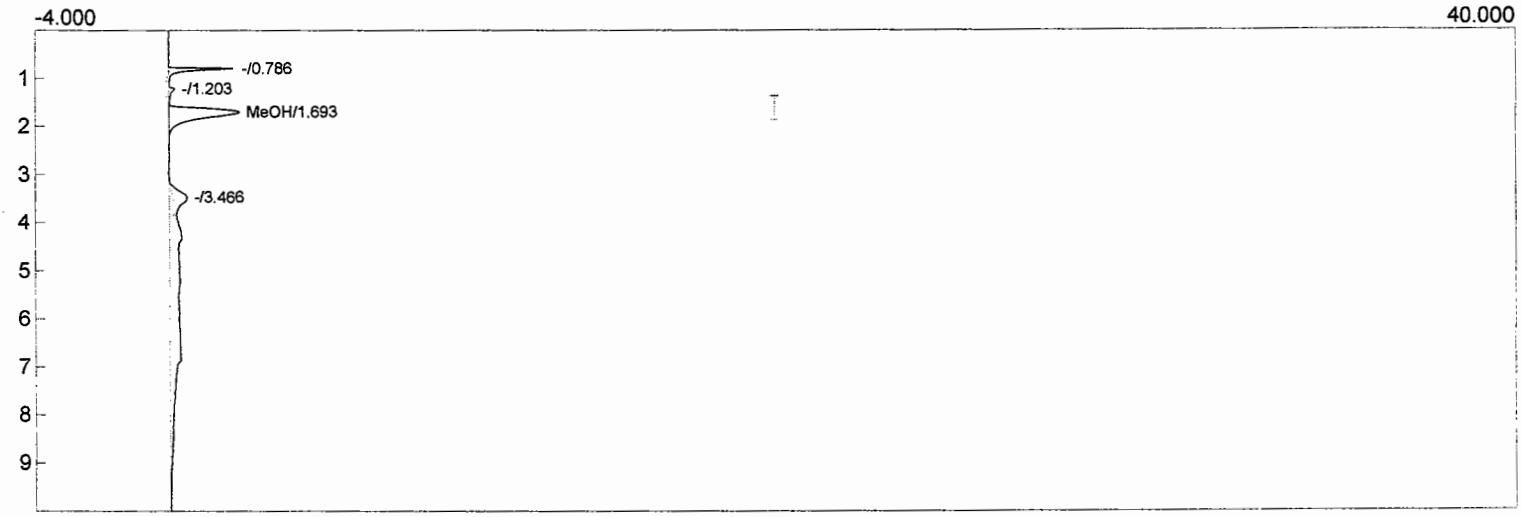
Component	Retention	Area
MeOH	1.746	138.8050
		138.8050

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 21:29:23
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR75.CHR ()
Sample: Run 2 Unspiked Imp
Operator: E. Vogt



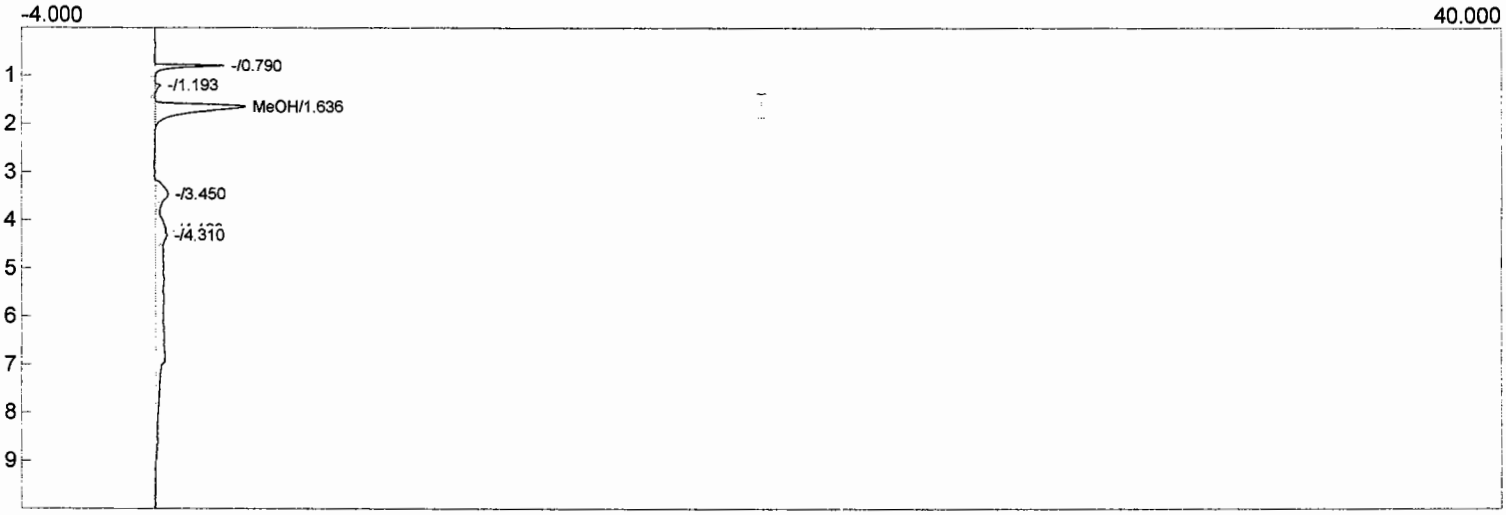
Component	Retention	Area
MeOH	1.703	136.2756
		136.2756

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 17:23:19
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR121.chr ()
Sample: Run 3 Spiked Imps
Operator: E. Vogt



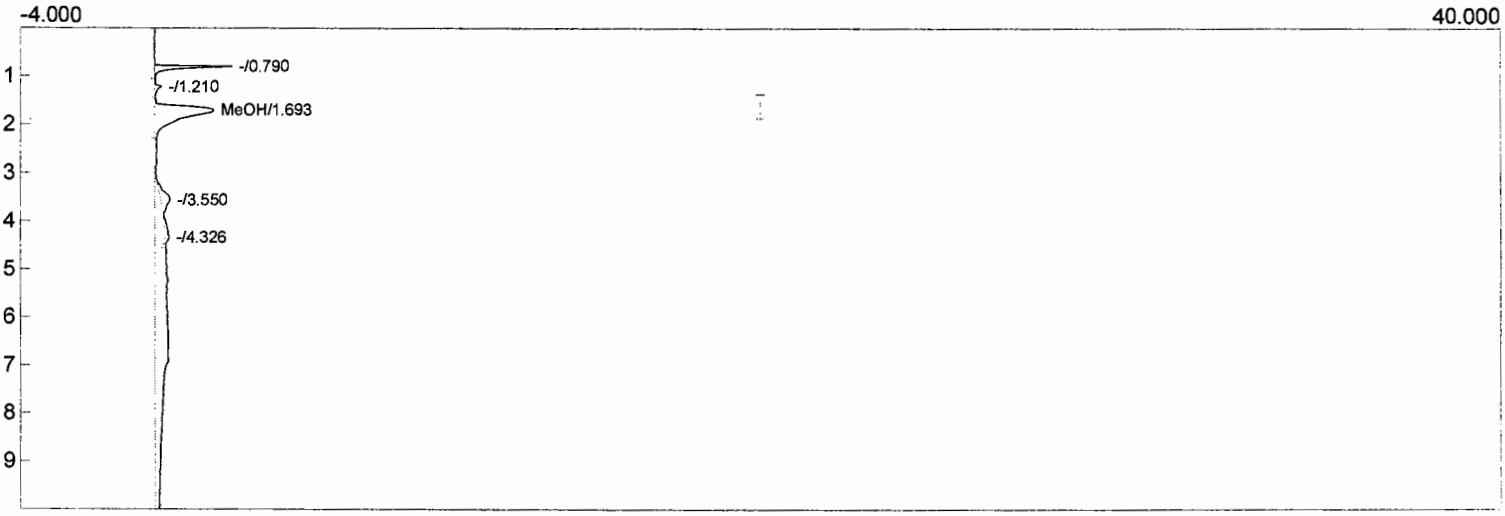
Component	Retention	Area
MeOH	1.693	27.9516
		27.9516

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 17:37:43
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR122.chr ()
Sample: Run 3 Spiked Imp
Operator: E. Vogt



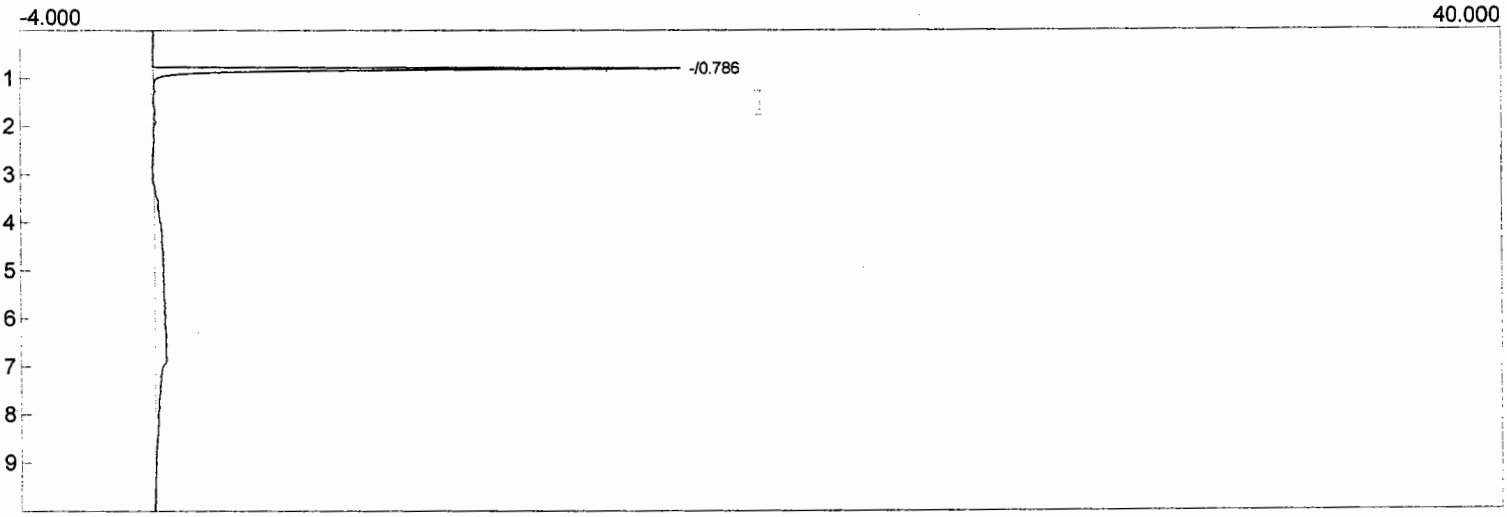
Component	Retention	Area
MeOH	1.636	28.8887
		28.8887

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 17:51:25
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR123.CHR ()
Sample: Run 3 Spiked Imps
Operator: E. Vogt



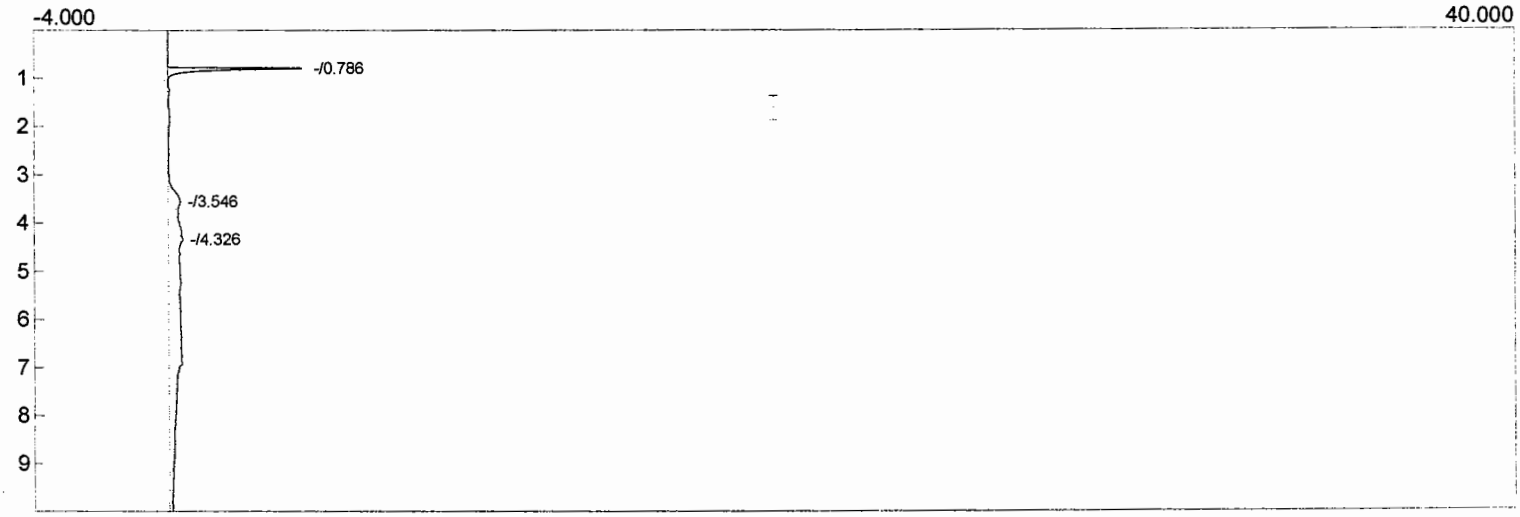
Component	Retention	Area
MeOH	1.693	28.2144
		28.2144

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 23:26:44
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR83.chr ()
Sample: Water Blank
Operator: E. Vogt



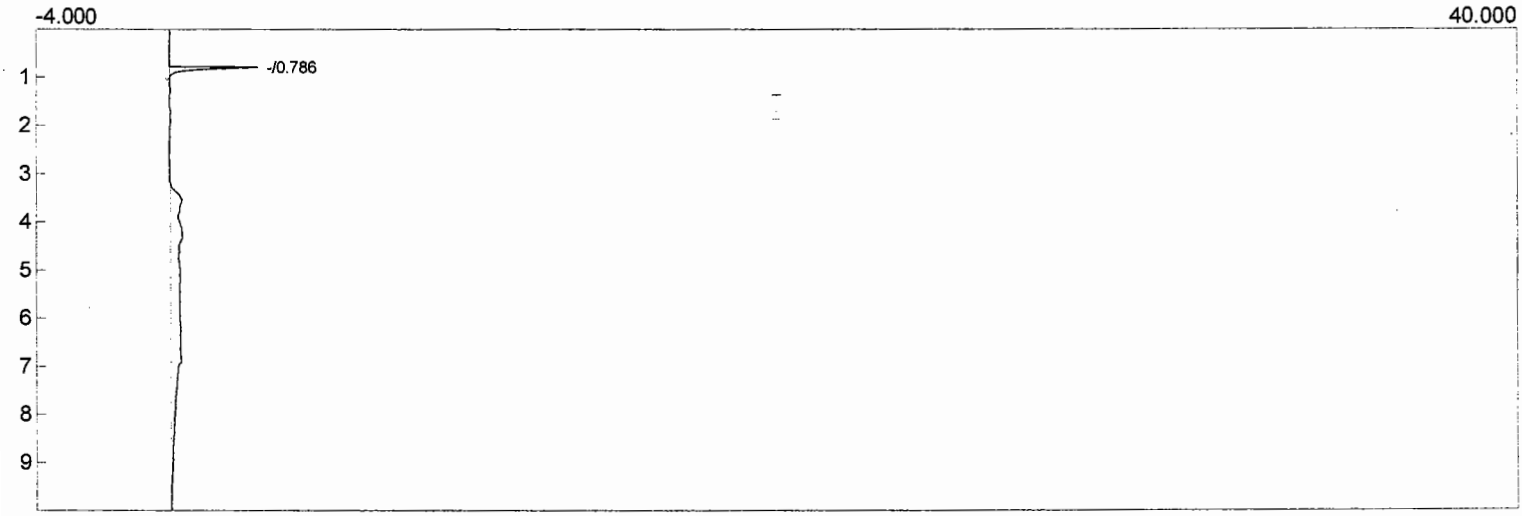
Component	Retention	Area
		0.0000

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 18:34:17
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR126.chr ()
Sample: Water Blank
Operator: E. Vogt



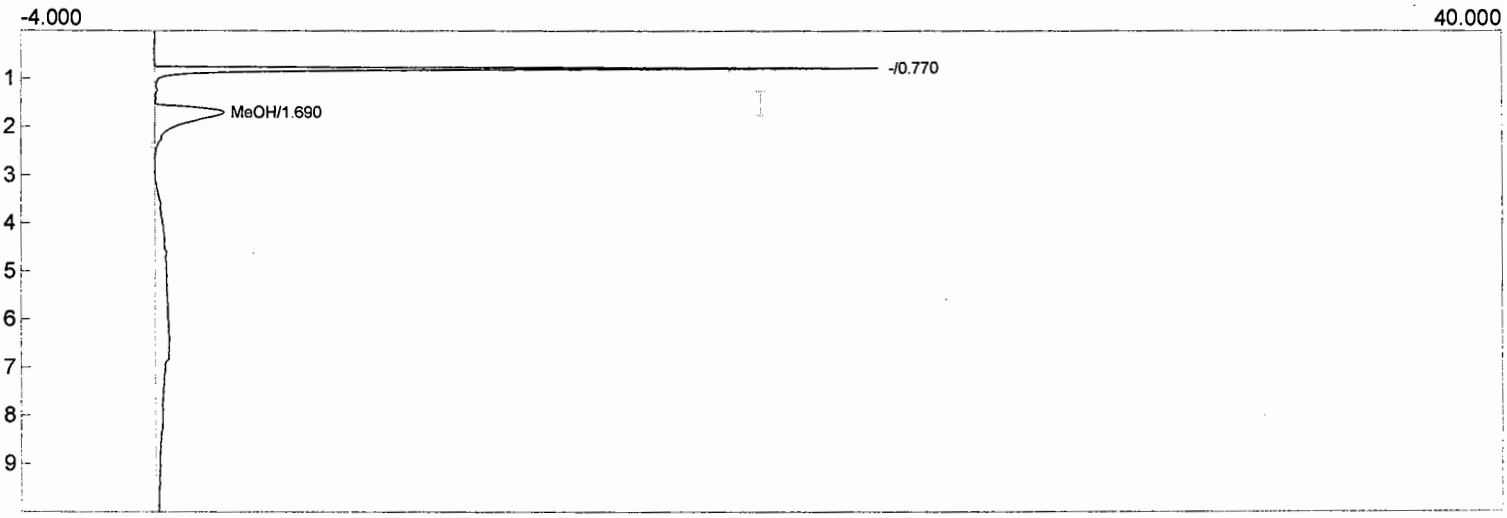
Component	Retention	Area
		0.0000

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 18:20:20
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR125.chr ()
Sample: Water Blank
Operator: E. Vogt



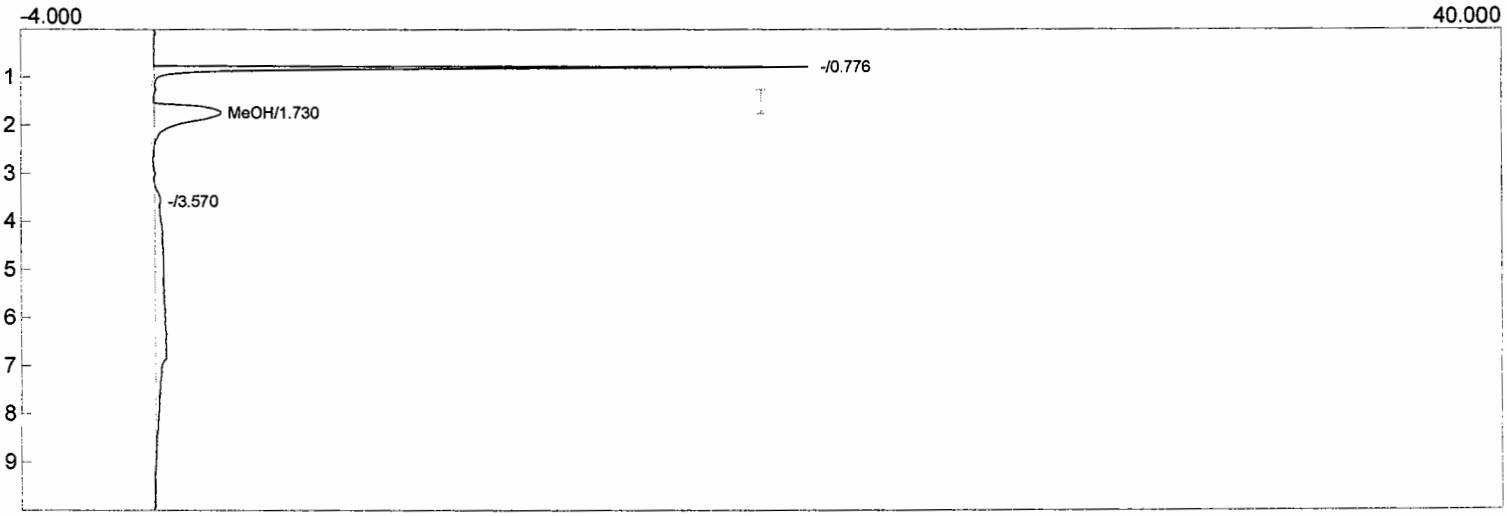
Component	Retention	Area
		0.0000

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 22:28:06
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR79.chr ()
Sample: 20 ppm MeOH Spike Solution
Operator: E. Vogt



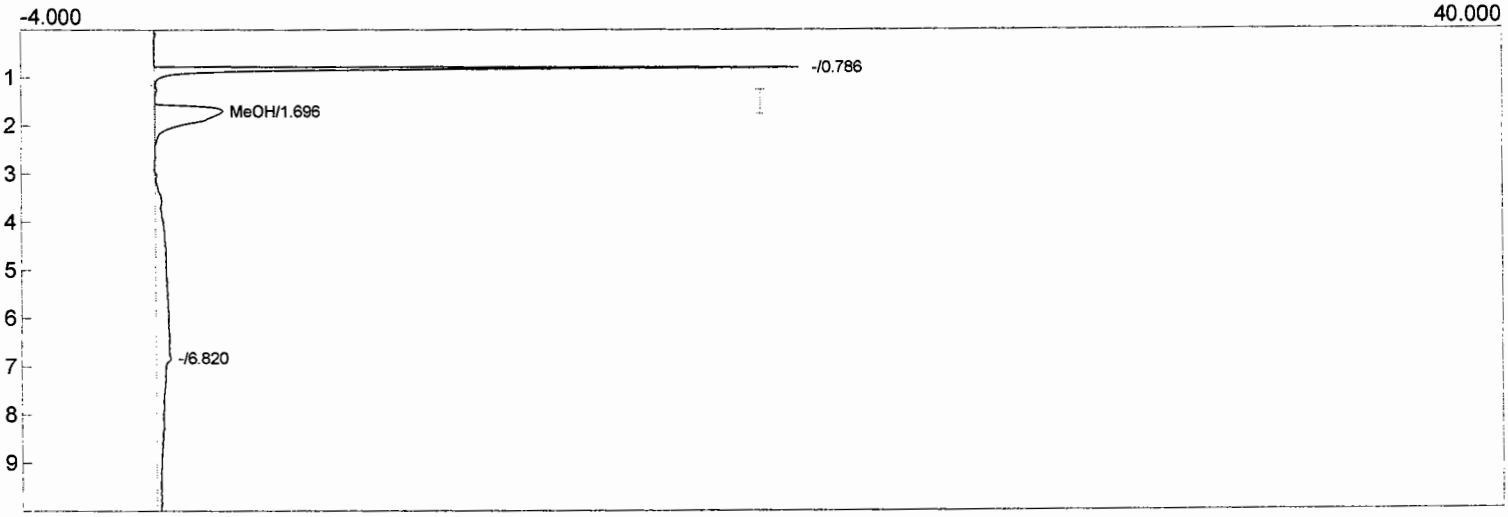
Component	Retention	Area
MeOH	1.690	42.5022
		42.5022

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 22:42:33
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR80.chr ()
Sample: 20 ppm MeOH Spike Solution
Operator: E. Vogt



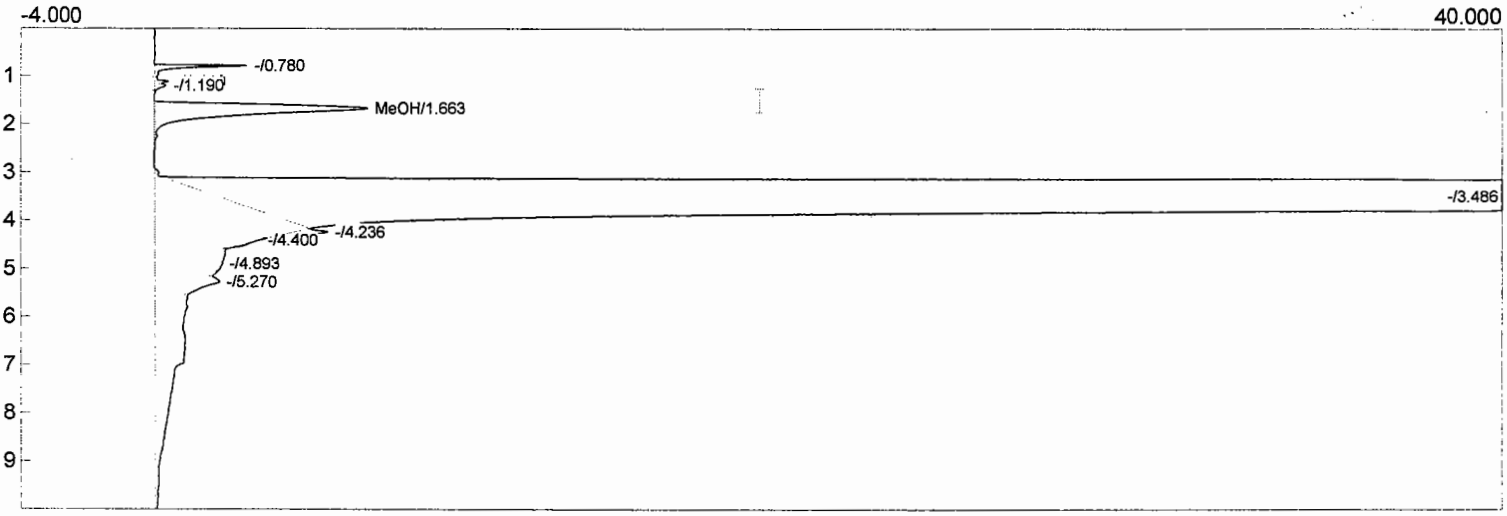
Component	Retention	Area
MeOH	1.730	43.9426
		43.9426

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 22:57:03
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR81.CHR ()
Sample: 20 ppm MeOH spike solution
Operator: E. Vogt



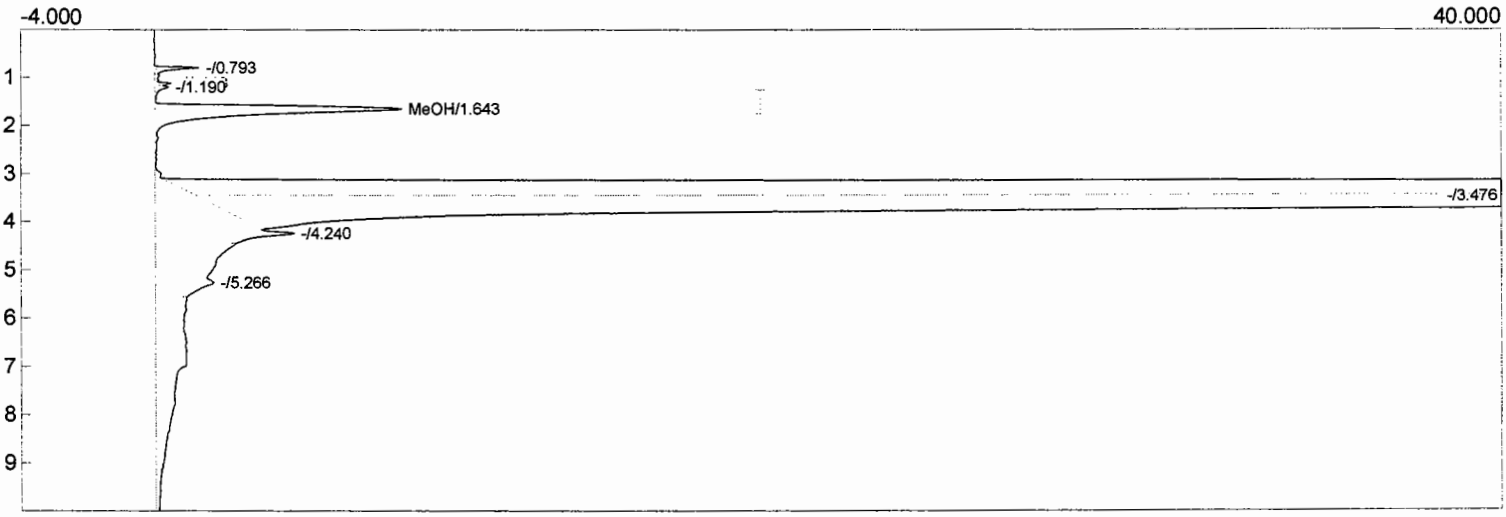
Component	Retention	Area
MeOH	1.696	44.8060
		44.8060

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 09:44:25
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR92.CHR ()
Sample: Run 1 Spiked Tube 1
Operator: E. Vogt



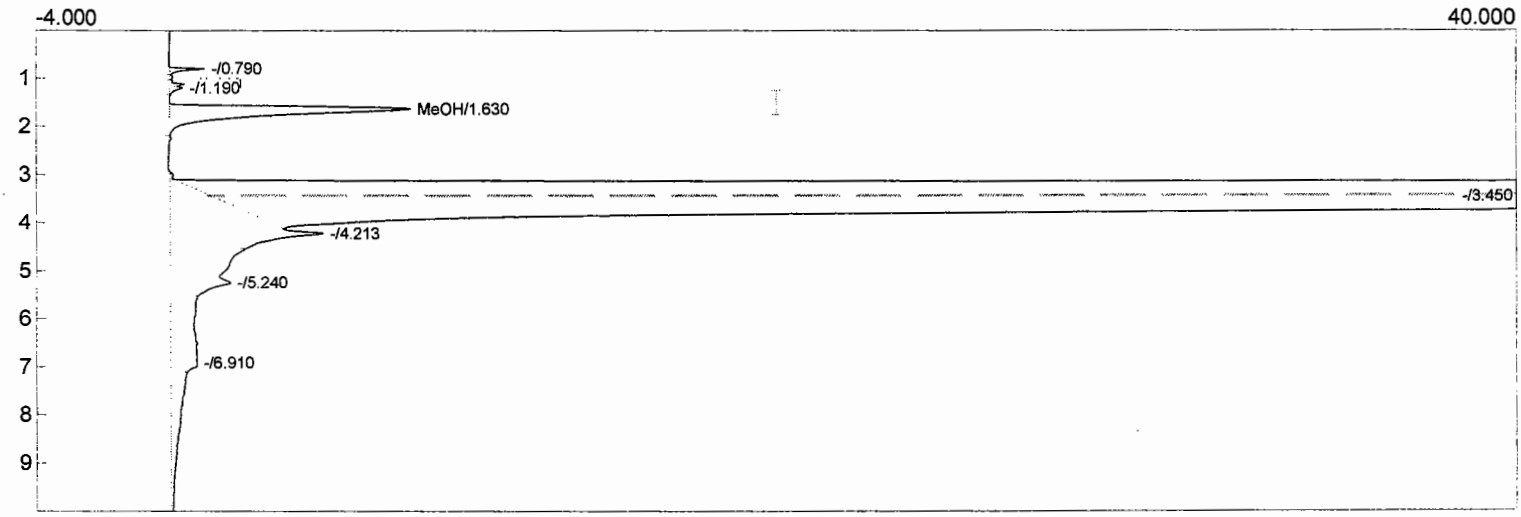
Component	Retention	Area
MeOH	1.663	85.8450
		85.8450

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 09:59:18
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR93.CHR ()
Sample: Run 1 Spiked Tube 1
Operator: E. Vogt



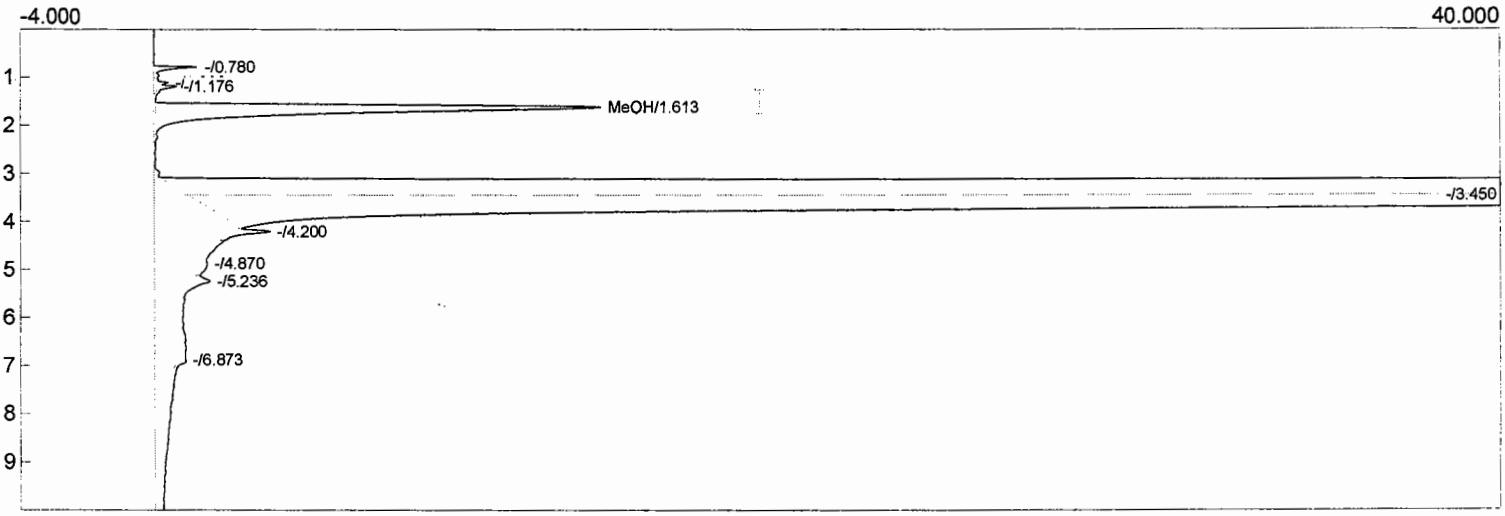
Component	Retention	Area
MeOH	1.643	85.7418
		85.7418

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 10:13:45
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR94.CHR ()
Sample: Run 1 Spiked Tube 1
Operator: E. Vogt



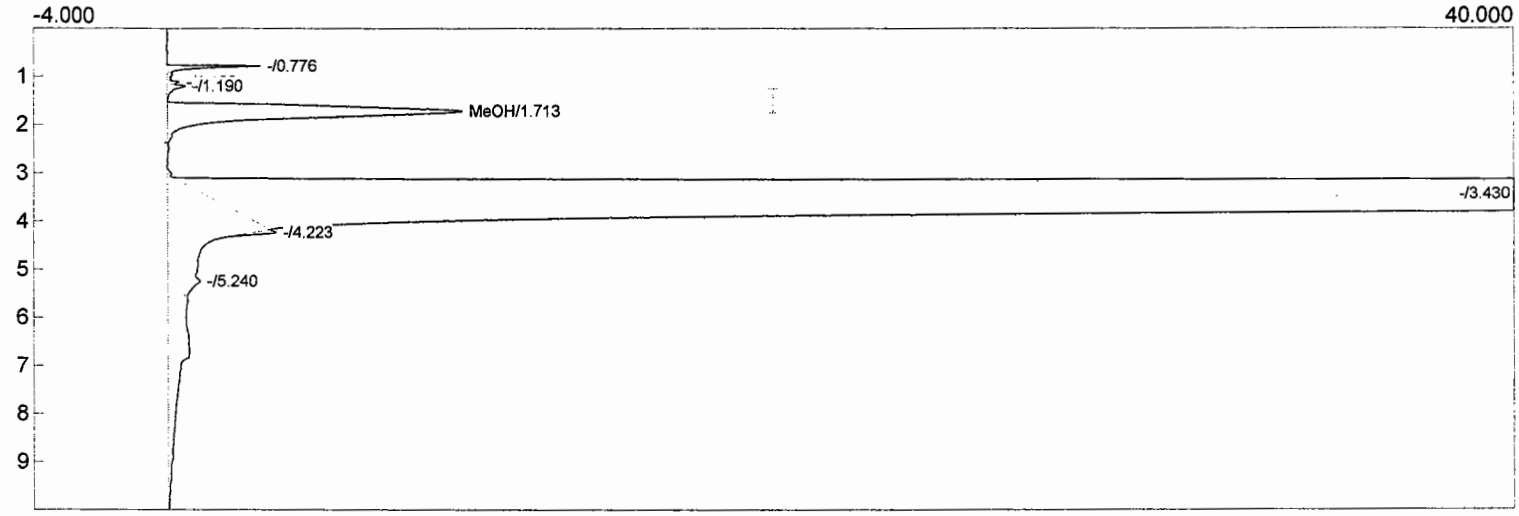
Component	Retention	Area
MeOH	1.630	84.5160
		84.5160

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 10:55:03
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR95.CHR ()
Sample: Run 1 Spiked Tube 2
Operator: E. Vogt



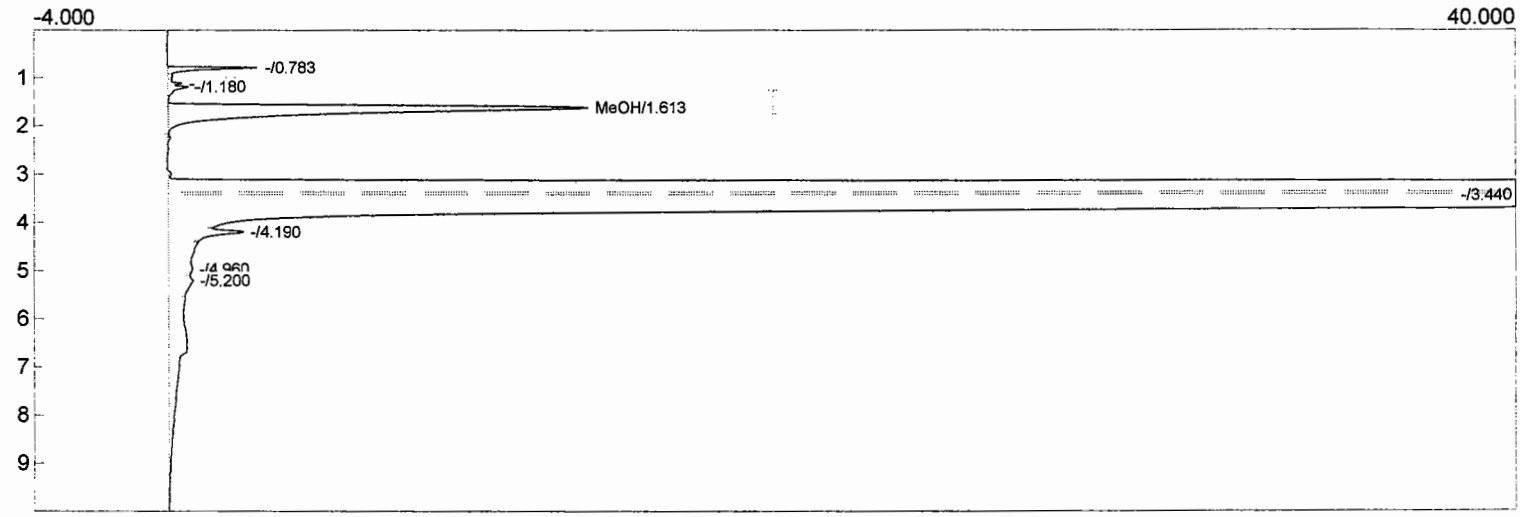
Component	Retention	Area
MeOH	1.613	145.4418
		145.4418

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 11:08:47
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR96.CHR ()
Sample: Run 1 Spiked Tube 2
Operator: E. Vogt



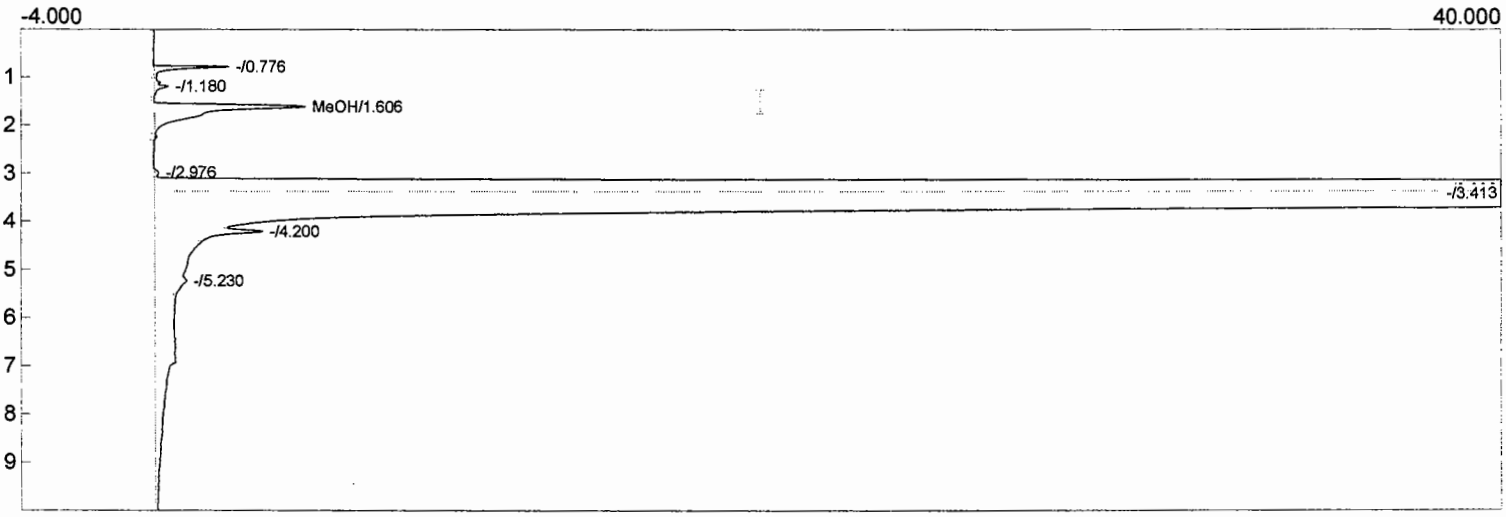
Component	Retention	Area
MeOH	1.713	136.6954
		136.6954

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 11:22:26
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR97.CHR ()
Sample: Run 1 Spiked Tube 2
Operator: E. Vogt



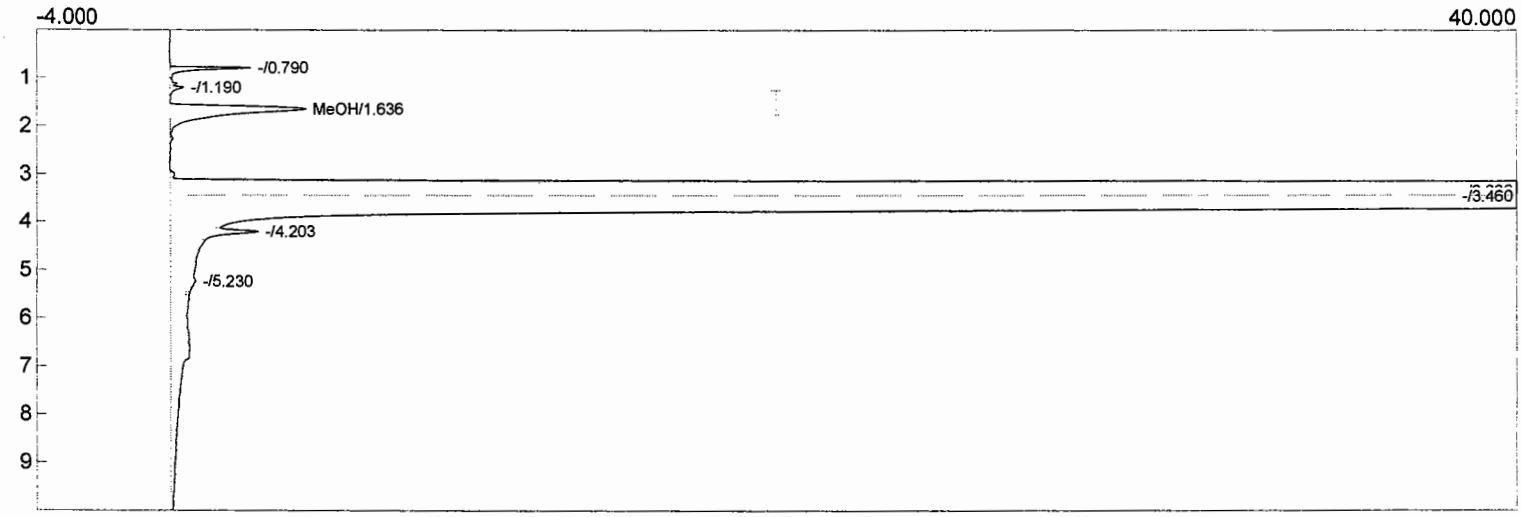
Component	Retention	Area
MeOH	1.613	133.1976
		133.1976

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 12:25:31
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR101.CHR ()
Sample: Run 2 Spiked Tube 1
Operator: E. Vogt



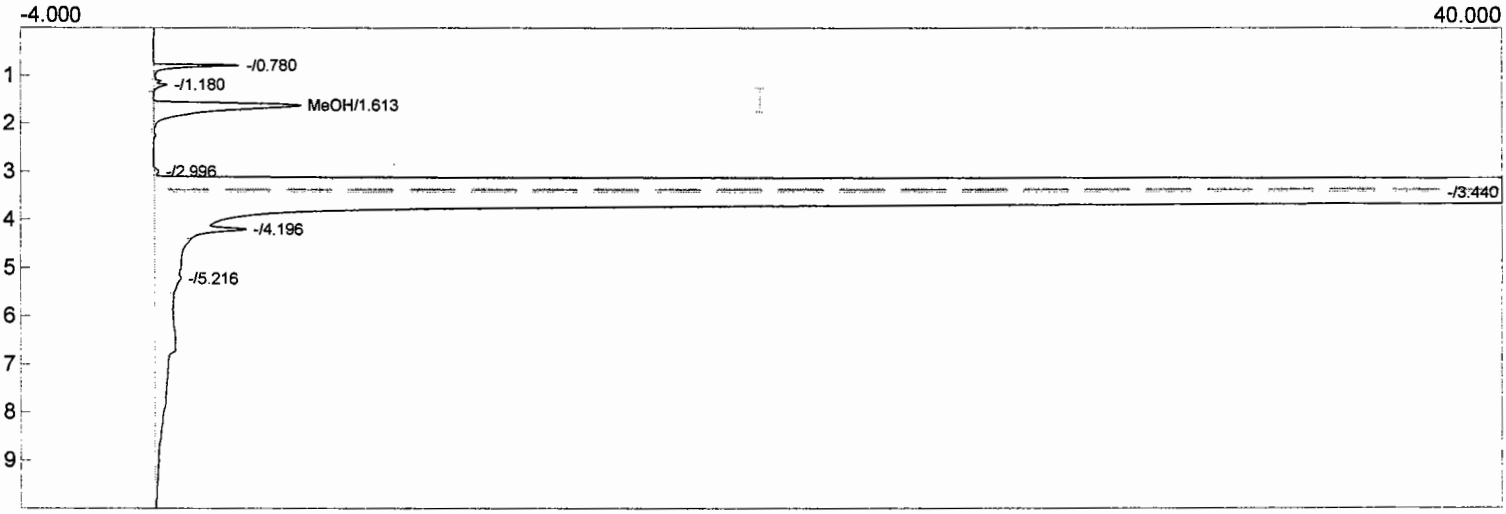
Component	Retention	Area
MeOH	1.606	47.6806
		47.6806

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 12:39:07
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR102.CHR ()
Sample: Run 2 Spiked Tube 1
Operator: E. Vogt



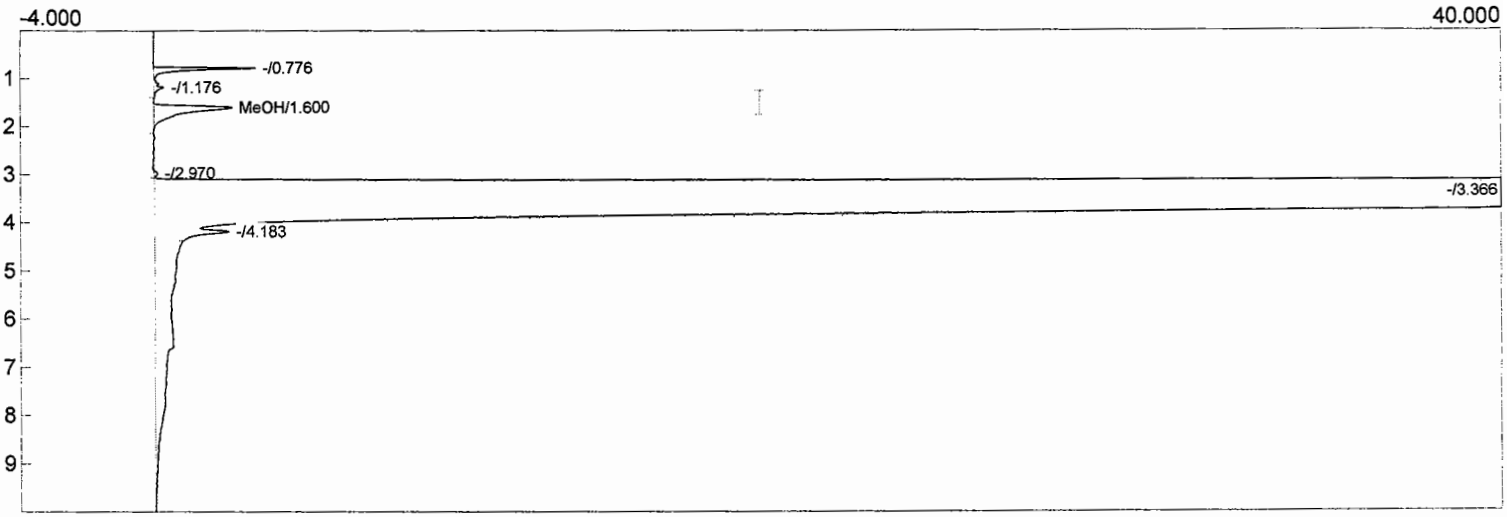
Component	Retention	Area
MeOH	1.636	46.9710
		46.9710

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 12:52:51
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR103.CHR ()
Sample: Run 2 Spiked Tube 1
Operator: E. Vogt



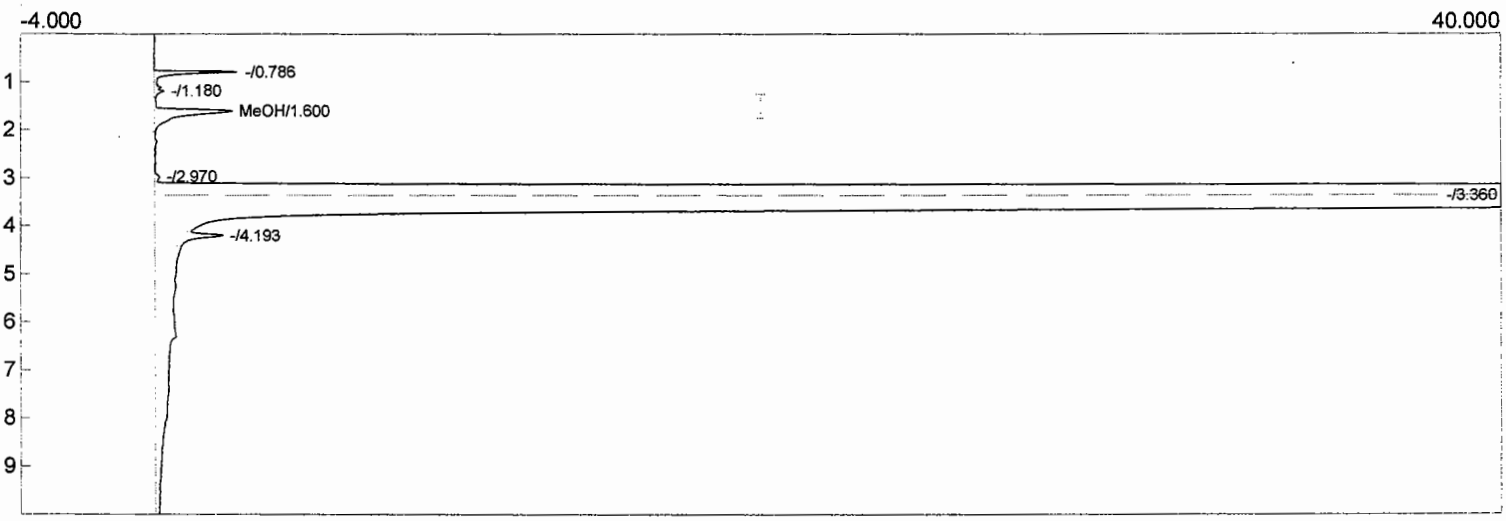
Component	Retention	Area
MeOH	1.613	46.7870
		46.7870

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 13:21:12
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR105.CHR ()
Sample: Run 2 Spiked Tube 2
Operator: E. Vogt



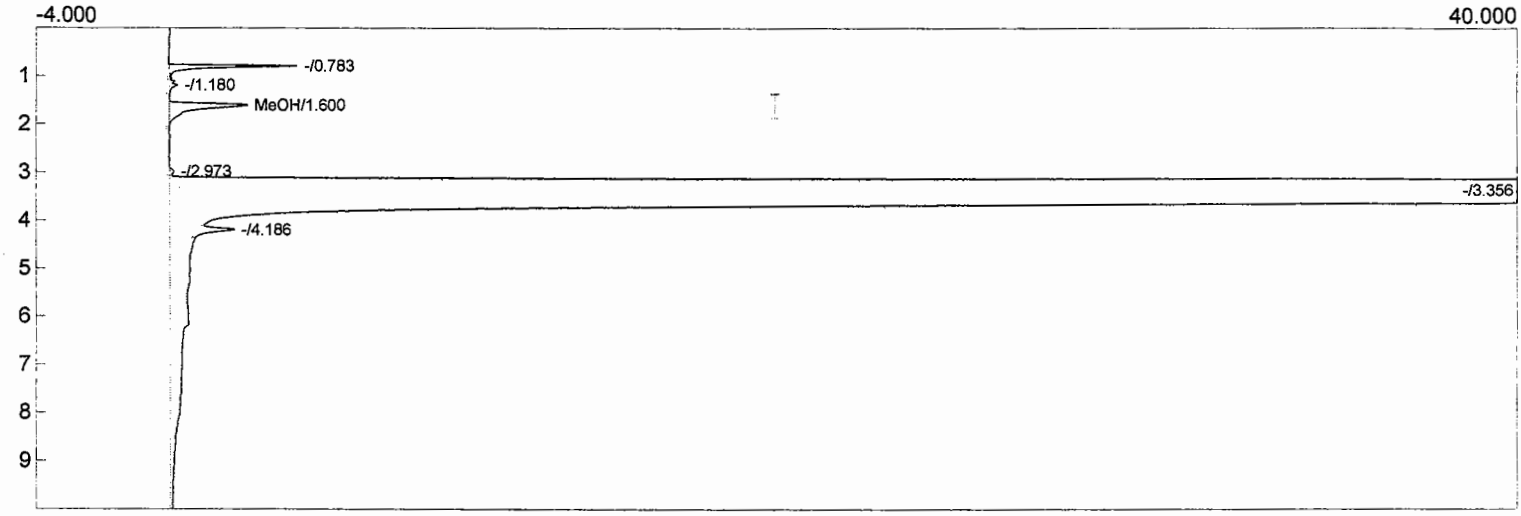
Component	Retention	Area
MeOH	1.600	22.8966
		22.8966

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 13:49:45
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR107.CHR ()
Sample: Run 2 Spiked Tube 2
Operator: E. Vogt



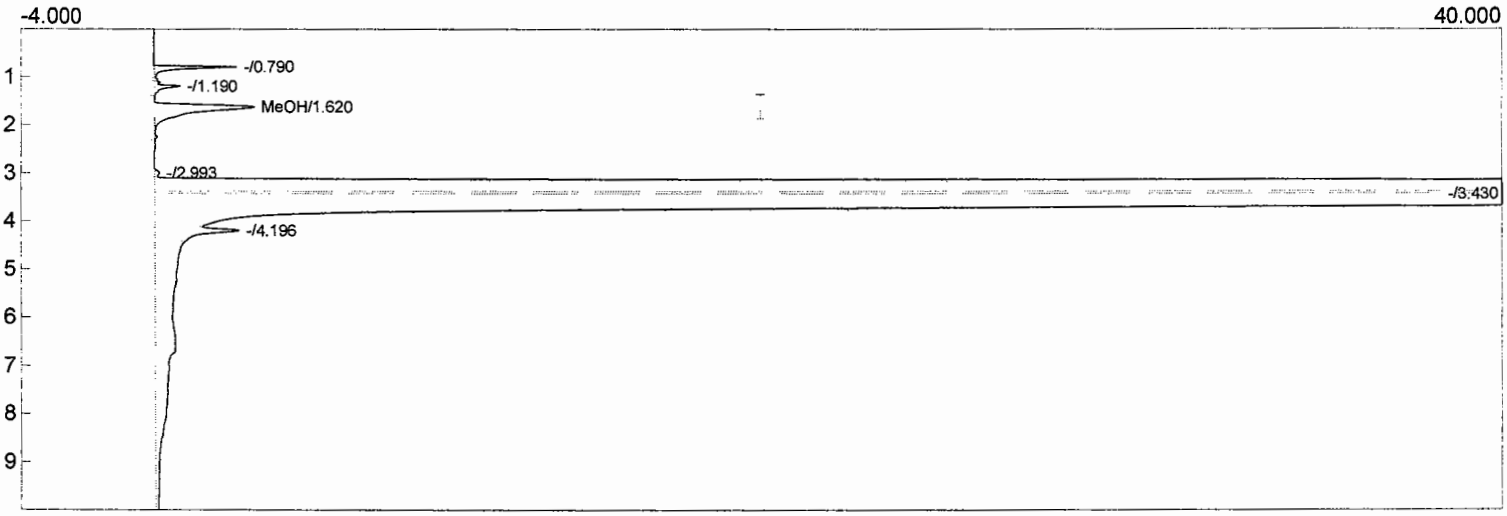
Component	Retention	Area
MeOH	1.600	19.5402
		19.5402

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 14:29:51
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR109.CHR ()
Sample: Run 2 Spiked Tube 2
Operator: E. Vogt



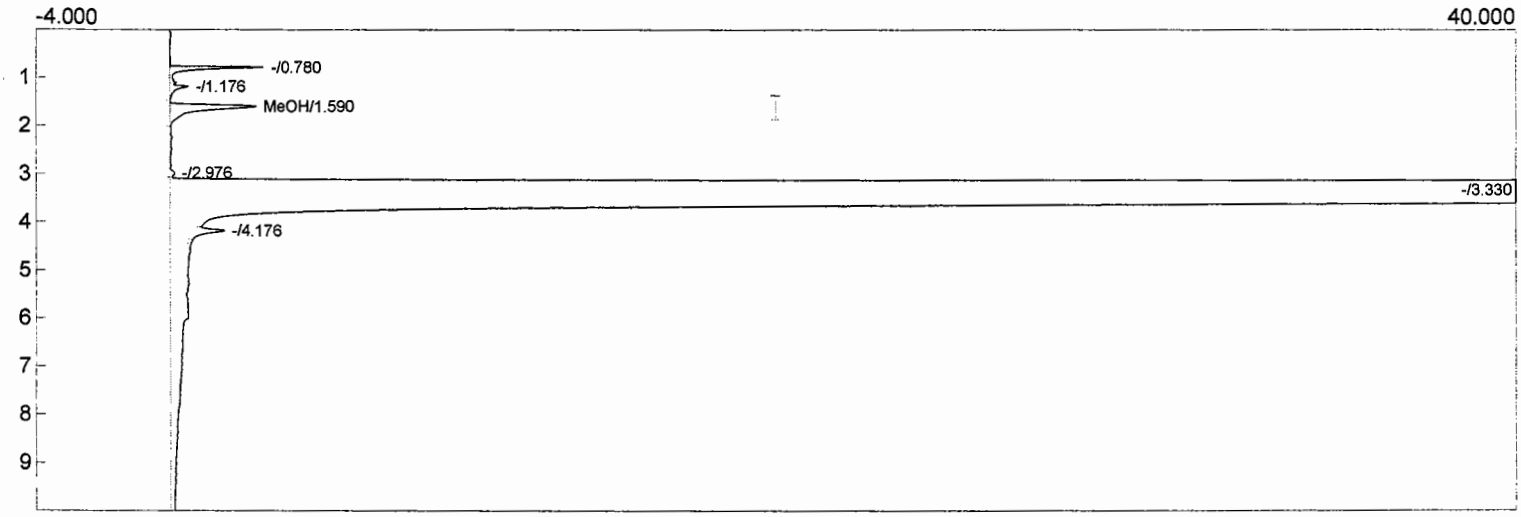
Component	Retention	Area
MeOH	1.600	19.0703
		19.0703

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 14:43:59
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR110.CHR ()
Sample: Run 3 Spiked Tube 1
Operator: E. Vogt



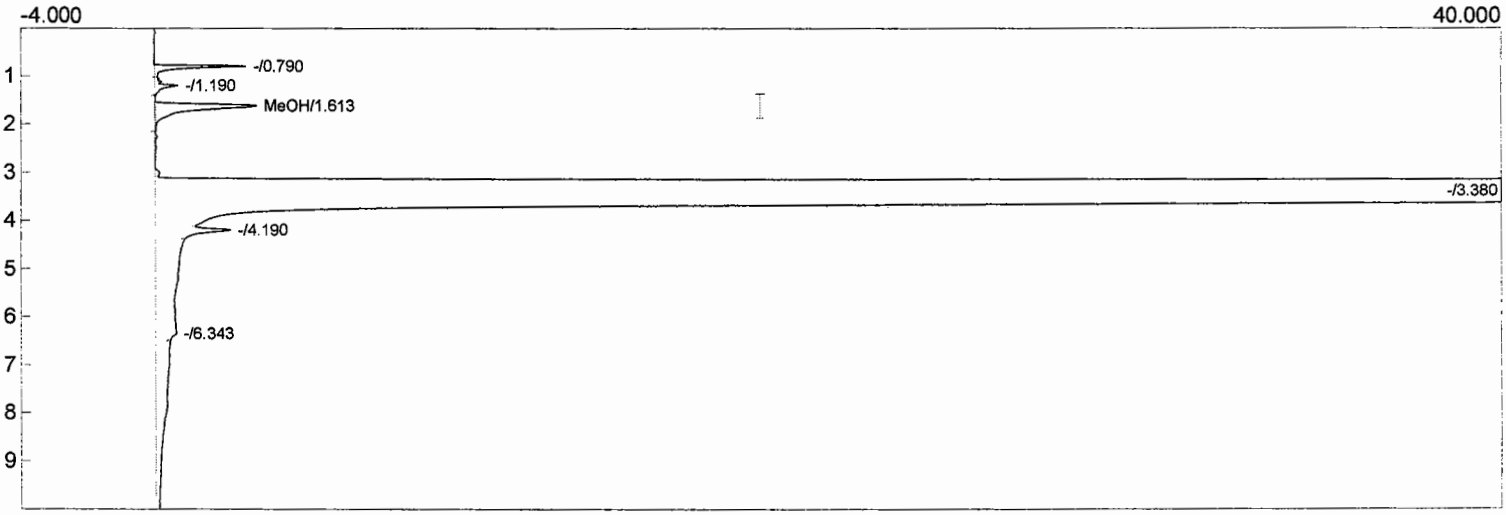
Component	Retention	Area
MeOH	1.620	30.7806
		30.7806

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 14:58:18
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR111.CHR ()
Sample: Run 3 Spiked Tube 1
Operator: E. Vogt



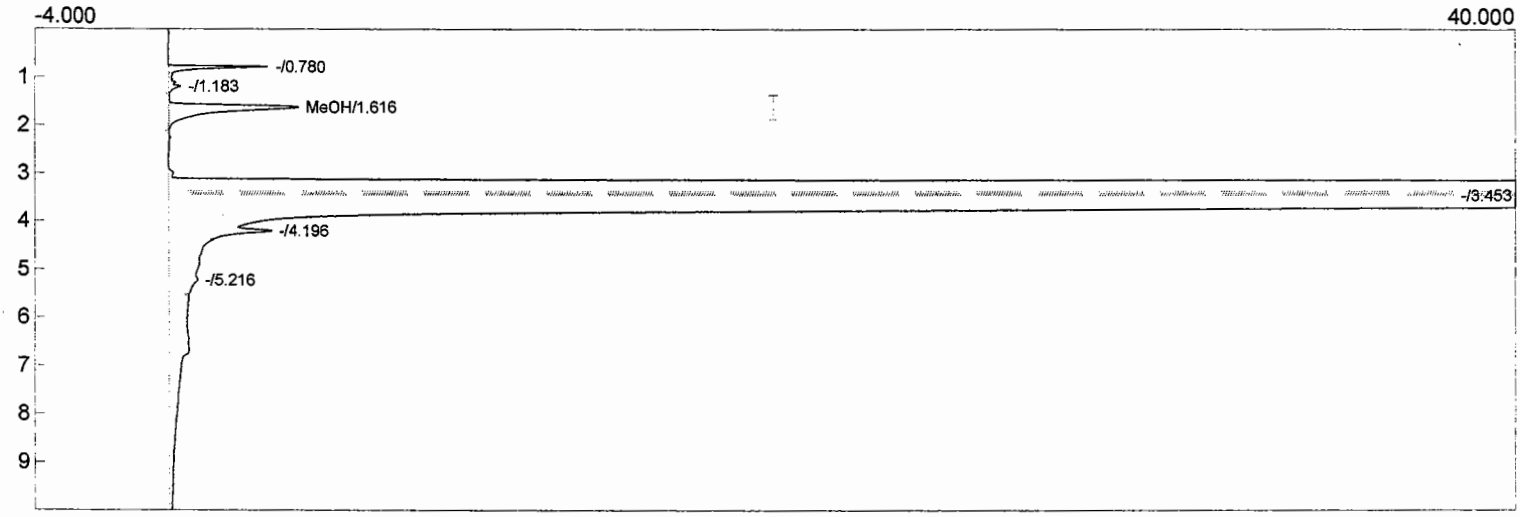
Component	Retention	Area
MeOH	1.590	19.7556
		19.7556

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 15:11:52
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR112.CHR ()
Sample: Run 3 Spiked Tube 1
Operator: E. Vogt



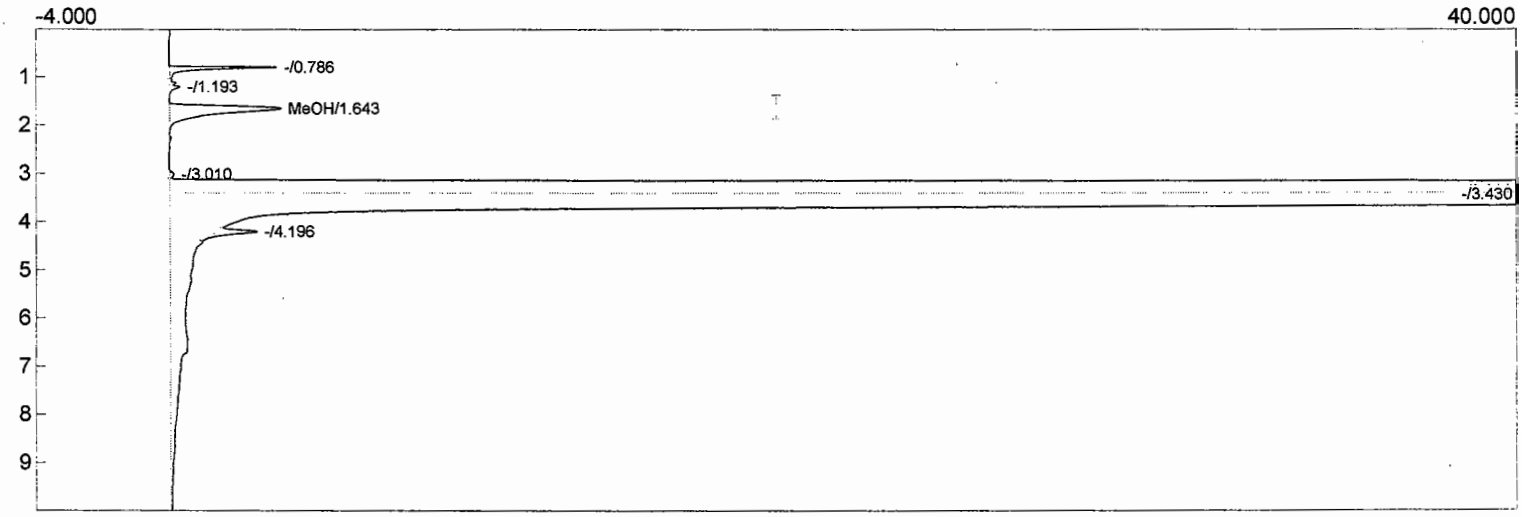
Component	Retention	Area
MeOH	1.613	25.8850
		25.8850

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 15:40:48
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR114.CHR ()
Sample: Run 3 Spiked Tube 2
Operator: E. Vogt



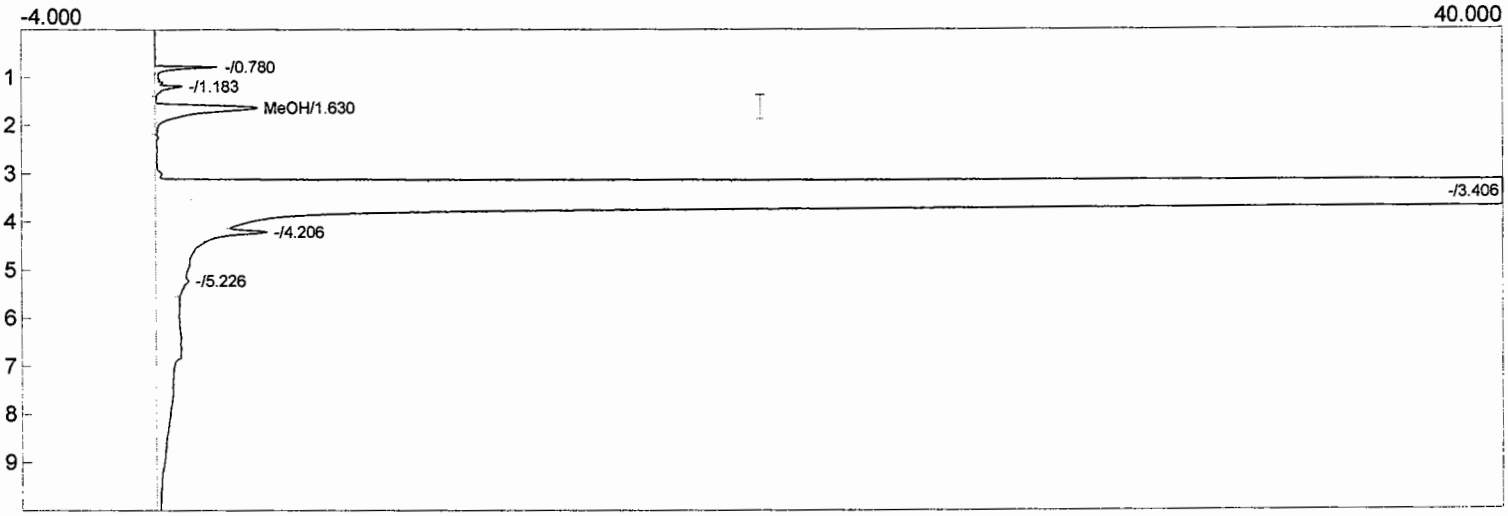
Component	Retention	Area
MeOH	1.616	36.6569
		36.6569

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 15:54:24
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR115.CHR ()
Sample: Run 3 Spiked Tube 2
Operator: E. Vogt



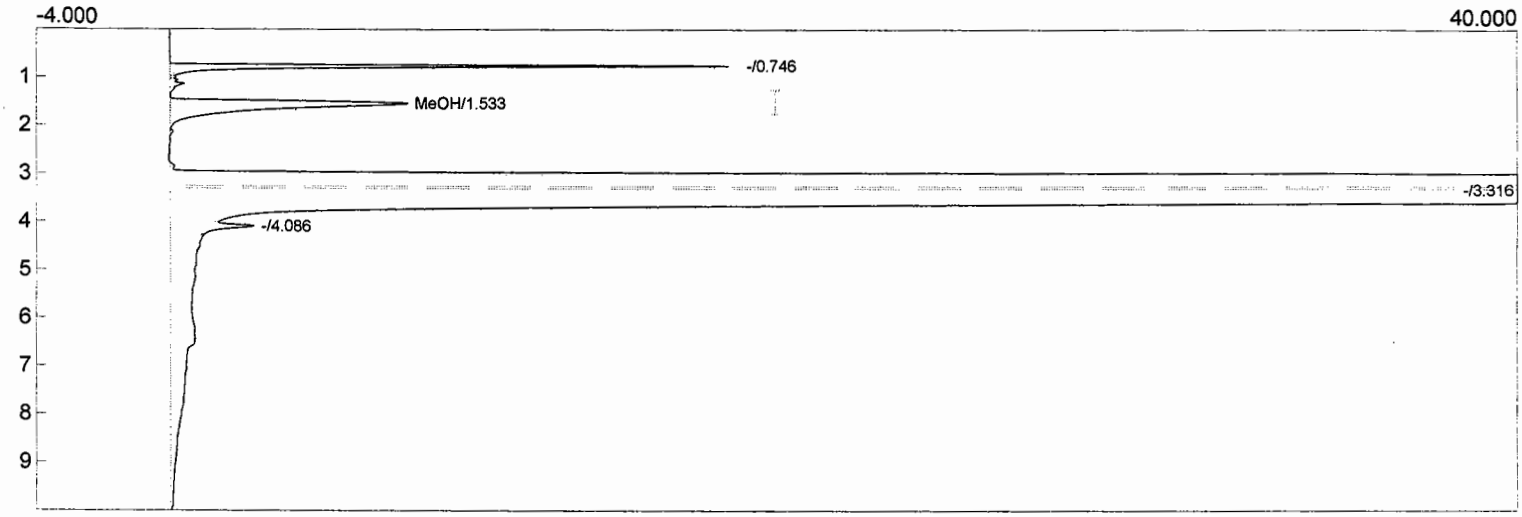
Component	Retention	Area
MeOH	1.643	35.7355
		35.7355

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 15:26:15
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR113.CHR ()
Sample: Run 3 Spiked Tube 2
Operator: E. Vogt



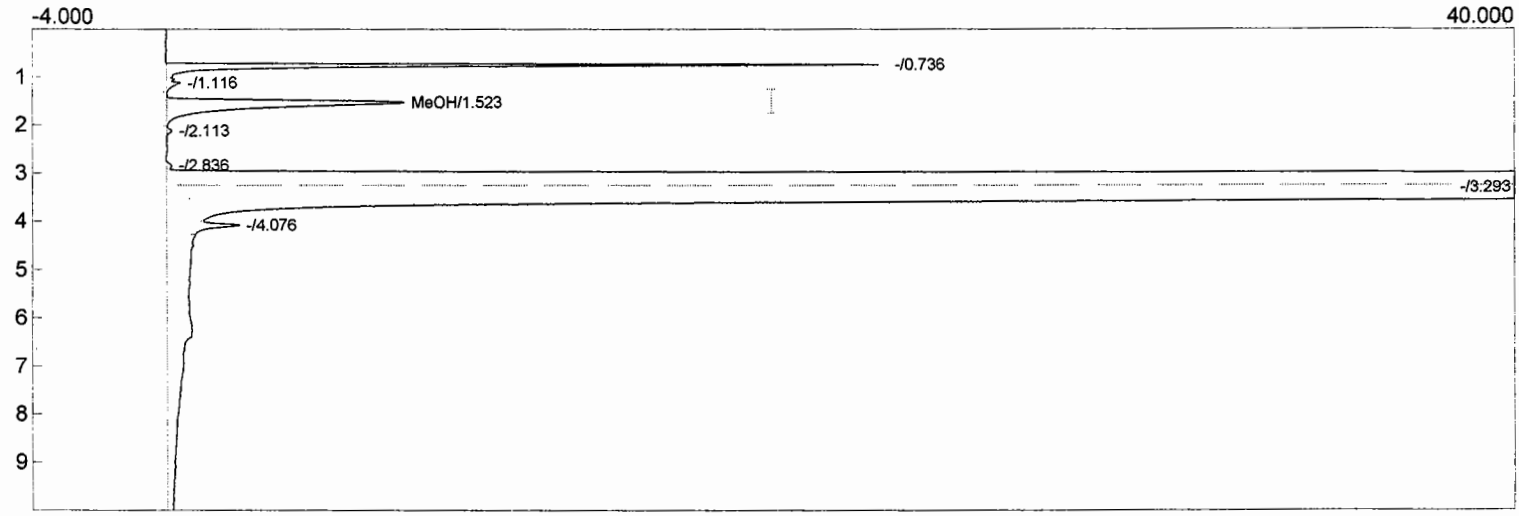
Component	Retention	Area
MeOH	1.630	32.6972
		32.6972

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 11:41:37
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR36.CHR ()
Sample: Run 1 unspiked tube 1
Operator: E. Vogt



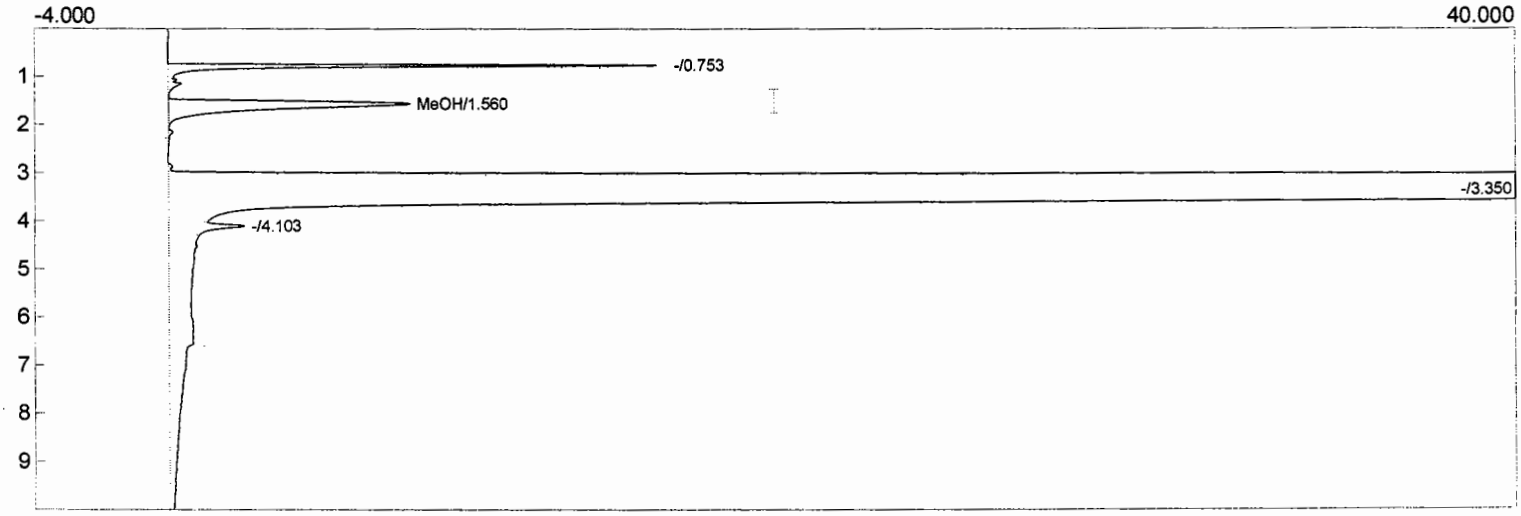
Component	Retention	Area
MeOH	1.533	78.2796
		78.2796

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 11:56:05
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR37.CHR ()
Sample: Run 1 unspiked tube 1
Operator: E. Vogt



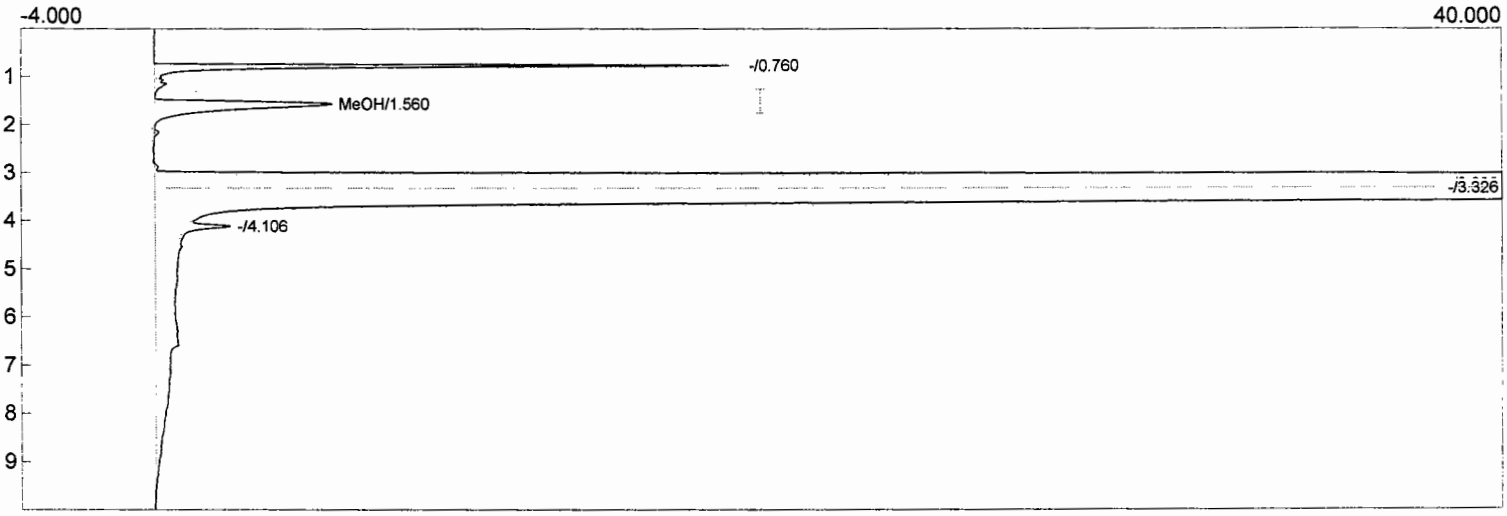
Component	Retention	Area
MeOH	1.523	71.2377
		71.2377

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 12:10:05
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR38.CHR ()
Sample: Run 1 unspiked tube 1
Operator: E. Vogt



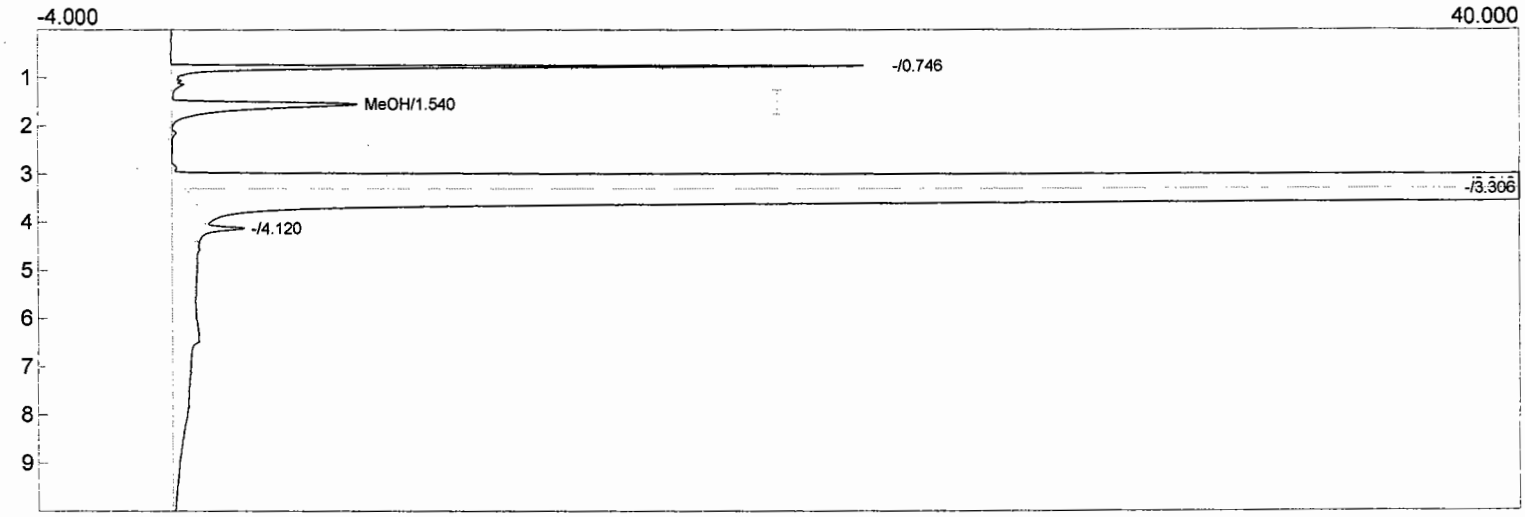
Component	Retention	Area
MeOH	1.560	77.1992
		77.1992

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 12:23:52
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR39.CHR ()
Sample: Run ~~2~~ 1 unspiked tube 1 2
Operator: E. Vogt 4 C



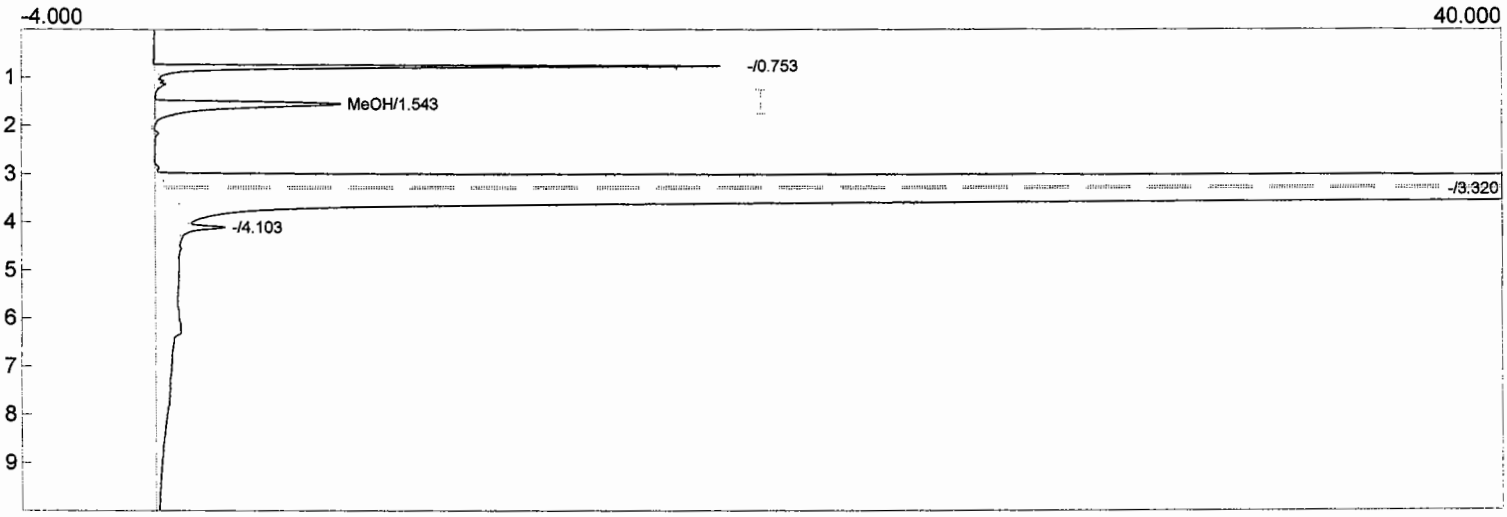
Component	Retention	Area
MeOH	1.560	58.1115
		58.1115

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 12:39:42
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR40.CHR ()
Sample: Run 1 unspiked tube 2
Operator: E. Vogt



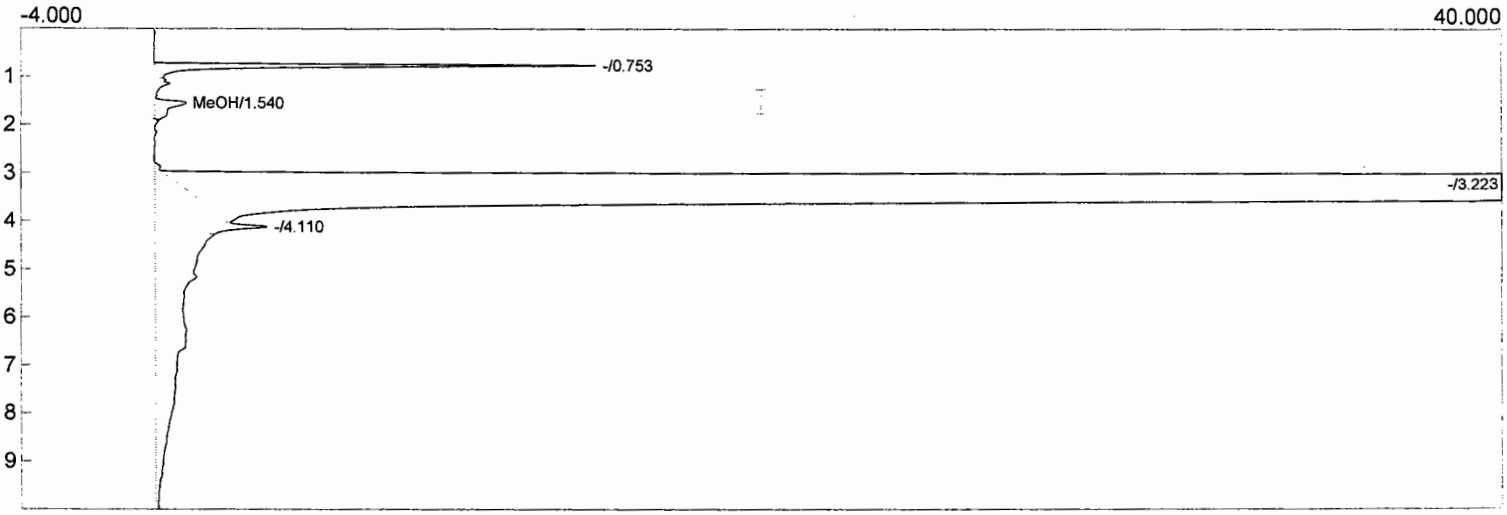
Component	Retention	Area
MeOH	1.540	54.4451
		54.4451

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 12:55:18
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR41.CHR ()
Sample: Run 1 unspiked tube 2
Operator: E. Vogt



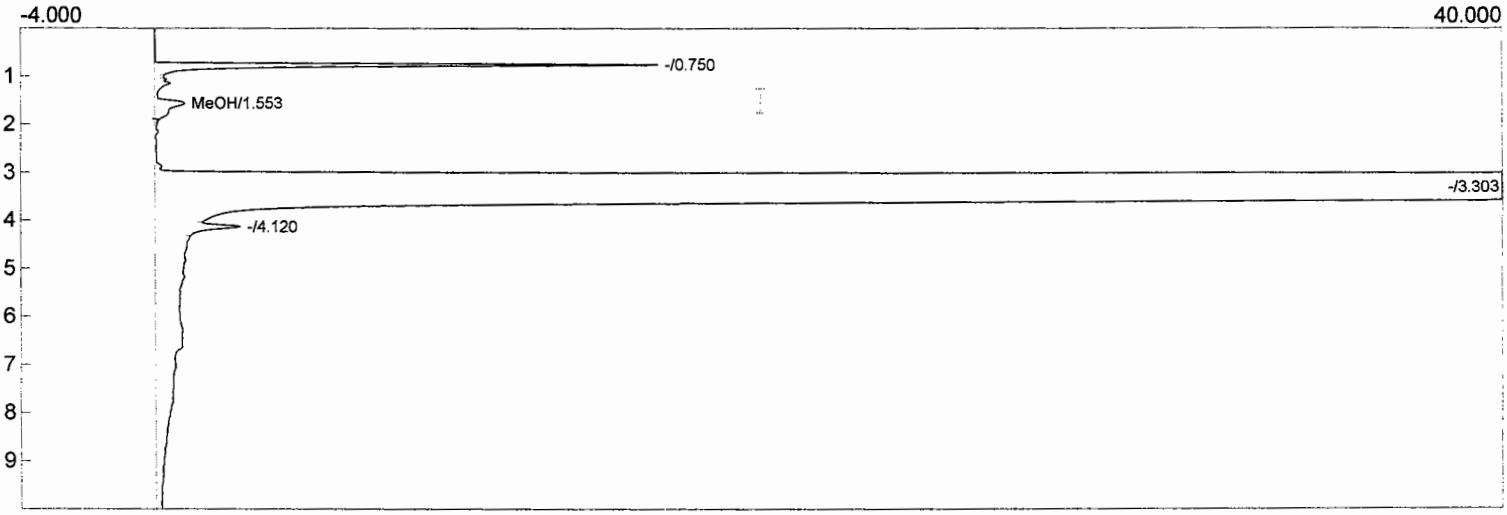
Component	Retention	Area
MeOH	1.543	50.5746
		50.5746

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 13:24:41
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR43.CHR ()
Sample: Run 2 unspiked tube 1
Operator: E. Vogt



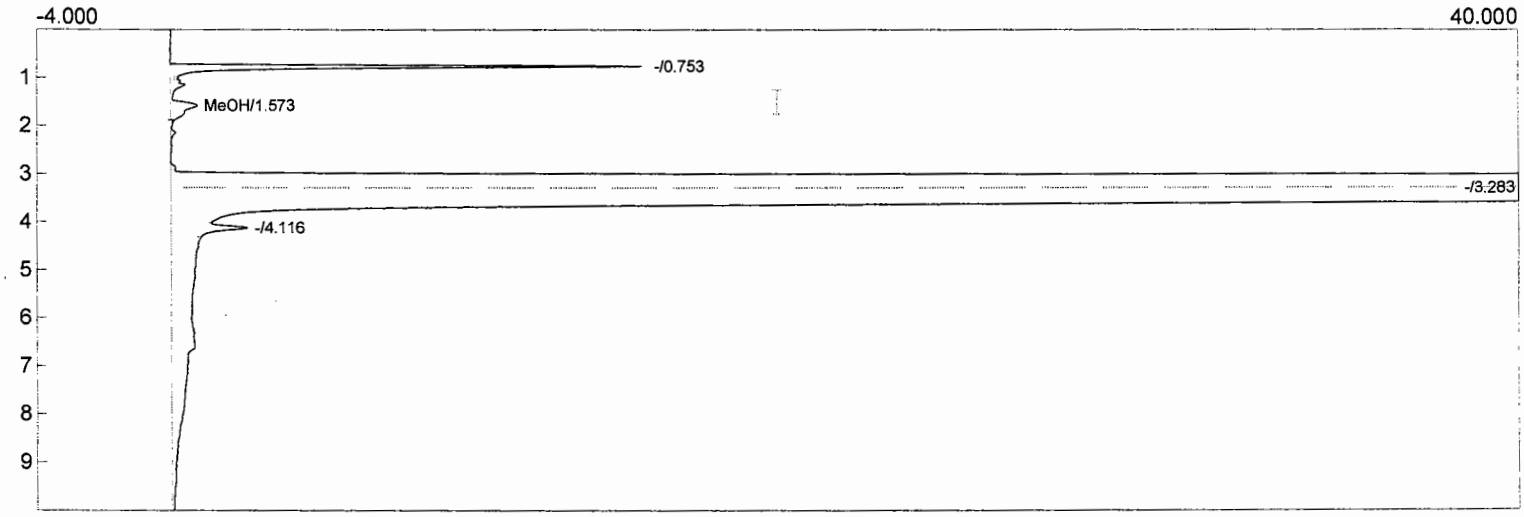
Component	Retention	Area
MeOH	1.540	11.3396
		11.3396

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 13:39:31
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR44.CHR ()
Sample: Run 2 unspiked tube 1
Operator: E. Vogt



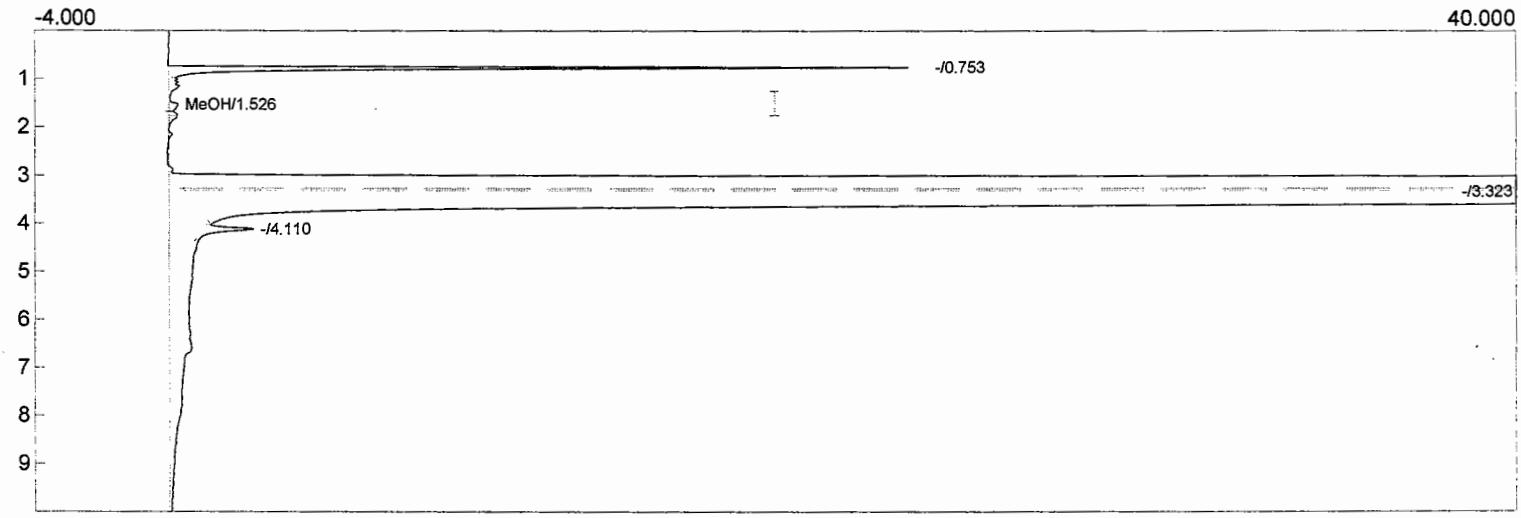
Component	Retention	Area
MeOH	1.553	10.7714
		10.7714

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 13:54:12
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR45.CHR ()
Sample: Run 2 unspiked tube 1
Operator: E. Vogt



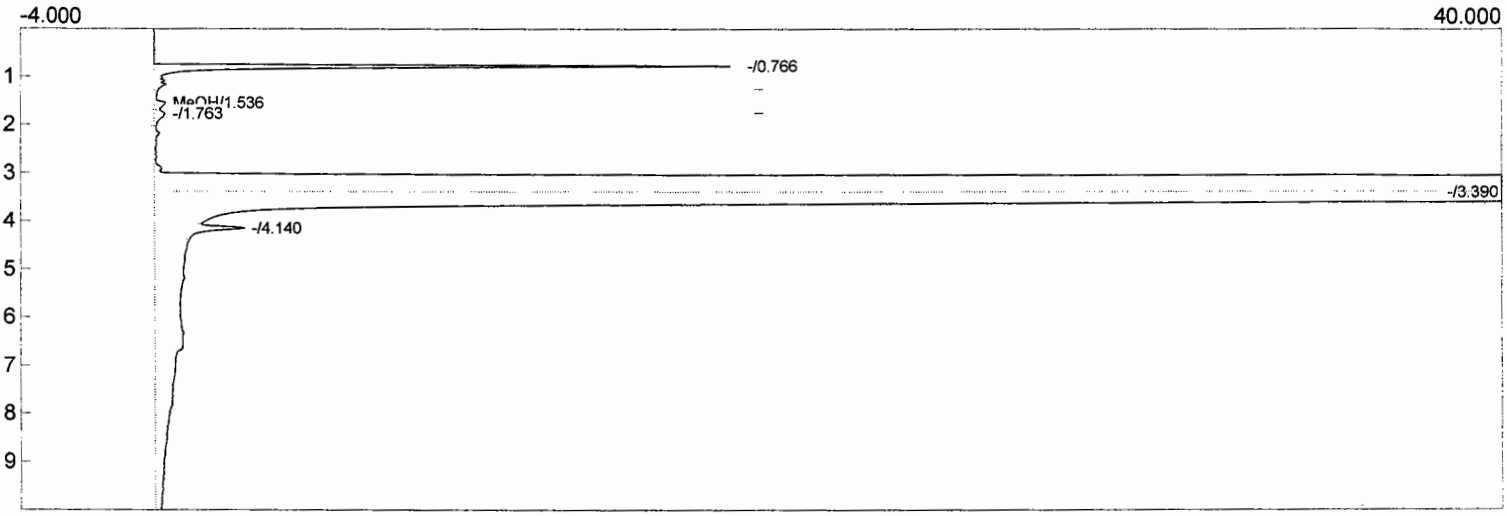
Component	Retention	Area
MeOH	1.573	10.0684
		10.0684

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 14:10:26
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR46.CHR ()
Sample: Run 2 unspiked tube 2
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



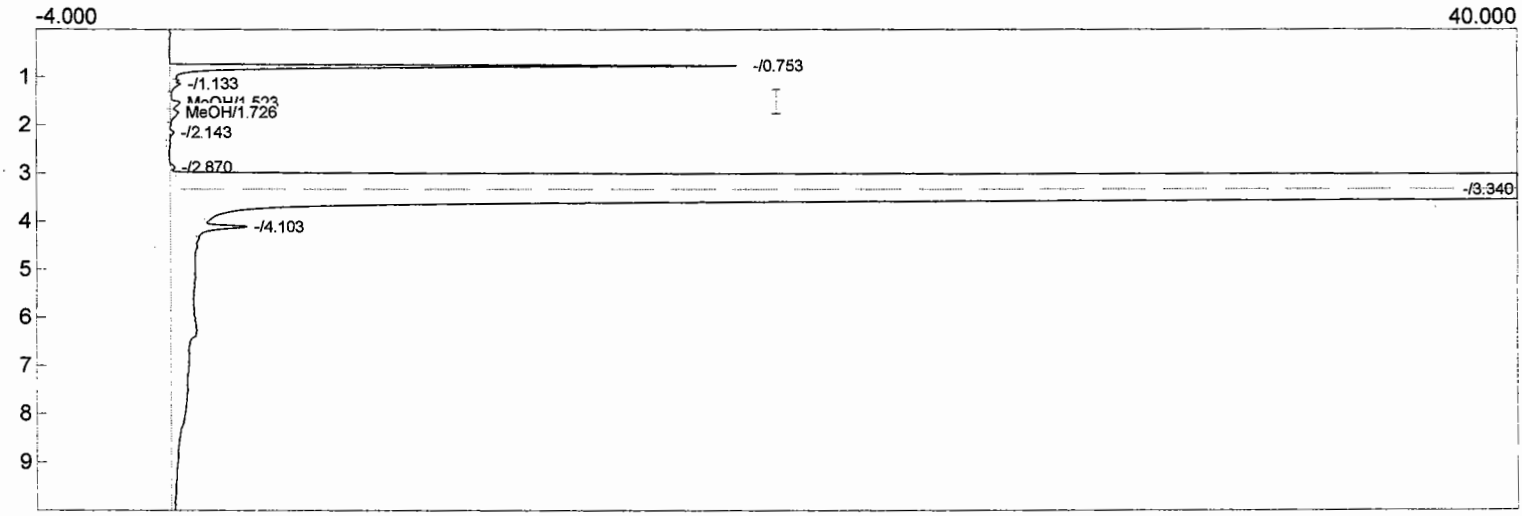
Component	Retention	Area
MeOH	1.526	2.0924
		2.0924

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 14:38:57
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR48.CHR ()
Sample: Run 2 unspiked tube 2
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



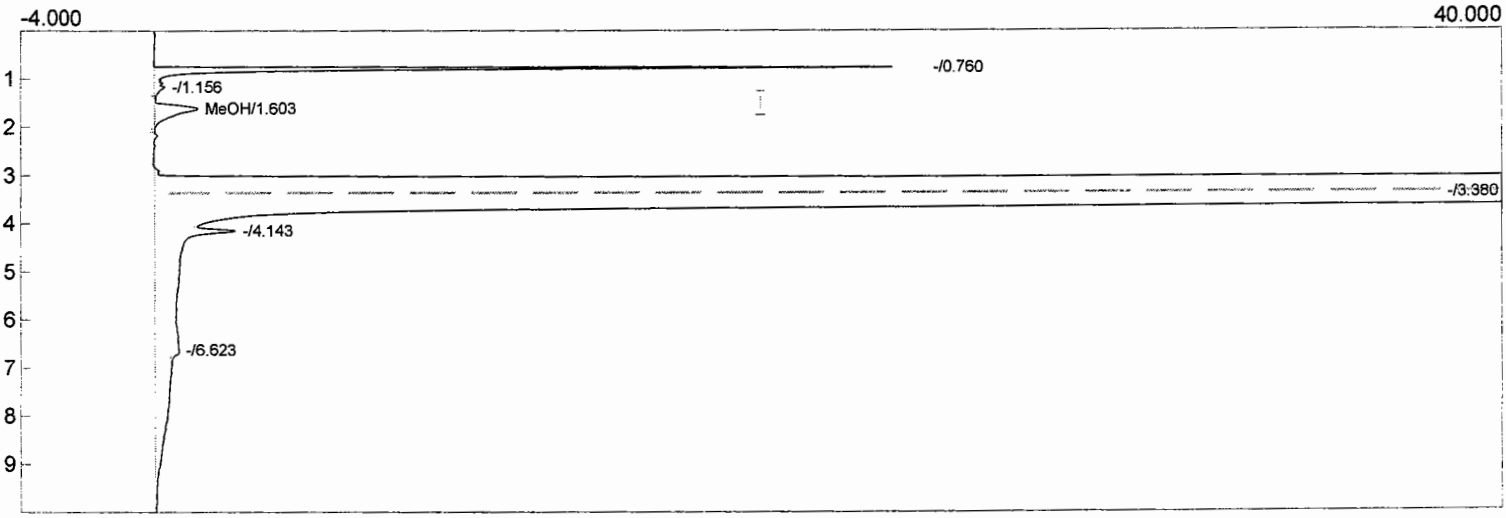
Component	Retention	Area
MeOH	1.536	2.1390
		2.1390

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 14:24:09
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR47.chr ()
Sample: Run 2 unspiked tube 2
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



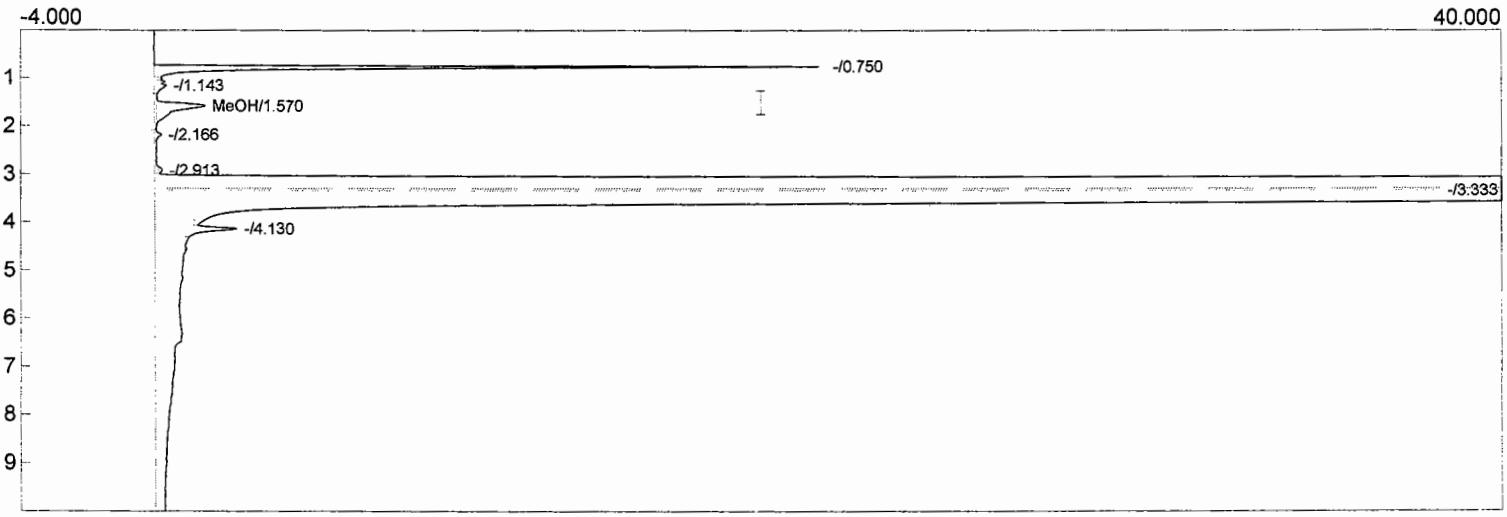
Component	Retention	Area
MeOH	1.523	1.9405
MeOH	1.726	1.8508
		3.7913

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 15:09:13
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR49.chr ()
Sample: Run 3 unspiked tube 1
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



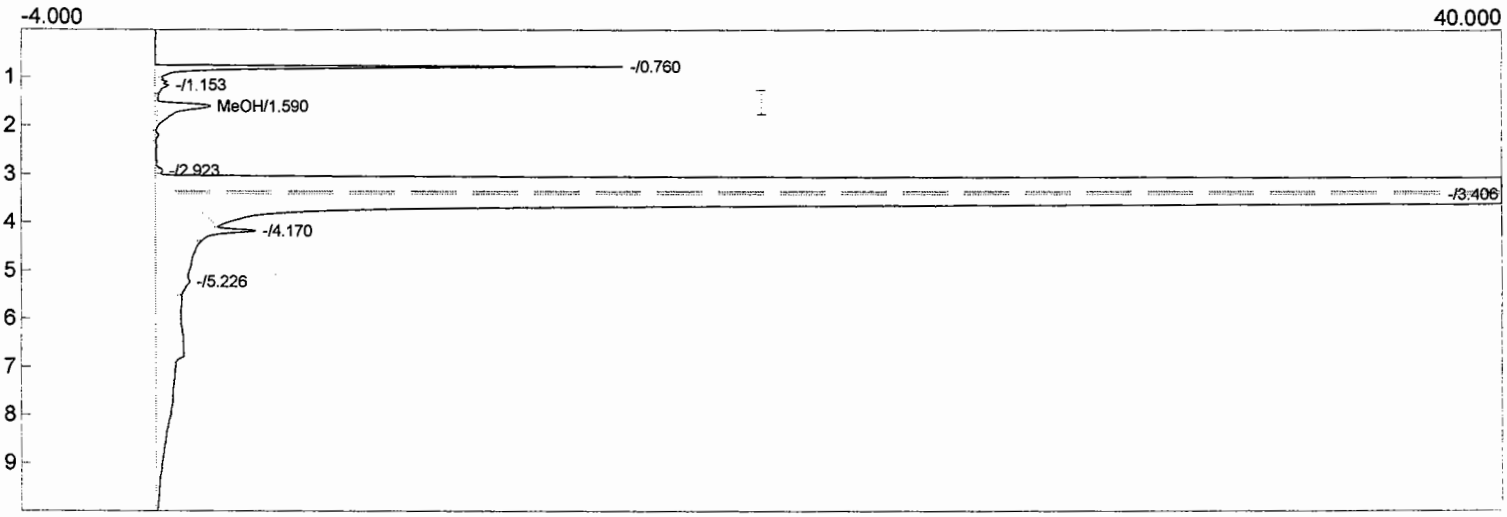
Component	Retention	Area
MeOH	1.603	16.3102
		16.3102

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 15:23:02
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR50.CHR ()
Sample: Run 3 unspiked tube 1
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



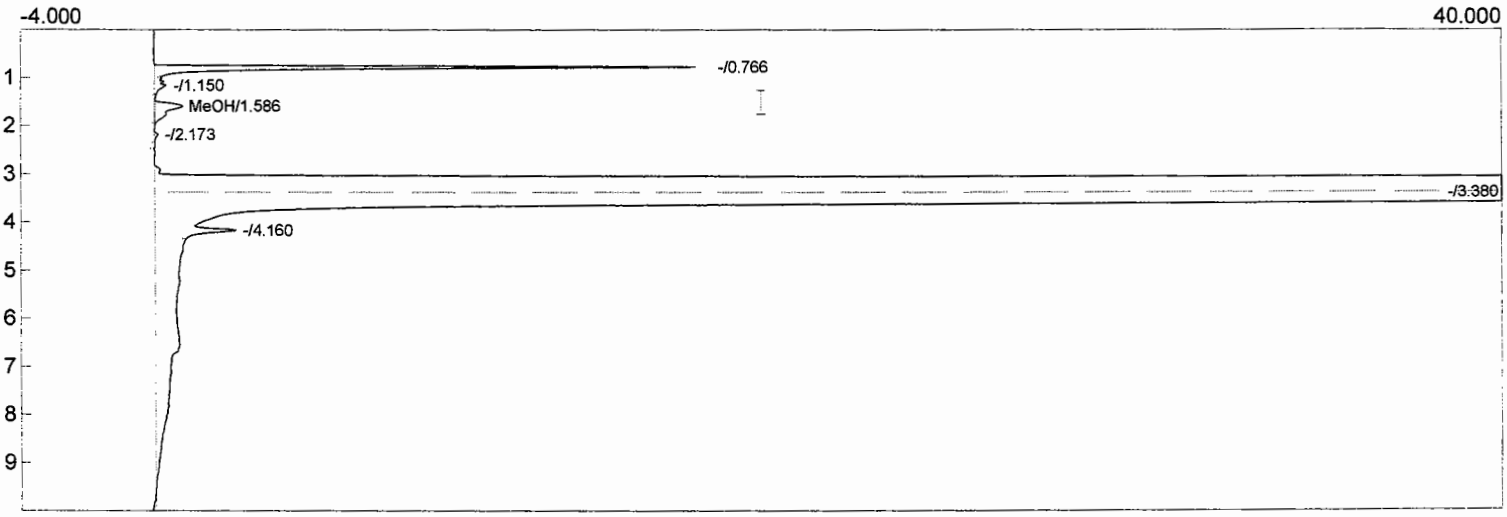
Component	Retention	Area
MeOH	1.570	15.5180
		15.5180

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 15:37:11
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR51.CHR ()
Sample: Run 3 unspiked tube 1
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



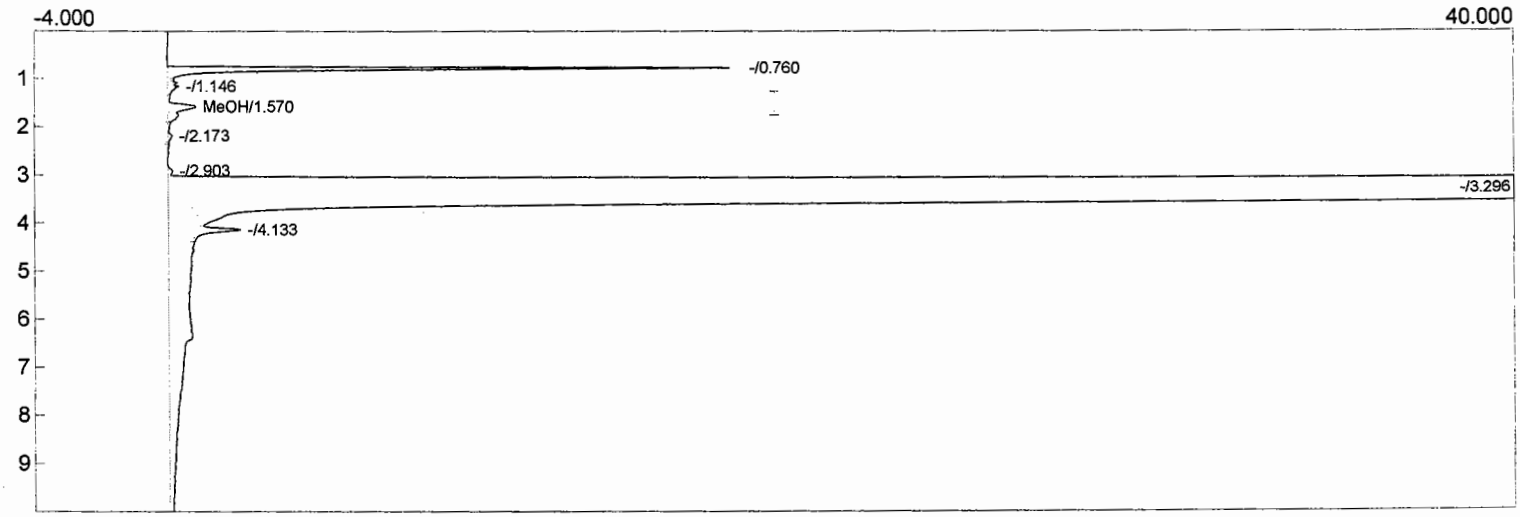
Component	Retention	Area
MeOH	1.590	18.4896
		18.4896

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 15:54:22
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR52.CHR ()
Sample: Run 3 unspiked tube 1 2
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



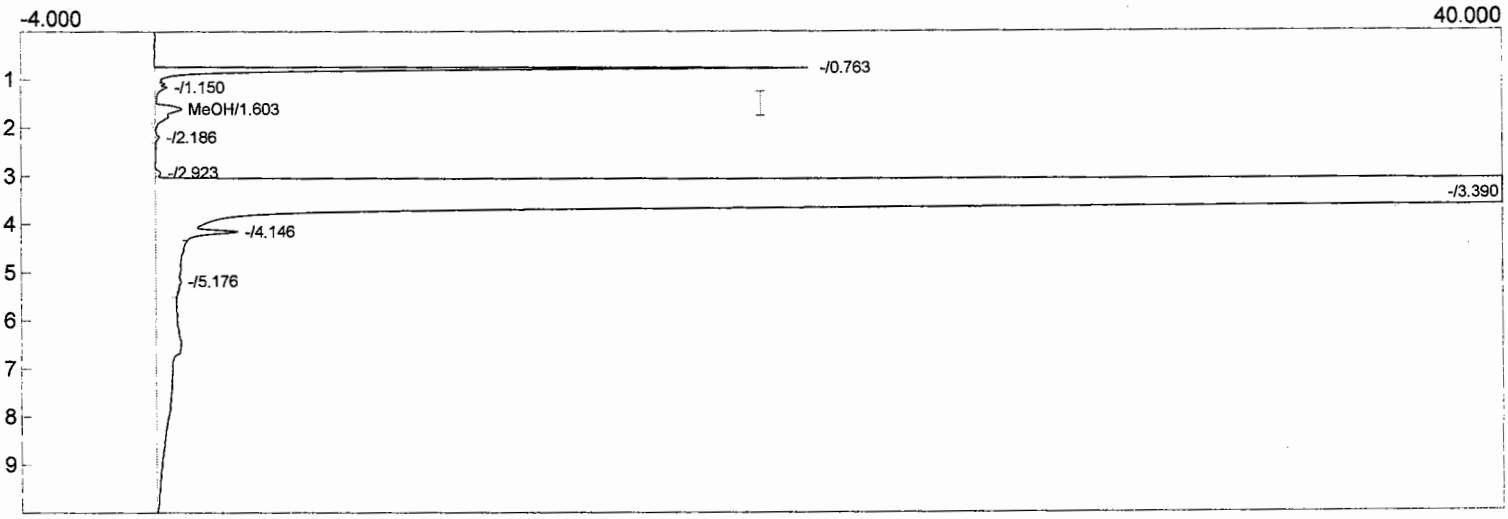
Component	Retention	Area
MeOH	1.586	9.9718
		9.9718

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 16:08:55
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR53.CHR ()
Sample: Run 3 unspiked tube A 2
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



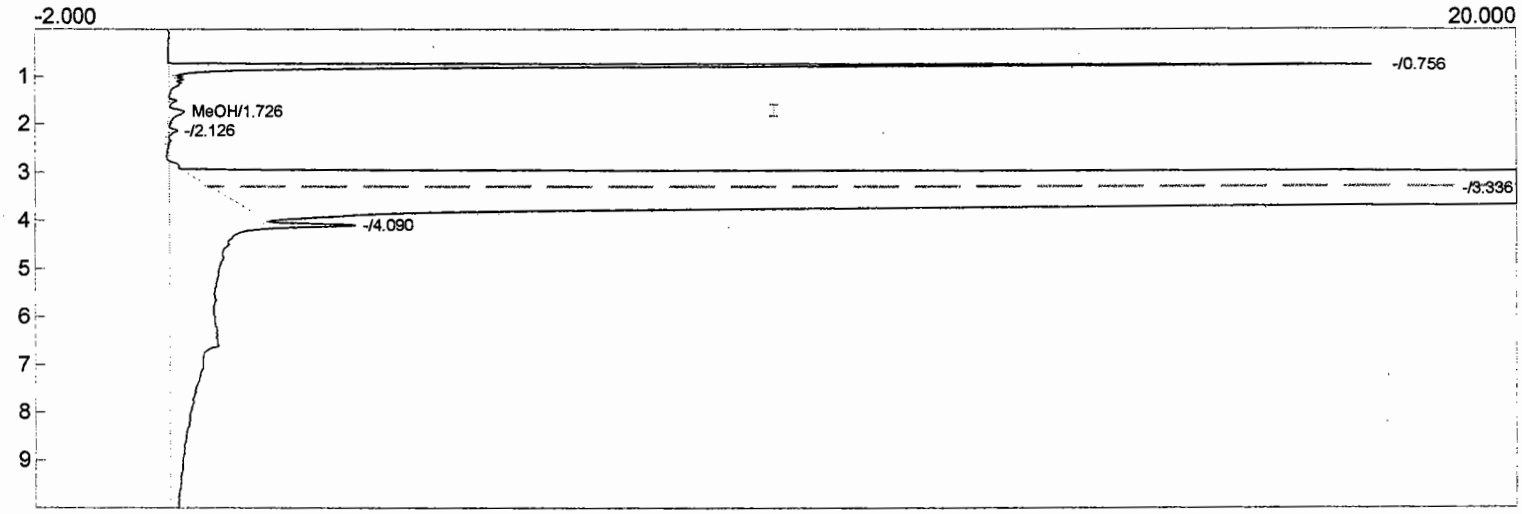
Component	Retention	Area
MeOH	1.570	8.5530
		8.5530

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 16:40:31
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR55.CHR ()
Sample: Run 3 unspiked tube 2
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



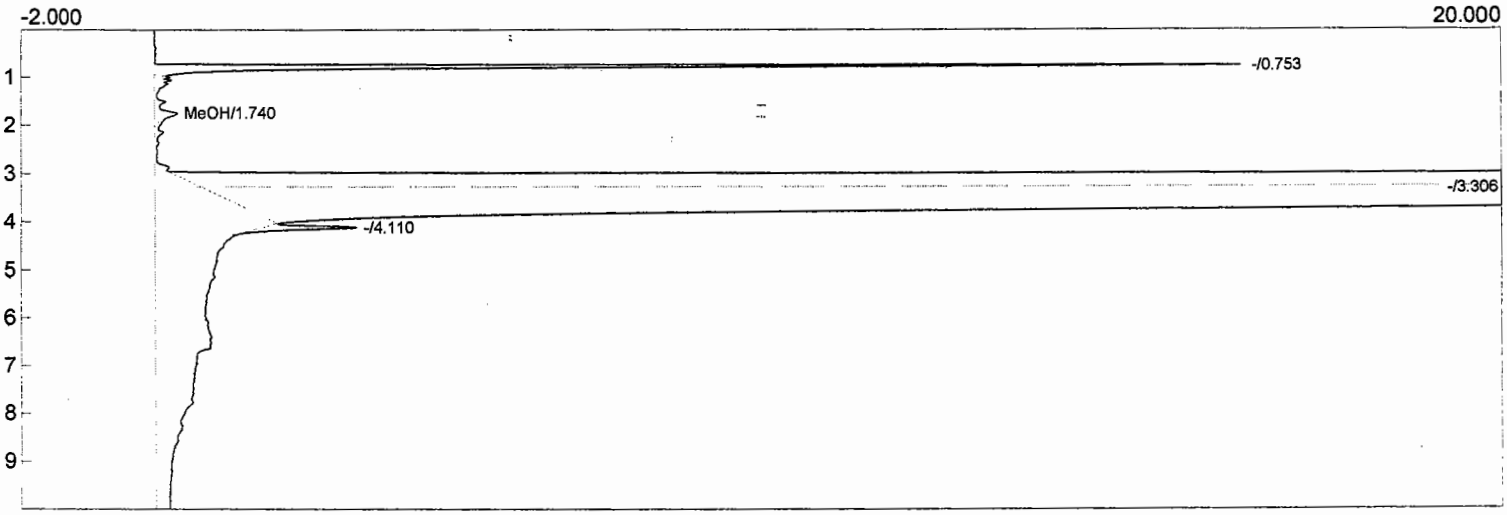
Component	Retention	Area
MeOH	1.603	9.8604
		9.8604

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 10:59:12
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR33.CHR ()
Sample: 3% n-propanol Blank
Operator: E. Vogt



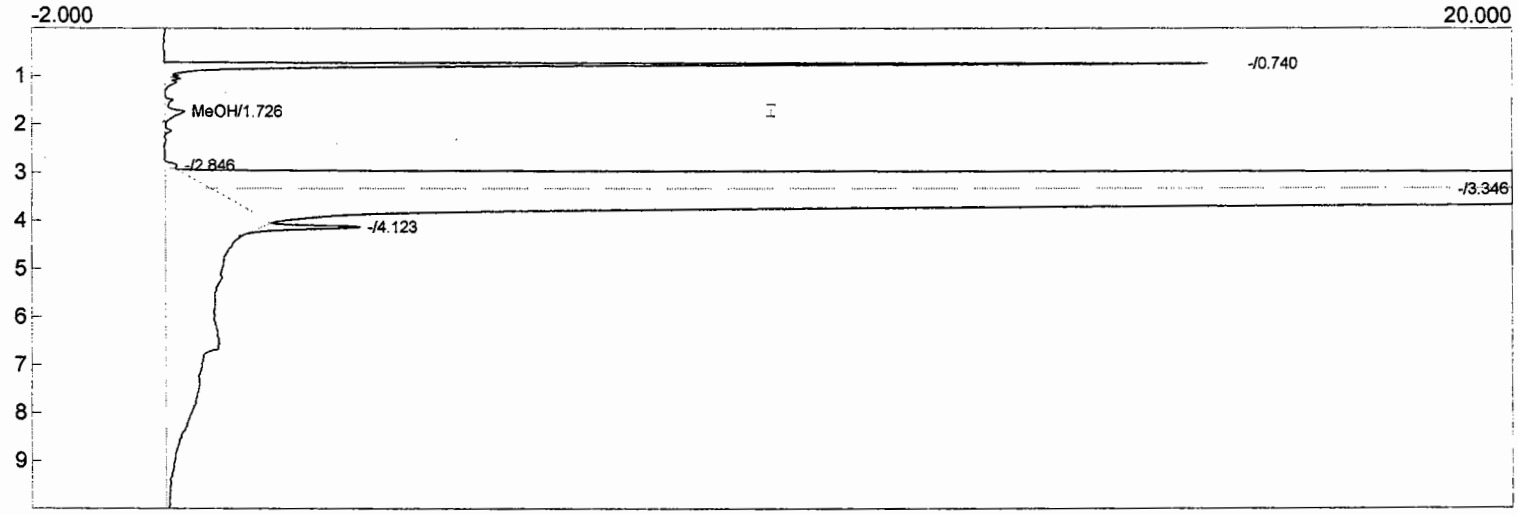
Component	Retention	Area
MeOH	1.726	1.7264
		1.7264

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 11:13:04
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR34.CHR ()
Sample: 3% n-propanol Blank
Operator: E. Vogt



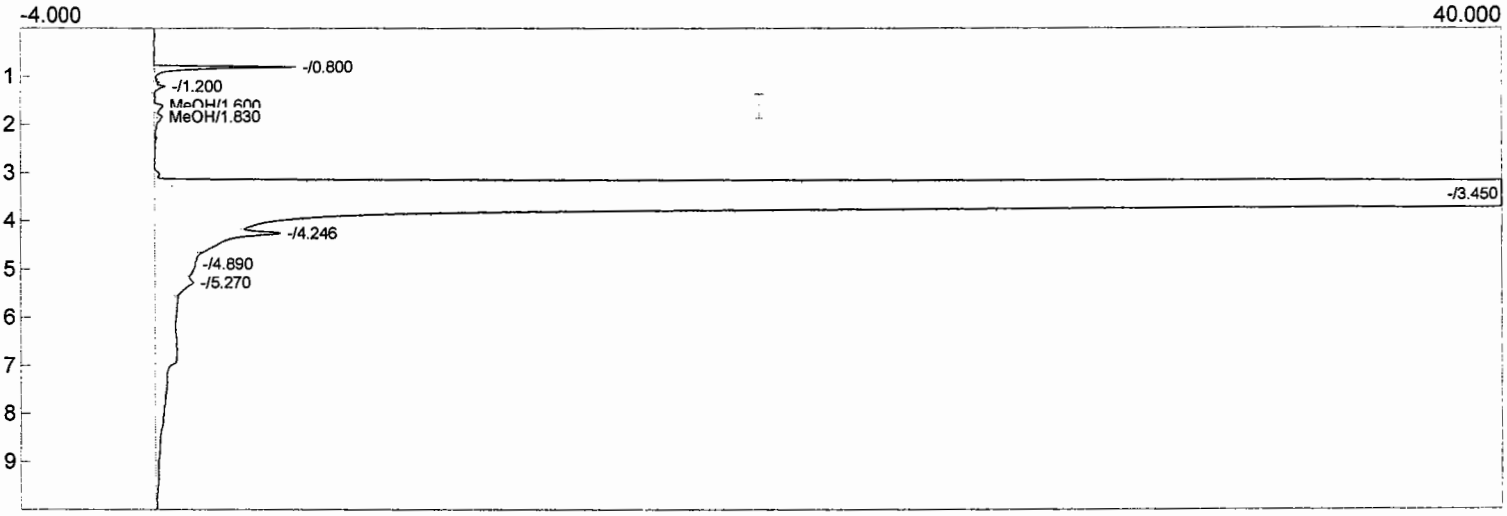
Component	Retention	Area
MeOH	1.740	1.9199
		1.9199

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/14/2011 11:27:07
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR35.CHR ()
Sample: 3% n-propanol Blank
Operator: E. Vogt



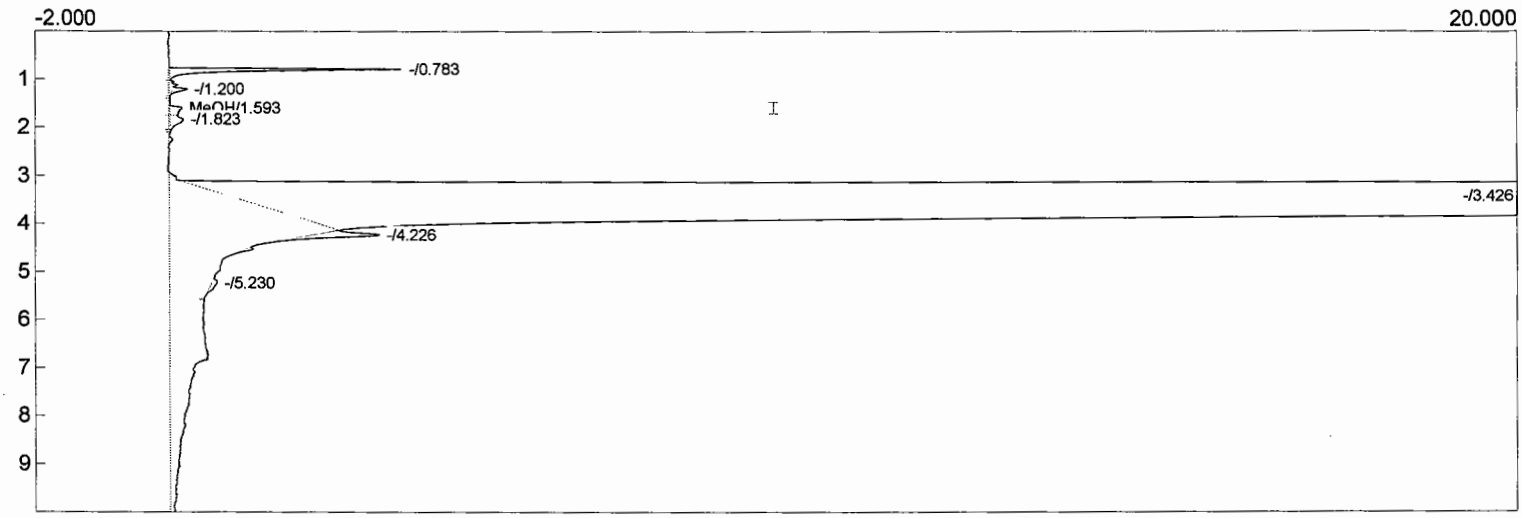
Component	Retention	Area
MeOH	1.726	1.9947
		1.9947

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/18/2011 09:32:53
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR136.CHR ()
Sample: Tube Media Blank
Operator: E. Vogt



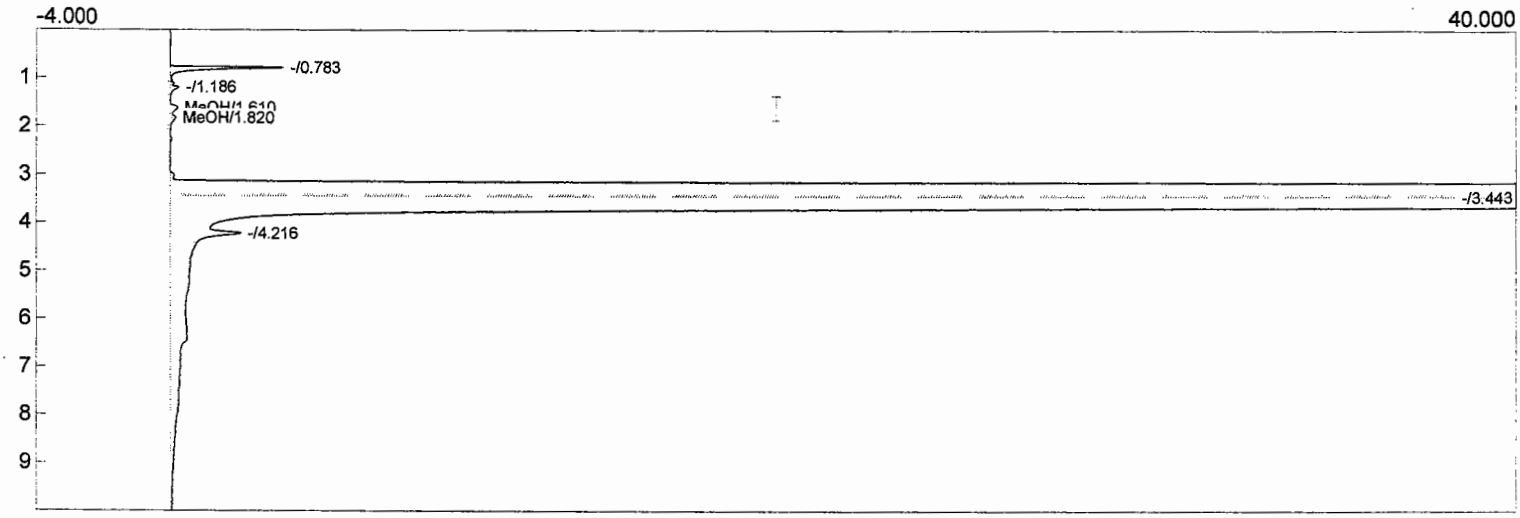
Component	Retention	Area
MeOH	1.600	1.3732
MeOH	1.830	1.0366
		2.4098

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/18/2011 09:47:03
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR137.CHR ()
Sample: Tube Media Blank
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



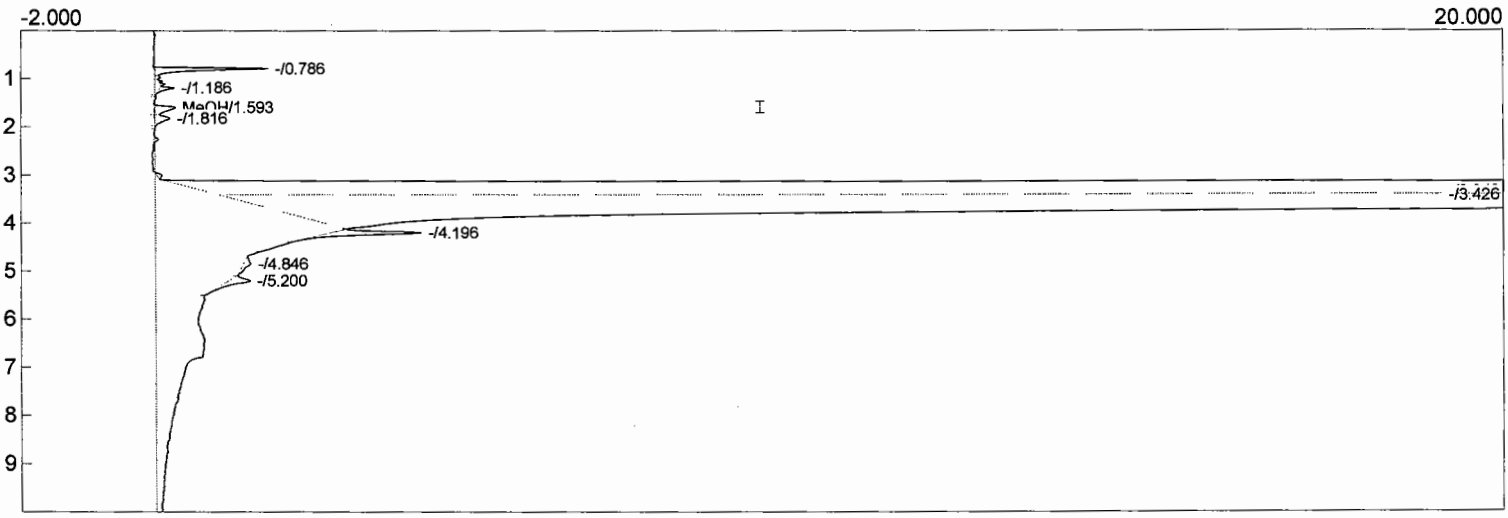
Component	Retention	Area
MeOH	1.593	1.5804
		1.5804

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/18/2011 10:00:46
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR138.CHR ()
Sample: Tube Media Blank
Operator: E. Vogt



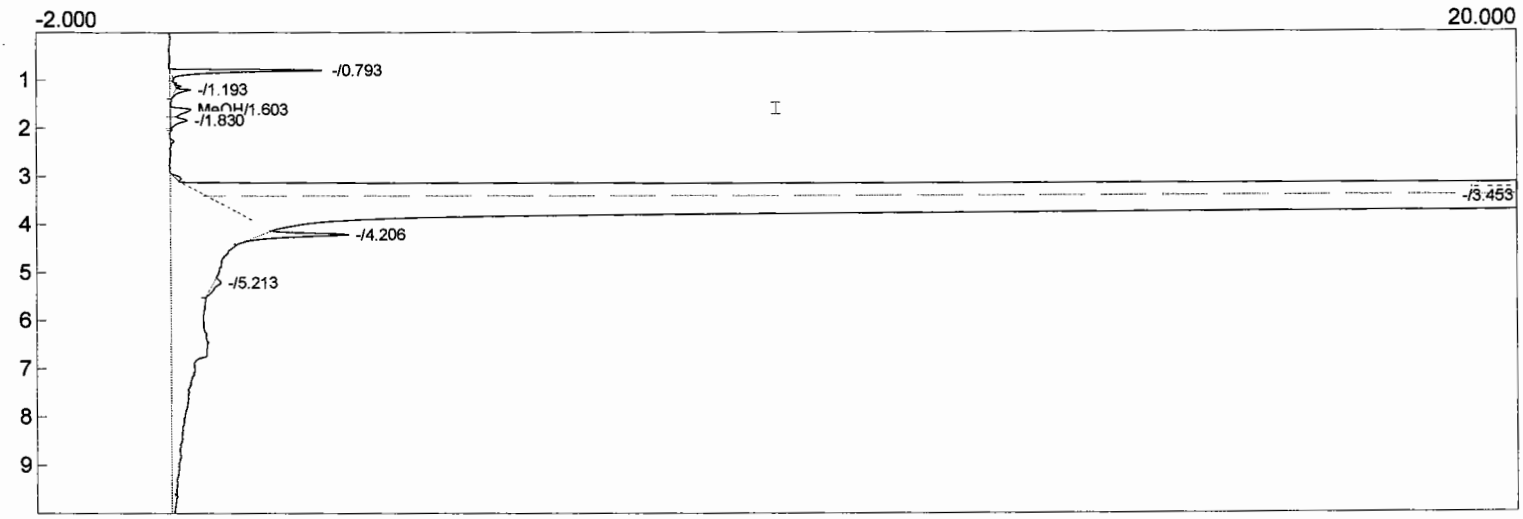
Component	Retention	Area
MeOH	1.610	1.2826
MeOH	1.820	0.7942
		2.0768

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 16:12:57
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR116.chr ()
Sample: ~~Spiked Tube Control~~ Field Tube Blank 4C
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



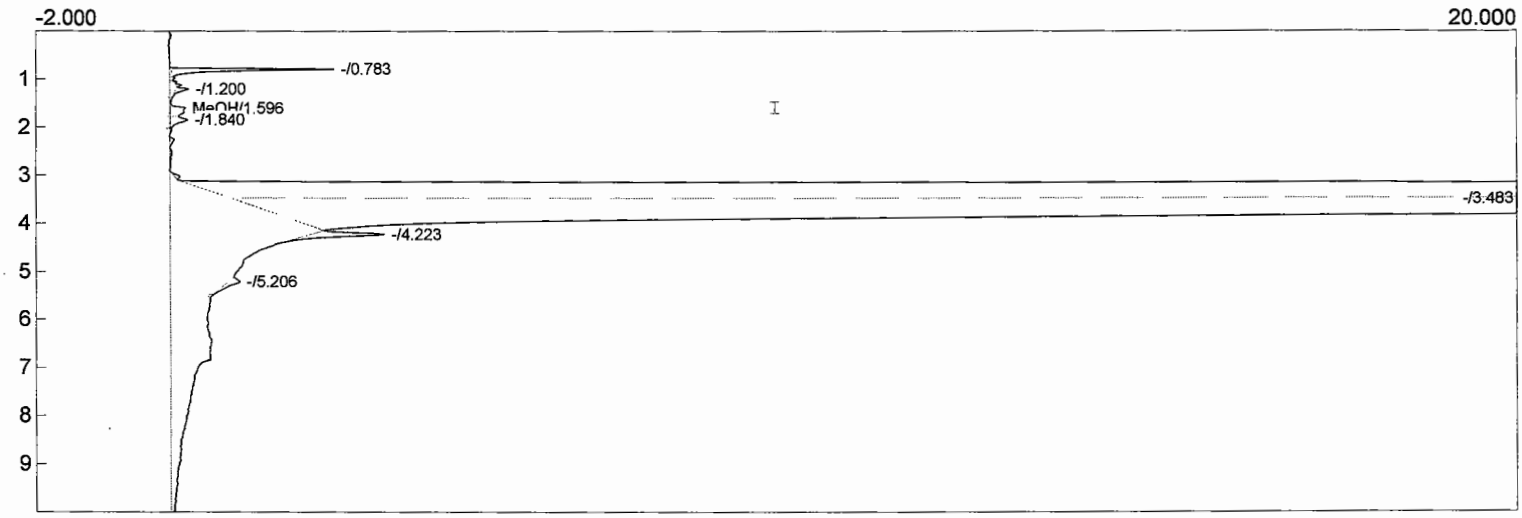
Component	Retention	Area
MeOH	1.593	2.2117
		2.2117

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 16:26:29
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR117.CHR ()
Sample: ~~Spiked Tube Control~~ Field Tube Blank 4C
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



Component	Retention	Area
MeOH	1.603	2.3672
		2.3672

Lab name: ARI Environmental
Client: BP, Whiting IN
Analysis date: 07/15/2011 16:40:08
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR118.CHR ()
Sample: ~~Spiked Tube Control~~ 4C Field Tube Blank
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



Component	Retention	Area
MeOH	1.596	2.2060
		2.2060

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ANALYTICAL SUMMARY

CLIENT: BP Whiting
LOCATION: Whiting, IN
SAMPLE DATES: 6/7/11-6/8/11
ANALYSIS: Hydrochloric Acid
METHOD: USEPA Method 26

Analyst: J. Ruggaber
Date of Completion: 6/30/2011
Template Control ID: USEPA-M26-HCl-Template-052T-REV1

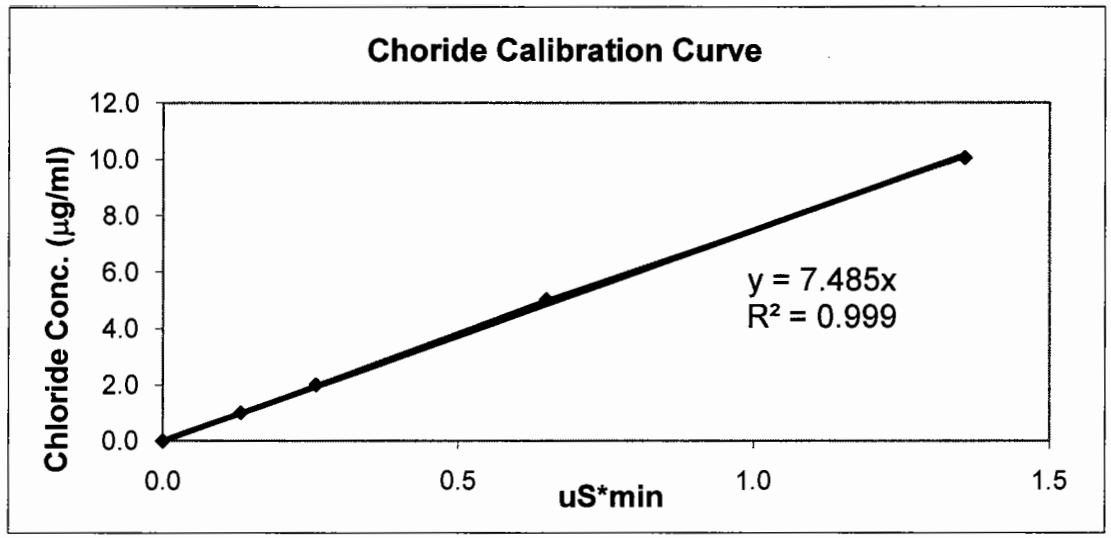
Calibration Curve Calculation

Std. (µg/ml)	Pre Cal (µS*min)	Post Cal (µS*min)	Average (µS*min)	Deviation (%)		Conc. Ug/ml	Peak Area	RE	Cal Conc	% Dif
0.0	0.00	0.00	0.00	0.00		1.0	0.132	0.131	1.0	-0.12
1.0	0.138	0.125	0.132	4.83		2.0	0.259	0.129	2.0	-1.55
2.0	0.265	0.254	0.259	2.14		5.0	0.650	0.129	5.0	-1.34
5.0	0.650	0.650	0.650	-0.04		10.1	1.357	0.135	10.4	3.01
10.1	1.356	1.358	1.357	-0.09			**mean RF--->**	0.1309		
					Second. Std.	5.0	0.6758	N/A	5.06	1.17

Sample Concentration Calculations

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Diluted Conc. (µg/ml)	Dilution Factor	Sample volume(ml)	Total Mass HCl (µg)
Run 1	0.151	0.154	0.153	-1.21	1.14	1	1000	1,174
Run 2	0.136	0.133	0.134	1.16	1.00	1	1000	1,032
Run 3	0.194	0.208	0.201	-3.68	1.50	1	1000	1,547
0.1 N H2SO4 Blank	<0.031	<0.031	<0.031	0.00	<0.23	1	1000	<234
Reagent DI Water Rinse	<0.031	<0.031	<0.031	0.00	<0.23	1	1000	<234
Lab DI Water Blank	<0.031	<0.031	<0.031	0.00	<0.23	1	1000	<234

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Actual Conc. (µg/ml)	Target Conc. (µg/ml)	R (%)	Pass/Fail
Run 1 spike	0.259	0.235	0.247	4.94	1.85	1.86	100%	Pass
Run 3 spike	0.287	0.286	0.286	0.30	2.14	2.27	94%	Pass


Choride Calibration Curve
Chloride Conc. (µg/ml)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
uS*min
y = 7.485x
R² = 0.999

ANALYTICAL SUMMARY

CLIENT: BP Whiting
LOCATION: Whiting, IN
SAMPLE DATES: 6/7/11-6/8/11
ANALYSIS: Hydrofluoric Acid
METHOD: USEPA Method 26

Analyst: J. Ruggaber
Date of Completion: 6/30/2011
Template Control ID: USEPA-M26-HCl-Template-052T-REV1

Calibration Curve Calculation

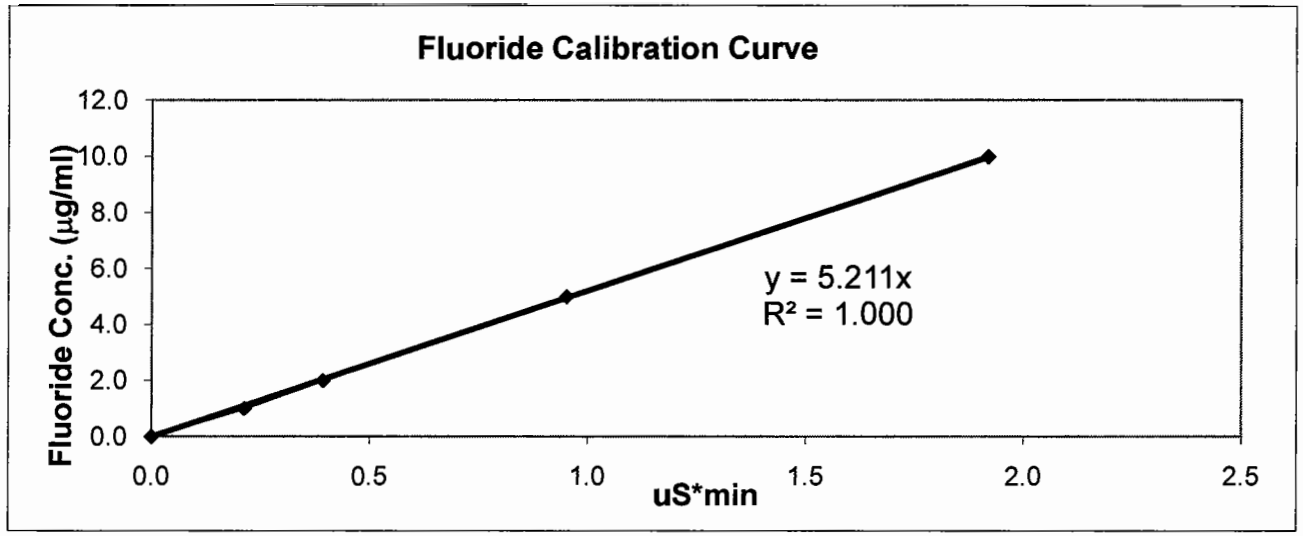
Std. (µg/ml)	Pre Cal (µS*min)	Post Cal (µS*min)	Average (µS*min)	Deviation (%)		Conc. Ug/ml	Peak Area	RE	Cal Conc	% Dif
0.0	0.00	0.00	0.00	0.00		1.0	0.213	0.213	1.1	7.56
1.0	0.206	0.220	0.213	-3.15		2.0	0.393	0.197	2.0	-0.70
2.0	0.394	0.392	0.393	0.25		5.0	0.952	0.190	4.8	-3.76
5.0	0.974	0.931	0.952	2.24		10.0	1.918	0.192	9.7	-3.09
10.0	1.967	1.870	1.918	2.54			**mean RF--->**	0.1979		
					Second. Std.	5.0	0.955	N/A	4.98	-1.16

Sample Concentration Calculations

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Diluted Conc. (µg/ml)	Dilution Factor	Sample volume(ml)	Total Mass HF(µg)
Run 1	0.010	0.011	0.011	-4.76	***0.05***	1	1000	58
Run 2	0.009	0.008	0.009	2.89	***0.05***	1	1000	47
Run 3	0.007	0.008	0.008	-3.95	***0.04***	1	1000	42
0.1 N H2SO4 Blank	<0.006	<0.006	<0.006	0.00	<0.03	1	1000	<32
Reagent DI Water Rinse	<0.006	<0.006	<0.006	0.00	<0.03	1	1000	<32
Lab DI Water Blank	<0.006	<0.006	<0.006	0.00	<0.03	1	1000	<32

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Actual Conc. (µg/ml)	Target Conc. (µg/ml)	R (%)	Pass/Fail
Run 1 spike	0.025	0.025	0.025	-0.81	0.13	0.14	89%	Pass
Run 3 spike	0.027	0.026	0.026	0.76	0.14	0.14	99%	Pass

Concentrations below the calibration curve


Fluoride Calibration Curve
Fluoride Conc. (µg/ml)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
uS*min
y = 5.211x
R² = 1.000

USEPA METHOD 26 TASK SCHEDULE

Client: BP

Location: Whiting, IN

Project Manager: S. Flaherty

Date Sampled: 6/9/11, 6/10/11, 6/13/11

Lab Project #: 08-314

Spreadsheet Template ID: USEPA-M26-HCl-Template-052T-REV1

Analyst: J. Ruggaber

Eluent

Sodium Carbonate (Na_2CO_3) manufacturer and lot: Fisher, lot 095351

Batch Number	Amount weighed/2L	Date/Time Prepared
1	1.6967 g	6/22/11, 13:00
2	1.6954 g	6/23/11, 15:27
3	g	

Sodium Bicarbonate ($NaHCO_3$) manufacturer and lot: Fisher, lot 103353

Batch Number	Amount weighed/2L	Date/Time Prepared
1	0.1677 g	6/22/11, 13:00
2	0.1682 g	6/23/11, 15:27
3	g	

Standard Identification

1) 1.0 ppm F, Cl, 6/22/11 (prepared in 0.1 N H2SO4)

2) 2.0 ppm F, Cl, 6/22/11 (prepared in 0.1 N H2SO4)

3) 5.0 ppm F, Cl, 6/22/11 (prepared in 0.1 N H2SO4)

4) 10.0 ppm F, Cl, 6/22/11 (prepared in 0.1 N H2SO4, used as spiking solution)

5) 1.0 ppm Cl, 6/22/11 (prepared in 0.1 N NaOH)

6) 2.0 ppm Cl, 6/22/11 (prepared in 0.1 N NaOH)

7) 5.0 ppm Cl, 6/22/11 (prepared in 0.1 N NaOH)

8) 10.0 ppm Cl, 6/22/11 (prepared in 0.1 N NaOH, used as spiking solution)

Secondary standard solutions:
5.0 ppm F, Cl 6/2211 check (prepared in 0.1 N H2SO4)
5.0 ppm Cl 6/2211 check (prepared in 0.1 N NaOH)

DATE	EQUIPMENT	TASK
6/22/11	-	Pour each sample into a 100 mL (or larger) volumetric flask. Dilute to volume with water.
6/22/11	ICS 1000 Anions	Equilibrate the instrument until a stable baseline is achieved.
6/22/11	ICS 1000 Anions	Inject each standard solution once. Plot the standard injection areas against calibration standard concentrations to determine an initial calibration curve.
6/22/11	ICS 1000 Anions	Inject secondary standard once. Check that the secondary standard is within 15% of the value generated by the initial calibration curve.
6/22/11-6/23/11	ICS 1000 Anions	Inject each sample solution in duplicate. Check that the area count for each anion in each duplicate injection is within 5% of the mean.
N/A	N/A	If necessary, dilute sample solutions if the peak areas are greater than the highest standard and re-inject in duplicate.
6/22/11-6/23/11	ICS 1000 Anions	Inject the midpoint standard once after every 20 sample injections.

6/24/11	ICS 1000 Anions	Inject each standard solution once at the end of the run.
6/30/11	-	For each anion, plot the average of the standard injections against calibration standard concentrations to determine a final calibration curve.
6/30/11	-	Determine the concentrations of each anion in each sample using the calibration curve.
7/22/11	-	Prepare report
		Report QA review
		Report distribution

ARI ENVIRONMENTAL, INC.

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

Chain of Custody Record 6738

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	Client Name	Location
08-314	BP Whiting	Whiting, In
Lab Project No.		
Steve Flaherty		
ARI Project Manager	ARI Sampler Initials	
Wauconda		
Analysis Location (Wauconda or Pasadena)		
ICR - Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: 26	Comments
31982	6-7-11	0.1N H_2SO_4 Imps Run 1	1	Bottle	1	✓	
30441	6-7-11	0.1N NaOH Imps Run 1	1	"	1	✓	
30442	6-8-11	0.1N H_2SO_4 Imps Run 2	1	"	1	✓	
30443	6-8-11	0.1N NaOH Imps Run 2	1	"	1	✓	
30444	6-8-11	0.1N H_2SO_4 Imps Run 3	1	"	1	✓	
30446	6-8-11	0.1N NaOH Imps Run 3	1	"	1	✓	
30447	6-8-11	0.1N H_2SO_4 Blank	1	"	1	✓	
30448	6-8-11	0.1N NaOH Blank	1	"	1	✓	
30449	6-8-11	Blank Rinse H_2O	1	"	1	✓	

Preservation Code: 1 = Ambient Temp. 2 = 4°C (Ice Packs) 3 = Dry Ice 4 = Other (Noted)

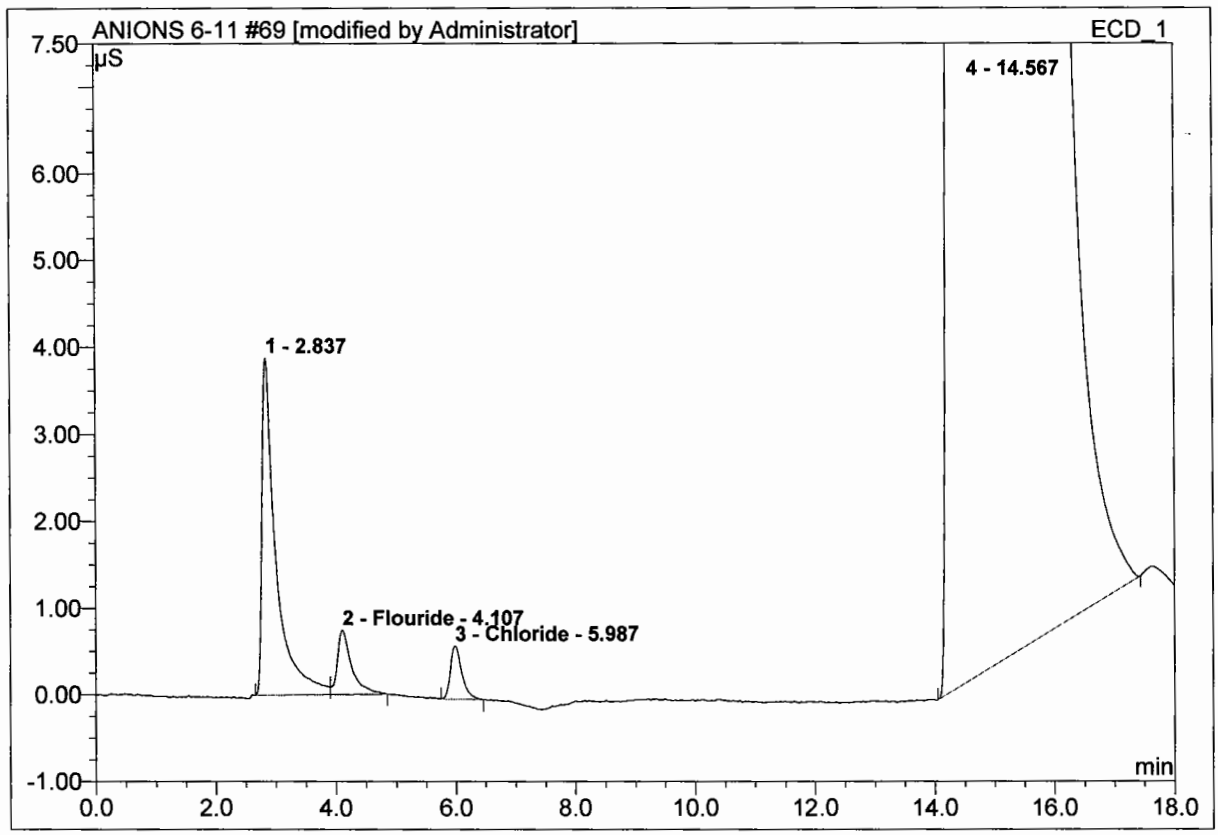
Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time 6-8-11	(2) Date / Time 6/10/11 2045	(3) Date / Time	HAND CARRY
	(1) Company	(2) Company ARI	(3) Company	FEDX
				UPS
Requested Analysis Completion Date: 6-30-11	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering Tier II: Compliance Tier III: QAPP	(1) Date / Time 6/10/11 1900	(2) Date / Time 6/15/11 14:44	(3) Date / Time	Yes No
Route Results Through: S. Flaherty	(1) Company	(2) Company ARI	(3) Company	

Form LF0001

C-155

69 1.0 ppm F, Cl H2SO4-pre

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 15:41**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**

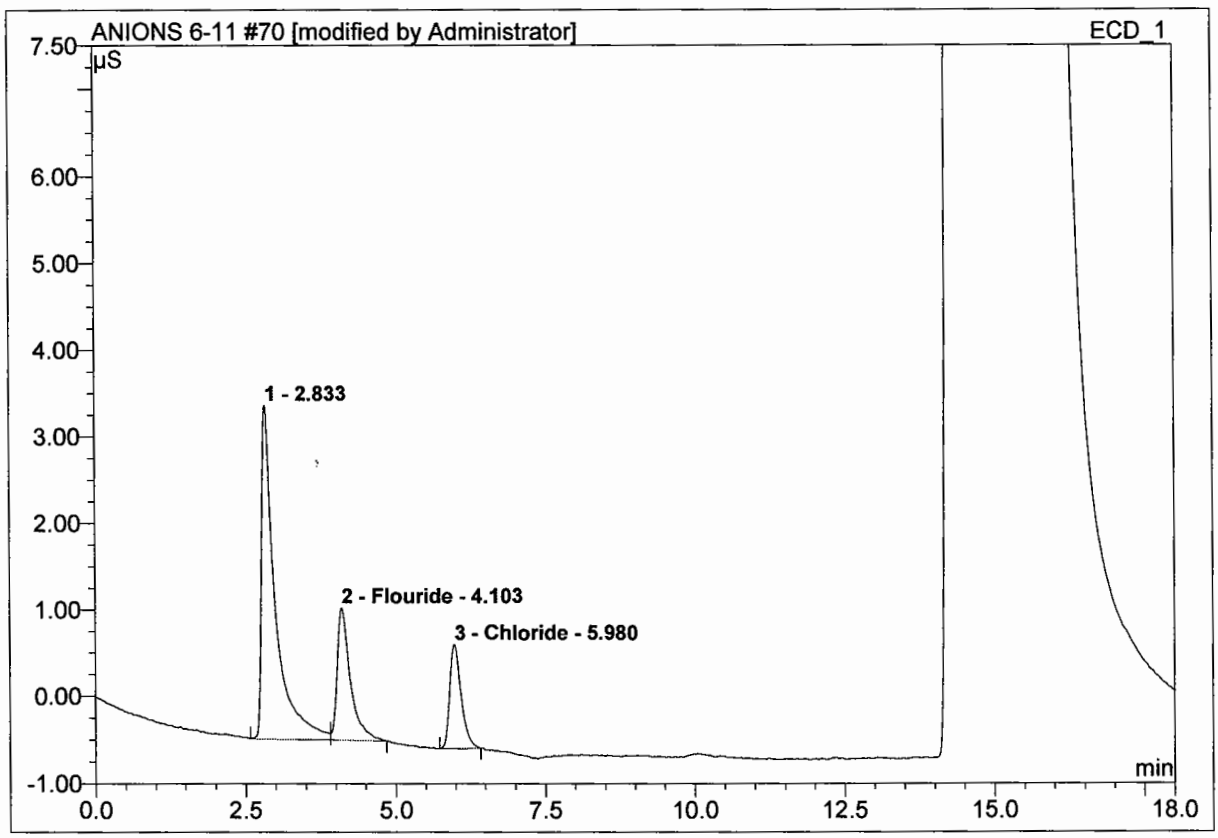


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.11	Flouride	0.743	0.2062
3	5.99	Chloride	0.613	0.1379
Total:			1.357	0.344

Chromeleon (c) Dionex 1996-2001
Version 6.60 Build 1428

70 2.0 ppm F, Cl H2SO4-pre

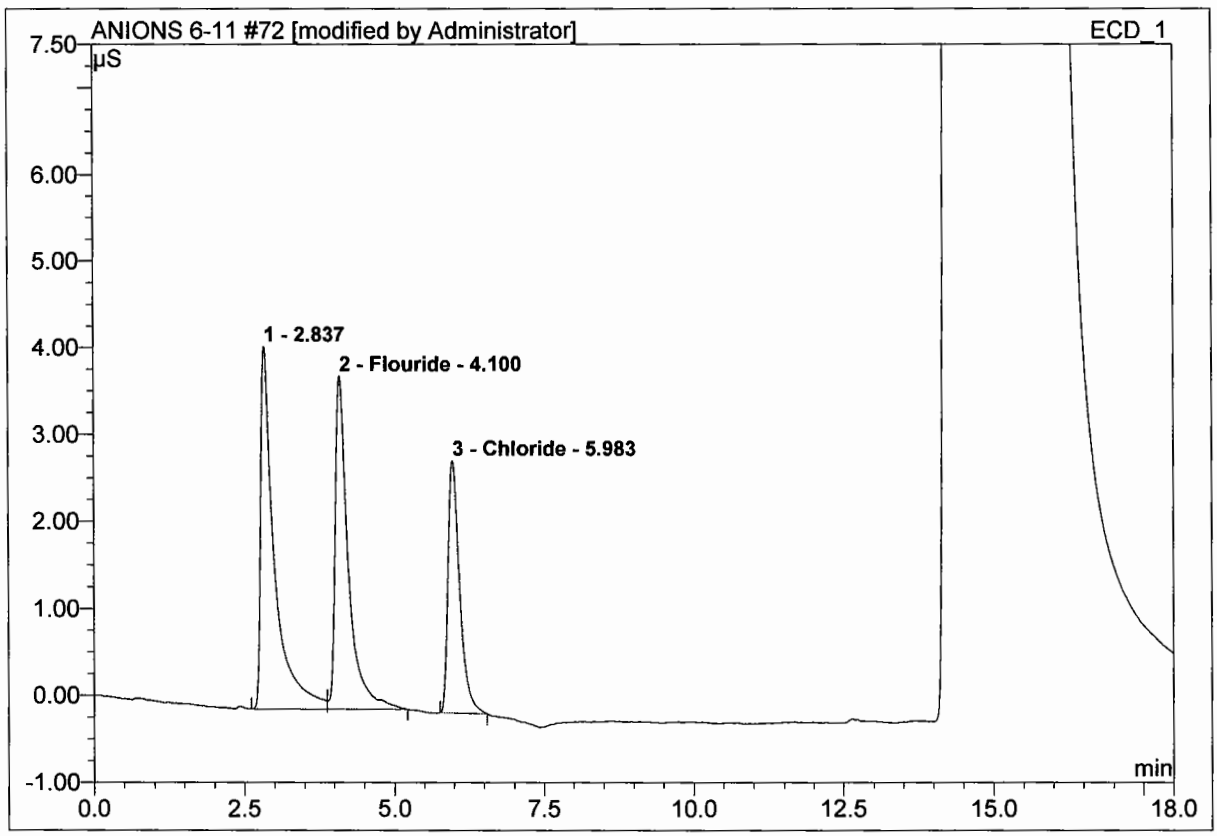
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 16:00**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.10	Flouride	1.522	0.3941
3	5.98	Chloride	1.192	0.2649
Total:			2.714	0.659

72 5.0 ppm F, Cl H2SO4-pre

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 16:40**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**

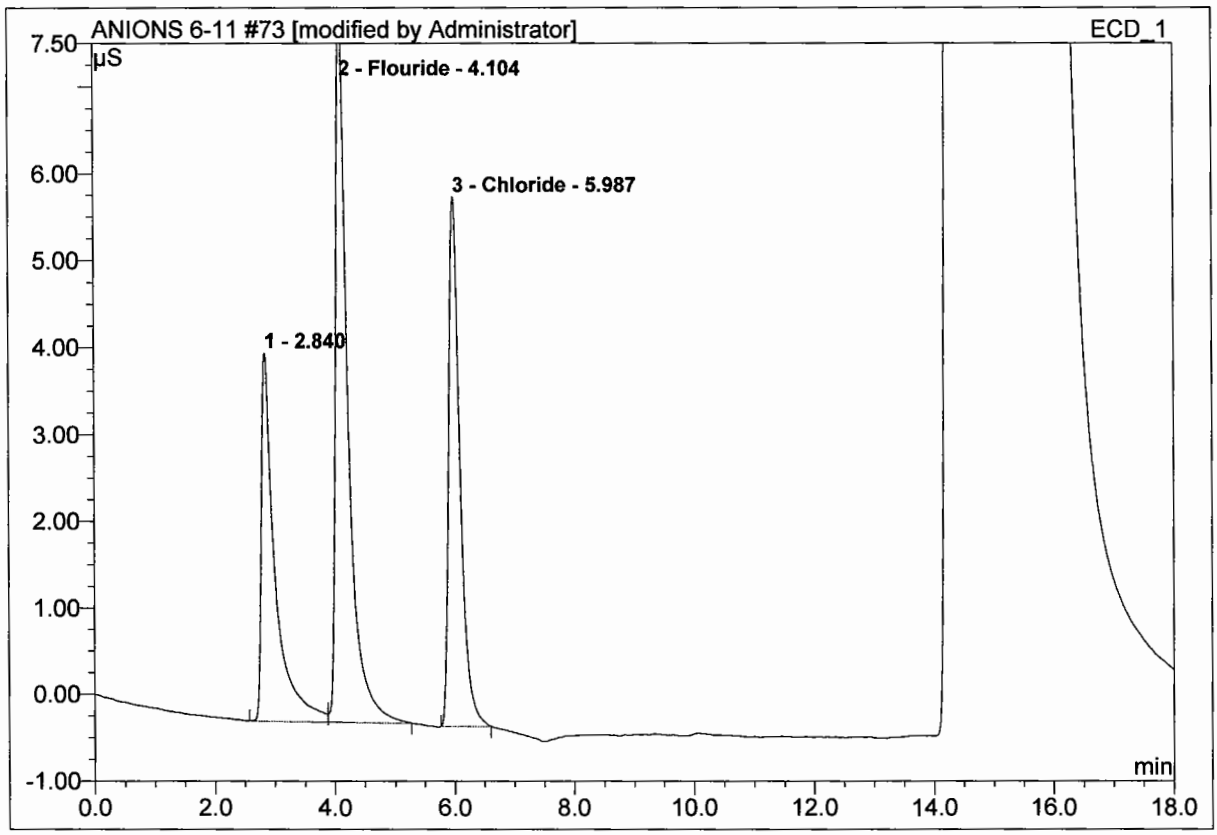


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.10	Flouride	3.831	0.9738
3	5.98	Chloride	2.899	0.6495
Total:			6.730	1.623

Chromeleon (c) Dionex 1996-2001
Version 6.60 Build 1428

73 10.0 ppm F, Cl H2SO4-pre

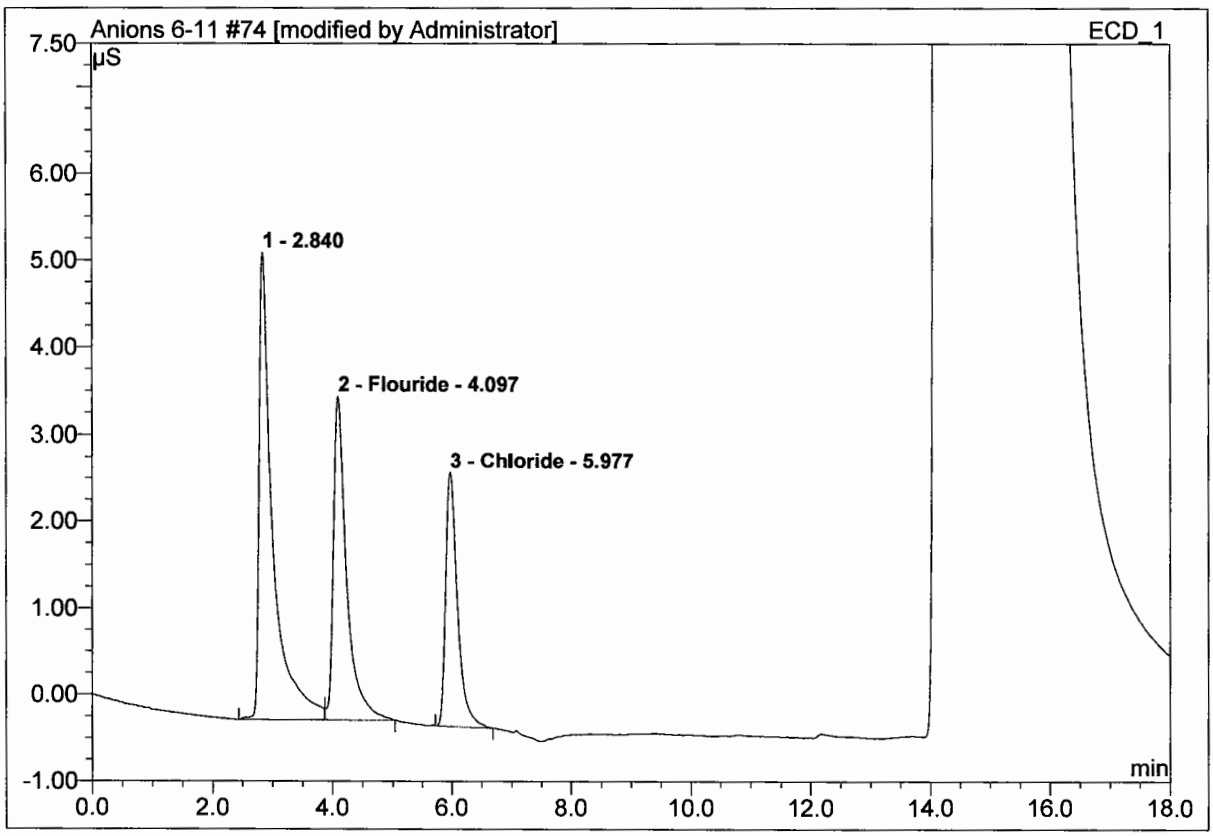
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 16:59**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.10	Flouride	8.235	1.9670
3	5.99	Chloride	6.105	1.3556
Total:			14.339	3.323

74 5.0 ppm 2nd std F, Cl H2SO4

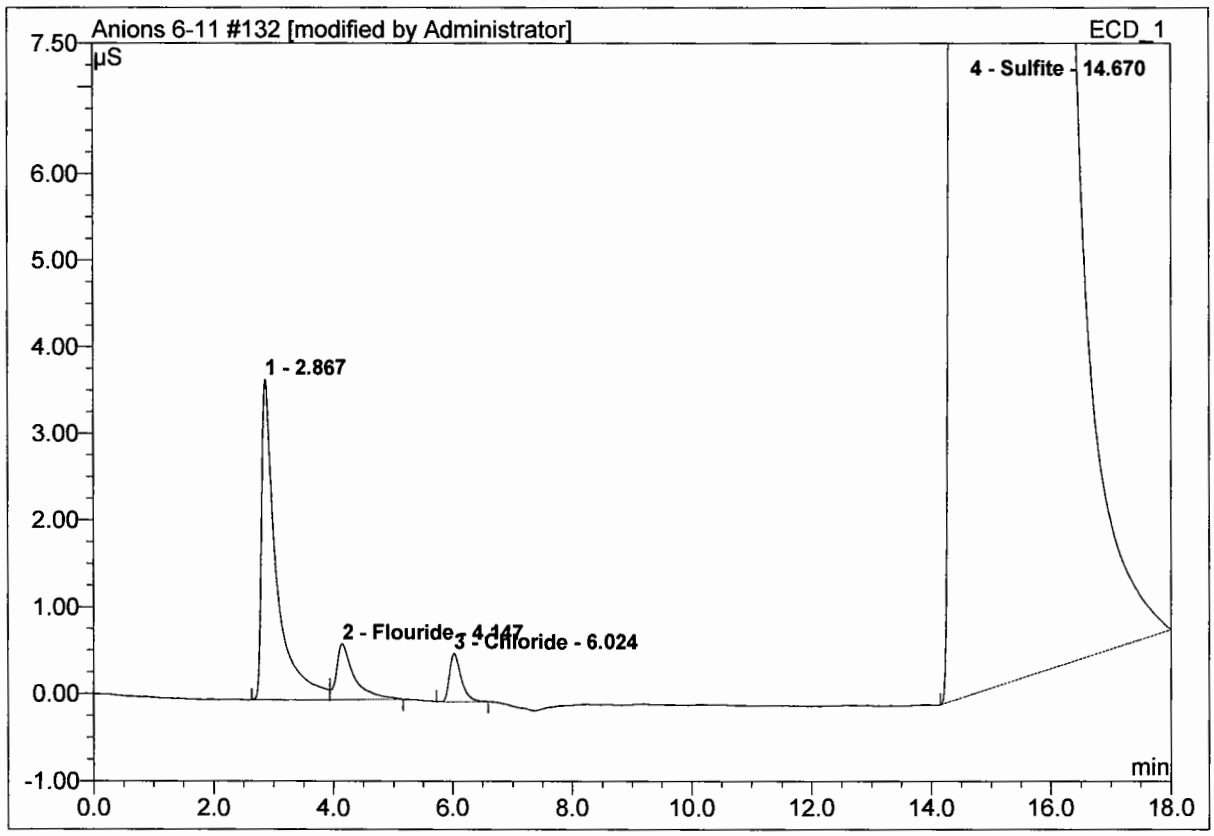
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 17:18**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.10	Flouride	3.730	0.9550
3	5.98	Chloride	2.934	0.6758
Total:			6.664	1.631

132 1.0 ppm F, Cl H2SO4

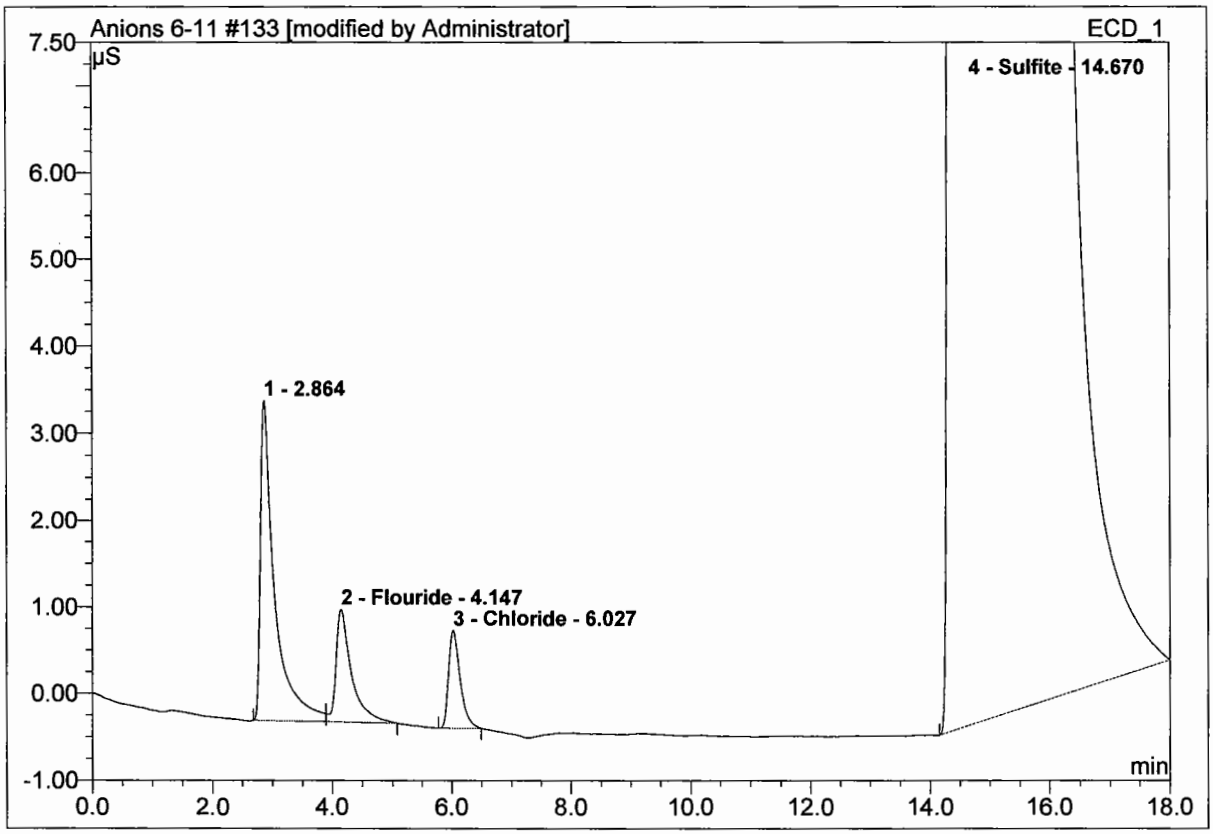
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 0:09**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.15	Flouride	0.638	0.2196
3	6.02	Chloride	0.552	0.1252
4	14.67	Sulfite	777.703	682.4652
Total:			778.894	682.810

133 2.0 ppm F, Cl H2SO4

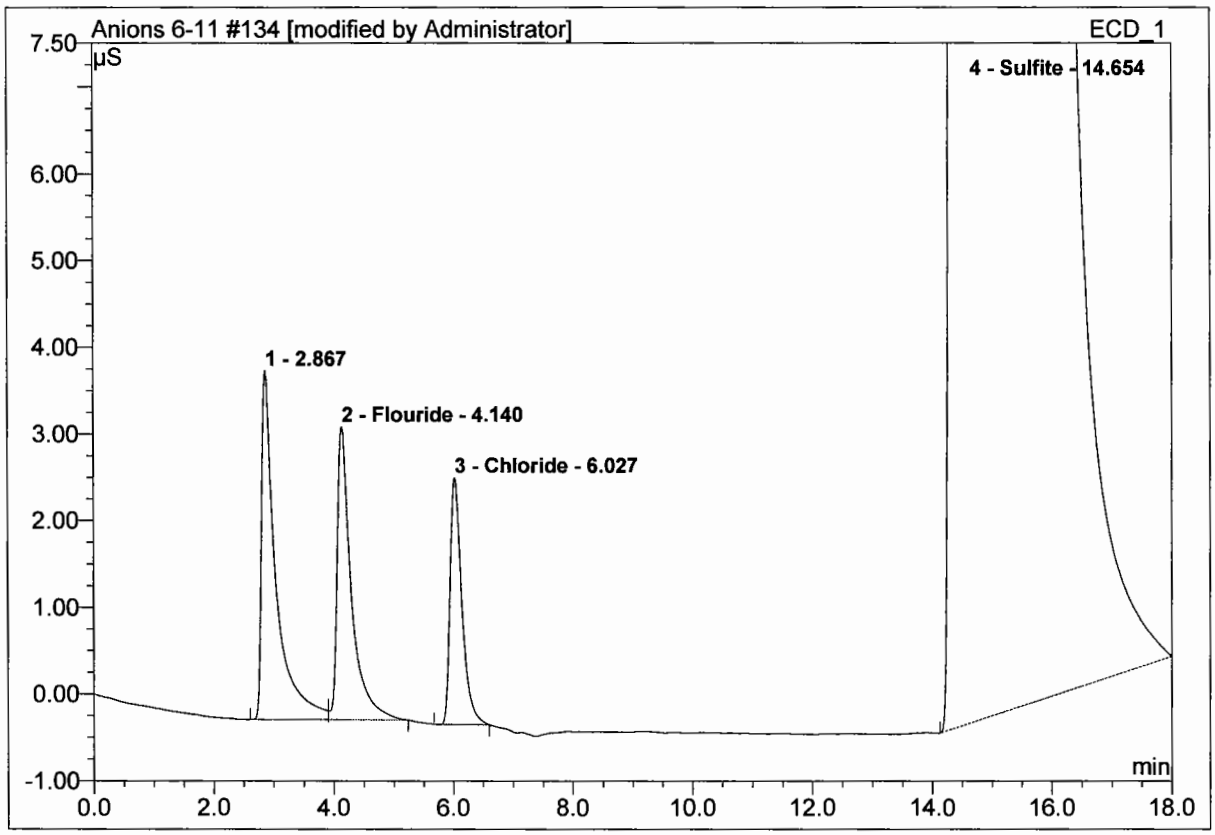
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 0:29**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.15	Flouride	1.299	0.3921
3	6.03	Chloride	1.125	0.2538
4	14.67	Sulfite	781.889	688.1689
Total:			784.313	688.815

134 5.0 ppm F, Cl H2SO4

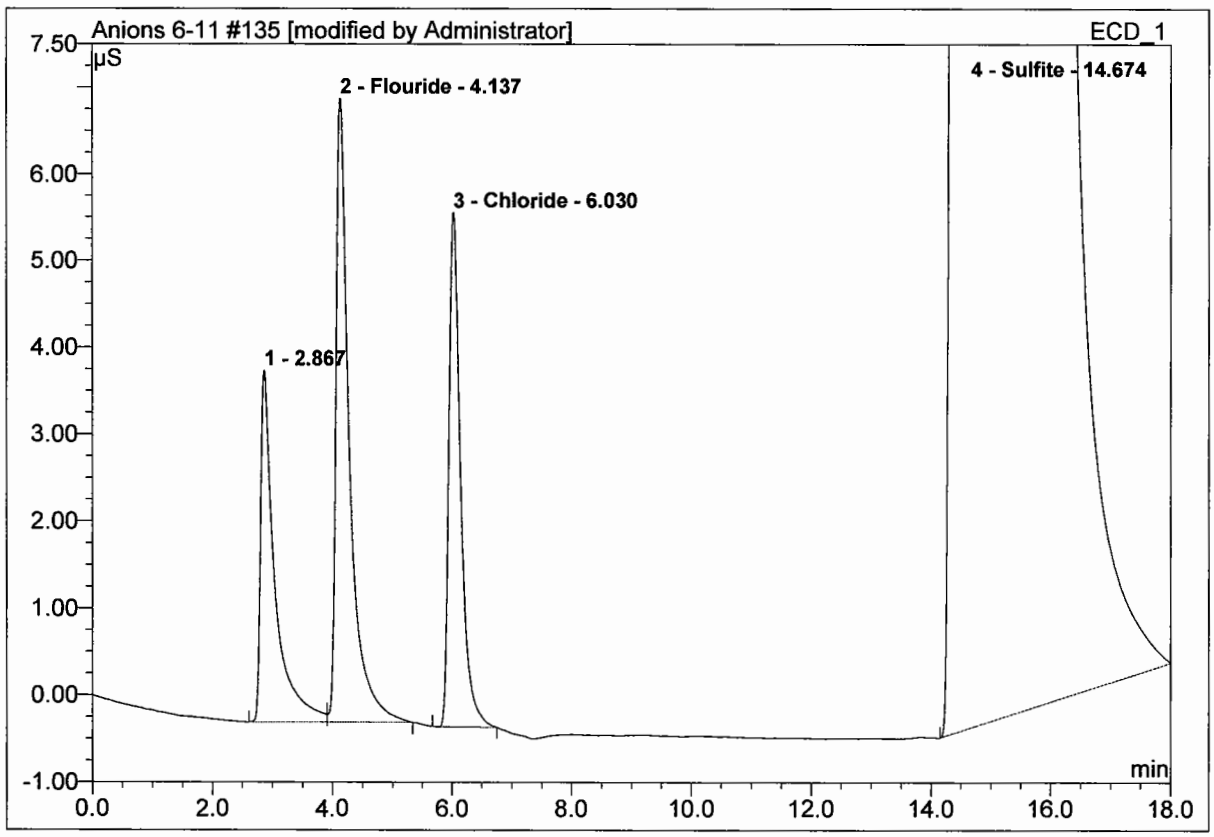
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 0:48**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.14	Flouride	3.382	0.9311
3	6.03	Chloride	2.845	0.6500
4	14.65	Sulfite	797.069	709.6867
Total:			803.296	711.268

135 10.0 ppm F, Cl H2SO4

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 1:07**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**

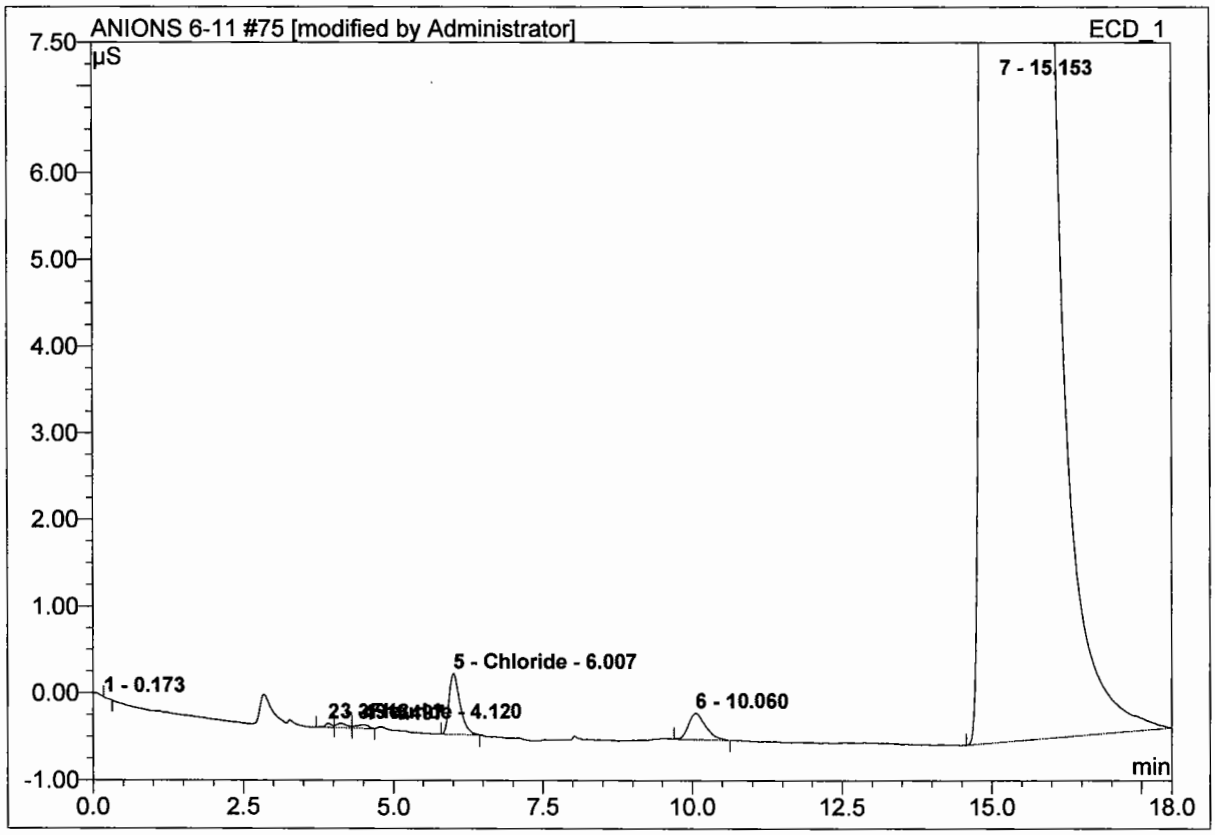


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.14	Flouride	7.188	1.8696
3	6.03	Chloride	5.921	1.3580
4	14.67	Sulfite	783.867	694.3464
Total:			796.977	697.574

Chromeleon (c) Dionex 1996-2001
Version 6.60 Build 1428

75 BP run 1 H2SO4

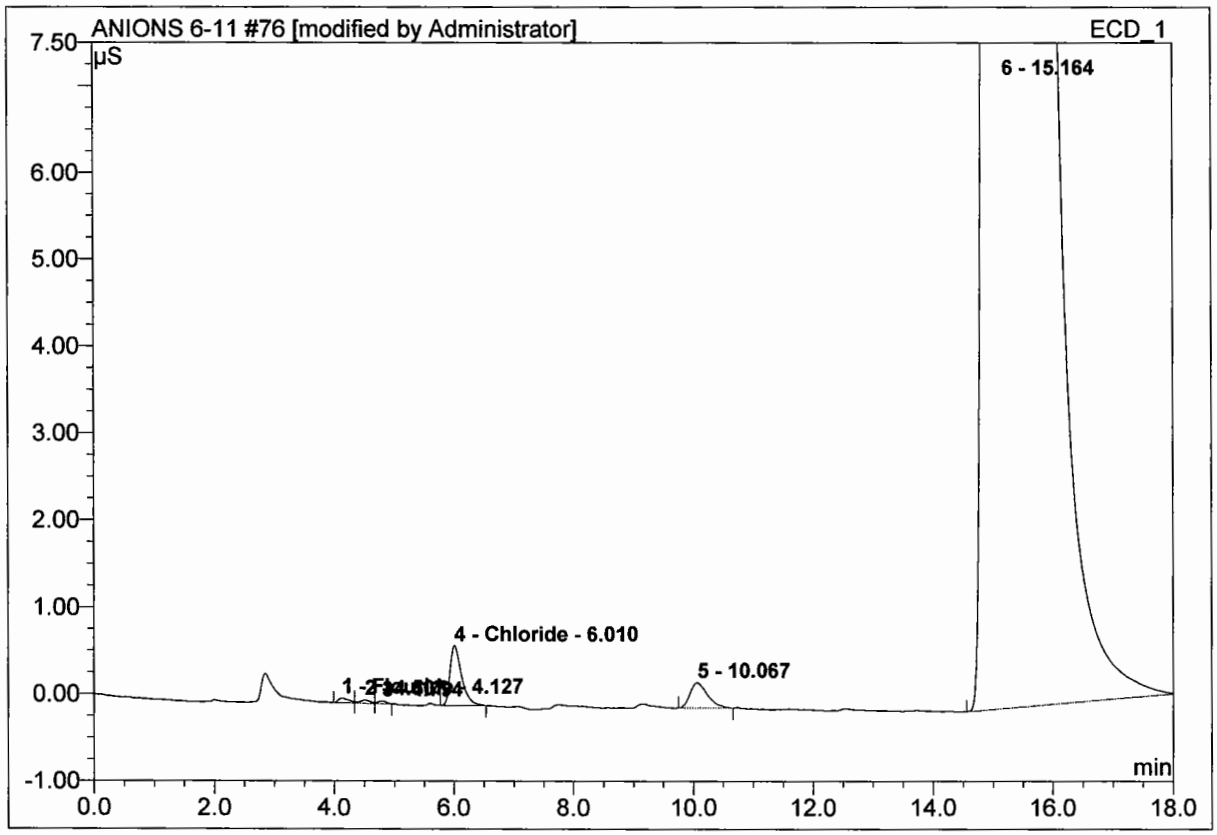
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 17:37**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
3	4.12	Flouride	0.051	0.0100
5	6.01	Chloride	0.701	0.1507
Total:			0.752	0.161

76 BP run 1 H2SO4

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 17:56**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**

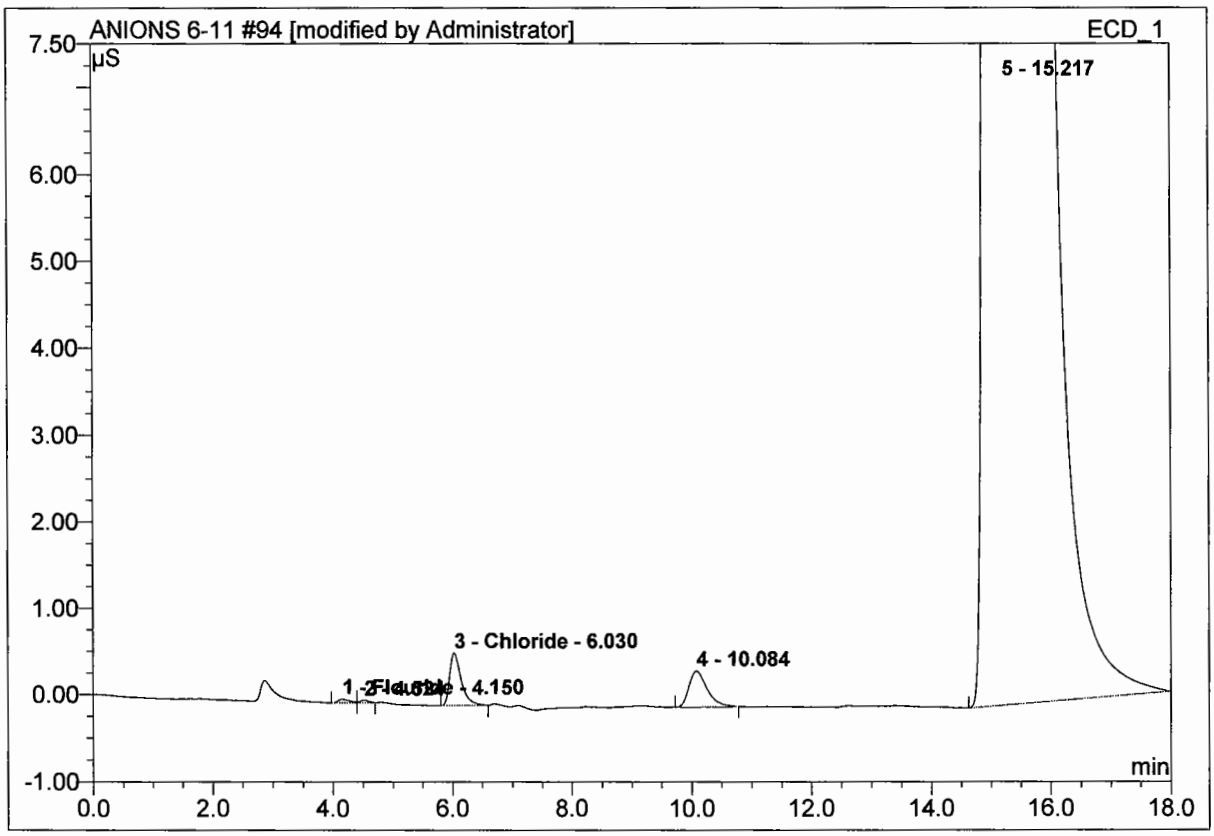


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.13	Flouride	0.053	0.0110
4	6.01	Chloride	0.687	0.1544
Total:			0.740	0.165

Chromeleon (c) Dionex 1996-2001
Version 6.60 Build 1428

94 BP run 2 H2SO4

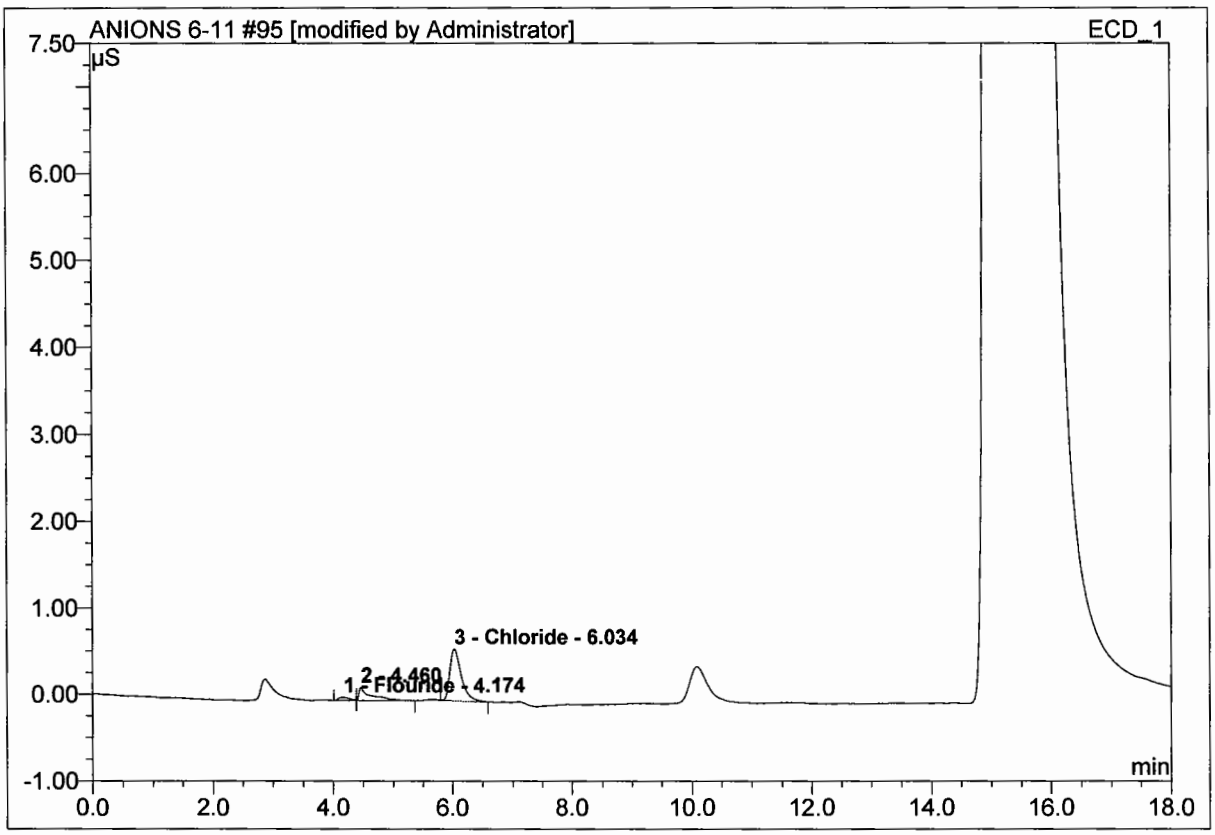
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 9:48**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.15	Flouride	0.041	0.0089
3	6.03	Chloride	0.609	0.1357
Total:			0.650	0.145

95 BP run 2 H2SO4

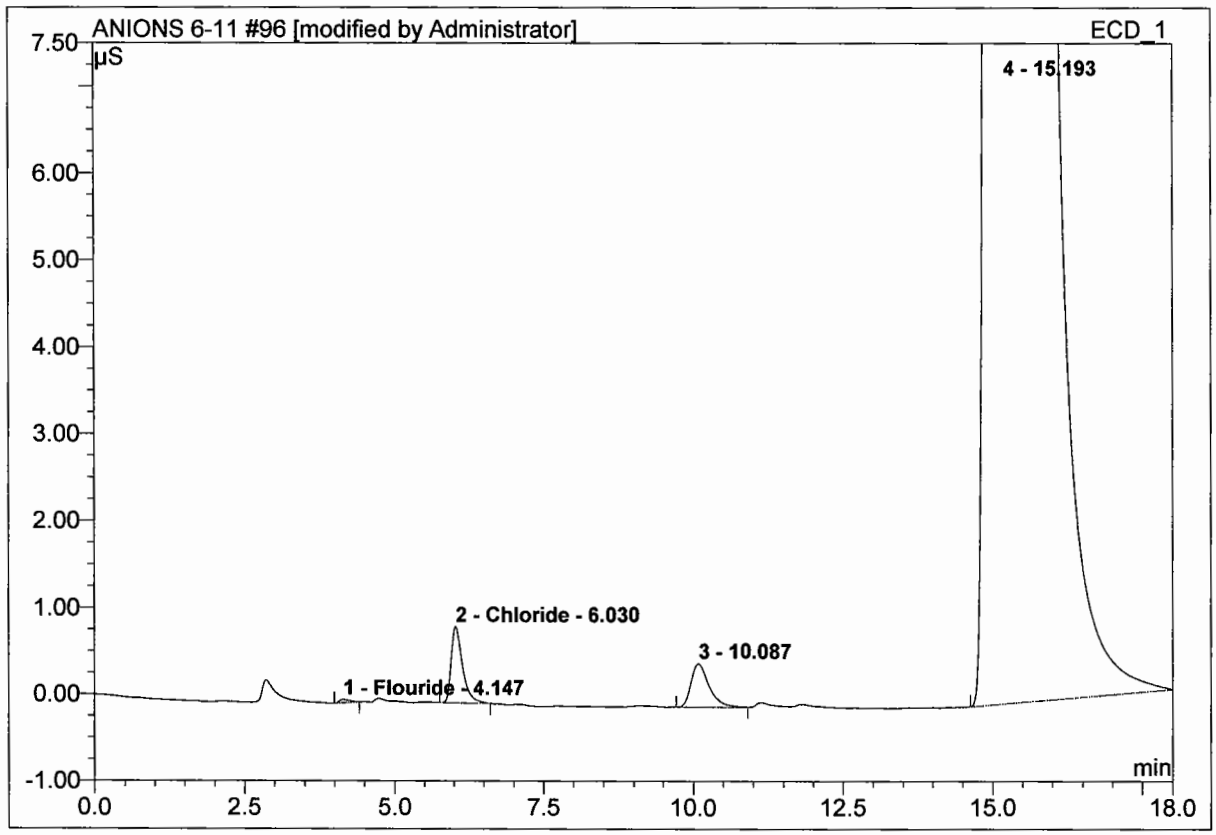
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 10:07**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.17	Flouride	0.038	0.0084
3	6.03	Chloride	0.601	0.1326
Total:			0.640	0.141

96 BP run 3 H2SO4

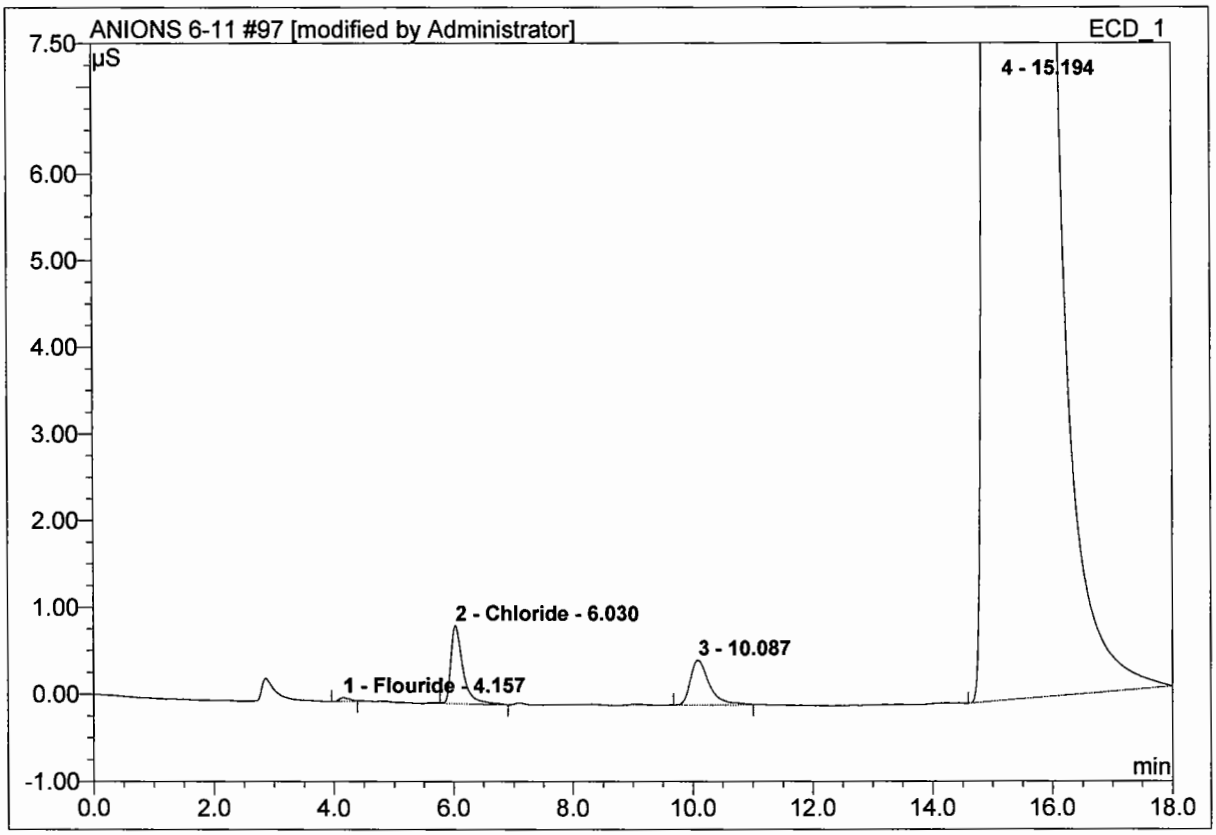
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 10:26**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.15	Flouride	0.038	0.0073
2	6.03	Chloride	0.880	0.1936
Total:			0.918	0.201

97 BP run 3 H2SO4

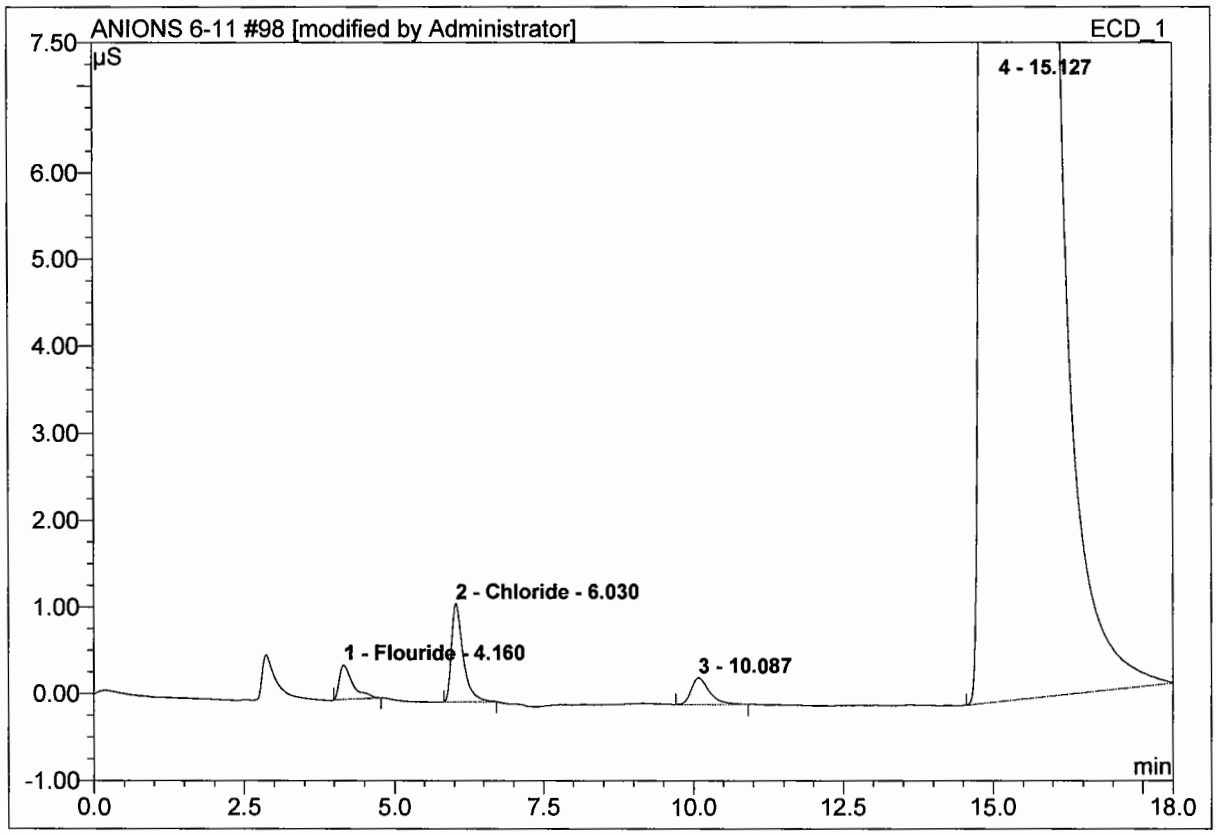
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 10:45**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.042	0.0079
2	6.03	Chloride	0.896	0.2084
Total:			0.938	0.216

98 BP Cl spike run 1 H2SO4

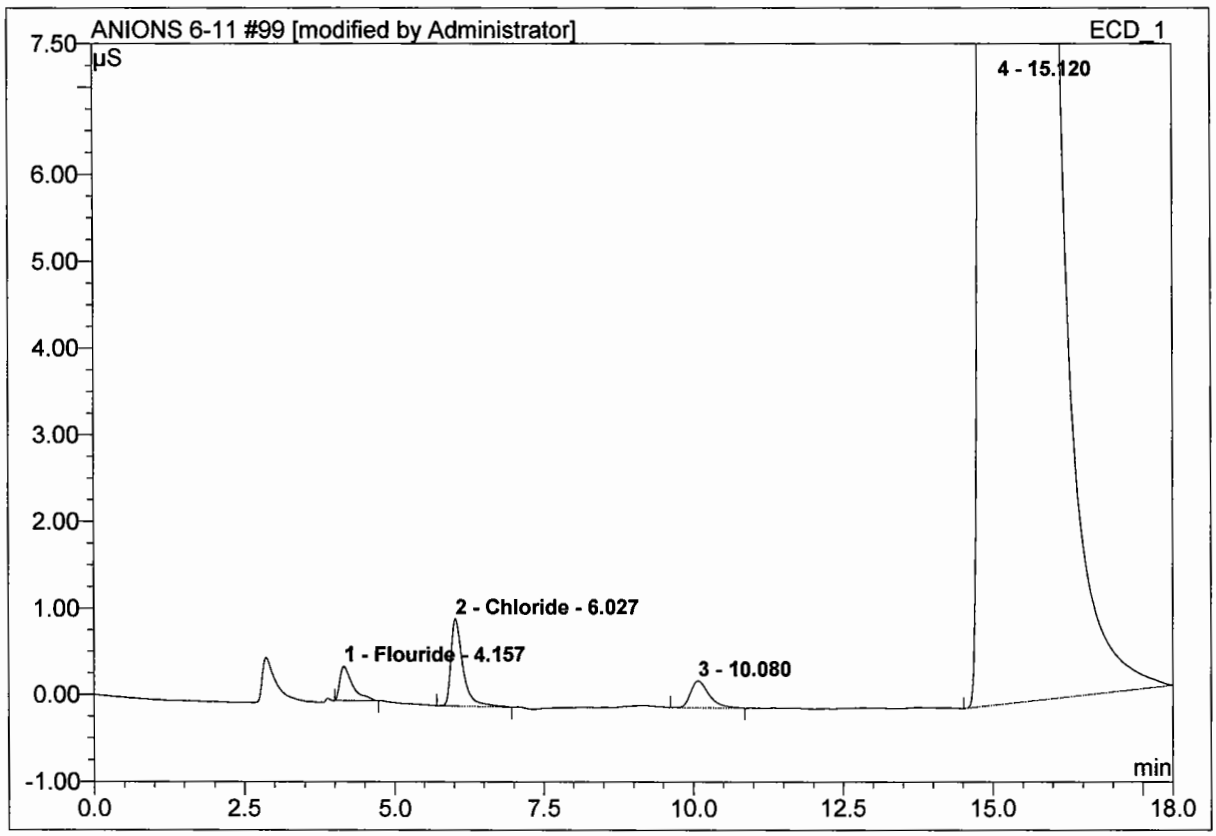
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 11:04**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.394	0.1015
2	6.03	Chloride	1.132	0.2590
Total:			1.526	0.360

99 BP Cl spike run 1 H2SO4

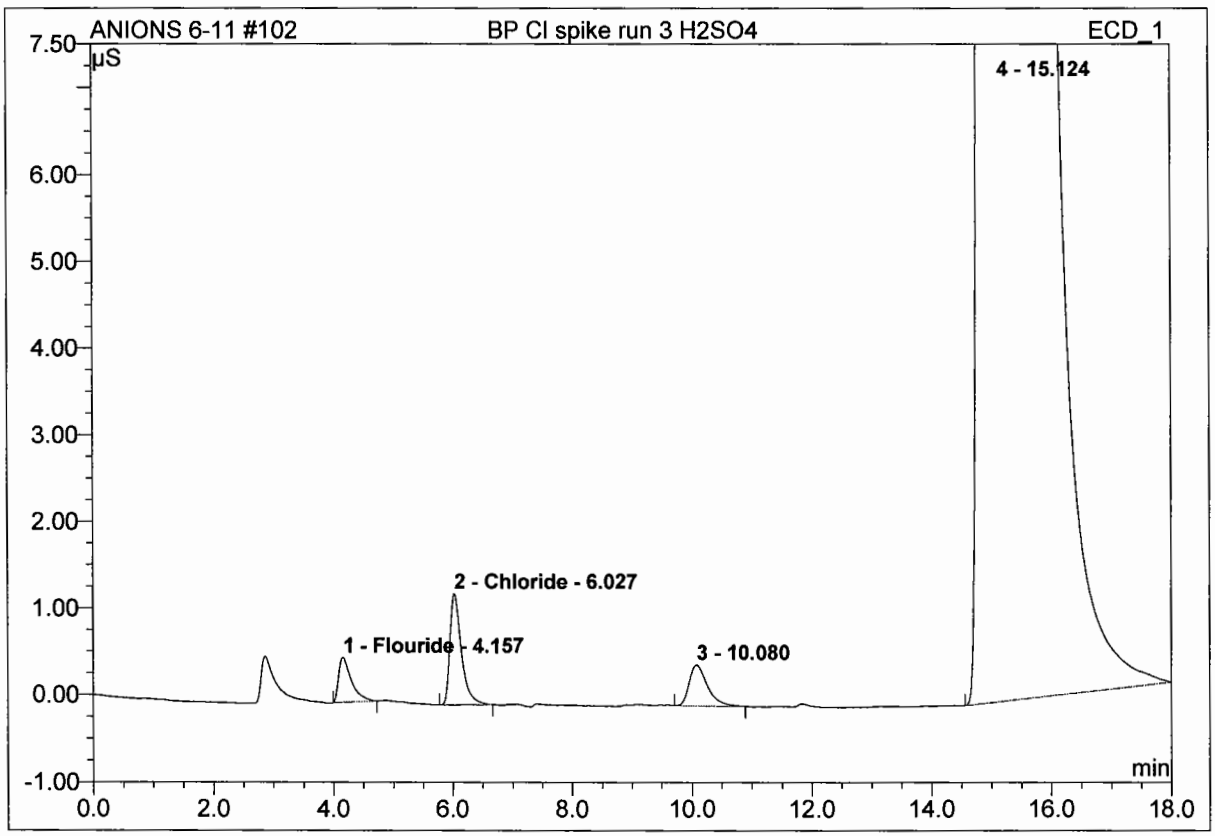
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 11:24**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.394	0.0989
2	6.03	Chloride	1.008	0.2346
Total:			1.403	0.333

102 BP Cl spike run 3 H2SO4

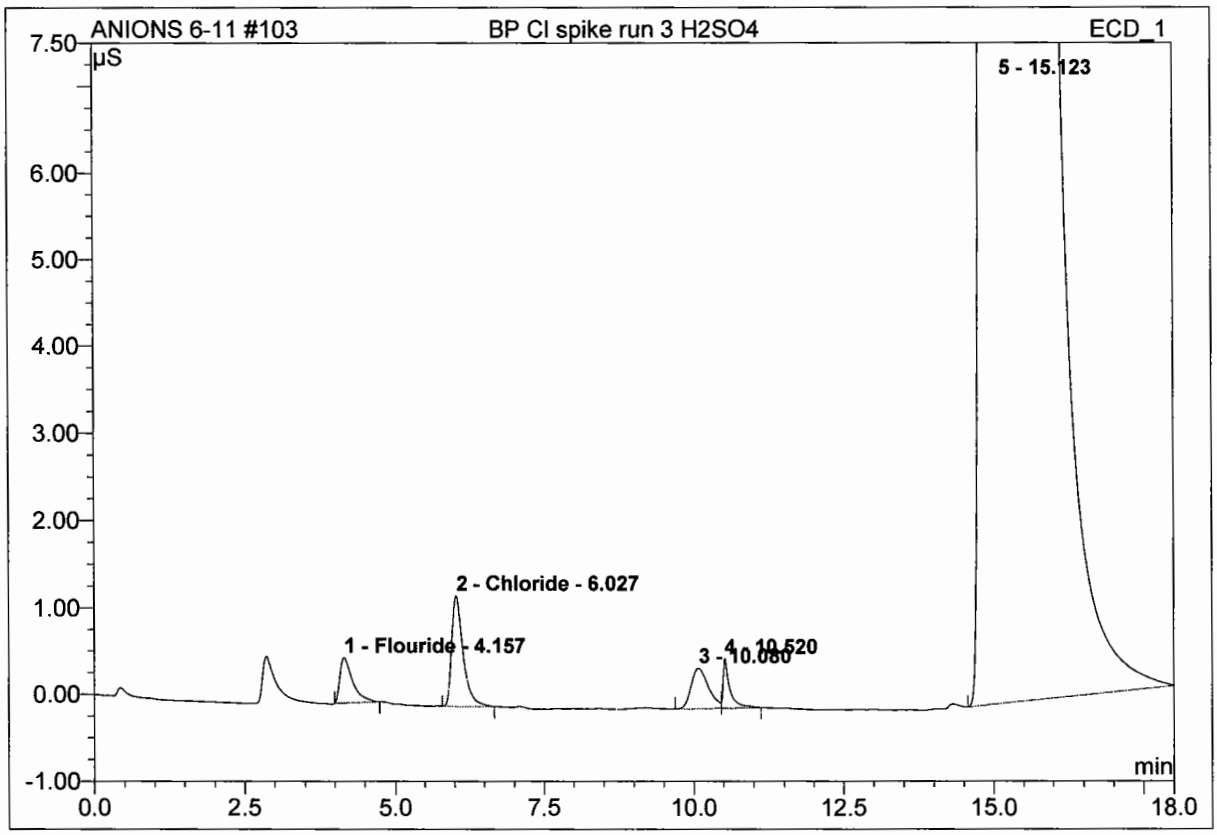
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 12:21**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.516	0.1277
2	6.03	Chloride	1.280	0.2873
Total:			1.796	0.415

103 BP Cl spike run 3 H2SO4

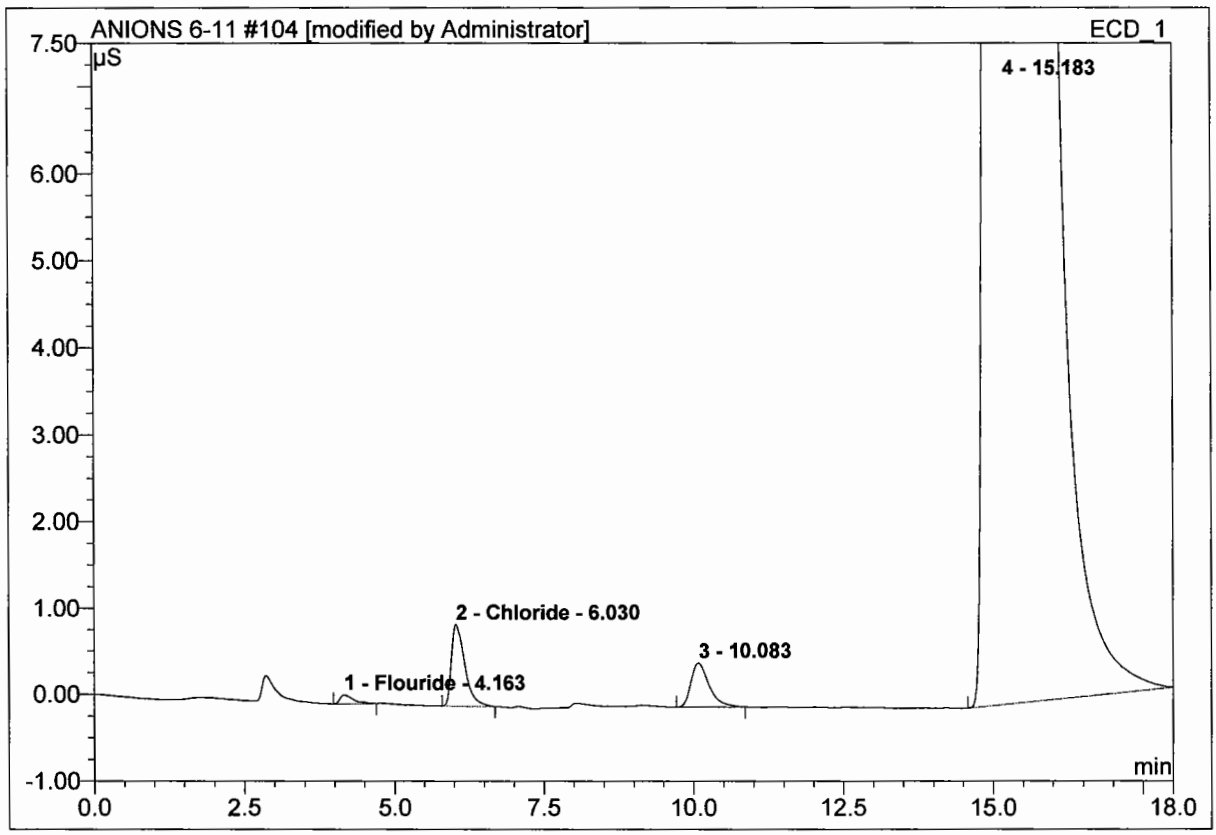
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 12:40**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.519	0.1278
2	6.03	Chloride	1.276	0.2856
Total:			1.796	0.413

104 BP F spike run 3 H2SO4

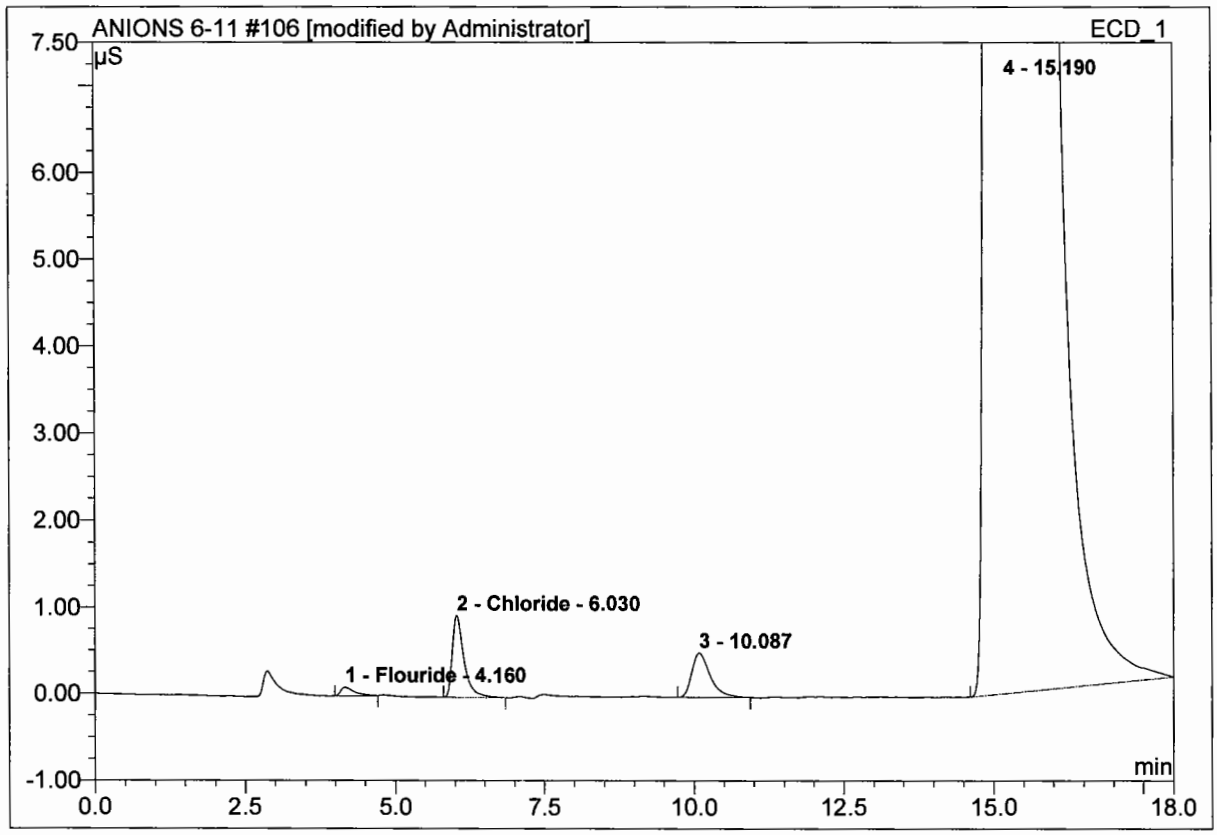
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 12:59**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.102	0.0266
2	6.03	Chloride	0.944	0.2446
Total:			1.046	0.271

106 BP F spike run 3 H2SO4

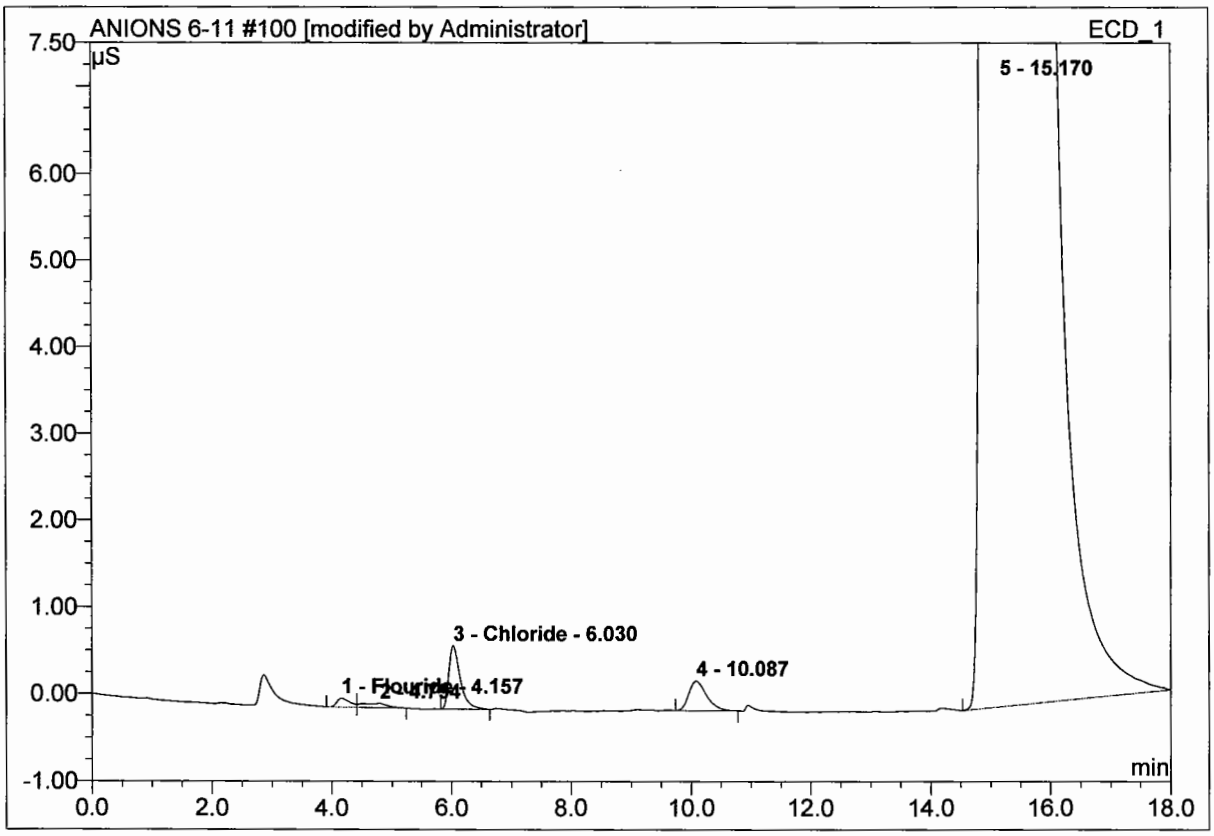
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 13:44**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.099	0.0262
2	6.03	Chloride	0.949	0.2172
Total:			1.049	0.243

100 BP F spike run 1 H2SO4

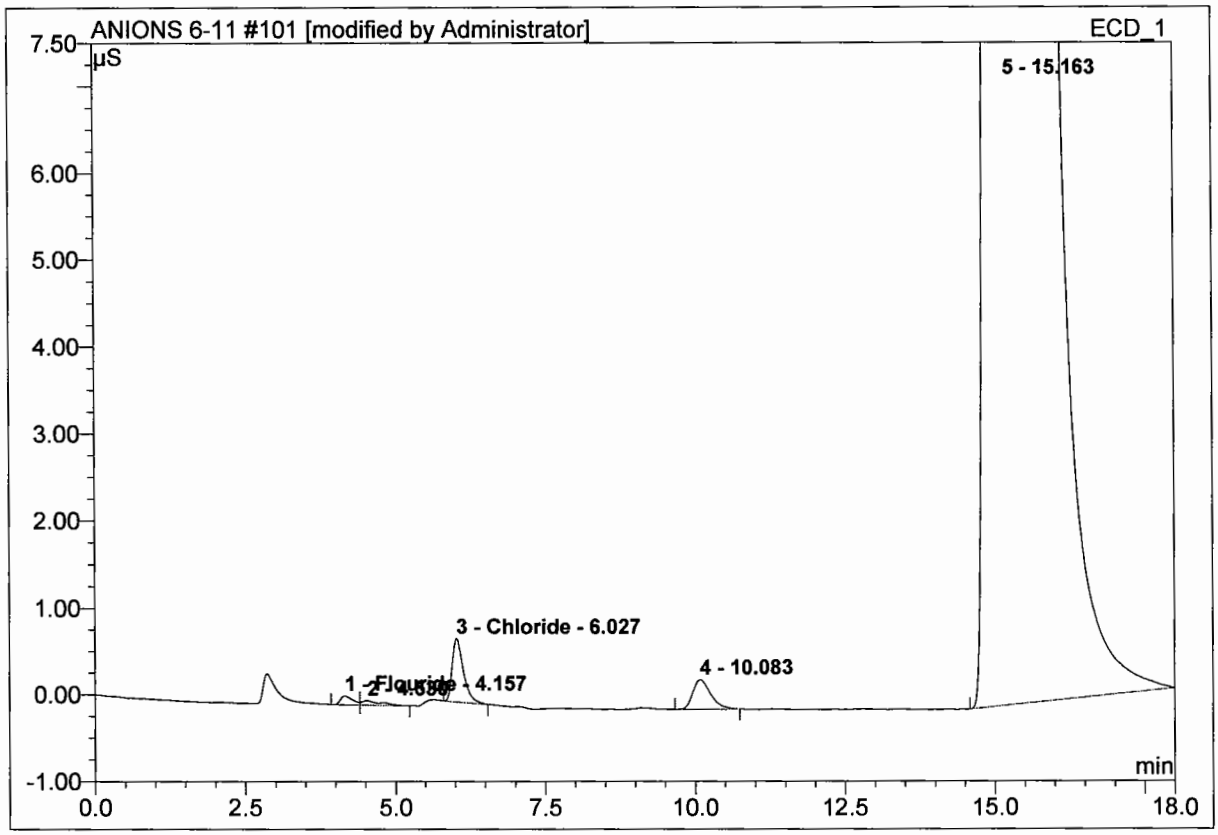
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 11:43**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.100	0.0249
3	6.03	Chloride	0.731	0.1631
Total:			0.832	0.188

101 BP F spike run 1 H2SO4

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 12:02**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**

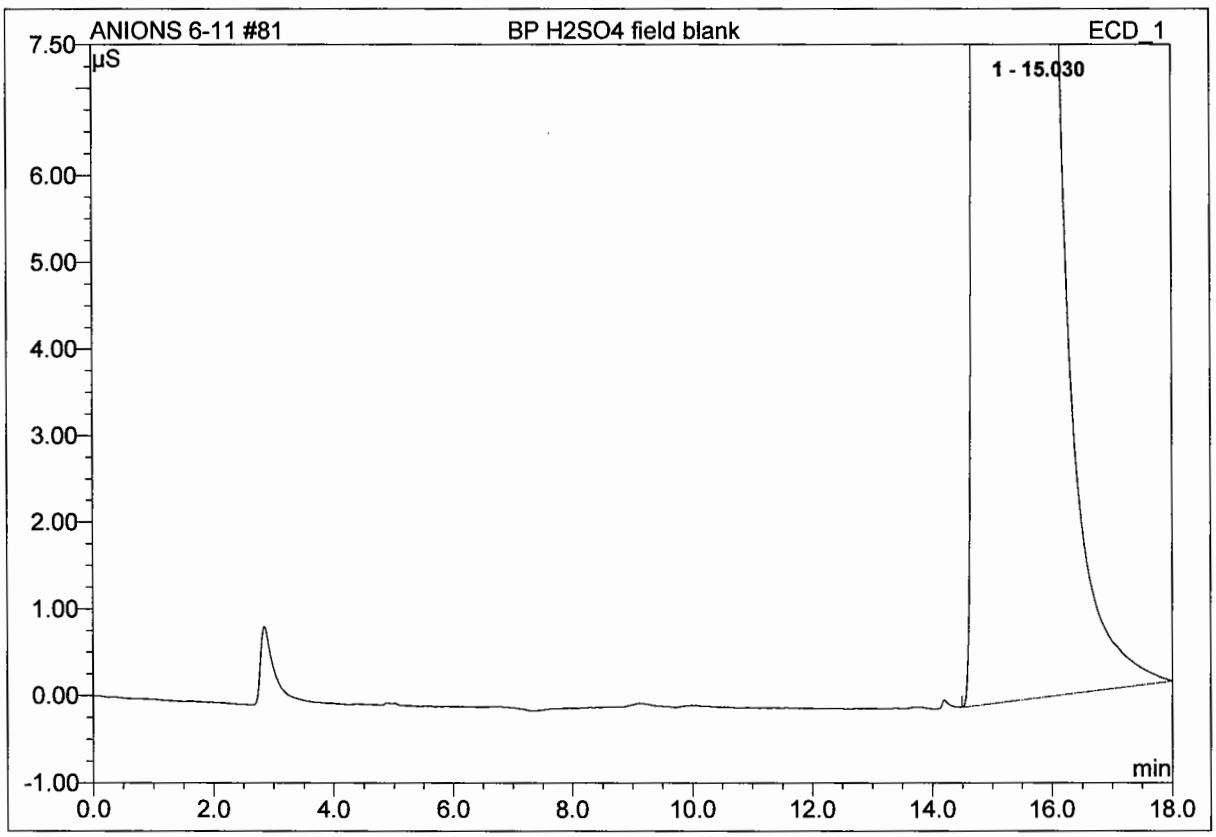


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.103	0.0245
3	6.03	Chloride	0.733	0.1594
Total:			0.836	0.184

Chromeleon (c) Dionex 1996-2001
Version 6.60 Build 1428

81 BP H2SO4 field blank

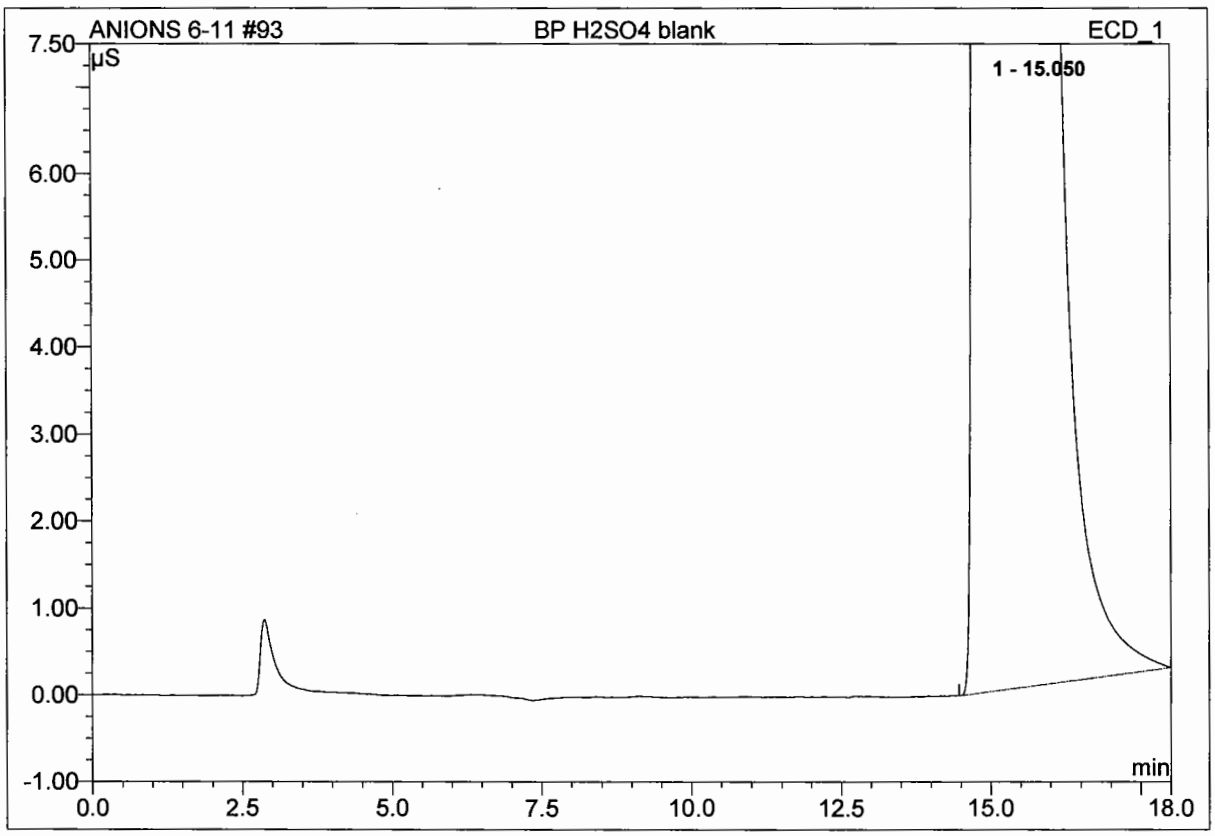
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 19:31**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

93 BP H2SO4 blank

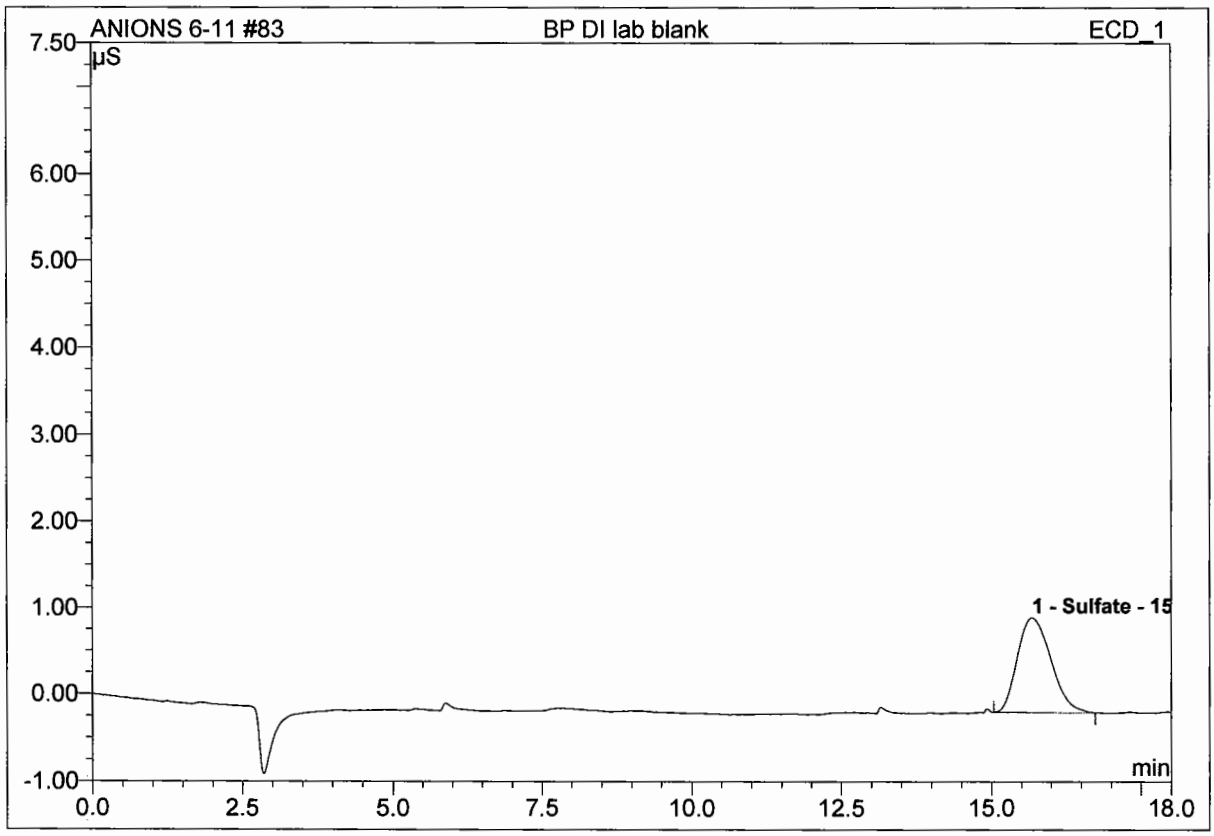
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 9:28**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

83 BP DI lab blank

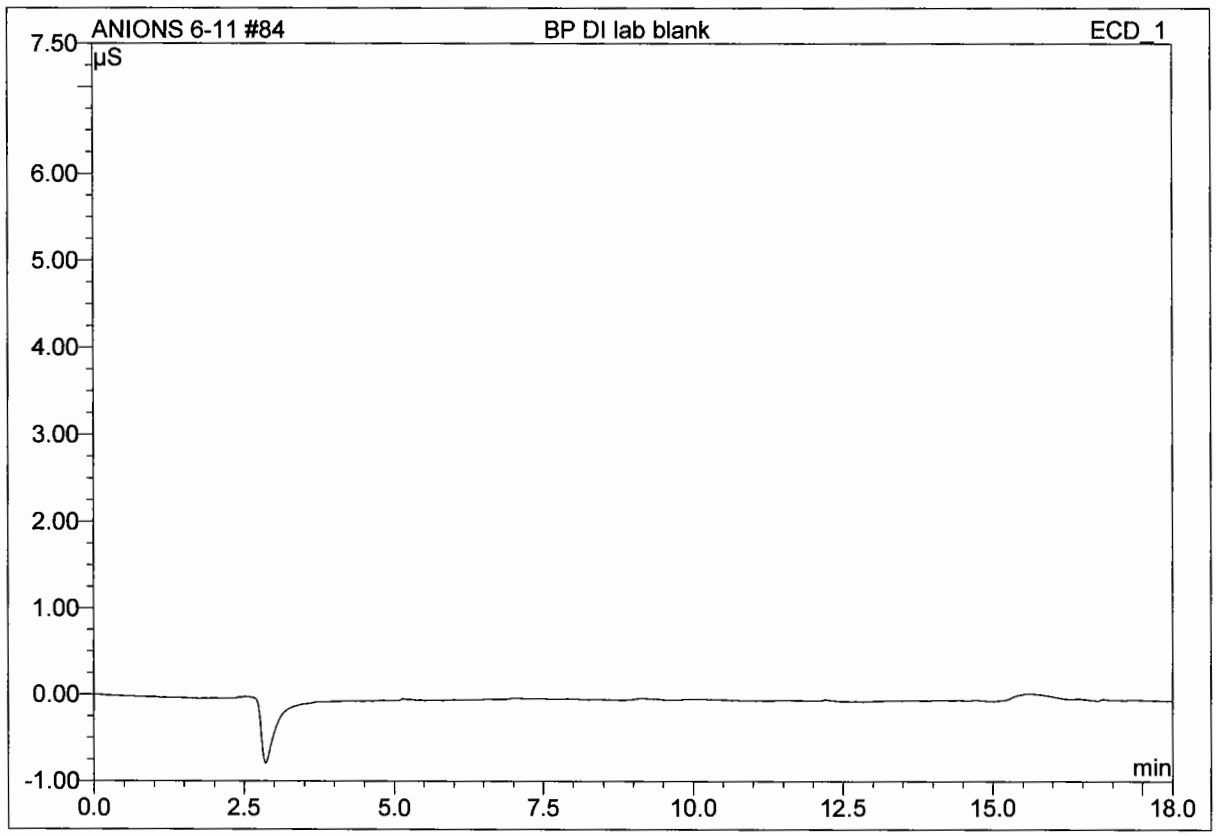
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 20:10**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	15.68	Sulfate	1.094	0.7116
Total:			1.094	0.712

84 BP DI lab blank

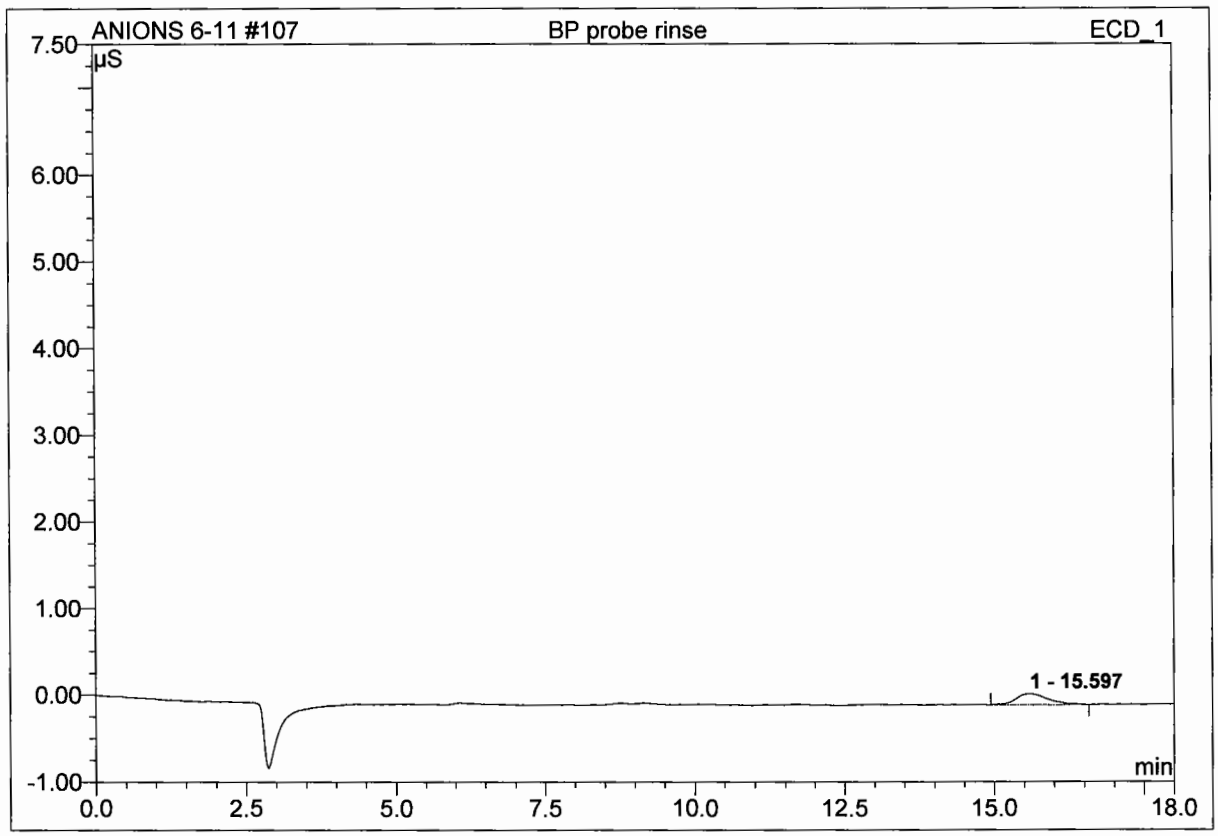
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/22/2011 20:29**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

107 BP probe rinse

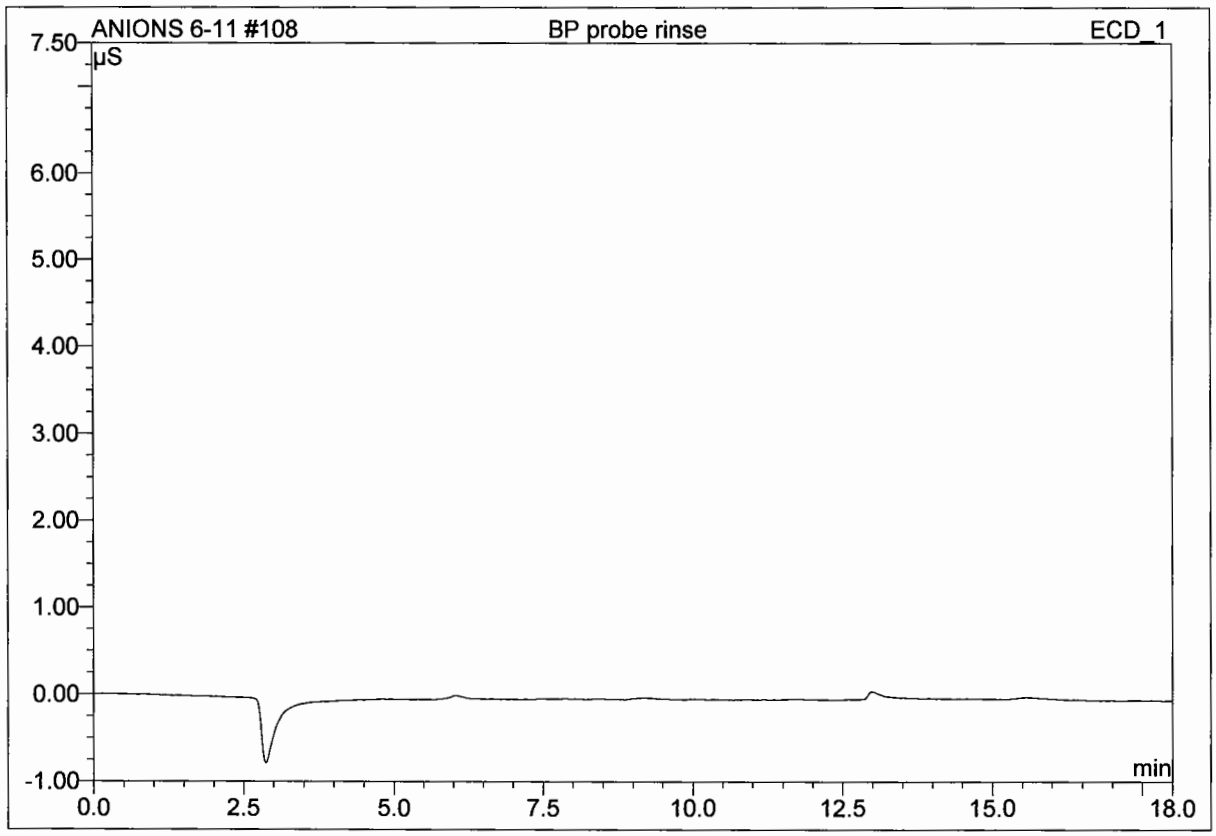
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 14:04**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

108 BP probe rinse

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/23/2011 14:23**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

ANALYTICAL SUMMARY

CLIENT: BP Whiting
LOCATION: Whiting, IN
SAMPLE DATES: 6/7/11-6/8/11
ANALYSIS: Chlorine
METHOD: USEPA Method 26

Analyst: J. Ruggaber
Date of Completion: 6/30/2011
Template Control ID: USEPA-M26-HCl-Template-052T-REV1

Calibration Curve Calculation

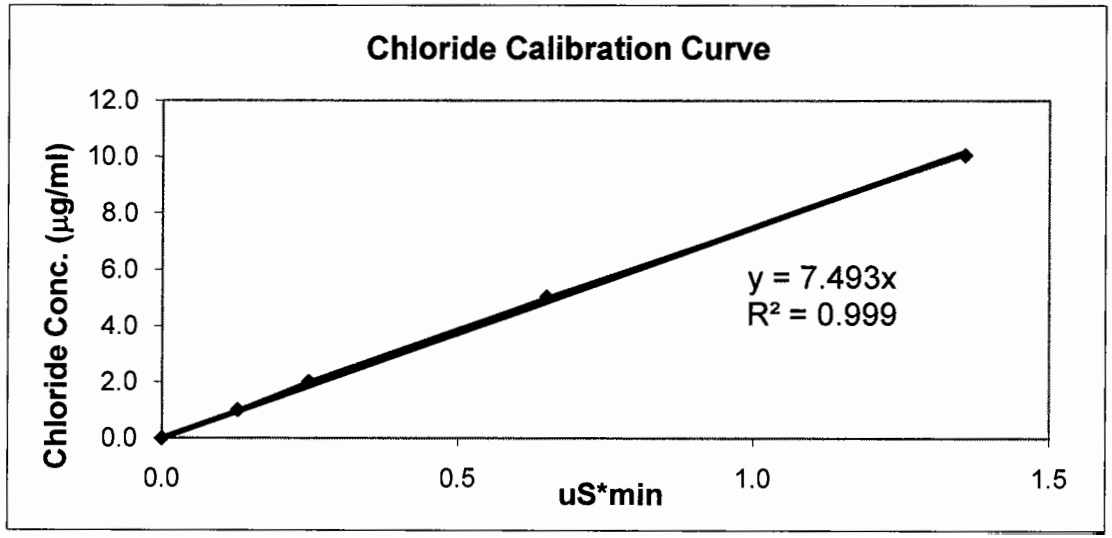
Std. (µg/ml)	Pre Cal (µS*min)	Post Cal (µS*min)	Average (µS*min)	Deviation (%)
0.0	0.00	0.00	0.00	0.00
1.0	0.128	0.127	0.128	0.27
2.0	0.245	0.250	0.248	-0.93
5.0	0.640	0.660	0.650	-1.52
10.1	1.343	1.372	1.357	-1.07

	Conc. Ug/mL	Peak Area	RE	Cal Conc	% Dif
	1.0	0.128	0.127	1.0	-1.27
	2.0	0.248	0.123	1.9	-4.25
	5.0	0.650	0.129	5.1	0.55
	10.1	1.357	0.135	10.6	4.97
		mean RF---	0.1285		
Second. Std.	5.0	0.6789	N/A	5.08	1.63

Sample Concentration Calculations

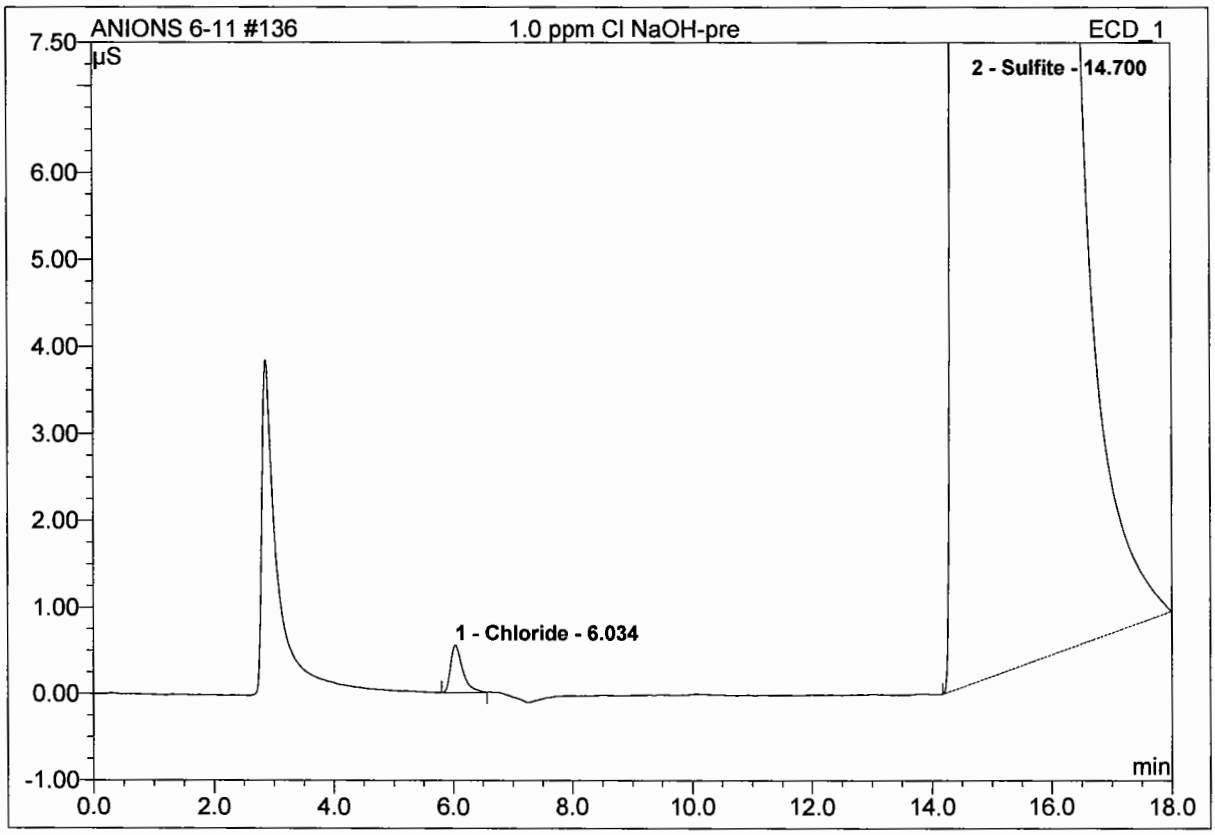
ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Diluted Conc. (µg/ml)	Dilution Factor	Sample volume(ml)	Total Mass Cl2 (µg)
Run 1	0.035	0.034	0.035	0.29	0.26	1	500	129
Run 2	0.037	0.037	0.037	-0.54	0.28	1	500	139
Run 3	0.071	0.075	0.073	-2.89	0.54	1	500	272
0.1 N NaOH Blank	<0.031	<0.031	<0.031	0.00	<0.23	1	500	<115
Reagent DI Water Rinse	<0.031	<0.031	<0.031	0.00	<0.23	1	500	<115
Lab DI Water Blank	<0.031	<0.031	<0.031	0.00	<0.23	1	500	<115

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Actual Conc. (µg/ml)	Target Conc. (µg/ml)	R (%)	Pass/Fail
Run 1 spike	0.133	0.142	0.137	-3.13	1.03	1.04	99%	Pass
Run 2 spike	0.145	0.143	0.144	0.80	1.08	1.06	102%	Pass


Chloride Calibration Curve
Chloride Conc. (µg/ml)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
uS*min
y = 7.493x
R² = 0.999

136 1.0 ppm Cl NaOH-pre

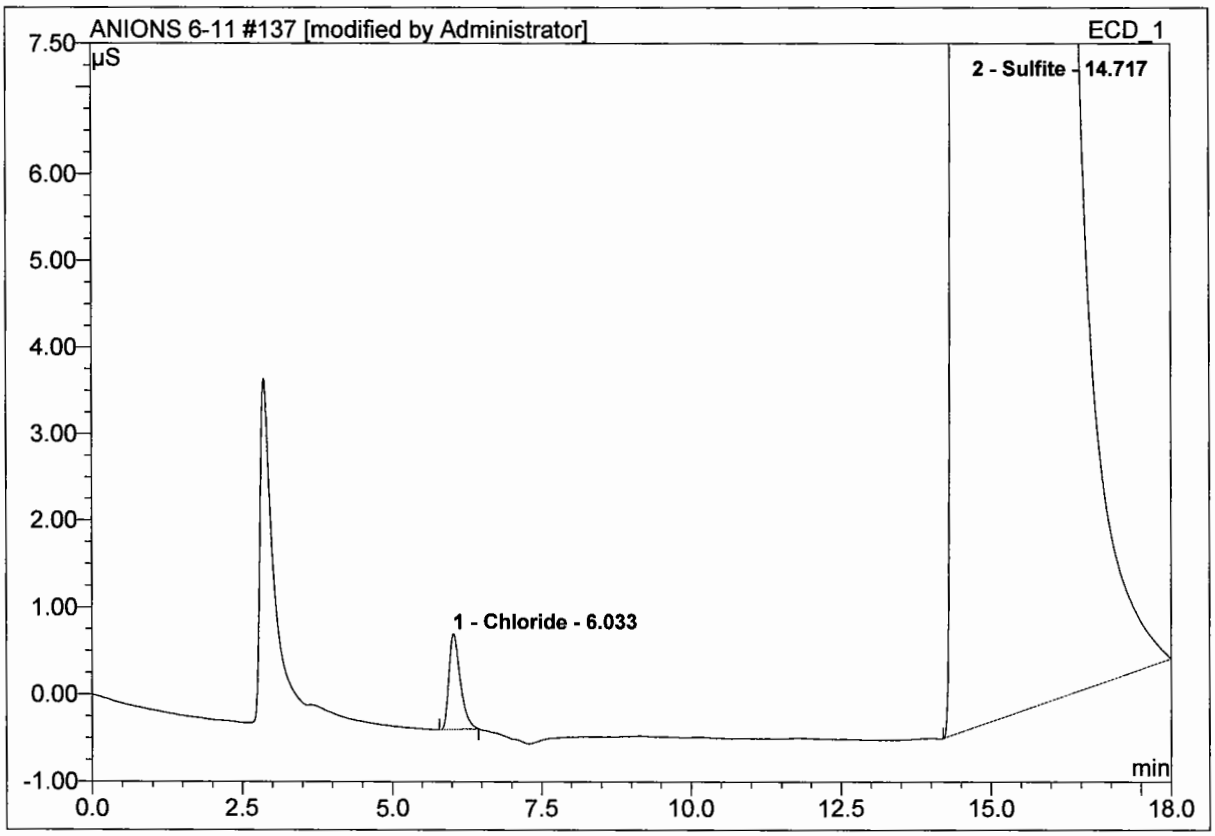
Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 9:38**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	0.548	0.1280
2	14.70	Sulfite	805.081	723.0042
Total:			805.628	723.132

137 2.0 ppm Cl NaOH-pre

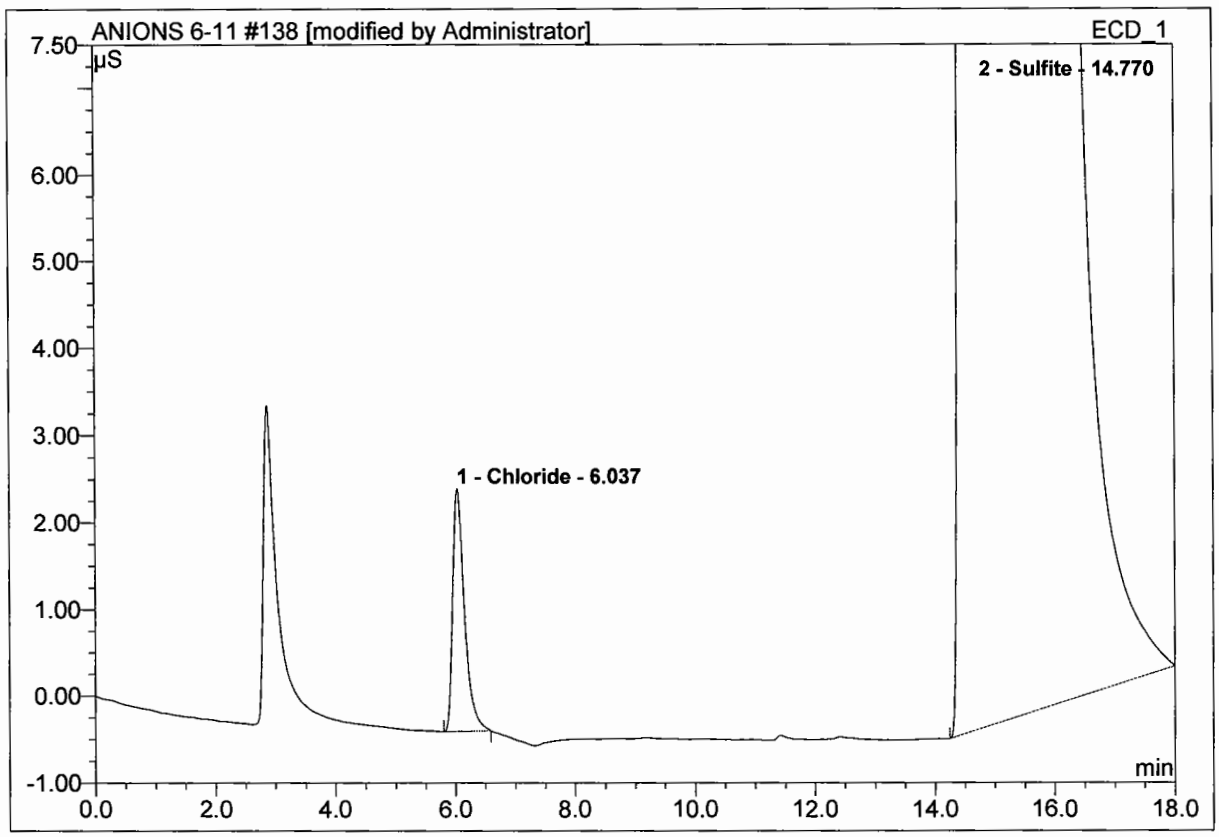
Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 9:57**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	1.100	0.2453
2	14.72	Sulfite	786.676	699.0682
Total:			787.776	699.314

138 5.0 ppm Cl NaOH-pre

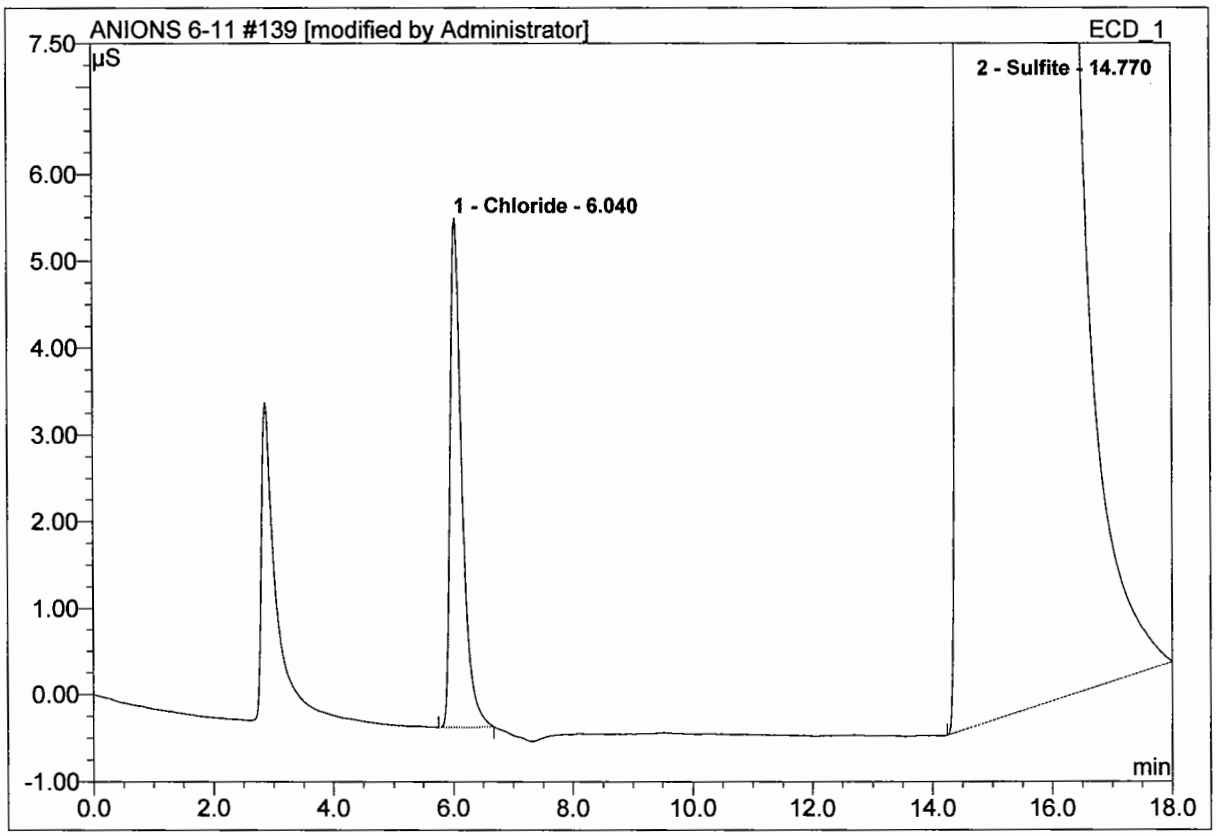
Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 10:16**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.04	Chloride	2.802	0.6401
2	14.77	Sulfite	743.288	643.0021
Total:			746.090	643.642

139 10.0 ppm Cl NaOH-pre

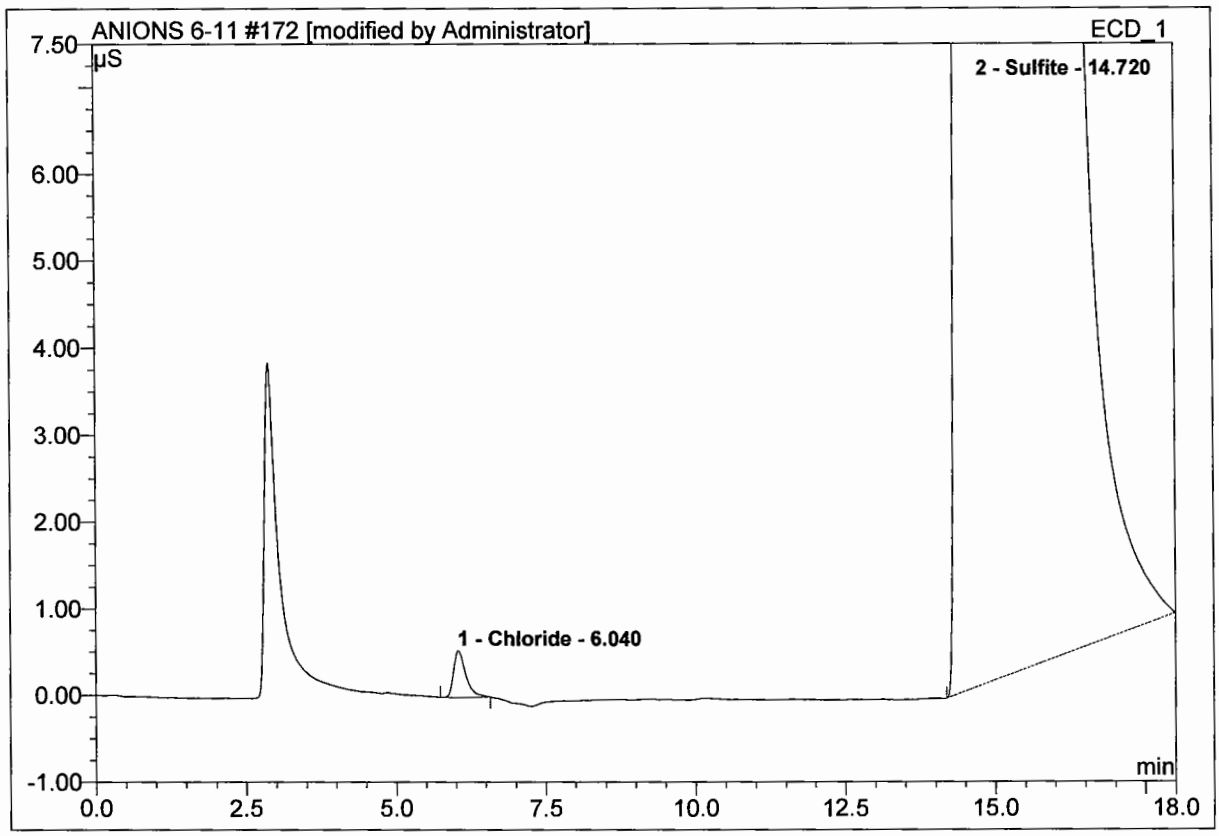
Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 10:35**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.04	Chloride	5.872	1.3426
2	14.77	Sulfite	743.919	644.5673
Total:			749.791	645.910

172 1.0 ppm Cl NaOH-post

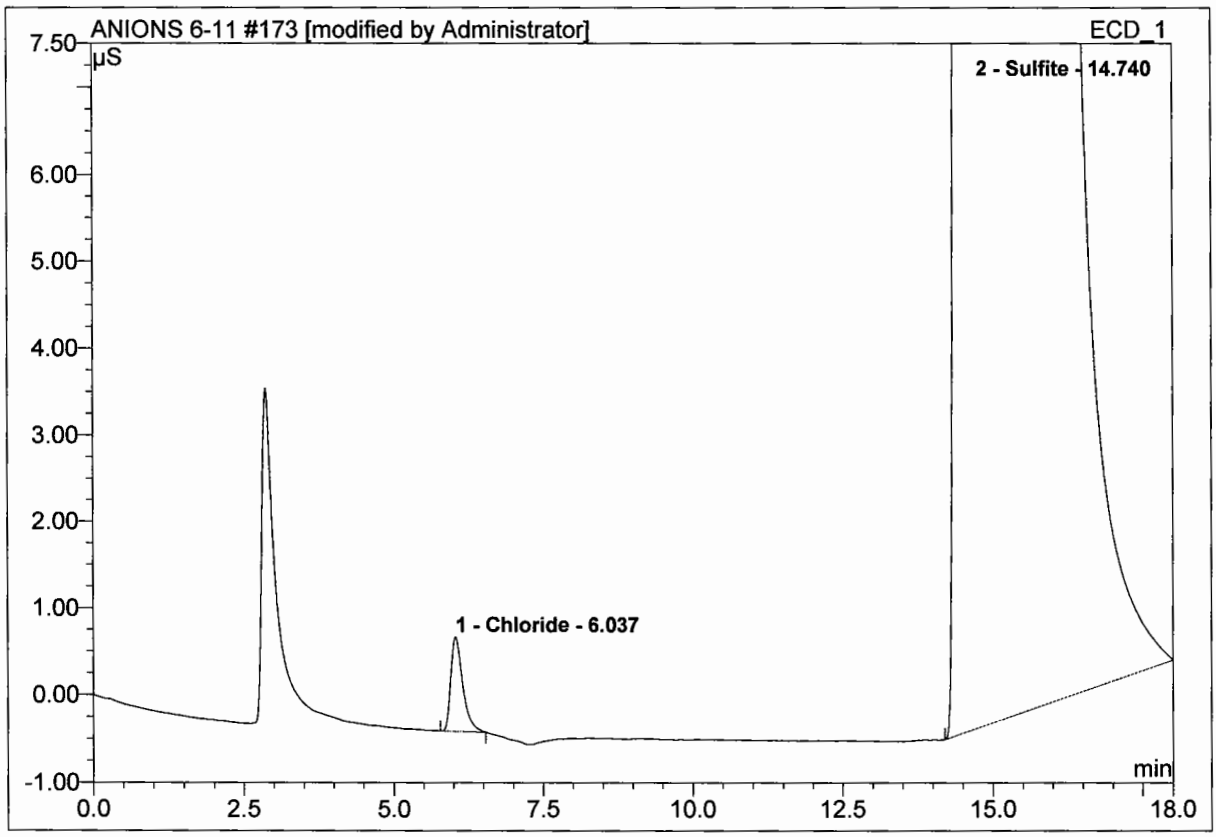
Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 21:41**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.04	Chloride	0.538	0.1273
2	14.72	Sulfite	801.669	723.7868
Total:			802.206	723.914

173 2.0 ppm Cl NaOH-post

Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 22:00**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.04	Chloride	1.081	0.2499
2	14.74	Sulfite	776.487	690.3660
Total:			777.569	690.616

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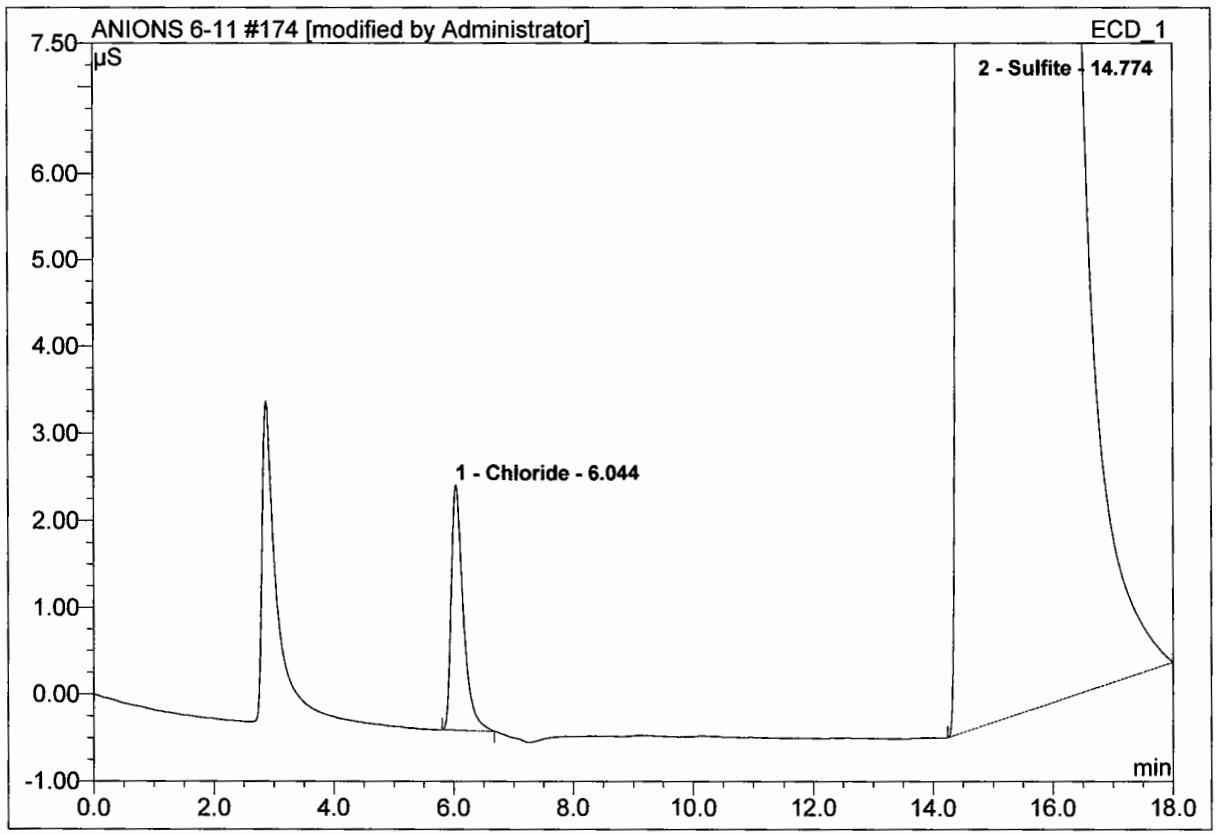
174 5.0 ppm Cl NaOH-post

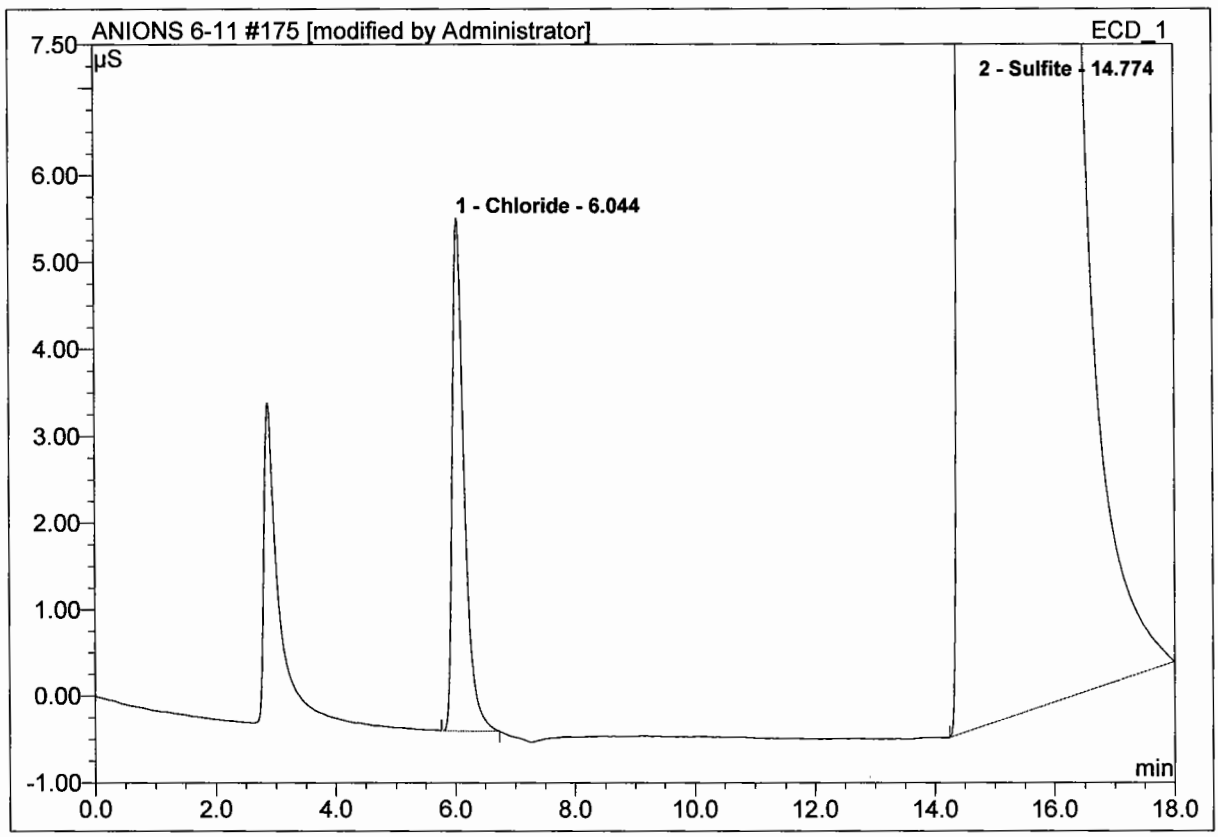
Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 22:19**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.04	Chloride	2.818	0.6599
2	14.77	Sulfite	748.753	654.8253
Total:			751.571	655.485

175 10.0 ppm Cl NaOH-post

Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**standard**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 22:38**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.04	Chloride	5.911	1.3717
2	14.77	Sulfite	749.569	654.3092
Total:			755.481	655.681

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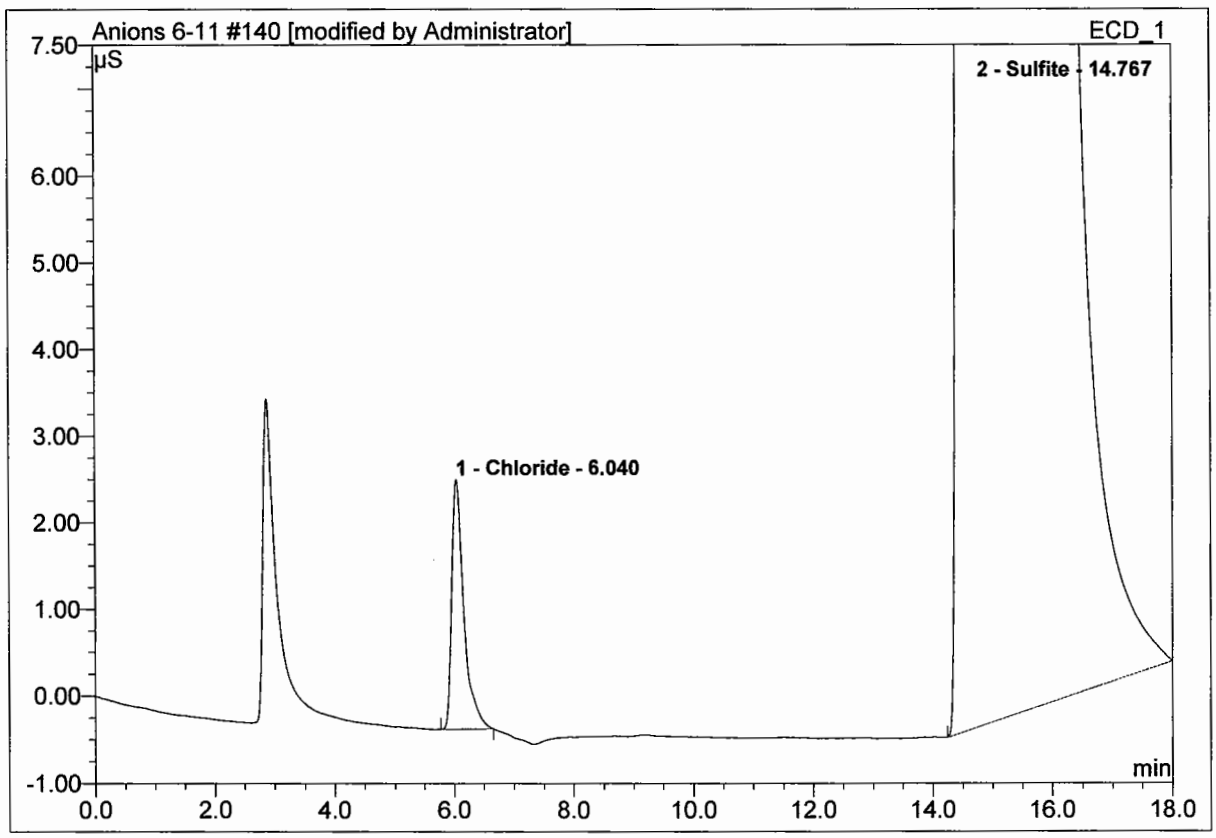
140 5.0 ppm 2nd std NaOH

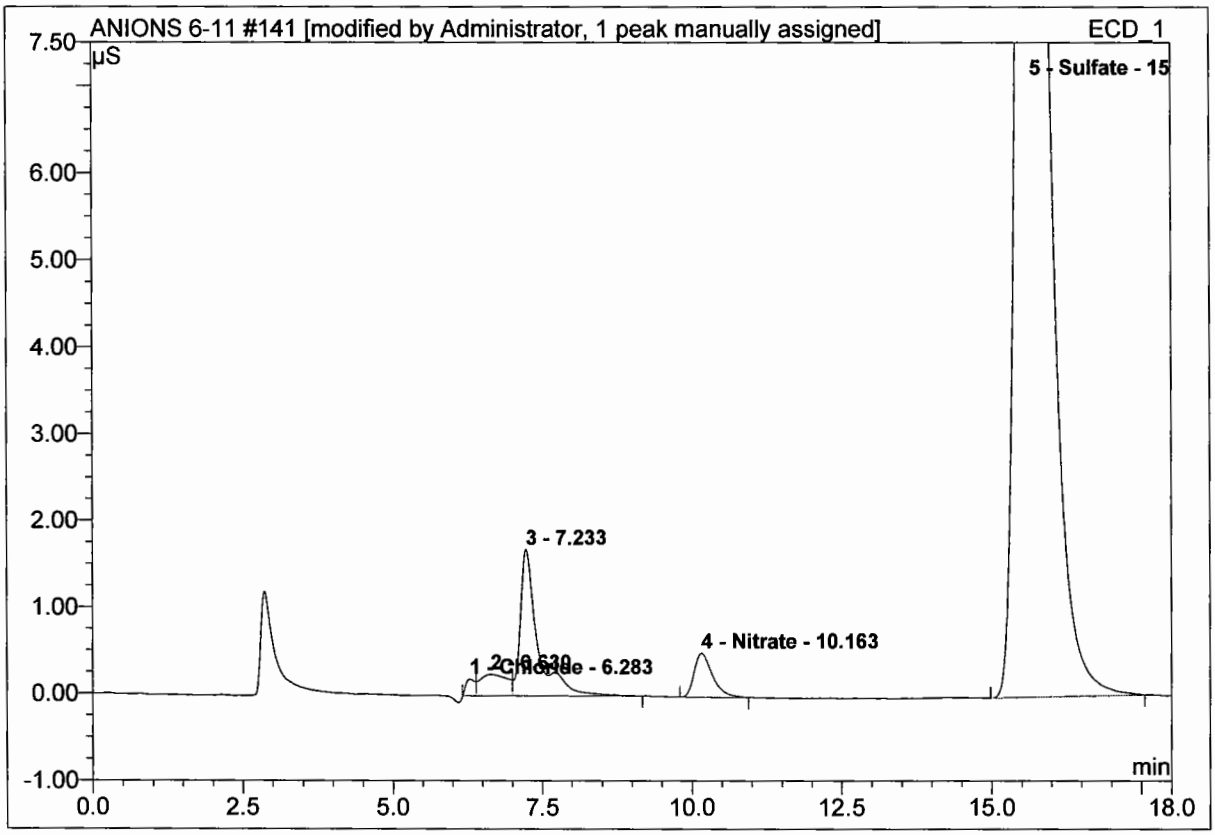
Client		*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 10:54**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.04	Chloride	2.876	0.6789
2	14.77	Sulfite	752.171	653.3684
Total:			755.047	654.047

141 BP run 1 NaOH

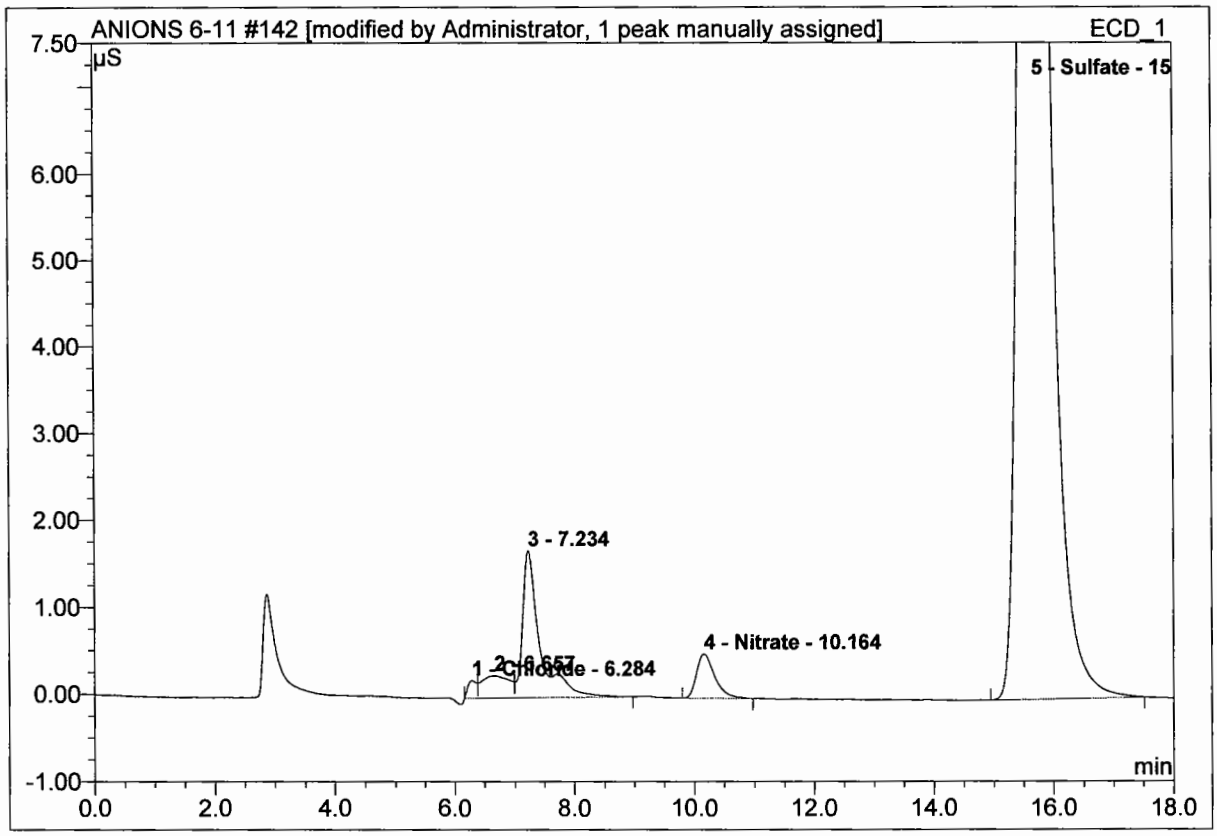
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 11:22**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.28	Chloride	0.194	0.0346
4	10.16	Nitrate	0.507	0.1798
5	15.66	Sulfate	22.932	11.3955
Total:			23.633	11.610

142 BP run 1 NaOH

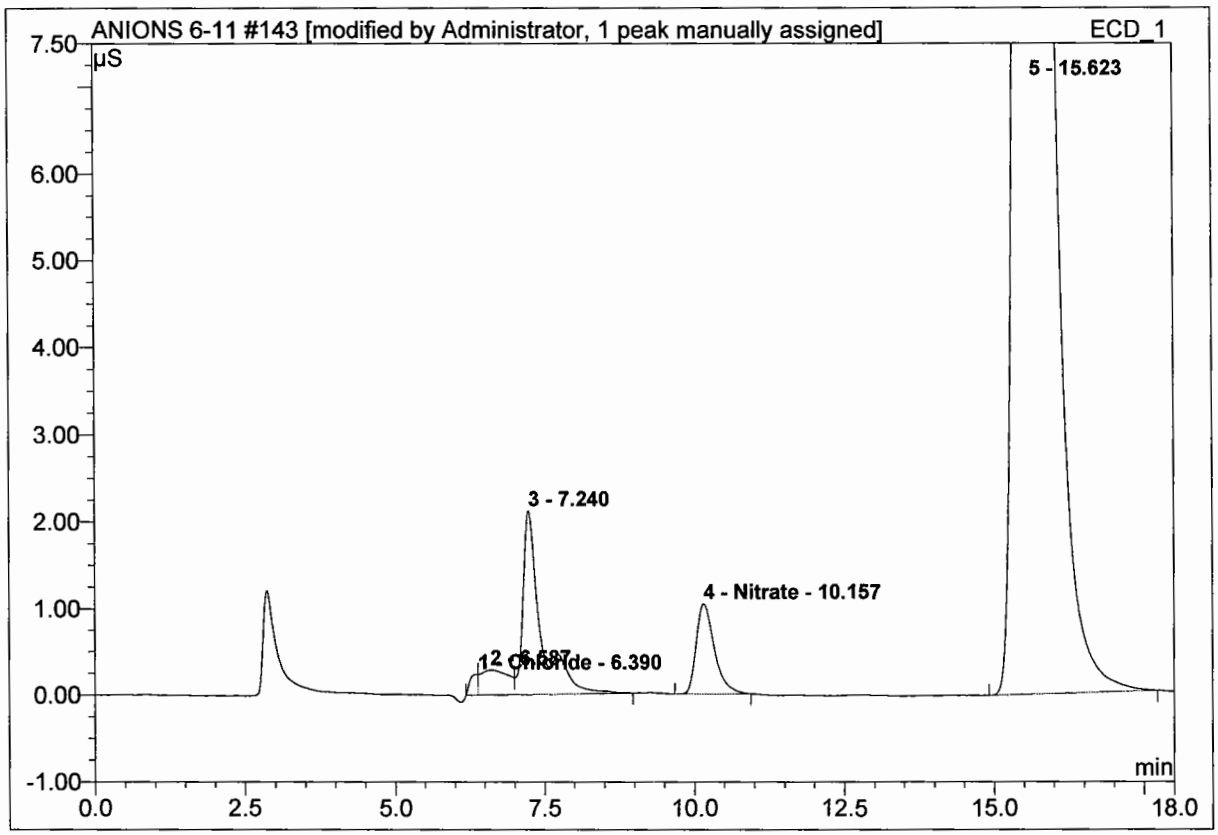
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 11:41**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.28	Chloride	0.199	0.0344
4	10.16	Nitrate	0.507	0.1793
5	15.66	Sulfate	21.948	10.7641
Total:			22.654	10.978

143 BP run 2 NaOH

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 12:00**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.39	Chloride	0.239	0.0370
4	10.16	Nitrate	1.042	0.3664
Total:			1.282	0.403

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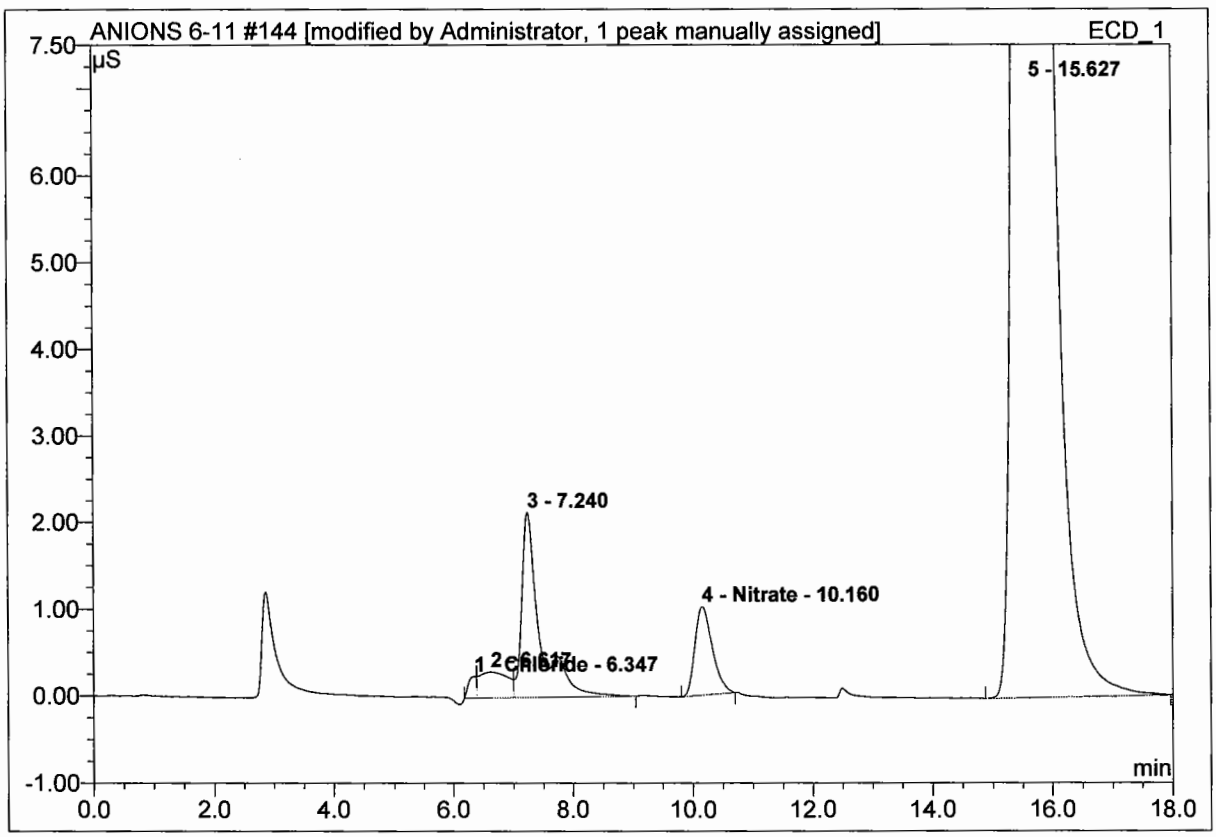
144 BP run 2 NaOH

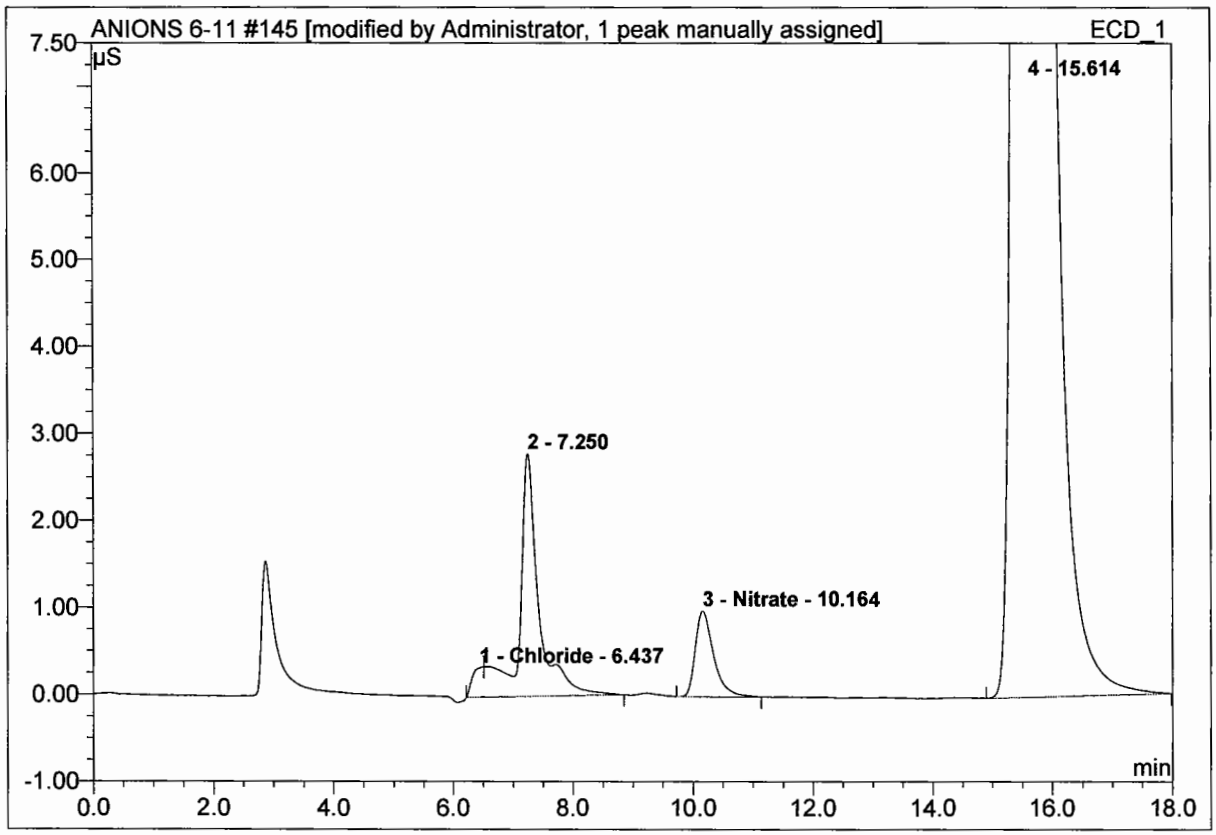
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 12:19**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.35	Chloride	0.248	0.0374
4	10.16	Nitrate	1.018	0.3408
Total:			1.266	0.378

145 BP run 3 NaOH

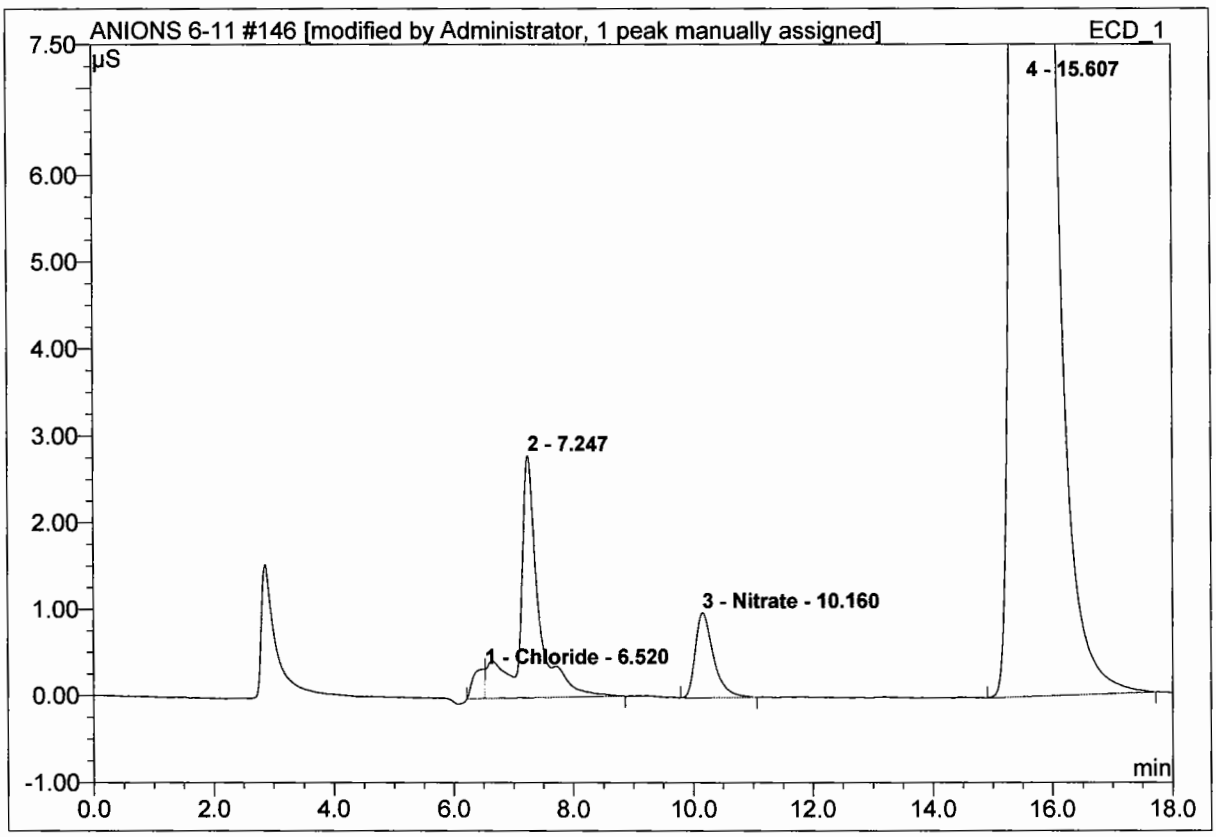
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 12:38**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.44	Chloride	0.335	0.0706
3	10.16	Nitrate	0.982	0.3502
Total:			1.317	0.421

146 BP run 3 NaOH

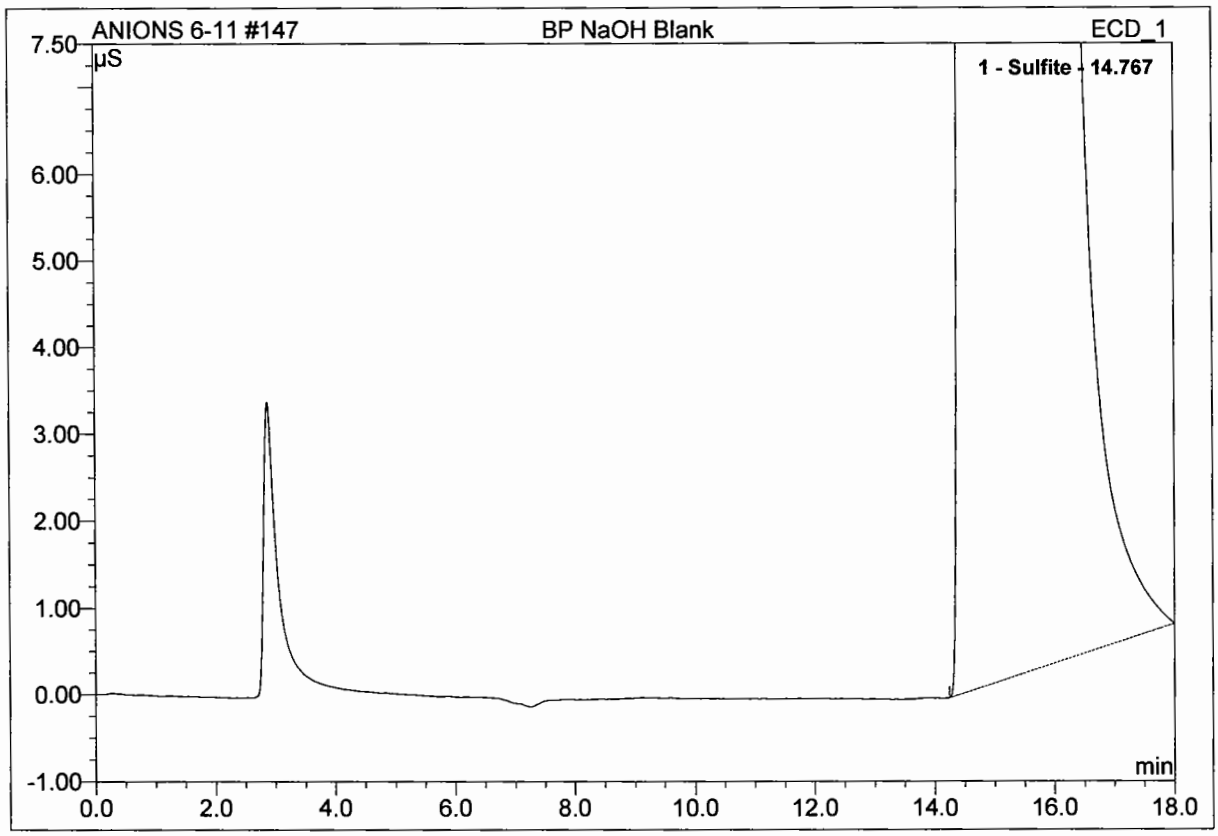
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 12:57**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.52	Chloride	0.343	0.0748
3	10.16	Nitrate	0.978	0.3465
Total:			1.321	0.421

147 BP NaOH Blank

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 13:16**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	14.77	Sulfite	745.720	644.6375
Total:			745.720	644.638

Chromeleon (c) Dionex 1996-2001
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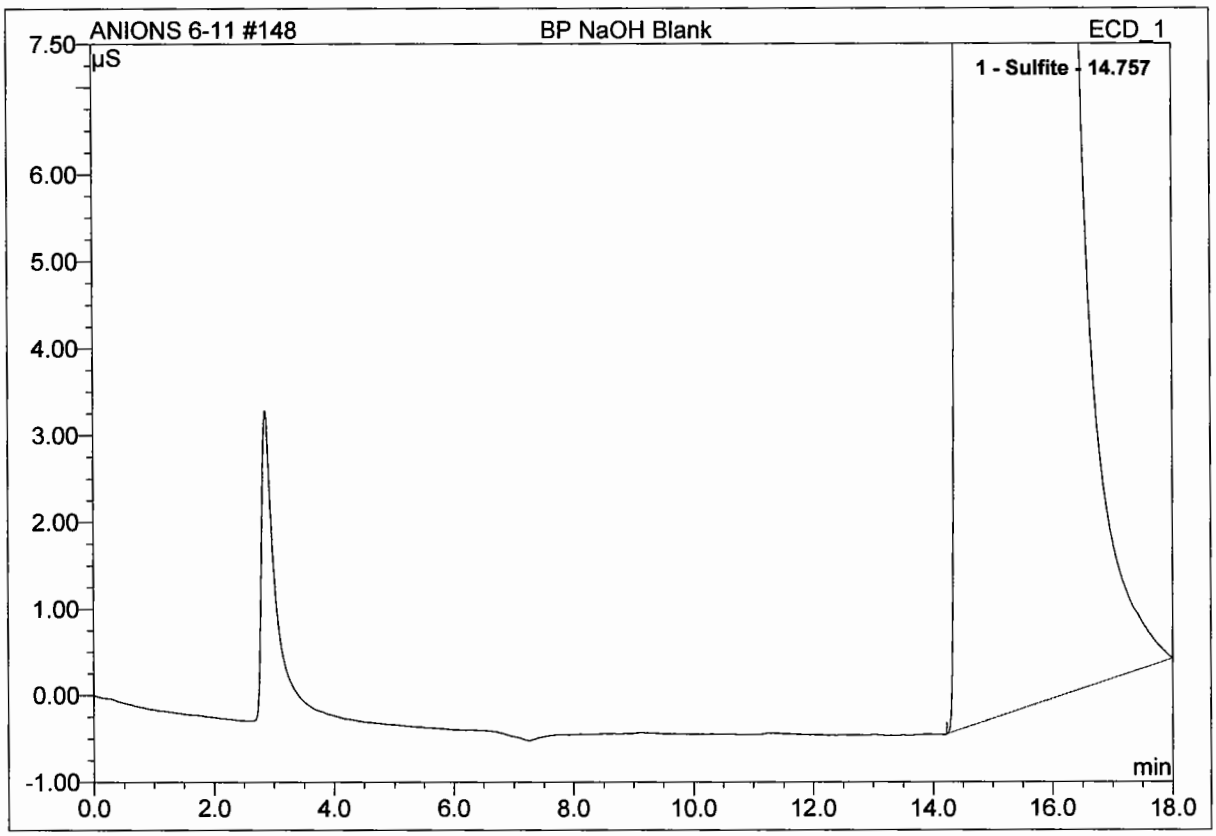
148 BP NaOH Blank

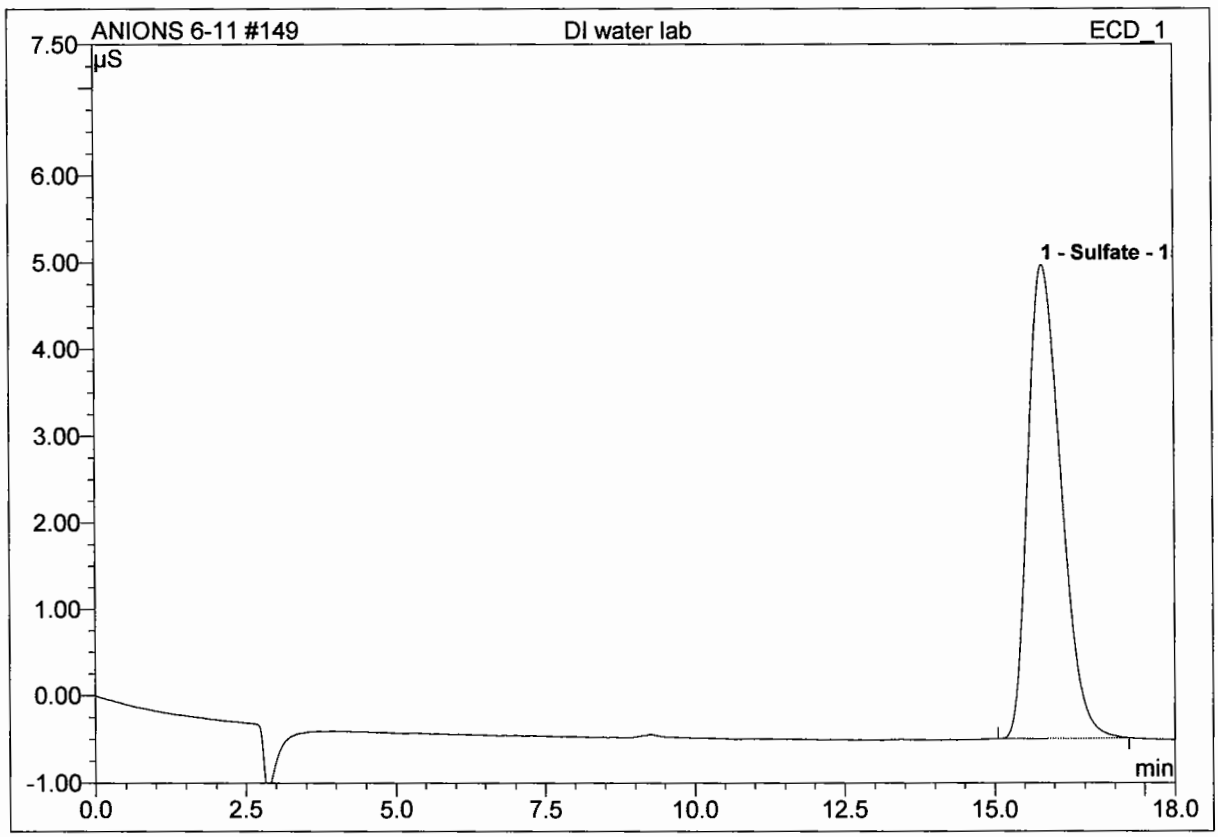
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 13:36**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	14.76	Sulfite	751.227	653.1491
Total:			751.227	653.149

149 DI water lab

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 13:55**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**

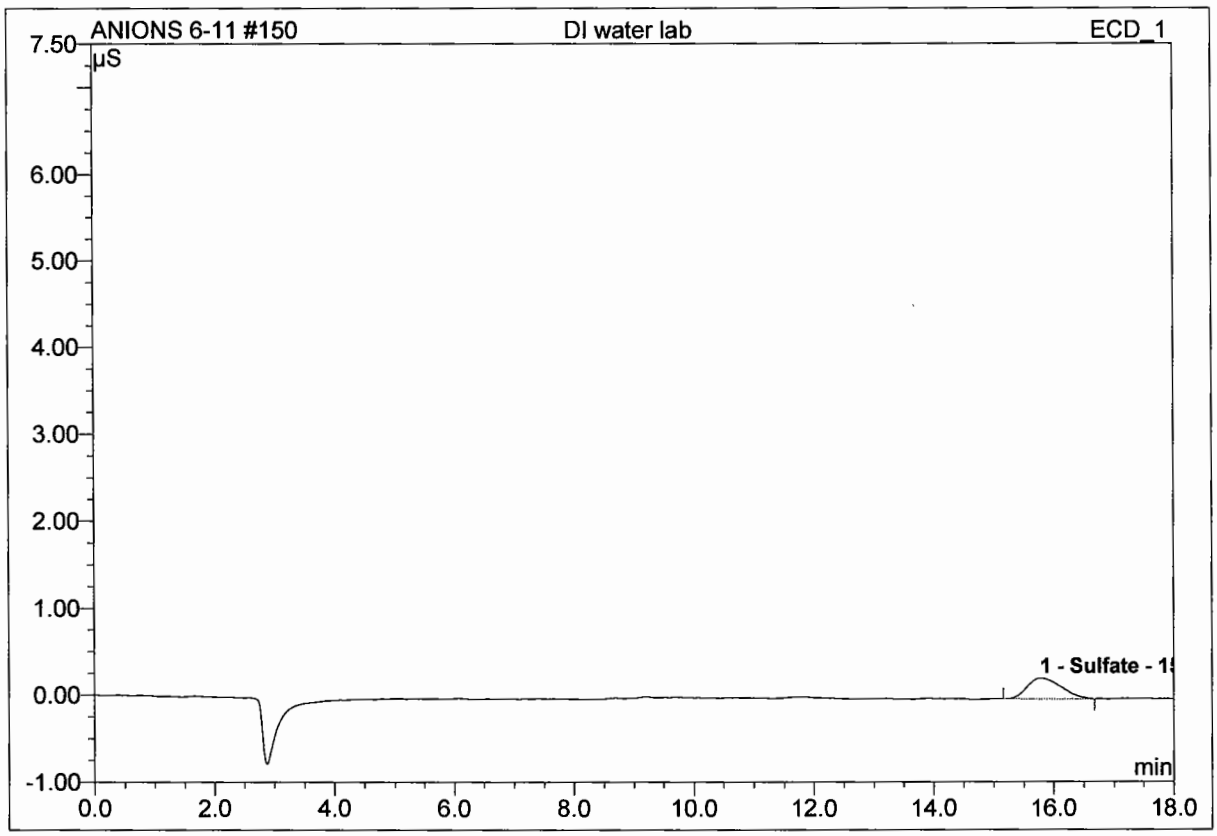


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	15.80	Sulfate	5.463	3.5123
Total:			5.463	3.512

Chromeleon (c) Dionex 1996-2001
Version 6.60 Build 1428

150 DI water lab

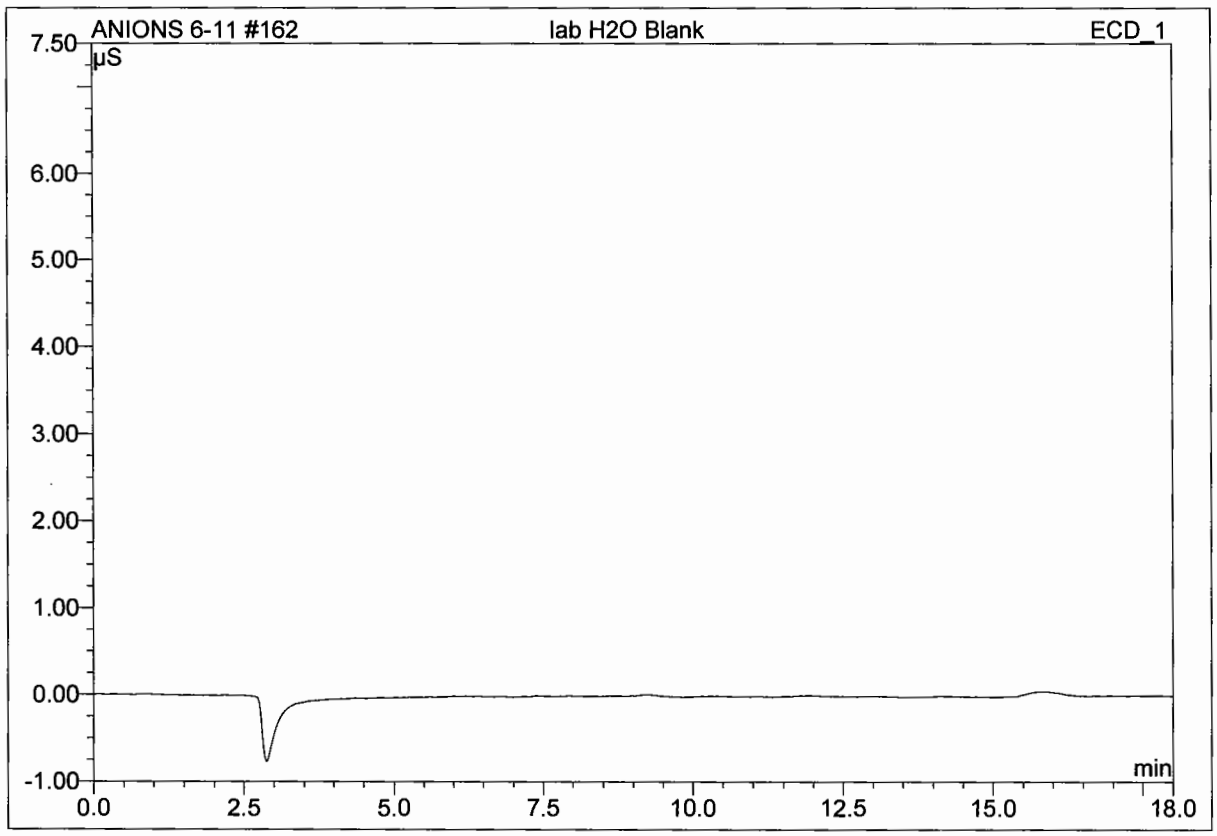
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 14:14**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	15.78	Sulfate	0.239	0.1570
Total:			0.239	0.157

162 lab H2O Blank

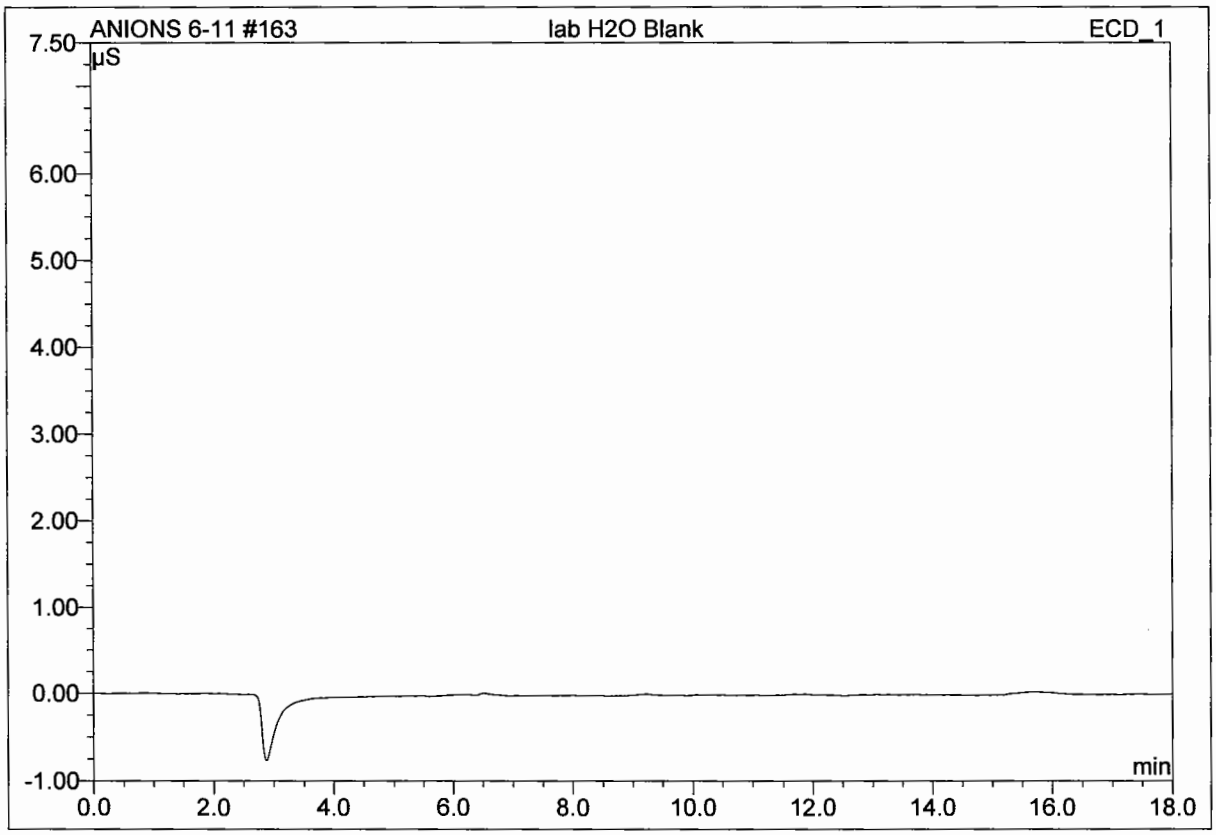
Client	**Valero Port Arthur**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 18:30**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

163 lab H2O Blank

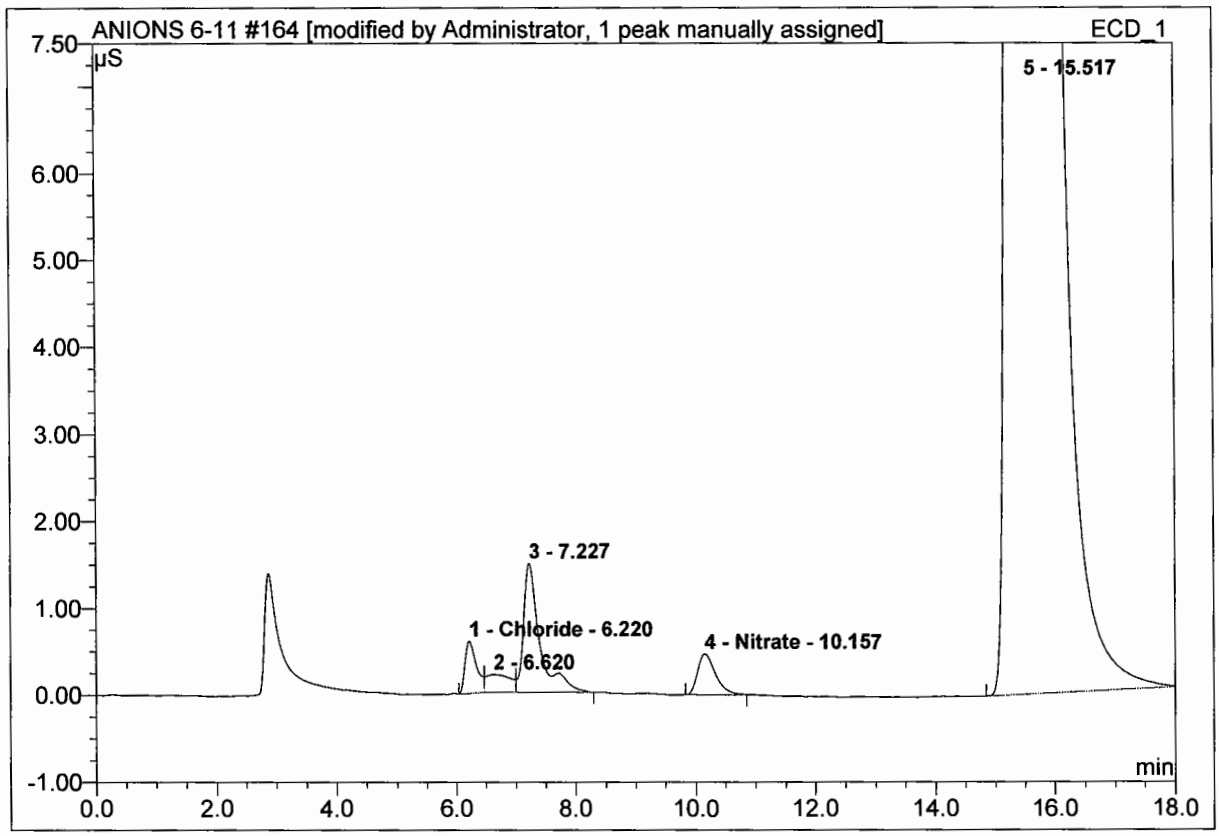
Client	**Valero Port Arthur**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 18:49**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

164 BP Cl spike NaOH 1

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 19:08**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.22	Chloride	0.599	0.1331
4	10.16	Nitrate	0.469	0.1631
Total:			1.068	0.296

Chromeleon (c) Dionex 1996-2001
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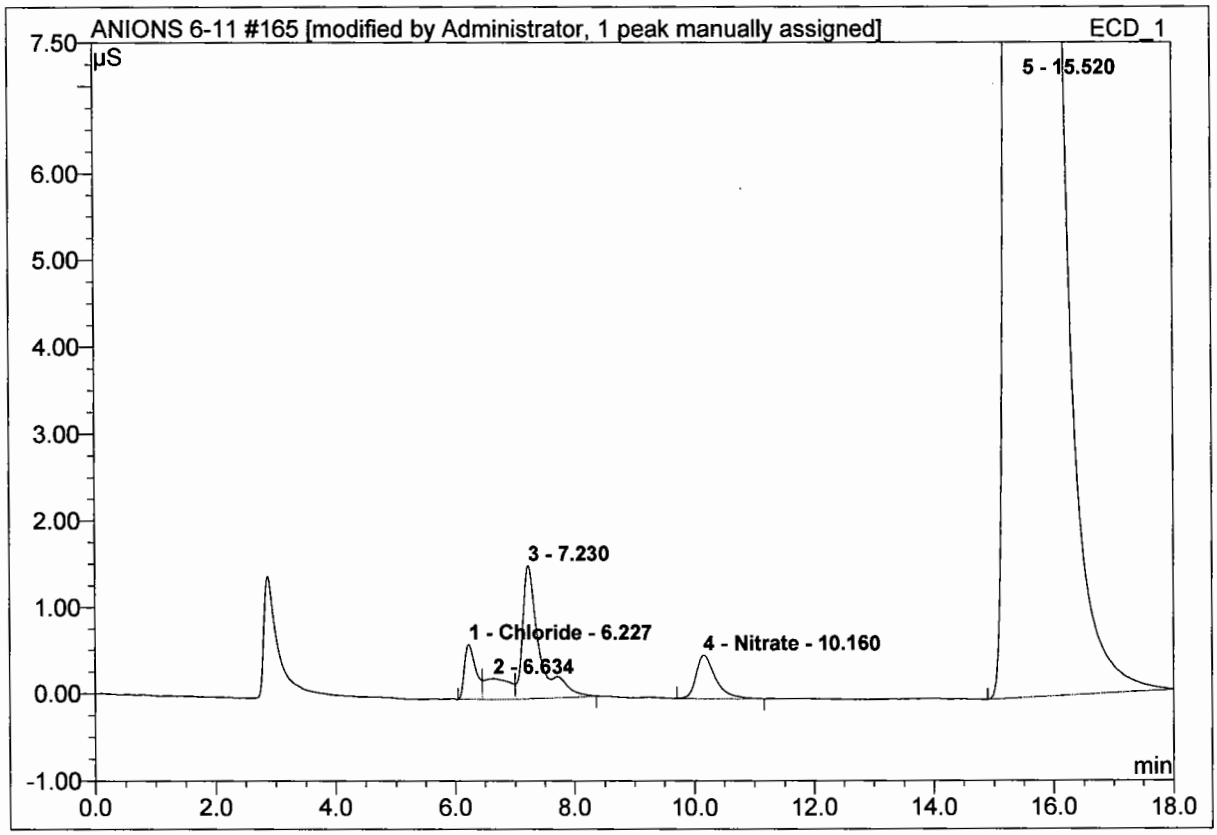
165 BP Cl spike NaOH 1

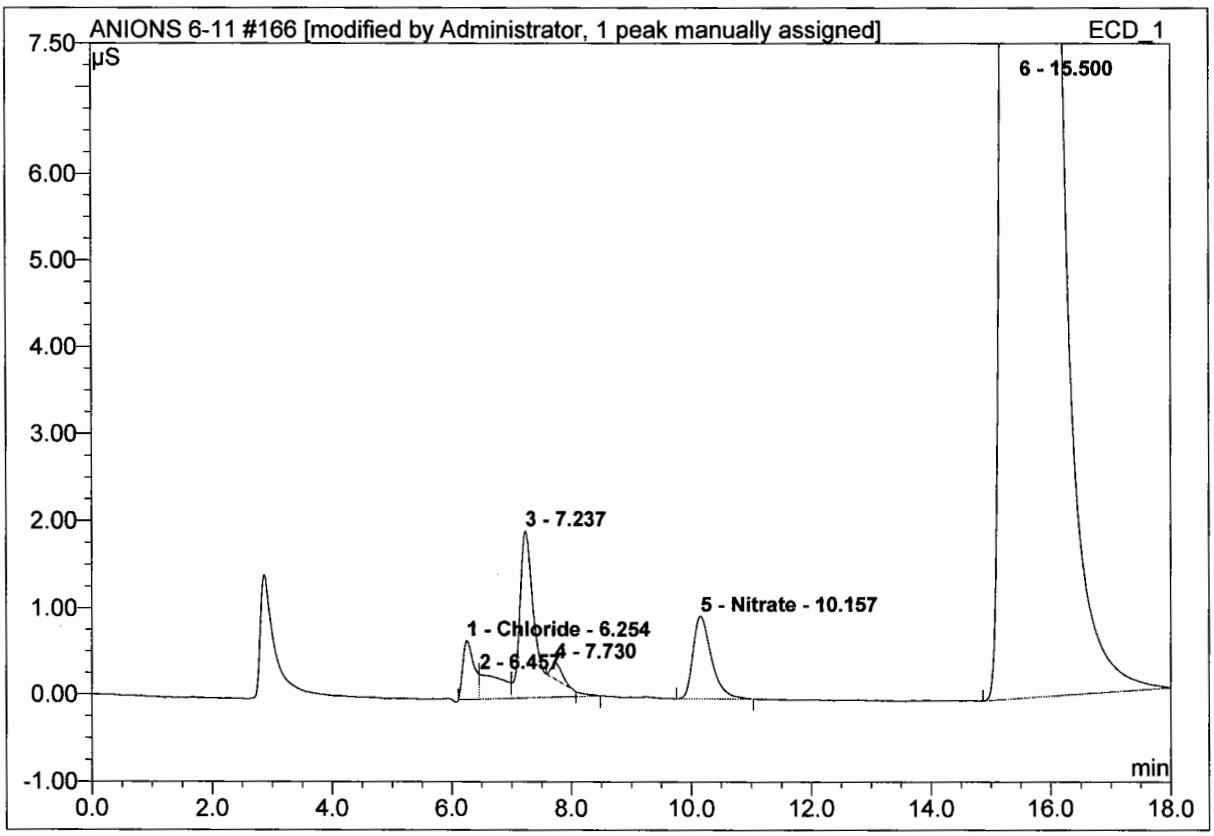
Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 19:27**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.23	Chloride	0.637	0.1417
4	10.16	Nitrate	0.501	0.1887
Total:			1.138	0.330

166 BP Cl spike NaOH 2

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 19:46**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**

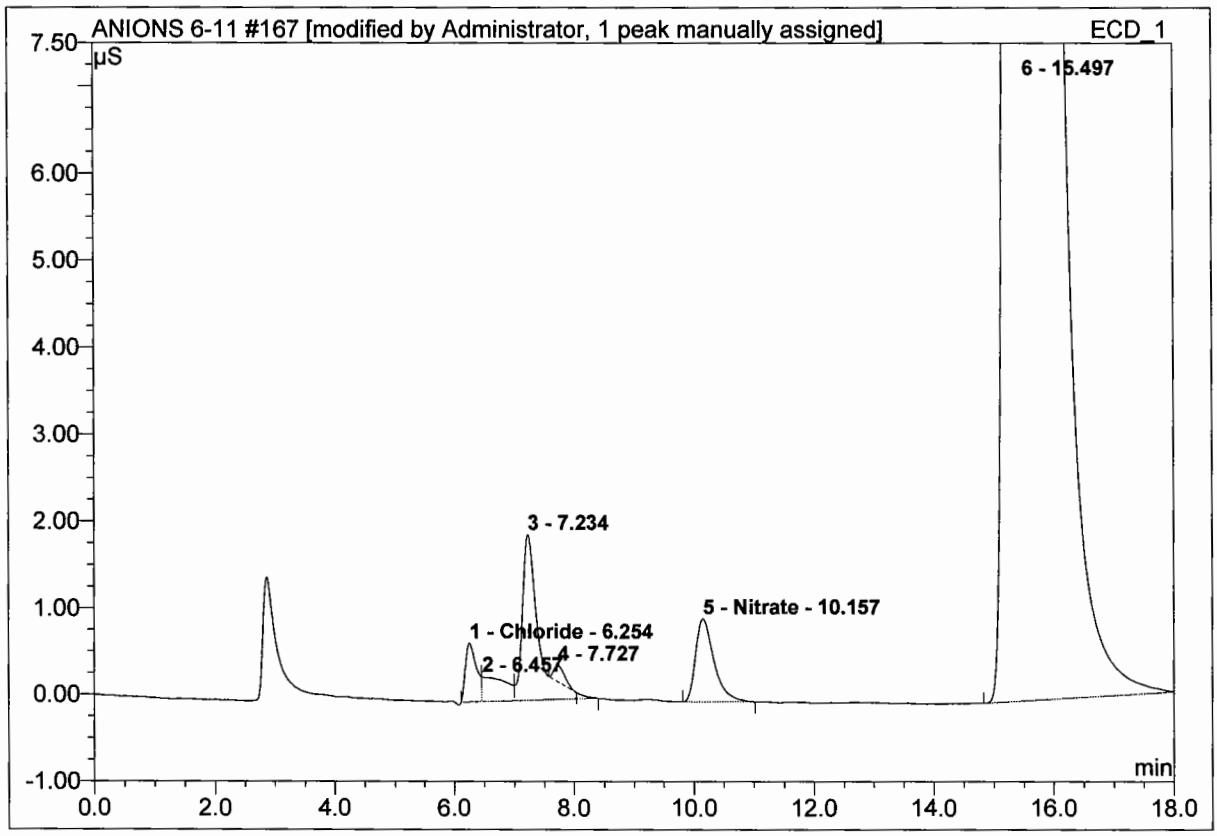


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.25	Chloride	0.679	0.1450
5	10.16	Nitrate	0.957	0.3400
Total:			1.636	0.485

Chromeleon (c) Dionex 1996-2001
Version 6.60 Build 1428

167 BP Cl spike NaOH 2

Client	**BP Whiting**	*Injection Volume:*	**35.0**
Vial Number:	**1**	*Channel:*	**ECD_1**
Sample Type:	**unknown**	*Wavelength:*	**n.a.**
Control Program:	**Anions 1000**	*Bandwidth:*	**n.a.**
Quantif. Method:	**ICS_1000_Anions**	*Dilution Factor:*	**1.0000**
Recording Time:	**6/24/2011 20:05**	*Sample Weight:*	**1.0000**
Run Time (min):	**12.00**	*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.25	Chloride	0.674	0.1437
5	10.16	Nitrate	0.954	0.3392
Total:			1.628	0.483

June 21, 2011

Laboratory Case Narrative

Client: BP, Whiting, IN
Source(s): FCCU 500
Sampling Date(s): 6/7 - 6/8/11
Analyses: USEPA Method 18 Methane & Ethane Analysis
ARI Project #: 08-313

1) Sample Receipt

Three (3) samples were received in good condition on 6/8/2011and logged in for analysis. All sample receipt criteria were met.

2) Laboratory Analysis

The bag samples were analyzed following USEPA Method 18 for methane and ethane.

3) QA/QC

All criteria as specified in USEPA Method 18 were met.

4) Discussion

These are final results for your review. Any questions can be directed to Eric Vogt at ARI at (847) 487-1580 x116.

Respectfully submitted,

Eric Vogt
Lab Manager
ARI Environmental, Inc.
Wauconda, IL

Texas NELAP ID: T104704428-10-2

951 Old Rand Road # 106

Wauconda, IL 60084

Texas NELAP ID: T 104704428-10-2

ARI ENVIRONMENTAL ANALYTICAL REPORT

BP-Whiting
Whiting, IN
FCCU 500

Lab Project #: 08-313
Project Manager: Steve Flaherty
Received: 6/8/2011
Reported: 6/21/2011

Sample ID: IGS Run 1
Lab Sample #: 0611051
Date Sampled: 06/07/2011
Field #: 45882

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methane	USEPA Method 18	Joel Ruggaber	06/21/2011	<0.2	ppmv	
Ethane	USEPA Method 18	Joel Ruggaber	06/21/2011	<0.1	ppmv	

Sample ID: IGS Run 2
Lab Sample #: 0611052
Date Sampled: 06/07/2011
Field #: 45883

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methane	USEPA Method 18	Joel Ruggaber	06/21/2011	<0.2	ppmv	
Ethane	USEPA Method 18	Joel Ruggaber	06/21/2011	<0.1	ppmv	

Sample ID: IGS Run 3
Lab Sample #: 0611053
Date Sampled: 06/07/2011
Field #: 45884

Analyte	Method	Analyst	Analysis Date	Result	Units	Notes
Methane	USEPA Method 18	Joel Ruggaber	06/21/2011	<0.2	ppmv	
Ethane	USEPA Method 18	Joel Ruggaber	06/21/2011	<0.1	ppmv	

Notes: UA - Not a NELAC accredited analyte under this method.
NA - Sample not tested for this analyte.
D - Value calculated from dilution.
J - Value less than the low standard but above the Limit of Quantitation (LOQ).

BP, Whiting, IN
Method 18 Methane Analysis

performed 6/10/11

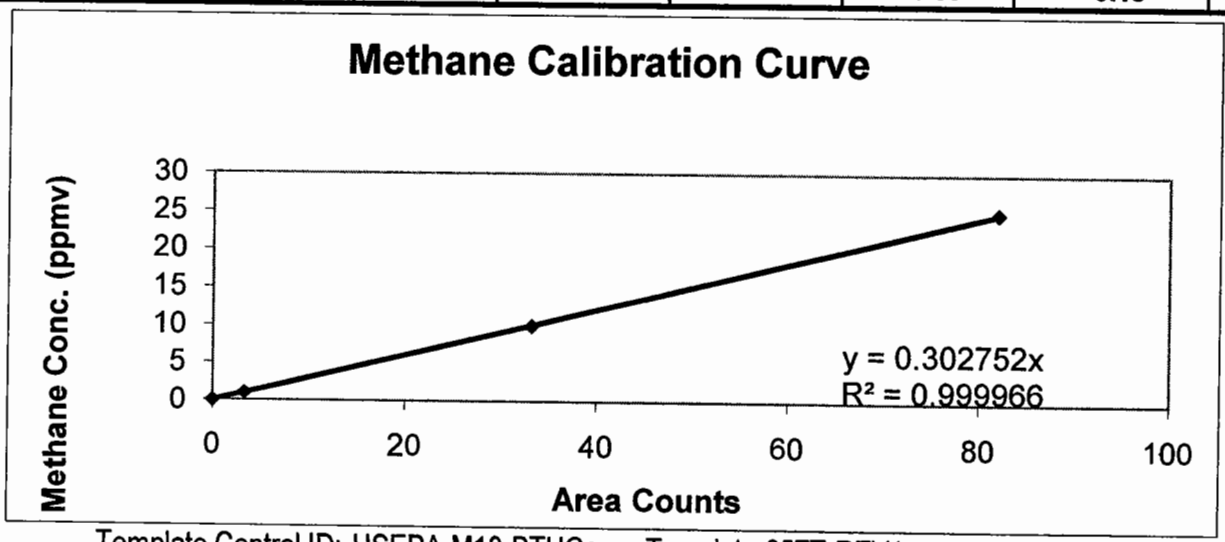
C-214

Calibration Curve Calculation

Pre-Std (ppmv) (cylinder #)		inj. 1 (area counts)	inj. 2 (area counts)	inj. 3 (area counts)	Average (area counts)	RE	Cal Conc (ppmv)	% Dif
0.995	value	3.30	3.17	3.46	3.31	3.3265	0.997	0.17
EB 0017574	deviation	-0.2	-4.3	4.5				
9.948	value	34.6	32.1	33.0	33.2	3.3385	10.001	0.54
EB 0017574	deviation	4.1	-3.3	-0.7				
24.870	value	82.0	82.3	81.7	82.0	3.2973	24.694	-0.71
EB 0017574	deviation	0.0	0.4	-0.4				
Secondary Std					mean RF	3.3207		
9.882	value	33	32	32	32		9.734	-1.49
EB 0007269	deviation	2.7	-1.3	-1.4				

Post Std			% Diff RF	
9.948	32	3.2387	-2.5	PASS
EB 0017574				

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Analysis 3 (area counts)	Average (area counts)	Concentration (ppmv)	Moisture Correction	Recovery Correction
IGS run 1	<0.59	<0.59	<0.59	<0.59	**<0.18**	<0.18	<0.18
IGS run 2	<0.59	<0.59	<0.59	<0.59	**<0.18**	<0.18	<0.18



Analyst: J. Ruggaber
Date Done: 06/17/11

Template Control ID: USEPA-M18-BTUComp-Template-057T-REV1

BP, Whiting, IN
Method 18 Methane Analysis

performed 6/13/11

Calibration Curve Calculation

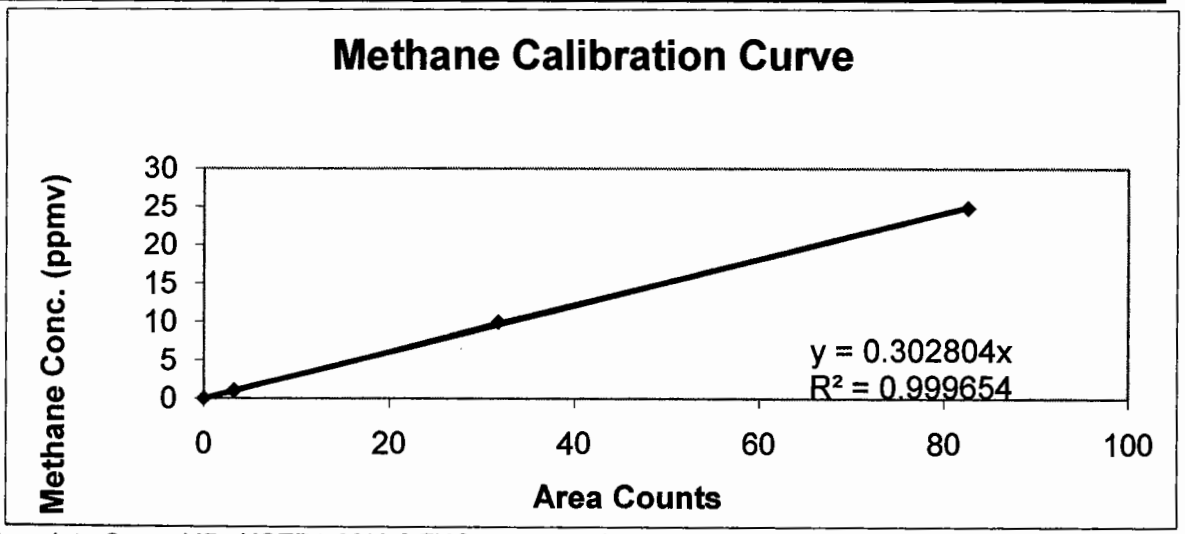
Pre-Std (ppmv) (cylinder #)		inj. 1 (area counts)	inj. 2 (area counts)	inj. 3 (area counts)	Average (area counts)	RE	Cal Conc (ppmv)	% Dif
0.995	value	3.30	3.32	3.18	3.27	3.2824	1.001	0.58
EB 0017574	deviation	0.9	1.6	-2.6				
9.948	value	31.9	31.8	31.5	31.7	3.1876	9.717	-2.32
EB 0017574	deviation	0.5	0.2	-0.7				
24.870	value	86.3	79.9	81.6	82.6	3.3201	25.303	1.74
EB 0017574	deviation	4.5	-3.3	-1.2				
Secondary Std					**mean RF**	3.2634		
9.882	value	33	32	32	32		9.736	-1.48
EB 0007269	deviation	2.7	-1.3	-1.4				

Post Std			% Diff RF	
9.948	33	3.3154	1.6	PASS
EB 0017574				

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Analysis 3 (area counts)	Average (area counts)	Concentration (ppmv)	Moisture Correction	Recovery Correction
IGS run 3	<0.59	<0.59	<0.59	<0.59	**<0.18**	<0.18	<0.18
Methane spike	2.94	3.00	3.14	3.03	**0.92**		

target	% recovery
0.90	101.9

Analyst: J. Ruggaber
Date Done: 06/17/11



Template Control ID: USEPA-M18-BTUComp-Template-057T-REV1

BP, Whiting, IN

Method 18 Ethane Analysis

performed 6/10/11

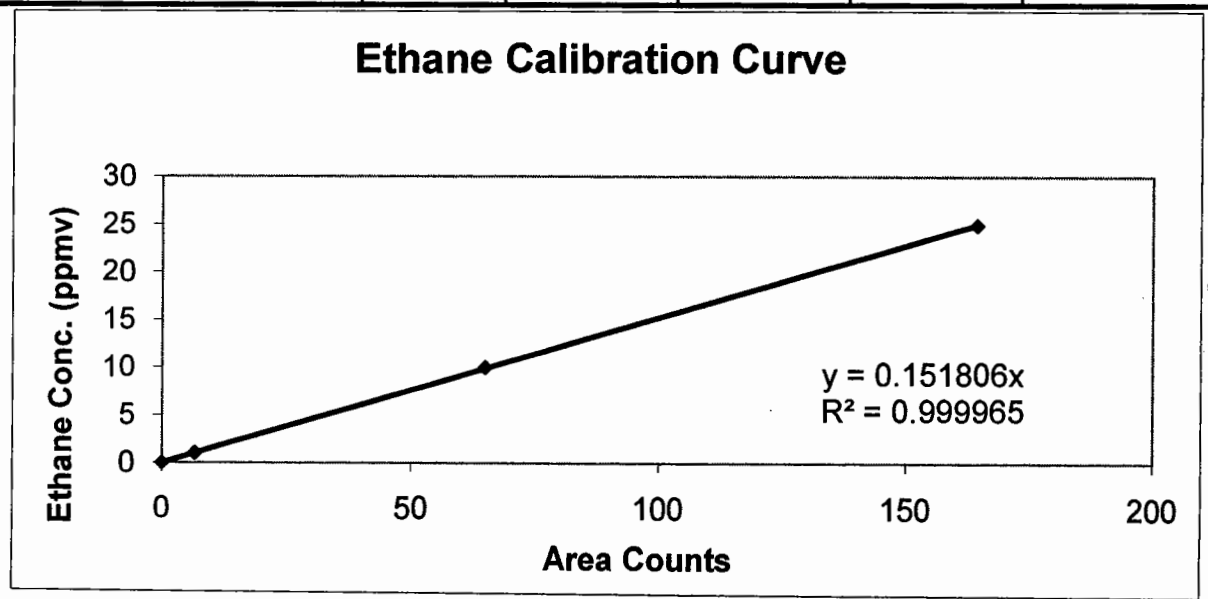
C-216

Calibration Curve Calculation

Pre-Std (ppmv) (cylinder #)		inj. 1 (area counts)	inj. 2 (area counts)	inj. 3 (area counts)	Average (area counts)	RE	Cal Conc (%)	% Dif
0.9962	value	6.79	6.35	6.74	6.63	6.6519	1.006	0.96
EB 0017574	deviation	2.5	-4.1	1.7				
9.962	value	66.2	64.4	64.1	64.9	6.5149	9.851	-1.12
EB 0017574	deviation	2.0	-0.7	-1.3				
24.905	value	164.1	165.5	163.4	164.3	6.5987	24.943	0.15
EB 0017574	deviation	-0.2	0.7	-0.5				
Secondary Std					**mean RF**	6.5885		
9.83	value	64	63	64	64		9.710	-1.23
EB 0007269	deviation	0.3	-0.8	0.5				

Post Std			% Diff RF	
9.962 EB 0017574	65	6.5113	-1.2	PASS

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Analysis 3 (area counts)	Average (area counts)	Concentration (ppmv)	Moisture Correction	Recovery Correction
IGS run 1	<0.63	<0.63	<0.63	<0.63	**<0.10**	<0.10	<0.10
IGS run 2	<0.63	<0.63	<0.63	<0.63	**<0.10**	<0.10	<0.10



Analyst: J. Ruggaber
Date Done: 06/17/11

Template Control ID: USEPA-M18-BTUComp-Template-057T-REV1

BP, Whiting, IN
Method 18 Ethane Analysis

performed 6/13/11

Calibration Curve Calculation

Pre-Std (ppmv) (cylinder #)		inj. 1 (area counts)	inj. 2 (area counts)	inj. 3 (area counts)	Average (area counts)	RE	Cal Conc (%)	% Dif
0.9962	value	6.79	6.35	6.74	6.63	6.6519	1.006	0.96
EB 0017574	deviation	2.5	-4.1	1.7				
9.962	value	66.2	64.4	64.1	64.9	6.5149	9.851	-1.12
EB 0017574	deviation	2.0	-0.7	-1.3				
24.905	value	164.1	165.5	163.4	164.3	6.5987	24.943	0.15
EB 0017574	deviation	-0.2	0.7	-0.5				
Secondary Std					**mean RF**	6.5885		
9.83	value	64.1	63.4	64.3	64.0		9.710	-1.23
EB 0007269	deviation	0.3	-0.8	0.5				

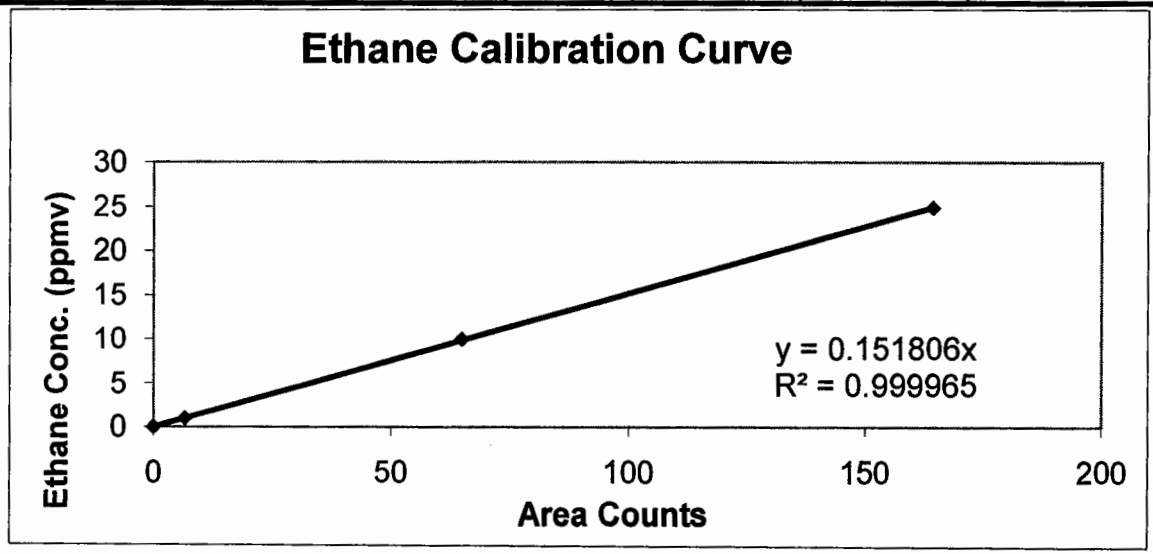
Post Std			% Diff RF	
9.962 EB 0017574	66	6.5892	0.0	PASS

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Analysis 3 (area counts)	Average (area counts)	Concentration (ppmv)	Moisture Correction	Recovery Correction
IGS run 3	<0.63	<0.63	<0.63	<0.63	**<0.10**	<0.10	<0.10
Ethane spike	3.22	3.23	3.23	3.23	**0.49**		

target 0.48 % recovery 102.0

Analyst: J. Ruggaber

Date Done: 06/17/11



Template Control ID: USEPA-M18-BTUComp-Template-057T-REV1

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USEPA Method 4
Relative Humidity and Moisture Calculation
Using Wet Bulb/Dry Bulb Measurements

Client:	**BP Whiting**
Location:	**Whiting IN**
Source:	**FCCU 500**
Analysis Date:	**6/10/2011**
Sample No.:	**Runs 1 and 2**
Lab No.:	**0611051 and 0611052**

Data Input:		FLARE-HRVOC-TEMPLATE-036T-REV1
Barometric pressure (P_{bar}):	29.09	**inches Hg**
Dry bulb (t_d) or ambient (T_{amb}) temperature:	79.7	**°F**
Wet bulb temperature (t_w)	68.0	**°F**
Static Pressure (S_t):	0.0	**inches H_2O**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Absolute Pressure:

= **29.97 inches Hg**

= **761.27 mm Hg**

Saturated vapor pressure of t_d:

S_{vp} = **0.6899 inches Hg**

Actual vapor pressure:

= **0.6899 inches Hg**

Fractional moisture content:

= **0.0230 B_{wo}**

Moisture content:

2.30 %

Fractional moisture content of gas at saturated conditions:

= **293.0 °Kelvin**

where:
A= 8.361
B=1893.5
C=27.65

= **0.0214 B_{wos}**

Percent moisture at saturated conditions:

= **2.14 %**

Percent relative humidity:

= **100.00 %**

Percent moisture used for emissions calculations:

For Bag Calculations not Stacks = **2.14 %**

Percent moisture used for emissions calculations:

= **0.0214 fractional**

= **0.9786 correction**

USEPA Method 4
Relative Humidity and Moisture Calculation
Using Wet Bulb/Dry Bulb Measurements

Client:	**BP Whiting**
Location:	**Whiting IN**
Source:	**FCCU 500**
Analysis Date:	**6/13/2011**
Sample No.:	**Run 3**
Lab No.:	**611053**

Data Input:	FLARE-HRVOC-TEMPLATE-036T-REV1	
Barometric pressure (P_{bar}):	29.26	**inches Hg**
Dry bulb (t_d) or ambient (T_{amb}) temperature:	77.9	**°F**
Wet bulb temperature (t_w)	68.0	**°F**
Static Pressure (S_t):	0.0	**inches H_2O**

Sample calculations @ standard conditions (29.92 inches Hg, 68.0 °F):

Absolute Pressure:

= **29.97 inches Hg**

= **761.27 mm Hg**

Saturated vapor pressure of t_d:

S_{vp} = **0.6899 inches Hg**

Actual vapor pressure:

= **0.6899 inches Hg**

Fractional moisture content:

= **0.0230 B_{wo}**

Moisture content:

2.30 %

Fractional moisture content of gas at saturated conditions:

= **293.0 °Kelvin**

where:
A= 8.361
B=1893.5
C=27.65

= **0.0214 B_{wos}**

Percent moisture at saturated conditions:

= **2.14 %**

Percent relative humidity:

= **100.00 %**

Percent moisture used for emissions calculations:

For Bag Calculations not Stacks = **2.14 %**

Percent moisture used for emissions calculations:

= **0.0214 fractional**

= **0.9786 correction**

GC Project Instrument Conditions

Project Information

Client: BP Whiting

Location: Whiting, IN

Date Sampled: 6/7/11 – 6/8/11

Lab Project #: 08-313

Analyst: J. Ruggaber

Method Number or Analyte(s): M18, Methane/Ethane

Instrument Information

Instrument ID: GC #3

Column: AT-Q, 30 m x 0.53 mm

Detection Type: FID

Carrier Gas: Helium

Run Information

Air Pressure: 25 psi

Carrier Gas Pressure: 26 psi

Hydrogen Pressure: 8 psi

Temperature Profile:

Initial Temperature (˚C)	Time (minutes)	Temperature Ramp (˚C/minute)	Temperature After Ramp (˚C)
38	4	25	150
150	5	0	150

Valve Temperature: 191 degrees C

Column Temperature: See gradient

Run Time: 13.48 minutes

Detector Voltage: N/A

Peak Retention Times

Component	Retention Time
Methane	1.379
Ethane	2.100

Special Requirements: None

USEPA METHOD 18 , ASTM 1945/1946 TASK SCHEDULE

Client: BP Whiting

Location: Whiting, IN

Project Manager: S. Flaherty

Date Sampled: 6/7/11 – 6/8/11

Lab Project #: 08-313

Spreadsheet Template ID: USEPA-M18-BTUComp-Template-057T-REV1

Analyst: J. Ruggaber

Reagents

Hydrogen Gas Manufacturer and Lot: Scott, K011471

Helium Gas Manufacturer and Lot: Scott, 1D002913

Air Manufacturer and Lot: Scott, K017751

Nitrogen Manufacturer and Lot: Scott, K024736

Standard Identification

1) Liquid Technology, EB-0017574

Secondary standard: Coastal, EB-0007269

DATE	EQUIPMENT	TASK
6/10/11	GC #3	Equilibrate the instrument until a stable baseline is achieved.
6/10/11	GC #3	Inject each compound to be analyzed once. Establish the retention time windows for each compound. Adjust GC conditions if needed to ensure separation.
6/10/11, 6/13/11	GC #3	Inject each standard in triplicate. Ensure that each standard agrees within 5% of the mean of the three injections. Plot the standard injection areas against calibration standard concentrations to determine an initial calibration curve.
6/10/11, 6/13/11	GC #3	Inject each sample in triplicate.
N/A	N/A	If necessary, dilute samples if the peak areas are greater than the highest standard and re-inject in triplicate.
N/A	N/A	Inject the midpoint standard and a blank once after every 20 sample injections. Check that the midpoint standard is within 10% of the value generated by the initial calibration curve.
6/13/11	GC #3	Inject each secondary standard in triplicate at the end of the run.
6/18/11	-	For each analyte, plot the average of the standard injections against calibration standard concentrations to determine a final calibration curve.
6/18/11	-	Determine the concentrations of each analyte in each sample using the calibration curve.
6/21/11		Prepare report
		Report QA review
		Report distribution

951 Old Rand Road, Unit 106
Wauconda, Illinois 60084

1710 Preston Road, Unit C
Pasadena, Texas 77503

SAMPLE RECEIPT CHECKLIST

Client Name: BP - Whiting

Site Location: Whiting IN

ARI Project Manager: S. Flaherty

Sample Collection Date(s): 6/7/11 - 6/8/11

Chain-of-Custody Number(s): 6737

Chain-of-Custody Form(s):

Custody release signatures, dates, and times present	(Yes)	No
Preservation code noted	(Yes)	No
Project information clearly identified	(Yes)	No
Sample information clearly identified	(Yes)	No
Analysis request clearly identified	(Yes)	No
Report tier level noted	(Yes)	No

Sample Containers:

Custody seal(s) applied and intact	Yes	No	(N/A)
Quantity of samples match number on COC	(Yes)	No	
Container label ID numbers and descriptions match COC	(Yes)	No	
All containers received in good condition	(Yes)	No	
Liquid levels at marked heights on containers	Yes	No	(N/A)
All container labels are legible	(Yes)	No	
All sample IDs are unique	(Yes)	No	
Samples received in correct type of container	(Yes)	No	
Samples received within the required holding time	(Yes)	No	
Samples received under the required preservation code	(Yes)	No	

Non-Conformances and/or Corrective Actions Applied:
All criteria for sample acceptance met

Samples Received by: Joel Ruggaber (Printed Name) _____ (Signature)

Date and Time Received: 6/8/11 15:40

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6737

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY		
08-313	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY	S.F.	
ARI Project Manager	ARI Sampler Initials	
Wauconda		
Analysis Location (Wauconda or Pasadena)		
Compliance - ICR		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: Method 18 - Methane & Ethane				Comments
45882	6-7-11	Run 1 - IGS	1	Bag	1	X				
45883	6-8-11	Run 2 - IGS	1	Bag	1	X				
45884	6-8-11	Run 3 - IGS	1	Bag	1	X				

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments

Requested Analysis Completion Date: 6-11-11

Report Level: Tier I: Engineering; Tier II: Compliance; Tier III: QAPP

Route Results Through: S. Flaherty

	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By
	S. Flaherty		Jeff
	(1) Date / Time	(2) Date / Time	(3) Date / Time
	6-8-11 @ 1240Hrs	6-8-11 @ 1258	6-8-11 15:35
	(1) Company	(2) Company	(3) Company
	ARI	ARI	ARI
	(1) Received By	(2) Received By	(3) Received By
	(1) Date / Time	(2) Date / Time	(3) Date / Time
	06.08.11 @ 1247	6/8/11 258	6/8/11 15:40
	(1) Company	(2) Company	(3) Company
	ARI	ARI	ARI

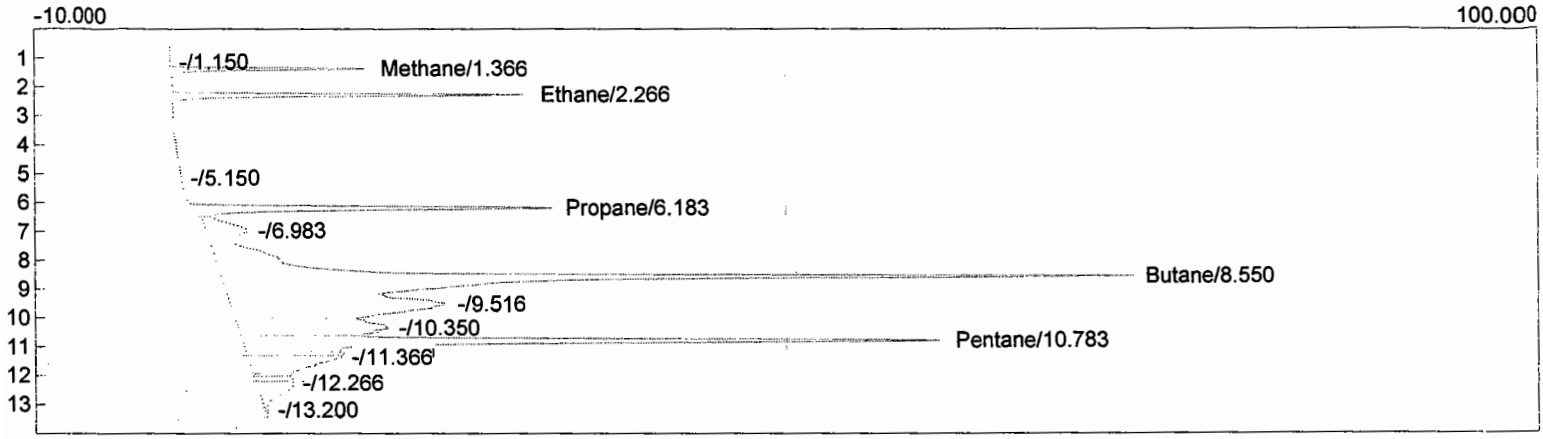
SHIPMENT: (HAND CARRY) FEDX UPS

Custody Seal Applied: Yes (No)

C-225

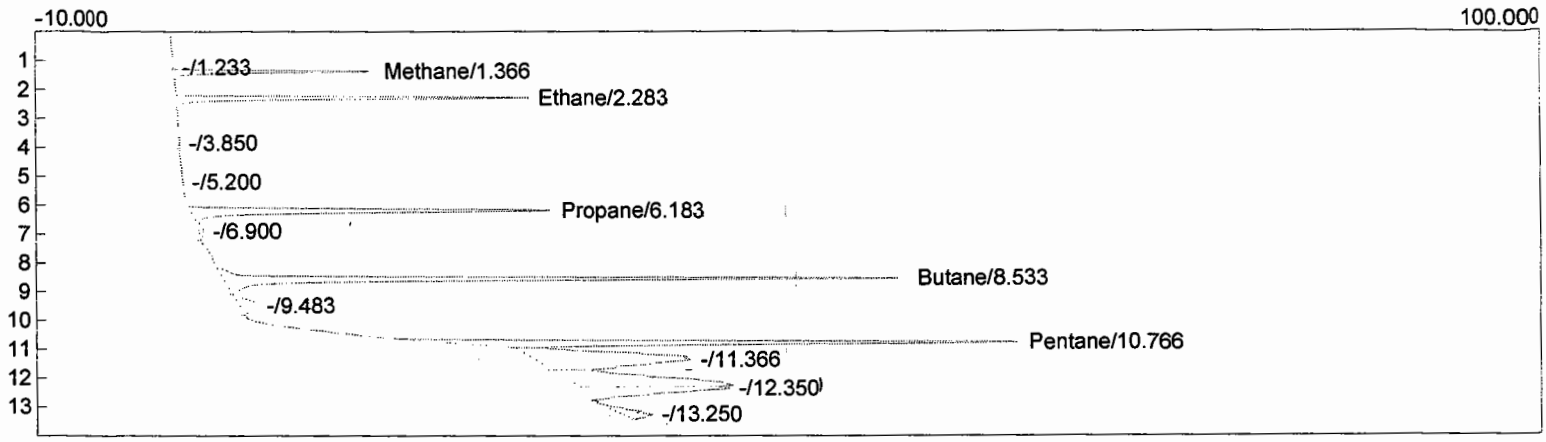
Form LF0001

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 13:04:21
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting06.CHR ()
Sample: 25 ppm c1-c5
Operator: J. Ruggaber



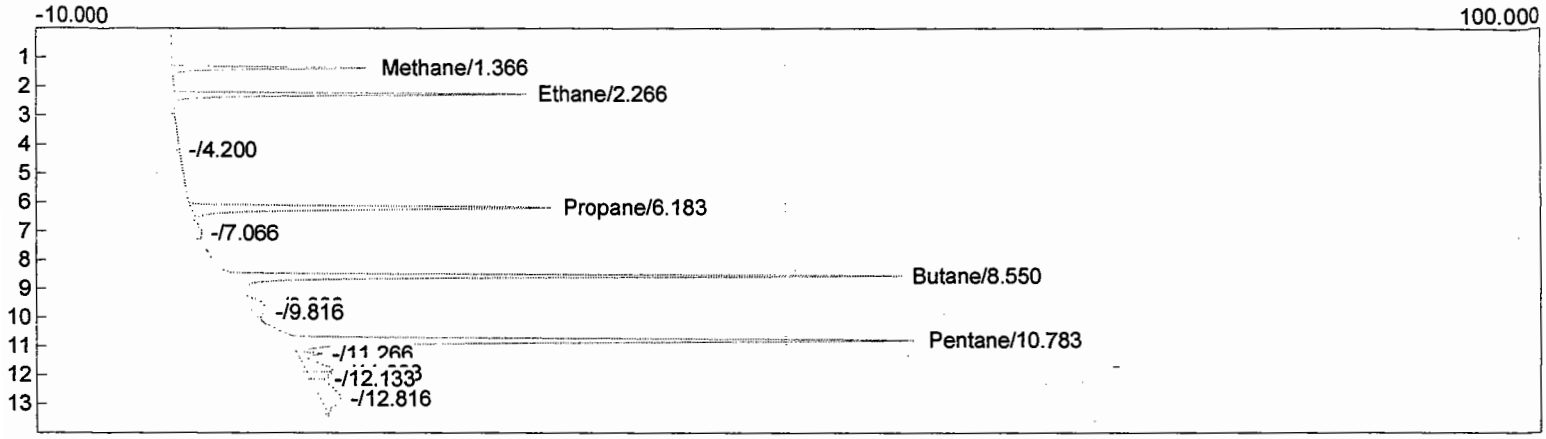
Number	Component	Retention	Area
1	Methane	1.366	82.0210
2	Ethane	2.266	164.0660
3	Propane	6.183	242.9855
4	Butane	8.550	1394.0230
5	Pentane	10.783	641.7885
5			2524.8840

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 12:42:52
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting07.CHR ()
Sample: 25 ppm c1-c5
Operator: J. Ruggaber



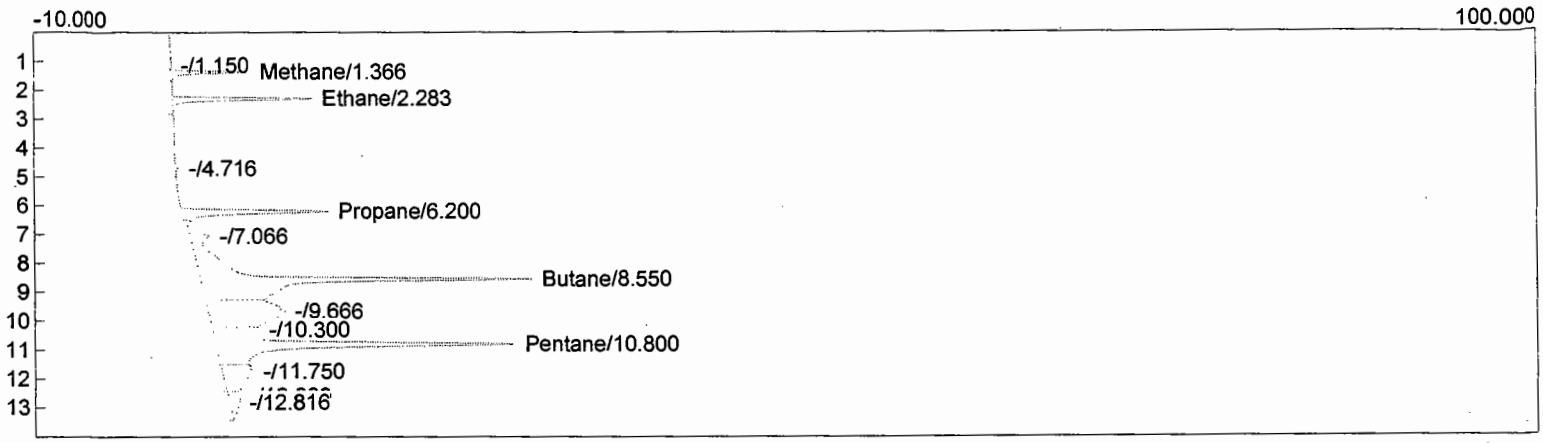
Number	Component	Retention	Area
1	Methane	1.366	82.2900
2	Ethane	2.283	165.5090
3	Propane	6.183	242.6810
4	Butane	8.533	407.1350
5	Pentane	10.766	358.0570
5			1255.6720

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 13:25:50
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting08.CHR ()
Sample: 25 ppm c1-c5
Operator: J. Ruggaber



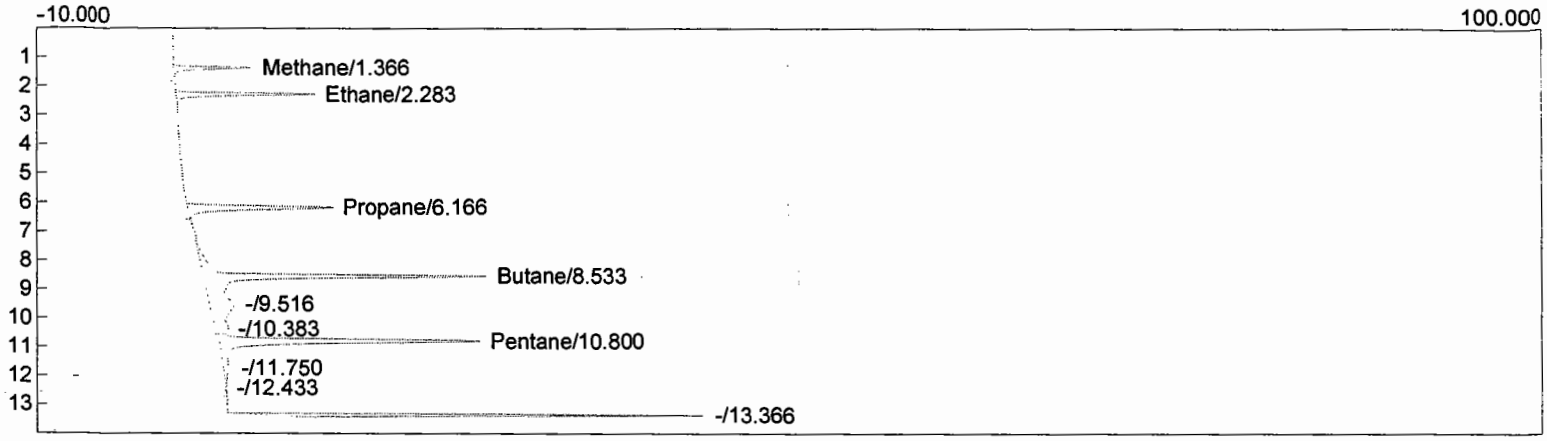
Number	Component	Retention	Area
1	Methane	1.366	81.6970
2	Ethane	2.266	163.4450
3	Propane	6.183	242.6975
4	Butane	8.550	383.7015
5	Pentane	10.783	466.8030
5			1338.3440

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 13:50:44
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting09.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



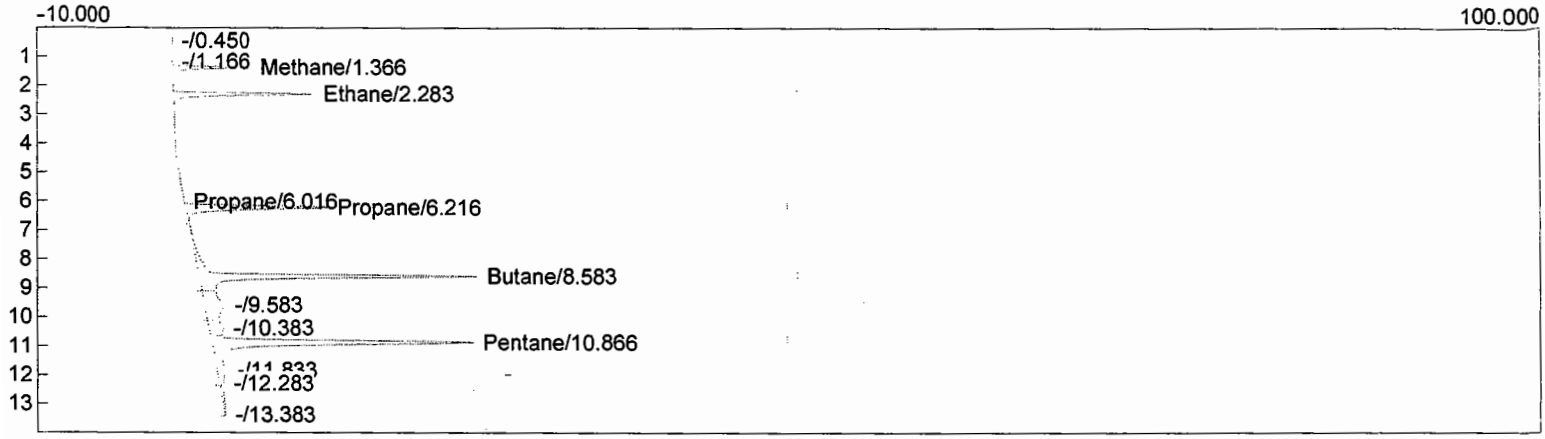
Number	Component	Retention	Area
1	Methane	1.366	34.5660
2	Ethane	2.283	66.2150
3	Propane	6.200	96.3560
4	Butane	8.550	519.6460
5	Pentane	10.800	381.0660
5			1097.8490

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 14:09:21
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting10.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



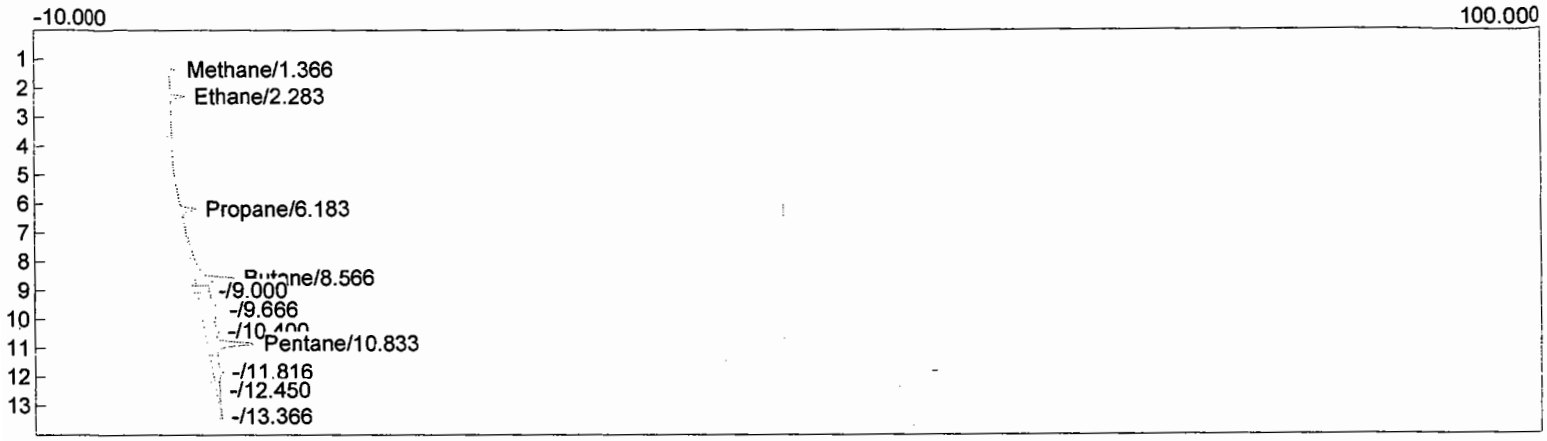
Number	Component	Retention	Area
1	Methane	1.366	32.1005
2	Ethane	2.283	64.4240
3	Propane	6.166	95.7440
4	Butane	8.533	233.6615
5	Pentane	10.800	206.8010
5			632.7310

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 14:28:08
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting11.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



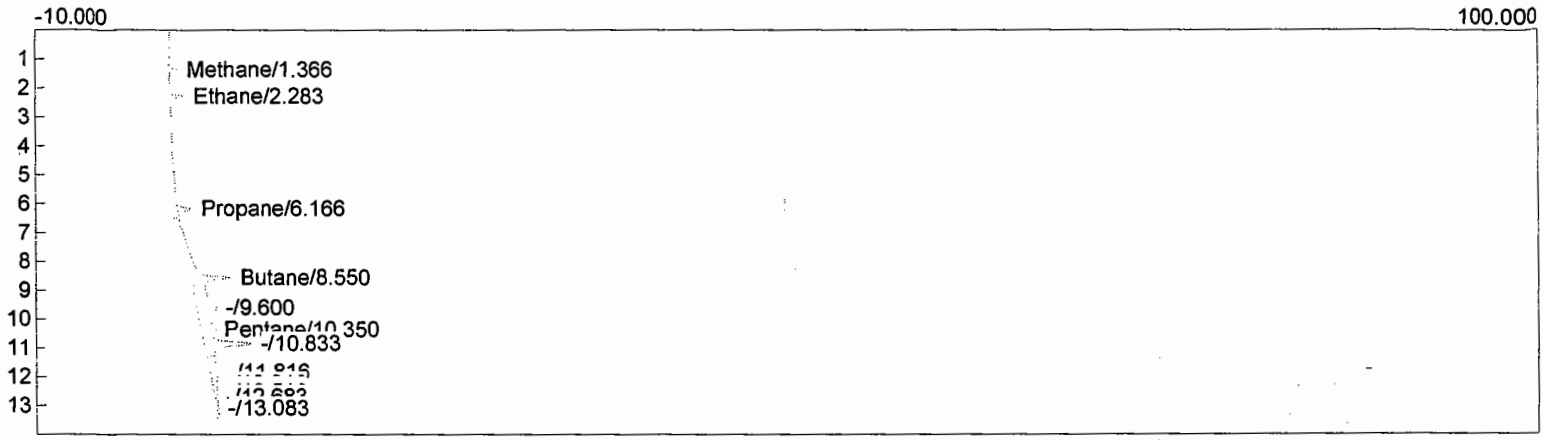
Number	Component	Retention	Area
1	Methane	1.366	32.9680
2	Ethane	2.283	64.0660
3	Propane	6.016	2.6755
3	Propane	6.216	96.7850
4	Butane	8.583	199.3845
5	Pentane	10.866	214.7470
6			610.6260

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 14:46:49
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting12.CHR ()
Sample: 1 ppm c1-c5
Operator: J. Ruggaber



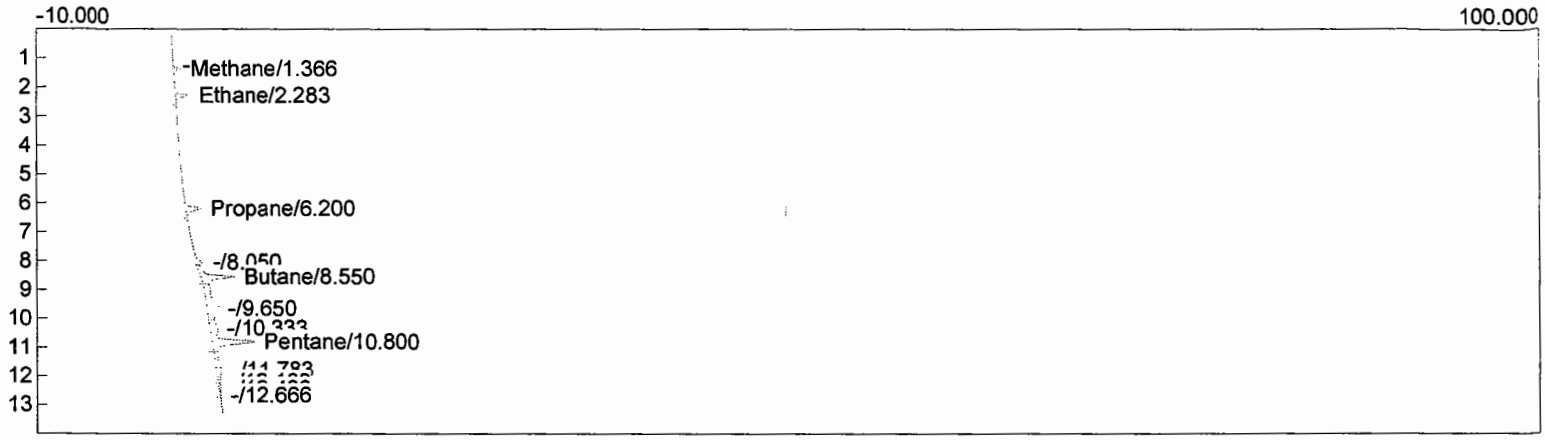
Number	Component	Retention	Area
1	Methane	1.366	3.3020
2	Ethane	2.283	6.7900
3	Propane	6.183	11.2620
4	Butane	8.566	58.3975
5	Pentane	10.833	54.2030
5			133.9545

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 15:05:09
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting13.CHR ()
Sample: 1 ppm c1-c5
Operator: J. Ruggaber



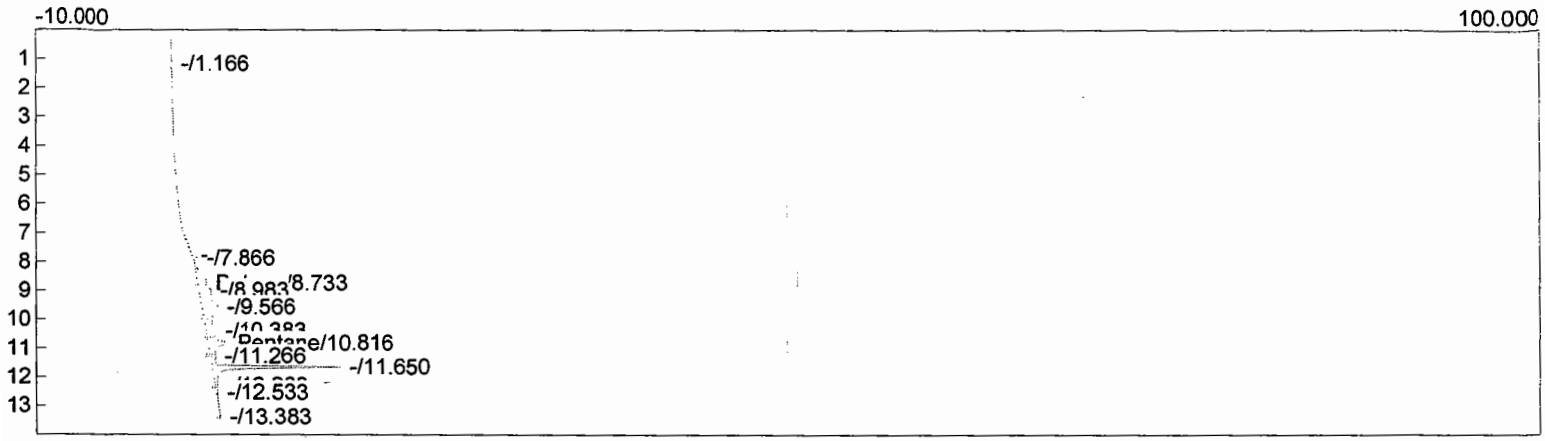
Number	Component	Retention	Area
1	Methane	1.366	3.1675
2	Ethane	2.283	6.3520
3	Propane	6.166	9.5015
4	Butane	8.550	66.6585
5	Pentane	10.350	28.2970
5			113.9765

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 15:23:49
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting14.CHR ()
Sample: 1 ppm c1-c5
Operator: J. Ruggaber



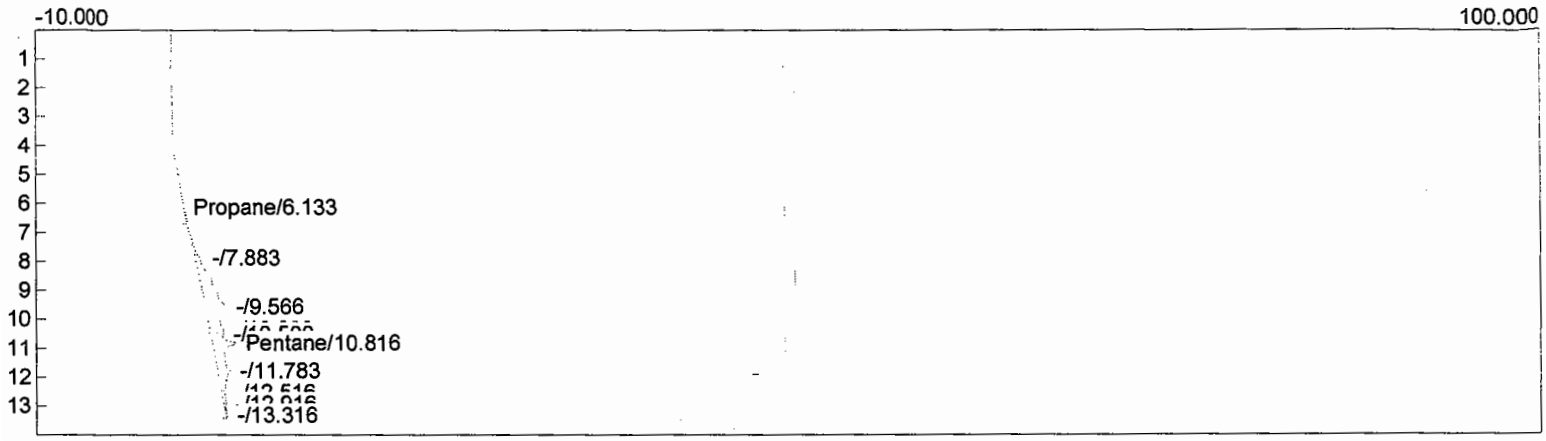
Number	Component	Retention	Area
1	Methane	1.366	3.4580
2	Ethane	2.283	6.7380
3	Propane	6.200	9.9720
4	Butane	8.550	28.2650
5	Pentane	10.800	39.0890
5			87.5220

Lab Name: An Environmental
Client: BP Whiting
Analysis date: 06/10/2011 15:42:46
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting15.CHR ()
Sample: IGS run 1
Operator: J. Ruggaber



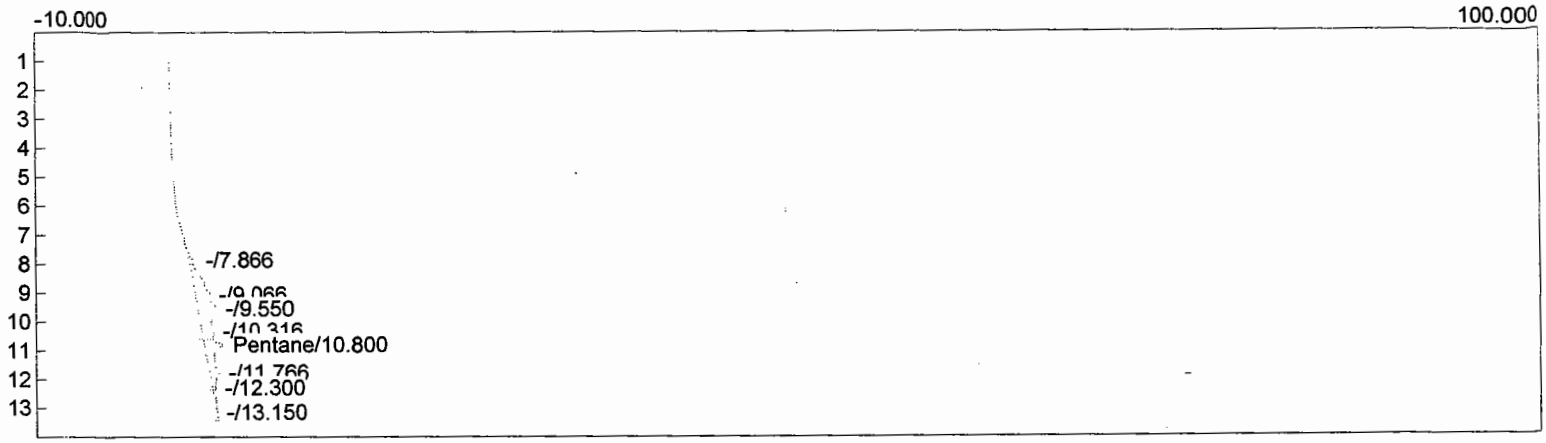
Number	Component	Retention	Area
4	Butane	8.733	16.9535
5	Pentane	10.816	27.3830
2			44.3365

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 16:01:07
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting16.CHR ()
Sample: IGS run 1
Operator: J. Ruggaber



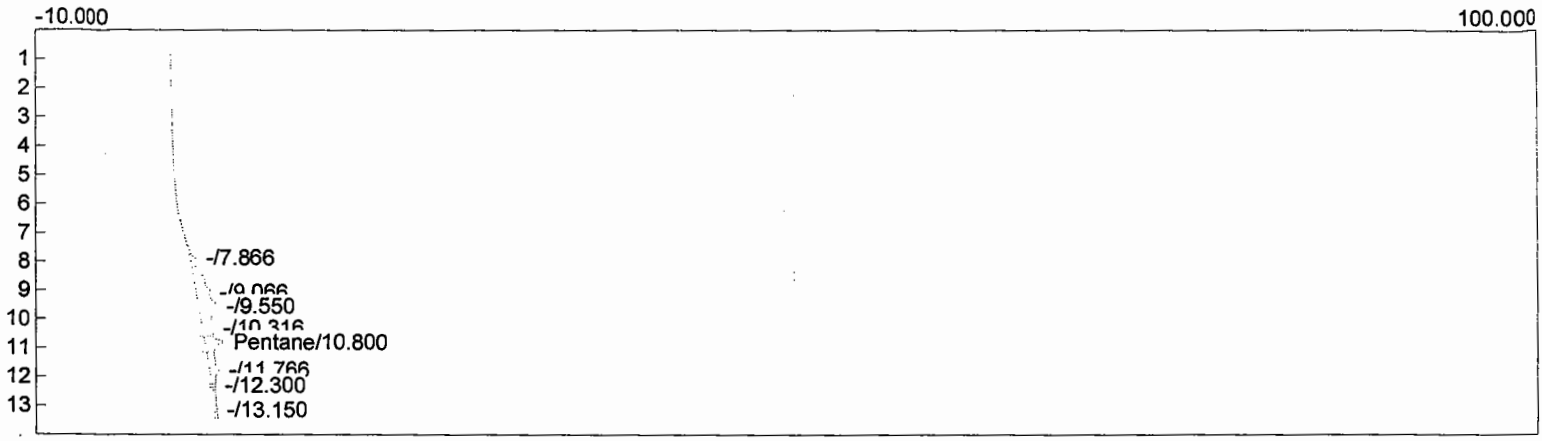
Number	Component	Retention	Area
3	Propane	6.133	4.3045
5	Pentane	10.816	37.9630
2			42.2675

Lab Name: Air Environmental
Client: BP Whiting
Analysis date: 06/10/2011 16:19:30
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting17.CHR ()
Sample: IGS run 1
Operator: J. Ruggaber



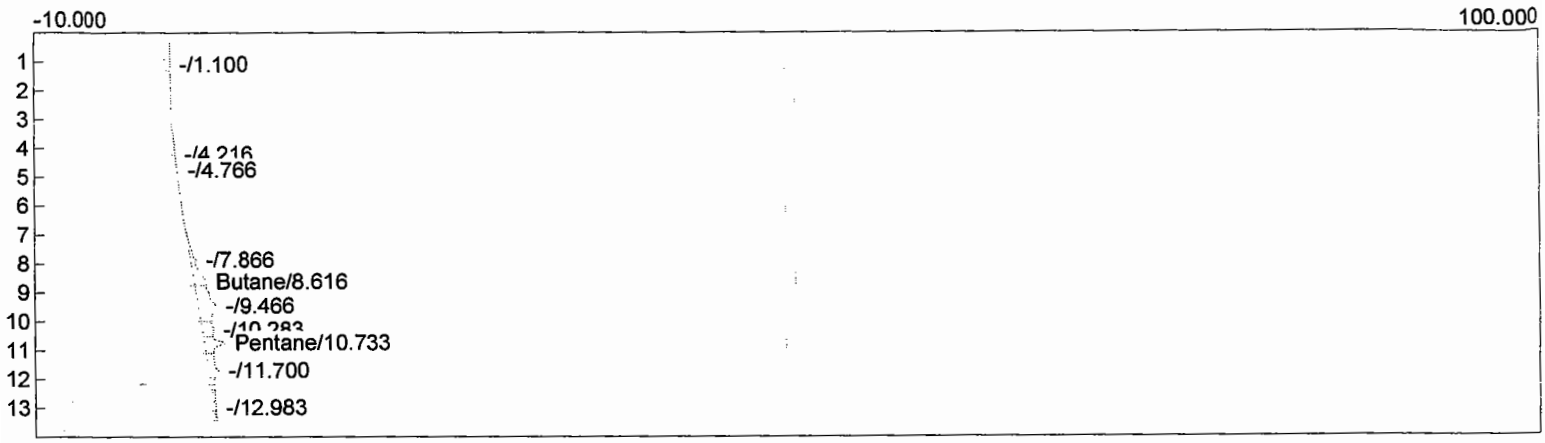
Number	Component	Retention	Area
5	Pentane	10.800	27.8005
1			27.8005

Lab name: Arl Environmental
Client: BP Whiting
Analysis date: 06/10/2011 16:19:30
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting17.CHR ()
Sample: IGS run 2
Operator: J. Ruggaber



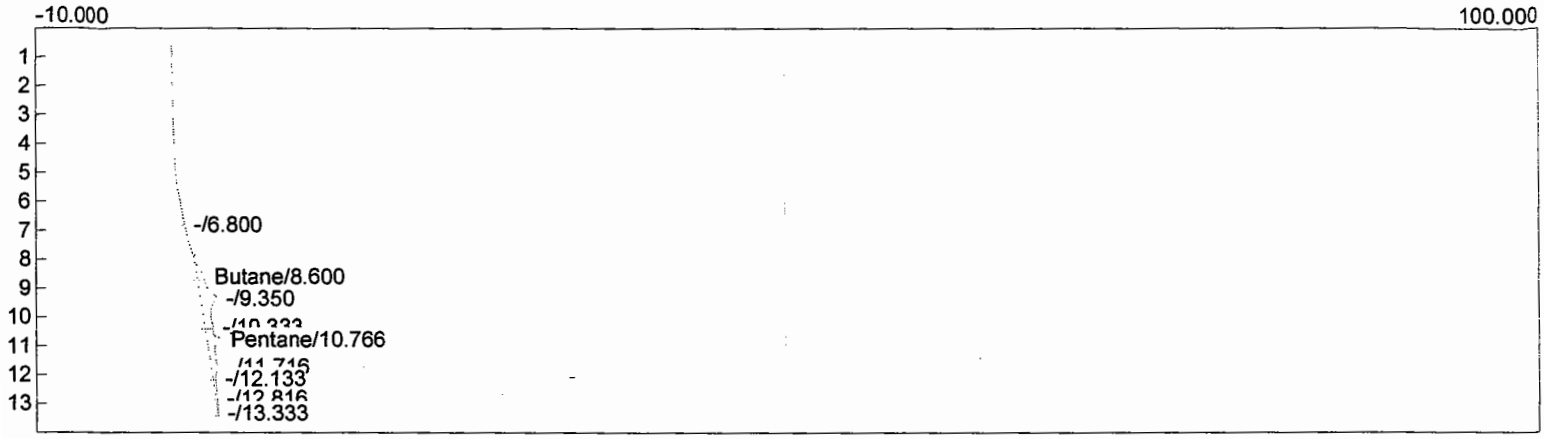
Number	Component	Retention	Area
5	Pentane	10.800	27.8005
1			27.8005

Lab name: Arl Environmental
Client: BP Whiting
Analysis date: 06/10/2011 16:42:00
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting18.CHR ()
Sample: IGS run 2
Operator: J. Ruggaber



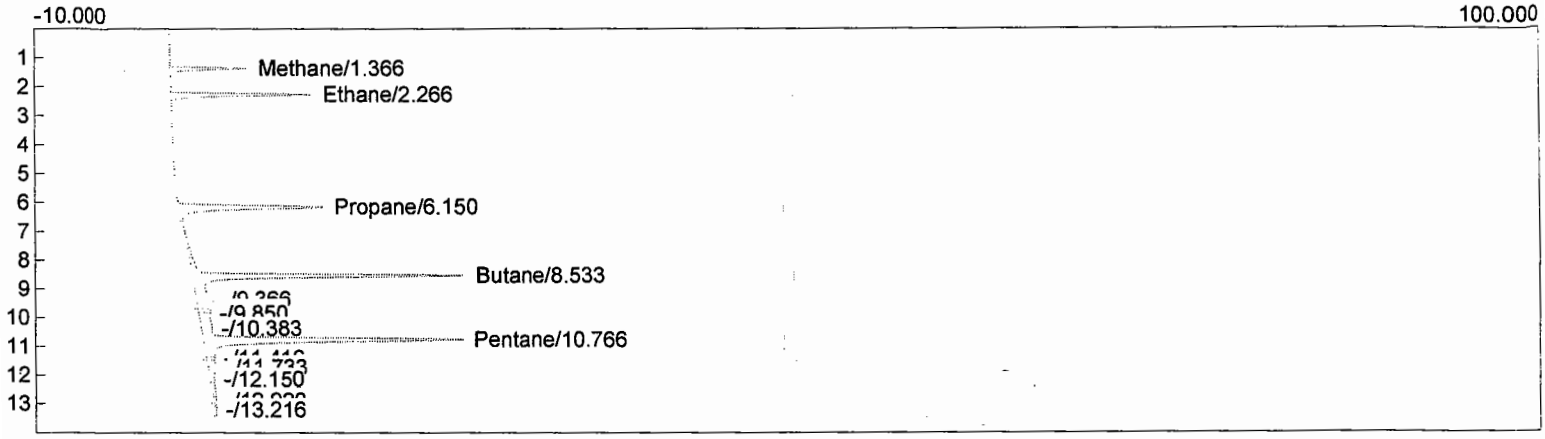
Number	Component	Retention	Area
4	Butane	8.616	26.6745
5	Pentane	10.733	30.7710
2			57.4455

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 17:01:38
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting19.CHR ()
Sample: IGS run 2
Operator: J. Ruggaber



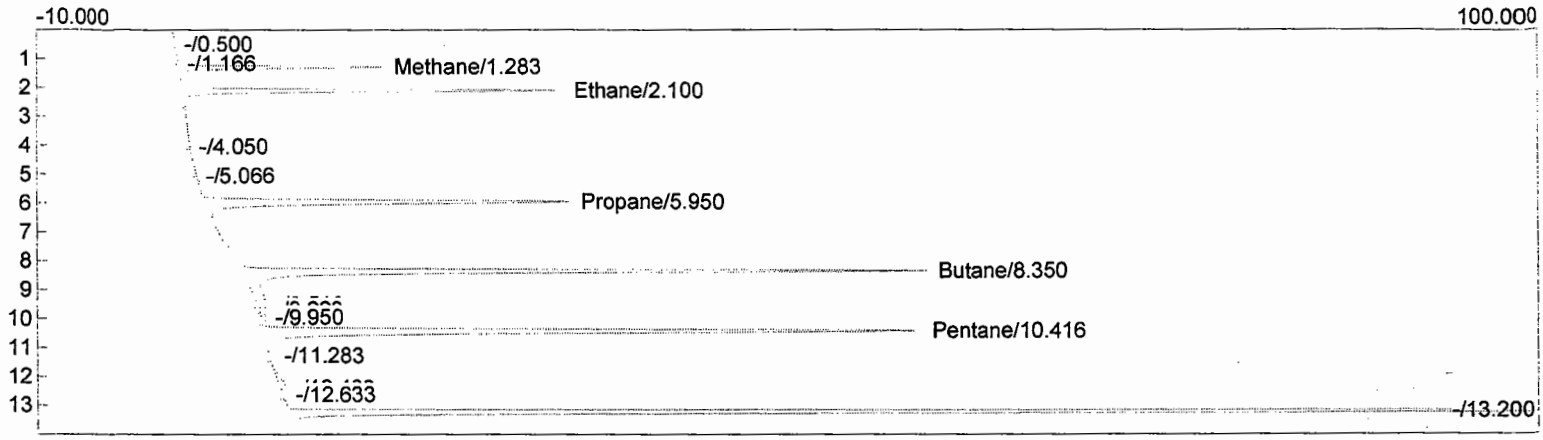
Number	Component	Retention	Area
4	Butane	8.600	12.0695
5	Pentane	10.766	25.7415
2			37.8110

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/10/2011 17:20:57
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting20.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



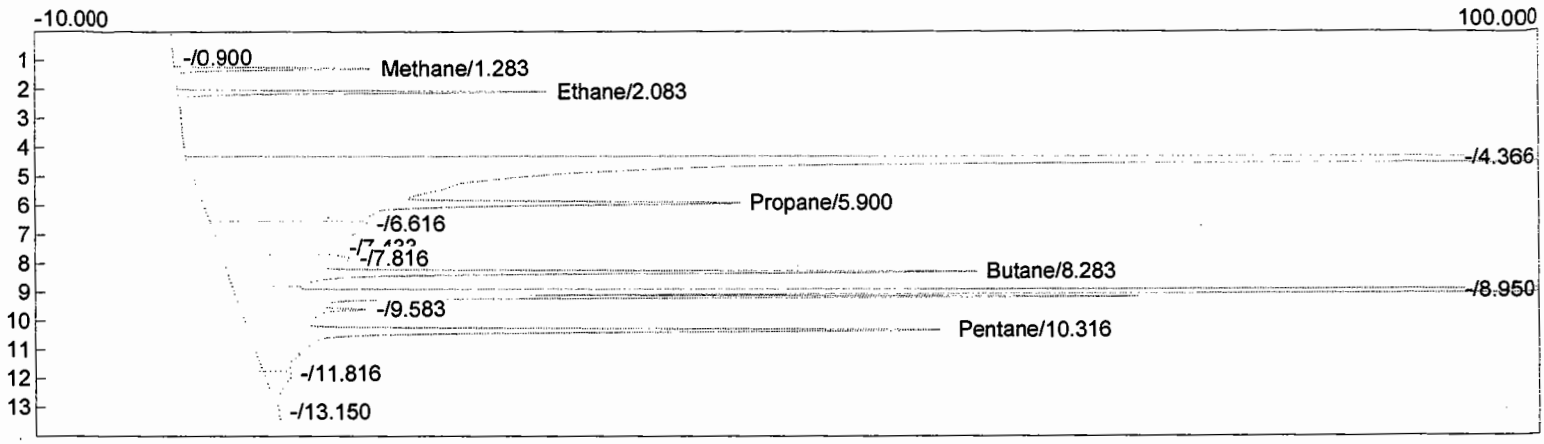
Number	Component	Retention	Area
1	Methane	1.366	32.2185
2	Ethane	2.266	64.8660
3	Propane	6.150	98.3430
4	Butane	8.533	175.5235
5	Pentane	10.766	208.8530
5			579.8040

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 09:18:27
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting22.CHR ()
Sample: 25 ppm c1-c5
Operator: J. Ruggaber



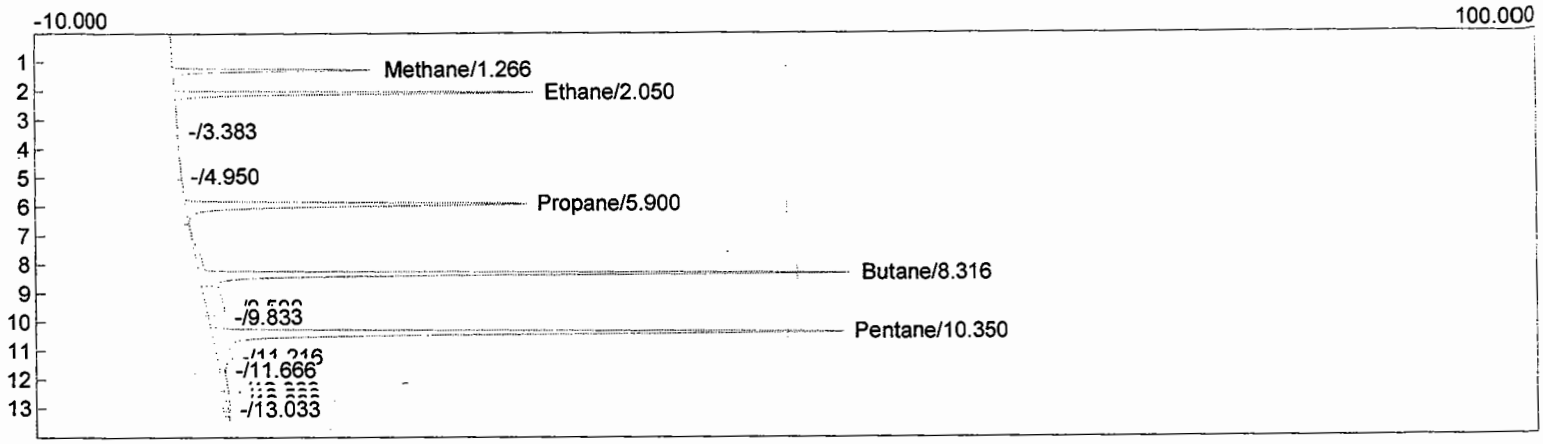
Number	Component	Retention	Area
1	Methane	1.283	86.2500
2	Ethane	2.100	174.8795
3	Propane	5.950	260.5285
4	Butane	8.350	426.8390
5	Pentane	10.416	455.1095
5			1403.6065

Lab name: Arl Environmental
Client: BP Whiting
Analysis date: 06/13/2011 09:36:39
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting23.CHR ()
Sample: 25 ppm c1-c5
Operator: J. Ruggaber



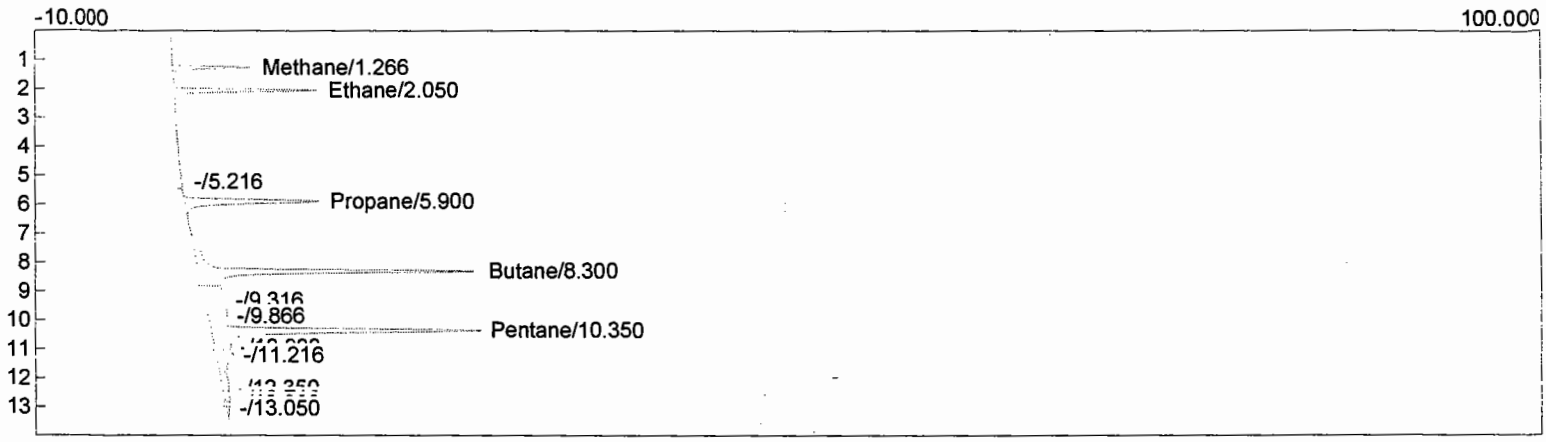
Number	Component	Retention	Area
1	Methane	1.283	79.8735
2	Ethane	2.083	163.3925
3	Propane	5.900	839.1415
4	Butane	8.283	592.9500
5	Pentane	10.316	760.8935
5			2436.2510

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 10:22:57
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting24.CHR ()
Sample: 25 ppm c1-c5
Operator: J. Ruggaber



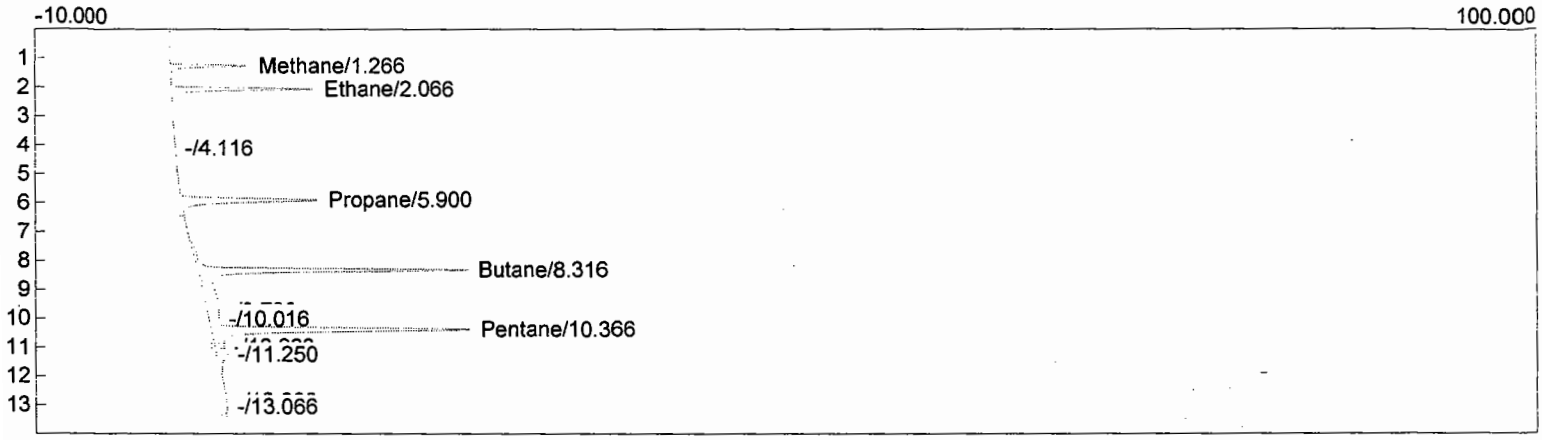
Number	Component	Retention	Area
1	Methane	1.266	81.5920
2	Ethane	2.050	162.8960
3	Propane	5.900	246.4965
4	Butane	8.316	396.4280
5	Pentane	10.350	471.8095
5			1359.2220

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 10:41:39
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting25.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



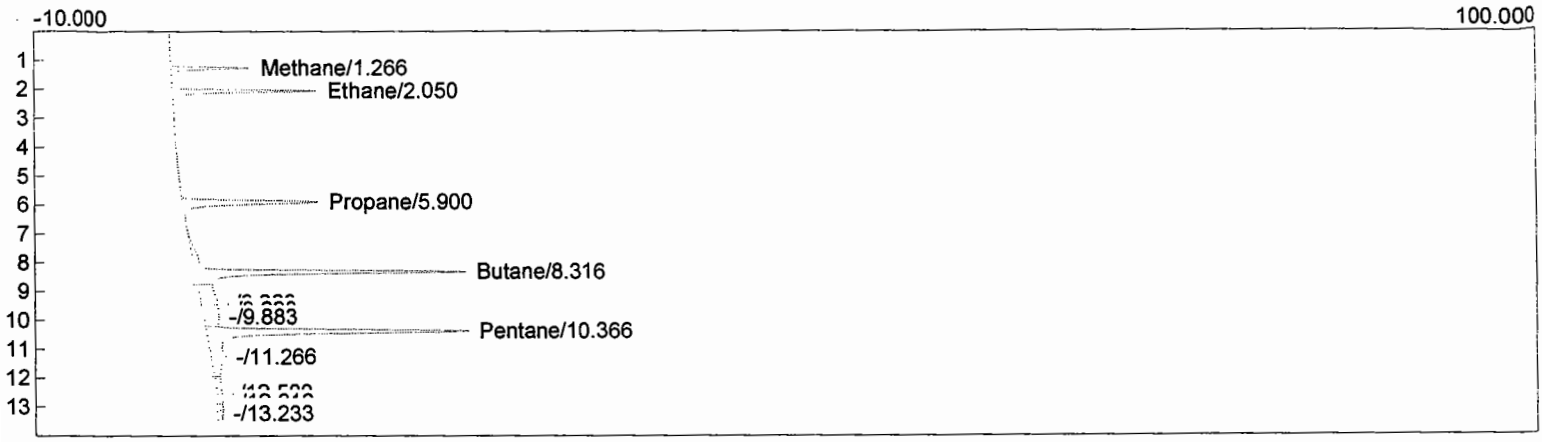
Number	Component	Retention	Area
1	Methane	1.266	31.8550
2	Ethane	2.050	64.0895
3	Propane	5.900	96.8680
4	Butane	8.300	223.7040
5	Pentane	10.350	221.3920
5			637.9085

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 10:59:32
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting26.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



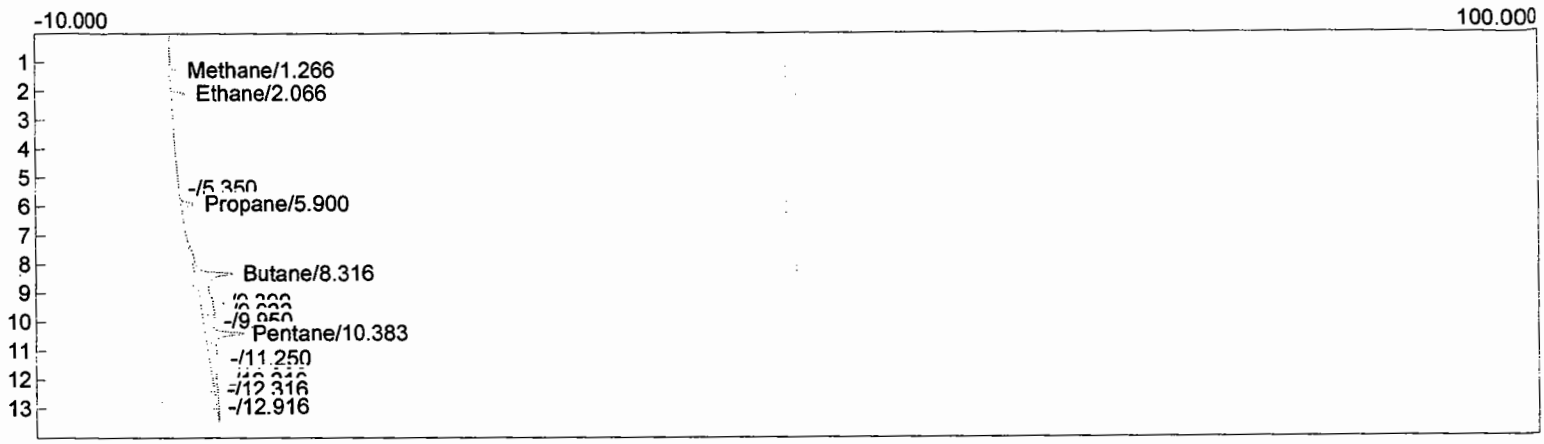
Number	Component	Retention	Area
1	Methane	1.266	31.7760
2	Ethane	2.066	64.9460
3	Propane	5.900	98.6250
4	Butane	8.316	178.2830
5	Pentane	10.366	204.6380
5			578.2680

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 11:18:11
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting27.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



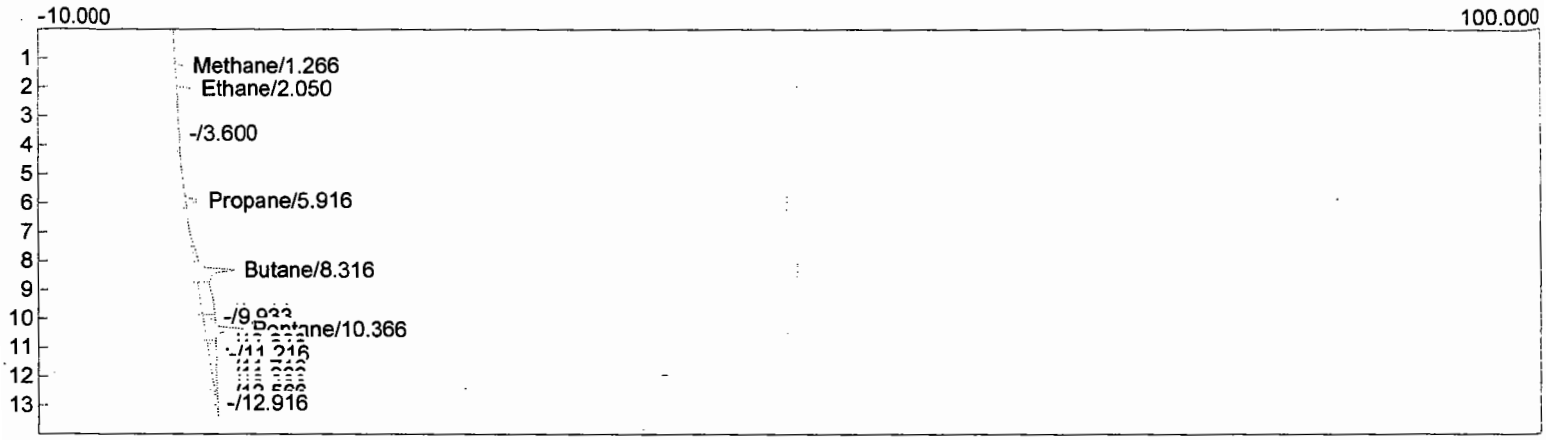
Number	Component	Retention	Area
1	Methane	1.266	31.5000
2	Ethane	2.050	64.4965
3	Propane	5.900	97.5145
4	Butane	8.316	197.8000
5	Pentane	10.366	212.7730
5			604.0840

Lab name: Arl Environmental
Client: BP Whiting
Analysis date: 06/13/2011 11:36:17
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting28.CHR ()
Sample: 1 ppm c1-c5
Operator: J. Ruggaber



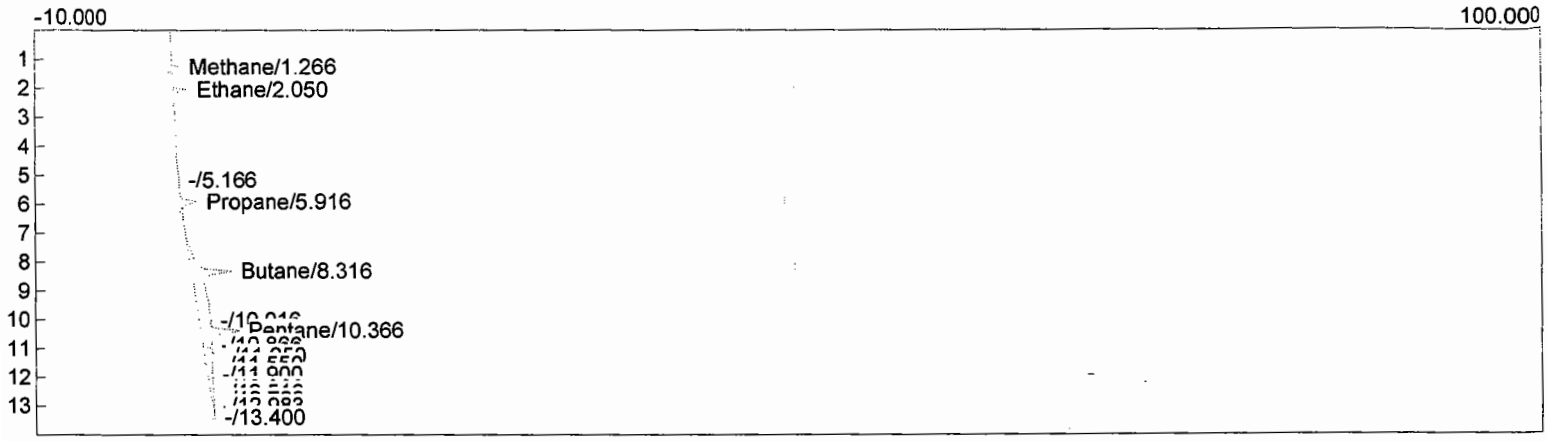
Number	Component	Retention	Area
1	Methane	1.266	3.2950
2	Ethane	2.066	6.5430
3	Propane	5.900	10.2895
4	Butane	8.316	53.0570
5	Pentane	10.383	39.1225
5			112.3070

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 11:57:27
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting29.CHR ()
Sample: 1 ppm c1-c5
Operator: J. Ruggaber



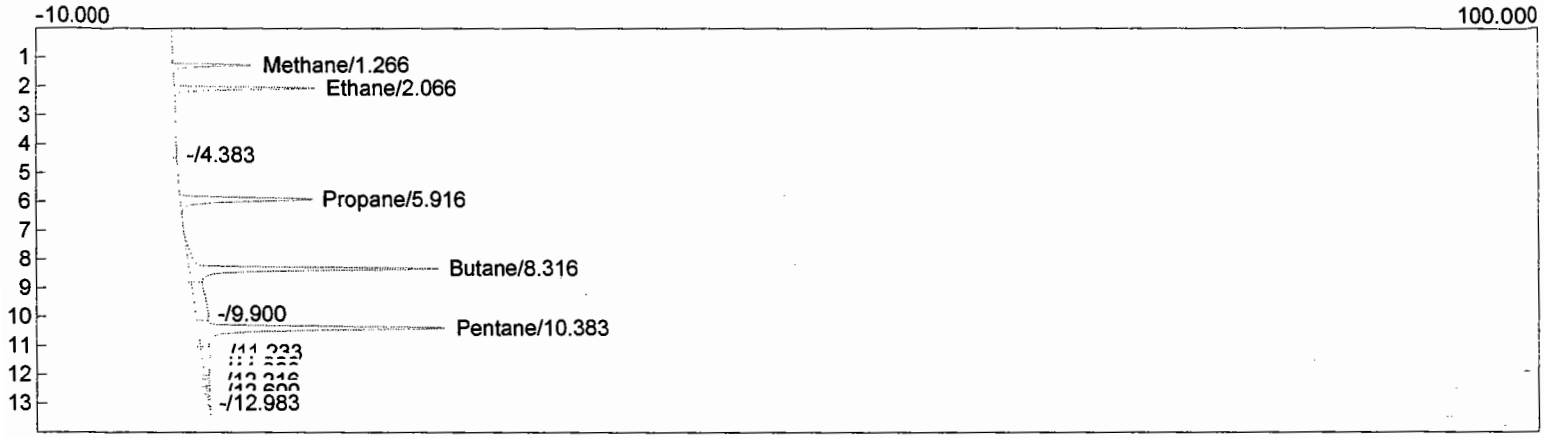
Number	Component	Retention	Area
1	Methane	1.266	3.3190
2	Ethane	2.050	6.7810
3	Propane	5.916	9.5900
4	Butane	8.316	58.6070
5	Pentane	10.366	51.1930
5			129.4900

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 12:18:25
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting30.CHR ()
Sample: 1 ppm c1-c5
Operator: J. Ruggaber



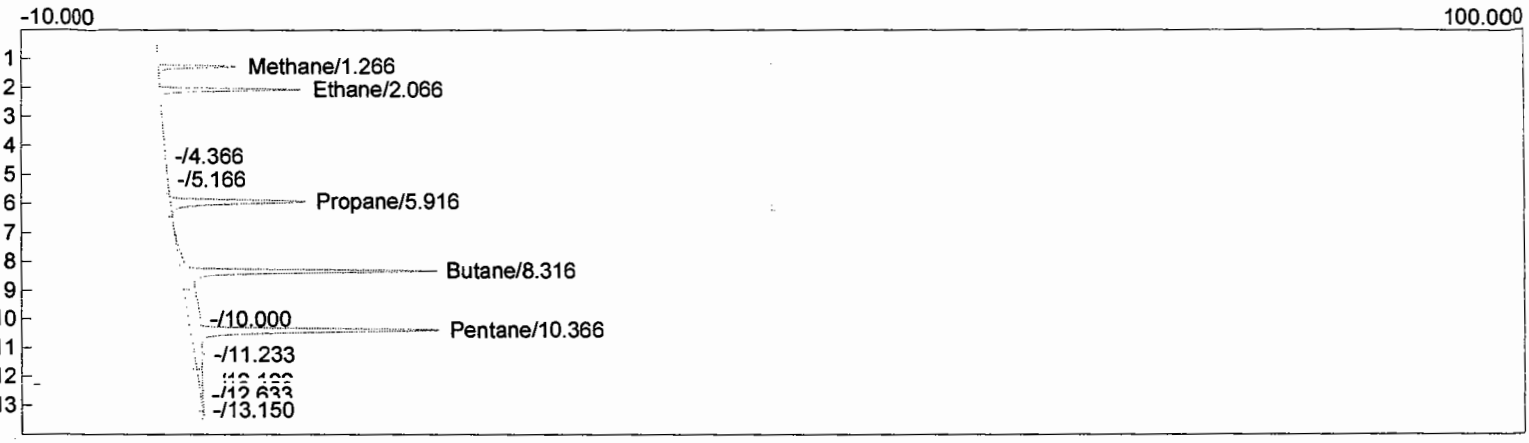
Number	Component	Retention	Area
1	Methane	1.266	3.1820
2	Ethane	2.050	6.4420
3	Propane	5.916	10.7460
4	Butane	8.316	62.7490
5	Pentane	10.366	50.6470
5			133.7660

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 12:42:55
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting31.CHR ()
Sample: 10 ppm c1-c5 2nd std
Operator: J. Ruggaber



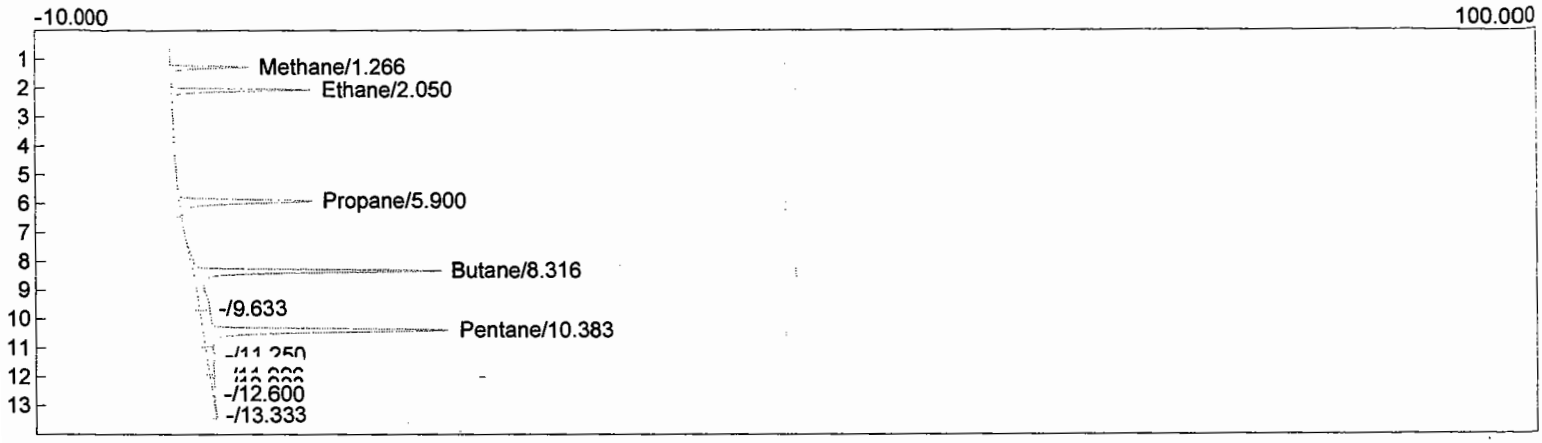
Number	Component	Retention	Area
1	Methane	1.266	33.0050
2	Ethane	2.066	64.1405
3	Propane	5.916	95.6390
4	Butane	8.316	174.0065
5	Pentane	10.383	201.8265
5			568.6175

Lab name: Arl Environmental
Client: BP Whiting
Analysis date: 06/13/2011 13:01:28
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting32.CHR ()
Sample: 10 ppm c1-c5 2nd std
Operator: J. Ruggaber



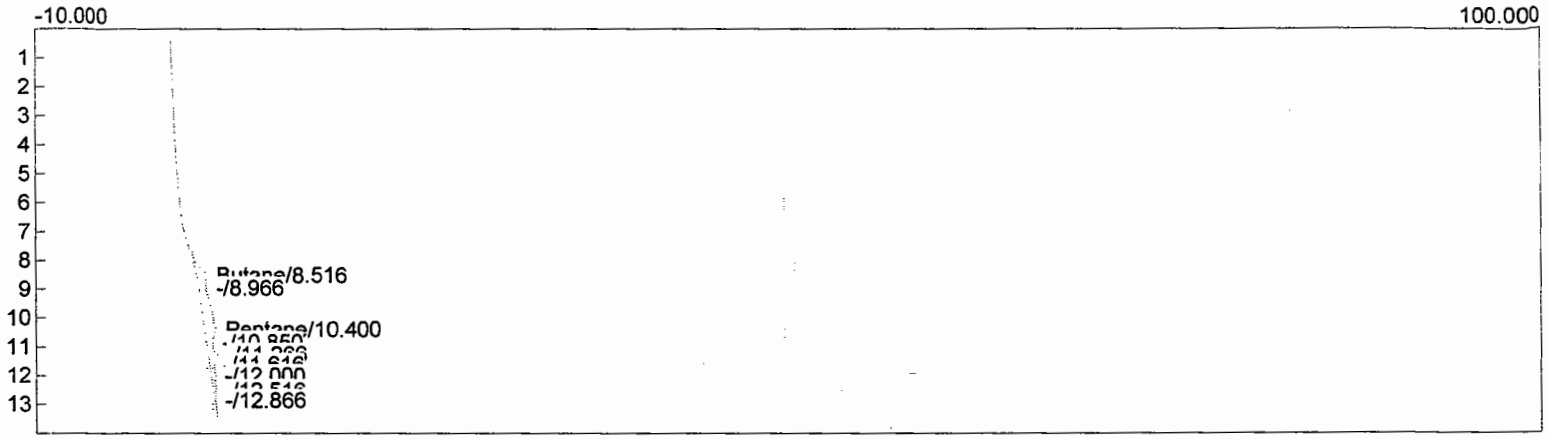
Number	Component	Retention	Area
1	Methane	1.266	31.7440
2	Ethane	2.066	63.4330
3	Propane	5.916	95.5810
4	Butane	8.316	185.1890
5	Pentane	10.366	198.7960
5			574.7430

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 13:20:04
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting33.CHR ()
Sample: 10 ppm c1-c5 2nd std
Operator: J. Ruggaber



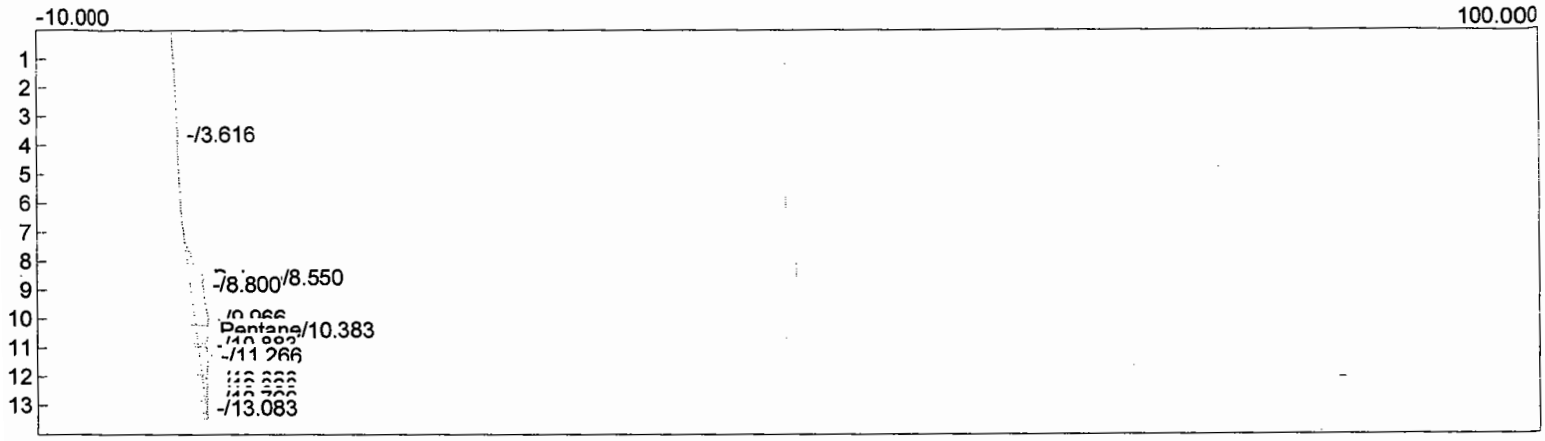
Number	Component	Retention	Area
1	Methane	1.266	31.7090
2	Ethane	2.050	64.3070
3	Propane	5.900	95.4170
4	Butane	8.316	159.5705
5	Pentane	10.383	211.7175
5			562.7210

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 13:39:05
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting34.CHR ()
Sample: IGS run 3
Operator: J. Ruggaber



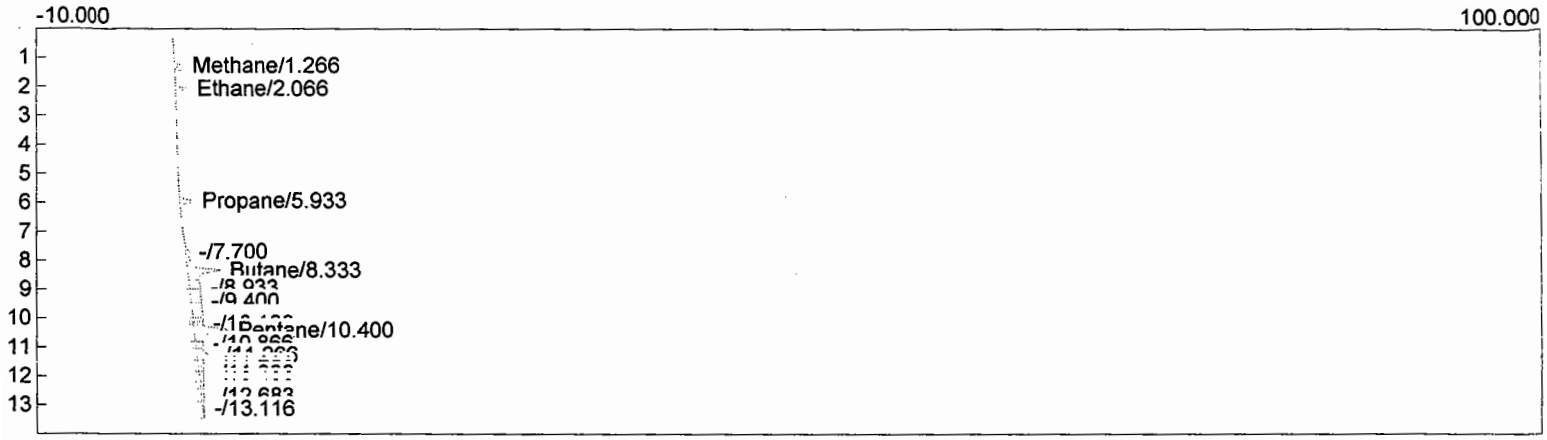
Number	Component	Retention	Area
4	Butane	8.516	19.5610
5	Pentane	10.400	67.4815
2			87.0425

Lab name: Arl Environmental
Client: BP Whiting
Analysis date: 06/13/2011 14:02:02
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting35.CHR ()
Sample: IGS run 3
Operator: J. Ruggaber



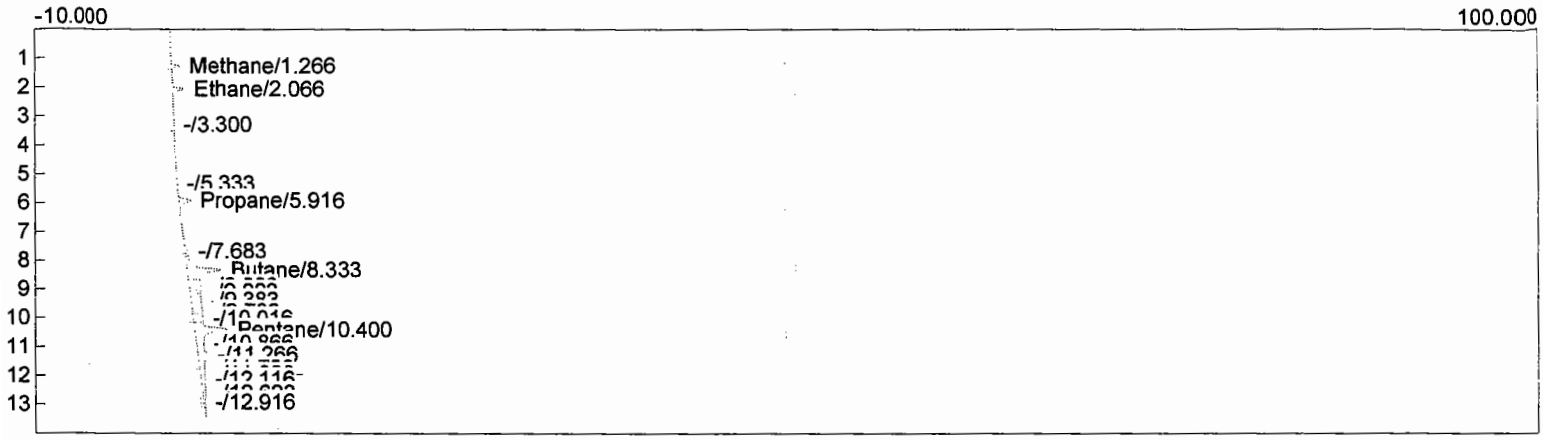
Number	Component	Retention	Area
4	Butane	8.550	42.8590
5	Pentane	10.383	31.1690
2			74.0280

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 14:48:15
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting37.CHR ()
Sample: methane spike
Operator: J. Ruggaber



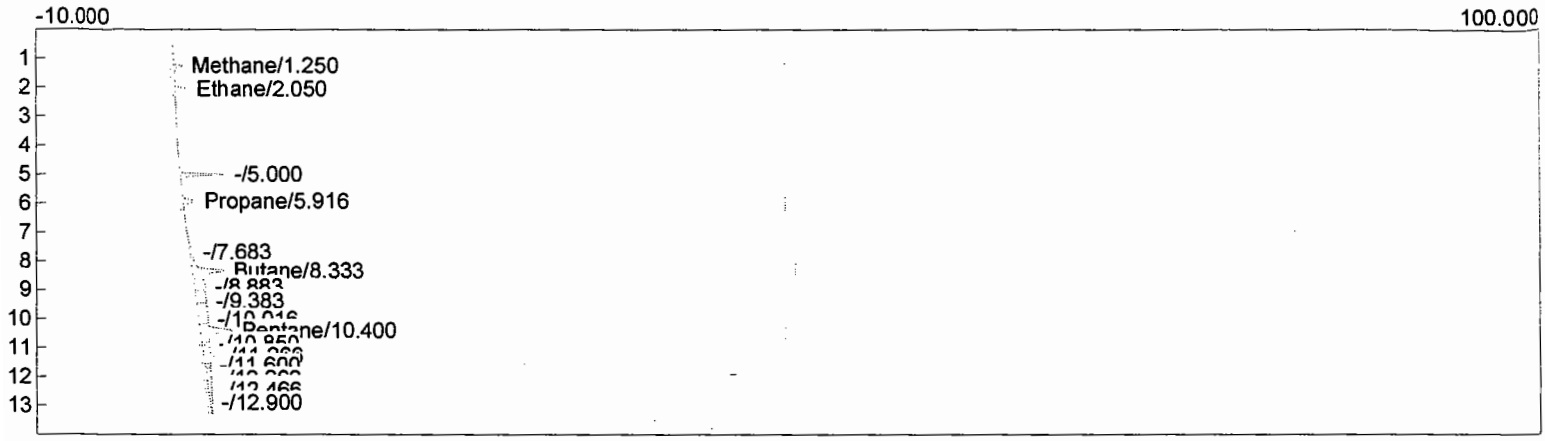
Number	Component	Retention	Area
1	Methane	1.266	2.9420
2	Ethane	2.066	5.7065
3	Propane	5.933	8.4670
4	Butane	8.333	40.3955
5	Pentane	10.400	39.0420
5			96.5530

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 15:09:58
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting38.CHR ()
Sample: methane spike
Operator: J. Ruggaber



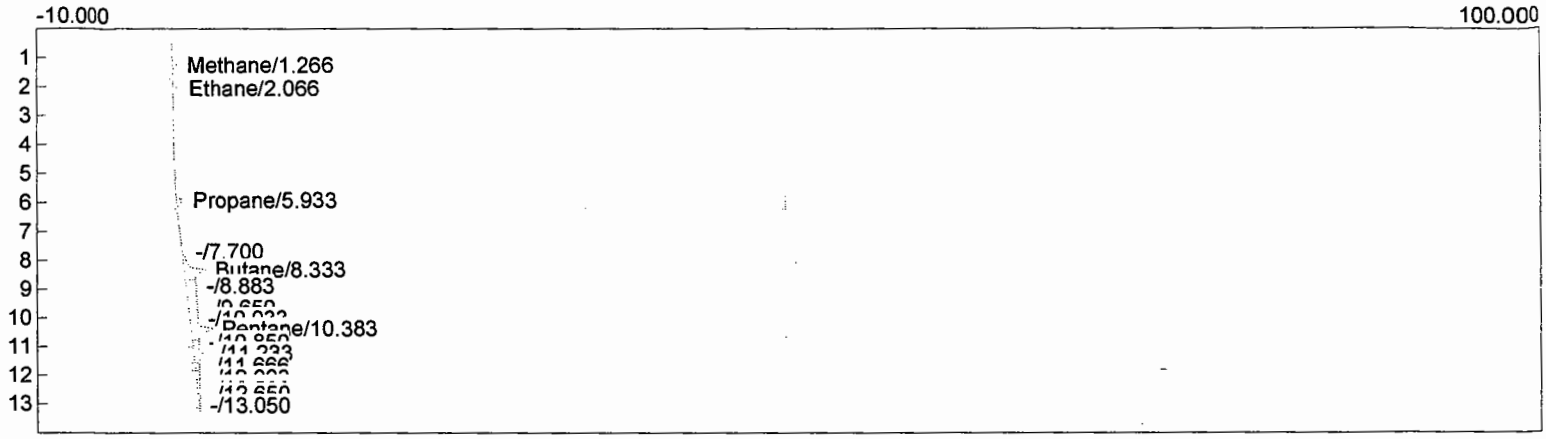
Number	Component	Retention	Area
1	Methane	1.266	3.0030
2	Ethane	2.066	5.7355
3	Propane	5.916	8.6600
4	Butane	8.333	42.2485
5	Pentane	10.400	40.7030
5			100.3500

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 15:30:09
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting39.CHR ()
Sample: methane spike
Operator: J. Ruggaber



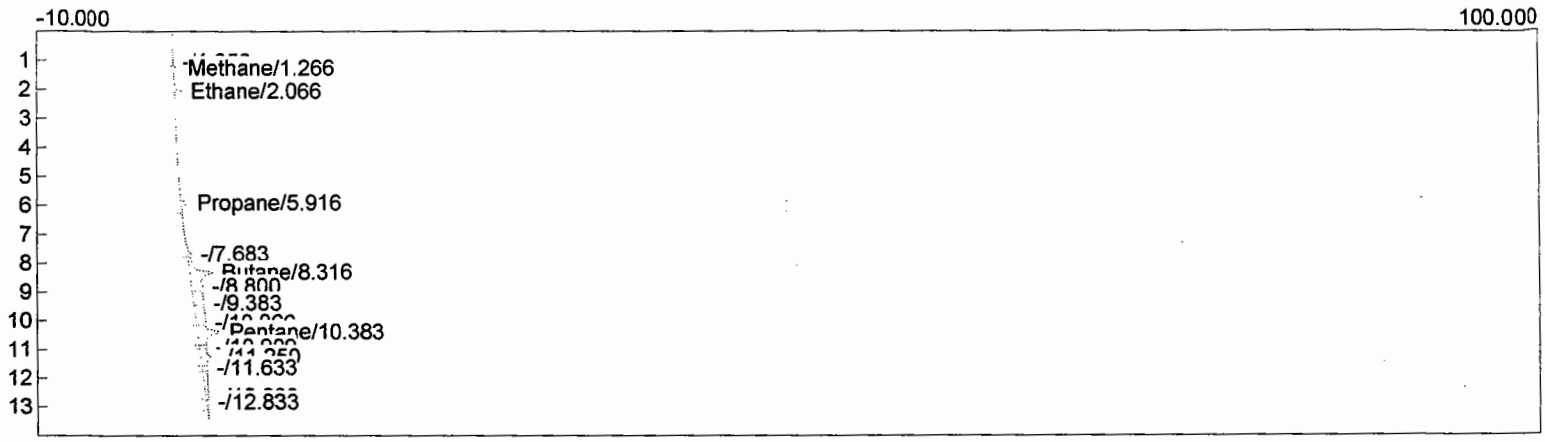
Number	Component	Retention	Area
1	Methane	1.250	3.1435
2	Ethane	2.050	5.6355
3	Propane	5.916	8.1360
4	Butane	8.333	37.0960
5	Pentane	10.400	38.0810
5			92.0920

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 15:55:11
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting40.CHR ()
Sample: ethane spike
Operator: J. Ruggaber



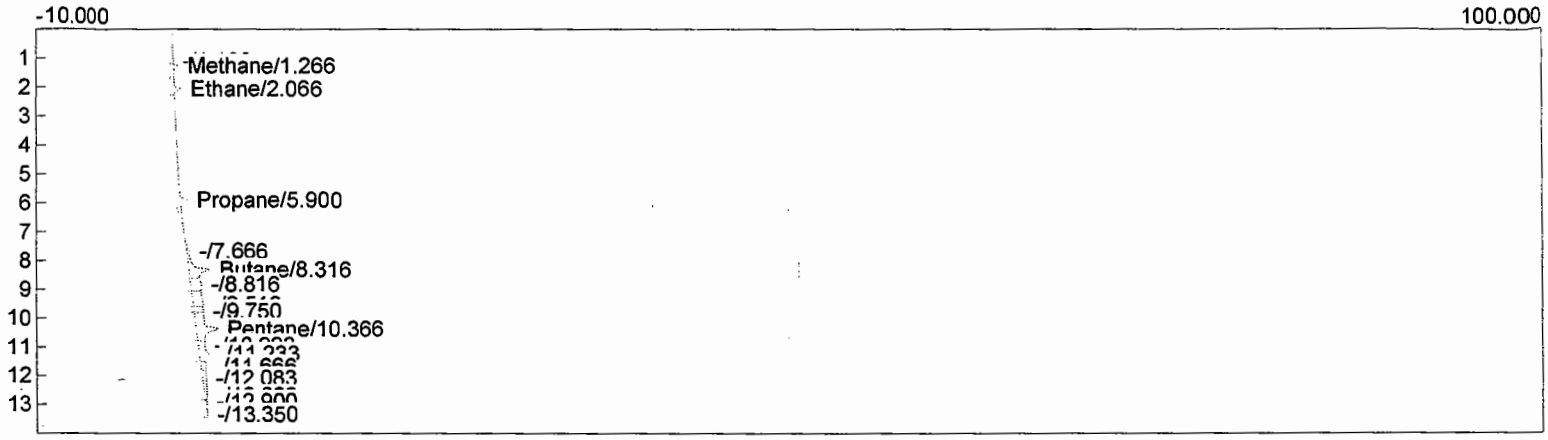
Number	Component	Retention	Area
1	Methane	1.266	3.7970
2	Ethane	2.066	3.2155
3	Propane	5.933	5.1100
4	Butane	8.333	31.6000
5	Pentane	10.383	32.5335
5			76.2560

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 16:14:38
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting41.CHR ()
Sample: ethane spike
Operator: J. Ruggaber



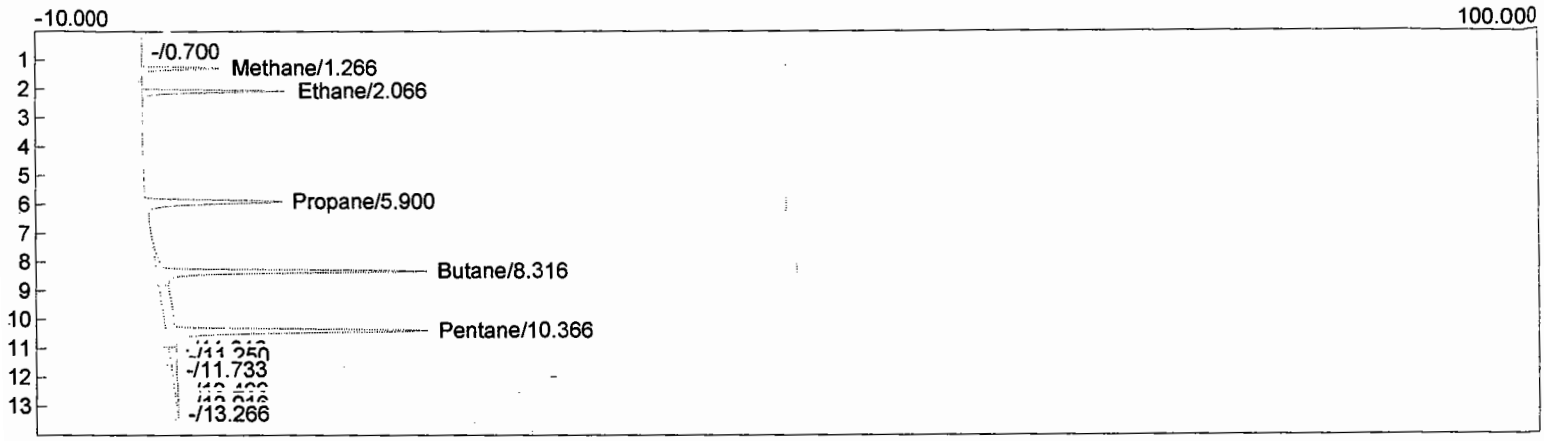
Number	Component	Retention	Area
1	Methane	1.266	2.4250
2	Ethane	2.066	3.2330
3	Propane	5.916	4.3410
4	Butane	8.316	32.2550
5	Pentane	10.383	34.0550
5			76.3090

Lab name: Arl Environmental
Client: BP Whiting
Analysis date: 06/13/2011 16:34:10
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting42.CHR ()
Sample: ethane spike
Operator: J. Ruggaber



Number	Component	Retention	Area
1	Methane	1.266	2.4910
2	Ethane	2.066	3.2290
3	Propane	5.900	4.5590
4	Butane	8.316	28.3270
5	Pentane	10.366	44.2005
5			82.8065

Lab name: Ari Environmental
Client: BP Whiting
Analysis date: 06/13/2011 16:53:05
Method: Gas Injection
Carrier: Helium
Data file: BPWhiting43.CHR ()
Sample: 10 ppm c1-c5
Operator: J. Ruggaber



Number	Component	Retention	Area
1	Methane	1.266	32.9815
2	Ethane	2.066	65.6415
3	Propane	5.900	96.9075
4	Butane	8.316	178.5100
5	Pentane	10.366	259.3170
5			633.3575

ALS Environmental
5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: ARI100
ALS WO#: L1021465
Date of Report 4-Aug-11
Date of Sample Receipt 22-Jun-11

Client Name: ARI Environmental, INC.
Client Address: 1710 Preston Road, Unit C
Pasadena TX 77503

Client Contact: Dan Fitzgerald
Client Project ID: BP - Whiting FCCU 500

COMMENTS: **VOCs via modified method 18 - Chilled Methanol Impingers - GC/MS Selected Ion Monitoring**
REVISED REPORT: to provide all target analyte data on the spiked fractions

Limits of Reporting have been defined by the level equivalent to the low instrument calibration point and sensitivity standard.

Nitrobenzene-d5 recoveries and nitrobenzene quantification were inconsistent. The purge and trap analysis suffered from run to run carry-over. There was no clear evidence for nitrobenzene source emissions. Detection limits for nitrobenzene were raised because of the uncertainty of low level data. Nitrobenzene data is also available from the SVOC data.

The spiked and unspiked trains for Runs 2 and 3 were contaminated with high levels of dichloromethane during recovery in the field. The peak size was severe enough to cause interferences from acrolein, acetonitrile, carbon disulfide, acrylonitrile and hexane region of the GC/MS instrumental run

Summary of the Method:
The sampling train consisted of 4 midget impingers. The 1st impinger was a moisture knock-out. The 2nd, 3rd and 4th impinger contained approximately 15mL each of methanol. Impingers 1 and 2 were recovered combined. Impingers 3 and 4 were each recovered separately. The methanolic impinger solutions were diluted 100-fold into water and analyzed by purge and trap GC/MS (i.e via SW846 5030B/8260B) using selected ion monitoring technique.

Certified by: _____
Ron McLeod, Ph.D.
General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.
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ALS Environmental

COMPOSITE TARGET ANALYTE DATA

Sample Name	Run 1			Run 2			Run 3			Blank Train			Laboratory Method Blank	
Client Container ID:	Train A 36950 36951 36952			45856 45857 45858			47340 47341 47342			47362 47363 47364				
ALS Sample ID	L1021465-1/2/3			L1021465-4/5/6			L1021465-7/8/9			L1021465-22/23/24			WG1304163-1	
Matrix	Impinger			Impinger			Impinger			Impinger			Impinger	
Sampling Date	7-Jun-11			8-Jun-11			8-Jun-11			8-Jun-11			n/a	
Date of Receipt	22-Jun-11			22-Jun-11			22-Jun-11			22-Jun-11			n/a	
VOC via Modified Method 18	**ug**	**Qualifier**	**Data Source**	**ug**	**Qualifier**	**Data Source**	**ug**	**Qualifier**	**Data Source**	**ug**	**Qualifier**	**Data Source**	**ug**	**Qualifier**
Target VOCs														
1,3-Butadiene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Pentane	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Acrolein	<4.3	BDL	UI1-2	<250	BDL, INT	UI1-2	<50	BDL, INT	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Acetone	83.2	ADL, B	UI1-2	<200	BDL	UI1-2	<800	BDL	UI1-2	51.0	ADL	UI1-2	2.74	ADL
Acetonitrile	<4.3	BDL	UI1-2	<86	BDL	UI1-2	<86	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Carbon Disulfide	<4.3	BDL	UI1-2	<86	BDL	UI1-2	<86	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Methylene Chloride	<4.3	BDL	UI1-2	n/a			n/a			1315	C	UI1-2	<2.4	BDL
Acrylonitrile	<4.3	BDL	UI1-2	<86	BDL	UI1-2	<86	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Methyl t-Butyl Ether (MTBE)	<4.3	BDL	UI1-2	<86	BDL	UI1-2	<86	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Hexane	<4.3	BDL	UI1-2	<86	BDL	UI1-2	<86	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
2,2,4-Trimethylpentane	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Benzene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Trichloroethene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
2-Nitropropane	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Methyl iso-Butyl Ketone	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Toluene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Tetrachloroethene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
1,2-Dibromoethane	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Chlorobenzene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Ethylbenzene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
m&p-Xylenes	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
o-Xylene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Styrene	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Cumene (Isopropylbenzene)	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Nitrobenzene	<21.5	BDL	UI1-2	<21.5	BDL	UI1-2	<21.5	BDL	UI1-2	<21.5	BDL	UI1-2	<12	BDL

ADL = Below Detection Limit
BDL = Below Detection Limit
DLL = Composite data where at least one data point (but not all data points) is above the detection limit
INT = Interference; Detection Limit Raised
UI# = Impinger Number from the Unspiked Train
SI# = Impinger Number from the Spiked Train
C = Carry-over from contaminated samples
B = Observed in the Field Blank at similar levels to the field run samples

ALS Environmental

COMPOSITE SPIKE RECOVERY DATA

Sample Name	Run 1	Run 2	Run 3	Run 1 Spiked	Run 2 Spiked	Run 3 Spiked	Blank Train
	Train A			Train B			
Client Container ID:	**36950 36951 36952**	**45856 45857 45858**	**47340 47341 47342**	**36953 36954 36955**	**45859 45860 45861**	**47337 47338 47339**	**47362 47363 47364**
ALS Sample ID	L1021465-1/2/3	L1021465-4/5/6	L1021465-7/8/9	L1021465-10/11/12	L1021465-13/14/15	L1021465-16/17/18	L1021465-22/23/24
Matrix	Impinger	Impinger	Impinger	Impinger	Impinger	Impinger	Impinger
Sampling Date	7-Jun-11	8-Jun-11	8-Jun-11	7-Jun-11	8-Jun-11	8-Jun-11	8-Jun-11
Date of Receipt	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11

VOC via Modified Method 18																					
	% Rec	**Qualifier**	**Data Source**	**% Rec**	**Qualifier**	**Data Source**	**% Rec**	**Qualifier**	**Data Source**	**% Rec**	**Qualifier**	**Data Source**	**% Rec**	**Qualifier**	**Data Source**	**% Rec**	**Qualifier**	**Data Source**	**% Rec**	**Qualifier**	**Data Source**
Labelled Analyte Recoveries																					
1,3-Butadiene-d6	77		UI1-4	51		UI1-4	27		UI1-4	59		SI1-4	26		SI1-4	39		SI1-4	100		SI1-2
Pentane-d12	96		UI1-4	114		UI1-4	61		UI1-4	73		SI1-4	57		SI1-4	81		SI1-4	100		SI1-2
acrylonitrile-d3	113		UI1-4	129	INT	UI1-2 D	75	INT	UI1-2 D	70		SI1-4	153	INT	UI1-2 D	71	INT	UI1-2 D	100		SI1-2
MTBE-d12	90		UI1-4	97	INT	UI1-2 D	49	INT	UI1-2 D	71		SI1-4	95	INT	UI1-2 D	63	INT	UI1-2 D	100		SI1-2
n-Hexane-d14	75		UI1-4	111	INT	UI1-2 D	43	INT	UI1-2 D	64		SI1-4	77	INT	UI1-2 D	73	INT	UI1-2 D	100		SI1-2
2,2,4-Trimethylpentane-d18	80		UI1-4	102		UI1-4	79		UI1-4	82		SI1-4	72		SI1-4	81		SI1-4	100		SI1-2
Benzene-d6	78		UI1-4	100		UI1-4	85		UI1-4	83		SI1-4	84		SI1-4	88		SI1-4	100		SI1-2
2-Nitropropane-d6	119		UI1-4	103		UI1-4	85		UI1-4	84		SI1-4	85		SI1-4	97		SI1-4	100		SI1-2
1.2-Dibromoethane-d4	87		UI1-4	95		UI1-4	83		UI1-4	80		SI1-4	82		SI1-4	82		SI1-4	100		SI1-2
Ethylbenzene-d10	74		UI1-4	102		UI1-4	89		UI1-4	84		SI1-4	81		SI1-4	94		SI1-4	100		SI1-2
Styrene-d8	75		UI1-4	96		UI1-4	86		UI1-4	76		SI1-4	79		SI1-4	90		SI1-4	100		SI1-2
Nitrobenzene-d5	269		UI1-4	434		UI1-4	121		UI1-4	74		SI1-4	238		SI1-4	127		SI1-4	100		SI1-2
Native Analyte Recoveries																					
Acrolein	-			-			-			83		SI1-2	83	DIL	SI1-2	48	DIL	SI1-2	-		
Acetonitrile	-			-			-			63		SI1-4	96	DIL	SI1-2	63	DIL	SI1-2	-		
Trichloroethene	-			-			-			122		SI1-2	173	INT	SI1-2	131	INT	SI1-2	-		
Methyl iso-Butyl Ketone	-			-			-			90		SI1-2	85		SI1-2	79		SI1-4	-		
Toluene	-			-			-			114		SI1-2	139		SI1-2	116		SI1-2	-		

INT = Interference
UI# = Impinger Number from the Unspiked Train
SI# = Impinger Number from the Spiked Train
D = Dilution Run

C-265

ALS Environmental

Instrument Run Date: 29-Jun-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	Laboratory P&T Method Blank	36950 - RUN 1 - IMPS 1 & 2	36951 - RUN 1 - IMP 3	36952 - RUN 1 - IMP 4	45856 - RUN 2 - IMPS 1 & 2	45857 - RUN 2 - IMP 3	45858 - RUN 2 - IMP 4	47340 - RUN 3 - IMPS 1 & 2
ALS Sample ID	WG1304163-1;mblk	L1021465-1;Ext1	L1021465-2;Ext1	L1021465-3;Ext1	L1021465-4;Ext1	L1021465-5;Ext1	L1021465-6;Ext1	L1021465-7;Ext1
Instrument File #	2101010.D	2201011.D	2301012.D	2401013.D	2501014.D	2601015.D	2701016.D	2801017.D
Sample Volume (mL)	24	43	24	24	43	24	24	43
Dilution Factor	1	1	1	1	1	1	1	1
VOC via Modified Method 18								
	ug	**ug**	**ug**	**ug**	**ug**	**ug**	**ug**	**ug**
1,3-Butadiene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Pentane	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Acrolein	<2.4	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Acetone	2.7	83	36	39	n/a	n/a	n/a	n/a
Acetonitrile	<2.4	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Carbon Disulfide	<2.4	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Methylene Chloride	<2.4	<4.3	3.9	44	n/a	n/a	n/a	n/a
Acrylonitrile	<2.4	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Methyl t-Butyl Ether (MTBE)	<2.4	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Hexane	<2.4	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
2,2,4-Trimethylpentane	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Benzene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Trichloroethene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
2-Nitropropane	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Methyl iso-Butyl Ketone	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Toluene	<2.4	<4.3	5.5	<2.4	<4.3	<2.4	<2.4	<4.3
Tetrachloroethene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
1,2-Dibromoethane	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Chlorobenzene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Ethylbenzene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
m&p-Xylenes	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
o-Xylene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Styrene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Cumene (Isopropylbenzene)	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Nitrobenzene	<12	<21.5	<12	<12	<21.5	<12	<12	<21.5
Labelled Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,3-Butadiene-d6	0	57	18	2	46	0	5	10
Pentane-d12	0	79	16	2	102	1	12	30
acrylonitrile-d3	0	111	1	0	14	0	0	34
MTBE-d12	0	88	1	0	4	0	2	16
n-Hexane-d14	0	72	3	0	14	0	2	38
2,2,4-Trimethylpentane-d18	0	79	1	0	101	0	1	48
Benzene-d6	0	77	1	0	95	4	0	51
2-Nitropropane-d6	0	118	1	0	103	0	0	45
1.2-Dibromoethane-d4	0	86	1	0	95	0	0	47
Ethylbenzene-d10	1	71	1	1	101	1	1	53
Styrene-d8	0	74	1	0	95	0	0	51
Nitrobenzene-d5	0	260	7	2	422	10	2	53
Native Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
Acrolein	-	-	-	-	-	-	-	-
Acetonitrile	-	-	-	-	-	-	-	-
Trichloroethene	-	-	-	-	-	-	-	-
Methyl iso-Butyl Ketone	-	-	-	-	-	-	-	-
Toluene	-	-	-	-	-	-	-	-
P&T Surrogate Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,2,-Dichloroethane-d4	101	97	93	100	82	89	88	79
Toluene-d8	97	79	94	94	80	99	94	88
4-Fluorobenzene	103	103	115	115	104	105	105	120

* Carry-over from prior run
INT = Interference
UI# = Impinger Number from the Unspiked Train
SI# = Impinger Number from the Spiked Train

ALS Environmental

Instrument Run Date: 08-Jul-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	**45856 - RUN 2 - IMPS 1 & 2**	**47340 - RUN 3 - IMPS 1 & 2**	**36953 - RUN 1 - IMPS 1 & 2 - SPIKED TRAIN**	**45859 - RUN 2 - IMPS 1 & 2 - SPIKED TRAIN**	**47337 - RUN 3 - IMPS 1 & 2 - SPIKED TRAIN**
ALS Sample ID	L1021465-4;20xEXT1	L1021465-7;20xEXT1	L1021465-10;20xEXT1	L1021465-13;20xEXT1	L1021465-16;20xEXT1
Instrument File #	6201062.D	6401064.D	6601066.D	6801068.D	7001070.D
Sample Volume (mL)	43	43	43	43	43
Dilution Factor	20	20	20	20	20
VOC via Modified Method 18					
	ug	**ug**	**ug**	**ug**	**ug**
1,3-Butadiene	n/a	n/a	n/a	n/a	n/a
Pentane	<86	<86	<86	<86	<86
Acrolein	<250	<86	3920	6021	3506
Acetone	165	802	632	177	539
Acetonitrile	<86	<86	5132	7718	5056
Carbon Disulfide	<86	<86	<86	<86	<86
Methylene Chloride	n/a	n/a	n/a	n/a	n/a
Acrylonitrile	<86	<86	<86	<86	<86
Methyl t-Butyl Ether (MTBE)	<86	<86	<86	<86	<86
Hexane	<86	<86	<86	<86	<86
2,2,4-Trimethylpentane	<86	<86	<86	<86	<86
Benzene	<86	<86	<86	<86	<86
Trichloroethene	<86	<86	4229	5691	4241
2-Nitropropane	n/a	<86	n/a	<86	<86
Methyl iso-Butyl Ketone	<86	<86	4832	7254	4486
Toluene	<86	<86	2300	3238	2283
Tetrachloroethene	<86	<86	<86	<86	<86
1,2-Dibromoethane	<86	<86	<86	<86	<86
Chlorobenzene	<86	<86	<86	<86	<86
Ethylbenzene	<86	<86	<86	<86	<86
m&p-Xylenes	<86	<86	<86	<86	<86
o-Xylene	<86	<86	<86	<86	<86
Styrene	<86	<86	<86	<86	<86
Cumene (Isopropylbenzene)	<86	<86	<86	<86	<86
Nitrobenzene	<430	<430	<430	<430	<430
Labelled Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,3-Butadiene-d6	DIL	DIL	DIL	DIL	DIL
Pentane-d12	103	35	55	73	47
acrylonitrile-d3	129	75	95	153	104
MTBE-d12	97	49	95	95	71
n-Hexane-d14	111	43	54	77	63
2,2,4-Trimethylpentane-d18	115	46	63	87	73
Benzene-d6	126	67	92	136	100
2-Nitropropane-d6	DIL	70	DIL	169	109
1.2-Dibromoethane-d4	128	70	93	145	101
Ethylbenzene-d10	128	67	90	136	101
Styrene-d8	126	66	90	137	100
Nitrobenzene-d5	149	85	92	201	112
Native Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
Acrolein	3	-	54	83	48
Acetonitrile	-	-	64	96	63
Trichloroethene	-	-	112	150	112
Methyl iso-Butyl Ketone	-	-	95	143	88
Toluene	-	-	144	203	143
P&T Surrogate Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,2,-Dichloroethane-d4	100	110	110	105	107
Toluene-d8	100	102	104	103	105
4-Fluorobenzene	101	101	101	103	102

DIL = Dilution; Recovery not quantifiable

ALS Environmental

Instrument Run Date: 29-Jun-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	**47341 - RUN 3 - IMP 3**	**36953 - RUN 1 - IMPS 1 & 2 - SPIKED TRAIN**	**36954 - RUN 1 - IMP 3 - SPIKED TRAIN**	**36955 - RUN 1 - IMP 4 - SPIKED TRAIN**	**45859 - RUN 2 - IMPS 1 & 2 - SPIKED TRAIN**	**45860 - RUN 2 - IMP 3 - SPIKED TRAIN**	**45861 - RUN 2 - IMP 4 - SPIKED TRAIN**	**47337 - RUN 3 - IMPS 1 & 2 - SPIKED TRAIN**
ALS Sample ID	L1021465-8;Ext1	L1021465-10;Ext1	L1021465-11;Ext1	L1021465-12;Ext1	L1021465-13;Ext1	L1021465-14;Ext1	L1021465-15;Ext1	L1021465-16;Ext1
Instrument File #	2901018.D	3101020.D	3301022.D	3401023.D	3501024.D	3601025.D	3701026.D	3801027.D
Sample Volume (mL)	24	43	24	24	43	24	24	43
Dilution Factor	1	1	1	1	1	1	1	1
VOC via Modified Method 18								
	ug	**ug**	**ug**	**ug**	**ug**	**ug**	**ug**	**ug**
1,3-Butadiene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Pentane	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Acrolein	n/a	3854	874	168	n/a	n/a	n/a	n/a
Acetone	n/a	53	33	30	n/a	n/a	n/a	n/a
Acetonitrile	n/a	3163	654	136	n/a	n/a	n/a	n/a
Carbon Disulfide	n/a	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Methylene Chloride	n/a	893	116	67	n/a	n/a	n/a	n/a
Acrylonitrile	n/a	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Methyl t-Butyl Ether (MTBE)	n/a	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
Hexane	n/a	<4.3	<2.4	<2.4	n/a	n/a	n/a	n/a
2,2,4-Trimethylpentane	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Benzene	<2.4	<4.3	<2.4	<2.4	4.3	<2.4	<2.4	<4.3
Trichloroethene	<2.4	1905	615	133	2708	<2.4	<2.4	2057
2-Nitropropane	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Methyl iso-Butyl Ketone	<2.4	3090	789	138	2914	9	<2.4	2352
Toluene	<2.4	1033	341	71	1255	<2.4	<2.4	1045
Tetrachloroethene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
1,2-Dibromoethane	3.2	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	9
Chlorobenzene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Ethylbenzene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
m&p-Xylenes	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
o-Xylene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Styrene	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Cumene (Isopropylbenzene)	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3
Nitrobenzene	<12	<21.5	<12	<12	26.1 *	<12	<12	<21.5
Labelled Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,3-Butadiene-d6	8	40	14	5	26	0	0	16
Pentane-d12	20	51	17	6	55	0	1	39
acrylonitrile-d3	12	56	12	2	30	0	0	47
MTBE-d12	4	55	13	3	15	0	0	23
n-Hexane-d14	13	49	12	3	34	0	0	56
2,2,4-Trimethylpentane-d18	25	66	14	3	72	0	0	69
Benzene-d6	28	66	14	3	84	0	0	79
2-Nitropropane-d6	32	69	13	2	85	0	0	87
1.2-Dibromoethane-d4	28	64	14	3	82	0	0	75
Ethylbenzene-d10	27	65	15	4	80	1	1	84
Styrene-d8	27	58	15	3	78	0	0	81
Nitrobenzene-d5	48	65	7	3	225	9	3	104
Native Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
Acrolein	-	83	19	4	6	n/a	n/a	n/a
Acetonitrile	-	50	10	2	-	n/a	n/a	n/a
Trichloroethene	-	122	39	9	173	-	-	131
Methyl iso-Butyl Ketone	-	90	23	4	85	-	-	69
Toluene	-	114	38	8	139	-	-	116
P&T Surrogate Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,2,-Dichloroethane-d4	85	81	76	73	83	75	73	75
Toluene-d8	83	88	93	90	88	89	97	80
4-Fluorobenzene	108	93	108	116	103	103	107	127

* Carry-over from prior run
INT = Interference
UI# = Impinger Number from the Unspiked Train
SI# = Impinger Number from the Spiked Train

ALS Environmental

Instrument Run Date: 29-Jun-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	47338 - RUN 3 - IMP 3 - SPIKED TRAIN	47359 - FIELD SPIKE - DEUTERATED	47360 - NATIVE SPIKE NATIVE & DEUTERATED	47361 - METHANOL BLANK	47339 - RUN 3 - IMP 4 - SPIKED TRAIN	47362 - BLANK TRAIN 1 - IMPS 1 & 2	47342 - RUN 3 - IMP 4	47363 - BLANK TRAIN 2 - IMP 3
ALS Sample ID	L1021465-17;Ext1	L1021465-19;Ext1	L1021465-20;Ext1	L1021465-21;Ext1	L1021465-18;RepExt1	L1021465-22;Ext1	L1021465-9;RepExt1	L1021465-23;Ext1
Instrument File #	3901028.D	4101030.D	4201031.D	4401033.D	4601035.D	4701036.D	4801037.D	4901038.D
Sample Volume (mL)	24	24	24	24	24	43	24	24
Dilution Factor	1	1	1	1	1	1	1	1
VOC via Modified Method 18								
	ug	**ug**	**ug**	**ug**	**ug**	**ug**	**ug**	**ug**
1,3-Butadiene	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
Pentane	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
Acrolein	n/a	-	4657	<2.4	n/a	<4.3	47	<2.4
Acetone	n/a	-	53	22	n/a	51	7.3	24
Acetonitrile	n/a	-	6294	5.5	n/a	<4.3	<2.4	<2.4
Carbon Disulfide	n/a	-	<2.4	<2.4	n/a	<4.3	<2.4	<2.4
Methylene Chloride	n/a	-	185	239	n/a	1315	<2.4	483
Acrylonitrile	n/a	-	31.2 *	<2.4	n/a	<4.3	<2.4	<2.4
Methyl t-Butyl Ether (MTBE)	n/a	-	<2.4	<2.4	n/a	<4.3	<2.4	<2.4
Hexane	n/a	-	<2.4	<2.4	n/a	<4.3	<2.4	<2.4
2,2,4-Trimethylpentane	<2.4	-	2.9 *	<2.4	<2.4	<4.3	<2.4	<2.4
Benzene	3.0	-	4.6 *	<2.4	<2.4	<4.3	<2.4	<2.4
Trichloroethene	311	-	1564	<2.4	7.3	<4.3	<2.4	<2.4
2-Nitropropane	<2.4	-	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4
Methyl iso-Butyl Ketone	334	-	3428	3.1	6.9	<4.3	<2.4	<2.4
Toluene	193	-	904	<2.4	4.4	<4.3	<2.4	<2.4
Tetrachloroethene	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
1,2-Dibromoethane	<2.4	-	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4
Chlorobenzene	<2.4	-	3.1 *	<2.4	<2.4	<4.3	<2.4	<2.4
Ethylbenzene	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
m&p-Xylenes	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
o-Xylene	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
Styrene	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
Cumene (Isopropylbenzene)	<2.4	-	<2.4	<2.4	<2.4	<4.3	<2.4	<2.4
Nitrobenzene	<12	-	17.5 *	<12	<12	<21.5	<12	<12
Labelled Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,3-Butadiene-d6	14	93	107	0	8	100	8	0
Pentane-d12	32	92	89	0	9	100	11	0
acrylonitrile-d3	2	94	113	0	0	100	5	0
MTBE-d12	0	91	98	0	0	100	3	0
n-Hexane-d14	3	78	76	0	1	100	8	0
2,2,4-Trimethylpentane-d18	11	86	83	0	0	100	6	0
Benzene-d6	8	84	87	0	0	100	7	0
2-Nitropropane-d6	9	105	141	0	0	100	8	0
1.2-Dibromoethane-d4	7	95	87	0	0	100	8	0
Ethylbenzene-d10	9	85	77	1	1	100	9	1
Styrene-d8	9	88	81	0	0	100	8	0
Nitrobenzene-d5	20	286	522	3	3	100	20	2
Native Analyte Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
Acrolein	n/a	n/a	100	-	2	-	1	-
Acetonitrile	n/a	n/a	100	-	-	-	-	-
Trichloroethene	20	-	100	-	-	-	-	-
Methyl iso-Butyl Ketone	10	-	100	-	-	-	-	-
Toluene	21	-	100	-	-	-	-	-
P&T Surrogate Recoveries	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**	**% Rec**
1,2,-Dichloroethane-d4	81	78	84	78	70	81	66	80
Toluene-d8	105	70	74	91	89	73	85	84
4-Fluorobenzene	113	103	100	114	118	98	108	118

* Carry-over from prior run
INT = Interference
UI# = Impinger Number from the Unspiked Train
SI# = Impinger Number from the Spiked Train

ALS Environmental

Analyte Quantitation References

VOC via Modified Method 18 Target VOCs	Corresponding Purge & Trap Internal Standard[2.]	Corresponding Field Spike[1.]
1,3-Butadiene	Fluorobenzene	1,3-Butadiene-d6
Pentane	Fluorobenzene	Pentane-d12
Acrolein	Fluorobenzene	Benzene-d6
Acetone	Fluorobenzene	acrylonitrile-d3
Acetonitrile	Fluorobenzene	acrylonitrile-d3
Carbon Disulfide	Fluorobenzene	Benzene-d6
Methylene Chloride	Fluorobenzene	Benzene-d6
Acrylonitrile	Fluorobenzene	acrylonitrile-d3
Methyl t-Butyl Ether (MTBE)	Fluorobenzene	MTBE-d12
Hexane	Fluorobenzene	n-Hexane-d14
2,2,4-Trimethylpentane	Chlorobenzene-d5	2,2,4-Trimethylpentane-d18
Benzene	Chlorobenzene-d5	Benzene-d6
Trichloroethene	Chlorobenzene-d5	Benzene-d6
2-Nitropropane	Chlorobenzene-d5	2-Nitropropane-d6
Methyl iso-Butyl Ketone	Chlorobenzene-d5	Ethylbenzene-d10
Toluene	Chlorobenzene-d5	Ethylbenzene-d10
Tetrachloroethene	Chlorobenzene-d5	Ethylbenzene-d10
1,2-Dibromoethane	Chlorobenzene-d5	1.2-Dibromoethane-d4
Chlorobenzene	Chlorobenzene-d5	Ethylbenzene-d10
Ethylbenzene	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
m&p-Xylenes	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
o-Xylene	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
Styrene	1,4-Dichlorobenzene-d4	Styrene-d8
Cumene (Isopropylbenzene)	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
Nitrobenzene	1,4-Dichlorobenzene-d4	Nitrobenzene-d5
Labelled Field Standards[1.]		
1,3-Butadiene-d6	Fluorobenzene	-
Pentane-d12	Fluorobenzene	-
acrylonitrile-d3	Fluorobenzene	-
MTBE-d12	Fluorobenzene	-
n-Hexane-d14	Fluorobenzene	-
2,2,4-Trimethylpentane-d18	Chlorobenzene-d5	-
Benzene-d6	Chlorobenzene-d5	-
2-Nitropropane-d6	Chlorobenzene-d5	-
1.2-Dibromoethane-d4	Chlorobenzene-d5	-
Ethylbenzene-d10	1,4-Dichlorobenzene-d4	-
Styrene-d8	1,4-Dichlorobenzene-d4	-
Nitrobenzene-d5	1,4-Dichlorobenzene-d4	-
Purge & Trap Surrogate Standards[2.]		
1,2,-Dichloroethane-d4	Chlorobenzene-d5	-
Toluene-d8	Chlorobenzene-d5	-
4-Fluorobenzene	1,4-Dichlorobenzene-d4	-

All target analyte and surrogate data are reported corrected for the corresponding P&T internal standard responses.
Target analyte data including the native spike recoveries are reported uncorrected for corresponding labelled field spike recoveries.

[1.] Spiked into impinger 2 just prior to sampling in the field.
[2.] Spiked into the purge water just prior to instrumental analysis.

MW2 - Spiked

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6706

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	EP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEEL FLINTKOTE		
ARI Project Manager		ARI Sampler Initials
ALS		
Analysis Location (Wauconda or Pasadena)		
IAR - Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: MW2 - IAR	Analysis Request: Spiked Sample	Analysis Request	Analysis Request	Comments
7952	6-7-11	Run1 - Inf MW2 - Spiked	1	40ml	3	X				
7953	6-7-11	Run1 - Inf 3 - Spiked Trans	1	20ml	3	X				
7954	6-7-11	Run1 - Inf 4 - Spiked Trans	1	20ml	3	X				
7955	6-8-11	Run2 - Inf MW2 - Spiked	1	40ml	3	X				
7956	6-8-11	Run 2 - Inf 3 - Spiked Trans	1	20ml	3	X				
7957	6-8-11	Run 2 - Inf 4 - Spiked Trans	1	20ml	3	X				
7958	6-8-11	Run 3 - Inf MW2 - Spiked	1	40ml	3	X				
7959	6-9-11	Run 3 - Inf 3 - Spiked Trans	1	20ml	3	X				
7960	6-9-11	Run 3 - Inf 4 - Spiked Trans	1	20ml	3	X				

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time	(2) Date / Time	(3) Date / Time	HAND CARRY
	(1) Company	(2) Company	(3) Company	FEDX
				UPS
Requested Analysis Completion Date: 7-14-11	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering / Tier II: Compliance / Tier III: QAPP	(1) Date / Time	(2) Date / Time	(3) Date / Time	Yes / No
Route Results Through: STL Inc. (ALS)	(1) Company ARI	(2) Company ARI	(3) Company ALS	

Form LF0001

C-271

C-272

MIB - Unspiked

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6707

ARI ENVIRONMENTAL INC.
951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL INC.
1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP-Whiting	Whiting, IN
Lab Project No.	Client Name: STEVE FLAHERTY	Location: [illegible]
ARI Project Manager: ALS	ARI Sampler Initials	
Analysis Location (Wauconda or Pasadena): ICR - Compliance		
Engineering or Compliance Test Samples		

Preservation Code
1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: MIB-ICR	Analysis Request: See attached Method 18 list	Analysis Request	Analysis Request	Comments
[illegible]	6-7-11	Run 1 - Imp 1 & 2	1	40 ml	3	X				
[illegible]	6-7-11	Run 1 - Imp 3	1	20 ml	3	X				
[illegible]	6-7-11	Run 1 - Imp 4	1	20 ml	3	X				
[illegible]	6-8-11	Run 2 - Imp 1 & 2	1	40 ml	3	X				
[illegible]	6-8-11	Run 2 - Imp 3	1	20 ml	3	X				
[illegible]	6-8-11	Run 2 - Imp 4	1	20 ml	3	X				
[illegible]	6-8-11	Run 3 - Imp 1 & 2	1	40 ml	3	X				
[illegible]	6-8-11	Run 3 - Imp 3	1	20 ml	3	X				
[illegible]	6-8-11	Run 3 - Imp 4	1	20 ml	3	X				

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time: [illegible]	(2) Date / Time: [illegible]	(3) Date / Time: [illegible]	HAND CARRY
	(1) Company: ARI	(2) Company: ARI	(3) Company: ARI	FEDX
Requested Analysis Completion Date: 7-14-11	(1) Received By: [illegible]	(2) Received By: [illegible]	(3) Received By: [illegible]	UPS
Report Level: Engineering / Compliance / Tier III: QAPP	(1) Date / Time: [illegible] 14:40	(2) Date / Time: [illegible] 16:15	(3) Date / Time: [illegible] 08:45	Custody Seal Applied
Route Results Through: [illegible] (ARI)	(1) Company: ARI	(2) Company: ARI	(3) Company: ALS	Yes / No

Form LF0001

ALS Environmental
5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: ARI100
ALS WO#: L1022356
Date of Report 13-Jul-11
Date of Sample Receipt 22-Jun-11

Client Name: ARI Environmental Inc.
951 Old Rand Road, Unit 106
Wauconda,ILL 60084
USA
Client Contact: Dan Fitzgerald
Client Project ID: BP - Whiting FCCU 500

COMMENTS: **SVOC via SW846 Method 3542/8270D**

Method Summary:
The 0010 train samples were extracted by SW846 Method 3542. For each train, the front half solids and the XAD2 sorbent were extracted together in a single soxhlet. The extraction standards for 8270D and PAH analyses were spiked into the solids/sorbent media just prior to extraction. The condensates were extracted by B/N/A liquid/liquid extraction technique using separatory funnels and dichloromethane as the extracting solvent. The extract from the soxhlet and the condensates for each train were combined for each train and reduced to a 5mL final volume. A 1/2 portion was removed and concentrated to 1mL for analysis of PAHs via isotope dilution and selected ion monitoring GC/LRMS analysis. A portion of the remaining extract was removed for analysis of semi-volatile organics via SW846 method 8270D.

Certified by:
Ron McLeod, Ph.D.
General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.
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ALS Laboratory Group

Sample Analysis Summary Report

Sample Name	Method Blank		BLANK 31842/843/841		0010-1 36962/963/965/ 964/961/960		0010-2 36975/31824/318 26/		0010-3 31830/829/832/ 831/828/827		Target Recovery Acceptance Limits
ALS Sample ID	WG1303407-1		L1022356-4		L1022356-1		L1022356-2		L1022356-3		
Sample Size	1		1		1		1		1		
Sample units	sample		sample		sample		sample		sample		
Moisture Content	n/a		n/a		n/a		n/a		n/a		
Matrix	QC		Stack		Stack		Stack		Stack		
Sampling Date	n/a		8-Jun-11		7-Jun-11		8-Jun-11		8-Jun-11		
Extraction Date	28-Jun-11		28-Jun-11		28-Jun-11		28-Jun-11		28-Jun-11		
Target Analytes	**ug/sample**		**ug/sample**		**ug/sample**		**ug/sample**		**ug/sample**		
Aniline	<1.85	U	<1.85	U	<1.85	U	<1.85	U	<1.85	U	
Phenol	<1.95	U	<1.95	U	9.85	M	8.65	M	7.8		
2-Methylphenol	<2.1	U	<2.1	U	<2.1	U	<2.1	U	<2.1	U	
4-Methylphenol&3-Methylphenol	<5.65	U	<5.65	U	<5.65	U	<5.65	U	<5.65	U	
o-Toluidine	<5	U	<5	U	<5	U	<5	U	<5	U	
Nitrobenzene	<1.95	U	<1.95	U	<1.95	U	<1.95	U	<1.95	U	
Isophorone	<2.25	U	<2.25	U	<2.25	U	<2.25	U	<2.25	U	
2,4-Dimethylphenol	<2.6	U	<2.6	U	<2.6	U	<2.6	U	<2.6	U	
Dibenzofuran	<2.3	U	<2.3	U	<2.3	U	<2.3	U	<2.3	U	
a,a-Dimethylphenethylamine	<12	U	<12	U	<12	U	<12	U	<12	U	
1,4-Phenylenediamine	<18	U	<18	U	<18	U	<18	U	<18	U	
Benzidine	<38	U	<38	U	<38	U	<38	U	<38	U	
Dimethylaminobenzene	<2.0	U	<2.0	U	<2.0	U	<2.0	U	<2.0	U	
3,3'-Dimethylbenzidine	<29	U	<29	U	<29	U	<29	U	<29	U	
3,3'-Dimethoxybenzidine	<29	U	<29	U	<29	U	<29	U	<29	U	
Extraction Standards	**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**
2-Fluorophenol	48		46		56		53		49		25-121
d5-Phenol	46		43		50		49		46		24-113
d5-Nitrobenzene	71		64		70		71		67		23-120
2-Fluorobiphenyl	70		61		71		68		64		30-115
2,4,6-Tribromophenol	48		44		66		60		55		19-122

U Indicates that this compound was not detected above the LOD.
M Indicates that a peak has been manually integrated.
R Indicates ratio failure on confirming ion due to interference

A L S L a b o r a t o r y G r o u p

ICR Petroleum Sector LCS Data for 0010/3542/8270D on 8270D LCS Performance Compounds

Sample Name	Laboratory Control Sample (LCS) #3	Laboratory Control Sample (LCS) #1	Laboratory Control Sample (LCS) #2	Target Solids Recovery Acceptance Limits
ALS Sample ID	WG1301133-2	WG1303407-2	WG1309259-2	
Sample Size	1	1	1	
ALS WO#	**L1021357**	**L1022356**	**L1028521**	
Extraction Date	23-Jun-11	28-Jun-11	11-Jul-11	
Target Analytes	**% Recovery**	**% Recovery**	**% Recovery**	**% Recovery**
Phenol	56	61	81	26-90
2-Chlorophenol	53	62	53	25-102
1,4-Dichlorobenzene	52	61	52	n/a
N-Nitrosodi-n-propylamine	66	66	67	41-126
1,2,4-Trichlorobenzene	64	71	61	n/a
4-Chloro-3-methylphenol	71	62	67	26-103
2,4-Dinitrotoluene	71	70	62	28-89
4-Nitrophenol	66	47	67	11-114
Acenaphthene	52	57	50	31-137
Pentachlorophenol	57	19	7 *	17-109
Pyrene	53	59	54	35-142
Extraction Standards	**% Rec**	**% Rec**	**% Rec**	**% Rec**
2-Fluorophenol	26	47	42	25-121
d5-Phenol	39	43	40	24-113
d5-Nitrobenzene	65	74	68	23-120
2-Fluorobiphenyl	70	71	63	30-115
2,4,6-Tribromophenol	66	60	47	19-122

* A bias to low recoveries on non-acidied resin media is common for acidic compounds and is most commonly observed for the more acidic components such as PCP. Note that field 'run' samples do not often show this bias since these samples are usually acidied by the source stack gases.

Method 0010

1 of 2

C-276

ARI ENVIRONMENTAL INC.
951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6780

ARI ENVIRONMENTAL INC.
1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY: BP-Whiting | Whiting, IN

Lab Project No.: STEVE FLAHERTY | Client Name: | Location: SMF

ARI Project Manager: ALS | ARI Sampler Initials:

Analysis Location (Wauconda or Pasadena): ICR - Compliance

Engineering or Compliance Test Samples:

Preservation Code: 1 = Ambient Temp. 2 = 4°C (Ice Packs) 3 = Dry Ice 4 = Other (Noted)

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: SVOC (See Method Method 0010 list)	Analysis Request: Archive			Comments
36962	6-7-11	Run 1 - XAD Trap	1	Trap	2	X				
36975	6-8-11	Run 2 - XAD Trap	1	Trap	2	X				
31830	6-8-11	Run 3 - XAD Trap	1	Trap	2	X				
31842	6-8-11	M0010 - Blank Trap	1	Trap	2	X				
36963	6-7-11	Run 1 - Condensate	1	1L Amber	1	X				
31824	6-8-11	Run 2 - Condensate	1	1L	1	X				
31829	6-8-11	Run 3 - Condensate	1	1L	1	X				
36965	6-7-11	Run 1 - Imp Contents	1	500ml	1		X			Archive
31826	6-8-11	Run 2 - Imp Contents	1	500ml	1		X			Archive
31832	6-8-11	Run 3 - Imp Contents	1	500ml	1		X			Archive
36964	6-7-11	Run 1 - Condensible Rinses	1	500ml	1	X				
31825	6-8-11	Run 2 - Condensible Rinses	1	250ml	1	X				
31831	6-8-11	Run 3 - Condensible Rinses	1	250ml	1	X				
					SMF					
31843	6-8-11	50 MeCl / 50 MeOH	1	250ml	1	X				

Special Instructions / Comments

	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By
	[signature]	[signature]	[signature]
	(1) Date / Time: 6/10/11 [illegible]	(2) Date / Time: 6/20/11 16:[illegible]	(3) Date / Time: 06/21/11 20:35
	(1) Company: ARI	(2) Company: ARI	(3) Company: ARI
Requested Analysis Completion Date: 6-30-11	(1) Received By: [signature]	(2) Received By: [signature]	(3) Received By: Tom Kr[illegible]
Report Level: Tier I: Engineering; Tier II: Compliance; Tier III: QAPP	(1) Date / Time: 6/10/11 14:[illegible]	(2) Date / Time: 06/20/11 16:45	(3) Date / Time: June 21/11 8:45
Route Results Through: S. Flaherty (ARI)	(1) Company: ARI	(2) Company: ARI	(3) Company: ALS

SHIPMENT: HAND CARRY (circled) FEDX UPS

Custody Seal Applied: Yes (circled) No

Form LF0001

Method 0010

2 of 2

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6781

ARI ENVIRONMENTAL INC.
951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL INC.
1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY: BP-Whiting | Whiting, IN

Lab Project No.: STEVE FLAHERTY | Client Name: | Location: IMF

ARI Project Manager: ALS | ARI Sampler Initials:

Analysis Location (Wauconda or Pasadena): ICR - Compliance

Engineering or Compliance Test Samples

Preservation Code
1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: SVOC (See attached Method 0010 list)				Comments
36961	6-7-11	Run 1 - Probe Wash	1	250ml	1	X				
36976	6-8-11	Run 2 - Probe Wash	1	250ml	1	X				
31828	6-8-11	Run 3 - Probe Wash	1	250ml	1	X				
31841	6-8-11	Filter Blank	1	Petri	1	X				
36960	6-7-11	Run 1 - Filter	1	Petri	1	X				
36974	6-8-11	Run 2 - Filter	1	Petri	1	X				
31827	6-8-11	Run 3 - Filter	1	Petri	1	X				

Special Instructions / Comments

Requested Analysis Completion Date: 6-30-11

Report Level: Tier I: Engineering | Tier II: Compliance | Tier III: QAPP

Route Results Through: S. Flaherty (ARI)

	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By
	[signature]	[signature]	[signature]
	(1) Date / Time: 6/10/11 1911	(2) Date / Time: 6/10/11 1911	(3) Date / Time: 6/21/11 [illegible]
	(1) Company: ARI	(2) Company: ARI	(3) Company: ARI
	(1) Received By: [signature]	(2) Received By: [signature]	(3) Received By: [signature]
	(1) Date / Time: 6/15/11 11:44	(2) Date / Time: 6/20/11 16:45	(3) Date / Time: June 21/11 8:45
	(1) Company: ARI	(2) Company: ARI	(3) Company: ALS

SHIPMENT: HAND CARRY | FEDX | UPS

Custody Seal Applied: Yes | No

Form LF0001

C-277

ALS Environmental
5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: ARI100
ALS WO#: L1022356
Date of Report 13-Jul-11
Date of Sample Receipt 22-Jun-11

Client Name: ARI Environmental Inc.
951 Old Rand Road, Unit 106
Wauconda,ILL 60084
USA
Client Contact: Dan Fitzgerald
Client Project ID: BP - Whiting FCCU 500

COMMENTS: **PAH by CARB Method 429 (LR Option) - Isotope Dilution**

High laboratory control sample recovery on acenaphthalene (above the target control limit of 50-150%) indicates a potential for high bias on the sample data for this target analyte.

Method Summary:
The 0010 train samples were extracted by SW846 Method 3542. For each train, the front half solids and the XAD2 sorbent were extracted together in a single soxhlet. The extraction standards for 8270D and PAH analyses were spiked into the solids/sorbent media just prior to extraction. The condensates were extracted by B/N/A liquid/liquid extraction technique using separatory funnels and dichloromethane as the extracting solvent. The extract from the soxhlet and the condensates for each train were combined for each train and reduced to a 5mL final volume. A 1/2 portion was removed and concentrated to 1mL for analysis of PAHs via isotope dilution and selected ion monitoring GC/LRMS analysis. A portion of the remaining extract was removed for analysis of semi-volatile organics via SW846 method 8270D.

Certified by:

Ron McLeod, Ph.D.
General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.
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The test results herein meet all of the requirements of ISO 17025:2005 and NELAC (2003) standards unless stated otherwise in the comments above.

ALS Environmental

Sample Analysis Summary Report

Sample Name	Method Blank		BLANK 31842/843/841		0010-1 36962/963/965 /964/961/960		0010-2 36975/31824 /31826/3182 5/36976/369		0010-3 31830/829/8 32/831/828/ 827		Laboratory Control Sample
ALS Sample ID	WG1303407-1		L1022356-4		L1022356-1		L1022356-2		L1022356-3		WG1303407-2
Sample Size	1		1		1		1		1		1
Sample units	sample		sample		sample		sample		sample		n/a
Moisture Content	n/a		n/a		n/a		n/a		n/a		n/a
Matrix	QC		Stack		Stack		Stack		Stack		QC
Sampling Date	n/a		8-Jun-11		7-Jun-11		8-Jun-11		8-Jun-11		n/a
Extraction Date	28-Jun-11		28-Jun-11		28-Jun-11		28-Jun-11		28-Jun-11		28-Jun-11
Target Analytes	**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample**		**% Recovery**
Naphthalene	105		242		3180		1230		1390		101
2-Methylnaphthalene	6.12		28.2		8000		570		1990		NS
Acenaphthylene	<4	U	<4	U	84		40.5		20.6		183
Acenaphthene	<4	U	<4	U	179		19		45.1		113
Fluorene	<4	U	9.42		211		51.2		52		115
Phenanthrene	6.52		17		580		206		135		119
Anthracene	<4	U	<4	U	18.4		5.16		6.44		118
Fluoranthene	<4	U	<4	U	121		42.3		17.3		127
Pyrene	<4	U	4.2		134		37.1		19.2		97
Benzo(a)anthracene	<4	U	<4	U	<9.28	R	<4	U	<4	U	118
Chrysene	<4	U	<4	U	34.1		12.8		5.94		122
Benzo(b)flouranthene	<4	U	<4	U	<15.7	R	<5.1	R	<4	U	123
Benzo(k)fluoranthene	<4	U	<4	U	<10.1	R	<4	U	<4	U	122
Benzo(e)pyrene	<4	U	<4	U	<30.9	R	<4	U	<4	U	NS
Benzo(a)pyrene	<4	U	<4	U	<4	U	<4	U	<4	U	108
Perylene	<4	U	<4	U	<4	U	<4	U	<4	U	NS
Indeno(1,2,3-cd)pyrene	<4	U	<4	U	<8.96	R	<4	U	<4	U	105
Dibenzo(a,h/a,c)anthracene	<4	U	<4	U	<5.92	R	<4	U	<4	U	127
Benzo(g,h,i)perylene	<4	U	<4	U	<4	U	<4	U	<4	U	117
Additional Analytes	**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample**		**ng/sample ecovery**
2-Chloronaphthalene	<4	U	<4	U	<4	U	<4	U	<4	U	NS
Biphenyl	178		182		16900		2560		1460		NS
7,12-Dimethylbenzo(a)anthracene	<4	U	<4	U	<4	U	<4	U	<4	U	NS
3-Methylcholanthrene	<4	U	<4	U	<4	U	<4	U	<4	U	NS
Dibenzo(a,e)pyrene	<4	U	<4	U	<4	U	<4	U	<4	U	NS
Field Sampling Standards	**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**
d10-Fluorene	NS		103		114		104		103		NS
d14-Terphenyl	NS		112		111		113		110		NS
Extraction Standards	**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**		**% Rec**
d8-Naphthalene	86		79		52		81		82		87
d10-2-Methylnaphthalene	91		82		55		90		89		86
d8-Acenaphthylene	105		94		64		104		100		99
d10-Phenanthrene	105		103		101		105		97		99
d10-Anthracene	108		107		104		109		98		100
d10-Fluoranthene	102		100		102		106		100		98
d12-Benzo(a)anthracene	97		95		136		136		127		95
d12-Chrysene	77		76		94		91		87		77
d12-Benzo(b)fluoranthene	101		99		126		127		117		104
d12-Benzo(k)fluoranthene	99		96		101		109		99		113
d12-Benzo(a)pyrene	94		91		124		126		114		103
d12-Perylene	104		83		120		121		109		114
d12-Indeno(1,2,3,c-d)pyrene	85		90		123		122		108		83
d14-Dibenz(a,h)anthracene	80		78		121		109		96		77
d12-Benzo(ghi)perylene	77		77		97		94		85		76

U	Indicates that this compound was not detected above the LOD.
NS	Indicates that this compound was not spiked
R	Indicates ratio failure on confirming ion due to interference
EMPC	Estimated maximum concentration due to interference

ALS Environmental
5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: ARI100
ALS WO#: L1023787
Date of Report 15-Jul-11
Date of Sample Receipt 22-Jun-11

Client Name: ARI Environmental Inc.
Client Address: 951 Old Rand Road
Unit 106
Wauconda, Il, 60084
Client Contact: Steve Flaherty
Client Project ID: BP - WHITING FCCU 500

COMMENTS:
Metals analysed via ICP-MS Method USEPA 6020A (MC 12-Jul-2011)
Sample Preparation via USEPA Method 29 (KC 12-Jul-2011)

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by:

Ron McLeod, Ph.D.
General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.
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ALS Environmental

Sample Analysis Summary Report

Sample Name		RUN 1 - METALS 47375/3186 1/47586/45 967	RUN 2 - METALS 47378/3187 1/47588/45 968	RUN 3 - METALS 47321/4773 5/47583/45 969	BLANK - METALS 45707/4564 1/45639/45 970
ALS Sample ID		L1023787-1	L1023787-2	L1023787-3	L1023787-4
Matrix		STACK	STACK	STACK	STACK
Analysis Type		Sample	Sample	Sample	Sample
Sampling Date		9-Jun-11	10-Jun-11	10-Jun-11	13-Jun-11
Date of Receipt		22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11
Multi-Metals via ICP-MS	**LOR**				
	ug	**ug**	**ug**	**ug**	**ug**
Front Half HF Fraction 1A					
Antimony	0.2	1.37	2.21	2.57	0.308
Arsenic	1	<	<	<	<
Beryllium	0.2	<	<	<	<
Cadmium	0.1	0.121	0.104	0.119	<
Chromium	1	10.5	16.9	15.7	2.22
Cobalt	0.2	0.540	1.06	0.914	<
Lead	0.5	12.9	11.6	9.76	<
Manganese	0.5	3.37	4.35	4.15	2.08
Nickel	0.2	12.5	20.1	17.2	1.12
Selenium	2	<	<	<	<
Back Half (HNO3 / H2O2) Fraction 2A					
Antimony	0.1	0.177	0.121	0.125	<
Arsenic	0.2	<	<	<	<
Beryllium	0.1	<	<	<	<
Cadmium	0.05	5.06	4.64	5.48	<
Chromium	0.15	3.14	2.21	1.75	0.568
Cobalt	0.1	2.31	1.21	0.658	<
Lead	0.05	7.37	5.20	8.60	0.230
Manganese	0.15	5.40	2.74	4.52	0.701
Nickel	0.1	3.29	5.55	3.57	0.605
Selenium	1	<	<	<	<

ALS Environmental

Sample QC Summary Report

Sample Name		LCB	LCS	LCS	LCSD	LCSD
ALS Sample ID		LCB	LCS	LCS	LCSD	LCSD
Matrix		STACK	STACK	STACK	STACK	STACK
Analysis Type		Blank	LCS	LCS	LCS	LCS
Sampling Date		n/a	n/a	n/a	n/a	n/a
Date of Receipt		n/a	n/a	n/a	n/a	n/a
Multi-Metals via ICP-MS	**LOR**					
	ug	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Front Half HF Fraction 1A						
Antimony	0.2	<	12.1	101	11.9	99
Arsenic	1	<	62.0	104	63.0	105
Beryllium	0.2	<	62.6	104	64.9	108
Cadmium	0.1	<	30.7	103	31.4	105
Chromium	1	<	64.9	108	64.8	108
Cobalt	0.2	<	62.2	104	62.8	105
Lead	0.5	<	64.2	108	65.3	109
Manganese	0.5	0.510	62.6	104	64.3	106
Nickel	0.2	<	60.5	103	62.6	106
Selenium	2	<	64.9	109	64.6	108
Back Half (HNO3 / H2O2) Fraction 2A						
Antimony	0.1	<	6.08	101	6.08	101
Arsenic	0.2	<	30.7	102	33.0	110
Beryllium	0.1	<	30.3	101	32.0	107
Cadmium	0.05	<	15.4	103	16.4	110
Chromium	0.15	<	30.9	102	33.3	111
Cobalt	0.1	<	30.8	103	32.2	107
Lead	0.05	<	30.8	103	32.7	109
Manganese	0.15	0.872	32.1	104	31.9	103
Nickel	0.1	<	30.6	102	32.3	107
Selenium	1	<	31.0	103	32.9	110

ALS Environmental

Sample QC Summary Report

Sample Name		RUN 1 - METALS 47375/3186 1/47586/45 967	RUN 1 - METALS 47375/3186 1/47586/45 967	RUN 1 - METALS 47375/3186 1/47586/45 967	RUN 1 - METALS 47375/3186 1/47586/45 967	RUN 1 - METALS 47375/3186 1/47586/45 967	RUN 1 - METALS 47375/3186 1/47586/45 967
ALS Sample ID		L1023787-1	L1023787-1	MS	MS	MSD	MSD
Matrix		STACK	STACK	STACK	STACK	STACK	STACK
Analysis Type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date		9-Jun-11	9-Jun-11	9-Jun-11	9-Jun-11	9-Jun-11	9-Jun-11
Date of Receipt		22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11
Multi-Metals via ICP-MS	**LOR ug**	**ug**	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Front Half HF Fraction 1A							
Antimony	0.2	1.37	1.42	26.4	104	27.0	107
Arsenic	1	<	<	118	98	118	98
Beryllium	0.2	<	<	125	104	129	107
Cadmium	0.1	0.121	0.120	61.1	102	62.7	104
Chromium	1	10.5	10.7	134	103	135	103
Cobalt	0.2	0.540	0.562	119	99	123	102
Lead	0.5	12.9	13.5	141	107	144	110
Manganese	0.5	3.37	4.06	122	99	123	99
Nickel	0.2	12.5	13.1	133	100	135	102
Selenium	2	<	<	121	101	121	102
Back Half (HNO3 / H2O2) Fraction 2A							
Antimony	0.1	0.177	0.193	12.6	104	12.4	102
Arsenic	0.2	<	<	60.6	101	59.0	98
Beryllium	0.1	<	<	60.4	101	62.2	104
Cadmium	0.05	5.06	5.40	36.9	106	35.7	102
Chromium	0.15	3.14	3.16	67.3	107	64.4	102
Cobalt	0.1	2.31	0.786	64.4	103	61.8	99
Lead	0.05	7.37	7.88	70.0	104	68.8	102
Manganese	0.15	5.40	5.62	66.8	102	64.1	98
Nickel	0.1	3.29	3.40	65.8	104	63.2	100
Selenium	1	<	<	60.8	101	57.7	95

Molhon 29

C-284

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6180

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP Whiting	Whiting, IN
Lab Project No.	Client Name	Location
Slug Flow		
ARI Project Manager	ARI Sampler Initials	
JLG		
Analysis Location (Wauconda or Pasadena)		
Wauconda		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request				Comments
97327	6/9/11	Run 1 Rep 1	1	poly	1	X				
97328	6/9/11	Run 1 Rep 2	1	poly	1	X				
97329	6/9/11	Run 1 Rep 3	1	poly	1	X				
97330	6/9/11	Run 1 Comp	1	poly	1	X				
97331	6/9/11	Run 2 Rep 1	1	poly	1	X				
97332	6/9/11	Run 2 Rep 2	1	poly	1	X				
97333	6/9/11	Run 2 Rep 3	1	poly	1	X				
97334	6/9/11	Run 2 Comp	1	poly	1	X				
97335	6/9/11	Run 3 Rep 1	1	poly	1	X				

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
Flow Rate	(1) Date / Time	(2) Date / Time	(3) Date / Time	HAND CARRY
Sample Temp	(1) Company	(2) Company ARI	(3) Company	FEDX
				UPS
Requested Analysis Completion Date:	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering Tier II: Compliance Tier III: QAPP	(1) Date / Time	(2) Date / Time 6/10/11 9:45P	(3) Date / Time	Yes No
Route Results Through:	(1) Company ARI	(2) Company ALS	(3) Company	

Form LF0001

ARI ENVIRONMENTAL INC.
951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6746

ARI ENVIRONMENTAL INC.
1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	RP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
[illegible]		[illegible]
ARI Project Manager		ARI Sampler Initials
[illegible]		
Analysis Location (Wauconda or Pasadena)		
ICR - [illegible]		
Engineering or Compliance Test Samples		

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: MIS - TCR	Analysis Request: See attached Method 13 list	Analysis Request	Analysis Request	Comments
47359	6-8-11	Field Spike - [illegible]	1	20ml	3	X				
47360	6-8-11	Dup Spike - [illegible]	1	20ml	3	X				
47361	6-8-11	Methanol Blank	1	20ml	3	X				
47362	6-8-11	Blank Train 1 - Imp 1 & 2	1	40ml	3	X				
47363	6-8-11	Blank Train 2 - Imp 2	1	20ml	3	X				
47364	6-8-11	Blank Train 3 - Imp 4	1	20ml	3	X				

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time [illegible]	(2) Date / Time [illegible]	(3) Date / Time [illegible]	HAND CARRY
	(1) Company ARI	(2) Company ARI	(3) Company ARI	FEDX
Requested Analysis Completion Date: 7-14-11	(1) Received By [illegible]	(2) Received By [illegible]	(3) Received By [illegible]	UPS
Report Level: Tier I: Engineering; Tier II: Compliance (ICR); Tier III: QAPP	(1) Date / Time 6-17-11 [illegible]	(2) Date / Time 06/20/11 [illegible]	(3) Date / Time Jun 24/11 8:45 P	Custody Seal Applied
Route Results Through: [illegible] (ARI)	(1) Company ARI	(2) Company ARI	(3) Company ALS	Yes No

Form LF0001

C-285

C-286

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6181

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP Whiting	Whiting IN
Lab Project No.	Client Name	Location
	Steve Flaherty	IN
ARI Project Manager		ARI Sampler Initials
Wauconda		
Analysis Location (Wauconda or Pasadena)		
I&R - Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: Method 29 Sb, As, Be, Cd, Cr, Co, Pb, Mn, Ni, Se				Comments
47586	4/9/11	M29 Filter -1	1	petri	1	X				
47587	4/10/11	M29 Filter -2	1	petri	1	X				
47588	4/10/11	M29 Filter -3	1	petri	1	X				
45459	4/13/11	M29 Filter Blank	1	petri	1	X				
45467	4/9/11	M29 PW -1	1	bottle	1	X				
45468	4/10/11	M29 PW -2	1	bottle	1	X				
45469	4/10/11	M29 PW -3	1	bottle	1	X				
45470	4/13/11	M29 Acetone Blank	1	bottle	1	X				

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time 4/14/11 11:49	(2) Date / Time	(3) Date / Time	HAND CARRY
	(1) Company ARI	(2) Company	(3) Company	(FEDX) UPS
Requested Analysis Completion Date: Normal	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering ~~Tier II: Compliance~~ Tier III: QAPP	(1) Date / Time	(2) Date / Time	(3) Date / Time	Yes No
Route Results Through: S. Flaherty	(1) Company	(2) Company	(3) Company	

Preservation Code: 1 = Ambient Temp. 2 = 4°C (Ice Packs) 3 = Dry Ice 4 = Other (Noted)

Form LF0001

ALS Environmental
5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Steve Kennedy
ALS Project ID: ARI100
ALS WO#: L1023790
Date of Report 22-Jul-11
Date of Sample Receipt 22-Jun-11

Client Name: ARI Environmental Inc.
Client Address: 951 Old Rand Rd. Unit 106
Wauconda, IL. 60084
847 487 1580
Client Contact: Eric Vogt
Client Project ID: BP-WHITING FCCU

COMMENTS:

Mercury Analysis via CVAA Method USEPA 7470A
Sample Preparation via USEPA Method 29
Sample Particulate Analysis via Gravimetric USEPA Method 5

Sample Preparation via ASTM D6784-02

MC1 21/07/11

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by:
Ron McLeod, Ph.D.
General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.
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ALS Environmental

Sample Analysis Summary Report

Sample Name		RUN 1 - 40703/47328/47325/47730/47731/47732/47733/47734	RUN 2 - 47597/47326/47327/47737/47738/47739/47740	RUN 3 - 47591/45908/45909/47745/47746/47747/47748	BLANK - 47750/47751/47756/47752/47753/47754/47755
ALS Sample ID		L1023790-1	L1023790-2	L1023790-3	L1023790-4
Matrix		STACK	STACK	STACK	STACK
Analysis Type		Sample	Sample	Sample	Sample
Sampling Date		13-Jun-11	13-Jun-11	14-Jun-11	14-Jun-11
Date of Receipt		22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11
PM via Gravimetric Analysis	**LOR**				
	mg	**mg**	**mg**	**mg**	**mg**
Acetone Particulate Matter	0.1	69.3	22.3	11.4	1.5
	g	**g**	**g**	**g**	**g**
Acetone Mass	0.1	98.7	100.4	94.2	100.7
Mercury via FIMS CVAA	**LOR**				
	ug	**ug**	**ug**	**ug**	**ug**
Analytical Fraction 1B	0.015	<	<	<	<
Analytical Fraction PROBE RINSE	0.050	<	0.0440	<	<
Analytical Fraction KCL	0.005	0.849	0.0726	0.246	<
Analytical Fraction 5%HNO3/ 10% H2O2	0.025	0.291	<	0.128	<
Analytical Fraction KMNO4	0.025	0.958	0.286	0.211	0.144
nalytical Fraction 10% HYDROXYLAMINE	0.025	-	-	-	<0.135
Analytical Fraction 10% HNO3	0.025	-	-	-	<

ALS Environmental

Sample QC Summary Report

Sample Name		LCB	LCS	LCS	LCSD	LCSD
ALS Sample ID		LCB	LCS	LCS	LCSD	LCSD
Matrix		STACK	STACK	STACK	STACK	STACK
Analysis Type		Blank	LCS	LCS	LCS	LCS
Sampling Date		n/a	n/a	n/a	n/a	n/a
Date of Receipt		n/a	n/a	n/a	n/a	n/a
Mercury via FIMS CVAA	**LOR**					
	ug	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Analytical Fraction 1B	0.02	0.0312	0.290	86	0.292	87
Analytical Fraction PROBE RINSE	0.050	<	0.0981	99	0.101	101
Analytical Fraction KCL	0.01	<	0.0937	94	0.0903	91
Analytical Fraction 5%HNO3/ 10% H2O2	0.03	<0.250	4.90	97	4.76	94
Analytical Fraction KMNO4	0.03	<	0.479	96	0.488	98

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ALS Environmental

Sample QC Summary Report

Sample Name		RUN 1 - 40703/47328/47325/47730/47731/47732/47733/47734	RUN 1 - 40703/47328/47325/47730/47731/47732/47733/47734	RUN 1 - 40703/47328/47325/47730/47731/47732/47733/47734	RUN 1 - 40703/47328/47325/47730/47731/47732/47733/47734	RUN 1 - 40703/47328/47325/47730/47731/47732/47733/47734	RUN 1 - 40703/47328/47325/47730/47731/47732/47733/47734
ALS Sample ID		L1023790-1	L1023790-1	MS	MS	MSD	MSD
Matrix		STACK	STACK	STACK	STACK	STACK	STACK
Analysis Type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date		13-Jun-11	13-Jun-11	13-Jun-11	13-Jun-11	13-Jun-11	13-Jun-11
Date of Receipt		22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11	22-Jun-11
Mercury via FIMS CVAA	**LOR**						
	ug	**ug**	**ug**	**ug**	**% Rec**	**ug**	**% Rec**
Analytical Fraction 1B	0.02	<	<	0.138	91	0.138	91
Analytical Fraction PROBE RINSE	0.050	<	<	0.0958	95	0.0927	92
Analytical Fraction KCL	0.01	0.849	0.853	1.83	78	1.83	78
Analytical Fraction 5%HNO3/ 10% H2O2	0.03	0.291	0.299	1.73	96	1.69	93
Analytical Fraction KMNO4	0.03	0.958	0.922	2.06	95	2.04	93

Ontario-Hydro (Hg)
D6784
1 of 2

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6775

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY		
	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FINERTY		IN
ARI Project Manager		ARI Sampler Initials
ALS		
Analysis Location (Wauconda or Pasadena)		
ICR - Compliance		
Engineering or Compliance Test Samples		

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: Ontario-Hydro (Hg) D6784	Comments
47730	6-13-11	Run 1 - KCl Imps (1 of 2)	1	100 amber	1	X	
47731	6-13-11	Run 1 - KCl Imps (2 of 2)	1	500 amber	1	X	
47737	6-13-11	Run 2 - KCl Imps (1 of 2)	1	1000 amber	1	X	
47738	6-13-11	Run 2 - KCl Imps (2 of 2)	1	1000 amber	1	X	
47745	6-14-11	Run 3 - KCl Imps (1 of 2)	1	1000 amber	1	X	
47746	6-14-11	Run 3 - KCl Imps (2 of 2)	1	1000 amber	1	X	
47733	6-13-11	Run 1 - KMnO4 Imps (1 of 2)	1	1000 amber	1	X	
47734	6-13-11	Run 1 - KMnO4 Imps (2 of 2)	1	1000 amber	1	X	
47740	6-13-11	Run 2 - KMnO4 Imps (1 of 1)	1	1000 amber	1	X	Sample No. 47740
47748	6-14-11	Run 3 - KMnO4 Imps (1 of 1)	1	1000 amber	1	X	
47732	6-13-11	Run 1 - Acetone Probe Wash (PW)	1	250 amber	1	X	
47736	6-13-11	Run 2 - Acetone PW	1	250 amber	1	X	
47742	6-14-11	Run 3 - Acetone PW	1	250 amber	1	X	
47750	6-14-11	BLANK - Filter	1	Petri	1	X	

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time 6/15/11 @ 17:30	(2) Date / Time 6/16/11 @ 08:45	(3) Date / Time 06/21/11 @ 08:45	HAND CARRY
	(1) Company ARI	(2) Company ARI	(3) Company ARI	FEDEX
Requested Analysis Completion Date: 7-11-11	(1) Received By	(2) Received By	(3) Received By	UPS
Report Level: Tier I: Engineering / Tier II: Compliance / Tier III: QAPP	(1) Date / Time 6/16/11 14:30	(2) Date / Time 06/20/11 10:45	(3) Date / Time 6/21/11 8:45	Custody Seal Applied
Route Results Through: C. Fleharty (ARI)	(1) Company ARI	(2) Company ARI	(3) Company ALS	Yes / No

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Form LF0001

Ontario Hydro (Hg)
SOP 6784

2 of 2

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6785

C-292

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	RP-Whitby	Whitby, ON
Lab Project No.	Client Name	Location
STEEL FLAMEKTY		
ARI Project Manager		ARI Sampler Initials
ALS		
Analysis Location (Wauconda or Pasadena)		
ICL - Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: Ontario Hydro (Hg) SOP 6784	Comments
47725	6-13-11	Run 1 - Nitric Rinse	1	Bottle	1	X	
47727	6-13-11	Run 2 - Nitric Rinse	1	Bottle	1	X	
45904	6-14-11	Run 3 - Nitric Rinse	1	Bottle	1	X	
47732	6-13-11	Run 1 - 5% HNO_3/10% H_2O_2 Imp	1	Bottle	1	X	
47739	6-13-11	Run 2 - 5% HNO_3/10% H_2O_2 Imp	1	Bottle	1	X	
47747	6-14-11	Run 3 - 5% HNO_3/10% H_2O_2 Imp	1	Bottle	1	X	
40703	6-13-11	Run 1 - Filter	1	Petri	1	X	
47597	6-13-11	Run 2 - Filter	1	Petri	1	X	
47591	6-14-11	Run 3 - Filter	1	Petri	1	X	
47754	6-14-11	BLANK - $KMnO_4$	1	Bottle	1	X	
47756	6-14-11	BLANK - 10% HNO_3	1	Bottle	1	X	
47751	6-14-11	BLANK - 0.1N HNO_3	1	Bottle	1	X	
47752	6-14-11	BLANK - 1N KCl	1	Bottle	1	X	
47755	6-14-11	BLANK - Hydroxylamine	1	Bottle	1	X	
47753	6-14-11	BLANK - 5% HNO_3/10% H_2O_2	1	Bottle	1	X	

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments

Requested Analysis Completion Date: 7-11-11

Report Level: Tier I: Engineering / Tier II: Compliance / Tier III: QAPP

Route Results Through: S. Fleharty (ARI)

	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By
	(1) Date / Time 6/17/11 @ 1350	(2) Date / Time 6/17/11 15:45	(3) Date / Time 06/21/11 10:35
	(1) Company ARI	(2) Company ARI	(3) Company ABI
	(1) Received By	(2) Received By	(3) Received By
	(1) Date / Time 6/17/11 17:30	(2) Date / Time 6/17/11 16:45	(3) Date / Time 6/21/11 8:45
	(1) Company ARI	(2) Company ARI	(3) Company ALS

SHIPMENT: HAND CARRY / FEDX / UPS

Custody Seal Applied: Yes / No

Form LF0001

ALS Environmental

5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: ARI100
ALS WO#: L1022728
Date of Report 5-Jul-11
Date of Sample Receipt 22-Jun-11

Client Name: ARI Environmental Inc.
Client Address: 951 Old Rand Rd. Unit 106
Wauconda, IL, 60084

Client Contact: Eric Vogt
Client Project ID: BP - Whiting FCCU 500

COMMENTS: **Hexavalent Chromium via SW846 Method 7199 on samples collected via 0061**

Samples were analyzed 1 to 2 days following the recommended hold times of 14 days.
Impact to data quality is anticpated to be minimal.

The field samples and the KOH blank were received at a strongly basic pH as determined via pH paper.

Certified by:

Ron McLeod, Ph.D.
General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.
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ALS Environmental

Sample Analysis Summary Report

Sample Name	31876 - RUN 1 - IMP CONTENTS	47736 - RUN 2 - IMP CONTENTS	47744 - RUN 3 - IMP CONTENTS	45704 BLANK - H2O	45705 BLANK - KOH	Laboratory Method Blank	Sample Matrix Spike	Laboratory Control Sample
ALS Sample ID	L1022728-1	L1022728-2	L1022728-3	L1022728-4	L1022728-5	WG1303767-1	L1022728-4MS	WG1303767-2
Matrix	QC	STACK	STACK	STACK	STACK	QC	QC	QC
Sampling Date	13-Jun-11	13-Jun-11	14-Jun-11	14-Jun-11	14-Jun-11	n/a	n/a	n/a
Analysis Date	29-Jun-11	29-Jun-11	29-Jun-11	29-Jun-11	29-Jun-11	29-Jun-11	29-Jun-11	29-Jun-11
Target Analytes	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
Cr (VI) via 7199	<15	<15	<15	<0.5	<20	<0.5	48.2	47.1
Cr (VI) via 7199 - Duplicate	<15	<15	<15	<0.5	<20	-	-	-
	ug/Sample	**ug/Sample**	**ug/Sample**	**ug/Sample**	**ug/Sample**	**ug/Sample**	**% Rec**	**% Rec**
Cr (VI) via 7199	<10	<10	<10	<0.2	<10	-	96	94
Cr (VI) via 7199 - Duplicate	<10	<10	<10	<0.2	<10	-	-	-
	mL	**mL**	**mL**	**mL**	**mL**	**mL**	**mL**	**mL**
Sample Volume Received	775	820	830	280	365	-	-	-

Hex Chrome
COC-1

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 61172

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY		
Lab Project No.	Client Name	Location
ARI Project Manager		ARI Sampler Initials
Analysis Location (Wauconda or Pasadena)		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request				Comments
61726	6-14-11	Run 1 - Inj Contents	1		1	X				
61727	6-14-11	Run 2 - Inj Contents	1		1	X				
61728	6-14-11	Run 3 - Inj Contents	1		1	X				
61730	6-14-11	BLANK - H_2O	1		1	X				
61731	6-14-11	BLANK - KOH	1		1	X				

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time	(2) Date / Time	(3) Date / Time	HAND CARRY
	(1) Company	(2) Company	(3) Company	FEDX
				UPS
Requested Analysis Completion Date:	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering / Tier II: Compliance / Tier III: QAPP	(1) Date / Time	(2) Date / Time	(3) Date / Time	Yes / No
Route Results Through:	(1) Company	(2) Company	(3) Company	

C-295

Form LF0001

ANALYTICAL PERSPECTIVES

20 July 2011

Steve Flaherty
ARI Environmental
951 N. Old Rand Rd., Unit 106
Wauconda, IL 60084

Ph.: 847-487-1580
Email: sflaherty@arienv.com

Subject: Certificate of Results

Dear Steve;

Attached to this narrative are the analytical results you requested on the sample submitted for the determination of the 17-2, 3, 7, 8-substituted polychlorinated dibenzo-*p*-dioxins and dibenzofurans and totals, and the 12 coplanar polychlorinated biphenyls. The insert below summarizes the relevant information pertaining to your project. In particular, QC annotations bring to your attention specific analytical observations and assessments made during the sample handling and data interpretation phases. Sample results relate only to the items tested.

Project Information Summary	When applicable, see QC Annotations for details
Client Project No.	BP-Whiting
AP Project No.	**A3305**
Analytical Protocol	WHO-2+ (Method 23 + HRPCB)
No. Samples Submitted	4
No. Samples Analyzed	4
No. Laboratory Method Blanks	1
No. BCS_3	1
No. Outstanding Samples	0
Date Received	23-Jun-2011
Condition Received	good
Temperature upon Receipt (C)	-1 (traps & filters); 23 (solvents)
Extraction within Holding Time	yes
Analysis within Holding Time	yes
Data meet QA/QC Requirements	yes
Exceptions	none
Analytical Difficulties	none

QC Annotations:

Please see Appendix A & B for data qualifier information.

Analytical Perspectives Certification IDs:

SOUTH CAROLINA	99054
ARKANSAS	88-0628
NEW JERSEY (NELAP)	NC005
FLORIDA (PRIMARY NELAP)	E87608
LOUISIANA	4024
NORTH CAROLINA	37783
WASHINGTON	C2027
TEXAS (NELAP)	T104704484-10-1
PENNSYLVANIA (NELAP)	68-01849

Analytical Perspectives remains committed to serving you in the most effective manner. Should you have any questions or need additional information and technical support, please do not hesitate to contact us. Thank you for choosing Analytical Perspectives as part of your analytical support team.

Sincerely,

Kimberly Mace, Ph.D.
Project Scientist

APPENDIX A: DATA QUALIFIERS / DATA ATTRIBUTES	
*	The reported concentration exceeds the calibration range (upper point of the calibration curve).[1]
>	Indicates high recoveries. Shown with the numeric value at the top of the range.[1]
B	The analyte is found in the method blank, at a level that is <=10x the sample concentration.
C	Two or more congeners co-elute. In EDDs C denotes the lowest IUPAC congener in a co-elution group and additional co-eluters for the group are shown with the number of the lowest IUPAC co-eluter.
E	The reported concentration exceeds the calibration range (upper point of the calibration curve).
EMPC	Represents an Estimated Maximum Possible Concentration. EMPC's arise in cases where the signal/noise ratio is not sufficient for peak identification (the determined ion-abundance ratio is outside the allowed theoretical range), where there is a co-eluting interference, or where a single ion is utilized for quantitation due to PFK interference.
ETH	Indicates the presence of a diphenyl ether that appears to interfere with the quantitation of a furan. The reported concentration is the maximum.
H/h	If the standard recovery is below the method or SOP specified value "H" is assigned. If the obtained value is less than half the specified value "h" is assigned.[1]
J	Indicates that an analyte has a concentration below the reporting limit (lowest point of the calibration curve).
ND	Indicates a non-detect.
NR	Indicates a value that is not reportable.
PR	Due to interference, the associated congener is poorly resolved.
QI	Indicates the presence of a quantitative interference.
Ra	The new ratio – [Ra] -- for 2,3,7,8-TCDD following the $^{37}Cl_4$-2,3,7,8-TCDD correction is shown between squared brackets in the DL column.[1]
SI	Denotes "Single Ion Mode" and is utilized for PCBs where the secondary ion trace has a significantly elevated noise level due to background PFK. Responses for such peaks are calculated using an EMPC approach based solely on the primary ion area(s) and may be considered estimates.[1]
U	The analyte was not detected. The estimated detection limit (EDL) may be reported for this analyte.
V	The labeled standard recovery was found to be outside of the method control limits.
X	Indicates results reported from reinjection, refractionation, or repeat analyses.
APPENDIX B: LAB ID IDENTIFIERS	
AR	Indicates use of the archived portion of the sample extract.
CU	Indicates a sample that required additional clean-up prior to MS injection/processing.
D	Indicates a dilution of the sample extract. The number that follows the "D" indicates the dilution factor.
DE	Indicates a dilution performed with the addition of ES (extraction standard) solution.
DUP	Designation for a duplicate sample.
MS	Designation for a matrix spike.
MSD	Designation for a matrix spike duplicate.
RJ	Indicates a reinjection of the sample extract.
S	Indicates a sample split. The number that follows the "S" indicates the split factor.

[1]Denotes data qualifiers/attributes whose use will be phased out over time

A3305 - TEQ
Project ID: BP-Whiting

Sample Summary Part 1 — ANALYTICAL PERSPECTIVES — **Method WHO-2**

Analyte	Method Blank	Blank	Run 1	Run 2	Run 3
	pg	pg	pg	pg	pg
2,3,7,8-TCDD	(2.3)	(1.77)	[10.5]	(2.33)	(1.97)
1,2,3,7,8-PeCDD	(2.51)	(2.14)	17.5	(2.53)	(2.54)
1,2,3,4,7,8-HxCDD	(2.18)	(2.02)	6.83	(2.5)	(1.83)
1,2,3,6,7,8-HxCDD	(2.16)	(1.95)	14.6	(2.67)	(1.9)
1,2,3,7,8,9-HxCDD	(2.35)	(2.14)	21	(2.71)	1.89
1,2,3,4,6,7,8-HpCDD	(3.02)	(2.19)	54.3	[4.65]	6.2
OCDD	(4.93)	(4.2)	67.3	24.3	24.9
2,3,7,8-TCDF	(1.65)	(1.53)	77.1	2.05	1.55
1,2,3,7,8-PeCDF	(1.55)	(1.47)	144	(2.19)	[1.88]
2,3,4,7,8-PeCDF	(1.55)	(1.44)	76.2	(2.02)	[1.72]
1,2,3,4,7,8-HxCDF	(1.33)	(0.972)	74.9	1.11	[2.37]
1,2,3,6,7,8-HxCDF	(1.34)	(0.958)	89.1	(1.25)	2.72
2,3,4,6,7,8-HxCDF	(1.24)	(0.835)	49.6	(1.16)	(0.945)
1,2,3,7,8,9-HxCDF	(1.64)	(1.13)	124	(1.51)	(1.21)
1,2,3,4,6,7,8-HpCDF	(1.3)	(1.24)	75.6	(2.27)	4.51
1,2,3,4,7,8,9-HpCDF	(2.12)	(1.9)	173	(3.3)	(2.21)
OCDF	(5.38)	(4.82)	156	(5.3)	3.72
ITEF TEQ (ND=0; EMPC=0)	0.00	0.00	103	0.34	0.752
ITEF TEQ (ND=0; EMPC=EMPC)	0.00	0.00	114	0.386	1.94
ITEF TEQ (ND=DL/2; EMPC=0)	2.94	2.43	105	3.33	3.09
ITEF TEQ (ND=DL/2; EMPC=EMPC)	2.94	2.43	114	3.36	3.87
ITEF TEQ (ND=DL; EMPC=EMPC)	5.87	4.85	114	6.34	5.79
PCB-77 33'44'-TeCB	[0.88]	6.39	520	72.2	89.5
PCB-81 344'5-TeCB	(0.547)	(0.544)	71.6	5.35	9.92
PCB-105 233'44'-PeCB	2.51	8.99	1080	149	215
PCB-114 2344'5-PeCB	(0.758)	(0.939)	[94.4]	15.1	[17.6]
PCB-118 23'44'5-PeCB	6.48	18.3	2980	432	604
PCB-123 2'344'5-PeCB	(0.685)	(0.928)	290	[42.4]	[63.2]
PCB-126 33'44'5-PeCB	(1.06)	(1.41)	69.9	4.8	[5.24]
PCB-156 233'44'5-HxCB	(0.726)	1.1	123	23	30.4
PCB-157 233'44'5'-HxCB	(0.793)	(0.662)	[36]	5.72	7.51
PCB-167 23'44'55'-HxCB	(0.581)	(0.466)	[108]	14.3	16.1
PCB-169 33'44'55'-HxCB	(1.11)	(0.929)	(18)	(1.44)	(2.75)
PCB-189 233'44'55'-HpCB	(1.51)	(1.44)	(56.8)	(3.85)	(3.66)
ITEF + WHO-2005					
PCDD/F + PCB TEQs (ND = 0)	0.00027	0.00149	110	0.848	0.79
PCDD/F + PCB TEQs (ND = DL / 2)	3.01	2.51	112	3.86	3.35
PCDD/F + PCB TEQs (ND = DL)	6.01	5.02	114	6.87	5.9
ITEF + WHO-1998					
PCDD/F + PCB TEQs (ND = 0)	0.000899	0.00391	111	0.908	0.863
PCDD/F + PCB TEQs (ND = DL / 2)	3	2.5	112	3.9	3.39
PCDD/F + PCB TEQs (ND = DL)	5.99	5	114	6.9	5.92
Checkcode	646-256-QCF	983-736-YHS	622-609-YFS	709-105-XLR	911-488-FBL
Lab ID	MB1_8794_W2_SDS-RJ2	A3305_8794_W2_001-RJ2	A3305_8794_W2_002-RJ2	A3305_8794_W2_003-RJ2	A3305_8794_W2_004-RJ2

( ) = DL
[ ] = EMPC

A3305 - DLs
Project ID: BP-Whiting

Sample Summary Part 5	ANALYTICAL PERSPECTIVES			Method WHO-2
Analyte	**Method Blank**	**Blank**	**Run 1**	**Run 2**	**Run 3**
	pg	pg	pg	pg	pg
2,3,7,8-TCDD	2.3	1.77	3.26	2.33	1.97
1,2,3,7,8-PeCDD	2.51	2.14	5.84	2.53	2.54
1,2,3,4,7,8-HxCDD	2.18	2.02	2.71	2.5	1.83
1,2,3,6,7,8-HxCDD	2.16	1.95	2.89	2.67	1.9
1,2,3,7,8,9-HxCDD	2.35	2.14	2.92	2.71	1.85
1,2,3,4,6,7,8-HpCDD	3.02	2.19	3.29	2.18	1.58
OCDD	4.93	4.2	5.43	4.6	2.95
2,3,7,8-TCDF	1.65	1.53	4.41	1.67	1.17
1,2,3,7,8-PeCDF	1.55	1.47	3.16	2.19	1.38
2,3,4,7,8-PeCDF	1.55	1.44	3.19	2.02	1.29
1,2,3,4,7,8-HxCDF	1.33	0.972	2.73	1.22	1.03
1,2,3,6,7,8-HxCDF	1.34	0.958	2.67	1.25	0.972
2,3,4,6,7,8-HxCDF	1.24	0.835	2.38	1.16	0.945
1,2,3,7,8,9-HxCDF	1.64	1.13	3.29	1.51	1.21
1,2,3,4,6,7,8-HpCDF	1.3	1.24	2.98	2.27	1.46
1,2,3,4,7,8,9-HpCDF	2.12	1.9	4.17	3.3	2.21
OCDF	5.38	4.82	5.66	5.3	3.23
Total TCDD	2.3	1.77	3.26	2.33	1.97
Total PeCDD	2.51	2.14	5.84	2.53	2.54
Total HxCDD	2.22	2.03	2.83	2.62	1.86
Total HpCDD	3.02	2.19	3.29	2.18	1.58
Total TCDF	1.65	1.53	4.41	1.67	1.17
Total PeCDF	1.55	1.45	3.18	2.1	1.34
Total HxCDF	1.38	0.966	2.74	1.28	1.03
Total HpCDF	1.67	1.53	3.52	2.73	1.79
PCB-77 33'44'-TeCB	0.558	0.608	9.69	1.3	3.02
PCB-81 344'5-TeCB	0.547	0.544	18.7	1.2	2.63
PCB-105 233'44'-PeCB	0.826	1.09	60.4	3.45	2.86
PCB-114 2344'5-PeCB	0.758	0.939	127	4.26	3.12
PCB-118 23'44'5-PeCB	0.678	0.889	122	3.46	2.82
PCB-123 2'344'5-PeCB	0.685	0.928	113	3.75	2.92
PCB-126 33'44'5-PeCB	1.06	1.41	24.5	2.51	3.61
PCB-156 233'44'5-HxCB	0.726	0.636	48.7	1.42	1.81
PCB-157 233'44'5'-HxCB	0.793	0.662	30.1	1.37	1.97
PCB-167 23'44'55'-HxCB	0.581	0.466	50	1.15	1.69
PCB-169 33'44'55'-HxCB	1.11	0.929	18	1.44	2.75
PCB-189 233'44'55'-HpCB	1.51	1.44	56.8	3.85	3.66
Checkcode	646-256-QCF	983-736-YHS	622-609-YFS	709-105-XLR	911-488-FBL
Lab ID	MB1_8794_W2_SDS-RJ2	A3305_8794_W2_001-RJ2	A3305_8794_W2_002-RJ2	A3305_8794_W2_003-RJ2	A3305_8794_W2_004-RJ2

A3305 - WHO-2005-TEQ

Project ID: BP-Whiting

Sample Summary Part 1

ANALYTICAL PERSPECTIVES

Method WHO-2

Analyte	Method Blank	Blank	Run 1	Run 2	Run 3
	pg	pg	pg	pg	pg
2,3,7,8-TCDD	(2.3)	(1.77)	[10.5]	(2.33)	(1.97)
1,2,3,7,8-PeCDD	(2.51)	(2.14)	17.5	(2.53)	(2.54)
1,2,3,4,7,8-HxCDD	(2.18)	(2.02)	6.83	(2.5)	(1.83)
1,2,3,6,7,8-HxCDD	(2.16)	(1.95)	14.6	(2.67)	(1.9)
1,2,3,7,8,9-HxCDD	(2.35)	(2.14)	21	(2.71)	1.89
1,2,3,4,6,7,8-HpCDD	(3.02)	(2.19)	54.3	[4.65]	6.2
OCDD	(4.93)	(4.2)	67.3	24.3	24.9
2,3,7,8-TCDF	(1.65)	(1.53)	77.1	2.05	1.55
1,2,3,7,8-PeCDF	(1.55)	(1.47)	144	(2.19)	[1.88]
2,3,4,7,8-PeCDF	(1.55)	(1.44)	76.2	(2.02)	[1.72]
1,2,3,4,7,8-HxCDF	(1.33)	(0.972)	74.9	1.11	[2.37]
1,2,3,6,7,8-HxCDF	(1.34)	(0.958)	89.1	(1.25)	2.72
2,3,4,6,7,8-HxCDF	(1.24)	(0.835)	49.6	(1.16)	(0.945)
1,2,3,7,8,9-HxCDF	(1.64)	(1.13)	124	(1.51)	(1.21)
1,2,3,4,6,7,8-HpCDF	(1.3)	(1.24)	75.6	(2.27)	4.51
1,2,3,4,7,8,9-HpCDF	(2.12)	(1.9)	173	(3.3)	(2.21)
OCDF	(5.38)	(4.82)	156	(5.3)	3.72
WHO-2005 TEQ (ND=0; EMPC=0)	**0**	**0**	**93.5**	**0.323**	**0.732**
WHO-2005 TEQ (ND=0; EMPC=EMPC)	**0**	**0**	**104**	**0.369**	**1.54**
WHO-2005 TEQ (ND=DL/2; EMPC=0)	**3.39**	**2.8**	**95.1**	**3.72**	**3.56**
WHO-2005 TEQ (ND=DL/2; EMPC=EMPC)	**3.39**	**2.8**	**104**	**3.75**	**4.1**
WHO-2005 TEQ (ND=DL; EMPC=EMPC)	**6.78**	**5.6**	**104**	**7.13**	**6.66**
Checkcode	646-256-QCF	983-736-YHS	622-609-YFS	709-105-XLR	911-488-FBL
Lab ID	MB1_8794_W2_SDS-RJ2	A3305_8794_W2_001-RJ2	A3305_8794_W2_002-RJ2	A3305_8794_W2_003-RJ2	A3305_8794_W2_004-RJ2

( ) = DL
[ ] = EMPC

A3305 - Totals

Project ID: BP-Whiting

Sample Summary Part 2

ANALYTICAL PERSPECTIVES

Method WHO-2

Analyte	Method Blank	Blank	Run 1	Run 2	Run 3
	pg	pg	pg	pg	pg
Totals					
TCDDs	14	0	184	0	13
PeCDDs	0	0	153	5.55	7.59
HxCDDs	0	0	108	6.67	19.1
HpCDDs	0	0	84.3	7.45	16.9
OCDD	0	0	67.3	24.3	24.9
TCDFs	0	0	2120	14.5	32.3
PeCDFs	0	0	860	0	5.37
HxCDFs	0	0	581	1.11	6.32
HpCDFs	0	0	325	0	4.51
OCDF	0	0	156	0	3.72
Total PCDD/Fs (ND=0; EMPC=0)	**14**	**0**	**4630**	**59.5**	**134**
Total PCDD/Fs (ND=0; EMPC=EMPC)	**14**	**12.1**	**4770**	**96.9**	**178**
Total PCDD/Fs (2378-X ND=DL; EMPC=EMPC)	**52.6**	**44.8**	**4770**	**129**	**191**
Total 2378s (ND=0; EMPC=0)	**0**	**0**	**1220**	**27.4**	**45.5**
Total 2378s (ND=0.5; EMPC=0)	**19.3**	**16.3**	**1220**	**44.4**	**53.6**
Total 2378s (ND=1; EMPC=0)	**38.6**	**32.7**	**1220**	**61.3**	**61.8**
Total 2378s (ND=0; EMPC=1)	**0**	**0**	**1230**	**32.1**	**51.4**
Total 2378s (ND=0.5; EMPC=1)	**19.3**	**16.3**	**1230**	**47.9**	**57.7**
Total 2378s (ND=1; EMPC=1)	**38.6**	**32.7**	**1230**	**63.8**	**64**
Checkcode	646-256-QCF	983-736-YHS	622-609-YFS	709-105-XLR	911-488-FBL
Lab ID	MB1_8794_W2_SDS-RJ2	A3305_8794_W2_001-RJ2	A3305_8794_W2_002-RJ2	A3305_8794_W2_003-RJ2	A3305_8794_W2_004-RJ2

( ) = DL
[ ] = EMPC

A3305 - Others
Project ID: BP-Whiting

Sample Summary Part 3

ANALYTICAL PERSPECTIVES

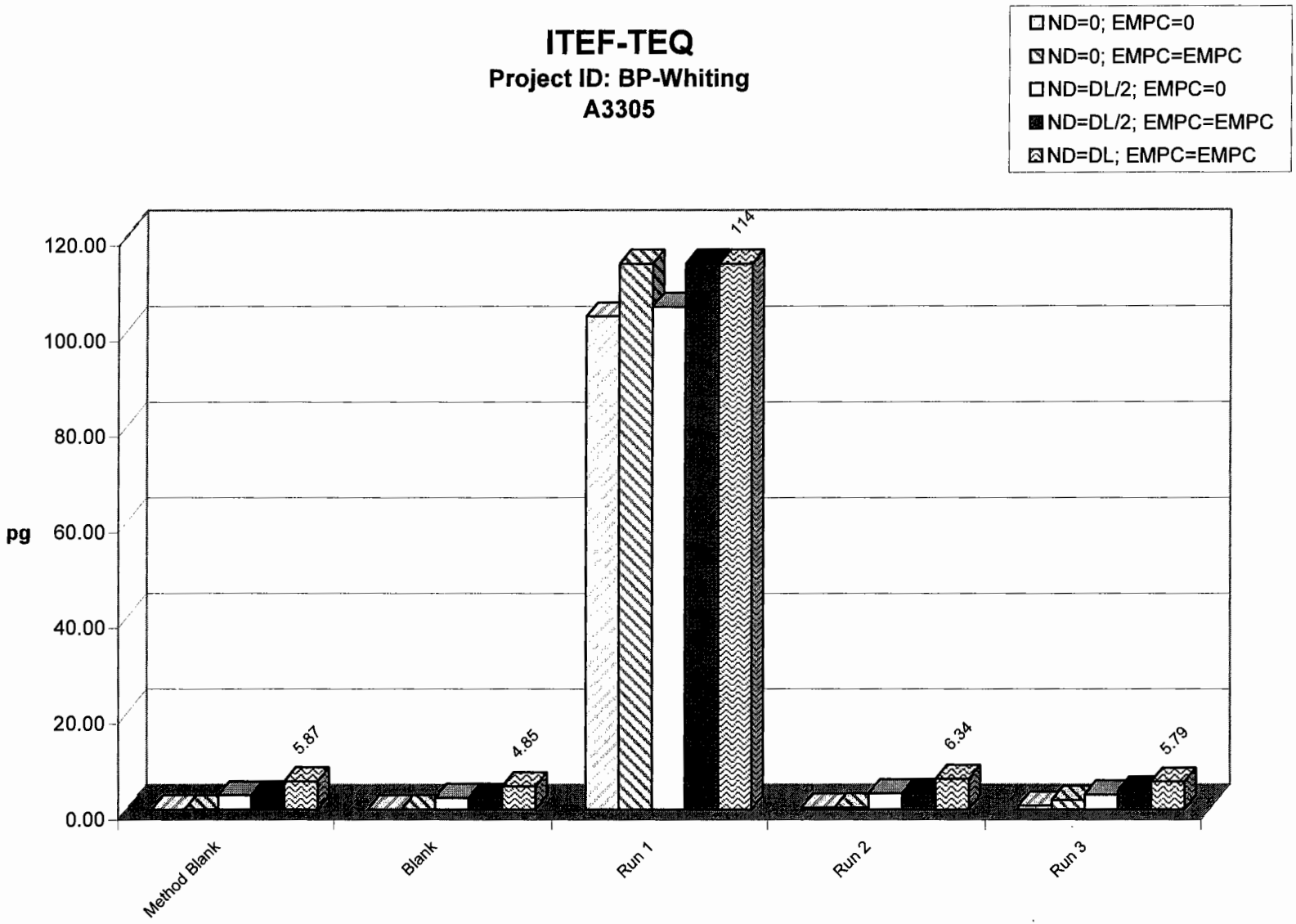
Method WHO-2

Analyte	Method Blank	Blank	Run 1	Run 2	Run 3
	pg	pg	pg	pg	pg
Other PCDD/Fs (ND=0, EMPC=0)					
Other TCDD	14	0	184	0	13
Other PeCDD	0	0	135	5.55	7.59
Other HxCDD	0	0	65.8	6.67	17.2
Other HpCDD	0	0	30	7.45	10.7
Other TCDF	0	0	2040	12.5	30.8
Other PeCDF	0	0	639	0	5.37
Other HxCDF	0	0	243	0	3.6
Other HpCDF	0	0	76.9	0	0
Other PCDD/Fs (ND=0, EMPC=EMPC)					
Other TCDD	14	12.1	245	12.4	17
Other PeCDD	0	0	135	9.59	13.4
Other HxCDD	0	0	73.4	6.67	17.2
Other HpCDD	0	0	30	7.45	10.7
Other TCDF	0	0	2040	22	48.4
Other PeCDF	0	0	687	4.33	14.3
Other HxCDF	0	0	255	2.4	5.97
Other HpCDF	0	0	76.9	0	0
Checkcode	646-256-QCF	983-736-YHS	622-609-YFS	709-105-XLR	911-488-FBL
Lab ID	MB1_8794_W2_SDS-RJ2	A3305_8794_W2_001-RJ2	A3305_8794_W2_002-RJ2	A3305_8794_W2_003-RJ2	A3305_8794_W2_004-RJ2

( ) = DL
[ ] = EMPC

ITEF-TEQ

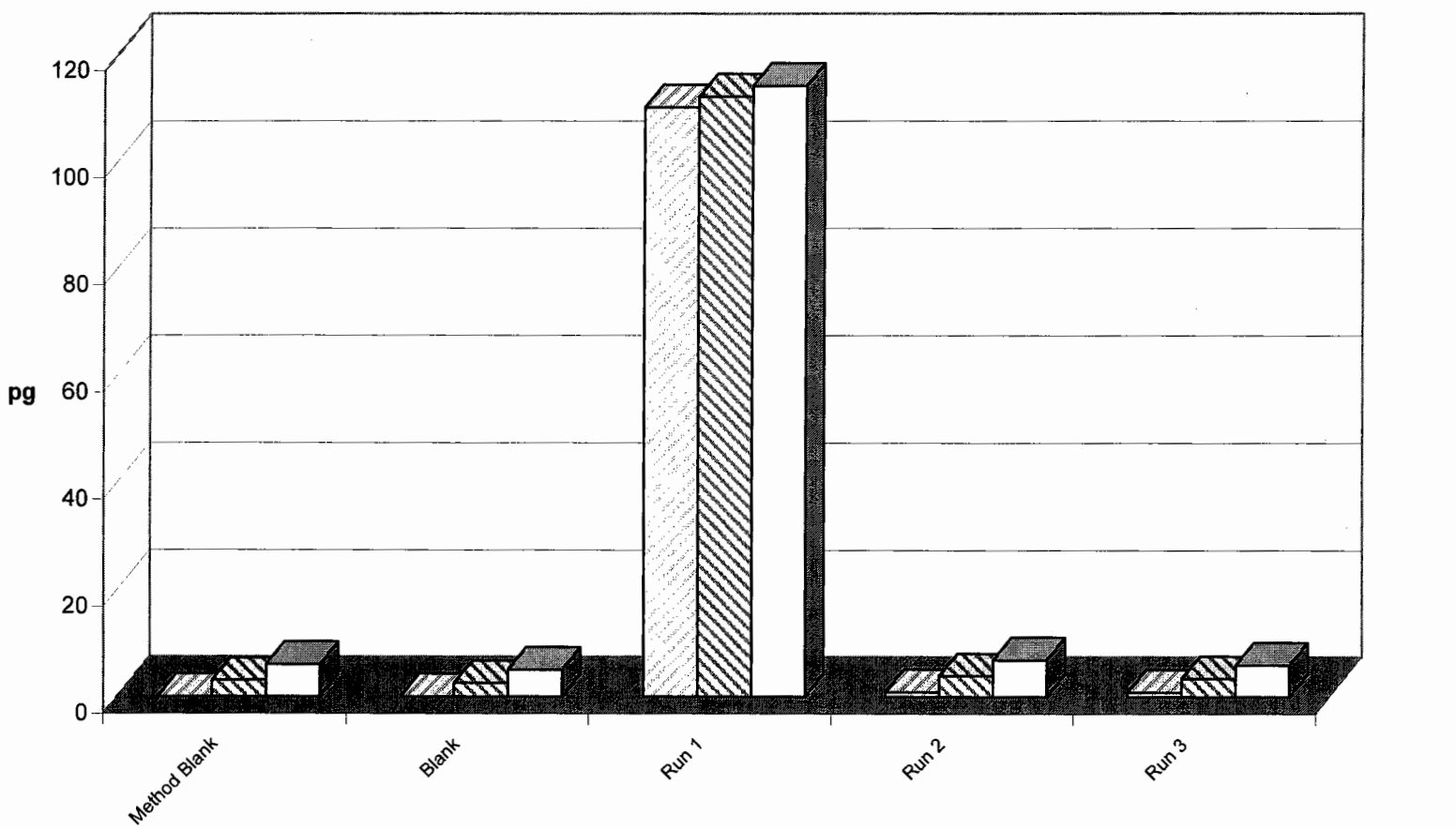
Project ID: BP-Whiting
A3305



ITEF + WHO-2005

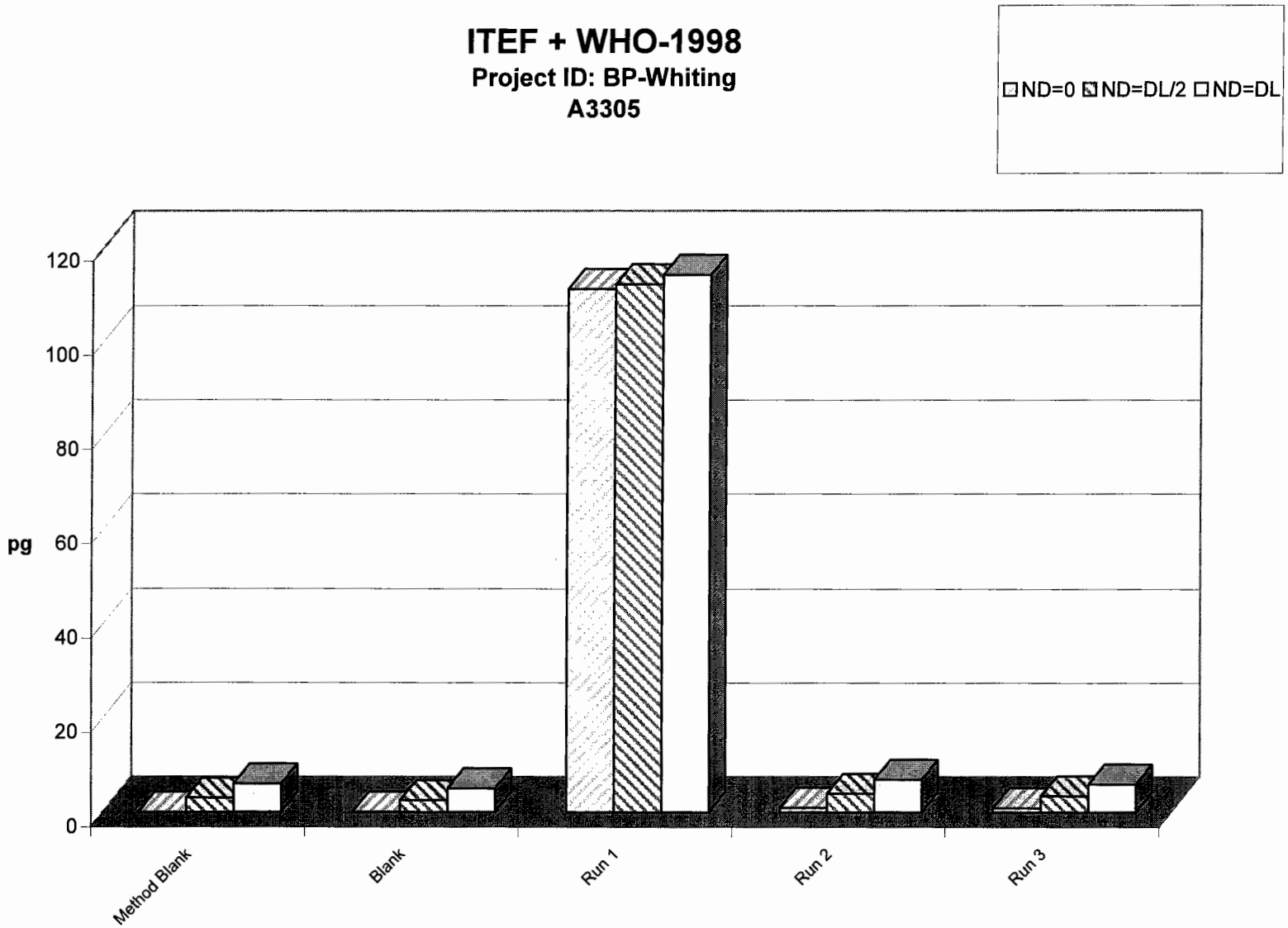
Project ID: BP-Whiting

A3305



ITEF + WHO-1998

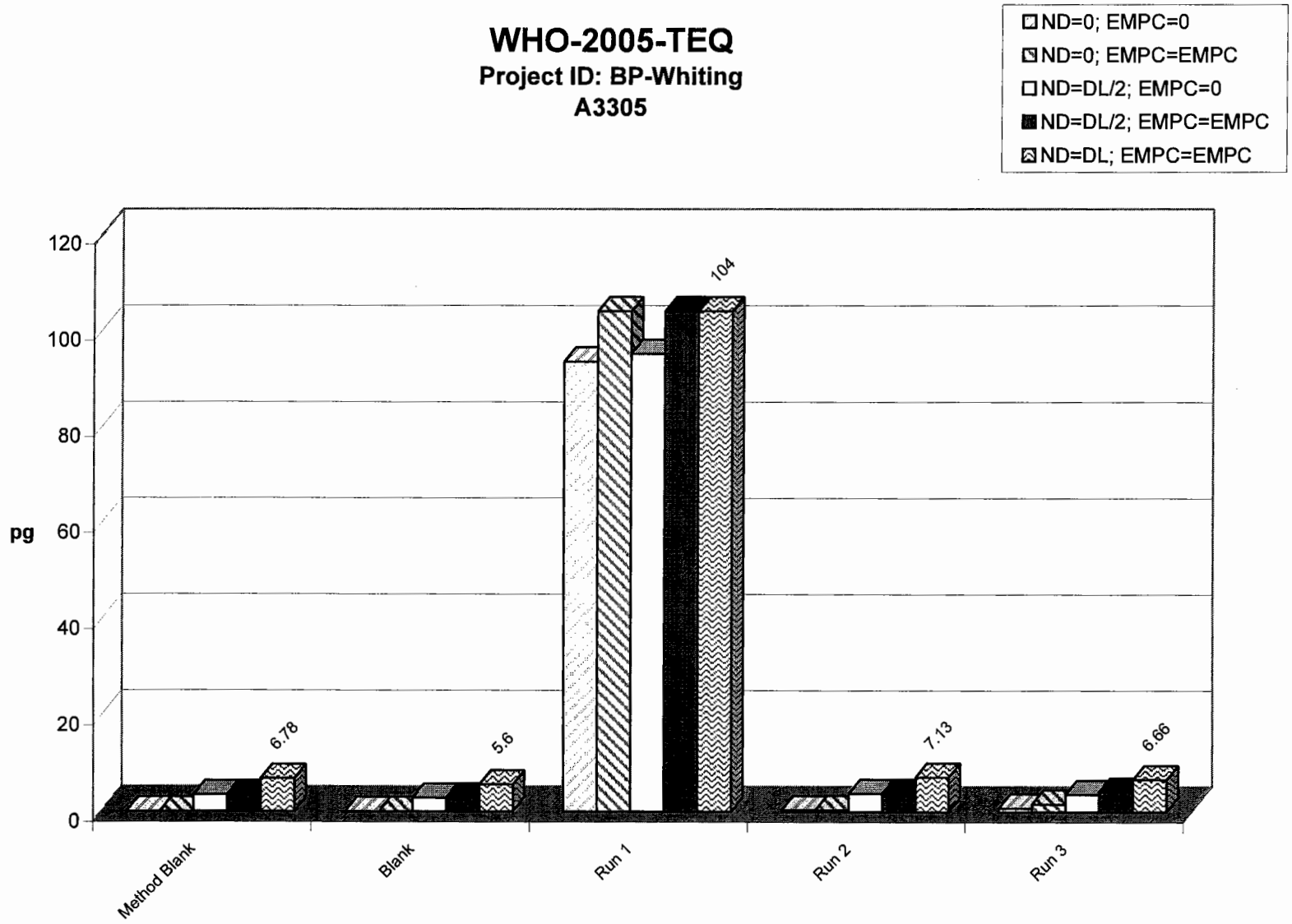
Project ID: BP-Whiting
A3305



WHO-2005-TEQ

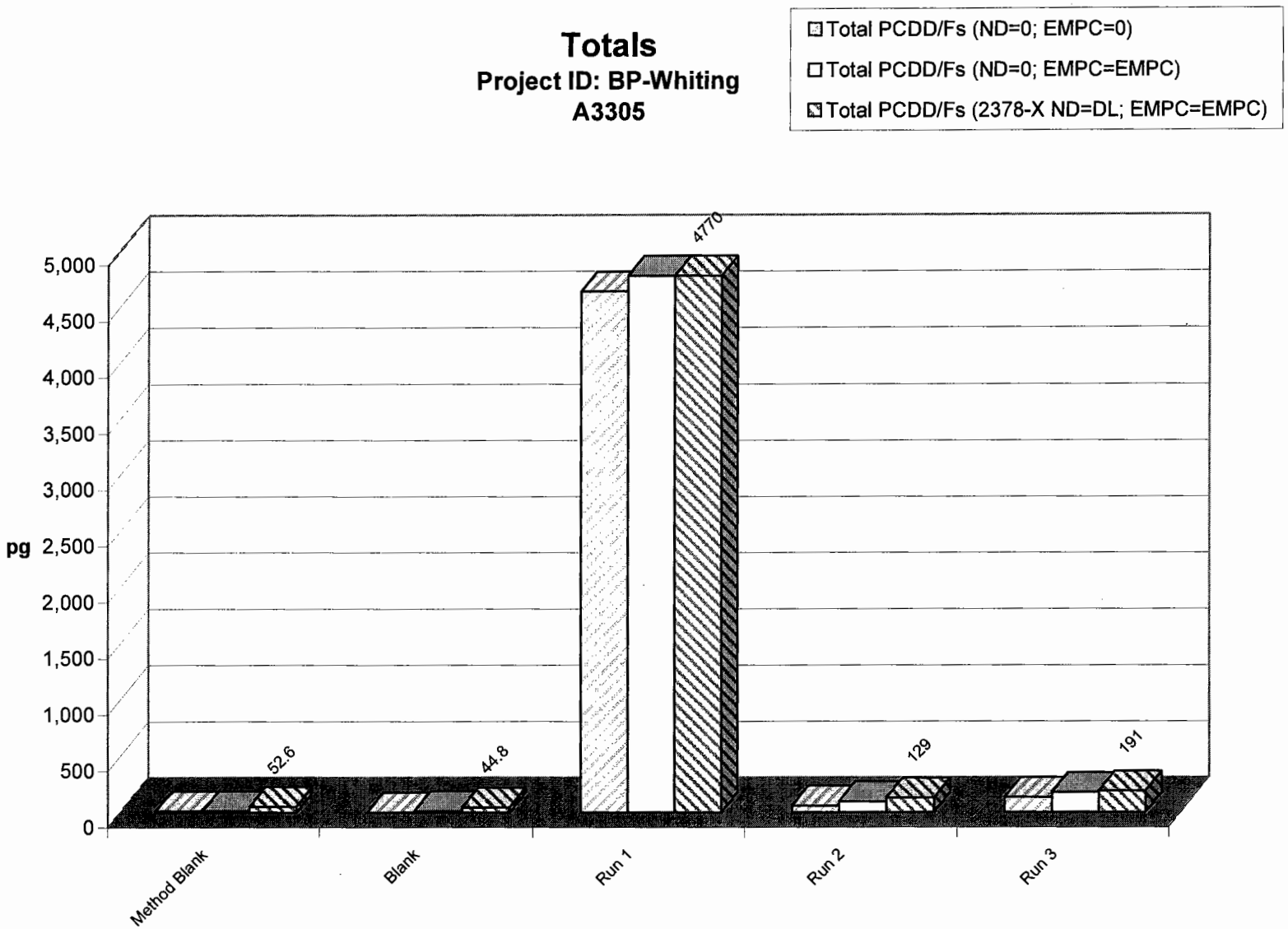
Project ID: BP-Whiting

A3305

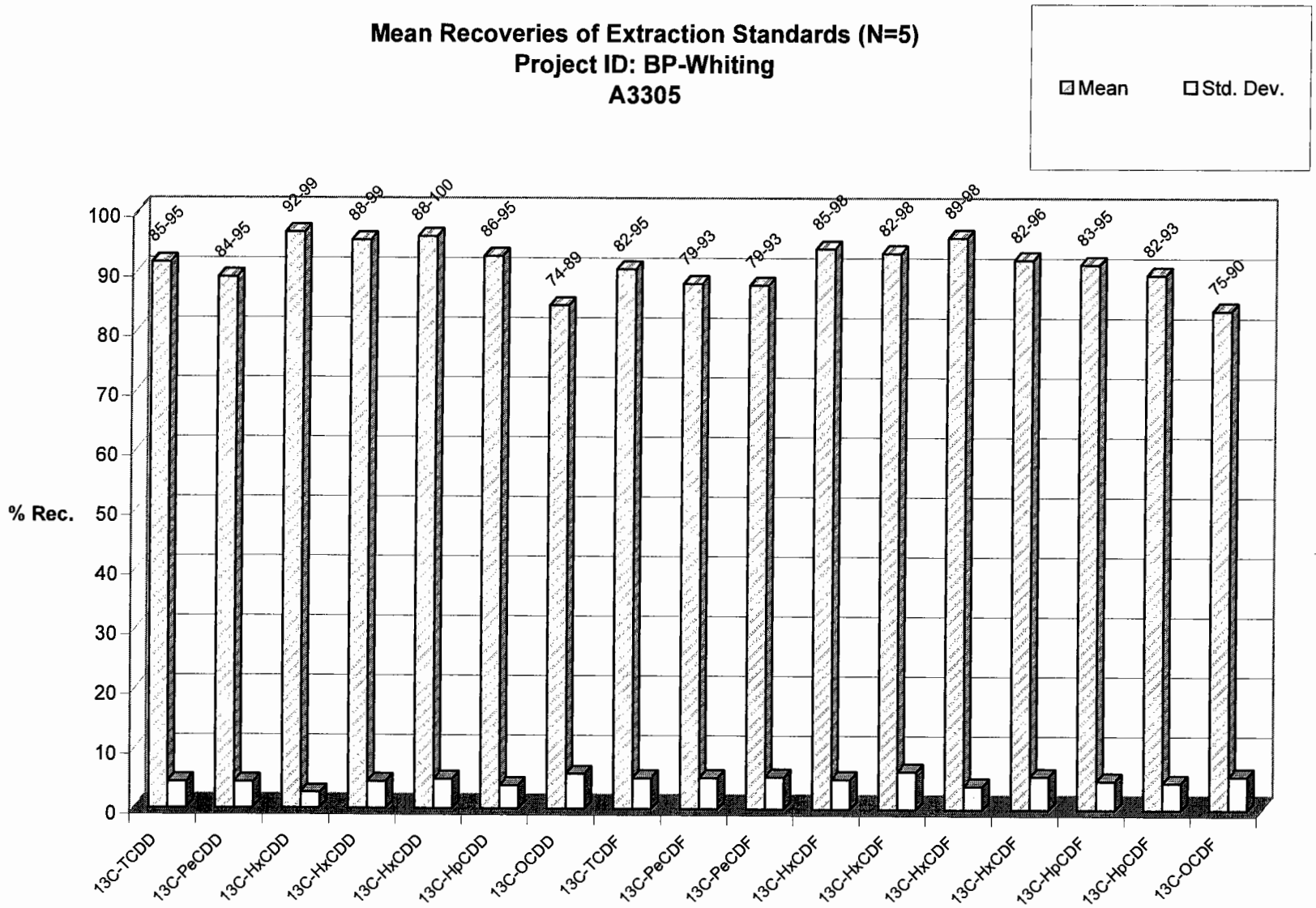


Totals

Project ID: BP-Whiting
A3305

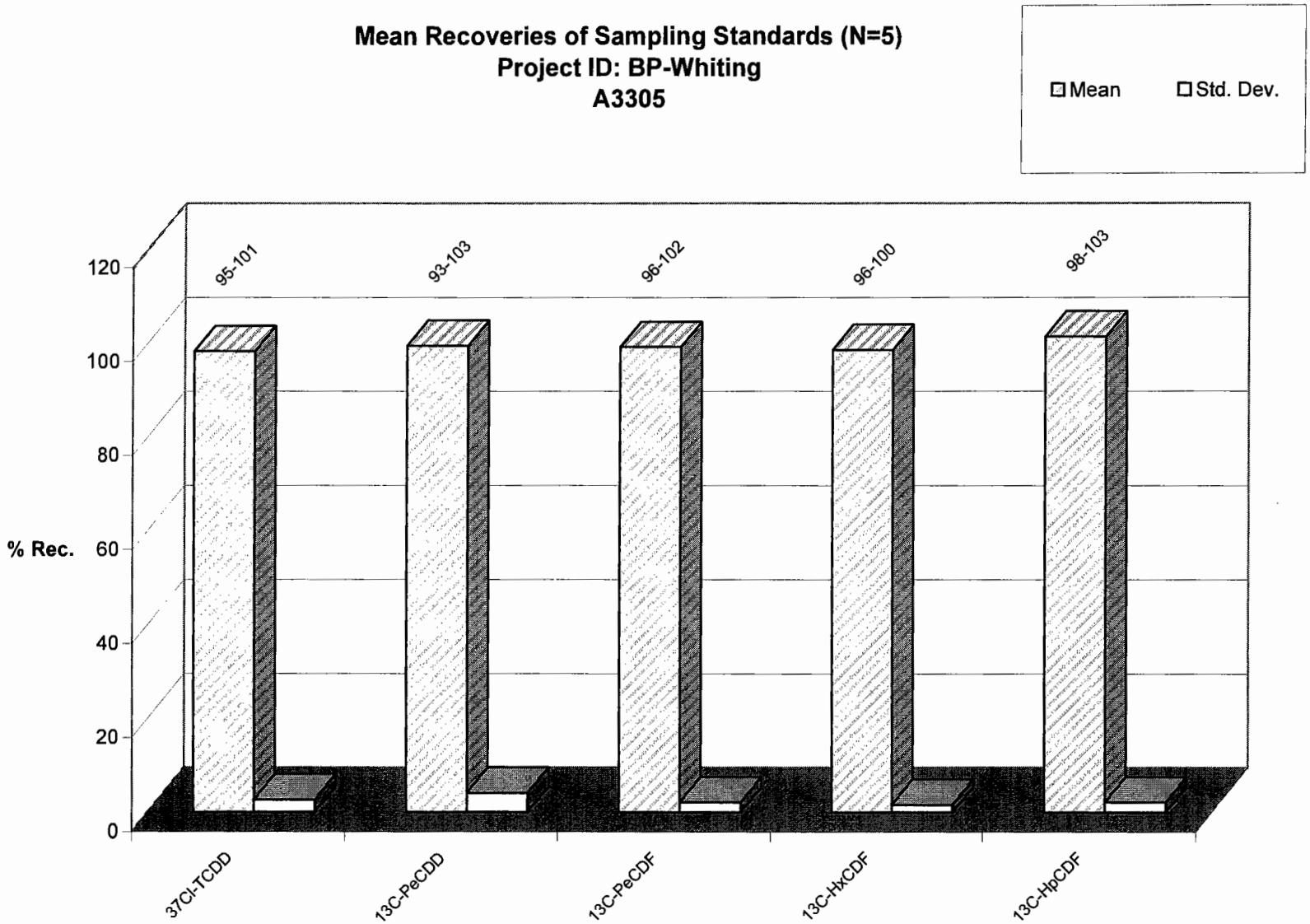


Mean Recoveries of Extraction Standards (N=5)
Project ID: BP-Whiting
A3305



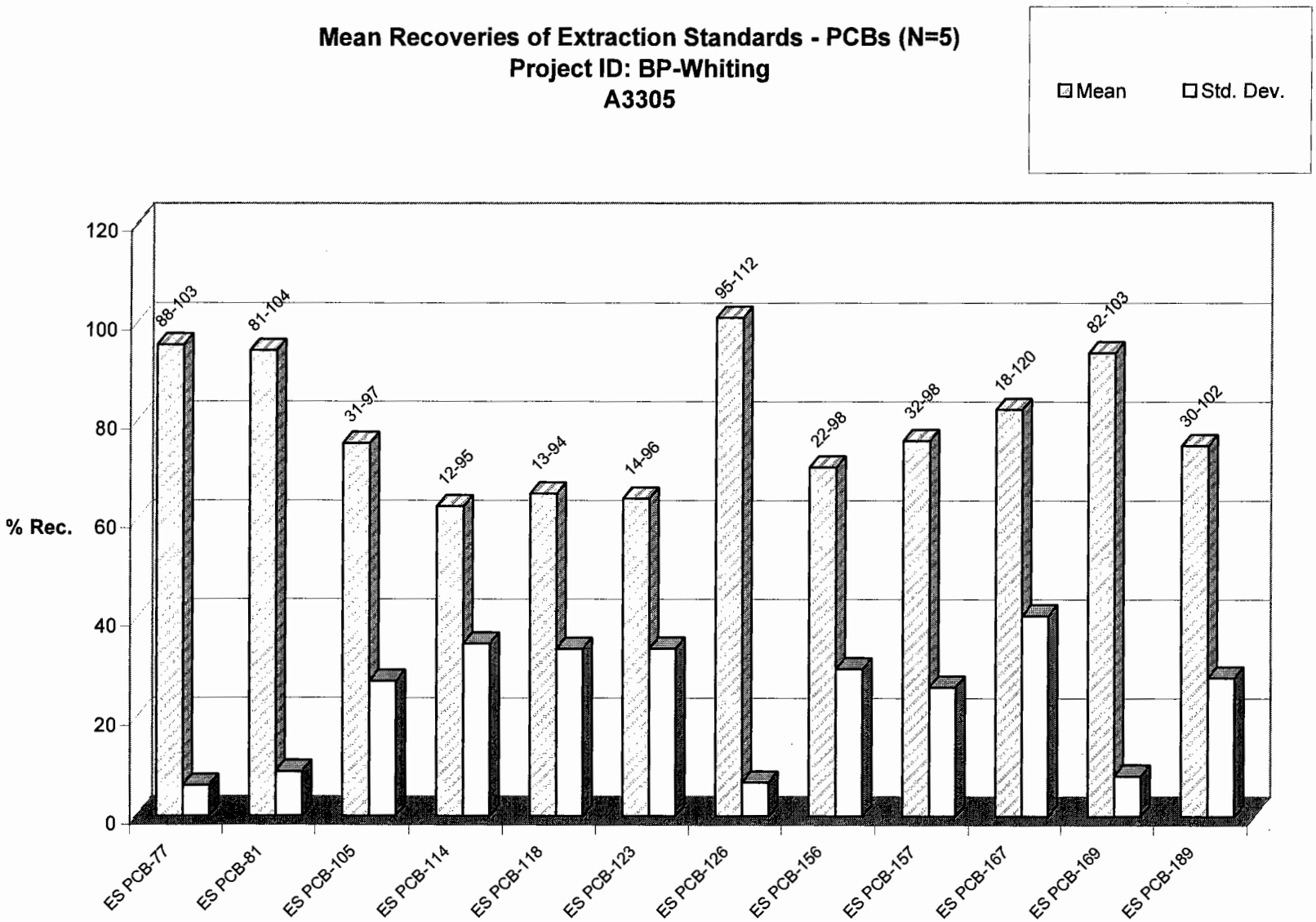
Method Specification Limits: Tetra-Hexa ES: 40-130%, Hepta-Octa ES: 25-130% (F = fail)

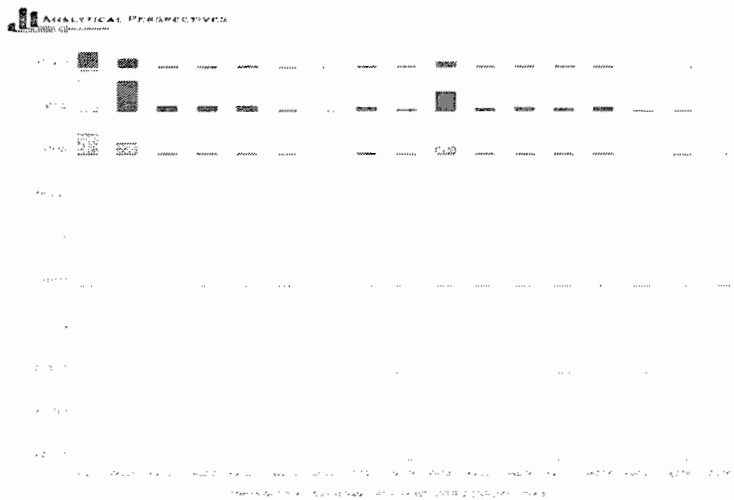
Mean Recoveries of Sampling Standards (N=5)
Project ID: BP-Whiting
A3305

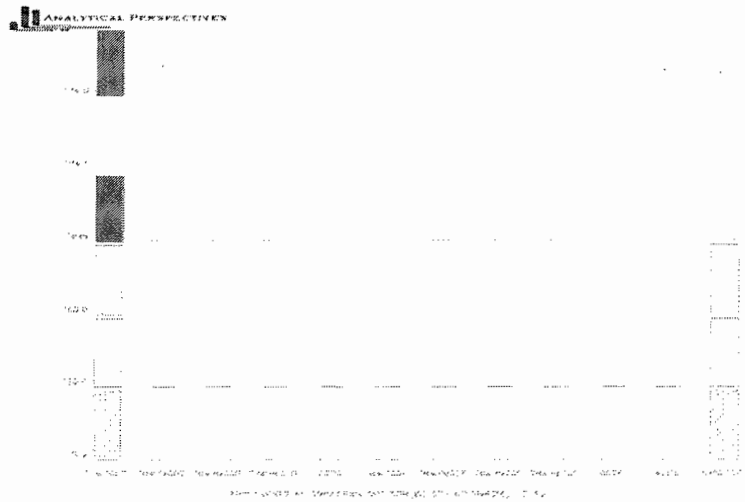


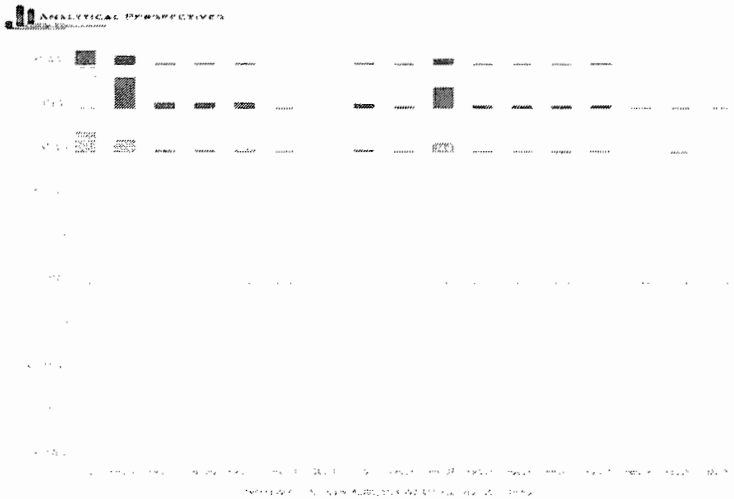
Method Specification Limits: Tetra-Octa SS: 70-130% (F = fail)

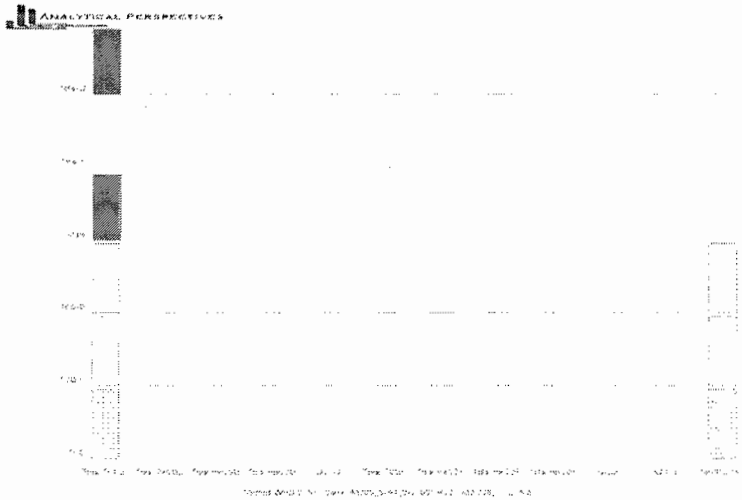
Mean Recoveries of Extraction Standards - PCBs (N=5)
Project ID: BP-Whiting
A3305

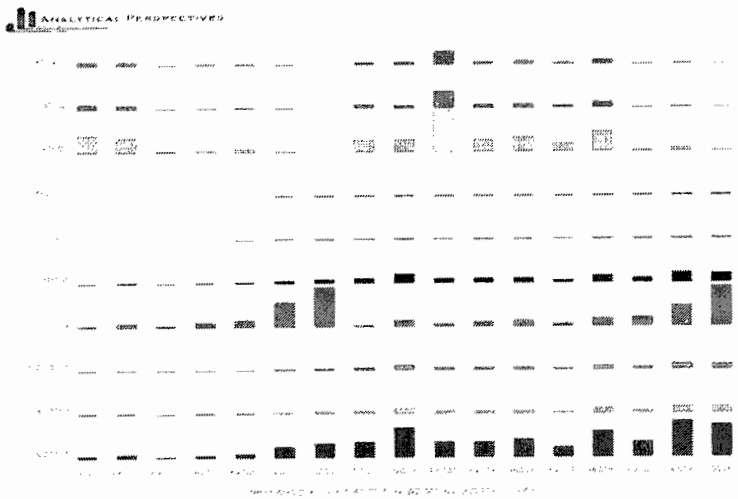


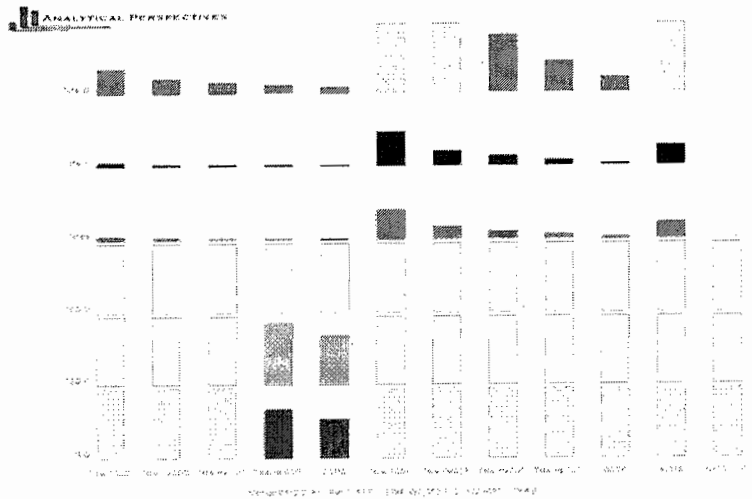

Analytical Perspectives

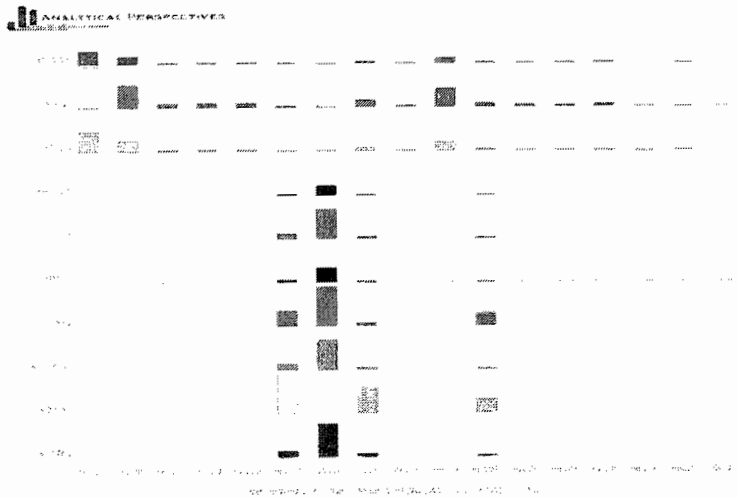

Analytical Perspectives

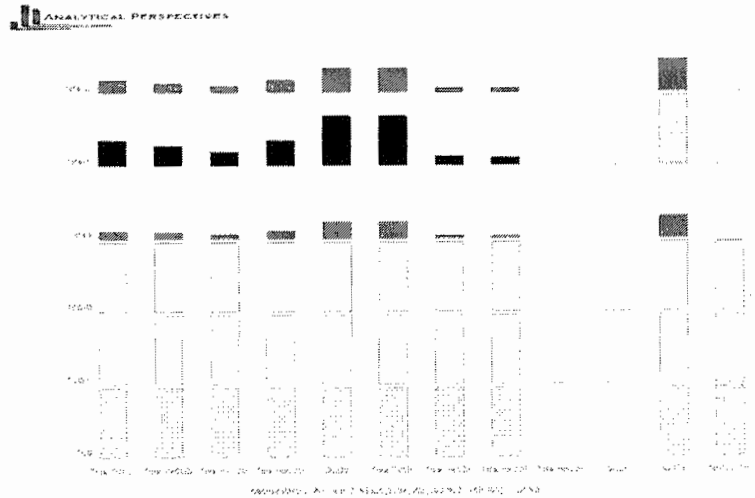

Analytical Perspectives

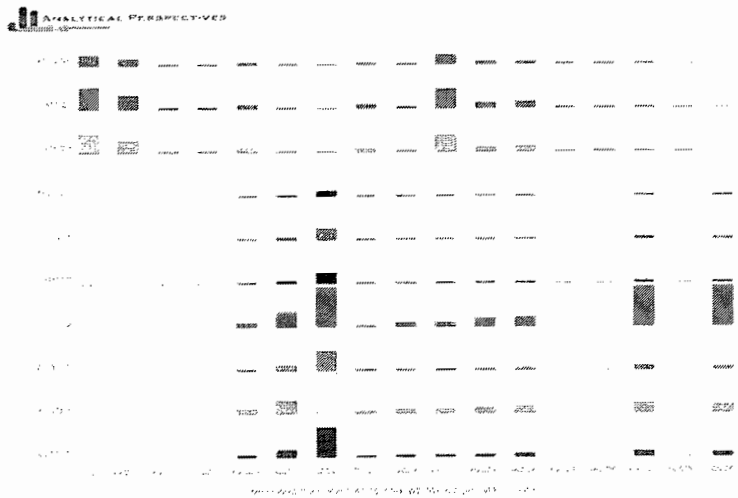

Analytical Perspectives

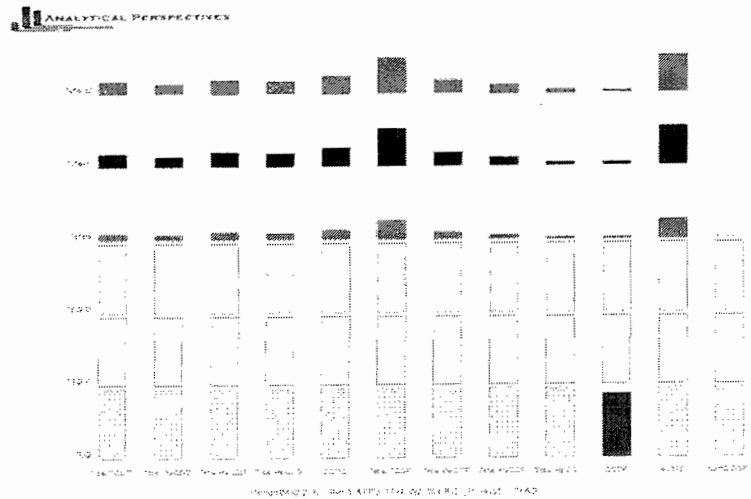









Analytical Perspectives


Analytical Perspectives

Sample ID: Method Blank

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID	MB1_8794_W2_SDS-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	00:47:29

Analyte	Conc. (pg)	DL (pg)	EMPC (pg)	Qualifiers
2378-TCDD	ND	2.3		
12378-PeCDD	ND	2.51		
123478-HxCDD	ND	2.18		
123678-HxCDD	ND	2.16		
123789-HxCDD	ND	2.35		
1234678-HpCDD	ND	3.02		
OCDD	ND	4.93		
2378-TCDF	ND	1.65		
12378-PeCDF	ND	1.55		
23478-PeCDF	ND	1.55		
123478-HxCDF	ND	1.33		
123678-HxCDF	ND	1.34		
234678-HxCDF	ND	1.24		
123789-HxCDF	ND	1.64		
1234678-HpCDF	ND	1.3		
1234789-HpCDF	ND	2.12		
OCDF	ND	5.38		
Totals				
Total TCDD	14		14	
Total PeCDD	ND	2.51	ND	
Total HxCDD	ND	2.22	ND	
Total HpCDD	ND	3.02	ND	
Total TCDF	ND	1.65	ND	
Total PeCDF	ND	1.55	ND	
Total HxCDF	ND	1.38	ND	
Total HpCDF	ND	1.67	ND	
Total PCDD/Fs	**14**		**14**	
ITEF TEQs				
TEQ: ND=0	0		0	
TEQ: ND=DL/2	2.94	2.94	2.94	
TEQ: ND=DL	5.87	5.87	5.87	

Standard	ES Recoveries	Qualifiers
ES 2378-TCDD	88.6	
ES 12378-PeCDD	85.1	
ES 123478-HxCDD	95.8	
ES 123678-HxCDD	95.1	
ES 123789-HxCDD	97	
ES 1234678-HpCDD	95	
ES OCDD	88.9	
ES 2378-TCDF	93	
ES 12378-PeCDF	89.4	
ES 23478-PeCDF	88.3	
ES 123478-HxCDF	97.5	
ES 123678-HxCDF	97.8	
ES 234678-HxCDF	98.1	
ES 123789-HxCDF	95.7	
ES 1234678-HpCDF	94	
ES 1234789-HpCDF	93.4	
ES OCDF	90.5	
Standard	**SS Recoveries**	
SS 37Cl-2378-TCDD	101	
SS 12347-PeCDD	103	
SS 12346-PeCDF	102	
SS 123469-HxCDF	100	
SS 1234689-HpCDF	100	

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Sample ID: Method Blank

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	:I ENVIRONMENTAL IN	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID:	MB1_8794_W2_SDS-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	00:47:29

Analyte	Conc. (pg/g)	DL (pg/g)	EMPC (pg/g)	Qualifiers	Standard	Recovery
PCB-77 33'44'-TeCB	EMPC		0.88	J	ES PCB-77	98.5
PCB-81 344'5-TeCB	ND	0.547			ES PCB-81	95.4
PCB-105 233'44'-PeCB	2.51			J	ES PCB-105	97
PCB-114 2344'5-PeCB	ND	0.758			ES PCB-114	95
PCB-118 23'44'5-PeCB	6.48			J	ES PCB-118	93.9
PCB-123 2'344'5-PeCB	ND	0.685			ES PCB-123	96.5
PCB-126 33'44'5-PeCB	ND	1.06			ES PCB-126	100
PCB-156 233'44'5-HxCB	ND	0.726			ES PCB-156	98.3
PCB-157 233'44'5'-HxCB	ND	0.793			ES PCB-157	97.9
PCB-167 23'44'55'-HxCB	ND	0.581			ES PCB-167	114
PCB-169 33'44'55'-HxCB	ND	1.11			ES PCB-169	100
PCB-189 233'44'55'-HpCB	ND	1.51			ES PCB-189	102

TEQs	ITEF + WHO-2005			WHO-1998		WHO-2005	
	Conc.	EMPC		Conc.	EMPC	Conc.	EMPC
DF+PCB (ND=0)	0.00027	0.000358	PCB (ND=0)	0.000899	0.000987	0.00027	0.000358
DF+PCB (ND=DL/2)	3.01	3.01	PCB (ND=DL/2)	0.0602	0.0602	0.0701	0.0702
DF+PCB (ND=DL)	6.01	6.01	PCB (ND=DL)	0.119	0.12	0.14	0.14
DF+PCB (< J-level=0)	0	0.000088	PCB (< J-level = 0)	0	0.000088	0	0.000088
	ITEF + WHO-1998						
DF+PCB (ND=0)	0.000899	0.000987	DF+PCB (ND=0)	0.000899	0.000987	0.00027	0.000358
DF+PCB (ND=DL/2)	3	3	DF+PCB (ND=DL/2)	3.62	3.62	3.46	3.46
DF+PCB (ND=DL)	5.99	5.99	DF+PCB (ND=DL)	7.24	7.24	6.92	6.92
DF+PCB (< J-level=0)	0	0.000088	DF+PCB (< J-level=0)	0	0.000088	0	0.000088

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Sample ID: Method Blank — TEQ Summary — Method WHO-2

Client Project Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Sample ID:	MB1_8794_W2_SDS-RJ2
Cliend Project ID:	BP-Whiting	Weight/Volume:	1	QC Batch No.:	8794
Date Collected:	08-Jun-2011	Split:	2	Date Extracted:	30-Jun-2011
Date Received:	23-Jun-2011	Dilution:	-	Date Analyzed:	20-Jul-2011 00:47
Lab Project No:	A3305	Units	pg		

Analyte	Result	Qualifiers	DLs	I-TEQ	WHO-1998	WHO-2005
2378-TCDD	(2.3)		2.3	(2.3)	(2.3)	(2.3)
12378-PeCDD	(2.51)		2.51	(1.26)	(2.51)	(2.51)
123478-HxCDD	(2.18)		2.18	(0.218)	(0.218)	(0.218)
123678-HxCDD	(2.16)		2.16	(0.216)	(0.216)	(0.216)
123789-HxCDD	(2.35)		2.35	(0.235)	(0.235)	(0.235)
1234678-HpCDD	(3.02)		3.02	(0.0302)	(0.0302)	(0.0302)
OCDD	(4.93)		4.93	(0.00493)	(0.000493)	(0.00148)
2378-TCDF	(1.65)		1.65	(0.165)	(0.165)	(0.165)
12378-PeCDF	(1.55)		1.55	(0.0775)	(0.0775)	(0.0465)
23478-PeCDF	(1.55)		1.55	(0.775)	(0.775)	(0.465)
123478-HxCDF	(1.33)		1.33	(0.133)	(0.133)	(0.133)
123678-HxCDF	(1.34)		1.34	(0.134)	(0.134)	(0.134)
234678-HxCDF	(1.24)		1.24	(0.124)	(0.124)	(0.124)
123789-HxCDF	(1.64)		1.64	(0.164)	(0.164)	(0.164)
1234678-HpCDF	(1.3)		1.3	(0.013)	(0.013)	(0.013)
1234789-HpCDF	(2.12)		2.12	(0.0212)	(0.0212)	(0.0212)
OCDF	(5.38)		5.38	(0.00538)	(0.000538)	(0.00161)

TEQ Summaries			
EMPC = 0, ND = 0	0	0	0
EMPC = 0, ND = DL / 2	2.94	3.56	3.39
EMPC = 0, ND = DL	5.87	7.12	6.78
EMPC = 0, < J-level = 0	0	0	0
EMPC = EMPC, ND = 0	0	0	0
EMPC = EMPC, ND = DL / 2	2.94	3.56	3.39
EMPC = EMPC, ND = DL	5.87	7.12	6.78
EMPC = EMPC, < J-level = 0	0	0	0

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Checkcode: 646-256-QCF

AP WHO-2 2010 Rev. A

Sample ID: Blank

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID	A3305_8794_W2_001-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	01:35:31

Analyte	Conc. (pg)	DL (pg)	EMPC (pg)	Qualifiers
2378-TCDD	ND	1.77		
12378-PeCDD	ND	2.14		
123478-HxCDD	ND	2.02		
123678-HxCDD	ND	1.95		
123789-HxCDD	ND	2.14		
1234678-HpCDD	ND	2.19		
OCDD	ND	4.2		
2378-TCDF	ND	1.53		
12378-PeCDF	ND	1.47		
23478-PeCDF	ND	1.44		
123478-HxCDF	ND	0.972		
123678-HxCDF	ND	0.958		
234678-HxCDF	ND	0.835		
123789-HxCDF	ND	1.13		
1234678-HpCDF	ND	1.24		
1234789-HpCDF	ND	1.9		
OCDF	ND	4.82		
Totals				
Total TCDD	ND		12.1	
Total PeCDD	ND	2.14	ND	
Total HxCDD	ND	2.03	ND	
Total HpCDD	ND	2.19	ND	
Total TCDF	ND	1.53	ND	
Total PeCDF	ND	1.45	ND	
Total HxCDF	ND	0.966	ND	
Total HpCDF	ND	1.53	ND	
Total PCDD/Fs	**ND**		**12.1**	
ITEF TEQs				
TEQ: ND=0	0		0	
TEQ: ND=DL/2	2.43	2.43	2.43	
TEQ: ND=DL	4.85	4.85	4.85	

Standard	ES Recoveries	Qualifiers
ES 2378-TCDD	94.8	
ES 12378-PeCDD	90.7	
ES 123478-HxCDD	98	
ES 123678-HxCDD	97.7	
ES 123789-HxCDD	95	
ES 1234678-HpCDD	91.2	
ES OCDD	84.1	
ES 2378-TCDF	95.3	
ES 12378-PeCDF	92.8	
ES 23478-PeCDF	92.6	
ES 123478-HxCDF	96.1	
ES 123678-HxCDF	96.5	
ES 234678-HxCDF	97.9	
ES 123789-HxCDF	94.4	
ES 1234678-HpCDF	92.5	
ES 1234789-HpCDF	88.5	
ES OCDF	82.5	
Standard	**SS Recoveries**	
SS 37Cl-2378-TCDD	96.1	
SS 12347-PeCDD	103	
SS 12346-PeCDF	100	
SS 123469-HxCDF	97.3	
SS 1234689-HpCDF	102	

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Sample ID: Blank

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	:I ENVIRONMENTAL I	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID:	A3305_8794_W2_001-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	01:35:31

Analyte	Conc. (pg/g)	DL (pg/g)	EMPC (pg/g)	Qualifiers	Standard	Recovery
PCB-77 33'44'-TeCB	6.39			J	ES PCB-77	90
PCB-81 344'5-TeCB	ND	0.544			ES PCB-81	89.8
PCB-105 233'44'-PeCB	8.99			J	ES PCB-105	94.7
PCB-114 2344'5-PeCB	ND	0.939			ES PCB-114	93.6
PCB-118 23'44'5-PeCB	18.3			J B	ES PCB-118	91.4
PCB-123 2'344'5-PeCB	ND	0.928			ES PCB-123	93.2
PCB-126 33'44'5-PeCB	ND	1.41			ES PCB-126	95.8
PCB-156 233'44'5-HxCB	1.1			J	ES PCB-156	88.7
PCB-157 233'44'5'-HxCB	ND	0.662			ES PCB-157	89
PCB-167 23'44'55'-HxCB	ND	0.466			ES PCB-167	120
PCB-169 33'44'55'-HxCB	ND	0.929			ES PCB-169	89.8
PCB-189 233'44'55'-HpCB	ND	1.44			ES PCB-189	92.9

TEQs	ITEF + WHO-2005			WHO-1998		WHO-2005	
	Conc.	EMPC		Conc.	EMPC	Conc.	EMPC
DF+PCB (ND=0)	0.00149	0.00149	PCB (ND=0)	0.00391	0.00391	0.00149	0.00149
DF+PCB (ND=DL/2)	2.51	2.51	PCB (ND=DL/2)	0.0796	0.0796	0.0861	0.0861
DF+PCB (ND=DL)	5.02	5.02	PCB (ND=DL)	0.155	0.155	0.171	0.171
DF+PCB (< J-level=0)	0	0	PCB (< J-level = 0)	0	0	0	0
	ITEF + WHO-1998						
DF+PCB (ND=0)	0.00391	0.00391	DF+PCB (ND=0)	0.00391	0.00391	0.00149	0.00149
DF+PCB (ND=DL/2)	2.5	2.5	DF+PCB (ND=DL/2)	3.04	3.04	2.88	2.88
DF+PCB (ND=DL)	5	5	DF+PCB (ND=DL)	6.07	6.07	5.77	5.77
DF+PCB (< J-level=0)	0	0	DF+PCB (< J-level=0)	0	0	0	0

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C-320

Sample ID: Blank — TEQ Summary — Method WHO-2

Client Project Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Sample ID:	A3305_8794_W2_001-RJ2
Cliend Project ID:	BP-Whiting	Weight/Volume:	1	QC Batch No.:	8794
Date Collected:	08-Jun-2011	Split:	2	Date Extracted:	30-Jun-2011
Date Received:	23-Jun-2011	Dilution:	-	Date Analyzed:	20-Jul-2011 01:35
Lab Project No:	A3305	Units	pg		

Analyte	Result	Qualifiers	DLs	I-TEQ	WHO-1998	WHO-2005
2378-TCDD	(1.77)		1.77	(1.77)	(1.77)	(1.77)
12378-PeCDD	(2.14)		2.14	(1.07)	(2.14)	(2.14)
123478-HxCDD	(2.02)		2.02	(0.202)	(0.202)	(0.202)
123678-HxCDD	(1.95)		1.95	(0.195)	(0.195)	(0.195)
123789-HxCDD	(2.14)		2.14	(0.214)	(0.214)	(0.214)
1234678-HpCDD	(2.19)		2.19	(0.0219)	(0.0219)	(0.0219)
OCDD	(4.2)		4.2	(0.0042)	(0.00042)	(0.00126)
2378-TCDF	(1.53)		1.53	(0.153)	(0.153)	(0.153)
12378-PeCDF	(1.47)		1.47	(0.0735)	(0.0735)	(0.0441)
23478-PeCDF	(1.44)		1.44	(0.72)	(0.72)	(0.432)
123478-HxCDF	(0.972)		0.972	(0.0972)	(0.0972)	(0.0972)
123678-HxCDF	(0.958)		0.958	(0.0958)	(0.0958)	(0.0958)
234678-HxCDF	(0.835)		0.835	(0.0835)	(0.0835)	(0.0835)
123789-HxCDF	(1.13)		1.13	(0.113)	(0.113)	(0.113)
1234678-HpCDF	(1.24)		1.24	(0.0124)	(0.0124)	(0.0124)
1234789-HpCDF	(1.9)		1.9	(0.019)	(0.019)	(0.019)
OCDF	(4.82)		4.82	(0.00482)	(0.000482)	(0.00145)

TEQ Summaries			
EMPC = 0, ND = 0	0	0	0
EMPC = 0, ND = DL / 2	2.42	2.96	2.8
EMPC = 0, ND = DL	4.85	5.91	5.6
EMPC = 0, < J-level = 0	0	0	0
EMPC = EMPC, ND = 0	0	0	0
EMPC = EMPC, ND = DL / 2	2.42	2.96	2.8
EMPC = EMPC, ND = DL	4.85	5.91	5.6
EMPC = EMPC, < J-level = 0	0	0	0

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Checkcode: 983-736-YHS

Sample ID: Run 1

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID	A3305_8794_W2_002-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	07-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	02:23:33

Analyte	Conc. (pg)	DL (pg)	EMPC (pg)	Qualifiers
2378-TCDD	EMPC		10.5	
12378-PeCDD	17.5			J
123478-HxCDD	6.83			J
123678-HxCDD	14.6			J
123789-HxCDD	21			J
1234678-HpCDD	54.3			
OCDD	67.3			J
2378-TCDF	77.1			
12378-PeCDF	144			
23478-PeCDF	76.2			
123478-HxCDF	74.9			
123678-HxCDF	89.1			
234678-HxCDF	49.6			J
123789-HxCDF	124			
1234678-HpCDF	75.6			
1234789-HpCDF	173			
OCDF	156			
Totals				
Total TCDD	184		256	
Total PeCDD	153		153	
Total HxCDD	108		116	
Total HpCDD	84.3		84.3	
Total TCDF	2120		2120	
Total PeCDF	860		908	
Total HxCDF	581		593	
Total HpCDF	325		325	
Total PCDD/Fs	**4630**		**4770**	
ITEF TEQs				
TEQ: ND=0	103		114	
TEQ: ND=DL/2	105	5.22	114	
TEQ: ND=DL	106	10.4	114	

Standard	ES Recoveries	Qualifiers
ES 2378-TCDD	85.2	
ES 12378-PeCDD	84.1	
ES 123478-HxCDD	92.3	
ES 123678-HxCDD	87.5	
ES 123789-HxCDD	87.8	
ES 1234678-HpCDD	86.3	
ES OCDD	74.3	
ES 2378-TCDF	82.1	
ES 12378-PeCDF	79.2	
ES 23478-PeCDF	78.7	
ES 123478-HxCDF	85.2	
ES 123678-HxCDF	82.1	
ES 234678-HxCDF	88.8	
ES 123789-HxCDF	82.3	
ES 1234678-HpCDF	82.8	
ES 1234789-HpCDF	82.1	
ES OCDF	75	
Standard	**SS Recoveries**	
SS 37Cl-2378-TCDD	94.7	
SS 12347-PeCDD	93.4	
SS 12346-PeCDF	96.3	
SS 123469-HxCDF	96.4	
SS 1234689-HpCDF	103	

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Sample ID: Run 1

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	:I ENVIRONMENTAL I	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID:	A3305_8794_W2_002-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	07-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	02:23:33

Analyte	Conc. (pg/g)	DL (pg/g)	EMPC (pg/g)	Qualifiers	Standard	Recovery
PCB-77 33'44'-TeCB	520				ES PCB-77	88.1
PCB-81 344'5-TeCB	71.6				ES PCB-81	81.3
PCB-105 233'44'-PeCB	1080				ES PCB-105	30.8
PCB-114 2344'5-PeCB	EMPC		94.4		ES PCB-114	12.1 V
PCB-118 23'44'5-PeCB	2980				ES PCB-118	13.2 V
PCB-123 2'344'5-PeCB	290				ES PCB-123	14.3 V
PCB-126 33'44'5-PeCB	69.9				ES PCB-126	102
PCB-156 233'44'5-HxCB	123				ES PCB-156	22.2 V
PCB-157 233'44'5'-HxCB	EMPC		36		ES PCB-157	32.2
PCB-167 23'44'55'-HxCB	EMPC		108		ES PCB-167	18 V
PCB-169 33'44'55'-HxCB	ND	18			ES PCB-169	82.3
PCB-189 233'44'55'-HpCB	ND	56.8			ES PCB-189	30.1

TEQs	ITEF + WHO-2005			WHO-1998		WHO-2005	
	Conc.	EMPC		Conc.	EMPC	Conc.	EMPC
DF+PCB (ND=0)	110	121	PCB (ND=0)	7.54	7.61	7.19	7.2
DF+PCB (ND=DL/2)	112	121	PCB (ND=DL/2)	7.67	7.7	7.47	7.47
DF+PCB (ND=DL)	114	121	PCB (ND=DL)	7.81	7.79	7.74	7.74
DF+PCB (< J-level=0)	92.2	103	PCB (< J-level = 0)	7.54	7.61	7.19	7.2
	ITEF + WHO-1998						
DF+PCB (ND=0)	111	121	DF+PCB (ND=0)	119	130	101	111
DF+PCB (ND=DL/2)	112	121	DF+PCB (ND=DL/2)	121	130	103	112
DF+PCB (ND=DL)	114	121	DF+PCB (ND=DL)	123	130	105	112
DF+PCB (< J-level=0)	92.5	103	DF+PCB (< J-level=0)	92.4	103	73.9	84.5

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Sample ID: Run 1 — TEQ Summary — Method WHO-2

Client Project Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Sample ID:	A3305_8794_W2_002-RJ2
Cliend Project ID:	BP-Whiting	Weight/Volume:	1	QC Batch No.:	8794
Date Collected:	07-Jun-2011	Split:	2	Date Extracted:	30-Jun-2011
Date Received:	23-Jun-2011	Dilution:	-	Date Analyzed:	20-Jul-2011 02:23
Lab Project No:	A3305	Units	pg		

Analyte	Result	Qualifiers	DLs	I-TEQ	WHO-1998	WHO-2005
2378-TCDD	[10.5]		3.26	[10.5]	[10.5]	[10.5]
12378-PeCDD	17.5	J	5.84	8.77	17.5	17.5
123478-HxCDD	6.83	J	2.71	0.683	0.683	0.683
123678-HxCDD	14.6	J	2.89	1.46	1.46	1.46
123789-HxCDD	21	J	2.92	2.1	2.1	2.1
1234678-HpCDD	54.3		3.29	0.543	0.543	0.543
OCDD	67.3	J	5.43	0.0673	0.00673	0.0202
2378-TCDF	77.1		4.41	7.71	7.71	7.71
12378-PeCDF	144		3.16	7.22	7.22	4.33
23478-PeCDF	76.2		3.19	38.1	38.1	22.9
123478-HxCDF	74.9		2.73	7.49	7.49	7.49
123678-HxCDF	89.1		2.67	8.91	8.91	8.91
234678-HxCDF	49.6	J	2.38	4.96	4.96	4.96
123789-HxCDF	124		3.29	12.4	12.4	12.4
1234678-HpCDF	75.6		2.98	0.756	0.756	0.756
1234789-HpCDF	173		4.17	1.73	1.73	1.73
OCDF	156		5.66	0.156	0.0156	0.0467

TEQ Summaries			
EMPC = 0, ND = 0	103	112	93.5
EMPC = 0, ND = DL / 2	105	113	95.1
EMPC = 0, ND = DL	106	115	96.8
EMPC = 0, < J-level = 0	85	84.8	66.7
EMPC = EMPC, ND = 0	114	122	104
EMPC = EMPC, ND = DL / 2	114	122	104
EMPC = EMPC, ND = DL	114	122	104
EMPC = EMPC, < J-level = 0	95.5	95.4	77.3

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Checkcode: 622-609-YFS

AP WHO-2 2010 Rev. A

Sample ID: Run 2

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID	A3305_8794_W2_003-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	03:59:36

Analyte	Conc. (pg)	DL (pg)	EMPC (pg)	Qualifiers
2378-TCDD	ND	2.33		
12378-PeCDD	ND	2.53		
123478-HxCDD	ND	2.5		
123678-HxCDD	ND	2.67		
123789-HxCDD	ND	2.71		
1234678-HpCDD	EMPC		4.65	J
OCDD	24.3			J
2378-TCDF	2.05			J
12378-PeCDF	ND	2.19		
23478-PeCDF	ND	2.02		
123478-HxCDF	1.11			J
123678-HxCDF	ND	1.25		
234678-HxCDF	ND	1.16		
123789-HxCDF	ND	1.51		
1234678-HpCDF	ND	2.27		
1234789-HpCDF	ND	3.3		
OCDF	ND	5.3		
Totals				
Total TCDD	ND		12.4	
Total PeCDD	5.55		9.59	
Total HxCDD	6.67		6.67	
Total HpCDD	7.45		12.1	
Total TCDF	14.5		24	
Total PeCDF	ND		4.33	
Total HxCDF	1.11		3.51	
Total HpCDF	ND	2.73	ND	
Total PCDD/Fs	**59.5**		**96.9**	
ITEF TEQs				
TEQ: ND=0	0.34		0.386	
TEQ: ND=DL/2	3.33	3.13	3.36	
TEQ: ND=DL	6.31	6.27	6.34	

Standard	ES Recoveries	Qualifiers
ES 2378-TCDD	93.8	
ES 12378-PeCDD	91	
ES 123478-HxCDD	98.9	
ES 123678-HxCDD	98.7	
ES 123789-HxCDD	100	
ES 1234678-HpCDD	95.2	
ES OCDD	86.9	
ES 2378-TCDF	89.1	
ES 12378-PeCDF	88.1	
ES 23478-PeCDF	88.6	
ES 123478-HxCDF	96.4	
ES 123678-HxCDF	93.9	
ES 234678-HxCDF	97.3	
ES 123789-HxCDF	95	
ES 1234678-HpCDF	92.4	
ES 1234789-HpCDF	92.2	
ES OCDF	84.8	
Standard	**SS Recoveries**	
SS 37Cl-2378-TCDD	98.8	
SS 12347-PeCDD	100	
SS 12346-PeCDF	97.8	
SS 123469-HxCDF	100	
SS 1234689-HpCDF	103	

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Sample ID: Run 2

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	:I ENVIRONMENTAL I	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID:	A3305_8794_W2_003-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	03:59:36

Analyte	Conc. (pg/g)	DL (pg/g)	EMPC (pg/g)	Qualifiers	Standard	Recovery
PCB-77 33'44'-TeCB	72.2				ES PCB-77	103
PCB-81 344'5-TeCB	5.35			J	ES PCB-81	104
PCB-105 233'44'-PeCB	149				ES PCB-105	68.5
PCB-114 2344'5-PeCB	15.1			J	ES PCB-114	45.4
PCB-118 23'44'5-PeCB	432				ES PCB-118	50.3
PCB-123 2'344'5-PeCB	EMPC		42.4		ES PCB-123	49
PCB-126 33'44'5-PeCB	4.8			J	ES PCB-126	112
PCB-156 233'44'5-HxCB	23				ES PCB-156	64
PCB-157 233'44'5'-HxCB	5.72			J	ES PCB-157	72.6
PCB-167 23'44'55'-HxCB	14.3			J	ES PCB-167	75.4
PCB-169 33'44'55'-HxCB	ND	1.44			ES PCB-169	103
PCB-189 233'44'55'-HpCB	ND	3.85			ES PCB-189	68.2

TEQs	ITEF + WHO-2005			WHO-1998		WHO-2005	
	Conc.	EMPC		Conc.	EMPC	Conc.	EMPC
DF+PCB (ND=0)	0.848	0.896	PCB (ND=0)	0.568	0.572	0.508	0.509
DF+PCB (ND=DL/2)	3.86	3.89	PCB (ND=DL/2)	0.575	0.579	0.53	0.531
DF+PCB (ND=DL)	6.87	6.89	PCB (ND=DL)	0.583	0.587	0.551	0.552
DF+PCB (< J-level=0)	0.0253	0.0731	PCB (< J-level = 0)	0.0768	0.0811	0.0253	0.0266
	ITEF + WHO-1998						
DF+PCB (ND=0)	0.908	0.958	DF+PCB (ND=0)	0.886	0.937	0.831	0.879
DF+PCB (ND=DL/2)	3.9	3.94	DF+PCB (ND=DL/2)	4.51	4.55	4.25	4.28
DF+PCB (ND=DL)	6.9	6.93	DF+PCB (ND=DL)	8.14	8.17	7.67	7.69
DF+PCB (< J-level=0)	0.0768	0.128	DF+PCB (< J-level=0)	0.0768	0.128	0.0253	0.0731

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Sample ID: Run 2 — TEQ Summary — Method WHO-2

Client Project Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Sample ID:	A3305_8794_W2_003-RJ2
Cliend Project ID:	BP-Whiting	Weight/Volume:	1	QC Batch No.:	8794
Date Collected:	08-Jun-2011	Split:	2	Date Extracted:	30-Jun-2011
Date Received:	23-Jun-2011	Dilution:	-	Date Analyzed:	20-Jul-2011 03:59
Lab Project No:	A3305	Units	pg		

Analyte	Result	Qualifiers	DLs	I-TEQ	WHO-1998	WHO-2005
2378-TCDD	(2.33)		2.33	(2.33)	(2.33)	(2.33)
12378-PeCDD	(2.53)		2.53	(1.27)	(2.53)	(2.53)
123478-HxCDD	(2.5)		2.5	(0.25)	(0.25)	(0.25)
123678-HxCDD	(2.67)		2.67	(0.267)	(0.267)	(0.267)
123789-HxCDD	(2.71)		2.71	(0.271)	(0.271)	(0.271)
1234678-HpCDD	[4.65]	J	2.18	[0.0465]	[0.0465]	[0.0465]
OCDD	24.3	J	4.6	0.0243	0.00243	0.00728
2378-TCDF	2.05	J	1.67	0.205	0.205	0.205
12378-PeCDF	(2.19)		2.19	(0.11)	(0.11)	(0.0657)
23478-PeCDF	(2.02)		2.02	(1.01)	(1.01)	(0.606)
123478-HxCDF	1.11	J	1.22	0.111	0.111	0.111
123678-HxCDF	(1.25)		1.25	(0.125)	(0.125)	(0.125)
234678-HxCDF	(1.16)		1.16	(0.116)	(0.116)	(0.116)
123789-HxCDF	(1.51)		1.51	(0.151)	(0.151)	(0.151)
1234678-HpCDF	(2.27)		2.27	(0.0227)	(0.0227)	(0.0227)
1234789-HpCDF	(3.3)		3.3	(0.033)	(0.033)	(0.033)
OCDF	(5.3)		5.3	(0.0053)	(0.00053)	(0.00159)

TEQ Summaries			
EMPC = 0, ND = 0	0.34	0.318	0.323
EMPC = 0, ND = DL / 2	3.33	3.94	3.72
EMPC = 0, ND = DL	6.32	7.56	7.11
EMPC = 0, < J-level = 0	0	0	0
EMPC = EMPC, ND = 0	0.386	0.365	0.369
EMPC = EMPC, ND = DL / 2	3.36	3.97	3.75
EMPC = EMPC, ND = DL	6.34	7.58	7.14
EMPC = EMPC, < J-level = 0	0.0465	0.0465	0.0465

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Sample ID: Run 3

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID	A3305_8794_W2_004-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	04:47:37

Analyte	Conc. (pg)	DL (pg)	EMPC (pg)	Qualifiers
2378-TCDD	ND	1.97		
12378-PeCDD	ND	2.54		
123478-HxCDD	ND	1.83		
123678-HxCDD	ND	1.9		
123789-HxCDD	1.89			J
1234678-HpCDD	6.2			J
OCDD	24.9			J
2378-TCDF	1.55			J
12378-PeCDF	EMPC		1.88	J
23478-PeCDF	EMPC		1.72	J
123478-HxCDF	EMPC		2.37	J
123678-HxCDF	2.72			J
234678-HxCDF	ND	0.945		
123789-HxCDF	ND	1.21		
1234678-HpCDF	4.51			J
1234789-HpCDF	ND	2.21		
OCDF	3.72			J
Totals				
Total TCDD	13		17	
Total PeCDD	7.59		13.4	
Total HxCDD	19.1		19.1	
Total HpCDD	16.9		16.9	
Total TCDF	32.3		49.9	
Total PeCDF	5.37		17.9	
Total HxCDF	6.32		11.1	
Total HpCDF	4.51		4.51	
Total PCDD/Fs	**134**		**178**	
ITEF TEQs				
TEQ: ND=0	0.752		1.94	
TEQ: ND=DL/2	3.09	2.55	3.87	
TEQ: ND=DL	5.42	5.1	5.79	

Standard	ES Recoveries	Qualifiers
ES 2378-TCDD	95.4	
ES 12378-PeCDD	94.6	
ES 123478-HxCDD	97.9	
ES 123678-HxCDD	97.5	
ES 123789-HxCDD	99.7	
ES 1234678-HpCDD	95.4	
ES OCDD	87.8	
ES 2378-TCDF	92.7	
ES 12378-PeCDF	90.8	
ES 23478-PeCDF	90.9	
ES 123478-HxCDF	94.2	
ES 123678-HxCDF	95.4	
ES 234678-HxCDF	96.6	
ES 123789-HxCDF	92.9	
ES 1234678-HpCDF	94.7	
ES 1234789-HpCDF	91.5	
ES OCDF	85	
Standard	**SS Recoveries**	
SS 37Cl-2378-TCDD	100	
SS 12347-PeCDD	96.8	
SS 12346-PeCDF	98.7	
SS 123469-HxCDF	98	
SS 1234689-HpCDF	98	

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Sample ID: Run 3

Method WHO-2

Client Data		Sample Data		Laboratory Data			
Name:	:I ENVIRONMENTAL I	Matrix:	Air	Lab Project ID:	A3305	Date Received:	23-Jun-2011
Project ID:	BP-Whiting	Weight/Volume:	1	Lab Sample ID:	A3305_8794_W2_004-RJ2	Date Extracted:	30-Jun-2011
Date Collected:	08-Jun-2011			QC Batch No:	8794	Date Analyzed:	20-Jul-2011
		Split:	2	Dilution:	-	Time Analyzed:	04:47:37

Analyte	Conc. (pg/g)	DL (pg/g)	EMPC (pg/g)	Qualifiers	Standard	Recovery
PCB-77 33'44'-TeCB	89.5				ES PCB-77	97.6
PCB-81 344'5-TeCB	9.92			J	ES PCB-81	101
PCB-105 233'44'-PeCB	215				ES PCB-105	86.5
PCB-114 2344'5-PeCB	EMPC		17.6	J	ES PCB-114	67.5
PCB-118 23'44'5-PeCB	604				ES PCB-118	77.8
PCB-123 2'344'5-PeCB	EMPC		63.2		ES PCB-123	68.6
PCB-126 33'44'5-PeCB	EMPC		5.24	J	ES PCB-126	94.8
PCB-156 233'44'5-HxCB	30.4				ES PCB-156	80.1
PCB-157 233'44'5'-HxCB	7.51			J	ES PCB-157	88.6
PCB-167 23'44'55'-HxCB	16.1			J	ES PCB-167	84.4
PCB-169 33'44'55'-HxCB	ND	2.75			ES PCB-169	94.3
PCB-189 233'44'55'-HpCB	ND	3.66			ES PCB-189	82.3

TEQs	ITEF + WHO-2005			WHO-1998		WHO-2005	
	Conc.	EMPC		Conc.	EMPC	Conc.	EMPC
DF+PCB (ND=0)	0.79	2.51	PCB (ND=0)	0.111	0.65	0.0381	0.565
DF+PCB (ND=DL/2)	3.35	4.47	PCB (ND=DL/2)	0.306	0.664	0.26	0.606
DF+PCB (ND=DL)	5.9	6.44	PCB (ND=DL)	0.502	0.678	0.482	0.647
DF+PCB (< J-level=0)	0.0344	1.75	PCB (< J-level = 0)	0.106	0.645	0.0344	0.561
	ITEF + WHO-1998						
DF+PCB (ND=0)	0.863	2.59	DF+PCB (ND=0)	0.837	2.57	0.77	2.1
DF+PCB (ND=DL/2)	3.39	4.53	DF+PCB (ND=DL/2)	4	5.14	3.82	4.71
DF+PCB (ND=DL)	5.92	6.47	DF+PCB (ND=DL)	7.17	7.71	6.87	7.31
DF+PCB (< J-level=0)	0.106	1.83	DF+PCB (< J-level=0)	0.106	1.83	0.0344	1.37

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Sample ID: Run 3 — TEQ Summary — Method WHO-2

Client Project Name:	ARI ENVIRONMENTAL INC.	Matrix:	Air	Lab Sample ID:	A3305_8794_W2_004-RJ2
Cliend Project ID:	BP-Whiting	Weight/Volume:	1	QC Batch No.:	8794
Date Collected:	08-Jun-2011	Split:	2	Date Extracted:	30-Jun-2011
Date Received:	23-Jun-2011	Dilution:	-	Date Analyzed:	20-Jul-2011 04:47
Lab Project No:	A3305	Units	pg		

Analyte	Result	Qualifiers	DLs	I-TEQ	WHO-1998	WHO-2005
2378-TCDD	(1.97)		1.97	(1.97)	(1.97)	(1.97)
12378-PeCDD	(2.54)		2.54	(1.27)	(2.54)	(2.54)
123478-HxCDD	(1.83)		1.83	(0.183)	(0.183)	(0.183)
123678-HxCDD	(1.9)		1.9	(0.19)	(0.19)	(0.19)
123789-HxCDD	1.89	J	1.85	0.189	0.189	0.189
1234678-HpCDD	6.2	J	1.58	0.062	0.062	0.062
OCDD	24.9	J	2.95	0.0249	0.00249	0.00746
2378-TCDF	1.55	J	1.17	0.155	0.155	0.155
12378-PeCDF	[1.88]	J	1.38	[0.0942]	[0.0942]	[0.0565]
23478-PeCDF	[1.72]	J	1.29	[0.858]	[0.858]	[0.515]
123478-HxCDF	[2.37]	J	1.03	[0.237]	[0.237]	[0.237]
123678-HxCDF	2.72	J	0.972	0.272	0.272	0.272
234678-HxCDF	(0.945)		0.945	(0.0945)	(0.0945)	(0.0945)
123789-HxCDF	(1.21)		1.21	(0.121)	(0.121)	(0.121)
1234678-HpCDF	4.51	J	1.46	0.0451	0.0451	0.0451
1234789-HpCDF	(2.21)		2.21	(0.0221)	(0.0221)	(0.0221)
OCDF	3.72	J	3.23	0.00372	0.000372	0.00112

TEQ Summaries			
EMPC = 0, ND = 0	0.752	0.726	0.732
EMPC = 0, ND = DL / 2	3.09	3.7	3.56
EMPC = 0, ND = DL	5.42	6.66	6.38
EMPC = 0, < J-level = 0	0	0	0
EMPC = EMPC, ND = 0	1.94	1.92	1.54
EMPC = EMPC, ND = DL / 2	3.87	4.48	4.1
EMPC = EMPC, ND = DL	5.79	7.04	6.66
EMPC = EMPC, < J-level = 0	1.19	1.19	0.808

ANALYTICAL PERSPECTIVES
2714 Exchange Drive
Wilmington, NC 28405, USA
Tel: +1 910 794-1613; Toll-Free 866 846-8290
Fax: +1 910 794-3919
info@ultratrace.com
www.ultratrace.com

Checkcode: 911-488-FBL

AP WHO-2 2010 Rev. A

Method 23

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6771

C-330
951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY	BP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FAHERTY		
ARI Project Manager		ARI Sampler Initials
Analytical Perspectives		
Analysis Location (Wauconda or Pasadena)		
ICK - Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: USEPA Method 23 (MM5)	Analysis Request: See attached M23 list for compounds	Analysis Request	Analysis Request	Comments
36161	6-7-11	Run 1 - Toluene Rinse	1	250 Amb	1	X				
36173	6-2-11	Run 2 - Toluene Rinse	1	250 Amb	1	X				
47372	6-2-11	Run 3 - Toluene Rinse	1	250 Amb	1	X				
36162	6-7-11	Run 1 - Probe Wash (PW) w/ Acetone/MeCl	1	250 Wide	1	X				
36172	6-2-11	Run 2 - PW	1	250 Wide	1	X				
47373	6-2-11	Run 3 - PW	1	250 Wide	1	X				
31839	6-2-11	Blank - MeCl/Acetone	1	250 Amb	1	X				
31840	6-2-11	Blank - Toluene	1	250 Amb	1	X				

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By	SHIPMENT:
	(1) Date / Time 6/11/11 1520	(2) Date / Time 6/9/11 16:20	(3) Date / Time	HAND CARRY
	(1) Company ARI	(2) Company ARI	(3) Company ARI	FEDX
				UPS
Requested Analysis Completion Date: 7-14-11	(1) Received By	(2) Received By	(3) Received By	Custody Seal Applied
Report Level: Tier I: Engineering / Tier II: ICK Compliance / Tier III: QAPP	(1) Date / Time 6/11/11 17:30	(2) Date / Time 6/11/11 16:45	(3) Date / Time	Yes / No
Route Results Through: Steve Faherty (ARI)	(1) Company ARI	(2) Company ARI	(3) Company	

Form LF0001

Method 23

ARI ENVIRONMENTAL, INC.

Chain of Custody Record 6782

951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

1710 Preston Rd., Unit C
Pasadena, Texas 77503

LAB USE ONLY		
	RP-Whiting	Whiting, IN
Lab Project No.	Client Name	Location
STEVE FLAHERTY		
ARI Project Manager		ARI Sampler Initials
Analytical Perspectives		
Analysis Location (Wauconda or Pasadena)		
ICR - Compliance		
Engineering or Compliance Test Samples		

Sample No.	Date Collected	Sample ID	Number of Containers	Container Type (Petri, Bottle, Bag, Tube, Summa, Bomb)	Preservation Code	Analysis Request: Method 23 (OP/PCBs)	Analysis Request: See Analysis List for compounds	Analysis Request	Analysis Request	Comments
36967	6-7-11	Run 1 - XAD Trap	1	trap	2	X				
36971	6-8-11	Run 2 - XAD Trap	1	trap	2	X				
31834	6-8-11	Run 3 - XAD Trap	1	trap	2	X				
31838	6-8-11	XAD Trap Blank	1	trap	2	X				
36966	6-7-11	Run 1 - Filter	1	petri	2	X				
36970	6-8-11	Run 2 - Filter	1	petri	2	X				
31833	6-8-11	Run 3 - Filter	1	petri	2	X				
31837	6-8-11	Filter Blank	1	petri	2	X				

Preservation Code

1 = Ambient Temp.
2 = 4°C (Ice Packs)
3 = Dry Ice
4 = Other (Noted)

Special Instructions / Comments

Requested Analysis Completion Date: 7-14-11

Report Level: Tier I: Engineering | Tier II: ICR Compliance | Tier III: QAPP

Route Results Through: S. FLAHERTY (ARI)

	(1) Relinquished By	(2) Relinquished By	(3) Relinquished By
	(1) Date / Time 6/10/11 2015	(2) Date / Time 6/20/11 1520	(3) Date / Time
	(1) Company ARI	(2) Company	(3) Company
	(1) Received By	(2) Received By	(3) Received By
	(1) Date / Time 6/15/11 14:40	(2) Date / Time 6/20/11 1520	(3) Date / Time 6/21/11 9:00
	(1) Company ARI	(2) Company ARI	(3) Company

SHIPMENT: HAND CARRY | FEDX | UPS

Custody Seal Applied: Yes / No

Form LF0001

C-331

APPENDIX D FTIR and Reference Method Monitoring Data

FTIR FIELD DATA SUMMARY

BP Whiting
Whiting, Indiana
FCC 500
6/7/2011
Stack Run #1

Spectrum	Date	Time	HCN (ppmv wb)	Acetaldehyde (ppmv wb)	Formaldehyde (ppmv wb)	Propanal (ppmv wb)
6-7-11FCCU500RUNS_000393.LAB	6/7/2011	12:58	0.70	0.14	0.30	0.30
6-7-11FCCU500RUNS_000394.LAB	6/7/2011	12:59	0.65	0.52	0.17	0.19
6-7-11FCCU500RUNS_000395.LAB	6/7/2011	13:00	0.57	0.36	0.23	0.21
6-7-11FCCU500RUNS_000396.LAB	6/7/2011	13:01	0.61	0.17	0.28	0.44
6-7-11FCCU500RUNS_000397.LAB	6/7/2011	13:02	0.63	0.01	0.32	0.45
6-7-11FCCU500RUNS_000398.LAB	6/7/2011	13:04	0.82	0.22	0.41	0.63
6-7-11FCCU500RUNS_000399.LAB	6/7/2011	13:05	0.37	0.12	0.30	0.19
6-7-11FCCU500RUNS_000400.LAB	6/7/2011	13:06	0.41	0.23	0.35	0.30
6-7-11FCCU500RUNS_000401.LAB	6/7/2011	13:07	0.63	0.12	0.27	0.14
6-7-11FCCU500RUNS_000402.LAB	6/7/2011	13:08	0.64	0.39	0.30	0.53
6-7-11FCCU500RUNS_000403.LAB	6/7/2011	13:09	0.42	0.65	0.21	0.40
6-7-11FCCU500RUNS_000404.LAB	6/7/2011	13:10	0.76	0.73	0.25	0.22
6-7-11FCCU500RUNS_000405.LAB	6/7/2011	13:11	0.56	0.56	0.26	0.18
6-7-11FCCU500RUNS_000406.LAB	6/7/2011	13:12	0.57	0.59	0.26	0.36
6-7-11FCCU500RUNS_000407.LAB	6/7/2011	13:13	0.25	0.63	0.23	0.32
6-7-11FCCU500RUNS_000408.LAB	6/7/2011	13:14	0.33	0.61	0.32	0.24
6-7-11FCCU500RUNS_000409.LAB	6/7/2011	13:15	0.56	0.67	0.23	0.21
6-7-11FCCU500RUNS_000410.LAB	6/7/2011	13:16	0.42	0.55	0.35	0.40
6-7-11FCCU500RUNS_000411.LAB	6/7/2011	13:17	0.73	0.62	0.35	0.51
6-7-11FCCU500RUNS_000412.LAB	6/7/2011	13:18	0.64	0.55	0.34	0.55
6-7-11FCCU500RUNS_000413.LAB	6/7/2011	13:20	0.51	0.35	0.30	0.14
6-7-11FCCU500RUNS_000414.LAB	6/7/2011	13:21	0.64	0.55	0.30	0.34
6-7-11FCCU500RUNS_000419.LAB	6/7/2011	13:26	0.81	0.13	0.22	0.11
6-7-11FCCU500RUNS_000420.LAB	6/7/2011	13:27	0.76	0.07	0.22	0.02
6-7-11FCCU500RUNS_000421.LAB	6/7/2011	13:28	0.90	0.19	0.20	0.05
6-7-11FCCU500RUNS_000422.LAB	6/7/2011	13:29	0.69	0.01	0.24	0.18
6-7-11FCCU500RUNS_000423.LAB	6/7/2011	13:30	0.84	0.04	0.22	0.18
6-7-11FCCU500RUNS_000424.LAB	6/7/2011	13:31	0.94	0.15	0.24	0.19
6-7-11FCCU500RUNS_000425.LAB	6/7/2011	13:32	0.72	0.02	0.19	0.17
6-7-11FCCU500RUNS_000426.LAB	6/7/2011	13:33	0.89	0.11	0.21	0.06
6-7-11FCCU500RUNS_000427.LAB	6/7/2011	13:34	0.71	0.13	0.28	0.20
6-7-11FCCU500RUNS_000428.LAB	6/7/2011	13:36	0.87	0.00	0.23	0.13
6-7-11FCCU500RUNS_000429.LAB	6/7/2011	13:37	0.71	0.01	0.19	0.15
6-7-11FCCU500RUNS_000430.LAB	6/7/2011	13:38	0.50	0.01	0.22	0.10
6-7-11FCCU500RUNS_000431.LAB	6/7/2011	13:39	0.92	0.02	0.27	0.17
6-7-11FCCU500RUNS_000432.LAB	6/7/2011	13:40	0.71	0.16	0.22	0.07
6-7-11FCCU500RUNS_000433.LAB	6/7/2011	13:41	0.89	0.07	0.24	0.03
6-7-11FCCU500RUNS_000434.LAB	6/7/2011	13:42	0.79	0.12	0.28	0.19
6-7-11FCCU500RUNS_000435.LAB	6/7/2011	13:43	0.91	0.01	0.26	0.22
6-7-11FCCU500RUNS_000439.LAB	6/7/2011	13:47	0.69	0.47	0.19	0.29
6-7-11FCCU500RUNS_000440.LAB	6/7/2011	13:48	0.58	0.26	0.19	0.16
6-7-11FCCU500RUNS_000441.LAB	6/7/2011	13:49	0.74	0.20	0.15	0.19
6-7-11FCCU500RUNS_000442.LAB	6/7/2011	13:50	0.69	0.10	0.25	0.27
6-7-11FCCU500RUNS_000443.LAB	6/7/2011	13:52	0.70	0.15	0.27	0.29
6-7-11FCCU500RUNS_000444.LAB	6/7/2011	13:53	0.73	0.05	0.17	0.26
6-7-11FCCU500RUNS_000445.LAB	6/7/2011	13:54	0.86	0.10	0.20	0.25
6-7-11FCCU500RUNS_000446.LAB	6/7/2011	13:55	0.65	0.02	0.20	0.22
6-7-11FCCU500RUNS_000447.LAB	6/7/2011	13:56	0.85	0.04	0.18	0.17
6-7-11FCCU500RUNS_000448.LAB	6/7/2011	13:57	0.57	0.17	0.22	0.14
6-7-11FCCU500RUNS_000449.LAB	6/7/2011	13:58	0.92	0.15	0.28	0.15
6-7-11FCCU500RUNS_000450.LAB	6/7/2011	13:59	0.93	0.05	0.26	0.24
6-7-11FCCU500RUNS_000451.LAB	6/7/2011	14:00	1.00	0.03	0.24	0.29
6-7-11FCCU500RUNS_000460.LAB	6/7/2011	14:10	0.99	0.32	0.12	0.10
6-7-11FCCU500RUNS_000461.LAB	6/7/2011	14:11	0.51	0.42	0.12	0.08
6-7-11FCCU500RUNS_000462.LAB	6/7/2011	14:12	0.90	0.27	0.15	0.04
6-7-11FCCU500RUNS_000463.LAB	6/7/2011	14:13	0.63	0.17	0.14	0.18
6-7-11FCCU500RUNS_000464.LAB	6/7/2011	14:14	0.83	0.22	0.16	0.15
6-7-11FCCU500RUNS_000465.LAB	6/7/2011	14:15	0.72	0.24	0.14	0.11
6-7-11FCCU500RUNS_000466.LAB	6/7/2011	14:16	0.58	0.10	0.15	0.13
6-7-11FCCU500RUNS_000467.LAB	6/7/2011	14:17	0.46	0.13	0.22	0.17
6-7-11FCCU500RUNS_000468.LAB	6/7/2011	14:18	0.57	0.21	0.21	0.06
6-7-11FCCU500RUNS_000469.LAB	6/7/2011	14:19	0.79	0.18	0.19	0.13
6-7-11FCCU500RUNS_000476.LAB	6/7/2011	14:27	0.76	0.09	0.24	0.05
6-7-11FCCU500RUNS_000477.LAB	6/7/2011	14:28	1.02	0.44	0.20	0.06
6-7-11FCCU500RUNS_000478.LAB	6/7/2011	14:29	0.93	0.41	0.15	0.09
6-7-11FCCU500RUNS_000479.LAB	6/7/2011	14:30	1.12	0.59	0.09	0.18
6-7-11FCCU500RUNS_000480.LAB	6/7/2011	14:31	0.85	0.61	0.11	0.18
6-7-11FCCU500RUNS_000481.LAB	6/7/2011	14:32	1.07	0.70	0.10	0.14
6-7-11FCCU500RUNS_000482.LAB	6/7/2011	14:33	1.23	0.41	0.15	0.26
6-7-11FCCU500RUNS_000483.LAB	6/7/2011	14:34	1.08	0.55	0.22	0.14
6-7-11FCCU500RUNS_000484.LAB	6/7/2011	14:35	0.70	0.48	0.18	0.03
6-7-11FCCU500RUNS_000485.LAB	6/7/2011	14:36	0.99	0.42	0.16	0.16
6-7-11FCCU500RUNS_000486.LAB	6/7/2011	14:37	0.67	0.55	0.13	0.06
6-7-11FCCU500RUNS_000487.LAB	6/7/2011	14:39	0.74	0.47	0.18	0.18

6-7-11FCCU500RUNS_000488.LAB	6/7/2011	14:40	1.00	0.45	0.18	0.26
6-7-11FCCU500RUNS_000489.LAB	6/7/2011	14:41	1.02	0.64	0.16	0.18
6-7-11FCCU500RUNS_000490.LAB	6/7/2011	14:42	0.84	0.53	0.11	0.29
6-7-11FCCU500RUNS_000491.LAB	6/7/2011	14:43	1.00	0.76	0.09	0.14
6-7-11FCCU500RUNS_000492.LAB	6/7/2011	14:44	0.78	0.54	0.13	0.30
6-7-11FCCU500RUNS_000493.LAB	6/7/2011	14:45	0.83	0.61	0.12	0.26
6-7-11FCCU500RUNS_000494.LAB	6/7/2011	14:46	0.69	0.70	0.14	0.17
6-7-11FCCU500RUNS_000495.LAB	6/7/2011	14:47	0.94	0.71	0.16	0.30
6-7-11FCCU500RUNS_000496.LAB	6/7/2011	14:48	0.84	0.59	0.17	0.30
6-7-11FCCU500RUNS_000497.LAB	6/7/2011	14:49	0.96	0.78	0.18	0.28
6-7-11FCCU500RUNS_000498.LAB	6/7/2011	14:50	1.00	1.00	0.13	0.23
6-7-11FCCU500RUNS_000499.LAB	6/7/2011	14:51	0.94	1.03	0.08	0.26
6-7-11FCCU500RUNS_000500.LAB	6/7/2011	14:52	0.91	1.27	0.16	0.09
Average=			**0.76**	**0.34**	**0.21**	**0.21**

FTIR FIELD DATA SUMMARY

BP Whiting
Whiting, Indiana
FCC 500
6/8/2011
Stack Run #2

Spectrum	Date	Time	HCN (ppmv wb)	Acetaldehyde (ppmv wb)	Formaldehyde (ppmv wb)	Propanal (ppmv wb)
6-8-11FCCU500RUNS_000093.LAB	6/8/2011	8:55	0.34	0.56	0.23	0.13
6-8-11FCCU500RUNS_000094.LAB	6/8/2011	8:56	0.12	0.52	0.32	0.14
6-8-11FCCU500RUNS_000095.LAB	6/8/2011	8:57	0.78	0.64	0.32	0.17
6-8-11FCCU500RUNS_000096.LAB	6/8/2011	8:58	0.40	0.67	0.26	0.23
6-8-11FCCU500RUNS_000097.LAB	6/8/2011	8:59	0.75	0.74	0.25	0.27
6-8-11FCCU500RUNS_000098.LAB	6/8/2011	9:00	0.53	0.77	0.42	0.17
6-8-11FCCU500RUNS_000099.LAB	6/8/2011	9:01	0.44	0.54	0.30	0.19
6-8-11FCCU500RUNS_000100.LAB	6/8/2011	9:02	0.40	0.44	0.40	0.14
6-8-11FCCU500RUNS_000101.LAB	6/8/2011	9:03	0.49	0.55	0.33	0.25
6-8-11FCCU500RUNS_000102.LAB	6/8/2011	9:04	0.51	0.50	0.40	0.31
6-8-11FCCU500RUNS_000103.LAB	6/8/2011	9:05	0.46	0.40	0.44	0.42
6-8-11FCCU500RUNS_000104.LAB	6/8/2011	9:06	0.55	0.36	0.48	0.24
6-8-11FCCU500RUNS_000105.LAB	6/8/2011	9:08	0.69	0.25	0.39	0.24
6-8-11FCCU500RUNS_000106.LAB	6/8/2011	9:09	0.58	0.24	0.44	0.18
6-8-11FCCU500RUNS_000107.LAB	6/8/2011	9:10	0.32	0.41	0.40	0.33
6-8-11FCCU500RUNS_000108.LAB	6/8/2011	9:11	0.44	0.38	0.38	0.23
6-8-11FCCU500RUNS_000109.LAB	6/8/2011	9:12	0.63	0.35	0.40	0.31
6-8-11FCCU500RUNS_000110.LAB	6/8/2011	9:13	0.49	0.39	0.41	0.27
6-8-11FCCU500RUNS_000111.LAB	6/8/2011	9:14	0.78	0.46	0.38	0.34
6-8-11FCCU500RUNS_000112.LAB	6/8/2011	9:15	0.83	0.56	0.38	0.25
6-8-11FCCU500RUNS_000113.LAB	6/8/2011	9:16	0.79	0.62	0.42	0.37
6-8-11FCCU500RUNS_000114.LAB	6/8/2011	9:17	0.71	0.84	0.35	0.22
6-8-11FCCU500RUNS_000115.LAB	6/8/2011	9:18	0.71	0.84	0.32	0.30
6-8-11FCCU500RUNS_000116.LAB	6/8/2011	9:19	0.57	1.02	0.32	0.26
6-8-11FCCU500RUNS_000117.LAB	6/8/2011	9:20	0.43	1.08	0.33	0.28
6-8-11FCCU500RUNS_000118.LAB	6/8/2011	9:21	0.77	1.02	0.38	0.32
6-8-11FCCU500RUNS_000119.LAB	6/8/2011	9:22	0.48	1.11	0.38	0.26
6-8-11FCCU500RUNS_000120.LAB	6/8/2011	9:24	0.53	1.08	0.29	0.19
6-8-11FCCU500RUNS_000121.LAB	6/8/2011	9:25	0.50	1.08	0.34	0.25
6-8-11FCCU500RUNS_000122.LAB	6/8/2011	9:26	0.49	0.99	0.31	0.33
6-8-11FCCU500RUNS_000123.LAB	6/8/2011	9:27	0.70	0.98	0.35	0.28
6-8-11FCCU500RUNS_000124.LAB	6/8/2011	9:28	0.56	1.00	0.38	0.24
6-8-11FCCU500RUNS_000125.LAB	6/8/2011	9:29	0.50	0.95	0.26	0.34
6-8-11FCCU500RUNS_000126.LAB	6/8/2011	9:30	0.59	0.87	0.27	0.29
6-8-11FCCU500RUNS_000127.LAB	6/8/2011	9:31	0.45	0.64	0.33	0.23
6-8-11FCCU500RUNS_000128.LAB	6/8/2011	9:32	0.73	0.79	0.31	0.18
6-8-11FCCU500RUNS_000129.LAB	6/8/2011	9:33	0.46	0.66	0.27	0.19
6-8-11FCCU500RUNS_000130.LAB	6/8/2011	9:34	0.35	0.60	0.34	0.28
6-8-11FCCU500RUNS_000131.LAB	6/8/2011	9:35	0.68	0.66	0.28	0.25
6-8-11FCCU500RUNS_000132.LAB	6/8/2011	9:36	0.56	0.83	0.33	0.33
6-8-11FCCU500RUNS_000133.LAB	6/8/2011	9:37	0.54	0.99	0.39	0.30
6-8-11FCCU500RUNS_000134.LAB	6/8/2011	9:38	0.57	1.29	0.34	0.42
6-8-11FCCU500RUNS_000135.LAB	6/8/2011	9:40	1.05	1.25	0.34	0.31
6-8-11FCCU500RUNS_000136.LAB	6/8/2011	9:41	0.37	1.19	0.32	0.25
6-8-11FCCU500RUNS_000137.LAB	6/8/2011	9:42	0.56	1.16	0.32	0.31
6-8-11FCCU500RUNS_000138.LAB	6/8/2011	9:43	0.56	1.13	0.30	0.30
6-8-11FCCU500RUNS_000139.LAB	6/8/2011	9:44	0.42	1.04	0.28	0.28
6-8-11FCCU500RUNS_000140.LAB	6/8/2011	9:45	0.64	0.97	0.45	0.34
6-8-11FCCU500RUNS_000141.LAB	6/8/2011	9:46	0.61	1.14	0.39	0.38
6-8-11FCCU500RUNS_000142.LAB	6/8/2011	9:47	0.87	1.17	0.29	0.30
6-8-11FCCU500RUNS_000143.LAB	6/8/2011	9:48	0.75	1.17	0.34	0.43
6-8-11FCCU500RUNS_000144.LAB	6/8/2011	9:49	0.71	1.13	0.30	0.29
6-8-11FCCU500RUNS_000145.LAB	6/8/2011	9:50	0.79	0.98	0.29	0.38
6-8-11FCCU500RUNS_000146.LAB	6/8/2011	9:51	0.53	1.10	0.32	0.38
6-8-11FCCU500RUNS_000147.LAB	6/8/2011	9:52	0.72	1.19	0.30	0.26
6-8-11FCCU500RUNS_000148.LAB	6/8/2011	9:53	0.58	1.22	0.30	0.26
6-8-11FCCU500RUNS_000149.LAB	6/8/2011	9:54	0.53	1.03	0.24	0.24
6-8-11FCCU500RUNS_000150.LAB	6/8/2011	9:56	0.56	1.00	0.28	0.25
6-8-11FCCU500RUNS_000151.LAB	6/8/2011	9:57	0.42	0.98	0.35	0.30
6-8-11FCCU500RUNS_000152.LAB	6/8/2011	9:58	0.62	1.05	0.35	0.34
6-8-11FCCU500RUNS_000153.LAB	6/8/2011	9:59	0.56	1.12	0.31	0.31
6-8-11FCCU500RUNS_000154.LAB	6/8/2011	10:00	0.69	1.05	0.25	0.32
6-8-11FCCU500RUNS_000155.LAB	6/8/2011	10:01	0.52	1.09	0.26	0.31
6-8-11FCCU500RUNS_000156.LAB	6/8/2011	10:02	0.65	1.00	0.28	0.30
6-8-11FCCU500RUNS_000157.LAB	6/8/2011	10:03	0.55	0.98	0.29	0.34
6-8-11FCCU500RUNS_000158.LAB	6/8/2011	10:04	0.52	0.92	0.34	0.25
6-8-11FCCU500RUNS_000159.LAB	6/8/2011	10:05	0.53	0.97	0.26	0.21
6-8-11FCCU500RUNS_000160.LAB	6/8/2011	10:06	0.54	0.90	0.27	0.29
6-8-11FCCU500RUNS_000161.LAB	6/8/2011	10:07	0.31	0.97	0.29	0.18
6-8-11FCCU500RUNS_000162.LAB	6/8/2011	10:08	0.56	0.88	0.24	0.34
6-8-11FCCU500RUNS_000163.LAB	6/8/2011	10:09	0.44	0.71	0.26	0.25
6-8-11FCCU500RUNS_000164.LAB	6/8/2011	10:10	0.51	0.72	0.24	0.20
6-8-11FCCU500RUNS_000165.LAB	6/8/2011	10:12	0.49	0.69	0.31	0.25
6-8-11FCCU500RUNS_000166.LAB	6/8/2011	10:13	0.43	0.62	0.29	0.16

6-8-11FCCU500RUNS_000167.LAB	6/8/2011	10:14	0.34	0.46	0.29	0.28
6-8-11FCCU500RUNS_000168.LAB	6/8/2011	10:15	0.62	0.49	0.26	0.30
6-8-11FCCU500RUNS_000169.LAB	6/8/2011	10:16	0.39	0.46	0.30	0.28
6-8-11FCCU500RUNS_000170.LAB	6/8/2011	10:17	0.49	0.61	0.24	0.26
6-8-11FCCU500RUNS_000171.LAB	6/8/2011	10:18	0.65	0.72	0.26	0.24
6-8-11FCCU500RUNS_000172.LAB	6/8/2011	10:19	0.51	0.84	0.33	0.26
6-8-11FCCU500RUNS_000173.LAB	6/8/2011	10:20	0.46	0.97	0.21	0.23
6-8-11FCCU500RUNS_000174.LAB	6/8/2011	10:21	0.28	1.10	0.30	0.22
6-8-11FCCU500RUNS_000175.LAB	6/8/2011	10:22	0.70	1.03	0.25	0.23
6-8-11FCCU500RUNS_000176.LAB	6/8/2011	10:23	0.58	1.08	0.29	0.28
6-8-11FCCU500RUNS_000177.LAB	6/8/2011	10:24	0.85	1.30	0.33	0.25
6-8-11FCCU500RUNS_000178.LAB	6/8/2011	10:25	0.58	1.37	0.21	0.30
6-8-11FCCU500RUNS_000179.LAB	6/8/2011	10:26	0.70	1.30	0.35	0.28
6-8-11FCCU500RUNS_000180.LAB	6/8/2011	10:28	0.59	1.25	0.25	0.38
6-8-11FCCU500RUNS_000181.LAB	6/8/2011	10:29	0.50	1.26	0.30	0.33
6-8-11FCCU500RUNS_000182.LAB	6/8/2011	10:30	0.72	1.26	0.31	0.36
6-8-11FCCU500RUNS_000183.LAB	6/8/2011	10:31	0.85	1.06	0.26	0.32
6-8-11FCCU500RUNS_000184.LAB	6/8/2011	10:32	0.47	1.27	0.30	0.32
6-8-11FCCU500RUNS_000185.LAB	6/8/2011	10:33	0.46	0.97	0.24	0.29
6-8-11FCCU500RUNS_000186.LAB	6/8/2011	10:34	0.49	0.83	0.25	0.28
6-8-11FCCU500RUNS_000187.LAB	6/8/2011	10:35	0.45	0.62	0.31	0.25
6-8-11FCCU500RUNS_000188.LAB	6/8/2011	10:36	0.48	0.57	0.29	0.27
6-8-11FCCU500RUNS_000189.LAB	6/8/2011	10:37	0.55	0.57	0.24	0.23
6-8-11FCCU500RUNS_000190.LAB	6/8/2011	10:38	0.63	0.36	0.26	0.30
6-8-11FCCU500RUNS_000191.LAB	6/8/2011	10:39	0.44	0.58	0.21	0.21
6-8-11FCCU500RUNS_000192.LAB	6/8/2011	10:40	0.66	0.54	0.23	0.30
6-8-11FCCU500RUNS_000193.LAB	6/8/2011	10:41	0.77	0.43	0.28	0.21
6-8-11FCCU500RUNS_000194.LAB	6/8/2011	10:43	0.41	0.55	0.29	0.27
6-8-11FCCU500RUNS_000195.LAB	6/8/2011	10:44	0.37	0.61	0.25	0.16
6-8-11FCCU500RUNS_000196.LAB	6/8/2011	10:45	0.52	0.50	0.30	0.26
6-8-11FCCU500RUNS_000197.LAB	6/8/2011	10:46	0.40	0.83	0.27	0.24
6-8-11FCCU500RUNS_000198.LAB	6/8/2011	10:47	0.55	0.86	0.23	0.23
6-8-11FCCU500RUNS_000199.LAB	6/8/2011	10:48	0.70	1.07	0.21	0.20
6-8-11FCCU500RUNS_000200.LAB	6/8/2011	10:49	0.56	1.01	0.23	0.32
6-8-11FCCU500RUNS_000201.LAB	6/8/2011	10:50	0.58	1.11	0.23	0.08
6-8-11FCCU500RUNS_000202.LAB	6/8/2011	10:51	0.60	1.24	0.27	0.23
6-8-11FCCU500RUNS_000203.LAB	6/8/2011	10:52	0.84	1.28	0.22	0.31
6-8-11FCCU500RUNS_000204.LAB	6/8/2011	10:53	0.80	1.24	0.23	0.25
6-8-11FCCU500RUNS_000205.LAB	6/8/2011	10:54	0.44	1.08	0.28	0.29
6-8-11FCCU500RUNS_000206.LAB	6/8/2011	10:55	0.63	1.33	0.21	0.39
Average=			**0.57**	**0.86**	**0.31**	**0.27**

FTIR FIELD DATA SUMMARY

BP Whiting
Whiting, Indiana
FCC 500
6/8/2011
Stack Run #3

Spectrum	Date	Time	HCN (ppmv wb)	Acetaldehyde (ppmv wb)	Formaldehyde (ppmv wb)	Propanal (ppmv wb)
6-8-11FCCU500RUNS_000282.LAB	6/8/2011	14:15	0.36	0.62	0.22	0.28
6-8-11FCCU500RUNS_000283.LAB	6/8/2011	14:16	0.62	0.24	0.32	0.25
6-8-11FCCU500RUNS_000284.LAB	6/8/2011	14:17	0.50	0.26	0.34	0.34
6-8-11FCCU500RUNS_000285.LAB	6/8/2011	14:18	0.55	0.27	0.30	0.35
6-8-11FCCU500RUNS_000286.LAB	6/8/2011	14:19	0.87	0.32	0.27	0.27
6-8-11FCCU500RUNS_000287.LAB	6/8/2011	14:20	-0.26	0.26	0.21	0.31
6-8-11FCCU500RUNS_000288.LAB	6/8/2011	14:21	0.75	0.36	0.29	0.26
6-8-11FCCU500RUNS_000289.LAB	6/8/2011	14:23	0.69	0.28	0.31	0.25
6-8-11FCCU500RUNS_000290.LAB	6/8/2011	14:24	0.76	0.28	0.21	0.22
6-8-11FCCU500RUNS_000291.LAB	6/8/2011	14:25	0.55	0.43	0.33	0.19
6-8-11FCCU500RUNS_000292.LAB	6/8/2011	14:26	0.31	0.24	0.22	0.32
6-8-11FCCU500RUNS_000293.LAB	6/8/2011	14:27	0.43	0.01	0.26	0.25
6-8-11FCCU500RUNS_000294.LAB	6/8/2011	14:28	0.62	-0.03	0.32	0.22
6-8-11FCCU500RUNS_000295.LAB	6/8/2011	14:29	0.74	0.23	0.21	0.18
6-8-11FCCU500RUNS_000296.LAB	6/8/2011	14:30	0.55	0.56	0.23	0.24
6-8-11FCCU500RUNS_000297.LAB	6/8/2011	14:31	0.49	0.36	0.26	0.23
6-8-11FCCU500RUNS_000298.LAB	6/8/2011	14:32	0.48	0.41	0.27	0.22
6-8-11FCCU500RUNS_000299.LAB	6/8/2011	14:33	0.16	0.23	0.36	0.15
6-8-11FCCU500RUNS_000300.LAB	6/8/2011	14:34	0.33	0.13	0.20	0.14
6-8-11FCCU500RUNS_000301.LAB	6/8/2011	14:35	0.46	0.34	0.23	0.10
6-8-11FCCU500RUNS_000302.LAB	6/8/2011	14:36	0.52	0.20	0.24	0.18
6-8-11FCCU500RUNS_000303.LAB	6/8/2011	14:38	0.61	0.24	0.28	0.12
6-8-11FCCU500RUNS_000304.LAB	6/8/2011	14:39	0.44	0.32	0.23	0.08
6-8-11FCCU500RUNS_000305.LAB	6/8/2011	14:40	0.41	0.50	0.21	0.06
6-8-11FCCU500RUNS_000306.LAB	6/8/2011	14:41	0.69	0.51	0.19	0.09
6-8-11FCCU500RUNS_000307.LAB	6/8/2011	14:42	0.62	0.53	0.15	0.00
6-8-11FCCU500RUNS_000308.LAB	6/8/2011	14:43	0.32	0.35	0.21	0.16
6-8-11FCCU500RUNS_000309.LAB	6/8/2011	14:44	0.34	0.50	0.25	0.16
6-8-11FCCU500RUNS_000310.LAB	6/8/2011	14:45	0.37	0.60	0.17	0.11
6-8-11FCCU500RUNS_000311.LAB	6/8/2011	14:46	0.31	0.83	0.27	0.11
6-8-11FCCU500RUNS_000312.LAB	6/8/2011	14:47	0.26	0.70	0.23	0.19
6-8-11FCCU500RUNS_000313.LAB	6/8/2011	14:48	0.37	0.52	0.21	0.14
6-8-11FCCU500RUNS_000314.LAB	6/8/2011	14:49	0.23	0.77	0.24	0.23
6-8-11FCCU500RUNS_000315.LAB	6/8/2011	14:50	0.45	0.68	0.29	0.37
6-8-11FCCU500RUNS_000316.LAB	6/8/2011	14:51	0.50	0.80	0.23	0.11
6-8-11FCCU500RUNS_000317.LAB	6/8/2011	14:52	0.39	0.99	0.20	0.16
6-8-11FCCU500RUNS_000318.LAB	6/8/2011	14:54	0.30	1.07	0.20	0.15
6-8-11FCCU500RUNS_000319.LAB	6/8/2011	14:55	0.12	0.92	0.18	0.16
6-8-11FCCU500RUNS_000320.LAB	6/8/2011	14:56	0.59	0.82	0.23	0.08
6-8-11FCCU500RUNS_000321.LAB	6/8/2011	14:57	0.37	0.76	0.23	0.14
6-8-11FCCU500RUNS_000322.LAB	6/8/2011	14:58	0.14	0.94	0.16	0.09
6-8-11FCCU500RUNS_000323.LAB	6/8/2011	14:59	0.14	0.99	0.23	0.16
6-8-11FCCU500RUNS_000324.LAB	6/8/2011	15:00	0.29	0.88	0.25	0.16
6-8-11FCCU500RUNS_000325.LAB	6/8/2011	15:01	0.42	0.75	0.14	0.17
6-8-11FCCU500RUNS_000326.LAB	6/8/2011	15:02	0.46	0.50	0.19	0.15
6-8-11FCCU500RUNS_000327.LAB	6/8/2011	15:03	0.69	0.57	0.22	0.09
6-8-11FCCU500RUNS_000328.LAB	6/8/2011	15:04	0.35	0.69	0.22	0.09
6-8-11FCCU500RUNS_000329.LAB	6/8/2011	15:05	0.51	0.47	0.27	0.19
6-8-11FCCU500RUNS_000330.LAB	6/8/2011	15:06	0.45	0.49	0.23	0.18
6-8-11FCCU500RUNS_000331.LAB	6/8/2011	15:07	0.45	0.53	0.23	0.27
6-8-11FCCU500RUNS_000332.LAB	6/8/2011	15:08	0.68	0.61	0.20	0.20
6-8-11FCCU500RUNS_000333.LAB	6/8/2011	15:10	0.53	0.42	0.19	0.26
6-8-11FCCU500RUNS_000334.LAB	6/8/2011	15:11	0.43	0.55	0.21	0.20
6-8-11FCCU500RUNS_000335.LAB	6/8/2011	15:12	0.63	0.50	0.18	0.26
6-8-11FCCU500RUNS_000336.LAB	6/8/2011	15:13	0.50	0.70	0.24	0.16
6-8-11FCCU500RUNS_000337.LAB	6/8/2011	15:14	0.59	0.83	0.19	0.15
6-8-11FCCU500RUNS_000338.LAB	6/8/2011	15:15	0.48	0.97	0.22	0.24
6-8-11FCCU500RUNS_000339.LAB	6/8/2011	15:16	0.41	1.05	0.21	0.19
6-8-11FCCU500RUNS_000345.LAB	6/8/2011	15:22	0.68	1.36	0.16	0.17
6-8-11FCCU500RUNS_000346.LAB	6/8/2011	15:23	0.77	1.17	0.16	0.01
6-8-11FCCU500RUNS_000347.LAB	6/8/2011	15:25	0.89	1.38	0.14	0.10
6-8-11FCCU500RUNS_000348.LAB	6/8/2011	15:26	0.74	1.05	0.14	0.05
6-8-11FCCU500RUNS_000349.LAB	6/8/2011	15:27	0.54	0.92	0.18	0.28
6-8-11FCCU500RUNS_000350.LAB	6/8/2011	15:28	0.62	1.05	0.20	0.28
6-8-11FCCU500RUNS_000351.LAB	6/8/2011	15:29	0.45	0.93	0.19	0.24
6-8-11FCCU500RUNS_000352.LAB	6/8/2011	15:30	0.43	0.56	0.21	0.39
6-8-11FCCU500RUNS_000353.LAB	6/8/2011	15:31	0.49	0.62	0.16	0.38
6-8-11FCCU500RUNS_000354.LAB	6/8/2011	15:32	0.52	0.59	0.14	0.08
6-8-11FCCU500RUNS_000355.LAB	6/8/2011	15:33	0.45	0.47	0.13	0.13
6-8-11FCCU500RUNS_000356.LAB	6/8/2011	15:34	0.74	0.33	0.16	0.01
6-8-11FCCU500RUNS_000357.LAB	6/8/2011	15:35	0.29	0.43	0.15	0.34
6-8-11FCCU500RUNS_000358.LAB	6/8/2011	15:36	0.43	0.29	0.13	0.21
6-8-11FCCU500RUNS_000359.LAB	6/8/2011	15:37	0.41	0.38	0.20	0.30
6-8-11FCCU500RUNS_000360.LAB	6/8/2011	15:38	0.42	0.55	0.22	0.23

6-8-11FCCU500RUNS_000361.LAB	6/8/2011	15:39	0.29	0.68	0.16	0.13
6-8-11FCCU500RUNS_000362.LAB	6/8/2011	15:41	0.39	0.68	0.25	0.20
6-8-11FCCU500RUNS_000369.LAB	6/8/2011	15:48	0.64	1.21	0.21	0.14
6-8-11FCCU500RUNS_000370.LAB	6/8/2011	15:49	0.45	1.06	0.18	0.29
6-8-11FCCU500RUNS_000371.LAB	6/8/2011	15:50	0.53	1.27	0.13	0.26
6-8-11FCCU500RUNS_000372.LAB	6/8/2011	15:51	0.54	1.26	0.14	0.19
6-8-11FCCU500RUNS_000373.LAB	6/8/2011	15:52	0.42	1.24	0.20	0.23
6-8-11FCCU500RUNS_000374.LAB	6/8/2011	15:53	0.60	1.17	0.20	0.28
6-8-11FCCU500RUNS_000375.LAB	6/8/2011	15:54	0.72	1.27	0.18	0.16
6-8-11FCCU500RUNS_000376.LAB	6/8/2011	15:56	0.82	1.37	0.10	0.13
6-8-11FCCU500RUNS_000377.LAB	6/8/2011	15:57	0.89	1.38	0.11	0.11
6-8-11FCCU500RUNS_000378.LAB	6/8/2011	15:58	0.81	1.48	0.10	0.12
6-8-11FCCU500RUNS_000379.LAB	6/8/2011	15:59	0.70	1.40	0.19	0.17
6-8-11FCCU500RUNS_000380.LAB	6/8/2011	16:00	0.74	1.27	0.14	0.21
6-8-11FCCU500RUNS_000381.LAB	6/8/2011	16:01	0.32	1.18	0.24	0.20
6-8-11FCCU500RUNS_000382.LAB	6/8/2011	16:02	0.58	1.26	0.14	0.24
6-8-11FCCU500RUNS_000383.LAB	6/8/2011	16:03	0.74	1.12	0.18	0.28
6-8-11FCCU500RUNS_000384.LAB	6/8/2011	16:04	0.68	1.28	0.11	0.28
6-8-11FCCU500RUNS_000385.LAB	6/8/2011	16:05	0.32	1.19	0.11	0.21
6-8-11FCCU500RUNS_000386.LAB	6/8/2011	16:06	0.39	1.20	0.16	0.22
6-8-11FCCU500RUNS_000387.LAB	6/8/2011	16:07	0.58	1.27	0.08	0.29
6-8-11FCCU500RUNS_000388.LAB	6/8/2011	16:08	0.57	1.36	0.10	0.11
6-8-11FCCU500RUNS_000389.LAB	6/8/2011	16:09	0.61	1.39	0.07	0.13
6-8-11FCCU500RUNS_000394.LAB	6/8/2011	16:15	0.80	1.04	0.09	0.08
Average=			**0.50**	**0.73**	**0.20**	**0.19**

FTIR FIELD DATA

BP Whiting
Whiting, Indiana
FCC 500
6/9/2011
Stack Run #1

Spectrum	Date	Time	NH_3 (ppmv wb)
6-9-11FCCU500RUNS_000048.LAB	6/9/2011	15:53	0.37
6-9-11FCCU500RUNS_000049.LAB	6/9/2011	15:54	0.36
6-9-11FCCU500RUNS_000050.LAB	6/9/2011	15:55	0.41
6-9-11FCCU500RUNS_000051.LAB	6/9/2011	15:56	0.37
6-9-11FCCU500RUNS_000052.LAB	6/9/2011	15:57	0.38
6-9-11FCCU500RUNS_000053.LAB	6/9/2011	15:58	0.35
6-9-11FCCU500RUNS_000054.LAB	6/9/2011	15:59	0.37
6-9-11FCCU500RUNS_000055.LAB	6/9/2011	16:00	0.37
6-9-11FCCU500RUNS_000056.LAB	6/9/2011	16:01	0.33
6-9-11FCCU500RUNS_000057.LAB	6/9/2011	16:03	0.45
6-9-11FCCU500RUNS_000058.LAB	6/9/2011	16:04	0.34
6-9-11FCCU500RUNS_000059.LAB	6/9/2011	16:05	0.37
6-9-11FCCU500RUNS_000060.LAB	6/9/2011	16:06	0.36
6-9-11FCCU500RUNS_000061.LAB	6/9/2011	16:07	0.39
6-9-11FCCU500RUNS_000062.LAB	6/9/2011	16:08	0.43
6-9-11FCCU500RUNS_000063.LAB	6/9/2011	16:09	0.39
6-9-11FCCU500RUNS_000064.LAB	6/9/2011	16:10	0.46
6-9-11FCCU500RUNS_000065.LAB	6/9/2011	16:11	0.37
6-9-11FCCU500RUNS_000066.LAB	6/9/2011	16:12	0.27
6-9-11FCCU500RUNS_000067.LAB	6/9/2011	16:13	0.44
6-9-11FCCU500RUNS_000068.LAB	6/9/2011	16:14	0.28
6-9-11FCCU500RUNS_000069.LAB	6/9/2011	16:15	0.46
6-9-11FCCU500RUNS_000070.LAB	6/9/2011	16:16	0.41
6-9-11FCCU500RUNS_000071.LAB	6/9/2011	16:17	0.31
6-9-11FCCU500RUNS_000072.LAB	6/9/2011	16:19	0.42
6-9-11FCCU500RUNS_000073.LAB	6/9/2011	16:20	0.35
6-9-11FCCU500RUNS_000074.LAB	6/9/2011	16:21	0.36
6-9-11FCCU500RUNS_000075.LAB	6/9/2011	16:22	0.41
6-9-11FCCU500RUNS_000076.LAB	6/9/2011	16:23	0.93
6-9-11FCCU500RUNS_000077.LAB	6/9/2011	16:24	0.36
6-9-11FCCU500RUNS_000078.LAB	6/9/2011	16:25	0.20
6-9-11FCCU500RUNS_000079.LAB	6/9/2011	16:26	0.51
6-9-11FCCU500RUNS_000080.LAB	6/9/2011	16:27	0.22
6-9-11FCCU500RUNS_000081.LAB	6/9/2011	16:28	0.11
6-9-11FCCU500RUNS_000082.LAB	6/9/2011	16:29	0.06
6-9-11FCCU500RUNS_000083.LAB	6/9/2011	16:30	0.65
6-9-11FCCU500RUNS_000084.LAB	6/9/2011	16:31	0.50
6-9-11FCCU500RUNS_000085.LAB	6/9/2011	16:32	0.41
6-9-11FCCU500RUNS_000086.LAB	6/9/2011	16:34	0.62
6-9-11FCCU500RUNS_000087.LAB	6/9/2011	16:35	0.24
6-9-11FCCU500RUNS_000088.LAB	6/9/2011	16:36	0.61
6-9-11FCCU500RUNS_000089.LAB	6/9/2011	16:37	0.62
6-9-11FCCU500RUNS_000090.LAB	6/9/2011	16:38	0.13
6-9-11FCCU500RUNS_000091.LAB	6/9/2011	16:39	0.36
6-9-11FCCU500RUNS_000092.LAB	6/9/2011	16:40	0.21
6-9-11FCCU500RUNS_000093.LAB	6/9/2011	16:41	0.48
6-9-11FCCU500RUNS_000094.LAB	6/9/2011	16:42	0.16
6-9-11FCCU500RUNS_000095.LAB	6/9/2011	16:43	0.12
6-9-11FCCU500RUNS_000096.LAB	6/9/2011	16:44	0.40
6-9-11FCCU500RUNS_000097.LAB	6/9/2011	16:45	0.61
6-9-11FCCU500RUNS_000098.LAB	6/9/2011	16:46	0.31
6-9-11FCCU500RUNS_000099.LAB	6/9/2011	16:47	0.02
6-9-11FCCU500RUNS_000100.LAB	6/9/2011	16:48	0.13
6-9-11FCCU500RUNS_000101.LAB	6/9/2011	16:50	0.23
6-9-11FCCU500RUNS_000102.LAB	6/9/2011	16:51	0.52
6-9-11FCCU500RUNS_000103.LAB	6/9/2011	16:52	0.11
6-9-11FCCU500RUNS_000104.LAB	6/9/2011	16:53	0.67
6-9-11FCCU500RUNS_000105.LAB	6/9/2011	16:54	0.38
6-9-11FCCU500RUNS_000106.LAB	6/9/2011	16:55	1.32
6-9-11FCCU500RUNS_000107.LAB	6/9/2011	16:56	0.12
6-9-11FCCU500RUNS_000108.LAB	6/9/2011	16:57	1.49
6-9-11FCCU500RUNS_000109.LAB	6/9/2011	16:58	0.07
6-9-11FCCU500RUNS_000110.LAB	6/9/2011	17:01	0.32
6-9-11FCCU500RUNS_000111.LAB	6/9/2011	17:02	1.23
6-9-11FCCU500RUNS_000112.LAB	6/9/2011	17:03	0.29
6-9-11FCCU500RUNS_000113.LAB	6/9/2011	17:05	1.06
6-9-11FCCU500RUNS_000114.LAB	6/9/2011	17:06	0.85
6-9-11FCCU500RUNS_000115.LAB	6/9/2011	17:07	0.49
6-9-11FCCU500RUNS_000116.LAB	6/9/2011	17:08	0.33
6-9-11FCCU500RUNS_000117.LAB	6/9/2011	17:09	0.32
6-9-11FCCU500RUNS_000118.LAB	6/9/2011	17:10	2.12
6-9-11FCCU500RUNS_000119.LAB	6/9/2011	17:11	0.55
6-9-11FCCU500RUNS_000120.LAB	6/9/2011	17:12	0.05
6-9-11FCCU500RUNS_000121.LAB	6/9/2011	17:13	1.34
6-9-11FCCU500RUNS_000122.LAB	6/9/2011	17:14	0.48
6-9-11FCCU500RUNS_000123.LAB	6/9/2011	17:15	0.11
6-9-11FCCU500RUNS_000124.LAB	6/9/2011	17:17	0.08
6-9-11FCCU500RUNS_000125.LAB	6/9/2011	17:18	1.25

6-9-11FCCU500RUNS_000126.LAB	6/9/2011	17:19	0.13
6-9-11FCCU500RUNS_000127.LAB	6/9/2011	17:20	0.01
6-9-11FCCU500RUNS_000128.LAB	6/9/2011	17:21	0.04
6-9-11FCCU500RUNS_000129.LAB	6/9/2011	17:22	1.29
6-9-11FCCU500RUNS_000130.LAB	6/9/2011	17:23	0.38
6-9-11FCCU500RUNS_000131.LAB	6/9/2011	17:24	0.43
6-9-11FCCU500RUNS_000132.LAB	6/9/2011	17:25	0.45
6-9-11FCCU500RUNS_000133.LAB	6/9/2011	17:26	0.62
6-9-11FCCU500RUNS_000134.LAB	6/9/2011	17:27	0.09
6-9-11FCCU500RUNS_000135.LAB	6/9/2011	17:28	0.09
6-9-11FCCU500RUNS_000136.LAB	6/9/2011	17:29	1.41
6-9-11FCCU500RUNS_000137.LAB	6/9/2011	17:30	1.10
6-9-11FCCU500RUNS_000138.LAB	6/9/2011	17:32	0.65
6-9-11FCCU500RUNS_000139.LAB	6/9/2011	17:33	0.51
6-9-11FCCU500RUNS_000140.LAB	6/9/2011	17:34	0.94
6-9-11FCCU500RUNS_000141.LAB	6/9/2011	17:35	0.49
6-9-11FCCU500RUNS_000142.LAB	6/9/2011	17:36	1.42
6-9-11FCCU500RUNS_000143.LAB	6/9/2011	17:37	0.62
6-9-11FCCU500RUNS_000144.LAB	6/9/2011	17:38	0.86
6-9-11FCCU500RUNS_000145.LAB	6/9/2011	17:39	1.16
6-9-11FCCU500RUNS_000146.LAB	6/9/2011	17:40	0.80
6-9-11FCCU500RUNS_000147.LAB	6/9/2011	17:41	0.60
6-9-11FCCU500RUNS_000148.LAB	6/9/2011	17:42	0.50
6-9-11FCCU500RUNS_000149.LAB	6/9/2011	17:43	1.08
6-9-11FCCU500RUNS_000150.LAB	6/9/2011	17:44	1.36
6-9-11FCCU500RUNS_000151.LAB	6/9/2011	17:45	0.47
6-9-11FCCU500RUNS_000152.LAB	6/9/2011	17:46	0.00
6-9-11FCCU500RUNS_000153.LAB	6/9/2011	17:48	0.76
6-9-11FCCU500RUNS_000154.LAB	6/9/2011	17:49	0.28
6-9-11FCCU500RUNS_000155.LAB	6/9/2011	17:50	1.30
6-9-11FCCU500RUNS_000156.LAB	6/9/2011	17:51	0.61
6-9-11FCCU500RUNS_000157.LAB	6/9/2011	17:52	0.47
6-9-11FCCU500RUNS_000158.LAB	6/9/2011	17:53	0.60
Average=			**0.51**

FTIR FIELD DATA

BP Whiting
Whiting, Indiana
FCC 500
6/10/2011
Stack Run #2

Spectrum	Date	Time	NH_3 (ppmv wb)
6-10-11FCCU500RUNS_000065.LAB	6/10/2011	8:16	1.64
6-10-11FCCU500RUNS_000066.LAB	6/10/2011	8:17	1.62
6-10-11FCCU500RUNS_000067.LAB	6/10/2011	8:18	1.67
6-10-11FCCU500RUNS_000068.LAB	6/10/2011	8:19	1.63
6-10-11FCCU500RUNS_000069.LAB	6/10/2011	8:20	1.72
6-10-11FCCU500RUNS_000070.LAB	6/10/2011	8:22	1.72
6-10-11FCCU500RUNS_000071.LAB	6/10/2011	8:23	1.69
6-10-11FCCU500RUNS_000072.LAB	6/10/2011	8:24	1.71
6-10-11FCCU500RUNS_000073.LAB	6/10/2011	8:25	1.71
6-10-11FCCU500RUNS_000074.LAB	6/10/2011	8:26	1.81
6-10-11FCCU500RUNS_000075.LAB	6/10/2011	8:27	1.69
6-10-11FCCU500RUNS_000076.LAB	6/10/2011	8:28	1.72
6-10-11FCCU500RUNS_000077.LAB	6/10/2011	8:29	1.52
6-10-11FCCU500RUNS_000078.LAB	6/10/2011	8:30	1.19
6-10-11FCCU500RUNS_000079.LAB	6/10/2011	8:31	1.31
6-10-11FCCU500RUNS_000080.LAB	6/10/2011	8:32	1.29
6-10-11FCCU500RUNS_000081.LAB	6/10/2011	8:33	1.20
6-10-11FCCU500RUNS_000082.LAB	6/10/2011	8:34	1.09
6-10-11FCCU500RUNS_000083.LAB	6/10/2011	8:35	1.00
6-10-11FCCU500RUNS_000084.LAB	6/10/2011	8:36	1.08
6-10-11FCCU500RUNS_000085.LAB	6/10/2011	8:38	1.09
6-10-11FCCU500RUNS_000086.LAB	6/10/2011	8:39	0.68
6-10-11FCCU500RUNS_000087.LAB	6/10/2011	8:40	0.64
6-10-11FCCU500RUNS_000088.LAB	6/10/2011	8:41	0.73
6-10-11FCCU500RUNS_000089.LAB	6/10/2011	8:42	0.96
6-10-11FCCU500RUNS_000090.LAB	6/10/2011	8:43	1.01
6-10-11FCCU500RUNS_000091.LAB	6/10/2011	8:44	0.99
6-10-11FCCU500RUNS_000092.LAB	6/10/2011	8:45	0.98
6-10-11FCCU500RUNS_000093.LAB	6/10/2011	8:46	1.10
6-10-11FCCU500RUNS_000094.LAB	6/10/2011	8:47	0.81
6-10-11FCCU500RUNS_000095.LAB	6/10/2011	8:48	1.07
6-10-11FCCU500RUNS_000096.LAB	6/10/2011	8:49	1.08
6-10-11FCCU500RUNS_000097.LAB	6/10/2011	8:50	1.12
6-10-11FCCU500RUNS_000098.LAB	6/10/2011	8:51	1.23
6-10-11FCCU500RUNS_000099.LAB	6/10/2011	8:53	0.81
6-10-11FCCU500RUNS_000100.LAB	6/10/2011	8:54	0.95
6-10-11FCCU500RUNS_000101.LAB	6/10/2011	8:55	1.21
6-10-11FCCU500RUNS_000102.LAB	6/10/2011	8:56	1.22
6-10-11FCCU500RUNS_000103.LAB	6/10/2011	8:57	1.30
6-10-11FCCU500RUNS_000104.LAB	6/10/2011	8:58	1.29
6-10-11FCCU500RUNS_000105.LAB	6/10/2011	8:59	1.00
6-10-11FCCU500RUNS_000106.LAB	6/10/2011	9:00	1.28
6-10-11FCCU500RUNS_000107.LAB	6/10/2011	9:01	1.27
6-10-11FCCU500RUNS_000108.LAB	6/10/2011	9:02	1.21
6-10-11FCCU500RUNS_000109.LAB	6/10/2011	9:03	1.07
6-10-11FCCU500RUNS_000110.LAB	6/10/2011	9:04	1.10
6-10-11FCCU500RUNS_000111.LAB	6/10/2011	9:05	0.74
6-10-11FCCU500RUNS_000112.LAB	6/10/2011	9:06	0.69
6-10-11FCCU500RUNS_000113.LAB	6/10/2011	9:07	0.99
6-10-11FCCU500RUNS_000114.LAB	6/10/2011	9:09	0.98
6-10-11FCCU500RUNS_000115.LAB	6/10/2011	9:10	0.94
6-10-11FCCU500RUNS_000116.LAB	6/10/2011	9:11	0.97
6-10-11FCCU500RUNS_000117.LAB	6/10/2011	9:12	0.96
6-10-11FCCU500RUNS_000118.LAB	6/10/2011	9:13	0.88
6-10-11FCCU500RUNS_000119.LAB	6/10/2011	9:14	0.93
6-10-11FCCU500RUNS_000120.LAB	6/10/2011	9:15	0.57
6-10-11FCCU500RUNS_000121.LAB	6/10/2011	9:16	0.97
6-10-11FCCU500RUNS_000122.LAB	6/10/2011	9:17	0.57
6-10-11FCCU500RUNS_000123.LAB	6/10/2011	9:18	0.94
6-10-11FCCU500RUNS_000124.LAB	6/10/2011	9:19	0.76
6-10-11FCCU500RUNS_000125.LAB	6/10/2011	9:20	1.03
6-10-11FCCU500RUNS_000126.LAB	6/10/2011	9:21	0.72
6-10-11FCCU500RUNS_000127.LAB	6/10/2011	9:22	1.05
6-10-11FCCU500RUNS_000128.LAB	6/10/2011	9:23	0.70
6-10-11FCCU500RUNS_000129.LAB	6/10/2011	9:25	0.78
6-10-11FCCU500RUNS_000130.LAB	6/10/2011	9:26	1.11
6-10-11FCCU500RUNS_000131.LAB	6/10/2011	9:27	1.02
6-10-11FCCU500RUNS_000132.LAB	6/10/2011	9:28	1.18
6-10-11FCCU500RUNS_000133.LAB	6/10/2011	9:29	0.76
6-10-11FCCU500RUNS_000134.LAB	6/10/2011	9:30	0.82
6-10-11FCCU500RUNS_000135.LAB	6/10/2011	9:31	1.15
6-10-11FCCU500RUNS_000136.LAB	6/10/2011	9:32	0.82
6-10-11FCCU500RUNS_000137.LAB	6/10/2011	9:33	0.92
6-10-11FCCU500RUNS_000138.LAB	6/10/2011	9:34	0.81
6-10-11FCCU500RUNS_000139.LAB	6/10/2011	9:35	0.74
6-10-11FCCU500RUNS_000140.LAB	6/10/2011	9:36	0.65
6-10-11FCCU500RUNS_000141.LAB	6/10/2011	9:37	0.62
6-10-11FCCU500RUNS_000142.LAB	6/10/2011	9:38	0.97

6-10-11FCCU500RUNS_000143.LAB	6/10/2011	9:40	0.68
6-10-11FCCU500RUNS_000144.LAB	6/10/2011	9:41	0.59
6-10-11FCCU500RUNS_000145.LAB	6/10/2011	9:42	0.57
6-10-11FCCU500RUNS_000146.LAB	6/10/2011	9:43	0.61
6-10-11FCCU500RUNS_000147.LAB	6/10/2011	9:44	0.66
6-10-11FCCU500RUNS_000148.LAB	6/10/2011	9:45	0.88
6-10-11FCCU500RUNS_000149.LAB	6/10/2011	9:46	0.88
6-10-11FCCU500RUNS_000150.LAB	6/10/2011	9:47	0.84
6-10-11FCCU500RUNS_000151.LAB	6/10/2011	9:48	0.61
6-10-11FCCU500RUNS_000152.LAB	6/10/2011	9:49	0.53
6-10-11FCCU500RUNS_000153.LAB	6/10/2011	9:50	0.60
6-10-11FCCU500RUNS_000154.LAB	6/10/2011	9:51	0.64
6-10-11FCCU500RUNS_000155.LAB	6/10/2011	9:52	0.56
6-10-11FCCU500RUNS_000156.LAB	6/10/2011	9:53	0.93
6-10-11FCCU500RUNS_000157.LAB	6/10/2011	9:54	0.98
6-10-11FCCU500RUNS_000158.LAB	6/10/2011	9:56	1.03
6-10-11FCCU500RUNS_000159.LAB	6/10/2011	9:57	0.73
6-10-11FCCU500RUNS_000160.LAB	6/10/2011	9:58	0.63
6-10-11FCCU500RUNS_000161.LAB	6/10/2011	9:59	0.78
6-10-11FCCU500RUNS_000162.LAB	6/10/2011	10:00	0.70
6-10-11FCCU500RUNS_000163.LAB	6/10/2011	10:01	0.70
6-10-11FCCU500RUNS_000164.LAB	6/10/2011	10:02	0.85
6-10-11FCCU500RUNS_000165.LAB	6/10/2011	10:03	0.82
6-10-11FCCU500RUNS_000166.LAB	6/10/2011	10:04	0.77
6-10-11FCCU500RUNS_000167.LAB	6/10/2011	10:05	0.78
6-10-11FCCU500RUNS_000168.LAB	6/10/2011	10:06	0.77
6-10-11FCCU500RUNS_000169.LAB	6/10/2011	10:07	0.69
6-10-11FCCU500RUNS_000170.LAB	6/10/2011	10:08	0.71
6-10-11FCCU500RUNS_000171.LAB	6/10/2011	10:09	0.61
6-10-11FCCU500RUNS_000172.LAB	6/10/2011	10:10	0.54
6-10-11FCCU500RUNS_000173.LAB	6/10/2011	10:12	0.92
6-10-11FCCU500RUNS_000174.LAB	6/10/2011	10:13	0.57
6-10-11FCCU500RUNS_000175.LAB	6/10/2011	10:14	0.54
6-10-11FCCU500RUNS_000176.LAB	6/10/2011	10:15	0.59
6-10-11FCCU500RUNS_000177.LAB	6/10/2011	10:16	0.59
6-10-11FCCU500RUNS_000178.LAB	6/10/2011	10:17	0.55
6-10-11FCCU500RUNS_000179.LAB	6/10/2011	10:18	0.61
6-10-11FCCU500RUNS_000180.LAB	6/10/2011	10:19	0.61
6-10-11FCCU500RUNS_000181.LAB	6/10/2011	10:20	0.53
6-10-11FCCU500RUNS_000182.LAB	6/10/2011	10:21	0.59
6-10-11FCCU500RUNS_000183.LAB	6/10/2011	10:22	0.72
6-10-11FCCU500RUNS_000184.LAB	6/10/2011	10:23	0.68
6-10-11FCCU500RUNS_000185.LAB	6/10/2011	10:24	0.98
6-10-11FCCU500RUNS_000186.LAB	6/10/2011	10:25	1.01
6-10-11FCCU500RUNS_000187.LAB	6/10/2011	10:27	1.03
6-10-11FCCU500RUNS_000188.LAB	6/10/2011	10:28	1.02
6-10-11FCCU500RUNS_000189.LAB	6/10/2011	10:29	1.04
6-10-11FCCU500RUNS_000190.LAB	6/10/2011	10:30	0.75
6-10-11FCCU500RUNS_000191.LAB	6/10/2011	10:31	1.14
6-10-11FCCU500RUNS_000192.LAB	6/10/2011	10:32	0.81
6-10-11FCCU500RUNS_000193.LAB	6/10/2011	10:33	1.13
6-10-11FCCU500RUNS_000194.LAB	6/10/2011	10:34	1.14
6-10-11FCCU500RUNS_000195.LAB	6/10/2011	10:35	1.14
6-10-11FCCU500RUNS_000196.LAB	6/10/2011	10:36	1.20
6-10-11FCCU500RUNS_000197.LAB	6/10/2011	10:37	1.21
6-10-11FCCU500RUNS_000198.LAB	6/10/2011	10:38	1.20
6-10-11FCCU500RUNS_000199.LAB	6/10/2011	10:39	0.87
6-10-11FCCU500RUNS_000200.LAB	6/10/2011	10:40	1.06
6-10-11FCCU500RUNS_000201.LAB	6/10/2011	10:41	1.05
6-10-11FCCU500RUNS_000202.LAB	6/10/2011	10:43	1.01
6-10-11FCCU500RUNS_000203.LAB	6/10/2011	10:44	1.05
6-10-11FCCU500RUNS_000204.LAB	6/10/2011	10:45	0.64
6-10-11FCCU500RUNS_000205.LAB	6/10/2011	10:46	0.67
6-10-11FCCU500RUNS_000206.LAB	6/10/2011	10:47	1.02
6-10-11FCCU500RUNS_000207.LAB	6/10/2011	10:48	0.56
6-10-11FCCU500RUNS_000208.LAB	6/10/2011	10:49	1.00
6-10-11FCCU500RUNS_000209.LAB	6/10/2011	10:50	0.87
6-10-11FCCU500RUNS_000210.LAB	6/10/2011	10:51	0.63
6-10-11FCCU500RUNS_000211.LAB	6/10/2011	10:52	0.88
6-10-11FCCU500RUNS_000212.LAB	6/10/2011	10:53	0.52
6-10-11FCCU500RUNS_000213.LAB	6/10/2011	10:54	0.83
6-10-11FCCU500RUNS_000214.LAB	6/10/2011	10:55	0.92
6-10-11FCCU500RUNS_000215.LAB	6/10/2011	10:56	0.65
6-10-11FCCU500RUNS_000216.LAB	6/10/2011	10:57	0.70
6-10-11FCCU500RUNS_000217.LAB	6/10/2011	10:59	0.74
6-10-11FCCU500RUNS_000218.LAB	6/10/2011	11:00	0.67
6-10-11FCCU500RUNS_000219.LAB	6/10/2011	11:01	0.74
6-10-11FCCU500RUNS_000220.LAB	6/10/2011	11:02	0.68
6-10-11FCCU500RUNS_000221.LAB	6/10/2011	11:03	0.70
6-10-11FCCU500RUNS_000222.LAB	6/10/2011	11:04	0.79
6-10-11FCCU500RUNS_000223.LAB	6/10/2011	11:05	0.65
6-10-11FCCU500RUNS_000224.LAB	6/10/2011	11:06	0.76
6-10-11FCCU500RUNS_000225.LAB	6/10/2011	11:07	0.70
6-10-11FCCU500RUNS_000226.LAB	6/10/2011	11:08	0.83
6-10-11FCCU500RUNS_000227.LAB	6/10/2011	11:09	0.86
6-10-11FCCU500RUNS_000228.LAB	6/10/2011	11:10	0.73
6-10-11FCCU500RUNS_000229.LAB	6/10/2011	11:11	0.75
6-10-11FCCU500RUNS_000230.LAB	6/10/2011	11:12	0.76

6-10-11FCCU500RUNS_000231.LAB	6/10/2011	11:14	0.64
6-10-11FCCU500RUNS_000232.LAB	6/10/2011	11:15	0.63
6-10-11FCCU500RUNS_000233.LAB	6/10/2011	11:16	0.72
Average =			**0.92**

FTIR FIELD DATA

BP Whiting
Whiting, Indiana
FCC 500
6/10/2011
Stack Run #1 3

Spectrum	Date	Time	NH_3 (ppmv wb)
6-10-11FCCU500RUNS_000280.LAB	6/10/2011	13:29	0.75
6-10-11FCCU500RUNS_000281.LAB	6/10/2011	13:30	0.76
6-10-11FCCU500RUNS_000282.LAB	6/10/2011	13:31	1.09
6-10-11FCCU500RUNS_000283.LAB	6/10/2011	13:32	0.73
6-10-11FCCU500RUNS_000284.LAB	6/10/2011	13:33	0.71
6-10-11FCCU500RUNS_000285.LAB	6/10/2011	13:34	0.74
6-10-11FCCU500RUNS_000286.LAB	6/10/2011	13:36	0.67
6-10-11FCCU500RUNS_000287.LAB	6/10/2011	13:37	0.99
6-10-11FCCU500RUNS_000288.LAB	6/10/2011	13:38	1.10
6-10-11FCCU500RUNS_000289.LAB	6/10/2011	13:39	1.10
6-10-11FCCU500RUNS_000290.LAB	6/10/2011	13:40	1.05
6-10-11FCCU500RUNS_000291.LAB	6/10/2011	13:41	0.78
6-10-11FCCU500RUNS_000292.LAB	6/10/2011	13:42	0.76
6-10-11FCCU500RUNS_000293.LAB	6/10/2011	13:43	1.04
6-10-11FCCU500RUNS_000294.LAB	6/10/2011	13:44	1.18
6-10-11FCCU500RUNS_000295.LAB	6/10/2011	13:45	0.88
6-10-11FCCU500RUNS_000296.LAB	6/10/2011	13:46	0.75
6-10-11FCCU500RUNS_000297.LAB	6/10/2011	13:47	0.81
6-10-11FCCU500RUNS_000298.LAB	6/10/2011	13:48	0.79
6-10-11FCCU500RUNS_000299.LAB	6/10/2011	13:49	0.92
6-10-11FCCU500RUNS_000300.LAB	6/10/2011	13:50	1.25
6-10-11FCCU500RUNS_000301.LAB	6/10/2011	13:52	0.79
6-10-11FCCU500RUNS_000302.LAB	6/10/2011	13:53	0.75
6-10-11FCCU500RUNS_000303.LAB	6/10/2011	13:54	0.84
6-10-11FCCU500RUNS_000304.LAB	6/10/2011	13:55	1.25
6-10-11FCCU500RUNS_000305.LAB	6/10/2011	13:56	1.17
6-10-11FCCU500RUNS_000306.LAB	6/10/2011	13:57	0.70
6-10-11FCCU500RUNS_000307.LAB	6/10/2011	13:58	0.66
6-10-11FCCU500RUNS_000308.LAB	6/10/2011	13:59	0.66
6-10-11FCCU500RUNS_000309.LAB	6/10/2011	14:00	1.03
6-10-11FCCU500RUNS_000310.LAB	6/10/2011	14:01	0.56
6-10-11FCCU500RUNS_000311.LAB	6/10/2011	14:02	0.94
6-10-11FCCU500RUNS_000312.LAB	6/10/2011	14:03	0.54
6-10-11FCCU500RUNS_000313.LAB	6/10/2011	14:04	0.87
6-10-11FCCU500RUNS_000314.LAB	6/10/2011	14:05	0.56
6-10-11FCCU500RUNS_000315.LAB	6/10/2011	14:06	0.86
6-10-11FCCU500RUNS_000316.LAB	6/10/2011	14:08	0.60
6-10-11FCCU500RUNS_000317.LAB	6/10/2011	14:09	0.49
6-10-11FCCU500RUNS_000318.LAB	6/10/2011	14:10	0.60
6-10-11FCCU500RUNS_000319.LAB	6/10/2011	14:11	0.50
6-10-11FCCU500RUNS_000320.LAB	6/10/2011	14:12	0.63
6-10-11FCCU500RUNS_000321.LAB	6/10/2011	14:13	0.93
6-10-11FCCU500RUNS_000322.LAB	6/10/2011	14:14	0.95
6-10-11FCCU500RUNS_000323.LAB	6/10/2011	14:15	0.91
6-10-11FCCU500RUNS_000324.LAB	6/10/2011	14:16	0.97
6-10-11FCCU500RUNS_000325.LAB	6/10/2011	14:17	1.01
6-10-11FCCU500RUNS_000326.LAB	6/10/2011	14:18	0.64
6-10-11FCCU500RUNS_000327.LAB	6/10/2011	14:19	0.91
6-10-11FCCU500RUNS_000328.LAB	6/10/2011	14:20	1.01
6-10-11FCCU500RUNS_000329.LAB	6/10/2011	14:21	1.08
6-10-11FCCU500RUNS_000330.LAB	6/10/2011	14:23	0.67
6-10-11FCCU500RUNS_000331.LAB	6/10/2011	14:24	1.04
6-10-11FCCU500RUNS_000332.LAB	6/10/2011	14:25	0.53
6-10-11FCCU500RUNS_000333.LAB	6/10/2011	14:26	1.06
6-10-11FCCU500RUNS_000334.LAB	6/10/2011	14:27	1.01
6-10-11FCCU500RUNS_000335.LAB	6/10/2011	14:28	1.09
6-10-11FCCU500RUNS_000336.LAB	6/10/2011	14:29	1.05
6-10-11FCCU500RUNS_000337.LAB	6/10/2011	14:30	1.07
6-10-11FCCU500RUNS_000338.LAB	6/10/2011	14:31	0.97
6-10-11FCCU500RUNS_000339.LAB	6/10/2011	14:32	0.60
6-10-11FCCU500RUNS_000340.LAB	6/10/2011	14:33	0.87
6-10-11FCCU500RUNS_000341.LAB	6/10/2011	14:34	0.57
6-10-11FCCU500RUNS_000342.LAB	6/10/2011	14:35	0.96
6-10-11FCCU500RUNS_000343.LAB	6/10/2011	14:36	0.85
6-10-11FCCU500RUNS_000344.LAB	6/10/2011	14:37	0.50
6-10-11FCCU500RUNS_000345.LAB	6/10/2011	14:39	0.60
6-10-11FCCU500RUNS_000346.LAB	6/10/2011	14:40	0.72
6-10-11FCCU500RUNS_000347.LAB	6/10/2011	14:41	0.88
6-10-11FCCU500RUNS_000348.LAB	6/10/2011	14:42	0.84
6-10-11FCCU500RUNS_000349.LAB	6/10/2011	14:43	0.81
6-10-11FCCU500RUNS_000350.LAB	6/10/2011	14:44	0.43
6-10-11FCCU500RUNS_000351.LAB	6/10/2011	14:45	0.81
6-10-11FCCU500RUNS_000352.LAB	6/10/2011	14:46	0.80
6-10-11FCCU500RUNS_000353.LAB	6/10/2011	14:47	0.87
6-10-11FCCU500RUNS_000354.LAB	6/10/2011	14:48	0.89
6-10-11FCCU500RUNS_000355.LAB	6/10/2011	14:49	0.96
6-10-11FCCU500RUNS_000356.LAB	6/10/2011	14:50	0.50
6-10-11FCCU500RUNS_000357.LAB	6/10/2011	14:51	0.83

6-10-11FCCU500RUNS_000358.LAB	6/10/2011	14:52	0.91
6-10-11FCCU500RUNS_000359.LAB	6/10/2011	14:53	0.97
6-10-11FCCU500RUNS_000360.LAB	6/10/2011	14:55	0.87
6-10-11FCCU500RUNS_000361.LAB	6/10/2011	14:56	0.86
6-10-11FCCU500RUNS_000362.LAB	6/10/2011	14:57	0.55
6-10-11FCCU500RUNS_000363.LAB	6/10/2011	14:58	0.62
6-10-11FCCU500RUNS_000364.LAB	6/10/2011	14:59	0.98
6-10-11FCCU500RUNS_000365.LAB	6/10/2011	15:00	1.04
6-10-11FCCU500RUNS_000366.LAB	6/10/2011	15:01	0.97
6-10-11FCCU500RUNS_000367.LAB	6/10/2011	15:02	0.61
6-10-11FCCU500RUNS_000368.LAB	6/10/2011	15:03	0.59
6-10-11FCCU500RUNS_000369.LAB	6/10/2011	15:04	0.98
6-10-11FCCU500RUNS_000370.LAB	6/10/2011	15:05	0.95
6-10-11FCCU500RUNS_000371.LAB	6/10/2011	15:06	0.91
6-10-11FCCU500RUNS_000372.LAB	6/10/2011	15:07	0.91
6-10-11FCCU500RUNS_000373.LAB	6/10/2011	15:08	0.90
6-10-11FCCU500RUNS_000374.LAB	6/10/2011	15:09	0.60
6-10-11FCCU500RUNS_000375.LAB	6/10/2011	15:11	0.86
6-10-11FCCU500RUNS_000376.LAB	6/10/2011	15:12	0.88
6-10-11FCCU500RUNS_000377.LAB	6/10/2011	15:13	0.82
6-10-11FCCU500RUNS_000378.LAB	6/10/2011	15:14	0.83
6-10-11FCCU500RUNS_000379.LAB	6/10/2011	15:15	0.95
6-10-11FCCU500RUNS_000380.LAB	6/10/2011	15:16	0.80
6-10-11FCCU500RUNS_000381.LAB	6/10/2011	15:17	0.82
6-10-11FCCU500RUNS_000382.LAB	6/10/2011	15:18	0.48
6-10-11FCCU500RUNS_000383.LAB	6/10/2011	15:19	0.55
6-10-11FCCU500RUNS_000384.LAB	6/10/2011	15:20	0.82
6-10-11FCCU500RUNS_000385.LAB	6/10/2011	15:21	0.51
6-10-11FCCU500RUNS_000386.LAB	6/10/2011	15:22	0.66
6-10-11FCCU500RUNS_000387.LAB	6/10/2011	15:23	0.91
6-10-11FCCU500RUNS_000388.LAB	6/10/2011	15:24	0.97
6-10-11FCCU500RUNS_000389.LAB	6/10/2011	15:26	0.60
6-10-11FCCU500RUNS_000390.LAB	6/10/2011	15:27	0.51
6-10-11FCCU500RUNS_000391.LAB	6/10/2011	15:28	0.97
6-10-11FCCU500RUNS_000392.LAB	6/10/2011	15:29	0.89
Average =			**0.82**

FTIR FIELD DATA QA/QC SUMMARY

Company: BP Whiting
Location: Whiting, IN
Source: FCC 500
Test Date: 6/7/2011

Operator: S. Yuchs

FTIR Instrument: MKS Instruments
FTIR Model: MKS - Model 2030
FTIR S/N: CAE Rental
Pathlength: 5.11
Temperature: 150 Deg C
Pressure: 0.9-1.0 ATM
Cell Volume: 200 mL
Computer: CAE Rental

Major Compound: HCN, Formaldehyde, Acetaldehyde, Propanal

QA/QC Parameter	Date Performed	Result	Pass Criteria	Comments
Setup Menu	6/7/2011	N/A	N/A	Recorded in Word File
System Leak Check	6/6/2011	< 200 ml/min	Y	Pre-site test
Positive Leak Check	6/7/2011	0	Y	Recorded in Word File
System Flow Rate	6/7/2011	10 LPM	N/A	Recorded in Word File
FTIR Resolution	6/7/2011	0.5	N/A	Recorded in Word File
Apodization Function	6/7/2011	med Norton Beer	N/A	Recorded in Word File
Scan Time	6/7/2011	60	N/A	Recorded in Excel File
Sample Conditioning System - Dilution	6/7/2011	N/A	N/A	SF6 Tracer Gas
Instrument Monitor Check				
Intensity - Pretest	6/7/2011	1.99 - KBr	Y	Recorded in Word File
Intensity- Posttest	6/7/2011	1.98 - KBr	Y	Recorded in Word File
S/N Ratio Test - Pretest	6/7/2011	1236/2007/1239	Y	60 scans / res 0.5
Peak analysis				
Ambient Air/Water Vapor	6/7/2011	Peak @ 3920	Y	Recorded in Word File
Baseline				
Nitrogen	6/7/2011	< 0.05 AU	Y	Recorded in Excel File
Background Spectra Recorded	6/7/2011	Y	N/A	Recorded in Excel File
Calibration Transfer Standard Instrument Check				
Ethylene 104 ppm	6/7/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/7/2011	10	Y	Recorded in Excel File
Calibration Transfer Standard - Sampling System Check				
Ethylene 104 ppm	6/7/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/7/2011	10	Y	Recorded in Excel File
Analyte Gases				
	6/7/2011	Various	Y	Recorded in Excel File
Dynamic Spiking ~ 90 % Stack Gas/ 10 % Cal				
HCN	6/7/2011	Validated	Y	Must be between 70 and 130 %
Acetaldehyde (surrogate for all aldehydes)	6/7/2011	Validated	Y	Must be between 70 and 130 %
System Response Time	6/7/2011	84sec + Scan Time	N/A	Recorded in Excel File

USEPA Method 320 FTIR Bullet List

Company: BP
Location: Whiting, IN
Source: FCC 500
Date: 6/7/2011
Operator: S. Yuchs

Pretest In-house Evaluations

X	FTIR compound and interferent evaluations
N/A	Sample conditioning evaluation (i.e. chiller, dilution)
X	LOD - MDL - MDC determinations
X	LOD and MAU determination
X	Complete setup menu

Pretest Field Data

X	Record setup menu
X	Record FTIR resolution
X	Record Apodization Function
64	Record scan time
X	Perform FTIR System leakcheck (200 ml/min)
X	Perform FTIR Cell leakcheck - Negative (NOx vacuum pump - absolute - only necessary if sampling negative batch type)
X	Perform FTIR Cell leakcheck - Positive (2 PSIG - 100 mm Hg)
X	Determine system response time
X	Instrument Monitor Check
X	Record and evaluate beam intensity (> 0.75 AU)
X	Perform S/N ratio test (at scan rate to be used - while running Nitrogen at instrument)
X	Record and evaluate peak analysis (ambient air water vapor)
X	Record baseline spectra (while running nitrogen at instrument)
X	Determine LOD MDC by collecting a minimum of 9 spectra with ultra high purity Nitrogen - calculate using Students t-Test
X	Evaluate baseline spectra (while running nitrogen through entire system)
X	Evaluate calibration transfer standard at instrument (ethylene ~ 50-100 ppm, SF6 ~ 10 ppm) - must be +/- 5% of gas value
X	If fixed pathlength instrument - collect a minimum 9 spectra of CTS to determine redundant pathlength (CTS must be +/- 5% of reference cal curve)
X	Evaluate calibration transfer standard through entire system (ethylene ~ 50-100 ppm, SF6 ~ 10 ppm) - must be +/- 5% of gas value
X	Evaluate analyte calibration standard at instrument - must be +/- 5% of gas value
X	Evaluate analyte calibration standard through entire system - must be +/- 5% of gas value
N/A	Perform QA Spike (if Method 301 validation is not done) Must be 10% spike/ 90 % spike gas Must collect 3 spectra of non spiked gas Must collect 3 spectra of spiked gas Use tracer gas as dilution determinate otherwise record sample and spike flow rates for dilution calculations Recovery must be +/- 20% for ARI (Method 320 states +/- 30%)
X	Perform Method 301 validation (when determining compound concentration by FTIR at a new type of source) Must be 10% spike/ 90 % spike gas Must collect 12 spectra of non spiked gas (can measure in pairs if using single FTIR) Must collect 12 spectra spiked gas (can measure in pairs if using single FTIR) Use tracer gas as dilution determinate otherwise record sample and spike flow rates for dilution calculations Recovery must be +/- 30%

Compliance Test Data

X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
X	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Start Test Run 1 (minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
	Start Test Run 2 (minimum 8 spectra per run)
	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
	Inject CTS through entire system - must be +/- 5% of gas value
	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
	Start Test Run 3(minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Inject nitrogen as baseline at instrument - must be +/- 5% of gas value
X	Inject CTS at instrument - must be +/- 5% of gas value
X	If baseline at instrument is +/- 0.02 AU then record another baseline
X	Record and evaluate beam intensity drift (< 5 %)

FTIR FIELD DATA QA/QC SUMMARY

Company: BP Whiting
Location: Whiting, IN
Source: FCC 500
Test Date: 6/8/2011

Operator: S. Yuchs

FTIR Instrument: MKS Instruments
FTIR Model: MKS - Model 2030
FTIR S/N: CAE Rental
Pathlength: 5.11
Temperature: 150 Deg C
Pressure: 0.9-1.0 ATM
Cell Volume: 200 mL
Computer: CAE Rental

Major Compound: HCN, Formaldehyde, Acetaldehyde, Propanal

QA/QC Parameter	Date Performed	Result	Pass Criteria	Comments
Setup Menu	6/8/2011	N/A	N/A	Recorded in Word File
System Leak Check	6/6/2011	< 200 ml/min	Y	Pre-site test
Positive Leak Check	6/8/2011	0	Y	Recorded in excel File
System Flow Rate	6/8/2011	10 LPM	N/A	Visually verified against 6-7 result
FTIR Resolution	6/8/2011	0.5	N/A	Recorded in Word File
Apodization Function	6/8/2011	med Norton Beer	N/A	Recorded in Word File
Scan Time	6/8/2011	60	N/A	Recorded in Excel File
Sample Conditioning System - Dilution	6/8/2011	N/A	N/A	SF6 Tracer Gas
Instrument Monitor Check				
Intensity - Pretest	6/8/2011	1.95 - KBr	Y	Visually verified against 6-7 result
Intensity- Posttest	6/8/2011	1.95 - KBr	Y	Visually verified against 6-7 result
S/N Ratio Test - Pretest	6/8/2011		Y	Visually verified against 6-7 result
Peak analysis				
Ambient Air/Water Vapor	6/8/2011	Peak @ 3920	Y	Recorded in Excel File
Baseline				
Nitrogen	6/8/2011	< 0.05 AU	Y	Recorded in Excel File
Background Spectra Recorded	6/8/2011	Y	N/A	Recorded in Excel File
Calibration Transfer Standard Instrument Check				
Ethylene 104 ppm	6/8/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/8/2011	10	Y	Recorded in Excel File
Calibration Transfer Standard - Sampling System Check				
Ethylene 100 ppm	6/8/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/8/2011	10	Y	Recorded in Excel File
Analyte Gases				
	6/8/2011	Various	Y	Recorded in Excel File
Dynamic Spiking ~ 90 % Stack Gas/ 10 % Cal				
HCN	6/7/2011	Validated	Y	Must be between 70 and 130 %
Acetaldehyde (surrogate for all aldehydes)	6/7/2011	Validated	Y	Must be between 70 and 130 %
System Response Time	6/7/2011	84sec + Scan Time	N/A	Recorded in Excel File

USEPA Method 320 FTIR Bullet List

Company: BP
Location: Whiting, IN
Source: FCC 500
Date: 6/8/2011
Operator: S. Yuchs

Pretest In-house Evaluations

X	FTIR compound and interferent evaluations
N/A	Sample conditioning evaluation (i.e. chiller, dilution)
X	LOD - MDL - MDC determinations
X	LOD and MAU determination
X	Complete setup menu

Pretest Field Data

X	Record setup menu
X	Record FTIR resolution
X	Record Apodization Function
64	Record scan time
X	Perform FTIR System leakcheck (200 ml/min)
X	Perform FTIR Cell leakcheck - Negative (NOx vacuum pump - absolute - only necessary if sampling negative batch type)
X	Perform FTIR Cell leakcheck - Positive (2 PSIG - 100 mm Hg)
X	Determine system response time
X	Instrument Monitor Check
X	Record and evaluate beam intensity (> 0.75 AU)
X	Perform S/N ratio test (at scan rate to be used - while running Nitrogen at instrument)
X	Record and evaluate peak analysis (ambient air water vapor)
X	Record baseline spectra (while running nitrogen at instrument)
X	Determine LOD MDC by collecting a minimum of 9 spectra with ultra high purity Nitrogen - calculate using Students t-Test
X	Evaluate baseline spectra (while running nitrogen through entire system)
X	Evaluate calibration transfer standard at instrument (ethylene ~ 50-100 ppm, SF6 ~ 10 ppm) - must be +/- 5% of gas value
X	If fixed pathlength instrument - collect a minimum 9 spectra of CTS to determine redundant pathlength (CTS must be +/- 5% of reference cal curve)
X	Evaluate calibration transfer standard through entire system (ethylene ~ 50-100 ppm, SF6 ~ 10 ppm) - must be +/- 5% of gas value
X	Evaluate analyte calibration standard at instrument - must be +/- 5% of gas value
X	Evaluate analyte calibration standard through entire system - must be +/- 5% of gas value
N/A	Perform QA Spike (if Method 301 validation is not done) Must be 10% spike/ 90 % spike gas Must collect 3 spectra of non spiked gas Must collect 3 spectra of spiked gas Use tracer gas as dilution determinate otherwise record sample and spike flow rates for dilution calculations Recovery must be +/- 20% for ARI (Method 320 states +/- 30%)
X	Perform Method 301 validation (when determining compound concentration by FTIR at a new type of source) Must be 10% spike/ 90 % spike gas Must collect 12 spectra of non spiked gas (can measure in pairs if using single FTIR) Must collect 12 spectra spiked gas (can measure in pairs if using single FTIR) Use tracer gas as dilution determinate otherwise record sample and spike flow rates for dilution calculations Recovery must be +/- 30%

Compliance Test Data

X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
X	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
N/A	Start Test Run 1 (minimum 8 spectra per run)
N/A	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
N/A	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Start Test Run 2 (minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Start Test Run 3(minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Inject nitrogen as baseline at instrument - must be +/- 5% of gas value
X	Inject CTS at instrument - must be +/- 5% of gas value
X	If baseline at instrument is +/- 0.02 AU then record another baseline
X	Record and evaluate beam intensity drift (< 5 %)

FTIR FIELD DATA QA/QC SUMMARY

Company: BP Whiting
Location: Whiting, IN
Source: FCC 500
Test Date: 6/9/2011

Operator: S. Yuchs

FTIR Instrument: MKS Instruments
FTIR Model: MKS - Model 2030
FTIR S/N: CAE Rental
Pathlength: 5.11
Temperature: 150 Deg C
Pressure: 0.9-1.0 ATM
Cell Volume: 200 mL
Computer: CAE Rental

Major Compound: NH3

QA/QC Parameter	Date Performed	Result	Pass Criteria	Comments
Setup Menu	6/9/2011	N/A	N/A	Recorded in Word File
System Leak Check	6/6/2011	< 200 ml/min	Y	Pre-site test
Positive Leak Check	6/9/2011	0	Y	Recorded in Excel File
System Flow Rate	6/9/2011	10 LPM	N/A	Visually verified against 6-7 result
FTIR Resolution	6/9/2011	0.5	N/A	Recorded in Word File
Apodization Function	6/9/2011	med Norton Beer	N/A	Recorded in Word File
Scan Time	6/9/2011	60	N/A	Recorded in Excel File
Sample Conditioning System - Dilution	6/9/2011	N/A	N/A	SF6 Tracer Gas
Instrument Monitor Check				
Intensity - Pretest	6/9/2011	1.95 - KBr	Y	Visually verified against 6-8 result
Intensity- Posttest	6/9/2011	1.94 - KBr	Y	Visually verified against 6-8 result
S/N Ratio Test - Pretest	6/9/2011		Y	Visually verified against 6-8 result
Peak analysis				
Ambient Air/Water Vapor	6/9/2011	Peak @ 3920	Y	Recorded in Excel File
Baseline				
Nitrogen	6/9/2011	< 0.05 AU	Y	Recorded in Excel File
Background Spectra Recorded	6/9/2011	Y	N/A	Recorded in Excel File
Calibration Transfer Standard Instrument Check				
Ethylene 104 ppm	6/9/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/9/2011	10	Y	Recorded in Excel File
Calibration Transfer Standard - Sampling System Check				
Ethylene 100 ppm	6/9/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/9/2011	10	Y	Recorded in Excel File
Analyte Gases				
NH3	6/9/2011	98-100	Y	Recorded in Excel File
Dynamic Spiking ~ 90 % Stack Gas/ 10 % Cal				
NH3	6/9/2011	Validated	Y	Must be between 70 and 130 %
System Response Time	6/7/2011	84sec + Scan Time	N/A	Recorded in Excel File

USEPA Method 320 FTIR Bullet List

Company: BP
Location: Whiting, IN
Source: FCC 500
Date: 6/9/2011
Operator: S. Yuchs

Pretest In-house Evaluations

X	FTIR compound and interferent evaluations
N/A	Sample conditioning evaluation (i.e. chiller, dilution)
X	LOD - MDL - MDC determinations
X	LOD and MAU determination
X	Complete setup menu

Pretest Field Data

X	Record setup menu
X	Record FTIR resolution
X	Record Apodization Function
64	Record scan time
X	Perform FTIR System leakcheck (200 ml/min)
X	Perform FTIR Cell leakcheck - Negative (NOx vacuum pump - absolute - only necessary if sampling negative batch type)
X	Perform FTIR Cell leakcheck - Positive (2 PSIG - 100 mm Hg)
X	Determine system response time
X	Instrument Monitor Check
X	Record and evaluate beam intensity (> 0.75 AU)
X	Perform S/N ratio test (at scan rate to be used - while running Nitrogen at instrument)
X	Record and evaluate peak analysis (ambient air water vapor)
X	Record baseline spectra (while running nitrogen at instrument)
X	Determine LOD MDC by collecting a minimum of 9 spectra with ultra high purity Nitrogen - calculate using Students t-Test
X	Evaluate baseline spectra (while running nitrogen through entire system)
X	Evaluate calibration transfer standard at instrument (ethylene ~ 50-100 ppm, SF6 ~ 10 ppm) - must be +/- 5% of gas value
X	If fixed pathlength instrument - collect a minimum 9 spectra of CTS to determine redundant pathlength (CTS must be +/- 5% of reference cal curve)
X	Evaluate calibration transfer standard through entire system (ethylene ~ 50-100 ppm, SF6 ~ 10 ppm) - must be +/- 5% of gas value
X	Evaluate analyte calibration standard at instrument - must be +/- 5% of gas value
X	Evaluate analyte calibration standard through entire system - must be +/- 5% of gas value
N/A	Perform QA Spike (if Method 301 validation is not done) Must be 10% spike/ 90 % spike gas Must collect 3 spectra of non spiked gas Must collect 3 spectra of spiked gas Use tracer gas as dilution determinate otherwise record sample and spike flow rates for dilution calculations Recovery must be +/- 20% for ARI (Method 320 states +/- 30%)
X	Perform Method 301 validation (when determining compound concentration by FTIR at a new type of source) Must be 10% spike/ 90 % spike gas Must collect 12 spectra of non spiked gas (can measure in pairs if using single FTIR) Must collect 12 spectra spiked gas (can measure in pairs if using single FTIR) Use tracer gas as dilution determinate otherwise record sample and spike flow rates for dilution calculations Recovery must be +/- 30%

Compliance Test Data

X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
X	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Start Test Run 1 (minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
N/A	Start Test Run 2 (minimum 8 spectra per run)
N/A	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
N/A	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
N/A	Start Test Run 3(minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Inject nitrogen as baseline at instrument - must be +/- 5% of gas value
X	Inject CTS at instrument - must be +/- 5% of gas value
X	If baseline at instrument is +/- 0.02 AU then record another baseline
X	Record and evaluate beam intensity drift (< 5 %)

FTIR FIELD DATA QA/QC SUMMARY

Company: BP Whiting
Location: Whiting, IN
Source: FCC 500
Test Date: 6/10/2011

Operator: S. Yuchs

FTIR Instrument: MKS Instruments
FTIR Model: MKS - Model 2030
FTIR S/N: CAE Rental
Pathlength: 5.11
Temperature: 150 Deg C
Pressure: 0.9-1.0 ATM
Cell Volume: 200 mL
Computer: CAE Rental

Major Compound: NH3

QA/QC Parameter	Date Performed	Result	Pass Criteria	Comments
Setup Menu	6/10/2011	N/A	N/A	Recorded in Word File
System Leak Check	6/6/2011	< 200 ml/min	Y	Pre-site test
Positive Leak Check	6/10/2011	0	Y	Recorded in Excel File
System Flow Rate	6/10/2011	10 LPM	N/A	Visually verified against 6-7 result
FTIR Resolution	6/10/2011	0.5	N/A	Recorded in Word File
Apodization Function	6/10/2011	med Norton Beer	N/A	Recorded in Word File
Scan Time	6/10/2011	60	N/A	Recorded in Excel File
Sample Conditioning System - Dilution	6/10/2011	N/A	N/A	SF6 Tracer Gas
Instrument Monitor Check				
Intensity - Pretest	6/10/2011	1.93 - KBr	Y	Visually verified against 6-9 result
Intensity- Posttest	6/10/2011	1.91 - KBr	Y	Visually verified against 6-9 result
S/N Ratio Test - Pretest	6/10/2011		Y	Visually verified against 6-9 result
Peak analysis				
Ambient Air/Water Vapor	6/10/2011	Peak @ 3920	Y	Recorded in Excel File
Baseline				
Nitrogen	6/10/2011	< 0.05 AU	Y	Recorded in Excel File
Background Spectra Recorded	6/10/2011	Y	N/A	Recorded in Excel File
Calibration Transfer Standard Instrument Check				
Ethylene 104 ppm	6/10/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/10/2011	10	Y	Recorded in Excel File
Calibration Transfer Standard - Sampling System Check				
Ethylene 100 ppm	6/10/2011	102-104	Y	Recorded in Excel File
SF6 10 ppm	6/10/2011	10	Y	Recorded in Excel File
Analyte Gases				
NH3	6/10/2011	98-100	Y	Recorded in Excel File
Dynamic Spiking ~ 90 % Stack Gas/ 10 % Cal				
NH3	6/9/2011	Validated	Y	Must be between 70 and 130 %
System Response Time	6/7/2011	84sec + Scan Time	N/A	Recorded in Excel File

USEPA Method 320 FTIR Bullet List

Company: BP
Location: Whiting, IN
Source: FCC 500
Date: 6/10/2011
Operator: S. Yuchs

Pretest In-house Evaluations

X	FTIR compound and interferent evaluations
N/A	Sample conditioning evaluation (i.e. chiller, dilution)
X	LOD - MDL - MDC determinations
X	LOD and MAU determination
X	Complete setup menu

Pretest Field Data

X	Record setup menu
X	Record FTIR resolution
X	Record Apodization Function
64	Record scan time
X	Perform FTIR System leakcheck (200 ml/min)
X	Perform FTIR Cell leakcheck - Negative (NOx vacuum pump - absolute - only necessary if sampling negative batch type)
X	Perform FTIR Cell leakcheck - Positive (2 PSIG - 100 mm Hg)
X	Determine system response time
X	Instrument Monitor Check
X	Record and evaluate beam intensity (> 0.75 AU)
X	Perform S/N ratio test (at scan rate to be used - while running Nitrogen at instrument)
X	Record and evaluate peak analysis (ambient air water vapor)
X	Record baseline spectra (while running nitrogen at instrument)
X	Determine LOD MDC by collecting a minimum of 9 spectra with ultra high purity Nitrogen - calculate using Students t-Test
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X	Evaluate calibration transfer standard through entire system (ethylene ~ 50-100 ppm, SF6 ~ 10 ppm) - must be +/- 5% of gas value
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X	Perform Method 301 validation (when determining compound concentration by FTIR at a new type of source) Must be 10% spike/ 90 % spike gas Must collect 12 spectra of non spiked gas (can measure in pairs if using single FTIR) Must collect 12 spectra spiked gas (can measure in pairs if using single FTIR) Use tracer gas as dilution determinate otherwise record sample and spike flow rates for dilution calculations Recovery must be +/- 30%

Compliance Test Data

X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
X	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
N/A	Start Test Run 1 (minimum 8 spectra per run)
N/A	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
N/A	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Start Test Run 2 (minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Start Test Run 3(minimum 8 spectra per run)
X	Inject nitrogen as baseline through entire system - must be +/- 5% of gas value
X	Inject CTS through entire system - must be +/- 5% of gas value
N/A	Inject analyte gas through entire system (based on test plan) - must be +/- 5% of gas value
X	Inject nitrogen as baseline at instrument - must be +/- 5% of gas value
X	Inject CTS at instrument - must be +/- 5% of gas value
X	If baseline at instrument is +/- 0.02 AU then record another baseline
X	Record and evaluate beam intensity drift (< 5 %)

BP Whiting
Whiting, Indiana
FCC 500 Stack ICR Testing
FTIR QA/QC Cyanide and Aldehyde Testing
6/7 through 6/8/11

Spectrum	Date	Time	HCN (ppmv wb)	Acetaldehyde (ppmv wb)	Formaldehyde (ppmv wb)	Propanal (ppmv wb)	Ethylene (ppmv wb)	SF6 (ppmv wb)	Comments
6/7/2011 Run 1									
6-7-11FCCU500RUNS_000004.LAB	6/7/2011	9:15	**0.00**	**0.02**	**0.04**	**0.00**	0.01	0.00	Baseline Pre-test
6-7-11FCCU500RUNS_000005.LAB	6/7/2011	9:16	**0.00**	**0.01**	**-0.02**	**-0.09**	0.47	0.00	
6-7-11FCCU500RUNS_000007.LAB	6/7/2011	9:18	0.15	0.88	-0.02	-0.02	**104.06**	**10.84**	CTS Pre-test
6-7-11FCCU500RUNS_000008.LAB	6/7/2011	9:19	0.11	0.83	-0.03	0.03	**104.31**	**10.74**	
6-7-11FCCU500RUNS_000009.LAB	6/7/2011	9:21	0.09	0.94	-0.03	-0.03	**104.20**	**10.71**	
6-7-11FCCU500RUNS_000010.LAB	6/7/2011	9:22	0.08	0.88	0.02	-0.02	**104.24**	**10.71**	
6-7-11FCCU500RUNS_000011.LAB	6/7/2011	9:23	0.06	0.86	0.02	0.05	**104.39**	**10.72**	
Analyte Confirmation via M301	see attached validation sheets								
6-7-11FCCU500RUNS_000570.LAB	6/7/2011	18:09	**-0.05**	**0.05**	**0.00**	**-0.08**	-1.62	0.00	Baseline Post-test
6-7-11FCCU500RUNS_000571.LAB	6/7/2011	18:11	**-0.05**	**0.01**	**0.03**	**-0.03**	-1.66	0.00	
6-7-11FCCU500RUNS_000574.LAB	6/7/2011	18:14	-0.05	0.81	0.01	0.07	**103.49**	**10.70**	CTS Post-test Run 1
6-7-11FCCU500RUNS_000575.LAB	6/7/2011	18:15	-0.05	0.90	-0.06	-0.01	**103.79**	**10.69**	
6-7-11FCCU500RUNS_000576.LAB	6/7/2011	18:16	-0.05	0.98	0.02	0.04	**103.88**	**10.71**	

6/8/2011 Run 2 Spectrum	Date	Time	HCN (ppmv wb)	Acetaldehyde (ppmv wb)	Formaldehyde (ppmv wb)	Propanal (ppmv wb)	Ethylene (ppmv wb)	SF6 (ppmv wb)	Comments
6-8-11FCCU500RUNS_000005.LAB	6/8/2011	7:07	**-0.01**	**-0.08**	**0.00**	**-0.03**	0.40	0.00	Baseline Pre-test
6-8-11FCCU500RUNS_000006.LAB	6/8/2011	7:08	**-0.01**	**-0.03**	**0.04**	**0.08**	-0.20	0.00	
6-8-11FCCU500RUNS_000017.LAB	6/8/2011	7:20	0.00	0.73	-0.04	-0.08	**103.62**	**10.70**	CTS Pre-test
6-8-11FCCU500RUNS_000018.LAB	6/8/2011	7:21	0.00	0.82	-0.07	0.03	**103.61**	**10.71**	
6-8-11FCCU500RUNS_000022.LAB	6/8/2011	7:25	-0.01	**99.91**	0.04	-0.19	-0.45	1.14	100 ppm Acetaldehyde
6-8-11FCCU500RUNS_000023.LAB	6/8/2011	7:26	-0.01	**99.44**	0.06	-0.14	-0.12	1.15	
6-8-11FCCU500RUNS_000026.LAB	6/8/2011	7:29	-0.01	-0.15	**10.86**	-0.23	-0.22	10.85	
6-8-11FCCU500RUNS_000027.LAB	6/8/2011	7:30	-0.01	-0.11	**10.98**	-0.22	-0.64	10.83	10 ppm Formaldehyde
6-8-11FCCU500RUNS_000036.LAB	6/8/2011	7:40	**50.42**	-0.47	-0.05	0.25	-0.58	4.16	50 ppm HCN
6-8-11FCCU500RUNS_000037.LAB	6/8/2011	7:41	**50.44**	-0.44	-0.01	0.26	-0.26	4.16	
6-8-11FCCU500RUNS_000262.LAB	6/8/2011	13:54	-0.54	0.25	0.15	0.38	**99.10**	**10.55**	CTS Post-test Run 2
6-8-11FCCU500RUNS_000263.LAB	6/8/2011	13:55	-0.55	0.36	0.14	0.37	**99.97**	**10.62**	
6-8-11FCCU500RUNS_000270.LAB	6/8/2011	14:02	**0.08**	**-0.04**	**0.01**	**0.02**	-0.64	0.00	Baseline Post-test Run 2
6-8-11FCCU500RUNS_000271.LAB	6/8/2011	14:03	**0.04**	**-0.04**	**0.09**	**0.02**	-0.48	0.00	

6/8/2011 Run 3 Spectrum	Date	Time	HCN (ppmv wb)	Acetaldehyde (ppmv wb)	Formaldehyde (ppmv wb)	Propanal (ppmv wb)	Ethylene (ppmv wb)	SF6 (ppmv wb)	Comments
6-8-11FCCU500RUNS_000457.LAB	6/8/2011	18:11	**-0.03**	**0.03**	**0.01**	**-0.02**	0.01	0.00	Baseline Post-test Run 3
6-8-11FCCU500RUNS_000458.LAB	6/8/2011	18:12	**-0.04**	**0.04**	**0.00**	**-0.01**	0.10	0.00	
6-8-11FCCU500RUNS_000461.LAB	6/8/2011	18:15	0.04	0.05	0.01	0.18	**102.34**	**10.48**	CTS Post-test Run 3
6-8-11FCCU500RUNS_000462.LAB	6/8/2011	18:16	0.03	0.08	0.02	0.29	**102.49**	**10.49**	

BP Whiting
Whiting, Indiana
FCC 500 Stack ICR Testing
FTIR QA/QC Ammonia Testing
6/9 through 6/10/11

6/9/2011 Run 1

Spectrum	Date	Time	NH_3 (ppmv wb)	Ethylene (ppmv wb)	SF6 (ppmv wb)	Comments
6-9-11FCCU500RUNS_000006.LAB	6/9/2011	13:08	**0.08**	0.22	0.00	Baseline Pre-test
6-9-11FCCU500RUNS_000007.LAB	6/9/2011	13:09	**0.09**	0.22	0.00	
6-9-11FCCU500RUNS_000013.LAB	6/9/2011	13:16	0.21	**104.40**	**10.50**	CTS Pre-test
6-9-11FCCU500RUNS_000014.LAB	6/9/2011	13:17	0.19	**104.04**	**10.45**	
6-9-11FCCU500RUNS_000031.LAB	6/9/2011	13:35	**99.39**	-0.63	**10.73**	100 ppm NH_3
6-9-11FCCU500RUNS_000032.LAB	6/9/2011	13:36	**99.73**	-0.41	**10.73**	
6-9-11FCCU500RUNS_000374.LAB	6/9/2011	19:45	**0.01**	0.05	0.07	Baseline Post-test
6-9-11FCCU500RUNS_000375.LAB	6/9/2011	19:46	**0.00**	0.05	0.01	
6-9-11FCCU500RUNS_000379.LAB	6/9/2011	19:50	0.44	**102.99**	**10.37**	CTS Post-test Run 1
6-9-11FCCU500RUNS_000380.LAB	6/9/2011	19:51	0.47	**103.51**	**10.37**	
6-9-11FCCU500RUNS_000417.LAB	6/9/2011	20:31	**99.36**	0.33	**10.51**	100 ppm NH_3
6-9-11FCCU500RUNS_000418.LAB	6/9/2011	20:32	**99.19**	0.31	**10.51**	

6/10/2011 Run 2

Spectrum	Date	Time	NH_3 (ppmv wb)	Ethylene (ppmv wb)	SF6 (ppmv wb)	Comments
6-10-11FCCU500RUNS_000005.LAB	6/10/2011	7:12	**0.07**	0.04	0.00	Baseline Pre-test Run 2
6-10-11FCCU500RUNS_000006.LAB	6/10/2011	7:13	**0.01**	0.10	0.00	
6-10-11FCCU500RUNS_000011.LAB	6/10/2011	7:18	-0.07	**104.59**	**10.55**	CTS Pre-test Run 2
6-10-11FCCU500RUNS_000012.LAB	6/10/2011	7:20	0.06	**104.29**	**10.49**	
6-10-11FCCU500RUNS_000015.LAB	6/10/2011	7:23	**99.14**	-0.32	**10.74**	100 ppm NH_3 Run 2
6-10-11FCCU500RUNS_000016.LAB	6/10/2011	7:24	**98.95**	-0.52	**10.73**	
6-10-11FCCU500RUNS_000262.LAB	6/10/2011	12:33	**0.01**	0.09	0.14	Baseline Post-test Run 2
6-10-11FCCU500RUNS_000263.LAB	6/10/2011	12:34	**0.03**	0.02	0.10	
6-10-11FCCU500RUNS_000267.LAB	6/10/2011	12:38	0.08	**102.78**	**10.41**	CTS Post-test Run 2
6-10-11FCCU500RUNS_000268.LAB	6/10/2011	12:39	0.07	**102.67**	**10.42**	

6/10/2011 Run 3

Spectrum	Date	Time	NH_3 (ppmv wb)	Ethylene (ppmv wb)	SF6 (ppmv wb)	Comments
6-10-11FCCU500RUNS_000520.LAB	6/10/2011	17:50	**0.03**	0.00	0.07	Baseline Post-test Run 3
6-10-11FCCU500RUNS_000521.LAB	6/10/2011	17:51	**0.06**	0.03	0.07	
6-10-11FCCU500RUNS_000528.LAB	6/10/2011	17:58	0.65	**103.14**	**10.27**	CTS Post-test Run 3
6-10-11FCCU500RUNS_000529.LAB	6/10/2011	17:59	0.62	**103.10**	**10.37**	

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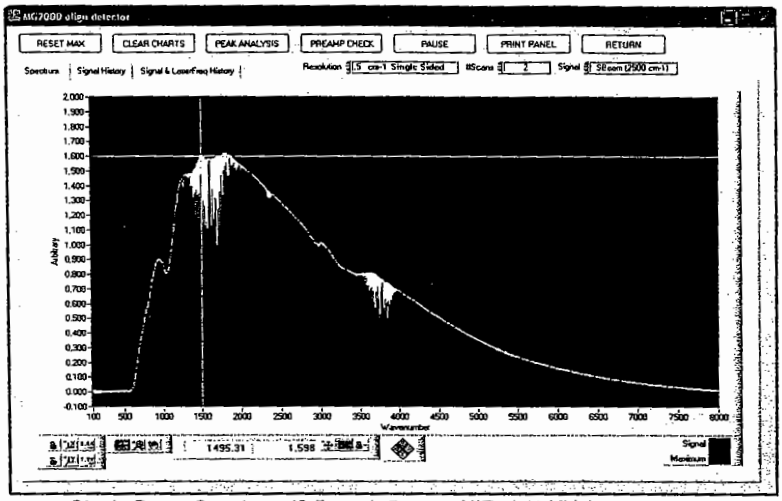
MultiGas 001633532 Repair Final Checkout

Model No.	**2030DBG2EKVS13T**
Serial No.	**001633532**
Interferometer	001632173
MAC Address	00-03-F4-02-E7-8B
Digitizer IP Address	192.168.254.10
Detector Type	0.25 mm LN2
Detector Cutoff	16 um
Det. Serial No.	H-14692
Det. Mfg. Date	Jan-05
Gain R31	902 ohms
Bias R6	15 ohms
Gas Cell Window	KBr
Window Material	KBr



Single Beam Spectrum (0.5 cm-1, 2 scan, NIR, 179 KHz)

Instrument Parameters	
Linearizer Offset	1436
Linearizer Linear	1000
Linearizer Quad	401
Linearizer Cubic	59
Sampling Velocity(KHz)	144 KHz
Mono Value	CA
Direction	Both
Sampling Mode	NearIR
Laser Phase Angle	86.83°

Preamp set to **-8.56** vdc blocked

Calibration1	
Gas	**Ethylene**
Concentration	100.0 ppm
Temperature(°C)	150°C
950cm-1 Left/Middle/Right	98.61 / 98.30 / 98.56
3000cm-1	99.61 ppm
Calibration2	
Gas	**CO**
Concentration	200.9 ppm
Temperature(°C)	150°C
CO Quant pt	204.40 ppm

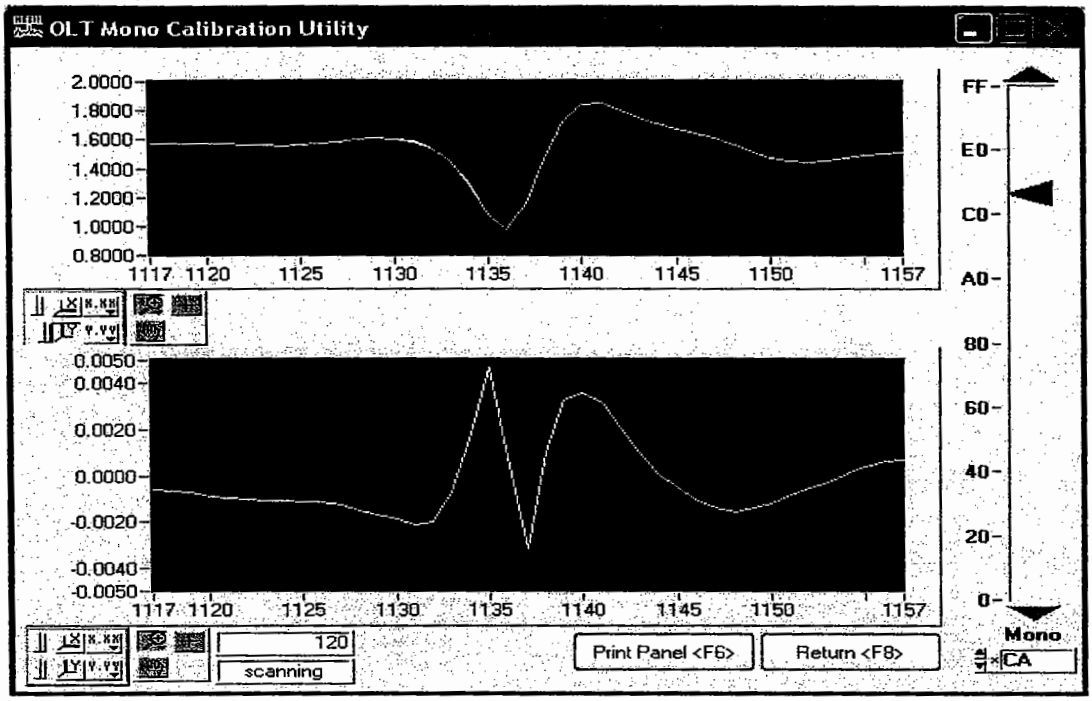
Pressure Transducer	750B13TFE3RF
Serial #	021734181
Range	0-1000 Torr
Transduce Slope	Factory set
Transducer Offset	0
Temp. Transmitter	0-200°C J Thermocouple
Transmitter Slope	Factory set
Transmitter Offset	-50

Final Voltage Checks	
120 VAC 60hz	X
220VAC 50hz	
Digitizer voltage set	5.02v

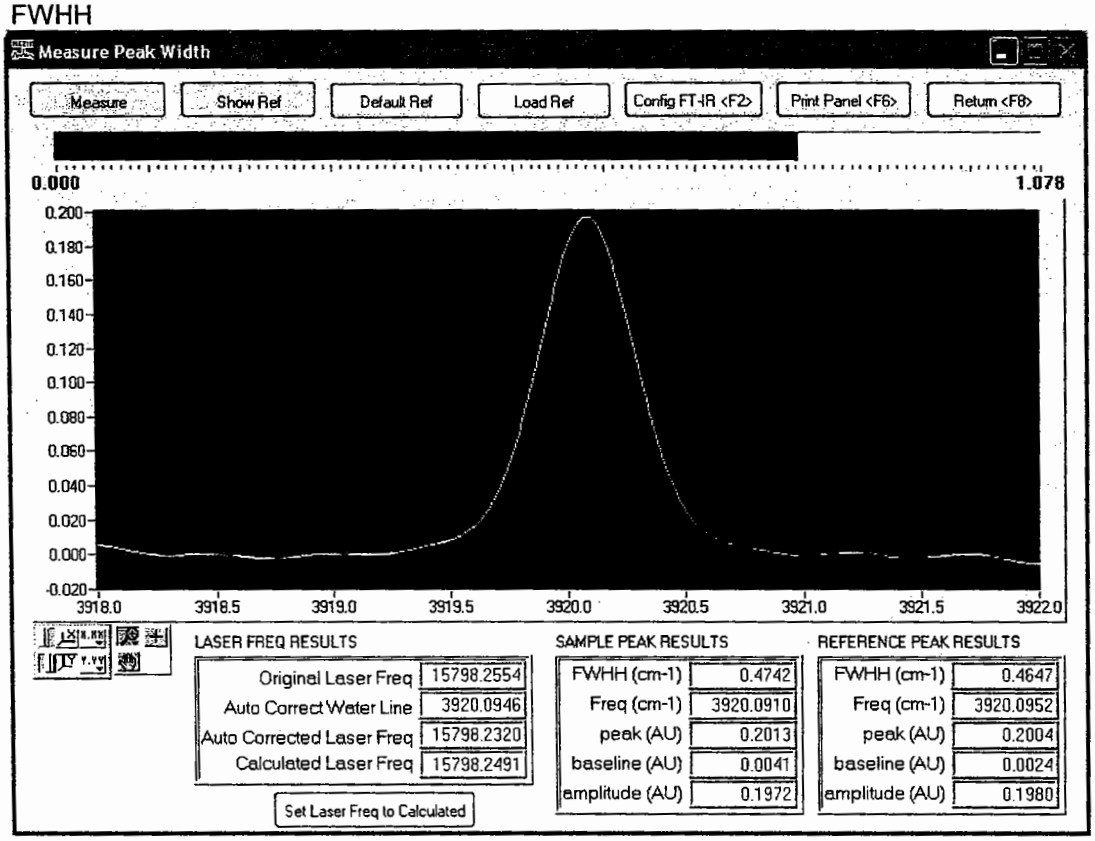
	Factory Measurements	Laser A voltages
Laser Freqency	15798.255cm-1	Laser A pp = 7.80 V
Apodization	Med Norton Beer	Laser A dc = -5.02 V
Linewidth @0.5 CM-1, 16 SCANS	0. 4742 cm-1	
Single Beam Max Signal	1.598	
Max Signal Location (cm-1)	1495.31 cm-1	

Signal-to-Noise (single sided)			1000-1100 cm-1 SNR	2100-2200 cm-1 SNR	2900-30000 cm-1 SNR
0.5 cm-1	2.9 sec	4 scans	851	1433	984
.5 cm-1	36.1 sec	64 scans	3132	4355	2235
4 cm-1	0.5	4 scans	3432	5717	4082
4 cm-1	7.5 sec	64 scans	8078	14528	4082

Mono Calibration



FWHH



ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	11:06:45	1.05	
06/07/11	11:07:00	13.68	
06/07/11	11:07:15	64.43	
06/07/11	11:07:30	78.90	
06/07/11	11:07:45	85.35	
06/07/11	11:08:00	85.68	
06/07/11	11:08:15	85.39	
06/07/11	11:08:30	85.39	
06/07/11	11:08:45	85.47	84.3 ppm CH4 Injection
06/07/11	11:09:00	85.47	
06/07/11	11:09:15	85.44	
06/07/11	11:09:30	85.23	**85.40** ppm CH4
06/07/11	11:09:45	85.65	
06/07/11	11:10:00	85.13	
06/07/11	11:10:15	85.25	
06/07/11	11:10:30	82.69	
06/07/11	11:10:45	71.42	
06/07/11	11:11:00	62.98	
06/07/11	11:11:15	54.38	
06/07/11	11:11:30	53.13	
06/07/11	11:11:45	52.69	
06/07/11	11:12:00	51.37	50ppm CH4 Injection
06/07/11	11:12:15	51.53	
06/07/11	11:12:30	51.25	
06/07/11	11:12:45	51.36	**51.38** ppm CH4
06/07/11	11:13:00	51.31	
06/07/11	11:13:15	51.22	
06/07/11	11:13:30	51.35	
06/07/11	11:13:45	51.16	
06/07/11	11:14:00	51.15	
06/07/11	11:14:15	51.30	
06/07/11	11:14:30	51.14	
06/07/11	11:14:45	51.10	
06/07/11	11:15:00	39.72	
06/07/11	11:15:15	28.53	
06/07/11	11:15:30	26.66	
06/07/11	11:15:45	26.36	
06/07/11	11:16:00	26.37	
06/07/11	11:16:15	26.31	
06/07/11	11:16:30	25.64	
06/07/11	11:16:45	25.49	
06/07/11	11:17:00	25.42	
06/07/11	11:17:15	25.35	25ppm CH4 Injection
06/07/11	11:17:30	25.44	
06/07/11	11:17:45	25.40	
06/07/11	11:18:00	25.32	**25.38** ppm CH4
06/07/11	11:18:15	25.42	
06/07/11	11:18:30	25.32	
06/07/11	11:18:45	24.73	
06/07/11	11:19:00	12.55	
06/07/11	11:19:15	1.89	
06/07/11	11:19:30	0.00	
06/07/11	11:19:45	-0.33	
06/07/11	11:20:00	-0.41	
06/07/11	11:20:15	-0.45	
06/07/11	11:20:30	0.43	Zero CH4 Injection
06/07/11	11:20:45	0.70	
06/07/11	11:21:00	0.67	
06/07/11	11:21:15	0.64	**0.61** ppm CH4
06/07/11	11:21:30	0.64	
06/07/11	11:21:45	0.67	
06/07/11	11:22:00	0.78	
06/07/11	11:22:15	3.14	
06/07/11	11:22:30	2.89	
06/07/11	11:22:45	73.31	
06/07/11	11:23:00	128.56	
06/07/11	11:23:15	128.57	
06/07/11	11:23:30	128.58	
06/07/11	11:23:45	128.58	
06/07/11	11:24:00	128.58	
06/07/11	11:24:15	128.59	
06/07/11	11:24:30	128.59	
06/07/11	11:24:45	128.59	
06/07/11	11:25:00	128.59	
06/07/11	11:25:15	128.60	
06/07/11	11:25:30	128.60	
06/07/11	11:25:45	128.60	
06/07/11	11:26:00	128.60	
06/07/11	11:26:15	128.60	
06/07/11	11:26:30	128.60	
06/07/11	11:26:45	128.61	
06/07/11	11:27:00	128.61	
06/07/11	11:27:15	128.61	
06/07/11	11:27:30	128.61	
06/07/11	11:27:45	128.62	
06/07/11	11:28:00	128.62	
06/07/11	11:28:15	128.62	
06/07/11	11:28:30	128.62	
06/07/11	11:28:45	128.62	
06/07/11	11:29:00	128.62	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	11:29:15	128.63	
06/07/11	11:29:30	128.63	
06/07/11	11:29:45	128.63	
06/07/11	11:30:00	128.63	
06/07/11	11:30:15	128.63	
06/07/11	11:30:30	124.56	
06/07/11	11:30:45	76.42	
06/07/11	11:31:00	47.30	
06/07/11	11:31:15	32.98	
06/07/11	11:31:30	26.79	
06/07/11	11:31:45	25.98	
06/07/11	11:32:00	22.35	
06/07/11	11:32:15	13.77	
06/07/11	11:32:30	13.87	
06/07/11	11:32:45	13.95	
06/07/11	11:33:00	14.01	
06/07/11	11:33:15	14.09	
06/07/11	11:33:30	14.43	
06/07/11	11:33:45	16.09	
06/07/11	11:34:00	10.43	
06/07/11	11:34:15	9.24	
06/07/11	11:34:30	7.62	
06/07/11	11:34:45	12.34	
06/07/11	11:35:00	40.59	
06/07/11	11:35:15	52.73	
06/07/11	11:35:30	57.52	
06/07/11	11:35:45	99.46	
06/07/11	11:36:00	128.61	
06/07/11	11:36:15	128.62	
06/07/11	11:36:30	127.99	
06/07/11	11:36:45	122.47	
06/07/11	11:37:00	119.48	
06/07/11	11:37:15	117.74	
06/07/11	11:37:30	116.63	
06/07/11	11:37:45	115.94	
06/07/11	11:38:00	115.82	
06/07/11	11:38:15	115.65	
06/07/11	11:38:30	115.17	
06/07/11	11:38:45	115.53	
06/07/11	11:39:00	115.85	
06/07/11	11:39:15	115.18	
06/07/11	11:39:30	115.15	
06/07/11	11:39:45	103.18	
06/07/11	11:40:00	48.59	
06/07/11	11:40:15	34.68	
06/07/11	11:40:30	30.20	
06/07/11	11:40:45	28.69	
06/07/11	11:41:00	28.47	
06/07/11	11:41:15	28.37	
06/07/11	11:41:30	28.34	
06/07/11	11:41:45	28.52	
06/07/11	11:42:00	25.92	
06/07/11	11:42:15	19.44	
06/07/11	11:42:30	17.53	
06/07/11	11:42:45	16.94	
06/07/11	11:43:00	16.60	
06/07/11	11:43:15	16.45	
06/07/11	11:43:30	16.36	
06/07/11	11:43:45	16.27	
06/07/11	11:44:00	15.49	
06/07/11	11:44:15	9.73	
06/07/11	11:44:30	6.52	
06/07/11	11:44:45	5.40	
06/07/11	11:45:00	5.01	
06/07/11	11:45:15	4.94	
06/07/11	11:45:30	4.96	
06/07/11	11:45:45	4.85	
06/07/11	11:46:00	4.74	
06/07/11	11:46:15	4.66	
06/07/11	11:46:30	4.59	
06/07/11	11:46:45	4.58	
06/07/11	11:47:00	4.53	
06/07/11	11:47:15	4.50	
06/07/11	11:47:30	4.46	
06/07/11	11:47:45	4.66	
06/07/11	11:48:00	5.34	
06/07/11	11:48:15	5.48	
06/07/11	11:48:30	5.53	
06/07/11	11:48:45	6.22	
06/07/11	11:49:00	11.38	
06/07/11	11:49:15	14.36	
06/07/11	11:49:30	15.40	
06/07/11	11:49:45	15.84	
06/07/11	11:50:00	16.10	
06/07/11	11:50:15	16.24	
06/07/11	11:50:30	16.64	
06/07/11	11:50:45	18.86	
06/07/11	11:51:00	18.59	
06/07/11	11:51:15	17.15	
06/07/11	11:51:30	16.74	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	11:51:45	16.63	
06/07/11	11:52:00	16.56	
06/07/11	11:52:15	13.32	
06/07/11	11:52:30	7.83	
06/07/11	11:52:45	5.82	
06/07/11	11:53:00	5.21	
06/07/11	11:53:15	4.96	
06/07/11	11:53:30	4.84	
06/07/11	11:53:45	4.76	
06/07/11	11:54:00	4.72	
06/07/11	11:54:15	4.71	
06/07/11	11:54:30	4.74	
06/07/11	11:54:45	4.79	
06/07/11	11:55:00	4.87	
06/07/11	11:55:15	4.87	
06/07/11	11:55:30	4.81	
06/07/11	11:55:45	5.09	
06/07/11	11:56:00	5.56	
06/07/11	11:56:15	5.79	
06/07/11	11:56:30	5.95	
06/07/11	11:56:45	6.42	
06/07/11	11:57:00	6.16	
06/07/11	11:57:15	5.98	
06/07/11	11:57:30	5.53	
06/07/11	11:57:45	5.37	
06/07/11	11:58:00	22.02	
06/07/11	11:58:15	66.81	
06/07/11	11:58:30	38.84	
06/07/11	11:58:45	22.04	
06/07/11	11:59:00	18.94	
06/07/11	11:59:15	17.53	
06/07/11	11:59:30	16.78	
06/07/11	11:59:45	16.42	
06/07/11	12:00:00	16.21	
06/07/11	12:00:15	16.20	
06/07/11	12:00:30	22.74	
06/07/11	12:00:45	43.12	
06/07/11	12:01:00	38.06	
06/07/11	12:01:15	26.17	
06/07/11	12:01:30	19.86	
06/07/11	12:01:45	16.99	
06/07/11	12:02:00	16.38	
06/07/11	12:02:15	16.40	
06/07/11	12:02:30	16.76	
06/07/11	12:02:45	22.09	
06/07/11	12:03:00	22.88	
06/07/11	12:03:15	19.85	
06/07/11	12:03:30	18.02	
06/07/11	12:03:45	17.24	
06/07/11	12:04:00	16.67	
06/07/11	12:04:15	16.42	
06/07/11	12:04:30	16.38	
06/07/11	12:04:45	16.08	
06/07/11	12:05:00	12.58	
06/07/11	12:05:15	8.57	
06/07/11	12:05:30	6.35	
06/07/11	12:05:45	5.34	
06/07/11	12:06:00	4.87	
06/07/11	12:06:15	4.67	
06/07/11	12:06:30	4.64	
06/07/11	12:06:45	4.99	
06/07/11	12:07:00	5.30	
06/07/11	12:07:15	5.32	
06/07/11	12:07:30	5.03	
06/07/11	12:07:45	4.73	
06/07/11	12:08:00	5.01	
06/07/11	12:08:15	10.83	
06/07/11	12:08:30	18.66	
06/07/11	12:08:45	23.20	
06/07/11	12:09:00	26.29	
06/07/11	12:09:15	28.70	
06/07/11	12:09:30	27.78	
06/07/11	12:09:45	27.29	
06/07/11	12:10:00	30.41	
06/07/11	12:10:15	41.90	
06/07/11	12:10:30	38.98	
06/07/11	12:10:45	33.43	
06/07/11	12:11:00	30.10	
06/07/11	12:11:15	28.49	
06/07/11	12:11:30	27.57	
06/07/11	12:11:45	27.32	
06/07/11	12:12:00	27.16	
06/07/11	12:12:15	27.03	
06/07/11	12:12:30	24.52	
06/07/11	12:12:45	20.81	
06/07/11	12:13:00	18.40	
06/07/11	12:13:15	17.21	
06/07/11	12:13:30	16.75	
06/07/11	12:13:45	15.96	
06/07/11	12:14:00	12.80	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	12:14:15	9.36	
06/07/11	12:14:30	7.06	
06/07/11	12:14:45	5.79	
06/07/11	12:15:00	5.12	
06/07/11	12:15:15	4.80	
06/07/11	12:15:30	4.61	
06/07/11	12:15:45	4.54	
06/07/11	12:16:00	4.51	
06/07/11	12:16:15	4.60	
06/07/11	12:16:30	4.69	
06/07/11	12:16:45	4.76	
06/07/11	12:17:00	4.99	
06/07/11	12:17:15	5.24	
06/07/11	12:17:30	5.35	
06/07/11	12:17:45	6.16	
06/07/11	12:18:00	15.23	
06/07/11	12:18:15	18.87	
06/07/11	12:18:30	18.34	
06/07/11	12:18:45	17.07	
06/07/11	12:19:00	16.55	
06/07/11	12:19:15	17.65	
06/07/11	12:19:30	17.28	
06/07/11	12:19:45	16.10	
06/07/11	12:20:00	13.33	
06/07/11	12:20:15	10.08	
06/07/11	12:20:30	7.66	
06/07/11	12:20:45	6.12	
06/07/11	12:21:00	5.30	
06/07/11	12:21:15	4.87	
06/07/11	12:21:30	4.69	
06/07/11	12:21:45	4.67	
06/07/11	12:22:00	5.03	
06/07/11	12:22:15	5.53	
06/07/11	12:22:30	12.94	
06/07/11	12:22:45	29.60	
06/07/11	12:23:00	43.74	
06/07/11	12:23:15	49.17	
06/07/11	12:23:30	47.86	
06/07/11	12:23:45	41.07	
06/07/11	12:24:00	32.22	
06/07/11	12:24:15	25.24	
06/07/11	12:24:30	20.94	
06/07/11	12:24:45	18.47	
06/07/11	12:25:00	17.13	
06/07/11	12:25:15	16.46	
06/07/11	12:25:30	16.04	
06/07/11	12:25:45	14.88	
06/07/11	12:26:00	12.35	
06/07/11	12:26:15	9.77	
06/07/11	12:26:30	7.86	
06/07/11	12:26:45	6.51	
06/07/11	12:27:00	5.77	
06/07/11	12:27:15	5.34	
06/07/11	12:27:30	6.82	
06/07/11	12:27:45	14.24	
06/07/11	12:28:00	20.70	
06/07/11	12:28:15	23.02	
06/07/11	12:28:30	23.59	
06/07/11	12:28:45	22.54	
06/07/11	12:29:00	20.51	
06/07/11	12:29:15	18.78	
06/07/11	12:29:30	17.76	
06/07/11	12:29:45	17.25	
06/07/11	12:30:00	16.93	
06/07/11	12:30:15	17.55	
06/07/11	12:30:30	27.84	
06/07/11	12:30:45	44.00	
06/07/11	12:31:00	47.86	
06/07/11	12:31:15	39.06	
06/07/11	12:31:30	27.50	
06/07/11	12:31:45	18.28	
06/07/11	12:32:00	12.78	
06/07/11	12:32:15	9.35	
06/07/11	12:32:30	7.27	
06/07/11	12:32:45	6.26	
06/07/11	12:33:00	5.34	
06/07/11	12:33:15	4.74	
06/07/11	12:33:30	4.46	
06/07/11	12:33:45	4.31	
06/07/11	12:34:00	4.40	
06/07/11	12:34:15	4.56	
06/07/11	12:34:30	4.80	
06/07/11	12:34:45	5.00	
06/07/11	12:35:00	5.12	
06/07/11	12:35:15	5.17	
06/07/11	12:35:30	5.18	
06/07/11	12:35:45	5.16	
06/07/11	12:36:00	5.21	
06/07/11	12:36:15	5.18	
06/07/11	12:36:30	5.15	

Date	Time	Total VOM	Comments
06/07/11	12:36:45	5.16	
06/07/11	12:37:00	5.16	
06/07/11	12:37:15	5.16	
06/07/11	12:37:30	5.16	
06/07/11	12:37:45	5.15	
06/07/11	12:38:00	5.17	
06/07/11	12:38:15	5.17	
06/07/11	12:38:30	5.18	
06/07/11	12:38:45	5.15	
06/07/11	12:39:00	5.09	
06/07/11	12:39:15	4.98	
06/07/11	12:39:30	4.84	
06/07/11	12:39:45	4.77	
06/07/11	12:40:00	4.71	
06/07/11	12:40:15	4.65	
06/07/11	12:40:30	4.56	
06/07/11	12:40:45	4.47	
06/07/11	12:41:00	4.40	
06/07/11	12:41:15	4.30	
06/07/11	12:41:30	4.17	
06/07/11	12:41:45	5.59	
06/07/11	12:42:00	6.39	
06/07/11	12:42:15	6.09	
06/07/11	12:42:30	5.74	
06/07/11	12:42:45	5.90	
06/07/11	12:43:00	6.03	
06/07/11	12:43:15	5.92	
06/07/11	12:43:30	5.83	
06/07/11	12:43:45	5.74	
06/07/11	12:44:00	5.65	
06/07/11	12:44:15	5.93	
06/07/11	12:44:30	6.07	
06/07/11	12:44:45	6.03	
06/07/11	12:45:00	5.94	
06/07/11	12:45:15	5.96	
06/07/11	12:45:30	5.94	
06/07/11	12:45:45	5.80	
06/07/11	12:46:00	5.68	
06/07/11	12:46:15	5.63	
06/07/11	12:46:30	5.54	
06/07/11	12:46:45	5.55	
06/07/11	12:47:00	5.51	
06/07/11	12:47:15	5.48	
06/07/11	12:47:30	5.42	
06/07/11	12:47:45	5.58	
06/07/11	12:48:00	5.69	
06/07/11	12:48:15	5.53	
06/07/11	12:48:30	5.62	
06/07/11	12:48:45	5.65	
06/07/11	12:49:00	5.50	
06/07/11	12:49:15	5.39	
06/07/11	12:49:30	5.48	
06/07/11	12:49:45	5.43	
06/07/11	12:50:00	5.21	
06/07/11	12:50:15	4.99	
06/07/11	12:50:30	4.82	
06/07/11	12:50:45	4.71	
06/07/11	12:51:00	4.66	
06/07/11	12:51:15	4.60	
06/07/11	12:51:30	4.56	
06/07/11	12:51:45	4.49	
06/07/11	12:52:00	4.43	
06/07/11	12:52:15	4.50	
06/07/11	12:52:30	4.62	
06/07/11	12:52:45	4.66	
06/07/11	12:53:00	4.66	
06/07/11	12:53:15	4.61	
06/07/11	12:53:30	4.56	
06/07/11	12:53:45	4.52	
06/07/11	12:54:00	4.51	
06/07/11	12:54:15	4.48	
06/07/11	12:54:30	4.47	
06/07/11	12:54:45	4.44	
06/07/11	12:55:00	4.38	
06/07/11	12:55:15	4.34	
06/07/11	12:55:30	4.29	
06/07/11	12:55:45	4.22	
06/07/11	12:56:00	4.20	
06/07/11	12:56:15	4.14	
06/07/11	12:56:30	4.13	
06/07/11	12:56:45	4.16	
06/07/11	12:57:00	4.24	M23-started
06/07/11	12:57:15	4.23	
06/07/11	12:57:30	4.17	
06/07/11	12:57:45	4.07	
06/07/11	12:58:00	4.04	
06/07/11	12:58:15	4.00	
06/07/11	12:58:30	4.00	
06/07/11	12:58:45	3.96	
06/07/11	12:59:00	4.02	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	12:59:15	4.03	
06/07/11	12:59:30	3.99	
06/07/11	12:59:45	3.93	
06/07/11	13:00:00	3.88	
06/07/11	13:00:15	3.88	
06/07/11	13:00:30	3.90	
06/07/11	13:00:45	3.92	
06/07/11	13:01:00	4.27	
06/07/11	13:01:15	4.51	
06/07/11	13:01:30	4.65	
06/07/11	13:01:45	4.47	
06/07/11	13:02:00	4.29	
06/07/11	13:02:15	4.25	
06/07/11	13:02:30	4.23	
06/07/11	13:02:45	4.25	
06/07/11	13:03:00	4.19	
06/07/11	13:03:15	4.07	
06/07/11	13:03:30	4.01	
06/07/11	13:03:45	4.08	
06/07/11	13:04:00	4.09	
06/07/11	13:04:15	4.04	
06/07/11	13:04:30	3.97	
06/07/11	13:04:45	3.91	
06/07/11	13:05:00	3.89	
06/07/11	13:05:15	3.88	
06/07/11	13:05:30	3.84	
06/07/11	13:05:45	3.83	
06/07/11	13:06:00	3.87	
06/07/11	13:06:15	4.03	
06/07/11	13:06:30	4.19	
06/07/11	13:06:45	4.27	
06/07/11	13:07:00	4.27	
06/07/11	13:07:15	4.31	
06/07/11	13:07:30	4.33	
06/07/11	13:07:45	4.28	
06/07/11	13:08:00	4.33	
06/07/11	13:08:15	5.18	
06/07/11	13:08:30	6.32	
06/07/11	13:08:45	4.90	
06/07/11	13:09:00	4.64	
06/07/11	13:09:15	4.50	
06/07/11	13:09:30	4.37	
06/07/11	13:09:45	4.50	
06/07/11	13:10:00	4.56	
06/07/11	13:10:15	4.47	
06/07/11	13:10:30	4.36	
06/07/11	13:10:45	4.29	
06/07/11	13:11:00	4.21	
06/07/11	13:11:15	4.13	
06/07/11	13:11:30	4.09	
06/07/11	13:11:45	4.02	
06/07/11	13:12:00	4.18	
06/07/11	13:12:15	4.25	
06/07/11	13:12:30	4.24	
06/07/11	13:12:45	4.07	
06/07/11	13:13:00	3.97	
06/07/11	13:13:15	3.83	
06/07/11	13:13:30	3.72	
06/07/11	13:13:45	3.62	
06/07/11	13:14:00	3.62	
06/07/11	13:14:15	3.61	
06/07/11	13:14:30	3.60	
06/07/11	13:14:45	3.68	
06/07/11	13:15:00	3.71	
06/07/11	13:15:15	3.66	
06/07/11	13:15:30	3.58	
06/07/11	13:15:45	3.60	
06/07/11	13:16:00	3.62	
06/07/11	13:16:15	3.63	
06/07/11	13:16:30	3.70	
06/07/11	13:16:45	3.75	
06/07/11	13:17:00	3.71	
06/07/11	13:17:15	3.64	
06/07/11	13:17:30	3.61	
06/07/11	13:17:45	3.60	
06/07/11	13:18:00	3.56	
06/07/11	13:18:15	3.50	
06/07/11	13:18:30	3.51	
06/07/11	13:18:45	3.53	
06/07/11	13:19:00	3.60	
06/07/11	13:19:15	3.70	
06/07/11	13:19:30	3.80	
06/07/11	13:19:45	6.60	
06/07/11	13:20:00	13.41	
06/07/11	13:20:15	10.91	
06/07/11	13:20:30	9.32	
06/07/11	13:20:45	6.76	
06/07/11	13:21:00	13.52	
06/07/11	13:21:15	10.35	
06/07/11	13:21:30	9.16	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	13:21:45	8.71	
06/07/11	13:22:00	8.25	
06/07/11	13:22:15	7.60	
06/07/11	13:22:30	7.17	
06/07/11	13:22:45	6.88	
06/07/11	13:23:00	6.41	
06/07/11	13:23:15	6.11	
06/07/11	13:23:30	5.58	
06/07/11	13:23:45	5.23	
06/07/11	13:24:00	5.07	
06/07/11	13:24:15	4.92	
06/07/11	13:24:30	4.76	
06/07/11	13:24:45	4.67	
06/07/11	13:25:00	4.62	
06/07/11	13:25:15	4.64	
06/07/11	13:25:30	4.64	
06/07/11	13:25:45	4.68	
06/07/11	13:26:00	4.58	
06/07/11	13:26:15	4.45	
06/07/11	13:26:30	4.60	
06/07/11	13:26:45	4.64	
06/07/11	13:27:00	4.67	0010 start
06/07/11	13:27:15	4.61	Start THC
06/07/11	13:27:30	4.59	
06/07/11	13:27:45	4.62	
06/07/11	13:28:00	4.49	
06/07/11	13:28:15	4.39	
06/07/11	13:28:30	4.45	
06/07/11	13:28:45	4.45	
06/07/11	13:29:00	4.46	
06/07/11	13:29:15	4.40	
06/07/11	13:29:30	4.31	
06/07/11	13:29:45	4.24	
06/07/11	13:30:00	4.18	
06/07/11	13:30:15	4.23	
06/07/11	13:30:30	4.24	
06/07/11	13:30:45	4.27	
06/07/11	13:31:00	4.23	
06/07/11	13:31:15	4.20	
06/07/11	13:31:30	4.16	
06/07/11	13:31:45	4.17	
06/07/11	13:32:00	4.18	
06/07/11	13:32:15	4.18	
06/07/11	13:32:30	4.21	
06/07/11	13:32:45	4.18	
06/07/11	13:33:00	4.20	
06/07/11	13:33:15	4.28	
06/07/11	13:33:30	4.31	
06/07/11	13:33:45	4.26	
06/07/11	13:34:00	4.13	
06/07/11	13:34:15	4.10	
06/07/11	13:34:30	4.05	
06/07/11	13:34:45	4.04	
06/07/11	13:35:00	4.05	
06/07/11	13:35:15	4.02	
06/07/11	13:35:30	3.99	
06/07/11	13:35:45	4.00	
06/07/11	13:36:00	3.96	
06/07/11	13:36:15	3.95	
06/07/11	13:36:30	3.93	
06/07/11	13:36:45	3.96	
06/07/11	13:37:00	3.99	
06/07/11	13:37:15	4.01	
06/07/11	13:37:30	3.95	
06/07/11	13:37:45	3.92	
06/07/11	13:38:00	3.91	
06/07/11	13:38:15	3.91	
06/07/11	13:38:30	3.90	
06/07/11	13:38:45	3.88	
06/07/11	13:39:00	3.86	
06/07/11	13:39:15	3.89	
06/07/11	13:39:30	4.00	
06/07/11	13:39:45	4.03	
06/07/11	13:40:00	3.96	
06/07/11	13:40:15	4.01	
06/07/11	13:40:30	3.99	
06/07/11	13:40:45	4.31	
06/07/11	13:41:00	4.48	
06/07/11	13:41:15	4.33	
06/07/11	13:41:30	4.22	
06/07/11	13:41:45	4.18	
06/07/11	13:42:00	4.11	
06/07/11	13:42:15	4.10	
06/07/11	13:42:30	4.14	
06/07/11	13:42:45	4.10	
06/07/11	13:43:00	4.99	
06/07/11	13:43:15	4.99	
06/07/11	13:43:30	4.63	
06/07/11	13:43:45	4.38	
06/07/11	13:44:00	4.28	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	13:44:15	4.21	
06/07/11	13:44:30	4.21	
06/07/11	13:44:45	4.23	
06/07/11	13:45:00	4.06	
06/07/11	13:45:15	3.98	
06/07/11	13:45:30	3.90	
06/07/11	13:45:45	3.85	
06/07/11	13:46:00	3.83	
06/07/11	13:46:15	3.81	
06/07/11	13:46:30	3.75	
06/07/11	13:46:45	3.80	
06/07/11	13:47:00	3.84	
06/07/11	13:47:15	3.80	
06/07/11	13:47:30	3.75	
06/07/11	13:47:45	3.71	
06/07/11	13:48:00	3.66	
06/07/11	13:48:15	3.67	
06/07/11	13:48:30	3.73	
06/07/11	13:48:45	3.74	
06/07/11	13:49:00	3.71	
06/07/11	13:49:15	3.76	
06/07/11	13:49:30	3.76	
06/07/11	13:49:45	3.67	
06/07/11	13:50:00	3.67	
06/07/11	13:50:15	3.70	
06/07/11	13:50:30	3.74	
06/07/11	13:50:45	3.71	
06/07/11	13:51:00	3.65	
06/07/11	13:51:15	3.65	
06/07/11	13:51:30	3.68	
06/07/11	13:51:45	3.74	
06/07/11	13:52:00	3.65	
06/07/11	13:52:15	3.61	
06/07/11	13:52:30	3.59	
06/07/11	13:52:45	3.57	
06/07/11	13:53:00	3.55	
06/07/11	13:53:15	3.52	
06/07/11	13:53:30	3.57	
06/07/11	13:53:45	3.65	
06/07/11	13:54:00	3.62	
06/07/11	13:54:15	3.57	
06/07/11	13:54:30	3.51	
06/07/11	13:54:45	3.49	
06/07/11	13:55:00	3.48	
06/07/11	13:55:15	3.50	
06/07/11	13:55:30	3.46	
06/07/11	13:55:45	3.46	
06/07/11	13:56:00	3.49	
06/07/11	13:56:15	3.54	
06/07/11	13:56:30	3.56	
06/07/11	13:56:45	3.59	
06/07/11	13:57:00	3.61	
06/07/11	13:57:15	3.64	
06/07/11	13:57:30	3.67	
06/07/11	13:57:45	3.69	
06/07/11	13:58:00	3.68	
06/07/11	13:58:15	3.62	
06/07/11	13:58:30	3.61	
06/07/11	13:58:45	3.65	
06/07/11	13:59:00	3.60	
06/07/11	13:59:15	3.60	
06/07/11	13:59:30	3.72	
06/07/11	13:59:45	3.69	
06/07/11	14:00:00	3.68	
06/07/11	14:00:15	3.67	
06/07/11	14:00:30	3.72	
06/07/11	14:00:45	3.73	
06/07/11	14:01:00	3.83	
06/07/11	14:01:15	3.92	
06/07/11	14:01:30	3.88	
06/07/11	14:01:45	5.43	
06/07/11	14:02:00	8.65	
06/07/11	14:02:15	8.35	
06/07/11	14:02:30	7.96	
06/07/11	14:02:45	7.21	
06/07/11	14:03:00	7.03	
06/07/11	14:03:15	6.73	
06/07/11	14:03:30	6.33	
06/07/11	14:03:45	5.87	
06/07/11	14:04:00	5.19	18/308
06/07/11	14:04:15	4.85	
06/07/11	14:04:30	4.65	
06/07/11	14:04:45	4.51	
06/07/11	14:05:00	4.40	
06/07/11	14:05:15	4.34	
06/07/11	14:05:30	4.17	
06/07/11	14:05:45	3.94	
06/07/11	14:06:00	3.81	
06/07/11	14:06:15	3.71	
06/07/11	14:06:30	3.67	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	14:06:45	3.62	
06/07/11	14:07:00	3.51	
06/07/11	14:07:15	3.48	
06/07/11	14:07:30	3.45	
06/07/11	14:07:45	3.40	
06/07/11	14:08:00	3.37	
06/07/11	14:08:15	3.36	
06/07/11	14:08:30	3.33	
06/07/11	14:08:45	3.34	
06/07/11	14:09:00	3.31	
06/07/11	14:09:15	3.26	
06/07/11	14:09:30	3.33	
06/07/11	14:09:45	3.29	
06/07/11	14:10:00	3.27	
06/07/11	14:10:15	3.31	
06/07/11	14:10:30	3.28	
06/07/11	14:10:45	3.23	
06/07/11	14:11:00	3.20	
06/07/11	14:11:15	3.31	
06/07/11	14:11:30	4.87	
06/07/11	14:11:45	4.15	
06/07/11	14:12:00	3.89	
06/07/11	14:12:15	3.66	
06/07/11	14:12:30	3.53	
06/07/11	14:12:45	3.45	
06/07/11	14:13:00	3.32	
06/07/11	14:13:15	3.23	
06/07/11	14:13:30	3.17	
06/07/11	14:13:45	3.16	
06/07/11	14:14:00	3.14	
06/07/11	14:14:15	3.11	
06/07/11	14:14:30	3.12	
06/07/11	14:14:45	3.09	
06/07/11	14:15:00	3.07	
06/07/11	14:15:15	3.10	
06/07/11	14:15:30	3.14	
06/07/11	14:15:45	3.12	
06/07/11	14:16:00	3.12	
06/07/11	14:16:15	3.22	
06/07/11	14:16:30	3.34	
06/07/11	14:16:45	3.44	
06/07/11	14:17:00	3.25	
06/07/11	14:17:15	3.15	
06/07/11	14:17:30	3.06	
06/07/11	14:17:45	3.08	
06/07/11	14:18:00	3.10	
06/07/11	14:18:15	3.06	
06/07/11	14:18:30	3.03	
06/07/11	14:18:45	3.01	
06/07/11	14:19:00	2.97	
06/07/11	14:19:15	2.99	
06/07/11	14:19:30	3.06	
06/07/11	14:19:45	3.09	
06/07/11	14:20:00	3.13	
06/07/11	14:20:15	3.15	
06/07/11	14:20:30	3.10	
06/07/11	14:20:45	3.10	
06/07/11	14:21:00	3.56	
06/07/11	14:21:15	5.21	
06/07/11	14:21:30	4.42	
06/07/11	14:21:45	4.29	
06/07/11	14:22:00	4.13	
06/07/11	14:22:15	4.03	
06/07/11	14:22:30	3.87	
06/07/11	14:22:45	3.76	
06/07/11	14:23:00	3.58	
06/07/11	14:23:15	3.51	
06/07/11	14:23:30	3.36	
06/07/11	14:23:45	3.19	
06/07/11	14:24:00	3.09	
06/07/11	14:24:15	3.02	
06/07/11	14:24:30	2.99	
06/07/11	14:24:45	2.97	
06/07/11	14:25:00	3.06	
06/07/11	14:25:15	3.13	
06/07/11	14:25:30	3.17	
06/07/11	14:25:45	3.02	
06/07/11	14:26:00	2.89	
06/07/11	14:26:15	2.82	
06/07/11	14:26:30	2.80	Run 1 THC Average
06/07/11	14:26:45	2.84	3.87 ppm THC as CH4
06/07/11	14:27:00	2.93	
06/07/11	14:27:15	2.94	
06/07/11	14:27:30	3.03	
06/07/11	14:27:45	3.01	
06/07/11	14:28:00	2.92	
06/07/11	14:28:15	2.88	
06/07/11	14:28:30	2.86	
06/07/11	14:28:45	2.83	
06/07/11	14:29:00	2.83	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	14:29:15	2.81	
06/07/11	14:29:30	2.79	
06/07/11	14:29:45	2.83	
06/07/11	14:30:00	2.84	
06/07/11	14:30:15	2.83	
06/07/11	14:30:30	2.85	
06/07/11	14:30:45	2.88	
06/07/11	14:31:00	2.88	
06/07/11	14:31:15	2.85	
06/07/11	14:31:30	2.83	
06/07/11	14:31:45	2.83	
06/07/11	14:32:00	2.83	
06/07/11	14:32:15	2.93	
06/07/11	14:32:30	2.96	
06/07/11	14:32:45	3.05	
06/07/11	14:33:00	3.12	
06/07/11	14:33:15	3.14	
06/07/11	14:33:30	3.08	
06/07/11	14:33:45	2.92	
06/07/11	14:34:00	2.84	
06/07/11	14:34:15	2.77	
06/07/11	14:34:30	2.85	
06/07/11	14:34:45	2.92	
06/07/11	14:35:00	2.88	
06/07/11	14:35:15	2.84	
06/07/11	14:35:30	2.83	
06/07/11	14:35:45	2.85	
06/07/11	14:36:00	2.86	
06/07/11	14:36:15	2.90	
06/07/11	14:36:30	2.88	
06/07/11	14:36:45	2.92	
06/07/11	14:37:00	2.98	
06/07/11	14:37:15	2.96	
06/07/11	14:37:30	2.96	
06/07/11	14:37:45	2.90	
06/07/11	14:38:00	2.88	
06/07/11	14:38:15	2.90	
06/07/11	14:38:30	2.90	
06/07/11	14:38:45	2.90	
06/07/11	14:39:00	2.93	
06/07/11	14:39:15	2.87	
06/07/11	14:39:30	2.76	
06/07/11	14:39:45	2.72	
06/07/11	14:40:00	2.72	
06/07/11	14:40:15	2.74	
06/07/11	14:40:30	2.71	
06/07/11	14:40:45	2.66	
06/07/11	14:41:00	2.63	
06/07/11	14:41:15	2.66	
06/07/11	14:41:30	2.69	
06/07/11	14:41:45	2.65	
06/07/11	14:42:00	2.67	
06/07/11	14:42:15	2.69	
06/07/11	14:42:30	2.68	
06/07/11	14:42:45	2.64	
06/07/11	14:43:00	2.62	
06/07/11	14:43:15	2.63	
06/07/11	14:43:30	2.60	
06/07/11	14:43:45	2.56	
06/07/11	14:44:00	2.57	
06/07/11	14:44:15	2.70	
06/07/11	14:44:30	2.70	
06/07/11	14:44:45	2.65	
06/07/11	14:45:00	2.60	
06/07/11	14:45:15	2.58	
06/07/11	14:45:30	2.59	
06/07/11	14:45:45	2.55	
06/07/11	14:46:00	2.58	
06/07/11	14:46:15	2.61	
06/07/11	14:46:30	2.64	
06/07/11	14:46:45	2.63	
06/07/11	14:47:00	3.22	
06/07/11	14:47:15	3.36	
06/07/11	14:47:30	3.64	
06/07/11	14:47:45	3.68	
06/07/11	14:48:00	3.72	
06/07/11	14:48:15	3.59	
06/07/11	14:48:30	3.37	
06/07/11	14:48:45	3.16	
06/07/11	14:49:00	2.99	
06/07/11	14:49:15	2.86	
06/07/11	14:49:30	2.88	
06/07/11	14:49:45	2.81	
06/07/11	14:50:00	2.75	
06/07/11	14:50:15	2.71	
06/07/11	14:50:30	2.69	
06/07/11	14:50:45	2.74	
06/07/11	14:51:00	2.75	
06/07/11	14:51:15	2.79	
06/07/11	14:51:30	2.76	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	14:51:45	2.64	
06/07/11	14:52:00	2.59	
06/07/11	14:52:15	2.54	
06/07/11	14:52:30	2.57	
06/07/11	14:52:45	2.60	
06/07/11	14:53:00	2.65	
06/07/11	14:53:15	2.68	
06/07/11	14:53:30	2.70	
06/07/11	14:53:45	3.08	
06/07/11	14:54:00	4.01	
06/07/11	14:54:15	3.99	
06/07/11	14:54:30	3.88	
06/07/11	14:54:45	3.69	
06/07/11	14:55:00	3.62	
06/07/11	14:55:15	3.43	
06/07/11	14:55:30	3.26	
06/07/11	14:55:45	3.20	
06/07/11	14:56:00	3.20	
06/07/11	14:56:15	3.09	
06/07/11	14:56:30	3.00	
06/07/11	14:56:45	2.92	
06/07/11	14:57:00	2.86	Port Change
06/07/11	14:57:15	2.76	
06/07/11	14:57:30	2.70	
06/07/11	14:57:45	2.64	
06/07/11	14:58:00	2.63	
06/07/11	14:58:15	2.60	
06/07/11	14:58:30	2.58	
06/07/11	14:58:45	2.62	
06/07/11	14:59:00	2.62	
06/07/11	14:59:15	2.65	
06/07/11	14:59:30	2.66	
06/07/11	14:59:45	2.65	
06/07/11	15:00:00	2.61	
06/07/11	15:00:15	2.58	
06/07/11	15:00:30	2.58	
06/07/11	15:00:45	2.59	
06/07/11	15:01:00	2.63	
06/07/11	15:01:15	2.61	
06/07/11	15:01:30	2.56	
06/07/11	15:01:45	2.59	
06/07/11	15:02:00	2.59	
06/07/11	15:02:15	2.61	
06/07/11	15:02:30	2.58	
06/07/11	15:02:45	2.51	
06/07/11	15:03:00	2.45	
06/07/11	15:03:15	2.43	
06/07/11	15:03:30	2.41	
06/07/11	15:03:45	2.41	
06/07/11	15:04:00	2.37	
06/07/11	15:04:15	2.38	
06/07/11	15:04:30	2.47	
06/07/11	15:04:45	2.55	
06/07/11	15:05:00	2.51	
06/07/11	15:05:15	2.42	
06/07/11	15:05:30	2.36	
06/07/11	15:05:45	2.31	
06/07/11	15:06:00	2.32	
06/07/11	15:06:15	2.33	
06/07/11	15:06:30	2.37	
06/07/11	15:06:45	2.47	
06/07/11	15:07:00	2.46	
06/07/11	15:07:15	3.12	
06/07/11	15:07:30	3.72	
06/07/11	15:07:45	3.67	
06/07/11	15:08:00	3.41	
06/07/11	15:08:15	3.54	
06/07/11	15:08:30	3.81	
06/07/11	15:08:45	3.72	
06/07/11	15:09:00	3.60	
06/07/11	15:09:15	3.56	
06/07/11	15:09:30	3.55	
06/07/11	15:09:45	3.34	
06/07/11	15:10:00	3.16	
06/07/11	15:10:15	3.01	
06/07/11	15:10:30	2.85	
06/07/11	15:10:45	2.74	
06/07/11	15:11:00	2.63	
06/07/11	15:11:15	2.54	
06/07/11	15:11:30	2.48	
06/07/11	15:11:45	2.45	
06/07/11	15:12:00	2.42	
06/07/11	15:12:15	2.40	
06/07/11	15:12:30	2.37	
06/07/11	15:12:45	2.35	
06/07/11	15:13:00	2.36	
06/07/11	15:13:15	2.33	
06/07/11	15:13:30	2.25	
06/07/11	15:13:45	2.29	
06/07/11	15:14:00	2.32	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	15:14:15	2.33	
06/07/11	15:14:30	2.26	
06/07/11	15:14:45	2.17	
06/07/11	15:15:00	2.14	
06/07/11	15:15:15	2.12	
06/07/11	15:15:30	2.11	
06/07/11	15:15:45	2.11	
06/07/11	15:16:00	2.12	
06/07/11	15:16:15	2.10	
06/07/11	15:16:30	2.13	
06/07/11	15:16:45	2.20	
06/07/11	15:17:00	2.22	
06/07/11	15:17:15	2.20	
06/07/11	15:17:30	2.14	
06/07/11	15:17:45	2.11	
06/07/11	15:18:00	2.10	
06/07/11	15:18:15	2.10	
06/07/11	15:18:30	2.08	
06/07/11	15:18:45	2.09	
06/07/11	15:19:00	2.09	
06/07/11	15:19:15	2.09	
06/07/11	15:19:30	2.07	
06/07/11	15:19:45	2.06	
06/07/11	15:20:00	2.05	
06/07/11	15:20:15	2.06	
06/07/11	15:20:30	2.04	
06/07/11	15:20:45	2.05	
06/07/11	15:21:00	2.06	
06/07/11	15:21:15	2.05	
06/07/11	15:21:30	2.12	
06/07/11	15:21:45	2.17	
06/07/11	15:22:00	2.14	
06/07/11	15:22:15	2.17	Port Change
06/07/11	15:22:30	2.62	
06/07/11	15:22:45	2.48	
06/07/11	15:23:00	1.96	
06/07/11	15:23:15	1.54	
06/07/11	15:23:30	1.23	
06/07/11	15:23:45	1.10	
06/07/11	15:24:00	1.07	
06/07/11	15:24:15	1.25	
06/07/11	15:24:30	1.52	
06/07/11	15:24:45	1.84	
06/07/11	15:25:00	2.17	
06/07/11	15:25:15	1.91	
06/07/11	15:25:30	1.79	
06/07/11	15:25:45	1.71	
06/07/11	15:26:00	1.68	
06/07/11	15:26:15	1.74	
06/07/11	15:26:30	1.89	
06/07/11	15:26:45	1.57	
06/07/11	15:27:00	1.36	
06/07/11	15:27:15	1.25	
06/07/11	15:27:30	1.20	
06/07/11	15:27:45	1.20	
06/07/11	15:28:00	1.12	
06/07/11	15:28:15	1.08	
06/07/11	15:28:30	1.02	
06/07/11	15:28:45	0.96	
06/07/11	15:29:00	1.00	
06/07/11	15:29:15	0.98	
06/07/11	15:29:30	0.95	
06/07/11	15:29:45	0.88	
06/07/11	15:30:00	0.86	
06/07/11	15:30:15	0.85	
06/07/11	15:30:30	0.82	
06/07/11	15:30:45	0.84	
06/07/11	15:31:00	0.90	
06/07/11	15:31:15	0.83	
06/07/11	15:31:30	0.82	
06/07/11	15:31:45	0.82	
06/07/11	15:32:00	0.80	
06/07/11	15:32:15	1.00	
06/07/11	15:32:30	1.03	
06/07/11	15:32:45	0.87	
06/07/11	15:33:00	0.85	
06/07/11	15:33:15	0.82	
06/07/11	15:33:30	0.83	
06/07/11	15:33:45	0.89	
06/07/11	15:34:00	0.99	
06/07/11	15:34:15	1.59	
06/07/11	15:34:30	2.12	
06/07/11	15:34:45	2.53	
06/07/11	15:35:00	2.68	
06/07/11	15:35:15	2.72	
06/07/11	15:35:30	2.72	
06/07/11	15:35:45	2.62	
06/07/11	15:36:00	2.54	Restart
06/07/11	15:36:15	2.43	
06/07/11	15:36:30	2.36	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	15:36:45	2.28	
06/07/11	15:37:00	2.26	
06/07/11	15:37:15	2.31	
06/07/11	15:37:30	2.27	
06/07/11	15:37:45	2.21	
06/07/11	15:38:00	2.15	
06/07/11	15:38:15	2.13	
06/07/11	15:38:30	2.10	
06/07/11	15:38:45	2.07	
06/07/11	15:39:00	2.04	
06/07/11	15:39:15	2.04	
06/07/11	15:39:30	2.04	
06/07/11	15:39:45	2.04	
06/07/11	15:40:00	2.04	
06/07/11	15:40:15	2.03	
06/07/11	15:40:30	2.02	
06/07/11	15:40:45	2.02	
06/07/11	15:41:00	2.01	
06/07/11	15:41:15	2.04	
06/07/11	15:41:30	2.02	
06/07/11	15:41:45	2.02	
06/07/11	15:42:00	2.01	
06/07/11	15:42:15	2.00	
06/07/11	15:42:30	2.02	
06/07/11	15:42:45	2.02	
06/07/11	15:43:00	2.03	
06/07/11	15:43:15	2.05	
06/07/11	15:43:30	2.09	
06/07/11	15:43:45	2.15	
06/07/11	15:44:00	2.20	
06/07/11	15:44:15	2.16	
06/07/11	15:44:30	2.16	
06/07/11	15:44:45	2.11	
06/07/11	15:45:00	2.09	
06/07/11	15:45:15	2.09	
06/07/11	15:45:30	2.07	
06/07/11	15:45:45	2.05	
06/07/11	15:46:00	2.05	
06/07/11	15:46:15	2.06	
06/07/11	15:46:30	2.07	
06/07/11	15:46:45	2.06	
06/07/11	15:47:00	2.05	
06/07/11	15:47:15	2.04	
06/07/11	15:47:30	2.06	
06/07/11	15:47:45	2.05	
06/07/11	15:48:00	2.03	
06/07/11	15:48:15	2.03	
06/07/11	15:48:30	2.02	
06/07/11	15:48:45	2.02	
06/07/11	15:49:00	1.99	
06/07/11	15:49:15	1.99	
06/07/11	15:49:30	2.05	
06/07/11	15:49:45	2.01	
06/07/11	15:50:00	2.00	
06/07/11	15:50:15	2.00	
06/07/11	15:50:30	1.99	
06/07/11	15:50:45	2.00	
06/07/11	15:51:00	2.00	
06/07/11	15:51:15	2.00	
06/07/11	15:51:30	1.99	
06/07/11	15:51:45	1.99	
06/07/11	15:52:00	1.98	
06/07/11	15:52:15	1.97	
06/07/11	15:52:30	2.30	
06/07/11	15:52:45	1.98	
06/07/11	15:53:00	1.97	
06/07/11	15:53:15	1.99	
06/07/11	15:53:30	1.99	
06/07/11	15:53:45	1.98	
06/07/11	15:54:00	1.97	
06/07/11	15:54:15	1.99	
06/07/11	15:54:30	1.99	
06/07/11	15:54:45	1.98	
06/07/11	15:55:00	1.98	
06/07/11	15:55:15	1.98	
06/07/11	15:55:30	1.96	
06/07/11	15:55:45	1.97	
06/07/11	15:56:00	1.95	26 start
06/07/11	15:56:15	1.98	
06/07/11	15:56:30	2.15	
06/07/11	15:56:45	2.25	
06/07/11	15:57:00	2.16	
06/07/11	15:57:15	2.08	
06/07/11	15:57:30	2.11	
06/07/11	15:57:45	2.22	
06/07/11	15:58:00	2.29	
06/07/11	15:58:15	2.39	
06/07/11	15:58:30	2.64	
06/07/11	15:58:45	2.83	
06/07/11	15:59:00	2.83	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	15:59:15	2.75	
06/07/11	15:59:30	2.81	
06/07/11	15:59:45	2.83	
06/07/11	16:00:00	2.75	
06/07/11	16:00:15	2.70	
06/07/11	16:00:30	2.66	
06/07/11	16:00:45	2.65	
06/07/11	16:01:00	2.63	
06/07/11	16:01:15	2.63	
06/07/11	16:01:30	2.68	
06/07/11	16:01:45	2.65	
06/07/11	16:02:00	2.66	
06/07/11	16:02:15	2.59	
06/07/11	16:02:30	2.63	
06/07/11	16:02:45	2.64	
06/07/11	16:03:00	2.63	
06/07/11	16:03:15	2.55	
06/07/11	16:03:30	2.62	
06/07/11	16:03:45	2.67	
06/07/11	16:04:00	2.63	
06/07/11	16:04:15	2.58	
06/07/11	16:04:30	2.55	
06/07/11	16:04:45	2.58	
06/07/11	16:05:00	2.58	
06/07/11	16:05:15	2.60	
06/07/11	16:05:30	2.62	
06/07/11	16:05:45	2.61	
06/07/11	16:06:00	2.49	restart 0010
06/07/11	16:06:15	2.42	
06/07/11	16:06:30	2.38	
06/07/11	16:06:45	2.48	
06/07/11	16:07:00	2.84	
06/07/11	16:07:15	2.71	
06/07/11	16:07:30	2.58	
06/07/11	16:07:45	2.56	
06/07/11	16:08:00	2.59	
06/07/11	16:08:15	2.58	
06/07/11	16:08:30	2.54	
06/07/11	16:08:45	2.53	
06/07/11	16:09:00	2.55	
06/07/11	16:09:15	2.50	
06/07/11	16:09:30	2.30	
06/07/11	16:09:45	2.22	
06/07/11	16:10:00	2.19	
06/07/11	16:10:15	2.15	
06/07/11	16:10:30	2.06	
06/07/11	16:10:45	2.08	
06/07/11	16:11:00	2.10	
06/07/11	16:11:15	2.09	
06/07/11	16:11:30	2.04	
06/07/11	16:11:45	1.97	
06/07/11	16:12:00	1.98	
06/07/11	16:12:15	2.02	
06/07/11	16:12:30	2.01	
06/07/11	16:12:45	2.00	
06/07/11	16:13:00	2.00	
06/07/11	16:13:15	2.05	
06/07/11	16:13:30	2.06	
06/07/11	16:13:45	2.04	
06/07/11	16:14:00	2.01	
06/07/11	16:14:15	2.03	
06/07/11	16:14:30	2.05	
06/07/11	16:14:45	2.17	
06/07/11	16:15:00	2.55	
06/07/11	16:15:15	2.71	
06/07/11	16:15:30	2.58	
06/07/11	16:15:45	2.48	
06/07/11	16:16:00	2.31	
06/07/11	16:16:15	2.14	
06/07/11	16:16:30	2.07	
06/07/11	16:16:45	2.04	
06/07/11	16:17:00	1.97	
06/07/11	16:17:15	2.05	
06/07/11	16:17:30	2.04	
06/07/11	16:17:45	2.01	
06/07/11	16:18:00	1.99	
06/07/11	16:18:15	1.93	
06/07/11	16:18:30	1.92	
06/07/11	16:18:45	1.96	
06/07/11	16:19:00	2.00	
06/07/11	16:19:15	2.01	
06/07/11	16:19:30	2.01	
06/07/11	16:19:45	2.06	
06/07/11	16:20:00	2.30	
06/07/11	16:20:15	2.29	
06/07/11	16:20:30	2.19	
06/07/11	16:20:45	2.17	
06/07/11	16:21:00	2.14	
06/07/11	16:21:15	2.11	
06/07/11	16:21:30	2.05	

Date	Time	Total VOM	Comments
06/07/11	16:21:45	2.03	
06/07/11	16:22:00	2.01	
06/07/11	16:22:15	1.98	
06/07/11	16:22:30	1.92	
06/07/11	16:22:45	1.90	
06/07/11	16:23:00	1.87	
06/07/11	16:23:15	1.86	
06/07/11	16:23:30	1.83	
06/07/11	16:23:45	1.88	
06/07/11	16:24:00	1.90	
06/07/11	16:24:15	2.03	
06/07/11	16:24:30	2.27	
06/07/11	16:24:45	2.25	
06/07/11	16:25:00	2.00	
06/07/11	16:25:15	1.91	
06/07/11	16:25:30	2.16	
06/07/11	16:25:45	2.22	
06/07/11	16:26:00	2.09	
06/07/11	16:26:15	2.05	
06/07/11	16:26:30	3.40	
06/07/11	16:26:45	2.81	
06/07/11	16:27:00	2.73	
06/07/11	16:27:15	2.54	
06/07/11	16:27:30	2.50	
06/07/11	16:27:45	2.44	
06/07/11	16:28:00	2.31	
06/07/11	16:28:15	2.22	
06/07/11	16:28:30	2.19	
06/07/11	16:28:45	2.18	
06/07/11	16:29:00	2.17	
06/07/11	16:29:15	2.13	
06/07/11	16:29:30	2.10	
06/07/11	16:29:45	2.10	
06/07/11	16:30:00	2.06	
06/07/11	16:30:15	2.02	
06/07/11	16:30:30	2.00	
06/07/11	16:30:45	1.97	
06/07/11	16:31:00	1.94	
06/07/11	16:31:15	1.95	
06/07/11	16:31:30	1.91	
06/07/11	16:31:45	1.84	
06/07/11	16:32:00	1.83	
06/07/11	16:32:15	1.81	
06/07/11	16:32:30	1.80	
06/07/11	16:32:45	1.80	
06/07/11	16:33:00	1.80	
06/07/11	16:33:15	1.78	
06/07/11	16:33:30	1.75	
06/07/11	16:33:45	1.74	
06/07/11	16:34:00	1.74	
06/07/11	16:34:15	1.73	
06/07/11	16:34:30	1.75	
06/07/11	16:34:45	1.77	
06/07/11	16:35:00	1.75	
06/07/11	16:35:15	1.74	
06/07/11	16:35:30	1.74	
06/07/11	16:35:45	1.74	
06/07/11	16:36:00	1.93	
06/07/11	16:36:15	1.81	
06/07/11	16:36:30	1.75	
06/07/11	16:36:45	1.73	
06/07/11	16:37:00	1.73	
06/07/11	16:37:15	1.72	
06/07/11	16:37:30	1.74	
06/07/11	16:37:45	1.76	
06/07/11	16:38:00	1.76	
06/07/11	16:38:15	1.76	
06/07/11	16:38:30	1.73	
06/07/11	16:38:45	1.72	
06/07/11	16:39:00	1.77	
06/07/11	16:39:15	1.79	
06/07/11	16:39:30	1.82	
06/07/11	16:39:45	1.92	
06/07/11	16:40:00	1.83	
06/07/11	16:40:15	1.73	
06/07/11	16:40:30	1.69	
06/07/11	16:40:45	1.71	
06/07/11	16:41:00	1.76	
06/07/11	16:41:15	1.74	
06/07/11	16:41:30	1.71	
06/07/11	16:41:45	1.72	
06/07/11	16:42:00	1.71	
06/07/11	16:42:15	1.72	
06/07/11	16:42:30	1.71	
06/07/11	16:42:45	1.78	
06/07/11	16:43:00	2.09	
06/07/11	16:43:15	1.95	
06/07/11	16:43:30	1.87	
06/07/11	16:43:45	1.79	
06/07/11	16:44:00	1.75	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	16:44:15	1.74	
06/07/11	16:44:30	1.74	
06/07/11	16:44:45	1.72	
06/07/11	16:45:00	1.75	
06/07/11	16:45:15	1.74	
06/07/11	16:45:30	1.79	
06/07/11	16:45:45	1.74	
06/07/11	16:46:00	1.75	
06/07/11	16:46:15	1.78	
06/07/11	16:46:30	1.92	
06/07/11	16:46:45	1.91	
06/07/11	16:47:00	1.93	
06/07/11	16:47:15	1.97	
06/07/11	16:47:30	1.94	
06/07/11	16:47:45	1.96	
06/07/11	16:48:00	1.98	
06/07/11	16:48:15	1.97	
06/07/11	16:48:30	1.90	
06/07/11	16:48:45	1.87	
06/07/11	16:49:00	1.88	
06/07/11	16:49:15	1.87	
06/07/11	16:49:30	1.82	
06/07/11	16:49:45	1.75	
06/07/11	16:50:00	1.75	
06/07/11	16:50:15	1.77	
06/07/11	16:50:30	1.75	
06/07/11	16:50:45	1.74	
06/07/11	16:51:00	1.75	
06/07/11	16:51:15	1.76	
06/07/11	16:51:30	1.76	
06/07/11	16:51:45	1.80	
06/07/11	16:52:00	1.85	
06/07/11	16:52:15	1.80	
06/07/11	16:52:30	1.80	
06/07/11	16:52:45	1.82	
06/07/11	16:53:00	1.81	
06/07/11	16:53:15	1.84	
06/07/11	16:53:30	1.87	
06/07/11	16:53:45	1.82	
06/07/11	16:54:00	1.70	
06/07/11	16:54:15	1.67	
06/07/11	16:54:30	1.64	
06/07/11	16:54:45	1.67	
06/07/11	16:55:00	1.67	
06/07/11	16:55:15	1.63	
06/07/11	16:55:30	1.67	
06/07/11	16:55:45	1.63	
06/07/11	16:56:00	1.70	
06/07/11	16:56:15	1.74	
06/07/11	16:56:30	1.64	
06/07/11	16:56:45	1.59	
06/07/11	16:57:00	1.57	
06/07/11	16:57:15	1.58	
06/07/11	16:57:30	1.57	
06/07/11	16:57:45	1.57	
06/07/11	16:58:00	1.61	
06/07/11	16:58:15	1.59	
06/07/11	16:58:30	1.63	
06/07/11	16:58:45	1.62	
06/07/11	16:59:00	1.72	
06/07/11	16:59:15	1.81	
06/07/11	16:59:30	1.78	
06/07/11	16:59:45	2.03	
06/07/11	17:00:00	2.27	
06/07/11	17:00:15	2.10	
06/07/11	17:00:30	1.99	
06/07/11	17:00:45	1.93	
06/07/11	17:01:00	1.88	
06/07/11	17:01:15	1.82	
06/07/11	17:01:30	1.73	
06/07/11	17:01:45	1.74	
06/07/11	17:02:00	1.72	
06/07/11	17:02:15	1.72	
06/07/11	17:02:30	1.70	
06/07/11	17:02:45	1.71	
06/07/11	17:03:00	1.71	
06/07/11	17:03:15	1.70	
06/07/11	17:03:30	1.70	
06/07/11	17:03:45	1.70	
06/07/11	17:04:00	1.71	
06/07/11	17:04:15	1.72	
06/07/11	17:04:30	1.61	
06/07/11	17:04:45	1.62	
06/07/11	17:05:00	1.61	
06/07/11	17:05:15	1.56	
06/07/11	17:05:30	1.54	
06/07/11	17:05:45	1.52	
06/07/11	17:06:00	1.51	
06/07/11	17:06:15	1.49	
06/07/11	17:06:30	1.47	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	17:06:45	1.49	
06/07/11	17:07:00	1.50	
06/07/11	17:07:15	1.49	
06/07/11	17:07:30	1.46	
06/07/11	17:07:45	1.54	
06/07/11	17:08:00	1.55	
06/07/11	17:08:15	1.58	
06/07/11	17:08:30	1.54	
06/07/11	17:08:45	1.47	
06/07/11	17:09:00	1.44	
06/07/11	17:09:15	1.50	
06/07/11	17:09:30	1.49	
06/07/11	17:09:45	1.48	
06/07/11	17:10:00	1.52	
06/07/11	17:10:15	1.50	
06/07/11	17:10:30	1.53	
06/07/11	17:10:45	1.50	
06/07/11	17:11:00	1.47	
06/07/11	17:11:15	1.48	
06/07/11	17:11:30	1.46	
06/07/11	17:11:45	1.46	
06/07/11	17:12:00	1.48	
06/07/11	17:12:15	1.47	
06/07/11	17:12:30	1.45	
06/07/11	17:12:45	1.42	
06/07/11	17:13:00	1.41	
06/07/11	17:13:15	1.41	
06/07/11	17:13:30	1.58	
06/07/11	17:13:45	2.05	
06/07/11	17:14:00	1.85	
06/07/11	17:14:15	1.63	
06/07/11	17:14:30	1.58	
06/07/11	17:14:45	1.56	
06/07/11	17:15:00	1.56	
06/07/11	17:15:15	1.54	
06/07/11	17:15:30	1.57	
06/07/11	17:15:45	1.60	
06/07/11	17:16:00	1.56	
06/07/11	17:16:15	1.50	
06/07/11	17:16:30	1.47	
06/07/11	17:16:45	1.46	
06/07/11	17:17:00	1.48	
06/07/11	17:17:15	1.44	
06/07/11	17:17:30	1.42	
06/07/11	17:17:45	1.42	
06/07/11	17:18:00	1.42	
06/07/11	17:18:15	1.41	
06/07/11	17:18:30	1.36	
06/07/11	17:18:45	1.37	
06/07/11	17:19:00	1.37	
06/07/11	17:19:15	1.39	
06/07/11	17:19:30	1.40	
06/07/11	17:19:45	1.39	
06/07/11	17:20:00	1.39	
06/07/11	17:20:15	1.41	
06/07/11	17:20:30	1.41	
06/07/11	17:20:45	1.44	
06/07/11	17:21:00	1.43	
06/07/11	17:21:15	1.43	
06/07/11	17:21:30	1.41	
06/07/11	17:21:45	1.39	
06/07/11	17:22:00	1.38	
06/07/11	17:22:15	1.33	
06/07/11	17:22:30	1.40	
06/07/11	17:22:45	1.42	
06/07/11	17:23:00	1.44	
06/07/11	17:23:15	1.42	
06/07/11	17:23:30	1.42	
06/07/11	17:23:45	1.42	
06/07/11	17:24:00	1.44	
06/07/11	17:24:15	1.46	
06/07/11	17:24:30	1.49	
06/07/11	17:24:45	1.49	
06/07/11	17:25:00	1.51	
06/07/11	17:25:15	1.49	
06/07/11	17:25:30	1.43	
06/07/11	17:25:45	1.42	
06/07/11	17:26:00	1.41	
06/07/11	17:26:15	1.39	
06/07/11	17:26:30	1.37	
06/07/11	17:26:45	1.37	
06/07/11	17:27:00	1.37	
06/07/11	17:27:15	1.34	
06/07/11	17:27:30	1.30	
06/07/11	17:27:45	1.32	
06/07/11	17:28:00	1.34	
06/07/11	17:28:15	1.37	
06/07/11	17:28:30	1.35	
06/07/11	17:28:45	1.05	
06/07/11	17:29:00	2.74	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	17:29:15	2.34	
06/07/11	17:29:30	2.12	
06/07/11	17:29:45	2.00	
06/07/11	17:30:00	1.88	
06/07/11	17:30:15	1.78	
06/07/11	17:30:30	1.78	
06/07/11	17:30:45	1.74	
06/07/11	17:31:00	1.76	
06/07/11	17:31:15	1.70	
06/07/11	17:31:30	1.62	
06/07/11	17:31:45	1.55	
06/07/11	17:32:00	1.51	
06/07/11	17:32:15	1.48	
06/07/11	17:32:30	1.46	
06/07/11	17:32:45	1.44	
06/07/11	17:33:00	1.47	
06/07/11	17:33:15	1.48	
06/07/11	17:33:30	1.49	
06/07/11	17:33:45	1.48	
06/07/11	17:34:00	1.44	
06/07/11	17:34:15	1.44	
06/07/11	17:34:30	1.48	
06/07/11	17:34:45	1.44	
06/07/11	17:35:00	1.42	
06/07/11	17:35:15	1.41	
06/07/11	17:35:30	1.42	
06/07/11	17:35:45	1.40	End 23-1 and 0010
06/07/11	17:36:00	1.40	
06/07/11	17:36:15	1.39	
06/07/11	17:36:30	1.38	
06/07/11	17:36:45	1.36	
06/07/11	17:37:00	1.39	
06/07/11	17:37:15	1.95	
06/07/11	17:37:30	1.77	
06/07/11	17:37:45	1.64	
06/07/11	17:38:00	1.61	
06/07/11	17:38:15	1.51	
06/07/11	17:38:30	1.52	
06/07/11	17:38:45	1.56	
06/07/11	17:39:00	1.60	
06/07/11	17:39:15	1.50	
06/07/11	17:39:30	1.42	
06/07/11	17:39:45	1.35	
06/07/11	17:40:00	1.36	
06/07/11	17:40:15	1.35	
06/07/11	17:40:30	1.34	
06/07/11	17:40:45	1.33	
06/07/11	17:41:00	1.30	
06/07/11	17:41:15	1.32	
06/07/11	17:41:30	1.34	
06/07/11	17:41:45	1.36	
06/07/11	17:42:00	1.36	
06/07/11	17:42:15	1.33	
06/07/11	17:42:30	1.34	
06/07/11	17:42:45	1.34	
06/07/11	17:43:00	1.33	
06/07/11	17:43:15	1.29	
06/07/11	17:43:30	1.26	
06/07/11	17:43:45	1.26	
06/07/11	17:44:00	1.26	
06/07/11	17:44:15	1.25	
06/07/11	17:44:30	1.27	
06/07/11	17:44:45	1.24	
06/07/11	17:45:00	1.25	
06/07/11	17:45:15	1.19	
06/07/11	17:45:30	1.28	
06/07/11	17:45:45	1.65	
06/07/11	17:46:00	1.65	
06/07/11	17:46:15	1.77	
06/07/11	17:46:30	3.13	
06/07/11	17:46:45	3.38	
06/07/11	17:47:00	3.26	
06/07/11	17:47:15	3.10	
06/07/11	17:47:30	3.31	
06/07/11	17:47:45	102.28	
06/07/11	17:48:00	78.59	
06/07/11	17:48:15	24.17	
06/07/11	17:48:30	10.72	
06/07/11	17:48:45	5.58	
06/07/11	17:49:00	3.49	
06/07/11	17:49:15	2.49	
06/07/11	17:49:30	1.90	
06/07/11	17:49:45	1.52	
06/07/11	17:50:00	1.25	
06/07/11	17:50:15	1.06	
06/07/11	17:50:30	0.91	
06/07/11	17:50:45	0.76	
06/07/11	17:51:00	0.64	
06/07/11	17:51:15	0.52	
06/07/11	17:51:30	0.43	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/07/11	17:51:45	0.32	
06/07/11	17:52:00	0.24	
06/07/11	17:52:15	0.22	
06/07/11	17:52:30	0.13	
06/07/11	17:52:45	0.10	
06/07/11	17:53:00	0.04	
06/07/11	17:53:15	-0.03	
06/07/11	17:53:30	-0.08	
06/07/11	17:53:45	-0.10	
06/07/11	17:54:00	-0.14	
06/07/11	17:54:15	-0.20	
06/07/11	17:54:30	-0.22	
06/07/11	17:54:45	1.57	
06/07/11	17:55:00	6.67	
06/07/11	17:55:15	34.53	
06/07/11	17:55:30	44.55	
06/07/11	17:55:45	46.37	
06/07/11	17:56:00	45.88	
06/07/11	17:56:15	46.19	
06/07/11	17:56:30	46.84	
06/07/11	17:56:45	48.30	
06/07/11	17:57:00	48.96	
06/07/11	17:57:15	49.03	
06/07/11	17:57:30	49.60	
06/07/11	17:57:45	49.76	
06/07/11	17:58:00	**49.79**	50ppm CH4 Injection
06/07/11	17:58:15	**49.89**	
06/07/11	17:58:30	**49.93**	
06/07/11	17:58:45	**50.00**	**49.90** ppm ch4
06/07/11	17:59:00	50.13	
06/07/11	17:59:15	50.29	
06/07/11	17:59:30	50.42	
06/07/11	17:59:45	50.57	
06/07/11	18:00:00	50.62	
06/07/11	18:00:15	48.50	
06/07/11	18:00:30	28.93	
06/07/11	18:00:45	5.41	
06/07/11	18:01:00	**0.83**	Zero CH4 Injection
06/07/11	18:01:15	**0.07**	
06/07/11	18:01:30	**-0.09**	
06/07/11	18:01:45	**-0.16**	**0.16** ppm ch4
06/07/11	18:02:00	-0.17	
06/07/11	18:02:15	-0.19	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	8:00:15	0.73	
06/08/11	8:00:30	-0.08	
06/08/11	8:00:45	-0.38	
06/08/11	8:01:00	-0.72	**Calibration Bias**
06/08/11	**8:01:15**	**-0.54**	0 ppm CH4 Injection
06/08/11	**8:01:30**	**-0.34**	
06/08/11	**8:01:45**	**-0.53**	
06/08/11	**8:02:00**	**-0.67**	**-0.57** ppm ch4
06/08/11	8:02:15	-0.76	
06/08/11	8:02:30	-0.83	
06/08/11	8:02:45	-0.84	
06/08/11	8:03:00	-0.86	
06/08/11	8:03:15	-0.47	
06/08/11	8:03:30	37.87	
06/08/11	8:03:45	77.42	
06/08/11	8:04:00	84.10	
06/08/11	8:04:15	84.31	
06/08/11	8:04:30	83.94	
06/08/11	8:04:45	83.82	**Calibration Bias**
06/08/11	**8:05:00**	**83.78**	84.3 ppm CH4 Injection
06/08/11	**8:05:15**	**83.72**	
06/08/11	**8:05:30**	**83.77**	
06/08/11	**8:05:45**	**83.69**	**83.74** ppm ch4
06/08/11	8:06:00	83.61	
06/08/11	8:06:15	83.59	
06/08/11	8:06:30	83.60	
06/08/11	8:06:45	76.23	
06/08/11	8:07:00	56.49	
06/08/11	8:07:15	52.21	
06/08/11	8:07:30	51.53	**Calibration Bias**
06/08/11	**8:07:45**	**51.45**	50 ppm CH4 Injection
06/08/11	**8:08:00**	**51.46**	
06/08/11	**8:08:15**	**51.51**	
06/08/11	**8:08:30**	**51.54**	**51.49** ppm ch4
06/08/11	8:08:45	51.57	
06/08/11	8:09:00	51.68	
06/08/11	8:09:15	50.69	
06/08/11	8:09:30	33.89	
06/08/11	8:09:45	28.12	
06/08/11	8:10:00	26.21	
06/08/11	8:10:15	25.43	
06/08/11	8:10:30	25.52	**Calibration Bias**
06/08/11	**8:10:45**	**25.66**	25 ppm CH4 Injection
06/08/11	**8:11:00**	**25.80**	
06/08/11	**8:11:15**	**26.00**	
06/08/11	**8:11:30**	**26.20**	**25.91** ppm ch4
06/08/11	8:11:45	26.37	
06/08/11	8:12:00	26.54	
06/08/11	8:12:15	25.23	
06/08/11	8:12:30	22.30	
06/08/11	8:12:45	8.29	
06/08/11	8:13:00	3.67	
06/08/11	8:13:15	3.04	
06/08/11	8:13:30	3.06	
06/08/11	8:13:45	3.02	
06/08/11	8:14:00	4.15	
06/08/11	8:14:15	4.62	
06/08/11	8:14:30	4.37	
06/08/11	8:14:45	4.18	
06/08/11	8:15:00	4.11	
06/08/11	8:15:15	4.05	
06/08/11	8:15:30	3.98	
06/08/11	8:15:45	3.96	
06/08/11	8:16:00	4.01	
06/08/11	8:16:15	4.12	
06/08/11	8:16:30	4.23	
06/08/11	8:16:45	4.30	
06/08/11	8:17:00	4.40	
06/08/11	8:17:15	4.54	
06/08/11	8:17:30	4.64	
06/08/11	8:17:45	4.77	
06/08/11	8:18:00	4.86	
06/08/11	8:18:15	4.96	
06/08/11	8:18:30	5.06	
06/08/11	8:18:45	5.14	
06/08/11	8:19:00	5.14	
06/08/11	8:19:15	5.08	
06/08/11	8:19:30	5.03	
06/08/11	8:19:45	5.00	
06/08/11	8:20:00	5.05	
06/08/11	8:20:15	5.07	
06/08/11	8:20:30	5.11	
06/08/11	8:20:45	5.23	
06/08/11	8:21:00	5.29	
06/08/11	8:21:15	5.28	
06/08/11	8:21:30	5.29	
06/08/11	8:21:45	5.31	
06/08/11	8:22:00	5.38	
06/08/11	8:22:15	5.43	
06/08/11	8:22:30	5.47	
06/08/11	8:22:45	5.49	
06/08/11	8:23:00	5.46	
06/08/11	8:23:15	5.52	
06/08/11	8:23:30	5.53	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	8:23:45	5.59	
06/08/11	8:24:00	5.57	
06/08/11	8:24:15	5.58	
06/08/11	8:24:30	5.58	
06/08/11	8:24:45	5.60	
06/08/11	8:25:00	5.58	
06/08/11	8:25:15	5.59	
06/08/11	8:25:30	5.58	
06/08/11	8:25:45	5.54	
06/08/11	8:26:00	5.54	
06/08/11	8:26:15	5.57	
06/08/11	8:26:30	5.58	
06/08/11	8:26:45	5.61	
06/08/11	8:27:00	6.02	
06/08/11	8:27:15	10.33	
06/08/11	8:27:30	13.95	
06/08/11	8:27:45	13.48	
06/08/11	8:28:00	12.83	
06/08/11	8:28:15	12.18	
06/08/11	8:28:30	11.65	
06/08/11	8:28:45	11.25	
06/08/11	8:29:00	10.98	
06/08/11	8:29:15	10.74	
06/08/11	8:29:30	10.56	
06/08/11	8:29:45	10.40	
06/08/11	8:30:00	10.22	
06/08/11	8:30:15	10.04	
06/08/11	8:30:30	9.89	
06/08/11	8:30:45	9.77	
06/08/11	8:31:00	9.64	
06/08/11	8:31:15	9.52	
06/08/11	8:31:30	9.41	
06/08/11	8:31:45	9.28	
06/08/11	8:32:00	9.17	
06/08/11	8:32:15	9.03	
06/08/11	8:32:30	8.96	
06/08/11	8:32:45	8.89	
06/08/11	8:33:00	8.85	
06/08/11	8:33:15	8.77	
06/08/11	8:33:30	8.72	
06/08/11	8:33:45	8.67	
06/08/11	8:34:00	8.63	
06/08/11	8:34:15	8.61	
06/08/11	8:34:30	8.59	
06/08/11	8:34:45	8.56	
06/08/11	8:35:00	8.57	
06/08/11	8:35:15	8.57	
06/08/11	8:35:30	8.62	
06/08/11	8:35:45	8.64	
06/08/11	8:36:00	8.61	
06/08/11	8:36:15	8.61	
06/08/11	8:36:30	8.60	
06/08/11	8:36:45	8.62	
06/08/11	8:37:00	8.68	
06/08/11	8:37:15	8.73	
06/08/11	8:37:30	8.73	
06/08/11	8:37:45	8.73	
06/08/11	8:38:00	8.73	
06/08/11	8:38:15	8.68	
06/08/11	8:38:30	8.66	
06/08/11	8:38:45	8.61	
06/08/11	8:39:00	8.56	
06/08/11	8:39:15	8.46	
06/08/11	8:39:30	8.29	
06/08/11	8:39:45	8.13	
06/08/11	8:40:00	7.91	
06/08/11	8:40:15	7.67	
06/08/11	8:40:30	7.38	
06/08/11	8:40:45	7.07	
06/08/11	8:41:00	6.78	
06/08/11	8:41:15	6.54	
06/08/11	8:41:30	6.28	
06/08/11	8:41:45	6.07	
06/08/11	8:42:00	5.88	
06/08/11	8:42:15	5.72	
06/08/11	8:42:30	5.57	
06/08/11	8:42:45	5.42	
06/08/11	8:43:00	5.25	
06/08/11	8:43:15	5.10	
06/08/11	8:43:30	4.95	
06/08/11	8:43:45	4.78	
06/08/11	8:44:00	4.60	
06/08/11	8:44:15	4.41	
06/08/11	8:44:30	4.30	
06/08/11	8:44:45	4.16	
06/08/11	8:45:00	4.04	
06/08/11	8:45:15	3.93	
06/08/11	8:45:30	3.83	
06/08/11	8:45:45	3.73	
06/08/11	8:46:00	3.57	
06/08/11	8:46:15	3.46	
06/08/11	8:46:30	3.34	
06/08/11	8:46:45	3.24	
06/08/11	8:47:00	3.10	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	8:47:15	2.96	
06/08/11	8:47:30	2.85	
06/08/11	8:47:45	2.74	
06/08/11	8:48:00	2.64	
06/08/11	8:48:15	2.56	
06/08/11	8:48:30	2.49	
06/08/11	8:48:45	2.39	
06/08/11	8:49:00	2.30	
06/08/11	8:49:15	2.24	
06/08/11	8:49:30	2.20	
06/08/11	8:49:45	2.13	
06/08/11	8:50:00	2.07	
06/08/11	8:50:15	1.98	
06/08/11	8:50:30	1.89	
06/08/11	8:50:45	1.84	
06/08/11	8:51:00	1.74	
06/08/11	8:51:15	1.67	
06/08/11	8:51:30	1.59	
06/08/11	8:51:45	1.50	
06/08/11	8:52:00	1.44	
06/08/11	8:52:15	1.35	
06/08/11	8:52:30	1.29	
06/08/11	8:52:45	1.21	
06/08/11	8:53:00	1.15	
06/08/11	8:53:15	1.09	
06/08/11	8:53:30	1.03	
06/08/11	8:53:45	0.95	
06/08/11	8:54:00	0.86	
06/08/11	8:54:15	0.81	
06/08/11	8:54:30	0.74	
06/08/11	8:54:45	0.70	
06/08/11	8:55:00	0.65	Begin Method 23
06/08/11	8:55:15	0.59	
06/08/11	8:55:30	0.55	
06/08/11	8:55:45	0.50	
06/08/11	8:56:00	0.43	
06/08/11	8:56:15	0.42	
06/08/11	8:56:30	0.41	
06/08/11	8:56:45	0.42	
06/08/11	8:57:00	0.49	
06/08/11	8:57:15	0.47	
06/08/11	8:57:30	0.44	
06/08/11	8:57:45	0.44	
06/08/11	8:58:00	0.46	
06/08/11	8:58:15	0.45	
06/08/11	8:58:30	0.50	
06/08/11	8:58:45	0.52	
06/08/11	8:59:00	0.53	
06/08/11	8:59:15	0.58	
06/08/11	8:59:30	0.60	
06/08/11	8:59:45	0.61	
06/08/11	9:00:00	0.65	
06/08/11	9:00:15	0.68	
06/08/11	9:00:30	0.77	
06/08/11	9:00:45	0.81	
06/08/11	9:01:00	0.88	
06/08/11	9:01:15	0.96	
06/08/11	9:01:30	1.05	
06/08/11	9:01:45	1.20	
06/08/11	9:02:00	1.31	
06/08/11	9:02:15	1.35	
06/08/11	9:02:30	1.31	
06/08/11	9:02:45	1.29	
06/08/11	9:03:00	1.59	
06/08/11	9:03:15	1.70	
06/08/11	9:03:30	1.75	
06/08/11	9:03:45	1.71	
06/08/11	9:04:00	1.66	
06/08/11	9:04:15	1.65	
06/08/11	9:04:30	1.72	
06/08/11	9:04:45	2.12	
06/08/11	9:05:00	2.30	
06/08/11	9:05:15	2.26	
06/08/11	9:05:30	2.11	
06/08/11	9:05:45	2.04	
06/08/11	9:06:00	1.98	
06/08/11	9:06:15	1.94	
06/08/11	9:06:30	1.95	
06/08/11	9:06:45	1.99	
06/08/11	9:07:00	2.03	
06/08/11	9:07:15	2.09	
06/08/11	9:07:30	2.14	
06/08/11	9:07:45	2.21	
06/08/11	9:08:00	2.29	
06/08/11	9:08:15	2.37	
06/08/11	9:08:30	2.42	
06/08/11	9:08:45	2.38	
06/08/11	9:09:00	2.36	
06/08/11	9:09:15	2.31	
06/08/11	9:09:30	2.29	
06/08/11	9:09:45	2.28	
06/08/11	9:10:00	2.32	
06/08/11	9:10:15	2.39	
06/08/11	9:10:30	2.36	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	9:10:45	2.36	
06/08/11	9:11:00	2.35	
06/08/11	9:11:15	2.30	
06/08/11	9:11:30	2.28	
06/08/11	9:11:45	2.24	
06/08/11	9:12:00	2.30	
06/08/11	9:12:15	2.32	
06/08/11	9:12:30	2.31	
06/08/11	9:12:45	2.38	
06/08/11	9:13:00	2.43	
06/08/11	9:13:15	2.45	
06/08/11	9:13:30	2.54	
06/08/11	9:13:45	2.67	
06/08/11	9:14:00	2.74	
06/08/11	9:14:15	2.76	
06/08/11	9:14:30	2.70	
06/08/11	9:14:45	2.64	
06/08/11	9:15:00	2.58	
06/08/11	9:15:15	2.45	
06/08/11	9:15:30	2.30	
06/08/11	9:15:45	2.21	
06/08/11	9:16:00	2.13	
06/08/11	9:16:15	2.03	
06/08/11	9:16:30	1.87	
06/08/11	9:16:45	1.74	
06/08/11	9:17:00	1.60	
06/08/11	9:17:15	1.52	
06/08/11	9:17:30	1.47	
06/08/11	9:17:45	1.41	
06/08/11	9:18:00	1.31	
06/08/11	9:18:15	1.25	
06/08/11	9:18:30	1.24	
06/08/11	9:18:45	1.21	
06/08/11	9:19:00	1.19	
06/08/11	9:19:15	1.17	
06/08/11	9:19:30	1.11	
06/08/11	9:19:45	1.05	
06/08/11	9:20:00	0.94	
06/08/11	9:20:15	0.90	
06/08/11	9:20:30	0.85	
06/08/11	9:20:45	0.79	
06/08/11	9:21:00	0.74	
06/08/11	9:21:15	0.64	
06/08/11	9:21:30	0.55	
06/08/11	9:21:45	0.48	
06/08/11	9:22:00	0.44	
06/08/11	9:22:15	0.40	
06/08/11	9:22:30	0.38	
06/08/11	9:22:45	0.35	
06/08/11	9:23:00	0.28	
06/08/11	9:23:15	0.22	
06/08/11	9:23:30	0.18	
06/08/11	9:23:45	0.12	
06/08/11	9:24:00	0.06	
06/08/11	9:24:15	-0.05	
06/08/11	9:24:30	-0.10	
06/08/11	9:24:45	-0.14	
06/08/11	9:25:00	-0.20	0010 start
06/08/11	9:25:15	-0.22	Start THC
06/08/11	9:25:30	-0.18	
06/08/11	9:25:45	-0.22	
06/08/11	9:26:00	-0.26	
06/08/11	9:26:15	-0.25	
06/08/11	9:26:30	-0.23	
06/08/11	9:26:45	-0.28	
06/08/11	9:27:00	-0.33	
06/08/11	9:27:15	-0.40	
06/08/11	9:27:30	-0.46	
06/08/11	9:27:45	-0.49	
06/08/11	9:28:00	-0.53	
06/08/11	9:28:15	-0.60	
06/08/11	9:28:30	-0.66	
06/08/11	9:28:45	-0.72	
06/08/11	9:29:00	-0.72	
06/08/11	9:29:15	-0.72	
06/08/11	9:29:30	-0.77	
06/08/11	9:29:45	-0.76	
06/08/11	9:30:00	-0.79	
06/08/11	9:30:15	-0.67	
06/08/11	9:30:30	-0.82	
06/08/11	9:30:45	-0.89	
06/08/11	9:31:00	-0.91	
06/08/11	9:31:15	-0.96	
06/08/11	9:31:30	-0.97	
06/08/11	9:31:45	-0.98	
06/08/11	9:32:00	-1.00	
06/08/11	9:32:15	-1.01	
06/08/11	9:32:30	-1.03	
06/08/11	9:32:45	-1.02	
06/08/11	9:33:00	-1.01	
06/08/11	9:33:15	-0.27	
06/08/11	9:33:30	1.44	
06/08/11	9:33:45	1.53	
06/08/11	9:34:00	5.43	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	9:34:15	3.03	
06/08/11	9:34:30	2.78	
06/08/11	9:34:45	2.83	
06/08/11	9:35:00	2.99	
06/08/11	9:35:15	3.34	
06/08/11	9:35:30	3.65	
06/08/11	9:35:45	3.95	
06/08/11	9:36:00	4.28	
06/08/11	9:36:15	4.40	
06/08/11	9:36:30	3.57	
06/08/11	9:36:45	3.09	
06/08/11	9:37:00	2.77	
06/08/11	9:37:15	2.61	
06/08/11	9:37:30	2.50	
06/08/11	9:37:45	2.38	
06/08/11	9:38:00	2.35	
06/08/11	9:38:15	2.30	
06/08/11	9:38:30	2.24	
06/08/11	9:38:45	2.18	
06/08/11	9:39:00	2.15	
06/08/11	9:39:15	2.18	
06/08/11	9:39:30	2.21	
06/08/11	9:39:45	2.20	
06/08/11	9:40:00	2.19	
06/08/11	9:40:15	2.20	
06/08/11	9:40:30	2.26	
06/08/11	9:40:45	2.40	
06/08/11	9:41:00	2.29	
06/08/11	9:41:15	2.29	
06/08/11	9:41:30	2.31	
06/08/11	9:41:45	2.49	
06/08/11	9:42:00	2.43	
06/08/11	9:42:15	2.30	
06/08/11	9:42:30	2.28	
06/08/11	9:42:45	2.24	
06/08/11	9:43:00	2.19	
06/08/11	9:43:15	2.19	
06/08/11	9:43:30	2.23	
06/08/11	9:43:45	2.21	
06/08/11	9:44:00	2.23	
06/08/11	9:44:15	2.31	
06/08/11	9:44:30	2.41	
06/08/11	9:44:45	2.58	
06/08/11	9:45:00	2.57	
06/08/11	9:45:15	2.47	
06/08/11	9:45:30	2.40	
06/08/11	9:45:45	2.38	
06/08/11	9:46:00	2.48	
06/08/11	9:46:15	2.48	
06/08/11	9:46:30	2.46	
06/08/11	9:46:45	2.42	
06/08/11	9:47:00	2.42	
06/08/11	9:47:15	2.42	
06/08/11	9:47:30	2.43	
06/08/11	9:47:45	2.39	
06/08/11	9:48:00	2.36	
06/08/11	9:48:15	2.34	
06/08/11	9:48:30	2.36	
06/08/11	9:48:45	2.38	
06/08/11	9:49:00	2.37	
06/08/11	9:49:15	2.33	
06/08/11	9:49:30	2.29	
06/08/11	9:49:45	2.31	
06/08/11	9:50:00	2.36	
06/08/11	9:50:15	2.31	
06/08/11	9:50:30	2.28	
06/08/11	9:50:45	2.32	
06/08/11	9:51:00	2.34	
06/08/11	9:51:15	2.40	
06/08/11	9:51:30	2.29	
06/08/11	9:51:45	2.21	
06/08/11	9:52:00	2.13	
06/08/11	9:52:15	2.12	
06/08/11	9:52:30	2.10	
06/08/11	9:52:45	2.04	
06/08/11	9:53:00	1.97	
06/08/11	9:53:15	1.95	
06/08/11	9:53:30	1.93	
06/08/11	9:53:45	1.89	
06/08/11	9:54:00	1.90	
06/08/11	9:54:15	1.94	
06/08/11	9:54:30	1.91	
06/08/11	9:54:45	1.86	
06/08/11	9:55:00	1.83	
06/08/11	9:55:15	1.79	
06/08/11	9:55:30	1.76	
06/08/11	9:55:45	1.75	
06/08/11	9:56:00	1.67	
06/08/11	9:56:15	1.67	
06/08/11	9:56:30	1.92	
06/08/11	9:56:45	2.09	
06/08/11	9:57:00	1.78	
06/08/11	9:57:15	1.74	
06/08/11	9:57:30	1.70	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	9:57:45	1.73	
06/08/11	9:58:00	1.84	
06/08/11	9:58:15	1.74	
06/08/11	9:58:30	1.63	
06/08/11	9:58:45	1.56	
06/08/11	9:59:00	1.51	
06/08/11	9:59:15	1.48	
06/08/11	9:59:30	1.48	
06/08/11	9:59:45	1.48	
06/08/11	10:00:00	1.51	
06/08/11	10:00:15	1.54	
06/08/11	10:00:30	1.52	
06/08/11	10:00:45	1.34	
06/08/11	10:01:00	1.25	
06/08/11	10:01:15	1.21	
06/08/11	10:01:30	1.19	
06/08/11	10:01:45	1.19	
06/08/11	10:02:00	1.20	
06/08/11	10:02:15	1.26	
06/08/11	10:02:30	1.21	
06/08/11	10:02:45	1.14	
06/08/11	10:03:00	1.13	
06/08/11	10:03:15	1.11	
06/08/11	10:03:30	1.08	
06/08/11	10:03:45	1.09	
06/08/11	10:04:00	1.03	
06/08/11	10:04:15	1.03	
06/08/11	10:04:30	1.00	
06/08/11	10:04:45	1.01	
06/08/11	10:05:00	0.98	
06/08/11	10:05:15	0.95	
06/08/11	10:05:30	0.96	
06/08/11	10:05:45	0.96	
06/08/11	10:06:00	0.96	
06/08/11	10:06:15	0.97	
06/08/11	10:06:30	0.96	
06/08/11	10:06:45	0.97	
06/08/11	10:07:00	1.02	
06/08/11	10:07:15	1.07	
06/08/11	10:07:30	1.18	
06/08/11	10:07:45	1.10	
06/08/11	10:08:00	1.05	
06/08/11	10:08:15	1.05	
06/08/11	10:08:30	1.07	
06/08/11	10:08:45	1.04	
06/08/11	10:09:00	1.08	
06/08/11	10:09:15	1.09	
06/08/11	10:09:30	1.14	
06/08/11	10:09:45	1.18	
06/08/11	10:10:00	1.20	
06/08/11	10:10:15	1.24	
06/08/11	10:10:30	1.28	
06/08/11	10:10:45	1.30	
06/08/11	10:11:00	1.22	
06/08/11	10:11:15	1.20	
06/08/11	10:11:30	1.21	
06/08/11	10:11:45	1.17	
06/08/11	10:12:00	1.20	
06/08/11	10:12:15	1.19	
06/08/11	10:12:30	1.19	
06/08/11	10:12:45	1.18	
06/08/11	10:13:00	1.18	
06/08/11	10:13:15	1.19	
06/08/11	10:13:30	1.21	
06/08/11	10:13:45	1.18	
06/08/11	10:14:00	1.15	
06/08/11	10:14:15	1.15	
06/08/11	10:14:30	1.14	
06/08/11	10:14:45	1.20	
06/08/11	10:15:00	1.27	
06/08/11	10:15:15	1.31	
06/08/11	10:15:30	1.35	
06/08/11	10:15:45	1.37	
06/08/11	10:16:00	1.47	
06/08/11	10:16:15	1.50	
06/08/11	10:16:30	1.53	
06/08/11	10:16:45	1.59	
06/08/11	10:17:00	1.65	
06/08/11	10:17:15	1.72	
06/08/11	10:17:30	1.79	
06/08/11	10:17:45	2.12	
06/08/11	10:18:00	2.61	
06/08/11	10:18:15	2.45	
06/08/11	10:18:30	2.23	
06/08/11	10:18:45	1.96	
06/08/11	10:19:00	1.77	
06/08/11	10:19:15	1.67	
06/08/11	10:19:30	1.61	
06/08/11	10:19:45	1.56	
06/08/11	10:20:00	1.54	
06/08/11	10:20:15	1.53	
06/08/11	10:20:30	1.49	
06/08/11	10:20:45	1.48	
06/08/11	10:21:00	1.55	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	10:21:15	1.54	
06/08/11	10:21:30	1.54	
06/08/11	10:21:45	1.54	
06/08/11	10:22:00	1.52	
06/08/11	10:22:15	1.62	
06/08/11	10:22:30	1.79	
06/08/11	10:22:45	1.68	
06/08/11	10:23:00	1.65	
06/08/11	10:23:15	1.61	
06/08/11	10:23:30	1.60	
06/08/11	10:23:45	1.62	
06/08/11	10:24:00	1.64	
06/08/11	10:24:15	1.79	
06/08/11	10:24:30	1.78	Run 2 THC Average
06/08/11	10:24:45	1.73	1.50 ppm THC as CH4
06/08/11	10:25:00	1.78	
06/08/11	10:25:15	1.79	
06/08/11	10:25:30	1.71	
06/08/11	10:25:45	1.64	
06/08/11	10:26:00	1.63	
06/08/11	10:26:15	1.64	
06/08/11	10:26:30	1.66	
06/08/11	10:26:45	1.75	
06/08/11	10:27:00	1.87	
06/08/11	10:27:15	2.05	
06/08/11	10:27:30	2.47	
06/08/11	10:27:45	2.18	
06/08/11	10:28:00	1.79	
06/08/11	10:28:15	1.58	
06/08/11	10:28:30	1.46	
06/08/11	10:28:45	1.43	
06/08/11	10:29:00	1.35	
06/08/11	10:29:15	1.34	
06/08/11	10:29:30	1.34	
06/08/11	10:29:45	1.34	
06/08/11	10:30:00	1.32	
06/08/11	10:30:15	1.31	
06/08/11	10:30:30	1.35	
06/08/11	10:30:45	1.33	
06/08/11	10:31:00	1.34	
06/08/11	10:31:15	1.28	
06/08/11	10:31:30	1.22	
06/08/11	10:31:45	1.20	
06/08/11	10:32:00	1.15	
06/08/11	10:32:15	1.11	
06/08/11	10:32:30	1.05	
06/08/11	10:32:45	1.02	
06/08/11	10:33:00	1.04	
06/08/11	10:33:15	1.02	
06/08/11	10:33:30	0.98	
06/08/11	10:33:45	0.95	
06/08/11	10:34:00	0.97	
06/08/11	10:34:15	0.91	
06/08/11	10:34:30	0.89	
06/08/11	10:34:45	0.86	
06/08/11	10:35:00	0.85	
06/08/11	10:35:15	0.85	
06/08/11	10:35:30	0.82	
06/08/11	10:35:45	0.80	
06/08/11	10:36:00	0.78	
06/08/11	10:36:15	0.75	
06/08/11	10:36:30	0.74	
06/08/11	10:36:45	0.71	
06/08/11	10:37:00	0.71	
06/08/11	10:37:15	0.72	
06/08/11	10:37:30	0.71	
06/08/11	10:37:45	0.69	
06/08/11	10:38:00	0.68	
06/08/11	10:38:15	0.66	
06/08/11	10:38:30	1.04	
06/08/11	10:38:45	2.29	
06/08/11	10:39:00	1.15	
06/08/11	10:39:15	0.94	
06/08/11	10:39:30	0.84	
06/08/11	10:39:45	0.79	
06/08/11	10:40:00	0.78	
06/08/11	10:40:15	0.80	
06/08/11	10:40:30	0.77	
06/08/11	10:40:45	0.74	
06/08/11	10:41:00	1.56	
06/08/11	10:41:15	1.42	
06/08/11	10:41:30	1.02	
06/08/11	10:41:45	0.86	
06/08/11	10:42:00	0.81	
06/08/11	10:42:15	0.82	
06/08/11	10:42:30	0.83	
06/08/11	10:42:45	0.83	
06/08/11	10:43:00	0.83	
06/08/11	10:43:15	0.82	
06/08/11	10:43:30	0.82	
06/08/11	10:43:45	0.85	
06/08/11	10:44:00	0.92	
06/08/11	10:44:15	0.86	
06/08/11	10:44:30	0.84	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	10:44:45	0.82	
06/08/11	10:45:00	0.83	
06/08/11	10:45:15	0.81	
06/08/11	10:45:30	0.84	
06/08/11	10:45:45	0.81	
06/08/11	10:46:00	0.79	
06/08/11	10:46:15	0.82	
06/08/11	10:46:30	0.81	
06/08/11	10:46:45	0.77	
06/08/11	10:47:00	0.75	
06/08/11	10:47:15	0.81	
06/08/11	10:47:30	0.82	
06/08/11	10:47:45	0.80	
06/08/11	10:48:00	0.79	
06/08/11	10:48:15	0.82	
06/08/11	10:48:30	0.85	
06/08/11	10:48:45	0.86	
06/08/11	10:49:00	0.89	
06/08/11	10:49:15	0.91	
06/08/11	10:49:30	0.94	
06/08/11	10:49:45	0.94	
06/08/11	10:50:00	0.93	
06/08/11	10:50:15	0.90	
06/08/11	10:50:30	0.94	
06/08/11	10:50:45	0.95	
06/08/11	10:51:00	0.95	
06/08/11	10:51:15	0.98	
06/08/11	10:51:30	0.99	
06/08/11	10:51:45	1.03	
06/08/11	10:52:00	1.07	
06/08/11	10:52:15	1.05	
06/08/11	10:52:30	1.03	
06/08/11	10:52:45	1.07	
06/08/11	10:53:00	1.18	
06/08/11	10:53:15	1.14	
06/08/11	10:53:30	1.06	
06/08/11	10:53:45	1.03	
06/08/11	10:54:00	1.01	
06/08/11	10:54:15	1.00	
06/08/11	10:54:30	1.01	
06/08/11	10:54:45	1.03	Port Change
06/08/11	10:55:00	1.07	
06/08/11	10:55:15	1.11	
06/08/11	10:55:30	1.18	
06/08/11	10:55:45	1.23	
06/08/11	10:56:00	1.32	
06/08/11	10:56:15	1.40	
06/08/11	10:56:30	1.50	
06/08/11	10:56:45	1.64	
06/08/11	10:57:00	1.53	
06/08/11	10:57:15	1.45	
06/08/11	10:57:30	1.42	
06/08/11	10:57:45	1.38	
06/08/11	10:58:00	1.35	
06/08/11	10:58:15	1.34	
06/08/11	10:58:30	1.32	
06/08/11	10:58:45	1.31	
06/08/11	10:59:00	1.33	
06/08/11	10:59:15	1.30	
06/08/11	10:59:30	1.29	
06/08/11	10:59:45	1.34	
06/08/11	11:00:00	1.34	
06/08/11	11:00:15	1.32	
06/08/11	11:00:30	1.34	
06/08/11	11:00:45	1.37	
06/08/11	11:01:00	1.43	
06/08/11	11:01:15	1.58	
06/08/11	11:01:30	1.65	
06/08/11	11:01:45	1.50	
06/08/11	11:02:00	1.42	
06/08/11	11:02:15	1.34	
06/08/11	11:02:30	1.39	
06/08/11	11:02:45	1.40	
06/08/11	11:03:00	1.36	
06/08/11	11:03:15	1.35	
06/08/11	11:03:30	1.31	
06/08/11	11:03:45	1.29	
06/08/11	11:04:00	1.32	
06/08/11	11:04:15	1.34	
06/08/11	11:04:30	1.31	
06/08/11	11:04:45	1.34	
06/08/11	11:05:00	1.36	
06/08/11	11:05:15	1.37	
06/08/11	11:05:30	1.34	
06/08/11	11:05:45	1.40	
06/08/11	11:06:00	1.40	
06/08/11	11:06:15	1.40	
06/08/11	11:06:30	1.40	
06/08/11	11:06:45	1.54	
06/08/11	11:07:00	1.56	
06/08/11	11:07:15	1.56	
06/08/11	11:07:30	1.57	
06/08/11	11:07:45	1.56	
06/08/11	11:08:00	1.59	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	11:08:15	1.61	
06/08/11	11:08:30	1.62	
06/08/11	11:08:45	1.64	
06/08/11	11:09:00	1.64	
06/08/11	11:09:15	1.66	
06/08/11	11:09:30	1.64	
06/08/11	11:09:45	1.62	
06/08/11	11:10:00	1.57	
06/08/11	11:10:15	1.59	
06/08/11	11:10:30	1.63	
06/08/11	11:10:45	1.64	
06/08/11	11:11:00	1.69	
06/08/11	11:11:15	1.75	
06/08/11	11:11:30	1.85	
06/08/11	11:11:45	1.98	
06/08/11	11:12:00	2.11	
06/08/11	11:12:15	2.18	
06/08/11	11:12:30	2.25	
06/08/11	11:12:45	2.26	
06/08/11	11:13:00	2.33	
06/08/11	11:13:15	2.46	
06/08/11	11:13:30	2.52	
06/08/11	11:13:45	2.57	
06/08/11	11:14:00	2.57	
06/08/11	11:14:15	2.55	
06/08/11	11:14:30	2.63	
06/08/11	11:14:45	2.73	
06/08/11	11:15:00	2.80	
06/08/11	11:15:15	2.84	
06/08/11	11:15:30	2.84	
06/08/11	11:15:45	2.82	
06/08/11	11:16:00	2.78	
06/08/11	11:16:15	2.81	
06/08/11	11:16:30	3.17	
06/08/11	11:16:45	3.94	
06/08/11	11:17:00	3.86	
06/08/11	11:17:15	3.64	
06/08/11	11:17:30	3.33	
06/08/11	11:17:45	3.25	
06/08/11	11:18:00	3.21	
06/08/11	11:18:15	3.26	
06/08/11	11:18:30	3.22	
06/08/11	11:18:45	3.25	
06/08/11	11:19:00	3.17	
06/08/11	11:19:15	3.14	
06/08/11	11:19:30	3.11	
06/08/11	11:19:45	3.08	
06/08/11	11:20:00	3.27	
06/08/11	11:20:15	3.39	
06/08/11	11:20:30	3.45	
06/08/11	11:20:45	3.36	
06/08/11	11:21:00	3.28	
06/08/11	11:21:15	3.29	
06/08/11	11:21:30	3.32	
06/08/11	11:21:45	3.33	
06/08/11	11:22:00	3.24	
06/08/11	11:22:15	3.14	
06/08/11	11:22:30	2.99	
06/08/11	11:22:45	2.99	
06/08/11	11:23:00	2.91	
06/08/11	11:23:15	2.79	
06/08/11	11:23:30	2.63	
06/08/11	11:23:45	2.48	
06/08/11	11:24:00	2.39	restart
06/08/11	11:24:15	2.41	
06/08/11	11:24:30	2.49	
06/08/11	11:24:45	2.52	
06/08/11	11:25:00	2.49	
06/08/11	11:25:15	2.41	
06/08/11	11:25:30	2.35	
06/08/11	11:25:45	2.25	
06/08/11	11:26:00	2.17	
06/08/11	11:26:15	2.33	
06/08/11	11:26:30	2.21	
06/08/11	11:26:45	2.15	
06/08/11	11:27:00	2.13	
06/08/11	11:27:15	2.16	
06/08/11	11:27:30	2.18	
06/08/11	11:27:45	2.24	
06/08/11	11:28:00	2.26	
06/08/11	11:28:15	2.26	
06/08/11	11:28:30	2.27	
06/08/11	11:28:45	2.30	
06/08/11	11:29:00	2.33	
06/08/11	11:29:15	2.30	
06/08/11	11:29:30	2.28	
06/08/11	11:29:45	2.32	
06/08/11	11:30:00	2.33	
06/08/11	11:30:15	2.35	
06/08/11	11:30:30	2.35	
06/08/11	11:30:45	2.37	
06/08/11	11:31:00	2.38	
06/08/11	11:31:15	2.39	
06/08/11	11:31:30	2.41	

Date	Time	Total VOM	Comments
06/08/11	11:31:45	2.41	
06/08/11	11:32:00	2.45	
06/08/11	11:32:15	2.49	
06/08/11	11:32:30	2.43	
06/08/11	11:32:45	2.35	
06/08/11	11:33:00	2.36	
06/08/11	11:33:15	2.37	
06/08/11	11:33:30	2.33	
06/08/11	11:33:45	2.26	
06/08/11	11:34:00	2.30	
06/08/11	11:34:15	2.35	
06/08/11	11:34:30	2.37	
06/08/11	11:34:45	2.36	
06/08/11	11:35:00	2.23	
06/08/11	11:35:15	2.19	
06/08/11	11:35:30	2.16	
06/08/11	11:35:45	2.15	
06/08/11	11:36:00	2.14	
06/08/11	11:36:15	2.12	
06/08/11	11:36:30	2.11	
06/08/11	11:36:45	2.07	
06/08/11	11:37:00	2.03	
06/08/11	11:37:15	2.00	
06/08/11	11:37:30	1.98	
06/08/11	11:37:45	1.96	
06/08/11	11:38:00	1.88	
06/08/11	11:38:15	1.81	
06/08/11	11:38:30	1.78	
06/08/11	11:38:45	1.79	
06/08/11	11:39:00	1.84	
06/08/11	11:39:15	1.78	
06/08/11	11:39:30	1.72	
06/08/11	11:39:45	1.70	
06/08/11	11:40:00	1.74	
06/08/11	11:40:15	1.75	
06/08/11	11:40:30	1.78	
06/08/11	11:40:45	1.76	
06/08/11	11:41:00	1.76	
06/08/11	11:41:15	1.82	
06/08/11	11:41:30	1.87	
06/08/11	11:41:45	1.90	
06/08/11	11:42:00	1.92	
06/08/11	11:42:15	1.88	
06/08/11	11:42:30	1.86	
06/08/11	11:42:45	1.87	
06/08/11	11:43:00	1.84	
06/08/11	11:43:15	1.80	
06/08/11	11:43:30	1.80	
06/08/11	11:43:45	1.85	
06/08/11	11:44:00	1.82	
06/08/11	11:44:15	1.78	
06/08/11	11:44:30	1.69	
06/08/11	11:44:45	1.58	
06/08/11	11:45:00	1.48	
06/08/11	11:45:15	1.39	
06/08/11	11:45:30	1.36	
06/08/11	11:45:45	1.31	
06/08/11	11:46:00	1.33	
06/08/11	11:46:15	1.40	
06/08/11	11:46:30	1.40	
06/08/11	11:46:45	1.44	
06/08/11	11:47:00	1.42	
06/08/11	11:47:15	1.44	
06/08/11	11:47:30	1.46	
06/08/11	11:47:45	1.47	
06/08/11	11:48:00	1.68	
06/08/11	11:48:15	1.68	
06/08/11	11:48:30	1.61	
06/08/11	11:48:45	1.56	
06/08/11	11:49:00	1.54	
06/08/11	11:49:15	1.58	
06/08/11	11:49:30	1.60	
06/08/11	11:49:45	1.63	
06/08/11	11:50:00	1.66	
06/08/11	11:50:15	1.69	
06/08/11	11:50:30	1.76	
06/08/11	11:50:45	1.82	
06/08/11	11:51:00	1.87	
06/08/11	11:51:15	1.90	
06/08/11	11:51:30	2.02	
06/08/11	11:51:45	2.11	
06/08/11	11:52:00	2.22	
06/08/11	11:52:15	2.29	
06/08/11	11:52:30	2.24	
06/08/11	11:52:45	2.18	
06/08/11	11:53:00	2.10	
06/08/11	11:53:15	2.04	
06/08/11	11:53:30	2.04	
06/08/11	11:53:45	2.03	
06/08/11	11:54:00	2.01	Restart 0010
06/08/11	11:54:15	1.98	
06/08/11	11:54:30	1.89	
06/08/11	11:54:45	1.83	
06/08/11	11:55:00	1.78	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	11:55:15	1.85	
06/08/11	11:55:30	1.85	
06/08/11	11:55:45	1.82	
06/08/11	11:56:00	1.76	
06/08/11	11:56:15	1.74	
06/08/11	11:56:30	1.71	
06/08/11	11:56:45	1.70	
06/08/11	11:57:00	1.69	
06/08/11	11:57:15	1.67	
06/08/11	11:57:30	1.66	
06/08/11	11:57:45	1.76	
06/08/11	11:58:00	1.76	
06/08/11	11:58:15	1.75	
06/08/11	11:58:30	1.74	
06/08/11	11:58:45	1.70	
06/08/11	11:59:00	1.70	
06/08/11	11:59:15	1.67	
06/08/11	11:59:30	1.74	
06/08/11	11:59:45	1.85	
06/08/11	12:00:00	2.06	
06/08/11	12:00:15	1.93	
06/08/11	12:00:30	1.91	
06/08/11	12:00:45	1.96	
06/08/11	12:01:00	1.93	
06/08/11	12:01:15	1.89	
06/08/11	12:01:30	1.90	
06/08/11	12:01:45	1.94	
06/08/11	12:02:00	1.98	
06/08/11	12:02:15	2.03	
06/08/11	12:02:30	2.07	
06/08/11	12:02:45	2.12	
06/08/11	12:03:00	2.14	
06/08/11	12:03:15	2.01	
06/08/11	12:03:30	1.94	
06/08/11	12:03:45	1.94	
06/08/11	12:04:00	1.98	
06/08/11	12:04:15	2.02	
06/08/11	12:04:30	2.02	
06/08/11	12:04:45	2.05	
06/08/11	12:05:00	2.10	
06/08/11	12:05:15	2.15	
06/08/11	12:05:30	2.22	
06/08/11	12:05:45	2.34	
06/08/11	12:06:00	2.38	
06/08/11	12:06:15	2.39	
06/08/11	12:06:30	2.39	
06/08/11	12:06:45	2.36	
06/08/11	12:07:00	2.36	
06/08/11	12:07:15	2.37	
06/08/11	12:07:30	2.34	
06/08/11	12:07:45	2.31	
06/08/11	12:08:00	2.32	
06/08/11	12:08:15	2.28	
06/08/11	12:08:30	2.32	
06/08/11	12:08:45	2.33	
06/08/11	12:09:00	2.34	
06/08/11	12:09:15	2.30	
06/08/11	12:09:30	2.26	
06/08/11	12:09:45	2.22	
06/08/11	12:10:00	2.19	
06/08/11	12:10:15	2.14	
06/08/11	12:10:30	2.15	
06/08/11	12:10:45	2.14	
06/08/11	12:11:00	2.11	
06/08/11	12:11:15	2.09	
06/08/11	12:11:30	2.10	
06/08/11	12:11:45	2.11	
06/08/11	12:12:00	2.13	
06/08/11	12:12:15	2.10	
06/08/11	12:12:30	2.21	
06/08/11	12:12:45	2.17	
06/08/11	12:13:00	2.13	
06/08/11	12:13:15	2.08	
06/08/11	12:13:30	2.00	
06/08/11	12:13:45	2.31	
06/08/11	12:14:00	2.11	VOST start
06/08/11	12:14:15	2.07	
06/08/11	12:14:30	2.01	
06/08/11	12:14:45	2.05	
06/08/11	12:15:00	2.08	
06/08/11	12:15:15	2.09	
06/08/11	12:15:30	2.11	
06/08/11	12:15:45	2.10	
06/08/11	12:16:00	2.09	
06/08/11	12:16:15	2.05	
06/08/11	12:16:30	2.04	
06/08/11	12:16:45	2.02	
06/08/11	12:17:00	2.00	
06/08/11	12:17:15	1.98	
06/08/11	12:17:30	2.00	
06/08/11	12:17:45	2.01	
06/08/11	12:18:00	1.99	
06/08/11	12:18:15	1.97	
06/08/11	12:18:30	2.04	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	12:18:45	2.01	
06/08/11	12:19:00	1.96	
06/08/11	12:19:15	1.94	
06/08/11	12:19:30	1.91	
06/08/11	12:19:45	1.90	
06/08/11	12:20:00	1.86	
06/08/11	12:20:15	1.82	
06/08/11	12:20:30	1.79	
06/08/11	12:20:45	1.77	
06/08/11	12:21:00	1.86	
06/08/11	12:21:15	1.87	
06/08/11	12:21:30	1.87	
06/08/11	12:21:45	1.89	
06/08/11	12:22:00	1.88	
06/08/11	12:22:15	1.87	
06/08/11	12:22:30	1.79	
06/08/11	12:22:45	1.75	
06/08/11	12:23:00	1.74	
06/08/11	12:23:15	1.71	
06/08/11	12:23:30	1.70	
06/08/11	12:23:45	1.69	
06/08/11	12:24:00	1.73	
06/08/11	12:24:15	1.75	
06/08/11	12:24:30	1.77	
06/08/11	12:24:45	1.75	
06/08/11	12:25:00	1.75	
06/08/11	12:25:15	1.73	
06/08/11	12:25:30	1.71	
06/08/11	12:25:45	1.72	
06/08/11	12:26:00	1.70	
06/08/11	12:26:15	1.69	
06/08/11	12:26:30	1.70	
06/08/11	12:26:45	1.69	
06/08/11	12:27:00	1.70	
06/08/11	12:27:15	1.72	
06/08/11	12:27:30	1.76	
06/08/11	12:27:45	1.79	
06/08/11	12:28:00	1.77	
06/08/11	12:28:15	1.73	
06/08/11	12:28:30	1.71	
06/08/11	12:28:45	1.70	
06/08/11	12:29:00	1.70	
06/08/11	12:29:15	1.70	
06/08/11	12:29:30	1.72	
06/08/11	12:29:45	1.74	
06/08/11	12:30:00	1.75	
06/08/11	12:30:15	1.76	
06/08/11	12:30:30	1.72	
06/08/11	12:30:45	1.76	
06/08/11	12:31:00	1.83	
06/08/11	12:31:15	1.86	
06/08/11	12:31:30	1.91	
06/08/11	12:31:45	1.89	
06/08/11	12:32:00	1.88	
06/08/11	12:32:15	1.86	
06/08/11	12:32:30	1.86	
06/08/11	12:32:45	1.88	
06/08/11	12:33:00	1.86	
06/08/11	12:33:15	1.85	
06/08/11	12:33:30	1.87	
06/08/11	12:33:45	1.86	
06/08/11	12:34:00	1.85	
06/08/11	12:34:15	1.85	
06/08/11	12:34:30	2.47	
06/08/11	12:34:45	2.56	
06/08/11	12:35:00	2.36	
06/08/11	12:35:15	2.18	
06/08/11	12:35:30	2.09	
06/08/11	12:35:45	2.06	
06/08/11	12:36:00	2.00	
06/08/11	12:36:15	2.02	
06/08/11	12:36:30	2.05	
06/08/11	12:36:45	2.06	
06/08/11	12:37:00	2.06	
06/08/11	12:37:15	2.02	
06/08/11	12:37:30	2.04	
06/08/11	12:37:45	2.00	
06/08/11	12:38:00	1.99	
06/08/11	12:38:15	1.99	
06/08/11	12:38:30	1.98	
06/08/11	12:38:45	1.99	
06/08/11	12:39:00	2.01	
06/08/11	12:39:15	2.01	
06/08/11	12:39:30	2.00	
06/08/11	12:39:45	2.03	
06/08/11	12:40:00	2.53	
06/08/11	12:40:15	2.45	
06/08/11	12:40:30	2.26	
06/08/11	12:40:45	2.19	
06/08/11	12:41:00	2.12	
06/08/11	12:41:15	2.08	
06/08/11	12:41:30	2.07	
06/08/11	12:41:45	2.09	
06/08/11	12:42:00	2.08	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	12:42:15	2.12	
06/08/11	12:42:30	2.13	
06/08/11	12:42:45	2.07	
06/08/11	12:43:00	2.03	
06/08/11	12:43:15	2.00	
06/08/11	12:43:30	1.99	
06/08/11	12:43:45	1.94	
06/08/11	12:44:00	1.93	
06/08/11	12:44:15	1.93	
06/08/11	12:44:30	1.93	
06/08/11	12:44:45	1.93	
06/08/11	12:45:00	1.86	
06/08/11	12:45:15	1.82	
06/08/11	12:45:30	1.82	
06/08/11	12:45:45	1.80	
06/08/11	12:46:00	1.79	
06/08/11	12:46:15	1.82	
06/08/11	12:46:30	1.83	
06/08/11	12:46:45	1.83	
06/08/11	12:47:00	1.85	
06/08/11	12:47:15	1.81	
06/08/11	12:47:30	1.76	
06/08/11	12:47:45	1.72	
06/08/11	12:48:00	1.70	
06/08/11	12:48:15	1.68	
06/08/11	12:48:30	1.67	
06/08/11	12:48:45	1.67	
06/08/11	12:49:00	1.64	
06/08/11	12:49:15	1.65	
06/08/11	12:49:30	1.64	
06/08/11	12:49:45	1.59	
06/08/11	12:50:00	1.55	
06/08/11	12:50:15	1.52	
06/08/11	12:50:30	1.50	
06/08/11	12:50:45	1.46	
06/08/11	12:51:00	1.14	
06/08/11	12:51:15	2.71	
06/08/11	12:51:30	1.93	
06/08/11	12:51:45	1.83	
06/08/11	12:52:00	1.74	
06/08/11	12:52:15	1.70	
06/08/11	12:52:30	1.62	
06/08/11	12:52:45	1.56	
06/08/11	12:53:00	1.52	
06/08/11	12:53:15	1.48	
06/08/11	12:53:30	1.47	
06/08/11	12:53:45	1.49	
06/08/11	12:54:00	1.49	
06/08/11	12:54:15	1.49	
06/08/11	12:54:30	1.47	
06/08/11	12:54:45	1.45	
06/08/11	12:55:00	1.44	
06/08/11	12:55:15	1.44	
06/08/11	12:55:30	1.43	
06/08/11	12:55:45	1.40	
06/08/11	12:56:00	1.39	
06/08/11	12:56:15	1.37	
06/08/11	12:56:30	1.35	
06/08/11	12:56:45	1.40	
06/08/11	12:57:00	1.38	
06/08/11	12:57:15	1.38	
06/08/11	12:57:30	1.36	
06/08/11	12:57:45	1.37	
06/08/11	12:58:00	1.36	
06/08/11	12:58:15	1.34	
06/08/11	12:58:30	1.32	
06/08/11	12:58:45	1.32	
06/08/11	12:59:00	1.37	
06/08/11	12:59:15	1.38	
06/08/11	12:59:30	1.37	
06/08/11	12:59:45	1.35	
06/08/11	13:00:00	1.31	
06/08/11	13:00:15	1.28	
06/08/11	13:00:30	1.28	
06/08/11	13:00:45	1.27	
06/08/11	13:01:00	1.25	
06/08/11	13:01:15	1.26	
06/08/11	13:01:30	1.28	
06/08/11	13:01:45	1.29	
06/08/11	13:02:00	1.30	
06/08/11	13:02:15	1.28	
06/08/11	13:02:30	1.25	
06/08/11	13:02:45	1.25	
06/08/11	13:03:00	1.31	
06/08/11	13:03:15	1.34	
06/08/11	13:03:30	1.36	
06/08/11	13:03:45	1.36	
06/08/11	13:04:00	1.38	
06/08/11	13:04:15	1.64	
06/08/11	13:04:30	1.64	
06/08/11	13:04:45	1.73	
06/08/11	13:05:00	1.63	
06/08/11	13:05:15	1.56	
06/08/11	13:05:30	1.55	

Date	Time	Total VOM	Comments
06/08/11	13:05:45	1.50	
06/08/11	13:06:00	1.46	
06/08/11	13:06:15	1.45	
06/08/11	13:06:30	1.41	
06/08/11	13:06:45	1.41	
06/08/11	13:07:00	1.40	
06/08/11	13:07:15	1.40	
06/08/11	13:07:30	1.40	
06/08/11	13:07:45	1.48	
06/08/11	13:08:00	1.50	
06/08/11	13:08:15	1.48	
06/08/11	13:08:30	1.49	
06/08/11	13:08:45	1.50	
06/08/11	13:09:00	1.49	
06/08/11	13:09:15	1.52	
06/08/11	13:09:30	1.53	
06/08/11	13:09:45	1.54	
06/08/11	13:10:00	1.53	
06/08/11	13:10:15	1.54	
06/08/11	13:10:30	1.54	
06/08/11	13:10:45	2.32	
06/08/11	13:11:00	1.98	
06/08/11	13:11:15	1.86	
06/08/11	13:11:30	1.78	
06/08/11	13:11:45	1.74	
06/08/11	13:12:00	1.73	
06/08/11	13:12:15	1.69	
06/08/11	13:12:30	1.68	
06/08/11	13:12:45	1.71	
06/08/11	13:13:00	1.69	
06/08/11	13:13:15	1.71	
06/08/11	13:13:30	1.71	
06/08/11	13:13:45	1.68	
06/08/11	13:14:00	1.70	
06/08/11	13:14:15	1.72	
06/08/11	13:14:30	1.71	
06/08/11	13:14:45	1.68	
06/08/11	13:15:00	1.66	
06/08/11	13:15:15	1.65	
06/08/11	13:15:30	1.64	
06/08/11	13:15:45	1.63	
06/08/11	13:16:00	1.67	
06/08/11	13:16:15	1.66	
06/08/11	13:16:30	1.64	
06/08/11	13:16:45	1.64	
06/08/11	13:17:00	1.63	
06/08/11	13:17:15	1.64	
06/08/11	13:17:30	1.65	
06/08/11	13:17:45	1.66	
06/08/11	13:18:00	1.72	
06/08/11	13:18:15	1.84	
06/08/11	13:18:30	1.79	
06/08/11	13:18:45	1.71	
06/08/11	13:19:00	1.66	
06/08/11	13:19:15	1.62	
06/08/11	13:19:30	1.55	
06/08/11	13:19:45	1.52	
06/08/11	13:20:00	1.50	
06/08/11	13:20:15	1.53	
06/08/11	13:20:30	1.53	
06/08/11	13:20:45	1.53	
06/08/11	13:21:00	1.53	
06/08/11	13:21:15	1.55	
06/08/11	13:21:30	1.55	
06/08/11	13:21:45	1.57	
06/08/11	13:22:00	1.57	
06/08/11	13:22:15	1.62	
06/08/11	13:22:30	1.60	
06/08/11	13:22:45	1.63	
06/08/11	13:23:00	1.61	
06/08/11	13:23:15	1.61	
06/08/11	13:23:30	1.58	
06/08/11	13:23:45	1.55	End 23-2 and 0010
06/08/11	13:24:00	1.47	
06/08/11	13:24:15	1.41	
06/08/11	13:24:30	1.41	
06/08/11	13:24:45	1.41	end run 2
06/08/11	13:25:00	1.42	
06/08/11	13:25:15	1.41	
06/08/11	13:25:30	1.38	
06/08/11	13:25:45	1.37	
06/08/11	13:26:00	1.35	
06/08/11	13:26:15	1.33	
06/08/11	13:26:30	1.34	
06/08/11	13:26:45	1.32	
06/08/11	13:27:00	1.33	
06/08/11	13:27:15	1.34	
06/08/11	13:27:30	1.31	
06/08/11	13:27:45	1.30	
06/08/11	13:28:00	1.30	
06/08/11	13:28:15	1.29	
06/08/11	13:28:30	1.32	
06/08/11	13:28:45	1.31	
06/08/11	13:29:00	1.34	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	13:29:15	1.31	
06/08/11	13:29:30	1.30	
06/08/11	13:29:45	1.28	
06/08/11	13:30:00	1.26	
06/08/11	13:30:15	1.24	
06/08/11	13:30:30	1.22	
06/08/11	13:30:45	1.22	
06/08/11	13:31:00	1.20	
06/08/11	13:31:15	1.22	
06/08/11	13:31:30	1.18	
06/08/11	13:31:45	1.20	
06/08/11	13:32:00	1.18	
06/08/11	13:32:15	1.20	
06/08/11	13:32:30	1.20	
06/08/11	13:32:45	1.19	
06/08/11	13:33:00	1.19	
06/08/11	13:33:15	1.18	
06/08/11	13:33:30	1.19	
06/08/11	13:33:45	4.02	
06/08/11	13:34:00	72.99	
06/08/11	13:34:15	32.02	
06/08/11	13:34:30	8.08	
06/08/11	13:34:45	2.97	
06/08/11	13:35:00	1.67	
06/08/11	13:35:15	1.13	
06/08/11	13:35:30	0.83	
06/08/11	13:35:45	0.64	
06/08/11	13:36:00	0.53	
06/08/11	13:36:15	0.45	
06/08/11	13:36:30	0.40	
06/08/11	13:36:45	0.31	
06/08/11	13:37:00	0.24	
06/08/11	13:37:15	0.18	
06/08/11	13:37:30	0.16	
06/08/11	13:37:45	0.12	
06/08/11	13:38:00	0.10	
06/08/11	13:38:15	0.03	
06/08/11	13:38:30	0.01	
06/08/11	13:38:45	-0.02	
06/08/11	13:39:00	-0.03	
06/08/11	13:39:15	-0.02	**Calibration bias**
06/08/11	**13:39:30**	**-0.06**	Zero CH4 Injection
06/08/11	**13:39:45**	**-0.07**	
06/08/11	**13:40:00**	**-0.07**	
06/08/11	**13:40:15**	**-0.05**	**-0.06** ppm ch4
06/08/11	13:40:30	-0.07	
06/08/11	13:40:45	-0.09	
06/08/11	13:41:00	-0.11	
06/08/11	13:41:15	-0.12	
06/08/11	13:41:30	0.93	
06/08/11	13:41:45	2.24	
06/08/11	13:42:00	1.98	
06/08/11	13:42:15	0.66	
06/08/11	13:42:30	0.18	
06/08/11	13:42:45	0.02	
06/08/11	13:43:00	0.03	
06/08/11	13:43:15	-0.02	
06/08/11	13:43:30	-0.33	
06/08/11	13:43:45	-0.44	
06/08/11	13:44:00	-0.51	
06/08/11	13:44:15	-0.53	
06/08/11	13:44:30	-0.57	
06/08/11	13:44:45	-0.56	
06/08/11	13:45:00	-0.54	
06/08/11	13:45:15	-0.56	
06/08/11	13:45:30	-0.59	
06/08/11	13:45:45	-0.60	
06/08/11	13:46:00	-0.62	
06/08/11	13:46:15	-0.61	
06/08/11	13:46:30	-0.61	
06/08/11	13:46:45	-0.59	
06/08/11	13:47:00	-0.58	
06/08/11	13:47:15	-0.60	
06/08/11	13:47:30	-0.57	
06/08/11	13:47:45	-0.31	
06/08/11	13:48:00	2.16	
06/08/11	13:48:15	14.86	
06/08/11	13:48:30	39.97	
06/08/11	13:48:45	45.67	
06/08/11	13:49:00	46.68	
06/08/11	13:49:15	48.07	
06/08/11	13:49:30	50.63	
06/08/11	**13:49:45**	**50.29**	50.0 ppm CH4 Injection
06/08/11	**13:50:00**	**50.09**	
06/08/11	**13:50:15**	**50.31**	
06/08/11	**13:50:30**	**50.08**	**50.19** ppm ch4
06/08/11	13:50:45	49.93	
06/08/11	13:51:00	49.43	
06/08/11	13:51:15	35.65	
06/08/11	13:51:30	91.06	
06/08/11	13:51:45	128.51	
06/08/11	13:52:00	128.52	
06/08/11	13:52:15	128.52	
06/08/11	13:52:30	128.53	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	13:52:45	128.53	
06/08/11	13:53:00	128.53	
06/08/11	13:53:15	128.53	
06/08/11	13:53:30	128.54	
06/08/11	13:53:45	128.54	
06/08/11	13:54:00	128.54	
06/08/11	13:54:15	128.54	
06/08/11	13:54:30	128.54	
06/08/11	13:54:45	128.54	
06/08/11	13:55:00	128.54	
06/08/11	13:55:15	65.04	
06/08/11	13:55:30	118.86	
06/08/11	13:55:45	51.58	
06/08/11	13:56:00	8.43	
06/08/11	13:56:15	1.63	
06/08/11	13:56:30	0.36	
06/08/11	13:56:45	0.08	
06/08/11	13:57:00	-0.04	
06/08/11	13:57:15	-0.15	
06/08/11	13:57:30	-0.17	
06/08/11	13:57:45	-0.23	
06/08/11	13:58:00	-0.25	
06/08/11	13:58:15	-0.26	
06/08/11	13:58:30	-0.32	
06/08/11	13:58:45	-0.33	
06/08/11	13:59:00	-0.36	
06/08/11	13:59:15	-0.38	
06/08/11	13:59:30	-0.39	
06/08/11	13:59:45	-0.40	
06/08/11	14:00:00	-0.45	
06/08/11	14:00:15	-0.43	
06/08/11	14:00:30	-0.45	
06/08/11	14:00:45	-0.46	
06/08/11	14:01:00	-0.47	
06/08/11	14:01:15	-0.48	
06/08/11	14:01:30	-0.47	
06/08/11	14:01:45	-0.50	
06/08/11	14:02:00	-0.51	
06/08/11	14:02:15	-0.51	
06/08/11	14:02:30	-0.52	
06/08/11	14:02:45	-0.53	
06/08/11	14:03:00	-0.54	
06/08/11	14:03:15	-0.47	
06/08/11	14:03:30	-0.51	
06/08/11	14:03:45	-0.56	
06/08/11	14:04:00	-0.58	
06/08/11	14:04:15	-0.59	
06/08/11	14:04:30	-0.58	
06/08/11	14:04:45	-0.59	
06/08/11	14:05:00	-0.62	
06/08/11	14:05:15	-0.61	
06/08/11	14:05:30	-0.62	
06/08/11	14:05:45	-0.62	
06/08/11	14:06:00	-0.65	
06/08/11	14:06:15	-0.64	
06/08/11	14:06:30	-0.64	
06/08/11	14:06:45	-0.66	
06/08/11	14:07:00	-0.67	
06/08/11	14:07:15	-0.67	
06/08/11	14:07:30	-0.68	
06/08/11	14:07:45	-0.69	
06/08/11	14:08:00	-0.67	
06/08/11	14:08:15	-0.69	
06/08/11	14:08:30	-0.67	
06/08/11	14:08:45	-0.66	
06/08/11	14:09:00	-0.65	
06/08/11	14:09:15	-0.66	
06/08/11	14:09:30	-0.66	
06/08/11	14:09:45	-0.68	
06/08/11	14:10:00	-0.66	
06/08/11	14:10:15	-0.65	
06/08/11	14:10:30	-0.66	
06/08/11	14:10:45	-0.66	
06/08/11	14:11:00	-0.61	
06/08/11	14:11:15	2.42	
06/08/11	14:11:30	3.60	
06/08/11	14:11:45	2.75	
06/08/11	14:12:00	2.41	
06/08/11	14:12:15	2.08	
06/08/11	14:12:30	1.99	
06/08/11	14:12:45	1.77	
06/08/11	14:13:00	1.68	
06/08/11	14:13:15	1.64	
06/08/11	14:13:30	1.61	
06/08/11	14:13:45	1.63	
06/08/11	14:14:00	1.65	
06/08/11	14:14:15	1.63	
06/08/11	14:14:30	1.65	
06/08/11	14:14:45	1.66	
06/08/11	14:15:00	1.66	Start M23 and M26 Run 3
06/08/11	14:15:15	1.63	
06/08/11	14:15:30	1.62	
06/08/11	14:15:45	1.63	
06/08/11	14:16:00	1.62	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	14:16:15	1.60	
06/08/11	14:16:30	1.61	
06/08/11	14:16:45	1.61	
06/08/11	14:17:00	1.60	
06/08/11	14:17:15	1.58	
06/08/11	14:17:30	1.58	
06/08/11	14:17:45	1.58	
06/08/11	14:18:00	1.58	
06/08/11	14:18:15	1.58	
06/08/11	14:18:30	1.56	
06/08/11	14:18:45	1.55	
06/08/11	14:19:00	1.55	
06/08/11	14:19:15	1.53	
06/08/11	14:19:30	1.53	
06/08/11	14:19:45	1.53	
06/08/11	14:20:00	1.53	
06/08/11	14:20:15	1.50	
06/08/11	14:20:30	1.51	
06/08/11	14:20:45	1.53	
06/08/11	14:21:00	1.52	
06/08/11	14:21:15	1.52	
06/08/11	14:21:30	1.52	
06/08/11	14:21:45	1.54	
06/08/11	14:22:00	1.55	
06/08/11	14:22:15	1.56	
06/08/11	14:22:30	1.57	
06/08/11	14:22:45	1.55	
06/08/11	14:23:00	1.58	
06/08/11	14:23:15	1.56	
06/08/11	14:23:30	1.56	
06/08/11	14:23:45	1.54	
06/08/11	14:24:00	1.53	
06/08/11	14:24:15	1.53	
06/08/11	14:24:30	1.53	
06/08/11	14:24:45	1.52	
06/08/11	14:25:00	1.52	
06/08/11	14:25:15	1.52	
06/08/11	14:25:30	1.51	
06/08/11	14:25:45	1.50	
06/08/11	14:26:00	1.47	
06/08/11	14:26:15	1.46	
06/08/11	14:26:30	1.45	
06/08/11	14:26:45	1.44	
06/08/11	14:27:00	1.44	
06/08/11	14:27:15	1.43	
06/08/11	14:27:30	1.42	
06/08/11	14:27:45	1.42	
06/08/11	14:28:00	1.43	
06/08/11	14:28:15	1.44	
06/08/11	14:28:30	1.44	
06/08/11	14:28:45	1.44	
06/08/11	14:29:00	1.41	
06/08/11	14:29:15	1.38	
06/08/11	14:29:30	1.37	
06/08/11	14:29:45	1.33	
06/08/11	14:30:00	1.31	
06/08/11	14:30:15	1.36	
06/08/11	14:30:30	1.75	
06/08/11	14:30:45	1.57	
06/08/11	14:31:00	1.43	
06/08/11	14:31:15	1.37	
06/08/11	14:31:30	1.34	
06/08/11	14:31:45	1.34	
06/08/11	14:32:00	1.32	
06/08/11	14:32:15	1.31	
06/08/11	14:32:30	1.31	
06/08/11	14:32:45	1.32	
06/08/11	14:33:00	1.32	
06/08/11	14:33:15	1.32	
06/08/11	14:33:30	1.37	
06/08/11	14:33:45	1.39	
06/08/11	14:34:00	1.47	
06/08/11	14:34:15	1.55	
06/08/11	14:34:30	1.59	
06/08/11	14:34:45	1.43	
06/08/11	14:35:00	1.36	
06/08/11	14:35:15	1.32	
06/08/11	14:35:30	1.29	
06/08/11	14:35:45	1.27	
06/08/11	14:36:00	1.26	
06/08/11	14:36:15	1.27	
06/08/11	14:36:30	1.24	
06/08/11	14:36:45	1.24	
06/08/11	14:37:00	1.23	
06/08/11	14:37:15	1.24	
06/08/11	14:37:30	1.22	
06/08/11	14:37:45	1.21	
06/08/11	14:38:00	1.21	
06/08/11	14:38:15	1.18	
06/08/11	14:38:30	1.16	
06/08/11	14:38:45	1.16	
06/08/11	14:39:00	1.15	
06/08/11	14:39:15	1.15	
06/08/11	14:39:30	1.15	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	14:39:45	1.15	
06/08/11	14:40:00	1.18	
06/08/11	14:40:15	1.17	
06/08/11	14:40:30	1.17	
06/08/11	14:40:45	1.16	
06/08/11	14:41:00	1.15	
06/08/11	14:41:15	1.13	
06/08/11	14:41:30	1.14	
06/08/11	14:41:45	1.17	
06/08/11	14:42:00	1.19	
06/08/11	14:42:15	1.21	
06/08/11	14:42:30	1.24	
06/08/11	14:42:45	1.21	
06/08/11	14:43:00	1.17	
06/08/11	14:43:15	1.19	
06/08/11	14:43:30	1.18	
06/08/11	14:43:45	1.17	
06/08/11	14:44:00	1.17	
06/08/11	14:44:15	1.18	
06/08/11	14:44:30	1.20	
06/08/11	14:44:45	1.18	
06/08/11	14:45:00	1.17	0010 start
06/08/11	14:45:15	1.19	Start THC
06/08/11	14:45:30	1.20	
06/08/11	14:45:45	1.19	
06/08/11	14:46:00	1.21	
06/08/11	14:46:15	1.21	
06/08/11	14:46:30	1.21	
06/08/11	14:46:45	1.16	
06/08/11	14:47:00	1.15	
06/08/11	14:47:15	1.17	
06/08/11	14:47:30	1.21	
06/08/11	14:47:45	1.21	
06/08/11	14:48:00	1.17	
06/08/11	14:48:15	1.20	
06/08/11	14:48:30	1.27	
06/08/11	14:48:45	1.29	
06/08/11	14:49:00	1.23	
06/08/11	14:49:15	1.25	
06/08/11	14:49:30	1.27	
06/08/11	14:49:45	1.27	
06/08/11	14:50:00	1.25	
06/08/11	14:50:15	1.25	
06/08/11	14:50:30	1.19	
06/08/11	14:50:45	1.25	
06/08/11	14:51:00	1.22	
06/08/11	14:51:15	1.23	
06/08/11	14:51:30	1.24	
06/08/11	14:51:45	1.21	
06/08/11	14:52:00	1.18	
06/08/11	14:52:15	1.20	
06/08/11	14:52:30	1.16	
06/08/11	14:52:45	1.18	
06/08/11	14:53:00	1.18	
06/08/11	14:53:15	1.16	
06/08/11	14:53:30	1.16	
06/08/11	14:53:45	1.14	
06/08/11	14:54:00	1.16	
06/08/11	14:54:15	1.19	
06/08/11	14:54:30	1.21	
06/08/11	14:54:45	1.17	
06/08/11	14:55:00	1.14	
06/08/11	14:55:15	1.14	
06/08/11	14:55:30	1.12	
06/08/11	14:55:45	1.14	
06/08/11	14:56:00	1.16	
06/08/11	14:56:15	1.19	
06/08/11	14:56:30	1.18	
06/08/11	14:56:45	1.16	
06/08/11	14:57:00	1.17	
06/08/11	14:57:15	1.16	
06/08/11	14:57:30	1.19	
06/08/11	14:57:45	1.17	
06/08/11	14:58:00	1.17	
06/08/11	14:58:15	1.16	
06/08/11	14:58:30	1.14	
06/08/11	14:58:45	1.19	
06/08/11	14:59:00	1.25	
06/08/11	14:59:15	1.27	
06/08/11	14:59:30	1.23	
06/08/11	14:59:45	1.19	
06/08/11	15:00:00	1.17	
06/08/11	15:00:15	1.14	
06/08/11	15:00:30	1.13	
06/08/11	15:00:45	1.14	
06/08/11	15:01:00	1.14	
06/08/11	15:01:15	1.20	
06/08/11	15:01:30	1.15	
06/08/11	15:01:45	1.12	
06/08/11	15:02:00	1.12	
06/08/11	15:02:15	1.16	
06/08/11	15:02:30	1.24	
06/08/11	15:02:45	1.29	
06/08/11	15:03:00	1.34	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	15:03:15	1.44	
06/08/11	15:03:30	1.55	
06/08/11	15:03:45	1.41	
06/08/11	15:04:00	1.30	
06/08/11	15:04:15	1.23	
06/08/11	15:04:30	1.25	
06/08/11	15:04:45	1.25	
06/08/11	15:05:00	1.24	
06/08/11	15:05:15	1.22	
06/08/11	15:05:30	1.18	
06/08/11	15:05:45	1.16	
06/08/11	15:06:00	1.12	
06/08/11	15:06:15	1.12	
06/08/11	15:06:30	1.12	
06/08/11	15:06:45	1.38	
06/08/11	15:07:00	2.25	
06/08/11	15:07:15	1.82	
06/08/11	15:07:30	1.54	
06/08/11	15:07:45	1.33	
06/08/11	15:08:00	1.29	
06/08/11	15:08:15	1.26	
06/08/11	15:08:30	1.22	
06/08/11	15:08:45	1.23	
06/08/11	15:09:00	1.21	
06/08/11	15:09:15	1.16	
06/08/11	15:09:30	1.10	
06/08/11	15:09:45	1.08	
06/08/11	15:10:00	1.06	
06/08/11	15:10:15	1.06	
06/08/11	15:10:30	1.03	
06/08/11	15:10:45	1.02	
06/08/11	15:11:00	1.01	
06/08/11	15:11:15	1.03	
06/08/11	15:11:30	0.99	
06/08/11	15:11:45	0.98	
06/08/11	15:12:00	0.97	
06/08/11	15:12:15	0.98	
06/08/11	15:12:30	0.97	
06/08/11	15:12:45	0.96	
06/08/11	15:13:00	0.94	
06/08/11	15:13:15	0.92	
06/08/11	15:13:30	0.90	
06/08/11	15:13:45	0.94	
06/08/11	15:14:00	0.93	
06/08/11	15:14:15	0.97	
06/08/11	15:14:30	0.96	
06/08/11	15:14:45	0.94	
06/08/11	15:15:00	0.94	
06/08/11	15:15:15	0.92	
06/08/11	15:15:30	1.26	
06/08/11	15:15:45	2.35	
06/08/11	15:16:00	1.36	
06/08/11	15:16:15	1.02	
06/08/11	15:16:30	0.94	
06/08/11	15:16:45	0.90	
06/08/11	15:17:00	0.91	
06/08/11	15:17:15	0.92	
06/08/11	15:17:30	0.90	
06/08/11	15:17:45	0.95	
06/08/11	15:18:00	0.94	
06/08/11	15:18:15	0.92	
06/08/11	15:18:30	0.93	
06/08/11	15:18:45	0.92	
06/08/11	15:19:00	0.91	
06/08/11	15:19:15	0.91	
06/08/11	15:19:30	0.89	
06/08/11	15:19:45	0.93	
06/08/11	15:20:00	0.93	
06/08/11	15:20:15	0.90	
06/08/11	15:20:30	0.93	
06/08/11	15:20:45	0.93	
06/08/11	15:21:00	0.91	
06/08/11	15:21:15	0.92	
06/08/11	15:21:30	0.95	
06/08/11	15:21:45	0.94	
06/08/11	15:22:00	0.95	
06/08/11	15:22:15	0.93	
06/08/11	15:22:30	0.93	
06/08/11	15:22:45	0.93	
06/08/11	15:23:00	0.93	
06/08/11	15:23:15	0.92	
06/08/11	15:23:30	0.93	
06/08/11	15:23:45	0.92	
06/08/11	15:24:00	0.91	
06/08/11	15:24:15	0.91	
06/08/11	15:24:30	0.90	
06/08/11	15:24:45	0.93	
06/08/11	15:25:00	0.91	
06/08/11	15:25:15	0.91	
06/08/11	15:25:30	0.92	
06/08/11	15:25:45	0.94	
06/08/11	15:26:00	1.60	
06/08/11	15:26:15	1.10	
06/08/11	15:26:30	1.16	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	15:26:45	1.19	
06/08/11	15:27:00	1.24	
06/08/11	15:27:15	1.31	
06/08/11	15:27:30	1.38	
06/08/11	15:27:45	1.32	
06/08/11	15:28:00	1.23	
06/08/11	15:28:15	1.17	
06/08/11	15:28:30	1.13	
06/08/11	15:28:45	1.06	
06/08/11	15:29:00	1.05	
06/08/11	15:29:15	1.05	
06/08/11	15:29:30	1.00	
06/08/11	15:29:45	1.00	
06/08/11	15:30:00	1.02	
06/08/11	15:30:15	0.97	
06/08/11	15:30:30	0.98	
06/08/11	15:30:45	0.98	
06/08/11	15:31:00	0.97	
06/08/11	15:31:15	1.02	
06/08/11	15:31:30	1.02	
06/08/11	15:31:45	1.01	
06/08/11	15:32:00	0.99	
06/08/11	15:32:15	0.99	
06/08/11	15:32:30	0.98	
06/08/11	15:32:45	0.96	
06/08/11	15:33:00	0.98	
06/08/11	15:33:15	0.97	
06/08/11	15:33:30	0.99	
06/08/11	15:33:45	0.98	
06/08/11	15:34:00	0.98	
06/08/11	15:34:15	1.00	
06/08/11	15:34:30	1.02	
06/08/11	15:34:45	1.02	
06/08/11	15:35:00	1.03	
06/08/11	15:35:15	1.04	
06/08/11	15:35:30	1.03	
06/08/11	15:35:45	1.03	
06/08/11	15:36:00	0.99	
06/08/11	15:36:15	0.94	
06/08/11	15:36:30	0.93	
06/08/11	15:36:45	0.92	
06/08/11	15:37:00	0.94	
06/08/11	15:37:15	0.94	
06/08/11	15:37:30	0.93	
06/08/11	15:37:45	0.92	
06/08/11	15:38:00	0.93	
06/08/11	15:38:15	0.94	
06/08/11	15:38:30	0.95	
06/08/11	15:38:45	0.93	
06/08/11	15:39:00	0.94	
06/08/11	15:39:15	0.91	
06/08/11	15:39:30	0.93	
06/08/11	15:39:45	0.94	
06/08/11	15:40:00	0.91	
06/08/11	15:40:15	0.93	
06/08/11	15:40:30	0.97	
06/08/11	15:40:45	0.98	
06/08/11	15:41:00	1.04	
06/08/11	15:41:15	1.09	
06/08/11	15:41:30	1.13	
06/08/11	15:41:45	0.96	
06/08/11	15:42:00	0.91	
06/08/11	15:42:15	0.86	
06/08/11	15:42:30	0.86	
06/08/11	15:42:45	0.88	
06/08/11	15:43:00	0.85	
06/08/11	15:43:15	0.88	
06/08/11	15:43:30	0.88	
06/08/11	15:43:45	0.82	
06/08/11	15:44:00	0.79	
06/08/11	15:44:15	0.77	
06/08/11	15:44:30	0.76	Run 3 THC Average
06/08/11	15:44:45	0.79	1.09 ppm THC as CH4
06/08/11	15:45:00	0.75	
06/08/11	15:45:15	0.74	
06/08/11	15:45:30	0.73	
06/08/11	15:45:45	0.73	
06/08/11	15:46:00	0.63	
06/08/11	15:46:15	0.80	
06/08/11	15:46:30	0.78	
06/08/11	15:46:45	0.74	
06/08/11	15:47:00	0.70	
06/08/11	15:47:15	0.74	
06/08/11	15:47:30	0.68	
06/08/11	15:47:45	0.71	
06/08/11	15:48:00	0.70	
06/08/11	15:48:15	0.69	
06/08/11	15:48:30	0.68	
06/08/11	15:48:45	0.68	
06/08/11	15:49:00	0.69	
06/08/11	15:49:15	0.68	
06/08/11	15:49:30	0.67	
06/08/11	15:49:45	0.66	
06/08/11	15:50:00	0.66	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	15:50:15	0.64	
06/08/11	15:50:30	0.67	
06/08/11	15:50:45	0.65	
06/08/11	15:51:00	0.67	
06/08/11	15:51:15	0.69	
06/08/11	15:51:30	0.68	
06/08/11	15:51:45	0.70	
06/08/11	15:52:00	0.71	
06/08/11	15:52:15	0.68	
06/08/11	15:52:30	0.66	
06/08/11	15:52:45	0.64	
06/08/11	15:53:00	0.61	
06/08/11	15:53:15	0.59	
06/08/11	15:53:30	0.57	
06/08/11	15:53:45	0.60	
06/08/11	15:54:00	0.58	
06/08/11	15:54:15	0.57	
06/08/11	15:54:30	0.55	
06/08/11	15:54:45	0.54	
06/08/11	15:55:00	0.53	
06/08/11	15:55:15	0.53	
06/08/11	15:55:30	0.55	
06/08/11	15:55:45	0.45	
06/08/11	15:56:00	0.49	
06/08/11	15:56:15	0.68	
06/08/11	15:56:30	0.71	
06/08/11	15:56:45	0.78	
06/08/11	15:57:00	0.76	
06/08/11	15:57:15	0.79	
06/08/11	15:57:30	0.78	
06/08/11	15:57:45	0.79	
06/08/11	15:58:00	0.78	
06/08/11	15:58:15	0.74	
06/08/11	15:58:30	0.72	
06/08/11	15:58:45	0.68	
06/08/11	15:59:00	0.65	
06/08/11	15:59:15	0.67	
06/08/11	15:59:30	0.68	
06/08/11	15:59:45	0.66	
06/08/11	16:00:00	0.69	
06/08/11	16:00:15	0.69	
06/08/11	16:00:30	0.65	
06/08/11	16:00:45	0.66	
06/08/11	16:01:00	0.67	
06/08/11	16:01:15	0.69	
06/08/11	16:01:30	0.67	
06/08/11	16:01:45	0.66	
06/08/11	16:02:00	0.68	
06/08/11	16:02:15	0.68	
06/08/11	16:02:30	0.70	
06/08/11	16:02:45	0.71	
06/08/11	16:03:00	0.69	
06/08/11	16:03:15	0.69	
06/08/11	16:03:30	0.68	
06/08/11	16:03:45	0.69	
06/08/11	16:04:00	0.69	
06/08/11	16:04:15	0.72	
06/08/11	16:04:30	0.72	
06/08/11	16:04:45	0.71	
06/08/11	16:05:00	0.68	
06/08/11	16:05:15	0.70	
06/08/11	16:05:30	0.70	
06/08/11	16:05:45	0.70	
06/08/11	16:06:00	0.71	
06/08/11	16:06:15	0.71	
06/08/11	16:06:30	0.73	
06/08/11	16:06:45	0.78	
06/08/11	16:07:00	0.77	
06/08/11	16:07:15	0.76	
06/08/11	16:07:30	0.72	
06/08/11	16:07:45	0.72	
06/08/11	16:08:00	0.73	
06/08/11	16:08:15	0.74	
06/08/11	16:08:30	0.74	
06/08/11	16:08:45	0.78	
06/08/11	16:09:00	0.77	
06/08/11	16:09:15	0.77	
06/08/11	16:09:30	0.75	
06/08/11	16:09:45	0.77	
06/08/11	16:10:00	0.79	
06/08/11	16:10:15	0.82	
06/08/11	16:10:30	0.82	
06/08/11	16:10:45	0.82	
06/08/11	16:11:00	0.79	
06/08/11	16:11:15	0.77	
06/08/11	16:11:30	0.76	
06/08/11	16:11:45	0.75	
06/08/11	16:12:00	0.74	
06/08/11	16:12:15	0.75	
06/08/11	16:12:30	0.77	
06/08/11	16:12:45	0.71	
06/08/11	16:13:00	0.70	
06/08/11	16:13:15	0.70	
06/08/11	16:13:30	0.64	

Date	Time	Total VOM	Comments
06/08/11	16:13:45	0.89	
06/08/11	16:14:00	0.84	
06/08/11	16:14:15	0.81	
06/08/11	16:14:30	0.79	
06/08/11	16:14:45	0.77	Port Change 23
06/08/11	16:15:00	0.76	
06/08/11	16:15:15	0.76	
06/08/11	16:15:30	0.77	
06/08/11	16:15:45	0.74	
06/08/11	16:16:00	0.75	
06/08/11	16:16:15	0.71	
06/08/11	16:16:30	0.70	
06/08/11	16:16:45	0.68	
06/08/11	16:17:00	0.68	
06/08/11	16:17:15	0.68	
06/08/11	16:17:30	0.69	
06/08/11	16:17:45	0.70	
06/08/11	16:18:00	0.73	
06/08/11	16:18:15	0.70	
06/08/11	16:18:30	0.71	
06/08/11	16:18:45	0.70	
06/08/11	16:19:00	0.72	
06/08/11	16:19:15	0.68	
06/08/11	16:19:30	0.66	
06/08/11	16:19:45	0.69	
06/08/11	16:20:00	0.64	
06/08/11	16:20:15	0.65	
06/08/11	16:20:30	0.64	
06/08/11	16:20:45	0.63	
06/08/11	16:21:00	0.63	
06/08/11	16:21:15	0.65	
06/08/11	16:21:30	0.63	
06/08/11	16:21:45	0.64	
06/08/11	16:22:00	0.66	
06/08/11	16:22:15	0.68	
06/08/11	16:22:30	0.70	
06/08/11	16:22:45	0.70	
06/08/11	16:23:00	0.70	
06/08/11	16:23:15	0.68	
06/08/11	16:23:30	0.70	
06/08/11	16:23:45	0.72	
06/08/11	16:24:00	0.75	
06/08/11	16:24:15	0.78	
06/08/11	16:24:30	0.73	
06/08/11	16:24:45	0.69	
06/08/11	16:25:00	0.81	
06/08/11	16:25:15	0.63	
06/08/11	16:25:30	0.86	
06/08/11	16:25:45	0.98	
06/08/11	16:26:00	0.96	
06/08/11	16:26:15	0.88	
06/08/11	16:26:30	0.85	
06/08/11	16:26:45	0.78	
06/08/11	16:27:00	0.78	
06/08/11	16:27:15	0.73	
06/08/11	16:27:30	0.70	
06/08/11	16:27:45	0.70	
06/08/11	16:28:00	0.69	restart
06/08/11	16:28:15	0.68	
06/08/11	16:28:30	0.67	
06/08/11	16:28:45	0.68	
06/08/11	16:29:00	0.66	
06/08/11	16:29:15	0.67	
06/08/11	16:29:30	0.70	
06/08/11	16:29:45	0.68	
06/08/11	16:30:00	0.71	
06/08/11	16:30:15	0.76	
06/08/11	16:30:30	0.72	
06/08/11	16:30:45	0.73	
06/08/11	16:31:00	0.71	
06/08/11	16:31:15	0.64	
06/08/11	16:31:30	0.63	
06/08/11	16:31:45	0.65	
06/08/11	16:32:00	0.68	
06/08/11	16:32:15	0.68	
06/08/11	16:32:30	0.70	
06/08/11	16:32:45	0.71	
06/08/11	16:33:00	0.71	
06/08/11	16:33:15	0.71	
06/08/11	16:33:30	0.71	
06/08/11	16:33:45	0.68	
06/08/11	16:34:00	0.67	
06/08/11	16:34:15	0.66	
06/08/11	16:34:30	0.66	
06/08/11	16:34:45	0.66	
06/08/11	16:35:00	0.67	
06/08/11	16:35:15	0.65	
06/08/11	16:35:30	0.67	
06/08/11	16:35:45	0.69	
06/08/11	16:36:00	0.68	
06/08/11	16:36:15	0.68	
06/08/11	16:36:30	0.71	
06/08/11	16:36:45	0.70	
06/08/11	16:37:00	0.70	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	16:37:15	0.72	
06/08/11	16:37:30	0.74	
06/08/11	16:37:45	0.73	
06/08/11	16:38:00	0.76	
06/08/11	16:38:15	0.81	
06/08/11	16:38:30	0.82	
06/08/11	16:38:45	0.82	
06/08/11	16:39:00	0.82	
06/08/11	16:39:15	0.84	
06/08/11	16:39:30	0.85	
06/08/11	16:39:45	0.87	
06/08/11	16:40:00	0.28	
06/08/11	16:40:15	1.04	
06/08/11	16:40:30	1.15	
06/08/11	16:40:45	1.10	
06/08/11	16:41:00	1.10	
06/08/11	16:41:15	1.09	
06/08/11	16:41:30	1.12	
06/08/11	16:41:45	1.13	
06/08/11	16:42:00	1.08	
06/08/11	16:42:15	1.09	
06/08/11	16:42:30	1.10	
06/08/11	16:42:45	1.11	
06/08/11	16:43:00	1.12	Restart 0010
06/08/11	16:43:15	1.13	
06/08/11	16:43:30	1.10	
06/08/11	16:43:45	1.17	
06/08/11	16:44:00	1.11	
06/08/11	16:44:15	1.04	
06/08/11	16:44:30	1.08	
06/08/11	16:44:45	1.14	
06/08/11	16:45:00	1.11	
06/08/11	16:45:15	1.10	
06/08/11	16:45:30	1.18	
06/08/11	16:45:45	1.19	
06/08/11	16:46:00	1.15	
06/08/11	16:46:15	1.11	
06/08/11	16:46:30	1.12	
06/08/11	16:46:45	1.12	
06/08/11	16:47:00	1.10	
06/08/11	16:47:15	1.12	
06/08/11	16:47:30	1.09	
06/08/11	16:47:45	1.07	
06/08/11	16:48:00	1.07	
06/08/11	16:48:15	1.07	
06/08/11	16:48:30	1.40	
06/08/11	16:48:45	1.20	
06/08/11	16:49:00	1.13	
06/08/11	16:49:15	1.10	
06/08/11	16:49:30	1.14	
06/08/11	16:49:45	1.14	
06/08/11	16:50:00	1.13	
06/08/11	16:50:15	1.11	
06/08/11	16:50:30	1.13	
06/08/11	16:50:45	1.11	
06/08/11	16:51:00	1.10	
06/08/11	16:51:15	1.11	
06/08/11	16:51:30	1.11	
06/08/11	16:51:45	1.08	
06/08/11	16:52:00	1.09	
06/08/11	16:52:15	1.09	
06/08/11	16:52:30	1.08	
06/08/11	16:52:45	1.05	
06/08/11	16:53:00	1.05	
06/08/11	16:53:15	1.00	
06/08/11	16:53:30	0.99	
06/08/11	16:53:45	0.99	
06/08/11	16:54:00	0.96	
06/08/11	16:54:15	0.96	
06/08/11	16:54:30	0.97	
06/08/11	16:54:45	0.97	
06/08/11	16:55:00	0.98	
06/08/11	16:55:15	0.98	
06/08/11	16:55:30	1.00	
06/08/11	16:55:45	0.99	
06/08/11	16:56:00	1.01	
06/08/11	16:56:15	1.00	
06/08/11	16:56:30	1.00	
06/08/11	16:56:45	1.00	
06/08/11	16:57:00	0.98	
06/08/11	16:57:15	0.99	
06/08/11	16:57:30	0.99	
06/08/11	16:57:45	0.98	
06/08/11	16:58:00	0.96	
06/08/11	16:58:15	0.94	
06/08/11	16:58:30	0.97	
06/08/11	16:58:45	0.97	
06/08/11	16:59:00	0.94	
06/08/11	16:59:15	0.97	
06/08/11	16:59:30	0.99	
06/08/11	16:59:45	0.96	
06/08/11	17:00:00	0.93	
06/08/11	17:00:15	0.92	
06/08/11	17:00:30	0.93	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	17:00:45	0.91	
06/08/11	17:01:00	0.92	
06/08/11	17:01:15	0.95	
06/08/11	17:01:30	0.92	
06/08/11	17:01:45	0.93	
06/08/11	17:02:00	0.92	
06/08/11	17:02:15	0.92	
06/08/11	17:02:30	0.90	
06/08/11	17:02:45	0.91	
06/08/11	17:03:00	0.91	
06/08/11	17:03:15	0.90	
06/08/11	17:03:30	0.94	
06/08/11	17:03:45	0.92	
06/08/11	17:04:00	0.92	
06/08/11	17:04:15	0.94	
06/08/11	17:04:30	0.91	
06/08/11	17:04:45	0.89	
06/08/11	17:05:00	0.88	
06/08/11	17:05:15	0.87	
06/08/11	17:05:30	0.88	
06/08/11	17:05:45	0.88	
06/08/11	17:06:00	0.88	
06/08/11	17:06:15	0.90	
06/08/11	17:06:30	0.93	
06/08/11	17:06:45	0.93	
06/08/11	17:07:00	0.89	
06/08/11	17:07:15	0.86	
06/08/11	17:07:30	0.89	
06/08/11	17:07:45	0.94	
06/08/11	17:08:00	0.97	start 18
06/08/11	17:08:15	1.04	
06/08/11	17:08:30	1.08	
06/08/11	17:08:45	1.91	
06/08/11	17:09:00	1.75	
06/08/11	17:09:15	1.48	
06/08/11	17:09:30	1.41	
06/08/11	17:09:45	1.41	
06/08/11	17:10:00	1.46	
06/08/11	17:10:15	1.47	
06/08/11	17:10:30	1.40	
06/08/11	17:10:45	1.33	
06/08/11	17:11:00	1.30	
06/08/11	17:11:15	1.27	
06/08/11	17:11:30	1.24	
06/08/11	17:11:45	1.21	
06/08/11	17:12:00	1.20	
06/08/11	17:12:15	1.18	
06/08/11	17:12:30	1.15	
06/08/11	17:12:45	1.14	
06/08/11	17:13:00	1.14	
06/08/11	17:13:15	1.18	
06/08/11	17:13:30	1.18	
06/08/11	17:13:45	1.17	
06/08/11	17:14:00	1.15	
06/08/11	17:14:15	1.11	
06/08/11	17:14:30	1.12	
06/08/11	17:14:45	1.23	
06/08/11	17:15:00	1.19	
06/08/11	17:15:15	1.16	
06/08/11	17:15:30	1.17	
06/08/11	17:15:45	1.18	
06/08/11	17:16:00	1.18	
06/08/11	17:16:15	1.19	
06/08/11	17:16:30	1.20	
06/08/11	17:16:45	1.19	
06/08/11	17:17:00	1.18	
06/08/11	17:17:15	1.20	
06/08/11	17:17:30	1.19	
06/08/11	17:17:45	1.20	
06/08/11	17:18:00	1.20	
06/08/11	17:18:15	1.17	
06/08/11	17:18:30	1.17	
06/08/11	17:18:45	1.16	
06/08/11	17:19:00	1.13	
06/08/11	17:19:15	1.12	
06/08/11	17:19:30	1.09	
06/08/11	17:19:45	1.11	
06/08/11	17:20:00	1.08	
06/08/11	17:20:15	1.07	
06/08/11	17:20:30	1.07	
06/08/11	17:20:45	1.08	
06/08/11	17:21:00	1.04	
06/08/11	17:21:15	1.04	
06/08/11	17:21:30	1.01	
06/08/11	17:21:45	1.03	
06/08/11	17:22:00	1.03	
06/08/11	17:22:15	1.05	
06/08/11	17:22:30	1.03	
06/08/11	17:22:45	1.05	
06/08/11	17:23:00	1.04	
06/08/11	17:23:15	1.05	
06/08/11	17:23:30	1.05	
06/08/11	17:23:45	1.05	
06/08/11	17:24:00	1.05	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	17:24:15	1.07	
06/08/11	17:24:30	1.04	
06/08/11	17:24:45	1.04	
06/08/11	17:25:00	1.04	
06/08/11	17:25:15	1.05	
06/08/11	17:25:30	1.05	
06/08/11	17:25:45	1.21	
06/08/11	17:26:00	0.98	
06/08/11	17:26:15	1.16	
06/08/11	17:26:30	1.12	
06/08/11	17:26:45	1.11	
06/08/11	17:27:00	1.10	
06/08/11	17:27:15	1.07	
06/08/11	17:27:30	0.98	
06/08/11	17:27:45	0.95	
06/08/11	17:28:00	0.93	
06/08/11	17:28:15	0.93	
06/08/11	17:28:30	0.92	
06/08/11	17:28:45	0.95	
06/08/11	17:29:00	0.92	
06/08/11	17:29:15	0.92	
06/08/11	17:29:30	0.91	
06/08/11	17:29:45	0.92	
06/08/11	17:30:00	0.90	
06/08/11	17:30:15	0.91	
06/08/11	17:30:30	0.90	
06/08/11	17:30:45	0.91	
06/08/11	17:31:00	0.92	
06/08/11	17:31:15	0.94	
06/08/11	17:31:30	0.92	
06/08/11	17:31:45	0.91	
06/08/11	17:32:00	0.90	
06/08/11	17:32:15	0.89	
06/08/11	17:32:30	0.87	
06/08/11	17:32:45	0.88	
06/08/11	17:33:00	0.87	
06/08/11	17:33:15	0.85	
06/08/11	17:33:30	0.86	
06/08/11	17:33:45	0.85	
06/08/11	17:34:00	0.88	
06/08/11	17:34:15	0.86	
06/08/11	17:34:30	0.85	
06/08/11	17:34:45	0.83	
06/08/11	17:35:00	0.84	
06/08/11	17:35:15	0.80	
06/08/11	17:35:30	0.92	
06/08/11	17:35:45	0.83	
06/08/11	17:36:00	0.83	
06/08/11	17:36:15	0.74	
06/08/11	17:36:30	0.73	
06/08/11	17:36:45	0.65	
06/08/11	17:37:00	0.65	
06/08/11	17:37:15	0.70	
06/08/11	17:37:30	0.69	
06/08/11	17:37:45	0.67	
06/08/11	17:38:00	0.69	
06/08/11	17:38:15	0.68	
06/08/11	17:38:30	0.72	
06/08/11	17:38:45	0.78	
06/08/11	17:39:00	0.78	
06/08/11	17:39:15	0.75	
06/08/11	17:39:30	0.74	
06/08/11	17:39:45	0.77	
06/08/11	17:40:00	0.77	
06/08/11	17:40:15	0.79	
06/08/11	17:40:30	0.78	
06/08/11	17:40:45	0.79	
06/08/11	17:41:00	0.78	
06/08/11	17:41:15	0.77	
06/08/11	17:41:30	0.76	
06/08/11	17:41:45	0.74	
06/08/11	17:42:00	0.74	
06/08/11	17:42:15	0.75	
06/08/11	17:42:30	0.74	
06/08/11	17:42:45	0.76	
06/08/11	17:43:00	0.79	
06/08/11	17:43:15	0.77	
06/08/11	17:43:30	0.76	
06/08/11	17:43:45	0.78	
06/08/11	17:44:00	0.77	
06/08/11	17:44:15	0.75	
06/08/11	17:44:30	0.76	
06/08/11	17:44:45	0.77	
06/08/11	17:45:00	-0.51	
06/08/11	17:45:15	1.21	
06/08/11	17:45:30	1.09	
06/08/11	17:45:45	0.98	
06/08/11	17:46:00	1.00	
06/08/11	17:46:15	1.00	
06/08/11	17:46:30	0.97	
06/08/11	17:46:45	0.96	
06/08/11	17:47:00	0.93	
06/08/11	17:47:15	0.92	
06/08/11	17:47:30	0.89	

Date	Time	Total VOM	Comments
06/08/11	17:47:45	0.91	
06/08/11	17:48:00	0.92	
06/08/11	17:48:15	0.91	
06/08/11	17:48:30	0.92	
06/08/11	17:48:45	0.89	
06/08/11	17:49:00	0.90	
06/08/11	17:49:15	0.92	
06/08/11	17:49:30	0.93	
06/08/11	17:49:45	0.94	
06/08/11	17:50:00	0.94	
06/08/11	17:50:15	0.97	
06/08/11	17:50:30	0.94	
06/08/11	17:50:45	0.94	
06/08/11	17:51:00	0.96	
06/08/11	17:51:15	0.97	
06/08/11	17:51:30	0.95	
06/08/11	17:51:45	0.97	
06/08/11	17:52:00	0.95	
06/08/11	17:52:15	0.92	
06/08/11	17:52:30	0.95	
06/08/11	17:52:45	0.96	
06/08/11	17:53:00	0.98	
06/08/11	17:53:15	0.98	
06/08/11	17:53:30	1.02	
06/08/11	17:53:45	1.00	
06/08/11	17:54:00	1.00	
06/08/11	17:54:15	0.99	
06/08/11	17:54:30	1.00	
06/08/11	17:54:45	1.00	
06/08/11	17:55:00	0.97	
06/08/11	17:55:15	0.94	
06/08/11	17:55:30	0.96	
06/08/11	17:55:45	0.95	
06/08/11	17:56:00	0.93	
06/08/11	17:56:15	0.94	
06/08/11	17:56:30	1.00	
06/08/11	17:56:45	0.96	
06/08/11	17:57:00	0.94	
06/08/11	17:57:15	0.92	
06/08/11	17:57:30	0.87	
06/08/11	17:57:45	0.85	
06/08/11	17:58:00	0.81	
06/08/11	17:58:15	0.76	
06/08/11	17:58:30	0.80	
06/08/11	17:58:45	0.75	
06/08/11	17:59:00	0.73	
06/08/11	17:59:15	0.74	
06/08/11	17:59:30	0.73	
06/08/11	17:59:45	0.72	
06/08/11	18:00:00	0.75	
06/08/11	18:00:15	0.75	
06/08/11	18:00:30	0.75	
06/08/11	18:00:45	0.73	
06/08/11	18:01:00	0.72	
06/08/11	18:01:15	0.68	
06/08/11	18:01:30	0.68	
06/08/11	18:01:45	0.70	
06/08/11	18:02:00	0.72	
06/08/11	18:02:15	0.69	
06/08/11	18:02:30	0.72	
06/08/11	18:02:45	0.71	
06/08/11	18:03:00	0.69	
06/08/11	18:03:15	0.71	
06/08/11	18:03:30	0.69	
06/08/11	18:03:45	0.64	
06/08/11	18:04:00	0.61	
06/08/11	18:04:15	0.63	
06/08/11	18:04:30	0.61	
06/08/11	18:04:45	0.65	
06/08/11	18:05:00	0.69	
06/08/11	18:05:15	0.67	
06/08/11	18:05:30	0.63	
06/08/11	18:05:45	0.63	
06/08/11	18:06:00	0.66	
06/08/11	18:06:15	0.64	
06/08/11	18:06:30	0.64	
06/08/11	18:06:45	0.64	
06/08/11	18:07:00	0.60	
06/08/11	18:07:15	0.59	
06/08/11	18:07:30	0.55	
06/08/11	18:07:45	0.56	
06/08/11	18:08:00	0.58	End m 18
06/08/11	18:08:15	0.56	
06/08/11	18:08:30	0.59	
06/08/11	18:08:45	0.59	
06/08/11	18:09:00	0.81	
06/08/11	18:09:15	0.76	
06/08/11	18:09:30	0.80	
06/08/11	18:09:45	0.75	
06/08/11	18:10:00	0.73	
06/08/11	18:10:15	0.74	
06/08/11	18:10:30	0.74	
06/08/11	18:10:45	0.73	
06/08/11	18:11:00	0.72	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	18:11:15	0.75	
06/08/11	18:11:30	0.75	
06/08/11	18:11:45	0.75	
06/08/11	18:12:00	0.73	
06/08/11	18:12:15	0.61	
06/08/11	18:12:30	0.63	
06/08/11	18:12:45	0.61	**End 0010**
06/08/11	18:13:00	0.65	
06/08/11	18:13:15	0.69	
06/08/11	18:13:30	0.67	
06/08/11	18:13:45	0.63	
06/08/11	18:14:00	0.63	
06/08/11	18:14:15	1.50	
06/08/11	18:14:30	1.58	
06/08/11	18:14:45	1.62	
06/08/11	18:15:00	1.67	
06/08/11	18:15:15	1.70	
06/08/11	18:15:30	1.68	
06/08/11	18:15:45	1.66	
06/08/11	18:16:00	1.64	
06/08/11	18:16:15	1.63	
06/08/11	18:16:30	1.60	
06/08/11	18:16:45	1.57	
06/08/11	18:17:00	1.57	
06/08/11	18:17:15	1.58	
06/08/11	18:17:30	1.58	
06/08/11	18:17:45	1.59	
06/08/11	18:18:00	1.61	
06/08/11	18:18:15	1.57	
06/08/11	18:18:30	1.69	
06/08/11	18:18:45	1.64	
06/08/11	18:19:00	1.62	
06/08/11	18:19:15	1.62	
06/08/11	18:19:30	1.61	
06/08/11	18:19:45	1.61	
06/08/11	18:20:00	1.60	
06/08/11	18:20:15	1.60	
06/08/11	18:20:30	1.62	
06/08/11	18:20:45	1.64	
06/08/11	18:21:00	1.66	
06/08/11	18:21:15	1.65	
06/08/11	18:21:30	1.67	
06/08/11	18:21:45	1.69	
06/08/11	18:22:00	1.74	
06/08/11	18:22:15	1.74	
06/08/11	18:22:30	1.75	
06/08/11	18:22:45	1.75	
06/08/11	18:23:00	1.77	
06/08/11	18:23:15	1.79	
06/08/11	18:23:30	1.79	
06/08/11	18:23:45	1.80	
06/08/11	18:24:00	1.79	
06/08/11	18:24:15	1.79	
06/08/11	18:24:30	1.80	
06/08/11	18:24:45	1.79	
06/08/11	18:25:00	1.79	
06/08/11	18:25:15	1.79	
06/08/11	18:25:30	1.81	
06/08/11	18:25:45	1.80	
06/08/11	18:26:00	1.81	
06/08/11	18:26:15	1.81	
06/08/11	18:26:30	1.85	
06/08/11	18:26:45	1.86	
06/08/11	18:27:00	1.85	
06/08/11	18:27:15	1.88	
06/08/11	18:27:30	1.89	
06/08/11	18:27:45	1.89	end 23
06/08/11	18:28:00	1.89	
06/08/11	18:28:15	1.91	
06/08/11	18:28:30	1.92	
06/08/11	18:28:45	1.91	
06/08/11	18:29:00	1.88	
06/08/11	18:29:15	1.85	
06/08/11	18:29:30	1.85	
06/08/11	18:29:45	1.84	
06/08/11	18:30:00	1.83	
06/08/11	18:30:15	1.81	
06/08/11	18:30:30	1.82	
06/08/11	18:30:45	1.83	
06/08/11	18:31:00	1.81	
06/08/11	18:31:15	1.81	
06/08/11	18:31:30	1.79	
06/08/11	18:31:45	1.80	
06/08/11	18:32:00	1.79	
06/08/11	18:32:15	1.78	
06/08/11	18:32:30	1.77	
06/08/11	18:32:45	1.76	
06/08/11	18:33:00	1.72	
06/08/11	18:33:15	1.70	
06/08/11	18:33:30	1.70	
06/08/11	18:33:45	1.71	
06/08/11	18:34:00	1.71	
06/08/11	18:34:15	1.72	
06/08/11	18:34:30	1.89	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	18:34:45	1.73	
06/08/11	18:35:00	1.69	
06/08/11	18:35:15	1.65	
06/08/11	18:35:30	1.66	
06/08/11	18:35:45	1.63	
06/08/11	18:36:00	1.65	
06/08/11	18:36:15	1.66	
06/08/11	18:36:30	1.67	
06/08/11	18:36:45	1.70	
06/08/11	18:37:00	1.75	
06/08/11	18:37:15	1.72	
06/08/11	18:37:30	1.73	
06/08/11	18:37:45	1.71	
06/08/11	18:38:00	1.71	
06/08/11	18:38:15	1.68	
06/08/11	18:38:30	1.65	
06/08/11	18:38:45	1.62	
06/08/11	18:39:00	1.61	
06/08/11	18:39:15	1.60	
06/08/11	18:39:30	1.61	
06/08/11	18:39:45	1.66	
06/08/11	18:40:00	1.64	
06/08/11	18:40:15	1.67	
06/08/11	18:40:30	1.61	
06/08/11	18:40:45	1.60	
06/08/11	18:41:00	1.58	
06/08/11	18:41:15	1.58	
06/08/11	18:41:30	1.64	
06/08/11	18:41:45	1.58	
06/08/11	18:42:00	1.58	
06/08/11	18:42:15	1.60	
06/08/11	18:42:30	1.53	
06/08/11	18:42:45	1.47	
06/08/11	18:43:00	1.46	
06/08/11	18:43:15	1.42	
06/08/11	18:43:30	1.44	
06/08/11	18:43:45	1.45	
06/08/11	18:44:00	1.43	
06/08/11	18:44:15	1.46	
06/08/11	18:44:30	1.46	
06/08/11	18:44:45	1.45	
06/08/11	18:45:00	1.44	
06/08/11	18:45:15	1.44	
06/08/11	18:45:30	1.47	
06/08/11	18:45:45	1.49	
06/08/11	18:46:00	1.50	
06/08/11	18:46:15	1.51	
06/08/11	18:46:30	1.53	
06/08/11	18:46:45	1.53	
06/08/11	18:47:00	1.52	
06/08/11	18:47:15	1.50	
06/08/11	18:47:30	1.49	
06/08/11	18:47:45	1.49	
06/08/11	18:48:00	1.51	
06/08/11	18:48:15	1.49	
06/08/11	18:48:30	1.54	
06/08/11	18:48:45	1.52	
06/08/11	18:49:00	1.55	
06/08/11	18:49:15	1.55	
06/08/11	18:49:30	1.57	
06/08/11	18:49:45	1.56	
06/08/11	18:50:00	1.54	
06/08/11	18:50:15	1.54	
06/08/11	18:50:30	1.54	
06/08/11	18:50:45	1.58	
06/08/11	18:51:00	1.57	
06/08/11	18:51:15	1.55	
06/08/11	18:51:30	1.58	
06/08/11	18:51:45	1.55	
06/08/11	18:52:00	1.55	
06/08/11	18:52:15	1.52	
06/08/11	18:52:30	1.55	
06/08/11	18:52:45	0.46	
06/08/11	18:53:00	1.56	
06/08/11	18:53:15	1.63	
06/08/11	18:53:30	1.64	
06/08/11	18:53:45	1.61	
06/08/11	18:54:00	1.58	
06/08/11	18:54:15	1.56	
06/08/11	18:54:30	1.55	
06/08/11	18:54:45	1.54	
06/08/11	18:55:00	1.52	
06/08/11	18:55:15	1.50	
06/08/11	18:55:30	1.50	
06/08/11	18:55:45	1.51	
06/08/11	18:56:00	1.51	
06/08/11	18:56:15	1.54	
06/08/11	18:56:30	1.53	
06/08/11	18:56:45	1.54	
06/08/11	18:57:00	1.58	
06/08/11	18:57:15	1.52	
06/08/11	18:57:30	1.60	
06/08/11	18:57:45	1.62	
06/08/11	18:58:00	1.56	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	18:58:15	1.58	
06/08/11	18:58:30	1.62	
06/08/11	18:58:45	1.66	
06/08/11	18:59:00	1.66	
06/08/11	18:59:15	1.68	
06/08/11	18:59:30	1.66	
06/08/11	18:59:45	1.65	
06/08/11	19:00:00	1.66	
06/08/11	19:00:15	1.66	
06/08/11	19:00:30	1.63	
06/08/11	19:00:45	1.63	
06/08/11	19:01:00	1.61	
06/08/11	19:01:15	1.63	
06/08/11	19:01:30	1.64	
06/08/11	19:01:45	1.65	
06/08/11	19:02:00	1.66	
06/08/11	19:02:15	1.64	
06/08/11	19:02:30	1.67	
06/08/11	19:02:45	1.69	
06/08/11	19:03:00	1.67	
06/08/11	19:03:15	1.68	
06/08/11	19:03:30	1.67	
06/08/11	19:03:45	1.66	
06/08/11	19:04:00	1.65	
06/08/11	19:04:15	1.65	
06/08/11	19:04:30	1.61	
06/08/11	19:04:45	1.62	
06/08/11	19:05:00	1.58	
06/08/11	19:05:15	1.81	
06/08/11	19:05:30	1.39	
06/08/11	19:05:45	1.53	
06/08/11	19:06:00	1.71	
06/08/11	19:06:15	1.71	
06/08/11	19:06:30	1.66	
06/08/11	19:06:45	1.64	
06/08/11	19:07:00	1.62	
06/08/11	19:07:15	1.60	
06/08/11	19:07:30	1.59	
06/08/11	19:07:45	1.64	
06/08/11	19:08:00	1.62	
06/08/11	19:08:15	1.61	
06/08/11	19:08:30	1.63	
06/08/11	19:08:45	1.58	
06/08/11	19:09:00	1.56	
06/08/11	19:09:15	1.58	
06/08/11	19:09:30	1.56	
06/08/11	19:09:45	1.57	
06/08/11	19:10:00	1.57	
06/08/11	19:10:15	1.52	
06/08/11	19:10:30	1.58	
06/08/11	19:10:45	1.55	
06/08/11	19:11:00	1.49	
06/08/11	19:11:15	1.43	
06/08/11	19:11:30	1.42	
06/08/11	19:11:45	1.41	
06/08/11	19:12:00	1.40	
06/08/11	19:12:15	1.40	
06/08/11	19:12:30	1.40	
06/08/11	19:12:45	1.42	
06/08/11	19:13:00	1.43	
06/08/11	19:13:15	1.43	
06/08/11	19:13:30	1.40	
06/08/11	19:13:45	1.42	
06/08/11	19:14:00	1.41	
06/08/11	19:14:15	1.42	
06/08/11	19:14:30	1.43	
06/08/11	19:14:45	1.41	
06/08/11	19:15:00	1.40	
06/08/11	19:15:15	1.40	
06/08/11	19:15:30	1.43	
06/08/11	19:15:45	1.41	
06/08/11	19:16:00	1.43	
06/08/11	19:16:15	1.44	
06/08/11	19:16:30	1.41	
06/08/11	19:16:45	1.41	
06/08/11	19:17:00	1.41	
06/08/11	19:17:15	1.44	
06/08/11	19:17:30	1.42	
06/08/11	19:17:45	1.40	
06/08/11	19:18:00	1.41	
06/08/11	19:18:15	1.40	
06/08/11	19:18:30	1.45	
06/08/11	19:18:45	1.46	
06/08/11	19:19:00	1.48	
06/08/11	19:19:15	1.45	
06/08/11	19:19:30	1.44	
06/08/11	19:19:45	1.43	
06/08/11	19:20:00	1.42	
06/08/11	19:20:15	1.42	
06/08/11	19:20:30	1.46	
06/08/11	19:20:45	1.46	
06/08/11	19:21:00	1.44	
06/08/11	19:21:15	1.44	
06/08/11	19:21:30	1.42	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	19:21:45	1.42	
06/08/11	19:22:00	1.42	
06/08/11	19:22:15	1.43	
06/08/11	19:22:30	1.47	
06/08/11	19:22:45	1.45	
06/08/11	19:23:00	1.42	
06/08/11	19:23:15	1.40	
06/08/11	19:23:30	1.40	
06/08/11	19:23:45	1.37	
06/08/11	19:24:00	1.38	
06/08/11	19:24:15	0.94	
06/08/11	19:24:30	1.56	
06/08/11	19:24:45	1.64	
06/08/11	19:25:00	1.70	
06/08/11	19:25:15	1.63	
06/08/11	19:25:30	1.52	
06/08/11	19:25:45	1.52	
06/08/11	19:26:00	1.49	
06/08/11	19:26:15	1.47	
06/08/11	19:26:30	1.46	
06/08/11	19:26:45	1.45	
06/08/11	19:27:00	1.44	
06/08/11	19:27:15	1.45	
06/08/11	19:27:30	1.45	
06/08/11	19:27:45	1.46	
06/08/11	19:28:00	1.47	
06/08/11	19:28:15	1.44	
06/08/11	19:28:30	1.46	
06/08/11	19:28:45	1.47	
06/08/11	19:29:00	1.49	
06/08/11	19:29:15	1.50	
06/08/11	19:29:30	1.48	
06/08/11	19:29:45	1.53	
06/08/11	19:30:00	1.54	
06/08/11	19:30:15	1.53	
06/08/11	19:30:30	1.59	
06/08/11	19:30:45	4.60	
06/08/11	19:31:00	3.58	
06/08/11	19:31:15	2.03	
06/08/11	19:31:30	1.40	
06/08/11	19:31:45	1.22	
06/08/11	19:32:00	1.08	
06/08/11	19:32:15	1.02	
06/08/11	19:32:30	1.00	
06/08/11	19:32:45	1.05	
06/08/11	19:33:00	1.07	
06/08/11	19:33:15	1.13	
06/08/11	19:33:30	1.04	
06/08/11	19:33:45	0.99	
06/08/11	19:34:00	0.99	
06/08/11	19:34:15	0.98	
06/08/11	19:34:30	0.89	
06/08/11	19:34:45	4.37	
06/08/11	19:35:00	17.97	
06/08/11	19:35:15	5.40	
06/08/11	19:35:30	0.93	
06/08/11	19:35:45	0.32	
06/08/11	19:36:00	0.16	
06/08/11	19:36:15	0.02	**Calibration Bias**
06/08/11	**19:36:30**	**0.20**	0 ppm CH4 Injection
06/08/11	**19:36:45**	**0.21**	
06/08/11	**19:37:00**	**0.16**	
06/08/11	**19:37:15**	**0.13**	**0.15** ppm ch4
06/08/11	19:37:30	0.10	
06/08/11	19:37:45	0.05	
06/08/11	19:38:00	0.56	
06/08/11	19:38:15	1.16	
06/08/11	19:38:30	1.64	
06/08/11	19:38:45	1.15	
06/08/11	19:39:00	0.44	
06/08/11	19:39:15	0.23	
06/08/11	19:39:30	0.11	
06/08/11	19:39:45	-0.06	
06/08/11	19:40:00	-0.19	
06/08/11	19:40:15	-0.28	
06/08/11	19:40:30	-0.33	
06/08/11	19:40:45	-0.39	
06/08/11	19:41:00	-0.42	
06/08/11	19:41:15	-0.45	
06/08/11	19:41:30	-0.47	
06/08/11	19:41:45	-0.19	
06/08/11	19:42:00	0.30	
06/08/11	19:42:15	8.77	
06/08/11	19:42:30	19.74	
06/08/11	19:42:45	26.98	
06/08/11	19:43:00	44.47	
06/08/11	19:43:15	47.11	
06/08/11	19:43:30	47.63	
06/08/11	19:43:45	47.85	
06/08/11	19:44:00	48.06	
06/08/11	19:44:15	48.31	
06/08/11	19:44:30	48.49	
06/08/11	19:44:45	48.63	
06/08/11	19:45:00	48.61	

ARI 15-second Averages

Date	Time	Total VOM	Comments
06/08/11	19:45:15	48.83	
06/08/11	19:45:30	49.03	
06/08/11	19:45:45	49.31	
06/08/11	19:46:00	49.41	
06/08/11	19:46:15	49.49	
06/08/11	19:46:30	49.63	
06/08/11	19:46:45	49.76	**Calibration Bias**
06/08/11	**19:47:00**	**49.82**	50 ppm CH4 Injection
06/08/11	**19:47:15**	**49.82**	
06/08/11	**19:47:30**	**49.81**	
06/08/11	**19:47:45**	**49.80**	**49.81** ppm ch4
06/08/11	19:48:00	49.68	
06/08/11	19:48:15	49.62	
06/08/11	19:48:30	49.70	
06/08/11	19:48:45	49.70	
06/08/11	19:49:00	49.86	
06/08/11	19:49:15	31.64	
06/08/11	19:49:30	7.74	

FTIR FIELD DATA SUMMARY

BP Whiting
Whiting, Indiana
FCC 500
6/7/2011
Stack Run #1

Spectrum	Date	Time	Methanol (ppmv wb)
6-7-11FCCU500RUNS_000393.LAB	6/7/2011	12:58	0.07
6-7-11FCCU500RUNS_000394.LAB	6/7/2011	12:59	0.07
6-7-11FCCU500RUNS_000395.LAB	6/7/2011	13:00	0.07
6-7-11FCCU500RUNS_000396.LAB	6/7/2011	13:01	0.07
6-7-11FCCU500RUNS_000397.LAB	6/7/2011	13:02	0.07
6-7-11FCCU500RUNS_000398.LAB	6/7/2011	13:04	0.07
6-7-11FCCU500RUNS_000399.LAB	6/7/2011	13:05	0.06
6-7-11FCCU500RUNS_000400.LAB	6/7/2011	13:06	0.07
6-7-11FCCU500RUNS_000401.LAB	6/7/2011	13:07	0.07
6-7-11FCCU500RUNS_000402.LAB	6/7/2011	13:08	0.07
6-7-11FCCU500RUNS_000403.LAB	6/7/2011	13:09	0.07
6-7-11FCCU500RUNS_000404.LAB	6/7/2011	13:10	0.07
6-7-11FCCU500RUNS_000405.LAB	6/7/2011	13:11	0.07
6-7-11FCCU500RUNS_000406.LAB	6/7/2011	13:12	0.07
6-7-11FCCU500RUNS_000407.LAB	6/7/2011	13:13	0.06
6-7-11FCCU500RUNS_000408.LAB	6/7/2011	13:14	0.06
6-7-11FCCU500RUNS_000409.LAB	6/7/2011	13:15	0.07
6-7-11FCCU500RUNS_000410.LAB	6/7/2011	13:16	0.07
6-7-11FCCU500RUNS_000411.LAB	6/7/2011	13:17	0.07
6-7-11FCCU500RUNS_000412.LAB	6/7/2011	13:18	0.07
6-7-11FCCU500RUNS_000413.LAB	6/7/2011	13:20	0.07
6-7-11FCCU500RUNS_000414.LAB	6/7/2011	13:21	0.07
6-7-11FCCU500RUNS_000419.LAB	6/7/2011	13:26	0.07
6-7-11FCCU500RUNS_000420.LAB	6/7/2011	13:27	0.07
6-7-11FCCU500RUNS_000421.LAB	6/7/2011	13:28	0.08
6-7-11FCCU500RUNS_000422.LAB	6/7/2011	13:29	0.07
6-7-11FCCU500RUNS_000423.LAB	6/7/2011	13:30	0.07
6-7-11FCCU500RUNS_000424.LAB	6/7/2011	13:31	0.08
6-7-11FCCU500RUNS_000425.LAB	6/7/2011	13:32	0.07
6-7-11FCCU500RUNS_000426.LAB	6/7/2011	13:33	0.08
6-7-11FCCU500RUNS_000427.LAB	6/7/2011	13:34	0.07
6-7-11FCCU500RUNS_000428.LAB	6/7/2011	13:36	0.07
6-7-11FCCU500RUNS_000429.LAB	6/7/2011	13:37	0.07
6-7-11FCCU500RUNS_000430.LAB	6/7/2011	13:38	0.07
6-7-11FCCU500RUNS_000431.LAB	6/7/2011	13:39	0.08
6-7-11FCCU500RUNS_000432.LAB	6/7/2011	13:40	0.07
6-7-11FCCU500RUNS_000433.LAB	6/7/2011	13:41	0.08
6-7-11FCCU500RUNS_000434.LAB	6/7/2011	13:42	0.07
6-7-11FCCU500RUNS_000435.LAB	6/7/2011	13:43	0.08
6-7-11FCCU500RUNS_000439.LAB	6/7/2011	13:47	0.07
6-7-11FCCU500RUNS_000440.LAB	6/7/2011	13:48	0.07
6-7-11FCCU500RUNS_000441.LAB	6/7/2011	13:49	0.07
6-7-11FCCU500RUNS_000442.LAB	6/7/2011	13:50	0.07
6-7-11FCCU500RUNS_000443.LAB	6/7/2011	13:52	0.07
6-7-11FCCU500RUNS_000444.LAB	6/7/2011	13:53	0.07
6-7-11FCCU500RUNS_000445.LAB	6/7/2011	13:54	0.07
6-7-11FCCU500RUNS_000446.LAB	6/7/2011	13:55	0.07
6-7-11FCCU500RUNS_000447.LAB	6/7/2011	13:56	0.07
6-7-11FCCU500RUNS_000448.LAB	6/7/2011	13:57	0.07
6-7-11FCCU500RUNS_000449.LAB	6/7/2011	13:58	0.08
6-7-11FCCU500RUNS_000450.LAB	6/7/2011	13:59	0.08
6-7-11FCCU500RUNS_000451.LAB	6/7/2011	14:00	0.08
6-7-11FCCU500RUNS_000460.LAB	6/7/2011	14:10	0.08
6-7-11FCCU500RUNS_000461.LAB	6/7/2011	14:11	0.07
6-7-11FCCU500RUNS_000462.LAB	6/7/2011	14:12	0.08
6-7-11FCCU500RUNS_000463.LAB	6/7/2011	14:13	0.07
6-7-11FCCU500RUNS_000464.LAB	6/7/2011	14:14	0.07
6-7-11FCCU500RUNS_000465.LAB	6/7/2011	14:15	0.07
6-7-11FCCU500RUNS_000466.LAB	6/7/2011	14:16	0.07
6-7-11FCCU500RUNS_000467.LAB	6/7/2011	14:17	0.07
6-7-11FCCU500RUNS_000468.LAB	6/7/2011	14:18	0.07
6-7-11FCCU500RUNS_000469.LAB	6/7/2011	14:19	0.07
6-7-11FCCU500RUNS_000476.LAB	6/7/2011	14:27	0.07
6-7-11FCCU500RUNS_000477.LAB	6/7/2011	14:28	0.08
6-7-11FCCU500RUNS_000478.LAB	6/7/2011	14:29	0.08
6-7-11FCCU500RUNS_000479.LAB	6/7/2011	14:30	0.08
6-7-11FCCU500RUNS_000480.LAB	6/7/2011	14:31	0.07
6-7-11FCCU500RUNS_000481.LAB	6/7/2011	14:32	0.08
6-7-11FCCU500RUNS_000482.LAB	6/7/2011	14:33	0.08
6-7-11FCCU500RUNS_000483.LAB	6/7/2011	14:34	0.08
6-7-11FCCU500RUNS_000484.LAB	6/7/2011	14:35	0.07
6-7-11FCCU500RUNS_000485.LAB	6/7/2011	14:36	0.08
6-7-11FCCU500RUNS_000486.LAB	6/7/2011	14:37	0.07
6-7-11FCCU500RUNS_000487.LAB	6/7/2011	14:39	0.07

6-7-11FCCU500RUNS_000488.LAB	6/7/2011	14:40	0.08
6-7-11FCCU500RUNS_000489.LAB	6/7/2011	14:41	0.08
6-7-11FCCU500RUNS_000490.LAB	6/7/2011	14:42	0.07
6-7-11FCCU500RUNS_000491.LAB	6/7/2011	14:43	0.08
6-7-11FCCU500RUNS_000492.LAB	6/7/2011	14:44	0.07
6-7-11FCCU500RUNS_000493.LAB	6/7/2011	14:45	0.07
6-7-11FCCU500RUNS_000494.LAB	6/7/2011	14:46	0.07
6-7-11FCCU500RUNS_000495.LAB	6/7/2011	14:47	0.08
6-7-11FCCU500RUNS_000496.LAB	6/7/2011	14:48	0.07
6-7-11FCCU500RUNS_000497.LAB	6/7/2011	14:49	0.08
6-7-11FCCU500RUNS_000498.LAB	6/7/2011	14:50	0.08
6-7-11FCCU500RUNS_000499.LAB	6/7/2011	14:51	0.08
6-7-11FCCU500RUNS_000500.LAB	6/7/2011	14:52	0.08
Average=			**0.07**

FTIR FIELD DATA SUMMARY

BP Whiting
Whiting, Indiana
FCC 500
6/8/2011
Stack Run #2

Spectrum	Date	Time	Methanol (ppmv wb)
6-8-11FCCU500RUNS_000093.LAB	6/8/2011	8:55	0.06
6-8-11FCCU500RUNS_000094.LAB	6/8/2011	8:56	0.06
6-8-11FCCU500RUNS_000095.LAB	6/8/2011	8:57	0.07
6-8-11FCCU500RUNS_000096.LAB	6/8/2011	8:58	0.07
6-8-11FCCU500RUNS_000097.LAB	6/8/2011	8:59	0.07
6-8-11FCCU500RUNS_000098.LAB	6/8/2011	9:00	0.07
6-8-11FCCU500RUNS_000099.LAB	6/8/2011	9:01	0.07
6-8-11FCCU500RUNS_000100.LAB	6/8/2011	9:02	0.07
6-8-11FCCU500RUNS_000101.LAB	6/8/2011	9:03	0.07
6-8-11FCCU500RUNS_000102.LAB	6/8/2011	9:04	0.07
6-8-11FCCU500RUNS_000103.LAB	6/8/2011	9:05	0.07
6-8-11FCCU500RUNS_000104.LAB	6/8/2011	9:06	0.07
6-8-11FCCU500RUNS_000105.LAB	6/8/2011	9:08	0.07
6-8-11FCCU500RUNS_000106.LAB	6/8/2011	9:09	0.07
6-8-11FCCU500RUNS_000107.LAB	6/8/2011	9:10	0.06
6-8-11FCCU500RUNS_000108.LAB	6/8/2011	9:11	0.07
6-8-11FCCU500RUNS_000109.LAB	6/8/2011	9:12	0.07
6-8-11FCCU500RUNS_000110.LAB	6/8/2011	9:13	0.07
6-8-11FCCU500RUNS_000111.LAB	6/8/2011	9:14	0.07
6-8-11FCCU500RUNS_000112.LAB	6/8/2011	9:15	0.07
6-8-11FCCU500RUNS_000113.LAB	6/8/2011	9:16	0.07
6-8-11FCCU500RUNS_000114.LAB	6/8/2011	9:17	0.07
6-8-11FCCU500RUNS_000115.LAB	6/8/2011	9:18	0.07
6-8-11FCCU500RUNS_000116.LAB	6/8/2011	9:19	0.07
6-8-11FCCU500RUNS_000117.LAB	6/8/2011	9:20	0.07
6-8-11FCCU500RUNS_000118.LAB	6/8/2011	9:21	0.07
6-8-11FCCU500RUNS_000119.LAB	6/8/2011	9:22	0.07
6-8-11FCCU500RUNS_000120.LAB	6/8/2011	9:24	0.07
6-8-11FCCU500RUNS_000121.LAB	6/8/2011	9:25	0.07
6-8-11FCCU500RUNS_000122.LAB	6/8/2011	9:26	0.07
6-8-11FCCU500RUNS_000123.LAB	6/8/2011	9:27	0.07
6-8-11FCCU500RUNS_000124.LAB	6/8/2011	9:28	0.07
6-8-11FCCU500RUNS_000125.LAB	6/8/2011	9:29	0.07
6-8-11FCCU500RUNS_000126.LAB	6/8/2011	9:30	0.07
6-8-11FCCU500RUNS_000127.LAB	6/8/2011	9:31	0.07
6-8-11FCCU500RUNS_000128.LAB	6/8/2011	9:32	0.07
6-8-11FCCU500RUNS_000129.LAB	6/8/2011	9:33	0.07
6-8-11FCCU500RUNS_000130.LAB	6/8/2011	9:34	0.06
6-8-11FCCU500RUNS_000131.LAB	6/8/2011	9:35	0.07
6-8-11FCCU500RUNS_000132.LAB	6/8/2011	9:36	0.07
6-8-11FCCU500RUNS_000133.LAB	6/8/2011	9:37	0.07
6-8-11FCCU500RUNS_000134.LAB	6/8/2011	9:38	0.07
6-8-11FCCU500RUNS_000135.LAB	6/8/2011	9:40	0.08
6-8-11FCCU500RUNS_000136.LAB	6/8/2011	9:41	0.06
6-8-11FCCU500RUNS_000137.LAB	6/8/2011	9:42	0.07
6-8-11FCCU500RUNS_000138.LAB	6/8/2011	9:43	0.07
6-8-11FCCU500RUNS_000139.LAB	6/8/2011	9:44	0.07
6-8-11FCCU500RUNS_000140.LAB	6/8/2011	9:45	0.07
6-8-11FCCU500RUNS_000141.LAB	6/8/2011	9:46	0.07
6-8-11FCCU500RUNS_000142.LAB	6/8/2011	9:47	0.07
6-8-11FCCU500RUNS_000143.LAB	6/8/2011	9:48	0.07
6-8-11FCCU500RUNS_000144.LAB	6/8/2011	9:49	0.07
6-8-11FCCU500RUNS_000145.LAB	6/8/2011	9:50	0.07
6-8-11FCCU500RUNS_000146.LAB	6/8/2011	9:51	0.07
6-8-11FCCU500RUNS_000147.LAB	6/8/2011	9:52	0.07
6-8-11FCCU500RUNS_000148.LAB	6/8/2011	9:53	0.07
6-8-11FCCU500RUNS_000149.LAB	6/8/2011	9:54	0.07
6-8-11FCCU500RUNS_000150.LAB	6/8/2011	9:56	0.07
6-8-11FCCU500RUNS_000151.LAB	6/8/2011	9:57	0.07
6-8-11FCCU500RUNS_000152.LAB	6/8/2011	9:58	0.07
6-8-11FCCU500RUNS_000153.LAB	6/8/2011	9:59	0.07
6-8-11FCCU500RUNS_000154.LAB	6/8/2011	10:00	0.07
6-8-11FCCU500RUNS_000155.LAB	6/8/2011	10:01	0.07
6-8-11FCCU500RUNS_000156.LAB	6/8/2011	10:02	0.07
6-8-11FCCU500RUNS_000157.LAB	6/8/2011	10:03	0.07
6-8-11FCCU500RUNS_000158.LAB	6/8/2011	10:04	0.07
6-8-11FCCU500RUNS_000159.LAB	6/8/2011	10:05	0.07
6-8-11FCCU500RUNS_000160.LAB	6/8/2011	10:06	0.07
6-8-11FCCU500RUNS_000161.LAB	6/8/2011	10:07	0.06
6-8-11FCCU500RUNS_000162.LAB	6/8/2011	10:08	0.07
6-8-11FCCU500RUNS_000163.LAB	6/8/2011	10:09	0.07
6-8-11FCCU500RUNS_000164.LAB	6/8/2011	10:10	0.07
6-8-11FCCU500RUNS_000165.LAB	6/8/2011	10:12	0.07
6-8-11FCCU500RUNS_000166.LAB	6/8/2011	10:13	0.07

6-8-11FCCU500RUNS_000167.LAB	6/8/2011	10:14	0.06
6-8-11FCCU500RUNS_000168.LAB	6/8/2011	10:15	0.07
6-8-11FCCU500RUNS_000169.LAB	6/8/2011	10:16	0.07
6-8-11FCCU500RUNS_000170.LAB	6/8/2011	10:17	0.07
6-8-11FCCU500RUNS_000171.LAB	6/8/2011	10:18	0.07
6-8-11FCCU500RUNS_000172.LAB	6/8/2011	10:19	0.07
6-8-11FCCU500RUNS_000173.LAB	6/8/2011	10:20	0.07
6-8-11FCCU500RUNS_000174.LAB	6/8/2011	10:21	0.06
6-8-11FCCU500RUNS_000175.LAB	6/8/2011	10:22	0.07
6-8-11FCCU500RUNS_000176.LAB	6/8/2011	10:23	0.07
6-8-11FCCU500RUNS_000177.LAB	6/8/2011	10:24	0.07
6-8-11FCCU500RUNS_000178.LAB	6/8/2011	10:25	0.07
6-8-11FCCU500RUNS_000179.LAB	6/8/2011	10:26	0.07
6-8-11FCCU500RUNS_000180.LAB	6/8/2011	10:28	0.07
6-8-11FCCU500RUNS_000181.LAB	6/8/2011	10:29	0.07
6-8-11FCCU500RUNS_000182.LAB	6/8/2011	10:30	0.07
6-8-11FCCU500RUNS_000183.LAB	6/8/2011	10:31	0.07
6-8-11FCCU500RUNS_000184.LAB	6/8/2011	10:32	0.07
6-8-11FCCU500RUNS_000185.LAB	6/8/2011	10:33	0.07
6-8-11FCCU500RUNS_000186.LAB	6/8/2011	10:34	0.07
6-8-11FCCU500RUNS_000187.LAB	6/8/2011	10:35	0.07
6-8-11FCCU500RUNS_000188.LAB	6/8/2011	10:36	0.07
6-8-11FCCU500RUNS_000189.LAB	6/8/2011	10:37	0.07
6-8-11FCCU500RUNS_000190.LAB	6/8/2011	10:38	0.07
6-8-11FCCU500RUNS_000191.LAB	6/8/2011	10:39	0.07
6-8-11FCCU500RUNS_000192.LAB	6/8/2011	10:40	0.07
6-8-11FCCU500RUNS_000193.LAB	6/8/2011	10:41	0.07
6-8-11FCCU500RUNS_000194.LAB	6/8/2011	10:43	0.07
6-8-11FCCU500RUNS_000195.LAB	6/8/2011	10:44	0.06
6-8-11FCCU500RUNS_000196.LAB	6/8/2011	10:45	0.07
6-8-11FCCU500RUNS_000197.LAB	6/8/2011	10:46	0.07
6-8-11FCCU500RUNS_000198.LAB	6/8/2011	10:47	0.07
6-8-11FCCU500RUNS_000199.LAB	6/8/2011	10:48	0.07
6-8-11FCCU500RUNS_000200.LAB	6/8/2011	10:49	0.07
6-8-11FCCU500RUNS_000201.LAB	6/8/2011	10:50	0.07
6-8-11FCCU500RUNS_000202.LAB	6/8/2011	10:51	0.07
6-8-11FCCU500RUNS_000203.LAB	6/8/2011	10:52	0.07
6-8-11FCCU500RUNS_000204.LAB	6/8/2011	10:53	0.07
6-8-11FCCU500RUNS_000205.LAB	6/8/2011	10:54	0.07
6-8-11FCCU500RUNS_000206.LAB	6/8/2011	10:55	0.07
Average=			**0.07**

FTIR FIELD DATA SUMMARY

BP Whiting
Whiting, Indiana
FCC 500
6/8/2011
Stack Run #3

Spectrum	Date	Time	Methanol (ppmv wb)
6-8-11FCCU500RUNS_000282.LAB	6/8/2011	14:15	0.06
6-8-11FCCU500RUNS_000283.LAB	6/8/2011	14:16	0.07
6-8-11FCCU500RUNS_000284.LAB	6/8/2011	14:17	0.07
6-8-11FCCU500RUNS_000285.LAB	6/8/2011	14:18	0.07
6-8-11FCCU500RUNS_000286.LAB	6/8/2011	14:19	0.07
6-8-11FCCU500RUNS_000287.LAB	6/8/2011	14:20	0.06
6-8-11FCCU500RUNS_000288.LAB	6/8/2011	14:21	0.07
6-8-11FCCU500RUNS_000289.LAB	6/8/2011	14:23	0.07
6-8-11FCCU500RUNS_000290.LAB	6/8/2011	14:24	0.07
6-8-11FCCU500RUNS_000291.LAB	6/8/2011	14:25	0.07
6-8-11FCCU500RUNS_000292.LAB	6/8/2011	14:26	0.06
6-8-11FCCU500RUNS_000293.LAB	6/8/2011	14:27	0.07
6-8-11FCCU500RUNS_000294.LAB	6/8/2011	14:28	0.07
6-8-11FCCU500RUNS_000295.LAB	6/8/2011	14:29	0.07
6-8-11FCCU500RUNS_000296.LAB	6/8/2011	14:30	0.07
6-8-11FCCU500RUNS_000297.LAB	6/8/2011	14:31	0.07
6-8-11FCCU500RUNS_000298.LAB	6/8/2011	14:32	0.07
6-8-11FCCU500RUNS_000299.LAB	6/8/2011	14:33	0.06
6-8-11FCCU500RUNS_000300.LAB	6/8/2011	14:34	0.06
6-8-11FCCU500RUNS_000301.LAB	6/8/2011	14:35	0.07
6-8-11FCCU500RUNS_000302.LAB	6/8/2011	14:36	0.07
6-8-11FCCU500RUNS_000303.LAB	6/8/2011	14:38	0.07
6-8-11FCCU500RUNS_000304.LAB	6/8/2011	14:39	0.07
6-8-11FCCU500RUNS_000305.LAB	6/8/2011	14:40	0.07
6-8-11FCCU500RUNS_000306.LAB	6/8/2011	14:41	0.07
6-8-11FCCU500RUNS_000307.LAB	6/8/2011	14:42	0.07
6-8-11FCCU500RUNS_000308.LAB	6/8/2011	14:43	0.06
6-8-11FCCU500RUNS_000309.LAB	6/8/2011	14:44	0.06
6-8-11FCCU500RUNS_000310.LAB	6/8/2011	14:45	0.06
6-8-11FCCU500RUNS_000311.LAB	6/8/2011	14:46	0.06
6-8-11FCCU500RUNS_000312.LAB	6/8/2011	14:47	0.06
6-8-11FCCU500RUNS_000313.LAB	6/8/2011	14:48	0.06
6-8-11FCCU500RUNS_000314.LAB	6/8/2011	14:49	0.06
6-8-11FCCU500RUNS_000315.LAB	6/8/2011	14:50	0.07
6-8-11FCCU500RUNS_000316.LAB	6/8/2011	14:51	0.07
6-8-11FCCU500RUNS_000317.LAB	6/8/2011	14:52	0.07
6-8-11FCCU500RUNS_000318.LAB	6/8/2011	14:54	0.06
6-8-11FCCU500RUNS_000319.LAB	6/8/2011	14:55	0.06
6-8-11FCCU500RUNS_000320.LAB	6/8/2011	14:56	0.07
6-8-11FCCU500RUNS_000321.LAB	6/8/2011	14:57	0.06
6-8-11FCCU500RUNS_000322.LAB	6/8/2011	14:58	0.06
6-8-11FCCU500RUNS_000323.LAB	6/8/2011	14:59	0.06
6-8-11FCCU500RUNS_000324.LAB	6/8/2011	15:00	0.06
6-8-11FCCU500RUNS_000325.LAB	6/8/2011	15:01	0.07
6-8-11FCCU500RUNS_000326.LAB	6/8/2011	15:02	0.07
6-8-11FCCU500RUNS_000327.LAB	6/8/2011	15:03	0.07
6-8-11FCCU500RUNS_000328.LAB	6/8/2011	15:04	0.06
6-8-11FCCU500RUNS_000329.LAB	6/8/2011	15:05	0.07
6-8-11FCCU500RUNS_000330.LAB	6/8/2011	15:06	0.07
6-8-11FCCU500RUNS_000331.LAB	6/8/2011	15:07	0.07
6-8-11FCCU500RUNS_000332.LAB	6/8/2011	15:08	0.07
6-8-11FCCU500RUNS_000333.LAB	6/8/2011	15:10	0.07
6-8-11FCCU500RUNS_000334.LAB	6/8/2011	15:11	0.07
6-8-11FCCU500RUNS_000335.LAB	6/8/2011	15:12	0.07
6-8-11FCCU500RUNS_000336.LAB	6/8/2011	15:13	0.07
6-8-11FCCU500RUNS_000337.LAB	6/8/2011	15:14	0.07
6-8-11FCCU500RUNS_000338.LAB	6/8/2011	15:15	0.07
6-8-11FCCU500RUNS_000339.LAB	6/8/2011	15:16	0.07
6-8-11FCCU500RUNS_000345.LAB	6/8/2011	15:22	0.07
6-8-11FCCU500RUNS_000346.LAB	6/8/2011	15:23	0.07
6-8-11FCCU500RUNS_000347.LAB	6/8/2011	15:25	0.08
6-8-11FCCU500RUNS_000348.LAB	6/8/2011	15:26	0.07
6-8-11FCCU500RUNS_000349.LAB	6/8/2011	15:27	0.07
6-8-11FCCU500RUNS_000350.LAB	6/8/2011	15:28	0.07
6-8-11FCCU500RUNS_000351.LAB	6/8/2011	15:29	0.07
6-8-11FCCU500RUNS_000352.LAB	6/8/2011	15:30	0.07
6-8-11FCCU500RUNS_000353.LAB	6/8/2011	15:31	0.07
6-8-11FCCU500RUNS_000354.LAB	6/8/2011	15:32	0.07
6-8-11FCCU500RUNS_000355.LAB	6/8/2011	15:33	0.07
6-8-11FCCU500RUNS_000356.LAB	6/8/2011	15:34	0.07
6-8-11FCCU500RUNS_000357.LAB	6/8/2011	15:35	0.06
6-8-11FCCU500RUNS_000358.LAB	6/8/2011	15:36	0.07
6-8-11FCCU500RUNS_000359.LAB	6/8/2011	15:37	0.07
6-8-11FCCU500RUNS_000360.LAB	6/8/2011	15:38	0.07

6-8-11FCCU500RUNS_000361.LAB	6/8/2011	15:39	0.06
6-8-11FCCU500RUNS_000362.LAB	6/8/2011	15:41	0.07
6-8-11FCCU500RUNS_000369.LAB	6/8/2011	15:48	0.07
6-8-11FCCU500RUNS_000370.LAB	6/8/2011	15:49	0.07
6-8-11FCCU500RUNS_000371.LAB	6/8/2011	15:50	0.07
6-8-11FCCU500RUNS_000372.LAB	6/8/2011	15:51	0.07
6-8-11FCCU500RUNS_000373.LAB	6/8/2011	15:52	0.07
6-8-11FCCU500RUNS_000374.LAB	6/8/2011	15:53	0.07
6-8-11FCCU500RUNS_000375.LAB	6/8/2011	15:54	0.07
6-8-11FCCU500RUNS_000376.LAB	6/8/2011	15:56	0.07
6-8-11FCCU500RUNS_000377.LAB	6/8/2011	15:57	0.08
6-8-11FCCU500RUNS_000378.LAB	6/8/2011	15:58	0.07
6-8-11FCCU500RUNS_000379.LAB	6/8/2011	15:59	0.07
6-8-11FCCU500RUNS_000380.LAB	6/8/2011	16:00	0.07
6-8-11FCCU500RUNS_000381.LAB	6/8/2011	16:01	0.06
6-8-11FCCU500RUNS_000382.LAB	6/8/2011	16:02	0.07
6-8-11FCCU500RUNS_000383.LAB	6/8/2011	16:03	0.07
6-8-11FCCU500RUNS_000384.LAB	6/8/2011	16:04	0.07
6-8-11FCCU500RUNS_000385.LAB	6/8/2011	16:05	0.06
6-8-11FCCU500RUNS_000386.LAB	6/8/2011	16:06	0.07
6-8-11FCCU500RUNS_000387.LAB	6/8/2011	16:07	0.07
6-8-11FCCU500RUNS_000388.LAB	6/8/2011	16:08	0.07
6-8-11FCCU500RUNS_000389.LAB	6/8/2011	16:09	0.07
6-8-11FCCU500RUNS_000394.LAB	6/8/2011	16:15	0.07
Average=			**0.07**

APPENDIX E Calibration Data

ARI REFERENCE METHOD CEMS DATA
USEPA METHOD 205
DILUTION SYSTEM VERIFICATION

Company: BP
Location: Whiting, IN
Dilution System ID: 4352
Dilution Flow Rate: 8.0 LPM
Verification date: 6/8/2011

Analyzer Info

Monitor type: Servomex Oxygen Analyzer
Monitor range: 18
Monitor Serial No.: 01440D/4213

Initial Calibration Data

Calibration Concentration		Calibration results		% Difference	
Zero:	0.0	Zero:	0.01	Zero:	0.00
Low:	5.0	Low:	5.09	Low:	1.76
Mid:	12.0	Mid:	12.03	Mid:	0.29
High:	18.0	High:	17.97	High:	0.15

Dilution System Verification

Mid level gas type: USEPA Protocol 1
Mid level concentration: 12.56
Mid level tank serial #: ALM-036029

High level dilution gas type: USEPA Protocol 1
High level concentration: 22.60
High level tank serial #: AAL16685
Target concentration No. 1: 12.56
Target concentration No. 2: 6.00

Dilution System Results

	Target Concentration No. 1			Target Concentration No. 2	
	Instrument Response	% difference from average*		Instrument Response	% difference from average*
Trial No. 1:	12.61	0.15	Trial No. 1:	6.07	0.02
Trial No. 2:	12.63	0.00	Trial No. 2:	6.07	0.05
Trial No. 3:	12.65	0.15	Trial No. 3:	6.08	0.07
Average:	12.630		Average:	6.072	

% Difference from target concentration: 0.56%

% Difference from target concentration: 1.20%

Mid Level Calibration Gas Results

	Instrument Response
Trial No. 1:	12.62
Trial No. 2:	12.64
Trial No. 3:	12.60

Mid Level calibration gas concentration: 12.56
Average analyzer response: 12.621
Percent difference: 0.49 *

* Must be less than 2 %

BP-Whiting; FCCU 500 Exhaust
Method 205-Dilution System Verification
6/8/11

Type	**0 - 25**
Units	**%v db**

Date	Time, s	Oxygen	Comments
06/08/11	16:25:00	0.04	
06/08/11	16:25:15	0.03	
06/08/11	16:25:30	0.02	
06/08/11	16:25:45	0.02	Calibration Error
06/08/11	16:26:00	**0.02**	Zero Gas (Nitrogen)
06/08/11	16:26:15	**0.01**	**0.01** % Oxygen
06/08/11	16:26:30	**0.01**	
06/08/11	16:26:45	**0.00**	
06/08/11	16:27:00	0.00	
06/08/11	16:27:15	1.68	
06/08/11	16:27:30	11.50	
06/08/11	16:27:45	10.77	
06/08/11	16:28:00	11.22	
06/08/11	16:28:15	12.08	
06/08/11	16:28:30	12.21	
06/08/11	16:28:45	11.52	
06/08/11	16:29:00	11.55	
06/08/11	16:29:15	12.05	
06/08/11	16:29:30	12.03	Calibration Error
06/08/11	16:29:45	**12.03**	12.0% Injection
06/08/11	16:30:00	**12.03**	**12.03** % Oxygen
06/08/11	16:30:15	**12.04**	
06/08/11	16:30:30	**12.04**	
06/08/11	16:30:45	12.04	
06/08/11	16:31:00	12.05	
06/08/11	16:31:15	11.39	
06/08/11	16:31:30	7.60	
06/08/11	16:31:45	5.36	
06/08/11	16:32:00	5.15	
06/08/11	16:32:15	5.08	Calibration Error
06/08/11	16:32:30	**5.09**	5.0% Injection
06/08/11	16:32:45	**5.09**	**5.09** % Oxygen
06/08/11	16:33:00	**5.09**	
06/08/11	16:33:15	**5.09**	
06/08/11	16:33:30	5.09	
06/08/11	16:33:45	6.23	
06/08/11	16:34:00	12.87	
06/08/11	16:34:15	16.18	
06/08/11	16:34:30	17.48	
06/08/11	16:34:45	17.81	
06/08/11	16:35:00	17.84	
06/08/11	16:35:15	17.86	
06/08/11	16:35:30	17.93	Calibration Error
06/08/11	16:35:45	**17.96**	18.0% Injection
06/08/11	16:36:00	**17.97**	**17.97** % Oxygen
06/08/11	16:36:15	**17.98**	
06/08/11	16:36:30	**17.98**	
06/08/11	16:36:45	17.99	
06/08/11	16:37:00	17.99	

06/08/11	16:37:15	17.99	
06/08/11	16:37:30	17.99	
06/08/11	16:37:45	17.99	
06/08/11	16:38:00	17.99	
06/08/11	16:38:15	17.98	
06/08/11	16:38:30	16.23	
06/08/11	16:38:45	13.45	
06/08/11	16:39:00	12.76	
06/08/11	16:39:15	12.71	
06/08/11	16:39:30	12.70	
06/08/11	16:39:45	12.70	
06/08/11	16:40:00	12.70	
06/08/11	16:40:15	12.70	
06/08/11	16:40:30	12.70	
06/08/11	16:40:45	12.63	Precision 1: Trial 1
06/08/11	16:41:00	**12.61**	12.56% Injection
06/08/11	16:41:15	**12.61**	**12.61** % Oxygen
06/08/11	16:41:30	**12.61**	
06/08/11	16:41:45	**12.61**	
06/08/11	16:42:00	12.62	
06/08/11	16:42:15	12.62	
06/08/11	16:42:30	12.62	
06/08/11	16:42:45	12.62	
06/08/11	16:43:00	12.79	
06/08/11	16:43:15	14.21	
06/08/11	16:43:30	10.31	
06/08/11	16:43:45	6.49	Precision 2: Trial 1
06/08/11	16:44:00	**6.07**	6.00% Injection
06/08/11	16:44:15	**6.06**	**6.07** % Oxygen
06/08/11	16:44:30	**6.07**	
06/08/11	16:44:45	**6.07**	
06/08/11	16:45:00	6.08	
06/08/11	16:45:15	6.08	
06/08/11	16:45:30	6.08	
06/08/11	16:45:45	6.18	
06/08/11	16:46:00	9.04	
06/08/11	16:46:15	17.22	
06/08/11	16:46:30	15.97	
06/08/11	16:46:45	13.42	
06/08/11	16:47:00	12.59	
06/08/11	16:47:15	12.59	
06/08/11	16:47:30	12.61	Accuracy #1
06/08/11	16:47:45	**12.62**	Cylinder #ALM-036029
06/08/11	16:48:00	**12.62**	**12.62** % Oxygen
06/08/11	16:48:15	**12.62**	
06/08/11	16:48:30	**12.62**	
06/08/11	16:48:45	12.62	
06/08/11	16:49:00	12.62	
06/08/11	16:49:15	14.24	
06/08/11	16:49:30	17.88	
06/08/11	16:49:45	19.49	
06/08/11	16:50:00	19.67	
06/08/11	16:50:15	19.68	
06/08/11	16:50:30	19.67	
06/08/11	16:50:45	19.67	
06/08/11	16:51:00	19.60	
06/08/11	16:51:15	17.18	
06/08/11	16:51:30	14.00	
06/08/11	16:51:45	12.64	

06/08/11	16:52:00	12.45	
06/08/11	16:52:15	12.45	
06/08/11	16:52:30	12.45	
06/08/11	16:52:45	12.57	
06/08/11	16:53:00	13.21	
06/08/11	16:53:15	12.81	
06/08/11	16:53:30	12.59	
06/08/11	16:53:45	12.60	
06/08/11	16:54:00	12.63	Precision 1: Trial 2
06/08/11	16:54:15	**12.63**	12.61% Injection
06/08/11	16:54:30	**12.63**	**12.63** % Oxygen
06/08/11	16:54:45	**12.63**	
06/08/11	16:55:00	**12.63**	
06/08/11	16:55:15	12.63	
06/08/11	16:55:30	12.63	
06/08/11	16:55:45	12.63	
06/08/11	16:56:00	12.63	
06/08/11	16:56:15	12.63	
06/08/11	16:56:30	13.25	
06/08/11	16:56:45	11.05	
06/08/11	16:57:00	6.71	
06/08/11	16:57:15	5.93	
06/08/11	16:57:30	5.89	
06/08/11	16:57:45	5.88	
06/08/11	16:58:00	5.88	
06/08/11	16:58:15	5.90	
06/08/11	16:58:30	6.32	
06/08/11	16:58:45	6.13	
06/08/11	16:59:00	6.01	Precision 2: Trial 2
06/08/11	16:59:15	**6.06**	6.00% Injection
06/08/11	16:59:30	**6.07**	**6.07** % Oxygen
06/08/11	16:59:45	**6.07**	
06/08/11	17:00:00	**6.08**	
06/08/11	17:00:15	6.08	
06/08/11	17:00:30	7.15	
06/08/11	17:00:45	15.44	
06/08/11	17:01:00	16.58	
06/08/11	17:01:15	13.80	
06/08/11	17:01:30	12.67	
06/08/11	17:01:45	12.51	
06/08/11	17:02:00	12.52	Accuracy #2
06/08/11	17:02:15	**12.61**	Cylinder #ALM-036029
06/08/11	17:02:30	**12.65**	**12.64** % Oxygen
06/08/11	17:02:45	**12.65**	
06/08/11	17:03:00	**12.66**	
06/08/11	17:03:15	12.67	
06/08/11	17:03:30	13.06	
06/08/11	17:03:45	15.68	
06/08/11	17:04:00	14.76	
06/08/11	17:04:15	12.99	
06/08/11	17:04:30	12.57	
06/08/11	17:04:45	12.54	Precision 1: Trial 3
06/08/11	17:05:00	**12.59**	12.61% Injection
06/08/11	17:05:15	**12.64**	**12.65** % Oxygen
06/08/11	17:05:30	**12.68**	
06/08/11	17:05:45	**12.68**	
06/08/11	17:06:00	12.69	
06/08/11	17:06:15	12.69	
06/08/11	17:06:30	12.99	

06/08/11	17:06:45	12.52	
06/08/11	17:07:00	7.75	
06/08/11	17:07:15	6.11	
06/08/11	17:07:30	6.02	Precision 2: Trial 3
06/08/11	17:07:45	**6.07**	6.00% Injection
06/08/11	17:08:00	**6.07**	**6.08** % Oxygen
06/08/11	17:08:15	**6.08**	
06/08/11	17:08:30	**6.09**	
06/08/11	17:08:45	6.10	
06/08/11	17:09:00	6.11	
06/08/11	17:09:15	8.57	
06/08/11	17:09:30	17.02	
06/08/11	17:09:45	16.91	
06/08/11	17:10:00	13.99	
06/08/11	17:10:15	12.75	
06/08/11	17:10:30	12.55	
06/08/11	17:10:45	12.54	Accuracy #3
06/08/11	17:11:00	**12.57**	Cylinder #ALM-036029
06/08/11	17:11:15	**12.61**	**12.60** % Oxygen
06/08/11	17:11:30	**12.61**	
06/08/11	17:11:45	**12.61**	
06/08/11	17:12:00	12.72	
06/08/11	17:12:15	12.73	
06/08/11	17:12:30	13.21	
06/08/11	17:12:45	16.55	

CEM Calibration Error Data Sheet
Analyzer Response

		ANALYZER SPAN VALUE (% or ppm)		ANALYZER SPAN VALUE (% or ppm)	
Plant Name:	BP	**Inlet Oxygen**	NA	**Stack Oxygen**	NA
Sampling Location:	FCCU 500 Exhaust	**Inlet Carbon Dioxide**	NA	**Stack Carbon Dioxide**	NA
Date:	6/7/2011	**Inlet Carbon Monoxide**	NA	**Stack Carbon Monoxide**	NA
Plant Rep.:	Cheryl Joyal	**Inlet Oxides of Nitrogen**	NA	**Stack Oxides of Nitrogen**	NA
Team Leader:	S. Flaherty	**Inlet Sulfur Dioxide**	NA	**Stack Sulfur Dioxide**	NA
CEM Operator:	S. Flaherty	**Inlet VOM (as CH4)**	NA	**Stack VOM (as CH4)**	100.00
Time:	Pre-Test Cals				

		CYLINDER NUMBER	CYLINDER VALUE (% or ppm)	ANALYZER CALIBRATION RESPONSE	DIFFERENCE (% OF GAS/SPAN)
Stack Total VOM	**Zero**	ALM-051406: Zero Air	0.0	0.61	0.61
Stack Total VOM	**Low**	ALM-049361: 84.3ppm	25.0	25.38	0.38
Stack Total VOM	**Mid**	ALM-049361: 84.3ppm	50.0	51.38	1.38
Stack Total VOM	**High**	ALM-049361: 84.3ppm	84.3	85.40	1.10

CEM Calibration Error Data Sheet
Analyzer Response

		ANALYZER SPAN VALUE (% or ppm)		ANALYZER SPAN VALUE (% or ppm)	
Plant Name:	BP	**Inlet Oxygen**	NA	**Stack Oxygen**	NA
Sampling Location:	FCCU 500 Exhaust	**Inlet Carbon Dioxide**	NA	**Stack Carbon Dioxide**	NA
Date:	6/8/2011	**Inlet Carbon Monoxide**	NA	**Stack Carbon Monoxide**	NA
Plant Rep.:	Cheryl Joyal	**Inlet Oxides of Nitrogen**	NA	**Stack Oxides of Nitrogen**	NA
Team Leader:	S. Flaherty	**Inlet Sulfur Dioxide**	NA	**Stack Sulfur Dioxide**	NA
CEM Operator:	S. Flaherty	**Inlet VOM (as CH4)**	NA	**Stack VOM (as CH4)**	100.00
Time:	Pre-Test Cals				

		CYLINDER NUMBER	CYLINDER VALUE (% or ppm)	ANALYZER CALIBRATION RESPONSE	DIFFERENCE (% OF GAS/SPAN)
Stack Total VOM	**Zero**	ALM-051406: Zero Air	0.0	-0.57	-0.57
Stack Total VOM	**Low**	ALM-049361: 84.3ppm	25.0	25.91	0.91
Stack Total VOM	**Mid**	ALM-049361: 84.3ppm	50.0	51.49	1.49
Stack Total VOM	**High**	ALM-049361: 84.3ppm	84.3	83.74	-0.56

ENVIRONMENTAL INC.

CEM CALIBRATION DATA
System Bias and Drift

Company: BP
Location: Whiting, IN
Source: FCCU 500 Exhaust

Run:	1			2			3		
Date:	6/7/2011			6/8/2011			6/8/2011		
Time:	13:27-14:27			09:25-10:25			14:45-15:45		
Total VOM	**Pretest**	**Posttest**	**Drift**	**Pretest**	**Posttest**	**Drift**	**Pretest**	**Posttest**	**Drift**
Zero Calibration Response	0.61	0.16	-0.45	-0.57	-0.06	0.51	-0.06	0.15	0.22
Zero Bias, % of Span	0.61	0.16	-0.45	-0.57	-0.06	0.51	-0.06	0.15	0.22
Cal. Error Response	50.00	50.00		50.00	50.00		50.00	50.00	
System Response to Cal	51.38	49.90	-1.48	51.49	50.19	-1.30	50.19	49.81	-0.38
Cal Bias, % of Span	1.38	-0.10	-1.48	1.49	0.19	-1.30	0.19	-0.19	-0.38

Interference Response

Analyzer Type:	Oxygen (O_2)
Manufacturer:	Servomex
Detector Type:	Paramagnetic
Model No.:	1440
Serial No.:	1420C/2765
Calibration Span (%):	11.27

Test Gas	Test Gas Conc.	High Standard			Zero			Maximum % Interference
		O_2 without interferent	O_2 with interferent	% Interference	Zero without interferent	Zero with interferent	% Interference	
NH_3	10 ppm	11.27	11.27	0.00	0.03	0.01	0.18	0.18
SO_2	20 ppm	11.25	11.25	0.00	0.01	0.01	0.00	0.00
CH_4	50 ppm	11.24	11.25	0.09	0.02	0.04	-0.18	0.18
CO	50 ppm	11.23	11.24	0.09	0.00	0.01	-0.09	0.09
CO_2	5%	11.23	11.26	0.27	0.00	-0.01	0.09	0.27
CO_2	12.55%	11.25	11.27	0.18	0.03	-0.02	0.44	0.44
NO_2	15 ppm	11.22	11.24	0.18	0.01	0.00	0.09	0.18
NO_x	15 ppm	11.22	11.25	0.27	0.01	0.01	0.00	0.27
H_2	1,020 ppm	11.24	11.23	-0.09	0.02	0.01	0.09	0.09
HCl	10 ppm	11.29	11.31	0.18	0.00	-0.01	0.09	0.18

Sum of the highest absolute value obtained with and without the pollutant present:	1.88	%
Allowable interference response:	2.5	%

Certification Date: 8/9/2006

Operator:

Interference Response

Analyzer Type: Carbon Dioxide (CO_2)
Manufacturer: Servomex
Detector Type: NDIR
Model No.: 1440
Serial No.: 1415C
Calibration Span (%): 11.41

Test Gas	Test Gas Conc.	High Standard			Zero			Maximum % Interference
		CO_2 without interferent	CO_2 with interferent	% Interference	Zero without interferent	Zero with interferent	% Interference	
NH_3	10 ppm	11.41	11.39	-0.18	0.01	0.01	0.00	0.18
SO_2	20 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
CH_4	50 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
CO	50 ppm	11.41	11.41	0.00	0.01	0.01	0.00	0.00
NO_2	15 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
NO_x	15 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
H_2	1,020 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
HCl	10 ppm	11.41	11.38	-0.26	0.01	0.01	0.00	0.26

Sum of the highest absolute value obtained with and without the pollutant present: 0.44 %
Allowable interference response: 2.5 %

Certification Date: 8/9/2006
Operator: [signature]

USEPA Method 301 Validation of FTIR Data

Company: BP Whiting
Location: Whiting, IN
Source: FCCU 500
Date: 6/7/2011

Operator: SEY
Parameter: Acetaldehyde

Spike Gas = **95 ppm**
Spike SF6 = **1.03 ppm**

Sample Pair	Ss	Su	Ss-Su	(Ss-Su)^2	Ss(SF6)	DF	1-DF	Cs	1-DF*Su	CS
1	8.16	0.15	8.01	64.16	0.08	0.078	0.922	7.38	0.14	7.52
2	8.13	0.15	7.98	63.68	0.09	0.087	0.913	8.30	0.14	8.44
3	8.21	0.14	8.07	65.12	0.08	0.078	0.922	7.38	0.13	7.51
4	8.12	0.13	7.99	63.84	0.09	0.088	0.912	8.39	0.12	8.51
5	8.20	0.16	8.04	64.64	0.07	0.069	0.931	6.55	0.15	6.70
6	8.32	0.17	8.15	66.42	0.07	0.070	0.930	6.64	0.16	6.80
7	8.42	0.22	8.20	67.24	0.08	0.082	0.918	7.75	0.20	7.95
8	8.50	0.20	8.30	68.89	0.09	0.083	0.917	7.93	0.18	8.12
9	7.64	0.24	7.40	54.76	0.09	0.083	0.917	7.93	0.22	8.15
10	7.72	0.24	7.48	55.95	0.08	0.082	0.918	7.75	0.22	7.97
11	8.04	0.24	7.80	60.84	0.07	0.071	0.929	6.73	0.22	6.96
12	8.03	0.21	7.82	61.15	0.07	0.069	0.931	6.55	0.20	6.74
	8.12	***0.19***	**7.94**	**756.70**	**0.081**	**0.078**	**0.922**	***7.44***	**0.17**	***7.61***

SD=	**0.2514**	**0.0420**		**SD SQRT(SD(Ss^2)+SD(Su^2)) =**	**0.2549**
SD^2=	0.0632	0.0018			
RSD=	**3.1%**	**22.4%**	**(< 50%)**	**t test = B/SD =**	***2.005***

if t test > 2.201 then must use correction factor

CsS=	**7.61**	
B=	***0.51***	
CF=	***1.069***	**(0.7<CF<1.3)**

% difference= ***6.29%***

Ss = spiked result
Su = unspiked result
Cs = diluted spike concentration
CS = expected spiked concentration
DF = dilution factor based on tracer gas or mass flowmeters
B = calculated bias
CF = calculated correction factor
t = student t test

USEPA Method 301 Validation of FTIR Data

Company: BP Whiting
Location: Whiting, IN
Source: FCCU 500
Date: 6/7/2011

Operator: SEY
Parameter: Formaldehyde

Spike Gas = 97.3 ppm
Spike SF6 = 9.86 ppm

Sample Pair	Ss	Su	Ss-Su	(Ss-Su)^2	Ss(SF6)	DF	1-DF	Cs	1-DF*Su	CS
1	4.30	0.01	4.29	18.40	0.411	0.042	0.958	4.06	0.01	4.07
2	4.37	0.02	4.35	18.88	0.412	0.042	0.958	4.07	0.02	4.08
3	4.21	0.02	4.19	17.56	0.395	0.040	0.960	3.90	0.02	3.92
4	4.07	0.02	4.05	16.40	0.399	0.040	0.960	3.94	0.02	3.96
5	3.98	0.02	3.97	15.72	0.387	0.039	0.961	3.82	0.01	3.83
6	3.92	0.02	3.91	15.25	0.385	0.039	0.961	3.80	0.01	3.81
7	3.85	0.02	3.83	14.67	0.383	0.039	0.961	3.78	0.02	3.80
8	3.77	0.02	3.75	14.06	0.381	0.039	0.961	3.76	0.02	3.78
9	3.75	0.02	3.73	13.91	0.382	0.039	0.961	3.77	0.02	3.79
10	3.76	0.02	3.74	13.99	0.380	0.039	0.961	3.75	0.02	3.77
11	3.71	0.01	3.70	13.69	0.379	0.038	0.962	3.74	0.01	3.75
12	3.65	0.03	3.62	13.10	0.377	0.038	0.962	3.72	0.03	3.75
	3.94	***0.02***	**3.93**	**185.64**	**0.389**	**0.039**	**0.961**	***3.84***	**0.02**	***3.86***

SD= 0.2420 0.0054 **SD SQRT(SD(Ss^2)+SD(Su^2)) =** 0.2421
SD^2= 0.0586 0.0000
RSD= 6.1% 29.3% **(< 50%)**

t test = B/SD = ***0.354***
if t test > 2.201 then must use correction factor

CsS= 3.86
B= ***0.09***
CF= ***1.022*** **(0.7<CF<1.3)**

% difference= ***2.17%***

Ss = spiked result
Su = unspiked result
Cs = diluted spike concentration
CS = expected spiked concentration
DF = dilution factor based on tracer gas or mass flowmeters
B = calculated bias
CF = calculated correction factor
t = student t test

USEPA Method 301 Validation of FTIR Data

Company: BP Whiting
Location: Whiting, IN
Source: FCCU 500
Date: 6/7/2011

Operator: SEY
Parameter: Hydrogen Cyanide

Spike Gas = 100 ppm
Spike SF6 = 10 ppm

Sample Pair	Ss	Su	Ss-Su	(Ss-Su)^2	Ss(SF6)	DF	1-DF	Cs	1-DF*Su	CS
1	9.37	0.43	8.94	79.92	0.98	0.098	0.902	9.80	0.39	10.19
2	9.38	0.39	8.99	80.82	1.01	0.101	0.899	10.10	0.35	10.45
3	8.93	0.33	8.60	73.96	0.84	0.084	0.916	8.40	0.30	8.70
4	9.04	0.34	8.70	75.69	0.86	0.086	0.914	8.60	0.31	8.91
5	8.28	0.37	7.91	62.57	0.91	0.091	0.909	9.10	0.34	9.44
6	8.73	0.29	8.44	71.23	0.89	0.089	0.911	8.90	0.26	9.16
7	9.30	0.33	8.97	80.46	0.86	0.086	0.914	8.60	0.30	8.90
8	9.39	0.31	9.08	82.45	0.85	0.085	0.915	8.50	0.28	8.78
9	8.77	0.63	8.14	66.26	0.93	0.093	0.907	9.30	0.57	9.87
10	8.82	0.61	8.21	67.40	0.91	0.091	0.909	9.10	0.55	9.65
11	8.48	0.24	8.24	67.90	0.93	0.093	0.907	9.30	0.22	9.52
12	8.57	0.27	8.30	68.89	0.91	0.091	0.909	9.10	0.25	9.35
	8.92	***0.38***	**8.54**	**877.55**	**0.907**	**0.091**	**0.909**	***9.07***	**0.34**	***9.41***

SD= 0.3800 0.1241
SD^2= 0.1444 0.0154
RSD= 4.3% 32.8% (< 50%)

SD SQRT(SD(Ss^2)+SD(Su^2)) = 0.3997

t test = B/SD = ***1.223***
if t test > 2.201 then must use correction factor

CsS= 9.41
B= ***-0.49***
CF= ***0.946*** (0.7<CF<1.3)

% difference= ***-5.48%***

Ss = spiked result
Su = unspiked result
Cs = diluted spike concentration
CS = expected spiked concentration
DF = dilution factor based on tracer gas or mass flowmeters
B = calculated bias
CF = calculated correction factor
t = student t test

USEPA Method 301 Validation of FTIR Data

Company: BP Whiting
Location: Whiting, IN
Source: FCCU 500
Date: 6/9/2011

Operator: SEY
Parameter: Ammonia

Spike Gas = 100 ppm
Spike SF6 = 10 ppm

Sample Pair	Ss	Su	Ss-Su	(Ss-Su)^2	Ss(SF6)	DF	1-DF	Cs	1-DF*Su	CS
1	9.27	0.56	8.71	75.86	0.93	0.093	0.907	9.30	0.51	9.81
2	9.06	0.40	8.66	75.00	0.94	0.094	0.906	9.40	0.36	9.76
3	9.03	0.47	8.56	73.27	0.92	0.092	0.908	9.20	0.43	9.63
4	9.05	0.34	8.71	75.86	0.91	0.091	0.909	9.10	0.31	9.41
5	9.51	0.14	9.37	87.80	0.90	0.090	0.910	9.00	0.13	9.13
6	9.62	0.28	9.34	87.27	0.90	0.090	0.910	9.00	0.25	9.25
7	8.06	0.21	7.85	61.62	0.95	0.095	0.905	9.50	0.19	9.69
8	8.12	0.23	7.89	62.25	0.94	0.094	0.906	9.40	0.21	9.61
9	8.18	0.31	7.87	61.94	0.96	0.096	0.904	9.60	0.28	9.88
10	8.11	0.21	7.90	62.33	0.96	0.096	0.904	9.60	0.19	9.79
11	9.43	0.41	9.02	81.36	0.92	0.092	0.908	9.20	0.37	9.57
12	9.61	0.49	9.12	83.17	0.93	0.093	0.907	9.30	0.44	9.74
	8.92	***0.34***	**8.58**	**887.74**	**0.930**	**0.093**	**0.907**	***9.30***	**0.31**	***9.61***

SD= **0.6281** **0.1303** **SD SQRT(SD(Ss^2)+SD(Su^2)) =** **0.6415**
SD^2= 0.3945 0.0170
RSD= **7.0%** **38.6%** **(< 50%)** **t test = B/SD =** ***1.069***
if t test > 2.201 then must use correction factor

CsS= **9.61**
B= ***-0.69***
CF= ***0.926*** **(0.7<CF<1.3)**

% difference= ***-7.68%***

Ss = spiked result
Su = unspiked result
Cs = diluted spike concentration
CS = expected spiked concentration
DF = dilution factor based on tracer gas or mass flowmeters
B = calculated bias
CF = calculated correction factor
t = student t test

SPECIALTY GASES OF AMERICA, INC.
AMERICAN INDUSTRIAL GASES, INC.
AMERICAN RARE GASES, INC.

6055 BRENT DR. TOLEDO, OH 43611
419-729-7732 FAX 419-729-2411

THE AMERICAN GAS GROUP

www.americangasgroup.com

ANALYTICAL REPORT

Certificate ID:	032111078	**Date:**	3/21/2011
Customer Name:	SGA LLC		
Customer Address:	300 Sumac Road		
	Wheeling IL 60090		
Purchase Order:	1541	**Work Order:**	116633-00
Lot Number:	0321JC11	**Product Name:**	3-Component Mixture
Size:	A31	**Pressure:**	1815 psig @ 70 Deg F
Content:	3330 Liters		
Serial #:	EB0025232		

Component	Nominal	Actual	Accuracy	Method
Hydrogen Cyanide	50.0 ppm	50.1 ppm	+/- 2% rel	Gravimetric
Sulfur Hexafluoride	5.00 ppm	5.00 ppm	+/- 2% rel	Gravimetric
Nitrogen	Balance	Balance		

Note: EXPIRATION DATE: 03/18/2012

NIST TRACEABLE

Issued by: Josh Jones

MSDS

GASES-COMPRESSED OR LIQUEFIED (INCLUDING REFRIGERANT GASES) UN1956 ERG2004

Scott Specialty Gases
1290 Combermere ST.
Troy, MI. 48083
800-774-9447

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- Some may burn, but none ignite readily .
- Containers may explode when heated.
- Ruptured cylinders may rocket.

HEALTH

- Vapors may cause dizziness or asphyxiation without warning.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire may produce irritating, corrosive and/or toxic gases.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 500 meters (1/3 mile).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

FIRE

- Use extinguishing agent suitable for type of surrounding fire.

Small Fires

- Dry chemical or CO_2.

Large Fires

- Water spray, fog or regular foam.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

Fire involving Tanks

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- Some of these materials, if spilled, may evaporate leaving a flammable residue.

SPILL OR LEAK

- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Do not direct water at spill or source of leak.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements or confined areas.
- Allow substance to evaporate.
- Ventilate the area.

FIRST AID

- Move victim to fresh air. • Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

1290 COMBERMERE STREET
Shipped TROY MI 48083
From: Phone: 248-589-2950 Fax: 248-589-2134

C E R T I F I C A T E O F A N A L Y S I S

ALASG
WAREHOUSE/STOCK/
UNIT A
27 FORESTWOOD COURT
ROMEOVILLE IL 60446

PROJECT #: 05-94003-001
PO#: GENERAL STOCK
ITEM #: 0501024 AL
DATE: 21Dec2010

CYLINDER #: ALM051406
FILL PRESSURE: 02000 PSIG

PURE MATERIAL: AIR CAS# 132259-10-0

GRADE: ZERO AIR

PURITY: -

IMPURITY	MAXIMUM CONCENTRATIONS	ACTUAL CONCENTRATIONS
THC	1 PPM	< 1 PPM
O2	20 TO 21%	20.8%

QC BATCH : AIR122110

ANALYST: _____
SAJAD HYDER

AIR LIQUIDE | Air Liquide America Specialty Gases LLC | Scott™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: IL-135-11
Document # : 40995246-002

Customer

ARI ENVIRONMENTAL, INC.

951 OLD RAND ROAD #106
WAUCONDA IL 60084
US

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM049361 **Certification Date:** 21Mar2011 **Exp. Date:** 20Mar2014
Cylinder Pressure*:** 1950 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
METHANE	84.3 PPM	+/- 1%	Direct NIST and VSL
AIR	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2751	30Apr2016	K022940	100.2 PPM	METHANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
MAN/3400/7506	02Mar2011	TCD/FID

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

METHANE

Date: 21Mar2011 Response Unit: AREA
Z1 = 0.00000 R1 = 899986.0 T1 = 758175.0
R2 = 899807.0 Z2 = 0.00000 T2 = 758270.0
Z3 = 0.00000 T3 = 758120.0 R3 = 905522.0
Avg. Concentration: 84.30 PPM

Second Triad Analysis

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999997
Constants: A = 0.06730628
B = 0.000108569 C = 0
D = 0 E = 0

APPROVED BY: ROBERT CESNIAK

E-18

AIR LIQUIDE Air Liquide America Specialty Gases LLC | Scott™

CUSTOM CLASS

6141 EASTON ROAD, BLDG 1, PLUMSTEADVILLE, PA 18949-0310 Phone: 800-331-4953 Fax: 215-766-7226

CERTIFICATE OF ACCURACY: Custom Class Calibration Standard

Product Information
Document # : 41650228-002
Item No.: MF300176-Z-30AL
P.O. No.: IL-240-11

Cylinder Number: ALM064806
Cylinder Size: 30AL
Certification Date: 25May2011
Expiration Date: 25May2012

Customer

ARI ENVIRONMENTAL, INC.
951 OLD RAND ROAD #106
WAUCONDA, IL 60084
US

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)	
FORMALDEHYDE	11.2	PPM	5	
SULFUR HEXAFLUORIDE	10.2	PPM	5	Dual-Certified
NITROGEN		BALANCE		

TRACEABILITY

Description	Traceability Type	Traceable To
BLEND PROCESS TRACEABILITY	WEIGHT	NIST
ANALYTICAL TRACEABILITY	GAS STANDARDS	SRS

APPROVED BY: T. Ludwig
T.LUDWIG

DATE: 5-25-11

SPECIALTY GASES OF AMERICA, INC.
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AMERICAN RARE GASES, INC.

6055 BRENT DR. TOLEDO, OH 43611
419-729-7732 FAX 419-729-2411

THE AMERICAN GAS GROUP

www.americangasgroup.com

ANALYTICAL REPORT

Certificate ID:	031611034	**Date:**	3/16/2011
Customer Name:	SGA LLC		
Customer Address:	300 Sumac Road		
	Wheeling IL 60090		
Purchase Order:	1538	**Work Order:**	116539-02
Lot Number:	0315SD11	**Product Name:**	3-Component Mixture
Size:	A31	**Pressure:**	2200 psig @ 80 Deg F
Content:	N/A		
Serial #:	EB0030041		

Component	Nominal	Actual	Accuracy	Method
Acetadehyde	1000 ppm	994 ppm	+/- 2% rel	Gravimetric
Sulfur Hexafluoride	10.0 ppm	10.0 ppm	+/- 2% rel	Gravimetric
Nitrogen	Balance	Balance		

Note: EXPIRATION DATE: 03/15/2012

Issued by: Josh Jones

SPECIALTY GASES OF AMERICA, INC.
AMERICAN INDUSTRIAL GASES, INC.
AMERICAN RARE GASES, INC.

6055 BRENT DR. TOLEDO, OH 43611
419-729-7732 FAX 419-729-2411

THE AMERICAN GAS GROUP

www.americangasgroup.com

ANALYTICAL REPORT

Certificate ID:	021811036	**Date:**	2/18/2011
Customer Name:	SGA LLC		
Customer Address:	300 Sumac Road		
	Wheeling IL 60090		
Purchase Order:	1483	**Work Order:**	115716-00
Lot Number:	0212SD11	**Product Name:**	3-Component Mixture, Certified
Size:	A31	**Pressure:**	2200 psig @ 80 Deg F
Content:	N/A		
Serial #:	CC275860		

Component	Nominal	Actual	Accuracy	Method
Ammonia	100 ppm	101 ppm	+/- 2% rel	FTIR
Sulfur Hexafluoride	10.0 ppm	9.85 ppm	+/- 5% rel	FTIR
Nitrogen	Balance	Balance		

Note: Expiration Date: 02/12/2012

Issued by: Josh Jones

SPECIALTY GASES OF AMERICA, INC.
AMERICAN INDUSTRIAL GASES, INC.
AMERICAN RARE GASES, INC.

6055 BRENT DR. TOLEDO, OH 43611
419-729-7732 FAX 419-729-2411

THE AMERICAN GAS GROUP

www.americangasgroup.com

ANALYTICAL REPORT

Certificate ID: 031111056 **Date:** 3/11/2011

Customer Name: SGA LLC

Customer Address: 300 Sumac Road

Wheeling IL 60090

Purchase Order: 1558 **Work Order:** 116834-02

Lot Number: 0310SD11 **Product Name:** 3-Component Mixture

Size: A31 **Pressure:** 2200 psig @ 80 Deg F

Content: N/A

Serial #: EB0025325

Component	Nominal	Actual	Accuracy	Method
Ethylene	100 ppm	99.4 ppm	+/- 2% rel	Gravimetric
Sulfur Hexafluoride	10.0 ppm	9.94 ppm	+/- 5% rel	Gravimetric
Nitrogen	Balance	Balance		

Note: EXPIRATION DATE: 03/10/2012

Issued by: Josh Jones

ARI ENVIRONMENTAL, INC.

Pretest Meter Calibration Data

Model #: Apex VOST Console
Serial #: VOST 212027
Date: 4/21/2011

Barometric Pressure, In. Hg: 29.55
Secondary Std. Model: Gilabrator Bubble Generator
Secondary Standard SN: 4878-S

DRY GAS METER DATA								SECONDARY STANDARD TEST METER DATA					
						Temperature			Average Flow			Temperature	
		Volume	Volume	Volume		T_{mi}	T_{mo}	Static	During Test	Volume		T_{mi}	T_{mo}
ΔH	Time	Initial	Final	Total		Inlet	Outlet	Pressure	Period	Total		Inlet	Outlet
(in. H_2O)	(min)	(liters)	(liters)	(Liters)		(°F)	(°F)	(in. Water)	(liters/min)	(liters)		(°F)	(°F)
0.59	11.0	0.000	5.474	5.474	Initial>	73	4	-0.20	0.5041	5.545	Initial>	76	76
					Final >	74	74				Final >	76	76
0.67	10.0	0.000	9.868	9.868	Initial>	72	72	-0.20	1.0040	10.040	Initial>	76	76
					Final >	73	73				Final >	76	76
0.75	10.0	0.000	14.951	14.951	Initial>	74	74	-0.20	1.5056	15.056	Initial>	76	76
					Final >	75	75				Final >	76	76
0.83	10.0	0.000	19.797	19.797	Initial>	76	76	-0.20	1.9984	19.984	Initial>	76	76
					Final >	76	76				Final >	76	76
0.98	12.0	0.000	29.871	29.871	Initial>	77	77	-0.20	2.5001	30.001	Initial>	76	76
					Final >	77	77				Final >	76	76

DRY GAS METER PRETEST CALIBRATION RESULTS

DRY GAS METER STANDARD VOLUME (Liters)	SECONDARY STANDARD VOLUME (Liters)	CALIBRATION FACTOR, Y_d (dimensionless)	Deviation (%)
5.5375	5.3921	0.9737	2.512
9.6797	9.7630	1.0086	-0.973
14.6138	14.6406	1.0018	-0.297
19.3001	19.4326	1.0069	-0.800
29.0779	29.1734	1.0033	-0.442

AVERAGE PRETEST METER CALIBRATION FACTOR, Y_d = 0.999

Signature: _____ **Date:** 4-21-11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Full-Test calibration

Meter Box: VOST 0212027
Date: 4/21/2011
Barometric 29.55
Amb Temp: 76
Calibrator: B.Crane

Reference Temperature	Thermometer Temperature	Difference % Mean	Thermometer Temperature	Difference % Mean
Altek	Probe		Filter	Flter
0	-3	-0.7	-2	-0.4
100	100	0.0	100	0.0
200	200	0.0	201	0.2
300	300	0.0	300	0.0
400	397	-0.3	398	-0.2
500	500	0.0	500	0.0

Reference Temperature	Thermometer Temperature	Difference % Mean	0.992 Temperature	Difference % Mean
Altek	Meter	Meter	Aux	Aux
0	-3	-0.7	-2	-0.4
100	99	-0.2	101	0.2
200	200	0.0	201	0.2
300	300	0.0	301	0.1
400	397	-0.3	398	-0.2
500	500	0.0	501	0.1

ARI ENVIRONMENTAL, INC.

Post Test Meter Calibration Data

Model #: Apex Instruments VOST Console
Serial #: VOST 0212027
Date: 6/29/2011

Barometric Pressure, in. Hg: 29.43
Secondary Std. Model: Gilabrator Bubble Generator
Secondary Standard SN: 8748-S

Pretest Meter Y_d = 0.999
Date of Pretest = 4/21/11

DRY GAS METER DATA							
						Temperature	
ΔH (in. H_2O)	Time (min)	Volume Initial (liters)	Volume Final (liters)	Volume Total (Liters)		T_{mi} Inlet (°F)	T_{mo} Outlet (°F)
0.55	10.0	0.000	4.595	4.595	Initial>	79	79
					Final >	81	81
0.55	10.0	0.000	4.472	4.472	Initial>	81	81
					Final >	81	81
0.55	11.0	0.000	4.846	4.846	Initial>	81	81
					Final >	82	82

SECONDARY STANDARD TEST METER DATA					
	Average Flow			Temperature	
Static Pressure (in. Water)	During Test Period (liters/min)	Volume Total (liters)		T_{mi} Inlet (°F)	T_{mo} Outlet (°F)
0.00	0.4797	4.797	Initial>	76	76
			Final >	76	76
0.00	0.4702	4.702	Initial>	76	76
			Final >	75	75
0.00	0.4505	4.956	Initial>	77	77
			Final >	77	77

DRY GAS METER POST TEST CALIBRATION RESULTS

DRY GAS METER STANDARD VOLUME (Liters)	SECONDARY STANDARD VOLUME (Liters)	CALIBRATION FACTOR, Y_d (dimensionless)	Deviation (%)
4.4254	4.6480	1.0503	-0.336
4.2990	4.5602	1.0608	-1.383
4.6542	4.7927	1.0298	1.719

AVERAGE POST TEST METER CALIBRATION FACTOR, Y = 1.047

AVERAGE PRETEST METER CALIBRATION FACTOR, Y_d = 0.999

% DIFFERENCE (Pretest -vs- Post Test) = -4.80% **(± 5.0% allowable)**

Signature: W H Crane **Date:** 6-29-11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Post-Test calibration

Meter Box: VOST 0212027
Date: 6/29/2011
Barometric 29.43
Amb Temp: 76
Calibrator: B.Crane

Reference Temperature	Thermometer Temperature	Difference % Mean	Thermometer Temperature	Difference % Mean
Altek	Probe		Filter	Filter
0	-2	-0.4	-2	-0.4
100	99	-0.2	99	-0.2
200	201	0.2	201	0.2
300	300	0.0	300	0.0
400	398	-0.2	398	-0.2
500	500	0.0	500	0.0

Reference Temperature	Thermometer Temperature	Difference % Mean	0.992 Temperature	Difference % Mean
Altek	Meter	Meter	Aux	Aux
0	-1	-0.2	-1	-0.2
100	100	0.0	99	-0.2
200	202	0.3	202	0.3
300	301	0.1	300	0.0
400	399	-0.1	398	-0.2
500	501	0.1	500	0.0

ARI ENVIRONMENTAL, INC.

Pretest Meter Calibration Data

Model #: Apex VOST Console
Serial #: VOST 209023
Date: 4/20/2011

Barometric Pressure, in. Hg: 29.35
Secondary Std. Model: Gilabrator Bubble Generator
Secondary Standard SN: 4878-S

DRY GAS METER DATA								SECONDARY STANDARD TEST METER DATA					
						Temperature			Average Flow			Temperature	
		Volume	Volume	Volume		T_{mi}	T_{mo}	Static	During Test	Volume		T_{mi}	T_{mo}
ΔH	Time	Initial	Final	Total		Inlet	Outlet	Pressure	Period	Total		Inlet	Outlet
(in. H_2O)	(min)	(liters)	(liters)	(Liters)		(°F)	(°F)	(in. Water)	(liters/min)	(liters)		(°F)	(°F)
0.94	10.0	0.000	10.177	10.177	Initial>	74	74	-0.10	1.0181	10.181	Initial>	75	75
					Final >	74	74				Final >	75	75
0.87	10.0	0.000	5.013	5.013	Initial>	74	74	-0.10	0.5069	5.069	Initial>	75	75
					Final >	74	74				Final >	75	75
1.06	10.0	0.000	15.202	15.202	Initial>	74	74	-0.10	1.5189	15.189	Initial>	75	75
					Final >	74	74				Final >	75	75
1.14	10.0	0.000	20.246	20.246	Initial>	74	74	-0.10	1.9930	19.930	Initial>	75	75
					Final >	74	74				Final >	75	75
1.30	10.0	0.000	25.352	25.352	Initial>	74	74	-0.10	2.5212	25.212	Initial>	75	75
					Final >	74	74				Final >	75	75

DRY GAS METER PRETEST CALIBRATION RESULTS

DRY GAS METER STANDARD VOLUME (Liters)	SECONDARY STANDARD VOLUME (Liters)	CALIBRATION FACTOR, Y_d (dimensionless)	Deviation (%)
9.8942	9.8539	0.9959	-0.277
4.8728	4.9061	1.0068	-1.367
14.7840	14.7010	0.9944	-0.123
19.6932	19.2897	0.9795	1.365
24.6697	24.4020	0.9891	0.401

AVERAGE PRETEST METER CALIBRATION FACTOR, Y_d = 0.993

Signature: _____ Date: 4·20·11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Full-Test calibration

Meter Box: VOST 209023
Date: 4/20/2011
Barometric 29.35
Amb Temp: 74
Calibrator: B. Crane

Reference Temperature	Thermometer Temperature	Difference % Mean	Thermometer Temperature	Difference % Mean
Altek	Probe		Filter	Flter
0	-1	-0.2	-1	-0.2
100	101	0.2	101	0.2
200	202	0.3	202	0.3
300	301	0.1	301	0.1
400	399	-0.1	399	-0.1
500	501	0.1	501	0.1

Reference Temperature	Thermometer Temperature	Difference % Mean	0.992 Temperature	Difference % Mean
Altek	Meter	Meter	Aux	Aux
0	-1	-0.2	-1	-0.2
100	100	0.0	101	0.2
200	201	0.2	202	0.3
300	300	0.0	302	0.3
400	398	-0.2	399	-0.1
500	500	0.0	501	0.1

ARI ENVIRONMENTAL, INC.

Post Test Meter Calibration Data

Model #: Apex Instruments VOST Console
Serial #: VOST 209023
Date: 6/29/2011

Barometric Pressure, in. Hg: 29.43
Secondary Std. Model: Gilabrator Bubble Generator
Secondary Standard SN: 8748-S

Pretest Meter Y_d = 0.993
Date of Pretest = 4/20/11

DRY GAS METER DATA								SECONDARY STANDARD TEST METER DATA					
						Temperature			Average Flow			Temperature	
ΔH	Time	Volume Initial	Volume Final	Volume Total		T_{mi} Inlet	T_{mo} Outlet	Static Pressure	During Test Period	Volume Total		T_{mi} Inlet	T_{mo} Outlet
(in. H_2O)	(min)	(liters)	(liters)	(Liters)		(°F)	(°F)	(in. Water)	(liters/min)	(liters)		(°F)	(°F)
0.91	10.0	0.000	4.858	4.858	Initial>	80	80	0.00	0.4985	4.985	Initial>	77	77
					Final >	82	82				Final >	79	79
0.91	10.0	0.000	4.852	4.852	Initial>	84	84	0.00	0.4872	4.872	Initial>	79	79
					Final >	85	85				Final >	79	79
0.91	10.0	0.000	4.942	4.942	Initial>	86	86	0.00	0.4915	4.915	Initial>	79	79
					Final >	88	88				Final >	78	78

DRY GAS METER POST TEST CALIBRATION RESULTS

DRY GAS METER STANDARD VOLUME (Liters)	SECONDARY STANDARD VOLUME (Liters)	CALIBRATION FACTOR, Y_d (dimensionless)	Deviation (%)
4.6742	4.8122	1.0295	-1.301
4.6384	4.6944	1.0121	0.444
4.7029	4.7402	1.0079	0.857

AVERAGE POST TEST METER CALIBRATION FACTOR, Y = 1.017

AVERAGE PRETEST METER CALIBRATION FACTOR, Y_d = 0.993

% DIFFERENCE (Pretest -vs- Post Test) = -2.37% **(± 5.0% allowable)**

Signature: _____ **Date:** 6.29.11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Post-Test calibration

Meter Box: VOST 209023
Date: 6/29/2011
Barometric 29.43
Amb Temp: 76
Calibrator: B. Crane

Reference Temperature	Thermometer Temperature	Difference % Mean	Thermometer Temperature	Difference % Mean
Altek	Probe		Filter	Flter
0	2	0.4	1	0.2
100	103	0.5	103	0.5
200	204	0.6	204	0.6
300	303	0.4	303	0.4
400	401	0.1	304	-11.2
500	503	0.3	503	0.3

Reference Temperature	Thermometer Temperature	Difference % Mean	0.992 Temperature	Difference % Mean
Altek	Meter	Meter	Aux	Aux
0	1	0.2	1	0.2
100	101	0.2	102	0.4
200	204	0.6	204	0.6
300	3021	358.0	303	0.4
400	401	0.1	401	0.1
500	502	0.2	502	0.2

ARI ENVIRONMENTAL, INC.

Pretest Meter Calibration Data

Model #: Apex VOST Console
Serial #: VOSt 703006
Date: 4/25/2011

Barometric Pressure, in. Hg: 29.15
Secondary Std. Model: Gilabrator Bubble Generator
Secondary Standard SN: 4878-S

DRY GAS METER DATA								SECONDARY STANDARD TEST METER DATA					
						Temperature			Average Flow			Temperature	
		Volume	Volume	Volume		T_{mi}	T_{mo}	Static	During Test	Volume		T_{mi}	T_{mo}
ΔH (in. H_2O)	Time (min)	Initial (liters)	Final (liters)	Total (Liters)		Inlet (°F)	Outlet (°F)	Pressure (in. Water)	Period (liters/min)	Total (liters)		Inlet (°F)	Outlet (°F)
3.74	10.0	0.000	24.903	24.903	Initial>	70	70	-0.20	2.4899	24.899	Initial>	72	72
					Final >	73	73				Final >	73	73
2.87	15.0	0.000	30.189	30.189	Initial>	73	73	-0.20	2.0088	30.132	Initial>	73	73
					Final >	75	75				Final >	73	73
2.17	10.0	0.000	15.071	15.071	Initial>	76	76	-0.20	1.5005	15.005	Initial>	73	73
					Final >	77	77				Final >	73	73
1.50	10.0	0.000	10.141	10.141	Initial>	77	77	-0.16	1.0085	10.085	Initial>	73	73
					Final >	78	78				Final >	73	73
0.91	12.0	0.000	6.100	6.100	Initial>	78	78	-0.20	0.5096	6.115	Initial>	74	74
					Final >	78	78				Final >	74	74

DRY GAS METER PRETEST CALIBRATION RESULTS

DRY GAS METER STANDARD VOLUME (Liters)	SECONDARY STANDARD VOLUME (Liters)	CALIBRATION FACTOR, Y_d (dimensionless)	Deviation (%)
24.3297	24.0411	0.9881	0.836
29.2921	29.0665	0.9923	0.420
14.5296	14.4744	0.9962	0.030
9.7421	9.7294	0.9987	-0.219
5.8459	5.8879	1.0072	-1.068

AVERAGE PRETEST METER CALIBRATION FACTOR, Y_d = 0.997

Signature: _____ **Date:** 4·25·11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Full-Test calibration

Meter Box: VOST 703006
Date: 4/25/2011
Barometric 29.15
Amb Temp: 74
Calibrator: B. Crane

Reference Temperature	Thermometer Temperature	Difference % Mean	Thermometer Temperature	Difference % Mean
Altek	Probe		Filter	Flter
0	0	0.0	0	0.0
100	102	0.4	102	0.4
200	203	0.5	203	0.5
300	302	0.3	302	0.3
400	400	0.0	400	0.0
500	502	0.2	503	0.3

Reference Temperature	Thermometer Temperature	Difference % Mean	0.992 Temperature	Difference % Mean
Altek	Meter	Meter	Aux	Aux
0	0	0.0	0	0.0
100	102	0.4	102	0.4
200	203	0.5	203	0.5
300	302	0.3	302	0.3
400	400	0.0	400	0.0
500	502	0.2	502	0.2

ARI ENVIRONMENTAL, INC.

Post Test Meter Calibration Data

Model #: Apex Instruments VOST Console **Barometric Pressure, in. Hg:** 29.43 **Pretest Meter Y_d =** 0.997

Serial #: VOST 703006 **Secondary Std. Model:** Gilabrator Bubble Generator **Date of Pretest =** 4/25/11

Date: 6/29/2011 **Secondary Standard SN:** 8748-S

DRY GAS METER DATA								SECONDARY STANDARD TEST METER DATA					
						Temperature			Average Flow			Temperature	
		Volume	Volume	Volume		T_{mi}	T_{mo}	Static	During Test	Volume		T_{mi}	T_{mo}
ΔH	Time	Initial	Final	Total		Inlet	Outlet	Pressure	Period	Total		Inlet	Outlet
(in. H_2O)	(min)	(liters)	(liters)	(Liters)		(°F)	(°F)	(in. Water)	(liters/min)	(liters)		(°F)	(°F)
0.91	10.0	0.000	5.037	5.037	Initial>	85	85	0.00	0.5037	5.037	Initial>	79	79
					Final >	88	88				Final >	80	80
0.91	11.0	0.000	5.624	5.624	Initial>	89	89	0.00	0.5080	5.588	Initial>	79	79
					Final >	90	90				Final >	78	78
0.91	10.0	0.000	5.126	5.126	Initial>	90	90	0.00	0.5094	5.094	Initial>	77	77
					Final >	91	91				Final >	80	80

DRY GAS METER POST TEST CALIBRATION RESULTS

DRY GAS METER STANDARD VOLUME (Liters)	SECONDARY STANDARD VOLUME (Liters)	CALIBRATION FACTOR, Y_d (dimensionless)	Deviation (%)
4.7977	4.8489	1.0107	0.128
5.3275	5.3893	1.0116	0.036
4.8470	4.9129	1.0136	-0.164

AVERAGE POST TEST METER CALIBRATION FACTOR, Y = 1.012

AVERAGE PRETEST METER CALIBRATION FACTOR, Y_d = 0.997

% DIFFERENCE (Pretest -vs- Post Test) = -1.50% **(± 5.0% allowable)**

Signature: _____ **Date:** 6-29-11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Post-Test calibration

Meter Box: VOST 703006
Date: 6/29/2011
Barometric 29.43
Amb Temp: 76
Calibrator: B.Crane

Reference Temperature	Thermometer Temperature	Difference % Mean	Thermometer Temperature	Difference % Mean
Altek	Probe		Filter	Flter
0	1	0.2	1	0.2
100	102	0.4	102	0.4
200	204	0.6	204	0.6
300	303	0.4	303	0.4
400	401	0.1	401	0.1
500	503	0.3	503	0.3

Reference Temperature	Thermometer Temperature	Difference % Mean	0.992 Temperature	Difference % Mean
Altek	Meter	Meter	Aux	Aux
0	1	0.2	1	0.2
100	103	0.5	102	0.4
200	204	0.6	204	0.6
300	304	0.5	303	0.4
400	402	0.2	401	0.1
500	504	0.4	503	0.3

APEX INSTRUMENTS METER CONSOLE CALIBRATION

APEX SOURCE TESTING EQUIPMENT INSTRUMENTS

Meter Console Information					
Console Model	MC-623	Console Serial Number	0511024	Encoder Model	HEDS-5701-A02
Gas Meter Model	AP25	Totalizer Scale Factor (Initial)	7.7500	Totalizer Model	Red Lion
Gas Meter Serial#	1902969	Totalizer Scale Factor (Final)	**7.7123**	Temp Display Model	Watlow SD31

Calibration Conditions							
WTM ID	539784	Calibration Technician	EW			Calibration Date	31-May-11
WTM Cal Factor	1.0024	Barometric Pressure	(Pb)	757	mm Hg		

	Calibration Data									Results		
	Run Time	Dry Gas Meter			Wet Test Meter		Standardized Volumes			Totalizer Gamma	Totalizer Gamma	Corrected Flowrate
	Elapsed	Gas Pressure	Gas Temp	Totalizer Display	Gas Volume	Gas Temp	Totalizer Initial SF	Totalizer Final SF	Wet Test Meter	Value	Variation	
	(Θ)	(P_m)	(t_m)		(V_w)	(t_w)	($V_{m(std)}$)	($V_{m(std)}$)	($V_{w(std)}$)	(Y)	(ΔY)	(Q_m)
	min	mm H_2O	°C	liters	liters	°C	std liters	std liters	std liters			slm
Run 1 - Initial	0.00	42.0	27	0.000	55.298	25.0						
Final	5.00	42.0	27	21.118	76.114	25.0						
Total/Avg	5.00	42.0	27.0	21.118	20.816	25.0	20.642	20.542	20.449	0.9955	-0.005	4.10
Run 2 - Initial	0.00	30.0	27	21.118	76.114	25.0						
Final	5.00	30.0	27	35.805	90.730	25.0						
Total/Avg	5.00	30.0	27.0	14.687	14.616	25.0	14.339	14.270	14.359	1.0062	0.006	2.88
Run 3 - Initial	0.00	22.0	27	35.805	90.730	25.0						
Final	6.00	22.0	27	46.507	101.266	25.0						
Total/Avg	6.00	22.0	27.0	10.702	10.536	25.0	10.441	10.390	10.350	0.9962	-0.004	1.73
Run 4 - Initial	0.00	17.0	27	46.507	101.266	25.0						
Final	14.00	17.0	27	57.357	111.923	25.0						
Total/Avg	14.00	17.0	27.0	10.850	10.657	25.0	10.580	10.529	10.469	0.9944	-0.006	0.75
Run 5 - Initial	0.00	14.0	27	57.357	111.923	25.0						
Final	26.00	14.0	27	67.944	122.458	25.0						
Total/Avg	26.00	14.0	27.0	10.587	10.535	25.0	10.320	10.270	10.349	1.0077	0.008	0.40

Average Meter Calibration Factor Y **1.0000**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using a Precision Wet Test Meter, which in turn was calibrated using the American Bell Prover # 3785, certificate # F107, which is traceable to the National Bureau of Standards (N.I.S.T.).

Signature Eric Cobb Date 5/31/11

Temperature Sensor Calibration Data Sheet

Unit	MC-623	Serial #	0511024
Date	5/27/2011	ThermoCouple No	Model Altek Series 22 Type K
Personnel	EW	Reference	105795

Reference Point Number	Reference Thermometer Temperature C	Thermocouple Display Temperature C	Absolute Temperature Difference %
1	38	38	0.0
2	93	93	0.0
3	149	149	0.0
4	260	260	0.0
5	371	371	0.0
6	482	482	0.0
7	593	594	-0.1
8	816	816	0.0
9	1038	1039	-0.1
10			
11			
12			
			-0.021
			<1.5

NIST Reference TC ID	**90728323**
Ice Water	**Meter TC**
32° F / 0° C	**Reading**
0.00	0.000

Checked By Eric W/A 5/31/11
(Personnel (Sign/Date)

ARI ENVIRONMENTAL, INC.

Post Test Meter Calibration Data

Model #: Apex Instruments VOST Console
Serial #: 511024
Date: 6/28/2011

Barometric Pressure, in. Hg: 29.32
Secondary Std. Model: Gilabrator Bubble Generator
Secondary Standard SN: 8748-S

Pretest Meter Y_d = 1.000
Date of Pretest = 5/31/11

DRY GAS METER DATA								SECONDARY STANDARD TEST METER DATA					
						Temperature			Average Flow			Temperature	
		Volume	Volume	Volume		T_{mi}	T_{mo}	Static	During Test	Volume		T_{mi}	T_{mo}
ΔH	Time	Initial	Final	Total		Inlet	Outlet	Pressure	Period	Total		Inlet	Outlet
(in. H_2O)	(min)	(liters)	(liters)	(Liters)		(°F)	(°F)	(in. Water)	(liters/min)	(liters)		(°F)	(°F)
0.63	10.0	0.000	5.082	5.082	Initial>	78	78	0.00	0.5082	5.082	Initial>	77	77
					Final >	80	80				Final >	78	78
0.63	10.0	0.000	5.182	5.182	Initial>	80	80	0.00	0.5113	5.113	Initial>	78	78
					Final >	82	82				Final >	80	80
0.63	10.0	0.000	5.213	5.213	Initial>	82	82	0.00	0.5138	5.138	Initial>	80	80
					Final >	82	82				Final >	81	81

DRY GAS METER POST TEST CALIBRATION RESULTS

DRY GAS METER STANDARD VOLUME (Liters)	SECONDARY STANDARD VOLUME (Liters)	CALIBRATION FACTOR, Y_d (dimensionless)	Deviation (%)
4.8862	4.8921	1.0012	-0.895
4.9639	4.9082	0.9888	0.348
4.9844	4.9185	0.9868	0.547

AVERAGE POST TEST METER CALIBRATION FACTOR, Y = 0.992

AVERAGE PRETEST METER CALIBRATION FACTOR, Y_d = 1.000

% DIFFERENCE (Pretest -vs- Post Test) = 0.77% **(± 5.0% allowable)**

Signature: _____ **Date:** 6-28-11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Post-Test calibration

Meter Box: VOST 511024
Date: 6/28/2011
Barometric 29.32
Amb Temp: 78
Calibrator: B. Crane

Reference Temperature	Thermometer Temperature	Difference % Mean	Thermometer Temperature	Difference % Mean
Altek	Probe		Filter	Flter
0	-1	-0.2	-1	-0.2
100	100	0.0	100	0.0
200	201	0.2	201	0.2
300	300	0.0	300	0.0
400	398	-0.2	398	-0.2
500	500	0.0	500	0.0

Reference Temperature	Thermometer Temperature	Difference % Mean	0.992 Temperature	Difference % Mean
Altek	Meter	Meter	Aux	Aux
0	-1	-0.2	-1	-0.2
100	100	0.0	99	-0.2
200	201	0.2	201	0.2
300	300	0.0	300	0.0
400	398	-0.2	398	-0.2
500	500	0.0	500	0.0

APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
5-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	MC522
Console Serial Number	611209
DGM Model Number	MS4
DGM Serial Number	DGM 971831

Calibration Conditions			
Date	Time	7-Dec-10	4:00
Barometric Pressure		29.4	in Hg
Theoretical Critical Vacuum[1]		13.9	in Hg
Calibration Technician		B. Crane	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	oR/in Hg

[1]For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

[2]The Critical Orifice Coefficient, K', must be entered in English units, $(ft^3*°R^{1/2})/(in.Hg*min)$.

Calibration Data

Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})		K'	(t_{amb})	(t_{amb})	
min	in H_2O	cubic feet	cubic feet	°F	°F		see above2	°F	°F	in Hg
10.0	3.3	708.600	718.900	76	77	OX73	0.7742	76	74	16
10.0	1.9	699.700	707.530	75	76	OX63	0.5896	75	75	18
13.0	1.1	690.900	698.550	75	75	OX55	0.4454	75	75	20
12.0	0.6	684.600	689.970	75	75	OX48	0.3447	74	74	21
17.0	0.3	677.400	682.550	75	75	OX40	0.2297	74	75	23

Results

Standardized Data				Dry Gas Meter				
				Calibration Factor		Flowrate	ΔH @	
Dry Gas Meter		Critical Orifice		Value	Variation	Std & Corr	0.75 SCFM	Variation
($V_{m(std)}$)	($Q_{m(std)}$)	($Vcr_{(std)}$)	($Q_{cr(std)}$)	(Y)	(ΔY)	($Q_{m(std)(corr)}$)	(ΔH@)	(ΔΔH@)
cubic feet	cfm	cubic feet	cfm			cfm	in H2O	
10.050	1.005	9.847	0.985	0.980	-0.011	0.985	1.885	0.055
7.627	0.763	7.499	0.750	0.983	-0.008	0.750	1.861	0.031
7.444	0.573	7.365	0.567	0.989	-0.002	0.567	1.883	0.053
5.219	0.435	5.266	0.439	1.009	0.018	0.439	1.793	-0.037
5.001	0.294	4.969	0.292	0.994	0.003	0.292	1.729	-0.101
				0.991	Y Average		1.830	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature B Crane Date 12-7-10

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Pre -Test

Meter Box: 611209
Calibrator: B. Crane
Date: 12/7/2010
Barometric: 29.42
Ambient Temp: 75
Reference Thermometer: Altek Thermocouple Source

Reference Temperature Altek	Thermometer Temperature Inlet	Difference (%) mean Inlet	Thermometer Temperature Oulet	Difference (%) mean Oulet	Thermometer Temperature Probe	Difference (%) mean Probe
0	0	0.00	-1	-0.22	-1	-0.22
100	97	-0.54	97	-0.54	97	-0.54
200	200	0.00	199	-0.15	199	-0.15
300	299	-0.13	299	-0.13	299	-0.13
400	396	-0.47	396	-0.47	395	-0.58
500	496	-0.42	496	-0.42	496	-0.42

Temperature Altek	Temperature Filter	(%) mean Filter	Temperature Exit	(%) mean Exit	Temperature Aux	(%) mean Aux
0	-1	-0.22	-1	-0.22	-1	-0.22
100	97	-0.54	97	-0.54	97	-0.54
200	199	-0.15	199	-0.15	200	0.00
300	299	-0.13	299	-0.13	299	-0.13
400	395	-0.58	395	-0.58	396	-0.47
500	496	-0.42	496	-0.42	496	-0.42

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
0	0	0.00
200	200	0.00
400	396	-0.47
600	598	-0.19
800	799	-0.08
1000	998	-0.14

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
1200	1196	-0.24
1400	1394	-0.32
1600	1597	-0.15
1800	1796	-0.18

Revised 10/03

APEX INSTRUMENTS METHOD 5 POST-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
3-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	MC522
Console Serial Number	611209
DGM Model Number	MS-4
DGM Serial Number	DGM 971831

Calibration Conditions			
Date	Time	20-Jun-11	2:00
Barometric Pressure		29.1	in Hg
Theoretical Critical Vacuum[1]		13.7	in Hg
Calibration Technician		B. Crane	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	oR/in Hg

[1]For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

[2]The Critical Orifice Coefficient, K', must be entered in English units, $(ft^3*°R^{1/2})/(in.Hg*min)$.

Calibration Data

Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})		K'	(t_{amb})	(t_{amb})	
min	in H_2O	cubic feet	cubic feet	°F	°F		see above2	°F	°F	in Hg
12.0	1.9	330.300	339.500	75	77	OX63	0.5896	76	76	19
10.0	1.9	339.500	347.140	77	78	OX63	0.5896	76	78	19
15.0	1.9	347.140	358.620	78	79	OX63	0.5896	78	77	19

Results

Standardized Data				Dry Gas Meter				
Dry Gas Meter		Critical Orifice		Calibration Factor		Flowrate	ΔH @	
($V_{m(std)}$)	($Q_{m(std)}$)	($Vcr_{(std)}$)	($Q_{cr(std)}$)	Value	Variation	Std & Corr	0.75 SCFM	Variation
cubic feet	cfm	cubic feet	cfm	(Y)	(ΔY)	($Q_{m(std)(corr)}$)	(ΔH@)	(ΔΔH@)
						cfm	in H2O	
8.854	0.738	8.890	0.741	1.004	-0.003	0.741	1.884	0.002
7.332	0.733	7.401	0.740	1.009	0.002	0.740	1.883	0.000
10.996	0.733	11.097	0.740	1.009	0.002	0.740	1.881	-0.002
Pretest Gamma	0.991	% Deviation	1.7	1.008	Y Average		1.883	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature B. Crane Date 6-28-11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Post-Test

Meter Box: 611209
Calibrator: B. Crane
Date: 6/20/2011
Barometric: 29.09
Ambient Temp: 78
Reference Thermometer: Altek Thermocouple Source

Reference Temperature Altek	Thermometer Temperature Inlet	Difference (%) mean Inlet	Thermometer Temperature Oulet	Difference (%) mean Oulet	Thermometer Temperature Probe	Difference (%) mean Probe
0	-1	-0.22	-1	-0.22	-1	-0.22
100	97	-0.54	97	-0.54	97	-0.54
200	200	0.00	200	0.00	200	0.00
300	299	-0.13	299	-0.13	299	-0.13
400	396	-0.47	396	-0.47	396	-0.47
500	496	-0.42	496	-0.42	496	-0.42

Reference Temperature Altek	Thermometer Temperature Filter	Difference (%) mean Filter	Thermometer Temperature Exit	Difference (%) mean Exit	Thermometer Temperature Aux	Difference (%) mean Aux
0	-1	-0.22	-1	-0.22	-1	-0.22
100	97	-0.54	97	-0.54	97	-0.54
200	200	0.00	199	-0.15	200	0.00
300	299	-0.13	299	-0.13	299	-0.13
400	396	-0.47	395	-0.58	396	-0.47
500	496	-0.42	496	-0.42	497	-0.31

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
0	0	0.00
200	200	0.00
400	396	-0.47
600	599	-0.09
800	800	0.00
1000	999	-0.07

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
1200	1197	-0.18
1400	1395	-0.27
1600	1598	-0.10
1800	1797	-0.13

Revised 10/03

APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
5-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	MC522
Console Serial Number	808023
DGM Model Number	MS4
DGM Serial Number	DGM 979751

Calibration Conditions			
Date	Time	10-Dec-10	2:00
Barometric Pressure		29.2	in Hg
Theoretical Critical Vacuum[1]		13.8	in Hg
Calibration Technician		B. Crane	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	oR/in Hg

[1]For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

[2]The Critical Orifice Coefficient, K', must be entered in English units, $(ft^3*°R^{1/2})/(in.Hg*min)$.

Calibration Data										
Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})		K'	(t_{amb})	(t_{amb})	
min	in H_2O	cubic feet	cubic feet	°F	°F		see above2	°F	°F	in Hg
10.0	1.5	951.500	959.270	67	69	OX63	0.5896	72	73	17
11.0	2.6	972.900	984.210	71	72	OX73	0.7742	72	73	15
10.0	0.9	987.850	993.750	73	73	OX55	0.4454	73	73	19
11.0	0.5	996.300	1001.330	73	73	OX48	0.3447	74	74	20
19.0	0.3	1001.700	1007.480	73	73	OX40	0.2297	74	74	21

Results							
Standardized Data				Dry Gas Meter			
				Calibration Factor		Flowrate	ΔH @
Dry Gas Meter		Critical Orifice		Value	Variation	Std & Corr	0.75 SCFM	Variation
($V_{m(std)}$)	($Q_{m(std)}$)	($Vcr_{(std)}$)	($Q_{cr(std)}$)	(Y)	(ΔY)	($Q_{m(std)(corr)}$)	(ΔH@)	(ΔΔH@)
cubic feet	cfm	cubic feet	cfm			cfm	in H2O	
7.612	0.761	7.461	0.746	0.980	-0.002	0.746	1.492	-0.034
11.037	1.003	10.776	0.980	0.976	-0.006	0.980	1.498	-0.028
5.717	0.572	5.633	0.563	0.985	0.003	0.563	1.499	-0.027
4.869	0.443	4.791	0.436	0.984	0.001	0.436	1.524	-0.001
5.592	0.294	5.515	0.290	0.986	0.004	0.290	1.617	0.091
				0.982	Y Average		1.526	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature _____ Date 12·10·10

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Pre -Test

Meter Box: 808023
Calibrator: B. Crane
Date: 12/10/2010
Barometric: 29.2
Ambient Temp: 71
Reference Thermometer: Altek Thermocouple Source

Reference Temperature Altek	Thermometer Temperature Inlet	Difference (%) mean Inlet	Thermometer Temperature Oulet	Difference (%) mean Oulet	Thermometer Temperature Probe	Difference (%) mean Probe
0	NA		-3	-0.65	-3	-0.65
100			97	-0.54	96	-0.71
200			199	-0.15	198	-0.30
300			300	0.00	298	-0.26
400			396	-0.47	395	-0.58
500			497	-0.31	494	-0.63

Temperature Altek	Temperature Filter	(%) mean Filter	Temperature Exit	(%) mean Exit	Temperature Aux	(%) mean Aux
0	-3	-0.65	-3	-0.65	-2	-0.43
100	96	-0.71	97	-0.54	97	-0.54
200	199	-0.15	199	-0.15	199	-0.15
300	299	-0.13	299	-0.13	300	0.00
400	395	-0.58	395	-0.58	396	-0.47
500	496	-0.42	497	-0.31	497	-0.31

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
0	-3	-0.65
200	199	-0.15
400	396	-0.47
600	599	-0.09
800	799	-0.08
1000	997	-0.21

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
1200	1195	-0.30
1400	1394	-0.32
1600	1596	-0.19
1800	1795	-0.22

Revised 10/03

APEX INSTRUMENTS METHOD 5 POST-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
3-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	MC522
Console Serial Number	808023
DGM Model Number	MS-4
DGM Serial Number	DGM 979751

Calibration Conditions			
Date	Time	17-Jun-11	2:30
Barometric Pressure		29.1	in Hg
Theoretical Critical Vacuum[1]		13.7	in Hg
Calibration Technician		B. Crane	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	oR/in Hg

[1]For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

[2]The Critical Orifice Coefficient, K', must be entered in English units, $(ft^3*°R^{1/2})/(in.Hg*min)$.

Calibration Data

Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})		K'	(t_{amb})	(t_{amb})	
min	in H_2O	cubic feet	cubic feet	°F	°F		see above2	°F	°F	in Hg
10.0	1.9	565.700	573.560	77	78	OX63	0.5896	76	76	19
10.0	1.9	573.560	581.530	78	78	OX63	0.5896	76	76	19
10.0	1.9	581.530	589.280	78	79	OX63	0.5896	76	77	19

Results

Standardized Data				Dry Gas Meter				
Dry Gas Meter		Critical Orifice		Calibration Factor		Flowrate	ΔH @	
				Value	Variation	Std & Corr	0.75 SCFM	Variation
($V_{m(std)}$)	($Q_{m(std)}$)	($Vcr_{(std)}$)	($Q_{cr(std)}$)	(Y)	(ΔY)	($Q_{m(std)(corr)}$)	(ΔH@)	(ΔΔH@)
cubic feet	cfm	cubic feet	cfm			cfm	in H2O	
7.546	0.755	7.411	0.741	0.982	-0.001	0.741	1.879	0.001
7.644	0.764	7.411	0.741	0.969	-0.014	0.741	1.877	-0.001
7.426	0.743	7.407	0.741	0.997	0.014	0.741	1.877	-0.001
Pretest Gamma	0.982	% Deviation	0.1	0.983	Y Average		1.877	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature B. Crane Date 6-17-11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Post-Test

Meter Box: 808023
Calibrator: B. Crane
Date: 6/17/2011
Barometric: 29.1
Ambient Temp: 75
Reference Thermometer: Altek Thermocouple Source

Reference Temperature Altek	Thermometer Temperature Inlet	Difference (%) mean Inlet	Thermometer Temperature Oulet	Difference (%) mean Oulet	Thermometer Temperature Probe	Difference (%) mean Probe
0	NA		1	0.22	1	0.22
100			99	-0.18	98	-0.36
200			202	0.30	202	0.30
300			302	0.26	301	0.13
400			398	-0.23	398	-0.23
500			499	-0.10	497	-0.31

Reference Temperature Altek	Thermometer Temperature Filter	Difference (%) mean Filter	Thermometer Temperature Exit	Difference (%) mean Exit	Thermometer Temperature Aux	Difference (%) mean Aux
0	1	0.22	1	0.22	1	0.22
100	99	-0.18	99	-0.18	99	-0.18
200	202	0.30	202	0.30	202	0.30
300	301	0.13	302	0.26	302	0.26
400	398	-0.23	398	-0.23	398	-0.23
500	498	-0.21	499	-0.10	499	-0.10

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
0	1	0.22
200	202	0.30
400	397	-0.35
600	600	0.00
800	801	0.08
1000	1000	0.00

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
1200	1197	-0.18
1400	1395	-0.27
1600	1600	0.00
1800	1797	-0.13

Revised 10/03

APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
5-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	MC522
Console Serial Number	402005
DGM Model Number	MS4
DGM Serial Number	DGM 331830

Calibration Conditions			
Date	Time	10-Jan-11	12:00
Barometric Pressure		29.7	in Hg
Theoretical Critical Vacuum[1]		14.0	in Hg
Calibration Technician		B. Crane	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	oR/in Hg

[1]For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

[2]The Critical Orifice Coefficient, K', must be entered in English units, $(ft^3 \cdot °R^{1/2})/(in.Hg \cdot min)$.

Calibration Data

Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})		K'	(t_{amb})	(t_{amb})	
min	in H_2O	cubic feet	cubic feet	°F	°F		see above2	°F	°F	in Hg
10.0	3.2	624.900	634.920	73	74	OX73	0.7747	73	74	14
10.0	1.9	647.600	655.230	75	75	OX63	0.5896	74	75	16
10.0	1.1	663.500	669.260	76	76	OX55	0.4454	76	76	18
12.0	0.7	672.400	677.750	76	77	OX48	0.3447	76	76	19
18.0	0.3	679.500	684.860	77	77	OX40	0.2297	76	77	21

Results

Standardized Data				Dry Gas Meter				
				Calibration Factor		Flowrate	ΔH @	
Dry Gas Meter		Critical Orifice		Value	Variation	Std & Corr	0.75 SCFM	Variation
($V_{m(std)}$)	($Q_{m(std)}$)	($Vcr_{(std)}$)	($Q_{cr(std)}$)	(Y)	(ΔY)	($Q_{m(std)(corr)}$)	(ΔH@)	(ΔΔH@)
cubic feet	cfm	cubic feet	cfm			cfm	in H2O	
9.918	0.992	9.958	0.996	1.004	-0.008	0.996	1.812	-0.064
7.507	0.751	7.572	0.757	1.009	-0.002	0.757	1.844	-0.032
5.646	0.565	5.712	0.571	1.012	0.002	0.571	1.865	-0.011
5.233	0.436	5.305	0.442	1.014	0.003	0.442	1.891	0.015
5.234	0.291	5.300	0.294	1.013	0.003	0.294	1.967	0.091
				1.010	Y Average		1.876	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature B. Crane Date 1-11-10

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Pre -Test

Meter Box: 402005
Calibrator: B. Crane
Date: 1/11/2011
Barometric: 29.38
Ambient Temp: 74
Reference Thermometer: Altek Thermocouple Source

Reference Temperature Altek	Thermometer Temperature Inlet	Difference (%) mean Inlet	Thermometer Temperature Oulet	Difference (%) mean Oulet	Thermometer Temperature Probe	Difference (%) mean Probe
0	NA		0	0.00	1	0.22
100			98	-0.36	99	-0.18
200			200	0.00	201	0.15
300			300	0.00	301	0.13
400			396	-0.47	397	-0.35
500			497	-0.31	498	-0.21

Temperature Altek	Temperature Filter	(%) mean Filter	Temperature Exit	(%) mean Exit	Temperature Aux	(%) mean Aux
0	0	0.00	1	0.22	1	0.22
100	99	-0.18	99	-0.18	99	-0.18
200	201	0.15	201	0.15	202	0.30
300	301	0.13	301	0.13	301	0.13
400	397	-0.35	397	-0.35	398	-0.23
500	498	-0.21	498	-0.21	498	-0.21

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
0	0	0.00
200	201	0.15
400	397	-0.35
600	599	-0.09
800	801	0.08
1000	1000	0.00

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
1200	1197	-0.18
1400	1395	-0.27
1600	1598	-0.10
1800	1795	-0.22

Revised 10/03

APEX INSTRUMENTS METHOD 5 POST-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
3-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	MC522
Console Serial Number	402005
DGM Model Number	MS-4
DGM Serial Number	DGM 331830

Calibration Conditions			
Date	Time	17-Jun-11	5:30
Barometric Pressure		29.1	in Hg
Theoretical Critical Vacuum[1]		13.7	in Hg
Calibration Technician		B. Crane	

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K_1	17.647	oR/in Hg

[1]For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

[2]The Critical Orifice Coefficient, K', must be entered in English units, $(ft^3*°R^{1/2})/(in.Hg*min)$.

Calibration Data

Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})		K'	(t_{amb})	(t_{amb})	
min	in H_2O	cubic feet	cubic feet	°F	°F		see above2	°F	°F	in Hg
10.0	1.9	93.700	101.310	80	81	OX63	0.5896	82	83	17
10.0	1.9	101.310	108.930	81	81	OX63	0.5896	83	83	17
10.0	1.9	108.930	116.550	81	82	OX63	0.5896	83	84	17

Results

Standardized Data				Dry Gas Meter				
				Calibration Factor		Flowrate	ΔH @	
Dry Gas Meter		Critical Orifice		Value	Variation	Std & Corr	0.75 SCFM	Variation
($V_{m(std)}$)	($Q_{m(std)}$)	($Vcr_{(std)}$)	($Q_{cr(std)}$)	(Y)	(ΔY)	($Q_{m(std)(corr)}$)	(ΔH@)	(ΔΔH@)
cubic feet	cfm	cubic feet	cfm			cfm	in H2O	
7.265	0.726	7.366	0.737	1.014	0.000	0.737	1.891	0.000
7.268	0.727	7.363	0.736	1.013	0.000	0.736	1.891	0.000
7.261	0.726	7.360	0.736	1.014	0.000	0.736	1.891	0.000
Pretest Gamma	1.010	% Deviation	0.3	1.014	Y Average		1.891	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature B. Crane Date 6·17·11

ARI Environmental, Inc.
Gas Meter Thermometer Calibration Data Form
Post-Test

Meter Box: 402005
Calibrator: B. Crane
Date: 6/17/2011
Barometric: 29.1
Ambient Temp: 78
Reference Thermometer: Altek Thermocouple Source

Reference Temperature Altek	Thermometer Temperature Inlet	Difference (%) mean Inlet	Thermometer Temperature Oulet	Difference (%) mean Oulet	Thermometer Temperature Probe	Difference (%) mean Probe
0	NA		2	0.43	2	0.43
100			100	0.00	100	0.00
200			202	0.30	202	0.30
300			301	0.13	302	0.26
400			398	-0.23	398	-0.23
500			498	-0.21	499	-0.10

Reference Temperature Altek	Thermometer Temperature Filter	Difference (%) mean Filter	Thermometer Temperature Exit	Difference (%) mean Exit	Thermometer Temperature Aux	Difference (%) mean Aux
0	2	0.43	2	0.43	2	0.43
100	100	0.00	100	0.00	100	0.00
200	202	0.30	202	0.30	203	0.45
300	302	0.26	302	0.26	302	0.26
400	398	-0.23	398	-0.23	398	-0.23
500	498	-0.21	499	-0.10	499	-0.10

Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
0	2	0.43
200	202	0.30
400	398	-0.23
600	601	0.09
800	802	0.16
1000	1001	0.07

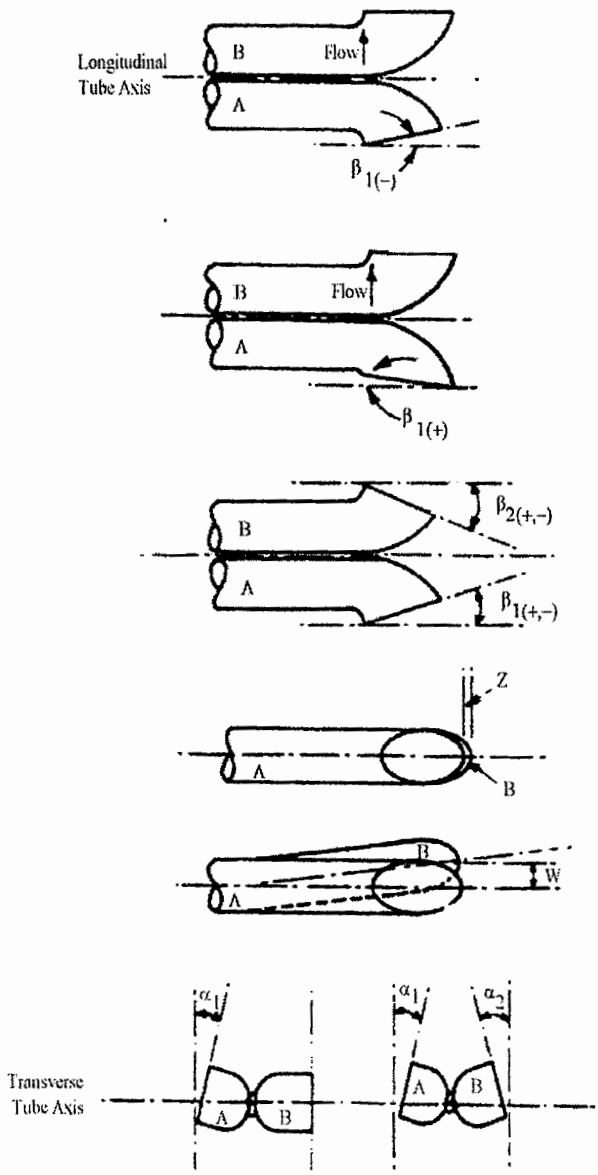
Reference Temperature Altek	Thermometer Temperature Stack	Difference (%) mean Stack
1200	1198	-0.12
1400	1396	-0.22
1600	1598	-0.10
1800	1795	-0.22

Revised 10/03

Pitot Tube Inspection Data

Client Name: _____

Pre-Sample Date:		**Post-Sample** Date:
8/24/2010		7/21/2011
Y	level?	Y
N	obstructions?	N
N	damaged?	N
1	$-10° < \alpha_1 < +10°$	0
1	$-10° < \alpha_2 < +10°$	0
0	$-5° < \beta_1 < +5°$	2
1	$-5° < \beta_2 < +5°$	2
1	γ	1
0	θ	1
0.890	A	0.94
0.440	$0.39375 < P_A < 0.5625$	0.470
0.450	$0.39375 < P_B < 0.5625$	0.470
0.375	$0.1875 \leq D_t \leq 0.375$	0.375
0.016	$A \tan \gamma < 0.125"$	0.016
0.00000	$A \tan \theta < 0.03125"$	0.01641
TRUE	$P_A = P_B +/- 0.063$	TRUE
PASS	**PASS/FAIL**	PASS



Comments: 10' effective length M5 probe, 2" OD sheath, 3/8"pitot tips, K-type thermocouple, New from Apex for DCR.

Pitot tube/probe number 997 meets or exceeds all specifications and criteria and/or applicable design features (per 40CFR60 Appendix A; Method 2) and is heareby assigned a pitot tube calibration factor of 0.84.

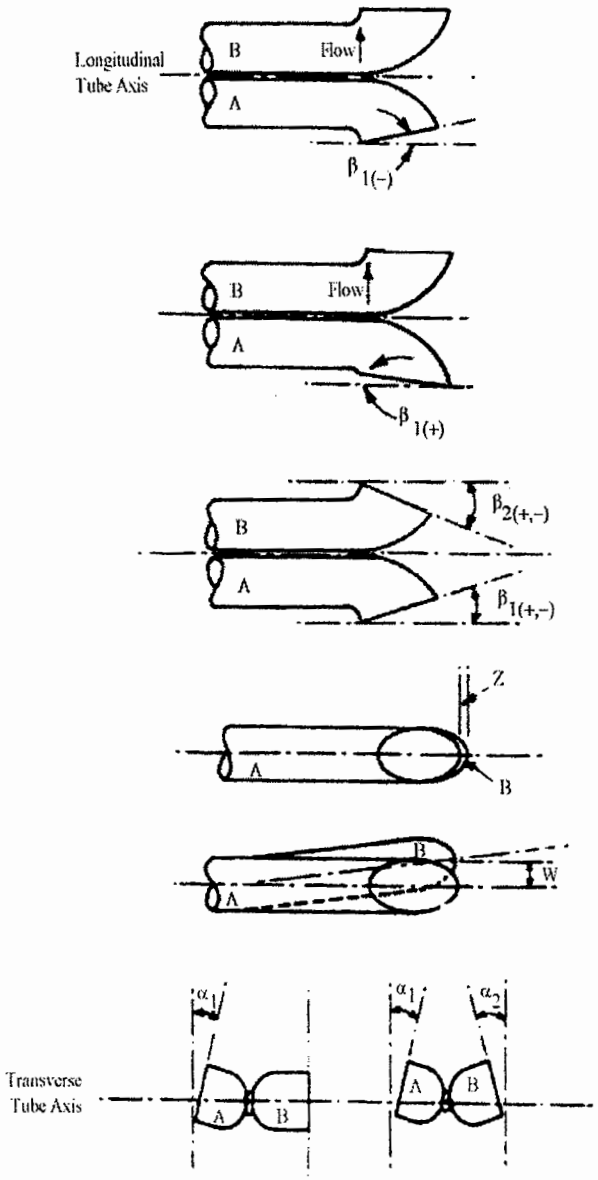
Signature: _____

Date: 7.21.11

Pitot Tube Inspection Data

Client Name: _____

	Pre-Sample		Post-Sample
	Date: 4/27/2011		**Date:** 7/21/2011
Y	level?		Y
N	obstructions?		N
N	damaged?		N
0	$-10° < \alpha_1 < +10°$		1
0	$-10° < \alpha_2 < +10°$		0
1	$-5° < \beta_1 < +5°$		1
1	$-5° < \beta_2 < +5°$		1
1	γ		1
0	θ		0
0.680	A		0.68
0.340	$0.2625 < P_A < 0.375$		0.340
0.340	$0.2625 < P_B < 0.375$		0.340
0.250	$0.1875 \leq D_t \leq 0.375$		0.250
0.012	$A \tan \gamma < 0.125"$		0.012
0.00000	$A \tan \theta < 0.03125"$		0.00000
TRUE	$P_A = P_B +/- 0.063$		TRUE
PASS	PASS/FAIL		PASS



Comments: 10' effective length M5 probe with s-type pitot tube, 1.4" tips, K-type thermocouple enclosed in a 1.5" OD sheath.

Pitot tube/probe number 354 meets or exceeds all specifications and criteria and/or applicable design features (per 40CFR60 Appendix A; Method 2) and is hereby assigned a pitot tube calibration factor of 0.84.

Signature: _____

Date: 7·21·11

ARI Environmental Inc.
Thermocouple Calibration Data Form

Calibrator: B. Crane
Thermocouple ID. 997

	pretest	posttest
Date:	8/24/2010	7/21/2011
Barometric:	29.28	29.1

Reference Thermometer = Mercury in glass

	Reference Point Number	Source	Reference Thermometer Temperature	Meter Readout Temperature	Difference (%)
Pre-Test	T.C	Ice Water	34.0	33.8	0.04
		Ambient	84.0	83.6	0.07
		Hot Water	210.0	208.7	0.19
Post-Test	T.C	Ice Water	32.0	32.1	-0.02
		Ambient	87.0	86.5	0.09
		Hot Water	212.0	211.7	0.04

a (temp. diff.) = (ref.temp + 460) - (Thermo. temp. + 460) / (ref. temp. +460) x 100

Where $-1.5 < a < 1.5$

ARI Environmental Inc.
Thermocouple Calibration Data Form

Calibrator: B. Crane
Thermocouple ID. 354

	pretest	posttest
Date:	4/27/2011	7/21/2011
Barometric:	28.83	29.1

Reference Thermometer = Mercury in glass

	Reference Point Number	Source	Reference Thermometer Temperature	Meter Readout Temperature	Difference (%)
Pre-Test	T.C	Ice Water	32.0	32.2	-0.04
		Ambient	68.0	69.1	-0.21
		Hot Water	212.0	211.7	0.04
Post-Test	T.C	Ice Water	32.0	32.2	-0.04
		Ambient	87.0	86.0	0.18
		Hot Water	212.0	212.0	0.00

a (temp. diff.) = (ref.temp + 460) - (Thermo. temp. + 460) / (ref. temp. +460) x 100

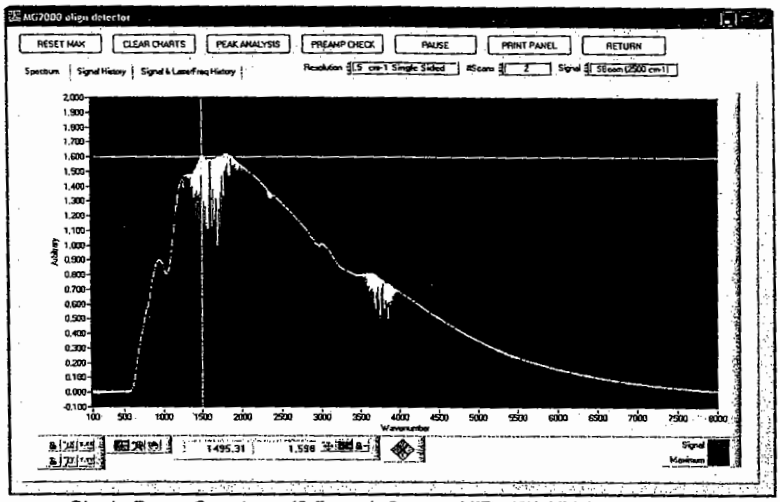
Where $-1.5 < a < 1.5$

mks
Technology for Productivity
On-Line™ Products

MultiGas 001633532 Repair Final Checkout

Model No.	**2030DBG2EKVS13T**
Serial No.	**001633532**
Interferometer	001632173
MAC Address	00-03-F4-02-E7-8B
Digitizer IP Address	192.168.254.10

Detector Type	0.25 mm LN2
Detector Cutoff	16 um
Det. Serial No.	H-14692
Det. Mfg. Date	Jan-05
Gain R31	902 ohms
Bias R6	15 ohms
Gas Cell Window	KBr
Window Material	KBr



Single Beam Spectrum (0.5 cm-1, 2 scan, NIR, 179 KHz)

Instrument Parameters	
Linearizer Offset	1436
Linearizer Linear	1000
Linearizer Quad	401
Linearizer Cubic	59
Sampling Velocity(KHz)	144 KHz
Mono Value	CA
Direction	Both
Sampling Mode	NearIR
Laser Phase Angle	86.83°

Preamp set to **-8.56** vdc blocked

Calibration1	
Gas	**Ethylene**
Concentration	100.0 ppm
Temperature(°C)	150°C
950cm-1Left?Middle/Right	98.61 / 98.30 / 98.56
3000cm-1	99.61 ppm
Calibration2	
Gas	**CO**
Concentration	200.9 ppm
Temperature(°C)	150°C
CO Quant pt	204.40 ppm

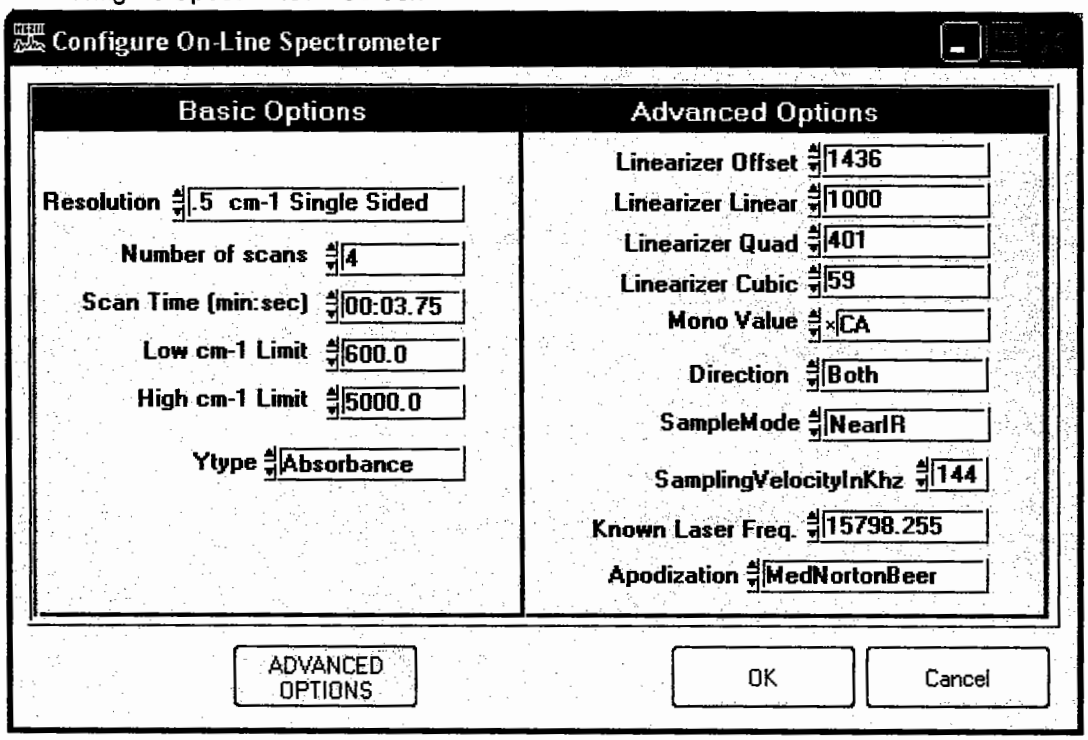
Pressure Transducer	750B13TFE3RF
Serial #	021734181
Range	0-1000 Torr
Transduce Slope	Factory set
Transducer Offset	0
Temp. Transmitter	0-200°C J Thermocouple
Transmitter Slope	Factory set
Transmitter Offset	-50

Final Voltage Checks	
120 VAC 60hZ	X
220VAC 50hZ	
Digitizer voltage set	5.02v

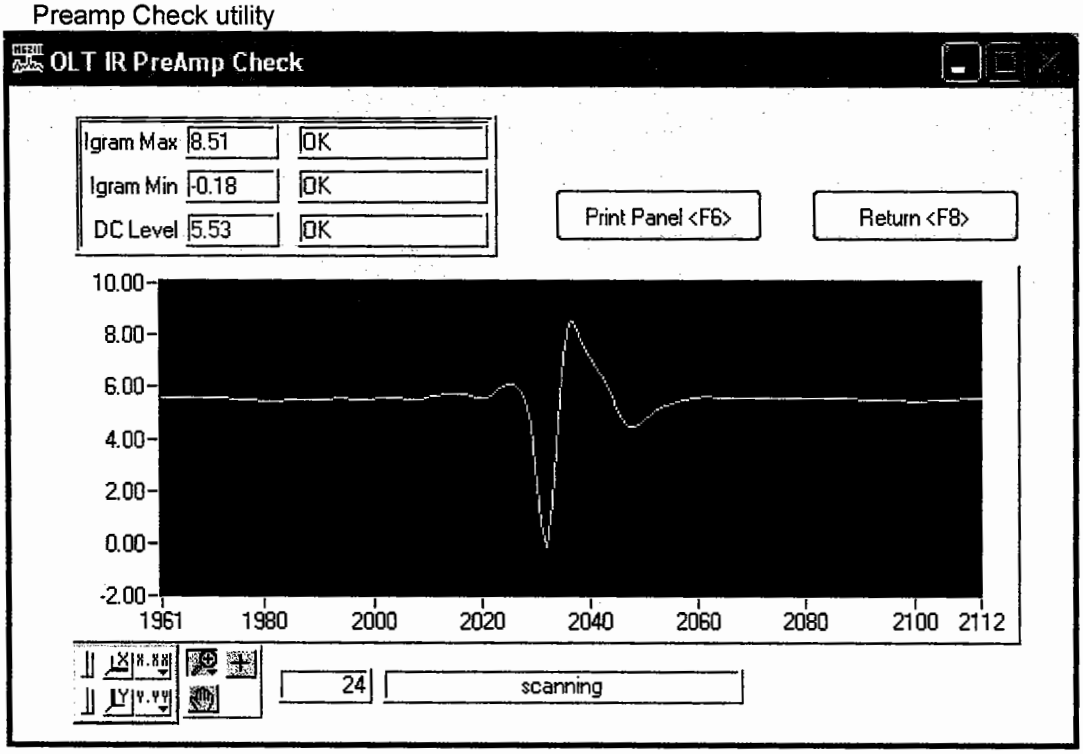
	Factory Measurements	Laser A voltages
Laser Freqency	15798.255cm-1	Laser A pp = 7.80 V
Apodization	Med Norton Beer	Laser A dc = -5.02 V
Linewidth @0.5 CM-1, 16 SCANS	0. 4742 cm-1	
Single Beam Max Signal	1.598	
Max Signal Location (cm-1)	1495.31 cm-1	

Signal-to-Noise (single sided)			1000-1100 cm-1 SNR	2100-2200 cm-1 SNR	2900-30000 cm-1 SNR
0.5 cm-1	2.9 sec	4 scans	851	1433	984
.5 cm-1	36.1 sec	64 scans	3132	4355	2235
4 cm-1	0.5	4 scans	3432	5717	4082
4 cm-1	7.5 sec	64 scans	8078	14528	4082

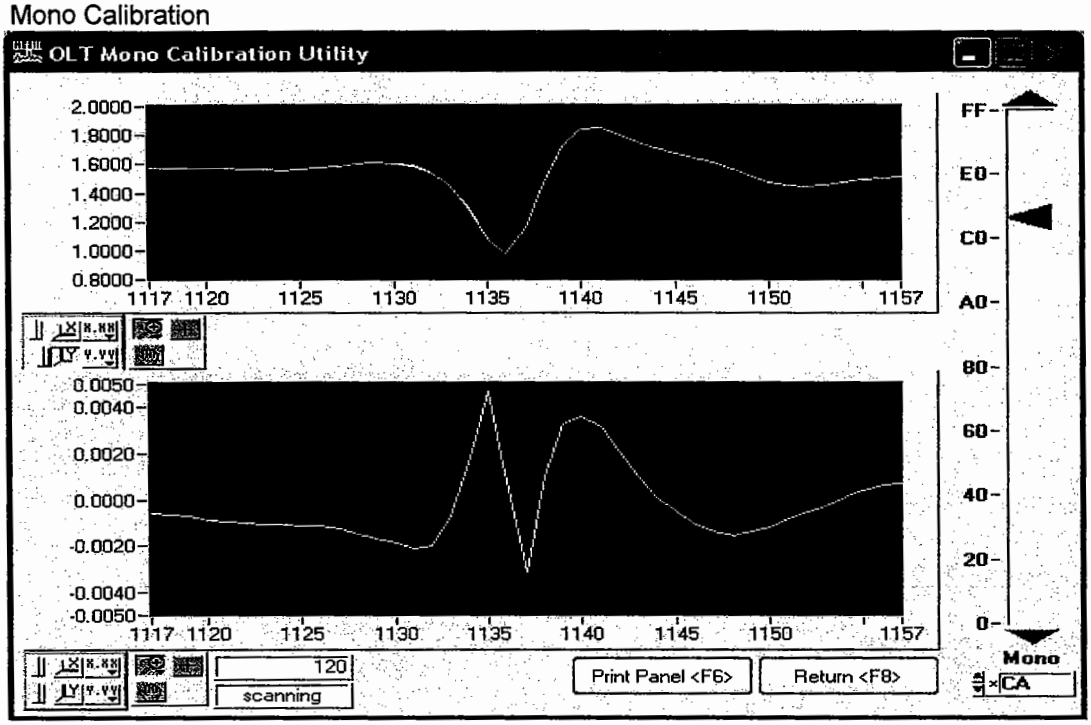
Configure Spectrometer Screen



Preamp Check utility



Mono Calibration



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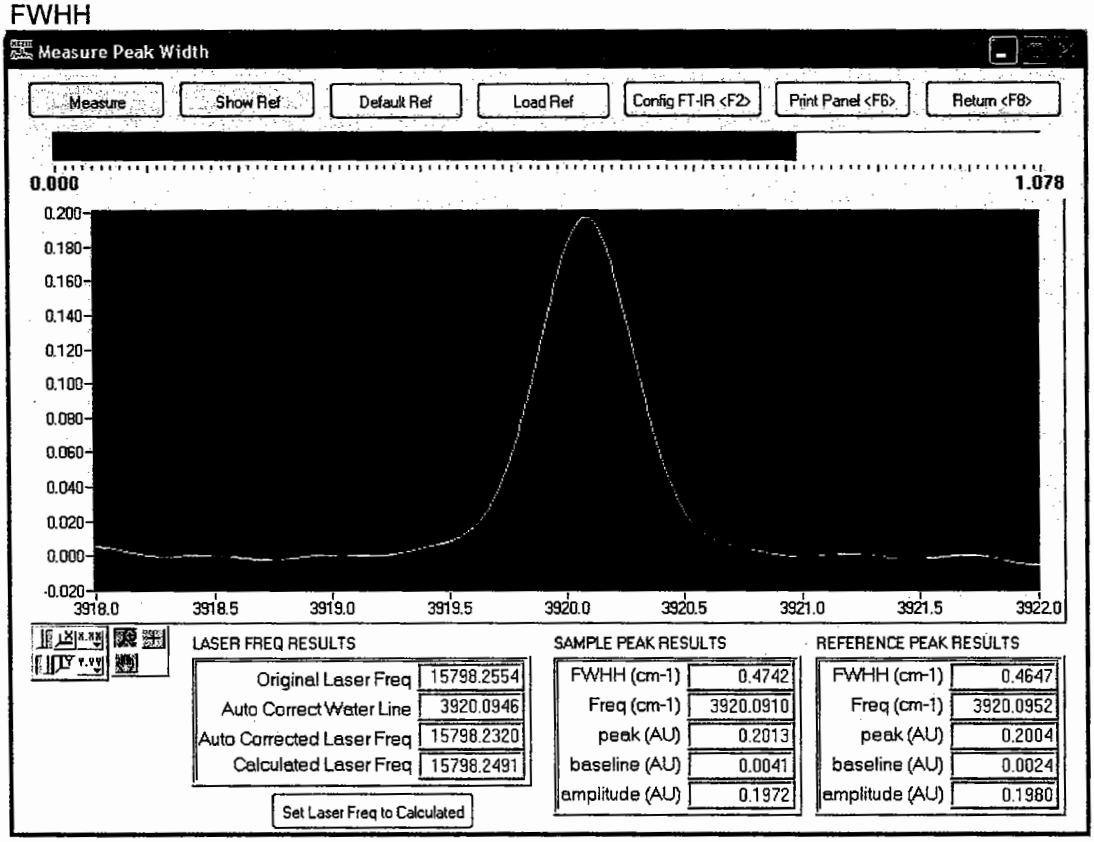

FTIR MDC Detection Limits

Monitor: FTIR
Manufacturer: MKS
Model: 2030
S/N: CAE Rental
Condition: System
Date: 6/7/2011
Operator: S. Yuchs
Compound: Hydrogen Cyanide

Target Concentration, ppm v 0.0

Repetition	Average FTIR Reading (ppm v)
1	0.009
2	0.078
3	-0.013
4	0.027
5	-0.013
6	-0.015
7	-0.014
8	-0.018
9	-0.001
10	-0.004
11	-0.001
12	-0.005

Total Population	**12**
t-Test Population (n-1)	**11**
Average RM reading	**0.00**
Standard Deviation	**0.027**
Student t- Test Value	**2.718**

MDL (LOD)	**0.073**
PQL (LOQ) (3 x MDL)	**0.218**

The USEPA defines MDL as "the minimum concentration that can be determined with 99% confidence that the true concentration is greater than zero." This procedure is outlined in 40CFR 136 and TTN EMC. The NELAC Standard (TNI) define detection limits as limit of detection - LOD and limit of quantification - LOQ. These terms were historically known as method detection limit - MDL and practical quantification limit - PQL.

Student t-Test Values	
t-Test Population	t-Test Value
7	2.998
8	2.896
9	2.821
10	2.764
11	2.718
12	2.681

FTIR MDC Detection Limits

Monitor: FTIR
Manufacturer: MKS
Model: 2030
S/N: CAE Rental
Condition: System
Date: 6/7/2011
Operator: S. Yuchs
Compound: Formaldehyde

Target Concentration, ppm v	0.0

Repetition	Average FTIR Reading (ppm v)
1	-0.003
2	0.017
3	0.012
4	-0.021
5	0.048
6	0.017
7	0.013
8	-0.035
9	-0.037
10	-0.062
11	0.001
12	0.002

Total Population	**12**
t-Test Population (n-1)	**11**
Average RM reading	**0.00**
Standard Deviation	**0.030**
Student t- Test Value	**2.718**

MDL (LOD)	**0.082**
PQL (LOQ) (3 x MDL)	**0.245**

The USEPA defines MDL as "the minimum concentration that can be determined with 99% confidence that the true concentration is greater than zero." This procedure is outlined in 40CFR 136 and TTN EMC.
The NELAC Standard (TNI) define detection limits as limit of detection - LOD and limit of quantification - LOQ. These terms were historically known as method detection limit - MDL and practical quantification limit - PQL.

Student t-Test Values	
t-Test Population	t-Test Value
7	2.998
8	2.896
9	2.821
10	2.764
11	2.718
12	2.681

FTIR MDC Detection Limits

Monitor: FTIR
Manufacturer: MKS
Model: 2030
S/N: CAE Rental
Condition: System
Date: 6/7/2011
Operator: S. Yuchs
Compound: Acetaldehyde

Target Concentration, ppm v	0.0

Repetition	Average FTIR Reading (ppm v)
1	0.010
2	-0.018
3	-0.047
4	-0.006
5	0.004
6	0.008
7	0.010
8	0.008
9	-0.008
10	0.001
11	0.005
12	-0.011

Total Population	**12**
t-Test Population (n-1)	**11**
Average RM reading	**0.00**
Standard Deviation	**0.016**
Student t- Test Value	**2.718**

MDL (LOD)	**0.044**
PQL (LOQ) (3 x MDL)	**0.133**

The USEPA defines MDL as "the minimum concentration that can be determined with 99% confidence that the true concentration is greater than zero." This procedure is outlined in 40CFR 136 and TTN EMC.
The NELAC Standard (TNI) define detection limits as limit of detection - LOD and limit of quantification - LOQ. These terms were historically known as method detection limit - MDL and practical quantification limit - PQL.

Student t-Test Values	
t-Test Population	t-Test Value
7	2.998
8	2.896
9	2.821
10	2.764
11	2.718
12	2.681

FTIR MDC Detection Limits

Monitor: FTIR
Manufacturer: MKS
Model: 2030
S/N: CAE Rental
Condition: System
Date: 6/7/2011
Operator: S. Yuchs
Compound: Propanal

Target Concentration, ppm v	0.0

Repetition	Average FTIR Reading (ppm v)
1	0.014
2	0.022
3	0.021
4	0.011
5	0.010
6	0.010
7	0.007
8	0.012
9	-0.004
10	-0.064
11	-0.076
12	0.015

Total Population	**12**
t-Test Population (n-1)	**11**
Average RM reading	**0.00**
Standard Deviation	**0.033**
Student t- Test Value	**2.718**

MDL (LOD)	**0.089**
PQL (LOQ) (3 x MDL)	**0.266**

The USEPA defines MDL as "the minimum concentration that can be determined with 99% confidence that the true concentration is greater than zero." This procedure is outlined in 40CFR 136 and TTN EMC. The NELAC Standard (TNI) define detection limits as limit of detection - LOD and limit of quantification - LOQ. These terms were historically known as method detection limit - MDL and practical quantification limit - PQL.

Student t-Test Values	
t-Test Population	t-Test Value
7	2.998
8	2.896
9	2.821
10	2.764
11	2.718
12	2.681

FTIR MDC Detection Limits

Monitor: FTIR
Manufacturer: MKS
Model: 2030
S/N: CAE Rental
Condition: System
Date: 6/7/2011
Operator: S. Yuchs
Compound: Ammonia

Target Concentration, ppm v	0.0

Repetition	Average FTIR Reading (ppm v)
1	-0.002
2	0.058
3	-0.028
4	-0.004
5	-0.016
6	-0.029
7	-0.017
8	0.040
9	0.061
10	0.011
11	0.008
12	0.059

Total Population	**12**
t-Test Population (n-1)	**11**
Average RM reading	**0.01**
Standard Deviation	**0.034**
Student t- Test Value	**2.718**

MDL (LOD)	**0.093**
PQL (LOQ) (3 x MDL)	**0.280**

The USEPA defines MDL as "the minimum concentration that can be determined with 99% confidence that the true concentration is greater than zero." This procedure is outlined in 40CFR 136 and TTN EMC. The NELAC Standard (TNI) define detection limits as limit of detection - LOD and limit of quantification - LOQ. These terms were historically known as method detection limit - MDL and practical quantification limit - PQL.

Student t-Test Values	
t-Test Population	t-Test Value
7	2.998
8	2.896
9	2.821
10	2.764
11	2.718
12	2.681

APPENDIX F Process Data

This section redacted as Confidential Business Information.

APPENDIX G Test Program Qualifications

Test Program Qualifications

ARI Environmental's offices in Wauconda, Illinois and Pasadena, Texas specialize in conducting stack emission, fugitive leak detection, ambient air and in-plant OSHA type testing for industrial clients.

ARI is organized so that its facilities and resources meet the requirements of ASTM D7036, Standard Practice for Competence of Air Emission Testing Bodies. ARI's laboratories in Pasadena, Texas and Wauconda, Illinois hold TCEQ NELAP Certificate No. T104704428-10-2.

During the past 27 years, ARI personnel have conducted over 5,000 separate stack emission tests for a variety of industrial clients throughout North America for the determination of degree of source compliance and to yield emissions data and control equipment performance data for in-house engineering purposes.

ARI presently has over 80 trained personnel for conducting source emission sampling, fugitive leak detection monitoring, ambient air monitoring and OSHA sampling programs. All test programs are supervised and conducted by onsite Qualified Individuals (QI) and/or Qualified Source Testing Individuals (QSTI) pursuant to ASTM D7036.

The key personnel involved in the test program were as follows:

Steven Flaherty
Mr. Flaherty is a Senior Project Manager with ARI. His 11 years experience includes emission compliance and CEM certification testing for a wide variety of industries including petrochemical, steel mills, electric utilities, cement plants, asphalt plants and general manufacturing plants. Mr. Flaherty is presently certified as a QSTI by the Source Evaluation Society (SES) pursuant to the requirements of ASTM D7036-04.

Steven Yuchs, Ph.D.
Dr. Yuchs has 14 years experience in environmental analysis and research and development. His experience includes industrial, academic and governmental laboratory management, with an emphasis in the environmental remediation sector. He is currently the Special Projects Manager for ARI. He is also responsible for coordinating and developing laboratory analysis procedures, laboratory quality assurance, new methods of laboratory analysis, and laboratory data reduction. Dr. Yuchs is presently certified as a QI by the SES pursuant to the requirements of ASTM D7036-04.

Nathan Sekulic
Mr. Sekulic is a Project Manager with ARI. His 10 years experience includes emission compliance and CEM certification testing for a wide variety of industries including petrochemical, steel mills, electric utilities, cement plants, asphalt plants and general manufacturing plants. Mr. Sekulic is presently certified as a QI by the SES pursuant to the requirements of ASTM D7036-04.

Robert Burton
Mr. Burton is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up. Mr. Burton has 5 years experience in conducting various source emission test programs.

Alex Reyes
Mr. Reyes is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up.

Ryan Mahoney
Mr. Mahoney is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up.

Terrence Davis
Mr. Davis is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up.

Ryan Lyons
Mr. Lyons is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up.

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

STEVEN M. FLAHERTY

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 26TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 25TH, 2013

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

John R. Smith, QSTI/QSTO Review Board

APPLICATION NO. 2008-237

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

STEVEN M. FLAHERTY

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 26TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 25TH, 2013

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

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SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

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STEVEN M. FLAHERTY

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS

ISSUED THIS 26TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 25H, 2013

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