

TEST REPORT

EMISSION TEST PROGRAM

EPA ICR FOR PETROLEUM REFINERIES

FCCU-1241 WET GAS SCRUBBER STACK

VALERO PORT ARTHUR REFINERY
PORT ARTHUR, TEXAS

PREPARED FOR:

THE PREMCOR REFINING GROUP INC.

A Wholly-Owned Subsidiary of Valero Energy

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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.

A handwritten signature in black ink, which appears to read 'Daniel E. Fitzgerald', followed by the date '8-19-11'.

Daniel E. Fitzgerald, QSTI
Division Manager, Source Testing
ARI Environmental, Inc.



SECTION ONE

Introduction and Summary

ARI Environmental, Inc. (ARI) was retained by the Valero Port Arthur Refinery (Valero) of The Premcor Refining Group Inc., a wholly owned subsidiary of Valero Energy, to conduct an emission test program at their refinery located in Port Arthur, Texas.

The testing was conducted on June 6 through 14, 2011 on the FCCU-1241 Wet Gas Scrubber (WGS) stack in response to the USEPA Section 114 Information Collection Request (ICR) for Petroleum Refineries. The test program was conducted pursuant to the sampling and analytical procedures presented in the Test Protocol (ARI Project No. H453-305) dated May 16, 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. Dan Fitzgerald, ARI's test team consisted of Messrs. Jerry Bovee, Greg Burch, Jeff Goldfine, Chris Hall, Andrew Hornbeck, Jeff Knapp and Ron Mullins. Sample recovery and laboratory shipment activities were performed by Messrs. Richard Brank-Campbell and Ron White of ARI. Mr. Robin Hill of Valero 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, ARI reference method monitoring data, laboratory data, process data, calibration data and test program qualifications are included in the appendices.



SECTION ONE

Introduction and Summary

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

Group ¹	Pollutant	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	4	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)	1	lb/hr, ppmv db
B	Dioxins and Furans (D/F), Polychlorinated Biphenyls (PCB)	3	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)	3	lb/hr, mg/dscm
	Other Metals ³	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)	2	lb/hr, ppmv db
	Sulfur Dioxide (SO ₂)	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

¹Simultaneous sampling was conducted for all pollutants in each group.

²Three test runs were conducted for each pollutant.

³Metals include antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), nickel (Ni) and selenium (Se).



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TABLE 1-2. POLLUTANTS AND TEST METHODS

Group	Pollutants	Test Methods	Isokinetic Sampling
A1	Speciated Volatile Organic HAP	USEPA Methods 18 and 308	No
A2	Speciated Semi-Volatile Organic HAP	SW-846 Method 0010 with SW-846 Method 8270C/D analytical finish	Yes
A1	Aldehydes	SW-846 Method 0011 with SW-846 Method 8315A	Yes
A3	THC	USEPA Method 25A	No
A3	CO	USEPA Method 10	No
A3	Methane, Ethane	USEPA Method 18	No
B	D/F, PCB	USEPA Method 23	Yes
E	HCl, Cl ₂ , HF	USEPA Method 26A	Yes
E	HCN	USEPA Other Test Method (OTM) 29	Yes
D2	Hg	ASTM D6784-02 (Ontario-Hydro Method)	Yes
D3	Cr ⁺⁶	SW-846 Method 0061	Yes
D1	Metals	USEPA Method 29	Yes
D1	PM, PM _{2.5}	USEPA Methods 5/202	Yes
D1	NH ₃	USEPA Conditional Test Method 027 (CTM-027)	Yes
D4	SO ₂ and NO _x	USEPA Methods 6C and 7E	No



SECTION TWO

Testing and Analytical Procedures

2.1 OVERVIEW

ARI conducted an emission test program on the FCCU-1241 WGS stack at the Valero Port Arthur Refinery located in Port Arthur, Texas. Testing was conducted in response to the USEPA Section 114 ICR for Petroleum Refineries. Three (3) test runs were conducted at the FCCU-1241 WGS 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, 6C, 7E, 10, 18, 23, 25A, 26A and 29; 40 CFR 51, Appendix M, USEPA Methods 202 and 205; 40 CFR 63, Appendix A, USEPA Method 308; USEPA OTM-29; CTM-027; SW-846 Methods 0010, 0011, 0061, 8270C/D and 8315A; ASTM D6784-02 (Ontario-Hydro Method); and the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods. All methods followed are those listed in Component 4 of the Petroleum Refinery Emissions Information Collection, Part VIII, Test Procedures, Methods and Reporting Requirements for the Information Collection Request for Petroleum Refineries.

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-1241 WGS stack in the four (4) 6-inch I.D. sampling ports provided in the 150-inch diameter duct. The sample ports were located approximately 460 inches (3.1 duct diameters) upstream and 688 inches downstream (4.6 duct diameters) from the nearest flow disturbances. Twenty-four (24) traverse points were used to sample the cross-sectional area of the stack. See Figure 2-1.

2.2.2 Flue Gas Volumetric Flow Rate (USEPA Method 2)

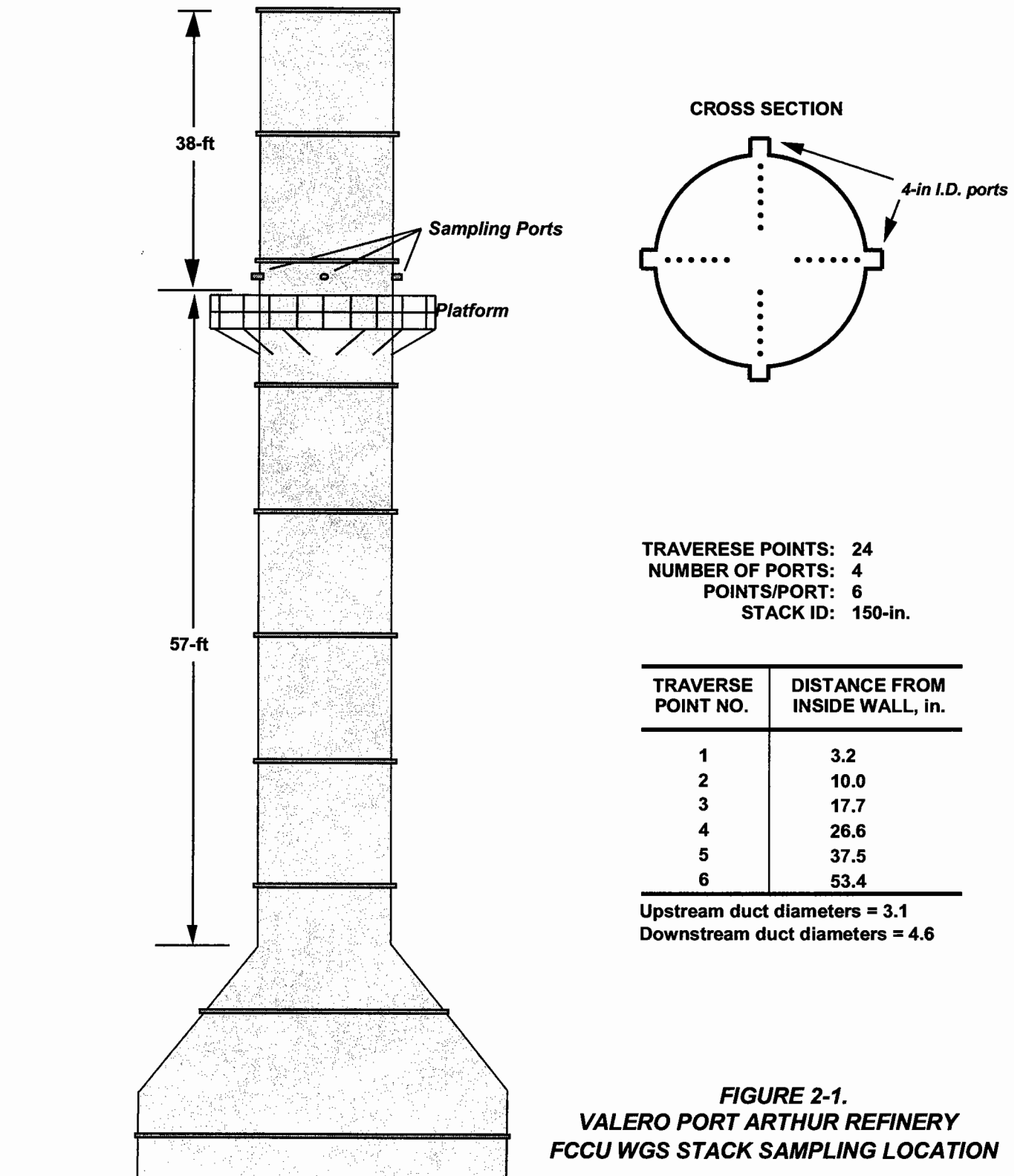
Gas velocity and volumetric flow rate were determined following USEPA Method 2. Velocity head measurements were performed using a Type S pitot tube and Dwyer inclined 0 – 10-in. water manometer. Temperature measurements were conducted using a Chromel-Alumel thermocouple connected to a digital direct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

2.2.3 Oxygen, Carbon Dioxide, Sulfur Dioxide, Nitrogen Oxides and Carbon Monoxide (USEPA Methods 3A, 6C, 7E and 10)

O₂ and CO₂ concentrations were determined following USEPA Method 3A procedures using ARI's Servomex, Inc. Model 1440C combination paramagnetic O₂ and non-dispersive infrared CO₂ analyzer. SO₂ sampling followed USEPA Method 6C procedures using ARI's Ametek (Bovar) Model 721-ATM non-dispersive ultraviolet SO₂ analyzer. NO_x sampling followed USEPA Method 7E procedures using ARI's California Analytical Instruments, Inc. Model 600-CLD chemiluminescent NO_x analyzer with low temperature NO₂ to NO conversion. CO sampling followed USEPA Method 10 procedures using ARI's Thermo Environmental Instruments, Inc. Model 48i gas filter correlation non-dispersive infrared CO analyzer.

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As shown in Figure 2-2, ARI's sampling system consisted of a heated 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 O₂, CO₂, SO₂, NO_x and CO analyzers.

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 average zero and calibration drift values obtained during each test run on the monitor were used to correct each monitor's raw data for instrument zero and drift for each respective test run.

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 in conjunction with the procedures described in the following subsections. The moisture calculated based upon the water collected was above the saturation point during some of the test runs. In these cases, the concentration at saturation is calculated based upon the saturation vapor pressure (S.V.P.) at the stack temperature divided by the stack pressure. The following calculation was used to determine the stack moisture content:

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

where:

- S.V.P. = Saturation vapor pressure at the stack temperature, in. Hg
- P_{bar} = Barometric pressure, in. Hg
- P_{static} = Absolute stack pressure, in. H₂O
- 13.6 = Conversion faction, in. Hg to in. H₂O

2.2.5 PM/PM_{2.5} (Filterable Plus Condensable) (USEPA Methods 5 and 202)

Due to entrained droplets that exist in the WGS exhaust, sampling was conducted in accordance with USEPA Methods 5 and 202 using an Apex Instruments, Inc. particulate sampling train (see Figure 2-3). The front-half probe and filter assemblies were analyzed for filterable PM using USEPA Method 5, but modified with the filtering temperatures set at 320°F. The back-half impinger catch was analyzed for condensable particulate matter (CPM) in accordance with USEPA Method 202 procedures.

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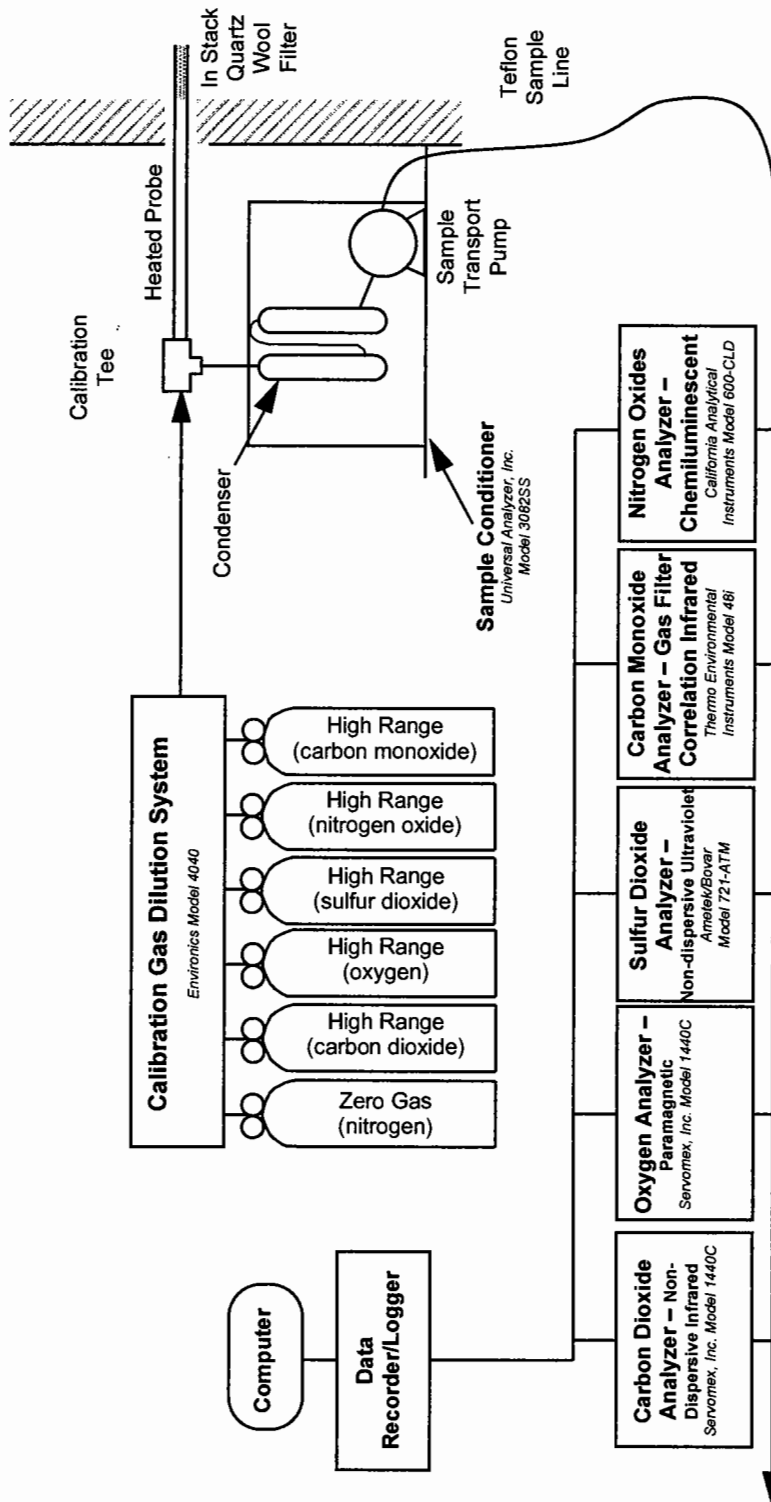


FIGURE 2-2. ARI REFERENCE METHOD CO₂, O₂, SO₂, NO_x AND CO SAMPLING SYSTEM

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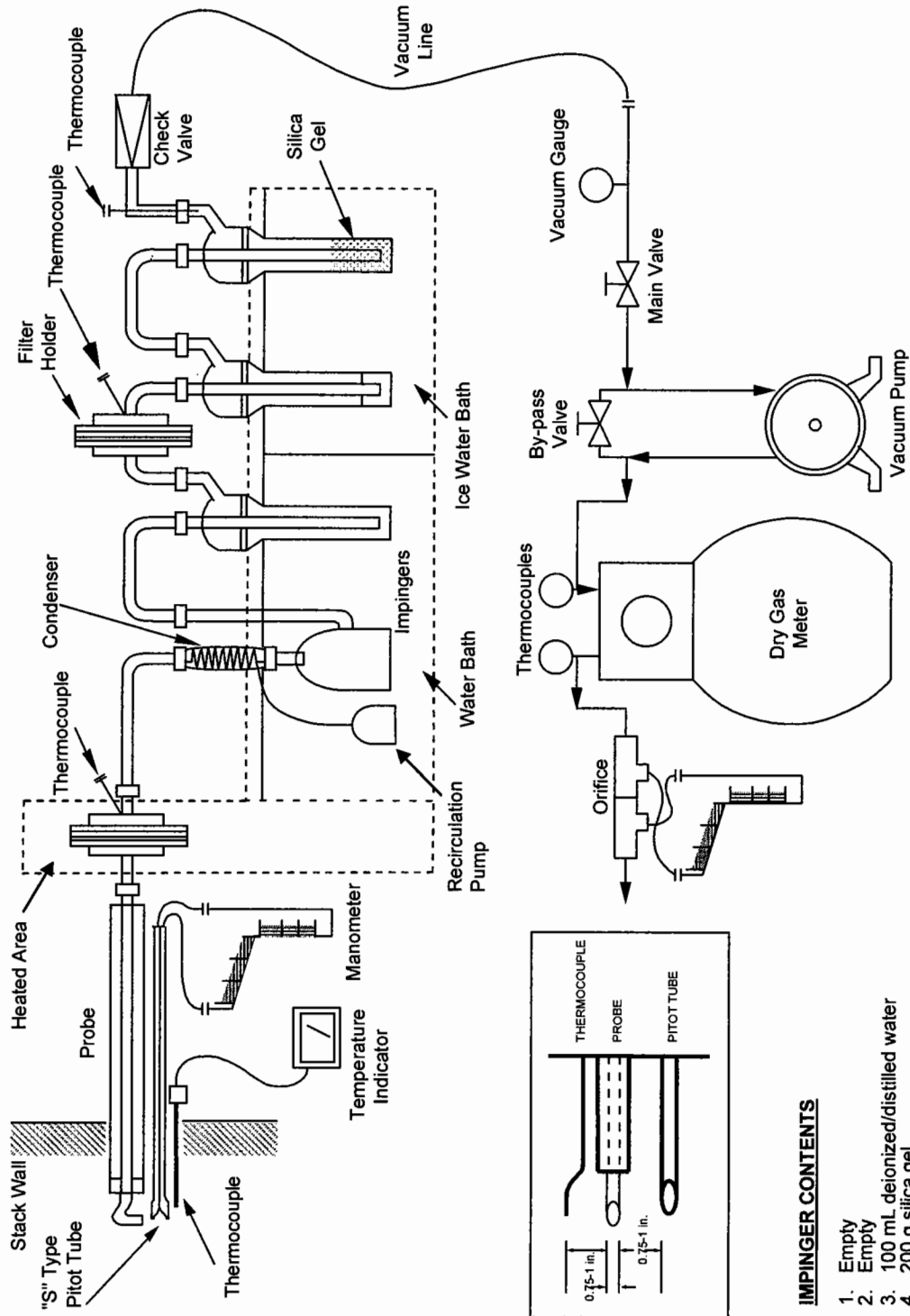


FIGURE 2-3. USEPA METHOD 5/202 PARTICULATE MATTER SAMPLING TRAIN



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2.2.5.1 Sampling Apparatus

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

Nozzle – Borosilicate glass.

Probe - Borosilicate glass with a heating system capable of maintaining a probe exit temperature of 320°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 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 support in direct contact with the sample stream. A quartz fiber filter was used that meets the requirements of USEPA Method 5.

Ambient Filter Holder - Unheated borosilicate glass with a 4-in. Teflon frit filter support 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. H₂O 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.

2.2.5.2 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 first and second impingers were initially empty. The third impinger contained 100 mL of deionized/distilled water. The fourth impinger contained 200 to 300 g of silica gel.

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The impingers were placed in a container that has 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 $\leq 68^{\circ}\text{F}$ 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 ft³/min at a vacuum of 15-in. Hg were 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.

2.2.5.3 Sample Recovery Procedures

After sampling was completed, a post-test nitrogen purge was conducted with the impingers still on ice at the meter $\Delta H@$ 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 5

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 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 - 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 4 - 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.

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Container 5 - The first two impingers (including the short stem), connecting glassware and front-half of the ambient filter were then 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 6 - The ambient filter was removed and placed in a Petri dish.

Containers 7 & 8 - 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.

2.2.5.4 Analytical Procedures

Method 5

The analytical procedures followed those described in USEPA Method 5.

Container 1 - 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 - The acetone washings were transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure. Then the contents were 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 dryness at ambient temperature and pressure. Then the contents were placed in a dessicator 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 4 - 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 5. The aqueous fraction from Container 4 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 redissolved in 100 mL of water and titrated with 0.1N NH₄OH to a pH of 7.0. The aqueous phase was 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.

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Container 5 - The contents of this container were combined with the organic extract from Container 4, 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 6 - 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 4. 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 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 5. This step was completed a total of three times. The procedures for Container 6 were completed prior to any procedures for Containers 4 and 5.

Container 7 - 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 8 - 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.

2.2.5.5 Total Dissolved Solids (TDS) and Total Suspended Solids (TSS)

In conjunction with every Method 5/202 sampling run, ARI collected samples of the scrubber recirculation liquid. Samples were collected at 15-minute intervals throughout the 120-minute sampling period to coincide with the PM/PM_{2.5} (5/202) sampling train. At each 15-minute interval, ARI collected 125 mL of scrubber recirculation liquid. With 8 intervals per 120 minutes of sample time, the final sample totaled 1,000 mL. This sample was marked and labeled for shipment to the laboratory. Analytical procedures followed those as described in ASTM Method D5907-10 for TDS and TSS.



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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.

Calibration gases were diluted from USEPA Protocol 1 high concentration standards. Dilution was performed using ARI's Environics Model 4040 Gas Dilution System. The dilution system was verified onsite before the start of testing following procedures described in USEPA Method 205.

2.2.7 Speciated Volatile Organic HAP (USEPA Method 18)

Volatile organic hazardous air pollutant (HAP) sampling and analysis were conducted following the Method 18 Midget Impinger Method approved by 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.

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



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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 2-4):

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 midjet 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 or fritted insert. The fifth impinger contained approximately 25 grams of silica gel to remove the final traces of moisture from the gas sample.

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 has an accuracy of $\pm 1\%$.

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.

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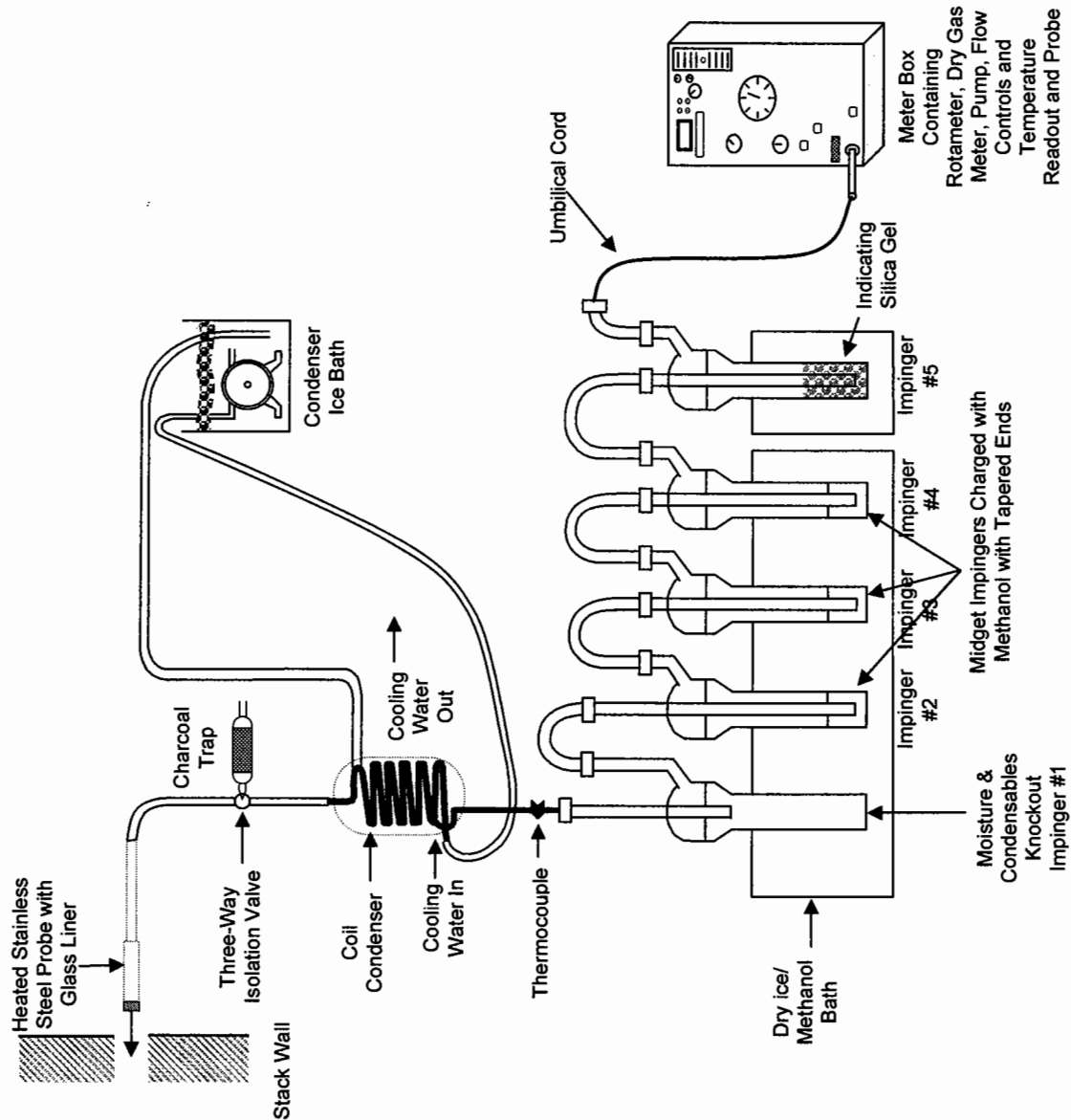


FIGURE 2-4. USEPA METHOD 18 MIDGET IMPINGER TRAIN



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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 liters/minute during each sampling run to collect a nominal 20 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 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.



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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 2-5.

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 run, the sampling train was disassembled, and all train samples were collected.

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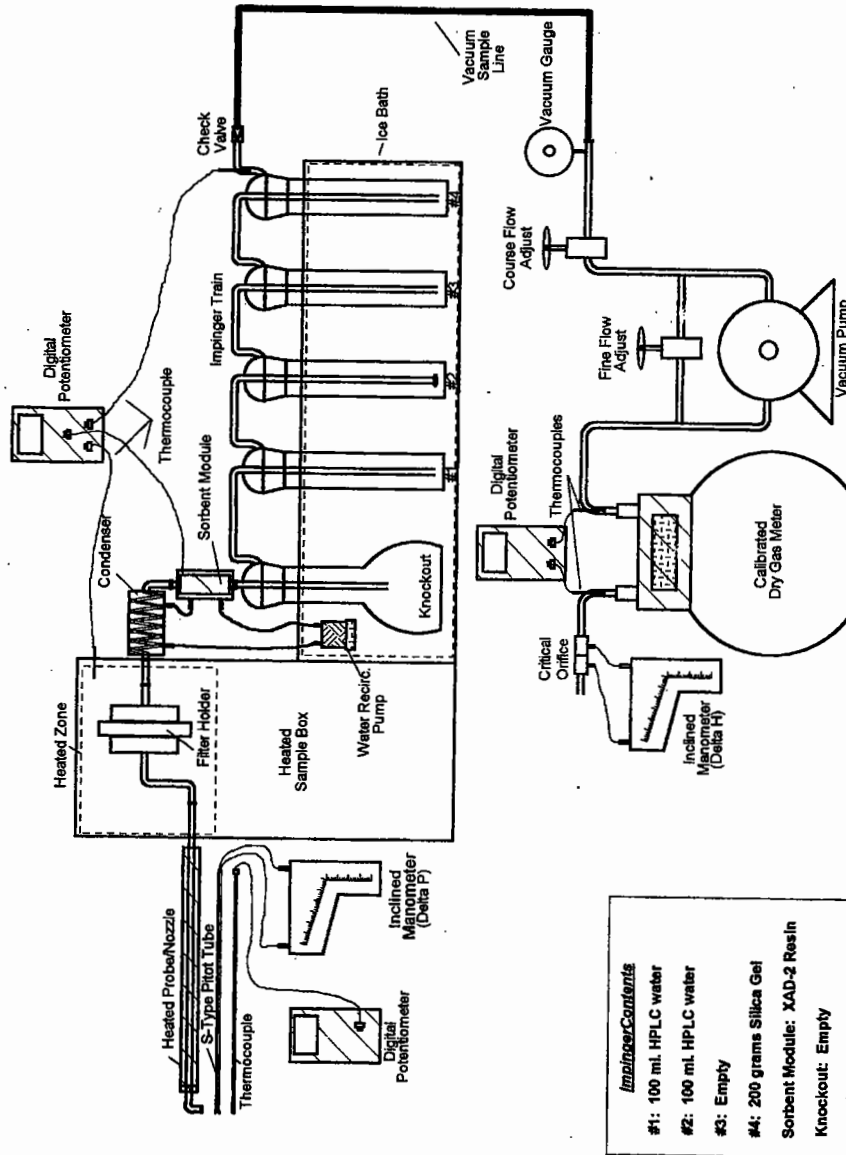


FIGURE 2-5. USEPA METHOD 23 SAMPLING TRAIN



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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 μ l of 100 picograms per μ l 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.

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.



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At the completion of each 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 can 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.



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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.

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 $^{13}\text{C}_{12}$ -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 $^{13}\text{C}_{12}$ -1,2,3,4-TCDD. Recoveries of the hexa- through octa- internal standards were calculated using $^{13}\text{C}_{12}$ -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.

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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 ng
¹³ C ₁₂ -1,2,3,4,7,8-Hexachlorodibenzodioxin	10 ng
¹³ C ₁₂ -2,3,4,7,8-Pentachlorodibenzofuran	10 ng
¹³ C ₁₂ -1,2,3,4,7,8-Hexachlorodibenzofuran	10 ng
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 ng
¹³ C ₁₂ -1,2,3,7,8-Pentachlorodibenzodioxin	10 ng
¹³ C ₁₂ -1,2,3,6,7,8-Hexachlorodibenzodioxin	10 ng
¹³ C ₁₂ -1,2,3,4,6,7,8-Heptachlorodibenzodioxin	10 ng
¹³ C ₁₂ -1,2,3,4,6,7,8,9-Octachlorodibenzodioxin	10 ng
¹³ C ₁₂ -2,3,7,8-Tetrachlorodibenzofuran	10 ng
¹³ C ₁₂ -1,2,3,7,8-Pentachlorodibenzofuran	10 ng
¹³ C ₁₂ -1,2,3,6,7,8-Hexachlorodibenzofuran	10 ng
¹³ C ₁₂ -1,2,3,4,6,7,8-Heptachlorodibenzofuran	10 ng
Dioxin and Furan Recovery Standards (applied to extracts prior to sample injection)	
Dioxin and Furan	
¹³ C ₁₂ -1,2,3,4-Tetrachlorodibenzodioxin	10 ng
¹³ C ₁₂ -1,2,3,7,8,9-Hexachlorodibenzodioxin	10 ng

Notes: ng = Nanogram



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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 250°F 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 2-6).

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 26A)

HCl, Cl₂ and HF sampling were conducted following USEPA Method 26A.

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 glass nozzle, 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 H₂SO₄, the third and fourth impingers contained 0.1N NaOH and the fifth impinger contained 200 grams of silica gel. See Figure 2-7.

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.

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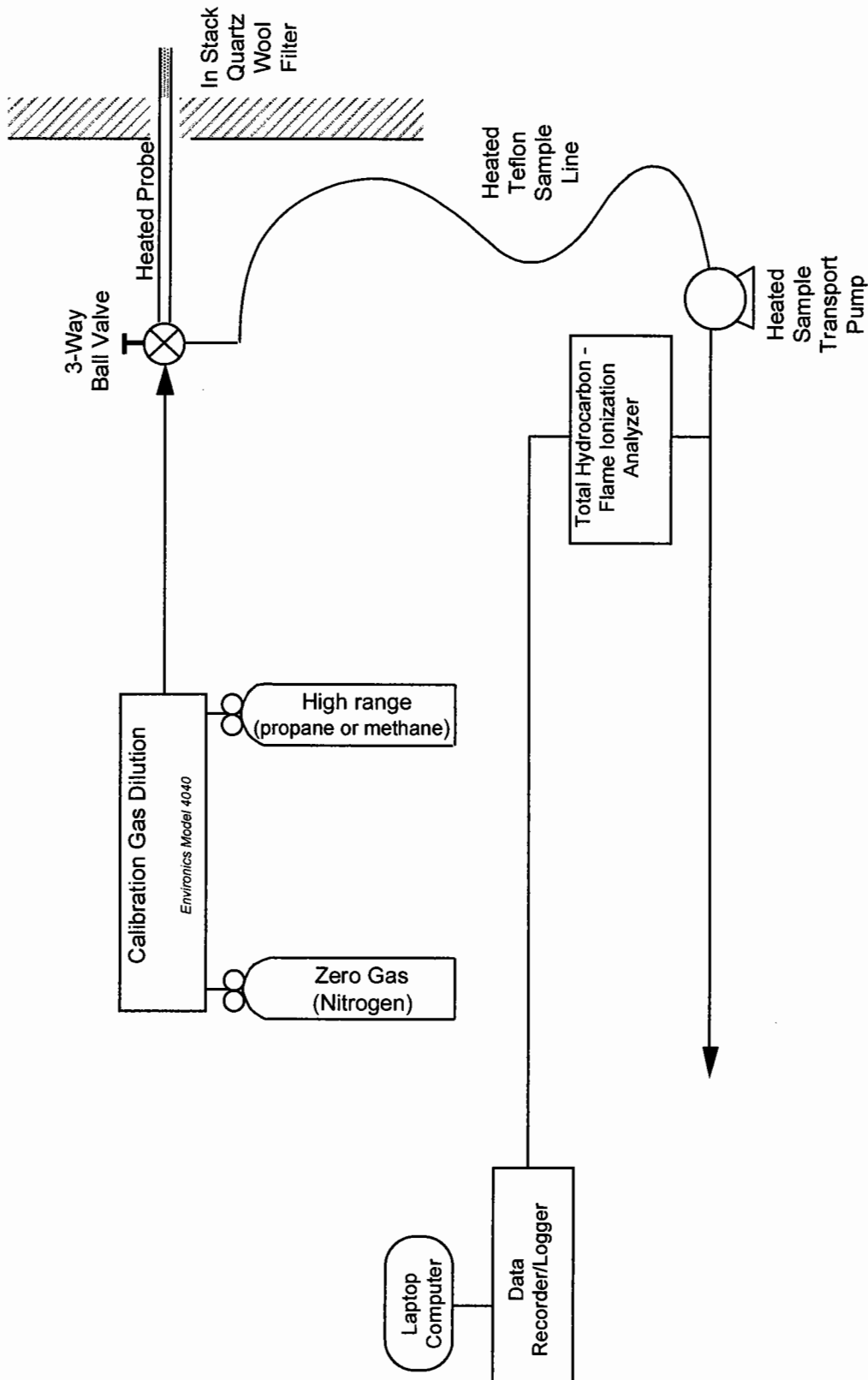


FIGURE 2-6. USEPA METHOD 25A - THC SAMPLING SYSTEM

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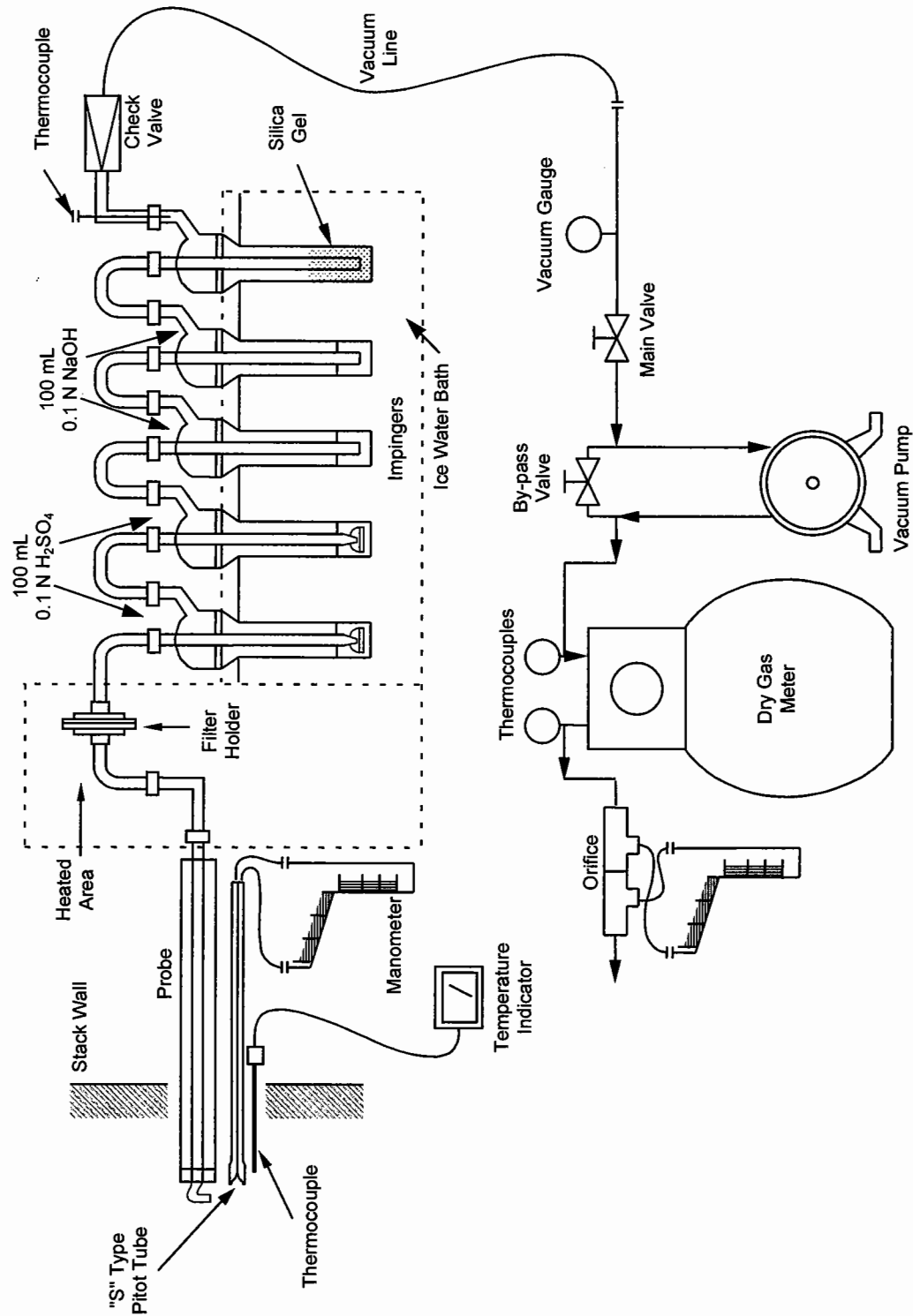


FIGURE 2-7. USEPA METHOD 26A SAMPLING TRAIN

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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 H₂SO₄ was placed in Container 4.

At ARI's laboratory, analysis of the samples was performed in accordance with USEPA Method 26A 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 (see Figure 2-8):

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

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 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 248°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.

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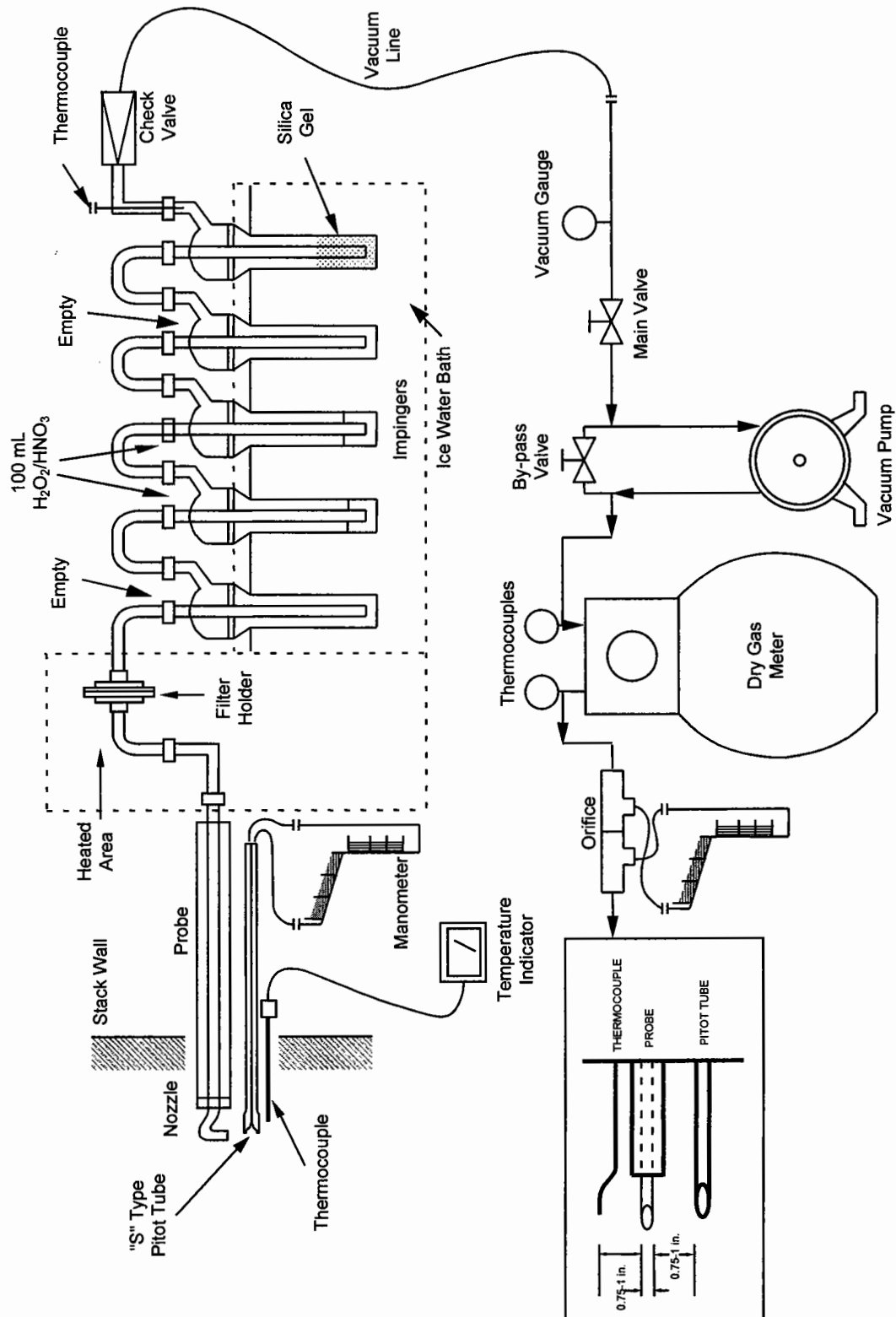


FIGURE 2-8. USEPA METHOD 29 SAMPLING TRAIN



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Draft Gauge - Inclined manometer with a readability of 0.01-in. H₂O in the 0- to 1-in. range and 0.1-in. H₂O 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 ft³/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.



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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 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 $\pm 2\%$.

2.2.13 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.



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2.2.13.1 Sampling Apparatus

As shown in Figure 2-9, 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.

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 $\pm 1\%$.

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

The spiked train included one midjet 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.

2.2.13.2 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 $\leq 2\%$ 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.

2.2.13.3 Sample Recovery Procedures

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

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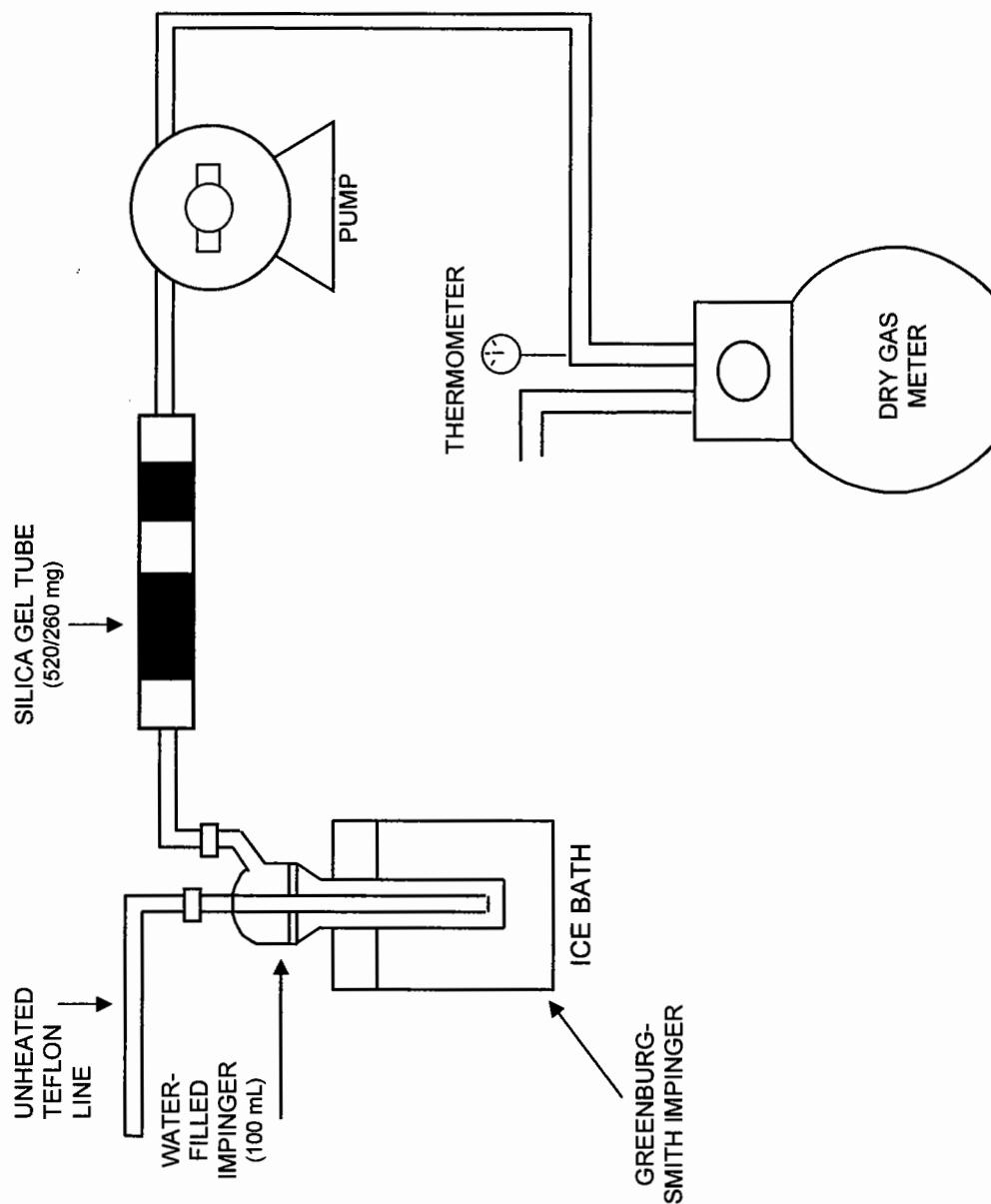


FIGURE 2-9. USEPA METHOD 308 SAMPLING TRAIN



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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.

2.2.13.4 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 liquid standards prepared in the same impinger absorbing solution matrix as well as standards prepared in the sorbent tube desorbing solution. The samples were analyzed and target analyte recoveries were determined to meet the QA recovery requirements set forth in USEPA Method 18. Analyte recovery was within the 70 to 130% R value range allowed by the method and the R value was applied to the analytical results.

2.2.14 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).

2.2.14.1 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 $\pm 27^{\circ}\text{F}$ 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 $\pm 27^{\circ}\text{F}$ 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.

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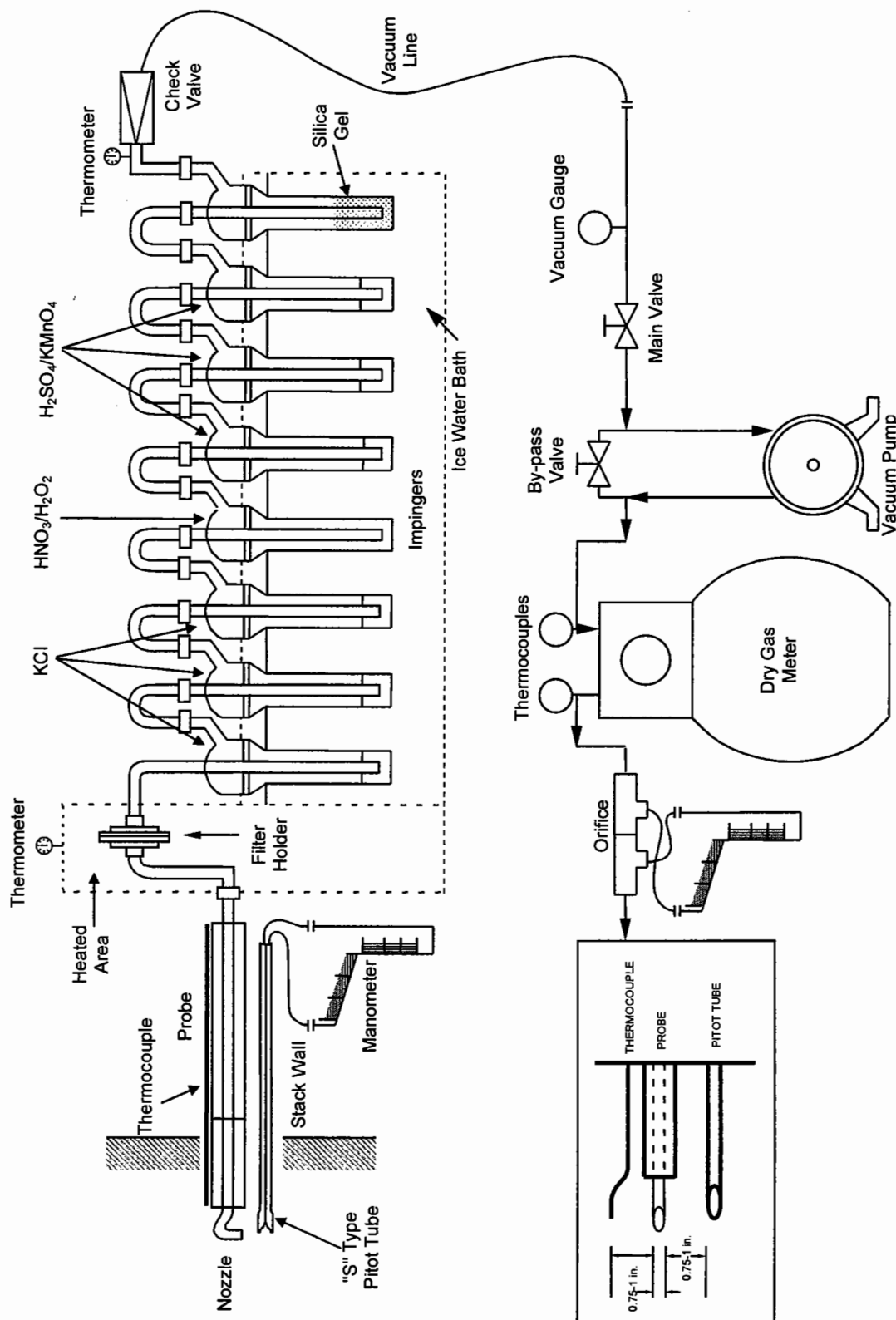


FIGURE 2-10. ASTM METHOD D6784-02 (ONTARIO HYDRO METHOD) MERCURY SAMPLING TRAIN

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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% HNO₃ and 10% hydrogen peroxide (H₂O₂). The fifth, sixth and seventh impingers each contained 100 mL of an aqueous solution of 4% potassium permanganate (KMnO₄) and 10% sulfuric acid (H₂SO₄). 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.

2.2.14.2 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.

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 ft³/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.

2.2.14.3 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.

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Container 2 - Loose particulate and 0.1 N HNO₃ 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 HNO₃ 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 HNO₃ and placed in a glass bottle. Small amounts of 5% KMnO₄ 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% HNO₃ and the rinses were added to Container 3. If the solution was clear, a small amount of 5% KMnO₄ 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 HNO₃ 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 HNO₃ 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 HNO₃ and added to Container 5. A third rinse was conducted using 0.1 N HNO₃ and several drops of 10% hydroxylamine solution and added to Container 5. If the solution was clear, a small amount of H₂SO₄/KMnO₄ 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 HNO₃ 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 HNO₃, 1 N KCl, 5% HNO₃/10% H₂O₂ and H₂SO₄/KMnO₄ were taken for blank analysis.

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

2.2.14.4 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.

2.2.15 Hydrogen Cyanide (OTM-29, Revised March 2011)

Sampling was conducted in accordance with USEPA OTM-29 using an Apex Instruments, Inc. sampling console, glassware and impinger train. The back half impinger catch was analyzed in accordance with OTM-29 procedures for HCN by ion chromatography (IC).

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2.2.15.1 Sampling Apparatus

Nozzle – Borosilicate glass with sharp, tapered leading edge.

Probe - Borosilicate glass with a heating system capable of maintaining a probe exit temperature of $248^{\circ}\text{F} \pm 25^{\circ}\text{F}$.

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

Filter Holder - Borosilicate glass with a Teflon filter support and a silicone rubber O-ring. The holder design provided a positive seal against leakage from the outside or around the filter. The filter holder was heated to $248^{\circ}\text{F} \pm 25^{\circ}\text{F}$ during sampling.

Filter Media – 4-in. quartz fiber filter.

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

Impingers – Five (5) impingers connected in series with glass ball joints. The first four impingers were of the Greenburg-Smith design with a standard tip. The fifth impinger was of the Greenburg-Smith design, but modified by replacing the standard tip with a $\frac{1}{2}$ -in.-i.d. glass tube extending to within $\frac{1}{2}$ in. of the bottom of the impinger flask.

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.

2.2.15.2 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 first four impingers initially contained 100 mL of 6.0 N sodium hydroxide (NaOH). The third impinger was initially empty. The fifth impinger contained 200 g of silica gel. The train was set up with the probe and filter holder as shown in Figure 2-11.

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 $0.02 \text{ ft}^3/\text{min}$ 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.

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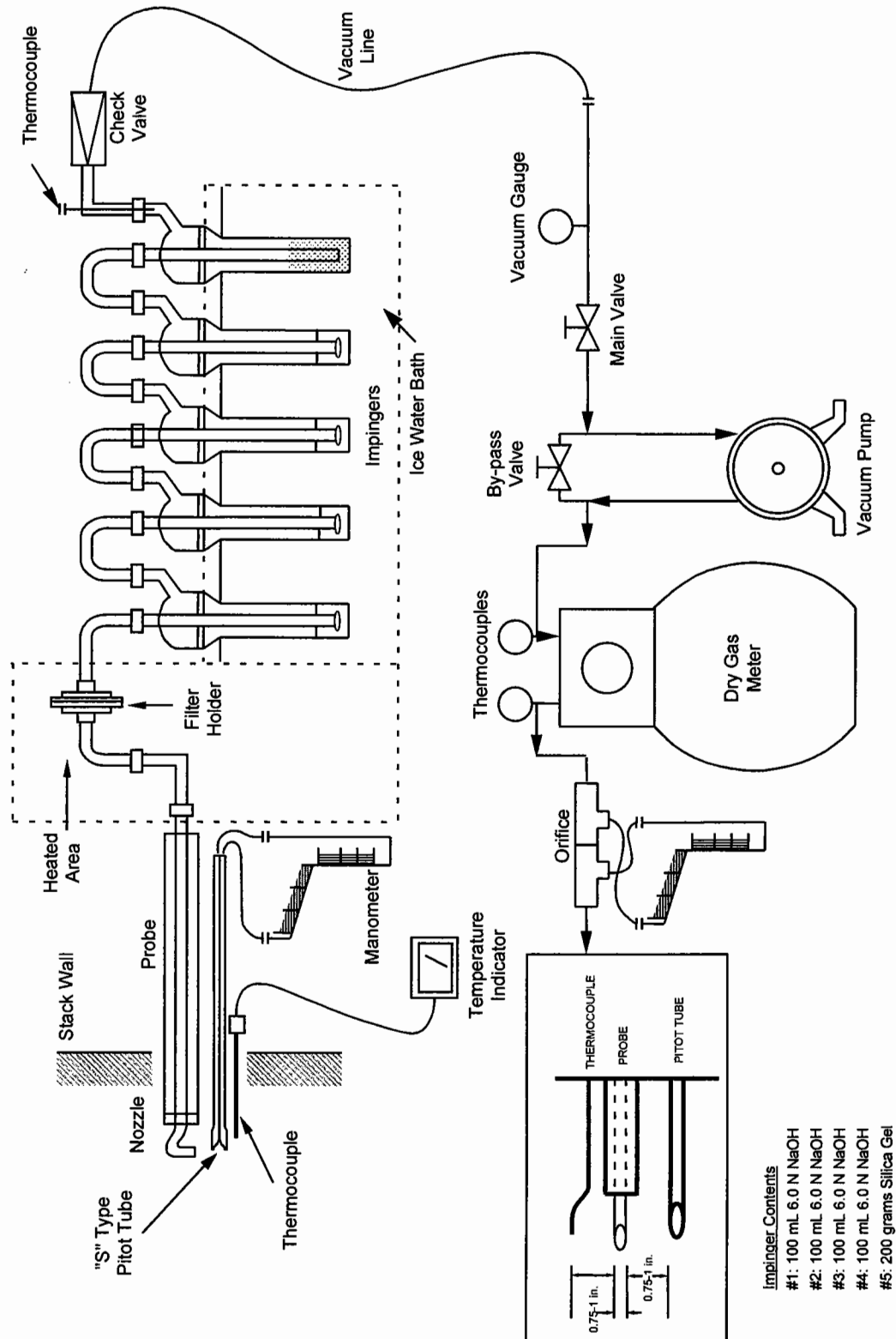


FIGURE 2-11. USEPA OTM-29 HYDROGEN CYANIDE SAMPLING TRAIN



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Stack CO₂ was continuously recorded using procedures of USEPA Method 3A. In conjunction, a bag sample of the dry gas meter effluent was collected to determine the CO₂ content of the sample gas after being subjected to the impinger absorbents. The difference between the stack gas and final sample CO₂ concentrations were used to adjust the final sample volume.

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 impinger pH indicator and sampling train data were recorded at specified intervals. The pH in the impingers needs to be ≥ 12 and was monitored at 15-minute intervals. Isokinetic sampling rates were set throughout the sampling period with the aid of a programmable calculator.

2.2.15.3 Sample Recovery Procedures

After sampling was completed, the sampling train was then moved carefully from the test site to the recovery area. The sample fractions were recovered as follows:

Container 1 – The pH was recorded for the first three impingers and the contents of impingers 1 through 3 were measured gravimetrically and placed in a glass bottle, sealed and labeled. A rinse of 0.1 N NaOH was performed on each of the first three impingers and placed in the same container.

Container 2 – After recording the pH and weighing, the contents of the fourth impinger were placed in a glass bottle along with the 0.1 N NaOH rinses. The contents of impinger 5 were weighed and then discarded.

Container 3 – 100 mL of 6.0 N NaOH was collected for blank analysis.

2.2.15.4 Analytical Procedures

The samples were analyzed by ion chromatography in accordance with USEPA OTM-29.

2.2.16 Ammonia (CTM-027)

The sampling procedures followed those described in Conditional Test Method 027 (CTM-027), Procedures for Collection and Analysis of Ammonia in Stationary Sources.

2.2.16.1 Sampling Apparatus

The sampling train used was a USEPA Method 17 sampling system. Assembled by ARI personnel, it consisted of the following:

Nozzle - Stainless steel (316) with sharp, tapered, leading edge and accurately measured round opening.

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Probe - Borosilicate glass with a heating system capable of preventing visible condensation at the exit end during sampling.

Pitot Tube - A Type-S pitot tube that met all geometric standards; attached to the probe to monitor stack gas velocity.

In-Stack Filter Holder - Glass fiber thimble contained in a borosilicate glass holder designed by Apex Instruments, Inc.

Draft Gauge - A dual-inclined manometer made by Dwyer with a readability of 0.01 in. H₂O in the 0- to 1-in. range and 0.1 in. H₂O in the 1- to 10-in. range. Velocity determination was conducted with a 0- to 0.25 in. H₂O range manometer with a readability of 0.005 in. H₂O.

Impingers - Four (4) impingers connected in series with glass ball joints. The first and second impingers were of the Greenburg-Smith design. The third and fourth impingers were Greenburg-Smith impingers modified by replacing the tip with a ½-inch glass tube extending to ½-inch from the bottom of the flask.

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

Barometer - Aneroid type to measure atmospheric pressure to ±0.1 in. Hg.

2.2.16.2 Sampling Procedures

Approximately 200 grams of silica gel was weighed and placed in a sealed impinger prior to each test run. 100 mL of 0.1N sulfuric acid (H₂SO₄) was placed into each of the first two impingers, the third impinger was initially empty and the fourth contained 200 grams of silica gel. The train was set-up with the probe as shown in Figure 2-12. The sampling train was leak-checked at the sampling site prior to each test run by plugging the inlet to the nozzle and pulling a 15-in. Hg vacuum; and at the conclusion of the test run, by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run.

The pitot tube and lines were leak-checked at the test site prior to and at the conclusion of each test run. The check was made by blowing into the impact opening of the pitot tube until 3 or more inches of water was recorded on the manometer and then capping the impact opening and holding it for 15 seconds to assure it was leak-free. The static pressure side of the pitot tube was leak-checked by the same procedure, except suction was used to obtain the 3-in. H₂O manometer reading. Crushed ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at 68°F or less.

During sampling, stack gas and sampling train data were recorded at each sampling point and whenever significant changes occurred in stack flow conditions. Isokinetic sampling rates were set throughout the sampling period with the aid of a calculator.

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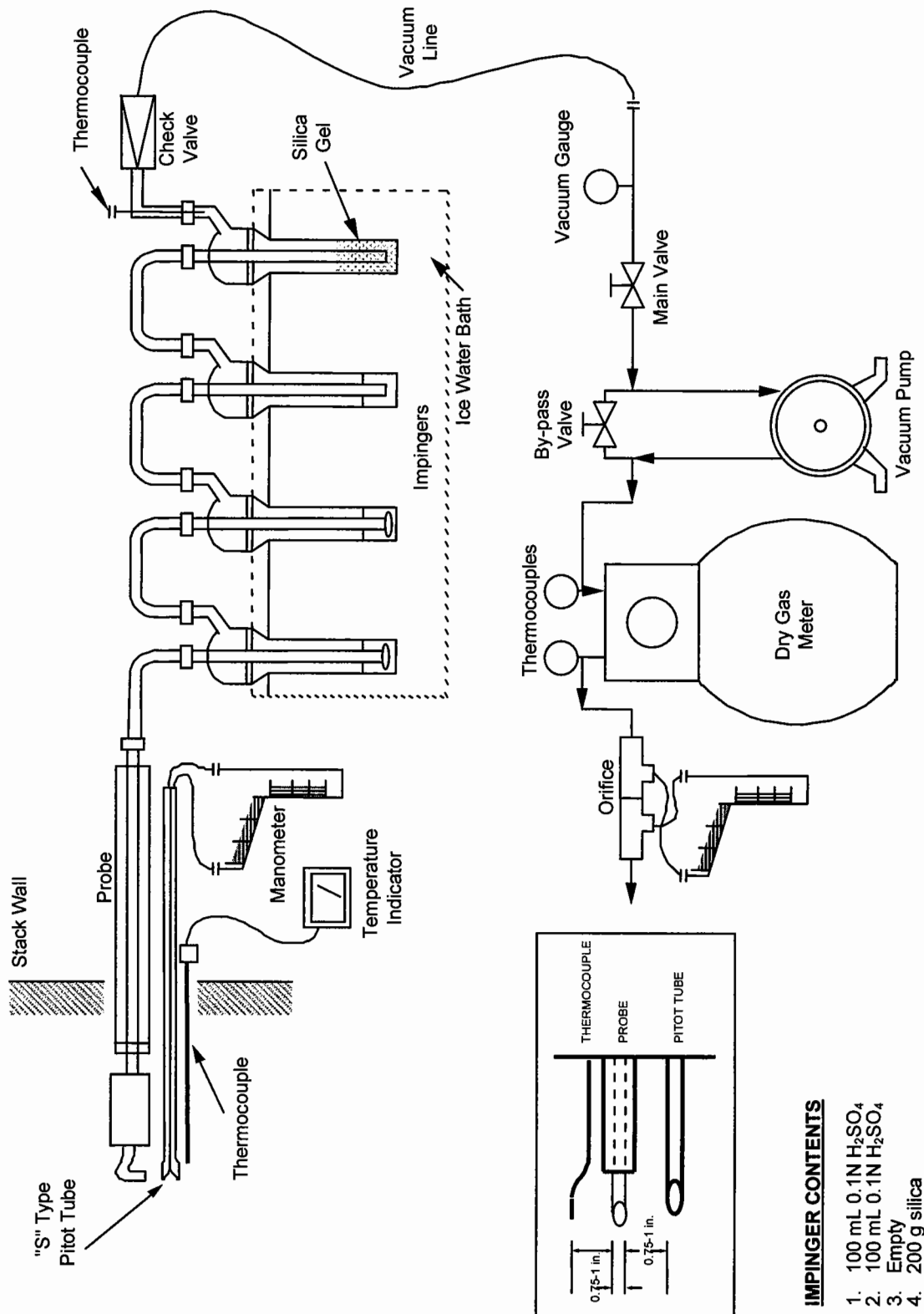


FIGURE 2-12. CONDITIONAL TEST METHOD 027 (CTM-027) AMMONIA SAMPLING TRAIN

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2.2.16.3 Sample Recovery Procedures

After sampling was completed and the final leak-checks were performed, the sampling train was moved to the cleanup area and recovered as follows:

Container No. 1 – The contents of impingers one, two and three were measured volumetrically and transferred to a polyethylene sample jar. The probe liner and connecting glassware were rinsed with 0.1N H₂SO₄ and this rinse was placed in the sample jar containing the impinger contents.

The weight of the silica gel in impinger four was determined and recorded.

2.2.16.4 Analytical Procedures

The analytical procedures followed those described in CTM-027.

At ARI's laboratory, the contents of Container No. 1 were analyzed for ammonium by ion chromatography.

2.2.17 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.

2.2.17.1 Sampling Apparatus

The sampling train was an Apex Instruments Modified Method 5 sampling train (see Figure 2-13). The major components are described below:

Nozzle - Borosilicate glass with sharp tapered leading edge.

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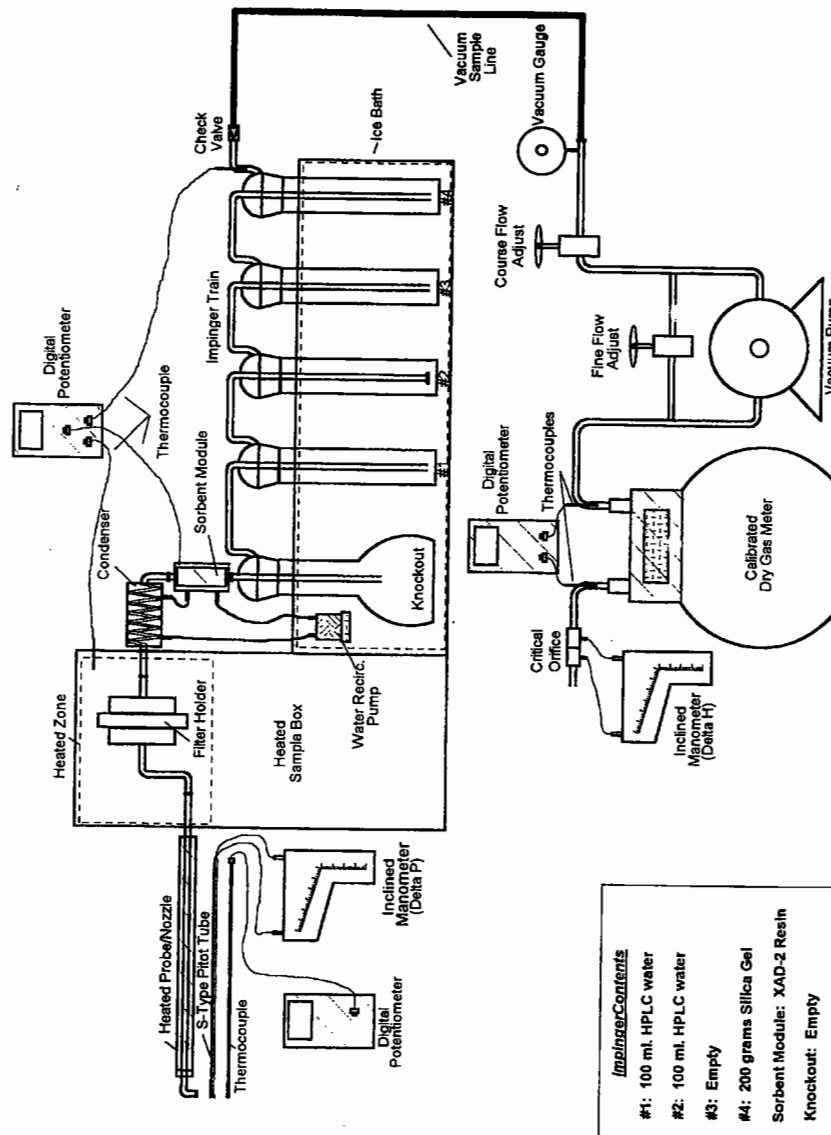


FIGURE 2-13. SW-846 METHOD 0010 SAMPLING TRAIN

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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.

2.2.17.2 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.

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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.

2.2.17.3 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.

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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.

2.2.17.4 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.

2.2.18 Aldehydes (SW-846 Method 0011)

Sampling for aldehydes (formaldehyde, acetaldehyde, propanal) was conducted in accordance with SW-846 Method 0011 using an Apex Instruments, Inc. sampling train as shown in Figure 2-14. The impinger catch was analyzed for aldehydes in accordance with SW-846 Method 8315A procedures.

2.2.18.1 Sampling Apparatus

The aldehydes sampling train met design specifications established by the USEPA. Assembled by ARI personnel, it consisted of the following:

Nozzle - Borosilicate glass with sharp, tapered, leading edge and accurately measured round opening.

Probe - Borosilicate glass with a heating system capable of maintaining a gas temperature of $248^{\circ}\text{F} \pm 25^{\circ}\text{F}$ at the exit end during sampling.

Pitot Tube - A Type-S pitot tube that met all geometric standards; attached to the probe to monitor stack gas velocity.

Draft Gauge - A dual-inclined oil gauge manometer made by Dwyer 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- to 10-in. range.

Impingers - Five impingers connected in series with O-ring ball joints. The first, third, fourth and fifth impingers were of the Greenburg-Smith design, modified by replacing the tip with a 1/2-in.-i.d. glass tube extending to 1/2-in. from the bottom of the flask. The first three impingers contained a 2,4-dinitrophenylhydrazine (DNPH) solution.

Filter Holder - Borosilicate glass with a quartz fiber, 4-in. diameter, placed between the second and third impinger.

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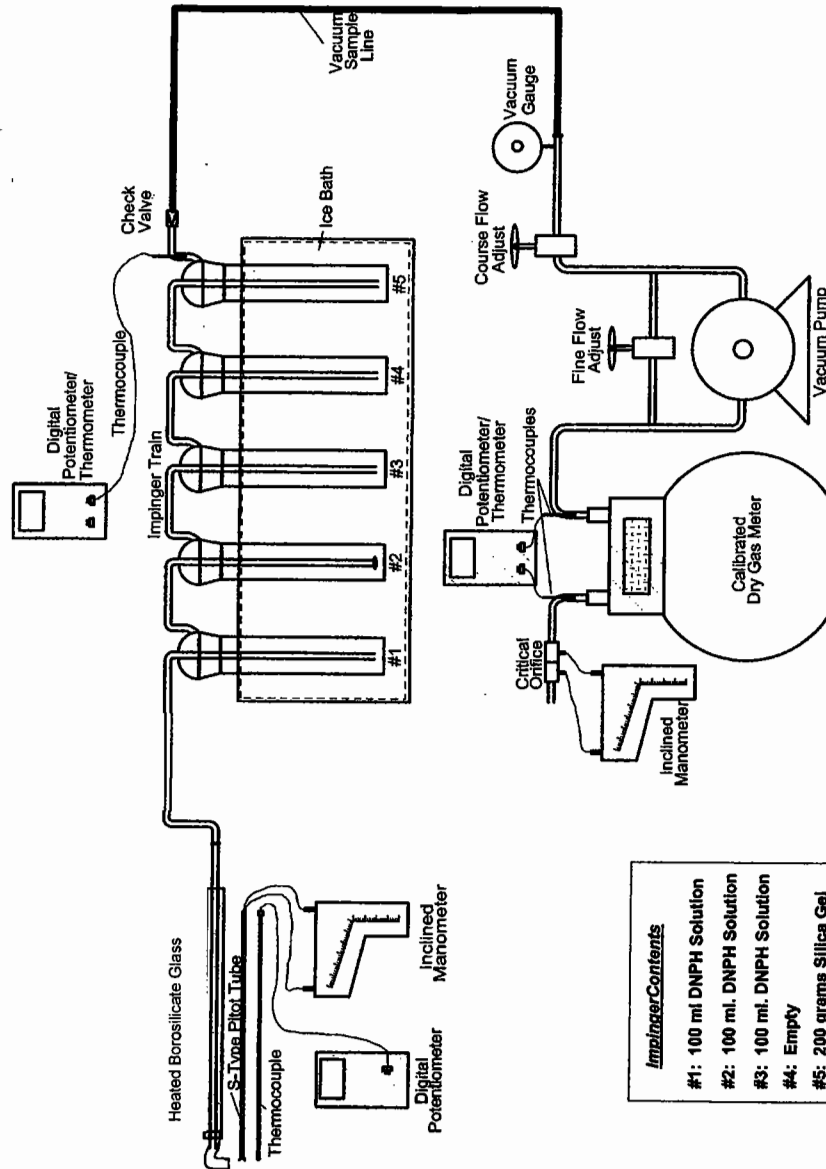


FIGURE 2-14. SW-846 METHOD 0011 SAMPLING TRAIN

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

Barometer - Aneroid type to measure atmospheric pressure to ± 0.1 in. Hg.

2.2.18.2 Sampling Procedures

Approximately 200 grams of silica gel were weighed and placed in a sealed impinger prior to each test run: 200 mL of DNPH was placed in the first impinger; the second and third impingers each contained 100 mL DNPH; the fourth impinger was empty, and the fifth impinger contained silica gel. The sampling train was leak-checked at the sampling site prior to each test run by plugging the inlet to the nozzle and pulling a 15-in. Hg vacuum; and at the conclusion of the test run, by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run.

The pitot tube and lines were leak-checked at the test site prior to and at the conclusion of each test run. The check was made by blowing into the impact opening of the pitot tube until 3 or more inches of water was recorded on the manometer and then capping the impact opening and holding it for 15 seconds to assure it was leak-free. The static pressure side of the pitot tube was leak-checked by the same procedure, except suction was used to obtain the 3-in. H₂O manometer reading. Crushed ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at 68°F or less.

During sampling, stack gas and sampling train data were recorded at each sampling point and whenever significant changes occurred in stack flow conditions. Isokinetic sampling rates were maintained within 10% of true isokinetic throughout the sampling period using isokinetic calculations. Sample rates were less than 28 liters per minute.

2.2.18.3 Sample Recovery Procedures

The sampling train was moved carefully from the test site to the cleanup area. The volume of DNPH from the first three impingers was measured, and sample fractions were recovered as follows:

Container 1 - Methylene chloride washings from all sample-exposed surfaces prior to the impinger train were placed in an amber glass container. Particulate was removed from the probe with the aid of a Teflon brush. The DNPH in the first three impinger sections of the sampling train was measured volumetrically and placed in the amber glass container. The impingers and connecting glassware were rinsed with methylene chloride and this rinse was added to the container for shipment to the laboratory. A final rinse of the impinger section was conducted using distilled H₂O and methylene chloride

Container 2 – Sample blank equal in volume to the sample runs.



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Testing and Analytical Procedures

Container 3 – The silica gel from the fifth impinger was weighed, and this value was recorded on the Sample Recovery and Integrity Sheet along with other pertinent data. The color of the indicating silica gel was observed to determine if there had been moisture breakthrough. The silica gel was weighed to the nearest 0.5 g.

2.2.18.4 Analytical Procedures

The analytical procedures followed those described in SW-846 Method 8315A.

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 0.1 N potassium hydroxide (KOH).

2.2.19.1 Sampling Apparatus

The recirculatory sampling train (see Figure 2-15) 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, 1/4" 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 1/2-inch glass tube extending to 1/2-inch from the bottom of the flask. The first impinger contained 150 mL of 0.1 N KOH solution. The second and third impingers each contained 75 mL of 0.1 N 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.

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.

SECTION TWO

Testing and Analytical Procedures

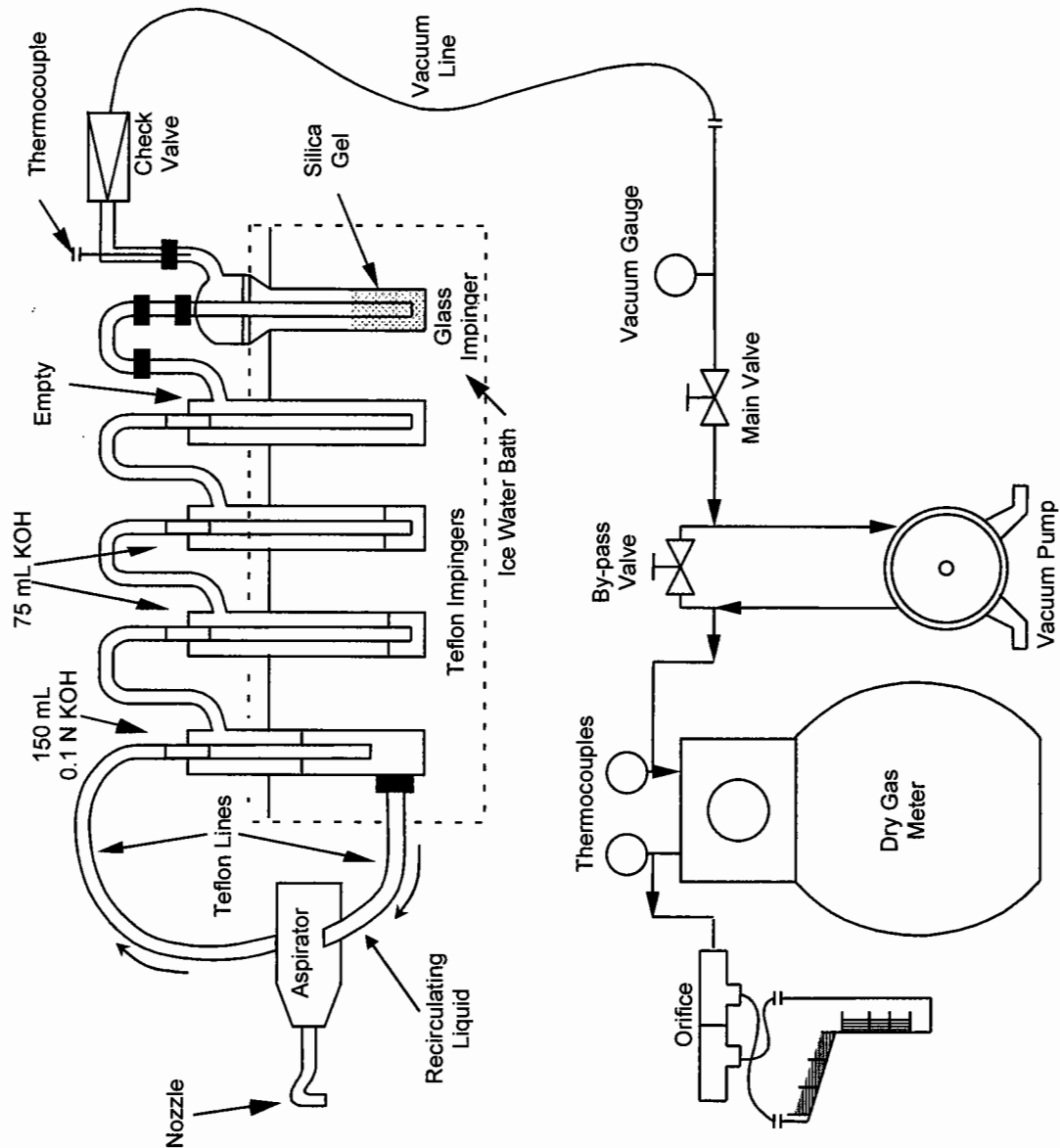


FIGURE 2-15. SW-846 METHOD 0061 SAMPLING TRAIN



SECTION TWO

Testing and Analytical Procedures

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 $0.02 \text{ ft}^3/\text{min}$ 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 0.1 N 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 purpose of an FCCU (Fluidized Catalytic Cracking Unit) is to convert gas oil (from the coker and from the gas oil hydrotreater) to higher-grade products. The primary products being gasoline, PP (propane/propylene) and BB (butane/butylenes). Other products generated from the unit are absorber gas, acid gas, light cycle oil and decanted oil.

The gas oil is converted by contacting it with hot fluidized catalyst at the base of the riser. As the mixture flows up the riser, the long chain hydrocarbons are "cracked" to lighter components. The mixture enters the reactor where the vaporized oil and catalyst are separated. The reactor vapors are sent overhead to the fractionator for separation, whereas the "spent" catalyst travels to the regenerator. In the regenerator, the carbon on the "spent" catalyst is burned to CO and CO₂ in the presence of air. The regenerated catalyst is sent back to the bottom of the riser, thus completing the cycle for the catalyst.

The reactor vapors enter the fractionator where light cycle oil and decanted oil are drawn off. The sulfur is removed from the light cycle oil before being sent out as diesel. The decanted oil is sold as carbon black feedstock. Gasoline and lighter products go overhead to be recovered in the rest of the unit. The absorber/stripper towers separate the absorber gas from the rest of the mixture. It is amine treated and then sent to the Ethylene Unit at Chevron Phillips Chemical Company. The PP and BB streams are separated by the depropanizer. The PP is also amine treated before being sent to Chevron Phillips Chemical Company.

The Port Arthur Refinery's FCCU catalyst regenerator is equipped with a Belco licensed process wet gas scrubber that controls the emission of SO₂ and PM to the atmosphere. PM removal is accomplished using a staged approach. The coarse fraction of particulate is captured in the Spray Tower through the use of multiple water spray curtains. Nearly 100% of particulate >3 microns in size is captured along with a smaller percentage of finer particulate. For the coarse fraction of particulate, the Spray Tower is basically a bulk removal device. It removes all the coarse particulate regardless of the inlet loading. A unique process of forced condensation, agglomeration and water spray filtration in the Agglo Filtering Modules captures the remaining finer fraction. Multiple spray curtains in the Spray Tower provide the liquid to gas contact for a staged approach. The final removal step occurs in the 9 droplet separators prior to entering the integral stack. Each droplet separator treats a portion of the flue gas removing free water droplets from the gas by centrifugal separation.

Table 3-1 presents a daily average of the FCCU and the wet gas scrubber operational data recorded during the days of testing. Hourly and 30 days work of daily operational data are presented in Appendix F.



SECTION THREE

Process Description

TABLE 3-1. PROCESS DATA SUMMARY

DATE :	6/6/2011	6/7/2011	6/8/2011	6/9/2011	6/10/2011	6/13/2011	6/14/2011
TIME :	11:00 - 17:00	14:00 - 16:00	08:00 - 17:00	07:00 - 17:00	07:00 - 17:00	09:00 - 18:00	07:00 - 12:00
FCC Charge Rate, BPD	76,857	55,925	52,083	51,842	51,642	49,970	53,656
Coke Burn Off, lb/hr	55,267	49,755	47,896	47,969	47,933	23,302	29,679
Scrubber Pressure Drop, in.H ₂ O	11.9	11.2	11.0	10.9	10.9	9.5	9.6
Scrubber Flow Rate, gpm	10,177	10,121	10,233	10,144	10,263	10,036	9,948
Liquid-to-Air Ratio	0.0674	0.0717	0.0743	0.0739	0.0745	0.1629	0.1213
Scrubber Liquor pH	7.0	7.1	6.8	6.9	6.9	7.0	6.9



SECTION FOUR

Test Results

The test results are presented in Table 4-1 through 4-17.

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 as detailed in the Table of Contents.

DISCUSSION

Volatile Organic HAPs

Data presented for the volatile organic HAPs (see Tables 4-6 and 4-17) should be qualified with the following observances:

Concentrations of acetone, methylene chloride and methanol appear as artifacts of cross-method contamination. Elevated levels of these four compounds were found in the associated blanks, both field and reagent, and 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 4-5.

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.

Poor labeled recoveries of 1,3-butadiene-d5 resulted in raised reporting levels for the native 1,3-butadiene and pentane.

Semi-Volatile HAPs

Samples showed a low bias for the extraction standard recoveries of acenaphthylene-d8, anthracene-d10, benzo(a)pyrene-d12 and perylene-d12. This represented a chemical loss of both the deuterated and corresponding native targets. Based upon poor reliability of the extraction standard recoveries for these compounds, quantification of native targets is not possible. Therefore on one sample (FCCU-0010-1), the value of benzo(a)pyrene is not available. The same is evident on two sample runs (FCCU-0010-1 and FCCU-0010-2) for perylene.

The second run (FCCU-0010-2) showed low recoveries for the more volatile extraction standards using the SW-846 Method 3542/8270D analytical procedures. The low recoveries are likely from volatile losses in the extract during the sample concentration procedure of the extract. The more volatile native target compounds are likely impacted with low recoveries.



SECTION FOUR

Test Results

Aldehydes

The analytical results of the USEPA Method 0011 train indicated elevated values of aldehydes in the sample runs as well as the field blank train. These levels cannot be considered representative of the atmospheric emissions from the FCCU WGS stack. Therefore, the data represented in Table 4-7 has been corrected for the field blank levels.

PCBs

During the course of the analytical preparation, the 13C12-PCB extraction standards were added after the extractions were completed. Therefore, the final values are not corrected for any losses that may have been incurred during extraction.



SECTION FOUR

Test Results

TABLE 4-1. FCCU-1241 WGS STACK HCl, Cl₂ AND HF TEST RESULTS SUMMARY

TEST RUN	FCCU-26A-1	FCCU-26A-2	FCCU-26A-3	
TEST DATE	6/6/2011	6/6/2011	6/7/2011	
TEST TIME	11:25 - 13:35	14:01 - 16:28	14:28 - 16:46	<u>Average</u>
<u>Stack Gas Parameters</u>				
Temperature, av. °F	141.7	141.5	140.0	141.1
Velocity, av. ft/sec	33.88	33.46	32.70	33.35
Volume flow, acfm	249,466	246,403	240,767	245,545
Volume flow, scfm	219,310	215,966	211,549	215,608
Volume flow, dscfm	174,021	171,218	170,907	172,049
Volume flow, scfh	13,158,586	12,957,967	12,692,945	12,936,499
Volume flow, dscfh	10,441,240	10,273,093	10,254,434	10,322,922
Moisture, av. % vol	20.65	20.72	19.21	20.19
CO ₂ , av. % vol, db	16.67	16.65	12.98	15.43
O ₂ , av. % vol, db	1.51	1.49	5.47	2.82
<u>Sampling System Data</u>				
Time, min	120.0	120.0	120.0	
Volume, dscf	74.443	73.876	73.495	
Volume, dscm	2.108	2.092	2.081	
Isokinetic Ratio, %	100.7	101.6	101.4	
<u>Hydrogen Chloride (HCl)</u>				
Concentration				
ppmv db	< 0.073	< 0.074	< 0.074	< 0.074
mg/dscm	< 0.1110	< 0.1118	< 0.1124	< 0.1118
lb/dscf x 10 ⁻⁶	< 0.0069	< 0.0070	< 0.0070	< 0.0070
Emission rate				
lb/hr	< 0.07236	< 0.07174	< 0.07198	< 0.07202
<u>Chlorine (Cl₂)</u>				
Concentration				
ppmv db	< 0.019	< 0.019	< 0.019	< 0.019
mg/dscm	< 0.0550	< 0.0554	< 0.0557	< 0.0554
lb/dscf x 10 ⁻⁶	< 0.0034	< 0.0035	< 0.0035	< 0.0035
Emission rate				
lb/hr	< 0.03587	< 0.03556	< 0.03568	< 0.03570
<u>Hydrogen Fluoride (HF)</u>				
Concentration				
ppmv db	< 0.018	< 0.018	< 0.018	< 0.018
mg/dscm	< 0.0152	< 0.0153	< 0.0154	< 0.0153
lb/dscf x 10 ⁻⁶	< 0.0009	< 0.0010	< 0.0010	< 0.0010
Emission rate				
lb/hr	< 0.00989	< 0.00981	< 0.00984	< 0.00985



SECTION FOUR

Test Results

TABLE 4-2. FCCU-1241 WGS STACK HCN TEST RESULTS SUMMARY

TEST RUN	FCCU-OTM29-1	FCCU-OTM29-2	FCCU-OTM29-3	
TEST DATE	6/6/2011	6/6/2011	6/7/2011	
TEST TIME	11:25 - 12:59	14:01 - 16:13	14:35 - 15:59	<u>Average</u>
<u>Stack Gas Parameters</u>				
Temperature, av. °F	141.8	141.8	140.2	141.3
Velocity, av. ft/sec	33.6	33.0	31.3	32.6
Volume flow, acfm	247,738	243,011	230,122	240,290
Volume flow, scfm	217,754	212,887	202,128	210,923
Volume flow, dscfm	172,787	168,777	162,337	167,967
Volume flow, scfh	13,065,270	12,773,214	12,127,688	12,655,390
Volume flow, dscfh	10,367,194	10,126,621	9,740,227	10,078,014
Moisture, av. % vol	20.65	20.72	19.69	20.35
CO ₂ , av. % vol, db	16.68	16.66	13.05	15.46
O ₂ , av. % vol, db	1.51	1.49	5.41	2.80
<u>Sampling Train Data</u>				
Sample volume, dscf	22.973	22.158	21.587	22.239
Sample volume, dscm	0.625	0.601	0.589	0.605
% Isokinetic	96.1	94.2	96.4	95.6
Total Sample Time, min.	60.0	60.0	60.0	60.0
HCN collected, µg	53,440	49,166	23,265	41,957
<u>Hydrogen Cyanide (HCN)</u>				
Concentration				
lb/dscf x 10 ⁻⁶	5.129	4.893	2.376	4.133
ppmv db	73.11	69.73	33.87	58.90
µg/dscm	82,137	78,349	38,055	66,180
Emission rate				
lb/hr	53.175	49.546	23.143	41.955



SECTION FOUR

Test Results

TABLE 4-3. FCCU-1241 WGS STACK SVOC CONCENTRATION TEST RESULTS SUMMARY

TEST RUN :	FCCU-0010-1	FCCU-0010-2	FCCU-0010-3	
TEST DATE :	6/8/2011	6/8/2011	6/9/2011	
TEST TIME :	08:16 - 12:53	14:02 - 18:39	07:34 - 12:04	<u>Average</u>
<u>SVOC Sample Parameters</u>				
Time, min	240	240	240	
Volume, dscm	4.076	4.142	4.140	
Volume, dscf	143.937	146.236	146.166	
Isokinetic rate, %	97.9	100.6	100.5	
<u>Concentration - µg/dscm</u>				
Acenaphthene	< 0.277207	0.122902	< 0.115714	< 0.171941
Acenaphthylene	< 0.051762	< 0.606060	< 0.006039	< 0.221287
Aniline	< 0.000454	< 0.000447	< 0.000447	< 0.000449
Anthracene	0.087332	< 0.013884	0.004155	< 0.035124
Benzidine	< 0.009322	< 0.009175	< 0.009180	< 0.009226
Benzo[a]anthracene	< 0.000981	< 0.002149	< 0.000966	< 0.001366
Benzo[b]fluoranthene	< 0.001212	< 0.000966	< 0.000966	< 0.001048
Benzo[k]fluoranthene	< 0.000981	< 0.000966	< 0.000966	< 0.000971
Benzo[g,h,i]perylene	< 0.000981	< 0.012073	0.001150	< 0.004735
Benzo[a]pyrene	N/A	< 0.024146	< 0.000966	< 0.012556
Benzo[e]pyrene	< 0.000981	< 0.051914	0.008214	< 0.020369
Biphenyl	< 0.221029	< 0.116383	< 0.084551	< 0.140655
Chrysene	< 0.002674	< 0.002463	< 0.000966	< 0.002034
Dibenz[a,h]anthracene	< 0.000981	< 0.001449	< 0.000966	< 0.001132
Dibenzofuran	< 0.000564	< 0.000555	< 0.000556	< 0.000558
Dibenzo(a,e)pyrene	< 0.000981	< 0.000966	< 0.000966	< 0.000971
3,3'-Dimethoxybenzidine	< 0.007114	< 0.007002	< 0.007006	< 0.007041
Dimethylaminobenzene	< 0.000491	< 0.000483	< 0.000483	< 0.000486
7,12-Dimethylbenz(a)anthracene	< 0.000981	< 0.000966	< 0.000966	< 0.000971
3,3'-Dimethylbenzidine	< 0.007114	< 0.007002	< 0.007006	< 0.007041
a,a-Dimethylphenethylamine	< 0.002944	< 0.002897	< 0.002899	< 0.002913
2,4-Dimethylphenol	< 0.000638	< 0.000628	< 0.000628	< 0.000631
Fluoranthene	0.022250	0.015671	0.007585	0.015169
Fluorene	0.133206	0.024387	< 0.073439	< 0.077011
Indeno(1,2,3-cd)pyrene	< 0.000981	< 0.024146	< 0.000966	< 0.008698
Isophorone	< 0.000552	< 0.000543	< 0.000544	< 0.000546
3-Methylcholanthrene	< 0.000981	< 0.000966	< 0.000966	< 0.000971
2-Methylnaphthalene	0.159701	0.106242	0.078512	0.114818
2-Methylphenol	0.015774	< 0.000507	0.003430	< 0.006570
3-Methylphenol & 4-Methylphenol	< 0.001386	< 0.001364	< 0.003189	< 0.001980
Naphthalene	0.282113	0.825787	0.199058	0.435653
Perylene	N/A	N/A	< 0.000966	< 0.000966
Phenanthrene	0.120205	0.130146	0.043242	0.097864
Phenol	0.003508	0.000761	0.001329	0.001866
1,4-Phenylenediamine	< 0.004416	< 0.004346	< 0.004348	< 0.004370
Pyrene	< 0.005618	< 0.002120	0.002754	< 0.003497
o-Toluidine	< 0.001227	< 0.001207	< 0.001208	< 0.001214

NA = Data not available



SECTION FOUR

Test Results

TABLE 4-4. FCCU-1241 WGS STACK SVOC EMISSION RATE TEST RESULTS SUMMARY

TEST RUN :	FCCU-0010-1	FCCU-0010-2	FCCU-0010-3	
TEST DATE :	6/8/2011	6/8/2011	6/9/2011	Average
TEST TIME :	08:16 - 12:53	14:02 - 18:39	07:34 - 12:04	
Stack Gas Parameters				
Temperature, av. °F	139.8	139.8	139.9	139.8
Velocity, av. ft/sec	32.415	32.874	32.637	32.642
Volume flow, acfm	238,676	242,056	240,311	240,347
Volume flow, scfm	210,208	212,971	211,613	211,597
Volume flow, dscfm	173,260	171,089	171,456	171,935
Volume flow, dsch	12,612,471	12,778,266	12,696,766	12,695,834
Volume flow, dscfh	10,395,620	10,265,318	10,287,335	10,316,091
Moisture, av. % vol	17.58	19.67	18.98	18.74
CO ₂ , av. % vol, db	12.57	13.28	13.43	13.09
O ₂ , av. % vol, db	5.90	5.23	5.12	5.42
SVOC Sample Parameters				
Time, min	240	240	240	
Volume, dscm	4.076	4.142	4.140	
Volume, dscf	143.937	146.236	146.166	
Isokinetic rate, %	97.9	100.6	100.5	
Emission Rate - lb/hr x 10⁻³				
Acenaphthene	< 0.179923	0.078771	< 0.074323	< 0.111005
Acenaphthylene	< 0.033596	< 0.388437	< 0.003879	< 0.141971
Aniline	< 0.000295	< 0.000286	< 0.000287	< 0.000289
Anthracene	0.056684	< 0.008898	0.002669	< 0.022750
Benzidine	< 0.006051	< 0.005881	< 0.005896	< 0.005942
Benzo[a]anthracene	< 0.000637	< 0.001377	< 0.000621	< 0.000878
Benzo[b]fluoranthene	< 0.000787	< 0.000619	< 0.000621	< 0.000675
Benzo[k]fluoranthene	< 0.000637	< 0.000619	< 0.000621	< 0.000626
Benzo[g,h,i]perylene	< 0.000637	< 0.007738	0.000739	< 0.003038
Benzo[a]pyrene	N/A	< 0.015476	< 0.000621	< 0.008048
Benzo[e]pyrene	< 0.000637	< 0.033272	0.005276	< 0.013062
Biphenyl	< 0.143461	< 0.074592	< 0.054307	< 0.090787
Chrysene	< 0.001736	< 0.001579	< 0.000621	< 0.001312
Dibenz[a,h]anthracene	< 0.000637	< 0.000929	< 0.000621	< 0.000729
Dibenzofuran	< 0.000366	< 0.000356	< 0.000357	< 0.000360
Dibenzo(a,e)pyrene	< 0.000637	< 0.000619	< 0.000621	< 0.000626
3,3'-Dimethoxybenzidine	< 0.004617	< 0.004488	< 0.004500	< 0.004535
Dimethylaminobenzene	< 0.000318	< 0.000310	< 0.000310	< 0.000313
7,12-Dimethylbenz(a)anthracene	< 0.000637	< 0.000619	< 0.000621	< 0.000626
3,3'-Dimethylbenzidine	< 0.004617	< 0.004488	< 0.004500	< 0.004535
a,a-Dimethylphenethylamine	< 0.001911	< 0.001857	< 0.001862	< 0.001877
2,4-Dimethylphenol	< 0.000414	< 0.000402	< 0.000403	< 0.000407
Fluoranthene	0.014442	0.010044	0.004872	0.009786
Fluorene	0.086459	0.015630	< 0.047169	< 0.049753
Indeno(1,2,3-cd)pyrene	< 0.000637	< 0.015476	< 0.000621	< 0.005578
Isophorone	< 0.000358	< 0.000348	< 0.000349	< 0.000352
3-Methylcholanthrene	< 0.000637	< 0.000619	< 0.000621	< 0.000626
2-Methylnaphthalene	0.103655	0.068093	0.050428	0.074058
2-Methylphenol	0.010238	< 0.000325	0.002203	< 0.004255
3-Methylphenol & 4-Methylphenol	< 0.000900	< 0.000874	< 0.002048	< 0.001274
Naphthalene	0.183107	0.529264	0.127854	0.280075
Perylene	N/A	N/A	< 0.000621	< 0.000621
Phenanthrene	0.078020	0.083413	0.027774	0.063069
Phenol	0.002277	0.000487	0.000853	0.001206
1,4-Phenylenediamine	< 0.002866	< 0.002786	< 0.002793	< 0.002815
Pyrene	< 0.003646	< 0.001359	0.001769	< 0.002258
o-Toluidine	< 0.000796	< 0.000774	< 0.000776	< 0.000782

NA = Data not available



SECTION FOUR

Test Results

TABLE 4-5. FCCU-1241 WGS STACK THC, CH₄, C₂H₆ AND CO TEST RESULTS SUMMARY

TEST RUN :	FCCU-0010-1	FCCU-0010-2	FCCU-0010-3	
TEST DATE :	6/8/2011	6/8/2011	6/9/2011	Average
TEST TIME :	08:16 - 12:53	14:02 - 18:39	07:34 - 12:04	
Stack Gas Parameters				
Temperature, av. °F	139.8	139.8	139.9	139.8
Velocity, av. ft/sec	32.415	32.874	32.637	32.642
Volume flow, acfm	238,676	242,056	240,311	240,347
Volume flow, scfm	210,208	212,971	211,613	211,597
Volume flow, dscfm	173,260	171,089	171,456	171,935
Volume flow, scfh	12,612,471	12,778,266	12,696,766	12,695,834
Volume flow, dscfh	10,395,620	10,265,318	10,287,335	10,316,091
Moisture, av. % vol	17.58	19.67	18.98	18.74
CO ₂ , av. % vol, db	12.57	13.28	13.43	13.09
O ₂ , av. % vol, db	5.90	5.23	5.12	5.42
Total Hydrocarbons (THC) as Propane				
Concentration				
ppmv db	0.76	0.82	0.06	0.54
lb/dscf x 10 ⁻⁶	0.0864	0.0937	0.0068	0.0623
Emission rate				
lb/hr	0.8984	0.9621	0.0699	0.6435
Methane (CH₄)				
Concentration				
ppmv db	1.2	1.1	1.0	1.1
lb/dscf x 10 ⁻⁶	0.0500	0.0458	0.0416	0.0458
Emission rate				
lb/hr	0.5194	0.4701	0.4283	0.4726
Ethane (C₂H₆)				
Concentration				
ppmv db	< 1.0	< 1.0	< 1.0	< 1.0
lb/dscf x 10 ⁻⁶	< 0.0781	< 0.0781	< 0.0781	< 0.0781
Emission rate				
lb/hr	< 0.8114	< 0.8012	< 0.8029	< 0.8052
Carbon Monoxide (CO)				
Concentration				
ppmv db	6.8	2.9	3.1	4.3
lb/dscf x 10 ⁻⁶	0.4925	0.2126	0.2288	0.3113
Emission rate				
lb/hr	5.1200	2.1825	2.3532	3.2186



SECTION FOUR

Test Results

TABLE 4-6. FCCU-1241 WGS STACK VOLATILE ORGANIC HAP TEST RESULTS SUMMARY

TEST RUN :	FCCU-18-1	FCCU-18-2	FCCU-18-3
TEST DATE :	6/8/2011	6/8/2011	6/9/2011
TEST TIME :	09:29 - 10:29	14:47 - 15:47	10:46 - 11:46
Stack Gas Parameters			
Temperature, av. °F	139.8	139.8	139.8
Velocity, av. ft/sec	32.42	32.874	32.637
Volume flow, acfm	238,676	242,056	240,311
Volume flow, scfm	210,208	212,971	211,613
Volume flow, dscfm	173,260	171,089	171,456
Volume flow, scfh	12,612,471	12,778,266	12,696,766
Volume flow, dscfh	10,395,620	10,265,318	10,287,335
Moisture, av. % vol	17.58	19.67	18.98
CO ₂ , av. % vol, db	12.57	13.28	13.43
O ₂ , av. % vol, db	5.90	5.23	5.12
Average			
			32.642
			240,347
			211,597
			171,935
			12,695,834
			10,316,091
			18.74
			13.09
			5.42

Run Numbers	FCCU-18-1			FCCU-18-2			FCCU-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 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 ^a		12,915	8.38257	127,063	81.43533	273,428	840	175.61664	137,802	88.47818		
Acetonitrile		< 219	< 0.14231	629	0.40281	< 251	< 0.16114	< 0.16114	< 563	< 0.36158		
Acrolein		< 201	< 0.13020	294	0.18847	< 252	< 0.16114	< 0.16114	< 249	< 0.15994		
Acrylonitrile		< 202	< 0.13084	< 441	< 0.28240	252	< 0.16163	< 0.15789	< 298	< 0.19162		
Benzene		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
1,3-Butadiene		< 1,003	< 0.65101	< 1,240	< 0.79453	< 1,254	< 0.80568	< 0.80568	< 1,166	< 0.75041		
Carbon disulfide		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Chlorobenzene		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Cumene		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
1,2-Dibromoethane		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Ethylbenzene		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Hexane		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Methyl isobutyl ketone		< 201	< 0.13020	< 248	< 0.15891	< 222	< 0.14240	< 0.14240	< 223	< 0.14384		
Methyl t-butyl ether		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Methylene chloride ^a		1,158	0.75161	1,721	1.10309	3,780	2,4756	2,42756	2,220	1,42742		
Nitrobenzene		< 1,008	< 0.65418	< 1,237	< 0.79298	< 1,229	< 0.78943	< 0.78943	< 1,158	< 0.74553		
2-Nitropropane		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Pentane		< 1,003	< 0.65101	< 1,240	< 0.79453	< 1,375	< 0.88300	< 0.88300	< 1,206	< 0.77618		
Styrene		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Tetrachloroethene		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Toluene		< 201	< 0.13020	< 248	< 0.15891	< 251	< 0.16114	< 0.16114	< 233	< 0.15008		
Trichloroethene		< 201	< 0.13020	< 248	< 0.15891	< 251	< 0.16114	< 0.16114	< 233	< 0.15008		
2,2,4 Trimethyl pentane		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		
Xylenes		< 202	< 0.13084	< 247	< 0.15860	< 246	< 0.15789	< 0.15789	< 232	< 0.14911		



SECTION FOUR

Test Results

TABLE 4-7. FCCU-1241 WGS STACK ALDEHYDES TEST RESULTS SUMMARY

TEST RUN	FCCU-0011-1	FCCU-0011-2	FCCU-0011-3	
TEST DATE	6/8/2011	6/8/2011	6/9/2011	
TEST TIME	08:26 - 10:07	14:34 - 16:36	07:34 - 09:03	<u>Average</u>
<u>Stack Gas Parameters</u>				
Temperature, av. °F	139.8	139.9	139.8	139.8
Velocity, av. ft/sec	31.29	32.52	32.49	32.10
Volume flow, acfm	230,381	239,477	239,240	236,366
Volume flow, scfm	202,903	210,667	210,705	208,092
Volume flow, dscfm	164,672	171,198	171,144	169,005
Volume flow, scfh	12,174,151	12,640,031	12,642,291	12,485,491
Volume flow, dscfh	9,880,342	10,271,885	10,268,659	10,140,295
Moisture, av. % vol	18.84	18.74	18.78	18.78
CO ₂ , av. % vol, db	12.57	13.28	13.44	13.10
O ₂ , av. % vol, db	5.90	5.23	5.12	5.42
<u>Aldehydes Sample</u>				
Time, min	60.0	60.0	60.0	
Volume, dscf	35.400	47.673	47.833	
Volume, dscm	1.003	1.350	1.355	
Isokinetic Ratio, %	100.7	100.8	101.1	
<u>Formaldehyde</u>				
Concentration				
lb/dscf x 10 ⁻⁶	< 0.0072	< 0.0053	< 0.0053	< 0.0059
µg/dscm	< 114.7	< 85.2	< 84.9	< 94.9
Emission rate				
lb/hr	< 0.0708	< 0.0546	< 0.0544	< 0.0599
<u>Acetaldehyde</u>				
Concentration				
lb/dscf x 10 ⁻⁶	0.0521	0.0371	0.0307	0.0400
µg/dscm	834.9	594.8	491.6	640.4
Emission rate				
lb/hr	0.5150	0.3814	0.3152	0.4039
<u>Propanal</u>				
Concentration				
lb/dscf x 10 ⁻⁶	< 0.0014	0.0086	0.0029	< 0.0043
µg/dscm	< 21.9	138.5	45.8	< 68.7
Emission rate				
lb/hr	< 0.0135	0.0888	0.0293	< 0.0439



SECTION FOUR

Test Results

TABLE 4-8. FCCU-1241 WGS STACK D/F CONCENTRATION TEST RESULTS SUMMARY

TEST RUN :	FCCU-23-1	FCCU-23-2	FCCU-23-3	
TEST DATE :	6/9/2011	6/10/2011	6/10/2011	
TEST TIME :	14:27 - 18:03	07:32 - 10:55	12:27 - 16:14	<u>Average</u>
<u>Stack Gas Parameters</u>				
Temperature, °F	139.8	139.8	139.7	139.8
Velocity, av. ft/sec	32.358	32.716	32.842	32.639
Volumetric flow, acfm	238,259	240,889	241,821	240,323
Volumetric flow, scfm	209,630	211,944	212,800	211,458
Volumetric flow, dscfm	169,942	170,264	172,198	170,801
Volumetric flow, scfh	12,577,825	12,716,668	12,767,990	12,687,494
Volumetric flow, dscfh	10,196,504	10,215,833	10,331,862	10,248,066
Moisture, av. % vol	18.93	19.67	19.08	19.23
Carbon Dioxide, av. % vol	12.96	13.27	13.25	13.16
Oxygen, av. % vol	5.57	5.28	5.29	5.38
<u>Sample Parameters</u>				
Time, min	180.0	180.0	180.0	180.0
Volume, dscf	107.223	107.912	108.019	107.718
Volume, dscm	3.037	3.056	3.059	3.051
Total Dioxins collected, picograms	19.31	23.01	16.75	19.69
Total Furans collected, picograms	4.43	14.78	4.80	8.00
Isokinetic Ratio, %	99.2	99.5	98.6	99.1
<u>Total Dioxins and Furans</u>				
Concentration, pg/dscm				
2,3,7,8-TCDD	< 0.32273	< 0.28467	< 0.25170	< 0.28637
Total TCDD	1.58070	< 0.28467	< 0.25170	< 0.70569
1,2,3,7,8 PeCDD	< 0.62569	< 0.55626	< 0.45764	< 0.54653
Total PeCDD	< 0.62569	< 0.55626	< 0.45764	< 0.54653
1,2,3,4,7,8 HxCDD	< 0.21076	< 0.26177	< 0.32689	< 0.26647
1,2,3,6,7,8 HxCDD	< 0.21076	< 0.25850	< 0.32035	< 0.26320
1,2,3,7,8,9 HxCDD	< 0.20747	< 0.25523	< 0.32035	< 0.26101
Total HxCDD	< 0.21076	< 0.26177	< 0.32689	< 0.26647
1,2,3,4,6,7,8 HpCDD	< 0.59276	< 0.88347	< 0.55571	< 0.67731
Total HpCDD	0.64875	0.92928	0.84337	0.80713
1,2,3,4,6,5,7,8 OCDD (Total)	3.29313	5.49716	< 3.59576	< 4.12868
2,3,7,8-TCDF	< 0.26345	< 0.49082	< 0.27132	< 0.34186
Total TCDF	< 0.26345	< 0.49082	< 0.27132	< 0.34186
1,2,3,7,8 PeCDF	< 0.46104	< 0.45810	< 0.49033	< 0.46982
2,3,4,7,8 PeCDF	< 0.46104	0.81476	< 0.49033	< 0.58871
Total PeCDF	< 0.46104	1.37102	< 0.49033	< 0.77413
1,2,3,4,7,8 HxCDF	< 0.12514	< 0.29449	< 0.19940	< 0.20634
1,2,3,6,7,8 HxCDF	< 0.12185	< 0.35993	< 0.19286	< 0.22488
2,3,4,6,7,8 HxCDF	< 0.12514	0.49409	< 0.19940	< 0.27288
1,2,3,7,8,9 HxCDF	< 0.13831	< 0.23232	< 0.21901	< 0.19655
Total HxCDF	< 0.13831	1.35793	< 0.21901	< 0.57175
1,2,3,4,6,7,8 HpCDF	< 0.13831	0.87366	< 0.22882	< 0.41360
1,2,3,4,7,8,9 HpCDF	< 0.16795	0.31511	< 0.19613	< 0.22640
Total HpCDF	< 0.16795	1.19105	< 0.19613	< 0.51838
1,2,3,4,6,5,7,8 OCDF (Total)	< 0.42811	< 0.42538	< 0.39226	< 0.41525
TOTAL	< 7.81789	< 12.36534	< 7.04441	< 9.07588



SECTION FOUR

Test Results

TABLE 4-9. FCCU-1241 WGS STACK D/F EMISSION RATE TEST RESULTS SUMMARY

TEST RUN :	FCCU-23-1	FCCU-23-2	FCCU-23-3	
TEST DATE :	6/9/2011	6/10/2011	6/10/2011	Average
TEST TIME :	14:27 - 18:03	07:32 - 10:55	12:27 - 16:14	
Stack Gas Parameters				
Temperature, °F	139.8	139.8	139.7	139.8
Velocity, av. ft/sec	32.358	32.716	32.842	32.639
Volumetric flow, acfm	238,259	240,889	241,821	240,323
Volumetric flow, scfm	209,630	211,944	212,800	211,458
Volumetric flow, dscfm	169,942	170,264	172,198	170,801
Volumetric flow, scfh	12,577,825	12,716,668	12,767,990	12,687,494
Volumetric flow, dscfh	10,196,504	10,215,833	10,331,862	10,248,066
Moisture, av. % vol	18.93	19.67	19.08	19.23
Carbon Dioxide, av. % vol	12.96	13.27	13.25	13.16
Oxygen, av. % vol	5.57	5.28	5.29	5.38
Sample Parameters				
Time, min	180.0	180.0	180.0	180.0
Volume, dscf	107.223	107.912	108.019	107.718
Volume, dscm	3.037	3.056	3.059	3.051
Total Dioxins collected, picograms	19.31	23.01	16.75	19.69
Total Furans collected, picograms	4.43	14.78	4.80	8.00
Isokinetic Ratio, %	99.2	99.5	98.6	99.1
Total Dioxins and Furans				
Mass Emission Rate, lb/hr x 10 ⁻¹²				
2,3,7,8-TCDD	< 205.456	< 181.574	< 162.367	< 183.132
Total TCDD	1,006.313	< 181.574	< 162.367	< 450.085
1,2,3,7,8 PeCDD	< 398.332	< 354.800	< 295.214	< 349.449
Total PeCDD	< 398.332	< 354.800	< 295.214	< 349.449
1,2,3,4,7,8 HxCDD	< 134.175	< 166.965	< 210.867	< 170.669
1,2,3,6,7,8 HxCDD	< 134.175	< 164.878	< 206.649	< 168.567
1,2,3,7,8,9 HxCDD	< 132.079	< 162.791	< 206.649	< 167.173
Total HxCDD	< 134.175	< 166.965	< 210.867	< 170.669
1,2,3,4,6,7,8 HpCDD	< 377.367	< 563.507	< 358.474	< 433.116
Total HpCDD	413.008	592.725	544.036	516.590
1,2,3,4,6,5,7,8 OCDD (Total)	2,096.486	3,506.263	< 2,319.535	< 2,640.761
2,3,7,8-TCDF	< 167.719	< 313.059	< 175.019	< 218.599
Total TCDF	< 167.719	< 313.059	< 175.019	< 218.599
1,2,3,7,8 PeCDF	< 293.508	< 292.189	< 316.300	< 300.666
2,3,4,7,8 PeCDF	< 293.508	519.678	< 316.300	< 376.496
Total PeCDF	< 293.508	874.479	< 316.300	< 494.762
1,2,3,4,7,8 HxCDF	< 79.666	< 187.836	< 128.629	< 132.044
1,2,3,6,7,8 HxCDF	< 77.570	< 229.577	< 124.411	< 143.853
2,3,4,6,7,8 HxCDF	< 79.666	315.146	< 128.629	< 174.480
1,2,3,7,8,9 HxCDF	< 88.052	< 148.181	< 141.281	< 125.838
Total HxCDF	< 88.052	866.130	< 141.281	< 365.155
1,2,3,4,6,7,8 HpCDF	< 88.052	557.245	< 147.607	< 264.302
1,2,3,4,7,8,9 HpCDF	< 106.921	200.984	< 126.520	< 144.808
Total HpCDF	< 106.921	759.690	< 126.520	< 331.044
1,2,3,4,6,5,7,8 OCDF (Total)	< 272.543	< 271.318	< 253.040	< 265.634
TOTAL	< 4,977.058	< 7,887.004	< 4,544.180	< 5,802.747



SECTION FOUR

Test Results

TABLE 4-10. FCCU-1241 WGS STACK PCB TEST RESULTS SUMMARY

TEST RUN	FCCU-23-1	FCCU-23-2	FCCU-23-3	
TEST DATE	6/9/2011	6/10/2011	6/10/2011	
TEST TIME	14:27 - 18:03	07:32 - 10:55	12:27 - 16:14	Average
Stack Gas Parameters				
Temperature, °F	139.8	139.8	139.7	139.8
Velocity, av. ft/sec	32.358	32.716	32.842	32.639
Volumetric flow, acfm	238,259	240,889	241,821	240,323
Volumetric flow, scfm	209,630	211,944	212,800	211,458
Volumetric flow, dscfm	169,942	170,264	172,198	170,801
Volumetric flow, scfh	12,577,825	12,716,668	12,767,990	12,687,494
Volumetric flow, dscfh	10,196,504	10,215,833	10,331,862	10,248,066
Moisture, av. % vol	18.93	19.67	19.08	19.23
Carbon Dioxide, av. % vol	12.96	13.27	13.25	13.16
Oxygen, av. % vol	5.57	5.28	5.29	5.38
Sample Parameters				
Time, min	180.0	180.0	180.0	180.0
Volume, dscf	107.223	107.912	108.019	107.718
Volume, dscm	3.037	3.056	3.059	3.051
Isokinetic Ratio, %	99.2	99.5	98.6	99.1
Total PCBs				
Concentration, pg/dscm				
PCB-81	< 0.17124	< 0.19633	< 0.13075	< 0.16611
PCB-77	0.46762	< 0.39265	< 0.35958	< 0.40662
PCB-123	< 0.23381	< 0.25195	< 0.22228	< 0.23602
PCB-118	< 2.33812	< 2.74858	3.24272	< 2.77647
PCB-114	< 0.12843	< 0.15052	< 0.16344	< 0.14746
PCB-105	0.95830	1.30230	< 0.91528	< 1.05863
PCB-126	< 0.12843	< 0.16361	< 0.49033	< 0.26079
PCB-167	< 0.22064	< 0.17015	< 0.15691	< 0.18257
PCB-156	< 0.23381	< 0.17015	< 0.28766	< 0.23054
PCB-157	< 0.23052	0.28108	< 0.15364	< 0.22174
PCB-169	< 3.62244	< 3.92654	< 5.55708	< 4.36869
PCB-189	< 0.10209	< 0.12434	< 0.09807	< 0.10816
TOTAL	< 8.83546	< 9.87821	< 11.77774	< 10.16380
Total PCBs				
Mass Emission Rate, lb/hr x 10 ⁻¹²				
PCB-81	< 109.017	< 125.224	< 84.347	< 106.196
PCB-77	297.701	< 250.447	< 231.954	< 260.034
PCB-123	< 148.850	< 160.704	< 143.389	< 150.981
PCB-118	< 1,488.505	< 1,753.131	2,091.799	< 1,777.812
PCB-114	< 81.763	< 96.005	< 105.433	< 94.400
PCB-105	610.077	830.650	< 590.427	< 677.052
PCB-126	< 81.763	< 104.353	< 316.300	< 167.472
PCB-167	< 140.465	< 108.527	< 101.216	< 116.736
PCB-156	< 148.850	< 108.527	< 185.563	< 147.647
PCB-157	< 146.754	< 179.279	< 99.107	< 141.713
PCB-169	< 2,306.134	< 2,504.473	< 3,584.736	< 2,798.448
PCB-189	< 64.991	< 79.308	< 63.260	< 69.186
TOTAL	< 5,624.872	< 6,300.629	< 7,597.532	< 6,507.678



SECTION FOUR

Test Results

TABLE 4-11. FCCU-1241 WGS STACK MERCURY TEST RESULTS SUMMARY

TEST RUN :	FCCU-OH-1	FCCU-OH-2	FCCU-OH-3	
TEST DATE :	6/9/2011	6/10/2011	6/10/2011	Average
TEST TIME :	14:27 - 18:03	07:32 - 10:55	12:27 - 16:14	
Stack Gas Parameters				
Temperature, °F	139.8	139.8	139.8	139.8
Velocity, av. ft/sec	32.558	32.284	32.082	32.308
Volumetric flow, acfm	239,728	237,707	236,221	237,885
Volumetric flow, scfm	210,923	209,145	207,837	209,302
Volumetric flow, dscfm	170,129	168,905	167,384	168,806
Volumetric flow, scfh	12,655,371	12,548,693	12,470,244	12,558,103
Volumetric flow, dscfh	10,207,716	10,134,301	10,043,044	10,128,354
Moisture, av. % vol	19.34	19.24	19.46	19.35
Carbon Dioxide, av. % vol	12.96	13.27	13.25	13.16
Oxygen, av. % vol	5.57	5.28	5.29	5.38
Metals Sample				
Time, min	180.0	180.0	180.0	
Volume, dscf	143.653	142.194	142.137	
Isokinetic Ratio, %	101.8	101.5	102.4	
Mercury Emissions				
Mercury-particle bound				
Mass, µg	< 0.0650	< 0.0650	< 0.0650	< 0.0650
Concentration				
µg/dscm	< 0.01598	< 0.01614	< 0.01615	< 0.01609
lb/dscf x 10 ⁻⁹	< 0.00100	< 0.00101	< 0.00101	< 0.00100
Emission Rate				
lb/hr	< 0.10183	< 0.10213	< 0.10125	< 0.10174
Mercury-oxidized				
Mass, µg	0.1200	0.1620	0.0822	0.1214
Concentration				
µg/dscm	0.02950	0.04023	0.02042	0.03005
lb/dscf x 10 ⁻⁹	0.00184	0.00251	0.00127	0.00188
Emission Rate				
lb/hr	0.18799	0.25454	0.12804	0.19019
Mercury-elemental				
Mass, µg	< 0.9385	< 0.9250	< 1.0520	< 0.9718
Concentration				
µg/dscm	< 0.23068	< 0.22970	< 0.26134	< 0.24057
lb/dscf x 10 ⁻⁹	< 0.01440	< 0.01434	< 0.01632	< 0.01502
Emission Rate				
lb/hr	< 1.47020	< 1.45339	< 1.63871	< 1.52077
Mercury-total				
Mass, µg	< 1.1235	< 1.1520	< 1.1992	< 1.1582
Concentration				
µg/dscm	< 0.27616	< 0.28607	< 0.29791	< 0.28671
lb/dscf x 10 ⁻⁹	< 0.01724	< 0.01786	< 0.01860	< 0.01790
Emission Rate				
lb/hr	< 1.76002	< 1.81007	< 1.86801	< 1.81270



SECTION FOUR

Test Results

**TABLE 4-12. FCCU-1241 WGS STACK HEXAVALENT CHROMIUM
TEST RESULTS SUMMARY**

TEST RUN	FCCU-0061-3	FCCU-0061-4	FCCU-0061-5	
TEST DATE	6/10/2011	6/13/2011	6/14/2011	
TEST TIME	12:27 - 16:32	13:25 - 17:03	07:37 - 11:12	Average
Stack Gas Parameters				
Temperature, av. °F	139.8	140.3	140.5	140.2
Velocity, av. ft/sec	32.67	22.37	22.46	25.83
Volume flow, acfm	240,545	164,691	165,410	190,215
Volume flow, scfm	211,642	145,072	145,511	167,408
Volume flow, dscfm	171,252	116,600	116,180	134,677
Volume flow, scfh	12,698,496	8,704,337	8,730,657	10,044,497
Volume flow, dscfh	10,275,148	6,995,987	6,970,801	8,080,645
Moisture, av. % vol	19.08	19.63	20.16	19.62
CO ₂ , av. % vol, db	13.25	17.42	17.04	15.90
O ₂ , av. % vol, db	5.29	0.73	1.20	2.41
Hex Chrome Sample				
Time, min	180.0	180.0	180.0	
Volume, dscf	142.081	130.873	132.352	
Volume, dscm	4.024	3.706	3.748	
Isokinetic Ratio, %	102.0	101.3	102.8	
Hexavalent Chromium				
Concentration				
lb/dscf x 10 ⁻⁹	< 0.03321	< 0.04444	< 0.04597	< 0.04121
µg/dscm	< 0.5318	< 0.6556	< 0.6859	< 0.6244
Emission rate				
lb/hr	< 0.000341	< 0.000311	< 0.000320	< 0.000324



SECTION FOUR

Test Results

TABLE 4-13. FCCU-1241 WGS STACK PARTICULATE MATTER TEST RESULTS SUMMARY

TEST RUN :	FCCU-5B-1	FCCU-5B-2	FCCU-5B-3	
TEST DATE :	6/13/2011	6/13/2011	6/14/2011	
TEST TIME :	09:32 - 11:45	13:40 - 17:03	07:52 - 11:12	<u>Average</u>
Stack Gas Parameters				
Temperature, av. °F	140.7	140.8	140.8	140.8
Velocity, av. ft/sec	23.018	22.826	22.597	22.813
Volume flow, acfm	169,484	168,067	166,382	167,978
Volume flow, scfm	149,344	148,071	146,293	147,903
Volume flow, dscfm	119,301	118,284	117,000	118,195
Volume flow, dscfh	7,158,050	7,097,012	7,019,978	7,091,680
Moisture, av. % vol	20.12	20.12	20.02	20.09
CO ₂ , av. % vol, db	17.24	17.42	17.04	17.23
O ₂ , av. % vol, db	0.92	0.73	1.20	0.95
Process Data				
Coke Burn Rate, lb/hr	22,373	22,858	29,679	24,970
Sample Train Data				
Time, min	120.0	120.0	120.0	
Volume, dscf	90.695	90.537	88.942	
Volume, dscm	2.569	2.564	2.519	
Isokinetic Ratio, %	102.3	103.0	102.5	
Particulate Matter (PM)				
Filterable PM collected, mg	49.83	33.17	24.54	35.85
Concentration				
gr/dscf	0.00848	0.00565	0.00426	0.00613
lb/dscf x 10 ⁻⁶	1.2115	0.8078	0.6084	0.8759
Emission rate				
lb/hr	8.6690	5.7315	4.2694	6.2233
lb/1000 lb of coke burn	0.39	0.25	0.14	0.26
Condensable PM collected, mg	13.5	12.6	13.5	13.2
Concentration				
gr/dscf	0.00230	0.00214	0.00233	0.00226
lb/dscf x 10 ⁻⁶	0.3282	0.3057	0.3334	0.3224
Emission rate				
lb/hr	2.3486	2.1685	2.3400	2.2857
Total PM collected, mg	63.3	45.7	38.0	49.0
Concentration				
gr/dscf	0.01077	0.00779	0.00659	0.00839
lb/dscf x 10 ⁻⁶	1.5397	1.1135	0.9418	1.1983
Emission rate				
lb/hr	11.0176	7.9000	6.6095	8.5090
lb/1000 lb of coke burn	0.49	0.35	0.22	0.35
Scrubber Recirculation Liquid				
Total Dissolved Solids (TDS)				
mg/L	13,468	16,228	15,808	15,168
Scrubber Recirculation Liquid				
Total Suspended Solids (TSS)				
mg/L	907	590	997	831



SECTION FOUR

Test Results

TABLE 4-14. FCCU-1241 WGS STACK SO₂ AND NO_x TEST RESULTS SUMMARY

TEST RUN	:	FCCU-29-1	FCCU-29-2	FCCU-29-3	
TEST DATE	:	6/13/2011	6/13/2011	6/14/2011	
TEST TIME	:	09:29 - 12:49	13:18 - 17:03	07:37 - 11:12	<u>Average</u>
<u>Stack Gas Parameters</u>					
Temperature, av. °F		140.7	140.5	140.7	140.6
Velocity, av. ft/sec		22.244	22.052	22.596	22.297
Volume flow, acfm		163,783	162,370	166,374	164,176
Volume flow, scfm		144,320	142,980	146,310	144,537
Volume flow, dscfm		115,288	114,188	116,818	115,431
Volume flow, scfh		8,659,217	8,578,811	8,778,626	8,672,218
Volume flow, dscfh		6,917,252	6,851,294	7,009,100	6,925,882
Moisture, av. % vol		20.12	20.14	20.16	20.14
CO ₂ , av. % vol, db		17.24	17.42	17.04	17.23
O ₂ , av. % vol, db		0.92	0.73	1.20	0.95
<u>Sulfur Dioxide (SO₂)</u>					
Concentration					
ppmv db		< 1.0	0.4	< 1.0	< 0.8
lb/dscf x 10 ⁻⁶		< 0.1661	0.0729	< 0.1661	< 0.1350
Emission rate					
lb/hr		< 1.1491	0.4994	< 1.1644	< 0.9376
<u>Nitrogen Oxides (NO_x) as NO₂</u>					
Concentration					
ppmv db		11.2	9.7	13.6	11.5
lb/dscf x 10 ⁻⁶		1.3363	1.1598	1.6281	1.3747
Emission rate					
lb/hr		9.2438	7.9459	11.4114	9.5337



SECTION FOUR

Test Results

TABLE 4-15. FCCU-1241 WGS STACK METALS TEST RESULTS SUMMARY

TEST RUN	FCCU-29-1	FCCU-29-2	FCCU-29-3	
TEST DATE	6/13/2011	6/13/2011	6/14/2011	Average
TEST TIME	09:29 - 12:49	13:18 - 17:03	07:37 - 11:12	
Stack Gas Parameters				
Temperature, av. °F	140.7	140.5	140.7	140.6
Velocity, av. ft/sec	22.244	22.052	22.596	22.297
Volume flow, acfm	163,783	162,370	166,374	164,176
Volume flow, scfm	144,320	142,980	146,310	144,537
Volume flow, dscfm	115,288	114,188	116,818	115,431
Volume flow, scfh	8,659,217	8,578,811	8,778,626	8,672,218
Volume flow, dscfh	6,917,252	6,851,294	7,009,100	6,925,882
Moisture, av. % vol	20.12	20.14	20.16	20.14
CO ₂ , av. % vol, db	17.24	17.42	17.04	17.23
O ₂ , av. % vol, db	0.92	0.73	1.20	0.95
Metals Sample				
Time, min	180.0	180.0	180.0	180.0
Volume, dscf	128.022	124.739	130.285	127.682
Volume, dscm	3.626	3.533	3.690	3.616
Isokinetic Ratio, %	100.7	99.1	101.1	100.3
Antimony (Sb)				
Concentration				
lb/dscf x 10 ⁻⁹	< 0.00517	< 0.00530	< 0.00508	< 0.00518
mg/dscm	< 0.000083	< 0.000085	< 0.000081	< 0.000083
Emission rate				
lb/hr x 10 ⁻⁴	< 0.35736	< 0.36326	< 0.35581	< 0.35881
Arsenic (As)				
Concentration				
lb/dscf x 10 ⁻⁹	< 0.02066	< 0.02121	< 0.02031	< 0.02073
mg/dscm	< 0.000331	< 0.000340	< 0.000325	< 0.000332
Emission rate				
lb/hr x 10 ⁻⁴	< 1.42942	< 1.45305	< 1.42324	< 1.43524
Beryllium (Be)				
Concentration				
lb/dscf x 10 ⁻⁹	< 0.00517	< 0.00530	< 0.00508	< 0.00518
mg/dscm	< 0.000083	< 0.000085	< 0.000081	< 0.000083
Emission rate				
lb/hr x 10 ⁻⁴	< 0.35736	< 0.36326	< 0.35581	< 0.35881
Cadmium (Cd)				
Concentration				
lb/dscf x 10 ⁻⁹	0.05387	0.04420	0.26106	0.11971
mg/dscm	0.000863	0.000708	0.004182	0.001918
Emission rate				
lb/hr x 10 ⁻⁴	3.72602	3.02840	18.29809	8.35084



SECTION FOUR

Test Results

TABLE 4-15 (CONTINUED). FCCU-1241 WGS STACK METALS TEST RESULTS SUMMARY

TEST RUN :	FCCU-29-1	FCCU-29-2	FCCU-29-3	
TEST DATE :	6/13/2011	6/13/2011	6/14/2011	
TEST TIME :	<u>09:29 - 12:49</u>	<u>13:18 - 17:03</u>	<u>07:37 - 11:12</u>	<u>Average</u>
<u>Chromium (Cr)</u>				
Concentration				
lb/dscf x 10 ⁻⁹	0.04198	0.06447	0.07577	0.06074
mg/dscm	0.000673	0.001033	0.001214	0.000973
Emission rate				
lb/hr x 10 ⁻⁴	2.90411	4.41728	5.31105	4.21081
<u>Lead (Pb)</u>				
Concentration				
lb/dscf x 10 ⁻⁹	0.02998	0.04190	0.02191	0.03127
mg/dscm	0.000480	0.000671	0.000351	0.000501
Emission rate				
lb/hr x 10 ⁻⁴	2.07385	2.87099	1.53591	2.16025
<u>Manganese (Mn)</u>				
Concentration				
lb/dscf x 10 ⁻⁹	0.22578	0.01893	0.04570	0.09680
mg/dscm	0.003617	0.000303	0.000732	0.001551
Emission rate				
lb/hr x 10 ⁻⁴	15.61761	1.29685	3.20347	6.70598
<u>Nickel (Ni)</u>				
Concentration				
lb/dscf x 10 ⁻⁹	0.12655	0.17796	0.17833	0.16095
mg/dscm	0.002027	0.002851	0.002857	0.002578
Emission rate				
lb/hr x 10 ⁻⁴	8.75401	12.19231	12.49958	11.14864
<u>Selenium (Se)</u>				
Concentration				
lb/dscf x 10 ⁻⁹	< 0.05166	< 0.05302	< 0.05076	< 0.05182
mg/dscm	< 0.000828	< 0.000849	< 0.000813	< 0.000830
Emission rate				
lb/hr x 10 ⁻⁴	< 3.57355	< 3.63263	< 3.55809	< 3.58809
<u>Cobalt (Co)</u>				
Concentration				
lb/dscf x 10 ⁻⁹	0.00629	0.00908	0.00981	0.00839
mg/dscm	0.000101	0.000146	0.000157	0.000134
Emission rate				
lb/hr x 10 ⁻⁴	0.43478	0.62239	0.68790	0.58169



SECTION FOUR

Test Results

TABLE 4-16. FCCU-1241 WGS STACK AMMONIA TEST RESULTS SUMMARY

TEST RUN :	FCCU-027-1	FCCU-027-2	FCCU-027-3	
TEST DATE :	6/13/2011	6/13/2011	6/14/2011	
TEST TIME :	10:00 - 11:36	13:54 - 17:03	14:28 - 16:46	<u>Average</u>
Stack Gas Parameters				
Temperature, av. °F	140.4	140.3	140.7	140.5
Velocity, av. ft/sec	23.17	22.92	22.96	23.02
Volume flow, acfm	170,625	168,784	169,050	169,487
Volume flow, scfm	150,425	148,678	148,664	149,255
Volume flow, dscfm	120,931	119,497	118,697	119,709
Volume flow, scfh	9,025,484	8,920,653	8,919,839	8,955,325
Volume flow, dscfh	7,255,876	7,169,848	7,121,849	7,182,524
Moisture, av. % vol	19.61	19.63	20.16	19.80
CO ₂ , av. % vol, db	17.24	17.42	17.04	17.23
O ₂ , av. % vol, db	0.92	0.73	1.20	0.95
Sampling System Data				
Time, min	60.0	60.0	60.0	
Volume, dscf	45.810	45.463	45.208	
Volume, dscm	1.297	1.288	1.280	
Isokinetic Ratio, %	102.5	103.0	103.1	
Ammonia (NH₃)				
Concentration				
ppmv db	0.686	2.790	1.470	1.649
mg/dscm	0.4856	1.9751	1.0411	1.1673
lb/dscf x 10 ⁻⁶	0.0303	0.1233	0.0650	0.0729
Emission rate				
lb/hr	0.21999	0.88415	0.46295	0.52236



SECTION FOUR

Test Results

TABLE 4-17. FCCU-1241 WGS STACK METHANOL TEST RESULTS SUMMARY

TEST RUN :	FCCU-308-3	FCCU-308-4	FCCU-308-5	
TEST DATE :	6/9/2011	6/9/2011	6/9/2011	
TEST TIME :	<u>08:42 - 09:42</u>	<u>12:52 - 13:52</u>	<u>15:29 - 16:29</u>	<u>Average</u>
<u>Stack Gas Parameters</u>				
Temperature, av. °F	139.9	139.8	139.8	139.8
Velocity, av. ft/sec	32.637	31.947	32.358	32.314
Volume flow, acfm	240,311	235,227	238,259	237,932
Volume flow, scfm	211,613	207,171	209,630	209,471
Volume flow, dscfm	171,456	166,470	169,942	169,289
Volume flow, scfh	12,696,766	12,430,234	12,577,825	12,568,275
Volume flow, dscfh	10,287,335	9,988,179	10,196,504	10,157,339
Moisture, av. % vol	18.98	19.65	18.93	19.19
CO ₂ , av. % vol, db	13.43	13.43	12.96	13.27
O ₂ , av. % vol, db	5.12	5.12	5.57	5.27
<u>Spiked Train Parameters</u>				
Time, min	60	60	60	
Volume, std liters	59.130	57.556	57.981	
Volume, dscf	2.088	2.032	2.047	
<u>Unspiked Train Parameters</u>				
Time, min	60	60	60	
Volume, std liters	58.053	57.019	57.461	
Volume, dscf	2.050	2.013	2.029	
<u>Methanol Data^a</u>				
Spike Recovered (R), fractional	3.298	0.891	0.802	
Concentration				
ppbv db	200	1,345	424	656
µg/dscm	266	1,791	564	874
lb/dscf x 10 ⁻⁶	0.01663	0.11184	0.03524	0.05457
Emission Rate				
lb/hr	0.17110	1.11707	0.35933	0.54917

^aArtifacts of cross-method contamination



Valero Port Arthur Refinery
Source: FCCU-1241 Wet Gas Scrubber Stack
Test Dates: 6/6 - 6/14/11

APPENDIX A

Calculation Summaries

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-26-1/FCCU-OTM29-1
 TEST DATE : 6/6/2011
 START TIME : 11:25
 END TIME : 13:35

GAS ANALYZER

Stack O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.531
 AVERAGE ZERO BIAS (C_o): 0.090

CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 1.51
 (OTM-029) % CORRECTED (C_{gas}): 1.51

GAS ANALYZER

Stack CO₂

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 9.95
 AVERAGE ZERO BIAS (C_o): 0.11

CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 16.67
 (OTM-029) % CORRECTED (C_{gas}): 16.68

GAS ANALYZER

Meter CO₂

SPAN VALUE : 19.6 ppm
 AVERAGE CAL. BIAS (C_m): 10.16
 AVERAGE ZERO BIAS (C_o): 0.12

CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 (OTM-029) % CORRECTED (C_{gas}): 13.32

CLOCK TIME

ELAPSED TIME

Stack		Meter
O ₂	CO ₂	CO ₂

11:25	0			
11:26	1	1.57	16.52	0.13
11:27	2	1.55	16.54	0.15
11:28	3	1.63	16.47	4.73
11:29	4	1.57	16.51	8.74
11:30	5	1.63	16.48	9.28
11:31	6	1.62	16.46	9.67
11:32	7	1.68	16.42	10.13
11:33	8	1.56	16.53	10.46
11:34	9	1.57	16.53	10.41
11:35	10	1.56	16.53	10.82
11:36	11	1.59	16.52	11.17
11:37	12	1.56	16.53	11.27
11:38	13	1.64	16.45	11.46
11:39	14	1.63	16.47	11.57
11:40	15	1.50	16.57	11.70
11:41	16	1.56	16.54	5.97
11:42	17	1.60	16.50	6.41
11:43	18	1.53	16.57	0.24
11:44	19	1.55	16.55	0.18
11:45	20	1.59	16.52	0.17
11:46	21	1.63	16.47	0.16
11:47	22	1.59	16.50	0.15
11:48	23	1.46	16.63	0.14
11:49	24	1.50	16.60	0.14
11:50	25	1.58	16.52	0.14
11:51	26	1.52	16.57	0.14
11:52	27	1.47	16.62	4.88
11:53	28	1.45	16.65	10.28
11:54	29	1.50	16.61	12.95
11:55	30	1.55	16.55	13.29
11:56	31	1.58	16.52	6.92
11:57	32	1.55	16.54	13.20
11:58	33	1.56	16.55	13.15
11:59	34	1.57	16.53	13.05
12:00	35	1.62	16.49	13.11
12:01	36	1.59	16.50	13.13
12:02	37	1.60	16.51	13.28
12:03	38	1.51	16.57	13.48
12:04	39	1.55	16.56	13.69
12:05	40	1.59	16.52	13.82
12:06	41	1.58	16.51	13.96
12:07	42	1.57	16.52	8.39
12:08	43	1.60	16.50	0.30
12:09	44	1.58	16.52	0.19
12:10	45	1.62	16.49	0.17
12:11	46	1.57	16.52	0.16
12:12	47	1.51	16.58	0.15
12:13	48	1.63	16.48	0.15
12:14	49	1.66	16.44	0.15
12:15	50	1.60	16.50	0.15
12:16	51	1.60	16.49	0.15
12:17	52	1.53	16.56	0.15
12:18	53	1.59	16.51	0.14
12:19	54	1.62	16.48	0.14
12:20	55	1.59	16.50	0.14
12:21	56	1.67	16.43	3.97
12:22	57	1.63	16.47	3.12
12:23	58	1.60	16.50	7.86
12:24	59	1.54	16.54	12.97
12:25	60	1.56	16.54	14.30
12:26	61	1.53	16.56	14.58
12:27	62	1.47	16.62	14.69
12:28	63	1.56	16.54	14.75
12:29	64	1.61	16.48	14.69
12:30	65	1.52	16.57	14.73
12:31	66	1.51	16.58	14.81
12:32	67	1.54	16.55	14.90
12:33	68	1.55	16.54	14.97
12:34	69	1.67	16.43	14.92
12:35	70	1.66	16.44	14.87
12:36	71	1.61	16.48	14.89
12:37	72	1.57	16.52	14.31
12:38	73	1.62	16.48	0.84

A-11.31
0.84

Continued FCCU-26-1/FCCU-OTM29-1

12:39	74	1.50	16.58	0.21
12:40	75	1.49	16.61	0.18
12:41	76	1.51	16.58	0.17
12:42	77	1.51	16.58	0.16
12:43	78	1.57	16.52	0.15
12:44	79	1.57	16.53	0.15
12:45	80	1.60	16.50	0.23
12:46	81	1.59	16.51	5.18
12:47	82	1.56	16.53	5.37
12:48	83	1.51	16.57	11.20
12:49	84	1.51	16.57	14.61
12:50	85	1.55	16.54	15.25
12:51	86	1.44	16.63	15.41
12:52	87	1.57	16.53	15.54
12:53	88	1.55	16.53	15.60
12:54	89	1.49	16.59	15.70
12:55	90	1.59	16.52	15.77
12:56	91	1.62	16.48	15.74
12:57	92	1.65	16.43	15.76
12:58	93	1.64	16.46	15.75
12:59	94	1.73	16.36	15.79
13:00	95	1.75	16.34	15.80
13:01	96	1.54	16.54	15.75
13:02	97	1.55	16.53	4.46
13:03	98	1.65	16.46	0.23
13:04	99	1.68	16.42	0.19
13:05	100	1.74	16.36	4.87
13:06	101	1.68	16.41	0.52
13:07	102	1.69	16.41	0.17
13:08	103	1.62	16.45	0.16
13:09	104	1.67	16.42	0.16
13:10	105	1.66	16.41	0.16
13:11	106	1.72	16.36	0.15
13:12	107	1.73	16.34	0.15
13:13	108	1.69	16.38	0.14
13:14	109	1.60	16.48	0.14
13:15	110	1.55	16.53	0.14
13:16	111	1.49	16.57	0.14
13:17	112	1.49	16.58	0.14
13:18	113	1.48	16.59	0.14
13:19	114	1.52	16.56	0.14
13:20	115	1.55	16.54	0.14
13:21	116	1.60	16.49	0.14
13:22	117	1.56	16.52	0.14
13:23	118	1.53	16.55	0.14
13:24	119	1.56	16.52	0.13
13:25	120	1.56	16.50	2.49
13:26	121	1.54	16.53	0.17
13:27	122	1.54	16.54	0.19
13:28	123	1.61	16.48	1.82
13:29	124	1.56	16.51	0.23
13:30	125	1.46	16.61	0.14
13:31	126	1.58	16.52	0.14
13:32	127	1.74	16.37	0.14
13:33	128	1.80	16.30	0.14
13:34	129	1.73	16.37	0.13
13:35	130	1.77	16.34	0.13
Uncorrected Average =		1.58	16.51	13.50
Corresponding Average to Meter (OTM-029) Values =		1.58	16.52	

$$\text{Example Calculation} = C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{\text{ma}}}{C_m - C_o}$$

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/6/2011
RUN NUMBER: FCCU-26A-1

γ FACTOR:	1.005	STACK DIAM:	150.0 inches
BAROMETRIC:	29.96 in. Hg	METER VOLUME:	78.042 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	99.1 °F
STACK TEMP:	141.7 °F	LIQUID COLL:	423.5 milliliters
SQ.RT ΔP:	0.5582 in.H ₂ O	CO₂:	16.67 % by volume
ΔH:	1.51 in.H ₂ O	O₂:	1.51 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 74.443 \text{ dscf}$$

$$\gamma = 1.005$$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 19.934 \text{ scf}$$

$$V_{lc} = 423.5 \text{ mL}$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2112$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2065$$

$$S.V.P. = 6.19 \text{ in. Hg}$$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.2065$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-26A-1

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/6/2011

BAROMETRIC: 29.96 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 141.7 °F
SQ.RT ΔP: 0.5582 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 16.67 % by volume
O₂: 1.51 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.73	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.10	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5582	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 141.7 \text{ °F} + 460$	=	601.7	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.97	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	33.880	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	249,465.63	acfm
Stack Area =		122.72	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right)$	=	219,309.77	scfm, wb
		13,158,586	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws})$	=	174,020.67	dscfm
		10,441,240	dscfh

HYDROGEN CHLORIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/6/2011
RUN NO: FCCU-26A-1

INPUT

V_m:	78.042 ft ³	Q_s:	10,441,240 dscfh
γ FACTOR:	1.005	T_s:	141.7 °F
P_{bar}:	29.96 in. Hg	Θ:	120 minutes
ΔH:	1.51	V_s:	33.880 fps
T_m:	99.1 °F	P_s:	29.97 in. Hg
HCl in sample:	< 234 μg	V_{lc}:	423.5 mL
		%O₂:	1.51 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	74.443 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	101.5 % I 100.7 % I*
A _n =	0.00043374 ft ²	Runtime (θ) =	120 minutes
* based upon saturation			
Total μg HCl in sample (M_n)		=	< 234 μg
Concentration of HCl			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0069 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{36.45 lb/lb - mole} \times 10^6$		=	< 0.073 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		=	< 0.1110 mg/dscm
HCl Mass Rate:		E = Q _s × C'_{s(lb/dscf)}	= < 0.07236 lb/hr

HYDROGEN FLUORIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/6/2011

RUN NO: FCCU-26A-1

INPUT

V_m:	78.042 ft ³	Q_s:	10,441,240 dscfh
γ FACTOR:	1.005	T_s:	141.7 °F
P_{bar}:	29.96 in. Hg	Θ:	120 minutes
ΔH:	1.51	V_s:	33.880 fps
T_m:	99.1 °F	P_s:	29.97 in. Hg
HF in sample:	< 32 μg	V_{lc}:	423.5 mL
		%O₂:	1.51 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	74.443 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	101.5 % I 100.7 % I*
A _n =	0.00043374 ft ²	Runtime (Θ) =	120 minutes
		* based upon saturation	
Total μg HF in sample (M _n)		=	< 32 μg
Concentration of HF			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} \text{ lb}/\mu\text{g})(M_n)}{V_{mstd}}$		=	< 0.0009 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 \text{ ft}^3/\text{lb-mole}}{20.01 \text{ lb/lb-mole}} \times 10^6$		=	< 0.018 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 \text{ ft}^3/\text{m}^3)}{(1000 \mu\text{g}/\text{mg})(V_{mstd})}$		=	< 0.0152 mg/dscm
HF Mass Rate:			
E = Q _s × C'_{s(lb/dscf)}		=	< 0.00989 lb/hr

CHLORINE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/6/2011

RUN NO: FCCU-26A-1

INPUT

V_m:	78.042 ft ³	Q_s:	10,441,240 dscfh
γ FACTOR:	1.005	T_s:	141.7 °F
P_{bar}:	29.96 in. Hg	Θ:	120 minutes
ΔH:	1.51	V_s:	33.880 fps
T_m:	99.1 °F	P_s:	29.97 in. Hg
Cl₂ in sample:	< 116 μg	V_{lc}:	423.5 mL
		%O₂:	1.51 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	74.443 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) \left(\gamma \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	101.5 % I 100.7 % I*
A _n =	0.00043374 ft ²	Runtime (Θ) =	120 minutes
		* based upon saturation	
Total μg Cl ₂ in sample (M _n)		=	< 116 μg
Concentration of Cl ₂			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0034 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{70.096 lb/lb - mole} \times 10^6$		=	< 0.019 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		=	< 0.0550 mg/dscm
Cl ₂ Mass Rate:			
E = Q _s × C'_{s(lb/dscf)}		=	< 0.03587 lb/hr

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS
TEST DATE: 6/6/2011
RUN NUMBER: FCCU-OTM29-1

γ FACTOR:	0.999	STACK DIAM:	150.00 inches
BAROMETRIC:	29.96 in. Hg	METER VOLUME:	23.055 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	92.1 °F
STACK TEMP:	141.8 °F	LIQUID COLL:	195.6 milliliters
SQ. RT ΔP:	0.5543 in.H ₂ O	CO₂:	16.68 % by volume
ΔH:	0.50 in.H ₂ O	O₂:	1.51 % by volume
		Meter Out CO₂:	13.32 % by volume
		ENGLISH UNITS	
		(29.92 in.Hg & 68 °F)	

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 22.083 \text{ dscf}$$

$$V_{actual} = \frac{(V_{mstd})(1 - \%CO_{2(dry)out})}{(1 - \%CO_{2(dry)in})} = 22.973 \text{ dscf}$$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 9.207 \text{ scf}$$

$$V_{lc} = 195.6 \text{ mL}$$

$$V_{lc} = 122.1 \text{ mL adjusted for saturation}$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{actual}} = 0.2861$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2065$$

$$S.V.P. = 6.19 \text{ in. Hg}$$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.2065$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-OTM29-1

SOURCE: 1241 FCCU WGS
TEST DATE: 6/6/2011

BAROMETRIC: 29.96 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 141.8 °F
SQ.RT ΔP: 0.5543 in.H₂O

STACK DIAM: 150.00 inches
CO₂: 16.68 % by volume
O₂: 1.51 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.73	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.10	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5543	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 141.8 \text{ °F} + 460$	=	601.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.97	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	33.646	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	247,738	acfm
Stack Area =		122.718 ft ²	
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	217,754.5 13,065,270	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	172,786.6 10,367,194	dscfm dscfh

HYDROGEN CYANIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS
TEST DATE: 6/6/2011
RUN NO: FCCU-OTM29-1

INPUT

V_{mstd}:	22.083 ft ³	Q_s:	10,367,194 dscfh
γ FACTOR:	0.999	T_s:	141.8 °F
P_{bar}:	29.96 in. Hg	Θ:	60.0 minutes
ΔH:	0.50 in. H ₂ O	V_s:	33.646 fps
T_m:	92.1 °F	P_s:	29.97 in. Hg
HCN in sample:	53,440 μg	V_{lc}:	195.6 mL
		%O₂:	1.51 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{\text{actual}} = \frac{(V_{\text{mstd}})(1 - \%CO_{2(\text{dry})\text{out}})}{(1 - \%CO_{2(\text{dry})\text{in}})}$		=	22.973 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_{\text{actual}}}{T_m} \right) (\gamma) \left(P_{\text{bar}} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	
A _n =	0.00027123 ft ²	Runtime (θ) =	108.1 % I 96.1 @ saturation 60 minutes
Total μg HCN in sample (M_n)		=	53,440 μg
Concentration of HCN			
$C'_{s(\text{lb/dscf})} = \frac{(2.2046 \times 10^{-9} \text{ lb/μg})(M_n)}{V_{\text{actual}}}$		=	5.1292 x 10 ⁻⁶ lbs/dscf
$C_{s(\text{ppmvdb})} = C'_{s(\text{lb/dscf})} \times \frac{385.26 \text{ ft}^3/\text{lb-mole}}{27.03 \text{ lb/lb-mole}} \times 10^6$		=	73.11 ppmv db
$C_{s(\text{μg/dscm})} = \frac{(M_{n,\text{μg}})(35.31)}{(V_{\text{mstd,dscf}})}$		=	82,137 μg/dscm
HCN Mass Rate:			
$E = Q_s \times C'_{s(\text{lb/dscf})}$		=	53.175 lbs/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
SOURCE : 1241 FCCU WGS Stack
REPETITION : FCCU-26-2/FCCU-OTM29-2
TEST DATE : 6/6/2011
START TIME : 14:01
END TIME : 16:28

GAS ANALYZER	Stack O₂
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SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.519
 AVERAGE ZERO BIAS (C_o): 0.088

CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 1.49
 (OTM-029) % CORRECTED (C_{gas}): 1.49

GAS ANALYZER	Stack CO₂
---------------------	-----------------------------

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 9.95
 AVERAGE ZERO BIAS (C_o): 0.15

CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 16.65
 (OTM-029) % CORRECTED (C_{gas}): 16.66

GAS ANALYZER	Meter CO₂
---------------------	-----------------------------

SPAN VALUE : 19.6 ppm
 AVERAGE CAL. BIAS (C_m): 10.15
 AVERAGE ZERO BIAS (C_o): 0.10

CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 (OTM-029) % CORRECTED (C_{gas}): 13.02

CLOCK TIME

ELAPSED TIME

Stack

Meter

O₂CO₂CO₂

14:01	0			
14:02	1	1.57	16.48	0.41
14:03	2	1.65	16.41	0.31
14:04	3	1.58	16.48	3.44
14:05	4	1.61	16.45	10.16
14:06	5	1.54	16.51	11.59
14:07	6	1.59	16.46	11.59
14:08	7	1.64	16.43	11.41
14:09	8	1.59	16.47	11.26
14:10	9	1.60	16.46	11.04
14:11	10	1.56	16.49	11.00
14:12	11	1.57	16.49	10.98
14:13	12	1.61	16.46	10.91
14:14	13	1.63	16.41	10.87
14:15	14	1.52	16.52	10.93
14:16	15	1.53	16.52	10.99
14:17	16	1.58	16.47	5.96
14:18	17	1.55	16.50	10.19
14:19	18	1.55	16.51	1.13
14:20	19	1.64	16.40	0.19
14:21	20	1.61	16.44	0.16
14:22	21	1.61	16.44	0.16
14:23	22	1.56	16.49	0.16
14:24	23	1.59	16.47	0.19
14:25	24	1.65	16.40	0.19
14:26	25	1.66	16.38	0.17
14:27	26	1.62	16.43	0.20
14:28	27	1.60	16.44	0.19
14:29	28	1.60	16.44	0.15
14:30	29	1.56	16.49	0.16
14:31	30	1.62	16.43	0.16
14:32	31	1.56	16.47	5.92
14:33	32	1.52	16.53	0.16
14:34	33	1.47	16.57	0.15
14:35	34	1.60	16.47	0.15
14:36	35	1.56	16.48	0.19
14:37	36	1.61	16.43	0.20
14:38	37	1.65	16.39	5.03
14:39	38	1.64	16.40	0.43
14:40	39	1.60	16.43	0.14
14:41	40	1.60	16.43	0.13
14:42	41	1.64	16.39	0.13
14:43	42	1.64	16.39	0.73
14:44	43	1.49	16.53	1.63
14:45	44	1.54	16.51	1.25
14:46	45	1.50	16.52	5.49
14:47	46	1.58	16.46	10.89
14:48	47	1.48	16.55	12.35
14:49	48	1.67	16.38	12.49
14:50	49	1.53	16.49	12.15
14:51	50	1.55	16.49	12.08
14:52	51	1.61	16.43	12.01
14:53	52	1.53	16.49	11.98
14:54	53	1.51	16.51	12.01
14:55	54	1.57	16.46	12.07
14:56	55	1.51	16.51	12.08
14:57	56	1.53	16.50	12.10
14:58	57	1.51	16.52	12.21
14:59	58	1.54	16.49	12.32
15:00	59	1.54	16.48	9.88
15:01	60	1.53	16.49	0.56
15:02	61	1.55	16.48	0.23
15:03	62	1.64	16.41	0.28
15:04	63	1.59	16.43	0.17
15:05	64	1.66	16.38	0.16
15:06	65	1.73	16.29	0.16
15:07	66	1.64	16.39	0.20
15:08	67	1.64	16.38	0.20
15:09	68	1.59	16.44	0.21
15:10	69	1.62	16.40	0.21
15:11	70	1.59	16.43	0.17
15:12	71	1.66	16.38	0.13
15:13	72	1.66	16.37	0.13
15:14	73	1.67	16.35	0.14
15:15	74	1.65	16.37	0.17
15:16	75	1.75	16.28	0.21

15:17	76	1.70	16.33	0.21
15:18	77	1.66	16.36	0.19
15:19	78	1.57	16.45	0.16
15:20	79	1.60	16.42	0.17
15:21	80	1.50	16.52	0.15
15:22	81	1.55	16.47	0.14
15:23	82	1.67	16.35	0.13
15:24	83	1.63	16.39	0.16
15:25	84	1.69	16.33	3.64
15:26	85	1.68	16.34	10.52
15:27	86	1.69	16.32	12.95
15:28	87	1.63	16.39	13.73
15:29	88	1.65	16.37	14.08
15:30	89	1.55	16.46	14.18
15:31	90	1.62	16.39	14.22
15:32	91	1.51	16.47	14.21
15:33	92	1.64	16.37	14.24
15:34	93	1.59	16.41	14.12
15:35	94	1.57	16.44	14.13
15:36	95	1.57	16.43	14.17
15:37	96	1.63	16.37	14.19
15:38	97	1.54	16.46	14.17
15:39	98	1.50	16.50	14.24
15:40	99	1.46	16.55	9.62
15:41	100	1.43	16.58	0.40
15:42	101	1.42	16.60	0.22
15:43	102	1.44	16.57	0.21
15:44	103	1.49	16.51	1.56
15:45	104	1.54	16.47	4.10
15:46	105	1.49	16.52	0.20
15:47	106	1.47	16.55	0.15
15:48	107	1.49	16.52	0.15
15:49	108	1.57	16.45	0.16
15:50	109	1.44	16.55	0.22
15:51	110	1.51	16.51	0.16
15:52	111	1.43	16.57	0.19
15:53	112	1.51	16.50	0.14
15:54	113	1.51	16.50	0.14
15:55	114	1.45	16.56	0.15
15:56	115	1.48	16.54	0.13
15:57	116	1.45	16.57	0.18
15:58	117	1.52	16.50	0.14
15:59	118	1.54	16.48	0.13
16:00	119	1.50	16.52	0.95
16:01	120	1.53	16.48	7.96
16:02	121	1.51	16.51	12.71
16:03	122	1.47	16.55	14.63
16:04	123	1.43	16.59	15.01
16:05	124	1.41	16.61	15.16
16:06	125	1.41	16.60	15.26
16:07	126	1.43	16.59	15.28
16:08	127	1.40	16.63	15.35
16:09	128	1.50	16.53	15.43
16:10	129	1.57	16.45	15.41
16:11	130	1.56	16.46	15.41
16:12	131	1.58	16.44	15.43
16:13	132	1.57	16.45	15.48
16:14	133	1.58	16.43	15.51
16:15	134	1.56	16.46	14.11
16:16	135	1.35	16.65	1.62
16:17	136	1.24	16.78	2.49
16:18	137	1.42	16.61	1.54
16:19	138	1.47	16.57	0.19
16:20	139	1.56	16.49	0.18
16:21	140	1.45	16.59	0.17
16:22	141	1.34	16.69	0.16
16:23	142	1.59	16.47	0.93
16:24	143	1.59	16.47	0.93
16:25	144	1.59	16.47	0.93
16:26	145	1.59	16.47	0.93
16:27	146	1.59	16.47	0.93
16:28	147	1.59	16.47	0.93
Uncorrected Average =		1.56	16.47	13.19
Corresponding Average to Meter (OTM-029) Values =		1.55	16.48	

$$\text{Example Calculation} = C_{\text{gas}} = \frac{(\bar{C} - C_o) C_{\text{ma}}}{C_m - C_o}$$

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/6/2011
RUN NUMBER: FCCU-26A-2

γ FACTOR:	1.005	STACK DIAM:	150.0 inches
BAROMETRIC:	29.86 in. Hg	METER VOLUME:	78.327 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	103.5 °F
STACK TEMP:	141.5 °F	LIQUID COLL:	465.6 milliliters
SQ.RT ΔP:	0.5504 in.H ₂ O	CO₂:	16.65 % by volume
ΔH:	1.46 in.H ₂ O	O₂:	1.49 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{\text{mstd}} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{\text{bar}} + \frac{\Delta H}{13.6}}{T_m} \right] = 73.876 \quad \text{dscf}$$

$\gamma = 1.005$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{\text{wstd}} = 0.04707 \times V_{\text{lc}} = 21.916 \quad \text{scf}$$

$V_{\text{lc}} = 465.6 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{\text{ws}} = \frac{V_{\text{wstd}}}{V_{\text{wstd}} + V_{\text{mstd}}} = 0.2288$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{\text{ws@saturation}} = \frac{\text{S.V.P.}}{P_{\text{bar}} + \frac{P_{\text{static}}}{13.6}} = 0.2072$$

$\text{S.V.P.} = 6.19 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{\text{ws}} = 0.2072$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-26A-2

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/6/2011

BAROMETRIC: 29.86 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 141.5 °F
SQ.RT ΔP: 0.5504 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 16.65 % by volume
O₂: 1.49 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.72	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.09	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5504	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 141.5 \text{ °F} + 460$	=	601.5	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.87	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	33.464	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	246,402.60	acfm
Stack Area =		122.72	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	215,966.12	scfm, wb
		12,957,967	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	171,218.22	dscfm
		10,273,093	dscfh

HYDROGEN CHLORIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/6/2011

RUN NO: FCCU-26A-2

INPUT

V_m:	78.327 ft ³	Q_s:	10,273,093 dscfh
γ FACTOR:	1.005	T_s:	141.5 °F
P_{bar}:	29.86 in. Hg	Θ:	120 minutes
ΔH:	1.46	V_s:	33.464 fps
T_m:	103.5 °F	P_s:	29.87 in. Hg
HCl in sample:	< 234 μg	V_{lc}:	465.6 mL
		%O₂:	1.49 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	73.876 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) \left(\gamma \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	104.6 % I 101.6 % I*
A _n =	0.00043374 ft ²	Runtime (Θ) =	120 minutes
		* based upon saturation	
Total μg HCl in sample (M_n)		=	< 234 μg
Concentration of HCl			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0070 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{36.45 lb/lb - mole} \times 10^6$		=	< 0.074 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		=	< 0.1118 mg/dscm
HCl Mass Rate:			
E = Q _s × C' _{s(lb/dscf)}		=	< 0.07174 lb/hr

HYDROGEN FLUORIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/6/2011
RUN NO: FCCU-26A-2

INPUT

V_m:	78.327 ft ³	Q_s:	10,273,093 dscfh
γ FACTOR:	1.005	T_s:	141.5 °F
P_{bar}:	29.86 in. Hg	Θ:	120 minutes
ΔH:	1.46	V_s:	33.464 fps
T_m:	103.5 °F	P_s:	29.87 in. Hg
HF in sample:	< 32 μg	V_{lc}:	465.6 mL
		%O₂:	1.49 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	73.876 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	104.6 % I 101.6 % I*
$A_n = 0.00043374 \text{ ft}^2$		Runtime (θ) = 120 minutes	
* based upon saturation			
Total μg HF in sample (M _n)		=	< 32 μg
Concentration of HF			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} \text{ lb}/\mu\text{g})(M_n)}{V_{mstd}}$		=	< 0.0010 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 \text{ ft}^3/\text{lb} - \text{mole}}{20.01 \text{ lb}/\text{lb} - \text{mole}} \times 10^6$		=	< 0.018 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 \text{ ft}^3/\text{m}^3)}{(1000 \mu\text{g}/\text{mg})(V_{mstd})}$		=	< 0.0153 mg/dscm
HF Mass Rate:			
$E = Q_s \times C'_{s(lb/dscf)}$		=	< 0.00981 lb/hr

CHLORINE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/6/2011
RUN NO: FCCU-26A-2

INPUT

V_m:	78.327 ft ³	Q_s:	10,273,093 dscfh
γ FACTOR:	1.005	T_s:	141.5 °F
P_{bar}:	29.86 in. Hg	Θ:	120 minutes
ΔH:	1.46	V_s:	33.464 fps
T_m:	103.5 °F	P_s:	29.87 in. Hg
Cl₂ in sample:	< 116 μg	V_{lc}:	465.6 mL
		%O₂:	1.49 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		= 73.876 dscf
Isokinetic Sampling Rate		
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		= 104.6 % I 101.6 % I*
A _n =	0.00043374 ft ²	Runtime (Θ) = 120 minutes
		* based upon saturation
Total μg Cl₂ in sample (M_n)		= < 116 μg
Concentration of Cl₂		
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		= < 0.0035 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{70.096 lb/lb - mole} \times 10^6$		= < 0.019 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		= < 0.0554 mg/dscm
Cl₂ Mass Rate:		
E = Q _s × C'_{s(lb/dscf)}		= < 0.03556 lb/hr

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS
TEST DATE: 6/6/2011
RUN NUMBER: FCCU-OTM29-2

γ FACTOR:	0.999	STACK DIAM:	150.00 inches
BAROMETRIC:	29.86 in. Hg	METER VOLUME:	22.350 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	94.8 °F
STACK TEMP:	141.8 °F	LIQUID COLL:	194.7 milliliters
SQ.RT ΔP:	0.5427 in.H ₂ O	CO₂:	16.66 % by volume
ΔH:	0.47 in.H ₂ O	O₂:	1.49 % by volume
		Meter Out CO₂:	13.02 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS			
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	21.231 dscf
$V_{actual} = \frac{(V_{mstd})(1 - \%CO_{2(dry)out})}{(1 - \%CO_{2(dry)in})}$		=	22.158 dscf
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS			
$V_{wstd} = 0.04707 \times V_{lc}$		=	9.165 scf
$V_{lc} = 194.7 \text{ mL}$			
$V_{lc} = 117.9 \text{ mL adjusted for saturation}$			
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED			
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{actual}}$		=	0.2926
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION			
$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}}$		=	0.2072
$S.V.P. = 6.19 \text{ in. Hg}$			
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS			
		$B_{ws} =$	0.2072

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-OTM29-2

SOURCE: 1241 FCCU WGS
TEST DATE: 6/6/2011

BAROMETRIC: 29.86 in. Hg	STACK DIAM: 150.00 inches	
STATIC PRES: 0.2 in.H ₂ O	CO₂: 16.66 % by volume	
STACK TEMP: 141.8 °F	O₂: 1.49 % by volume	
SQ.RT ΔP: 0.5427 in.H ₂ O		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.73	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.09	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5427	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 141.8 \text{ °F} + 460$	=	601.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.87	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	33.004	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	243,011	acfm
Stack Area =	122.718 ft ²		
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	212,886.9 12,773,214	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	168,777.0 10,126,621	dscfm dscfh

HYDROGEN CYANIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS
TEST DATE: 6/6/2011
RUN NO: FCCU-OTM29-2

INPUT

V_{mstd}:	21.231 ft ³	Q_s:	10,126,621 dscfh
γ FACTOR:	0.999	T_s:	141.8 °F
P_{bar}:	29.86 in. Hg	Θ:	60.0 minutes
ΔH:	0.47 in. H ₂ O	V_s:	33.004 fps
T_m:	94.8 °F	P_s:	29.87 in. Hg
HCN in sample:	49,166 μg	V_{lc}:	194.7 mL
		%O₂:	1.49 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{\text{actual}} = \frac{(V_{\text{mstd}})(1 - \%CO_{2(\text{dry})\text{out}})}{(1 - \%CO_{2(\text{dry})\text{in}})}$		=	22.158 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{\text{bar}} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	107.0 % I
A _n = 0.00027123 ft ²		Runtime (θ) =	94.2 @ saturation 60 minutes
Total μg HCN in sample (M_n)		=	49,166 μg
Concentration of HCN			
$C'_{s(\text{lb/dscf})} = \frac{(2.2046 \times 10^{-9} \text{ lb/μg})(M_n)}{V_{\text{actual}}}$		=	4.8926 x 10 ⁻⁶ lbs/dscf
$C_{s(\text{ppmvdb})} = C'_{s(\text{lb/dscf})} \times \frac{385.26 \text{ ft}^3/\text{lb-mole}}{27.03 \text{ lb/lb-mole}} \times 10^6$		=	69.73 ppmv db
$C_{s(\text{μg/dscm})} = \frac{(M_{n,\text{μg}})(35.31)}{(V_{\text{mstd,dscf}})}$		=	78,349 μg/dscm
HCN Mass Rate:			
E = Q _s × C'_{s(lb/dscf)}		=	49.546 lbs/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
SOURCE : 1241 FCCU WGS Stack
REPETITION : FCCU-26-3/FCCU-OTM29-3
TEST DATE : 6/7/2011
START TIME : 14:35
END TIME : 16:46

GAS ANALYZER **Stack O₂**

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.604
 AVERAGE ZERO BIAS (C_o): 0.102

 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 5.47
 (OTM-029) % CORRECTED (C_{gas}): 5.41

GAS ANALYZER **Stack CO₂**

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 10.04
 AVERAGE ZERO BIAS (C_o): 0.13

 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 12.98
 (OTM-029) % CORRECTED (C_{gas}): 13.05

GAS ANALYZER **Meter CO₂**

SPAN VALUE : 19.6 ppm
 AVERAGE CAL. BIAS (C_m): 9.98
 AVERAGE ZERO BIAS (C_o): 0.19

 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 (OTM-029) % CORRECTED (C_{gas}): 9.80

CLOCK TIME	ELAPSED TIME	Stack		Meter
		O ₂	CO ₂	CO ₂
14:35	0	---	---	---
14:36	1	4.82	13.65	0.17
14:37	2	4.83	13.66	0.19
14:38	3	4.86	13.64	1.16
14:39	4	4.88	13.62	5.85
14:40	5	4.88	13.63	8.98
14:41	6	4.85	13.66	9.36
14:42	7	4.85	13.65	9.32
14:43	8	4.86	13.64	9.32
14:44	9	5.02	13.49	9.24
14:45	10	5.05	13.48	9.09
14:46	11	4.85	13.66	9.07
14:47	12	4.76	13.75	9.19
14:48	13	4.75	13.76	9.26
14:49	14	4.66	13.84	9.26
14:50	15	4.80	13.71	9.24
14:51	16	4.87	13.61	4.71
14:52	17	5.01	13.51	9.14
14:53	18	4.82	13.69	3.36
14:54	19	4.81	13.71	0.28
14:55	20	4.82	13.70	0.20
14:56	21	4.96	13.57	0.21
14:57	22	4.94	13.59	0.38
14:58	23	5.07	13.46	5.78
14:59	24	5.03	13.50	0.94
15:00	25	4.99	13.53	0.76
15:01	26	5.03	13.49	0.86
15:02	27	4.95	13.57	2.18
15:03	28	5.01	13.51	6.41
15:04	29	4.92	13.58	9.43
15:05	30	5.00	13.53	9.95
15:06	31	5.58	13.00	8.21
15:07	32	5.03	13.49	9.66
15:08	33	4.94	13.57	9.65
15:09	34	5.03	13.49	9.61
15:10	35	5.02	13.50	9.65
15:11	36	5.00	13.52	9.64
15:12	37	5.02	13.51	9.64
15:13	38	5.10	13.42	9.63
15:14	39	5.15	13.37	9.60
15:15	40	4.94	13.56	9.61
15:16	41	5.04	13.48	9.77
15:17	42	5.19	13.33	4.64
15:18	43	5.17	13.35	0.24
15:19	44	5.09	13.42	0.28
15:20	45	5.11	13.41	4.26
15:21	46	5.33	13.21	0.79
15:22	47	5.84	12.76	3.33
15:23	48	6.10	12.56	7.38
15:24	49	6.03	12.61	9.36
15:25	50	6.11	12.54	9.58
15:26	51	6.10	12.54	9.59
15:27	52	6.20	12.45	9.64
15:28	53	6.11	12.53	9.63
15:29	54	6.24	12.41	9.78
15:30	55	6.16	12.47	9.84
15:31	56	6.24	12.41	9.87
15:32	57	6.21	12.44	9.86
15:33	58	6.14	12.50	9.89
15:34	59	5.97	12.63	9.96
15:35	60	6.13	12.51	10.09
15:36	61	6.08	12.55	10.05
15:37	62	6.03	12.59	3.64
15:38	63	6.12	12.52	0.22
15:39	64	6.08	12.54	0.19
15:40	65	5.94	12.66	0.19
15:41	66	5.82	12.75	0.23
15:42	67	6.05	12.58	0.20
15:43	68	6.07	12.56	3.54
15:44	69	6.06	12.56	0.31
15:45	70	5.99	12.62	0.20
15:46	71	5.97	12.64	4.35
15:47	72	5.97	12.63	8.30
15:48	73	5.83	12.75	10.12

15:49	74	5.92	12.68	10.50
15:50	75	5.94	12.67	10.53
15:51	76	6.13	12.51	10.49
15:52	77	5.88	12.70	10.40
15:53	78	5.88	12.71	10.50
15:54	79	5.89	12.71	10.54
15:55	80	5.80	12.78	10.51
15:56	81	5.84	12.75	10.57
15:57	82	5.81	12.77	10.55
15:58	83	5.85	12.73	10.54
15:59	84	5.89	12.71	10.54
16:00	85	5.84	12.74	10.58
16:01	86	5.86	12.73	4.13
16:02	87	5.93	12.68	0.27
16:03	88	5.84	12.75	1.70
16:04	89	5.83	12.76	0.22
16:05	90	5.87	12.73	0.18
16:06	91	5.81	12.77	0.17
16:07	92	5.80	12.78	0.16
16:08	93	5.79	12.79	0.16
16:09	94	5.84	12.74	0.16
16:10	95	5.72	12.85	0.18
16:11	96	5.80	12.78	0.51
16:12	97	5.81	12.78	0.18
16:13	98	5.69	12.87	0.11
16:14	99	5.78	12.80	0.11
16:15	100	5.79	12.79	0.11
16:16	101	5.83	12.76	0.10
16:17	102	5.93	12.67	0.10
16:18	103	5.82	12.76	0.10
16:19	104	5.81	12.77	0.26
16:20	105	5.71	12.85	1.00
16:21	106	5.75	12.82	1.02
16:22	107	5.80	12.78	1.04
16:23	108	5.76	12.80	1.80
16:24	109	5.85	12.74	8.75
16:25	110	5.68	12.87	9.97
16:26	111	5.86	12.72	9.99
16:27	112	5.92	12.67	10.00
16:28	113	5.83	12.76	3.52
16:29	114	5.71	12.84	0.25
16:30	115	5.88	12.71	0.25
16:31	116	5.79	12.78	0.21
16:32	117	5.75	12.82	0.19
16:33	118	5.85	12.73	0.16
16:34	119	5.87	12.71	0.21
16:35	120	5.98	12.62	0.19
16:36	121	5.90	12.69	0.20
16:37	122	5.88	12.71	0.18
16:38	123	5.77	12.79	0.18
16:39	124	5.76	12.81	0.17
16:40	125	5.82	12.76	0.15
16:41	126	5.82	12.76	0.15
16:42	127	5.89	12.70	0.20
16:43	128	5.77	12.80	0.21
16:44	129	5.76	12.81	0.19
16:45	130	5.99	12.62	0.23
16:46	131	5.91	12.69	0.17

Uncorrected Average = 5.58 12.99 9.79

Corresponding Average to Meter (OTM-029) Values = 5.51 13.06

Example Calculation =
$$C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{\text{ma}}}{C_m - C_o}$$

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/7/2011
RUN NUMBER: FCCU-26A-3

γ FACTOR:	1.005	STACK DIAM:	150.0 inches
BAROMETRIC:	29.86 in. Hg	METER VOLUME:	76.871 ft ³
STATIC PRES:	0.19 in.H ₂ O	METER TEMP:	95.8 °F
STACK TEMP:	140.0 °F	LIQUID COLL:	371.3 milliliters
SQ.RT ΔP:	0.5370 in.H ₂ O	CO₂:	12.98 % by volume
ΔH:	1.39 in.H ₂ O	O₂:	5.47 % by volume

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] =$	73.495 dscf
$\gamma = 1.005$	
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS	
$V_{wstd} = 0.04707 \times V_{lc} = 17.477 \quad \text{scf}$	
$V_{lc} = 371.3 \text{ mL}$	
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED	
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1921$	
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION	
$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1969$	
$S.V.P. = 5.881 \text{ in. Hg}$	
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS	
$B_{ws} = 0.1921$	

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-26A-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/7/2011

BAROMETRIC: 29.86 in. Hg
STATIC PRES: 0.19 in.H₂O
STACK TEMP: 140.0 °F
SQ. RT ΔP: 0.537 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 12.98 % by volume
O₂: 5.47 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 30.30 \text{ lb/lb-mole}$$

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d(1 - B_{ws}) + 18(B_{ws}) = 27.93 \text{ lb/lb-mole}$$

PITOT TUBE COEFFICIENT

$$C_p \text{ (from calibration curve or geometric specifications)} = 0.84$$

AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O

$$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i} = 0.5370 \text{ in. H}_2\text{O}$$

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

$$T_s = 140.0 \text{ °F} + 460 = 600.0 \text{ °R}$$

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6} = 29.87 \text{ in.Hg}$$

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}} = 32.699 \text{ ft/sec}$$

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s = 240,767.08 \text{ acfm}$$

$$\text{Stack Area} = 122.72 \text{ ft}^2$$

**STACK GAS VOLUMETRIC FLOW RATE,
standard conditions, wet basis**

$$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) = 211,549.08 \text{ scfm, wb}$$

$$12,692,945 \text{ scfh, wb}$$

**STACK GAS VOLUMETRIC FLOW RATE,
standard conditions, dry basis**

$$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws}) = 170,907.23 \text{ dscfm}$$

$$10,254,434 \text{ dscfh}$$

HYDROGEN CHLORIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/7/2011
RUN NO: FCCU-26A-3

INPUT

V_m:	76.871 ft ³	Q_s:	10,254,434 dscfh
γ FACTOR:	1.005	T_s:	140.0 °F
P_{bar}:	29.86 in. Hg	Θ:	120 minutes
ΔH:	1.39	V_s:	32.699 fps
T_m:	95.8 °F	P_s:	29.87 in. Hg
HCl in sample:	< 234 μg	V_{lc}:	371.3 mL
		%O₂:	5.47 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	73.495 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) \left(\gamma \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	101.4 % I
A _n = 0.00043374 ft ²		Runtime (θ) = 120 minutes	
Total μg HCl in sample (M_n)		=	< 234 μg
Concentration of HCl			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0070 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{36.45 lb/lb - mole} \times 10^6$		=	< 0.074 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		=	< 0.1124 mg/dscm
HCl Mass Rate:		$E = Q_s \times C'_{s(lb/dscf)} = < 0.07198 lb/hr$	

HYDROGEN FLUORIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/7/2011

RUN NO: FCCU-26A-3

INPUT

V_m :	76.871 ft ³	Q_s :	10,254,434 dscfh
γ FACTOR:	1.005	T_s :	140.0 °F
P_{bar} :	29.86 in. Hg	θ :	120 minutes
ΔH :	1.39	V_s :	32.699 fps
T_m :	95.8 °F	P_s :	29.87 in. Hg
HF in sample:	< 32 µg	V_{lc} :	371.3 mL
		%O ₂ :	5.47 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	73.495 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	101.4 % I
$A_n =$	0.00043374 ft ²	Runtime (θ) =	120 minutes
Total µg HF in sample (M_n)		=	< 32 µg
Concentration of HF			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0010 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{20.01 lb/lb - mole} \times 10^6$		=	< 0.018 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		=	< 0.0154 mg/dscm
HF Mass Rate:		$E = Q_s \times C'_{s(lb/dscf)} =$	
		< 0.00984 lb/hr	

CHLORINE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/7/2011
RUN NO: FCCU-26A-3

INPUT

V_m:	76.871 ft ³	Q_s:	10,254,434 dscfh
γ FACTOR:	1.005	T_s:	140.0 °F
P_{bar}:	29.86 in. Hg	Θ:	120 minutes
ΔH:	1.39	V_s:	32.699 fps
T_m:	95.8 °F	P_s:	29.87 in. Hg
Cl₂ in sample:	< 116 μg	V_{lc}:	371.3 mL
		%O₂:	5.47 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		= 73.495 dscf
Isokinetic Sampling Rate		
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		= 101.4 % I
A _n = 0.00043374 ft ²		Runtime (θ) = 120 minutes
Total μg Cl₂ in sample (M_n)		= < 116 μg
Concentration of Cl₂		
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		= < 0.0035 x 10 ⁻⁶ lb/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{70.096 lb/lb - mole} \times 10^6$		= < 0.019 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		= < 0.0557 mg/dscm
Cl₂ Mass Rate:		
E = Q _s × C'_{s(lb/dscf)}		= < 0.03568 lb/hr

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS
TEST DATE: 6/7/2011
RUN NUMBER: FCCU-OTM29-3

γ FACTOR:	0.999	STACK DIAM:	150.00 inches
BAROMETRIC:	29.86 in. Hg	METER VOLUME:	21.660 ft ³
STATIC PRES:	0.19 in.H ₂ O	METER TEMP:	88.5 °F
STACK TEMP:	140.2 °F	LIQUID COLL:	161.6 milliliters
SQ.RT ΔP:	0.5127 in.H ₂ O	CO₂:	13.05 % by volume
ΔH:	0.41 in.H ₂ O	O₂:	5.41 % by volume
		Meter Out CO₂:	9.80 % by volume
			ENGLISH UNITS
			(29.92 in.Hg & °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 20.809 \text{ dscf}$$

$$V_{actual} = \frac{(V_{mstd})(1 - \%CO_{2(dry)out})}{(1 - \%CO_{2(dry)in})} = 21.587 \text{ dscf}$$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 7.607 \text{ scf}$$

$$V_{lc} = 161.6 \text{ mL}$$

$$V_{lc} = 108.4 \text{ mL adjusted for saturation}$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{actual}} = 0.2606$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1969$$

$$S.V.P. = 5.881 \text{ in. Hg}$$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.1969$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-OTM29-3

SOURCE: 1241 FCCU WGS
TEST DATE: 6/7/2011

BAROMETRIC: 29.86 in. Hg	STACK DIAM: 150.00 inches
STATIC PRES: 0.19 in.H ₂ O	CO₂: 13.05 % by volume
STACK TEMP: 140.2 °F	O₂: 5.41 % by volume
SQ.RT ΔP: 0.5127 in.H ₂ O	

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.30	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	27.88	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5127	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.2 \text{ °F} + 460$	=	600.2	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.87	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	31.253	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	230,122	acfm
Stack Area =		122.718 ft ²	
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	202,128.1 12,127,688	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	162,337.1 9,740,227	dscfm dscfh

HYDROGEN CYANIDE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS
TEST DATE: 6/7/2011
RUN NO: FCCU-OTM29-3

INPUT

V_{mstd}:	20.809 ft ³	Q_s:	9,740,227 dscfh
γ FACTOR:	0.999	T_s:	140.2 °F
P_{bar}:	29.86 in. Hg	Θ:	60.0 minutes
ΔH:	0.41 in. H ₂ O	V_s:	31.253 fps
T_m:	88.5 °F	P_s:	29.87 in. Hg
HCN in sample:	23,265 μg	V_{lc}:	161.6 mL
		%O₂:	5.41 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{\text{actual}} = \frac{(V_{\text{mstd}})(1 - \%CO_{2(\text{dry})\text{out}})}{(1 - \%CO_{2(\text{dry})\text{in}})}$		=	21.587 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) \left(\gamma \left(P_{\text{bar}} + \left(\frac{\Delta H}{13.6} \right) \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	105.8 % I
A _n =	0.00027123 ft ²	Runtime (θ) =	96.4 @ saturation 60 minutes
Total μg HCN in sample (M _n)		=	23,265 μg
Concentration of HCN			
$C'_{s(\text{lb/dscf})} = \frac{(2.2046 \times 10^{-9} \text{ lb/μg})(M_n)}{V_{\text{actual}}}$		=	2.3760 x 10 ⁻⁶ lbs/dscf
$C_{s(\text{ppmvdb})} = C'_{s(\text{lb/dscf})} \times \frac{385.26 \text{ ft}^3/\text{lb-mole}}{27.03 \text{ lb/lb-mole}} \times 10^6$		=	33.87 ppmv db
$C_{s(\text{μg/dscm})} = \frac{(M_{n,\text{μg}})(35.31)}{(V_{\text{mstd,dscf}})}$		=	38,055 μg/dscm
HCN Mass Rate:			
E = Q _s × C' _{s(lb/dscf)}		=	23.143 lbs/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-0010-1/FCCU-0011-1
 TEST DATE : 6/8/2011
 START TIME : 8:16
 END TIME : 12:53

GAS ANALYZER O_2

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.596
 AVERAGE ZERO BIAS (C_o): 0.101

CALIBRATION GAS: EPA Protocol O_2
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 5.90

GAS ANALYZER CO_2

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 10.02
 AVERAGE ZERO BIAS (C_o): 0.10

CALIBRATION GAS: EPA Protocol CO_2
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 12.67

GAS ANALYZER CO

SPAN VALUE : 80.1 ppm
 AVERAGE CAL. BIAS (C_m): 43.21
 AVERAGE ZERO BIAS (C_o): 3.07

CALIBRATION GAS: EPA Protocol CO
 CALIBRATION PPM (C_{ma}): 40.0
 PPM CORRECTED (C_{gas}): 6.8

GAS ANALYZER VOCs

SPAN VALUE : 90 ppm
 AVERAGE CAL. BIAS (C_m): 30.61
 AVERAGE ZERO BIAS (C_o): 0.10

CALIBRATION GAS: EPA Protocol C_3H_8
 CALIBRATION ppm (C_{ma}): 30.0
 ppm CORRECTED (C_{gas}): 0.62

$$\text{Example Calculation} = C_{gas} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME ELAPSED TIME CO C_2H_6 O_2 CO_2

8:16	0				
8:17	1	11.1	0.7	6.19	12.41
8:18	2	11.0	0.7	6.26	12.35
8:19	3	11.1	0.6	6.16	12.43
8:20	4	11.5	0.7	6.21	12.39
8:21	5	11.0	0.8	6.37	12.25
8:22	6	10.7	0.6	6.38	12.24
8:23	7	10.6	0.6	6.22	12.38
8:24	8	10.7	0.6	6.26	12.34
8:25	9	10.5	0.6	6.25	12.35
8:26	10	10.5	0.6	6.37	12.25
8:27	11	11.6	0.6	6.11	12.47
8:28	12	11.4	0.6	6.25	12.35
8:29	13	11.1	0.6	6.39	12.24
8:30	14	11.0	0.6	6.32	12.30
8:31	15	10.8	0.6	6.20	12.39
8:32	16	10.8	0.6	6.16	12.43
8:33	17	10.6	0.6	6.28	12.32
8:34	18	10.5	0.6	6.30	12.31
8:35	19	10.6	0.6	6.28	12.33
8:36	20	10.7	0.6	6.18	12.41
8:37	21	10.8	0.6	6.22	12.36
8:38	22	11.0	0.6	6.25	12.36
8:39	23	10.7	0.6	6.26	12.34
8:40	24	10.9	0.6	6.28	12.33
8:41	25	11.3	0.6	6.32	12.29
8:42	26	10.9	0.6	6.22	12.38
8:43	27	10.9	0.6	6.13	12.46
8:44	28	10.9	0.5	6.18	12.42
8:45	29	10.8	0.5	6.22	12.38
8:46	30	10.9	0.5	6.26	12.34
8:47	31	10.9	0.5	6.24	12.36
8:48	32	10.6	0.5	6.23	12.36
8:49	33	10.5	0.5	6.21	12.38
8:50	34	10.6	0.5	6.18	12.40
8:51	35	10.6	0.5	6.23	12.38
8:52	36	10.9	0.5	6.17	12.42
8:53	37	11.2	0.5	6.18	12.42
8:54	38	11.5	0.5	6.23	12.38
8:55	39	11.2	0.5	6.06	12.51
8:56	40	11.0	0.5	6.26	12.34
8:57	41	11.0	0.5	6.40	12.22
8:58	42	10.9	0.5	6.23	12.37
8:59	43	10.9	0.5	6.30	12.31
9:00	44	10.8	0.5	6.33	12.27
9:01	45	10.8	0.5	6.14	12.44
9:02	46	10.7	0.5	6.33	12.28
9:03	47	10.7	0.5	6.29	12.31
9:04	48	10.9	0.5	6.28	12.32
9:05	49	10.9	0.5	6.28	12.32
9:06	50	10.9	0.5	8.31	12.29
9:07	51	11.5	0.6	6.31	12.29
9:08	52	11.3	0.6	6.22	12.37
9:09	53	11.0	0.6	6.21	12.38
9:10	54	11.1	0.6	6.22	12.38
9:11	55	11.1	0.6	6.14	12.45
9:12	56	11.2	0.6	6.22	12.37
9:13	57	11.1	0.6	6.22	12.37
9:14	58	11.0	0.6	6.34	12.28
9:15	59	10.7	0.6	6.23	12.37
9:16	60	10.7	0.6	6.29	12.31
9:17	61	10.8	0.6	6.10	12.48
9:18	62	10.8	0.6	6.14	12.45
9:19	63	11.3	0.6	6.38	12.24
9:20	64	11.4	0.6	6.26	12.34
9:21	65	11.5	0.6	8.11	12.46
9:22	66	11.1	0.6	6.23	12.37
9:23	67	11.0	0.6	6.36	12.25
9:24	68	11.0	0.5	6.39	12.23
9:25	69	11.1	0.6	6.19	12.40
9:26	70	11.1	0.6	6.14	12.45
9:27	71	11.2	0.6	6.35	12.26
9:28	72	11.0	0.5	6.43	12.19
9:29	73	10.7	0.6	6.31	12.30
9:30	74	10.9	0.5	6.25	12.34
9:31	75	10.8	0.6	6.18	12.41
9:32	76	11.0	0.6	6.15	12.43
9:33	77	11.3	0.6	6.24	12.35
9:34	78	11.2	0.6	6.04	12.52
9:35	79	11.2	0.6	8.19	12.41
9:36	80	11.3	0.6	6.21	12.39
9:37	81	11.3	0.6	6.11	12.46
9:38	82	11.3	0.6	6.27	12.34
9:39	83	11.2	0.6	6.22	12.38
9:40	84	10.9	0.6	6.24	12.36
9:41	85	10.7	0.6	6.22	12.37
9:42	86	10.8	0.6	6.20	12.40
9:43	87	10.9	0.6	6.29	12.32
9:44	88	10.7	0.6	6.30	12.30
9:45	89	11.0	0.6	6.26	12.34
9:46	90	11.6	0.6	6.31	12.30
9:47	91	11.3	0.6	6.23	12.36
9:48	92	11.4	0.6	6.17	12.42
9:49	93	11.0	0.6	6.34	12.28

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-0010-1/FCCU-0011-1

CLOCK TIME	ELAPSED TIME	CO	C ₂ H ₄	O ₂	CO ₂
9:50	94	11.0	0.6	6.29	12.31
9:51	95	10.8	0.6	6.23	12.37
9:52	96	10.7	0.6	6.24	12.35
9:53	97	10.9	0.6	6.13	12.44
9:54	98	11.0	0.6	8.21	12.38
9:55	99	10.9	0.6	6.25	12.35
9:56	100	11.1	0.6	6.25	12.35
9:57	101	10.8	0.6	6.16	12.42
9:58	102	11.2	0.7	6.29	12.31
9:59	103	11.3	0.7	6.34	12.26
10:00	104	11.1	0.6	6.37	12.24
10:01	105	10.8	0.6	6.32	12.28
10:02	106	10.5	0.6	6.20	12.38
10:03	107	10.4	0.7	6.14	12.43
10:04	108	10.1	0.7	6.24	12.34
10:05	109	9.9	0.7	6.24	12.34
10:06	110	9.9	0.7	6.00	12.54
10:07	111	10.1	0.7	5.87	12.66
10:08	112	10.4	0.7	5.84	12.69
10:09	113	10.7	0.7	5.86	12.67
10:10	114	10.5	0.7	5.95	12.61
10:11	115	10.7	0.7	6.11	12.47
10:12	116	10.5	0.7	6.11	12.46
10:13	117	10.4	0.7	5.94	12.60
10:14	118	10.2	0.7	5.83	12.70
10:15	119	10.1	0.7	5.84	12.69
10:16	120	10.0	0.7	5.95	12.60
10:17	121	10.0	0.8	5.96	12.59
10:18	122	10.2	0.7	6.09	12.48
10:19	123	10.3	0.7	5.99	12.56
10:20	124	10.1	0.7	5.90	12.64
10:21	125	10.0	0.8	5.95	12.60
10:22	126	9.9	0.8	5.95	12.59
10:23	127	9.7	0.8	5.89	12.65
10:24	128	9.8	0.8	5.87	12.65
10:25	129	10.6	0.8	5.99	12.56
10:26	130	10.3	0.8	6.04	12.51
10:27	131	10.3	0.8	6.08	12.49
10:28	132	10.1	0.8	6.13	12.45
10:29	133	9.9	0.8	5.95	12.59
10:30	134	9.8	0.8	5.97	12.57
10:31	135	9.9	0.8	5.94	12.60
10:32	136	9.8	0.8	5.95	12.60
10:33	137	9.6	0.8	5.84	12.69
10:34	138	10.0	0.8	5.92	12.62
10:35	139	10.2	0.8	5.92	12.62
10:36	140	10.1	0.8	5.90	12.65
10:37	141	10.2	0.8	6.01	12.55
10:38	142	10.4	0.8	5.91	12.63
10:39	143	10.2	0.8	5.99	12.56
10:40	144	9.9	0.8	5.90	12.63
10:41	145	9.7	0.8	5.90	12.64
10:42	146	9.5	0.8	5.96	12.58
10:43	147	9.8	0.8	6.01	12.55
10:44	148	10.0	0.8	6.03	12.53
10:45	149	10.1	0.8	5.91	12.62
10:46	150	10.0	0.8	5.88	12.66
10:47	151	9.7	0.8	6.05	12.52
10:48	152	9.3	0.7	6.05	12.51
10:49	153	9.4	0.8	5.88	12.65
10:50	154	9.7	0.8	5.76	12.75
10:51	155	9.9	0.8	5.67	12.83
10:52	156	9.8	0.8	5.76	12.75
10:53	157	10.0	0.9	5.73	12.78
10:54	158	10.2	0.8	5.78	12.76
10:55	159	9.8	0.8	5.96	12.60
10:56	160	9.5	0.8	5.94	12.61
10:57	161	9.4	0.8	5.78	12.73
10:58	162	9.2	0.8	5.79	12.73
10:59	163	9.2	0.8	5.75	12.76
11:00	164	9.3	0.8	5.80	12.72
11:01	165	9.5	0.8	5.95	12.60
11:02	166	9.8	0.8	5.78	12.74
11:03	167	10.1	0.8	5.87	12.68
11:04	168	10.1	0.9	5.92	12.62
11:05	169	9.5	0.9	5.80	12.71
11:06	170	9.3	0.9	5.83	12.70
11:07	171	9.2	0.8	5.95	12.60
11:08	172	9.1	0.8	5.64	12.68
11:09	173	9.4	0.8	5.97	12.58
11:10	174	9.7	0.8	5.97	12.58
11:11	175	9.8	0.8	5.82	12.71
11:12	176	9.7	0.8	5.82	12.72
11:13	177	9.5	0.8	5.97	12.59
11:14	178	9.2	0.8	5.89	12.64
11:15	179	9.1	0.8	5.73	12.77
11:16	180	8.9	0.9	5.88	12.66
11:17	181	9.3	0.9	5.68	12.81
11:18	182	9.2	0.9	5.63	12.87
11:19	183	9.3	0.9	5.56	12.93
11:20	184	9.3	0.9	5.45	13.03
11:21	185	9.2	0.9	5.63	12.89
11:22	186	9.2	0.9	5.45	13.05
11:23	187	9.1	0.9	5.45	13.06

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-0010-1/FCCU-0011-1

CLOCK TIME	ELAPSED TIME	CO	C ₂ H ₆	O ₂	CO ₂
11:24	188	8.9	0.9	5.51	12.99
11:25	189	8.5	0.8	5.72	12.81
11:26	190	8.5	0.8	5.63	12.87
11:27	191	8.4	0.8	5.64	12.86
11:28	192	8.6	0.8	5.50	12.99
11:29	193	9.1	0.8	5.54	12.95
11:30	194	9.6	0.9	5.51	13.00
11:31	195	9.2	0.9	5.66	12.87
11:32	196	8.8	0.9	5.73	12.80
11:33	197	8.6	0.8	5.68	12.83
11:34	198	8.6	0.8	5.65	12.86
11:35	199	8.6	0.8	5.82	12.72
11:36	200	8.7	0.8	5.77	12.77
11:37	201	9.0	0.8	5.76	12.78
11:38	202	9.1	0.8	5.74	12.80
11:39	203	8.9	0.8	5.70	12.83
11:40	204	8.7	0.8	5.77	12.77
11:41	205	8.4	0.8	5.76	12.77
11:42	206	8.6	0.8	5.74	12.79
11:43	207	8.8	0.8	5.78	12.75
11:44	208	8.7	0.8	5.86	12.70
11:45	209	8.7	0.8	5.78	12.76
11:46	210	8.7	0.8	5.79	12.75
11:47	211	8.6	0.8	5.84	12.71
11:48	212	8.7	0.7	5.82	12.72
11:49	213	8.5	0.8	5.80	12.74
11:50	214	8.6	0.8	5.82	12.73
11:51	215	8.6	0.8	5.89	12.67
11:52	216	8.2	0.7	5.92	12.65
11:53	217	8.3	0.8	5.81	12.73
11:54	218	8.3	0.8	5.96	12.60
11:55	219	8.4	0.8	5.82	12.72
11:56	220	8.7	0.8	5.81	12.73
11:57	221	8.7	0.8	5.75	12.77
11:58	222	8.9	0.8	5.81	12.74
11:59	223	8.9	0.8	5.79	12.76
12:00	224	8.4	0.8	5.89	12.67
12:01	225	8.1	0.7	5.88	12.68
12:02	226	8.2	0.7	5.76	12.76
12:03	227	8.5	0.7	5.83	12.71
12:04	228	8.5	0.8	5.83	12.71
12:05	229	9.0	0.8	5.77	12.77
12:06	230	8.8	0.8	5.88	12.69
12:07	231	8.7	0.8	5.83	12.72
12:08	232	8.5	0.8	5.89	12.67
12:09	233	8.8	0.8	5.82	12.73
12:10	234	8.6	0.8	5.80	12.74
12:11	235	8.5	0.8	5.87	12.68
12:12	236	8.7	0.8	5.91	12.64
12:13	237	8.6	0.8	5.90	12.65
12:14	238	9.0	0.8	5.96	12.62
12:15	239	8.5	0.8	5.84	12.72
12:16	240	8.4	0.8	5.80	12.75
12:17	241	8.3	0.8	5.76	12.76
12:18	242	8.4	0.8	5.67	12.85
12:19	243	8.5	0.8	5.82	12.73
12:20	244	8.5	0.9	5.95	12.62
12:21	245	8.5	0.9	5.84	12.70
12:22	246	8.9	0.9	5.80	12.75
12:23	247	8.8	1.0	5.66	12.86
12:24	248	8.5	1.0	5.80	12.75
12:25	249	8.6	0.9	5.89	12.67
12:26	250	8.5	0.9	5.91	12.66
12:27	251	8.4	0.9	5.85	12.71
12:28	252	8.4	1.0	5.73	12.80
12:29	253	8.5	1.0	5.84	12.71
12:30	254	8.1	0.9	5.91	12.65
12:31	255	8.1	0.9	5.78	12.76
12:32	256	8.5	1.0	5.68	12.84
12:33	257	8.6	1.0	5.70	12.83
12:34	258	8.7	1.0	5.85	12.71
12:35	259	8.8	1.0	5.81	12.74
12:36	260	8.9	1.0	5.79	12.76
12:37	261	8.8	1.0	5.96	12.62
12:38	262	8.4	0.9	6.02	12.56
12:39	263	8.4	0.9	5.92	12.63
12:40	264	8.4	1.0	5.75	12.78
12:41	265	8.4	1.0	5.68	12.85
12:42	266	8.4	1.0	5.73	12.79
12:43	267	8.7	1.0	5.83	12.73
12:44	268	8.8	1.0	5.83	12.72
12:45	269	8.8	1.0	5.95	12.63
12:46	270	8.6	1.0	5.78	12.76
12:47	271	8.8	1.0	5.76	12.78
12:48	272	8.4	1.0	5.84	12.71
12:49	273	8.3	1.0	5.78	12.76
12:50	274	8.4	1.0	5.80	12.75
12:51	275	8.3	1.0	5.73	12.80
12:52	276	8.8	1.0	5.63	12.88
12:53	277	8.9	1.1	5.70	12.84
Uncorrected Average (C) =		9.87	0.73	5.993	12.569

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011
RUN NUMBER: FCCU-0010-1

γ FACTOR:	1.005	STACK DIAM:	150.000 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	153.002 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	106.0 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	652.1 milliliters
SQ. RT ΔP:	0.5345 in.H ₂ O	CO₂:	12.57 % by volume
ΔH:	1.40 in.H ₂ O	O₂:	5.90 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 143.937 \text{ dscf}$$

$\gamma = 1.005$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 30.694 \text{ scf}$$

$V_{lc} = 652.1 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1758$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1965$$

$S.V.P. = 5.881 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.1758$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0010-1

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011

BAROMETRIC: 29.92 in. Hg	STACK DIAM: 150.000 inches	
STATIC PRES: 0.2 in.H ₂ O	CO₂: 12.57 % by volume	
STACK TEMP: 139.8 °F	O₂: 5.90 % by volume	
SQ.RT ΔP: 0.5345 in.H ₂ O		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.247	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.095	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5345	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8 \text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.415	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	238,676	acfm
Stack Area =		122.7184	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	210,207.8 12,612,471	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	173,260.3 10,395,620	dscfm dscfh

METHOD 0010 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/8/2011

RUN NO: FCCU-0010-1

INPUT

V_m:	153.002 ft ³	Q_s:	10,395.620 dscfh
γ FACTOR:	1.005	T_s:	139.8 °F
P_{bar}:	29.92 in. Hg	Θ:	240 minutes
ΔH:	1.40 in. H ₂ O	V_s:	32.415 fps
T_m:	106.0 °F	P_s:	29.93 in. Hg
		V_{lc}:	652.1 mL

**Volume of Sample at Standard
Conditions on a Dry Basis:**

**English Units
(29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 143.937 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)} = 97.95 \% I$$

A_n = 0.00043374 ft² Runtime (Θ) = 240 minutes

SVOC CALCULATION SUMMARY



COMPANY : Valero Port Arthur Refinery
 LOCATION : Port Arthur, Texas
 SOURCE : 1241 FCCU WGS Stack
 TEST DATE : 6/8/2011
 TEST RUN NO. : FCCU-0010-1

SAMPLE VOLUME : 143.937 dscf
 SAMPLE VOLUME : 4.076 dscm
 GAS FLOW RATE : 10,395,620 dscfh
 STACK O₂ CONTENT : 5.90 %

VOST COMPOUND	TOTAL SAMPLE MASS (nanogram)	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻⁹)	STACK GAS CONCENTRATION (µg/dscm)	STACK GAS CONCENTRATION (ppb)	EMISSION RATE (lb/hr x 10 ⁻³)
Acenaphthene	< 1130	154.21	< 0.017308	< 0.277207	< 0.043239	< 0.179923
Acenaphthylene	< 211	152.19	< 0.003232	< 0.051762	< 0.008181	< 0.033596
Aniline	< 1.85	93.13	< 0.000028	< 0.000454	< 0.000117	< 0.000295
Anthracene	356	178.23	0.005453	0.087332	0.011786	0.056684
Benidine	< 38	184.24	< 0.000582	< 0.009322	< 0.001217	< 0.006051
Benzo[a]anthracene	< 4	228.29	< 0.000061	< 0.000981	< 0.000103	< 0.000637
Benzo[b]fluoranthene	< 4.94	252.31	< 0.000076	< 0.001212	< 0.000116	< 0.000787
Benzo[k]fluoranthene	< 4	252.31	< 0.000061	< 0.000981	< 0.000094	< 0.000637
Benzo[g,h,i]perylene	< 4	276.33	< 0.000061	< 0.000981	< 0.000085	< 0.000637
Benzo[a]pyrene	n/a	252.31	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Benzo[e]pyrene	< 4	252.31	< 0.000061	< 0.000981	< 0.000094	< 0.000637
Biphenyl	< 901	154.21	< 0.013800	< 0.221029	< 0.034477	< 0.143461
Chrysene	< 10.9	228.28	< 0.000167	< 0.002674	< 0.000282	< 0.001736
Dibenz[a,h]anthracene	< 4	278.35	< 0.000061	< 0.000981	< 0.000085	< 0.000637
Dibenzofuran	< 2.3	168.19	< 0.000035	< 0.000564	< 0.000081	< 0.000366
Dibenzo(a,e)pyrene	< 4	302.37	< 0.000061	< 0.000981	< 0.000078	< 0.000637
3,3'-Dimethoxybenzidine	< 29	244.29	< 0.000444	< 0.007114	< 0.000700	< 0.004617
Dimethylaminobenzene	< 2.0	225.29	< 0.000031	< 0.000491	< 0.000052	< 0.000318
7,12-Dimethylbenz(a)anthracene	< 4	256.34	< 0.000061	< 0.000981	< 0.000092	< 0.000637
3,3'-Dimethylbenzidine	< 29	212.29	< 0.000444	< 0.007114	< 0.000806	< 0.004617
a,a-Dimethylphenethylamine	< 12	149.23	< 0.000184	< 0.002944	< 0.000475	< 0.001911
2,4-Dimethylphenol	< 2.6	122.17	< 0.000040	< 0.000638	< 0.000126	< 0.000414
Fluoranthene	90.7	202.26	0.001389	0.022250	0.002646	0.014442
Fluorene	543	166.22	0.008317	0.133206	0.019276	0.086459
Indeno(1,2,3-cd)pyrene	< 4	276.33	< 0.000061	< 0.000981	< 0.000085	< 0.000637
Isophorone	< 2.25	138.21	< 0.000034	< 0.000552	< 0.000096	< 0.000358
3-Methylcholanthrene	< 4	268.35	< 0.000061	< 0.000981	< 0.000088	< 0.000637
2-Methylnaphthalene	651	142.20	0.009971	0.159701	0.027014	0.103655
2-Methylphenol	64.3	108.14	0.000985	0.015774	0.003509	0.010238
3-Methylphenol & 4-Methylphenol	< 5.65	108.14	< 0.000087	< 0.001386	< 0.000308	< 0.000900
Naphthalene	1150	128.17	0.017614	0.282113	0.052945	0.183107
Perylene	n/a	252.31	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Phenanthrene	490	178.23	0.007505	0.120205	0.016223	0.078020
Phenol	14.3	94.11	0.000219	0.003508	0.000897	0.002277
1,4-Phenylenediamine	< 18	108.10	< 0.000276	< 0.004416	< 0.000983	< 0.002866
Pyrene	< 22.9	202.25	< 0.000351	< 0.005618	< 0.000668	< 0.003646
o-Toluidine	< 5	107.17	< 0.000077	< 0.001227	< 0.000275	< 0.000796

**CO CALIBRATION CORRECTION DATA SHEET
USEPA METHOD 10**

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: Thermo Environmental Model 48i
RUN NO: FCCU-0010-1
TEST DATE: 6/8/2011

INPUT

CO AVERAGE CHART READING (C): 9.87 ppmv
AVG PRE/POST ZERO DRIFT READING (C_o): 3.07 ppmv
CAL GAS CONCENTRATION (C_{ma}): 40.0 ppmv
AVG CAL PRE/POST TEST READING (C_m): 43.21 ppmv
STACK GAS VOLUMETRIC FLOW RATE (Q_{std}): 10,395,620 dscfh

CALCULATIONS

STACK CO AVERAGE CHART READING = 9.9 ppmv

STACK CO CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{CO CONC, ppmv} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = 6.8 \text{ ppmv db}$$

(corrected)

CO CONC. (lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{28 \text{ lb / lb - mole}}{385.26 \times 10^6 \text{ ft}^3 / \text{lb - mole}} \right) = 0.4925 \times 10^{-6} \text{ lbs/dscf}$$

CO EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 10,395,620 dscfh

STACK CO EMISSION RATE =

$$\text{CO}_{\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = 5.1200 \text{ lbs/hr}$$
$$= 22.425 \text{ ton/yr}$$

METHOD 18 METHANE (CH₄) AND ETHANE (C₂H₆) CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
RUN NUMBER: FCCU-0010-1
TEST DATE: 6/8/2011

INPUT DATA

Methane (CH₄) = 1.2 ppmv db
Ethane (C₂H₆) = < 1.0 ppmv db
Stack gas volumetric flow rate (Q_s) = 10,395,620 dscfh

CALCULATIONS

Concentration in stack gas (lb/dscf)

Methane	$C'_{\text{gas(methane)}} = \frac{(C_{\text{gas(methane)}})(16.04)}{(385.26 \times 10^6)} =$	0.04996 x 10 ⁻⁶ lb/dscf as methane
Ethane	$C'_{\text{gas(ethane)}} = \frac{(C_{\text{gas(ethane)}})(30.07)}{(385.26 \times 10^6)} =$	< 0.07805 x 10 ⁻⁶ lb/dscf as ethane

Emission rates (lb/hr)

$$E_{\text{THC(methane)}} = C'_{\text{gas(methane)}} \times Q_s = 0.51938 \text{ lb/hr of methane}$$

$$E_{\text{THC(ethane)}} = C'_{\text{gas(ethane)}} \times Q_s = < 0.81139 \text{ lb/hr of ethane}$$

METHOD 25A TOTAL HYDROCARBON (THC) CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
RUN NUMBER: FCCU-0010-2
TEST DATE: 6/8/2011

INPUT DATA

THC as propane (C_3H_8) = 0.66 ppmv wb
0.82 ppmv db
Stack gas volumetric flow rate (Q_s) = 10,265,318 dscfh

CALCULATIONS

THC concentration in stack gas (lb/dscf)

$$C'_{\text{gas (propane)}} = \frac{(C_{\text{gas (propane)}})(44.09)}{(385.26 \times 10^6)} = 0.09372 \times 10^{-6} \text{ lb/dscf as propane}$$

THC emission rate

$$E_{\text{THC (propane)}} = C'_{\text{gas (propane)}} \times Q_s = 0.96206 \text{ lb/hr}$$

Volatile Organic HAPs Laboratory Data Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date:
Run No:

6/8/2011
 FCCU-18-1

Compound	Molecular Weight	Sample Train A	% Recovery	Sample Train B	% Recovery
		Analysis (M _u) (micrograms)		Analysis (M _u) (micrograms)	
Acetone	58.08	265.9		285	
Acetonitrile	41.05	4.7		5068	111
Acrolein	56.06	< 4.3		5570	144
Acrylonitrile	53.06	< 4.3	85	< 4.3	89
Benzene	78.11	< 4.3	104	< 4.3	103
1,3-Butadiene	54.09	< 4.3	5		0
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	92	< 4.3	91
Ethylbenzene	106.17	< 4.3	100	< 4.3	94
Hexane	86.18	< 4.3	83	< 4.3	33
Methyl isobutyl ketone	100.16	< 4.3		3628	136
Methyl t-butyl ether	88.15	< 4.3	94	< 4.3	95
Methylene chloride	84.93	24.3		25.1	
Nitrobenzene	123.06	< 21.5	82	< 21.5	86
2-Nitropropane	89.09	< 4.3	81	< 4.3	84
Pentane	72.15	< 4.3	11		0
Styrene	104.15	< 4.3	94	< 4.3	91
Tetrachloroethene	165.83	< 4.3		< 4.3	
Toluene	92.14	< 4.3		1149	128
Trichloroethene	131.39	< 4.3		2504	89
2,2,4 Trimethyl pentane	114.23	< 4.3	109	< 4.3	89
Xylenes	106.16	< 4.3		< 4.3	

VOLATILE ORGANIC HAPS CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
 LOCATION: Port Arthur, Texas
 SOURCE: 1241 FCCU WGS Stack
 SAMPLE: VolHAPs - Methanol Impingers
 TEST DATE: 6/8/2011
 RUN NO: FCCU-18-1

INPUT

Q_a : 10,395,620 dscfh
 P_{bar} : 29.92 in Hg

A Train:

V_m Unspiked: 22.488 liters
 V_m Unspiked: 0.793 cubic ft
 Y Sample : 1.000
 T_m Sample: 93.7 °F
 ΔH Sample: 0.19 in. H₂O

B Train:

V_m Spiked: 22.267 liters
 V_m Spiked: 0.786 cubic ft
 Y Sample : 1.000
 T_m Sample: 94.2 °F
 ΔH Sample: 0.26 in. H₂O

Volume of sample at standard

conditions on dry basis

$V_{mstd} \text{ Train A } (V_s) = (17.647)(V_m)(Y_d)(P_{bar} + \Delta H / 13.6) / (T_m)$
 $V_{mstd} \text{ Train A } (V_s) = \text{dscf} \times 28.32$
 $V_{mstd} \text{ Train B } (V_s) = (17.647)(V_m)(Y_d)(P_{bar} + \Delta H / 13.6) / (T_m)$
 $V_{mstd} \text{ Train B } (V_s) = \text{dscf} \times 28.32$

English units
 (29.92 in. Hg 68° F)

= 0.757 dscf
 = 21.435 std liters
 = 0.750 dscf
 = 21.228 std liters

Compound	Molecular Weight	Mass/Volume (M _v) (µg/liter)	A TRAIN				B TRAIN				AVERAGE	
			VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	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	12.4051	7.7450E-07	5,137	12,405	8.05136	8.3822E-07	5,560	13,426	8.71378	12,915	8.38257
Acetonitrile	41.05	< 0.2183	< 1.3690E-08	< 128	< 219	< 0.14231					< 219	< 0.14231
Acrolein	56.06	< 0.2006	< 1.2525E-08	< 86	< 201	< 0.13020					< 201	< 0.13020
Acrylonitrile	53.06	< 0.2006	< 1.2525E-08	< 91	< 201	< 0.13020					< 202	< 0.13084
Benzene	78.11	< 0.2006	< 1.2525E-08	< 62	< 201	< 0.13020					< 202	< 0.13084
1,3-Butadiene	54.09	< 0.2006	< 1.2525E-07	< 892	< 2006	< 1.30202					< 1003	< 0.65101
Carbon disulfide	76.14	< 0.2006	< 1.2525E-08	< 63	< 201	< 0.13020					< 202	< 0.13084
Chlorobenzene	112.56	< 0.2006	< 1.2525E-08	< 43	< 201	< 0.13020					< 202	< 0.13084
Cumene	120.19	< 0.2006	< 1.2525E-08	< 40	< 201	< 0.13020					< 202	< 0.13084
1,2-Dibromoethane	187.86	< 0.2006	< 1.2525E-08	< 26	< 201	< 0.13020					< 202	< 0.13084
Ethylbenzene	106.17	< 0.2006	< 1.2525E-08	< 45	< 201	< 0.13020					< 202	< 0.13084
Hexane	86.18	< 0.2006	< 1.2525E-08	< 56	< 201	< 0.13020					< 202	< 0.13084
Methyl isobutyl ketone	100.16	< 0.2006	< 1.2525E-08	< 48	< 201	< 0.13020					< 201	< 0.13020
Methyl t-butyl ether	88.15	< 0.2006	< 1.2525E-08	< 55	< 201	< 0.13020					< 202	< 0.13084
Methylcyclohexane	84.93	1.1337	7.0779E-08	321	1,134	0.73580	7.3822E-08	335	1,182	0.76742	1,168	0.76161
Nitrobenzene	123.06	< 1.0030	< 6.2624E-08	< 196	< 1003	< 0.65101					< 1008	< 0.65418
2-Nitropropane	89.09	< 0.2006	< 1.2525E-08	< 54	< 201	< 0.13020					< 202	< 0.13084
Pentane	72.15	< 0.2006	< 1.2525E-07	< 689	< 2006	< 1.30202					< 1003	< 0.65101
Styrene	104.15	< 0.2006	< 1.2525E-08	< 46	< 201	< 0.13020					< 202	< 0.13084
Tetrachloroethene	165.83	< 0.2006	< 1.2525E-08	< 29	< 201	< 0.13020					< 202	< 0.13084
Toluene	92.14	< 0.2006	< 1.2525E-08	< 52	< 201	< 0.13020					< 201	< 0.13020
Trichloroethane	131.39	< 0.2006	< 1.2525E-08	< 37	< 201	< 0.13020					< 201	< 0.13084
2,2,4 Trimethyl pentane	114.23	< 0.2006	< 1.2525E-08	< 42	< 201	< 0.13020					< 202	< 0.13084
Xylenes	106.16	< 0.2006	< 1.2525E-08	< 45	< 201	< 0.13020					< 202	< 0.13084

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011
RUN NUMBER: FCCU-0011-1

γ FACTOR:	1.001	STACK DIAM:	150.0 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	36.830 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	91.5 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	174.6 milliliters
SQ. RT ΔP:	0.5145 in.H ₂ O	CO₂:	12.57 % by volume
ΔH:	1.20 in.H ₂ O	O₂:	5.90 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

<p>VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS</p> $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 35.400 \text{ dscf}$ <p style="text-align: center;">$\gamma = 1.001$</p>
<p>VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS</p> $V_{wstd} = 0.04707 \times V_{lc} = 8.218 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 174.6 \text{ mL}$</p>
<p>FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED</p> $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1884$
<p>FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION</p> $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1965$ <p style="text-align: center;">$S.V.P. = 5.881 \text{ in. Hg}$</p>
<p>FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS</p> <p style="text-align: right;">$B_{ws} = 0.1884$</p>

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0011-1

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011

BAROMETRIC: 29.92 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 139.8 °F
SQ.RT ΔP: 0.5145 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 12.57 % by volume
O₂: 5.90 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.25	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	27.94	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5145	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8 \text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	31.289	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	230,380.95	acfm
Stack Area =		122.71846	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	202,902.52	scfm, wb
		12,174,151	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	164,672.36	dscfm
		9,880,342	dscfh

ALDEHYDES CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011
RUN NO: FCCU-0011-1

INPUT

V_m:	36.830 ft ³	Q_s:	9,880,342 dscfh
γ FACTOR:	1.001	T_s:	139.8 °F
P_{bar}:	29.92 in. Hg	Θ:	60.0 minutes
ΔH:	1.20	V_s:	31.289 fps
T_m:	91.5 °F	P_s:	29.93 in. Hg
Formaldehyde:	< 115 μg	V_{ic}:	174.6 mL
Acetaldehyde:	837 μg	%O₂:	5.90 %
Propanal:	< 22 μg		

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	35.400 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{ic}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	100.7 % I
A _n =	0.00043682 ft ²	Runtime (θ) =	60 minutes
Total μg Formaldehyde in sample (M_n)		=	< 115 μg
Total μg Acetaldehyde in sample (M_n)		=	837 μg
Total μg Propanal in sample (M_n)		=	< 22 μg
Concentration of Aldehydes		× 10⁻⁶ lb/dscf	
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0072 formaldehyde
		=	0.0521 acetaldehyde
		=	< 0.0014 propanal
		μg/dscm	
$C_{s(\mu g/dscm)} = \frac{(M_n)(35.31 ft^3 / m^3)}{(V_{mstd})}$		=	< 114.7 formaldehyde
		=	834.9 acetaldehyde
		=	< 21.9 propanal
Aldehydes Mass Rate:		lb/hr	
E = Q _s × C' _{s(lb/dscf)}		=	< 0.0708 formaldehyde
		=	0.5150 acetaldehyde
		=	< 0.0135 propanal

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-0010-2/FCCU-0011-2
 TEST DATE : 6/8/2011
 START TIME : 14:02
 END TIME : 18:39

GAS ANALYZER O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.600
 AVERAGE ZERO BIAS (C_o): 0.093
 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 5.23

GAS ANALYZER CO₂

SPAN VALUE : 19.80 %
 AVERAGE CAL. BIAS (C_m): 10.00
 AVERAGE ZERO BIAS (C_o): 0.17
 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 13.28

GAS ANALYZER CO

SPAN VALUE : 80.1 ppm
 AVERAGE CAL. BIAS (C_m): 43.02
 AVERAGE ZERO BIAS (C_o): 2.70
 CALIBRATION GAS: EPA Protocol CO
 CALIBRATION PPM (C_{ma}): 40.0
 PPM CORRECTED (C_{gas}): 2.9

GAS ANALYZER VOCs

SPAN VALUE : 90 ppm
 AVERAGE CAL. BIAS (C_m): 30.00
 AVERAGE ZERO BIAS (C_o): 0.00
 CALIBRATION GAS: EPA Protocol C₃H₈
 CALIBRATION ppm (C_{ma}): 30.0
 ppm CORRECTED (C_{gas}): 0.66

$$\text{Example Calculation} = C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME	ELAPSED TIME	CO	C ₃ H ₈	O ₂	CO ₂
14:02	0				
14:03	1	8.0	1.1	5.51	13.02
14:04	2	7.8	1.1	5.44	13.08
14:05	3	7.8	1.1	5.43	13.09
14:06	4	7.6	1.1	5.37	13.15
14:07	5	7.6	1.1	5.34	13.18
14:08	6	7.8	1.1	5.25	13.27
14:09	7	7.9	1.1	5.31	13.22
14:10	8	7.5	1.0	5.35	13.22
14:11	9	6.8	0.9	5.46	13.12
14:12	10	6.8	0.9	5.30	13.27
14:13	11	6.6	0.9	5.44	13.14
14:14	12	6.4	0.9	5.41	13.17
14:15	13	6.2	0.9	5.27	13.30
14:16	14	6.4	0.9	5.22	13.36
14:17	15	6.6	1.0	5.38	13.20
14:18	16	6.6	0.9	5.47	13.10
14:19	17	6.7	0.9	5.45	13.11
14:20	18	6.7	0.9	5.43	13.14
14:21	19	6.5	0.9	5.45	13.13
14:22	20	6.4	0.9	5.45	13.12
14:23	21	6.3	0.9	5.44	13.14
14:24	22	6.3	0.9	5.39	13.18
14:25	23	6.0	0.9	5.51	13.04
14:26	24	6.0	0.9	5.50	13.06
14:27	25	6.5	0.9	5.45	13.13
14:28	26	6.6	0.9	5.29	13.29
14:29	27	6.6	0.9	5.52	13.06
14:30	28	6.2	0.9	5.55	13.01
14:31	29	6.1	0.9	5.61	12.96
14:32	30	6.0	0.9	5.35	13.21
14:33	31	6.1	0.8	5.44	13.13
14:34	32	6.2	0.9	5.51	13.07
14:35	33	6.4	0.9	5.44	13.12
14:36	34	6.5	0.9	5.51	13.07
14:37	35	6.3	0.9	5.54	13.04
14:38	36	6.1	0.8	5.57	12.99
14:39	37	5.9	0.8	5.50	13.06
14:40	38	5.9	0.8	5.41	13.15
14:41	39	5.8	0.8	5.53	13.04
14:42	40	6.1	0.8	5.43	13.13
14:43	41	6.3	0.8	5.53	13.04
14:44	42	6.4	0.8	5.48	13.09
14:45	43	6.4	0.8	5.53	13.04
14:46	44	6.2	0.8	5.54	13.03
14:47	45	6.0	0.8	5.39	13.18
14:48	46	5.9	0.8	5.40	13.16
14:49	47	5.8	0.8	5.36	13.20
14:50	48	5.8	0.8	5.33	13.23
14:51	49	5.9	0.8	5.30	13.26
14:52	50	6.0	0.8	5.35	13.23
14:53	51	6.2	0.8	5.35	13.22
14:54	52	6.3	0.8	5.35	13.22
14:55	53	6.5	0.8	5.38	13.19
14:56	54	6.3	0.8	5.53	13.03
14:57	55	5.9	0.8	5.59	12.96
14:58	56	5.7	0.8	5.50	13.06
14:59	57	5.6	0.8	5.39	13.17
15:00	58	5.6	0.8	5.48	13.08
15:01	59	6.0	0.8	5.30	13.26
15:02	60	6.2	0.8	5.28	13.30
15:03	61	6.3	0.8	5.34	13.24
15:04	62	5.9	0.8	5.24	13.33
15:05	63	5.8	0.8	5.39	13.18
15:06	64	5.6	0.7	5.56	12.99
15:07	65	5.6	0.8	5.50	13.07
15:08	66	5.6	0.8	5.34	13.23
15:09	67	5.7	0.8	5.28	13.28
15:10	68	5.9	0.8	5.30	13.26
15:11	69	6.0	0.8	5.40	13.17
15:12	70	5.9	0.8	5.38	13.19
15:13	71	5.8	0.8	5.35	13.21
15:14	72	5.7	0.8	5.38	13.20
15:15	73	5.7	0.8	5.35	13.21
15:16	74	5.7	0.8	5.36	13.21
15:17	75	5.7	0.8	5.48	13.09
15:18	76	5.7	0.8	5.48	13.08
15:19	77	5.8	0.8	5.38	13.18
15:20	78	5.7	0.7	5.54	13.02
15:21	79	5.7	0.7	5.50	13.06
15:22	80	5.7	0.8	5.52	13.05
15:23	81	5.8	0.8	5.38	13.18
15:24	82	5.7	0.8	5.50	13.06
15:25	83	5.6	0.8	5.53	13.02
15:26	84	5.6	0.8	5.45	13.10
15:27	85	5.8	0.7	5.45	13.11
15:28	86	5.9	0.7	5.48	13.08
15:29	87	5.7	0.8	5.36	13.20
15:30	88	5.6	0.7	5.43	13.13
15:31	89	5.5	0.8	5.29	13.26
15:32	90	5.6	0.8	5.24	13.32
15:33	91	5.6	0.8	5.18	13.38
15:34	92	5.8	0.8	5.21	13.35
15:35	93	6.2	0.8	5.34	13.23

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-0010-2/FCCU-0011-2

CLOCK TIME	ELAPSED TIME	CO	C ₂ H ₄	O ₂	CO ₂
15:38	94	8.1	0.8	5.40	13.17
15:37	95	5.9	0.7	5.50	13.06
15:38	96	5.7	0.7	5.49	13.07
15:39	97	5.7	0.7	5.43	13.13
15:40	98	5.5	0.7	5.40	13.15
15:41	99	5.4	0.7	5.45	13.11
15:42	100	5.4	0.7	5.61	12.94
15:43	101	5.5	0.7	5.57	12.97
15:44	102	5.6	0.7	5.53	13.02
15:45	103	5.7	0.7	5.52	13.04
15:46	104	5.9	0.7	5.46	13.11
15:47	105	6.1	0.8	5.43	13.14
15:48	106	8.0	0.8	5.38	13.18
15:49	107	5.6	0.8	5.42	13.14
15:50	108	5.5	0.7	5.40	13.15
15:51	109	5.4	0.8	5.32	13.23
15:52	110	5.6	0.8	5.31	13.25
15:53	111	5.9	0.8	5.15	13.40
15:54	112	6.2	0.8	5.17	13.40
15:55	113	6.1	0.7	5.39	13.19
15:56	114	5.9	0.7	5.28	13.29
15:57	115	5.8	0.7	5.20	13.36
15:58	116	5.7	0.7	5.24	13.32
15:59	117	5.7	0.7	5.12	13.44
16:00	118	5.8	0.8	5.12	13.44
16:01	119	5.9	0.7	5.22	13.35
16:02	120	5.9	0.7	5.41	13.17
16:03	121	5.9	0.7	5.20	13.37
16:04	122	5.5	0.7	5.24	13.33
16:05	123	5.6	0.7	5.44	13.12
16:06	124	5.4	0.7	5.33	13.23
16:07	125	5.3	0.7	5.26	13.30
16:08	126	5.7	0.7	5.22	13.33
16:09	127	6.1	0.7	5.20	13.36
16:10	128	6.1	0.7	5.13	13.44
16:11	129	5.9	0.7	5.42	13.16
16:12	130	5.6	0.6	5.45	13.11
16:13	131	5.5	0.7	5.22	13.34
16:14	132	5.4	0.7	5.21	13.36
16:15	133	5.4	0.7	5.17	13.40
16:16	134	5.7	0.7	5.23	13.34
16:17	135	5.7	0.7	5.12	13.45
16:18	136	5.6	0.7	5.27	13.30
16:19	137	5.5	0.6	5.37	13.19
16:20	138	5.4	0.6	5.24	13.33
16:21	139	5.5	0.7	4.99	13.56
16:22	140	5.7	0.7	5.15	13.43
16:23	141	5.6	0.7	5.14	13.44
16:24	142	5.5	0.7	5.23	13.34
16:25	143	5.2	0.6	5.33	13.24
16:26	144	5.2	0.6	5.28	13.29
16:27	145	5.4	0.7	5.11	13.46
16:28	146	5.4	0.6	5.16	13.41
16:29	147	5.7	0.7	5.18	13.40
16:30	148	5.6	0.6	5.24	13.35
16:31	149	5.4	0.6	5.17	13.41
16:32	150	5.4	0.6	5.23	13.33
16:33	151	5.2	0.6	5.21	13.35
16:34	152	5.2	0.6	5.25	13.33
16:35	153	5.2	0.6	5.25	13.32
16:36	154	5.3	0.6	5.16	13.40
16:37	155	5.4	0.6	5.22	13.34
16:38	156	5.4	0.6	5.21	13.35
16:39	157	5.5	0.6	5.23	13.35
16:40	158	5.4	0.6	5.30	13.27
16:41	159	5.2	0.6	5.33	13.24
16:42	160	5.1	0.6	5.29	13.27
16:43	161	5.2	0.6	5.23	13.33
16:44	162	5.4	0.6	5.25	13.31
16:45	163	5.4	0.6	5.28	13.28
16:46	164	5.3	0.6	5.30	13.28
16:47	165	5.3	0.6	5.31	13.26
16:48	166	5.2	0.6	5.30	13.27
16:49	167	5.2	0.5	5.34	13.23
16:50	168	5.0	0.5	5.35	13.21
16:51	169	4.9	0.5	5.28	13.28
16:52	170	5.1	0.6	5.31	13.25
16:53	171	5.3	0.5	5.24	13.31
16:54	172	5.7	0.6	5.30	13.26
16:55	173	5.7	0.6	5.31	13.27
16:56	174	5.4	0.6	5.35	13.22
16:57	175	5.2	0.5	5.51	13.05
16:58	176	4.9	0.5	5.54	13.01
16:59	177	4.9	0.5	5.47	13.08
17:00	178	5.0	0.6	5.05	13.50
17:01	179	5.6	0.6	4.95	13.61
17:02	180	5.7	0.6	5.19	13.37
17:03	181	5.5	0.6	5.39	13.18
17:04	182	5.4	0.6	5.38	13.18
17:05	183	5.2	0.6	5.35	13.21
17:06	184	5.0	0.6	5.24	13.32
17:07	185	5.1	0.6	5.09	13.48
17:08	186	5.3	0.6	5.07	13.48
17:09	187	5.3	0.6	5.33	13.23

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-0010-2/FCCU-0011-2

CLOCK TIME	ELAPSED TIME	CO	C ₂ H ₆	O ₂	CO ₂
17:10	188	5.4	0.6	5.28	13.29
17:11	189	5.5	0.6	5.35	13.22
17:12	190	5.6	0.6	5.36	13.21
17:13	191	5.4	0.6	5.20	13.36
17:14	192	5.2	0.6	5.27	13.29
17:15	193	5.1	0.6	5.23	13.33
17:16	194	5.0	0.6	5.33	13.24
17:17	195	5.2	0.6	5.33	13.23
17:18	196	5.3	0.6	5.27	13.28
17:19	197	5.3	0.6	5.23	13.33
17:20	198	5.4	0.6	5.25	13.31
17:21	199	5.3	0.6	5.24	13.32
17:22	200	5.3	0.6	5.30	13.25
17:23	201	5.1	0.6	5.47	13.10
17:24	202	5.0	0.6	5.28	13.28
17:25	203	5.0	0.6	5.37	13.18
17:26	204	5.0	0.6	5.28	13.27
17:27	205	5.2	0.6	5.21	13.35
17:28	206	5.3	0.6	5.38	13.17
17:29	207	5.3	0.6	5.36	13.20
17:30	208	5.1	0.6	5.35	13.20
17:31	209	5.3	0.6	5.31	13.25
17:32	210	5.3	0.6	5.28	13.28
17:33	211	5.2	0.6	5.42	13.14
17:34	212	5.2	0.5	5.29	13.26
17:35	213	5.3	0.6	5.29	13.26
17:36	214	5.3	0.6	5.27	13.29
17:37	215	5.3	0.5	5.31	13.23
17:38	216	5.2	0.5	5.37	13.16
17:39	217	5.0	0.5	5.40	13.15
17:40	218	5.1	0.5	5.21	13.34
17:41	219	5.1	0.5	5.14	13.41
17:42	220	5.1	0.5	5.22	13.33
17:43	221	5.5	0.5	5.13	13.43
17:44	222	5.7	0.5	5.25	13.31
17:45	223	5.6	0.5	5.33	13.24
17:46	224	5.3	0.5	5.33	13.23
17:47	225	5.1	0.5	5.48	13.07
17:48	226	5.0	0.5	5.38	13.17
17:49	227	5.0	0.5	5.16	13.38
17:50	228	5.0	0.5	5.14	13.40
17:51	229	5.1	0.5	5.26	13.30
17:52	230	5.4	0.5	5.26	13.29
17:53	231	5.4	0.5	5.45	13.11
17:54	232	5.1	0.5	5.38	13.18
17:55	233	5.1	0.4	5.23	13.33
17:56	234	5.1	0.4	5.24	13.31
17:57	235	5.1	0.5	5.29	13.26
17:58	236	5.3	0.4	5.24	13.31
17:59	237	5.3	0.5	5.30	13.26
18:00	238	5.3	0.4	5.33	13.23
18:01	239	5.4	0.5	5.23	13.33
18:02	240	5.3	0.4	5.23	13.33
18:03	241	5.2	0.4	5.46	13.10
18:04	242	5.1	0.5	5.32	13.23
18:05	243	4.9	0.4	5.26	13.28
18:06	244	5.0	0.4	5.31	13.24
18:07	245	5.1	0.4	5.33	13.23
18:08	246	5.3	0.4	5.27	13.29
18:09	247	5.5	0.5	5.36	13.20
18:10	248	5.3	0.4	5.46	13.09
18:11	249	5.4	0.4	5.33	13.22
18:12	250	5.3	0.4	5.43	13.12
18:13	251	5.2	0.4	5.29	13.26
18:14	252	4.9	0.4	5.17	13.38
18:15	253	4.9	0.4	5.28	13.27
18:16	254	5.3	0.4	5.25	13.30
18:17	255	5.3	0.4	5.22	13.33
18:18	256	5.4	0.4	5.12	13.44
18:19	257	5.5	0.4	5.47	13.09
18:20	258	5.3	0.4	5.41	13.15
18:21	259	5.2	0.4	5.37	13.18
18:22	260	5.2	0.4	5.32	13.23
18:23	261	5.1	0.4	5.27	13.28
18:24	262	5.2	0.4	5.19	13.37
18:25	263	5.3	0.4	5.19	13.36
18:26	264	5.6	0.4	5.20	13.35
18:27	265	5.7	0.4	5.36	13.20
18:28	266	5.5	0.3	5.52	13.04
18:29	267	5.2	0.4	5.50	13.06
18:30	268	5.1	0.4	5.33	13.22
18:31	269	5.1	0.4	5.16	13.38
18:32	270	5.4	0.4	5.27	13.28
18:33	271	5.3	0.3	5.38	13.17
18:34	272	5.5	0.4	5.37	13.18
18:35	273	5.6	0.4	5.29	13.27
18:36	274	5.5	0.4	5.24	13.32
18:37	275	5.4	0.4	5.38	13.17
18:38	276	5.4	0.4	5.25	13.30
18:39	277	5.3	0.4	5.45	13.09
Uncorrected Average (C) =		5.65	0.66	5.334	13.227

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011
RUN NUMBER: FCCU-0010-2

γ FACTOR:	1.005	STACK DIAM:	150.000 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	154.887 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	103.4 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	763.8 milliliters
SQ.RT ΔP:	0.5400 in.H ₂ O	CO₂:	13.28 % by volume
ΔH:	1.40 in.H ₂ O	O₂:	5.23 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 146.236 \text{ dscf}$ <p style="text-align: center;">γ = 1.005</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS
$V_{wstd} = 0.04707 \times V_{lc} = 35.952 \text{ scf}$ <p style="text-align: center;">V_{lc} = 763.8 mL</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1973$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION
$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$ <p style="text-align: center;">S.V.P. = 5.881 in. Hg</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS
$B_{ws} = 0.1967$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0010-2

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011

BAROMETRIC: 29.89 in. Hg	STACK DIAM: 150.000 inches	
STATIC PRES: 0.2 in.H ₂ O	CO₂: 13.28 % by volume	
STACK TEMP: 139.8 °F	O₂: 5.23 % by volume	
SQ.RT ΔP: 0.54 in.H ₂ O		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.33	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	27.91	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5400	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8 \text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.874	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	242,056	acfm
Stack Area =	122.7184 ft ²		
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	212,971.1 12,778,266	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	171,088.6 10,265,318	dscfm dscfh

METHOD 0010 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/8/2011

RUN NO: FCCU-0010-2

INPUT

V_m:	154.887 ft ³	Q_s:	10,265,318 dscfh
γ FACTOR:	1.005	T_s:	139.8 °F
P_{bar}:	29.89 in. Hg	Θ:	240 minutes
ΔH:	1.40 in. H ₂ O	V_s:	32.874 fps
T_m:	103.4 °F	P_s:	29.90 in. Hg
		V_{lc}:	763.8 mL

**Volume of Sample at Standard
Conditions on a Dry Basis:**

**English Units
(29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 146.236 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)} = 100.86 \% I$$

100.6 % I* @saturation

A_n = 0.00043374 ft² Runtime (Θ) = 60 minutes

SVOC CALCULATION SUMMARY



COMPANY : Valero Port Arthur Refinery
 LOCATION : Port Arthur, Texas
 SOURCE : 1241 FCCU WGS Stack
 TEST DATE : 6/8/2011
 TEST RUN NO. : FCCU-0010-2

SAMPLE VOLUME : 146.236 dscf
 SAMPLE VOLUME : 4.142 dscm
 GAS FLOW RATE : 10,265,318 dscfh
 STACK O₂ CONTENT : 5.23 %

VOST COMPOUND	TOTAL SAMPLE MASS (nanogram)	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻⁶)	STACK GAS CONCENTRATION (µg/dscm)	STACK GAS CONCENTRATION (ppb)	EMISSION RATE (lb/hr x 10 ⁻³)
Acenaphthene	509	154.21	0.007673	0.122902	0.019170	0.078771
Acenaphthylene	< 2510	152.19	< 0.037840	< 0.606060	0.095789	< 0.388437
Aniline	< 2	93.13	< 0.000028	< 0.000447	0.000115	< 0.000286
Anthracene	< 58	178.23	< 0.000867	< 0.013884	0.001874	< 0.008898
Benidine	< 38	184.24	< 0.000573	< 0.009175	0.001198	< 0.005881
Benzo[a]anthracene	< 9	228.29	< 0.000134	< 0.002149	0.000226	< 0.001377
Benzo[b]fluoranthene	< 4	252.31	< 0.000060	< 0.000966	0.000092	< 0.000619
Benzo[k]fluoranthene	< 4	252.31	< 0.000060	< 0.000966	0.000092	< 0.000619
Benzo[g,h,i]perylene	< 50	276.33	< 0.000754	< 0.012073	0.001051	< 0.007738
Benzo[a]pyrene	< 100	252.31	< 0.001508	< 0.024146	0.002302	< 0.015476
Benzo[e]pyrene	< 215	252.31	< 0.003241	< 0.051914	0.004949	< 0.033272
Biphenyl	< 482	154.21	< 0.007266	< 0.116383	0.018154	< 0.074592
Chrysene	< 10	228.28	< 0.000154	< 0.002463	0.000260	< 0.001579
Dibenz[a,h]anthracene	< 6	278.35	< 0.000090	< 0.001449	0.000125	< 0.000929
Dibenzofuran	< 2	168.19	< 0.000035	< 0.000555	0.000079	< 0.000356
Dibenzo(a,e)pyrene	< 4	302.37	< 0.000060	< 0.000966	0.000077	< 0.000619
3,3'-Dimethoxybenzidine	< 29	244.29	< 0.000437	< 0.007002	0.000689	< 0.004488
Dimethylaminobenzene	< 2	225.29	< 0.000030	< 0.000483	0.000052	< 0.000310
7,12-Dimethylbenz(a)anthracene	< 4	256.34	< 0.000060	< 0.000966	0.000091	< 0.000619
3,3'-Dimethylbenzidine	< 29	212.29	< 0.000437	< 0.007002	0.000793	< 0.004488
a,a-Dimethylphenethylamine	< 12	149.23	< 0.000181	< 0.002897	0.000467	< 0.001857
2,4-Dimethylphenol	< 3	122.17	< 0.000039	< 0.000628	0.000124	< 0.000402
Fluoranthene	64.9	202.26	0.000978	0.015671	0.001864	0.010044
Fluorene	101	166.22	0.001523	0.024387	0.003529	0.015630
Indeno(1,2,3-cd)pyrene	< 100	276.33	< 0.001508	< 0.024146	0.002102	< 0.015476
Isophorone	< 2	138.21	< 0.000034	< 0.000543	0.000095	< 0.000348
3-Methylcholanthrene	< 4	268.35	< 0.000060	< 0.000966	0.000087	< 0.000619
2-Methylnaphthalene	440	142.20	0.006633	0.106242	0.017971	0.068093
2-Methylphenol	< 2	108.14	< 0.000032	< 0.000507	0.000113	< 0.000325
3-Methylphenol & 4-Methylphenol	< 6	108.14	< 0.000085	< 0.001364	0.000303	< 0.000874
Naphthalene	3420	128.17	0.051559	0.825787	0.154977	0.529264
Perylene	n/a	252.31	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Phenanthrene	539	178.23	0.008126	0.130146	0.017565	0.083413
Phenol	3.15	94.11	0.000047	0.000761	0.000194	0.000487
1,4-Phenylenediamine	< 18	108.10	< 0.000271	< 0.004346	0.000967	< 0.002786
Pyrene	< 9	202.25	< 0.000132	< 0.002120	0.000252	< 0.001359
o-Toluidine	< 5	107.17	< 0.000075	< 0.001207	0.000271	< 0.000774

CO CALIBRATION CORRECTION DATA SHEET USEPA METHOD 10

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: Thermo Environmental Model 48i
RUN NO: FCCU-0010-2
TEST DATE: 6/8/2011

INPUT

CO AVERAGE CHART READING (C):	5.65	ppmv
AVG PRE/POST ZERO DRIFT READING (C _o):	2.70	ppmv
CAL GAS CONCENTRATION (C _{ma}):	40.0	ppmv
AVG CAL PRE/POST TEST READING (C _m):	43.02	ppmv
STACK GAS VOLUMETRIC FLOW RATE (Q _{std}):	10,265,318	dscfh

CALCULATIONS

STACK CO AVERAGE CHART READING = 5.65 ppmv

STACK CO CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{CO CONC, ppmv} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = 2.9 \text{ ppmv db}$$

(corrected)

CO CONC.(lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{28 \text{ lb / lb - mole}}{385.26 \times 10^6 \text{ ft}^3 / \text{lb - mole}} \right) = 0.2126 \times 10^{-6} \text{ lbs/dscf}$$

CO EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 10,265,318 dscfh

STACK CO EMISSION RATE =

$$\text{CO}_{\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = 2.1825 \text{ lbs/hr}$$

$$= 9.5592 \text{ ton/yr}$$

METHOD 18 METHANE (CH₄) AND ETHANE (C₂H₆) CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
RUN NUMBER: FCCU-0010-2
TEST DATE: 6/8/2011

INPUT DATA

Methane (CH₄) = 1.1 ppmv db
Ethane (C₂H₆) = < 1.0 ppmv db
Stack gas volumetric flow rate (Q_s) = 10,265,318 dscfh

CALCULATIONS

Concentration in stack gas (lb/dscf)

Methane	$C'_{\text{gas(methane)}} = \frac{(C_{\text{gas(methane)}})(16.04)}{(385.26 \times 10^6)} =$	0.04580 x 10 ⁻⁶ lb/dscf as methane
Ethane	$C'_{\text{gas(ethane)}} = \frac{(C_{\text{gas(ethane)}})(30.07)}{(385.26 \times 10^6)} =$	< 0.07805 x 10 ⁻⁶ lb/dscf as ethane

Emission rates (lb/hr)

$$E_{\text{THC(methane)}} = C'_{\text{gas(methane)}} \times Q_s = 0.47013 \text{ lb/hr of methane}$$

$$E_{\text{THC(ethane)}} = C'_{\text{gas(ethane)}} \times Q_s = < 0.80122 \text{ lb/hr of ethane}$$

METHOD 25A TOTAL HYDROCARBON (THC) CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
RUN NUMBER: FCCU-0010-1
TEST DATE: 6/8/2011

INPUT DATA

THC as propane (C_3H_8) = 0.62 ppmv wb
0.76 ppmv db
Stack gas volumetric flow rate (Q_s) = 10,395,620 dscfh

CALCULATIONS

THC concentration in stack gas (lb/dscf)

$$C'_{\text{gas (propane)}} = \frac{(C_{\text{gas (propane)}})(44.09)}{(385.26 \times 10^6)} = 0.08642 \times 10^{-6} \text{ lb/dscf as propane}$$

THC emission rate

$$E_{\text{THC (propane)}} = C'_{\text{gas (propane)}} \times Q_s = 0.89843 \text{ lb/hr}$$

Volatile Organic HAPs Laboratory Data Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date:
Run No:

6/8/2011
 FCCU-18-2

Compound	Molecular Weight	Sample Train A	% Recovery	Sample Train B	% Recovery
		Analysis (M _w) (micrograms)		Analysis (M _w) (micrograms)	
Acetone	58.08	2,690		1724	
Acetonitrile	41.05	10.9		5963	160
Acrolein	56.06	5.1		5983	140
Acrylonitrile	53.06	11.0	60	< 4.3	90
Benzene	78.11	< 4.3	73	< 4.3	101
1,3-Butadiene	54.09	< 4.3	0		0
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	70	< 4.3	93
Ethylbenzene	106.17	< 4.3	87	< 4.3	94
Hexane	86.18	< 4.3	11	< 4.3	49
Methyl isobutyl ketone	100.16	< 4.3		4339	137
Methyl t-butyl ether	88.15	< 4.3	59	< 4.3	95
Methylene chloride	84.93	33.9		25.9	
Nitrobenzene	123.06	< 21.5	58	< 21.5	102
2-Nitropropane	89.09	< 4.3	58	< 4.3	92
Pentane	72.15	< 4.3	0		2
Styrene	104.15	< 4.3	81	< 4.3	93
Tetrachloroethene	165.83	< 4.3		< 4.3	
Toluene	92.14	< 4.3		1208	68
Trichloroethene	131.39	< 4.3		2736	60
2,2,4 Trimethyl pentane	114.23	< 4.3	45	< 4.3	92
Xylenes	106.16	< 4.3		< 4.3	

VOLATILE ORGANIC HAPS CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
SAMPLE: VolHAPs - Methanol Impingers
TEST DATE: 6/9/2011
RUN NO: FCCU-18-2

INPUT

Q_a : 10,265,318 dscfh
P_{bar} : 29.89 in Hg

A Train:

V_m Unspiked: 18,206 liters
V_m Unspiked: 0.643 cubic ft
Y Sample : 1,000
T_m Sample: 94.0 °F
ΔH Sample: 0.20 in. H₂O

B Train:

V_m Spiked: 18,218 liters
V_m Spiked: 0.643 cubic ft
Y Sample : 1,000
T_m Sample: 92.3 °F
ΔH Sample: 0.28 in. H₂O

Volume of sample at standard

conditions on dry basis

V_{msid} Train A (V_a) = (17.647)(V_m)(Y_a)(P_{bar}+ΔH/13.6)/(T_m)
V_{msid} Train A (V_a-liters) = dscf x 28.32
V_{msid} Train B (V_b) = (17.647)(V_m)(Y_b)(P_{bar}+ΔH/13.6)/(T_m)
V_{msid} Train B (V_b-liters) = dscf x 28.32

English units
(29.92 in. Hg 68° F)

= 0.612 dscf
= 17.343 std liters
= 0.615 dscf
= 17.411 std liters

Compound	Molecular Weight	Mass/Volume (M _v) (μg/liter)	A TRAIN				B TRAIN				AVERAGE	
			VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (μg/dscm)	VOC Emission (lb/hr)	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	155,1072	9.6839E-06	64,236	155,107	99,40876	6.1822E-06	41,008	99,019	63,46190	127,063	81,43533
Acetonitrile	41.05	0.6285	3.9240E-08	368	629	0.40281	< 1.5420E-08	< 112	< 247	< 0.15829	629	0.40281
Acrolein	56.06	0.2841	1.8360E-08	126	294	0.18847	< 1.5420E-08	< 76	< 247	< 0.15829	294	0.18847
Acrylonitrile	53.06	< 0.6343	< 3.9600E-08	< 288	< 634	< 0.40550	< 0.0000E+00	< 0	< 0	< 0.00000	< 441	< 0.28240
Benzene	78.11	< 0.2479	< 1.5480E-08	< 76	< 248	< 0.15891	< 1.5420E-08	< 78	< 247	< 0.15829	< 247	< 0.15860
1,3-Butadiene	54.09	< 0.2479	< 1.5480E-08	< 78	< 248	< 0.15891	< 1.5420E-08	< 53	< 247	< 0.15829	< 247	< 0.15860
Carbon disulfide	76.14	< 0.2479	< 1.5480E-08	< 53	< 248	< 0.15891	< 1.5420E-08	< 49	< 247	< 0.15829	< 247	< 0.15860
Chlorobenzene	112.56	< 0.2479	< 1.5480E-08	< 50	< 248	< 0.15891	< 1.5420E-08	< 32	< 247	< 0.15829	< 247	< 0.15860
Cumene	120.19	< 0.2479	< 1.5480E-08	< 32	< 248	< 0.15891	< 1.5420E-08	< 56	< 247	< 0.15829	< 247	< 0.15860
1,2-Dibromoethane	187.86	< 0.2479	< 1.5480E-08	< 69	< 248	< 0.15891	< 1.5420E-08	< 69	< 247	< 0.15829	< 247	< 0.15860
Ethylbenzene	106.17	< 0.2479	< 1.5480E-08	< 60	< 248	< 0.15891	< 1.5420E-08	< 67	< 247	< 0.15829	< 248	< 0.15891
Hexane	86.18	< 0.2479	< 1.5480E-08	< 68	< 248	< 0.15891	< 1.5420E-08	< 421	< 1235	< 0.79143	< 1,721	< 1,10309
Methyl isobutyl ketone	100.16	< 0.2479	< 1.5480E-08	< 242	< 248	< 0.15891	< 1.5420E-08	< 241	< 247	< 0.15829	< 247	< 0.15860
Methyl t-butyl ether	88.15	< 0.2479	< 1.5480E-08	< 67	< 248	< 0.15891	< 1.5420E-08	< 67	< 247	< 0.15829	< 247	< 0.15860
Methylene chloride	84.93	1.9547	1.2204E-07	554	1,955	1,25277	< 0.0000E+00	< 0	< 0	< 0.00000	< 1240	< 0.79453
Nitrobenzene	123.06	< 1.2397	< 7.7400E-08	< 242	< 248	< 0.15891	< 1.5420E-08	< 57	< 247	< 0.15829	< 247	< 0.15860
2-Nitropropane	89.09	< 0.2479	< 1.5480E-08	< 67	< 248	< 0.15891	< 1.5420E-08	< 36	< 247	< 0.15829	< 247	< 0.15860
Pentane	72.15	< 0.2479	< 1.5480E-08	< 827	< 248	< 0.15891	< 1.5420E-08	< 57	< 247	< 0.15829	< 247	< 0.15860
Styrene	104.15	< 0.2479	< 1.5480E-08	< 57	< 248	< 0.15891	< 1.5420E-08	< 36	< 247	< 0.15829	< 247	< 0.15860
Tetrachloroethene	165.83	< 0.2479	< 1.5480E-08	< 36	< 248	< 0.15891	< 1.5420E-08	< 52	< 247	< 0.15829	< 247	< 0.15860
Toluene	92.14	< 0.2479	< 1.5480E-08	< 65	< 248	< 0.15891	< 1.5420E-08	< 52	< 247	< 0.15829	< 247	< 0.15860
Trichloroethene	131.39	< 0.2479	< 1.5480E-08	< 45	< 248	< 0.15891	< 1.5420E-08	< 52	< 247	< 0.15829	< 247	< 0.15860
2,2,4 Trimethyl pentane	114.23	< 0.2479	< 1.5480E-08	< 56	< 248	< 0.15891	< 1.5420E-08	< 52	< 247	< 0.15829	< 247	< 0.15860
Xylenes	106.16	< 0.2479	< 1.5480E-08	< 56	< 248	< 0.15891	< 1.5420E-08	< 52	< 247	< 0.15829	< 247	< 0.15860

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011
RUN NUMBER: FCCU-0011-2

γ FACTOR:	1.001	STACK DIAM:	150.0 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	50.085 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	97.7 °F
STACK TEMP:	139.9 °F	LIQUID COLL:	233.5 milliliters
SQ. RT ΔP:	0.5353 in.H ₂ O	CO₂:	13.28 % by volume
ΔH:	2.19 in.H ₂ O	O₂:	5.23 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 47.673 \text{ dscf}$$

$\gamma = 1.001$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 10.991 \text{ scf}$$

$V_{lc} = 233.5 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1874$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$$

$S.V.P. = 5.881 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.1874$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0011-2

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011

BAROMETRIC: 29.89 in. Hg	STACK DIAM: 150.0 inches
STATIC PRES: 0.20 in.H ₂ O	CO₂: 13.28 % by volume
STACK TEMP: 139.9 °F	O₂: 5.23 % by volume
SQ.RT ΔP: 0.5353 in.H ₂ O	

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.33	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.02	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5353	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.9\text{ °F} + 460$	=	599.9	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.524	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	239,477.04	acfm
Stack Area =	122.71846	ft ²	
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	210,667.18	scfm, wb
		12,640,031	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	171,198.09	dscfm
		10,271,885	dscfh

ALDEHYDES CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/8/2011
RUN NO: FCCU-0011-2

INPUT

V_m:	50.085 ft ³	Q_s:	10,271,885 dscfh
γ FACTOR:	1.001	T_s:	139.9 °F
P_{bar}:	29.89 in. Hg	Θ:	60.0 minutes
ΔH:	2.19	V_s:	32.524 fps
T_m:	97.7 °F	P_s:	29.90 in. Hg
Formaldehyde:	< 115 μg	V_{lc}:	233.5 mL
Acetaldehyde:	803 μg	%O₂:	5.23 %
Propanal:	187 μg		

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	47.673 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	100.8 % I
A _n =	0.00056551 ft ²	Runtime (Θ) =	60 minutes
Total μg Formaldehyde in sample (M_n)		=	< 115 μg
Total μg Acetaldehyde in sample (M_n)		=	803 μg
Total μg Propanal in sample (M_n)		=	187 μg
Concentration of Aldehydes		x 10⁻⁶ lb/dscf	
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0053 formaldehyde
		=	0.0371 acetaldehyde
		=	0.0086 propanal
		μg/dscm	
$C_{s(\mu g/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(V_{mstd})}$		=	< 85.2 formaldehyde
		=	594.8 acetaldehyde
		=	138.5 propanal
Aldehydes Mass Rate:		lb/hr	
E = Q _s × C'_{s(lb/dscf)}		=	< 0.0546 formaldehyde
		=	0.3814 acetaldehyde
		=	0.0888 propanal

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-0010-3/FCCU-0011-3
 TEST DATE : 6/9/2011
 START TIME : 7:34
 END TIME : 12:14

GAS ANALYZER

O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.618
 AVERAGE ZERO BIAS (C_o): 0.124
 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 5.12

GAS ANALYZER

CO₂

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 9.94
 AVERAGE ZERO BIAS (C_o): 0.13
 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 13.43

GAS ANALYZER

CO

SPAN VALUE : 80.1 ppm
 AVERAGE CAL. BIAS (C_m): 39.46
 AVERAGE ZERO BIAS (C_o): 0.09
 CALIBRATION GAS: EPA Protocol CO
 CALIBRATION PPM (C_{ma}): 40.0
 PPM CORRECTED (C_{gas}): 3.1

GAS ANALYZER

VOCs

SPAN VALUE : 90 ppm
 AVERAGE CAL. BIAS (C_m): 30.18
 AVERAGE ZERO BIAS (C_o): 0.00
 CALIBRATION GAS: EPA Protocol C₃H₈
 CALIBRATION ppm (C_{ma}): 30.0
 ppm CORRECTED (C_{gas}): 0.05

$$\text{Example Calculation} = C_{\text{gas}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME	ELAPSED TIME	CO	C ₃ H ₈	O ₂	CO ₂
7:34	0				
7:35	1	3.4	0.0	5.27	13.24
7:36	2	3.2	0.0	5.20	13.31
7:37	3	3.1	0.0	5.15	13.36
7:38	4	3.0	0.0	5.12	13.40
7:39	5	3.1	0.0	5.12	13.40
7:40	6	3.4	0.0	5.24	13.29
7:41	7	3.5	0.0	5.26	13.27
7:42	8	3.1	0.0	5.26	13.27
7:43	9	3.3	0.0	5.17	13.34
7:44	10	3.2	0.0	5.18	13.34
7:45	11	3.2	0.0	5.16	13.37
7:46	12	3.2	0.0	5.05	13.47
7:47	13	3.6	0.0	5.00	13.53
7:48	14	3.5	0.0	5.08	13.47
7:49	15	3.3	0.0	5.09	13.46
7:50	16	3.2	0.0	4.94	13.59
7:51	17	3.2	0.0	5.11	13.44
7:52	18	3.2	0.0	5.18	13.35
7:53	19	3.2	0.0	5.15	13.37
7:54	20	3.5	0.0	5.20	13.34
7:55	21	3.5	0.0	5.36	13.18
7:56	22	3.1	0.0	5.36	13.18
7:57	23	3.1	0.0	5.23	13.30
7:58	24	3.0	0.0	5.18	13.36
7:59	25	3.1	0.0	5.29	13.24
8:00	26	3.2	0.0	5.17	13.36
8:01	27	3.5	0.0	5.22	13.31
8:02	28	3.5	0.0	5.25	13.28
8:03	29	3.4	0.0	5.17	13.36
8:04	30	3.2	0.0	5.18	13.36
8:05	31	3.3	0.0	5.20	13.34
8:06	32	3.0	0.0	5.30	13.23
8:07	33	3.1	0.0	5.30	13.23
8:08	34	3.2	0.0	5.19	13.34
8:09	35	3.4	0.0	5.12	13.41
8:10	36	3.6	0.0	5.27	13.27
8:11	37	3.6	0.0	5.13	13.41
8:12	38	3.5	0.0	5.16	13.38
8:13	39	3.1	0.0	5.31	13.23
8:14	40	3.1	0.0	5.22	13.32
8:15	41	3.2	0.0	5.06	13.47
8:16	42	3.3	0.0	5.14	13.40
8:17	43	3.5	0.0	5.12	13.41
8:18	44	3.6	0.0	5.22	13.33
8:19	45	3.5	0.0	5.22	13.32
8:20	46	3.4	0.0	5.19	13.35
8:21	47	3.3	0.0	5.11	13.43
8:22	48	3.2	0.0	5.14	13.39
8:23	49	3.2	0.0	5.08	13.46
8:24	50	3.3	0.0	5.20	13.34
8:25	51	3.5	0.0	5.20	13.34
8:26	52	3.6	0.0	5.27	13.27
8:27	53	3.4	0.0	5.25	13.28
8:28	54	3.3	0.0	5.21	13.31
8:29	55	3.2	0.0	5.22	13.32
8:30	56	3.1	0.0	5.19	13.35
8:31	57	3.3	0.0	5.13	13.41
8:32	58	3.4	0.0	5.30	13.26
8:33	59	3.3	0.0	5.29	13.25
8:34	60	3.1	0.0	5.27	13.28
8:35	61	3.1	0.0	5.13	13.40
8:36	62	3.4	0.0	4.96	13.56
8:37	63	3.4	0.0	5.21	13.33
8:38	64	3.4	0.0	5.17	13.37
8:39	65	3.4	0.0	5.17	13.38
8:40	66	3.1	0.0	5.34	13.21
8:41	67	3.1	0.0	5.10	13.43
8:42	68	2.9	0.0	5.19	13.35
8:43	69	3.2	0.0	5.06	13.48
8:44	70	3.3	0.0	5.11	13.43
8:45	71	3.4	0.0	5.14	13.39
8:46	72	3.4	0.0	5.27	13.28
8:47	73	3.2	0.1	5.16	13.39
8:48	74	3.2	0.1	5.14	13.40
8:49	75	3.0	0.0	5.28	13.25
8:50	76	3.0	0.1	5.11	13.42
8:51	77	3.2	0.1	4.98	13.56
8:52	78	3.5	0.1	5.23	13.32
8:53	79	3.5	0.1	5.31	13.24
8:54	80	3.4	0.1	5.33	13.22
8:55	81	3.0	0.1	5.32	13.23
8:56	82	3.0	0.0	5.28	13.28
8:57	83	2.9	0.0	5.20	13.34
8:58	84	3.0	0.1	5.23	13.31
8:59	85	3.1	0.1	5.23	13.32
9:00	86	3.4	0.0	5.28	13.27
9:01	87	3.5	0.0	5.45	13.09
9:02	88	3.1	0.0	5.52	13.03
9:03	89	3.0	0.0	5.39	13.16
9:04	90	3.1	0.0	5.35	13.19

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-0010-3/FCCU-0011-3

CLOCK TIME	ELAPSED TIME	CO	C ₂ H ₆	O ₂	CO ₂
9:05	91	3.0	0.1	5.19	13.34
9:06	92	3.1	0.1	5.25	13.29
9:07	93	3.4	0.0	5.26	13.29
9:08	94	3.5	0.0	5.25	13.29
9:09	95	3.3	0.0	5.36	13.19
9:10	96	3.3	0.0	5.35	13.19
9:11	97	3.2	0.0	5.30	13.23
9:12	98	3.1	0.1	5.32	13.22
9:13	99	3.2	0.1	5.15	13.39
9:14	100	3.3	0.1	5.20	13.33
9:15	101	3.4	0.0	5.22	13.33
9:16	102	3.5	0.0	5.18	13.36
9:17	103	3.3	0.0	5.31	13.24
9:18	104	3.2	0.0	5.27	13.27
9:19	105	3.2	0.0	5.37	13.17
9:20	106	3.3	0.0	5.05	13.48
9:21	107	3.5	0.0	5.16	13.37
9:22	108	3.8	0.0	5.28	13.27
9:23	109	3.4	0.0	5.34	13.21
9:24	110	3.4	0.0	5.28	13.28
9:25	111	3.3	0.0	5.15	13.38
9:26	112	3.3	0.0	5.09	13.44
9:27	113	3.2	0.0	5.24	13.31
9:28	114	3.5	0.1	4.97	13.55
9:29	115	3.7	0.1	5.17	13.38
9:30	116	3.6	0.1	5.21	13.34
9:31	117	3.2	0.1	5.27	13.27
9:32	118	3.2	0.1	5.04	13.49
9:33	119	3.2	0.1	5.10	13.44
9:34	120	3.2	0.0	5.11	13.43
9:35	121	3.3	0.0	5.18	13.37
9:36	122	3.8	0.0	5.03	13.51
9:37	123	3.4	0.0	5.20	13.35
9:38	124	3.2	0.0	5.10	13.44
9:39	125	3.0	0.0	5.00	13.54
9:40	126	2.9	0.0	5.02	13.52
9:41	127	3.1	0.0	4.94	13.59
9:42	128	3.4	0.0	4.98	13.59
9:43	129	3.4	0.0	5.19	13.36
9:44	130	3.3	0.0	5.33	13.22
9:45	131	3.2	0.1	5.11	13.43
9:46	132	3.1	0.1	5.08	13.46
9:47	133	3.1	0.0	4.99	13.54
9:48	134	3.4	0.1	5.04	13.50
9:49	135	3.8	0.1	5.14	13.41
9:50	136	3.4	0.1	5.24	13.31
9:51	137	3.3	0.1	5.18	13.37
9:52	138	3.2	0.1	5.27	13.27
9:53	139	3.1	0.1	5.31	13.23
9:54	140	3.2	0.0	5.19	13.35
9:55	141	3.4	0.0	5.31	13.24
9:56	142	3.5	0.0	5.32	13.22
9:57	143	3.3	0.0	5.37	13.19
9:58	144	3.3	0.0	5.30	13.25
9:59	145	3.2	0.0	5.44	13.11
10:00	146	3.1	0.0	5.32	13.22
10:01	147	3.2	0.0	5.09	13.45
10:02	148	3.4	0.0	5.22	13.33
10:03	149	3.5	0.0	5.17	13.38
10:04	150	3.5	0.0	5.26	13.27
10:05	151	3.2	0.0	5.27	13.28
10:06	152	3.1	0.0	5.33	13.22
10:07	153	3.0	0.0	5.32	13.22
10:08	154	3.2	0.0	5.18	13.36
10:09	155	3.2	0.0	5.18	13.36
10:10	156	3.5	0.0	5.12	13.43
10:11	157	3.6	0.0	5.23	13.33
10:12	158	3.5	0.0	5.35	13.21
10:13	159	3.0	0.0	5.34	13.21
10:14	160	2.9	0.0	5.26	13.29
10:15	161	3.0	0.0	5.18	13.36
10:16	162	3.0	0.0	5.17	13.37
10:17	163	3.2	0.0	5.23	13.32
10:18	164	3.4	0.0	5.25	13.30
10:19	165	3.4	0.0	5.41	13.15
10:20	166	3.1	0.0	5.25	13.30
10:21	167	3.0	0.0	5.27	13.28
10:22	168	2.8	0.0	5.38	13.18
10:23	169	2.9	0.0	5.17	13.38
10:24	170	3.2	0.0	5.23	13.32
10:25	171	3.3	0.0	5.27	13.28
10:26	172	3.5	0.0	5.38	13.16
10:27	173	3.3	0.1	5.31	13.25
10:28	174	3.2	0.0	5.33	13.23
10:29	175	2.9	0.1	5.39	13.16
10:30	176	2.9	0.0	5.14	13.40
10:31	177	2.9	0.0	5.22	13.33
10:32	178	3.2	0.0	5.16	13.39
10:33	179	3.4	0.0	5.39	13.17
10:34	180	3.3	0.0	5.40	13.16
10:35	181	3.2	0.0	5.35	13.20
10:36	182	3.1	0.0	5.48	13.07
10:37	183	3.1	0.0	5.18	13.36
10:38	184	3.1	0.0	5.22	13.33
10:39	185	3.4	0.0	5.19	13.36
10:40	186	3.1	0.0	5.28	13.30

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-0010-3/FCCU-0011-3

CLOCK TIME	ELAPSED TIME	CO	C ₂ H ₄	O ₂	CO ₂
10:41	187	3.3	0.0	5.27	13.28
10:42	188	3.2	0.0	5.35	13.21
10:43	189	3.1	0.0	5.28	13.27
10:44	190	3.3	0.0	5.27	13.28
10:45	191	3.2	0.0	5.31	13.24
10:46	192	3.2	0.0	5.22	13.33
10:47	193	3.2	0.0	5.37	13.18
10:48	194	3.2	0.0	5.33	13.23
10:49	195	2.9	0.0	5.36	13.19
10:50	196	2.9	0.0	5.26	13.29
10:51	197	2.9	0.0	5.15	13.39
10:52	198	3.1	0.0	5.07	13.47
10:53	199	3.3	0.0	5.23	13.33
10:54	200	3.5	0.0	5.23	13.33
10:55	201	3.3	0.0	5.33	13.24
10:56	202	3.1	0.0	5.17	13.38
10:57	203	2.9	0.0	5.26	13.27
10:58	204	3.0	0.0	5.44	13.12
10:59	205	3.0	0.0	4.85	13.59
11:00	206	3.4	0.0	5.12	13.44
11:01	207	3.6	0.0	5.32	13.24
11:02	208	3.5	0.0	5.26	13.30
11:03	209	3.0	0.0	5.35	13.21
11:04	210	2.9	0.0	5.24	13.30
11:05	211	3.0	0.0	5.27	13.29
11:06	212	2.9	0.0	5.26	13.29
11:07	213	3.2	0.0	5.12	13.43
11:08	214	3.4	0.0	5.33	13.24
11:09	215	3.5	0.0	5.35	13.21
11:10	216	3.2	0.0	5.38	13.20
11:11	217	3.0	0.0	5.23	13.33
11:12	218	2.9	0.0	5.30	13.26
11:13	219	2.9	0.0	5.25	13.30
11:14	220	3.1	0.0	5.25	13.30
11:15	221	3.1	0.0	5.34	13.22
11:16	222	3.2	0.0	5.30	13.26
11:17	223	3.1	0.0	5.34	13.22
11:18	224	2.9	0.0	5.43	13.12
11:19	225	3.1	0.0	5.26	13.29
11:20	226	3.0	0.0	5.13	13.42
11:21	227	2.9	0.0	5.10	13.44
11:22	228	3.1	0.0	5.26	13.30
11:23	229	3.2	0.0	5.41	13.15
11:24	230	3.0	0.1	5.35	13.21
11:25	231	3.0	0.0	5.25	13.32
11:26	232	3.1	0.1	5.24	13.31
11:27	233	2.9	0.0	5.24	13.31
11:28	234	2.9	0.0	5.21	13.34
11:29	235	3.0	0.0	5.19	13.36
11:30	236	3.1	0.0	5.17	13.39
11:31	237	3.2	0.0	5.41	13.16
11:32	238	3.0	0.0	5.48	13.08
11:33	239	2.7	0.0	5.34	13.22
11:34	240	2.9	0.0	5.16	13.40
11:35	241	3.0	0.0	5.06	13.49
11:36	242	3.2	0.0	5.33	13.22
11:37	243	3.2	0.0	5.34	13.23
11:38	244	3.2	0.0	5.43	13.14
11:39	245	2.9	0.0	5.40	13.18
11:40	246	2.7	0.0	5.41	13.16
11:41	247	2.7	0.0	5.32	13.25
11:42	248	2.8	0.0	5.31	13.25
11:43	249	2.8	0.0	5.19	13.36
11:44	250	3.2	0.0	5.31	13.26
11:45	251	3.2	0.0	5.39	13.18
11:46	252	3.1	0.0	5.42	13.15
11:47	253	2.9	0.0	5.26	13.30
11:48	254	2.7	0.0	5.29	13.27
11:49	255	2.7	0.0	5.26	13.31
11:50	256	2.7	0.0	5.34	13.23
11:51	257	2.9	0.0	5.20	13.36
11:52	258	3.3	0.0	5.28	13.30
11:53	259	3.3	0.0	5.46	13.11
11:54	260	2.9	0.0	5.33	13.24
11:55	261	2.8	0.0	5.57	13.00
11:56	262	2.8	0.0	5.36	13.20
11:57	263	2.7	0.0	5.21	13.35
11:58	264	2.9	0.0	5.31	13.25
11:59	265	3.3	0.0	5.21	13.36
12:00	266	3.1	0.0	5.36	13.22
12:01	267	2.8	0.0	5.48	13.09
12:02	268	2.8	0.0	5.30	13.27
12:03	269	2.7	0.0	5.27	13.31
12:04	270	2.8	0.0	5.13	13.43
12:05	271	3.0	0.0	5.15	13.42
12:06	272	3.1	0.0	5.38	13.20
12:07	273	3.1	0.0	5.40	13.17
12:08	274	3.0	0.0	5.29	13.27
12:09	275	2.9	0.0	5.46	13.11
12:10	276	2.9	0.0	5.40	13.18
12:11	277	2.7	0.0	5.32	13.25
12:12	278	2.9	0.0	5.18	13.38
12:13	279	3.0	0.0	5.39	13.18
12:14	280	3.5	0.0	5.29	13.29
Uncorrected Average (C) =		3.18	0.05	5.239	13.309

**ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY**

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011
RUN NUMBER: FCCU-0010-3

γ FACTOR:	1.005	STACK DIAM:	150.000 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	152.081 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	94.0 °F
STACK TEMP:	139.9 °F	LIQUID COLL:	727.3 milliliters
SQ.RT ΔP:	0.5373 in.H ₂ O	CO₂:	13.43 % by volume
ΔH:	1.39 in.H ₂ O	O₂:	5.12 % by volume

**ENGLISH UNITS
(29.92 in.Hg & °F)**

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 146.166 \text{ dscf}$$

$\gamma = 1.005$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 34.234 \text{ scf}$$

$V_{lc} = 727.3 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1898$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1965$$

$S.V.P. = 5.881 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.1898$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0010-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011

BAROMETRIC: 29.92 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 139.9 °F
SQ.RT ΔP: 0.5373 in.H₂O

STACK DIAM: 150.000 inches
CO₂: 13.43 % by volume
O₂: 5.12 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.35	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.01	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5373	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.9\text{ °F} + 460$	=	599.9	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.637	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	240,311	acfm
Stack Area =		122.7184	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	211,612.8 12,696,766	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	171,455.6 10,287,335	dscfm dscfh

METHOD 0010 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011
RUN NO: FCCU-0010-3

INPUT

V_m:	152.081 ft ³	Q_s:	10,287,335 dscfh
γ FACTOR:	1.005	T_s:	139.9 °F
P_{bar}:	29.92 in. Hg	Θ:	240 minutes
ΔH:	1.39 in. H ₂ O	V_s:	32.637 fps
T_m:	94.0 °F	P_s:	29.93 in. Hg
		V_{lc}:	727.3 mL

**Volume of Sample at Standard
Conditions on a Dry Basis:**

**English Units
(29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 146.166 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 100.51 \% I$$

A_n = 0.00043374 ft² **Runtime (θ) = 60 minutes**

SVOC CALCULATION SUMMARY



COMPANY : Valero Port Arthur Refinery
 LOCATION : Port Arthur, Texas
 SOURCE : 1241 FCCU WGS Stack
 TEST DATE : 6/9/2011
 TEST RUN NO. : FCCU-0010-3

SAMPLE VOLUME : 146.166 dscf
 SAMPLE VOLUME : 4.140 dscm
 GAS FLOW RATE : 10,287,335 dscfh
 STACK O₂ CONTENT : 5.12 %

VOST COMPOUND	TOTAL SAMPLE MASS (nanogram)	MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻⁶)	STACK GAS CONCENTRATION (µg/dscm)	STACK GAS CONCENTRATION (ppb)	EMISSION RATE (lb/hr x 10 ⁻³)
Acenaphthene	< 479	154.21	< 0.007225	< 0.115714	< 0.018049	< 0.074323
Acenaphthylene	< 25	152.19	< 0.000377	< 0.006039	< 0.000955	< 0.003879
Aniline	< 2	93.13	< 0.000028	< 0.000447	< 0.000115	< 0.000287
Anthracene	17.2	178.23	0.000259	0.004155	0.000561	0.002669
Benzidine	< 38	184.24	< 0.000573	< 0.009180	< 0.001198	< 0.005896
Benzo[a]anthracene	< 4	228.29	< 0.000060	< 0.000966	< 0.000102	< 0.000621
Benzo[b]fluoranthene	< 4	252.31	< 0.000060	< 0.000966	< 0.000092	< 0.000621
Benzo[k]fluoranthene	< 4	252.31	< 0.000060	< 0.000966	< 0.000092	< 0.000621
Benzo[g,h,i]perylene	4.76	276.33	0.000072	0.001150	0.000100	0.000739
Benzo[a]pyrene	< 4	252.31	< 0.000060	< 0.000966	< 0.000092	< 0.000621
Benzo[e]pyrene	34	252.31	0.000513	0.008214	0.000783	0.005276
Biphenyl	< 350	154.21	< 0.005279	< 0.084551	< 0.013188	< 0.054307
Chrysene	< 4	228.28	< 0.000060	< 0.000966	< 0.000102	< 0.000621
Dibenz[a,h]anthracene	< 4	278.35	< 0.000060	< 0.000966	< 0.000084	< 0.000621
Dibenzofuran	< 2	168.19	< 0.000035	< 0.000556	< 0.000079	< 0.000357
Dibenzo[a,e]pyrene	< 4	302.37	< 0.000060	< 0.000966	< 0.000077	< 0.000621
3,3'-Dimethoxybenzidine	< 29	244.29	< 0.000437	< 0.007006	< 0.000690	< 0.004500
Dimethylaminobenzene	< 2	225.29	< 0.000030	< 0.000483	< 0.000052	< 0.000310
7,12-Dimethylbenz(a)anthracene	< 4	256.34	< 0.000060	< 0.000966	< 0.000091	< 0.000621
3,3'-Dimethylbenzidine	< 29	212.29	< 0.000437	< 0.007006	< 0.000794	< 0.004500
a,a-Dimethylphenethylamine	< 12	149.23	< 0.000181	< 0.002899	< 0.000467	< 0.001862
2,4-Dimethylphenol	< 3	122.17	< 0.000039	< 0.000628	< 0.000124	< 0.000403
Fluoranthene	31.4	202.26	0.000474	0.007585	0.000902	0.004872
Fluorene	< 304	166.22	< 0.004585	< 0.073439	< 0.010627	< 0.047169
Indeno(1,2,3-cd)pyrene	< 4	276.33	< 0.000060	< 0.000966	< 0.000084	< 0.000621
Isophorone	< 2	138.21	< 0.000034	< 0.000544	< 0.000095	< 0.000349
3-Methylcholanthrene	< 4	268.35	< 0.000060	< 0.000966	< 0.000087	< 0.000621
2-Methylnaphthalene	325	142.20	0.004902	0.078512	0.013281	0.050428
2-Methylphenol	14.2	108.14	0.000214	0.003430	0.000763	0.002203
3-Methylphenol & 4-Methylphenol	< 13	108.14	< 0.000199	< 0.003189	< 0.000709	< 0.002048
Naphthalene	824	128.17	0.012428	0.199058	0.037358	0.127854
Perylene	< 4	252.31	< 0.000060	< 0.000966	< 0.000092	< 0.000621
Phenanthrene	179	178.23	0.002700	0.043242	0.005836	0.027774
Phenol	5.5	94.11	0.000083	0.001329	0.000340	0.000853
1,4-Phenylenediamine	< 18	108.10	< 0.000271	< 0.004348	< 0.000968	< 0.002793
Pyrene	11.4	202.25	0.000172	0.002754	0.000328	0.001769
o-Toluidine	< 5	107.17	< 0.000075	< 0.001208	< 0.000271	< 0.000776

CO CALIBRATION CORRECTION DATA SHEET
USEPA METHOD 10

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: Thermo Environmental Model 48i
RUN NO: FCCU-0010-3
TEST DATE: 6/9/2011

INPUT

CO AVERAGE CHART READING (C): 3.18 ppmv
AVG PRE/POST ZERO DRIFT READING (C_o): 0.09 ppmv
CAL GAS CONCENTRATION (C_{ma}): 40.0 ppmv
AVG CAL PRE/POST TEST READING (C_m): 39.46 ppmv
STACK GAS VOLUMETRIC FLOW RATE (Q_{std}): 10,287,335 dscfh

CALCULATIONS

STACK CO AVERAGE CHART READING = 3.18 ppmv

STACK CO CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{CO CONC, ppmv (corrected)} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = 3.1 \text{ ppmv db}$$

CO CONC.(lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{28\text{lb/lb-mole}}{385.26 \times 10^6 \text{ft}^3/\text{lb-mole}} \right) = 0.2288 \times 10^{-6} \text{ lbs/dscf}$$

CO EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 10,287,335 dscfh

STACK CO EMISSION RATE =

$$\text{CO}_{\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = 2.3532 \text{ lbs/hr} \\ = 10.307 \text{ ton/yr}$$

METHOD 18 METHANE (CH₄) AND ETHANE (C₂H₆) CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
RUN NUMBER: FCCU-0010-3
TEST DATE: 6/9/2011

INPUT DATA

Methane (CH₄) = 1.0 ppmv db
Ethane (C₂H₆) = < 1.0 ppmv db
Stack gas volumetric flow rate (Q_s) = 10,287,335 dscfh

CALCULATIONS

Concentration in stack gas (lb/dscf)

Methane	$C'_{\text{gas(methane)}} = \frac{(C_{\text{gas(methane)}})(16.04)}{(385.26 \times 10^6)} =$	0.04163 x 10 ⁻⁶ lb/dscf as methane
Ethane	$C'_{\text{gas(ethane)}} = \frac{(C_{\text{gas(ethane)}})(30.07)}{(385.26 \times 10^6)} =$	< 0.07805 x 10 ⁻⁶ lb/dscf as ethane

Emission rates (lb/hr)

$$E_{\text{THC(methane)}} = C'_{\text{gas(methane)}} \times Q_s = 0.42831 \text{ lb/hr of methane}$$

$$E_{\text{THC(ethane)}} = C'_{\text{gas(ethane)}} \times Q_s = < 0.80294 \text{ lb/hr of ethane}$$

METHOD 25A TOTAL HYDROCARBON (THC) CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
RUN NUMBER: FCCU-0010-3
TEST DATE: 6/9/2011

INPUT DATA

THC as propane (C_3H_8) = 0.05 ppmv wb
0.06 ppmv db
Stack gas volumetric flow rate (Q_s) = 10,287,335 dscfh

CALCULATIONS

THC concentration in stack gas (lb/dscf)

$$C'_{\text{gas (propane)}} = \frac{(C_{\text{gas (propane)}})(44.09)}{(385.26 \times 10^6)} = 0.00679 \times 10^{-6} \text{ lb/dscf as propane}$$

THC emission rate

$$E_{\text{THC(propane)}} = C'_{\text{gas(propane)}} \times Q_s = 0.06989 \text{ lb/hr}$$

Volatile Organic HAPs Laboratory Data Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date:
Run No:

6/9/2011
 FCCU-18-3

Compound	Molecular Weight	Sample Train A Analysis		Sample Train B Analysis	
		(M _u) (micrograms)	% Recovery	(M _u) (micrograms)	% Recovery
Acetone	58.08	4,832		4732	
Acetonitrile	41.05	14.4		5375	157
Acrolein	56.06	< 4.3		6082	167
Acrylonitrile	53.06	4.5	88	< 4.3	81
Benzene	78.11	< 4.3	97	< 4.3	111
1,3-Butadiene	54.09	< 4.3	2		7
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	95	< 4.3	90
Ethylbenzene	106.17	< 4.3	99	< 4.3	107
Hexane	86.18	< 4.3	60	< 4.3	94
Methyl isobutyl ketone	100.16	3.8		3753	122
Methyl t-butyl ether	88.15	< 4.3	93	< 4.3	94
Methylene chloride	84.93	64.4		67.9	
Nitrobenzene	123.06	< 21.5	123	< 21.5	88
2-Nitropropane	89.09	< 4.3	88	< 4.3	78
Pentane	72.15	< 4.3	7	< 4.3	18
Styrene	104.15	< 4.3	97	< 4.3	99
Tetrachloroethene	165.83	< 4.3		< 4.3	
Toluene	92.14	< 4.3		1189	77
Trichloroethene	131.39	< 4.3		2830	75
2,2,4 Trimethyl pentane	114.23	< 4.3	87	< 4.3	115
Xylenes	106.16	< 4.3		< 4.3	

VOLATILE ORGANIC HAPS CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
 LOCATION: Port Arthur, Texas
 SOURCE: 1241 FCCU WGS Stack
 SAMPLE: VolHAPs - Methanol Impingers
 TEST DATE: 6/9/2011
 RUN NO: FCCU-18-3

INPUT

Q_a : 10,287.335 dscfh
 P_{bar} : 29.92 in Hg

A Train:

V_m Unspiked: 17.936 liters
 V_m Unspiked: 0.633 cubic ft
 Y Sample : 1.000
 T_m Sample: 92.8 °F
 ΔH Sample: 0.20 in. H₂O

B Train:

18.676 liters
 0.659 cubic ft
 1.000
 92.5 °F
 0.28 in. H₂O

Volume of sample at standard

conditions on dry basis

$V_{mstd} \text{ Train A } (V_s) = (17.647)(V_m)(Y_d)(P_{bar} + \Delta H/13.6)/(T_m)$
 $V_{mstd} \text{ Train A } (V_s) = \text{dscf} \times 28.32$
 $V_{mstd} \text{ Train B } (V_d) = (17.647)(V_m)(Y_d)(P_{bar} + \Delta H/13.6)/(T_m)$
 $V_{mstd} \text{ Train B } (V_d) = \text{dscf} \times 28.32$

English units
 (29.92 in. Hg 68° F)

= 0.605 dscf
 = 17.140 std liters
 = 0.631 dscf
 = 17.860 std liters

Compound	Molecular Weight	Mass/Volume (M _v) (µg/liter)	A TRAIN				B TRAIN				AVERAGE	
			VOC Concentration (lb/dscf)	VOC Concentration (ppb)	VOC Concentration (µg/dscm)	VOC Emission (lb/hr)	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	281.9206	1.7601E-05	116.755	281.921	181.07143	1.6541E-05	109.720	264.9349	170.16185	273.428	175.61664
Acetonitrile	41.05	0.8402	5.2454E-08	492	840	0.53962			840	0.53962	840	0.53962
Acrolein	56.06	< 0.2509	< 1.5663E-08	< 108	< 251	< 0.16114			< 251	< 0.16114	< 251	< 0.16114
Acrylonitrile	53.06	0.2626	1.6392E-08	119	263	0.16863			109	0.15464	252	0.16163
Benzene	78.11	< 0.2509	< 1.5663E-08	< 77	< 251	< 0.16114			< 74	< 0.15464	< 246	< 0.15789
1,3-Butadiene	54.09	< 2.5088	< 1.5663E-07	< 1116	< 2509	< 1.61136			< 0	< 0.00000	< 1254	< 0.80588
Carbon disulfide	76.14	< 0.2509	< 1.5663E-08	< 79	< 251	< 0.16114			< 76	< 0.15464	< 246	< 0.15789
Chlorobenzene	112.56	< 0.2509	< 1.5663E-08	< 54	< 251	< 0.16114			< 51	< 0.15464	< 246	< 0.15789
Cumene	120.19	< 0.2509	< 1.5663E-08	< 50	< 251	< 0.16114			< 48	< 0.15464	< 246	< 0.15789
1,2-Dibromoethane	187.86	< 0.2509	< 1.5663E-08	< 32	< 251	< 0.16114			< 31	< 0.15464	< 246	< 0.15789
Ethylbenzene	106.17	< 0.2509	< 1.5663E-08	< 57	< 251	< 0.16114			< 55	< 0.15464	< 246	< 0.15789
Hexane	86.18	< 0.2509	< 1.5663E-08	< 70	< 251	< 0.16114			< 67	< 0.15464	< 246	< 0.15789
Methyl isobutyl ketone	100.16	0.2217	1.3842E-08	53	222	0.14240			< 2408	< 0.15464	222	0.14240
Methyl t-butyl ether	88.15	< 0.2509	< 1.5663E-08	< 68	< 251	< 0.16114			< 66	< 0.15464	< 246	< 0.15789
Methylene chloride	84.93	3.7574	2.3459E-07	1,064	3,757	2,41329			3,8018	2,44183	3,780	2,42756
Nitrobenzene	123.06	< 1.2544	< 7.8317E-08	< 245	< 1254	< 8.0588			< 1,2038	< 0.77319	< 1229	< 0.78943
2-Nitropropane	89.09	< 0.2509	< 1.5663E-08	< 88	< 251	< 0.16114			< 7,5159E-08	< 0.15464	< 246	< 0.15789
Pentane	72.15	< 2.5088	< 1.5663E-07	< 836	< 2509	< 1.61136			< 0.2408	< 0.15464	< 1375	< 0.88300
Styrene	104.15	< 0.2509	< 1.5663E-08	< 58	< 251	< 0.16114			< 0.2408	< 0.15464	< 246	< 0.15789
Tetrachloroethene	165.83	< 0.2509	< 1.5663E-08	< 36	< 251	< 0.16114			< 0.2408	< 0.15464	< 246	< 0.15789
Toluene	92.14	< 0.2509	< 1.5663E-08	< 65	< 251	< 0.16114			< 0.2408	< 0.15464	< 251	< 0.16114
Trichloroethene	131.39	< 0.2509	< 1.5663E-08	< 46	< 251	< 0.16114			< 0.2408	< 0.15464	< 251	< 0.16114
2,2,4 Trimethyl pentane	114.23	< 0.2509	< 1.5663E-08	< 53	< 251	< 0.16114			< 0.2408	< 0.15464	< 246	< 0.15789
Xylenes	106.16	< 0.2509	< 1.5663E-08	< 57	< 251	< 0.16114			< 0.2408	< 0.15464	< 246	< 0.15789



Methanol Laboratory Data Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/9/2011
Run No: FCCU-308-3

Compound	Molecular Weight	Spiked Value (S) (micrograms)	Spiked Train Analysis (M _s) (micrograms)	Unspiked Train Analysis (M _u) (micrograms)
Methanol	32.04	317.8	1,100.0	51.0

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/9/2011
Run No: FCCU-308-4

Compound	Molecular Weight	Spiked Value (S) (micrograms)	Spiked Train Analysis (M _s) (micrograms)	Unspiked Train Analysis (M _u) (micrograms)
Methanol	32.04	317.8	375.0	91.0

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/9/2011
Run No: FCCU-308-5

Compound	Molecular Weight	Spiked Value (S) (micrograms)	Spiked Train Analysis (M _s) (micrograms)	Unspiked Train Analysis (M _u) (micrograms)
Methanol	32.04	317.8	281.0	26.0

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
SAMPLE: Methanol
TEST DATE: 6/9/2011
RUN NO: FCCU-308-3

Q_s: 10,287,335 dscfh

P_{bar}: 29.92 in Hg

V_m Spiked:	61.376 liters
V_m Spiked:	2.167 cubic ft
Y Spiked :	1.000
T_m Spiked:	88.9 °F
ΔH Spiked:	0.63 in. H ₂ O

V_m Unspiked:	60.253 liters
V_m Unspiked:	2.128 cubic ft
Y Sample :	1.000
T_m Sample:	88.8 °F
ΔH Sample:	0.59 in. H ₂ O

Volume of sample at standard conditions on dry basis				English units (29.92 in. Hg 68° F)
V_{nstd} Spiked (V_s) = $(17.647)(V_m)(P_{bar} + \Delta H / 13.6) / (T_m)$	=			dscf
V_{nstd} Spiked ($V_{s-liters}$) = dscf x 28.32	=			std liters
Unspiked (V_u) = $(17.647)(V_m)(P_{bar} + \Delta H / 13.6) / (T_m)$	=			dscf
Unspiked ($V_{u-liters}$) = dscf x 28.32	=			std liters

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

$$R = (M_v * V_{s\text{-liters}}) / S$$
$$C_s = 2.2046 \times 10^{-9} \text{ lb}/\mu\text{g} \times M_u / V_u$$

$$\text{Reported } C_s = C_s / R$$

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

$$\text{Reported ppb} = \text{ppb}/R$$

Compound	Molecular Weight	Mass/volume (M _n) (μg/liter)	Fraction of Spike Recovered R (fractional)	VOC Concentration (lb/dscf)	Reported VOC Concentration (lb/dscf)	VOC Concentration (ppb)	Reported VOC Concentration (μg/dscm)	Reported VOC Emission (lb/hr)
Methanol	32.04	17.7	3.3	5.4849E-08	1.5632E-08	660	266	0.17110

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011
RUN NUMBER: FCCU-0011-3

γ FACTOR:	1.001	STACK DIAM:	150.0 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	49.475 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	89.6 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	234.9 milliliters
SQ. RT ΔP:	0.5352 in.H ₂ O	CO₂:	13.44 % by volume
ΔH:	2.18 in.H ₂ O	O₂:	5.12 % by volume

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 47.833 \text{ dscf}$ <p style="text-align: center;">$\gamma = 1.001$</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS $V_{wstd} = 0.04707 \times V_{lc} = 11.057 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 234.9 \text{ mL}$</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1878$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1965$ <p style="text-align: center;">$S.V.P. = 5.881 \text{ in. Hg}$</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS $B_{ws} = 0.1878$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0011-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011

BAROMETRIC: 29.92 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 139.8 °F
SQ.RT ΔP: 0.5352 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 13.44 % by volume
O₂: 5.12 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.36	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.04	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5352	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8 \text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.492	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	239,239.93	acfm
Stack Area =		122.71846	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	210,704.86	scfm, wb
		12,642,291	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	171,144.32	dscfm
		10,268,659	dscfh

ALDEHYDES CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/9/2011

RUN NO: FCCU-0011-3

INPUT

V_m:	49.475 ft ³	Q_s:	10,268,659 dscfh
γ FACTOR:	1.001	T_s:	139.8 °F
P_{bar}:	29.92 in. Hg	Θ:	60.0 minutes
ΔH:	2.18	V_s:	32.492 fps
T_m:	89.6 °F	P_s:	29.93 in. Hg
Formaldehyde:	< 115 μg	V_{lc}:	234.9 mL
Acetaldehyde:	666 μg	%O₂:	5.12 %
Propanal:	62 μg		

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	47.833 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) \left(\gamma \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	101.1 % I
A _n = 0.00056551 ft ²		Runtime (Θ) = 60 minutes	
Total μg Formaldehyde in sample (M_n)		=	< 115 μg
Total μg Acetaldehyde in sample (M_n)		=	666 μg
Total μg Propanal in sample (M_n)		=	62 μg
Concentration of Aldehydes		x 10⁻⁶ lb/dscf	
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} \text{ lb} / \mu\text{g})(M_n)}{V_{mstd}}$		=	< 0.0053 formaldehyde
		=	0.0307 acetaldehyde
		=	0.0029 propanal
		μg/dscm	
$C_{s(\mu\text{g/dscm})} = \frac{(M_n)(35.31 \text{ ft}^3 / \text{m}^3)}{(V_{mstd})}$		=	< 84.9 formaldehyde
		=	491.6 acetaldehyde
		=	45.8 propanal
Aldehydes Mass Rate:		lb/hr	
E = Q _s × C' _{s(lb/dscf)}		=	< 0.0544 formaldehyde
		=	0.3152 acetaldehyde
		=	0.0293 propanal

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-308-4

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011

BAROMETRIC: 29.92 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 139.8 °F
SQ.RT ΔP: 0.5252 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 13.43 % by volume
O₂: 5.12 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 30.35 \text{ lb/lb-mole}$$

MOLECULAR WEIGHT OF STACK GAS, wet basis

$$M_s = M_d (1 - B_{ws}) + 18(B_{ws}) = 27.93 \text{ lb/lb-mole}$$

PITOT TUBE COEFFICIENT

$$C_p \text{ (from calibration curve or geometric specifications)} = 0.84$$

AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O

$$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p} = 0.5252 \text{ in. H}_2\text{O}$$

AVERAGE ABSOLUTE STACK GAS TEMPERATURE

$$T_s = 139.8 \text{ °F} + 460 = 599.8 \text{ °R}$$

ABSOLUTE STACK GAS PRESSURE

$$P_s = P_{bar} + \frac{P_{static}}{13.6} = 29.93 \text{ in.Hg}$$

STACK GAS VELOCITY

$$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}} = 31.947 \text{ ft/sec}$$

STACK GAS VOLUMETRIC FLOW RATE, actual

$$Q_s = 60 \times V_s \times A_s = 235,227.00 \text{ acfm}$$

$$\text{Stack Area} = 122.71846 \text{ ft}^2$$

**STACK GAS VOLUMETRIC FLOW RATE,
standard conditions, wet basis**

$$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) = \begin{matrix} 207,170.56 \text{ scfm, wb} \\ 12,430,234 \text{ scfh, wb} \end{matrix}$$

**STACK GAS VOLUMETRIC FLOW RATE,
standard conditions, dry basis**

$$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws}) = \begin{matrix} 166,469.64 \text{ dscfm} \\ 9,988,179 \text{ dscfh} \end{matrix}$$



METHANOL CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
SAMPLE: Methanol
TEST DATE: 6/9/2011
RUN NO: FCCU-308-4

INPUT

Q_s : 9,988,179 dscfh
 P_{bar} : 29.92 in Hg

Spiked Train:

V_m Spiked: 60.079 liters
 V_m Spiked: 2.121 cubic ft
 Y Spiked : 1.000
 T_m Spiked: 92 °F
 ΔH Spiked: 0.63 in. H₂O

Unspiked Train:

V_m Unspiked: 59.716 liters
 V_m Unspiked: 2.109 cubic ft
 Y Sample : 1.000
 T_m Sample: 93.8 °F
 ΔH Sample: 0.61 in. H₂O

Volume of sample at standard conditions on dry basis

V_{mstd} Spiked (V_d) = $(17.647)(V_m)(Y_d)(P_{bar} + \Delta H / 13.6) / (T_m)$
 V_{mstd} Spiked ($V_{s-liters}$) = dscf x 28.32
 V_{mstd} Unspiked (V_u) = $(17.647)(V_m)(Y_d)(P_{bar} + \Delta H / 13.6) / (T_m)$
 V_{mstd} Unspiked ($V_{u-liters}$) = dscf x 28.32

English units
(29.92 in. Hg 68° F)

= 2.032 dscf
= 57.556 std liters
= 2.013 dscf
= 57.019 std liters

Recovery Calculations

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

VOC Concentration

$C_s = 2.2046 \times 10^{-9} \text{ lb}/\mu\text{g} \times M_u / V_u$
Reported $C_s = C_s / R$
ppb = $C_s * (385.26 \times 10^9 / \text{MW})$
Reported ppb = ppb/R

Stack gas volume flow rate

$Q_s = \text{dscfh}$

Stack VOC emission rate

$Q_s \times C_s$

Compound	Molecular Weight	Mass/volume (M_u) ($\mu\text{g}/\text{liter}$)	Fraction of Spike Recovered R (fractional)	VOC Concentration (lb/dscf)	Reported VOC Concentration (lb/dscf)	VOC Concentration (ppb)	Reported VOC Concentration (ppb)	Reported VOC Emission (lb/hr)
Methanol	32.04	4.92	0.89	9.9643E-08	1.1184E-07	1,198	1,345	1.11707

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-23-1/FCCU-OH-1
 TEST DATE : 6/9/2011
 START TIME : 14:47
 END TIME : 18:03

GAS ANALYZER O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.579
 AVERAGE ZERO BIAS (C_o): 0.105
 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 5.57

GAS ANALYZER CO₂

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 9.96
 AVERAGE ZERO BIAS (C_o): 0.11
 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 12.96

$$\text{Example Calculation} = C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME ELAPSED TIME O₂ CO₂

14:47	0		
14:48	1	5.53	12.97
14:49	2	5.43	13.07
14:50	3	5.49	13.01
14:51	4	5.53	12.97
14:52	5	5.55	12.96
14:53	6	5.46	13.04
14:54	7	5.37	13.12
14:55	8	5.32	13.18
14:56	9	5.21	13.28
14:57	10	5.36	13.14
14:58	11	5.25	13.25
14:59	12	5.53	12.97
15:00	13	5.42	13.07
15:01	14	5.41	13.09
15:02	15	5.34	13.14
15:03	16	5.33	13.16
15:04	17	5.29	13.20
15:05	18	5.56	12.95
15:06	19	5.47	13.03
15:07	20	5.26	13.23
15:08	21	5.38	13.11
15:09	22	5.23	13.26
15:10	23	5.33	13.16
15:11	24	5.40	13.10
15:12	25	5.36	13.13
15:13	26	5.70	12.82
15:14	27	5.45	13.03
15:15	28	5.23	13.24
15:16	29	5.16	13.33
15:17	30	5.27	13.23
15:18	31	5.39	13.10
15:19	32	5.38	13.12
15:20	33	5.41	13.08
15:21	34	5.38	13.11
15:22	35	5.30	13.18
15:23	36	5.32	13.17
15:24	37	5.44	13.06
15:25	38	5.62	12.89
15:26	39	5.37	13.11
15:27	40	5.30	13.19
15:28	41	5.20	13.28
15:29	42	5.44	13.05
15:30	43	5.44	13.04
15:31	44	5.58	12.93
15:32	45	5.42	13.06
15:33	46	5.36	13.12
15:34	47	5.36	13.14
15:35	48	5.34	13.15
15:36	49	5.31	13.18
15:37	50	5.51	12.98
15:38	51	5.50	12.99
15:39	52	5.26	13.21
15:40	53	5.33	13.14
15:41	54	5.54	12.96
15:42	55	5.33	13.16
15:43	56	5.48	13.02
15:44	57	5.44	13.05
15:45	58	5.51	12.97
15:46	59	5.25	13.23
15:47	60	5.15	13.32
15:48	61	5.46	13.03
15:49	62	5.54	12.95
15:50	63	5.35	13.13
15:51	64	5.46	13.03
15:52	65	5.51	12.97
15:53	66	5.39	13.09
15:54	67	5.25	13.23
15:55	68	5.38	13.11
15:56	69	5.53	12.95
15:57	70	5.59	12.91
15:58	71	5.36	13.12
15:59	72	5.37	13.10
16:00	73	5.37	13.11
16:01	74	5.49	13.00
16:02	75	5.44	13.04
16:03	76	5.47	13.02
16:04	77	5.60	12.90
16:05	78	5.43	13.05
16:06	79	5.43	13.06
16:07	80	5.27	13.21
16:08	81	5.43	13.06
16:09	82	5.66	12.85
16:10	83	5.68	12.83
16:11	84	5.69	12.81
16:12	85	5.61	12.89
16:13	86	5.36	13.13
16:14	87	5.55	12.94
16:15	88	5.76	12.78
16:16	89	5.59	12.91
16:17	90	5.61	12.89
16:18	91	5.57	12.93
16:19	92	5.44	13.06
16:20	93	5.53	12.95

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-23-1/FCCU-OH-1

CLOCK TIME	ELAPSED TIME	O ₂	CO ₂
16:21	94	5.53	12.96
16:22	95	5.64	12.87
16:23	96	5.81	12.73
16:24	97	5.77	12.76
16:25	98	5.56	12.94
16:26	99	5.64	12.87
16:27	100	5.44	13.04
16:28	101	5.58	12.92
16:29	102	5.60	12.90
16:30	103	5.83	12.72
16:31	104	5.72	12.79
16:32	105	5.67	12.84
16:33	106	5.61	12.89
16:34	107	5.63	12.88
16:35	108	5.73	12.79
16:36	109	5.82	12.72
16:37	110	5.72	12.80
16:38	111	5.78	12.75
16:39	112	5.85	12.69
16:40	113	5.70	12.81
16:41	114	5.60	12.89
16:42	115	5.78	12.75
16:43	116	5.83	12.71
16:44	117	5.83	12.70
16:45	118	5.85	12.69
16:46	119	5.76	12.76
16:47	120	5.69	12.82
16:48	121	5.82	12.71
16:49	122	5.81	12.72
16:50	123	5.91	12.64
16:51	124	5.86	12.68
16:52	125	5.87	12.67
16:53	126	5.65	12.85
16:54	127	5.60	12.89
16:55	128	5.61	12.89
16:56	129	5.70	12.82
16:57	130	5.84	12.70
16:58	131	5.93	12.61
16:59	132	5.98	12.58
17:00	133	5.80	12.73
17:01	134	5.68	12.82
17:02	135	5.75	12.77
17:03	136	5.86	12.68
17:04	137	6.00	12.57
17:05	138	5.90	12.65
17:06	139	5.71	12.80
17:07	140	5.83	12.70
17:08	141	5.77	12.75
17:09	142	5.76	12.76
17:10	143	5.86	12.69
17:11	144	5.89	12.65
17:12	145	5.94	12.61
17:13	146	5.78	12.74
17:14	147	5.83	12.70
17:15	148	5.90	12.64
17:16	149	5.89	12.65
17:17	150	5.98	12.57
17:18	151	5.98	12.58
17:19	152	5.98	12.57
17:20	153	5.78	12.74
17:21	154	5.83	12.69
17:22	155	5.77	12.75
17:23	156	5.87	12.66
17:24	157	5.84	12.70
17:25	158	6.01	12.55
17:26	159	5.91	12.64
17:27	160	5.86	12.67
17:28	161	5.76	12.76
17:29	162	5.81	12.71
17:30	163	5.95	12.60
17:31	164	6.09	12.48
17:32	165	5.99	12.57
17:33	166	5.89	12.64
17:34	167	5.84	12.69
17:35	168	5.84	12.69
17:36	169	5.95	12.61
17:37	170	5.95	12.60
17:38	171	5.97	12.59
17:39	172	6.07	12.50
17:40	173	5.92	12.62
17:41	174	5.82	12.71
17:42	175	5.95	12.60
17:43	176	5.93	12.61
17:44	177	5.99	12.57
17:45	178	5.94	12.61
17:46	179	5.99	12.56
17:47	180	5.89	12.64
17:48	181	5.81	12.70
17:49	182	5.80	12.72
17:50	183	6.07	12.50
17:51	184	6.08	12.49
17:52	185	5.96	12.58
17:53	186	5.99	12.55
17:54	187	5.87	12.65

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-23-1/FCCU-OH-1

CLOCK TIME	ELAPSED TIME	O ₂	CO ₂
17:55	188	5.92	12.62
17:56	189	5.95	12.59
17:57	190	5.92	12.62
17:58	191	6.09	12.47
17:59	192	6.02	12.52
18:00	193	5.99	12.55
18:01	194	5.83	12.68
18:02	195	5.98	12.56
18:03	196	6.14	12.43
Uncorrected Average (C) =		5.642	12.871

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/9/2011
RUN NUMBER: FCCU-23-1

γ FACTOR:	1.005	STACK DIAM:	150.000 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	112.287 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	97.0 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	532.0 milliliters
SQ. RT ΔP:	0.5321 in.H ₂ O	CO₂:	12.96 % by volume
ΔH:	1.36 in.H ₂ O	O₂:	5.57 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 107.223 \text{ dscf}$ <p style="text-align: center;">$\gamma = 1.005$</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS $V_{wstd} = 0.04707 \times V_{lc} = 25.041 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 532.0 \text{ mL}$</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1893$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$ <p style="text-align: center;">$S.V.P. = 5.881 \text{ in. Hg}$</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS $B_{ws} = 0.1893$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-23-1

SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/9/2011

BAROMETRIC: 29.89 in. Hg	STACK DIAM: 150.000 inches	
STATIC PRES: 0.2 in.H ₂ O	CO₂: 12.96 % by volume	
STACK TEMP: 139.8 °F	O₂: 5.57 % by volume	
SQ.RT ΔP: 0.5321 in.H ₂ O		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.296	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	27.968	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5321	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8\text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.358	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	238,259	acfm
Stack Area =	122.7184 ft ²		
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	209,630.4 12,577,825	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	169,941.7 10,196,504	dscfm dscfh

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/9/2011
RUN NO: FCCU-23-1

INPUT

V_m:	112.287 ft ³	Q_s:	10,196,504 dscfh
γ FACTOR:	1.005	T_s:	139.8 °F
P_{bar}:	29.89 in. Hg	Θ:	180 minutes
ΔH:	1.36 in. H ₂ O	V_s:	32.358 fps
T_m:	97.0 °F	P_s:	29.90 in. Hg
HCl in sample:	0.00 μg	V_{lc}:	532.0 mL

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		= 107.223 dscf
Isokinetic Sampling Rate		
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		= 99.19 % I
A _n = 0.00043374 ft ²		Runtime (θ) = 180 minutes

DIOXINS AND FURANS EMISSIONS SUMMARY

COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/9/2011
TEST RUN NO. : FCCU-23-1
TEST TIME : 14:27 - 18:03

SAMPLE VOLUME (V_{mstd}): 107.223 dscf
SAMPLE VOLUME (V_{mstd}): 3.037 dscm
GAS FLOW RATE (Q_{std}): 10,196,504 dscfh
OXYGEN CONTENT (% O_2): 5.57 %

DIOXIN / FURAN	TOTAL SAMPLE MASS (M_n) (picogram)	ESTIMATED DETECTION LIMIT (picogram)	STACK GAS CONCENTRATION (picogram/dscm)	DETECTION LIMIT STACK GAS CONCENTRATION (picogram/dscm)	STACK GAS CONCENTRATION (lb/dscf x 10^{-15})	EMISSION RATE (lb/hr x 10^{-12})
2,3,7,8-TCDD	< 0.98	< 0.98	BDL	< 0.32273	< 0.02015	< 205.456
Total TCDD	4.80	< 0.98	ADL	< 0.32273	0.09869	1006.313
1,2,3,7,8-PeCDD	< 1.90	< 1.90	BDL	< 0.62569	< 0.03907	< 398.332
Total PeCDD	< 1.90	< 1.90	BDL	< 0.62569	< 0.03907	< 398.332
1,2,3,4,7,8-HxCDD	< 0.64	< 0.64	BDL	< 0.21076	< 0.01316	< 134.175
1,2,3,6,7,8-HxCDD	< 0.64	< 0.64	BDL	< 0.21076	< 0.01316	< 134.175
1,2,3,7,8,9-HxCDD	< 0.63	< 0.63	BDL	< 0.20747	< 0.01295	< 132.079
Total HxCDD	< 0.64	< 0.64	BDL	< 0.21076	< 0.01316	< 134.175
1,2,3,4,6,7,8-HpCDD	< 1.80	< 0.89	BDL	< 0.29309	< 0.03701	< 377.367
Total HpCDD	1.97	< 0.89	ADL	< 0.29309	0.04050	413.008
1,2,3,4,6,5,7,8 OCDD	10.00	< 1.90	ADL	< 0.62569	0.20561	2096.486
2,3,7,8-TCDF	< 0.80	< 0.80	BDL	< 0.26345	< 0.01645	< 167.719
Total TCDF	< 0.80	< 0.80	BDL	< 0.26345	< 0.01645	< 167.719
1,2,3,7,8-PeCDF	< 1.40	< 1.40	BDL	< 0.46104	< 0.02879	< 293.508
2,3,4,7,8-PeCDF	< 1.40	< 1.40	BDL	< 0.46104	< 0.02879	< 293.508
Total PeCDF	< 1.40	< 1.40	BDL	< 0.46104	< 0.02879	< 293.508
1,2,3,4,7,8-HxCDF	< 0.38	< 0.38	BDL	< 0.12514	< 0.00781	< 79.666
1,2,3,6,7,8-HxCDF	< 0.37	< 0.37	BDL	< 0.12185	< 0.00761	< 77.570
2,3,4,6,7,8-HxCDF	< 0.38	< 0.38	BDL	< 0.12514	< 0.00781	< 79.666
1,2,3,7,8,9-HxCDF	< 0.42	< 0.42	BDL	< 0.13831	< 0.00864	< 88.052
Total HxCDF	< 0.42	< 0.42	BDL	< 0.13831	< 0.00864	< 88.052
1,2,3,4,6,7,8-HpCDF	< 0.42	< 0.42	BDL	< 0.13831	< 0.00864	< 88.052
1,2,3,4,7,8,9-HpCDF	< 0.51	< 0.51	BDL	< 0.16795	< 0.01049	< 106.921
Total HpCDF	< 0.51	< 0.51	BDL	< 0.16795	< 0.01049	< 106.921
1,2,3,4,6,5,7,8 OCDF	< 1.30	< 1.30	BDL	< 0.42811	< 0.02673	< 272.543
TOTAL	< 23.74		< 7.81789		< 0.48811	< 4977.058

$$C_{n,dscf} = \frac{M_{n,pq}}{V_{mstd,dscf}} \times \frac{lb}{2.2046 \times 10^{-12} \text{ pg}}$$

$$ER_{lb/hr} = C_{lb/dscf} \times Q_{std,dscfh}$$

$$\text{Emission Rate, lb/hr}$$



DIOXINS & FURANS CALCULATION SUMMARY

COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/9/2011
TEST RUN NO. : FCCU-23-1

SAMPLE VOLUME : 107.223 dscf
SAMPLE VOLUME : 3.037 dscm
GAS FLOW RATE : 10,196.504 dscfh
OXYGEN CONTENT : 5.57 %

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	AVG MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻¹⁵)	STACK GAS CONCENTRATION (µg/dscf x 10 ⁻⁵)	STACK GAS CONCENTRATION (pg/dscm)	STACK GAS CONCENTRATION (ppt)	EMISSION RATE (lb/hr) x10 ⁻⁹
TOTAL DIOXIN (AS TCDD)	19.31	333.06	0.39703	0.01801	6.35903	459.26	4.048
TCDD	4.80	333.06	0.09669	0.00448	1.58070	114.16	1.006
PeCDD	1.90	368.67	0.03907	0.00177	0.82569	40.82	0.398
HxCDD	0.64	402.75	0.01316	0.00060	0.21076	12.59	0.134
HpCDD	1.97	436.80	0.04050	0.00184	0.64875	35.73	0.413
OCDD	10.00	470.84	0.20561	0.00933	3.29313	168.24	2.096
TOTAL FURAN (AS TCDF)	4.43	317.07	0.09108	0.00413	1.45886	110.67	0.929
TCDF	0.80	317.07	0.01645	0.00075	0.26345	19.99	0.168
PeCDF	1.40	352.68	0.02879	0.00131	0.46104	31.44	0.294
HxCDF	0.42	385.18	0.00864	0.00039	0.13831	8.64	0.088
HpCDF	0.51	419.21	0.01049	0.00048	0.16795	9.64	0.107
OCDF	1.30	442.80	0.02673	0.00121	0.42811	23.26	0.273



DIOXINS & FURANS CALCULATION SUMMARY

COMPANY : Valero Port Arthur Refinery
 LOCATION : Port Arthur, Texas
 SOURCE : FCCU 1241 WGS Stack
 TEST DATE : 6/9/2011
 TEST RUN NO. : FCCU-23-1

SAMPLE VOLUME : 107.223 dscf
 GAS FLOW RATE : 3.037 dscm
 OXYGEN CONTENT : 10.196,504 dscfh
 5.57 %

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	AVG MOLECULAR WEIGHT	2,3,7,8-TCDD TOXICITY EQUIVALENCE FACTORS (TEF)	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻⁶)	STACK GAS CONCENTRATION (µg/dscf x 10 ⁻⁵)	STACK GAS CONCENTRATION (pg/dscm)	2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscm)	STACK GAS CONCENTRATION (ppt)	2,3,7,8-TCDD TOXICITY EQUIVALENCE (ppt)	EMISSION RATE (lb/hr x 10 ⁻³)	2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/hr x 10 ⁻³)
2,3,7,8-TCDD	< 0.98	319.90	1	< 0.02015	< 0.00091	< 0.32273	< 0.323	< 24.27	< 2.43E-01	< 0.2055	< 0.2055
1,2,3,7,8-PeCDD	< 1.90	355.85	0.5	< 0.03907	< 0.00177	< 0.62569	< 0.313	< 42.29	< 2.11E+01	< 0.3963	< 0.1992
1,2,3,4,7,8-HxCDD	< 0.64	389.82	0.1	< 0.01316	< 0.00060	< 0.21076	< 0.021	< 13.01	< 1.30E+00	< 0.1342	< 0.0134
1,2,3,6,7,8-HxCDD	< 0.64	389.82	0.1	< 0.01316	< 0.00060	< 0.21076	< 0.021	< 13.01	< 1.30E+00	< 0.1342	< 0.0134
1,2,3,7,8,9-HxCDD	< 0.63	389.82	0.1	< 0.01295	< 0.00059	< 0.20747	< 0.021	< 12.90	< 1.28E+00	< 0.1321	< 0.0132
1,2,3,4,6,7,8-HpCDD	< 1.80	423.78	0.01	< 0.03701	< 0.00168	< 0.59276	< 0.006	< 33.65	< 3.36E-01	< 0.3774	< 0.0038
TOTAL DIOXIN (AS TCDD)	19.31	333.06	N/A	0.39703	0.01801	6.35903	N/A	459.26	N/A	4.0483	N/A
TCDD	4.80	333.06	N/A	0.09869	0.00448	1.58070	N/A	114.16	N/A	1.0063	N/A
PeCDD	1.90	368.67	N/A	< 0.03907	0.00177	0.62569	N/A	40.82	N/A	< 0.3983	N/A
HxCDD	0.64	402.75	N/A	0.01316	0.00060	0.21076	N/A	12.59	N/A	0.1342	N/A
HpCDD	1.87	436.80	N/A	< 0.04050	0.00184	0.64875	N/A	35.73	N/A	< 0.4130	N/A
OCDD	10.00	470.84	0.00	0.20561	0.00933	3.29313	N/A	168.24	N/A	2.0965	N/A
2,3,7,8-TCDF	0.80	303.90	0.10	0.01645	0.00075	0.26345	< 0.026	20.85	< 2.09E+00	0.1677	< 0.0168
1,2,3,7,8-PeCDF	1.40	339.86	0.05	0.02679	0.00131	0.46104	< 0.023	32.63	< 1.63E+01	0.2935	< 0.0147
2,3,4,7,8-PeCDF	1.40	339.86	0.50	0.02879	0.00131	0.46104	< 0.231	32.63	< 1.63E+01	0.2935	< 0.1468
1,2,3,4,7,8-HxCDF	0.38	373.82	0.10	0.00781	0.00035	0.12514	< 0.013	8.05	< 8.05E-01	0.0797	< 0.0080
1,2,3,6,7,8-HxCDF	0.37	373.82	0.10	0.00781	0.00035	0.12514	< 0.012	7.84	< 7.84E-01	0.0776	< 0.0078
2,3,4,6,7,8-HxCDF	0.38	373.82	0.10	0.00781	0.00035	0.12514	< 0.013	8.05	< 8.05E-01	0.0797	< 0.0080
1,2,3,7,8,9-HxCDF	0.42	373.82	0.1	< 0.00864	0.00039	0.13831	< 0.014	8.90	< 8.90E-01	< 0.0881	< 0.0088
1,2,3,4,6,7,8-HpCDF	0.42	407.78	0.01	0.00864	0.00039	0.13831	< 0.001	8.16	< 8.16E-02	0.0881	< 0.0009
1,2,3,4,7,8,9-HpCDF	0.51	407.78	0.01	< 0.01049	0.00048	0.16795	< 0.002	9.91	< 9.91E-02	< 0.1069	< 0.0011
TOTAL FURAN (AS TCDF)	4.43	317.07	N/A	0.09108	0.00413	1.45886	N/A	110.67	N/A	0.9287	N/A
TCDF	0.80	317.07	N/A	0.01645	0.00075	0.26345	N/A	19.99	N/A	0.1677	N/A
PeCDF	1.40	352.68	N/A	0.02879	0.00131	0.46104	N/A	31.44	N/A	0.2935	N/A
HxCDF	0.42	385.18	N/A	0.00864	0.00039	0.13831	N/A	8.64	N/A	0.0881	N/A
HpCDF	0.51	419.21	N/A	0.01049	0.00048	0.16795	N/A	9.64	N/A	0.1069	N/A
OCDF	1.30	442.80	0.001	< 0.02873	0.00121	0.42811	N/A	23.26	N/A	< 0.2725	N/A
TOTAL 2,3,7,8-TCDD TOXICITY EQUIVALENCE							< 1.038		< 7.31E+01		< 0.661

PCBs EMISSIONS SUMMARY

COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/9/2011
TEST RUN NO. : FCCU-23-1
TEST TIME : 14:27 - 18:03

SAMPLE VOLUME (V_{nsld}): 107.223 dscf
SAMPLE VOLUME (V_{nsld}): 3.037 dscm
GAS FLOW RATE (Q_{std}): 10,196,504 dscfh
OXYGEN CONTENT ($\%O_2$): 5.57 %

PCB	COMPOUND	TOTAL SAMPLE MASS (M_n) (picogram)	ESTIMATED DETECTION LIMIT (picogram)	STACK GAS CONCENTRATION (picogram/dscm)	DETECTION LIMIT STACK GAS CONCENTRATION (picogram/dscm)	STACK GAS CONCENTRATION (lb/dscf x 10^{-15})	EMISSION RATE (lb/hr x 10^{-12})
PCB-81		< 0.52	< 0.52	< 0.17124	< 0.17124	< 0.01069	< 109.017
PCB-77		1.42	< 0.51	0.46762	< 0.16795	0.02920	297.701
PCB-123		< 0.71	< 0.45	< 0.23381	< 0.14819	< 0.01460	< 148.850
PCB-118		< 7.10	< 0.39	< 2.33812	< 0.12843	< 0.14598	< 1488.505
PCB-114		< 0.39	< 0.39	< 0.12843	< 0.12843	< 0.00802	< 81.763
PCB-105		2.91	< 0.37	0.95830	< 0.12185	0.05983	610.077
PCB-126		< 0.39	< 0.39	< 0.12843	< 0.12843	< 0.00802	< 81.763
PCB-167		< 0.67	< 0.67	< 0.22064	< 0.22064	< 0.01378	< 140.465
PCB-156		< 0.71	< 0.71	< 0.23381	< 0.23381	< 0.01460	< 148.850
PCB-157		< 0.70	< 0.70	< 0.23052	< 0.23052	< 0.01439	< 146.754
PCB-169		< 11.00	< 0.80	< 3.62244	< 0.26345	< 0.22617	< 2306.134
PCB-189		< 0.31	< 0.31	< 0.10209	< 0.10209	< 0.00637	< 64.991
TOTAL		< 26.83		< 8.83546		< 0.55165	< 5624.872

$$C_{\text{lb/dscf}} = \frac{M_{\text{ns,pg}}}{V_{\text{nsld,dscf}}} \times \frac{\text{lb}}{2.2046 \times 10^{-12} \text{ pg}}$$

$$ER_{\text{lb/hr}} = C_{\text{lb/dscf}} \times Q_{\text{std,dscfh}}$$



METHANOL CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
 LOCATION: Port Arthur, Texas
 SOURCE: 1241 FCCU WGS Stack
 SAMPLE: Methanol
 TEST DATE: 6/9/2011
 RUN NO: FCCU-308-5

INPUT

Q_s : 10,196,504 dscfh
 P_{bar} : 29.89 in Hg

Spiked Train:

V_m Spiked: 60.443 liters
 V_m Spiked: 2.134 cubic ft
 Y Spiked : 1.000
 T_m Spiked: 90.7 °F
 ΔH Spiked: 0.61 in. H₂O

Unspiked Train:

V_m Unspiked: 60.025 liters
 V_m Unspiked: 2.120 cubic ft
 Y Sample : 1.000
 T_m Sample: 91.8 °F
 ΔH Sample: 0.59 in. H₂O

Volume of sample at standard conditions on dry basis

V_{mstd} Spiked (V_s) = $(17.647)(V_m)(Y_d)(P_{bar} + \Delta H/13.6)/(T_m)$
 V_{mstd} Spiked ($V_{s-liters}$) = dscf x 28.32
 V_{mstd} Unspiked (V_u) = $(17.647)(V_m)(Y_d)(P_{bar} + \Delta H/13.6)/(T_m)$
 V_{mstd} Unspiked ($V_{u-liters}$) = dscf x 28.32

English units
 (29.92 in. Hg 68° F)

= 2.047 dscf
 = 57.981 std liters
 = 2.029 dscf
 = 57.461 std liters

Recovery Calculations

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

Stack gas volume flow rate

$Q_s = \text{dscfh}$

Stack VOC emission rate

$Q_s \times C_s$

VOC Concentration

$C_s = 2.2046 \times 10^{-9} \text{ lb}/\mu\text{g} \times M_u / V_u$
 Reported $C_s = C_s / R$
 $\text{ppb} = C_s * (385.26 \times 10^9 / \text{MW})$
 Reported $\text{ppb} = \text{ppb}/R$

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)	VOC Emission (lb/hr)	Reported VOC Emission (lb/hr)
Methanol	32.04	4.4	0.80	2.8250E-08	3.5240E-08	340	424	564.4	0.35933

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011
RUN NUMBER: FCCU-OH-1

γ FACTOR:	1.001	STACK DIAM:	150.000 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	150.755 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	97.1 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	731.8 milliliters
SQ.RT ΔP:	0.5349 in.H ₂ O	CO₂:	12.96 % by volume
ΔH:	2.20 in.H ₂ O	O₂:	5.57 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 143.653 \text{ dscf}$$

$\gamma = 1.001$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 34.446 \text{ scf}$$

$V_{lc} = 731.8 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1934$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$$

$S.V.P. = 5.881 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.1934$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-OH-1

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011

BAROMETRIC: 29.89 in. Hg	STACK DIAM: 150.000 inches
STATIC PRES: 0.2 in.H ₂ O	CO₂: 12.96 % by volume
STACK TEMP: 139.8 °F	O₂: 5.57 % by volume
SQ.RT ΔP: 0.5349 in.H ₂ O	

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.296	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	27.918	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5349	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8 \text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.558	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	239,728	acfm
Stack Area =		122.7184	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	210,922.9	scfm, wb
		12,655,371	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	170,128.6	dscfm
		10,207,716	dscfh

ONTARIO HYDRO ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/9/2011
RUN NO: FCCU-OH-1

INPUT

V_m:	150.755 ft ³	Q_s:	10,207,716 dscfh
γ FACTOR:	1.001	T_s:	139.8 °F
P_{bar}:	29.89 in. Hg	Θ:	180 minutes
ΔH:	2.20 in. H ₂ O	V_s:	32.558 fps
T_m:	97.1 °F	P_s:	29.90 in. Hg
		V_{lc}:	731.8 mL

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		= 143.653 dscf
Isokinetic Sampling Rate		
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		= 101.81 % I
A _n = 0.00056551 ft ²		Runtime (θ) = 180 minutes



Mercury Emissions Calculation Summary Ontario Hydro (ASTM Method D6784-02)

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/9/2011
Run #: FCCU-OH-1

Test Data Input

Metals Laboratory Analysis Weights (Mt)

Barometric pressure (P_{bar}):	29.89 inches Hg	Hg-FH (particle bound)	< 0.065 μg
Stack pressure (P_s):	29.90 Inches Hg Abs.	Hg-KCl (oxidized)	0.1200 μg
Test length (θ):	180.0 minutes	Hg-Acid/KMnO ₄ (elemental)	< 0.9385 μg
Sample nozzle diameter (D_n):	0.3220 inches	Hg-Total	< 1.1235 μg
Sample nozzle area (A_n):	0.000565 ft ²		
Stack temperature (T_s):	139.8 °F		
Volume metered (V_{mstd}):	143.653 dscf		
Stack gas velocity (V_s):	32.558 ft/sec		
Stack gas volumetric flow (Q_{std}):	10,207,716 dscfh		
Fractional Moisture content (B_{ws}):	0.1934 %		

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

Mercury concentration ($\mu\text{g}/\text{dscm}$):

$$C_s = \frac{M_t}{\left(\frac{V_{mstd}}{35.31 \text{ dscf / dscm}} \right)}$$

Hg-FH (particle bound)	=	< 0.01598 $\mu\text{g}/\text{dscm}$
Hg-KCl (oxidized)	=	0.02950 $\mu\text{g}/\text{dscm}$
Hg-Acid/KMnO ₄ (elemental)	=	< 0.23068 $\mu\text{g}/\text{dscm}$
Hg-Total	=	< 0.27616 $\mu\text{g}/\text{dscm}$

Mercury concentration ($\times 10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} \text{ lb}}{\mu\text{g}} \times M_t \right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	< 0.00100 $\times 10^{-9}$ lb/dscf
Hg-KCl (oxidized)	=	0.00184 $\times 10^{-9}$ lb/dscf
Hg-Acid/KMnO ₄ (elemental)	=	< 0.01440 $\times 10^{-9}$ lb/dscf
Hg-Total	=	< 0.01724 $\times 10^{-9}$ lb/dscf

Mercury emission rate ($\times 10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	< 0.10183 $\times 10^{-4}$ lb/hr
Hg-KCl (oxidized)	=	0.18799 $\times 10^{-4}$ lb/hr
Hg-Acid/KMnO ₄ (elemental)	=	< 1.47020 $\times 10^{-4}$ lb/hr
Hg-Total	=	< 1.76002 $\times 10^{-4}$ lb/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-23-2/FCCU-OH-2
 TEST DATE : 6/10/2011
 START TIME : 7:32
 END TIME : 10:55

GAS ANALYZER O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.580
 AVERAGE ZERO BIAS (C_o): 0.106
 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 5.28

GAS ANALYZER CO₂

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 10.00
 AVERAGE ZERO BIAS (C_o): 0.14
 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 13.27

$$\text{Example Calculation} = C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME ELAPSED TIME O₂ CO₂

7:32	0	---	---
7:33	1	5.34	13.19
7:34	2	5.44	13.11
7:35	3	5.35	13.20
7:36	4	5.59	12.98
7:37	5	5.47	13.10
7:38	6	5.39	13.17
7:39	7	5.33	13.23
7:40	8	5.28	13.27
7:41	9	5.22	13.35
7:42	10	5.34	13.22
7:43	11	5.44	13.13
7:44	12	5.46	13.12
7:45	13	5.46	13.11
7:46	14	5.39	13.18
7:47	15	5.22	13.35
7:48	16	5.22	13.35
7:49	17	5.26	13.32
7:50	18	5.44	13.14
7:51	19	5.43	13.14
7:52	20	5.31	13.26
7:53	21	5.37	13.20
7:54	22	5.46	13.11
7:55	23	5.28	13.29
7:56	24	5.23	13.35
7:57	25	5.20	13.38
7:58	26	5.51	13.08
7:59	27	5.35	13.23
8:00	28	5.35	13.23
8:01	29	5.25	13.32
8:02	30	5.35	13.23
8:03	31	4.94	12.10
8:04	32	5.42	13.18
8:05	33	5.44	13.15
8:06	34	5.35	13.22
8:07	35	5.28	13.29
8:08	36	5.33	13.25
8:09	37	5.35	13.24
8:10	38	5.30	13.29
8:11	39	5.38	13.21
8:12	40	5.39	13.20
8:13	41	5.37	13.21
8:14	42	5.19	13.38
8:15	43	5.27	13.32
8:16	44	5.24	13.33
8:17	45	5.46	13.13
8:18	46	5.64	12.96
8:19	47	5.45	13.14
8:20	48	5.30	13.27
8:21	49	5.48	13.10
8:22	50	5.25	13.33
8:23	51	5.28	13.30
8:24	52	5.43	13.15
8:25	53	5.52	13.07
8:26	54	5.27	13.31
8:27	55	5.34	13.25
8:28	56	5.30	13.28
8:29	57	5.36	13.09
8:30	58	3.49	6.16
8:31	59	1.67	4.07
8:32	60	1.69	4.04
8:33	61	1.61	3.88
8:34	62	1.71	4.18
8:35	63	1.63	4.10
8:36	64	1.63	4.07
8:37	65	1.61	4.08
8:38	66	1.61	4.08
8:39	67	1.66	4.04
8:40	68	1.66	4.02
8:41	69	1.69	4.00
8:42	70	1.64	4.04
8:43	71	1.67	4.03
8:44	72	1.62	4.06
8:45	73	1.60	4.08
8:46	74	3.81	9.58
8:47	75	5.45	13.04
8:48	76	5.46	13.06
8:49	77	5.38	13.15
8:50	78	5.27	13.28
8:51	79	5.26	13.29
8:52	80	5.36	13.21
8:53	81	5.26	13.31
8:54	82	5.32	13.26
8:55	83	5.37	13.21
8:56	84	5.23	13.34
8:57	85	5.10	13.47
8:58	86	5.16	13.42
8:59	87	5.34	13.24
9:00	88	5.51	13.08
9:01	89	5.43	13.16
9:02	90	5.22	13.36
9:03	91	5.13	13.44
9:04	92	5.26	13.33
9:05	93	5.32	13.28

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-23-2/FCCU-OH-2

CLOCK TIME ELAPSED TIME O₂ CO₂

9:06	94	5.42	13.17
9:07	95	5.33	13.26
9:08	96	5.43	13.15
9:09	97	5.41	13.17
9:10	98	5.22	13.36
9:11	99	5.29	13.30
9:12	100	5.45	13.14
9:13	101	5.33	13.26
9:14	102	5.27	13.32
9:15	103	5.31	13.26
9:16	104	5.31	13.28
9:17	105	5.31	13.28
9:18	106	5.31	13.29
9:19	107	5.38	13.22
9:20	108	5.43	13.16
9:21	109	5.44	13.15
9:22	110	5.31	13.29
9:23	111	5.27	13.33
9:24	112	5.30	13.30
9:25	113	5.21	13.38
9:26	114	5.37	13.23
9:27	115	5.58	13.02
9:28	116	5.42	13.18
9:29	117	5.38	13.22
9:30	118	5.44	13.15
9:31	119	5.24	13.35
9:32	120	5.32	13.27
9:33	121	5.37	13.22
9:34	122	5.42	13.18
9:35	123	5.41	13.19
9:36	124	5.40	13.19
9:37	125	5.45	13.14
9:38	126	5.30	13.28
9:39	127	5.28	13.31
9:40	128	5.37	13.23
9:41	129	5.35	13.25
9:42	130	5.48	13.12
9:43	131	5.26	13.33
9:44	132	5.31	13.28
9:45	133	5.36	13.24
9:46	134	5.31	13.27
9:47	135	5.21	13.38
9:48	136	5.42	13.18
9:49	137	5.54	13.06
9:50	138	5.49	13.10
9:51	139	5.34	13.24
9:52	140	5.45	13.15
9:53	141	5.35	13.23
9:54	142	5.38	13.21
9:55	143	5.43	13.16
9:56	144	5.36	13.23
9:57	145	5.37	13.22
9:58	146	5.34	13.25
9:59	147	5.29	13.30
10:00	148	5.30	13.30
10:01	149	5.35	13.24
10:02	150	5.37	13.23
10:03	151	5.52	13.07
10:04	152	5.51	13.08
10:05	153	5.30	13.29
10:06	154	5.16	13.42
10:07	155	5.25	13.33
10:08	156	5.38	13.21
10:09	157	5.29	13.30
10:10	158	5.33	13.28
10:11	159	5.46	13.14
10:12	160	5.46	13.13
10:13	161	5.28	13.30
10:14	162	5.35	13.23
10:15	163	5.23	13.35
10:16	164	5.47	13.13
10:17	165	5.48	13.11
10:18	166	5.41	13.19
10:19	167	5.33	13.26
10:20	168	5.36	13.22
10:21	169	5.30	13.29
10:22	170	5.37	13.22
10:23	171	5.40	13.19
10:24	172	5.41	13.18
10:25	173	5.47	13.12
10:26	174	5.50	13.09
10:27	175	5.47	13.11
10:28	176	5.27	13.32
10:29	177	5.27	13.31
10:30	178	5.24	13.35
10:31	179	5.31	13.28
10:32	180	5.47	13.14
10:33	181	5.37	13.22
10:34	182	5.34	13.24
10:35	183	5.23	13.35
10:36	184	5.22	13.37
10:37	185	5.24	13.35
10:38	186	5.27	13.32
10:39	187	5.33	13.25

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-23-2/FCCU-OH-2

CLOCK TIME	ELAPSED TIME	O ₂	CO ₂
10:40	188	5.51	13.08
10:41	189	5.40	13.19
10:42	190	5.34	13.24
10:43	191	5.26	13.32
10:44	192	5.25	13.33
10:45	193	5.29	13.30
10:46	194	5.42	13.17
10:47	195	5.57	13.02
10:48	196	5.30	13.27
10:49	197	5.37	13.21
10:50	198	5.48	13.10
10:51	199	5.23	13.34
10:52	200	5.42	13.18
10:53	201	5.48	13.11
10:54	202	5.24	13.35
10:55	203	5.27	13.31
Uncorrected Average (C) =		5.351	13.225

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/10/2011
RUN NUMBER: FCCU-23-2

γ FACTOR:	1.005	STACK DIAM:	150.000 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	112.414 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	94.1 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	779.5 milliliters
SQ. RT ΔP:	0.5374 in.H ₂ O	CO₂:	13.27 % by volume
ΔH:	1.38 in.H ₂ O	O₂:	5.28 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 107.912 \text{ dscf}$ <p style="text-align: center;">$\gamma = 1.005$</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS $V_{wstd} = 0.04707 \times V_{lc} = 36.691 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 779.5 \text{ mL}$</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2537$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$ <p style="text-align: center;">$S.V.P. = 5.881 \text{ in. Hg}$</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS $B_{ws} = 0.1967$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-23-2

SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/10/2011

BAROMETRIC: 29.89 in. Hg	STACK DIAM: 150.000 inches	
STATIC PRES: 0.2 in.H ₂ O	CO₂: 13.27 % by volume	
STACK TEMP: 139.8 °F	O₂: 5.28 % by volume	
SQ. RT ΔP: 0.5374 in.H ₂ O		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.33	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	27.91	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5374	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8\text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.716	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	240,889	acfm
Stack Area =		122.7184	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	211,944.5 12,716,668	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	170,263.9 10,215,833	dscfm dscfh

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/10/2011
RUN NO: FCCU-23-2

INPUT

V_m:	112.414 ft ³	Q_s:	10,215,833 dscfh
γ FACTOR:	1.005	T_s:	139.8 °F
P_{bar}:	29.89 in. Hg	Θ:	180 minutes
ΔH:	1.38 in. H ₂ O	V_s:	32.716 fps
T_m:	94.1 °F	P_s:	29.90 in. Hg
HCl in sample:	0.00 μg	V_{lc}:	779.5 mL

**Volume of Sample at Standard
 Conditions on a Dry Basis:**

**English Units
 (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 107.912 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 107.26 \% I$$

99.47 % I* @saturation

A_n = 0.00043374 ft² Runtime (θ) = 60 minutes

DIOXINS AND FURANS EMISSIONS SUMMARY

COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/10/2011
TEST RUN NO. : FCCU-23-2
TEST TIME : 07:32 - 10:55

SAMPLE VOLUME (V_{msld}): 107.912 dscf
SAMPLE VOLUME (V_{msld}): 3.056 dscm
GAS FLOW RATE (Q_{std}): 10,215,833 dscfh
OXYGEN CONTENT ($\%O_2$): 5.28 %

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (M_n) (picogram)	ESTIMATED DETECTION LIMIT (picogram)	STACK GAS CONCENTRATION (picogram/dscm)	DETECTION LIMIT STACK GAS CONCENTRATION (picogram/dscm)	STACK GAS CONCENTRATION (lb/dscf x 10^{-15})	EMISSION RATE (lb/hr x 10^{-12})
2,3,7,8-TCDD	< 0.87	< 0.87	BDL	< 0.28467	< 0.01777	< 181.574
Total TCDD	< 0.87	< 0.87	BDL	< 0.28467	< 0.01777	< 181.574
1,2,3,7,8-PeCDD	< 1.70	< 1.70	BDL	< 0.55626	< 0.03473	< 354.800
Total PeCDD	< 1.70	< 1.70	BDL	< 0.55626	< 0.03473	< 354.800
1,2,3,4,7,8-HxCDD	< 0.80	< 0.80	BDL	< 0.26177	< 0.01634	< 166.965
1,2,3,6,7,8-HxCDD	< 0.79	< 0.79	BDL	< 0.25850	< 0.01614	< 164.878
1,2,3,7,8,9-HxCDD	< 0.78	< 0.78	BDL	< 0.25523	< 0.01594	< 162.791
Total HxCDD	< 0.80	< 0.80	BDL	< 0.26177	< 0.01634	< 166.965
1,2,3,4,6,7,8-HpCDD	< 2.70	< 0.53	BDL	< 0.88347	< 0.05516	< 563.507
Total HpCDD	2.84	< 0.53	ADL	0.92928	0.05802	592.725
1,2,3,4,6,5,7,8-OCDD	16.80	< 1.50	ADL	5.49716	0.34322	3506.263
2,3,7,8-TCDF	< 1.50	< 1.50	BDL	< 0.49082	< 0.03064	< 313.059
Total TCDF	< 1.50	< 1.50	BDL	< 0.49082	< 0.03064	< 313.059
1,2,3,7,8-PeCDF	< 1.40	< 1.40	BDL	< 0.45810	< 0.02860	< 292.189
2,3,4,7,8-PeCDF	2.49	< 1.40	ADL	0.81476	0.05087	519.678
Total PeCDF	4.19	< 1.40	ADL	1.37102	0.08560	874.479
1,2,3,4,7,8-HxCDF	< 0.90	< 0.65	BDL	< 0.29449	< 0.01839	< 187.836
1,2,3,6,7,8-HxCDF	< 1.10	< 0.62	BDL	< 0.35993	< 0.02247	< 229.577
2,3,4,6,7,8-HxCDF	1.51	< 0.64	ADL	0.49409	0.03085	315.146
1,2,3,7,8,9-HxCDF	< 0.71	< 0.71	BDL	< 0.23232	< 0.01451	< 148.181
Total HxCDF	4.15	< 0.71	ADL	1.35793	0.08478	866.130
1,2,3,4,6,7,8-HpCDF	2.67	< 0.44	ADL	0.87366	0.05455	557.245
1,2,3,4,7,8,9-HpCDF	0.96	< 0.54	ADL	0.31511	0.01967	200.984
Total HpCDF	3.64	< 0.54	ADL	1.19105	0.07436	759.690
1,2,3,4,6,5,7,8-OCDF	< 1.30	< 1.20	BDL	< 0.42538	< 0.02656	< 271.318
TOTAL	< 37.79		< 12.36534		< 0.77204	< 7887.004

$$C_{b/dscf} = \frac{M_{\text{avg}}}{V_{\text{msld dscf}}} \times \frac{\text{lb}}{2.2046 \times 10^{-12} \text{ pg}}$$

Emission Rate, lb/hr

$$ER_{b/hr} = C_{b/dscf} \times Q_{\text{std dscfh}}$$

DIOXINS & FURANS CALCULATION SUMMARY



COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/10/2011
TEST RUN NO. : FCCU-23-2

SAMPLE VOLUME : 107.912 dscf
SAMPLE VOLUME : 3.056 dscm
GAS FLOW RATE : 10,215.833 dscfh
OXYGEN CONTENT : 5.28 %

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	AVG MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻¹⁵)	STACK GAS CONCENTRATION (µg/dscf x 10 ⁻⁵)	STACK GAS CONCENTRATION (pg/dscm)	STACK GAS CONCENTRATION (ppt)	EMISSION RATE (lb/hr) x10 ⁻⁹
TOTAL DIOXIN (AS TCDD)	23.01	333.06	0.47009	0.02132	7.52916	543.76	4.802
TCDD	0.87	333.06	0.01777	0.00081	0.28467	20.56	0.182
PeCDD	1.70	368.67	0.03473	0.00158	0.55626	36.29	0.355
HxCDD	0.80	402.75	0.01634	0.00074	0.26177	15.63	0.167
HpCDD	2.84	436.80	0.05802	0.00263	0.92928	51.17	0.593
OCDD	16.80	470.84	0.34322	0.01557	5.49716	280.84	3.506
TOTAL FURAN (AS TCDF)	14.78	317.07	0.30195	0.01370	4.83619	366.89	3.085
TCDF	1.50	317.07	0.03064	0.00139	0.49082	37.24	0.313
PeCDF	4.19	352.68	0.08560	0.00388	1.37102	93.51	0.874
HxCDF	4.15	385.18	0.08478	0.00385	1.35793	84.80	0.866
HpCDF	3.64	419.21	0.07436	0.00337	1.19105	66.34	0.760
OCDF	1.30	442.80	0.02656	0.00120	0.42538	23.11	0.271

DIOXINS & FURANS CALCULATION SUMMARY



COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/10/2011
TEST RUN NO. : FCCU-23-2

SAMPLE VOLUME : 107.912 dscf
SAMPLE VOLUME : 3.056 dscm
GAS FLOW RATE : 10,215,833 dscfh
OXYGEN CONTENT : 5.28 %

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	AVG MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻¹⁵)	STACK GAS CONCENTRATION (µg/dscf x 10 ⁻⁵)	STACK GAS CONCENTRATION (pg/dscm)	STACK GAS CONCENTRATION (ppt)	EMISSION RATE (lb/hr) x10 ⁹
TOTAL DIOXIN (AS TCDD)	23.01	333.06	0.47009	0.02132	7.52915	543.76	4.802
TCDD	0.87	333.06	0.01777	0.00081	0.28467	20.56	0.182
PeCDD	1.70	388.67	0.03473	0.00188	0.55626	36.29	0.355
HxCDD	0.80	402.75	0.01634	0.00074	0.26177	15.63	0.167
HpCDD	2.84	436.80	0.05802	0.00263	0.92928	51.17	0.593
OCDD	16.80	470.84	0.34322	0.01557	5.49716	280.84	3.506
TOTAL FURAN (AS TCDF)	14.78	317.07	0.30195	0.01370	4.83619	366.89	3.085
TCDF	1.50	317.07	0.03064	0.00139	0.49082	37.24	0.313
PeCDF	4.19	352.68	0.08560	0.00388	1.37102	93.51	0.874
HxCDF	4.15	385.18	0.08478	0.00385	1.35793	84.80	0.866
HpCDF	3.64	419.21	0.07436	0.00337	1.19105	68.34	0.760
OCDF	1.30	442.80	0.02656	0.00120	0.42538	23.11	0.271

PCBs EMISSIONS SUMMARY

COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/10/2011
TEST RUN NO. : FCCU-23-2
TEST TIME : 07:32 - 10:55

SAMPLE VOLUME (V_{mstd}): 107.912 dscf
SAMPLE VOLUME (V_{mstd}): 3.056 dscm
GAS FLOW RATE (Q_{std}): 10,215,833 dscfh
OXYGEN CONTENT (%O₂): 5.28 %

PCB COMPOUND	TOTAL SAMPLE MASS (M_n) (picogram)	ESTIMATED DETECTION LIMIT (picogram)	DETECTION LIMIT		STACK GAS CONCENTRATION (picogram/dscm)	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻¹⁵)	EMISSION RATE (lb/hr x 10 ⁻¹²)
			STACK GAS CONCENTRATION (picogram/dscm)	STACK GAS CONCENTRATION (picogram/dscm)			
PCB-81	< 0.60	< 0.60	BDL	< 0.19633	< 0.19633	< 0.01226	< 125.224
PCB-77	< 1.20	< 0.67	BDL	< 0.39265	< 0.21923	< 0.02452	< 250.447
PCB-123	< 0.77	< 0.51	BDL	< 0.25195	< 0.16688	< 0.01573	< 160.704
PCB-118	< 8.40	< 0.48	BDL	< 2.74858	< 0.15706	< 0.17161	< 1753.131
PCB-114	< 0.46	< 0.46	BDL	< 0.15052	< 0.15052	< 0.00940	< 96.005
PCB-105	3.98	< 0.45	ADL	1.30230	< 0.14725	0.08131	830.650
PCB-126	< 0.50	< 0.50	BDL	< 0.16361	< 0.16361	< 0.01021	< 104.353
PCB-167	< 0.52	< 0.52	BDL	< 0.17015	< 0.17015	< 0.01062	< 108.527
PCB-156	< 0.52	< 0.52	BDL	< 0.17015	< 0.17015	< 0.01062	< 108.527
PCB-157	0.86	< 0.52	ADL	0.28108	< 0.17015	0.01755	179.279
PCB-169	< 12.00	< 0.55	BDL	< 3.92654	< 0.17997	< 0.24516	< 2504.473
PCB-189	< 0.38	< 0.38	BDL	< 0.12434	< 0.12434	< 0.00776	< 79.308
TOTAL	< 30.19			< 9.87821		< 0.61675	< 6300.629

Concentration, lb/dscf

Emission Rate, lb/hr

$$C_{lb/dscf} = \frac{M_{n,pg}}{V_{mstd,dscf}} \times \frac{lb}{2.2046 \times 10^{-12} pg}$$

$$ER_{lb/hr} = C_{lb/dscf} \times Q_{std,dscfh}$$

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011
RUN NUMBER: FCCU-OH-2

γ FACTOR:	1.001	STACK DIAM:	150.000 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	148.760 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	95.3 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	719.7 milliliters
SQ.RT ΔP:	0.5308 in.H ₂ O	CO₂:	13.27 % by volume
ΔH:	2.15 in.H ₂ O	O₂:	5.28 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 142.194 \text{ dscf}$$

$\gamma = 1.001$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 33.876 \text{ scf}$$

$V_{lc} = 719.7 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1924$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$$

$S.V.P. = 5.881 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.1924$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-OH-2

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011

BAROMETRIC: 29.89 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 139.8 °F
SQ.RT ΔP: 0.5308 in.H₂O

STACK DIAM: 150.000 inches
CO₂: 13.27 % by volume
O₂: 5.28 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.33	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	27.96	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5308	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8\text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.284	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	237,707	acfm
Stack Area =		122.7184	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	209,144.9	scfm, wb
		12,548,693	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	168,905.0	dscfm
		10,134,301	dscfh

ONTARIO HYDRO ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011
RUN NO: FCCU-OH-2

INPUT

V_m:	148.760 ft ³	Q_s:	10,134,301 dscfh
γ FACTOR:	1.001	T_s:	139.8 °F
P_{bar}:	29.89 in. Hg	Θ:	180 minutes
ΔH:	2.15 in. H ₂ O	V_s:	32.284 fps
T_m:	95.3 °F	P_s:	29.90 in. Hg
		V_{lc}:	719.7 mL

**Volume of Sample at Standard
Conditions on a Dry Basis:**

**English Units
(29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 142.194 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 101.51 \% I$$

A_n = 0.00056551 ft²
Runtime (θ) = 60 minutes



Mercury Emissions Calculation Summary Ontario Hydro (ASTM Method D6784-02)

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/10/2011
Run #: FCCU-OH-2

Test Data Input

Barometric pressure (P_{bar}): 29.89 inches Hg
Stack pressure (P_s): 29.90 Inches Hg Abs.
Test length (θ): 180.0 minutes
Sample nozzle diameter (D_n): 0.3220 inches
Sample nozzle area (A_n): 0.000565 ft²
Stack temperature (T_s): 139.8 °F
Volume metered (V_{mstd}): 142.194 dscf
Stack gas velocity (V_s): 32.284 ft/sec
Stack gas volumetric flow (Q_{std}): 10,134,301 dscfh
Fractional Moisture content (B_{ws}): 0.1924 %

Metals Laboratory Analysis Weights (Mt)

Hg-FH (particle bound) < 0.065 µg
Hg-KCl (oxidized) 0.1620 µg
Hg-Acid/KMnO₄ (elemental) < 0.9250 µg
Hg-Total < 1.1520 µg

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

Mercury concentration (µg/dscm):

$$C_s = \left[\frac{M_t}{\left(\frac{V_{mstd}}{35.31 \text{ dscf / dscm}} \right)} \right]$$

Hg-FH (particle bound) = < 0.01614 µg/dscm
Hg-KCl (oxidized) = 0.04023 µg/dscm
Hg-Acid/KMnO₄ (elemental) = < 0.22970 µg/dscm
Hg-Total = < 0.28607 µg/dscm

Mercury concentration ($\times 10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} \text{ lb}}{\mu\text{g}} \times M_t \right)}{V_{mstd}}$$

Hg-FH (particle bound) = < 0.00101 $\times 10^{-9}$ lb/dscf
Hg-KCl (oxidized) = 0.00251 $\times 10^{-9}$ lb/dscf
Hg-Acid/KMnO₄ (elemental) = < 0.01434 $\times 10^{-9}$ lb/dscf
Hg-Total = < 0.01786 $\times 10^{-9}$ lb/dscf

Mercury emission rate ($\times 10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound) = < 0.10213 $\times 10^{-4}$ lb/hr
Hg-KCl (oxidized) = 0.25454 $\times 10^{-4}$ lb/hr
Hg-Acid/KMnO₄ (elemental) = < 1.45339 $\times 10^{-4}$ lb/hr
Hg-Total = < 1.81007 $\times 10^{-4}$ lb/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-23-3/FCCU-OH-3/FCCU-0061-3
 TEST DATE : 6/10/2011
 START TIME : 12:28
 END TIME : 16:33

GAS ANALYZER

O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.574
 AVERAGE ZERO BIAS (C_o): 0.096
 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 5.29

GAS ANALYZER

CO₂

SPAN VALUE : 19.80 %
 AVERAGE CAL. BIAS (C_m): 9.99
 AVERAGE ZERO BIAS (C_o): 0.13
 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 13.25

$$\text{Example Calculation} = C_{\text{gas}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME ELAPSED TIME O₂ CO₂

12:28	0		
12:29	1	5.22	13.35
12:30	2	5.27	13.31
12:31	3	5.22	13.35
12:32	4	5.40	13.18
12:33	5	5.47	13.12
12:34	6	5.51	13.07
12:35	7	5.36	13.22
12:36	8	5.24	13.33
12:37	9	5.18	13.39
12:38	10	5.34	13.23
12:39	11	5.37	13.22
12:40	12	5.39	13.19
12:41	13	5.36	13.22
12:42	14	5.38	13.19
12:43	15	5.35	13.22
12:44	16	5.27	13.30
12:45	17	5.17	13.40
12:46	18	5.24	13.34
12:47	19	5.50	13.09
12:48	20	5.54	13.04
12:49	21	5.30	13.27
12:50	22	5.41	13.16
12:51	23	5.27	13.30
12:52	24	5.29	13.28
12:53	25	5.33	13.24
12:54	26	5.50	13.08
12:55	27	5.41	13.16
12:56	28	5.32	13.26
12:57	29	5.34	13.23
12:58	30	5.31	13.26
12:59	31	5.40	13.17
13:00	32	5.36	13.22
13:01	33	5.63	12.94
13:02	34	5.41	13.17
13:03	35	5.42	13.16
13:04	36	5.43	13.15
13:05	37	5.22	13.34
13:06	38	5.24	13.33
13:07	39	5.35	13.23
13:08	40	5.40	13.17
13:09	41	5.54	13.03
13:10	42	5.47	13.11
13:11	43	5.38	13.20
13:12	44	5.45	13.13
13:13	45	5.37	13.20
13:14	46	5.19	13.37
13:15	47	5.34	13.23
13:16	48	5.37	13.21
13:17	49	5.45	13.14
13:18	50	5.50	13.09
13:19	51	5.47	13.10
13:20	52	5.36	13.20
13:21	53	5.50	13.08
13:22	54	5.26	13.31
13:23	55	5.36	13.22
13:24	56	5.46	13.12
13:25	57	5.53	13.05
13:26	58	5.40	13.18
13:27	59	5.44	13.13
13:28	60	5.48	13.09
13:29	61	5.40	13.17
13:30	62	5.31	13.26
13:31	63	5.33	13.26
13:32	64	5.38	13.21
13:33	65	5.37	13.21
13:34	66	5.36	13.21
13:35	67	5.28	13.29
13:36	68	5.29	13.29
13:37	69	5.30	13.27
13:38	70	5.42	13.16
13:39	71	5.50	13.08
13:40	72	5.44	13.14
13:41	73	5.36	13.21
13:42	74	5.27	13.30
13:43	75	5.22	13.35
13:44	76	5.30	13.28
13:45	77	5.33	13.25
13:46	78	5.52	13.07
13:47	79	5.35	13.22
13:48	80	5.27	13.30
13:49	81	5.42	13.15
13:50	82	5.21	13.36
13:51	83	5.25	13.32
13:52	84	5.51	13.08
13:53	85	5.40	13.18
13:54	86	5.37	13.21
13:55	87	5.35	13.22
13:56	88	5.32	13.26
13:57	89	5.20	13.36
13:58	90	5.22	13.34
13:59	91	5.26	13.31
14:00	92	5.32	13.26
14:01	93	5.39	13.19

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-23-3/FCCU-OH-3/FCCU-0061-3

CLOCK TIME ELAPSEO TIME O₂ CO₂

14:02	94	5.54	13.03
14:03	95	5.37	13.20
14:04	96	5.24	13.33
14:05	97	5.21	13.35
14:06	98	5.24	13.34
14:07	99	5.40	13.19
14:08	100	5.43	13.15
14:09	101	5.37	13.21
14:10	102	5.25	13.30
14:11	103	5.32	13.26
14:12	104	5.33	13.25
14:13	105	5.37	13.21
14:14	106	5.49	13.09
14:15	107	5.41	13.16
14:16	108	5.48	13.09
14:17	109	5.35	13.22
14:18	110	5.16	13.40
14:19	111	5.37	13.20
14:20	112	5.41	13.16
14:21	113	5.47	13.10
14:22	114	5.32	13.25
14:23	115	5.40	13.17
14:24	116	5.41	13.16
14:25	117	5.22	13.33
14:26	118	5.39	13.17
14:27	119	5.35	13.22
14:28	120	5.41	13.17
14:29	121	5.42	13.14
14:30	122	5.34	13.22
14:31	123	5.22	13.34
14:32	124	5.25	13.32
14:33	125	5.35	13.21
14:34	126	5.47	13.10
14:35	127	5.50	13.08
14:36	128	5.31	13.26
14:37	129	5.21	13.34
14:38	130	5.42	13.14
14:39	131	5.33	13.23
14:40	132	5.38	13.19
14:41	133	5.45	13.12
14:42	134	5.35	13.22
14:43	135	5.45	13.12
14:44	136	5.35	13.22
14:45	137	5.19	13.37
14:46	138	5.25	13.31
14:47	139	5.27	13.30
14:48	140	5.40	13.17
14:49	141	5.40	13.17
14:50	142	5.29	13.27
14:51	143	5.33	13.23
14:52	144	5.25	13.31
14:53	145	5.37	13.19
14:54	146	5.24	13.32
14:55	147	5.48	13.10
14:56	148	5.44	13.13
14:57	149	5.39	13.18
14:58	150	5.27	13.28
14:59	151	5.39	13.17
15:00	152	5.33	13.24
15:01	153	5.35	13.20
15:02	154	5.39	13.18
15:03	155	5.52	13.05
15:04	156	5.50	13.06
15:05	157	5.34	13.22
15:06	158	5.33	13.23
15:07	159	5.22	13.33
15:08	160	5.30	13.25
15:09	161	5.49	13.07
15:10	162	5.44	13.12
15:11	163	5.45	13.11
15:12	164	5.37	13.18
15:13	165	5.34	13.21
15:14	166	5.35	13.20
15:15	167	5.31	13.24
15:16	168	5.29	13.25
15:17	169	5.42	13.14
15:18	170	5.49	13.07
15:19	171	5.41	13.14
15:20	172	5.23	13.31
15:21	173	5.32	13.23
15:22	174	5.32	13.22
15:23	175	5.38	13.17
15:24	176	5.45	13.11
15:25	177	5.41	13.14
15:26	178	5.22	13.32
15:27	179	5.18	13.37
15:28	180	5.08	13.47
15:29	181	5.33	13.22
15:30	182	5.41	13.15
15:31	183	5.36	13.21
15:32	184	5.36	13.20
15:33	185	5.39	13.17
15:34	186	5.24	13.30
15:35	187	5.22	13.33

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-23-3/FCCU-OH-3/FCCU-0061-3

CLOCK TIME	ELAPSED TIME	O ₂	CO ₂
15:36	188	5.22	13.33
15:37	189	5.40	13.17
15:38	190	5.38	13.18
15:39	191	5.50	13.06
15:40	192	5.35	13.19
15:41	193	5.39	13.16
15:42	194	5.30	13.25
15:43	195	5.42	13.14
15:44	196	5.43	13.13
15:45	197	5.44	13.12
15:46	198	5.37	13.18
15:47	199	5.29	13.26
15:48	200	5.18	13.37
15:49	201	5.44	13.12
15:50	202	5.50	13.06
15:51	203	5.46	13.09
15:52	204	5.32	13.22
15:53	205	5.43	13.12
15:54	206	5.22	13.32
15:55	207	5.24	13.31
15:56	208	5.42	13.13
15:57	209	5.42	13.13
15:58	210	5.51	13.04
15:59	211	5.41	13.13
16:00	212	5.35	13.19
16:01	213	5.09	13.45
16:02	214	5.32	13.23
16:03	215	5.38	13.17
16:04	216	5.51	13.04
16:05	217	5.34	13.20
16:06	218	5.19	13.34
16:07	219	5.28	13.26
16:08	220	5.45	13.10
16:09	221	5.47	13.09
16:10	222	5.47	13.09
16:11	223	5.31	13.24
16:12	224	5.37	13.18
16:13	225	5.25	13.29
16:14	226	5.42	13.14
16:15	227	5.28	13.27
16:16	228	5.47	13.09
16:17	229	5.38	13.17
16:18	230	5.54	13.01
16:19	231	5.32	13.21
16:20	232	5.26	13.28
16:21	233	5.31	13.23
16:22	234	5.43	13.12
16:23	235	5.43	13.12
16:24	236	5.36	13.19
16:25	237	5.41	13.14
16:26	238	5.28	13.26
16:27	239	5.26	13.28
16:28	240	5.30	13.25
16:29	241	5.37	13.18
16:30	242	5.43	13.13
16:31	243	5.48	13.06
16:32	244	5.43	13.11
16:33	245	5.44	13.09
Uncorrected Average (C) =		5.360	13.204

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/10/2011
RUN NUMBER: FCCU-23-3

γ FACTOR:	1.005	STACK DIAM:	150.000 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	113.759 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	100.2 °F
STACK TEMP:	139.7 °F	LIQUID COLL:	541.1 milliliters
SQ.RT ΔP:	0.5402 in.H ₂ O	CO₂:	13.25 % by volume
ΔH:	1.40 in.H ₂ O	O₂:	5.29 % by volume

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 108.019 \text{ dscf}$$

$\gamma = 1.005$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 25.470 \text{ scf}$$

$V_{lc} = 541.1 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1908$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$$

$S.V.P. = 5.881 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$B_{ws} = 0.1908$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-23-3

SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/10/2011

BAROMETRIC: 29.89 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 139.7 °F
SQ.RT ΔP: 0.5402 in.H₂O

STACK DIAM: 150.000 inches
CO₂: 13.25 % by volume
O₂: 5.29 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.33	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	27.98	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5402	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.7 \text{ °F} + 460$	=	599.7	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg}\sqrt{\Delta P})\sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.842	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	241,821	acfm
Stack Area =		122.7184	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	212,799.8 12,767,990	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	172,197.7 10,331,862	dscfm dscfh

METHOD 23 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: FCCU 1241 WGS Stack
TEST DATE: 6/10/2011
RUN NO: FCCU-23-3

INPUT

V_m:	113.759 ft ³	Q_s:	10,331,862 dscfh
γ FACTOR:	1.005	T_s:	139.7 °F
P_{bar}:	29.89 in. Hg	Θ:	180 minutes
ΔH:	1.40 in. H ₂ O	V_s:	32.842 fps
T_m:	100.2 °F	P_s:	29.90 in. Hg
HCl in sample:	0.00 μg	V_{lc}:	541.1 mL

**Volume of Sample at Standard
 Conditions on a Dry Basis:**

**English Units
 (29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 108.019 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 98.61 \% I$$

A_n = 0.00043374 ft² Runtime (θ) = 60 minutes

DIOXINS AND FURANS EMISSIONS SUMMARY

COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/10/2011
TEST RUN NO. : FCCU-23-3
TEST TIME : 12:27 - 16:14

SAMPLE VOLUME (V_{msid}): 108.019 dscf
SAMPLE VOLUME (V_{msid}): 3.059 dscm
GAS FLOW RATE (Q_{gid}): 10,331,862 dscfh
OXYGEN CONTENT ($\%O_2$): 5.29 %

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (M_n) (picogram)	ESTIMATED DETECTION LIMIT (picogram)	STACK GAS CONCENTRATION (picogram/dscm)	DETECTION LIMIT STACK GAS CONCENTRATION (picogram/dscm)	STACK GAS CONCENTRATION (lb/dscf x 10^{-15})	EMISSION RATE (lb/hr x 10^{-12})
2,3,7,8-TCDD	< 0.77	< 0.77	BDL	< 0.25170	< 0.01572	< 162.367
Total TCDD	< 0.77	< 0.77	BDL	< 0.25170	< 0.01572	< 162.367
1,2,3,7,8-PeCDD	< 1.40	< 1.40	BDL	< 0.45764	< 0.02857	< 295.214
Total PeCDD	< 1.40	< 1.40	BDL	< 0.45764	< 0.02857	< 295.214
1,2,3,4,7,8-HxCDD	< 1.00	< 1.00	BDL	< 0.32689	< 0.02041	< 210.867
1,2,3,6,7,8-HxCDD	< 0.98	< 0.98	BDL	< 0.32035	< 0.02000	< 206.649
1,2,3,7,8,9-HxCDD	< 0.98	< 0.98	BDL	< 0.32035	< 0.02000	< 206.649
Total HxCDD	< 1.00	< 1.00	BDL	< 0.32689	< 0.02041	< 210.867
1,2,3,4,6,7,8-HpCDD	< 1.70	< 0.56	BDL	< 0.18306	< 0.03470	< 358.474
Total HpCDD	2.58	< 0.56	ADL	< 0.18306	0.05266	544.036
1,2,3,4,6,5,7,8-OCDD	< 11.00	< 1.70	BDL	< 0.55571	< 0.22450	< 2319.535
2,3,7,8-TCDF	< 0.83	< 0.83	BDL	< 0.27132	< 0.01694	< 175.019
Total TCDF	< 0.83	< 0.83	BDL	< 0.27132	< 0.01694	< 175.019
1,2,3,7,8-PeCDF	< 1.50	< 1.50	BDL	< 0.49033	< 0.03061	< 316.300
2,3,4,7,8-PeCDF	< 1.50	< 1.50	BDL	< 0.49033	< 0.03061	< 316.300
Total PeCDF	< 1.50	< 1.50	BDL	< 0.49033	< 0.03061	< 316.300
1,2,3,4,7,8-HxCDF	< 0.61	< 0.61	BDL	< 0.19940	< 0.01245	< 128.629
1,2,3,6,7,8-HxCDF	< 0.59	< 0.59	BDL	< 0.19286	< 0.01204	< 124.411
2,3,4,6,7,8-HxCDF	< 0.61	< 0.61	BDL	< 0.19940	< 0.01245	< 128.629
1,2,3,7,8,9-HxCDF	< 0.67	< 0.67	BDL	< 0.21901	< 0.01367	< 141.281
Total HxCDF	< 0.67	< 0.67	BDL	< 0.21901	< 0.01367	< 141.281
1,2,3,4,6,7,8-HpCDF	< 0.70	< 0.49	BDL	< 0.22882	< 0.01429	< 147.607
1,2,3,4,7,8,9-HpCDF	< 0.60	< 0.60	BDL	< 0.19613	< 0.01225	< 126.520
Total HpCDF	< 0.60	< 0.60	BDL	< 0.19613	< 0.01225	< 126.520
1,2,3,4,6,5,7,8-OCDF	< 1.20	< 1.10	BDL	< 0.39226	< 0.02449	< 253.040
TOTAL	< 21.55		< 7.04441		< 0.43982	< 4544.180

$$C_{to/dscf} = \frac{M_{n,ox}}{V_{msid,dscf}} \times \frac{lb}{2.2046 \times 10^{-13} \text{ pg}}$$

$$\text{Emission Rate, lb/hr}$$

$$ER_{lb/hr} = C_{to/dscf} \times Q_{gid,dscfh}$$

DIOXINS & FURANS CALCULATION SUMMARY



COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/10/2011
TEST RUN NO. : FCCU-23-3

SAMPLE VOLUME : 108.019 dscf
SAMPLE VOLUME : 3.059 dscm
GAS FLOW RATE : 10,331,862 dscfh
OXYGEN CONTENT : 5.29 %

DIOXIN / FURAN COMPOUND	TOTAL SAMPLE MASS (picogram)	AVG MOLECULAR WEIGHT	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻¹⁵)	STACK GAS CONCENTRATION (µg/dscf x 10 ⁻⁵)	STACK GAS CONCENTRATION (pg/dscm)	STACK GAS CONCENTRATION (ppt)	EMISSION RATE (lb/hr) x10 ⁻⁹
TOTAL DIOXIN (AS TCDD)	16.76	333.06	0.34186	0.01551	5.47536	395.44	3.532
TCDD	0.77	333.06	0.01572	0.00071	0.25170	18.18	0.162
PeCDD	1.40	388.67	0.02857	0.00130	0.45764	29.86	0.295
HxCDD	1.00	402.75	0.02041	0.00093	0.32689	19.52	0.211
HpCDD	2.58	436.80	0.05266	0.00239	0.84337	46.44	0.544
OCDD	11.00	470.84	0.22450	0.01018	3.59576	183.70	2.320
TOTAL FURAN (AS TCDF)	4.80	317.07	0.09796	0.00444	1.56906	119.03	1.012
TCDF	0.83	317.07	0.01694	0.00077	0.27132	20.58	0.175
PeCDF	1.50	352.68	0.03061	0.00139	0.49033	33.44	0.316
HxCDF	0.67	385.18	0.01367	0.00062	0.21901	13.68	0.141
HpCDF	0.60	419.21	0.01225	0.00056	0.19613	11.25	0.127
OCDF	1.20	442.80	0.02449	0.00111	0.39226	21.31	0.253

DIOXINS & FURANS CALCULATION SUMMARY



COMPANY : Valero Port Arthur Refinery				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/hr x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (ppt)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscm)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)			
LOCATION : Port Arthur, Texas				EMISSION RATE (lb/hr x 10 ⁻⁶)				EMISSION RATE (lb/hr x 10 ⁻⁶)				EMISSION RATE (lb/hr x 10 ⁻⁶)				EMISSION RATE (lb/hr x 10 ⁻⁶)				EMISSION RATE (lb/hr x 10 ⁻⁶)			
SOURCE : FCCU 1241 WGS Stack				2,3,7,8-TCDD TOXICITY EQUIVALENCE (ppt)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (ppt)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (ppt)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (ppt)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (ppt)			
TEST DATE : 6/10/2011				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscm)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscm)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscm)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscm)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscm)			
TEST RUN NO. : FCCU-23-3				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (pg/dscf x 10 ⁻⁶)			
SAMPLE VOLUME : 108.019 dscf				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)			
SAMPLE VOLUME : 3.059 dscm				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)			
GAS FLOW RATE : 10,331,862 dscfh				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)			
OXYGEN CONTENT : 5.29 %				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (lb/dscf x 10 ⁻⁶)			
TOTAL SAMPLE MASS (picogram)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (TEF)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (TEF)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (TEF)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (TEF)				2,3,7,8-TCDD TOXICITY EQUIVALENCE (TEF)			
DIOXIN / FURAN COMPOUND				AVG MOLECULAR WEIGHT				AVG MOLECULAR WEIGHT				AVG MOLECULAR WEIGHT				AVG MOLECULAR WEIGHT				AVG MOLECULAR WEIGHT			
2,3,7,8-TCDD				319.90				319.90				319.90				319.90				319.90			
1,2,3,4,7,8-PeCDD				355.85				355.85				355.85				355.85				355.85			
1,2,3,4,7,8-HxCDD				368.82				368.82				368.82				368.82				368.82			
1,2,3,6,7,8-HxCDD				368.82				368.82				368.82				368.82				368.82			
1,2,3,7,8,9-HxCDD				368.82				368.82				368.82				368.82				368.82			
1,2,3,4,6,7,8-HpCDD				423.78				423.78				423.78				423.78				423.78			
TOTAL DIOXIN (AS TCDD)				16.76				16.76				16.76				16.76				16.76			
TCDD				333.06				333.06				333.06				333.06				333.06			
PeCDD				368.67				368.67				368.67				368.67				368.67			
HxCDD				402.75				402.75				402.75				402.75				402.75			
HxCDD				436.80				436.80				436.80				436.80				436.80			
OCDD				470.84				470.84				470.84				470.84				470.84			
2,3,7,8-TCDF				303.90				303.90				303.90				303.90				303.90			
1,2,3,7,8-PeCDF				339.88				339.88				339.88				339.88				339.88			
2,3,4,7,8-PeCDF				339.88				339.88				339.88				339.88				339.88			
1,2,3,4,7,8-HxCDF				373.62				373.62				373.62				373.62				373.62			
1,2,3,6,7,8-HxCDF				373.82				373.82				373.82				373.82				373.82			
2,3,4,6,7,8-HxCDF				373.82				373.82				373.82				373.82				373.82			
1,2,3,7,8,9-HxCDF				373.82				373.82				373.82				373.82				373.82			
1,2,3,4,6,7,8-HpCDF				407.78				407.78				407.78				407.78				407.78			
1,2,3,4,7,8,9-HpCDF				407.78				407.78				407.78				407.78				407.78			
TOTAL FURAN (AS TCDF)				4.80				4.80				4.80				4.80				4.80			
TCDF				317.07				317.07				317.07				317.07				317.07			
PeCDF				352.66				352.66				352.66				352.66				352.66			
HxCDF				385.18				385.18				385.18				385.18				385.18			
HxCDF				419.21				419.21				419.21				419.21				419.21			
OCDF				442.80				442.80				442.80				442.80				442.80			
TOTAL 2,3,7,8-TCDD TOXICITY EQUIVALENCE				< 0.965				< 0.965				< 0.965				< 0.965				< 0.965			

PCBs EMISSIONS SUMMARY

COMPANY : Valero Port Arthur Refinery
LOCATION : Port Arthur, Texas
SOURCE : FCCU 1241 WGS Stack
TEST DATE : 6/10/2011
TEST RUN NO. : FCCU-23-3
TEST TIME : 12:27 - 16:14

SAMPLE VOLUME (V_{mstd}): 108.019 dscf
SAMPLE VOLUME (V_{mstd}): 3.059 dscm
GAS FLOW RATE (Q_{std}): 10,331,862 dscfh
OXYGEN CONTENT (%O₂): 5.29 %

PCB COMPOUND	TOTAL SAMPLE MASS (M_n) (picogram)	ESTIMATED DETECTION LIMIT (picogram)	STACK GAS CONCENTRATION (picogram/dscm)	DETECTION LIMIT STACK GAS CONCENTRATION (picogram/dscm)	STACK GAS CONCENTRATION (lb/dscf x 10 ⁻¹⁵)	EMISSION RATE (lb/hr x 10 ⁻¹²)
PCB-81	< 0.40	< 0.40	BDL	< 0.13075	< 0.00816	< 84.347
PCB-77	< 1.10	< 0.44	BDL	< 0.35958	< 0.02245	< 231.954
PCB-123	< 0.68	< 0.32	BDL	< 0.22228	< 0.01388	< 143.389
PCB-118	9.92	< 0.28	ADL	3.24272	0.20246	2091.799
PCB-114	< 0.50	< 0.30	BDL	< 0.16344	< 0.01020	< 105.433
PCB-105	< 2.80	< 0.30	BDL	< 0.91528	< 0.05715	< 590.427
PCB-126	< 1.50	< 0.30	BDL	< 0.49033	< 0.03061	< 316.300
PCB-167	< 0.48	< 0.48	BDL	< 0.15691	< 0.00980	< 101.216
PCB-156	< 0.88	< 0.49	BDL	< 0.28766	< 0.01796	< 185.563
PCB-157	< 0.47	< 0.47	BDL	< 0.15364	< 0.00959	< 99.107
PCB-169	< 17.00	< 0.52	BDL	< 5.55708	< 0.34696	< 3584.736
PCB-189	< 0.30	< 0.30	BDL	< 0.09807	< 0.00612	< 63.260
TOTAL	< 36.03		< 11.7774		< 0.73535	< 7597.532

$$C_{lb/dscf} = \frac{M_{avg}}{V_{mstd,dscf}} \times \frac{lb}{2.2046 \times 10^{-12} \text{ pg}}$$

$$ER_{lb/hr} = C_{lb/dscf} \times Q_{std,dscfh}$$

Emission Rate, lb/hr

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011
RUN NUMBER: FCCU-OH-3

γ FACTOR:	1.001	STACK DIAM:	150.000 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	149.320 ft ³
STATIC PRES:	0.200 in.H ₂ O	METER TEMP:	97.6 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	729.8 milliliters
SQ.RT ΔP:	0.5272 in.H ₂ O	CO₂:	13.25 % by volume
ΔH:	2.14 in.H ₂ O	O₂:	5.29 % by volume

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 142.137 \text{ dscf}$$

$\gamma = 1.001$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 34.352 \text{ scf}$$

$V_{lc} = 729.8 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1946$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$$

$S.V.P. = 5.881 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.1946$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-OH-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011

BAROMETRIC: 29.89 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 139.8 °F
SQ.RT ΔP: 0.5272 in.H₂O

STACK DIAM: 150.000 inches
CO₂: 13.25 % by volume
O₂: 5.29 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.33	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d (1 - B_{ws}) + 18B_{ws}$	=	27.93	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5272	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8 \text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.082	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	236,221	acfm
Stack Area =	122.7184 ft ²		
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right)$	=	207,837.4 12,470,244	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws})$	=	167,384.1 10,043,044	dscfm dscfh

ONTARIO HYDRO ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011
RUN NO: FCCU-OH-3

INPUT

V_m:	149.320 ft ³	Q_s:	10,043,044 dscfh
γ FACTOR:	1.001	T_s:	139.8 °F
P_{bar}:	29.89 in. Hg	Θ:	180 minutes
ΔH:	2.14 in. H ₂ O	V_s:	32.082 fps
T_m:	97.6 °F	P_s:	29.90 in. Hg
		V_{lc}:	729.8 mL

**Volume of Sample at Standard
Conditions on a Dry Basis:**

**English Units
(29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 142.137 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 102.39 \% I$$

A_n = 0.00056551 ft² Runtime (θ) = 60 minutes



Mercury Emissions Calculation Summary Ontario Hydro (ASTM Method D6784-02)

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/10/2011
Run #: FCCU-OH-3

Test Data Input

Metals Laboratory Analysis Weights (Mt)

Barometric pressure (P_{bar}):	29.89 inches Hg	Hg-FH (particle bound)	< 0.065 μg
Stack pressure (P_s):	29.90 Inches Hg Abs.	Hg-KCl (oxidized)	0.0822 μg
Test length (θ):	180.0 minutes	Hg-Acid/KMnO ₄ (elemental)	< 1.0520 μg
Sample nozzle diameter (D_n):	0.3220 inches	Hg-Total	< 1.1992 μg
Sample nozzle area (A_n):	0.000565 ft ²		
Stack temperature (T_s):	139.8 °F		
Volume metered (V_{mstd}):	142.137 dscf		
Stack gas velocity (V_s):	32.082 ft/sec		
Stack gas volumetric flow (Q_{std}):	10,043,044 dscfh		
Fractional Moisture content (B_{ws}):	0.1946 %		

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

Mercury concentration ($\mu\text{g/dscm}$):

$$C_s = \left[\frac{M_t}{\left(\frac{V_{mstd}}{35.31 \text{ dscf/dscm}} \right)} \right]$$

Hg-FH (particle bound)	=	< 0.01615 $\mu\text{g/dscm}$
Hg-KCl (oxidized)	=	0.02042 $\mu\text{g/dscm}$
Hg-Acid/KMnO ₄ (elemental)	=	< 0.26134 $\mu\text{g/dscm}$
Hg-Total	=	< 0.29791 $\mu\text{g/dscm}$

Mercury concentration ($\times 10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} \text{ lb}}{\mu\text{g}} \times M_t \right)}{V_{mstd}}$$

Hg-FH (particle bound)	=	< 0.00101 $\times 10^{-9}$ lb/dscf
Hg-KCl (oxidized)	=	0.00127 $\times 10^{-9}$ lb/dscf
Hg-Acid/KMnO ₄ (elemental)	=	< 0.01632 $\times 10^{-9}$ lb/dscf
Hg-Total	=	< 0.01860 $\times 10^{-9}$ lb/dscf

Mercury emission rate ($\times 10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

Hg-FH (particle bound)	=	< 0.10125 $\times 10^{-4}$ lb/hr
Hg-KCl (oxidized)	=	0.12804 $\times 10^{-4}$ lb/hr
Hg-Acid/KMnO ₄ (elemental)	=	< 1.63871 $\times 10^{-4}$ lb/hr
Hg-Total	=	< 1.86801 $\times 10^{-4}$ lb/hr

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011
RUN NUMBER: FCCU-0061-3

γ FACTOR:	0.999	STACK DIAM:	150.0 inches
BAROMETRIC:	29.89 in. Hg	METER VOLUME:	148.895 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	95.0 °F
STACK TEMP:	139.8 °F	LIQUID COLL:	711.9 milliliters
SQ. RT ΔP:	0.5373 in.H ₂ O	CO₂:	13.25 % by volume
ΔH:	2.05 in.H ₂ O	O₂:	5.29 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 142.081 \text{ dscf}$ <p style="text-align: center;">γ = 0.999</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS $V_{wstd} = 0.04707 \times V_{lc} = 33.509 \text{ scf}$ <p style="text-align: center;">V_{lc} = 711.9 mL</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.1908$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1967$ <p style="text-align: center;">S.V.P. = 5.881 in. Hg</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS $B_{ws} = 0.1908$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0061-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/10/2011

BAROMETRIC: 29.89 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 139.8 °F
SQ.RT ΔP: 0.5373 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 13.25 % by volume
O₂: 5.29 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.33	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	27.98	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.5373	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 139.8 \text{ °F} + 460$	=	599.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.90	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	32.669	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	240,544.62	acfm
Stack Area =		122.71846	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right)$	=	211,641.61 12,698,496	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws})$	=	171,252.47 10,275,148	dscfm dscfh

HEXAVALENT CHROMIUM CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/10/2011

RUN NO: FCCU-0061-3

INPUT

V_m:	148.895 ft ³	Q_s:	10,275,148 dscfh
γ FACTOR:	0.999	T_s:	139.8 °F
P_{bar}:	29.89 in. Hg	Θ:	180.0 minutes
ΔH:	2.05	V_s:	32.669 fps
T_m:	95.0 °F	P_s:	29.90 in. Hg
HexChrome:	< 2 μg/L	V_{lc}:	711.9 mL
Sample Volume:	1070 mL	%O₂:	5.29 %
Total Mass of Cr⁺⁶:	< 2.1 μg		

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	142.081 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	102.0 % I
A _n =	0.00055502 ft ²	Runtime (Θ) =	180 minutes
Total μg Hexavalent Chromium in sample (M_n)		=	< 2.1 μg
Concentration of Hexavalent Chromium			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0000332 x 10 ⁻⁶ lb/dscf
$C_{s(\mu g/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(V_{mstd})}$		=	< 0.5318 μg/dscm
Hexavalent Chromium Mass Rate:		$E = Q_s \times C'_{s(lb/dscf)}$	= < 0.000341 lb/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-5B-1, FCCU-29-1, FCCU-027-1
 TEST DATE : 6/13/2011
 START TIME : 9:29
 END TIME : 12:49

GAS ANALYZER O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.567
 AVERAGE ZERO BIAS (C_o): 0.089

CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 0.92

GAS ANALYZER CO₂

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 9.99
 AVERAGE ZERO BIAS (C_o): 0.08

CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 17.24

GAS ANALYZER SO₂

SPAN VALUE : 90.0 ppm
 AVERAGE CAL. BIAS (C_m): 43.16
 AVERAGE ZERO BIAS (C_o): 1.57

CALIBRATION GAS: EPA Protocol SO₂
 CALIBRATION PPM (C_{ma}): 45.00
 PPM CORRECTED (C_{gas}): -0.73

GAS ANALYZER NO_x

SPAN VALUE : 90.0 ppm
 AVERAGE CAL. BIAS (C_m): 43.33
 AVERAGE ZERO BIAS (C_o): 1.13

CALIBRATION GAS: EPA Protocol NO
 CALIBRATION PPM (C_{ma}): 45.00
 PPM CORRECTED (C_{gas}): 11.19

$$\text{Example Calculation} = C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME	ELAPSED TIME	SO ₂	NO _x	O ₂	CO ₂
9:29	0				
9:30	1	0.8	16.7	1.67	16.51
9:31	2	0.8	17.4	1.70	16.51
9:32	3	0.7	17.2	1.77	16.43
9:33	4	0.7	17.3	1.72	16.47
9:34	5	0.7	17.1	1.74	16.44
9:35	6	0.8	16.9	1.76	16.42
9:36	7	0.8	17.0	1.79	16.38
9:37	8	0.8	17.2	1.77	16.41
9:38	9	0.7	17.1	1.78	16.39
9:39	10	0.6	17.1	1.76	16.39
9:40	11	0.7	16.9	1.80	16.37
9:41	12	0.7	16.5	1.77	16.38
9:42	13	0.7	16.1	1.72	16.42
9:43	14	0.7	15.8	1.70	16.44
9:44	15	0.7	15.5	1.64	16.48
9:45	16	0.6	15.4	1.65	16.48
9:46	17	0.6	15.1	1.64	16.49
9:47	18	0.6	14.7	1.55	16.56
9:48	19	0.7	14.6	1.51	16.61
9:49	20	0.7	14.4	1.50	16.63
9:50	21	0.7	14.6	1.45	16.66
9:51	22	0.7	14.6	1.48	16.65
9:52	23	0.7	15.0	1.46	16.67
9:53	24	0.8	15.1	1.50	16.64
9:54	25	0.7	15.2	1.51	16.63
9:55	26	0.8	15.3	1.52	16.63
9:56	27	0.6	15.1	1.48	16.66
9:57	28	0.7	15.0	1.49	16.65
9:58	29	0.7	14.7	1.46	16.67
9:59	30	0.8	14.4	1.40	16.71
10:00	31	0.6	12.1	1.05	17.03
10:01	32	0.6	13.8	1.32	16.78
10:02	33	0.7	13.9	1.30	16.80
10:03	34	0.8	13.5	1.30	16.80
10:04	35	0.7	13.3	1.23	16.86
10:05	36	0.7	13.3	1.21	16.88
10:06	37	0.7	12.9	1.21	16.89
10:07	38	0.8	12.8	1.14	16.95
10:08	39	0.7	12.6	1.11	16.97
10:09	40	0.7	12.2	1.09	16.99
10:10	41	0.6	12.2	1.05	17.02
10:11	42	0.7	11.9	1.03	17.05
10:12	43	0.7	11.9	1.01	17.08
10:13	44	0.8	12.1	1.03	17.07
10:14	45	0.7	11.9	1.05	17.04
10:15	46	0.6	11.9	1.03	17.06
10:16	47	0.6	11.9	1.01	17.09
10:17	48	0.6	11.9	1.02	17.06
10:18	49	0.6	12.0	1.03	17.07
10:19	50	0.7	11.9	1.04	17.07
10:20	51	0.6	11.5	0.99	17.08
10:21	52	0.6	11.7	0.94	17.12
10:22	53	0.6	11.7	0.97	17.12
10:23	54	0.7	11.5	0.93	17.14
10:24	55	0.5	11.4	0.95	17.13
10:25	56	0.5	11.2	0.88	17.18
10:26	57	0.6	11.1	0.86	17.21
10:27	58	0.6	11.1	0.89	17.18
10:28	59	0.5	11.1	0.88	17.19
10:29	60	0.6	11.1	0.87	17.18
10:30	61	0.5	10.9	0.86	17.21
10:31	62	0.5	10.9	0.85	17.21
10:32	63	0.5	10.8	0.82	17.24
10:33	64	0.6	10.8	0.81	17.24
10:34	65	0.4	10.8	0.80	17.26
10:35	66	0.5	10.6	0.79	17.27
10:36	67	0.5	10.4	0.78	17.27
10:37	68	0.6	10.1	0.77	17.28
10:38	69	0.5	10.0	0.76	17.27
10:39	70	0.5	9.7	0.72	17.33
10:40	71	0.4	9.8	0.75	17.32
10:41	72	0.4	9.7	0.72	17.32
10:42	73	0.5	9.6	0.71	17.35
10:43	74	0.5	9.6	0.72	17.40
10:44	75	0.5	9.7	0.70	17.43
10:45	76	0.5	9.7	0.69	17.42
10:46	77	0.5	9.8	0.71	17.43
10:47	78	0.5	10.0	0.73	17.42
10:48	79	0.5	10.1	0.73	17.41
10:49	80	0.6	10.0	0.71	17.41
10:50	81	0.5	10.1	0.71	17.43
10:51	82	0.5	10.2	0.75	17.41
10:52	83	0.4	10.5	0.80	17.37
10:53	84	0.5	10.6	0.83	17.35
10:54	85	0.6	10.6	0.81	17.35
10:55	86	0.6	10.7	0.86	17.31
10:56	87	0.4	10.8	0.86	17.30
10:57	88	0.4	11.1	0.90	17.28
10:58	89	0.4	11.3	0.93	17.26
10:59	90	0.5	11.5	0.96	17.23
11:00	91	0.4	11.6	0.99	17.20
11:01	92	0.4	11.8	1.03	17.16
11:02	93	0.5	11.6	1.03	17.15

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-SB-1, FCCU-29-1, FCCU-027-1

CLOCK TIME	ELAPSED TIME	SO ₂	NO _x	O ₂	CO ₂
11:03	94	0.5	11.9	1.07	17.12
11:04	95	0.5	11.9	1.11	17.09
11:05	96	0.4	12.0	1.09	17.11
11:06	97	0.5	11.7	1.08	17.12
11:07	98	0.6	11.9	1.04	17.15
11:08	99	0.4	11.8	1.05	17.15
11:09	100	0.5	11.9	1.07	17.14
11:10	101	0.4	12.2	1.11	17.09
11:11	102	0.5	12.3	1.17	17.04
11:12	103	0.5	12.3	1.17	17.03
11:13	104	0.5	12.3	1.17	17.02
11:14	105	0.5	12.5	1.20	17.00
11:15	106	0.5	12.5	1.20	16.99
11:16	107	0.5	12.5	1.21	16.98
11:17	108	0.3	12.5	1.23	16.96
11:18	109	0.4	12.7	1.22	16.96
11:19	110	0.5	12.8	1.28	16.91
11:20	111	0.6	12.8	1.25	16.94
11:21	112	0.6	12.9	1.24	16.94
11:22	113	0.6	12.7	1.23	16.95
11:23	114	0.6	12.6	1.21	16.96
11:24	115	0.6	12.5	1.20	17.01
11:25	116	0.7	12.2	1.16	17.11
11:26	117	0.7	12.3	1.16	17.14
11:27	118	0.7	12.1	1.16	17.14
11:28	119	0.6	12.0	1.11	17.19
11:29	120	0.6	12.1	1.11	17.19
11:30	121	1.0	9.4	0.71	17.50
11:31	122	0.7	12.3	1.13	17.15
11:32	123	0.8	12.0	1.17	17.11
11:33	124	0.7	11.4	1.10	17.15
11:34	125	0.8	11.3	1.04	17.20
11:35	126	0.8	11.1	0.99	17.23
11:36	127	0.8	11.1	0.98	17.25
11:37	128	0.8	10.8	0.91	17.28
11:38	129	0.9	10.5	0.86	17.33
11:39	130	1.0	10.5	0.83	17.36
11:40	131	1.0	10.2	0.84	17.36
11:41	132	0.9	9.9	0.78	17.43
11:42	133	1.0	9.7	0.73	17.47
11:43	134	1.1	9.6	0.72	17.49
11:44	135	1.1	9.4	0.67	17.52
11:45	136	1.0	9.3	0.66	17.55
11:46	137	1.1	9.1	0.65	17.54
11:47	138	1.1	8.8	0.59	17.60
11:48	139	1.1	8.7	0.56	17.61
11:49	140	1.1	8.3	0.53	17.64
11:50	141	1.1	8.1	0.49	17.68
11:51	142	1.2	8.1	0.48	17.71
11:52	143	1.2	7.9	0.46	17.73
11:53	144	1.1	8.0	0.47	17.72
11:54	145	1.2	7.9	0.48	17.72
11:55	146	1.3	7.6	0.47	17.73
11:56	147	1.2	7.6	0.43	17.77
11:57	148	1.2	7.7	0.49	17.72
11:58	149	1.1	7.6	0.47	17.72
11:59	150	1.2	7.5	0.46	17.74
12:00	151	1.3	7.6	0.46	17.74
12:01	152	1.3	7.8	0.48	17.73
12:02	153	1.4	7.7	0.49	17.73
12:03	154	1.4	7.8	0.47	17.73
12:04	155	1.4	7.6	0.46	17.74
12:05	156	1.4	7.9	0.47	17.75
12:06	157	1.3	8.1	0.50	17.72
12:07	158	1.4	8.0	0.50	17.72
12:08	159	1.3	8.0	0.48	17.75
12:09	160	1.5	8.5	0.52	17.72
12:10	161	1.4	8.7	0.58	17.67
12:11	162	1.5	9.0	0.60	17.66
12:12	163	1.5	9.2	0.62	17.64
12:13	164	1.4	9.5	0.65	17.60
12:14	165	1.4	9.9	0.71	17.57
12:15	166	1.3	10.3	0.74	17.53
12:16	167	1.6	10.4	0.76	17.50
12:17	168	1.7	10.5	0.83	17.48
12:18	169	1.4	10.6	0.85	17.44
12:19	170	1.5	10.7	0.87	17.43
12:20	171	1.6	10.9	0.89	17.41
12:21	172	1.6	11.2	0.95	17.37
12:22	173	1.5	11.2	0.96	17.35
12:23	174	1.7	11.4	0.98	17.31
12:24	175	1.5	11.5	0.97	17.33
12:25	176	1.6	11.7	1.03	17.30
12:26	177	1.7	11.7	1.05	17.25
12:27	178	1.6	11.9	1.04	17.26
12:28	179	1.6	12.1	1.07	17.25
12:29	180	1.6	12.3	1.12	17.19
12:30	181	1.7	12.1	1.10	17.20
12:31	182	1.7	12.1	1.05	17.23
12:32	183	1.6	12.0	1.07	17.24
12:33	184	1.6	12.1	1.07	17.22
12:34	185	1.8	11.9	1.05	17.25
12:35	186	1.7	11.8	1.02	17.27
12:36	187	1.7	11.8	1.03	17.25

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-SB-1, FCCU-29-1, FCCU-027-1

CLOCK TIME	ELAPSED TIME	SO ₂	NO _x	O ₂	CO ₂
12:37	188	1.8	11.7	1.01	17.27
12:38	189	1.7	11.6	1.00	17.28
12:39	190	1.7	11.6	0.98	17.29
12:40	191	1.7	11.6	1.00	17.28
12:41	192	1.7	11.8	1.02	17.27
12:42	193	1.8	11.6	1.04	17.24
12:43	194	1.5	11.6	1.02	17.25
12:44	195	1.8	11.5	1.00	17.28
12:45	196	1.7	11.5	1.02	17.28
12:46	197	1.9	11.5	1.02	17.26
12:47	198	1.8	11.4	1.03	17.25
12:48	199	1.8	11.4	1.03	17.27
12:49	200	1.7	11.3	1.04	17.24
Uncorrected Average (C) =		0.90	11.63	1.009	17.173

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NUMBER: FCCU-5B-1

γ FACTOR:	0.999	STACK DIAM:	150.00 inches
BAROMETRIC:	29.98 in. Hg	METER VOLUME:	95.660 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	100.1 °F
STACK TEMP:	140.7 °F	LIQUID COLL:	502.4 milliliters
SQ. RT ΔP:	0.3805 in.H ₂ O	CO₂:	17.24 % by volume
ΔH:	1.93 in.H ₂ O	O₂:	0.92 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 90.695 \text{ dscf}$$

$\gamma = 0.999$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 23.648 \text{ scf}$$

$V_{lc} = 502.4 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2068$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2012$$

$S.V.P. = 6.034 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.2012$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refiner
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-5B-1

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011

BAROMETRIC: 29.98 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 140.7 °F
SQ.RT ΔP: 0.3805 in.H₂O

STACK DIAM: 150.00 inches
CO₂: 17.24 % by volume
O₂: 0.92 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.80	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.22	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3805	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.7 \text{ °F} + 460$	=	600.7	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.99	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	23.018	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	169,484	acfm
Stack Area =		122.718	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	149,344 8,960,654	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	119,301 7,158,050	dscfm dscfh

ARI ENVIRONMENTAL, INC.
USEPA METHOD 202 - CONDENSIBLE PARTICULATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/11
RUN NUMBER: FCCU-5B-1

INPUT

V_m:	95.66	ft ³	Q_s:	119,301	dscfm
γ FACTOR:	0.999		T_s:	140.7	°F
P_{bar}:	29.98	in.Hg	Runtime:	120	minutes
ΔH:	1.93	in.H ₂ O	V_s:	23.018	ft/sec
T_m:	100.1	°F	P_s:	29.99	in.Hg
V_{lc}:	502.4	mL	Noz. diam:	0.373	inches
N:	0.0000		m_{lb}:	0.00	mL
V_t:	0.00	mL	m_{ob}:	0.00	mL
m_r:	7.65	mg			
m_o:	5.85	mg			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 90.695 \text{ dscf}$$

MASS OF AMMONIA CORRECTION

$$\text{Equation \#1} \quad m_c = 17.03 \times V_T \times N = 0.00 \text{ mg}$$

MASS OF THE FIELD BLANK

$$\text{Equation \#2} \quad m_{fb} = m_{lb} + m_{ob} = 0.00 \text{ mg}$$

MASS OF INORGANIC CONDENSIBLE PM

$$\text{Equation \#3} \quad m_i = m_r - m_c = 7.65 \text{ mg}$$

TOTAL MASS OF CONDENSIBLE PM

$$\text{Equation \#4} \quad m_{cpm} = m_i + m_o - m_{fb} = 13.50 \text{ mg}$$

TOTAL CONCENTRATION OF CONDENSIBLE PM - METRIC UNITS

$$\text{Equation \#5} \quad C_{cpm} = \frac{m_{cpm}}{V_{m(std)}} = 0.1488 \text{ mg/dscf}$$

TOTAL CONCENTRATION OF CONDENSIBLE PM - ENGLISH UNITS

$$C_s = (0.01543)(C_{cpm}) \quad \text{Total} = 0.00230 \text{ gr/dscf}$$

$$C'_s = (2.205 \times 10^{-6})(C_{cpm}) \quad C'_s \text{ Total} = 0.3282 \times 10^{-6} \text{ lbs/dscf}$$

EMISSION RATE

$$pmr = \left(\frac{C_s}{7000} \right) (Q_{std})(60) \quad \text{Total} = 2.3486 \text{ lbs/hr}$$

$$10.2869 \text{ ton/yr}$$

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.20 \text{ \% I}$$

$$102.29 \text{ @ saturation}$$

$$A_n = 0.000759 \text{ ft}^2$$

$$\text{Runtime} = 120 \text{ minutes}$$

ARI ENVIRONMENTAL, INC.
USEPA METHOD 5 - FILTERABLE PARTICULATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/11
RUN NUMBER: FCCU-5B-1

INPUT

V_m:	95.66	ft ³	Q_s:	119,301	dscfm
γ FACTOR:	0.999		T_s:	140.7	°F
P_{bar}:	29.98	in.Hg	Runtime:	120	minutes
ΔH:	1.93	in.H ₂ O	V_s:	23.018	ft/sec
T_m:	100.1	°F	P_s:	29.99	in.Hg
V_{lc}:	502.4	mL	Noz. diam:	0.373	inches
M_n front:	49.83	mg	Regenerator Coke Burn (R_c):	22,373	lb/hr
CO₂:	17.24	% by volume			
O₂:	0.92	% by volume			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 90.695 \text{ dscf}$$

$\gamma = 0.999$

VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 23.648 \text{ scf}$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} \times 100 = 20.68 \%$$

PARTICULATE CONCENTRATION IN STACK GAS ON A DRY BASIS

$$C_s = (0.01543) \left(\frac{M_n}{V_{mstd}} \right) \quad \text{Total} = 0.00848 \text{ gr/dscf}$$

$$C'_s = (2.205 \times 10^{-6}) \left(\frac{M_n}{V_{mstd}} \right) \quad C'_s \text{ Total} = 1.2115 \times 10^{-6} \text{ lbs/dscf}$$

EMISSION RATE

$$pmr = \left(\frac{C_s}{7000} \right) (Q_{std})(60) = 8.6690 \text{ lbs/hr}$$

$$pmr_{lb/1000lb \text{ cokeburn}} = \frac{(pmr)(1000)}{(R_c)} \quad \text{Total} = 0.387 \text{ lb/1000 lb coke burn}$$

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.20 \%$$

102.29 @ saturation

A_n = 0.0007588 ft² Runtime = 120 minutes

ARI ENVIRONMENTAL, INC.
USEPA METHOD 5/202 - TOTAL PM CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/11
RUN NUMBER: FCCU-5B-1

INPUT

V_m:	95.66	ft ³	Q_s:	119,301	dscfm
γ FACTOR:	0.999		T_s:	140.7	°F
P_{bar}:	29.98	in.Hg	Runtime:	120	minutes
ΔH:	1.93	in.H ₂ O	V_s:	23.018	ft/sec
T_m:	100.1	°F	P_s:	29.99	in.Hg
V_{lc}:	502.4	mL	Noz. diam:	0.373	inches
M_n total:	63.3	mg	Regenerator Coke Burn (R_c):	22,373	lb/hr
CO₂:	17.24	% by volume			
O₂:	0.92	% by volume			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS					
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$	=	90.695	dscf		
$\gamma = 0.999$					
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS					
$V_{wstd} = 0.04707 \times V_{lc}$	=	23.648	scf		
FRACTIONAL MOISTURE CONTENT OF STACK GAS					
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} \times 100$	=	20.68	%		
PARTICULATE CONCENTRATION IN STACK GAS ON A DRY BASIS					
$C_s = (0.01543) \left(\frac{M_n}{V_{mstd}} \right)$	Total	=	0.01077	gr/dscf	
$C'_s = (2.205 \times 10^{-6}) \left(\frac{M_n}{V_{mstd}} \right)$	C's Total	=	1.5397	x 10 ⁻⁶ lbs/dscf	
EMISSION RATE					
$pmr = \left(\frac{C_s}{7000} \right) (Q_{std})(60)$	Total	=	11.0176 48.257	lbs/hr ton/yr	
$pmr_{lb/1000lbcokeburn} = \frac{(pmr)(1000)}{(R_c)}$	Total	=	0.492	lb/1000 lb coke burn	
ISOKINETIC SAMPLING RATE					
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$	=	103.20 102.29	% I @ saturation		
$A_n = 0.000759 \text{ ft}^2$	Runtime =	120	minutes		

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NUMBER: FCCU-29-1

γ FACTOR:	1.005	STACK DIAM:	150.00 inches
BAROMETRIC:	29.98 in. Hg	METER VOLUME:	133.837 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	98.5 °F
STACK TEMP:	140.7 °F	LIQUID COLL:	710.3 milliliters
SQ. RT ΔP:	0.3677 in.H ₂ O	CO₂:	17.24 % by volume
ΔH:	1.94 in.H ₂ O	O₂:	0.92 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 128.022 \text{ dscf}$ <p style="text-align: center;">$\gamma = 1.005$</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS $V_{wstd} = 0.04707 \times V_{lc} = 33.434 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 710.3 \text{ mL}$</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2071$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2012$ <p style="text-align: center;">$S.V.P. = 6.034 \text{ in. Hg}$</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS $B_{ws} = 0.2012$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-29-1

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011

BAROMETRIC: 29.98 in. Hg	STACK DIAM: 150.00 inches	
STATIC PRES: 0.2 in.H ₂ O	CO₂: 17.24 % by volume	
STACK TEMP: 140.7 °F	O₂: 0.92 % by volume	
SQ.RT ΔP: 0.3677 in.H ₂ O		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.80	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.22	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3677	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.7 \text{ °F} + 460$	=	600.7	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.99	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.244	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	163,783	acfm
Stack Area =	122.7184 ft ²		
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	144,320.3 8,659,217	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	115,287.5 6,917,252	dscfm dscfh

METHOD 29 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NO: FCCU-29-1

INPUT

V_m:	133.837 ft ³	Q_s:	6,917,252 dscfh
γ FACTOR:	1.005	T_s:	140.7 °F
P_{bar}:	29.98 in. Hg	Θ:	180.0 minutes
ΔH:	1.94 in. H ₂ O	V_s:	22.244 fps
T_m:	98.5 °F	P_s:	29.99 in. Hg
		V_{lc}:	710.3 mL

**Volume of Sample at Standard
Conditions on a Dry Basis:**

**English Units
(29.92 in. Hg, 68 °F)**

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 128.022 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = \begin{matrix} 101.61 & \% I \\ 100.69 & \% I^* @saturation \end{matrix}$$

A_n = 0.00075072 ft²
Runtime (θ) = 180 minutes



Metals Laboratory Data Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/13/2011
Run #: FCCU-29-1

Front Half Metal Calculation

Metal	Detection Limit (micrograms)	FH Sample (M _{fh}) (micrograms)	FH Blank (M _{fhb}) (micrograms)	<u>I Value</u>	<u>II Values</u>		Greater Value I vs II (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
				<u>A Value</u> (4 inch filter) (micrograms)	5 % of FH Sample (micrograms)	Lesser value (M _{fhb}) vs 5% (micrograms)			
Antimony	0.2	0.2000	0.2000	17.590	0.010	0.010	17.590	0.200	0.0000
Arsenic	1	1.0000	1.0000	17.590	0.050	0.050	17.590	1.000	0.0000
Beryllium	0.2	0.2000	0.2000	17.590	0.010	0.010	17.590	0.200	0.0000
Cadmium	0.1	0.1000	0.1220	17.590	0.005	0.005	17.590	0.122	-0.0220
Chromium	1	2.7700	1.3500	17.590	0.139	0.139	17.590	1.350	1.4200
Lead	0.5	1.0500	0.5000	17.590	0.053	0.053	17.590	0.500	0.5500
Manganese	0.5	1.5800	1.9200	17.590	0.079	0.079	17.590	1.920	-0.3400
Nickel	0.2	6.7200	1.5800	17.590	0.336	0.336	17.590	1.580	5.1400
Selenium	2	2.0000	2.0000	17.590	0.100	0.100	17.590	2.000	0.0000
Cobalt	0.2	0.2240	0.2000	17.590	0.011	0.011	17.590	0.200	0.0240

Back Half Metal Calculation

Metal	Detection Limit (micrograms)	BH Sample (M _{bh}) (micrograms)	BH Blank (M _{bhb}) (micrograms)	<u>I Value</u>	<u>II Values</u>		Greater Value I vs II (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
				(micrograms)	5 % of BH Sample (micrograms)	Lesser value (M _{bh}) vs 5% (micrograms)			
Antimony	0.1	0.1000	0.1000	1.000	0.005	0.005	1.000	0.100	0.0000
Arsenic	0.2	0.2000	0.2000	1.000	0.010	0.010	1.000	0.200	0.0000
Beryllium	0.1	0.1000	0.1000	1.000	0.005	0.005	1.000	0.100	0.0000
Cadmium	0.05	3.2000	0.0500	1.000	0.160	0.160	1.000	0.050	3.1500
Chromium	0.15	1.3200	0.3020	1.000	0.066	0.066	1.000	0.302	1.0180
Lead	0.05	1.3000	0.1090	1.000	0.065	0.065	1.000	0.109	1.1910
Manganese	0.15	13.7000	0.2490	1.000	0.685	0.685	1.000	0.249	13.4510
Nickel	0.1	3.1300	0.9210	1.000	0.157	0.157	1.000	0.921	2.2090
Selenium	1	1.0000	1.0000	1.000	0.050	0.050	1.000	1.000	0.0000
Cobalt	0.1	0.4410	0.1000	1.000	0.022	0.022	1.000	0.100	0.3410

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	0.200	0.200	0.100	0.100	0.300 BDL
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	0.100	0.122	3.200	0.050	3.128 ADL
Chromium	2.770	1.350	1.320	0.302	2.438 ADL
Lead	1.050	0.500	1.300	0.109	1.741 ADL
Manganese	1.580	1.920	13.700	0.249	13.111 ADL
Nickel	6.720	1.580	3.130	0.921	7.349 ADL
Selenium	2.000	2.000	1.000	1.000	3.000 BDL
Cobalt	0.224	0.200	0.441	0.100	0.365 ADL

$$M_t = (M_{fh} - M_{fhb}) + (M_{bh} - M_{bhb})$$



USEPA Method 29
Metals Emissions Calculation Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/13/2011
Run #: FCCU-29-1

Test Data Input

Barometric pressure (P_{bar}): 29.98 inches Hg
Stack pressure (P_s): 29.99 Inches Hg Abs.
Test length (θ): 180.0 minutes
Sample nozzle diameter (D_n): 0.3710 inches
Sample nozzle area (A_n): 0.000751 ft²
Stack temperature (T_s): 140.7 °F
Volume metered (V_{mstd}): 128.022 dscf
Stack gas velocity (V_s): 22.244 ft/sec
Stack gas volumetric flow (Q_{std}): 6,917,252 dscfh
Fractional Moisture content (B_{ws}): 0.2012
Stack Oxygen Content ($\%O_2$): 0.92 %

Metals Laboratory Analysis Weights (M_i)

Antimony (Sb): < 0.30 µg
Arsenic (As): < 1.20 µg
Beryllium (Be): < 0.30 µg
Cadmium (Cd): 3.13 µg
Chromium (Cr): 2.44 µg
Lead (Pb): 1.74 µg
Manganese (Mn): 13.11 µg
Nickel (Ni): 7.35 µg
Selenium (Se): < 3.00 µg
Cobalt (Co): 0.37 µg

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

Metals concentration (µg/dscm):

$$C_s = \left(\frac{M_i}{\left(\frac{V_{mstd}}{35.315 \text{ dscf / dscm}} \right)} \right)$$

=	< 0.082755 µg/dscm	Antimony (Sb)	=	3.616683 µg/dscm	Manganese (Mn)
=	< 0.331021 µg/dscm	Arsenic (As)	=		
=	< 0.082755 µg/dscm	Beryllium (Be)	=	2.027229 µg/dscm	Nickel (Ni)
=	0.862862 µg/dscm	Cadmium (Cd)	=	< 0.827553 µg/dscm	Selenium (Se)
=	0.672525 µg/dscm	Chromium (Cr)	=	0.100686 µg/dscm	Cobalt (Co)
=	0.480257 µg/dscm	Lead (Pb)	=		

Metals concentration ($\times 10^{-9}$ lb/dscf):

$$C'_s = \left(\frac{\left(\frac{2.2046 \times 10^{-9} \text{ lb}}{\mu\text{g}} \times M_i \right)}{V_{mstd}} \right)$$

=	< 0.005166 $\times 10^{-9}$ lb/dscf	Antimony (Sb)	=	0.225778 $\times 10^{-9}$ lb/dscf	Manganese (Mn)
=	< 0.020665 $\times 10^{-9}$ lb/dscf	Arsenic (As)	=		
=	< 0.005166 $\times 10^{-9}$ lb/dscf	Beryllium (Be)	=	0.126553 $\times 10^{-9}$ lb/dscf	Nickel (Ni)
=	0.053866 $\times 10^{-9}$ lb/dscf	Cadmium (Cd)	=	< 0.051661 $\times 10^{-9}$ lb/dscf	Selenium (Se)
=	0.041984 $\times 10^{-9}$ lb/dscf	Chromium (Cr)	=	0.006285 $\times 10^{-9}$ lb/dscf	Cobalt (Co)
=	0.029981 $\times 10^{-9}$ lb/dscf	Lead (Pb)	=		

Metals emission rate ($\times 10^{-4}$ lb/hr):

$$E_{m, \text{lb/hr}} = C'_s \times Q_{std}$$

=	< 0.357355 $\times 10^{-4}$ lb/hr	Antimony (Sb)	=	15.617614 $\times 10^{-4}$ lb/hr	Manganese (Mn)
=	< 1.429421 $\times 10^{-4}$ lb/hr	Arsenic (As)	=		
=	< 0.357355 $\times 10^{-4}$ lb/hr	Beryllium (Be)	=	8.754011 $\times 10^{-4}$ lb/hr	Nickel (Ni)
=	3.726024 $\times 10^{-4}$ lb/hr	Cadmium (Cd)	=	< 3.573552 $\times 10^{-4}$ lb/hr	Selenium (Se)
=	2.904107 $\times 10^{-4}$ lb/hr	Chromium (Cr)	=	0.434782 $\times 10^{-4}$ lb/hr	Cobalt (Co)
=	2.073851 $\times 10^{-4}$ lb/hr	Lead (Pb)	=		

SO₂ CALIBRATION CORRECTION DATA SHEET

USEPA METHOD 6C

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: Bovar-Western Research 721-ATM
RUN NO: FCCU-29-1
TEST DATE: 6/13/2011

INPUT

SO₂ AVERAGE CHART READING (C): 0.90 ppmv
 AVG PRE/POST ZERO DRIFT READING (C_o): 1.57 ppmv
 CAL GAS CONCENTRATION (C_{ma}): 45.0 ppmv
 AVG CAL PRE/POST TEST READING (C_m): 43.16 ppmv
 STACK GAS VOLUMETRIC FLOW RATE (Q_{std}): 6,917,252.0 dscfh

CALCULATIONS

STACK SO₂ AVERAGE CHART READING = 0.90 ppmv

STACK SO₂ CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{SO}_2 \text{ CONC, ppmv} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = (0.7) \text{ ppmv db} < 1.0 \text{ BDL}$$

(corrected)

SO₂ CONC.(lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{64 \text{ lb / lb - mole}}{385.26 \times 10^6 \text{ ft}^3 / \text{lb - mole}} \right) = (0.1205) \times 10^{-6} \text{ lbs/dscf} < 0.1661 \text{ BDL}$$

SO₂ EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 6,917,252 dscfh

STACK SO₂ EMISSION RATE =

$$\text{SO}_{2\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = -0.8332 \text{ lbs/hr} < 1.1491 \text{ BDL}$$

NO_x CALIBRATION CORRECTION DATA SHEET

USEPA METHOD 7E

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: CAI Model 600 CLD
RUN NO: FCCU-29-1
TEST DATE: 6/13/2011

INPUT

NO_x AVERAGE CHART READING (C): 11.63 ppmv
 AVG PRE/POST ZERO DRIFT READING (C_o): 1.13 ppmv
 CAL GAS CONCENTRATION (C_{ma}): 45.0 ppmv
 AVG CAL PRE/POST TEST READING (C_m): 43.33 ppmv
 STACK GAS VOLUMETRIC FLOW RATE (Q_{std}): 6,917,252.0 dscfh

CALCULATIONS

STACK NO_x AVERAGE CHART READING = 11.63 ppmv

STACK NO_x CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{NO}_x \text{ CONC, ppmv} = C_{\text{gas,ppm}} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o} = 11.2 \text{ ppmv db}$$

(corrected)

NO_x CONC.(lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{46 \text{ lb/lb-mole}}{385.26 \times 10^6 \text{ ft}^3/\text{lb-mole}} \right) = 1.3363 \times 10^{-6} \text{ lbs/dscf}$$

NO_x EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 6,917,252 dscfh

STACK NO_x EMISSION RATE =

$$\text{SO}_{2\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = 9.2438 \text{ lbs/hr}$$

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NUMBER: FCCU-027-1

γ FACTOR:	1.001	STACK DIAM:	150.0 inches
BAROMETRIC:	29.98 in. Hg	METER VOLUME:	47.330 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	89.8 °F
STACK TEMP:	140.4 °F	LIQUID COLL:	251.4 milliliters
SQ.RT ΔP:	0.3836 in.H ₂ O	CO₂:	17.24 % by volume
ΔH:	1.97 in.H ₂ O	O₂:	0.92 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS $V_{\text{mstd}} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{\text{bar}} + \frac{\Delta H}{13.6}}{T_m} \right] = 45.810 \text{ dscf}$ <p style="text-align: center;">$\gamma = 1.001$</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS $V_{\text{wstd}} = 0.04707 \times V_{\text{lc}} = 11.833 \text{ scf}$ <p style="text-align: center;">$V_{\text{lc}} = 251.4 \text{ mL}$</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED $B_{\text{ws}} = \frac{V_{\text{wstd}}}{V_{\text{wstd}} + V_{\text{mstd}}} = 0.2053$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION $B_{\text{ws@saturation}} = \frac{\text{S.V.P.}}{P_{\text{bar}} + \frac{P_{\text{static}}}{13.6}} = 0.1961$ <p style="text-align: center;">$\text{S.V.P.} = 5.881 \text{ in. Hg}$</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS $B_{\text{ws}} = 0.1961$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-027-1

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011

BAROMETRIC: 29.98 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 140.4 °F
SQ.RT ΔP: 0.3836 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 17.24 % by volume
O₂: 0.92 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.80	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.29	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3836	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.4 \text{ °F} + 460$	=	600.4	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.99	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	23.173	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	170,625.14	acfm
Stack Area =		122.71846	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right)$	=	150,424.74 9,025,484	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws})$	=	120,931.27 7,255,876	dscfm dscfh

AMMONIA CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/13/2011

RUN NO: FCCU-027-1

INPUT

V_m :	47.330 ft ³	Q_s :	7,255,876 dscfh
γ FACTOR:	1.001	T_s :	140.4 °F
P_{bar} :	29.98 in. Hg	Θ :	60 minutes
ΔH :	1.97	V_s :	23.173 fps
T_m :	89.8 °F	P_s :	29.99 in. Hg
NH_3 in sample:	630 µg	V_{lc} :	251.4 mL
		%O ₂ :	0.92 %

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	45.810 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	103.9 % I 102.5 % I*
$A_n =$	0.00075477 ft ²	Runtime (Θ) =	60 minutes
		* based upon saturation	
Total µg NH₃ in sample (M_n)		=	630 µg
Concentration of NH₃			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	0.0303 x 10 ⁻⁶ lbs/dscf
$C_{s(ppmvdb)} = C'_{s(lb/dscf)} \times \frac{385.26 ft^3/lb - mole}{17.031 lb/lb - mole} \times 10^6$		=	0.686 ppmv db
$C_{s(mg/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(1000 \mu g/mg)(V_{mstd})}$		=	0.4856 mg/dscm
NH₃ Mass Rate:			
		$E = Q_s \times C'_{s(lb/dscf)}$	= 0.21999 lbs/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-6B-2, FCCU-29-2, FCCU-027-2, FCCU-0061-4
 TEST DATE : 6/13/2011
 START TIME : 13:18
 END TIME : 17:03

GAS ANALYZER O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.567
 AVERAGE ZERO BIAS (C_o): 0.089
 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 0.73

GAS ANALYZER CO₂

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 9.99
 AVERAGE ZERO BIAS (C_o): 0.08
 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 17.42

GAS ANALYZER SO₂

SPAN VALUE : 90.0 ppm
 AVERAGE CAL. BIAS (C_m): 43.16
 AVERAGE ZERO BIAS (C_o): 1.57
 CALIBRATION GAS: EPA Protocol SO₂
 CALIBRATION PPM (C_{ma}): 45.00
 PPM CORRECTED (C_{gas}): 0.44

GAS ANALYZER NO_x

SPAN VALUE : 90.0 ppm
 AVERAGE CAL. BIAS (C_m): 43.33
 AVERAGE ZERO BIAS (C_o): 1.13
 CALIBRATION GAS: EPA Protocol NO
 CALIBRATION PPM (C_{ma}): 45.00
 PPM CORRECTED (C_{gas}): 9.71

$$\text{Example Calculation} = C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME ELAPSED TIME SO₂ NO_x O₂ CO₂

13:18	0				
13:19	1	1.8	10.7	0.85	17.35
13:20	2	2.0	10.8	0.83	17.38
13:21	3	2.1	10.5	0.83	17.39
13:22	4	1.9	10.4	0.77	17.43
13:23	5	1.9	10.3	0.77	17.43
13:24	6	1.8	10.3	0.74	17.45
13:25	7	1.9	10.1	0.74	17.48
13:26	8	1.8	10.0	0.72	17.48
13:27	9	2.0	9.8	0.71	17.48
13:28	10	1.9	9.9	0.69	17.51
13:29	11	2.1	9.9	0.68	17.51
13:30	12	2.0	9.7	0.69	17.51
13:31	13	2.0	9.5	0.65	17.53
13:32	14	1.9	9.5	0.65	17.53
13:33	15	1.9	9.6	0.65	17.54
13:34	16	1.9	9.7	0.67	17.55
13:35	17	1.9	9.1	0.64	17.54
13:36	18	2.0	9.7	0.60	17.58
13:37	19	1.9	10.2	0.74	17.51
13:38	20	2.1	10.0	0.76	17.46
13:39	21	1.9	9.8	0.68	17.50
13:40	22	1.9	9.3	0.64	17.52
13:41	23	1.9	9.2	0.63	17.54
13:42	24	1.9	9.3	0.64	17.52
13:43	25	1.9	9.5	0.67	17.50
13:44	26	2.1	9.4	0.70	17.50
13:45	27	2.1	9.2	0.66	17.52
13:46	28	1.9	9.3	0.64	17.53
13:47	29	2.0	9.4	0.68	17.52
13:48	30	2.1	9.5	0.69	17.50
13:49	31	2.0	11.4	0.96	17.26
13:50	32	1.9	9.1	0.65	17.53
13:51	33	2.0	8.8	0.61	17.56
13:52	34	2.0	8.7	0.60	17.57
13:53	35	1.9	9.1	0.61	17.56
13:54	36	1.8	9.4	0.67	17.52
13:55	37	1.9	10.0	0.72	17.49
13:56	38	1.9	10.3	0.81	17.44
13:57	39	1.9	10.5	0.82	17.42
13:58	40	1.9	10.6	0.86	17.39
13:59	41	1.9	10.7	0.85	17.39
14:00	42	1.9	10.9	0.87	17.38
14:01	43	1.9	11.1	0.90	17.35
14:02	44	2.0	11.2	0.92	17.31
14:03	45	1.9	11.4	0.93	17.30
14:04	46	1.9	11.8	0.99	17.25
14:05	47	1.9	11.8	1.01	17.24
14:06	48	1.9	11.9	1.00	17.24
14:07	49	1.9	12.1	1.03	17.21
14:08	50	2.1	12.3	1.08	17.17
14:09	51	2.1	12.7	1.11	17.14
14:10	52	1.9	12.8	1.18	17.09
14:11	53	2.0	13.2	1.19	17.06
14:12	54	2.0	13.1	1.21	17.03
14:13	55	2.0	13.1	1.20	17.04
14:14	56	2.0	13.3	1.22	17.02
14:15	57	2.0	13.0	1.23	17.01
14:16	58	1.9	13.0	1.22	17.01
14:17	59	2.0	13.2	1.24	16.99
14:18	60	1.9	13.4	1.24	17.00
14:19	61	2.1	13.3	1.28	16.94
14:20	62	1.9	13.1	1.28	16.95
14:21	63	1.9	13.2	1.24	16.97
14:22	64	2.0	13.3	1.26	16.97
14:23	65	2.0	13.1	1.24	16.98
14:24	66	2.0	12.9	1.19	17.01
14:25	67	1.9	12.7	1.16	17.03
14:26	68	2.0	12.7	1.10	17.08
14:27	69	2.0	12.9	1.15	17.07
14:28	70	1.9	13.1	1.17	17.05
14:29	71	2.0	13.1	1.21	16.99
14:30	72	2.0	13.1	1.22	16.97
14:31	73	2.1	12.9	1.19	17.00
14:32	74	2.1	12.8	1.22	16.97
14:33	75	2.0	12.6	1.14	17.03
14:34	76	2.0	12.4	1.15	17.04
14:35	77	1.9	12.5	1.14	17.04
14:36	78	1.9	12.8	1.13	17.05
14:37	79	1.9	12.6	1.14	17.06
14:38	80	1.9	12.4	1.15	17.04
14:39	81	2.0	12.1	1.09	17.07
14:40	82	2.0	11.9	1.08	17.08
14:41	83	1.9	11.7	1.07	17.09
14:42	84	2.1	11.6	1.01	17.14
14:43	85	1.9	11.7	0.99	17.15
14:44	86	2.0	11.6	1.00	17.15
14:45	87	2.0	11.6	1.04	17.13
14:46	88	1.9	11.7	1.02	17.13
14:47	89	2.0	11.6	1.02	17.14
14:48	90	2.0	11.7	1.01	17.14
14:49	91	2.1	11.6	1.02	17.14
14:50	92	2.1	11.9	1.02	17.12
14:51	93	2.0	11.6	1.02	17.14

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-5B-2, FCCU-29-2, FCCU-027-2
and FCCU-0061-4

CLOCK TIME	ELAPSED TIME	SO ₂	NO _x	O ₂	CO ₂
14:52	94	2.0	11.5	1.01	17.15
14:53	95	2.1	11.5	1.00	17.17
14:54	96	1.9	11.3	1.02	17.15
14:55	97	1.9	11.1	0.96	17.20
14:56	98	2.0	10.9	0.92	17.23
14:57	99	2.0	11.1	0.89	17.26
14:58	100	2.1	11.2	0.94	17.24
14:59	101	2.0	11.4	0.95	17.22
15:00	102	1.9	11.7	1.00	17.18
15:01	103	2.0	11.6	1.02	17.16
15:02	104	2.1	11.3	1.02	17.15
15:03	105	1.9	11.1	0.95	17.19
15:04	106	2.1	11.0	0.92	17.22
15:05	107	2.0	10.9	0.91	17.23
15:06	108	1.9	10.8	0.88	17.26
15:07	109	2.0	11.0	0.93	17.22
15:08	110	2.1	10.8	0.91	17.23
15:09	111	1.9	10.8	0.88	17.24
15:10	112	2.0	10.5	0.86	17.28
15:11	113	2.0	10.3	0.82	17.31
15:12	114	2.0	10.0	0.80	17.31
15:13	115	2.0	10.0	0.75	17.33
15:14	116	2.1	9.8	0.76	17.35
15:15	117	1.8	9.4	0.71	17.38
15:16	118	1.9	9.1	0.64	17.44
15:17	119	2.0	9.1	0.65	17.44
15:18	120	2.0	8.9	0.63	17.45
15:19	121	2.0	8.5	0.62	17.47
15:20	122	1.9	7.5	0.50	17.59
15:21	123	2.0	8.4	0.56	17.54
15:22	124	1.8	8.4	0.57	17.52
15:23	125	2.0	7.9	0.54	17.56
15:24	126	1.8	8.1	0.52	17.58
15:25	127	1.9	7.9	0.53	17.58
15:26	128	1.9	7.9	0.53	17.58
15:27	129	1.9	7.9	0.52	17.58
15:28	130	1.9	7.8	0.52	17.59
15:29	131	1.8	8.1	0.54	17.57
15:30	132	1.9	8.3	0.58	17.55
15:31	133	1.9	8.4	0.59	17.53
15:32	134	2.1	8.3	0.58	17.53
15:33	135	2.0	8.6	0.59	17.53
15:34	136	2.0	8.1	0.60	17.52
15:35	137	1.9	7.8	0.53	17.56
15:36	138	1.9	7.6	0.53	17.57
15:37	139	1.8	7.7	0.53	17.57
15:38	140	1.9	7.2	0.53	17.58
15:39	141	1.8	7.1	0.46	17.62
15:40	142	2.0	7.4	0.50	17.60
15:41	143	2.0	7.3	0.51	17.58
15:42	144	1.9	7.1	0.51	17.59
15:43	145	1.8	6.9	0.46	17.62
15:44	146	2.0	6.5	0.45	17.62
15:45	147	2.0	6.4	0.43	17.65
15:46	148	1.9	6.5	0.43	17.65
15:47	149	2.0	6.2	0.41	17.67
15:48	150	2.0	6.0	0.36	17.70
15:49	151	1.9	5.8	0.33	17.74
15:50	152	2.1	6.9	0.35	17.72
15:51	153	2.2	8.2	0.49	17.59
15:52	154	2.0	8.6	0.58	17.51
15:53	155	2.1	8.4	0.56	17.55
15:54	156	2.0	8.6	0.54	17.56
15:55	157	2.0	8.7	0.56	17.55
15:56	158	2.0	8.5	0.55	17.56
15:57	159	2.0	8.3	0.53	17.58
15:58	160	2.0	8.2	0.52	17.59
15:59	161	2.0	8.5	0.52	17.59
16:00	162	2.1	8.6	0.56	17.58
16:01	163	2.0	8.6	0.56	17.58
16:02	164	2.0	8.8	0.54	17.59
16:03	165	2.0	8.9	0.61	17.53
16:04	166	2.2	8.8	0.59	17.54
16:05	167	2.0	9.0	0.59	17.55
16:06	168	2.2	9.2	0.59	17.55
16:07	169	2.1	9.4	0.66	17.50
16:08	170	2.0	9.6	0.64	17.51
16:09	171	2.0	9.7	0.66	17.49
16:10	172	2.1	9.5	0.66	17.49
16:11	173	2.1	9.7	0.65	17.50
16:12	174	1.9	9.9	0.69	17.48
16:13	175	2.1	10.1	0.72	17.45
16:14	176	2.2	9.6	0.67	17.48
16:15	177	2.1	9.5	0.66	17.48
16:16	178	1.9	9.7	0.65	17.50
16:17	179	2.0	9.8	0.68	17.48
16:18	180	2.1	10.1	0.70	17.47
16:19	181	2.0	10.4	0.73	17.45
16:20	182	2.0	10.6	0.78	17.41
16:21	183	2.1	10.6	0.79	17.38
16:22	184	2.0	10.6	0.78	17.39
16:23	185	1.9	10.6	0.77	17.40
16:24	186	2.0	10.5	0.77	17.40
16:25	187	2.0	10.6	0.76	17.40

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-5B-2, FCCU-29-2, FCCU-027-2
and FCCU-0061-4

CLOCK TIME	ELAPSED TIME	SO ₂	NO _x	O ₂	CO ₂
16:26	188	2.1	10.6	0.77	17.40
16:27	189	1.9	10.9	0.79	17.38
16:28	190	2.0	11.0	0.85	17.33
16:29	191	1.9	11.0	0.86	17.32
16:30	192	2.0	11.1	0.85	17.32
16:31	193	2.0	10.9	0.86	17.31
16:32	194	1.9	10.7	0.79	17.35
16:33	195	2.1	11.1	0.80	17.36
16:34	196	2.0	11.1	0.90	17.29
16:35	197	2.0	11.0	0.85	17.32
16:36	198	2.0	11.1	0.85	17.32
16:37	199	2.0	11.2	0.88	17.30
16:38	200	2.0	11.3	0.89	17.28
16:39	201	2.0	11.2	0.87	17.29
16:40	202	2.1	11.1	0.86	17.29
16:41	203	1.9	10.9	0.84	17.32
16:42	204	2.1	10.8	0.82	17.33
16:43	205	2.0	11.0	0.84	17.33
16:44	206	2.0	10.9	0.85	17.31
16:45	207	2.1	11.0	0.84	17.32
16:46	208	2.1	11.0	0.86	17.31
16:47	209	1.9	10.7	0.82	17.33
16:48	210	2.0	10.6	0.78	17.37
16:49	211	2.1	10.4	0.77	17.37
16:50	212	1.9	6.3	5.05	14.36
16:51	213	2.0	10.2	0.73	17.40
16:52	214	2.0	10.0	0.72	17.42
16:53	215	2.1	9.8	0.69	17.46
16:54	216	1.9	10.0	0.70	17.45
16:55	217	2.0	10.0	0.72	17.42
16:56	218	1.9	10.1	0.70	17.44
16:57	219	1.9	10.0	0.71	17.44
16:58	220	1.9	10.2	0.71	17.43
16:59	221	2.0	10.3	0.75	17.42
17:00	222	1.9	10.2	0.75	17.41
17:01	223	1.9	10.3	0.73	17.41
17:02	224	2.1	10.1	0.73	17.42
17:03	225	2.0	10.0	0.71	17.43
Uncorrected Average (C) =		1.98	10.24	0.817	17.350

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NUMBER: FCCU-5B-2

γ FACTOR:	0.999	STACK DIAM:	150.00 inches
BAROMETRIC:	29.98 in. Hg	METER VOLUME:	96.335 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	105.0 °F
STACK TEMP:	140.8 °F	LIQUID COLL:	502.6 milliliters
SQ.RT ΔP:	0.3774 in.H ₂ O	CO₂:	17.42 % by volume
ΔH:	1.90 in.H ₂ O	O₂:	0.73 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

<p>VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS</p> $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 90.537 \text{ dscf}$ <p style="text-align: center;">$\gamma = 0.999$</p>
<p>VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS</p> $V_{wstd} = 0.04707 \times V_{lc} = 23.657 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 502.6 \text{ mL}$</p>
<p>FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED</p> $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2072$
<p>FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION</p> $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2012$ <p style="text-align: center;">$S.V.P. = 6.034 \text{ in. Hg}$</p>
<p>FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS</p> <p style="text-align: right;">$B_{ws} = 0.2012$</p>

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refiner
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-5B-2

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011

BAROMETRIC: 29.98 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 140.8 °F
SQ.RT ΔP: 0.3774 in.H₂O

STACK DIAM: 150.00 inches
CO₂: 17.42 % by volume
O₂: 0.73 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.82	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.24	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3774	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.8 \text{ °F} + 460$	=	600.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.99	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.826	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	168,067	acfm
Stack Area =		122.718	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	148,071 8,884,245	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	118,284 7,097,012	dscfm dscfh

ARI ENVIRONMENTAL, INC.
USEPA METHOD 202 - CONDENSIBLE PARTICULATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/11
RUN NUMBER: FCCU-5B-2

INPUT

V_m: 96.335 ft³
γ FACTOR: 0.999
P_{bar}: 29.98 in.Hg
ΔH: 1.9 in.H₂O
T_m: 105 °F
V_{lc}: 502.6 mL
N: 0.0000
V_t: 0.00 mL
m_r: 5.95 mg
m_o: 6.60 mg

Q_s: 118,284 dscfm
T_s: 140.8 °F
Runtime: 120 minutes
V_s: 22.826 ft/sec
P_s: 29.99 in.Hg
Noz. diam: 0.373 inches
m_{lb}: 0.00 mL
m_{ob}: 0.00 mL

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 90.537 \text{ dscf}$$

MASS OF AMMONIA CORRECTION

Equation #1 $m_c = 17.03 \times V_T \times N = 0.00 \text{ mg}$

MASS OF THE FIELD BLANK

Equation #2 $m_{fb} = m_{lb} + m_{ob} = 0.00 \text{ mg}$

MASS OF INORGANIC CONDENSIBLE PM

Equation #3 $m_i = m_r - m_c = 5.95 \text{ mg}$

TOTAL MASS OF CONDENSIBLE PM

Equation #4 $m_{cpm} = m_i + m_o - m_{fb} = 12.55 \text{ mg}$

TOTAL CONCENTRATION OF CONDENSIBLE PM - METRIC UNITS

Equation #5 $C_{cpm} = \frac{m_{cpm}}{V_{m(std)}} = 0.1386 \text{ mg/dscf}$

TOTAL CONCENTRATION OF CONDENSIBLE PM - ENGLISH UNITS

$C_s = (0.01543)(C_{cpm})$ Total = 0.00214 gr/dscf
 $C'_s = (2.205 \times 10^{-6})(C_{cpm})$ C'_s Total = 0.3057 x 10⁻⁶ lbs/dscf

EMISSION RATE

$pmr = \left(\frac{C_s}{7000} \right) (Q_{std})(60)$ Total = 2.1685 lbs/hr
9.4981 ton/yr

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 103.95 \% I$$

102.99 @ saturation

A_n = 0.000759 ft² **Runtime** = 120 minutes

ARI ENVIRONMENTAL, INC.
USEPA METHOD 5/202 - TOTAL PM CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/11
RUN NUMBER: FCCU-5B-2

INPUT

V_m:	96.335	ft ³	Q_s:	118,284	dscfm
γ FACTOR:	0.999		T_s:	140.8	°F
P_{bar}:	29.98	in.Hg	Runtime:	120	minutes
ΔH:	1.9	in.H ₂ O	V_s:	22.826	ft/sec
T_m:	105	°F	P_s:	29.99	in.Hg
V_{lc}:	502.6	mL	Noz. diam:	0.373	inches
M_n total:	45.7	mg	Regenerator Coke Burn (R_c):	22,858	lb/hr
CO₂:	17.42	% by volume			
O₂:	0.73	% by volume			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS					
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$	=	90.537	dscf		
$\gamma = 0.999$					
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS					
$V_{wstd} = 0.04707 \times V_{lc}$	=	23.657	scf		
FRACTIONAL MOISTURE CONTENT OF STACK GAS					
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} \times 100$	=	20.72	%		
PARTICULATE CONCENTRATION IN STACK GAS ON A DRY BASIS					
$C_s = (0.01543) \left(\frac{M_n}{V_{mstd}} \right)$	Total	=	0.00779	gr/dscf	
$C'_s = (2.205 \times 10^{-6}) \left(\frac{M_n}{V_{mstd}} \right)$	C'_s Total	=	1.1135	x 10 ⁻⁶ lbs/dscf	
EMISSION RATE					
$pmr = \left(\frac{C_s}{7000} \right) (Q_{std}) (60)$	Total	=	7.9000 34.602	lbs/hr ton/yr	
$pmr_{lb/1000lbcokeburn} = \frac{(pmr)(1000)}{(R_c)}$	Total	=	0.346	lb/1000 lb coke burn	
ISOKINETIC SAMPLING RATE					
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$	=	103.95 102.99	% I @ saturation		
$A_n = 0.000759 \text{ ft}^2$	Runtime =	120	minutes		

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NUMBER: FCCU-29-2

γ FACTOR:	1.005	STACK DIAM:	150.00 inches
BAROMETRIC:	29.95 in. Hg	METER VOLUME:	131.810 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	103.9 °F
STACK TEMP:	140.5 °F	LIQUID COLL:	694.1 milliliters
SQ.RT ΔP:	0.3645 in.H ₂ O	CO₂:	17.42 % by volume
ΔH:	1.90 in.H ₂ O	O₂:	0.73 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 124.739 \text{ dscf}$$

$\gamma = 1.005$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 32.671 \text{ scf}$$

$V_{lc} = 694.1 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2076$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2014$$

$S.V.P. = 6.034 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.2014$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-29-2

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011

BAROMETRIC: 29.95 in. Hg	STACK DIAM: 150.00 inches
STATIC PRES: 0.2 in.H ₂ O	CO₂: 17.42 % by volume
STACK TEMP: 140.5 °F	O₂: 0.73 % by volume
SQ.RT ΔP: 0.3645 in.H ₂ O	

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.82	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.24	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3645	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.5 \text{ °F} + 460$	=	600.5	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.96	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.052	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	162,370	acfm
Stack Area =		122.7184	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	142,980.2 8,578,811	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	114,188.2 6,851,294	dscfm dscfh

METHOD 29 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NO: FCCU-29-2

INPUT

V_m:	131.810 ft ³	Q_s:	6,851,294 dscfh
γ FACTOR:	1.005	T_s:	140.5 °F
P_{bar}:	29.95 in. Hg	Θ:	180.0 minutes
ΔH:	1.90 in. H ₂ O	V_s:	22.052 fps
T_m:	103.9 °F	P_s:	29.96 in. Hg
		V_{lc}:	694.1 mL

**Volume of Sample at Standard
Conditions on a Dry Basis:**

English Units
(29.92 in. Hg, 68 °F)

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 124.739 \text{ dscf}$$

Isokinetic Sampling Rate

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = \begin{matrix} 99.99 & \% I \\ 99.05 & \% I^* @saturation \end{matrix}$$

A_n = 0.00075072 ft²

Runtime (θ) = 180 minutes



Metals Laboratory Data Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/13/2011
Run #: FCCU-29-2

Front Half Metal Calculation

Metal	Detection Limit (micrograms)	FH Sample (M _{fh}) (micrograms)	FH Blank (M _{fhb}) (micrograms)	<u>I Value</u>	<u>II Values</u>		Greater Value I vs II (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
				<u>A Value</u> (4 inch filter) (micrograms)	5 % of FH Sample (micrograms)	Lesser value (M _{fhb}) vs 5% (micrograms)			
Antimony	0.2	0.2000	0.2000	17.590	0.010	0.010	17.590	0.200	0.000
Arsenic	1	1.0000	1.0000	17.590	0.050	0.050	17.590	1.000	0.000
Beryllium	0.2	0.2000	0.2000	17.590	0.010	0.010	17.590	0.200	0.000
Cadmium	0.1	0.5330	0.1220	17.590	0.027	0.027	17.590	0.122	0.411
Chromium	1	3.3900	1.3500	17.590	0.170	0.170	17.590	1.350	2.040
Lead	0.5	1.3000	0.5000	17.590	0.065	0.065	17.590	0.500	0.800
Manganese	0.5	1.8100	1.9200	17.590	0.091	0.091	17.590	1.920	-0.110
Nickel	0.2	8.6800	1.5800	17.590	0.434	0.434	17.590	1.580	7.100
Selenium	2	2.0000	2.0000	17.590	0.100	0.100	17.590	2.000	0.000
Cobalt	0.2	0.3110	0.2000	17.590	0.016	0.016	17.590	0.200	0.111

Back Half Metal Calculation

Metal	Detection Limit (micrograms)	BH Sample (M _{bh}) (micrograms)	BH Blank (M _{bhb}) (micrograms)	<u>I Value</u>	<u>II Values</u>		Greater Value I vs II (micrograms)	Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
				(micrograms)	5 % of BH Sample (micrograms)	Lesser value (M _{bh}) vs 5% (micrograms)			
Antimony	0.1	0.1000	0.1000	1.000	0.005	0.005	1.000	0.100	0.000
Arsenic	0.2	0.2000	0.2000	1.000	0.010	0.010	1.000	0.200	0.000
Beryllium	0.1	0.1000	0.1000	1.000	0.005	0.005	1.000	0.100	0.000
Cadmium	0.05	2.1400	0.0500	1.000	0.107	0.107	1.000	0.050	2.090
Chromium	0.15	1.9100	0.3020	1.000	0.096	0.096	1.000	0.302	1.608
Lead	0.05	1.6800	0.1090	1.000	0.084	0.084	1.000	0.109	1.571
Manganese	0.15	1.4300	0.2490	1.000	0.072	0.072	1.000	0.249	1.181
Nickel	0.1	3.8900	0.9210	1.000	0.195	0.195	1.000	0.921	2.969
Selenium	1	1.0000	1.0000	1.000	0.050	0.050	1.000	1.000	0.000
Cobalt	0.1	0.5030	0.1000	1.000	0.025	0.025	1.000	0.100	0.403

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)
	(micrograms)	(micrograms)	(micrograms)	(micrograms)	(micrograms)
Antimony	0.200	0.200	0.100	0.100	0.300 BDL
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	0.533	0.122	2.140	0.050	2.501 ADL
Chromium	3.390	1.350	1.910	0.302	3.648 ADL
Lead	1.300	0.500	1.680	0.109	2.371 ADL
Manganese	1.810	1.920	1.430	0.249	1.071 ADL
Nickel	8.680	1.580	3.890	0.921	10.069 ADL
Selenium	2.000	2.000	1.000	1.000	3.000 BDL
Cobalt	0.311	0.200	0.503	0.100	0.514 ADL

$$M_t = (M_{fh} - M_{fhb}) + (M_{bh} - M_{bhb})$$



USEPA Method 29 Metals Emissions Calculation Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/13/2011
Run #: FCCU-29-2

Test Data Input

Barometric pressure (P_{bar}): 29.95 inches Hg
Stack pressure (P_s): 29.96 inches Hg Abs.
Test length (θ): 180.0 minutes
Sample nozzle diameter (D_n): 0.3710 inches
Sample nozzle area (A_n): 0.000751 ft²
Stack temperature (T_s): 140.5 °F
Volume metered (V_{mstd}): 124.739 dscf
Stack gas velocity (V_s): 22.052 ft/sec
Stack gas volumetric flow (Q_{std}): 6,851,294 dscfh
Fractional Moisture content (B_{wa}): 0.2014
Stack Oxygen Content (%O₂): 0.73 %

Metals Laboratory Analysis Weights (M_t)

Antimony (Sb): < 0.30 µg
Arsenic (As): < 1.20 µg
Beryllium (Be): < 0.30 µg
Cadmium (Cd): 2.50 µg
Chromium (Cr): 3.65 µg
Lead (Pb): 2.37 µg
Manganese (Mn): 1.07 µg
Nickel (Ni): 10.07 µg
Selenium (Se): < 3.00 µg
Cobalt (Co): 0.51 µg

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

Metals concentration (µg/dscf):

$$C_s = \frac{M_t}{\left(\frac{V_{mstd}}{35.315 \text{ dscf / dscm}} \right)}$$

=	< 0.084933 µg/dscf	Antimony (Sb)	=	0.303212 µg/dscf	Manganese (Mn)
=	< 0.339733 µg/dscf	Arsenic (As)	=		
=	< 0.084933 µg/dscf	Beryllium (Be)	=	2.850644 µg/dscf	Nickel (Ni)
=	0.708060 µg/dscf	Cadmium (Cd)	=	< 0.849333 µg/dscf	Selenium (Se)
=	1.032789 µg/dscf	Chromium (Cr)	=	0.145519 µg/dscf	Cobalt (Co)
=	0.671256 µg/dscf	Lead (Pb)	=		

Metals concentration ($\times 10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} \text{ lb}}{\mu\text{g}} \times M_t \right)}{V_{mstd}}$$

=	< 0.005302 $\times 10^{-9}$ lb/dscf	Antimony (Sb)	=	0.018929 $\times 10^{-9}$ lb/dscf	Manganese (Mn)
=	< 0.021208 $\times 10^{-9}$ lb/dscf	Arsenic (As)	=		
=	< 0.005302 $\times 10^{-9}$ lb/dscf	Beryllium (Be)	=	0.177956 $\times 10^{-9}$ lb/dscf	Nickel (Ni)
=	0.044202 $\times 10^{-9}$ lb/dscf	Cadmium (Cd)	=	< 0.053021 $\times 10^{-9}$ lb/dscf	Selenium (Se)
=	0.064474 $\times 10^{-9}$ lb/dscf	Chromium (Cr)	=	0.009084 $\times 10^{-9}$ lb/dscf	Cobalt (Co)
=	0.041904 $\times 10^{-9}$ lb/dscf	Lead (Pb)	=		

Metals emission rate ($\times 10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

=	< 0.363263 $\times 10^{-4}$ lb/hr	Antimony (Sb)	=	1.296849 $\times 10^{-4}$ lb/hr	Manganese (Mn)
=	< 1.453052 $\times 10^{-4}$ lb/hr	Arsenic (As)	=		
=	< 0.363263 $\times 10^{-4}$ lb/hr	Beryllium (Be)	=	12.192314 $\times 10^{-4}$ lb/hr	Nickel (Ni)
=	3.028402 $\times 10^{-4}$ lb/hr	Cadmium (Cd)	=	< 3.632629 $\times 10^{-4}$ lb/hr	Selenium (Se)
=	4.417277 $\times 10^{-4}$ lb/hr	Chromium (Cr)	=	0.622390 $\times 10^{-4}$ lb/hr	Cobalt (Co)
=	2.870988 $\times 10^{-4}$ lb/hr	Lead (Pb)	=		

SO₂ CALIBRATION CORRECTION DATA SHEET

USEPA METHOD 6C

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: Bovar-Western Research 721-ATM
RUN NO: FCCU-29-2
TEST DATE: 6/13/2011

INPUT

SO ₂ AVERAGE CHART READING (C):	1.98 ppmv
AVG PRE/POST ZERO DRIFT READING (C _o):	1.57 ppmv
CAL GAS CONCENTRATION (C _{ma}):	45.0 ppmv
AVG CAL PRE/POST TEST READING (C _m):	43.16 ppmv
STACK GAS VOLUMETRIC FLOW RATE (Q _{std}):	6,851,294 dscfh

CALCULATIONS

STACK SO₂ AVERAGE CHART READING = 1.98 ppmv

STACK SO₂ CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{SO}_2 \text{ CONC, ppmv} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = 0.4 \text{ ppmv db}$$

(corrected)

SO₂ CONC.(lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{64 \text{ lb / lb - mole}}{385.26 \times 10^6 \text{ ft}^3 \text{ / lb - mole}} \right) = 0.0729 \times 10^{-6} \text{ lbs/dscf}$$

SO₂ EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 6,851,294 dscfh

STACK SO₂ EMISSION RATE =

$$\text{SO}_{2\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = 0.4994 \text{ lbs/hr}$$

NO_x CALIBRATION CORRECTION DATA SHEET
USEPA METHOD 7E

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: CAI Model 600 CLD
RUN NO: FCCU-29-2
TEST DATE: 6/13/2011

INPUT

NO _x AVERAGE CHART READING (C):	10.24	ppmv
AVG PRE/POST ZERO DRIFT READING (C _o):	1.13	ppmv
CAL GAS CONCENTRATION (C _{ma}):	45.0	ppmv
AVG CAL PRE/POST TEST READING (C _m):	43.33	ppmv
STACK GAS VOLUMETRIC FLOW RATE (Q _{std}):	6,851,294	dscfh

CALCULATIONS

STACK NO_x AVERAGE CHART READING = 10.24 ppmv

STACK NO_x CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{NO}_x \text{ CONC, ppmv} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = 9.7 \text{ ppmv db}$$

(corrected)

NO_x CONC. (lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{46 \text{ lb/lb-mole}}{385.26 \times 10^6 \text{ ft}^3/\text{lb-mole}} \right) = 1.1598 \times 10^{-6} \text{ lbs/dscf}$$

NO_x EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 6,851,294 dscfh

STACK NO_x EMISSION RATE =

$$\text{SO}_{2\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = 7.9459 \text{ lbs/hr}$$

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NUMBER: FCCU-027-2

γ FACTOR:	1.001	STACK DIAM:	150.0 inches
BAROMETRIC:	29.95 in. Hg	METER VOLUME:	47.585 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	96.4 °F
STACK TEMP:	140.3 °F	LIQUID COLL:	255.2 milliliters
SQ. RT ΔP:	0.3794 in.H ₂ O	CO₂:	17.42 % by volume
ΔH:	1.95 in.H ₂ O	O₂:	0.73 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 45.463 \text{ dscf}$ <p style="text-align: center;">$\gamma = 1.001$</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS $V_{wstd} = 0.04707 \times V_{lc} = 12.012 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 255.2 \text{ mL}$</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2090$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.1963$ <p style="text-align: center;">$S.V.P. = 5.881 \text{ in. Hg}$</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS $B_{ws} = 0.1963$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-027-2

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011

BAROMETRIC: 29.95 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 140.3 °F
SQ.RT ΔP: 0.3794 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 17.42 % by volume
O₂: 0.73 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.82	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.30	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3794	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.3 \text{ °F} + 460$	=	600.3	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.96	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.923	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	168,784.04	acfm
Stack Area =		122.71846	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right)$	=	148,677.54 8,920,653	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws})$	=	119,497.46 7,169,848	dscfm dscfh

AMMONIA CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/13/2011

RUN NO: FCCU-027-2

INPUT

V_m:	47.585 ft ³	Q_s:	7,169,848 dscfh
γ FACTOR:	1.001	T_s:	140.3 °F
P_{bar}:	29.95 in. Hg	Θ:	60 minutes
ΔH:	1.95	V_s:	22.923 fps
T_m:	96.4 °F	P_s:	29.96 in. Hg
NH₃ in sample:	2,543 μg	V_{lc}:	255.2 mL
		%O₂:	0.73 %

Volume of Sample at Standard Conditions on a Dry Basis:	English Units (29.92 in. Hg, 68 °F)
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$	= 45.463 dscf
Isokinetic Sampling Rate	
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$	= 104.8 % I 103.0 % I*
$A_n = 0.00075477 \text{ ft}^2$	Runtime (θ) = 60 minutes
* based upon saturation	
Total $\mu\text{g NH}_3$ in sample (M_n)	= 2,543 μg
Concentration of NH_3	
$C'_{s(\text{lb/dscf})} = \frac{(2.2046 \times 10^{-9} \text{ lb}/\mu\text{g})(M_n)}{V_{mstd}}$	= 0.1233 $\times 10^{-6}$ lbs/dscf
$C_{s(\text{ppmvdb})} = C'_{s(\text{lb/dscf})} \times \frac{385.26 \text{ ft}^3/\text{lb} - \text{mole}}{17.031 \text{ lb}/\text{lb} - \text{mole}} \times 10^6$	= 2.790 ppmv db
$C_{s(\text{mg/dscm})} = \frac{(M_n)(35.31 \text{ ft}^3/\text{m}^3)}{(1000 \mu\text{g}/\text{mg})(V_{mstd})}$	= 1.9751 mg/dscm
NH ₃ Mass Rate:	
$E = Q_s \times C'_{s(\text{lb/dscf})}$	= 0.88415 lbs/hr

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011
RUN NUMBER: FCCU-0061-4

γ FACTOR:	0.987	STACK DIAM:	150.0 inches
BAROMETRIC:	29.95 in. Hg	METER VOLUME:	141.360 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	106.2 °F
STACK TEMP:	140.3 °F	LIQUID COLL:	734.0 milliliters
SQ.RT ΔP:	0.3702 in.H ₂ O	CO₂:	17.42 % by volume
ΔH:	1.98 in.H ₂ O	O₂:	0.73 % by volume

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] =$	130.873 dscf
$\gamma = 0.987$	
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS	
$V_{wstd} = 0.04707 \times V_{lc} =$	
34.549 scf	
$V_{lc} = 734.0 \text{ mL}$	
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED	
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} =$	
0.2089	
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION	
$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} =$	
0.1963	
$S.V.P. = 5.881 \text{ in. Hg}$	
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS	
$B_{ws} =$	
0.1963	

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0061-4

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/13/2011

BAROMETRIC: 29.95 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 140.3 °F
SQ.RT ΔP: 0.3702 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 17.42 % by volume
O₂: 0.73 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.82	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.30	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\sqrt{\Delta P} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3702	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.3 \text{ °F} + 460$	=	600.3	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.96	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.367	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	164,691.22	acfm
Stack Area =	122.71846	ft ²	
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	145,072.29	scfm, wb
		8,704,337	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	116,599.79	dscfm
		6,995,987	dscfh

HEXAVALENT CHROMIUM CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/13/2011

RUN NO: FCCU-0061-4

INPUT

V_m:	141.360 ft ³	Q_s:	6,995,987 dscfh
γ FACTOR:	0.987	T_s:	140.3 °F
P_{bar}:	29.95 in. Hg	Θ:	180.0 minutes
ΔH:	1.98	V_s:	22.367 fps
T_m:	106.2 °F	P_s:	29.96 in. Hg
HexChrome:	< 2 µg/L	V_{lc}:	734.0 mL
Sample Volume:	1319 mL	%O₂:	0.73 %
Total Mass of Cr⁺⁶:	< 2.6 µg		

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	130.873 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	103.1 % I 101.3 % I*
A _n =	0.00075477 ft ²	Runtime (Θ) =	180 minutes
		* based upon saturation	
Total µg Hexavalent Chromium in sample (M_n)		=	< 2.6 µg
Concentration of Hexavalent Chromium			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0000444 x 10 ⁻⁶ lb/dscf
$C_{s(\mu g/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(V_{mstd})}$		=	< 0.6556 µg/dscm
Hexavalent Chromium Mass Rate:		E = Q _s × C' _{s(lb/dscf)}	= < 0.000311 lb/hr

MONITOR DATA SUMMARY

COMPANY : Valero Port Arthur Refinery
 SOURCE : 1241 FCCU WGS Stack
 REPETITION : FCCU-5B-3, FCCU-29-3, FCCU-027-3, FCCU-0061-5
 TEST DATE : 6/14/2011
 START TIME : 7:37
 END TIME : 11:12

GAS ANALYZER O₂

SPAN VALUE : 9.00 %
 AVERAGE CAL. BIAS (C_m): 4.521
 AVERAGE ZERO BIAS (C_o): 0.043
 CALIBRATION GAS: EPA Protocol O₂
 CALIBRATION % (C_{ma}): 4.50
 % CORRECTED (C_{gas}): 1.20

GAS ANALYZER CO₂

SPAN VALUE : 19.60 %
 AVERAGE CAL. BIAS (C_m): 10.00
 AVERAGE ZERO BIAS (C_o): 0.09
 CALIBRATION GAS: EPA Protocol CO₂
 CALIBRATION % (C_{ma}): 10.00
 % CORRECTED (C_{gas}): 17.04

GAS ANALYZER SO₂

SPAN VALUE : 90.0 ppm
 AVERAGE CAL. BIAS (C_m): 43.56
 AVERAGE ZERO BIAS (C_o): 2.06
 CALIBRATION GAS: EPA Protocol SO₂
 CALIBRATION PPM (C_{ma}): 45.00
 PPM CORRECTED (C_{gas}): -1.35

GAS ANALYZER NO_x

SPAN VALUE : 90.0 ppm
 AVERAGE CAL. BIAS (C_m): 45.09
 AVERAGE ZERO BIAS (C_o): 1.44
 CALIBRATION GAS: EPA Protocol NO
 CALIBRATION PPM (C_{ma}): 45.00
 PPM CORRECTED (C_{gas}): 13.64

$$\text{Example Calculation} = C_{\text{gas}} = \left(\bar{C} - C_o \right) \frac{C_{ma}}{C_m - C_o}$$

CLOCK TIME ELAPSED TIME SO₂ NO_x O₂ CO₂

7:37	0	---	---	---	---
7:38	1	1.8	13.4	1.23	17.03
7:39	2	1.8	13.5	1.16	17.09
7:40	3	1.6	13.9	1.20	17.07
7:41	4	1.5	13.7	1.22	17.05
7:42	5	1.4	14.1	1.19	17.07
7:43	6	1.4	13.8	1.20	17.07
7:44	7	1.4	13.7	1.14	17.13
7:45	8	1.3	14.4	1.18	17.10
7:46	9	1.2	14.1	1.20	17.07
7:47	10	1.3	14.1	1.11	17.16
7:48	11	1.3	15.0	1.12	17.16
7:49	12	1.3	14.5	1.18	17.11
7:50	13	1.2	14.5	1.15	17.14
7:51	14	1.2	16.1	1.12	17.16
7:52	15	1.2	14.8	1.16	17.12
7:53	16	1.2	14.3	1.12	17.16
7:54	17	1.2	15.3	1.12	17.17
7:55	18	1.2	17.0	1.10	17.19
7:56	19	1.1	14.5	1.08	17.21
7:57	20	1.2	14.0	1.13	17.17
7:58	21	1.1	13.9	1.15	17.14
7:59	22	1.1	13.8	1.15	17.15
8:00	23	1.1	14.0	1.15	17.14
8:01	24	1.1	14.0	1.16	17.15
8:02	25	1.0	13.7	1.15	17.15
8:03	26	1.0	13.7	1.15	17.14
8:04	27	1.0	13.5	1.13	17.16
8:05	28	1.0	13.4	1.10	17.18
8:06	29	1.1	13.5	1.08	17.22
8:07	30	0.9	13.6	1.12	17.19
8:08	31	0.8	13.0	1.03	17.25
8:09	32	0.9	13.3	1.10	17.20
8:10	33	0.9	13.6	1.11	17.20
8:11	34	0.9	13.9	1.14	17.16
8:12	35	0.8	14.1	1.18	17.13
8:13	36	0.9	14.1	1.20	17.09
8:14	37	1.0	14.1	1.18	17.14
8:15	38	1.0	14.4	1.19	17.12
8:16	39	1.0	13.7	1.22	17.08
8:17	40	0.8	13.7	1.11	17.19
8:18	41	0.7	13.8	1.14	17.15
8:19	42	0.7	13.7	1.11	17.17
8:20	43	0.9	13.5	1.10	17.19
8:21	44	0.8	13.5	1.07	17.21
8:22	45	0.8	13.4	1.07	17.22
8:23	46	0.8	13.4	1.07	17.20
8:24	47	0.8	13.2	1.05	17.23
8:25	48	0.9	12.9	1.00	17.27
8:26	49	0.8	13.0	1.01	17.26
8:27	50	0.7	12.8	1.02	17.26
8:28	51	0.8	12.4	0.95	17.31
8:29	52	0.8	12.2	0.93	17.33
8:30	53	0.9	12.1	0.92	17.33
8:31	54	0.8	11.6	0.88	17.38
8:32	55	0.7	11.7	0.84	17.42
8:33	56	0.8	11.8	0.82	17.44
8:34	57	0.8	11.9	0.86	17.40
8:35	58	0.8	11.5	0.88	17.38
8:36	59	0.6	11.5	0.86	17.40
8:37	60	0.8	12.0	0.88	17.38
8:38	61	0.8	12.0	0.94	17.33
8:39	62	0.8	12.0	0.89	17.37
8:40	63	0.8	12.2	0.92	17.33
8:41	64	0.8	12.0	0.77	17.39
8:42	65	0.7	13.1	0.88	17.36
8:43	66	0.9	13.1	0.98	17.27
8:44	67	0.9	13.6	1.02	17.24
8:45	68	0.8	13.0	1.05	17.22
8:46	69	0.8	13.8	0.97	17.29
8:47	70	0.8	14.1	1.10	17.18
8:48	71	0.8	14.6	1.14	17.16
8:49	72	0.8	14.2	1.19	17.08
8:50	73	0.8	14.7	1.19	17.10
8:51	74	0.7	14.8	1.20	17.06
8:52	75	0.8	15.2	1.27	17.03
8:53	76	0.8	15.0	1.30	16.96
8:54	77	0.8	15.2	1.24	17.02
8:55	78	0.8	15.1	1.26	17.01
8:56	79	0.7	15.1	1.28	17.00
8:57	80	0.8	14.9	1.24	17.04
8:58	81	0.9	15.4	1.27	16.99
8:59	82	0.9	15.9	1.37	16.93
9:00	83	1.0	15.7	1.38	16.90
9:01	84	0.9	15.2	1.33	16.92
9:02	85	0.9	15.5	1.30	16.99
9:03	86	1.0	15.2	1.37	16.90
9:04	87	0.9	15.3	1.36	16.91
9:05	88	0.9	15.3	1.36	16.90
9:06	89	0.8	15.5	1.40	16.87
9:07	90	0.9	15.4	1.38	16.89
9:08	91	0.8	15.6	1.36	16.90
9:09	92	0.9	15.7	1.37	16.89
9:10	93	1.0	15.9	1.40	16.87

MONITOR DATA SUMMARY

Continued (page 2 of 3): FCCU-5B-3, FCCU-29-3, FCCU-027-3 and
FCCU-0061-5

CLOCK TIME	ELAPSED TIME	SO ₂	NO _x	O ₂	CO ₂
9:11	94	0.8	15.7	1.41	16.87
9:12	95	0.9	15.2	1.40	16.87
9:13	96	0.9	15.7	1.36	16.90
9:14	97	0.8	15.6	1.38	16.88
9:15	98	0.8	15.8	1.39	16.87
9:16	99	0.8	16.2	1.45	16.81
9:17	100	0.9	15.9	1.43	16.83
9:18	101	0.7	15.8	1.38	16.96
9:19	102	0.9	15.6	1.43	16.83
9:20	103	1.0	15.9	1.37	16.88
9:21	104	0.9	16.0	1.44	16.83
9:22	105	0.8	16.1	1.43	16.83
9:23	106	0.8	15.9	1.41	16.62
9:24	107	0.9	15.7	1.35	16.88
9:25	108	0.8	15.8	1.36	16.87
9:26	109	0.9	15.6	1.38	16.86
9:27	110	0.7	15.7	1.38	16.87
9:28	111	0.9	15.7	1.39	16.85
9:29	112	0.7	15.7	1.40	16.84
9:30	113	0.9	15.9	1.38	16.86
9:31	114	0.8	15.9	1.42	16.83
9:32	115	0.9	15.8	1.43	16.80
9:33	116	0.9	15.6	1.41	16.82
9:34	117	0.8	15.6	1.36	16.86
9:35	118	1.0	15.8	1.36	16.87
9:36	119	0.9	15.6	1.39	16.85
9:37	120	0.8	15.6	1.34	16.87
9:38	121	0.9	15.5	1.36	16.85
9:39	122	0.9	15.6	1.33	16.89
9:40	123	1.0	15.8	1.38	16.85
9:41	124	0.9	15.2	1.39	16.84
9:42	125	0.8	15.4	1.32	16.90
9:43	126	0.8	15.5	1.34	16.88
9:44	127	0.9	15.3	1.31	16.88
9:45	128	1.0	15.9	1.35	16.89
9:46	129	1.0	15.9	1.38	16.84
9:47	130	0.9	15.8	1.38	16.83
9:48	131	0.9	15.8	1.33	16.87
9:49	132	1.2	15.5	1.38	16.86
9:50	133	1.0	15.8	1.33	16.87
9:51	134	0.9	16.1	1.39	16.83
9:52	135	0.9	16.2	1.41	16.79
9:53	136	0.8	15.7	1.44	16.76
9:54	137	0.8	15.8	1.35	16.85
9:55	138	0.8	15.9	1.42	16.81
9:56	139	0.9	16.0	1.45	16.78
9:57	140	0.8	15.9	1.40	16.80
9:58	141	0.8	15.5	1.36	16.83
9:59	142	0.8	15.1	1.32	16.87
10:00	143	0.9	15.0	1.31	16.87
10:01	144	0.8	15.2	1.35	16.86
10:02	145	0.8	15.0	1.39	16.83
10:03	146	0.8	14.6	1.28	16.90
10:04	147	0.8	15.4	1.32	16.88
10:05	148	0.8	14.7	1.37	16.81
10:06	149	0.9	15.1	1.30	16.89
10:07	150	0.8	15.1	1.35	16.84
10:08	151	0.7	14.8	1.31	16.87
10:09	152	0.7	15.0	1.26	16.92
10:10	153	0.7	15.4	1.32	16.87
10:11	154	0.8	15.0	1.29	16.88
10:12	155	0.7	15.0	1.26	16.92
10:13	156	0.6	15.4	1.31	16.87
10:14	157	0.8	15.3	1.32	16.87
10:15	158	0.8	15.1	1.29	16.88
10:16	159	0.8	15.2	1.27	16.91
10:17	160	0.6	15.1	1.25	16.93
10:18	161	0.7	14.9	1.24	16.93
10:19	162	0.6	15.0	1.24	16.93
10:20	163	0.7	15.0	1.25	16.94
10:21	164	0.6	14.9	1.23	16.93
10:22	165	0.6	15.2	1.23	16.95
10:23	166	0.7	15.3	1.29	16.88
10:24	167	0.8	15.2	1.29	16.86
10:25	168	0.6	15.2	1.30	16.87
10:26	169	0.6	15.6	1.33	16.85
10:27	170	0.6	15.3	1.34	16.82
10:28	171	0.6	15.1	1.28	16.86
10:29	172	0.5	15.4	1.30	16.87
10:30	173	0.7	15.2	1.32	16.84
10:31	174	0.5	14.8	1.21	16.92
10:32	175	0.5	14.8	1.24	16.91
10:33	176	0.5	15.1	1.26	16.89
10:34	177	0.5	15.0	1.26	16.87
10:35	178	0.5	14.9	1.31	16.84
10:36	179	0.6	14.8	1.28	16.86
10:37	180	0.5	14.9	1.32	16.84
10:38	181	0.8	14.6	1.31	16.84
10:39	182	0.6	15.0	1.33	16.82
10:40	183	0.5	14.4	1.33	16.80
10:41	184	0.5	14.2	1.20	16.91
10:42	185	0.5	14.5	1.20	16.95
10:43	186	0.5	15.0	1.32	16.85
10:44	187	0.6	14.9	1.36	16.80

MONITOR DATA SUMMARY

Continued (page 3 of 3): FCCU-5B-3, FCCU-29-3, FCCU-027-3 and
FCCU-0081-5

CLOCK TIME	ELAPSED TIME	SO ₂	NO _x	O ₂	CO ₂
10:45	188	0.6	15.3	1.39	16.77
10:46	189	0.6	15.6	1.45	16.71
10:47	190	0.5	15.9	1.48	16.67
10:48	191	0.6	16.0	1.48	16.66
10:49	192	0.5	15.8	1.46	16.67
10:50	193	0.6	16.0	1.47	16.68
10:51	194	0.5	15.7	1.45	16.68
10:52	195	0.5	15.7	1.36	16.76
10:53	196	0.5	15.4	1.38	16.75
10:54	197	0.5	15.2	1.32	16.79
10:55	198	0.5	15.0	1.31	16.81
10:56	199	0.5	15.1	1.23	16.88
10:57	200	0.4	15.2	1.31	16.82
10:58	201	0.5	14.9	1.28	16.83
10:59	202	0.4	14.6	1.20	16.90
11:00	203	0.5	14.7	1.19	16.91
11:01	204	0.4	14.4	1.21	16.91
11:02	205	0.3	14.7	1.17	16.94
11:03	206	0.3	14.7	1.23	16.89
11:04	207	0.3	14.4	1.23	16.88
11:05	208	0.4	13.8	1.12	16.96
11:06	209	0.6	14.0	1.10	17.00
11:07	210	0.4	14.0	1.16	16.96
11:08	211	0.3	13.5	1.10	16.99
11:09	212	0.4	13.5	1.07	17.01
11:10	213	0.4	13.3	1.08	17.02
11:11	214	0.3	12.9	1.05	17.03
11:12	215	0.4	12.8	1.03	17.05
Uncorrected Average (C) =		0.81	14.66	1.238	16.985

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011
RUN NUMBER: FCCU-5B-3

γ FACTOR:	0.999	STACK DIAM:	150.00 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	93.515 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	97.1 °F
STACK TEMP:	140.8 °F	LIQUID COLL:	473.1 milliliters
SQ.RT ΔP:	0.3731 in.H ₂ O	CO₂:	17.04 % by volume
ΔH:	1.84 in.H ₂ O	O₂:	1.20 % by volume

ENGLISH UNITS
(29.92 in.Hg & °F)

<p>VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS</p> $V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 88.942 \text{ dscf}$ <p style="text-align: center;">$\gamma = 0.999$</p>
<p>VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS</p> $V_{wstd} = 0.04707 \times V_{lc} = 22.269 \text{ scf}$ <p style="text-align: center;">$V_{lc} = 473.1 \text{ mL}$</p>
<p>FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED</p> $B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2002$
<p>FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION</p> $B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2016$ <p style="text-align: center;">$S.V.P. = 6.034 \text{ in. Hg}$</p>
<p>FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS</p> <p style="text-align: right;">$B_{ws} = 0.2002$</p>

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refiner
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-5B-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011

BAROMETRIC: 29.92 in. Hg
STATIC PRES: 0.2 in.H₂O
STACK TEMP: 140.8 °F
SQ.RT ΔP: 0.3731 in.H₂O

STACK DIAM: 150.00 inches
CO₂: 17.04 % by volume
O₂: 1.20 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.77	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.22	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p}$	=	0.3731	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.8 \text{ °F} + 460$	=	600.8	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.597	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	166,382	acfm
Stack Area =		122.718	ft ²
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	146,293 8,777,602	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	117,000 7,019,978	dscfm dscfh

ARI ENVIRONMENTAL, INC.
USEPA METHOD 202 - CONDENSIBLE PARTICULATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/11
RUN NUMBER: FCCU-5B-3

INPUT

V_m:	93.515	ft ³	Q_s:	117,000	dscfm
γ FACTOR:	0.999		T_s:	140.8	°F
P_{bar}:	29.92	in.Hg	Runtime:	120	minutes
ΔH:	1.84	in.H ₂ O	V_s:	22.597	ft/sec
T_m:	97.1	°F	P_s:	29.93	in.Hg
V_{lc}:	473.1	mL	Noz. diam:	0.373	inches
N:	0.0000		m_{lb}:	0.00	mL
V_t:	0.00	mL	m_{ob}:	0.00	mL
m_r:	8.80	mg			
m_o:	4.65	mg			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 88.942 \text{ dscf}$$

MASS OF AMMONIA CORRECTION

$$\text{Equation \#1} \quad m_c = 17.03 \times V_T \times N = 0.00 \text{ mg}$$

MASS OF THE FIELD BLANK

$$\text{Equation \#2} \quad m_{fb} = m_{lb} + m_{ob} = 0.00 \text{ mg}$$

MASS OF INORGANIC CONDENSIBLE PM

$$\text{Equation \#3} \quad m_i = m_r - m_c = 8.80 \text{ mg}$$

TOTAL MASS OF CONDENSIBLE PM

$$\text{Equation \#4} \quad m_{cpm} = m_i + m_o - m_{fb} = 13.45 \text{ mg}$$

TOTAL CONCENTRATION OF CONDENSIBLE PM - METRIC UNITS

$$\text{Equation \#5} \quad C_{cpm} = \frac{m_{cpm}}{V_{m(std)}} = 0.1512 \text{ mg/dscf}$$

TOTAL CONCENTRATION OF CONDENSIBLE PM - ENGLISH UNITS

$$C_s = (0.01543)(C_{cpm}) \quad \text{Total} = 0.00233 \text{ gr/dscf}$$

$$C'_s = (2.205 \times 10^{-6})(C_{cpm}) \quad C'_s \text{ Total} = 0.3334 \times 10^{-6} \text{ lbs/dscf}$$

EMISSION RATE

$$pmr = \left(\frac{C_s}{7000} \right) (Q_{std})(60) \quad \text{Total} = 2.3400 \text{ lbs/hr}$$

$$10.2493 \text{ ton/yr}$$

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 102.46 \text{ \% I}$$

$$A_n = 0.000759 \text{ ft}^2$$

$$\text{Runtime} = 120 \text{ minutes}$$

ARI ENVIRONMENTAL, INC.
USEPA METHOD 5/202 - TOTAL PM CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/11
RUN NUMBER: FCCU-5B-3

INPUT

V_m:	93.515	ft ³	Q_s:	117,000	dscfm
γ FACTOR:	0.999		T_s:	140.8	°F
P_{bar}:	29.92	in.Hg	Runtime:	120	minutes
ΔH:	1.84	in.H ₂ O	V_s:	22.597	ft/sec
T_m:	97.1	°F	P_s:	29.93	in.Hg
V_{ic}:	473.1	mL	Noz. diam:	0.373	inches
M_n total:	38.0	mg	Regenerator Coke Burn (R_c):	29,679	lb/hr
CO₂:	17.04	% by volume			
O₂:	1.20	% by volume			

ENGLISH UNITS
(29.92 in.Hg & 68 °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 88.942 \text{ dscf}$$

$\gamma = 0.999$

VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{ic} = 22.269 \text{ scf}$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} \times 100 = 20.02 \%$$

PARTICULATE CONCENTRATION IN STACK GAS ON A DRY BASIS

$$C_s = (0.01543) \left(\frac{M_n}{V_{mstd}} \right) \quad \text{Total} = 0.00659 \text{ gr/dscf}$$

$$C'_s = (2.205 \times 10^{-6}) \left(\frac{M_n}{V_{mstd}} \right) \quad C'_s \text{ Total} = 0.9418 \times 10^{-6} \text{ lbs/dscf}$$

EMISSION RATE

$$pmr = \left(\frac{C_s}{7000} \right) (Q_{std})(60) \quad \text{Total} = \begin{matrix} 6.6095 \text{ lbs/hr} \\ 28.949 \text{ ton/yr} \end{matrix}$$

$$pmr_{lb/1000lb \text{ coke burn}} = \frac{(pmr)(1000)}{(R_c)} \quad \text{Total} = 0.223 \text{ lb/1000 lb coke burn}$$

ISOKINETIC SAMPLING RATE

$$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{ic}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)} = 102.46 \%$$

$A_n = 0.000759 \text{ ft}^2 \quad \text{Runtime} = 120 \text{ minutes}$

**ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY**

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011
RUN NUMBER: FCCU-29-3

γ FACTOR:	1.005	STACK DIAM:	150.00 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	135.289 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	93.7 °F
STACK TEMP:	140.7 °F	LIQUID COLL:	713.0 milliliters
SQ. RT ΔP:	0.3730 in.H ₂ O	CO₂:	17.04 % by volume
ΔH:	1.98 in.H ₂ O	O₂:	1.20 % by volume

**ENGLISH UNITS
(29.92 in.Hg & °F)**

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 130.285 \text{ dscf}$ <p style="text-align: center;">γ = 1.005</p>
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS
$V_{wstd} = 0.04707 \times V_{lc} = 33.561 \text{ scf}$ <p style="text-align: center;">V_{lc} = 713.0 mL</p>
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2048$
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION
$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2016$ <p style="text-align: center;">S.V.P. = 6.034 in. Hg</p>
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS
$B_{ws} = 0.2016$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-29-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011

BAROMETRIC: 29.92 in. Hg	STACK DIAM: 150.00 inches	
STATIC PRES: 0.2 in.H ₂ O	CO₂: 17.04 % by volume	
STACK TEMP: 140.7 °F	O₂: 1.20 % by volume	
SQ.RT ΔP: 0.373 in.H ₂ O		

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.77	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18B_{ws}$	=	28.20	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3730	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.7\text{ °F} + 460$	=	600.7	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.596	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	166,374	acfm
Stack Area =	122.7184 ft ²		
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)$	=	146,310.4 8,778,626	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92}\right)(Q_s)\left(\frac{P_s}{T_s}\right)(1 - B_{ws})$	=	116,818.3 7,009,100	dscfm dscfh

METHOD 29 ISOKINETIC CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011
RUN NO: FCCU-29-3

INPUT

V_m:	135.289 ft ³	Q_s:	7,009,100 dscfh
γ FACTOR:	1.005	T_s:	140.7 °F
P_{bar}:	29.92 in. Hg	Θ:	180.0 minutes
ΔH:	1.98 in. H ₂ O	V_s:	22.596 fps
T_m:	93.7 °F	P_s:	29.93 in. Hg
		V_{lc}:	713.0 mL

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	130.285 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$		=	101.71 % I
$A_n = 0.00075072 \text{ ft}^2$		Runtime (θ) =	180 minutes
			101.13 % I* @saturation



Metals Laboratory Data Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 6/14/2011
Run #: FCCU-29-3

Front Half Metal Calculation

Metal	Detection Limit (micrograms)	FH Sample (M _{fh}) (micrograms)	FH Blank (M _{fhb}) (micrograms)	<u>I Value</u>	<u>II Values</u>			Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
				<u>A Value</u> (4 inch filter) (micrograms)	5 % of FH Sample (micrograms)	Lesser value (M _{fhb}) vs 5% (micrograms)	Greater Value I vs II (micrograms)		
Antimony	0.2	0.2000	0.2000	17.590	0.010	0.010	17.590	0.200	0.000
Arsenic	1	1.0000	1.0000	17.590	0.050	0.050	17.590	1.000	0.000
Beryllium	0.2	0.2000	0.2000	17.590	0.010	0.010	17.590	0.200	0.000
Cadmium	0.1	0.1000	0.1220	17.590	0.005	0.005	17.590	0.122	-0.022
Chromium	1	3.8200	1.3500	17.590	0.191	0.191	17.590	1.350	2.470
Lead	0.5	1.2100	0.5000	17.590	0.061	0.061	17.590	0.500	0.710
Manganese	0.5	1.6200	1.9200	17.590	0.081	0.081	17.590	1.920	-0.300
Nickel	0.2	7.9500	1.5800	17.590	0.398	0.398	17.590	1.580	6.370
Selenium	2	2.0000	2.0000	17.590	0.100	0.100	17.590	2.000	0.000
Cobalt	0.2	0.3760	0.2000	17.590	0.019	0.019	17.590	0.200	0.176

Back Half Metal Calculation

Metal	Detection Limit (micrograms)	BH Sample (M _{bh}) (micrograms)	BH Blank (M _{bhb}) (micrograms)	<u>I Value</u>	<u>II Values</u>			Blank Value Used (micrograms)	Blank Corrected Sample Mass (micrograms)
				(micrograms)	5 % of BH Sample (micrograms)	Lesser value (M _{bh}) vs 5% (micrograms)	Greater Value I vs II (micrograms)		
Antimony	0.1	0.1000	0.1000	1.000	0.005	0.005	1.000	0.100	0.000
Arsenic	0.2	0.2000	0.2000	1.000	0.010	0.010	1.000	0.200	0.000
Beryllium	0.1	0.1000	0.1000	1.000	0.005	0.005	1.000	0.100	0.000
Cadmium	0.05	15.5000	0.0500	1.000	0.775	0.775	1.000	0.050	15.450
Chromium	0.15	2.3100	0.3020	1.000	0.116	0.116	1.000	0.302	2.008
Lead	0.05	0.6940	0.1090	1.000	0.035	0.035	1.000	0.109	0.585
Manganese	0.15	3.2500	0.2490	1.000	0.163	0.163	1.000	0.249	3.001
Nickel	0.1	5.0900	0.9210	1.000	0.255	0.255	1.000	0.921	4.169
Selenium	1	1.0000	1.0000	1.000	0.050	0.050	1.000	1.000	0.000
Cobalt	0.1	0.5040	0.1000	1.000	0.025	0.025	1.000	0.100	0.404

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	0.200	0.200	0.100	0.100	0.300 BDL
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	0.100	0.122	15.500	0.050	15.428 ADL
Chromium	3.820	1.350	2.310	0.302	4.478 ADL
Lead	1.210	0.500	0.694	0.109	1.295 ADL
Manganese	1.620	1.920	3.250	0.249	2.701 ADL
Nickel	7.950	1.580	5.090	0.921	10.539 ADL
Selenium	2.000	2.000	1.000	1.000	3.000 BDL
Cobalt	0.376	0.200	0.504	0.100	0.580 ADL

$$M_t = (M_{fh} - M_{fhb}) + (M_{bh} - M_{bhb})$$



USEPA Method 29
Metals Emissions Calculation Summary

Client: Valero Port Arthur Refinery
Location: Port Arthur, Texas
Source: 1241 FCCU WGS Stack
Date: 06/14/11
Run #: FCCU-29-3

Test Data Input

Barometric pressure (P_{bar}): 29.92 inches Hg
Stack pressure (P_s): 29.93 Inches Hg Abs.
Test length (θ): 180.0 minutes
Sample nozzle diameter (D_n): 0.3710 inches
Sample nozzle area (A_n): 0.000751 ft²
Stack temperature (T_s): 140.7 °F
Volume metered (V_{mstd}): 130.285 dscf
Stack gas velocity (V_s): 22.596 ft/sec
Stack gas volumetric flow (Q_{std}): 7,009,100 dscfh
Fractional Moisture content (B_{ws}): 0.2016
Stack Oxygen Content (%O₂): 1.20 %

Metals Laboratory Analysis Weights (M_t)

Antimony (Sb):	< 0.30 µg	Manganese (Mn):	2.70 µg
Arsenic (As):	< 1.20 µg	Nickel (Ni):	10.54 µg
Beryllium (Be):	< 0.30 µg	Selenium (Se):	< 3.00 µg
Cadmium (Cd):	15.43 µg	Cobalt (Co):	0.58 µg
Chromium (Cr):	4.48 µg		
Lead (Pb):	1.30 µg		

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

Metals concentration (µg/dscm):

$$C_s = \frac{M_t}{\left(\frac{V_{mstd}}{35.315 \text{ dscf / dscm}} \right)}$$

=	< 0.081318 µg/dscm	Antimony (Sb)	=	0.732129 µg/dscm	Manganese (Mn)
=	< 0.325270 µg/dscm	Arsenic (As)	=		
=	< 0.081318 µg/dscm	Beryllium (Be)	=	2.856686 µg/dscm	Nickel (Ni)
=	4.181892 µg/dscm	Cadmium (Cd)	=	< 0.813176 µg/dscm	Selenium (Se)
=	1.213800 µg/dscm	Chromium (Cr)	=	0.157214 µg/dscm	Cobalt (Co)
=	0.351021 µg/dscm	Lead (Pb)	=		

Metals concentration ($\times 10^{-9}$ lb/dscf):

$$C'_s = \frac{\left(\frac{2.2046 \times 10^{-9} \text{ lb}}{\mu\text{g}} \times M_t \right)}{V_{mstd}}$$

=	< 0.005076 $\times 10^{-9}$ lb/dscf	Antimony (Sb)	=	0.045704 $\times 10^{-9}$ lb/dscf	Manganese (Mn)
=	< 0.020306 $\times 10^{-9}$ lb/dscf	Arsenic (As)	=		
=	< 0.005076 $\times 10^{-9}$ lb/dscf	Beryllium (Be)	=	0.178334 $\times 10^{-9}$ lb/dscf	Nickel (Ni)
=	0.261062 $\times 10^{-9}$ lb/dscf	Cadmium (Cd)	=	< 0.050764 $\times 10^{-9}$ lb/dscf	Selenium (Se)
=	0.075774 $\times 10^{-9}$ lb/dscf	Chromium (Cr)	=	0.009814 $\times 10^{-9}$ lb/dscf	Cobalt (Co)
=	0.021913 $\times 10^{-9}$ lb/dscf	Lead (Pb)	=		

Metals emission rate ($\times 10^{-4}$ lb/hr):

$$E_m = C'_s \times Q_{std}$$

=	< 0.355809 $\times 10^{-4}$ lb/hr	Antimony (Sb)	=	3.203470 $\times 10^{-4}$ lb/hr	Manganese (Mn)
=	< 1.423237 $\times 10^{-4}$ lb/hr	Arsenic (As)	=		
=	< 0.355809 $\times 10^{-4}$ lb/hr	Beryllium (Be)	=	12.499580 $\times 10^{-4}$ lb/hr	Nickel (Ni)
=	18.298085 $\times 10^{-4}$ lb/hr	Cadmium (Cd)	=	< 3.558093 $\times 10^{-4}$ lb/hr	Selenium (Se)
=	5.311046 $\times 10^{-4}$ lb/hr	Chromium (Cr)	=	0.687898 $\times 10^{-4}$ lb/hr	Cobalt (Co)
=	1.535910 $\times 10^{-4}$ lb/hr	Lead (Pb)	=		

SO₂ CALIBRATION CORRECTION DATA SHEET

USEPA METHOD 6C

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: Bovar-Western Research 721-ATM
RUN NO: FCCU-29-3
TEST DATE: 6/14/2011

INPUT

SO ₂ AVERAGE CHART READING (C):	0.81 ppmv
AVG PRE/POST ZERO DRIFT READING (C _o):	2.06 ppmv
CAL GAS CONCENTRATION (C _{ma}):	45.0 ppmv
AVG CAL PRE/POST TEST READING (C _m):	43.56 ppmv
STACK GAS VOLUMETRIC FLOW RATE (Q _{std}):	7,009,100 dscfh

CALCULATIONS

STACK SO₂ AVERAGE CHART READING = 0.81 ppmv

STACK SO₂ CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{SO}_2 \text{ CONC, ppmv} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = (1.3) \text{ ppmv db}$$

(corrected) **< 1.0 BDL**

SO₂ CONC.(lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{64 \text{ lb / lb - mole}}{385.26 \times 10^6 \text{ ft}^3 / \text{lb - mole}} \right) = (0.224) \times 10^{-6} \text{ lbs/dscf}$$

< 0.1661 BDL

SO₂ EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 7,009,100 dscfh

STACK SO₂ EMISSION RATE =

$$\text{SO}_{2\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = -1.569 \text{ lbs/hr}$$

< 1.1644 BDL

NO_x CALIBRATION CORRECTION DATA SHEET
USEPA METHOD 7E

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
MONITOR ID: CAI Model 600 CLD
RUN NO: FCCU-29-3
TEST DATE: 6/14/2011

INPUT

NO_x AVERAGE CHART READING (C): 14.66 ppmv
AVG PRE/POST ZERO DRIFT READING (C_o): 1.44 ppmv
CAL GAS CONCENTRATION (C_{ma}): 45.0 ppmv
AVG CAL PRE/POST TEST READING (C_m): 45.09 ppmv
STACK GAS VOLUMETRIC FLOW RATE (Q_{std}): 7,009,100 dscfh

CALCULATIONS

STACK NO_x AVERAGE CHART READING = 14.66 ppmv

STACK NO_x CONC. CORRECTED FOR ZERO AND CALIBRATION DRIFT:

$$\text{NO}_x \text{ CONC, ppmv} = C_{\text{gas,ppm}} = (\bar{C} - C_o) \frac{C_{ma}}{C_m - C_o} = 13.6 \text{ ppmv db}$$

(corrected)

NO_x CONC.(lbs/dscf) =

$$C_{\text{gas,lb/dscf}} = (C_{\text{gas,ppm}}) \left(\frac{46 \text{ lb/lb-mole}}{385.26 \times 10^6 \text{ ft}^3/\text{lb-mole}} \right) = 1.6281 \times 10^{-6} \text{ lbs/dscf}$$

NO_x EMISSION RATE:

STACK GAS VOLUMETRIC FLOW RATE = 7,009,100 dscfh

STACK NO_x EMISSION RATE =

$$\text{SO}_{2\text{pmr}} = (C_{\text{gas,lb/dscf}})(Q_{\text{std}}) = 11.4114 \text{ lbs/hr}$$

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011
RUN NUMBER: FCCU-027-3

γ FACTOR:	1.001	STACK DIAM:	150.0 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	46.475 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	85.9 °F
STACK TEMP:	140.7 °F	LIQUID COLL:	249.8 milliliters
SQ.RT ΔP:	0.3790 in.H ₂ O	CO₂:	17.04 % by volume
ΔH:	1.92 in.H ₂ O	O₂:	1.20 % by volume

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE @ STANDARD CONDITIONS, DRY BASIS	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] =$	45.208 dscf
$\gamma = 1.001$	
VOLUME OF WATER IN SAMPLE @ STANDARD CONDITIONS	
$V_{wstd} = 0.04707 \times V_{lc} =$	11.758 scf
$V_{lc} = 249.8 \text{ mL}$	
FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED	
$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} =$	0.2064
FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION	
$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} =$	0.2016
$S.V.P. = 6.034 \text{ in. Hg}$	
FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS	
$B_{ws} =$	0.2016

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-027-3

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011

BAROMETRIC: 29.92 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 140.7 °F
SQ.RT ΔP: 0.379 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 17.04 % by volume
O₂: 1.20 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.77	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.20	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3790	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.7 \text{ °F} + 460$	=	600.7	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.959	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	169,050.35	acfm
Stack Area =	122.71846	ft ²	
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right)$	=	148,663.98 8,919,839	scfm, wb scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws})$	=	118,697.48 7,121,849	dscfm dscfh

AMMONIA CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/14/2011

RUN NO: FCCU-027-3

INPUT

V_m:	46.475 ft ³	Q_s:	7,121,849 dscfh
γ FACTOR:	1.001	T_s:	140.7 °F
P_{bar}:	29.92 in. Hg	Θ:	60 minutes
ΔH:	1.92	V_s:	22.959 fps
T_m:	85.9 °F	P_s:	29.93 in. Hg
NH₃ in sample:	1,333 μg	V_{lc}:	249.8 mL
		%O₂:	1.20 %

Volume of Sample at Standard Conditions on a Dry Basis:	English Units (29.92 in. Hg, 68 °F)
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$	= 45.208 dscf
Isokinetic Sampling Rate	
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\theta)(V_s)(P_s)(A_n)}$	= 103.9 % I 103.1 % I*
$A_n = 0.00075477 \text{ ft}^2$	Runtime (θ) = 60 minutes
* based upon saturation	
Total $\mu\text{g NH}_3$ in sample (M_n)	= 1,333 μg
Concentration of NH_3	
$C'_{s(\text{lb/dscf})} = \frac{(2.2046 \times 10^{-9} \text{ lb}/\mu\text{g})(M_n)}{V_{mstd}}$	= 0.0650 x 10 ⁻⁶ lbs/dscf
$C_{s(\text{ppmvdb})} = C'_{s(\text{lb/dscf})} \times \frac{385.26 \text{ ft}^3/\text{lb} - \text{mole}}{17.031 \text{ lb}/\text{lb} - \text{mole}} \times 10^6$	= 1.470 ppmv db
$C_{s(\text{mg/dscm})} = \frac{(M_n)(35.31 \text{ ft}^3/\text{m}^3)}{(1000 \mu\text{g}/\text{mg})(V_{mstd})}$	= 1.0411 mg/dscm
NH ₃ Mass Rate:	
$E = Q_s \times C'_{s(\text{lb/dscf})}$	= 0.46295 lbs/hr

ARI ENVIRONMENTAL, INC.
MOISTURE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery
LOCATION: Port Arthur, Texas
SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011
RUN NUMBER: FCCU-0061-5

γ FACTOR:	0.987	STACK DIAM:	150.0 inches
BAROMETRIC:	29.92 in. Hg	METER VOLUME:	139.107 ft ³
STATIC PRES:	0.20 in.H ₂ O	METER TEMP:	90.4 °F
STACK TEMP:	140.5 °F	LIQUID COLL:	737.6 milliliters
SQ.RT ΔP:	0.3709 in.H ₂ O	CO₂:	17.04 % by volume
ΔH:	1.98 in.H ₂ O	O₂:	1.20 % by volume

ENGLISH UNITS
(29.92 in.Hg & °F)

VOLUME OF SAMPLE

@ STANDARD CONDITIONS, DRY BASIS

$$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right] = 132.352 \text{ dscf}$$

$\gamma = 0.987$

VOLUME OF WATER IN SAMPLE

@ STANDARD CONDITIONS

$$V_{wstd} = 0.04707 \times V_{lc} = 34.719 \text{ scf}$$

$V_{lc} = 737.6 \text{ mL}$

FRACTIONAL MOISTURE CONTENT OF STACK GAS AS MEASURED

$$B_{ws} = \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = 0.2078$$

FRACTIONAL MOISTURE CONTENT OF STACK GAS @ SATURATION

$$B_{ws@saturation} = \frac{S.V.P.}{P_{bar} + \frac{P_{static}}{13.6}} = 0.2016$$

$S.V.P. = 6.034 \text{ in. Hg}$

FRACTIONAL MOISTURE CONTENT USED IN CALCULATIONS

$$B_{ws} = 0.2016$$

ARI ENVIRONMENTAL, INC.
FLOW RATE CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refin
LOCATION: Port Arthur, Texas
RUN NUMBER: FCCU-0061-5

SOURCE: 1241 FCCU WGS Stack
TEST DATE: 6/14/2011

BAROMETRIC: 29.92 in. Hg
STATIC PRES: 0.20 in.H₂O
STACK TEMP: 140.5 °F
SQ.RT ΔP: 0.3709 in.H₂O

STACK DIAM: 150.0 inches
CO₂: 17.04 % by volume
O₂: 1.20 % by volume

DRY MOLECULAR WEIGHT OF STACK GAS			
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$	=	30.77	lb/lb-mole
MOLECULAR WEIGHT OF STACK GAS, wet basis			
$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$	=	28.20	lb/lb-mole
PITOT TUBE COEFFICIENT			
C_p (from calibration curve or geometric specifications)	=	0.84	
AVERAGE VELOCITY HEAD OF STACK GAS, in. H₂O			
$\overline{\sqrt{\Delta P}} = \frac{1}{n} \sum_{i=1}^n \sqrt{\Delta p_i}$	=	0.3709	in. H ₂ O
AVERAGE ABSOLUTE STACK GAS TEMPERATURE			
$T_s = 140.5 \text{ °F} + 460$	=	600.5	°R
ABSOLUTE STACK GAS PRESSURE			
$P_s = P_{bar} + \frac{P_{static}}{13.6}$	=	29.93	in.Hg
STACK GAS VELOCITY			
$V_s = (85.49)(C_p)(\text{avg } \sqrt{\Delta P}) \sqrt{\frac{T_s}{(P_s)(M_s)}}$	=	22.465	ft/sec
STACK GAS VOLUMETRIC FLOW RATE, actual			
$Q_s = 60 \times V_s \times A_s$	=	165,409.85	acfm
Stack Area =	122.71846	ft ²	
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, wet basis			
$Q_{stdw} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right)$	=	145,510.96	scfm, wb
		8,730,657	scfh, wb
STACK GAS VOLUMETRIC FLOW RATE, standard conditions, dry basis			
$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws})$	=	116,180.01	dscfm
		6,970,801	dscfh

HEXAVALENT CHROMIUM CALCULATION SUMMARY

COMPANY: Valero Port Arthur Refinery

LOCATION: Port Arthur, Texas

SOURCE: 1241 FCCU WGS Stack

TEST DATE: 6/14/2011

RUN NO: FCCU-0061-5

INPUT

V_m:	139.107 ft ³	Q_s:	6,970,801 dscfh
γ FACTOR:	0.987	T_s:	140.5 °F
P_{bar}:	29.92 in. Hg	Θ:	180.0 minutes
ΔH:	1.98	V_s:	22.465 fps
T_m:	90.4 °F	P_s:	29.93 in. Hg
HexChrome:	< 2 μg/L	V_{lc}:	737.6 mL
Sample Volume:	1380 mL	%O₂:	1.20 %
Total Mass of Cr⁺⁶:	< 2.8 μg		

Volume of Sample at Standard Conditions on a Dry Basis:		English Units (29.92 in. Hg, 68 °F)	
$V_{mstd} = \left(\frac{528}{29.92} \right) \times V_m \times \gamma \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$		=	132.352 dscf
Isokinetic Sampling Rate			
$\%ISO = \frac{(100)(T_s) \left[(0.002669 \times V_{lc}) + \left(\frac{V_m}{T_m} \right) (\gamma) \left(P_{bar} + \left(\frac{\Delta H}{13.6} \right) \right) \right]}{(60)(\Theta)(V_s)(P_s)(A_n)}$		=	103.8 % I 102.8 % I*
A _n =	0.00075477 ft ²	Runtime (Θ) =	180 minutes
		* based upon saturation	
Total μg Hexavalent Chromium in sample (M_n)		=	< 2.8 μg
Concentration of Hexavalent Chromium			
$C'_{s(lb/dscf)} = \frac{(2.2046 \times 10^{-9} lb/\mu g)(M_n)}{V_{mstd}}$		=	< 0.0000460 x 10 ⁻⁶ lb/dscf
$C_{s(\mu g/dscm)} = \frac{(M_n)(35.31 ft^3/m^3)}{(V_{mstd})}$		=	< 0.6859 μg/dscm
Hexavalent Chromium Mass Rate:		$E = Q_s \times C'_{s(lb/dscf)}$	
		=	< 0.000320 lb/hr



Valero Port Arthur Refinery
Source: FCCU-1241 Wet Gas Scrubber Stack
Test Dates: 6/6 - 6/14/11

APPENDIX B

Field Data

**ARI REFERENCE METHOD CEMS DATA
USEPA METHOD 205
DILUTION SYSTEM VERIFICATION**

Company: <u>VALECO PORT ARTHUR</u> Location: <u>1241 FCC WGS/SABISRU</u> Dilution System ID: <u>3371</u> Dilution Flow Rate: <u>5.0 LPM</u> Verification date: <u>6-3-11</u>	Analyzer Info Monitor type: <u>SERVO-MEX 1440 O₂</u> Monitor range: <u>22.70%</u> Monitor Serial No.: <u>01440D1/4143</u>
---	---

Initial Calibration Data

<u>Calibration Concentration</u>	<u>Calibration results</u>	<u>Time</u>
Zero: <u>0.00</u>	Zero: <u>0.04</u>	Zero: <u>1706</u>
Low: <u> </u>	Low: <u> </u>	Low: <u> </u>
Mid: <u>11.35</u>	Mid: <u>11.45</u>	Mid: <u>1714</u>
High: <u>22.70</u>	High: <u>22.73</u>	High: <u>1710</u>

Dilution System Verification

Mid level gas type: <u>USEPA Protocol 1</u> Mid level concentration: <u>7.61%</u> Mid level tank serial #: <u>AAL5614</u>	High level dilution gas type: <u>USEPA Protocol 1</u> High level concentration: <u>22.70%</u> High level tank serial #: <u>1C102306</u> Target concentration No. 1: <u>5.70</u> Target concentration No. 2: <u>17.10</u>
--	---

Dilution System Results

<u>Target Concentration No. 1</u>		<u>Target Concentration No. 2</u>	
<u>Instrument Response</u>	<u>Time</u>	<u>Instrument Response</u>	<u>Time</u>
Trial No. 1: <u>5.77</u>	<u>1716</u>	Trial No. 1: <u>17.16</u>	<u>1719</u>
Trial No. 2: <u>5.80</u>	<u>1724</u>	Trial No. 2: <u>17.16</u>	<u>1727</u>
Trial No. 3: <u>5.81</u>	<u>1733</u>	Trial No. 3: <u>17.16</u>	<u>1736</u>
Average: <u> </u>		Average: <u> </u>	

% Difference from target concentration: % Difference from target concentration:

Mid Level Calibration Gas Results

<u>Instrument Response</u>	<u>Time</u>
Trial No. 1: <u>7.62</u>	<u>1721</u>
Trial No. 2: <u>7.62</u>	<u>1730</u>
Trial No. 3: <u>7.62</u>	<u>1739</u>

**ARI REFERENCE METHOD CEMS DATA
USEPA METHOD 205
DILUTION SYSTEM VERIFICATION**

Company: Valero
Location: Port Arthur, TX
Dilution System ID: 2471
Dilution Flow Rate: 5.2 PM
Verification date: 6-10-11

Analyzer Info
Monitor type: O2
Monitor range: 15%
Monitor Serial No.: X8440/D46

Initial Calibration Data

<u>Calibration Concentration</u>	<u>Calibration results</u>	<u>% Diff</u> <u>Time</u>
Zero: <u>0.00</u>	Zero: <u>0.03</u>	Zero: <u>0.20</u>
Low: _____	Low: _____	Low: _____
Mid: <u>2.50</u>	Mid: <u>2.62</u>	Mid: <u>0.83</u>
High: <u>15.00</u>	High: <u>15.04</u>	High: <u>0.25</u>

Dilution System Verification

Mid level gas type: <u>USEPA Protocol 1</u>	High level dilution gas type: <u>USEPA Protocol 1</u>
Mid level concentration: <u>2.609</u>	High level concentration: <u>22.2</u>
Mid level tank serial #: <u>AAL5814</u>	High level tank serial #: <u>CC102706</u>
	Target concentration No. 1: <u>2.50</u>
	Target concentration No. 2: <u>15.00</u>

Dilution System Results

<u>Target Concentration No. 1</u>		<u>Target Concentration No. 2</u>	
<u>Instrument Response</u>	<u>Time</u>	<u>Instrument Response</u>	<u>Time</u>
Trial No. 1: <u>2.61</u>	_____	Trial No. 1: <u>14.98</u>	_____
Trial No. 2: <u>2.57</u>	_____	Trial No. 2: <u>14.98</u>	_____
Trial No. 3: <u>2.60</u>	_____	Trial No. 3: <u>14.98</u>	_____
Average: <u>2.597</u>	_____	Average: <u>14.98</u>	_____

% Difference from target concentration: 1.24 % Difference from target concentration: 0.12

Mid Level Calibration Gas Results

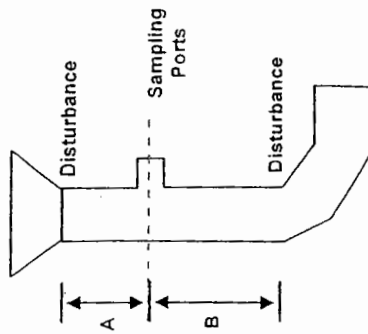
<u>Instrument Response</u>	<u>Time</u>
Trial No. 1: <u>2.50</u>	_____
Trial No. 2: <u>2.51</u>	_____
Trial No. 3: <u>2.50</u>	_____
<u>1.05% d.f.t</u>	



TRAVERSE POINT LOCATIONS FOR CIRCULAR AND RECTANGULAR STACKS AND DUCTS

Facility VALERO Ref Arthur
Date 6/3/11
Sampling Location FCCU
Inside of Far Wall to
Outside of Port (Distance C) 167.25 in.
Inside of Near Wall to
Outside of Port (Distance D) 17.25 in.
Stack ID (Distance C - Distance D) 150 in.
Port Distance Downstream From Disturbance (B) 688 in.
Port Distance Upstream From Disturbance (A) 460 in.
Equivalent Diameters Downstream From Disturbance (B) 4.6 (≥ 2.0)
Equivalent Diameters Upstream From Disturbance (A) 3.1 (≥ 0.5)
Number of Ports Used 4 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 _____ in. (for monorail bracket specs.)
Port Length Outside of Stack _____ in. (for monorail bracket specs.)



Port Traverse Point Number	Fractional % of Stack I.D. (frac. %)	Stack I.D. (inches)	Product of Columns 2 and 3 (inches)	Port Depth (inches)	Traverse Point Location From Outside of Port (Sum of 4 and 5 in inches)
1	2.1	150	3.15	17.25	26.4
2	6.7		10.05		27.3
3	11.8		17.7		34.95
4	17.7		26.55		43.8
5	25.9		37.5		54.75
6	35.6		53.4		70.65
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 [Signature] 6/3/11
Field Supervisor Signature/Date _____

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

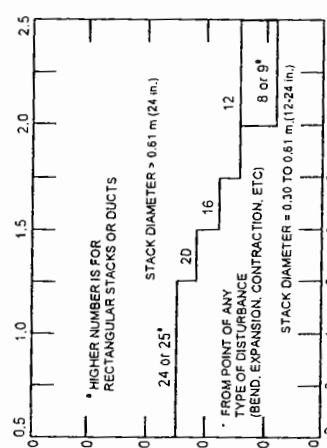
Pts	4	6	8	10	12
1	6.7	4.4	3.2	2.6	2.1
2	25.0	14.6	10.5	8.2	6.7
3	75.0	28.6	19.4	14.6	11.8
4	93.3	70.4	32.3	22.6	17.7
5	85.4	67.7	34.2	25.0	
6	95.6	80.6	65.8	35.6	
7	89.5	77.4	64.4		
8	96.8	85.4	75.0		
9			91.8	82.3	
10			97.4	86.2	
11				93.3	
12				97.9	

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

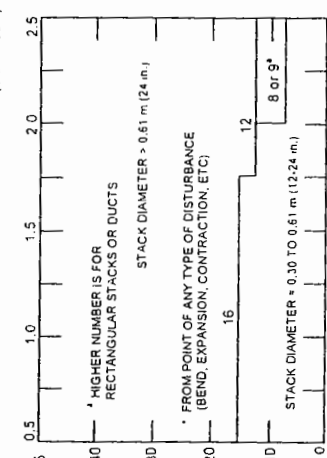
Pts	2	3	4	5	6	7	8	9
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7
3	83.3	62.5	50.0	41.7	35.7	31.3	27.8	
4		87.5	70.0	58.3	50.0	43.8	38.9	
5			90.0	75.0	64.3	56.3	50.0	
6				91.7	78.6	68.8	61.1	
7					92.9	81.3	72.2	
8						93.8	83.3	
9							94.4	

*3 point CEMS data traverse point locations (valid for rectangular and round stacks)

DUCT DIAMETERS UPSTREAM FROM FLOW DISTURBANCE* (DISTANCE A)

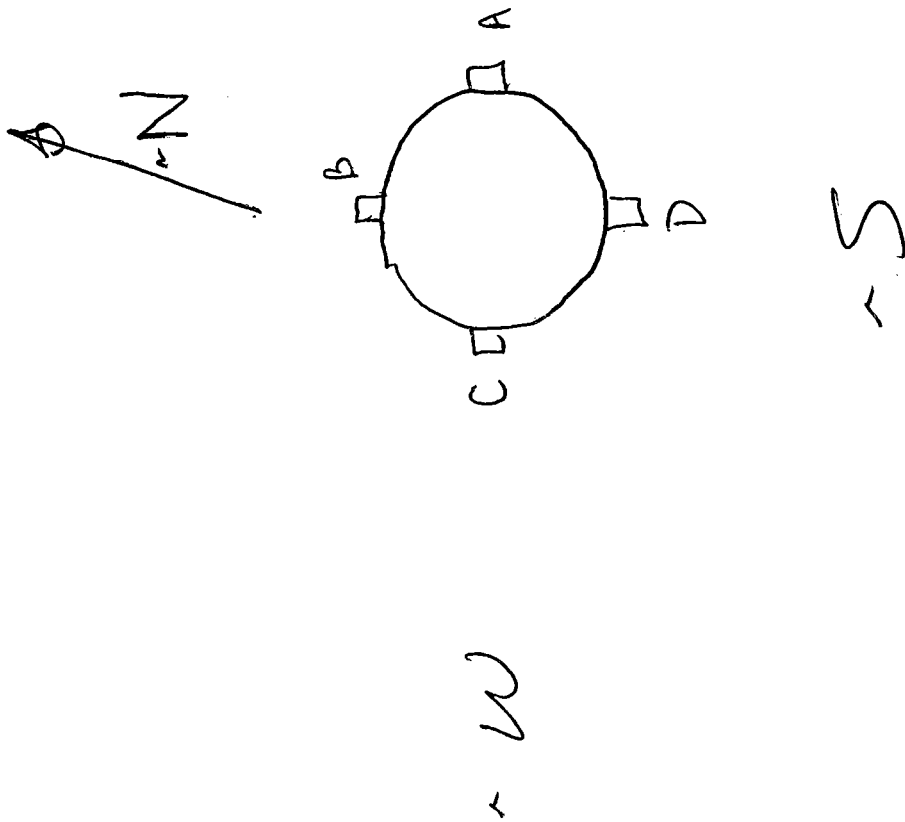


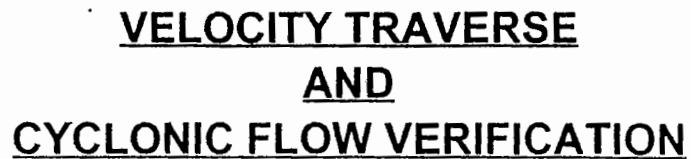
DUCT DIAMETERS DOWNSTREAM FROM FLOW DISTURBANCE* (DISTANCE B)



DUCT DIAMETERS UPSTREAM FROM FLOW DISTURBANCE* (DISTANCE A)

DUCT DIAMETERS DOWNSTREAM FROM FLOW DISTURBANCE* (DISTANCE B)





SCHEMATIC OF TRAVERSE POINT LAYOUT

RUN NO. _____ STATIC, in.H2O _____

[illegible]



SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 9/6/11

Nozzle Clean: Y/N

Nozzle ID: G-6 0010,23,26A

Nozzle Undamaged: Y/N

Nozzle Type: GLASS

Absent of Nicks or Dents: Y/N

Inspected By: KNAPP

Leading Edge Sharp: Y/N

Nozzle Diameter			ΔD (inches)	D_{avg} (inches)
D_1 (inches)	D_2 (inches)	D_3 (inches)		
0.281	0.283	0.282	0.002	0.282

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)



SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6.6.11

Nozzle Clean: (Y) / N

Nozzle ID: DTM-029

Nozzle Undamaged: (Y) / N

Nozzle Type: Glass

Absent of Nicks or Dents: (Y) / N

Inspected By: J. Goldstein

Leading Edge Sharp: (Y) / N

Nozzle Diameter			ΔD (inches)	D_{avg} (inches)
D_1 (inches)	D_2 (inches)	D_3 (inches)		
0.223	0.222	0.223	0.001	0.223

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)



SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6-9-11

Nozzle Clean: (Y) N

Nozzle ID: 0011 (Run 1)

Nozzle Undamaged: (Y) N

Nozzle Type: Glass

Absent of Nicks or Dents: (Y) N

Inspected By: J. Goldfuss

Leading Edge Sharp: (Y) N

Nozzle Diameter			ΔD (inches)	D_{avg} (inches)
D_1 (inches)	D_2 (inches)	D_3 (inches)		
0.283	0.283	0.284	0.001	0.283

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)



SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6-9-11

Nozzle ID: 0011 (Run 2-3), OH

Nozzle Type: Glass

Inspected By: J. Goldfine

Nozzle Clean: (Y) N

Nozzle Undamaged: (Y) N

Absent of Nicks or Dents: (Y) N

Leading Edge Sharp: (Y) N

Nozzle Diameter			ΔD (inches)	D_{avg} (inches)
D_1 (inches)	D_2 (inches)	D_3 (inches)		
0.322	0.321	0.322	0.001	0.322

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)



SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6/13/11

Nozzle ID: 6-2 EPA 29

Nozzle Type: glass

Inspected By: Kunaf

Nozzle Clean: Y/N

Nozzle Undamaged: Y/N

Absent of Nicks or Dents: Y/N

Leading Edge Sharp: Y/N

Nozzle Diameter			ΔD (inches)	D_{avg} (inches)
D_1 (inches)	D_2 (inches)	D_3 (inches)		
0.370	0.371	0.371	0.001	0.371

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)



SAMPLING NOZZLE INSPECTION AND MEASUREMENT

Date: 6-13-11

Nozzle Clean: Y / N

Nozzle ID: C2+6-1

Nozzle Undamaged: Y / N

Nozzle Type: Glass

Absent of Nicks or Dents: Y / N

Inspected By: KWAP

Leading Edge Sharp: Y / N

Nozzle Diameter			ΔD (inches)	D_{avg} (inches)
D_1 (inches)	D_2 (inches)	D_3 (inches)		
0.372	0.373	0.371	0.002	0.372

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)

Nozzle Clean: ☒ Y ☐ NNozzle Undamaged: Y/N

Absent of Nicks or Dents: ☒ Y ☐ N

Leading Edge Sharp: ☒ Y ☐ N

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

$$D_{avg} = \text{average of } D_1, D_2, \text{ and } D_3, (\text{inches})$$

CEMS CALIBRATION DATA



Plant	Valero Refining	Plant Rep.	Robin Hill
Location	Port Arthur, Texas	Team Leader	Dan Fitzgerald
Source	FCCU 645	CEM Operator	Greg Burch
Date	6-6-11		
Run Number	1		
Start Time	1125		
Stop Time	1335		

Analyzer Span Values (% or ppm)

CO ₂		%
O ₂		%

STACK

CALIBRATION ERROR - 841 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 942 hrs	System Response	Time	System Response	Time	Drift (% of Span)	
CO ₂ Zero	0.00	64073	0.03		0.11		0.12			Co=
CO ₂ Low										
CO ₂ Mid	10.00	102306	10.04		9.94		9.96			Cm=
CO ₂ High	19.6	19.6	19.62							
O ₂ Zero	0.00		0.03		0.09		0.09			Co=
O ₂ Low										
O ₂ Mid	4.50	102306	4.54		4.52		4.54			Cm=
O ₂ High	9.00	22.7	9.01							

Meter

CALIBRATION ERROR - 41901 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 930 hrs	System Response	Time	System Response	Time	Drift (% of Span)	
CO ₂ Zero	0.00		0.08		0.15		0.08			Co=
CO ₂ Low										
CO ₂ Mid	10.00	102306	10.16		10.19		10.14			Cm=
CO ₂ High	19.60	19.6	19.66							
O ₂ Zero	0.00		0.02		0.01		0.02			Co=
O ₂ Low										
O ₂ Mid	4.50	102306	4.55		4.52		4.49			Cm=
O ₂ High	9.00	22.1	9.00							

CEMS CALIBRATION DATA



Plant	Valero Refining	Plant Rep.	Robin Hill
Location	Port Arthur, Texas	Team Leader	Dan Fitzgerald
Source	FCCU	CEM Operator	Greg Burch
Date	6-6-11		
Run Number	2		
Start Time			
Stop Time			

Analyzer Span Values (% or ppm)

CO ₂		%
O ₂		%

STACK									
CALIBRATION ERROR - 841 hrs					SYSTEM BIAS CHECK				
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 1393 hrs		1648 hrs		Calibration Correction Factors
					System Response	Time	System Response	Time (% of Span)	
CO ₂ Zero	0.00	CC64078			0.12		0.18		Co=
CO ₂ Low		CC102306							
CO ₂ Mid	10.00	19.60			9.96		9.94		Cm=
CO ₂ High	19.60								
O ₂ Zero	0.00	CC64078			0.09		0.08		Co=
O ₂ Low									
O ₂ Mid	4.50	CC102306			4.54		4.50		Cm=
O ₂ High	9.00	22.7							

Meter									
CALIBRATION ERROR - 901 hrs					SYSTEM BIAS CHECK				
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 1353 hrs		1631 hrs		Calibration Correction Factors
					System Response	Time	System Response	Time (% of Span)	
CO ₂ Zero	0.00				0.08		0.12		Co=
CO ₂ Low									
CO ₂ Mid	4.50	17.60			10.14		10.17		Cm=
CO ₂ High	19.60								
O ₂ Zero	0.00				0.02		-0.01		Co=
O ₂ Low									
O ₂ Mid	4.50				4.49		4.50		Cm=
O ₂ High	9.00								

OTM 029 Stack CO₂ = 16.66
 Meter = 13.16
 O₂ = 1.49

CEMS CALIBRATION DATA



Plant	Valero Refining	Plant Rep.	Robin Hill
Location	Port Arthur, Texas	Team Leader	Dan Fitzgerald
Source	FCCU	CEM Operator	Greg Burch
Date	6-7-11		
Run Number	3		
Start Time	1430		
Stop Time	1646		

Analyzer Span Values (% or ppm)

CO ₂		%
O ₂		%

STACK 1209

CALIBRATION ERROR - (6-11 0841 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 1028 hrs	System Response	Time	System Response	Time	Drift (% of Span)	
CO ₂ Zero	0.00	0.03			0.17		0.10			Co=
CO ₂ Low										
CO ₂ Mid	10.00	10.04			10.04		10.04			Cm=
CO ₂ High	19.60	19.62								
O ₂ Zero	0.00	0.03			0.10		0.10			Co=
O ₂ Low										
O ₂ Mid	4.50	4.54			4.59		4.62			Cm=
O ₂ High	9.00	9.01								

Meter

CALIBRATION ERROR -					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 1420 hrs	System Response	Time	System Response	Time	Drift (% of Span)	
CO ₂ Zero	0.00	0.08			0.14		0.24			Co=
CO ₂ Low										
CO ₂ Mid	10.00	10.16			9.97		9.99			Cm=
CO ₂ High	19.60	19.66								
O ₂ Zero	0.00									Co=
O ₂ Low										
O ₂ Mid	4.50									Cm=
O ₂ High	9.00									

CEMS CALIBRATION DATA



Plant Valero
 Location Port Arthur TX
 Source FCCU W65
 Date 6-8-11
 Run Number 1
 Start Time 811
 Stop Time 1253

Plant Rep. Robin Hill
 Team Leader Don Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)

CO		ppm
CO ₂		%
O ₂		%
THC		ppm
NO _x		ppm
SO ₂		ppm

CALIBRATION ERROR - 0651 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 751 hrs	1332 hrs		Drift (% of Span)			
				System Response	Time	System Response		Time		
CO Zero	0.0	CC64098	0.1		3.1		3.0		Co=	
CO Low		CC102306								
CO Mid	40.0	202	40.8		43.1		43.3		Cm=	
CO High	80.1		80.3							
CO ₂ Zero	0.00	CC64098	0.05		0.08	0.08	0.13		Co=	
CO ₂ Low		CC102306								
CO ₂ Mid	10.00	19.60	10.15		10.01		10.03		Cm=	
CO ₂ High	19.60		19.60							
O ₂ Zero	0.00	CC64098	0.02		0.08		0.12		Co=	
O ₂ Low		CC102306 22.70								
O ₂ Mid	4.50		4.61		4.57		4.62		Cm=	
O ₂ High	9.00		9.05							
THC Zero	0.0	CC64098	0.2		0.2		0.0		Co=	
THC Low	30.0	ALA10C5822	30.6		30.6		30.6			
THC Mid	50.0	999.8	51.2						Cm=	
THC High	90.0		90.3							

CEMS CALIBRATION DATA



Plant Vakro
 Location Port Arthur TX
 Source FCCU LGS
 Date 6-8-11
 Run Number 2
 Start Time 1402
 Stop Time 1839

Plant Rep. _____
 Team Leader _____
 CEM Operator _____

Analyzer Span Values (% or ppm)

CO _____ ppm
 CO₂ _____ %
 O₂ _____ %
 THC _____ ppm
 NO_x _____ ppm
 SO₂ _____ ppm

	CALIBRATION ERROR - 0651 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 1332 hrs 1907 hrs					
					System Response	Time	System Response	Time	Drift (% of Span)	
CO Zero	0.0		0.1		3.0		2.4		Co=	
CO Low										
CO Mid	40.0		40.8		43.3		42.7		Cm=	
CO High	80.1		80.3							
CO ₂ Zero	0.00		0.65		0.13		0.21		Co=	
CO ₂ Low										
CO ₂ Mid	10.00		10.15		10.03		9.97		Cm=	
CO ₂ High	19.60		19.60							
O ₂ Zero	0.00		0.02		0.12		0.06		Co=	
O ₂ Low										
O ₂ Mid	4.50		4.61		4.62		4.58		Cm=	
O ₂ High	9.00		9.05							
THC Zero	0.0		0.2		0.0		0.60		Co=	
THC Low	30.0		30.6		30.6		29.4			
THC Mid	50.0		51.2						Cm=	
THC High	90.0		90.3							

CEMS CALIBRATION DATA



Plant Valero
 Location Port Arthur
 Source FCCU WGS
 Date 6-9-11
 Run Number 3
 Start Time 734
 Stop Time 1214

Plant Rep. Robin Hill
 Team Leader Dan Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)

CO		ppm
CO ₂		%
O ₂		%
THC		ppm
NO _x		ppm
SO ₂		ppm

	CALIBRATION ERROR - 0.54 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors		
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 722 hrs 1218 hrs		System Response	Time	System Response		Time	Drift (% of Span)
					System Response	Time						
CO Zero	0.0		0.1		0.9		-0.7					Co=
CO Low												
CO Mid	40.0		39.9		39.6		39.3					Cm=
CO High	80.1		79.2									
CO ₂ Zero	0.00		0.08		0.19		0.12					Co=
CO ₂ Low												
CO ₂ Mid	10.00		10.13		9.92	9.91	9.92					Cm=
CO ₂ High	19.60		19.52									
O ₂ Zero	0.00		0.03		0.14		0.11					Co=
O ₂ Low												
O ₂ Mid	4.50		4.52		4.63		4.61					Cm=
O ₂ High	9.00		9.05									
THC Zero	0.0		0.0		0.0		0.0					Co=
THC Low	30.0		29.8		29.8		29.6					
THC Mid	50.0		49.4									Cm=
THC High	90.0		90.0									

CEMS CALIBRATION DATA



Plant	Valero Refining	Plant Rep.	Robin Hill
Location	Port Arthur, Texas	Team Leader	Dan Fitzgerald
Source	FCCU WGS	CEM Operator	Greg Burch
Date	6-9-11		
Run Number	FCCU-23-1	FCCU-OH-1	
Start Time	1844	1447	
Stop Time		1803	

Analyzer Span Values (% or ppm)

CO ₂		%
O ₂		%

STACK									
CALIBRATION ERROR - 0.654 hrs					SYSTEM BIAS CHECK				
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 1218 hrs	System Response	Time	System Response	Time	Drift (% of Span)
CO ₂ Zero	0.00	0.08		0.12		0.11			Co=
CO ₂ Low									
CO ₂ Mid	10.00	10.13		9.97		9.95			Cm=
CO ₂ High	19.60	19.52							
O ₂ Zero	0.00	0.03		0.11		0.10			Co=
O ₂ Low									
O ₂ Mid	4.50	4.52		4.61		4.55			Cm=
O ₂ High	9.00	9.05							

CEMS CALIBRATION DATA



Plant	Valero Refining	Plant Rep.	Robin Hill
Location	Port Arthur, Texas	Team Leader	Dan Fitzgerald
Source	FCCU WGS	CEM Operator	Greg Burch
Date	5-10-11		
Run Number	FCCU-29-2 FCCU 23-2		
Start Time	732		
Stop Time	1055		

Analyzer Span Values (% or ppm)

CO ₂		%
O ₂		%

STACK

	CALIBRATION ERROR - 0707 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 722 hrs		1106 hrs		Drift (% of Span)	
					System Response	Time	System Response	Time		
CO ₂ Zero	0.00	cc64098	0.05		0.19		0.10			Co=
CO ₂ Low		cc102306								
CO ₂ Mid	10.00		10.14		10.01		9.99			Cm=
CO ₂ High	19.60	19.60	19.59							
O ₂ Zero	0.00	cc64098	0.05		0.13		0.08			Co=
O ₂ Low		cc102306								
O ₂ Mid	4.50		4.58		4.59		4.52			Cm=
O ₂ High	9.00	22.70	7.04							

CEMS CALIBRATION DATA



Plant	Valero Refining	Plant Rep.	Robin Hill
Location	Port Arthur, Texas	Team Leader	Dan Fitzgerald
Source	FCCU WGS	CEM Operator	Greg Burch
Date	6-10-11		
Run Number	FCCU-29-3	FCCU-04-3	FCCU-0081-3
Start Time	1223		
Stop Time	1633		

Analyzer Span Values (% or ppm)

CO ₂		%
O ₂		%

STACK									
CALIBRATION ERROR - 507				SYSTEM BIAS CHECK					
				Pretest: 1107 hrs 1635 hrs					
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	System Response	Time	System Response	Time	Drift (% of Span)
CO ₂ Zero	0.00		0.05		0.10		0.16		Co=
CO ₂ Low			1						
CO ₂ Mid	10.00		10.14		9.99		10.00		Cm=
CO ₂ High	19.60		19.59						
O ₂ Zero	0.00		0.05		0.08		0.11		Co=
O ₂ Low									
O ₂ Mid	4.50		4.58		4.57		4.58		Cm=
O ₂ High	9.00		9.04						

CEMS CALIBRATION DATA



Plant: Volco
 Location: Port Arthur TX
 Source: FCCU
 Date: 6-13-11
 Run Number: FCCU-S0-1, FCCU-29-1, FCCU-0061-4, FCCU-027-1
 Start Time: 929 / 1313
 Stop Time: 1249 / 1703

Plant Rep: Robin Hill
 Team Leader: Dan F.
 CEM Operator: Greg D.

Analyzer Span Values (% or ppm)

CO ppm
 CO₂ %
 O₂ %
 THC ppm
 NO_x ppm
 SO₂ ppm

	CALIBRATION ERROR - 0737 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors		
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 837 hrs 1709 hrs		System Response	Time	System Response		Time	Drift (% of Span)
					System Response	Time						
CO ₂ Zero	0.00	CC64098	0.07		0.07		0.09					Co=
CO ₂ Low		CC73855										
CO ₂ Mid	10.00		10.14		7.96		10.03					Cm=
CO ₂ High	19.60	19.60	19.63									
O ₂ Zero	0.00	CC64098	0.03		0.13		0.05					Co=
O ₂ Low		CC73855										
O ₂ Mid	4.50		4.61		4.57		4.57					Cm=
O ₂ High	9.00	22.1	9.01									
NO _x Zero	0.0	CC64098	0.4		1.4		0.9					Co=
NO _x Low		CC73855										
NO _x Mid	45.0	CC149689	46.8		43.1		42.5					Cm=
NO _x High	90.0	993.5	90.6									
SO ₂ Zero	0.0	CC64098	-0.3		1.7		1.8					Co=
SO ₂ Low		CC102277										
SO ₂ Mid	45.0		46.2		42.7		43.6					Cm=
SO ₂ High	90.0	1001	90.4									

CEMS CALIBRATION DATA



Plant Valero
 Location Port Arthur Tx
 Source FCCU W65
 Date 6-14-11
 Run Number FCCU-29-3, FCCU-027-3, FCCU-513-3, FCCU-0061-5
 Start Time 6-14-11 7:35
 Stop Time 6-14-11 11:2

Plant Rep. Robin H. 11
 Team Leader Don Fitzgerald
 CEM Operator Graig Durand

Analyzer Span Values (% or ppm)

CO ppm
 CO₂ %
 O₂ %
 THC ppm
 NO_x ppm
 SO₂ ppm

	CALIBRATION ERROR - 123 hrs				SYSTEM BIAS CHECK					Calibration
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Time	Pretest: 722	hrs 1124	hrs		Drift	Correction Factors
					System Response	Time	System Response	Time	(% of Span)	
CO ₂ Zero	0.00	CC4093	0.08		0.09		0.07			Co=
CO ₂ Low		CC73859								
CO ₂ Mid	10.00		10.15		9.98		10.02			Cm=
CO ₂ High	19.60	19.60	19.63							
O ₂ Zero	0.00	CC4093	0.00		0.03		0.04			Co=
O ₂ Low		CC73859								
O ₂ Mid	4.50	22.70	4.63		4.51		4.57			Cm=
O ₂ High	9.00		9.01							
NO _x Zero	0.0	CC4093	0.4		1.7		1.2			Co=
NO _x Low		CC149609								
NO _x Mid	45.0		46.7		44.5		45.7			Cm=
NO _x High	90.0	9939	90.6							
SO ₂ Zero	0.0	CC4093	0.7		2.6		1.6			Co=
SO ₂ Low		CC102277								
SO ₂ Mid	45.0		46.7		44.5		45.7			Cm=
SO ₂ High	90.0	1001.0	90.3							



B-24

FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	~90	PROBE HEATER SETTING	320	WEIGHT OF PARTICULATE, mg	
DATE	6/13/11	BROMETRIC PRESSURE	29.98	HEATER BOX SETTING	320	Filter No.	
LOCATION	East Arthur, TX	ASSUMED MOISTURE, %	84	METER H ₂ O	1.755	Sample	
OPERATOR	AM	PROBE LENGTH, in.	14	C ₂ FACTOR	0.98	Final wt	
STACK NO	PCU	NOZZLE DIAMETER, in.	0.24	Y ₂ FACTOR	0.9987	Tare wt	
RUN NO	1000	STACK DIAMETER, in.	150	PITOT/THERM #		Wt gain	
SAMPLE BOX NO	1000	MINUTES PER POINT	5			TOTAL	mg
METER BOX NO	1000	NUMBER OF POINTS	4				
START TIME	0932	NUMBER OF PORTS	4				

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _s)	VELOCITY (ft/min)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{mg}) °F		COND. EXIT TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _{mg}) °F	OUTLET (T _{mg}) °F				
0932	6	0	0.20	140	0.20	0.20	2.16		203.335	90	416	312	81	64	4
	5	5		141	0.18	0.18	2.3		207.4	91	316	315	80	63	5
	4	10		141	0.15	0.15	1.9		211.7	92	316	310	81	63	5
	3	15		141	0.13	0.13	1.7		215.9	93	315	312	82	62	5
	2	20		141	0.12	0.12	1.6		219.9	94	315	312	81	62	5
	1	25		140	0.11	0.11	1.4		223.6	96	313	313	80	62	5
1000	6	30		141	0.14	0.14	2.5		227.020	97	315	311	80	65	5
	5	35		141	0.16	0.16	2.1		231.8	98	315	314	81	66	5
	4	40		141	0.15	0.15	1.8		235.6	101	317	313	81	67	5
	3	45		140	0.14	0.14	1.8		240.0	101	319	315	82	68	5
	2	50		141	0.12	0.12	1.6		244.0	103	318	314	82	69	5
	1	55		141	0.11	0.11	1.5		247.5	102	319	314	80	69	5
1003	6	60		141	0.20	0.20	2.6		250.175	102	320	312	84	64	5
	5	65		141	0.17	0.17	2.6		255.4	102	319	314	81	64	5
	4	70		140	0.15	0.15	2.3		259.8	102	319	314	82	64	5
	3	75		141	0.12	0.12	1.6		263.7	103	320	313	82	68	5
	2	80		141	0.12	0.12	1.6		267.5	104	322	314	83	68	5
	1	85		140	0.11	0.11	1.5		270.6	104	321	316	82	68	5
1103	6	90		141	0.20	0.20	2.7		274.560	105	318	313	84	68	5
	5	95		141	0.16	0.16	2.1		279.1	105	318	314	83	69	5
	4	100		140	0.14	0.14	1.9		283.4	106	317	314	83	69	5
	3	105		140	0.14	0.14	1.9		287.5	107	318	315	82	67	5
	2	110		141	0.12	0.12	1.6		291.4	108	317	313	84	69	5
	1	115		141	0.12	0.12	1.6		295.4	109	316	312	82	69	5
1145		120							299.995						
AVERAGE	2495	120 min	0.20	140.7	0.3805	1.93			195.660	100.1		-320	+85	<68	Max 5

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT	ORSAT DATA	TIME	CO ₂	O ₂	LEAK CHECK
FINAL INITIAL LIQUID COLLECTED	#1 #2 #3 #4	#	TRIAL 1				SYSTEM PRE: 40.00/40.00
TOTAL COLLECTED (specify ml or g)			TRIAL 2				POST: 40.00/40.00
			TRIAL 3				PITOT PRE: 40.00/40.00
			Average				POST: 40.00/40.00

OK 6/13/11



Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-5B-1

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-10-11
6-13-11
6-13-11
5/202
47600
797.4 mg

IMPINGER RECOVERY DATA SHEET

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	LO				
	Empty	383.5	820.6	437.1	
2	Empty	606.2	615.9	9.7	
3	Water	691.0	728.3	37.3	
4	Silica Gel	777.0	795.3	18.3	
5			TOTAL =	502.4	
6					

N₂ Flow 20¹/₂ min
Start 12:45
End 13:45



B-26

FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	95
DATE	6/13/11	BAROMETRIC PRESSURE	29.98
LOCATION	East Astoria, TX	ASSUMED MOISTURE, %	19
OPERATOR	AK	PROBE LENGTH, in.	84
STACK NO	2004	NOZZLE DIAMETER, in.	0.373
RUN NO	2004-502	STACK DIAMETER, in.	150
SAMPLE BOX NO	APR	MINUTES PER POINT	24
METER BOX NO	104021	NUMBER OF POINTS	4
START TIME	1340	NUMBER OF PORTS	

PROBE HEATER SETTING	320
HEATER BOX SETTING	320
METER H ₂ O	1.755
C _p FACTOR	0.84
Y ₄ FACTOR	0.9987
PITOT/THERM #	

Filter No.	
Sample	
Final wt.	
Tare wt.	
Wt. gain	
TOTAL	mg

WEIGHT OF PARTICULATE, mg	
A	
B	

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (AP ₂)	VELOCITY (ft/min)
1340	6	0	0.20	141	0.20	0.20
	5	5		141	0.17	0.17
	4	10		141	0.14	0.14
	3	15		141	0.13	0.13
	2	20		140	0.11	0.11
	1	25		141	0.11	0.11
1410 (475)	6	30		141	0.11	0.11
	5	35		140	0.17	0.17
	4	40		141	0.15	0.15
	3	45		141	0.13	0.13
	2	50		141	0.12	0.12
	1	55		141	0.11	0.11
1505 (430)	6	60		140	0.20	0.20
	5	65		141	0.16	0.16
	4	70		141	0.15	0.15
	3	75		141	0.14	0.14
	2	80		140	0.12	0.12
	1	85		141	0.11	0.11
1600 (630)	6	90		141	0.18	0.18
	5	95		141	0.15	0.15
	4	100		141	0.14	0.14
	3	105		141	0.13	0.13
	2	110		141	0.12	0.12
	1	115		141	0.11	0.11
1703		120				
AVERAGE	24875	120	0.20	140.8	0.3774	0.3774

GAS SAMPLE TEMP AT DRY GAS METER (T _{gm}) °F	GAS SAMPLE VOLUME (V _{gm}) ft ³	DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	ACTUAL	DESIRED	GAS SAMPLE INLET (T _{gm}) °F	OUTLET (T _{out}) °F	COND. EXIT TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
100	299.245	2.16	2.16		100	106	314	84	66	5
100	303.8	2.2	2.2		100		315	78	64	5
100	308.0	1.8	1.8		100		313	76	54	5
101	311.9	1.7	1.7		100		313	79	57	5
101	315.8	1.6	1.6		101		315	81	59	5
101	319.5	1.4	1.4		101		314	82	61	5
102	323.020	2.5	2.5		102		314	84	64	5
102	327.3	2.2	2.2		102		314	82	58	5
103	331.5	2.0	2.0		103		315	81	56	5
104	335.9	1.7	1.7		104		314	82	53	5
105	339.8	1.6	1.6		105		314	83	55	5
106	343.5	1.5	1.5		106		313	83	56	5
107	346.95	2.1	2.1		107		313	81	57	5
107	351.4	2.0	2.0		107		315	79	60	5
107	355.8	1.9	1.9		107		313	79	61	5
108	360.1	1.6	1.6		108		313	79	60	5
109	364.1	1.5	1.5		109		314	78	60	5
110	368.1	2.0	2.0		110		314	83	60	5
108	372.080	1.9	1.9		108		313	80	57	5
108	376.2	1.7	1.7		108		314	77	56	5
108	380.4	1.6	1.6		108		314	77	59	5
108	384.4	1.5	1.5		108		313	77	59	5
108	388.4	1.6	1.6		108		313	77	59	5
108	392.0	1.5	1.5		108		312	80	60	5
108	395.580									
Average	96.335	1.90	1.90		104.8	104.8	320	85	56.8	110x5

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT (g)
#1	#2	#3
#4		
FINAL INITIAL LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	
SYSTEM PRE: 50.40 JOK	CFM@15"Hg
POST: 50.40 JOK	CFM@15"Hg
PITOT PRE: 41-1 JOK	@ > 3"H ₂ O
POST: 41-1 JOK	@ > 3"H ₂ O



Company:
Location:
Source:
Run No.:

Valevo
Post Arthur, TX
FCCU-1241 Scrubbers
FCCU-5B-2

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-13-11
6-13-11
6-13-11
5/202
47541
783.6mg

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	377.8	792.1	414.3	
2	Empty	590.1	650.4	60.3	
3	Water	719.3	723.5	4.2	
4	Silica Gel	811.0	834.8	23.8	
5			TOTAL=	502.6	
6					

IMPINGER RECOVERY DATA SHEET



FIELD DATA.

LEAK CHECK	
SYSTEM PRE: 4002 ✓	CFM@15"Hg
POST: 1.02 ✓	CFM@15"Hg
PITOT PRE: 1.1 ✓	@ > 3"H ₂ O
POST: 1.1 ✓	@ > 3"H ₂ O

ORSAT	TIME	CO ₁	O ₁
DATA			
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER			SILICA GEL WEIGHT
	#1	#2	#3	#4
FINAL				
INITIAL				
LIQUID COLLECTED				



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 scrubber
FCCU-5B-3

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-13-11
6-14-11
6-14-11
5/202
47005
787.3 mg

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	384.2	700.2	316.0	
2	Empty	607.4	733.7	126.3	
3	Water	692.1	703.1	11.0	
4	Silica Gel	774.4	794.2	19.8	
5			TOTAL =	473.1	
6					

N₂ Purge 20⁴min
Start 1140
End 1240



FIELD DATA SHEET

Plant:	Vg/ero	Meter No.:	1105003	Ambient Temperature:	92
Date:	6-8-11	Y Factor:	1.000	Barometric Pressure:	29.92
Location:	Pent Airtruv, TX	Trap Contents:	methanol	Stack Diameter:	150
Source:	FCCU	USEPA Method:	18	Pre-Test Leak Check:	✓
Run No.:	FCCU-918-1	Compound Analysis:	ICR Speciated Volatiles	Post-Test Leak Check:	✓
Operators:	SBV	Spike in Trap (Y/N):	Y -- Labeled		
Comments:	Labeled Spike				

[illegible]

Primo
Temp
of



IMPINGER RECOVERY DATA SHEET

Native
L1010608-22
ICRD. Field
Spk D-001
L1010608-15
L1010608-20

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-18 -1B

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/7/11
6/8/11
6/8/11
Method 18
N/A
N/A

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	83.8	84.0	0.2	
2	Methanol	92.7	96.5	3.8	
3	Methanol	97.2	97.2	0.0	
4	Methanol	98.1	98.3	0.2	
5	Silica Gel	107.2	108.3	1.1	
6					

5 ml
w/ native



FIELD DATA SHEET

Plant:	Valenc
Date:	6-8-11
Location:	Port Arthur, TX
Source:	FCCU
Run No.:	FCCU-110-IN
Operators:	JPB
Comments:	Labeled Splice Native Splice

Meter No.: 1105002
Y Factor: 1.000
Trap Contents: Methanol
USEPA Method: 1K
Compound Analysis: For Speciated Volatiles
Spike in Trap (Y/N): Y - Labeled 6101008-20
X - Negative 6101008-22

[illegible]

293
 294
 294
 296
 295
 295
 296
 294
 292
 292
 290
 294

293.8



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-18 - 1A

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/7/11
6/8/11
6/8/11
M18
N/A
N/A

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	82.7	82.7 85.3	2.6	
2	Methanol	92.6	92.7 98.5	5.9	
3	Methanol	99.0	99.3	0.3	
4	Methanol	97.1	97.1	0.0	
5	Silica Gel	108.5	110.6	2.1	
6					



Plant:

Plant: Valero
Date: 6-8-11
Location: Port Arthur, TX
Source: FCCU
Run No.: FCCU-1118-2
Operators: JB
Comments: Labeled spike

Meter No.:
Y Factor:
Trap Contents:
USEPA Method:
Compound Analysis:
Spike in Trap (Y/N):

1105003
1.000
Methanol
1B
ICR Spectroscopy
Y-labeler

Ambient Temperature:
Barometric Pressure:
Stack Diameter:
Pre-Test Leak Check:
Post-Test Leak Check:

Clock Time	Sampling Time (min)	Meter Pressure $\text{mm}(\text{H}_2\text{O})$	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)
1447	0	-	-	-	0.000	-
1452	5	5	0	0.20	1.200	94
1457	10	5	0	0.20	2.450	94
1502	15	5	0	0.20	3.980	94
1507	20	5	0	0.20	5.260	94
1512	25	5	0	0.20	6.280	94
1517	30	5	0	0.20	7.280	94
1522	35	5	0	0.20	9.100	94
1527	40	5	0	0.20	10.440	94
1532	45	5	0	0.20	12.510	94
1537	50	5	0	0.20	13.950	94
1542	55	6	0	0.20	16.300	94
1547	60	6	0	0.20	18.206	94
	60	5.2	0.0	0.20	18.206	94

Probe
T₁ and
T₂

205

256

266

287

284

285

287

203

286

587

287

187

284.9



Company:
Location:
Source:
Run No.:

Valero
Port Arthur
FCCU Tail Scrubber
FEU-18-2A

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/8/11
6/8/11
6/8/11
M18
N/A
N/A

IMPINGER RECOVERY DATA SHEET

Measurement Method: Weight or Volume

Labeled spike
only
Impinger No.:

	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	<u>Empty</u>	<u>83.8</u>	<u>84.7</u>	<u>0.9</u>	
2	<u>Methanol</u>	<u>92.7</u>	<u>84.0</u>	<u>-8.7</u>	
3	<u>Methanol</u>	<u>97.8</u>	<u>103.9</u>	<u>6.1</u>	
4	<u>Methanol</u>	<u>97.1</u>	<u>102.1</u>	<u>5.0</u>	
5	<u>Silica Gel</u>	<u>106.5</u>	<u>111.7</u>	<u>3.2</u>	
6					



FIELD DATA SHEET

Plant: Valero
Date: 6-8-11
Location: Port Arthur, TX
Source: FCC 4
Run No.: FCC4-418-2N
Operators: JB
Comments: Labeled Spike
 Native Spike

Meter No.: 1105002
Y Factor: 1.000
Trap Contents: methanol
USEPA Method: 1B
Compound Analysis: ICR Speciated Volatiles
Spike in Trap (Y/N): Y-Labeled L101008-18
 Y-Native L101008-25

Ambient Temperature: 92
Barometric Pressure: 29.82
Stack Diameter: 150
Pre-Test Leak Check: ✓
Post-Test Leak Check: ✓

Clock Time	Sampling Time (min)	Meter Pressure mm(Hg, H ₂ O)	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vm liters)	Gas Meter Temperature (°F)
1447	0	-	-	-	0.000	-
1452	5	7	0	0.20	1.250	92
1457	10	7	0	0.20	2.350	92
1502	15	7	0	0.20	3.460	92
1507	20	7	0	0.20	4.530	92
1512	25	7	0	0.20	5.280	92
1517	30	7	0	0.20	7.170	92
1522	35	7	0	0.20	8.920	92
1527	40	7	0	0.20	10.810	92
1532	45	7	0	0.20	12.620	93
1537	50	7	0	0.20	14.510	93
1542	55	7	0	0.20	16.520	92
1547	60	7	0	0.20	18.218	93
	60	7.0	0.0	0.20	18.218	92.3

Probe Temp
 283
 284
 284
 284
 285
 285
 287
 287
 287
 287
 287

2849



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Vulcan
Port Arthur
FCCU 1241 Scrubber
FCCU - 18 - 2B

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/8/11
6/8/11
6/8/11
M8
N/A
N/A

Labeled and
Native Spike

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	82.9	83.3	0.4	
2	Methanol	92.2	100.0	7.8	
3	Methanol	98.7	98.9	0.2	
4	Methanol	98.3	98.4	0.1	
5	Silica Gel	107.2	108.7	1.5	
6					



FIELD DATA SHEET

Plant:	Verdeco	Meter No.:	1105003	Ambient Temperature:	~90
Date:	6/9/11	Y Factor:	1.000	Barometric Pressure:	29.92
Location:	Port Arthur, TX	Trap Contents:	Methanol	Stack Diameter:	150
Source:	FECC	USEPA Method:	18	Pre-Test Leak Check:	<0.0025cf
Run No.:	FECC-18-3	Compound Analysis:	PCR Speciated Volatiles	Post-Test Leak Check:	
Operators:	AT/TB	Spike in Trap (Y/N):	Y. Labeled 41010608-17		
Comments:					

[illegible]



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur
PCLU 1241 S. Garretts
PCLU - 18 - 3B

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/8/11
6/9/11
6/9/11
18
N/A
N/A

labeled only
spike

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	83.4	86.0	2.6	
2	Methanol	93.7	97.9	4.2	
3	Methanol	97.4	99.1	1.3	
4	Methanol	97.2	90.5	-6.7	
5	Silica Gel	107.6	109.6	2.0	
6					



FIELD DATA SHEET

Plant:	Valsco	Meter No.:	1105002	Ambient Temperature:	~90
Date:	6/9/11	Y Factor:	1000	Barometric Pressure:	29.92
Location:	Post Arthur TX	Trap Contents:	Methanol	Stack Diameter:	150
Source:	FLCU	USEPA Method:	18	Pre-Test Leak Check:	~0.002/lot
Run No.:	FLCU-18-3N	Compound Analysis:	ICR specified 16101588-20	Post-Test Leak Check:	~0.002
Operators:	AH/JPB	Spike In Trap (Y/N):	Y- Labeled 61010588-20		
Comments:			Y- Native 61010608-23		

[illegible]

IMPINGER RECOVERY DATA SHEET



Company:
Location:
Source:
Run No.:

Videnc
Port Arthur
FCCU 1241 Scrubber
FCCU - 18 - 3A

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No.:
Filter Container No.:

6/8/11
6/9/11
6/9/11
M18
N/A
N/A

Labeled and Native spikes

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	<i>Empty</i>	<i>82.1</i>	<i>85.3</i>	<i>3.2</i>	
2	<i>Methanol</i>	<i>92.7</i>	<i>97.4</i>	<i>4.7</i>	
3	<i>Methanol</i>	<i>97.7</i>	<i>98.2</i>	<i>0.5</i>	
4	<i>Methanol</i>	<i>99.0</i>	<i>98.7</i>	<i>-0.3</i>	
5	<i>Silica Gel</i>	<i>108.4</i>	<i>110.0</i>	<i>1.6</i>	
6					



FIELD DATA

DATE	6/9/11	AMBIENT TEMPERATURE	90
LOCATION	Port Arthur	BAROMETRIC PRESSURE	29.89
OPERATOR	Kevin	ASSUMED MOISTURE, %	2.0
STACK NO	FEED	PROBE LENGTH, in.	73"
RUN NO.	FEED-23-1	NOZZLE DIAMETER, in.	0.282
SAMPLE BOX NO		STACK DIAMETER, in.	1.50
METER BOX NO	504619	MINUTES PER POINT	1.5
STAR-1 TIME	1427	NUMBER OF PORTS	24

PROBE HEATER SETTING	255
HEATER BOX SETTING	255
METER H ₂ O	1.87
C ₂ FACTOR	0.84
V ₂ FACTOR	1.005
PITOT/TERM #	1104250

WEIGHT OF PARTICULATE, mg	
Filter No.	
Sample	
Fluid wt.	
Thru wt.	
Wt. gain	
TOTAL	

A* B*

same
13
Method

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY		GAS SAMPLE VOLUME (V _m) ft ³	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE DRY GAS METER INLET (T _{in}) °F	OUTLET (T _{out}) °F	SAMPLE BOX TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
					(ΔP) _s	HEAD (ΔP) _h		ACTUAL	DESIRED						
1427	06	0	0.20	140	0.36	0.36	920.066	1.70	1.70	95	NA	255	56	59	6.0
1434.5	5	7.5		140	0.34	0.34	924.70	1.60	1.60	95		254	57	59	6.0
1442	4	15		139	0.30	0.30	929.55	1.45	1.45	96		255	58	60	6.0
1449.5	3	32.5		140	0.27	0.27	934.06	1.30	1.30	96		254	59	61	6.0
1457	2	30		140	0.27	0.27	938.48	1.30	1.30	97		258	60	62	6.0
1504.5	1	37.5		140	0.24	0.24	943.30	1.15	1.15	97		257	60	61	6.0
1512/1523	06	15.0		140	0.36	0.36	947.840	1.10	1.10	97		256	59	60	6.0
1530.5	5	52.5		140	0.32	0.32	953.15	1.50	1.50	98		255	57	58	6.0
1543	4	60.0		140	0.32	0.32	958.40	1.50	1.50	98		255	56	57	6.0
1550.5	3	67.5		139	0.28	0.28	963.02	1.35	1.35	98		256	57	58	6.0
1558	2	75		140	0.23	0.23	967.78	1.10	1.10	98		255	58	59	6.0
1605.5	1	82.5		140	0.22	0.22	972.10	1.05	1.05	98		254	57	66	6.0
1613/1619	A 6	90		139	0.34	0.34	976.358	1.60	1.60	99		255	60	62	6.0
1619.5	5	95		140	0.30	0.30	981.21	1.45	1.45	98		254	59	61	6.0
1634	4	108.105		140	0.28	0.28	986.17	1.35	1.35	98		255	58	60	6.0
1641.5	3	105.125		140	0.25	0.25	990.85	1.20	1.20	97		255	55	60	6.0
1649	2	120		140	0.24	0.24	995.48	1.15	1.15	97		255	56	58	6.0
1656.5	1	127.5		139	0.22	0.22	999.82	1.05	1.05	97		255	57	59	6.0
1704/1708	B 6	135		140	0.36	0.36	1004.18	1.70	1.70	97		255	57	62	6.0
1715.5	5	142.5		140	0.32	0.32	1009.35	1.50	1.50	97		254	56	60	6.0
1733	4	150		140	0.28	0.28	1014.10	1.35	1.35	97		255	57	59	6.0
1740.5	3	157.5		140	0.27	0.27	1018.78	1.30	1.30	96		254	58	59	6.0
1748	2	165		140	0.25	0.25	1023.43	1.20	1.20	96		254	59	60	6.0
1755.5	1	172.5		140	0.22	0.22	1027.95	1.05	1.05	96		254	59	60	6.0
1803		180					1032.353					253	60	59	6.0
AVERAGE	24	180					102.287								

VOLUME OR WEIGHT OF LIQUID		IMPINGER		SILICA GEL	
WATER COLLECTED		VOLUME (ml) OR WEIGHT (g)		WEIGHT	
FINAL		#1	#2	#3	#4
INITIAL					
LIQUID COLLECTED					
TOTAL					

COLLECTED (specify ml or g)

ORSAT	TIME	CO ₂	O ₂
DATA			
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK

SYSTEM PRE: 0.606 CFM@15"Hg

POST: 0.606 CFM@15"Hg

PITOT PRE: ✓ @ 3"H₂O

POST: ✓ @ 3"H₂O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCA - 1241 Scrubber
FCCA - 23 - 1

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-9-11
6-9-11
6-9-11
23
47653
784.5 mg

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	345.5	853.7	508.2	
2	Water	687.4	629.2	418 58.2	
3	Water	689.9	750.9	61.0	
4	Empty	614.5	619.8	5.3	
5	SG	815.4	831.1	15.7	
6			TOTAL =	648.4 532.0	



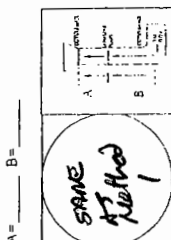
FIELD DATA

LABORATORY
DATE 6/10/01
LOCATION Port Arthur, TX
OPERATOR K. W. A. P.
STACK NO. ECU-23-2
RUN NO. ECU-23-2
SAMPLE BOX NO. 504019
METER BOX NO. 504019
START TIME 4

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE 29.89
ASSUMED MOISTURE, % 2.0
PROBE LENGTH, in. 73.1
NOZZLE DIAMETER, in. 0.282
STACK DIAMETER, in. 150
MINUTES PER POINT 24
NUMBER OF PORTS 4

PROBE HEATER SETTING 255
HEATER BOX SETTING 255
METER H₂O 1.85
C₂ FACTOR 0.84
Y₂ FACTOR 1.005
PITOT/TERM # 1104250

WEIGHT OF PARTICULATE, mg
Filter No. 255
Sample 255
Final wt. 1.85
Tare wt. 0.84
Wt. gain 1.005



CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (9) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY (ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP. °F	SORBENT MODULE TEMP. °F	IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
						ACTUAL	DESIRED		INLET (T _{in}) °F	OUTLET (T _{out}) °F				
0732	06	0	0.20	139	0.36	1.70	1.70	38.30	87	N/A	254	59	64	6.0
0739.5	05	7.5		140	0.34	1.60	1.60	43.42	88		255	57	61	6.0
0747	4	15		140	0.32	1.50	1.50	48.45	90		254	56	60	6.0
0754.5	3	22.5		140	0.27	1.30	1.30	52.91	90		253	57	58	6.0
0802	2	30		140	0.24	1.15	1.15	58.0	91		254	58	59	6.0
	1	37.5		140	0.22	1.05	1.05	62.42	91		255	59	60	6.0
0817/0828	A6	45		140	0.35	1.65	1.65	66.528	93		253	62	64	6.0
	5	52.5		140	0.33	1.55	1.55	71.31	94		254	57	60	6.0
0843	4	60		139	0.31	1.45	1.45	76.54	94		255	56	57	6.0
	3	67.5		139	0.27	1.30	1.30	81.18	94		251	55	57	6.0
0858	2	75		140	0.23	1.10	1.10	85.85	94		254	52	59	6.0
	1	82.5		140	0.21	1.05	1.05	90.14	95		253	57	60	6.0
0913/0920	B6	90		140	0.34	1.60	1.60	94.401	95		256	58	61	6.0
	5	97.5		140	0.33	1.55	1.55	99.280	95		259	56	57	6.0
0935	4	105		140	0.31	1.45	1.45	104.20	95		259	57	58	6.0
	3	112.5		139	0.28	1.35	1.35	109.0	95		254	58	59	6.0
0950	2	120		140	0.24	1.15	1.15	113.70	96		253	59	60	6.0
	1	127.5		140	0.22	1.05	1.05	118.11	95		254	57	57	6.0
1005/1010	C6	135		140	0.36	1.70	1.70	122.206	97		253	56	58	6.0
	3			139	0.34	1.60	1.60	127.16	98		254	57	59	6.0
1025	4	150		140	0.31	1.45	1.45	132.32	98		254	55	57	6.0
	3			140	0.30	1.40	1.40	137.10	98		255	56	57	6.0
1040	2	165		140	0.27	1.30	1.30	141.90	98		254	57	58	6.0
	1			140	0.22	1.05	1.05	146.60	98		253	58	59	6.0
1058		180		139.8	0.308	1.57	1.57	150.714	94.1		253	58	59	6.0
AVERAGE	24	180		139.8	0.308	1.57	1.57	112.414	94.1		253	58	59	6.0

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED		IMPINGER VOLUME (ml) OR WEIGHT (g)		SILICA GEL WEIGHT	
#1		#2	#3	#4	#
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL					

ORSAT DATA		TIME		CO ₂		O ₂	
TRIAL 1							
TRIAL 2							
TRIAL 3							
Average							

LEAK CHECK
SYSTEM PRE: 0.006 CFM@15"Hg
POST: 0.006 CFM@15"Hg
PITOT PRE: 1/4 @ > 3"H₂O
POST: @ > 3"H₂O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Part Arthur TX
FCCU-1241 Scrubber
FCCU-23-2

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-7-11
6-10-11
6-10-11
23
47579 4545
798.0 mg 782.5 mg

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	358.8	988.3	629.5	
2	Water	712.1	839.0	126.9	
3	Water	704.9	710.2	5.3	
4	Empty	610.9	614.0	3.1	
5	Silica Gel	764.5	779.2	14.7	
6			TOTAL =	779.5	



FIELD DATA

PLANT: VALERO DATE: 8/10/14 LOCATION: Port of Houston, TX OPERATOR: ENVART STACK NO: FWU RUN NO: FWU-23-3 SAMPLE BOX NO: 504019 METER BOX NO: 24 START TIME: 4

AMBIENT TEMPERATURE: 94 BAROMETRIC PRESSURE: 29.89 ASSUMED MOISTURE, %: 70 PROBE LENGTH, in: 73 NOZZLE DIAMETER, in: 1.50 STACK DIAMETER, in: 1.5 MINUTES PER POINT: 2.5 NUMBER OF PORTS: 4

PROBE HEATER SETTING: 255 HEATER BOX SETTING: 255 C_p FACTOR: 1.005 Y₂ FACTOR: 1.005 PITOT/THERM # 1104250

WEIGHT OF PARTICULATE, mg: 255

File No. 187 Sample: Final Time: 1005 Wt. gain: 100.2

A= same B= Refined

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY		GAS SAMPLE VOLUME (V _m) ft ³	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE DRY INLET (T _m) °F	SAMPLE BOX TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔV _s)	(ΔP _s)		ACTUAL	DESIRED					
1227	06	0	0.20	140	0.36	0.36	151.65	1.70	1.70	98	254	57	62	6.0
1242	5	7.5		140	0.35	0.35	156.80	1.60	1.60	99	255	57	57	6.0
1257	9	15		140	0.33	0.33	161.90	1.55	1.55	98	254	56	57	6.0
1312	3	22.5		140	0.30	0.30	166.54	1.45	1.45	99	255	56	58	6.0
1327	2	30		139	0.26	0.26	170.98	1.25	1.25	100	254	57	59	6.0
1342	1	37.5		139	0.21	0.21	175.58	1.00	1.00	101	255	58	60	6.0
1357	86	45		140	0.36	0.36	179.72	1.70	1.70	101	254	60	63	6.0
1412	5	52.5		140	0.34	0.34	184.92	1.60	1.60	101	255	56	58	6.0
1427	4	60		140	0.30	0.30	189.90	1.45	1.45	101	256	56	58	6.0
1442	3	67.5		139	0.27	0.27	194.91	1.30	1.30	101	257	57	59	6.0
1457	2	75		139	0.24	0.24	199.45	1.15	1.15	101	256	58	59	6.0
1472	1	82.5		140	0.22	0.22	203.80	1.05	1.05	101	256	59	60	6.0
1487	86	90		140	0.36	0.36	208.16	1.70	1.70	103	255	60	64	6.0
1502	5	97.5		140	0.34	0.34	213.11	1.60	1.60	101	256	58	61	6.0
1517	4	105		139	0.31	0.31	218.21	1.50	1.50	101	251	56	57	6.0
1532	3	112.5		140	0.27	0.27	223.50	1.30	1.30	102	252	55	57	6.0
1547	2	120		140	0.23	0.23	228.05	1.10	1.10	102	251	56	57	6.0
1562	1	127.5		140	0.22	0.22	232.48	1.05	1.05	101	251	57	58	6.0
1577	86	135		140	0.36	0.36	236.62	1.70	1.70	100	255	58	59	6.0
1592	5	142.5		139	0.35	0.35	241.22	1.60	1.60	100	254	57	60	6.0
1607	4	150		140	0.32	0.32	246.90	1.50	1.50	99	253	56	59	6.0
1622	3	157.5		140	0.28	0.28	251.80	1.35	1.35	98	254	57	59	6.0
1637	2	165		139	0.26	0.26	256.60	1.25	1.25	98	254	58	60	6.0
1652	1	172.5		140	0.22	0.22	261.11	1.05	1.05	98	255	59	61	6.0
1667	86	180					265.42							
AVERAGE	24	180			0.2512	0.2512	113.759	1.358	1.358					

LEAK CHECK: SYSTEM PRE: 0.007 CFM@15" Hg POST: 2.007 CFM@15" Hg

PITOT PRE: V @ > 3" H₂O POST: V @ > 3" H₂O

ORSAT DATA: TRIAL 1: 100.2 CO₂: 100.2 O₂: 100.2

SILICA GEL WEIGHT: 134.7 IMPINGER VOLUME (ml) or WEIGHT (g): 134.7 #1: 134.7 #2: 134.7 #3: 134.7 #4: 134.7

WATER COLLECTED: 134.7 LIQUID COLLECTED: 134.7 COLLECTED (specify ml or g): 134.7

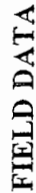


IMPINGER RECOVERY DATA SHEET

Company: Valero
 Location: Port Arthur, TX
 Source: FCCU - 1241 Scrubber
 Run No.: FCCU-23-3
 Date Set-up: 6-10-11
 Test Date: 6-10-11
 Date Recovered: 6-10-11
 USEPA Method: 23
 Corresponding Filter No: 47536
 Filter Container No: 781.6 mg

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	346.9	864.0	517.1	
2	Water	688.9	687.7	-1.2	
3	Water	689.8	689.6	-0.2	
4	Empty	568.8	571.6	2.8	
5	Silica Gel	814.1	836.7	22.6	
6			TOTAL =	541.1	



FIELD DATA

AMBIENT TEMPERATURE	91	PROBE HEATER SETTING	255
BAROMETRIC PRESSURE	29.96	HEATER BOX SETTING	205
ASSUMED MOISTURE, %	2.0	METER H ₂ O	1.87
PROBE LENGTH, in	73.4	C ₀ FACTOR	0.84
NOZZLE DIAMETER, in	0.324	X ₀ FACTOR	1.005
STACK DIAMETER, in	1.50	PITOT/THERM #	1104250
MINUTES PER POINT	5		
NUMBER OF POINTS	24	PRESSURE	
NUMBER OF PORTS	24	DIFFERENTIAL	

DATE	VALERO PA	WEIGHT OF PARTICULATE, mg	A=	B=
LOCATION	FCCU	Filter No.		
OPERATOR	KWAPP	Sample		
STACK NO	FCCU	Final wt		
RUN NO	FCCU-26A-1	Tare wt		
SAMPLE BOX NO		Wt. gain		
METER BOX NO	504019	TOTAL		mg
START TIME	1125			

3EE
 1127105
 1

START TIME	NUMBER OF PORTS		DIFFERENTIAL ACROSS ORIFICE			GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP. °F	Filter COOL. EXIT TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg		
	CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (Ø) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (t _g) °F		VELOCITY HEAD (ΔP)	VELOCITY HEAD (ΔP)						ACTUAL (ΔH) in. H ₂ O	DESIRED
1125	4														
1125	86	0.2	143	0.44	2.10	2.10	213.481	95	250	259	250	64	5.0		
1130	85	5	142	0.44	2.10	212.65	96	97	260	248	261	61	5.0		
1135	84	10	142	0.35	1.65	221.40	97	94	262	251	260	60	5.0		
1140	83	15	142	0.30	1.45	224.80	94	95	264	252	251	61	5.0		
1145	82	20	143	0.28	1.35	228.05	95	96	265	254	250	60	5.0		
1150	81	25	142	0.20	0.95	231.10	96	94	266	253	254	60	5.0		
1155/1200	80	30	142	0.40	1.50	233.66	94	97	266	251	255	64	5.0		
1204	75	35	142	0.40	1.90	236.87	97	98	265	252	256	63	5.0		
1209	74	40	142	0.34	1.60	240.05	98	99	263	253	254	64	5.0		
1214	73	45	143	0.28	1.35	243.40	99	100	264	252	251	57	5.0		
1219	72	50	142	0.25	1.20	246.55	100	101	265	254	251	55	5.0		
1224	71	55	141	0.22	1.05	249.45	101	99	266	253	254	56	5.0		
1229/1233	70	60	141	0.44	2.10	252.243	99	100	267	254	253	59	5.0		
1238	65	65	141	0.40	1.90	256.10	100	100	266	255	252	58	5.0		
1243	64	70	141	0.34	1.60	259.50	100	101	265	254	252	60	5.0		
1248	63	75	142	0.28	1.35	263.30	101	102	266	253	253	61	5.0		
1253	62	80	141	0.26	1.25	266.37	102	102	265	253	252	62	5.0		
1258	61	85	141	0.20	0.95	269.40	102	102	266	254	253	62	5.0		
1303/1305	60	90	141	0.44	2.10	272.046	102	102	267	255	254	64	5.0		
1305/1310	59	95	141	0.38	1.80	257.90	102	102	264	253	252	64	5.0		
1315	58	100	141	0.30	1.45	274.75	102	102	263	252	251	63	5.0		
1320	57	105	141	0.25	1.20	283.05	102	102	263	253	252	64	5.0		
1325	56	110	142	0.22	1.05	286.20	102	102	264	253	254	65	5.0		
1330	55	115	141	0.20	0.95	288.86	102	102	265	256	254	66	5.0		
1335		120			291.523					256	254	66	5.0		
AVERAGE					78.047										

VOLUME OR WEIGHT OF LIQUID		IMPINGER		SILICA GEL	
WATER COLLECTED		VOLUME (ml) OR WEIGHT (g)		WEIGHT	
	#1	#2	#3	#4	#
FINAL					
INITIAL					
LIQUID COLLECTED					

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
AVG PRE			

LEAK CHECK	
SYSTEM PRE: 0-000	CFM @ 15" Hg
POST: 0.000	CFM @ 15" Hg
PITOT PRE: ✓	@ > 3" H ₂ O
POST: ✓	@ > 3" H ₂ O

10-11-12



IMPINGER RECOVERY DATA SHEET

Company: Valero
 Location: Port Arthur, TX
 Source: FW Z6A FCCU - 1241 Scrubber
 Run No.: FCCU-Z6A-1
 Date Set-up: 6-3-2011
 Test Date: 6-6-2011
 Date Recovered: 6-6-2011
 USEPA Method: 26A
 Corresponding Filter No: 40847
 Filter Container No: 896.9 mg

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	0.1N H ₂ SO ₄	680.0	927.8	247.8	
2	0.1N H ₂ SO ₄	704.9	893.2	188.3	
3	0.1N NaOH	711.7	747.5	35.8	
4	0.1N NaOH	705.6	639.9	- 65.7	
5	Silica Gel	799.4	816.7	17.3	
6				423.5	



FIELD DATA

PLANT	WATER PA	AMBIENT TEMPERATURE	98
DATE	6/6/11	BAROMETRIC PRESSURE	29.06
LOCATION	ECU	ASSUMED MOISTURE, %	2.0
OPERATOR	KWAPP	PROBE LENGTH, in	73
STACK NO	ECU	NOZZLE DIAMETER, in	0.282
RUN NO.	ECU-26A-2	STACK DIAMETER, in	150
SAMPLE BOX NO		MINUTES PER POINT	5
METER BOX NO	504019	NUMBER OF PORTS	24
START TIME	1401	NUMBER OF PORTS	24

WEIGHT OF PARTICULATE, mg

Filter No.	255
Sample	265
Final wt	287
Tare wt	0.88
Wt. gain	104250

TOTAL

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP °F	F _{dry} EXIT TEMP °F	P _{atm} SOURCE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔP _s)	(ΔP _s)	ACTUAL	DESIRED		INLET (T _{m1}) °F	OUTLET (T _{m2}) °F					
1401	A6	0	0.20	141	0.38	0.38	1.80	1.80	282.06	100	100	265	252	254	66	6.0
1406	5	5		141	0.38	0.38	1.80	1.80	295.65	100	100	266	254	255	64	6.0
1411	4	10		142	0.30	0.30	1.45	1.45	299.30	102	102	267	253	251	63	6.0
1416	3	15		141	0.26	0.26	1.25	1.25	302.55	102	102	266	252	254	62	6.0
1421	2	20		142	0.22	0.22	1.05	1.05	305.65	101	101	264	252	252	60	6.0
1426	1	25		142	0.20	0.20	0.95	0.95	308.71	102	102	265	253	254	60	6.0
1431	M306	30		142	0.38	0.38	1.80	1.80	311.76	101	101	266	254	252	64	6.0
1448	5	35		141	0.38	0.38	1.80	1.80	314.66	102	102	267	252	254	63	6.0
1453	4	40		141	0.38	0.38	1.80	1.80	318.23	102	102	265	254	253	63	6.0
1458	3	45		142	0.30	0.30	1.45	1.45	321.78	103	103	264	255	254	62	6.0
1503	2	50		142	0.28	0.28	1.35	1.35	325.27	104	104	265	254	253	62	6.0
1508	1	55		141	0.20	0.20	0.95	0.95	328.35	105	105	267	256	253	65	6.0
1513	C6	60		142	0.34	0.34	1.60	1.60	331.00	106	106	268	255	254	64	6.0
1528	5	65		142	0.36	0.36	1.70	1.70	334.48	107	107	266	254	253	63	6.0
1533	4	70		141	0.32	0.32	1.50	1.50	337.98	106	106	267	255	254	62	6.0
1538	3	75		141	0.26	0.26	1.25	1.25	341.55	105	105	266	256	255	63	6.0
1543	2	80		141	0.24	0.24	1.15	1.15	345.02	105	105	268	255	256	64	6.0
1548	1	85		142	0.38	0.38	1.80	1.80	348.15	104	104	265	252	253	65	6.0
1553	B6	90		142	0.38	0.38	1.80	1.80	351.68	105	105	266	253	254	64	6.0
1603	5	95		141	0.36	0.36	1.70	1.70	354.65	106	106	267	254	253	63	6.0
1608	4	100		142	0.24	0.24	1.15	1.15	358.42	105	105	265	255	254	64	6.0
1613	3	105		141	0.24	0.24	1.15	1.15	361.55	104	104	266	256	255	65	6.0
1618	2	110		141	0.24	0.24	1.15	1.15	364.57	105	105	265	256	255	64	6.0
1623	1	115		141	0.22	0.22	1.05	1.05	367.65	105	105	266	254	253	63	6.0
1628		120							370.38							
AVERAGE									370.38							

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4	#5	#6
FINAL INITIAL LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

LEAK CHECK

SYSTEM PRE: 0.008 CFM@15" Hg

POST: 0.018 CFM@15" Hg

PITOT PRE: 2.3" H₂O

POST: 2.3" H₂O

ORSAT DATA

TRIAL 1	CO ₂	O ₂
TRIAL 2		
TRIAL 3		
Average		

TIME

78.327

141.5

0.5504

1.46

0.4527

103.5

78.327

414



IMPINGER RECOVERY DATA SHEET

Company: Valero
 Location: Port Arthur, TX
 Source: FCCU-1241 Scrubber
 Run No.: FCCU-26A-2
 Date Set-up: 6-3-2011
 Test Date: 6-6-2011
 Date Recovered: 6-6-2011
 USEPA Method: 26A
 Corresponding Filter No: 42997
 Filter Container No: 779.7 mg

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.
PH 4 1	0.1N H ₂ SO ₄	615.8	920.8	305.0	
PH 3 2	0.1N H ₂ SO ₄	658.4	740.6	82.2	
PH 9 3	0.1N NaOH	705.9	754.3	48.4	
PH 9 4	0.1N NaOH	688.7	700.8	12.1	
5	Silica Gel	813.4	831.3	17.9	
6			TOTAL	= 465.6	



FIELD DATA

PLANT	VALERO	AMBIENT TEMPERATURE	86
DATE	6/1/14	BAROMETRIC PRESSURE	29.86
LOCATION	POST A-3140 R	ASSUMED MOISTURE, %	2.0
OPERATOR	KATIA	PROBE LENGTH, in	13.0
STACK NO	FCCU	NOZZLE DIAMETER, in	0.282
RUN NO	FCCU-26A-3	STACK DIAMETER, in	150
SAMPLE BOX NO		MINUTES PER POINT	5
METER BOX NO	504019	NUMBER OF POINTS	24
START TIME	1428	NUMBER OF PORTS	4

PROBE HEATER SETTING 255
HEATER BOX SETTING 265
METER H₂O 1.87
C₂ FACTOR 0.84
Y₂ FACTOR 1.005
PITOT/TERM # 1104250

WEIGHT OF PARTICULATE, mg
TOTAL

Filter No. Sample
Final wt. Tare wt.
Wt. gain

A² = B =

same as 15 Meter

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (0.1 min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _g) °F	VELOCITY HEAD (ΔP _s)	VELOCITY (ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP °F	Filter COND. EXIT TEMP °F	Probe MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _m) °F	OUTLET (T _m) °F					
1428	06	0	40.19	140	0.38	0.38	1.80	1.80	372.486	90	PIA	264	253	252	66	7.0
1433	5	5		140	0.37	0.37	1.75	1.75	376.008	90		265	254	254	61	7.0
1438	4	10		141	0.37	0.37	1.75	1.75	379.52	91		265	255	256	60	7.0
1443	3	15		140	0.30	0.30	1.45	1.45	383.15	92		263	256	254	59	7.0
1448	2	20		139	0.26	0.26	1.25	1.25	386.58	93		264	255	253	59	7.0
1453	1	25		140	0.22	0.22	1.05	1.05	389.45	94		265	254	252	60	7.0
1458	06	30		141	0.37	0.37	1.75	1.75	392.342	93		264	253	254	64	7.0
1511	5	35		140	0.34	0.34	1.60	1.60	395.86	94		265	254	253	64	7.0
1516	4	40		140	0.30	0.30	1.45	1.45	399.34	95		264	252	251	63	7.0
1521	3	45		140	0.28	0.28	1.35	1.35	402.61	95		265	253	254	62	7.0
1526	2	50		140	0.28	0.28	1.35	1.35	405.84	95		266	252	254	63	7.0
1531	1	55		141	0.24	0.24	1.15	1.15	408.98	96		267	253	256	64	7.0
1536	06	60		140	0.38	0.38	1.80	1.80	411.884	95		265	254	254	65	7.0
1549	5	65		140	0.36	0.36	1.70	1.70	415.44	96		266	254	253	64	7.0
1554	4	70		146	0.34	0.34	1.35	1.35	419.13	97		265	253	254	61	7.0
1559	3	75		140	0.28	0.28	1.35	1.35	422.65	97		266	252	251	62	7.0
1604	2	80		140	0.22	0.22	1.05	1.05	425.43	98		265	253	252	62	7.0
1609	1	85		139	0.22	0.22	1.05	1.05	428.31	98		264	254	253	63	7.0
1614	06	90		140	0.37	0.37	1.75	1.75	431.085	100		265	253	252	66	7.0
1621	5	95		140	0.30	0.30	1.45	1.45	434.50	101		266	254	254	64	7.0
1626	4	100		140	0.26	0.26	1.25	1.25	437.80	100		264	265	253	63	7.0
1631	3	105		140	0.22	0.22	1.05	1.05	441.01	100		263	263	258	64	7.0
1636	2	110		140	0.20	0.20	0.95	0.95	443.90	100		263	260	256	65	7.0
1641	1	115		140	0.20	0.20	0.95	0.95	446.65	100		264	257	254	66	7.0
1646		120							449.352							
AVERAGE				140.0	0.3011	0.3011	1.390	1.390	76.871	95.8						

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4		
FINAL INITIAL LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

SYSTEM PRE: 0.004 CFM@15"Hg
POST: 0.004 CFM@15"Hg
PITOT PRE: 0.004 CFM@15"Hg
POST: 0.004 CFM@15"Hg

LEAK CHECK: 0.004 CFM@15"Hg
POST: 0.004 CFM@15"Hg

PITOT PRE: 0.004 CFM@15"Hg
POST: 0.004 CFM@15"Hg



IMPINGER RECOVERY DATA SHEET

Company: Valero
 Location: Port Arthur, TX
 Source: FCCU-1241 Scrubber
 Run No.: FCCU-26A-3
 Date Set-up: 6-7-11
 Test Date: 6-7-11
 Date Recovered: 6-7-11
 USEPA Method: 26A
 Corresponding Filter No: 40805
 Filter Container No: 781.4 mg

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.
PH 3	1	0.1 N H ₂ SO ₄	829.6	267.6	
PH 4	2	0.1 N H ₂ SO ₄	740.9	78.7	
PH 8	3	0.1 N NaOH	716.4	4.8	
PH 8	4	0.1 N NaOH	693.5	2.1	
	5	Silica Gel	792.8	18.1	
	6		804.6	371.3	
			TOTAL =		



FIELD DATA

PLANT Valero
DATE 6/13/11
LOCATION East Arthur
OPERATOR Knope
STACK NO FCU
RUN NO FCU-29-1
SAMPLE BOX NO 50407
METER BOX NO 0929
STAR TIME 0929

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, %
PROBE LENGTH, in
NOZZLE DIAMETER, in
STACK DIAMETER, in
MINUTES PER POINT
NUMBER OF PORTS

PROBE HEATER SETTING
HEATER BOX SETTING
METER Hg
C₀ FACTOR
Y₀ FACTOR
PITOT/THERM #

WEIGHT OF PARTICULATE, mg
Filter No.
Sample
Final wt.
Therm.
Wt. gain

A= B=
same as Method 1

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (°F)	VELOCITY HEAD		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP °F	Probe Exit Temp °F	F _{Hev} Sample Exit Temp °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔP _s)	HEAD (ΔP _s)	ACTUAL	DESIRED		INLET (T _{m0}) °F	OUTLET (T _{m0}) °F					
0929	06	0	0.20	141	0.20	0.20	2.15	2.85	267.521	90	N/A	258	251	248	50	6.0
0944	5	7.5	0.15	141	0.15	0.15	2.15	2.15	274.70	91		259	253	250	52	5.0
	4	15	0.14	140	0.14	0.14	2.0	2.0	280.53	91		260	254	251	53	5.0
0959	3	22.5	0.13	140	0.13	0.13	1.85	1.85	288.80	91		261	252	252	55	5.0
	2	30.0	0.12	141	0.12	0.12	1.70	1.70	291.68	92		258	249	251	57	5.0
	1	37.5	0.12	141	0.12	0.12	1.70	1.70	296.91	93		257	250	252	59	5.0
1014/1022 AG	5	45	0.16	141	0.16	0.16	2.30	2.30	302.101	94		260	254	252	54	5.0
	4	52.5	0.14	141	0.14	0.14	2.0	2.0	308.05	95		261	253	254	56	5.0
1037	4	60	0.14	140	0.14	0.14	2.0	2.0	313.73	96		259	257	253	57	5.0
	3	67.5	0.13	141	0.13	0.13	1.85	1.85	319.48	97		258	255	254	58	5.0
1052	2	75	0.12	141	0.12	0.12	1.70	1.70	324.85	98		260	255	253	59	5.0
	1	82.5	0.11	140	0.11	0.11	1.55	1.55	330.04	98		261	254	253	61	5.0
1107/1113 BG	6	90	0.15	141	0.15	0.15	2.15	2.15	335.098	98		260	255	254	64	5.0
	5	97.5	0.14	140	0.14	0.14	2.0	2.0	340.84	99		259	254	253	59	5.0
1128	4	105	0.14	141	0.14	0.14	2.0	2.0	346.54	100		258	255	254	56	5.0
	3	112.5	0.13	141	0.13	0.13	1.85	1.85	352.20	102		260	254	252	57	5.0
1143	2	120	0.12	141	0.12	0.12	1.70	1.70	357.63	103		259	253	253	58	5.0
	1	127.5	0.11	140	0.11	0.11	1.55	1.55	362.80	104		258	254	252	59	5.0
1158/1201 CG	6	135	0.16	140	0.16	0.16	2.30	2.30	367.981	105		260	254	253	60	5.0
	5	142.5	0.15	140	0.15	0.15	2.15	2.15	373.75	105		259	255	252	58	5.0
1219	4	150	0.13	141	0.13	0.13	1.85	1.85	379.55	105		258	254	253	56	5.0
	3	157.5	0.13	141	0.13	0.13	1.85	1.85	385.12	105		259	255	254	57	5.0
1234	2	165	0.12	141	0.12	0.12	1.70	1.70	390.80	106		259	254	255	58	5.0
	1	172.5	0.12	141	0.12	0.12	1.70	1.70	396.25	106		260	255	253	54	5.0
1249		180							401.358							
AVERAGE	24	180		140.7	0.158	0.158	1.94	1.94	133.837	98.5						

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED		IMPINGER VOLUME (ml) OR WEIGHT (g)		SILICA GEL WEIGHT	
#1		#2		#3	
#4					
FINAL INITIAL					
LIQUID COLLECTED					
TOTAL		COLLECTED (specify ml or g)			

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	SYSTEM PRE: 2.008	CFM @ 15" Hg
	POST: 0.000	CFM @ 15" Hg
PITOT PRE: V	POST: V	@ > 3" H ₂ O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-29-1

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-10-11
6-13-11
6-13-11
29
RD 1594
86.0136 g

Test America

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	594.1	903.6	309.5	444656
2	5% HNO ₃	703.5	928.4	224.9	444656
3	5% HNO ₃	683.2	836.1	152.9	444656
4	Empty	577.2	578.9	1.7	
5	Silica Gel	805.1	826.4	21.3	
6			TOTAL =	710.3	



FIELD DATA

DATE	6/13/11	AMBIENT TEMPERATURE	98
LOCATION	Port Arthur	BAROMETRIC PRESSURE	29.95
OPERATOR	R. W. P.	ASSUMED MOISTURE, %	2.0
STACK NO	FEU-29-2	PROBE LENGTH, in.	73"
RUN NO.	504019	NOZZLE DIAMETER, in.	0.371
SAMPLE BOX NO	1318	STACK DIAMETER, in.	150
METER BOX NO		MINUTES PER POINT	7.5
START TIME	1318	NUMBER OF PORTS	24

WEIGHT OF PARTICULATE, mg

Filter No.	Sample	Final wt.	Wt. gain

TOTAL

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (0) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _s)	VELOCITY (ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{mg}) °F		SAMPLE BOX TEMP. °F	P _{inlet} COMP. EXIT TEMP °F	P _{outlet} COMP. EXIT TEMP °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _{mg}) °F	OUTLET (T _{mg}) °F					
1318	006	0	0.20	140	0.16	0.16	2.30	2.30	402.463	103	102	261	255	255	57	4.6
1333	5	7.5		140	0.14	0.14	2.0	2.0	403.70	102	102	260	254	254	58	4.0
1343	4	15		141	0.13	0.13	1.85	1.85	414.15	102	102	259	253	253	59	4.0
1343	3	22.5		141	0.13	0.13	1.85	1.85	419.67	102	102	262	256	256	60	4.0
1403	2	30		141	0.12	0.12	1.70	1.70	425.12	101	101	260	255	255	58	4.0
1403	1	37.5		140	0.12	0.12	1.70	1.70	430.50	102	102	258	256	256	56	4.0
1435	5	45		141	0.17	0.17	2.40	2.40	435.635	103	103	257	255	255	57	4.0
1435	4	52.5		140	0.17	0.17	2.0	2.0	441.54	102	102	260	256	256	56	4.0
1450	3	60		141	0.13	0.13	1.85	1.85	446.80	102	102	259	253	253	57	4.0
1505	2	67.5		140	0.12	0.12	1.70	1.70	452.20	103	103	258	254	254	58	4.0
1530	1	75		141	0.12	0.12	1.70	1.70	457.70	103	103	258	255	255	57	4.0
1530	5	82.5		141	0.16	0.16	2.30	2.30	463.02	103	103	260	255	255	56	4.0
1545	4	90		141	0.14	0.14	2.0	2.0	468.231	104	104	259	254	254	57	4.0
1600	3	97.5		140	0.14	0.14	2.0	2.0	473.95	105	105	258	253	253	58	4.0
1600	1	105		140	0.14	0.14	2.0	2.0	479.70	106	106	260	254	254	57	4.0
1633	5	112.5		140	0.13	0.13	1.85	1.85	485.41	106	106	259	253	253	58	4.0
1648	4	120		140	0.12	0.12	1.70	1.70	490.85	106	106	260	254	254	57	4.0
1703	3	127.5		140	0.11	0.11	1.55	1.55	496.20	106	106	260	255	255	58	4.0
	1	135		141	0.16	0.16	2.30	2.30	501.157	106	106	261	255	255	57	4.0
	5	142.5		141	0.15	0.15	2.15	2.15	507.40	106	106	260	254	254	56	4.0
	4	150		140	0.13	0.13	1.85	1.85	513.05	106	106	259	253	253	57	4.0
	3	157.5		140	0.13	0.13	1.85	1.85	518.67	106	106	259	256	256	58	4.0
	2	165		141	0.11	0.11	1.55	1.55	524.21	106	106	260	254	254	59	4.0
	1	172.5		141	0.11	0.11	1.55	1.55	529.24							
AVERAGE	24	180		140.5	0.133	0.133	2.265	2.265	534.273							

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4	#5	#6
FINAL INITIAL LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

LEAK CHECK

SYSTEM PRE:	CFM @ 15" Hg
POST:	0.006
PITOT PRE:	CFM @ 15" Hg
POST:	0.004

PITOT PRE: ☒ POST: ☒



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-29-2

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-13-11
6-13-11
6-13-11
29
RD 1595
88.2761 g

Test America

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	594.7	935.9	341.2	1144673
2	5% HNO ₃ / 10% H ₂ O ₂	640.8	912.5	271.7 RW 271.7	1444673
3	5% HNO ₃ / 10% H ₂ O ₂	683.3	741.8	58.5	1444673
4	Empty	618.8	620.9	2.1	
5	Silica Gel	812.0	832.6	20.6	
6			TOTAL =	694.1	



FIELD DATA

PLANT VALERO
DATE 6/14/11
LOCATION Port Arthur
OPERATOR RWAPP
STACK NO FCW
RUN NO. FCW-29-3
SAMPLE BOX NO 304019
METER BOX NO 017
START TIME 017
AMBIENT TEMPERATURE 84
BAROMETRIC PRESSURE 29.92
ASSUMED MOISTURE, % 2.0
PROBE LENGTH, in 73.1
NOZZLE DIAMETER, in 0.371
STACK DIAMETER, in 150.12
MINUTES PER POINT 7.5
NUMBER OF PORTS 24

PROBE HEATER SETTING 255
HEATER BOX SETTING 260
METER H₂O 187
C₂ FACTOR 0.87
Y₂ FACTOR 1.005
PITOT/THERM # 110250

WEIGHT OF PARTICULATE, mg
Filter No. _____
Sample _____
Final wt. _____
Tare wt. _____
Wt. gain _____
TOTAL _____

A= _____ B= _____

SPARE
AS 11000
NC 11000

PRESSURE DIFFERENTIAL ACROSS ORIFICE METER										GAS SAMPLE VOLUME (V _m) ft ³		GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP		Probe Exit TEMP		Exit TEMP		CROSS SECTION			
ACTUAL (ΔH) in H ₂ O										DESIRED		INLET (T _m) °F		OUTLET (T _m) °F		°F		°F		°F		IMPINGER OUTLET TEMP	
VELOCITY HEAD (ΔP _s)										VELOCITY (ΔP _s) ^{1/2}													
STACK TEMP (T _g) °F																							
STATIC PRESSURE (in. H ₂ O)																							
SAMPLING TIME (min)																							
TRAVERSE POINT NUMBER																							
CLOCK TIME																							
START TIME																							
NUMBER OF PORTS																							
24																							
0737	DL	0	20.20	141	0.16	2.25	2.25	535.14	85	111	260	254	248	64	3.0								
0752	5	7.5		141	0.15	2.15	2.15	570.92	87		261	255	251	63	3.0								
0815	4	15		141	0.15	2.15	2.15	546.60	89		260	254	252	64	3.0								
0825	3	22.5		141	0.14	2.0	2.0	582.60	91		259	253	252	62	3.0								
0807	2	30		140	0.13	1.85	1.85	558.30	91		258	255	253	60	3.0								
0822	1	37.5		141	0.12	1.70	1.70	563.80	92		259	256	252	59	3.0								
0822	DL	45.0		141	0.16	2.25	2.25	564.04	93		260	257	253	63	3.0								
0847	5	52.5		140	0.15	2.15	2.15	575.07	95		261	256	252	60	3.0								
0847	4	60		141	0.13	1.85	1.85	581.02	95		263	257	254	59	3.0								
0902	3	67.5		140	0.13	1.85	1.85	586.51	94		260	255	253	58	3.0								
0902	2	75		141	0.12	1.70	1.70	592.06	94		261	254	253	57	3.0								
0917	DL	82.5		141	0.12	1.70	1.70	597.25	95		260	255	252	58	3.0								
0947	5	97.5		141	0.16	2.25	2.25	602.517	94		259	254	253	59	3.0								
0947	4	105		141	0.15	2.15	2.15	608.38	94		259	255	254	58	3.0								
1002	3	112.5		141	0.14	2.0	2.0	614.30	94		260	255	254	57	3.0								
1002	2	120		140	0.13	1.85	1.85	620.00	94		261	256	255	58	3.0								
1017	DL	127.5		141	0.13	1.70	1.70	625.70	94		259	253	253	60	3.0								
1017	1	135		141	0.16	2.25	2.25	631.16	95		258	254	252	61	3.0								
1017	DL	142.5		141	0.16	2.25	2.25	636.391	95		260	255	251	62	3.0								
1042	4	150		141	0.15	2.15	2.15	642.42	96		259	256	250	60	3.0								
1042	3	157.5		140	0.13	1.85	1.85	648.50	97		259	255	251	61	3.0								
1057	2	165		141	0.12	1.70	1.70	653.70	98		260	254	252	62	3.0								
1102	1	172.5		141	0.12	1.70	1.70	660.15	98		259	253	251	62	3.0								
1102	DL	180						665.35	98		258	254	250	61	3.0								
1102	DL	180						670.433															
AVERAGE										135.289		93.1											
24										140.7		1.983		1.983		140.7		1.983		140.7			

VOLUME OR WEIGHT OF LIQUID COLLECTED

WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4	#5	#6

FINAL INITIAL LIQUID COLLECTED TOTAL COLLECTED (specify ml or g)

LEAK CHECK

SYSTEM PRE: 0.006 CFM@15"Hg
POST: 0.006 CFM@15"Hg
PITOT PRE: 4 @ > 3"H₂O
POST: @ > 3"H₂O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-29-3

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-13-11
6-14-11
6-14-11
79
2D1602
82.50589

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	596.6	895.6	299.0	
2	5% HNO ₃ / 10% H ₂ O ₂	699.5	892.8	193.3	
3	5% HNO ₃ / 10% H ₂ O ₂	688.0	853.1	165.1	
4	Empty	579.3	613.8	34.5	
5	Silica Gel	801.4	822.5	21.1	
6				214.0 713.0	



FIELD DATA

ANT	DATE	LOCATION	OPERATOR	STACK NO	RUN NO	SAMPLE BOX NO	METER BOX NO	START TIME	AMBIENT TEMPERATURE	BAROMETRIC PRESSURE	ASSUMED MOISTURE, %	PROBE LENGTH, in.	NOZZLE DIAMETER, in.	STACK DIAMETER, in.	MINUTES PER POINT	NUMBER OF PORTS	PROBE HEATER SETTING	HEATER BOX SETTING	METER H ₂ O	C ₂ FACTOR	PITOT/THERM #	WEIGHT OF PARTICULATE, mg	Filter No.	Sample	Final wt	Therm wt	Wt gain	TOTAL
60	6/18/11	East Aetna	Knap	EC05	EC00-0010-1	504019	504019	0816	88	29.42	20	73	0.282	150	10	4	255	1.87	0.84	1.005	104250							

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (t) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _g) °F	VELOCITY HEAD		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		PITOT/THERM #	SAMPLE BOX TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔP _h)	(ΔP _h) / (ΔP _h)		INLET (T _m) °F	OUTLET (T _m) °F					
0816	A6	0	0.20	140	0.34		457.45	96	N/A		255	59	60	5.0
0821	6	5	140	140	0.38		454.75	97			256	58	60	5.0
0826	5	10	139	139	0.38		458.20	96			257	57	59	5.0
0831	5	15	139	139	0.38		461.85	95			255	58	59	5.0
0836	A4	20	140	140	0.32		465.42	95			254	58	59	5.0
0841	4	25	140	140	0.32		468.81	95			253	57	59	5.0
0846	3	30	140	140	0.22		472.17	96			254	57	60	5.0
0851	3	35	140	140	0.22		475.15	96			255	57	61	5.0
0856	2	40	139	139	0.20		477.95	97			255	57	60	5.0
0901	2	45	140	140	0.20		480.64	98			254	56	59	5.0
0906	1	50	140	140	0.18		483.20	99			255	57	59	5.0
0911	1	55	140	140	0.18		485.70	100			252	57	59	5.0
0916	END	60					488.161	100	0.008 @ 12 in. H ₂ O		254	57	59	5.0
0931	B6	60	140	140	0.40		488.103	104			255	59	61	5.0
0936	6	65	139	139	0.40		492.64	103			254	55	55	5.0
0941	5	70	140	140	0.38		496.44	104			255	55	56	5.0
0946	5	75	140	140	0.37		500.05	104			256	55	55	5.0
0951	4	80	140	140	0.32		503.61	105			254	56	55	5.0
0956	4	85	140	140	0.34		506.98	106			255	57	56	5.0
1001	3	90	139	139	0.30		510.40	107			256	57	57	5.0
1006	3	95	140	140	0.30		513.65	106			254	57	58	5.0
1011	2	100	140	140	0.24		516.95	106			255	58	58	5.0
1016	2	105	141	141	0.26		519.91	106			255	58	59	5.0
1021	1	110	140	140	0.20		522.72	106			255	59	59	5.0
1026	1	115	140	140	0.18		525.46	107			255	59	60	5.0
AVERAGE														

VOLUME OR WEIGHT OF LIQUID	IMPINGER	SILICA GEL			
WATER COLLECTED	VOLUME (ml) OR WEIGHT (g)	WEIGHT			
FINAL	#1	#2	#3	#4	#5
INITIAL					
LIQUID COLLECTED					
TOTAL	COLLECTED (specify ml or g)				

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	SYSTEM PRE: 0.008	CFM @ 15" Hg
	POST: 0.008	CFM @ 15" Hg
PITOT PRE: ✓	POST: ✓	@ > 3" H ₂ O



FIELD DATA
0010
PAGE 2

PLANT	VALERO	AMBIENT TEMPERATURE	92	PROBE HEATER SETTING	255
DATE	6/18/11	BAROMETRIC PRESSURE	29.92	HEATER BOX SETTING	255
OPERATOR	Art Arthur	ASSUMED MOISTURE, %	20	METER H ₂ O	1.87
LOCATION	KAPP	PROBE LENGTH, in	13.1	C ₂ FACTOR	0.84
STACK NO	FEED	NOZZLE DIAMETER, in	0.282	Y ₂ FACTOR	1.003
RUN NO	FEED-0610-1	STACK DIAMETER, in	150	PITOT/THERM #	1104250
SAMPLE BOX NO		MINUTES PER POINT	10		
METER BOX NO	504019	NUMBER OF POINTS	24		
STAR/ TIME	0816	NUMBER OF PORTS	4		

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _g) °F	VELOCITY HEAD (ΔP _g)	VELOCITY (ΔP _g)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{md}) °F		SAMPLE BOX TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGING OUTLET TEMP. °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _{md})	OUTLET (T _{md})				
1031	END	120	0.20	140	—	—	1.90	1.90	521.923	104	109	254	59	62	5.0
1047	06	120		140	0.40	0.40	1.90	1.90	528.636	109	109	254	59	61	5.0
1052	6	125		140	0.34	0.34	1.60	1.60	532.51	110	110	254	58	57	5.0
1057	5	130		141	0.34	0.34	1.60	1.60	536.30	109	109	254	56	58	5.0
1102	5	135		139	0.30	0.30	1.45	1.45	540.00	109	109	254	55	56	5.0
1107	4	140		139	0.30	0.30	1.45	1.45	543.31	109	109	254	55	56	5.0
1112	4	145		139	0.30	0.30	1.45	1.45	546.55	110	110	254	54	55	5.0
1117	03	150		139	0.28	0.28	1.35	1.35	549.76	110	110	254	53	55	5.0
1122	3	155		140	0.26	0.26	1.25	1.25	552.91	111	111	254	53	55	5.0
1127	2	160		140	0.20	0.20	1.05	1.05	555.91	111	111	254	53	55	5.0
1132	2	165		140	0.20	0.20	1.05	1.05	558.65	112	112	254	53	55	5.0
1137	1	170		139	0.20	0.20	0.95	0.95	561.40	112	112	254	53	55	5.0
1142	1	175		140	0.18	0.18	0.95	0.95	564.22	112	112	254	53	55	5.0
1147	END	180		140	—	—	1.90	1.90	566.672	104	109	254	53	55	5.0
1153	06	180		140	0.40	0.40	1.90	1.90	566.878	111	111	254	53	55	5.0
1158	6	185		140	0.40	0.40	1.90	1.90	570.65	112	112	254	53	55	5.0
1203	5	190		140	0.36	0.36	1.70	1.70	574.50	112	112	254	53	55	5.0
1208	5	195		140	0.36	0.36	1.70	1.70	578.10	112	112	254	53	55	5.0
1213	4	200		139	0.30	0.30	1.45	1.45	581.75	112	112	254	53	55	5.0
1218	4	205		140	0.30	0.30	1.45	1.45	585.14	112	112	254	53	55	5.0
1223	3	210		140	0.28	0.28	1.35	1.35	588.17	112	112	254	53	55	5.0
1228	3	215		140	0.26	0.26	1.25	1.25	591.42	112	112	254	53	55	5.0
1233	2	220		139	0.24	0.24	1.15	1.15	594.42	111	111	254	53	55	5.0
1238	2	225		139	0.24	0.24	1.15	1.15	597.50	111	111	254	53	55	5.0
1243	1	230		140	0.20	0.20	1.05	1.05	600.34	111	111	254	53	55	5.0
AVERAGE															

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	#1	#2	#3	#4	SILICA GEL WEIGHT
FINAL INITIAL LIQUID COLLECTED					
TOTAL					

IMPINGING VOLUME (ml) OR WEIGHT (g)	#1	#2	#3	#4
COLLECTED (specify ml or g)				

LEAK CHECK	
SYSTEM PRE: CPM@15"Hg	
POST: CPM@15"Hg	
PITOT PRE: @ > 3"H ₂ O	
POST: @ > 3"H ₂ O	



IMPINGER RECOVERY DATA SHEET

Company: Valero Date Set-up: 6-7-11
Location: Port Arthur, TX Test Date: 6-8-11
Source: Det FCCU-1241 Scrubber Date Recovered: 6-8-11
Run No.: FCCU-0010-1 USEPA Method: 0010
47006-47534
786.8 mg 781.8 mg

Corresponding Filter No:
Filter Container No:

Measurement Method: Weight or Volume

XAD-2

Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL	Difference wt/vol g/mL	Sample Container No.
1	Empty	613.4	1100.6	487.2	4
2	100 DI Water	677.4	796.4	119.0	5
3	DI Water	691.7	707.6	15.9	5
4	Empty	610.3	612.6	2.3	5
5	Silica Gel	714.0	741.7	27.7	
6			TOTAL =	1052.1	



FIELD DATA
0010 PAGE 1

PLANT UN560
DATE 6/18/11
LOCATION PORT ARTHUR
OPERATOR KNAPP
STACK NO FEED
RUN NO. FEED-0010-2
SAMPLE BOX NO 594019
METER BOX NO 1402
STAR TIME

AMBIENT TEMPERATURE 97
BAROMETRIC PRESSURE 29.89
ASSUMED MOISTURE, % 28
PROBE LENGTH, in. 73"
NOZZLE DIAMETER, in. 0.282
STACK DIAMETER, in. 150
MINUTES PER POINT 10
NUMBER OF PORTS 4

PROBE HEATER SETTING 255
HEATER BOX SETTING 255
METER H_0 1.87
 C_p FACTOR 0.84
 V_p FACTOR 1.003
PITOT/THERM # 1642520

WEIGHT OF PARTICULATE, mg
Filter No. 1
Sample 1
Final wt. 1
Tare wt. 1
Wt. gain 1
TOTAL

SAVES
AS
METHOD
1

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s), °F	VELOCITY		GAS SAMPLE VOLUME (V _m), ft ³	DIFFERENTIAL ACROSS ORIFICE METER		GAS SAMPLE DRY GAS METER INLET (T _{mg}), °F	GAS SAMPLE OUTLET (T _{mg}), °F	SAMPLE BOX TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
					(ΔP _s)	(ΔP _s) / ΔP _t		ACTUAL	DESIRABLE						
1402	C6	0	0.20	140	0.40		606.653	1.90	1.90	100	100	255	58	59	5.0
1407	C6	5		140	0.40		606.00	1.90	1.90	100	100	255	57	58	5.0
1412	C6	10		140	0.36		603.90	1.70	1.70	99	99	254	56	57	5.0
1417	C6	15		139	0.36		617.30	1.70	1.70	99	99	254	57	57	5.0
1422	C6	20		140	0.32		620.85	1.50	1.50	100	100	255	57	57	5.0
1427	C6	25		140	0.32		624.87	1.50	1.50	100	100	254	57	57	5.0
1432	C6	30		139	0.28		627.37	1.35	1.35	101	101	255	58	58	5.0
1437	C6	35		139	0.28		630.50	1.35	1.35	101	101	254	58	59	5.0
1442	C6	40		140	0.24		633.60	1.15	1.15	101	101	254	57	58	5.0
1447	C6	45		140	0.23		636.70	1.10	1.10	101	101	255	56	57	5.0
1452	C6	50		139	0.22		639.42	1.05	1.05	102	102	255	57	57	5.0
1457	C6	55		139	0.22		642.25	1.05	1.05	103	103	254	58	58	5.0
1502	C6	60		140	0.38		645.014	0.902	0.902	103	103	254	61	64	5.0
1512	C6	65		140	0.38		648.81	1.80	1.80	103	103	254	57	61	5.0
1517	C6	70		140	0.32		652.60	1.50	1.50	103	103	254	56	59	5.0
1522	C6	75		139	0.32		656.00	1.50	1.50	103	103	255	57	58	5.0
1527	C6	80		140	0.28		659.21	1.35	1.35	103	103	255	57	59	5.0
1532	C6	85		140	0.27		662.44	1.30	1.30	103	103	254	58	60	5.0
1537	C6	90		140	0.25		665.54	1.20	1.20	103	103	253	59	61	5.0
1542	C6	95		140	0.25		668.69	1.20	1.20	104	104	254	58	61	5.0
1547	C6	100		139	0.23		671.51	1.10	1.10	105	105	254	57	60	5.0
1552	C6	105		139	0.22		674.36	1.05	1.05	106	106	255	56	59	5.0
1557	C6	110		140	0.22		677.08	1.05	1.05	106	106	255	57	59	5.0
1602	C6	115		140	0.20		679.90	0.95	0.95	106	106	255	58	60	5.0
1607	C6														
AVERAGE															

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	#1	#2	#3	#4	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
FINAL INITIAL						
LIQUID COLLECTED						
TOTAL						

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
AVERAGE			

LEAK CHECK	
SYSTEM PRE: 0.008	CFM@15" Hg
POST: 0.006	CFM@15" Hg
PITOT PRE: 1	@ > 3" H ₂ O
POST: 1	@ > 3" H ₂ O



FIELD DATA

0010 PAGE 2

495

PLANT	VALERO	AMBIENT TEMPERATURE	98	PROBE HEATER SETTING	255	WEIGHT OF PARTICULATE, mg	
DATE	6/13/99	BAROMETRIC PRESSURE	29.87	HEATER BOX SETTING	118	Filter No.	
LOCATION	Port Hagerman	ASSUMED MOISTURE, %	2.87	METER H ₂ O	255	Sample	
OPERATOR	Kenny	PROBE LENGTH, in.	73"	C ₂ FACTOR	0.84	Final wt.	
STACK NO	FEU	NOZZLE DIAMETER, in.	0.282	Y ₂ FACTOR	1.005	Throw	
RUN NO.	FEU-0010-2	STACK DIAMETER, in.	150	PITOT/THERM #	104250	Wt. gain	
SAMPLE BOX NO	504019	MINUTES PER POINT	10				
METER BOX NO	1902	NUMBER OF PORTS	4				
STAR TIME							

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _s)	VELOCITY (ΔP _s)	DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{mg}) °F		SAMPLE BOX TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
1612	END	120	1020	140	0.38	0.38	1.80	687.502	106	114	254	253	64	5.0
1614	B6	120		140	0.38	0.38	1.80	687.764	106		255	57	61	5.0
1624	6	125		140	0.38	0.38	1.80	686.74	105		256	56	60	5.0
1629	5	130		139	0.34	0.34	1.60	690.26	107		255	57	57	5.0
1634	5	135		140	0.34	0.34	1.60	693.53	107		254	58	59	5.0
1639	4	140		140	0.34	0.34	1.60	696.80	107		255	59	60	5.0
1644	4	145		140	0.32	0.32	1.50	700.31	106		255	60	61	5.0
1649	3	150		139	0.28	0.28	1.35	703.62	106		256	59	61	5.0
1654	3	155		140	0.28	0.28	1.35	706.80	106		255	58	60	5.0
1659	2	160		140	0.24	0.24	1.15	709.97	105		256	57	59	5.0
1704	2	165		140	0.22	0.22	1.05	715.56	105		254	56	59	5.0
1709	1	170		140	0.20	0.20	0.95	718.45	105		254	57	60	5.0
1714	1	175		140	0.20	0.20	0.95	721.05	105		254	57	60	5.0
1719	END	180						723.741	105	leak ✓ 0.008 @ 12" H ₂ O	254	57	60	5.0
1739	D6	180		140	0.36	0.36	1.70	724.035	105		254	60	64	5.0
1744	6	185		140	0.36	0.36	1.70	727.43	104		255	58	60	5.0
1749	5	190		140	0.36	0.36	1.70	730.92	104		255	57	58	5.0
1754	5	195		140	0.35	0.35	1.65	734.30	104		254	56	57	5.0
1759	4	200		140	0.34	0.34	1.60	737.66	103		255	57	58	5.0
1804	4	205		139	0.33	0.33	1.55	741.03	103		254	58	59	5.0
1809	3	210		140	0.30	0.30	1.45	744.41	102		257	60	61	5.0
1814	3	215		140	0.28	0.28	1.35	747.70	102		256	59	60	5.0
1819	2	220		140	0.28	0.28	1.35	751.08	102		252	58	60	5.0
1824	2	225		140	0.24	0.24	1.15	754.05	102		253	58	60	5.0
1829	1	230		139	0.22	0.22	1.05	757.10	102		253	58	61	5.0
AVERAGE														

VOLUME OR WEIGHT OF LIQUID		IMPINGER VOLUME (ml) OR WEIGHT (g)		SILICA GEL WEIGHT	
WATER COLLECTED	#1	#2	#3	#4	#
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL					

ORSAT DATA	TIME	CO ₁	O ₁
TRIAL 1			
TRIAL 2			
TRIAL 3			
AVERAGE			

SYSTEM PRE:	CPM@15" Hg
POST:	CPM@15" Hg
PITOT PRE:	@ > 3" H ₂ O
POST:	@ > 3" H ₂ O

LEAK CHECK	
------------	--



AMBIENT TEMPERATURE		PROBE HEATER SETTING		WEIGHT OF PARTICULATE, mg	
BAROMETRIC PRESSURE	HEATER BOX SETTING	Filter No.			
ASSUMED MOISTURE, %	METER H ₂ O	Sample			
PROBE LENGTH, in.	C _p FACTOR	Final-wt			
NOZZLE DIAMETER, in.	Y _d FACTOR	Tare wt			
STACK DIAMETER, in.	PHOTO/THERM #	Wt. gain			
MINUTES PER POINT		TOTAL			mg
VAC-50 PA	92				
6/8/74	29.89				
Port A thru F	20		1.87		255
Knapp	73.71				255
PCU	0.282		0.84		
FCU-0010-2	150		1.065		
RUN NO	20				
SAMPLE BOX NO	10				

METER BOX NO					
METER BOX	504061				
START TIME	1406				
NUMBER OF PORTS	2				
NUMBER OF POINTS	24				
DIFFERENTIAL	24				
PRESSURE					
CROSS SECTION					
GAS SAMPLE					
LAST					

[illegible]

VOLUME OR WEIGHT OF LIQUID		IMPINGER		SILICA GEL	
WATER COLLECTED		VOLUME (ml) OR WEIGHT (g)		WEIGHT	
		#1	#2	#3	#4
FINAL					
INITIAL					
INQUIRY COLLECTED					

ORSAT DATA	TIME	CO ₁	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
AVERAGE			

VOLUME OR WEIGHT OF LIQUID		IMPURITIES		SILICA GEL WEIGHT
WATER COLLECTED	μ_1	VOLUME (ml) OR WEIGHT (μ_2)	μ_3	
		μ_2	μ_4	
FINAL				
INITIAL				
LIQUID COLLECTED				
TOTAL				
COLLECTED (specify ml or g)				



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-0010-2

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-8-11
6-8-11
6-8-11
0010
47534 47006
781.8 mg 786.8 mg

XAD-2 88-13
L1010588-13

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 KD	630.4 85.6	846.6	501.0	
2	100 ml Water	715.6	945.7	230.1	
3	DI Water	687.5	692.1	4.6	
4	Empty	608.3	612.2	3.9	
5	Silica Gel	764.6	788.8	24.2	
6			TOTAL =	763.8	



FIELD DATA

DATE	08/11/11	AMBIENT TEMPERATURE	87
LOCATION	PORT ARTHUR	BAROMETRIC PRESSURE	29.92
OPERATOR	K. A. A. P.	ASSUMED MOISTURE, %	20
STACK NO.	CCU	PROBE LENGTH, in.	73.1
RUN NO.	CCU-0010-3	NOZZLE DIAMETER, in.	0.382
SAMPLE BOX NO.	584019	STACK DIAMETER, in.	150
METER BOX NO.	0734	MINUTES PER POINT	10
START TIME	0734	NUMBER OF POINTS	24
		NUMBER OF PORTS	4

PROBE HEATER SETTING	255
HEATER BOX SETTING	255
METER H ₂ O	1.87
C _p FACTOR	0.85
Y ₂ FACTOR	1.885
PITOT/THERM #	1104250

WEIGHT OF PARTICULATE, mg	
Filter No.	
Sample	
Final wt.	
Therm.	
Wt. gain	
TOTAL	

A=	B=

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
					(ΔP) _s	(ΔP) _h		INLET (T _m) °F	OUTLET (T _m) °F				
0734	06	0	0.20	140	0.40	0.40	765.400	87	NA	251	59	66	6.0
0739	6	5		140	0.40	0.40	765.12	88		254	56	62	6.0
0744	5	10		140	0.36	0.36	772.70	89		255	56	60	6.0
0749	5	15		139	0.36	0.36	776.12	89		255	57	60	6.0
0754	4	20		140	0.34	0.34	779.85	90		255	56	59	6.0
0759	4	25		140	0.34	0.34	783.10	91		256	56	58	6.0
0804	3	30		140	0.28	0.28	786.45	91		255	55	59	6.0
0809	3	35		140	0.28	0.28	789.50	91		254	56	58	6.0
0814	2	40		139	0.24	0.24	792.72	91		255	57	57	6.0
0819	2	45		140	0.22	0.22	795.54	92		254	57	58	6.0
0824	1	50		140	0.22	0.22	798.34	93		255	58	59	6.0
0829	1	55		140	0.21	0.21	801.11	93		255	58	60	6.0
0834	END	60					803.840	95	0.009 @ 14.14 ft	257	60	64	6.0
0839	A6	60		140	0.38	0.38	804.433	95		256	57	61	6.0
0843	6	65		140	0.38	0.38	808.40	94		254	56	60	6.0
0848	5	70		139	0.32	0.32	811.90	94		255	55	57	6.0
0853	5	75		140	0.32	0.32	815.20	94		256	56	58	6.0
0858	4	80		140	0.26	0.26	818.52	95		255	56	57	6.0
0903	4	85		139	0.26	0.26	822.14	95		254	57	58	6.0
0908	3	90		140	0.23	0.23	824.58	94		255	58	59	6.0
0913	3	95		140	0.24	0.24	827.53	94		254	58	59	6.0
0918	2	100		140	0.22	0.22	830.90	94		255	58	58	6.0
0923	2	105		140	0.22	0.22	833.10	94		256	59	59	6.0
0928	1	110		140	0.22	0.22	835.83	94		256	60	59	6.0
0933	1	115		140	0.20	0.20	838.65	94		255	59	60	6.0
0938	END	120					841.55	NA	0.008 @ 15.14 ft	255	59	60	6.0
AVERAGE							75.597						

VOLUME OR WEIGHT OF LIQUID	6.910	27941	92.850
WATER COLLECTED			
IMPINGER			
VOLUME (ml) OR WEIGHT (g)			
#1			
#2			
#3			
#4			
FINAL INITIAL			
LIQUID COLLECTED			
TOTAL			

LEAK CHECK	
SYSTEM PRE: 0.008	CFM @ 15" Hg
POST: 0.006	CFM @ 15" Hg
PITOT PRE: ✓	@ > 3" H ₂ O
POST: ✓	@ > 3" H ₂ O



IMPINGER RECOVERY DATA SHEET

Company: Valero
 Location: Port Arthur, TX
 Source: FCCU-1241 Scrubber
 Run No.: FCCU-0010-3
 Date Set-up: 6-8-11
 Test Date: 6-9-11
 Date Recovered: 6-9-11
 USEPA Method: 0010
 Corresponding Filter No: 47547
 Filter Container No: 779.9 mg

XAD-2

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	300.5 357.4	1058.9	701.5	
2	DI Water	682.3	682.5	0.2	
3	DI Water	694.5	694.7	0.2	
4	Empty	612.2	614.2	2.0	
5	Silica Gel	727.6	751.0	23.4	
6			TOTAL =	727.3	



Field Blank

PLANT	Vabco		AMBIENT TEMPERATURE	20	PROBE HEATER SETTING		<table border="1"> <tr> <td>Filter No.</td> <td>Sample</td> <td>Final</td> <td>Tare</td> <td>Wt. pan</td> <td>TOTAL</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Filter No.	Sample	Final	Tare	Wt. pan	TOTAL						
Filter No.	Sample	Final	Tare	Wt. pan	TOTAL														
DATE	6/19/11		BAROMETRIC PRESSURE	29.92	HEATER BOX SETTING														
LOCATION	Port Arthur, TX		ASSUMED MOISTURE, %		METER H ₂ O														
OPERATOR	AN/208		PROBE LENGTH, in.		C _p FACTOR														
STACK NO	BLLH		NOZZLE DIAMETER, in.		Y _d FACTOR														
RUN NO	0010 - Field Blank		STACK DIAMETER, in.		PITOT/THERM #														
SAMPLE BOX NO			MINUTES PER POINT																
METER BOX NO	1104027		NUMBER OF POINTS																
START TIME			NUMBER OF PORTS																
			PRESSURE DIFFERENTIAL																
			GAS SAMPLE																
			CROSS SECTION																
			LAST																
			A =		B =														
			WEIGHT OF PARTICULATE, mg																

[illegible]

VOLUME OR WEIGHT OF LIQUID		IMPFINGER		SILICA GEL	
WATER COLLECTED		VOLUME (ml) OR WEIGHT (g)		WEIGHT	
#1	#2	#3	#4	#	
FINAL					
INITIAL					
LIQUID COLLECTED					

ORSAT	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	
SYSTEM PRE: <u>40.02/40</u>	CFM@15"Hg
POST: <u>40.02/40</u>	CFM@15"Hg
PITOT PRE: _____	@ > 3"H ₂ O
POST: _____	@ > 3"H ₂ O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-0010-Blank

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-8-11
6-9-11
6-9-11
0010
47543
787.9 mg

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				
	<u>Empty</u>	<u>357.5</u>	<u>357.8</u>	<u>0.3</u>	
2	<u>DI Water</u>	<u>718.1</u>	<u>717.9</u>	<u>-0.2</u>	
3	<u>DI Water</u>	<u>730.5</u>	<u>730.2</u>	<u>-0.3</u>	
4	<u>Empty</u>	<u>631.8</u>	<u>635.0</u>	<u>3.2</u>	
5	<u>SilicaGel</u>	<u>778.3</u>	<u>771.6</u>	<u>2.3</u>	
6		<u>769.3</u>			

TXAD-2



FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	87	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	6-8-11	BAROMETRIC PRESSURE	29.92	HEATER BOX SETTING	1.82	Filter No.	
LOCATION	Port Arthur	ASSUMED MOISTURE, %	19.1	METER H ₂ O	1.82	Sample	
OPERATOR	JK	PROBE LENGTH, in	75	C ₂ FACTOR	1.84	Final wt	
STACK NO	FGU	NOZZLE DIAMETER, in	0.883	Y ₂ FACTOR	1.001	Therm	
RUN NO	FGU-DU-1	STACK DIAMETER, in	150	PITOT/THERM #	83	Wt gain	
SAMPLE BOX NO	APR	MINUTES PER POINT	2.5			TOTAL	
METER BOX NO	903012	NUMBER OF POINTS	2145				
START TIME	826						

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (9) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _s)	VELOCITY (ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER INLET (T _{in}) °F		SAMPLE BOX TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED							
826	B-1	0	0.20	140	0.40	0.40	1.8	1.70	925.650	87	248			67	2
831	2	5		140	0.34	0.34	1.5	1.50	931.47	87	248			64	2
836	3	10		141	0.23	0.23	1.2	1.10	934.93	87	248			63	2
841	4	15		140	0.20	0.20	1.1	0.88	935.96	88	247			63	2
846	5	20		140	0.39	0.39	0.88	0.82	937.38	88	247			62	2
851	6	25		139	0.36	0.36	1.7	1.75	938.79	87	245			66	2
856	7	30		140	0.31	0.31	1.6	1.60	940.43	91	250			68	2
861	8	35		140	0.31	0.31	1.4	1.38	941.19	90	247			58	2
866	9	40		139	0.23	0.23	1.0	1.02	944.01	91	245			59	2
871	10	45		139	0.21	0.21	0.94	0.94	945.60	91	242			61	2
876	11	50		139	0.18	0.18	0.80	0.80	946.96	91	241			60	2
881	12	55		140	0.39	0.39	1.7	1.74	948.37	91	247			60	2
886	13	60		140	0.34	0.34	1.5	1.52	949.95	92	248			51	2
891	14	65		140	0.23	0.23	1.0	1.03	951.71	93	249			50	2
896	15	70		140	0.20	0.20	0.89	0.89	953.30	93	249			52	2
901	16	75		140	0.19	0.19	0.84	0.84	954.63	93	253			51	2
906	17	80		139	0.18	0.18	0.81	0.81	955.99	91	248			56	2
911	18	85		140	0.40	0.40	1.5	1.49	957.13	94	246			56	2
916	19	90		140	0.23	0.23	1.2	1.18	958.84	95	241			56	2
921	20	95		140	0.26	0.26	0.99	0.99	960.87	95	244			56	2
926	21	100		139	0.22	0.22	0.90	0.90	962.01	95	244			53	2
931	22	105		139	0.20	0.20	0.90	0.90	963.91	95	243			58	2
936	23	110		140	0.20	0.20	0.90	0.90	965.21	96	245			59	2
941	24	115		140	0.20	0.20	0.90	0.90	966.480						
AVERAGE	2145	60 min	0.20	139.8	0.5145	0.5145	1.20	1.20	36.830	91.5	250			258	max

VOLUME OR WEIGHT OF LIQUID COLLECTED		IMPINGER VOLUME (ml) OR WEIGHT (g)		SILICA GEL WEIGHT	
WATER COLLECTED		#1 #2 #3 #4			
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL					

LEAK CHECK

SYSTEM PRE: 1000 CFM @ 5" Hg

POST: 1000 CFM @ 5" Hg

PITOT PRE: 77-01k @ 3" H₂O

POST: 77-01k @ 3" H₂O



IMPINGER RECOVERY DATA SHEET

Company:

Location:

Source:

Run No.:

Valero

Port Arthur, TX

FCCU-1241 Scrubber

FCCU-0011-1

Date Set-up:

Test Date:

Date Recovered:

USEPA Method:

Corresponding Filter No:

Filter Container No:

6-7-11

6-8-11

6-8-11

0011

47006 N/A

~~786.8~~ 700g N/A

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	DNPH	803.7	954.6	150.9	2
2	DNPH	710.9	722.9	12.0	3
3	DNPH	700.6	701.3	0.7	3
4	Empty	618.1	620.9	2.8	3
5	Silica Gel	808.6	816.8	8.2	
6				174.6	



FIELD DATA

PLANT	16000	AMBIENT TEMPERATURE	13	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	8-2-11	BAROMETRIC PRESSURE	25.89	HEATER BOX SETTING			
LOCATION	Point Arthur Sta	ASSUMED MOISTURE, %	19	METER H ₂ O	1.82		
OPERATOR	GB	PROBE LENGTH, in	3.22	C _p FACTOR	1.00		
STACK NO	FECCV	NOZZLE DIAMETER, in	150	Y _g FACTOR	83		
RUN NO.	FECCV-0011-2	STACK DIAMETER, in	2.5	PITOT/THERM #			
SAMPLE BOX NO	903012	MINUTES PER POINT	24				
METER BOX NO	1434	NUMBER OF POINTS	1				
START TIME							

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (01 min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _g) °F	VELOCITY HEAD (AP ₃)	VELOCITY (ft/min)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{mg}) °F		SAMPLE BOX TEMP °F	COND. EXIT TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET	OUTLET (T _{m, out}) °F					
1430	A-1	0	30.20	141	0.41	0.41	3.1	3.07	183.850	93	245	245	245		67	
1431	A-2	5	30.20	140	0.36	0.36	2.7	2.70	181.86	95	247	247	247		58	
1432	A-3	10	30.20	140	0.32	0.32	2.2	2.18	182.96	95	243	243	243		58	
1433	A-4	15	30.20	140	0.25	0.25	1.9	1.83	184.08	96	244	244	244		58	
1434	A-5	20	30.20	140	0.22	0.22	1.7	1.66	185.99	96	248	248	248		59	
1435	A-6	25	30.20	140	0.20	0.20	1.5	1.50	187.91	96	243	243	243		59	
1436	A-7	30	30.20	139	0.40	0.40	3.0	3.02	189.81	97	245	245	245		67	
1437	A-8	35	30.20	139	0.36	0.36	2.7	2.72	188.53	97	248	248	248		67	
1438	A-9	40	30.20	140	0.32	0.32	2.4	2.41	184.94	97	245	245	245		67	
1439	A-10	45	30.20	140	0.27	0.27	2.0	2.03	187.01	97	248	248	248		60	
1440	A-11	50	30.20	140	0.24	0.24	1.8	1.81	188.03	98	242	242	242		62	
1441	A-12	55	30.20	140	0.21	0.21	1.6	1.59	190.94	98	243	243	243		63	
1442	A-13	60	30.20	140	0.39	0.39	3.6	3.64	192.72	98	249	249	249		67	
1443	A-14	65	30.20	140	0.34	0.34	2.6	2.56	193.02	99	248	248	248		67	
1444	A-15	70	30.20	140	0.32	0.32	2.4	2.42	194.43	99	249	249	249		54	
1445	A-16	75	30.20	140	0.25	0.25	1.9	1.89	199.44	99	249	249	249		55	
1446	A-17	80	30.20	140	0.23	0.23	1.7	1.74	100.93	99	249	249	249		56	
1447	A-18	85	30.20	140	0.21	0.21	1.6	1.59	1003.95	99	248	248	248		56	
1448	A-19	90	30.20	139	0.39	0.39	3.6	3.65	1005.65	99	248	248	248		67	
1449	A-20	95	30.20	140	0.33	0.33	2.5	2.50	1007.93	99	248	248	248		60	
1450	A-21	100	30.20	140	0.28	0.28	2.4	2.42	1010.13	99	243	243	243		51	
1451	A-22	105	30.20	140	0.26	0.26	2.0	1.97	1012.12	99	244	244	244		53	
1452	A-23	110	30.20	140	0.23	0.23	1.7	1.72	1014.17	99	243	243	243		54	
1453	A-24	115	30.20	139	0.21	0.21	1.6	1.59	1015.44	99	248	248	248		57	
1454	A-25	120	30.20	139	0.21	0.21	1.6	1.59	1017.935	99	248	248	248		57	
AVERAGE	2448	60 min	30.20	139.9	0.353	0.353	2.19	2.19	50.085	99.7	245	245	245		68	MAX

VOLUME OR WEIGHT OF LIQUID		IMPINGER		SILICA GEL	
WATER COLLECTED		VOLUME (ml) OR WEIGHT (g)		WEIGHT	
FINAL		#1	#2	#3	#4
INITIAL					
LIQUID COLLECTED					
TOTAL		COLLECTED (specify ml or g)			

SYSTEM PRE: 1040	CFM@15" Hg
POST: 1040	CFM@15" Hg
PITOT PRE: 44-86	@ > 3" H ₂ O
POST: 44-86	@ > 3" H ₂ O

LEAK CHECK	
SYSTEM PRE: 1040	CFM@15" Hg
POST: 1040	CFM@15" Hg
PITOT PRE: 44-86	@ > 3" H ₂ O
POST: 44-86	@ > 3" H ₂ O

IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero, Port Arthur
PA, TX
FCCU-1241 Scrubber
FCCU-0011-2

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-8-11
6-8-11
6-8-11
0011
N/A
N/A

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	DNPH	807.8	986.2	178.4	2
2	DNPH	719.6	761.1	41.5	3
3	DNPH	703.6	705.1	1.5	3
4	Empty	608.7	610.1	11.4 1.4	3
5	Silica Gel	819.2	829.9	10.7	
6			TOTAL =	233.5	



IMPINGER RECOVERY DATA SHEET

Company: Valero
 Location: Port Arthur, TX
 Source: FCCU-1241 Scrubber
 Run No.: FCCU-0011-3
 Date Set-up: 6-8-11
 Test Date: 6-9-11
 Date Recovered: 6-9-11
 USEPA Method: 0011
 Corresponding Filter No: N/A
 Filter Container No: N/A

Measurement Method: Weight or Volume

<u>Impinger No.</u>	<u>Impinger Contents</u>	<u>Initial wt/vol g/mL</u>	<u>Final wt/vol g/mL</u>	<u>Difference wt/vol g/mL</u>	<u>Sample Container No.</u>
1	DNPH	811.9	961.9	150.0	X
2	DNPH	713.6	783.8	70.2	X
3	DNPH	715.0	717.4	2.4	X
4	Empty	612.9	612.9	Ø	
5	Silica Gel	814.4	826.7	12.3	
6					



FIELD DATA

LEAK CHECK

SYSTEM PRE: 0.000 CFM@15"Hg

POST: 0.000 CFM@15"Hg

PITOT PRE: @ > 3" H₂O

POST: @ > 1" H₂O

ORSAT DATA	TIME	CO ₁	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

VOLUME OR WEIGHT OF LIQUID	IMPINGER			SILICA GEL WEIGHT
WATER COLLECTED	#1	#2	#3	#4
FINAL INITIAL				
LIQUID COLLECTED				
TOTAL COLLECTED (spec./l ml or g)				



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-0011-3 Blank

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-8-11
6-8-11
6-8-11
0011
N/A
N/A

Measurement Method: Weight or Volume

<u>Impinger No.</u>	<u>Impinger Contents</u>	<u>Initial wt/vol g/mL</u>	<u>Final wt/vol g/mL</u>	<u>Difference wt/vol g/mL</u>	<u>Sample Container No.</u>
1	DNPH	816.5	816.6	0.1	7
2	DNPH	683.5	683.6	0.1	2
3	DNPH	711.5	711.8	0.3	2
4	Empty	543.3	543.4	0.1	
5	Silica Gel	812.2	814.8	2.6	
6					



FIELD DATA

PLANT	Ukero	AMBIENT TEMPERATURE	90
DATE	6-9-11	BAROMETRIC PRESSURE	29.59
LOCATION	Port Arthur	ASSUMED MOISTURE, %	19.1
OPERATOR	JTC	PROBE LENGTH, in	764
STACK NO	2000	NOZZLE DIAMETER, in	0.322
RUN NO	150-3	STACK DIAMETER, in	150.3
SAMPLE BOX NO	APR2	MINUTES PER POINT	7.5
METER BOX NO	903012	NUMBER OF POINTS	24pts
START TIME	1423	NUMBER OF PORTS	4

PROBE HEATER SETTING	250
HEATER BOX SETTING	250
METER H ₂ O	1.84
C ₂ FACTOR	1.84
Y ₂ FACTOR	1.84
PITOT/TERM #	83

WEIGHT OF PARTICULATE, mg	47546
Filter No.	
Sample	
Final wt	
True wt	
Wt. gain	
TOTAL	mg

CLOCK TIME	TRAVERSE NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP) (in. H ₂ O)	VELOCITY (ft/min)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O				GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{mg}) °F		SAMPLE BOX TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED				INLET (T _{mg}) °F	OUTLET (T _{mg}) °F				
1427	D-1	0	0.20	140	0.40	0.35	3.0	3.00			69.95	95	250	250		67	7
1442	2	7.5		140	0.35	0.32	2.6	2.62			71.21	95	250	250		63	7
1457	3	15.0		140	0.32	0.26	2.1	2.71			83.21	97	248	248		63	7
1512	4	22.5		139	0.26	0.23	2.0	1.96			90.82	98	248	248		62	7
1523	5	30.0		140	0.22	0.29	1.7	1.94			96.98	98	248	248		63	7
1538	6	37.5		140	0.39	0.34	2.9	1.66			102.69	98	252	252		61	7
1553	1	45.0		139	0.34	0.29	2.6	2.57			102.18	98	252	252		52	7
1608/1618	2	52.5		140	0.29	0.25	2.2	2.19			115.20	99	251	251		57	7
1624	3	60.0		140	0.25	0.22	1.9	1.89			122.05	99	250	250		53	7
1649	4	67.5		140	0.22	0.38	1.7	1.66			128.42	99	250	250		53	7
1653	5	75.0		140	0.38	0.35	1.7	1.66			134.40	99	250	250		53	7
1658/1668	6	82.5		140	0.35	0.30	2.0	2.87			140.09	99	250	250		53	7
1674	1	90.0		140	0.30	0.24	2.6	2.63			145.13	99	250	250		53	7
1679	2	97.5		139	0.24	0.21	2.3	2.26			152.18	99	250	250		53	7
1684	3	105.0		140	0.21	0.26	1.8	1.81			159.15	99	250	250		53	7
1689	4	112.5		140	0.26	0.21	1.7	1.66			165.63	99	250	250		53	7
1694	5	120.0		140	0.21	0.38	1.6	1.58			171.62	99	250	250		53	7
1699/1708	6	127.5		140	0.38	0.37	2.9	2.85			177.05	99	250	250		53	7
1713	1	135.0		139	0.37	0.29	2.8	2.79			182.42	99	250	250		53	7
1718	2	142.5		140	0.29	0.26	2.2	2.18			187.64	99	250	250		53	7
1723	3	150.0		140	0.26	0.24	2.0	1.46			196.32	99	250	250		53	7
1728	4	157.5		140	0.24	0.22	1.8	1.81			203.11	99	250	250		53	7
1733	5	165.0		139	0.22	0.22	1.7	1.66			209.21	99	250	250		53	7
1738	6	172.5		140	0.22	0.22	1.7	1.66			215.25	99	250	250		53	7
1743	1	180.0		140	0.22	0.22	1.7	1.66			220.750	99	250	250		53	7
AVERAGE	24pts	180mn	10.20	139.8	0.5349	0.5349	2.18	2.20			150.755	97.1	250	250		268	MAX 8

VOLUME OR WEIGHT OF LIQUID	IMPINGER	SILICA GEL
WATER COLLECTED	VOLUME (ml) OR WEIGHT (g)	WEIGHT
FINAL INITIAL	#1 #2 #3 #4	#8
LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

LEAK CHECK	SYSTEM PRE: 2001	CFM@15" Hg
	POST: 2001	CFM@15" Hg
	PITOT PRE: 41-06	@ > 3" H ₂ O
	POST: 41-06	@ > 3" H ₂ O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-OH-1

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-9-11
6-9-11
6-9-11
ASTM D6784-02
47546
785.6 mg

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	1 M KCl	718.1	979.7	261.6	
2	1 M KCl	706.7	963.5	256.8	
3	1 M KCl	692.1	874.4	182.3	
4	5% HNO ₃ / 10% H ₂ O ₂	687.7	693.8	6.1	
5	4% KMnO ₄ / 10% H ₂ SO ₄	717.0	717.4	0.4	
6	4% KMnO ₄ / 10% H ₂ SO ₄	748.7	748.7	Ø	
7	4% KMnO ₄ / 10% H ₂ SO ₄	680.7	682.3	1.6	
8	Silica Gel	813.7	836.7	23.0	

TOTAL = 731.8



FIELD DATA

PLANT Vclero
DATE 5/10/11
LOCATION Port Arthur, TX
OPERATOR JF
STACK NO FCCU
RUN NO FCCU-04-2
SAMPLE BOX NO 462
METER BOX NO 103012
START TIME 732

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE 29.89
ASSUMED MOISTURE, % 74
PROBE LENGTH, in 74
NOZZLE DIAMETER, in 0.322
STACK DIAMETER, in 150
MINUTES PER POINT 7.5
NUMBER OF POINTS 24
NUMBER OF PORTS 4

PROBE HEATER SETTING 250
HEATER BOX SETTING 250
METER H₂O 1.88
C_p FACTOR 1.001
Y_d FACTOR 83
PITOT/THERM # 83

WEIGHT OF PARTICULATE, mg			
Filter No.	45525		
Sample			
Final wt			
Tare wt			
Wt. gain			
TOTAL			
mg			

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CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (AP ₂) (in. H ₂ O)	VELOCITY (ft/min)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{gm}) °F		SAMPLE BOX TEMP °F	P _{exhaust} TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _{gm}) °F	OUTLET (T _{gm}) °F					
732	A-1	0	10.20	140	0.39	0.39	2.9	2.89	221.650	84		253	252		57	6
747	2	7.5		140	0.35	0.35	2.6	2.59	228.77	86		257	253		54	6
	3	15		140	0.31	0.31	2.3	2.29	235.56	87		255	250		57	6
802	4	20.5		140	0.26	0.26	1.9	1.87	242.01	89		257	248		59	6
	5	30		139	0.23	0.23	1.7	1.71	248.03	90		257	249		60	6
	6	37.5		140	0.21	0.21	1.6	1.57	253.32	92		255	251		61	6
819	B-1	45		140	0.40	0.40	3.0	2.99	258.55	93		251	252		67	7
	2	52.5		140	0.33	0.33	2.5	2.47	265.48	93		250	250		52	7
843	3	60		140	0.29	0.29	2.2	2.17	272.50	93		251	251		52	6
	4	67.5		139	0.25	0.25	1.9	1.88	279.01	95		252	250		54	6
858	5	75		139	0.22	0.22	1.7	1.65	284.82	96		257	251		55	5
	6	82.5		140	0.20	0.20	1.5	1.55	290.29	96		256	251		56	5
913	1	90		140	0.38	0.38	2.9	2.86	295.51	96		265	250		57	7
	2	97.5		140	0.34	0.34	2.6	2.56	302.71	97		265	250		67	7
935	3	100		140	0.27	0.27	2.0	2.04	309.51	98		270	249		50	7
	4	112.5		140	0.24	0.24	1.8	1.82	315.83	99		267	252		53	6
950	5	120		139	0.22	0.22	1.7	1.67	321.59	100		264	251		57	5
	6	127.5		140	0.21	0.21	1.6	1.59	327.12	101		264	250		69	5
1005	1	130		140	0.39	0.39	3.0	2.96	332.37	101		260	252		67	7
	2	142.5		140	0.34	0.34	2.6	2.58	339.91	101		262	254		61	7
1025	3	150		140	0.31	0.31	2.4	2.35	346.80	101		263	253		59	6
	4	157.5		139	0.28	0.28	2.1	2.13	353.37	100		257	250		56	6
1040	5	165		140	0.23	0.23	1.7	1.74	359.62	100		254	250		54	6
	6	172.5		140	0.20	0.20	1.5	1.52	365.48	100		257	251		57	6
1055		180							370.410							
AVERAGE	24pts	180 min.	10.20	139.8	0.3303		2.15		148.760	95.3		2250	2250		CGF	N/A

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED		IMPINGER VOLUME (ml) OR WEIGHT (g)		SILICA GEL WEIGHT	
#1		#2		#4	
FINAL INITIAL LIQUID COLLECTED					
TOTAL					

COLLECTED (specify ml or g)

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK

SYSTEM PRE: 1061 CFM@15"Hg
POST: 1061 CFM@15"Hg

PITOT PRE: 11-016 @ > 3"H₂O
POST: 11-016 @ > 3"H₂O



IMPINGER RECOVERY DATA SHEET

Company: Valero
 Location: Port Arthur, TX
 Source: FCCU-1241 Scrubber
 Run No.: FCCU-OH-2
 Date Set-up: 6-9-11
 Test Date: 6-10-11
 Date Recovered: 6-10-11
 USEPA Method: ASTM D6784-02
 Corresponding Filter No: 47535
 Filter Container No: 786.3 mg

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	1 M KCl	709.3	978.7	269.4	
2	1 M KCl	714.8	983.3	268.5	
3	1 M KCl	688.5	843.0	154.5	
4	5% HNO ₃ / 10% H ₂ O ₂	653.2	656.8	3.6	
5	4% KMnO ₄ / 10% H ₂ SO ₄	701.3	701.7	0.4	
6	4% KMnO ₄ / 10% H ₂ SO ₄	730.4	731.0	0.6	
7	4% KMnO ₄ / 10% H ₂ SO ₄	661.4	661.4	0	
8	Silica Gel	790.5	813.2	22.7	

TOTAL = 719.7



FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	94	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	42996
DATE	6:10:11	BAROMETRIC PRESSURE	129.89	HEATER BOX SETTING	250	Filter No.	
LOCATION	Port Arthur TX	ASSUMED MOISTURE, %	78	METER Hg	1.82	Sample	
OPERATOR	JK	PROBE LENGTH, in	0.322	Cp FACTOR	1.001	Final wt.	
STACK NO	FCU	NOZZLE DIAMETER, in	150	Vd FACTOR	83	Tare wt.	
RUN NO	FCU-04-3	STACK DIAMETER, in	75	PITOT/THERM #		Wt. gain	
SAMPLE BOX NO	APEX	MINUTES PER POINT	2400			TOTAL	mg
METER BOX NO	135012	NUMBER OF POINTS	4				
START TIME	12:27	NUMBER OF PORTS					

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (01 min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _g) °F	VELOCITY HEAD (AP _g)	VELOCITY (ft/min)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _m) °F		SAMPLE BOX TEMP °F	EXIT TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _m) °F	OUTLET (T _m) °F					
12:27	0-1	0	0.20	140	0.38		2.9	2.55	371.300	96	260	252			68	10
	2	7.5		140	0.34		2.6	2.55	375.35	95	256	251			59	10
12:27	3	15		140	0.29		2.2	2.18	385.20	95	252	250			61	10
	4	21.5		140	0.24		1.8	1.80	391.60	95	254	250			62	8
12:57	5	30		140	0.22		1.7	1.67	397.49	96	252	253			63	7
	6	37.5		139	0.20		1.6	1.62	401.44	96	250	257			64	6
13:00/13:00C	1	45		140	0.10		3.0	3.01	408.97	96	260	251			67	11
	2	52.5		140	0.33		2.5	2.49	414.95	97	262	250			56	11
13:37	3	60		140	0.30		2.2	2.16	421.77	98	261	250			58	11
	4	67.5		139	0.26		2.0	1.97	428.05	98	254	250			61	10
13:49	5	75		139	0.23		1.7	1.74	434.47	98	257	251			61	10
	6	82.5		140	0.21		1.6	1.59	440.82	99	255	253			62	9
14:01/14:00B	1	90		140	0.39		2.9	2.94	446.19	98	258	251			66	10
	2	97.5		139	0.34		2.6	2.57	453.38	98	260	249			55	10
14:05	3	105		140	0.27		2.0	2.04	460.08	98	257	250			57	8
	4	112.5		140	0.24		1.8	1.81	466.45	98	258	253			57	8
15:00	5	120		139	0.22		1.7	1.66	472.34	99	253	252			58	7
	6	127.5		140	0.20		1.5	1.51	478.18	99	252	251			60	6
15:05/15:00A	1	135		140	0.39		2.9	2.94	483.39	98	262	251			67	9
	2	142.5		140	0.33		2.5	2.50	489.15	98	261	253			57	9
15:44	3	150		140	0.31		2.4	2.35	496.52	99	260	251			57	8
	4	157.5		139	0.24		2.0	1.95	503.14	99	257	250			57	7
15:59	5	165		140	0.22		1.7	1.67	509.72	100	258	251			57	7
	6	172.5		140	0.21		1.6	1.59	515.71	100	253	250			59	7
16:14		180							520.620							
AVERAGE	240AS	180 min	102.0	139.8	0.5272		2.14		149.320	97.6	220	220			68	11

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4	#5	#6
FINAL INITIAL LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
AVERAGE			

LEAK CHECK	SYSTEM PRE: 2.000	CFM @ 15" Hg
	POST: 2.000	CFM @ 15" Hg
PITOT PRE: 17.000		@ > 3" H ₂ O
POST: 17.000		@ > 3" H ₂ O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241 Scrubber
FCCU-OH-3

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-10-11
6-10-11
6-10-11
ASTM D6784-02
47996
779.7 mg

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	1 M KCl	720.5	969.2	248.7	
2	1 M KCl	702.4	962.5	260.1	
3	1 M KCl	685.4	877.8	192.4	
4	5% HNO ₃ / 10% H ₂ O ₂	751.9	754.2	2.3	
5	4% KMnO ₄ / 10% H ₂ SO ₄	653.4	658.0	4.6	
6	4% KMnO ₄ / 10% H ₂ SO ₄	702.1	705.0	2.9	
7	4% KMnO ₄ / 10% H ₂ SO ₄	663.0	664.1	1.1	
8	Silica Gel	825.6	843.3	17.7	

TOTAL 729.8



FIELD DATA

PLANT	Valeco	AMBIENT TEMPERATURE	90
DATE	6/19/11	BAROMETRIC PRESSURE	29.89
LOCATION	East Arthur TX	ASSUMED MOISTURE, %	19
OPERATOR	AA	PROBE LENGTH, in.	84
STACK NO	FLU	NOZZLE DIAMETER, in.	0.319
RUN NO.	FLU-0061-1	STACK DIAMETER, in.	150
SAMPLE BOX NO	APX	MINUTES PER POINT	7.5
METER BOX NO	1927	NUMBER OF POINTS	24
START TIME	1927	NUMBER OF PORTS	4

PROBE HEATER SETTING	HEATER BOX SETTING	WEIGHT OF PARTICULATE, mg
METER Hg	C ₂ FACTOR	Filter No.
Y ₂ FACTOR	PITOT/THERM #	Sample
		Final wt.
		Tare wt.
		Wt. gain
		TOTAL

WEIGHT OF PARTICULATE, mg	mg
Filter No.	
Sample	
Final wt.	
Tare wt.	
Wt. gain	
TOTAL	

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (°F)	VELOCITY HEAD (in. H ₂ O)	VELOCITY (ft/min)	DIFFERENTIAL PRESSURE (in. H ₂ O)	GAS SAMPLE VOLUME (l/min)	GAS SAMPLE TEMP AT DRY GAS METER (°F)	INLET (T _{in}) °F	OUTLET (T _{out}) °F	SAMPLE BOX TEMP (°F)	COND. EXIT TEMP (°F)	SORBENT MODULE TEMP (°F)	LAST IMPINGER OUTLET TEMP (°F)	PUMP VACUUM in. Hg
1427	A6	0	0.20	139	0.35	0.35	2.4	769.700	90	90	NA	NA	NA	NA	66	6
		7.5		140	0.26	0.26	1.8	777.3	91	91	NA	NA	NA	NA	66	6
		15		140	0.22	0.22	1.5	784.7	93	93	NA	NA	NA	NA	66	6
		22.5		140	0.23	0.23	1.6	788.5	93	93	NA	NA	NA	NA	66	6
		30		140	0.23	0.23	1.6	783.7	93	93	NA	NA	NA	NA	66	6
		37.5		139	0.26	0.26	2.0	794.0	93	93	NA	NA	NA	NA	66	6
		45		139	0.36	0.36	2.5	804.645	93	93	NA	NA	NA	NA	66	6
		52.5		139	0.29	0.29	2.0	811.2	93	93	NA	NA	NA	NA	66	6
		60		140	0.26	0.26	1.8	817.2	94	94	NA	NA	NA	NA	66	6
		67.5		140	0.24	0.24	1.7	823.0	93	93	NA	NA	NA	NA	66	6
		75		140	0.22	0.22	1.5	828.15	93	93	NA	NA	NA	NA	66	6
		82.5		140	0.23	0.23	1.6	833.6	95	95	NA	NA	NA	NA	66	6
		90		140	0.33	0.33	2.3	839.105	93	93	NA	NA	NA	NA	66	6
		97.5		139	0.25	0.25	1.7	845.13	93	93	NA	NA	NA	NA	66	6
		105		140	0.22	0.22	1.5	850.9	93	93	NA	NA	NA	NA	66	6
		112.5		140	0.22	0.22	1.5	856.1	93	93	NA	NA	NA	NA	66	6
		120		139	0.23	0.23	1.6	861.3	91	91	NA	NA	NA	NA	66	6
		127.5		140	0.24	0.24	1.7	866.4	91	91	NA	NA	NA	NA	66	6
		135		140	0.35	0.35	2.4	872.030	89	89	NA	NA	NA	NA	66	6
		142.5		140	0.25	0.25	1.7	878.3	90	90	NA	NA	NA	NA	66	6
		150		139	0.22	0.22	1.5	883.9	90	90	NA	NA	NA	NA	66	6
		157.5		140	0.21	0.21	1.5	888.7	90	90	NA	NA	NA	NA	66	6
		165		140	0.22	0.22	1.5	894.2	91	91	NA	NA	NA	NA	66	6
		172.5		139	0.23	0.23	1.6	899.1	91	91	NA	NA	NA	NA	66	6
1803		180						904.260								
AVERAGE	24pts	180 mins	0.20	139.7	0.5032	0.5032	0.5032	134.560	91.8	91.8	NA	NA	NA	NA	68	Max 6

VOLUME OF LIQUID COLLECTED	IMPINGER	SILICA GEL WEIGHT			
WATER COLLECTED	VOLUME (ml) OR WEIGHT (g)	WEIGHT			
FINAL	#1	#2	#3	#4	#5
INITIAL					
LIQUID COLLECTED					
TOTAL	COLLECTED (specify ml or g)				

ORSAT	DATA	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	SYSTEM PRE: 40.002 JPS	CFM@15" Hg
	POST: 50.002 JPS	CFM@15" Hg
PITOT PRE: 40.002 JPS	@ > 3" H ₂ O	
POST: 40.002 JPS	@ > 3" H ₂ O	



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur
FCCU 1241 scrubber
FLU-0061-1

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/9/11
6/9/11
6/9/11
0061
N/A
N/A

pH 9

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	0.5m KOH	1223.6	578.7	594.7	
2	0.5m KOH	513.8	610.7	96.9	
3	0.5m KOH	511.4	624.8	113.4	
4	Empty	425.2	574.9	149.7	
5	Silica Gel	766.1	805.5	39.4	
6			TOTAL =	415.4	

Nitrogen purge
start: 10:33
stop: 19:25



FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	~85
DATE	6/10/11	BAROMETRIC PRESSURE	29.89
LOCATION	Port Arthur, TX	ASSUMED MOISTURE, %	84
OPERATOR	AA	PROBE LENGTH, in.	1755
STACK NO	FCG	NOZZLE DIAMETER, in.	0.84
RUN NO	FCG12-00161-2	STACK DIAMETER, in.	0.319
SAMPLE BOX NO	AP6A	MINUTES PER POINT	150
METER BOX NO	1104027	NUMBER OF POINTS	75
START TIME	0732	NUMBER OF PORTS	4

PROBE HEATER SETTING	HEATER BOX SETTING	WEIGHT OF PARTICULATE, mg
	METER H ₂ O	
	C _p FACTOR	
	Y _d FACTOR	
	PITOT/THERM #	

Filter No.	Sample	Final wt	Tare wt	Wt. gain	TOTAL
					mg

A= B=

A B

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{mg}) °F		SAMPLE BOX TEMP. °F	COND. EXIT TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
						ACTUAL	DESIRED		INLET (T _{mg}) °F	OUTLET (T _{mg}) °F					
0732	6	0	0.2	140	0.37	2.6		909.530	86	AVG	NA	NA	NA	65	5
	5	7.5		140	0.34	2.4		916.4	87					54	5
	4	15		140	0.30	2.1		922.8	89					56	5
	3	22.5		140	0.26	1.8		929.0	91					60	5
	2	30		139	0.24	1.7		934.5	92					62	5
0817/0428	1	37.5		139	0.22	1.5		940.1	93					62	4
	6	45		140	0.38	2.7		945.535	91					63	5
	5	52.5		140	0.33	2.3		952.7	92					63	5
	4	60		139	0.29	2.0		959.1	93					64	5
	3	67.5		140	0.25	1.8		965.5	93					67	5
0913/0920	2	75		140	0.23	1.6		971.9	94					66	5
	1	82.5		140	0.23	1.6		977.4	93					69	5
	6	90		140	0.38	2.7		982.600	92					64	5
	5	97.5		140	0.35	2.5		989.3	93					55	5
	4	105		139	0.31	2.2		996.0	93					58	5
1005/1010	3	112.5		140	0.25	1.8		1002.4	93					59	5
	2	120		140	0.22	1.5		1008.2	94					55	5
	1	127.5		140	0.22	1.6		1013.9	96					53	5
	6	135		140	0.36	2.5		1019.435	96					64	5
	5	142.5		140	0.32	2.3		1025.9	96					53	5
1055	4	150		139	0.27	1.9		1032.3	97					50	5
	3	157.5		140	0.24	1.7		1038.6	97					47	5
	2	165		139	0.21	1.5		1044.1	98					47	5
	1	172.5		140	0.22	1.6		1049.6	98					46	5
		180						1053.650							
AVERAGE	24Hrs	180 mins	0.2	139.8	0.5297	1.95		144.120	93.2	AVG	NA	NA	NA	<68	Max 6

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT	
#1	#2	#3	#4
FINAL			
INITIAL			
LIQUID COLLECTED			
TOTAL	COLLECTED (specify ml or g)		

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	SYSTEM PRE: 50.000/15" Hg	CFM@15" Hg
	POST: 36.000/15" Hg	CFM@15" Hg
	PITOT PRE: 11-1/2" H ₂ O	@ > 3" H ₂ O
	POST: 4-1/2" H ₂ O	@ > 3" H ₂ O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Vulcan
Port Arthur
FCCU 12AT scrubber
FCCU-0061 -2

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/9/11
6/10/11
6/10/11
0061
N/A
N/A

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	KOH	589.1	556.0	-33.1	
2	KOH	510.7	589.1	78.4	
3	KOH	512.8	601.9	89.1	
4	Empty	432.7	535.7	103.0	
5	Silica Gel	728.9	1022.0	293.1	
6				530.5	



FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	~90
DATE	6/10/11	BAROMETRIC PRESSURE	29.89
LOCATION	Port Arthur, TX	ASSUMED MOISTURE, %	19
OPERATOR	AK	PROBE LENGTH, in.	84
STACK NO.	FLCU	NOZZLE DIAMETER, in.	0.319
RUN NO.	FLCU-0061-3	STACK DIAMETER, in.	150
SAMPLE BOX NO.	APX	MINUTES PER POINT	7.5
METER BOX NO.	1104027	NUMBER OF POINTS	24
START TIME	1227	NUMBER OF PORTS	4

PROBE HEATER SETTING	HEATER BOX SETTING	WEIGHT OF PARTICULATE, mg
METER H ₂ O	METER H ₂ O	Filter No.
C _p FACTOR	C _p FACTOR	Sample
V ₄ FACTOR	V ₄ FACTOR	Final wt.
PITOT/TERM #	PITOT/TERM #	Tare wt.
		Wt. gain
		TOTAL

A= B=

CROSS SECTION

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (S) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _h)	VELOCITY (ΔP _h)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP. °F	COND. EXIT TEMP. °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
									INLET (T _m) °F	OUTLET (T _m) °F					
1227	A 6	0	0.2	140	0.38	0.38	2.7	53.95	91	AVG	NA	NA	NA	64	5
	5	7.5		140	0.35	0.35	2.5	60.9	93					54	5
	4	15		139	0.30	0.30	2.1	67.7	93					54	5
	3	23.5		140	0.26	0.26	1.8	73.9	95					59	5
	2	30		140	0.23	0.23	1.6	80.0	97					60	5
	1	37.5		139	0.22	0.22	1.6	85.6	98					61	5
1322/1322.0	6	45		140	0.37	0.37	2.16	91.165	96					67	5
	5	52.5		140	0.33	0.33	2.3	98.1	96					67	5
	4	60		140	0.30	0.30	2.1	105.0	97					67	5
	3	67.5		140	0.27	0.27	1.9	115.5	98					67	5
	2	75		139	0.24	0.24	1.7	117.0	98					67	5
	1	82.5		140	0.23	0.23	1.6	123.6	99					67	5
1407/1430C	6	90		140	0.38	0.38	2.7	128.855	95					66	5
	5	97.5		139	0.34	0.34	2.4	136.2	95					66	5
	4	105		139	0.31	0.31	2.2	143.7	96					66	5
	3	112.5		140	0.27	0.27	1.9	149.8	97					66	5
1502/1538	2	120		140	0.24	0.24	1.7	155.6	97					66	5
	1	127.5		140	0.22	0.22	1.6	161.2	97					66	5
1528/1547 B	6	135		140	0.38	0.38	2.7	166.575	91					66	5
	5	142.5		139	0.34	0.34	2.4	173.16	92					66	5
	4	150		140	0.30	0.30	2.1	180.0	93					66	5
	3	157.5		140	0.26	0.26	1.8	186.1	93					66	5
	2	165		140	0.24	0.24	1.7	191.8	93					66	5
	1	172.5		140	0.23	0.23	1.6	197.4	93					66	5
1632		180						202.890							
AVERAGE	24PTS	180min	0.2	139.8	0.5373	0.5373	2.05	148.895	95.0	AVG	NA	NA	NA	<68	Max 5

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT		
#1	#2	#3	#4	#5
FINAL INITIAL LIQUID COLLECTED				
TOTAL	COLLECTED (specify ml or g)			

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	SYSTEM PRE: 40.00240K CFM@15"Hg
	POST: 60.00240K CFM@15"Hg
PITOT PRE: 4.40240K @ > 3"H ₂ O	
POST: 4.40240K @ > 3"H ₂ O	



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Vulcan
Port Arthur
FCCU-124 Sclbber
FCCU-0061-3

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/10/11
6/10/11
6/10/11
0061
N/A
N/A

pH 9

N₂ purge
start: 1706
stop: 1736

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	0.1 M KOH	1364.2	1577.7	213.5	
2	0.1 M KOH	514.8	598.2	83.4	
3	0.1 M KOH	512.8	621.4	108.6	
4	Empty	426.4	606.5	180.1	
5	Empty	434.9	518.5	83.6	
6	Silica Gel	764.9	797.3	32.4	
7	Silica Gel #2	752.1	762.4	10.3	
8			TOTAL=	711.9	



FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	92
DATE	6-13-11	BAROMETRIC PRESSURE	29.93
LOCATION	West Arthur, TX	ASSUMED MOISTURE, %	100
OPERATOR	FLCU	PROBE LENGTH, in.	6'
STACK NO	FLCU	NOZZLE DIAMETER, in.	0.375
RUN NO	FLCU-0001-4	STACK DIAMETER, in.	150
SAMPLE BOX NO	NA	MINUTES PER POINT	7.5
METER BOX NO	004100	NUMBER OF POINTS	29
START TIME	1325	NUMBER OF PORTS	4

PROBE HEATER SETTING	NA
HEATER BOX SETTING	NA
METER H ₂ O	1000
C ₂ FACTOR	0.85
V ₂ FACTOR	0.85
PITOT/THERM #	114251

WEIGHT OF PARTICULATE, mg	
Filter No.	
Sample	
Final wt.	
Tare wt.	
Wt. gain	
TOTAL	

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _g) °F	VELOCITY HEAD		DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (cc) if	GAS SAMPLE TEMP AT DRY GAS METER		COND. EXIT TEMP °F	SORBENT MODULE TEMP. °F	LAST IMPINGER OUTLET TEMP. °F	PUMP VACUUM in. Hg
					(ΔP ₃)	(ΔP ₂)			INLET (T _{in}) °F	OUTLET (T _{out}) °F				
1325	1	7.5	0.2	141	0.19	0.436	2.7	780.366	97	94	NA	NA	65	4
	2	15.0	0.2	140	0.19	0.436	2.7	787.520	101	95	NA	NA	65	4
	3	22.5	0.2	140	0.19	0.424	2.6	794.310	103	95	NA	NA	62	4
	4	30.0	0.2	140	0.15	0.387	2.1	800.1070	103	96	NA	NA	60	4
	5	37.5	0.2	140	0.13	0.360	1.9	808.120	112	96	NA	NA	60	4
1410	6	45.0	0.2	140	0.12	0.346	1.7	813.570	113	97	NA	NA	60	4
1420	1	52.5	0.2	141	0.16	0.400	2.3	818.492	107	96	NA	NA	63	4
	2	60.0	0.2	141	0.15	0.387	2.1	828.120	114	97	NA	NA	62	4
	3	67.5	0.2	140	0.13	0.360	1.9	832.870	114	97	NA	NA	62	4
	4	75.0	0.2	140	0.12	0.346	1.7	836.610	115	98	NA	NA	62	4
1505	5	82.5	0.2	140	0.11	0.332	1.6	842.070	115	98	NA	NA	62	4
1515	6	90.0	0.2	140	0.11	0.332	1.6	847.100	117	99	NA	NA	62	4
	1	97.5	0.2	141	0.18	0.404	2.2	852.535	110	100	NA	NA	62	4
	2	105.0	0.2	140	0.15	0.387	2.1	859.370	119	101	NA	NA	62	4
	3	112.5	0.2	140	0.12	0.346	1.7	865.480	120	102	NA	NA	62	4
	4	120.0	0.2	140	0.12	0.346	1.7	870.950	117	102	NA	NA	62	4
1600	5	127.5	0.2	140	0.11	0.332	1.6	876.470	118	102	NA	NA	62	4
1618	6	135.0	0.2	140	0.11	0.332	1.6	881.810	119	102	NA	NA	62	4
	1	142.5	0.2	141	0.17	0.412	2.4	887.207	113	101	NA	NA	62	4
	2	150.0	0.2	141	0.15	0.387	2.1	893.820	121	103	NA	NA	62	4
	3	157.5	0.2	141	0.13	0.360	1.9	899.910	121	103	NA	NA	62	4
	4	165.0	0.2	140	0.12	0.346	1.7	904.750	121	104	NA	NA	62	4
	5	172.5	0.2	140	0.12	0.346	1.7	910.990	115	104	NA	NA	62	4
1703	6	180.0	0.2	140	0.11	0.332	1.6	916.470	112	102	NA	NA	62	4
AVERAGE		180	0.2	140.3	0.11	0.332	1.6	921.726	116	101	NA	NA	62	4
								141.360	1132	94.3				
								106.2						

VOLUME OR WEIGHT OF LIQUID		IMPINGER		SILICA GEL WEIGHT	
WATER COLLECTED		VOLUME (ml) OR WEIGHT (g)			
FINAL	#1	#2	#3	#4	#
LIQUID COLLECTED					
TOTAL					

LEAK CHECK	
SYSTEM PRE: 0.000	CPM@15"Hg
POST: 0.000	CPM@15"Hg
PITOT PRE: 0.0	@ 3"H ₂ O
POST: 0.0	@ 3"H ₂ O



IMPINGER RECOVERY DATA SHEET

Company: Valdano Date Set-up: 6/13/11
 Location: Port Arthur Test Date: 6/13/11
 Source: FCU-1241 scrubber Date Recovered: 6/13/11
 Run No.: FCU-0061-4 USEPA Method: 0061
 Corresponding Filter No: N/A
 Filter Container No: N/A

pH 9.5
 N₂ purge
 start: 17:50
 stop: 18:20

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 (added 150 mL KOH)	0.5 M KOH	160 mL + 150g 1234.1g	72 mL 1810.1g	425.7g 75 mL	
2	0.5 M KOH	70 mL 506.7g	145 mL 582.1g	74.4g 92 mL	
3	0.5 M KOH	70 mL 509.4g	162 mL 604.6g	95.2g 92 mL	
4	Empty	0 mL 432.9g	92 mL 526.3g	93.4g 8 mL	
5	Empty Silica Gel	0 mL 438.7g	28 mL 446.2g	7.5g	
6	Silica Gel	835.6g	873.4g	37.8g	

* ADDED 150 mL 0.5 M KOH @ 135 min IN TEST (PORT 4)
 TOTAL = 724g



FIELD DATA

PLANT
DATE 6-14-11
LOCATION Point Arthur, TX
OPERATOR JB
STACK NO FCLU
RUN NO FCLU-001-5
SAMPLE BOX NO NA
METER BOX NO 60180
START TIME 0731

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.92
ASSUMED MOISTURE, % 22.1
PROBE LENGTH, in. 6.322
NOZZLE DIAMETER, in. 130
STACK DIAMETER, in. 7.5
MINUTES PER POINT 24
NUMBER OF POINTS 4

PROBE HEATER SETTING
HEATER BOX SETTING NA
METER Hg NA
C₀ FACTOR 1.002
Y₄ FACTOR 0.987
PITOT/THERM # 1104251

WEIGHT OF PARTICULATE, mg			
Filter No.			
Sample			
Final wt.			
Tare wt.			
Wt gain			
TOTAL			

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP °F	COND. EXIT TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔP _h)	(ΔP _h)			INLET (T _{m,i}) °F	OUTLET (T _{m,o}) °F					
0737	1	7.5	0.2	141	0.19	0.19	2.6	922.074	89	77	NA	NA	NA	48	6
	2	15.0		141	0.17	0.17	2.4	928.910	92	78				47	6
	3	22.5		141	0.15	0.15	2.1	935.320	93	79				49	5
	4	30.0		140	0.12	0.12	1.7	941.250	94	80				50	5
	5	37.5		140	0.12	0.12	1.7	946.670	94	81				51	5
0822	6	45.0		140	0.11	0.11	1.6	952.070	97	81				52	5
0832	1	52.5		141	0.16	0.16	2.3	957.302	96	82				53	7
	2	60.0		141	0.15	0.15	2.1	964.900	99	83				54	6
	3	67.5		141	0.15	0.15	2.1	970.230	99	84				54	5
	4	75.0		141	0.12	0.12	1.7	976.190	96	84				54	5
	5	82.5		140	0.12	0.12	1.7	982.000	96	84				54	5
0917	6	90.0		140	0.11	0.11	1.6	986.860	96	84				55	5
0936	1	97.5		141	0.17	0.17	2.4	992.113	97	84				55	5
	2	105.0		141	0.17	0.17	2.4	998.350	99	85				56	6
	3	112.5		140	0.13	0.13	1.9	1004.800	98	85				56	5
	4	120.0		140	0.12	0.12	1.7	1010.500	98	85				56	5
	5	127.5		140	0.11	0.11	1.6	1015.910	97	86				59	5
1021	6	135.0		140	0.11	0.11	1.6	1021.100	100	86				60	5
1027	1	142.5		141	0.17	0.17	2.4	1026.638	100	87				61	5
	2	150.0		141	0.17	0.17	2.4	1032.850	99	86				57	5
	3	157.5		140	0.14	0.14	2.0	1039.170	99	87				55	5
	4	165.0		140	0.12	0.12	1.7	1045.110	101	88				58	5
	5	172.5		140	0.12	0.12	1.7	1050.420	101	88				61	5
1112	6	180.0		140	0.11	0.11	1.6	1055.310	100	88				62	5
AVERAGE		180		140.5			1.98	139.107	99	88				62	

VOLUME OR WEIGHT OF LIQUID		IMPINGER		SILICA GEL	
WATER COLLECTED		VOLUME (ml) OR WEIGHT (g)		WEIGHT	
FINAL	#1	#2	#3	#4	#
INITIAL					
LIQUID COLLECTED					
TOTAL	COLLECTED (specify ml or g)				

ORSAT		TIME		CO ₂		O ₂	
DATA		TRIAL 1					
TRIAL 2							
TRIAL 3							
Average							

LEAK CHECK		SYSTEM PRE: 0.002		CFM@15" Hg	
POST:		POST:		CFM@15" Hg	
PITOT PRE: 0.00		PITOT PRE: 0.00		@ > 3" H ₂ O	
POST:		POST:		@ > 3" H ₂ O	



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur
FCCU-1241 Scrubber
FCCU-0061-5

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/13/11
6/14/11
6/14/11
0061
NA
NA

pH 9.5

N₂ purge
start: 1156
stop: 1226

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	0.5 M KOH	160ml 1386.6g +150ml 1236.8g	734ml 1819.3g	424ml 432.5g	
2	0.5 M KOH	70ml 510.8g	160ml 602.1g	90ml 91.3g	
3	0.5 M KOH	70ml 508.2g	145ml 583.5g	75ml 75.3g	
4	Empty	0ml 425.7g	48ml 525.4g	48ml 99.7g	
5	Empty	0ml 429.6g	~7ml 432.0g	7ml 7.4g	
6	Silica Gel	911.8g	943.2g	31.4g	

* added 150 ml 0.5 M KOH to Impinger #1
Q 40 min into test run

TOTAL = 737.6g



FIELD DATA

PLANT	Unit 10	AMBIENT TEMPERATURE	87	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	6-13-11	BAROMETRIC PRESSURE	29.98	HEATER BOX SETTING		Filter No.	
LOCATION	Port Arthur TX	ASSUMED MOISTURE, %	1.82	METER Hg	1.82	Sample	
OPERATOR	JP	PROBE LENGTH, in.	74	Cp FACTOR	1.82	Final wt	
STACK NO	FEU 022	NOZZLE DIAMETER, in.	0.372	Y4 FACTOR	1.001	Tare wt	
RUN NO.	FEU-022-1	STACK DIAMETER, in.	150	PITOT/THERM #	83	Wt gain	
SAMPLE BOX NO	1000	MINUTES PER POINT	2.5			TOTAL	mg
METER BOX NO	1000	NUMBER OF POINTS	24				
START TIME	1000	NUMBER OF PORTS	6				

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔP _s)	(√ΔP _s)	ACTUAL	DESIRED		INLET (T _{m,i}) °F	OUTLET (T _{m,o}) °F				
1000	A-6	0	0.20	140	0.20	0.19	2.6	2.63	521.450	86	252			67	
							2.5	2.50	523.69	86	250			50	
1005	1	5		140	0.14	0.14	1.8	1.84	525.84	86	251			47	
							1.6	1.58	527.81	86	250			50	
1010	2	10		140	0.12	0.12	1.6	1.58	525.62	87	249			53	
							1.5	1.45	531.44	87	248			51	
1015/1022	3-5	15		140	0.20	0.20	2.6	2.64	533.15	88	250			66	
							2.4	2.38	535.30	88	249			50	
1027	7	20		140	0.16	0.16	2.1	2.12	537.51	89	251			51	
							2.1	2.11	537.62	89	252			52	
1032	3	25		140	0.13	0.13	1.7	1.72	541.55	89	250			54	
							1.6	1.59	543.30	89	250			63	
1037/1103	6-6	30		141	0.20	0.20	2.7	2.65	545.12	90	251			67	
							2.3	2.25	547.51	90	250			53	
1108	4	35		140	0.15	0.15	2.0	1.99	547.62	90	251			56	
							1.7	1.72	551.71	90	253			38	
1113	2	40		141	0.12	0.12	1.6	1.59	553.38	91	252			59	
							1.6	1.59	555.17	91	253			60	
1118/1124	D-6	45		141	0.19	0.19	2.5	2.52	557.02	92	252			67	
							2.1	2.13	557.18	93	250			62	
1126	4	50		140	0.15	0.15	2.0	1.99	561.31	93	250			63	
							1.7	1.73	563.42	94	251			64	
1131	3	55		140	0.13	0.13	1.5	1.47	565.51	95	250			64	
							1.5	1.47	567.27	95	251			64	
1135		60		140	0.11	0.11			568.850						
AVERAGE	24pts	60 min	0.20	140.4	0.3835	1.97			47.330	89.8				266	MAX

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED		IMPINGER VOLUME (ml) OR WEIGHT (g)		SILICA GEL WEIGHT	
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL					

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
AVERAGE			

LEAK CHECK	
SYSTEM PRE: 1000	CFM@15" Hg
POST: 000	CFM@15" Hg
PITOT PRE: 77-0K	@ > 3" H ₂ O
POST: 77-0K	@ > 3" H ₂ O



Company:
Location:
Source:
Run No.:

Valero
Port Arthur TX
FCCU-1241 Scrubber
FCCU-027-1

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-10-11
6-13-11
6-13-11
CTMO27
N/A
N/A

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	0.1N H ₂ SO ₄	716.2	908.0	191.8	H44653
2	0.1N H ₂ SO ₄	711.5	754.1	42.6	H44654
3	Empty	581.8	586.5	4.7	H44654
4	Silica Gel	817.5	829.8	12.3	
5			TOTAL =	251.4 251.4	
6					



FIELD DATA

PLANT	Valero	AMBIENT TEMPERATURE	98	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	6.13.11	BAROMETRIC PRESSURE	29.95	HEATER BOX SETTING	1.82	Filter No.	
LOCATION	Port Arthur TX	ASSUMED MOISTURE, %	1.1	METER H_0	1.82	Sample	
OPERATOR	RE	PROBE LENGTH, in	74	C_p FACTOR	1.84	Final wt	
STACK NO	FCU	NOZZLE DIAMETER, in	0.372	Y_0 FACTOR	1.001	Flow	
RUN NO	FCU-027-2	STACK DIAMETER, in	150.7	PITOT/THERM #	83	Wt. gain	
SAMPLE BOX NO	APEX	MINUTES PER POINT	2.5			TOTAL	
METER BOX NO	123012	NUMBER OF PORTS	24				
START TIME	1654						

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (9) min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		SAMPLE BOX TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔP _s)	(ΔP _s) / √ΔP _s			INLET (T _m) °F	OUTLET (T _m) °F				
1354	0-6	0	0.20	140	0.20	0.18	2.7	570.440	94				67	7
1359	5	5		140	0.18	0.16	2.4	572.65	94				53	7
	4	5		140	0.16	0.15	2.1	574.85	94				53	7
	3			141	0.13	0.13	1.7	577.01	94				52	7
1404	2	10		141	0.12		1.6	578.82	94				54	6
	1			140	0.11		1.5	580.59	94				57	6
1409/1450	6	15		140	0.19		2.5	582.38	96				67	8
	5			141	0.17		2.3	584.45	96				54	8
1455	4	20		140	0.14		1.9	586.61	96				53	8
	3	25		141	0.13		1.7	588.71	96				55	7
1500	2			141	0.12		1.6	590.81	97				54	7
	1			140	0.10		1.6	592.62	97				54	7
1505/1515	6	30		140	0.20		2.7	594.47	98				67	8
	5			140	0.17		2.3	596.57	98				54	8
1550	4	35		141	0.15		2.0	598.69	98				54	7
	3			140	0.12		1.5	600.74	98				56	7
1600	2	40		140	0.11		1.5	602.87	98				58	7
	1			141	0.11		1.5	604.25	99				61	6
1605/1615	6	45		140	0.18		2.4	605.95	99				69	8
	5			140	0.16		2.2	608.05	99				61	8
1653	4	50		141	0.15		2.0	610.16	99				52	8
	3			140	0.14		1.9	612.37	99				54	8
1658	2	55		140	0.12		1.6	614.41	99				55	7
	1			140	0.11		1.5	616.18	99				53	7
1703		60						618.025						
AVERAGE	24145	60 min	0.20	140.3	0.3794		1.95	47.585	96.4				268	1742

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4		
FINAL INITIAL LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
AVERAGE			

LEAK CHECK	SYSTEM PRE: 1000	CFM @ 15" Hg
	POST: 1000	CFM @ 15" Hg
PITOT PRE: 1-016		@ > 3" H ₂ O
POST: 1-016		@ > 3" H ₂ O

OK 6/13/11



IMPINGER RECOVERY DATA SHEET

Company:	<u>Valero</u>	Date Set-up:	<u>6-13-11</u>
Location:	<u>Port Arthur, TX</u>	Test Date:	<u>6-13-11</u>
Source:	<u>FCCU-1241 Scrubber</u>	Date Recovered:	<u>6-13-11</u>
Run No.:	<u>FCCU-027-2</u>	USEPA Method:	<u>CTM027</u>
		Corresponding Filter No:	<u>N/A</u>
		Filter Container No:	<u>N/A</u>

Measurement Method:		Weight or Volume	
Impinger No.	Impinger Contents	Initial wt/vol g/mL	Final wt/vol g/mL
1	0.1 N H ₂ SO ₄	684.9	891.0
2	0.1 N H ₂ SO ₄	695.5	729.9
3	Empty	590.9	594.5
4	Silica Gel	805.6	816.7
5			TOTAL = 285.2
6			
		Difference wt/vol g/mL	Sample Container No.
		206.1	
		34.4	
		3.6	
		11.1	

Valero Port Arthur Refinery: Port Arthur, Texas
Scrubber Effluent TDS/TSS Samples

Plant: Valero Port Arthur Refinery

Location: Port Arthur, Texas

Source: 1241 FCCU WGS Scrubber Effluent

Date: 6-13-11

Run No.: FCCU-5B-1

Aliquot Number	Clock Time	Aliquot Volume, mL
1	0932	125
2	0947	125
3	1007	125
4	1022	125
5	1043	125
6	1057	125
7	1115	125
8	1130	125

Sample Label No.: 437503

Collector: Chris Hall

Greg Bavel

Date: 6-14-11

Run No.: FCCU-5B-3

Aliquot Number	Clock Time	Aliquot Volume, mL
1	0752	125
2	0807	125
3	0847	125
4	0902	125
5	0947	125
6	1002	125
7	1042	125
8	1057	125

Sample Label No.: 437505

Date: 6-13-11

Run No.: FCCU-5B-2

Aliquot Number	Clock Time	Aliquot Volume, mL
1	1340	125
2	1355	125
3	1435	125
4	1450	125
5	1530	125
6	1545	125
7	1633	125
8	1648	125

Sample Label No.: 437504



FIELD DATA

B-102

PLANT	Valero	AMBIENT TEMPERATURE	84	PROBE HEATER SETTING	250	A=	B=
DATE	5-14-11	BAROMETRIC PRESSURE	29.92	HEATER BOX SETTING			
LOCATION	Port Arthur, TX	ASSUMED MOISTURE, %	1.84	METER H ₂ O	1.84		
OPERATOR	JK	PROBE LENGTH, in.	7.4	C _p FACTOR	1.84		
STACK NO.	FEU-004-3	NOZZLE DIAMETER, in.	0.372	Y _d FACTOR	1.001		
RUN NO.	FEU-004-3	STACK DIAMETER, in.	150	PITOT/THERM #	83		
SAMPLE BOX NO.	APEN	MINUTES PER POINT	2.5				
METER BOX NO.	703012	NUMBER OF POINTS	24				
START TIME	807	NUMBER OF PORTS	4				

Filter No.	Sample	Final wt.	Tare wt.	Wt. gain	TOTAL

WEIGHT OF PARTICULATE, mg	
A	B

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _s)	DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER (T _{mg}) °F		SAMPLE BOX TEMP °F	SORBENT MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
						ACTUAL	DESIRED		INLET	OUTLET (T _{mg}) °F				
807	A-6	0	0.20	141	0.20	2.6	2.61	619.500	82	251	251		67	5
812	5	5	141	140	0.18	2.4	2.35	621.68	82	250	250		62	5
817	3	10	141	141	0.13	2.0	1.96	623.84	82	248	248		61	5
822	2	10	141	141	0.12	1.7	1.70	625.88	82	249	249		62	5
827	1	15	140	140	0.11	1.6	1.57	627.74	83	248	248		63	4
832	6	15	140	140	0.11	1.4	1.44	629.52	83	250	250		64	4
837	5	20	141	141	0.19	2.5	2.49	631.07	85	251	251		67	5
842	4	20	141	141	0.16	2.1	2.10	633.61	85	249	249		58	5
847	3	20	140	140	0.14	1.8	1.84	635.54	85	251	251		57	5
852	2	25	140	140	0.12	1.6	1.58	637.35	85	250	250		58	4
857	1	30	141	141	0.11	1.4	1.44	639.15	85	249	249		61	4
862	6	30	140	140	0.18	2.4	2.37	640.94	86	252	252		67	5
867	5	35	141	141	0.16	2.1	2.11	642.69	87	250	250		67	5
872	3	40	141	141	0.15	2.0	1.97	644.81	87	249	249		55	5
877	2	40	140	140	0.17	1.9	1.85	646.98	88	249	249		57	5
882	1	45	141	141	0.17	1.5	1.58	650.68	88	250	250		59	5
887	6	45	141	141	0.17	1.5	1.45	652.44	88	251	251		61	5
892	5	50	141	141	0.20	2.6	2.61	654.12	89	248	248		67	5
897	4	50	141	141	0.17	2.3	2.25	656.30	89	251	251		56	5
902	3	55	140	140	0.15	2.0	1.98	658.44	89	250	250		56	5
907	2	55	141	141	0.13	1.7	1.72	660.48	89	250	250		58	5
912	1	60	141	141	0.12	1.6	1.59	662.38	89	251	251		61	5
917	6	60	141	141	0.12	1.6	1.59	664.13	89	252	252		63	5
922	5	60	141	141	0.12	1.6	1.59	665.94	89	252	252		63	5
AVERAGE	24hrs	60min	0.20	140.7	0.3790	1.92		46.475	85.9	250			268	MAX

VOLUME OR WEIGHT OF LIQUID		IMPINGER		SILICA GEL	
WATER COLLECTED	VOLUME (ml) OR WEIGHT (g)	#1	#2	#3	#4
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL	COLLECTED (specify ml or g)				

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

LEAK CHECK	
SYSTEM PRE: 1000	CFM@15" Hg
POST: 1000	CFM@15" Hg
PITOT PRE: 11-014	
POST: 11-014	@ > 3" H ₂ O



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur TX
FCCU - 1241 Scrubber
FCCU - 027-3

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-13-11
6-14-11
6-14-11
CTMD27
N/A
N/A

Measurement Method: Weight or Volume

<u>Impinger No.</u>	<u>Impinger Contents</u>	<u>Initial wt/vol g/mL</u>	<u>Final wt/vol g/mL</u>	<u>Difference wt/vol g/mL</u>	<u>Sample Container No.</u>
1	0.1 N H ₂ SO ₄	716.4	918.9	202.5	
2	0.1 N H ₂ SO ₄	710.8	742.6	31.8	
3	Empty	584.8	588.4	3.6	
4	Silica Gel	827.3	839.2	11.9	
5				249.8	
6					



FIELD DATA

CLIENT	Ukero	AMBIENT TEMPERATURE	91	PROBE HEATER SETTING	250	WEIGHT OF PARTICULATE, mg	
DATE	06-01-14	BAROMETRIC PRESSURE	29.96	HEATER BOX SETTING	250	Filter No.	11558
LOCATION	Boothman TX	ASSUMED MOISTURE, %	17	METER H ₂ O	1.754	Sample	
OPERATOR	VC	PROBE LENGTH, in	17	C ₂ FACTOR	0.51	Final wt	
STACK NO	FCU STACK	NOZZLE DIAMETER, in	0.223	1/2 FACTOR	0.51	Tare wt	
RUN NO	FCU 0029-1	STACK DIAMETER, in	150	PITOT/THERM #	83	Wt gain	
SAMPLE BOX NO	APPT	MINUTES PER POINT	2.5			TOTAL	
METER BOX NO	110002	NUMBER OF POINTS	2.5				
START TIME	1125	NUMBER OF PORTS	4				

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s), °F	VELOCITY HEAD (ΔP _s)	VELOCITY (ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE DRY GAS METER (T _{dm}), °F		Filter Sample Box TEMP, °F	Probe Exit TEMP, °F	SORBENT MODULE TEMP, °F	LAST IMPINGER OUTLET TEMP, °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _{dm}), °F	OUTLET (T _{dm}), °F					
1125	0-1	0	+0.2	140	0.43	0.43	0.34	0.34	548.500	90	251	242	242	112.13	63	4
1130	2	5		140	0.37	0.37	0.61	0.61	545.70	91	247	241	241		63	4
1135	3	10		141	0.30	0.30	0.51	0.51	600.83	91	248	242	242		63	4
1140	4	15		142	0.29	0.29	0.49	0.49	601.12	91	246	243	243		62	4
1145	5	20		142	0.20	0.20	0.33	0.33	603.98	91	247	241	241		63	4
1150	6	25		142	0.43	0.43	0.30	0.30	604.62/500.93	93	249	242	242	13.13	67	4
1200	7	30		142	0.36	0.36	0.59	0.59	606.24	93	253	241	241		61	4
1205	8	35		142	0.21	0.21	0.43	0.43	606.89	93	253	243	243		61	4
1210	9	40		142	0.19	0.19	0.34	0.34	607.88	93	258	242	242		63	4
1215	10	45		143	0.47	0.47	0.32	0.32	607.64	93	253	242	242		63	4
1220	11	50		143	0.41	0.41	0.33	0.33	610.41/110.93	93	251	242	242	13.13	66	4
1225	12	55		142	0.33	0.33	0.64	0.64	611.93	93	254	241	241		61	4
1230	13	60		142	0.25	0.25	0.51	0.51	612.84	92	256	240	240		56	4
1235	14	65		142	0.22	0.22	0.38	0.38	613.88	92	251	241	241		57	4
1240	15	70		142	0.40	0.40	0.34	0.34	614.87	92	258	241	241		58	4
1245	16	75		142	0.40	0.40	0.61	0.61	615.96	92	247	241	241	12.13	62	4
1250	17	80		142	0.34	0.34	0.61	0.61	616.52/66.60	92	249	240	240		62	4
1255	18	85		142	0.28	0.28	0.53	0.53	617.53	92	248	240	240		63	4
1259	19	90		142	0.25	0.25	0.38	0.38	618.57	92	252	242	242		63	4
AVERAGE	24pts	60min		141	0.22	0.22	0.34	0.34	620.51	92	254	243	243		60	4
							0.496	0.496	621.38	92	253	244	244		60	4
							0.496	0.496	622.173		250	250	250		266	4
							0.496	0.496	23.055	92.1						

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT	LEAK CHECK
FINAL (INITIAL)	#1 #2 #3 #4	W	SYSTEM PRE: 1000
LIQUID COLLECTED			POST: 1000
TOTAL	COLLECTED (specify ml or g)		PITOT PRE: 4-04
			POST: 4-02

Leak checks
-0.38
-0.16
-0.08
-0.62



IMPINGER RECOVERY DATA SHEET

Company: Valero
Location: Port Arthur, TX
Source: FCCU-1241 Wet Gas Scrubber
Run No.: FCCU-DTM 29-1

Date Set-up: 6-3-2011
Test Date: 6-6-2011
Date Recovered: 6-6-2011
USEPA Method: DTM 29
Corresponding Filter No: 47538
Filter Container No: 782.7 mg

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.
PH > 13 1	6N NaOH	713.8	856.5	142.7	
PH > 13 2	6N NaOH	729.4	757.7	28.3	
PH > 13 3	6N NaOH	714.2	720.4	6.2	
PH > 13 4	6N NaOH	718.4	728.7	10.3	
5	Silica Gel	793.3	801.4	8.1	
6				195.6	



FIELD DATA

CLIENT	Valero	AMBIENT TEMPERATURE	93
DATE	6.6.11	BAROMETRIC PRESSURE	29.86
LOCATION	Port Arthur TX	ASSUMED MOISTURE, %	141
OPERATOR	JB	PROBE LENGTH, in.	78"
STACK NO	FCU STACK	NOZZLE DIAMETER, in.	0.223
RUN NO.	FCU-00001-2	STACK DIAMETER, in.	150"
SAMPLE BOX NO.	APSC	MINUTES PER POINT	2.5
METER BOX NO.	1401027	NUMBER OF POINTS	24pts
START TIME	1401	NUMBER OF PORTS	

PROBE HEATER SETTING	220
HEATER BOX SETTING	250
METER H ₂ O	1.359
C ₂ FACTOR	0.587
1/2 FACTOR	0.587
PITOT/TERM #	43

WEIGHT OF PARTICULATE, mg	47548
Filter No.	
Sample	
Final wt	
Pure wt	
Wt gain	
TOTAL	

A =	B =

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (s)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD		GAS SAMPLE VOLUME (V _m) ft ³	DIFFERENTIAL PRESSURE ACROSS ORIFICE METER		GAS SAMPLE DRY GAS METER INLET (T _{inlet}) °F	OUTLET (T _{outlet}) °F	SAMPLE BOX TEMP °F	COND. EXIT TEMP °F	MODULE TEMP °F	LAST IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
					(ΔP _h)	(ΔP _g)		ACTUAL	DESIRED							
1401	1	0	40.20	141	0.46	0.39	22.400	0.72	0.50	93	93	246	243	112	67	2
1406	2	5		142	0.39	0.34	23.96	0.60	0.50	93		258	245		56	2
	3	5		142	0.34	0.28	25.07	0.52	0.43	93		257	245		57	2
	4	10		142	0.28	0.25	26.83	0.43	0.39	94		257	242		60	2
1411	5	10		141	0.25	0.22	27.90	0.39	0.34	94		255	240		60	2
	6	15		141	0.22	0.18	30.50	0.34	0.30	94		254	241	13/13/13	59	2
1416/1448	1	15		142	0.18	0.14	32.92	0.30	0.50	94		256	242	13/13/13	67	2
1418	2	20		142	0.14	0.12	35.92	0.50	0.50	95		252	241		63	2
1448	3	20		142	0.12	0.09	38.88	0.41	0.41	95		249	242		61	2
1453	4	25		141	0.09	0.07	41.76	0.38	0.38	95		251	241		61	2
	5	25		142	0.07	0.05	43.62	0.33	0.33	95		252	243		62	2
1458/1523	6	30		142	0.05	0.04	46.50	0.28	0.28	96		262	241	13/13/13	63	2
1528	1	35		142	0.04	0.03	50.31	0.62	0.55	96		255	242		67	2
1533/1558	2	35		142	0.03	0.02	53.82	0.41	0.41	96		255	243		59	2
	3	40		142	0.02	0.02	57.11	0.36	0.36	96		253	244		61	2
1538/1558	4	45		142	0.02	0.02	60.11	0.31	0.31	96		250	242	12/13/13	63	2
	5	50		142	0.02	0.02	63.11	0.62	0.62	96		247	241	13/13/13	63	2
1603	6	50		142	0.02	0.02	66.11	0.41	0.41	96		246	240		61	2
	1	55		142	0.02	0.02	69.11	0.41	0.41	95		248	241		62	2
1608	2	55		142	0.02	0.02	72.11	0.41	0.41	95		252	242		63	2
	3	60		142	0.02	0.02	75.02	0.38	0.38	95		250	241		61	2
1613	4	60		142	0.02	0.02	78.02	0.29	0.29	95		252	242		64	2
AVERAGE	24pts	60 min	40.20	141.8	0.5427	0.465	22.350	0.465	0.465	94.8		2250	2250		268	MAX

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4		
FINAL INITIAL LIQUID COLLECTED		
TOTAL	COLLECTED (specify ml or g)	

LEAK CHECK	SYSTEM PRE: 1000	CPM@15"Hg
	POST: 1000	CPM@15"Hg
	PITOT PRE: 1100	@ > 3"H ₂ O
	POST: 1100	@ > 3"H ₂ O

Leak check
-0.27
-0.29
-0.15
-0.41



IMPINGER RECOVERY DATA SHEET

Company: Valero
Location: Port Arthur, TX
Source: FCCU-1241 Scrubber
Run No.: FCU-29-2
Date Set-up: 6-3-2011
Test Date: 6-6-2011
Date Recovered: 6-6-2011
USEPA Method: OTM 29
Corresponding Filter No: 47542
Filter Container No: 783.6 mg

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 pH > 13	6N NaOH	691.0	832.2	141.2	
2 pH > 13	6N NaOH	715.0	737.4	22.4	
3 pH > 13	6N NaOH	705.2	718.0	12.8	
4 pH > 13	6N NaOH	698.2	709.6	11.4	
5	Silica Gel	807.2	814.1	6.9	
6			TOTAL =	194.7	



FIELD DATA

ANT	108	DATE	10/11/04	LOCATION	PORT ARTHUR	PROBE LENGTH, in	14.1	NOZZLE DIAMETER, in	0.25	STACK DIAMETER, in	15.0	MINUTES PER POINT	2.5	NUMBER OF PORTS	4												
OPERATOR	ITC	STACK NO	1000	SAMPLE BOX NO	1000	WEIGHT OF PARTICULATE, mg	40.950	DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	0.61	DESIRABLE	0.61	GAS SAMPLE VOLUME (V _m) ft ³	646.270	GAS SAMPLE TEMP AT DRY INLET (T _{md}) °F	88	TEMP AT DRY OUTLET (T _{mo}) °F	88	Probe EXIT TEMP °F	241	Filter Temp °F	255	Module Temp °F	112	Impinger Temp °F	67	Pump Vacuum in. Hg	2
WEIGHT OF PARTICULATE, mg	40.950	DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	0.61	DESIRABLE	0.61	GAS SAMPLE VOLUME (V _m) ft ³	646.270	GAS SAMPLE TEMP AT DRY INLET (T _{md}) °F	88	TEMP AT DRY OUTLET (T _{mo}) °F	88	Probe EXIT TEMP °F	241	Filter Temp °F	255	Module Temp °F	112	Impinger Temp °F	67	Pump Vacuum in. Hg	2	CROSS SECTION					
WEIGHT OF PARTICULATE, mg	40.950	DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	0.61	DESIRABLE	0.61	GAS SAMPLE VOLUME (V _m) ft ³	646.270	GAS SAMPLE TEMP AT DRY INLET (T _{md}) °F	88	TEMP AT DRY OUTLET (T _{mo}) °F	88	Probe EXIT TEMP °F	241	Filter Temp °F	255	Module Temp °F	112	Impinger Temp °F	67	Pump Vacuum in. Hg	2	CROSS SECTION					

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _h)	VELOCITY (AP _h)	ACTUAL	DESIRABLE	GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY INLET (T _{md}) °F	TEMP AT DRY OUTLET (T _{mo}) °F	Probe EXIT TEMP °F	Filter Temp °F	Module Temp °F	Impinger Temp °F	Pump Vacuum in. Hg
1435	1	0	0.19	140	0.40	0.40	0.61	0.61	646.270	88	88	241	255	112	67	2
1440	3	3		140	0.33	0.33	0.51	0.51	644.34	88	88	243	257		62	2
1445	4	10		139	0.27	0.27	0.41	0.41	648.38	88	88	244	257		62	2
1450/1500	5	10		141	0.25	0.25	0.39	0.39	649.80	88	88	242	258		63	2
1505	6	15		141	0.20	0.20	0.31	0.31	650.19	88	88	244	262		63	2
1510	7	20		141	0.22	0.22	0.34	0.34	651.01	88	88	243	263		64	2
1515/1520	8	25		141	0.39	0.39	0.60	0.60	651.81/652.06	89	89	247	260	113	67	2
1525	9	30		140	0.35	0.35	0.55	0.55	653.14	89	89	247	261		63	2
1530	10	35		140	0.41	0.41	0.61	0.61	654.22	89	89	246	262		62	2
1535/1540	11	40		140	0.34	0.34	0.51	0.51	655.13	89	89	248	256		60	2
1545	12	45		140	0.31	0.31	0.48	0.48	655.92	89	89	247	254		60	2
1550	13	50		141	0.29	0.29	0.46	0.46	656.68	89	89	247	253	113	65	2
1555	14	55		141	0.38	0.38	0.55	0.55	657.44/657.65	89	89	247	252		60	2
1600	15	0		141	0.29	0.29	0.41	0.41	658.82	89	89	251	253		61	2
1605	16	5		141	0.39	0.39	0.61	0.61	659.61	89	89	247	255		62	2
1610	17	10		140	0.31	0.31	0.48	0.48	660.48	89	89	247	255		62	2
1615	18	15		140	0.29	0.29	0.46	0.46	661.29	89	89	247	255		63	2
1620	19	20		140	0.19	0.19	0.39	0.39	661.07	89	89	248	254		64	2
1625	20	25		140	0.26	0.26	0.41	0.41	662.78/662.99	89	89	251	251	113	67	2
1630	21	30		140	0.32	0.32	0.49	0.49	663.91	89	89	250	251		67	2
1635	22	35		140	0.25	0.25	0.41	0.41	665.05	89	89	250	251		68	2
1640	23	40		140	0.41	0.41	0.61	0.61	666.02	89	89	248	261		65	2
1645	24	45		140	0.37	0.37	0.57	0.57	666.91	89	89	247	260		68	2
1650	25	50		140	0.33	0.33	0.53	0.53	667.91	89	89	247	259		69	2
1655	26	55		140	0.31	0.31	0.51	0.51	668.91	89	89	247	259		60	2
1659	27	0		140	0.31	0.31	0.51	0.51	669.91	89	89	247	259		60	2
AVERAGE	24	60	0.19	140.2	0.3127	0.3127	0.41	0.41	21.660	88.5	88.5	250	250		268	2

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
FINAL INITIAL	#1 #2 #3 #4	#
LIQUID COLLECTED		
TOTAL		

LEAK CHECK

SYSTEM PRE: 000 CPM@15"Hg

POST: 1000 CPM@15"Hg

PITOT PRE: 41-04 @ > 3"H₂O

POST: 41-04 @ > 3"H₂O

Leak check

0.025

0.021

0.012

0.038



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur, TX
FCCU-1241
FCCU-OTM 29-3

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6-6-11
6-7-11
6-7-11
OTM 29
40850
822.2 mg

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.
pH > 13 1	6N NaOH	718.3	829.0	110.7	
pH > 13 2	6N NaOH	732.5	756.4	23.9	
pH > 13 3	6N NaOH	718.3	730.3	12.0	
pH > 13 4	6N NaOH	722.5	731.5	9.0	
5	Silica Gel	RW 786.8 822.2	792.8	6.0	40850
6				161.6	



FIELD DATA SHEET

[illegible]



Plant:	Valero	Meter No.:	1105003	Ambient Temperature:	90
Date:	6-8-11	Y Factor:	1.000	Barometric Pressure:	29.89
Location:	Port Arthur, TX	Trap Contents:	Water / SG	Stack Diameter:	150
Source:	FCCU	USEPA Method:	309	Pre-Test Leak Check:	✓
Run No.:	FCCU-4308-2	Compound Analysis:	Methanol	Post-Test Leak Check:	✓
Operators:	SB	Spike in Trap (Y/N):	N		
Comments:	Unspiked				

B-111



FIELD DATA SHEET

Plant:	Valero	Meter No.:	1105002	Ambient Temperature:	90
Date:	6-8-11	Y Factor:	1.800	Barometric Pressure:	29.89
Location:	Port Arthur, TX	Trap Contents:	Water / SG	Stack Diameter:	150
Source:	FLCU	USEPA Method:	308	Pre-Test Leak Check:	✓
Run No.:	FLCU-11308-2S	Compound Analysis:	Methanol	Post-Test Leak Check:	✓
Operators:	JB	Spike in Trap (Y/N):	Y		
Comments:	5044ed				

[illegible]



Ambient Temperature: 92
Barometric Pressure: 29.92
Stack Diameter: 150
Pre-Test Leak Check: ✓
Post-Test Leak Check: ✓

Meter No.: 1105003
Y Factor: 1.000
Trap Contents: Water/50-
USEPA Method: 308
Compound Analysis: Methanol
Spike in Trap (YIN): N

Plant: Valero
Date: 6-8-11
Location: Port Arthur, TX
Source: FCCY
Run No.: FCCY-1308-1
Operators: 5B
Comments: Unsorted

Clock Time	Sampling Time (min)	Meter Pressure mm Hg (H ₂ O) <i>93</i>	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (V _m liters)	Gas Meter Temperature (°F)
1153	0	—	—	—	0.000	—
1158	5	15	0	1.0	5.120	96
1203	10	15	0	1.0	10.510	97
1208	15	15	0	1.0	15.900	97
1213	20	15	0	1.0	21.500	97
1218	25	15	0	1.0	27.560	97
1223	30	15	0	0.9	31.710	97
1228	35	15	0	0.9	37.400	97
1233	40	15	0	0.9	42.210	97
1238	45	15	0	0.9	47.380	97
1243	50	15	0	0.9	51.380	97
1248	55	15	0	0.9	56.130	97
1253	60	15	0	0.9	61.309	97
	60	15.0	0	0.94	61.309	96.9



Ambient Temperature: ~90
Barometric Pressure: 29.93
Stack Diameter: 150
Pre-Test Leak Check: 10,000 JOL
Post-Test Leak Check: 10,000 JOL

1105003
1000
Water / 56
308
Methanol
N

Meter No.:
Y Factor:
Trap Contents:
USEPA Method:
Compound Analysis:
Spike in Trap (Y/N):

Plant: Yale
 Date: 6-9-11
 Location: Post Archway TX
 Source: FCCU
 Run No.: FCCU-308-3-
 Operators: TR/AAH

Clock Time	Sampling Time (min)	Meter Pressure mm(Hg. H ₂ O)	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (Vn liters)	Gas Meter Temperature (°F)
0842	0	15	0	0.9	0.000	87
0847	5	15	0	0.9	6.30	86
0852	10	15	0	0.9	11.24	86
0857	15	15	0	0.9	16.09	88
0902	20	15	0	0.9	20.73	89
0907	25	15	0	0.9	25.67	89
0912	30	15	0	0.9	30.74	89
0917	35	15	0	0.9	35.73	89
0922	40	15	0	0.9	40.55	89
0927	45	15	0	0.9	45.43	89
0932	50	15	0	0.9	50.37	90
0937	55	15	0	0.9	55.35	90
0942	60				60.253	
		15.0		0.9	60.253	88.8



FIELD DATA SHEET

Clock Time	Sampling Time (min)	Meter Pressure (in. H ₂ O)	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (V _m liters)	Gas Meter Temperature (°F)
0842	0	16	0	0.9	0.000	88
0847	5	16	0	0.9	6.40	88
0852	10	16	0	0.9	11.63	89
0857	15	16	0	0.9	16.57	89
0902	20	16	0	0.9	21.39	89
0907	25	16	0	0.9	26.07	89
0912	30	16	0	0.9	30.98	89
0917	35	16	0	0.9	36.16	89
0922	40	16	0	0.9	40.35	89
0927	45	16	0	0.9	46.51	89
0932	50	16	0	0.9	51.96	90
0937	55	16	0	0.9	56.89	89
0942	60				61.376	
		14.0		0.9	61.376	88.9



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Vulero
Port Arthur
FCCU 121 Scrubber
FCCU-308-3

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/8/11
6/9/11
6/9/11
M308
NA
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.
Non Spiked 1	Empty	83.7	92.8	9.1	
2	Water	104.2	95.2	-9.0	
3					
Spiked 4 1	Empty	83.9	89.9	6.0	
5 2	Spiked Solu	103.4	103.7	0.3	
6					



FIELD DATA SHEET

Clock Time	Sampling Time (min)	Meter Pressure P_m (at. H ₂ O)	Sample Vacuum (in. Hg)	Gas Sample Rate (liters/min)	Gas Sample Volume (V _m liters)	Gas Meter Temperature (°F)
1252	0	—	—	—	0.000	—
1257	5	16	0	0.9	4.520	94
1302	10	16	0	0.9	9.030	93
1307	15	16	0	0.9	14.620	94
1312	20	16	0	0.9	20.120	94
1317	25	15	0	0.9	25.310	94
1322	30	15	0	0.9	30.350	94
1327	35	15	0	0.9	35.420	94
1332	40	16	0	0.9	40.570	94
1337	45	15	0	0.9	45.630	94
1342	50	15	0	0.9	50.740	94
1347	55	15	0	0.9	54.750	93
1352	60	15	0	0.9	59.716	93
		15.4		0.9	59.716	93.8



FIELD DATA SHEET

Plant:	Vacadero	Meter No.:	1105002	Ambient Temperature:	~90
Date:	6/9/11	Y Factor:	1.000	Barometric Pressure:	29.92
Location:	Port Arthur, TX	Trap Contents:	Water/56	Stack Diameter:	150
Source:	Field	USEPA Method:	308	Pre-Test Leak Check:	NO, 0.002 Jdk
Run No.:	Field-308-46	Compound Analysis:	Methanol	Post-Test Leak Check:	
Operators:	AH/JSB	Spike in Trap (Y/N):	Y		
Comments:					

[illegible]



Company:
Location:
Source:
Run No.:

Valero
Port Arthur
FEU 1241 Scrubber
ELU-308 -4

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/9/11
6/9/11
6/9/11
308
N/A
N/A

IMPINGER RECOVERY DATA SHEET

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 non spiked	Empty	83.7	90.5	6.8	
2	Water	104.5	104.7	0.2	
3					
4 1 spiked	Empty	83.6	98.6	15.0	
5 2	Spiked Solu	104.1	104.2	0.1	
6					



FIELD DATA

ANT	Valero	AMBIENT TEMPERATURE	92	PROBE HEATER SETTING	NA
DATE	6-5-11	BAROMETRIC PRESSURE	29.92	HEATER BOX SETTING	NA
LOCATION	Port Arthur, TX	ASSUMED MOISTURE, %	51	METER Hg	NA
OPERATOR	JR. SB	PROBE LENGTH, in	NA	C ₁ FACTOR	0.94
STACK NO	100	NOZZLE DIAMETER, in	1.50	C ₂ FACTOR	0.94
RUN NO.	100-4	STACK DIAMETER, in	1.50	PITOT/THERM #	83
SAMPLE BOX NO		MINUTES PER POINT	60		
METER BOX NO		NUMBER OF POINTS	60		
START TIME		NUMBER OF PORTS	60		

CLOCK TIME	TRAVERSE POINT NUMBER	SAMPLING TIME (0.1 min.)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP (T _s) °F	VELOCITY HEAD (ΔP _s)	VELOCITY (ΔP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O		GAS SAMPLE VOLUME (V _m) ft ³	GAS SAMPLE TEMP AT DRY GAS METER		COND. EXIT TEMP °F	SORBENT MODULE TEMP °F	IMPINGER OUTLET TEMP °F	PUMP VACUUM in. Hg
							ACTUAL	DESIRED		INLET (T _m) °F	OUTLET (T _m) °F				
A-1	1		10.20	140	0.40	0.36									
	2			140	0.36	0.33									
	3			140	0.33	0.24									
	4			140	0.24	0.20									
	5			140	0.20	0.19									
	6			140	0.19	0.34									
B-1	1			137	0.29	0.23									
	2			137	0.23	0.21									
	3			140	0.21	0.20									
	4			140	0.20	0.46									
	5			140	0.46	0.35									
	6			137	0.29	0.21									
C-1	1			140	0.21	0.20									
	2			137	0.20	0.38									
	3			140	0.38	0.34									
	4			141	0.25	0.23									
	5			140	0.23	0.20									
	6			140	0.20	0.20									
AVERAGE															

VOLUME OR WEIGHT OF LIQUID WATER COLLECTED	IMPINGER VOLUME (ml) OR WEIGHT (g)	SILICA GEL WEIGHT
#1	#2	#3
#4	#5	#6
FINAL INITIAL		
LIQUID COLLECTED		
TOTAL COLLECTED (specify ml or g)		

ORSAT DATA	TIME	CO ₂	O ₂
TRIAL 1			
TRIAL 2			
TRIAL 3			
Average			

SYSTEM PRE:	CFM@15" Hg
POST:	CFM@15" Hg
PITOT PRE:	@ > 1" H ₂ O
POST:	@ > 3" H ₂ O



FIELD DATA SHEET

Plant:

Valero

Date:

6-9-11

Location:

Port Arthur, TX

Source:

FECU

Run No.:

ECU-308-55

Operators:

573

Comments:

Meter No.:

2035 611

Y Factor:

0881

Trap Contents:

Water / SG-

USEPA Method:

305

Compound Analysis:

Methano

Spike in Trap (Y/N):



Ambient Temperature:

26

Barometric Pressure:

659

Stack Diameter:

50

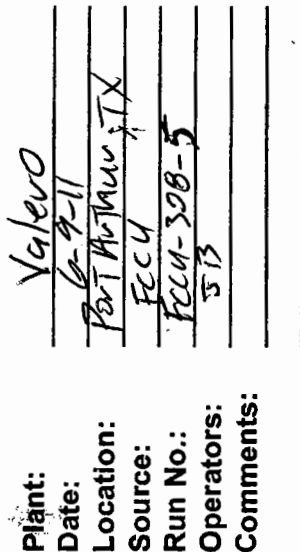
Pre-Test Leak Check:

7

Post-Test Leak Check:

✓

[illegible]



Meter No.: 1105003
Y Factor: 1.000
Trap Contents: Water / SG
USEPA Method: 308
Compound Analysis: mChemo
Spike in Trap (Y/N): N

Ambient Temperature: 90
 Barometric Pressure: 29.89
 Stack Diameter: 152
 Pre-Test Leak Check: ✓
 Post-Test Leak Check: ✓

B-122



IMPINGER RECOVERY DATA SHEET

Company:
Location:
Source:
Run No.:

Valero
Port Arthur
FCCU 1241 Sump
FNU - 208 - 5

Date Set-up:
Test Date:
Date Recovered:
USEPA Method:
Corresponding Filter No:
Filter Container No:

6/9/11
6/9/11
6/9/11
308
N/A
N/A

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 non spike	Empty	85.1	90.9	5.8	
2	water	103.2	103.4	0.2	
3					
4 spiked	Empty	82.5	97.7	15.2	
5 spiked	Spiked Solu	101.8	101.9	0.1	
6					



Valero Port Arthur Refinery
Source: FCCU-1241 Wet Gas Scrubber Stack
Test Dates: 6/6 - 6/14/11

APPENDIX C

Analytical Data



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#: L1020406 Revision 1
Date of Report 4-Aug-11
Date of Sample Receipt 20-Jun-11

Client Name: ARI Environmental, INC.
Client Address: 1710 Preston Road, Unit C
Pasadena TX 77503

Client Contact: Dan Fitzgerald
Client Project ID: FCCU-1241 Wet Gas Scrubber

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.

Reporting limit on butadiene and pentane raised on the Run samples because of poor labeled butadiene recoveries.

Summary of the Method:

The sampling train consisted of 4 midjet 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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COMPOSITE TARGET ANALYTE DATA

Sample Name	Run 1B			Run 2A			Run 3B			Blank B Train			Laboratory Method Blank	
Client Container ID:	H44621 H44622 H44623			H44565 H44566 H44567			H44615 H44616 H44617			H44560 H44564 H44563				
ALS Sample ID	L1020406-10/11/12			L1020406-19/20/21			L1020406-4/5/6			L1020406-16/17/18			WG1304163-1	
Matrix	Impinger			Impinger			Impinger			Impinger			Impinger	
Sampling Date	8-Jun-11			8-Jun-11			9-Jun-11			9-Jun-11			n/a	
Date of Receipt	20-Jun-11			20-Jun-11			20-Jun-11			20-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	UI1-4	<4.3	BDL	UI1-4	<4.3	BDL	UI1-4	<4.3	BDL	UI1-2	<2.4	BDL
Pentane	<4.3	BDL	UI1-4	<4.3	BDL	UI1-4	<4.3	BDL	UI1-4	<4.3	BDL	UI1-2	<2.4	BDL
Acrolein	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	7.8	ADL, C	UI1-2	<2.4	BDL
Acetone	134	ADL, B	UI1-2	945	ADL, B	UI1-2	2276	ADL, B	UI1-2	2344	ADL, B	UI1-2	<2.4	BDL
Acetonitrile	4.7	ADL, B, C	UI1-2	6.8	ADL, B, C	UI1-2	5.5	ADL, B, C	UI1-2	18.5	ADL, C	UI1-2	<2.4	BDL
Carbon Disulfide	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Methylene Chloride	13.2	ADL, B	UI1-2	15.7	ADL, B	UI1-2	32.1	ADL, B	UI1-2	54.9	ADL, B	UI1-2	3.36	ADL
Acrylonitrile	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Methyl t-Butyl Ether (MTBE)	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<2.4	BDL
Hexane	<4.3	BDL	UI1-2	<4.3	BDL	UI1-2	<4.3	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	13.8	ADL, C	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 high samples
B = Observed in the Field Blank at similar levels to the field run samples

ALS Environmental

COMPOSITE SPIKE RECOVERY DATA

COMPOSITE OF FIRE RECOVERY DATA																								
Sample Name	Run 1B			Run 2A			Run 3B			Blank B Train			Run 1A (Spiked)			Run 2B (Spiked)			Run 3A (Spiked)			Blank A Train (Spiked)		
Client Container ID:	H44621 H44622 H44623			H44565 H44566 H44567			H44615 H44616 H44617			H44560 H44564 H44563			H44618 H44619 H44620			H44568 H44569 H44570			H44612 H44613 H44614			H44561 H44562 H44624		
ALS Sample ID	L1020406-10/11/12			L1020406-19/20/21			L1020406-4/5/6			L1020406-16/17/18			L1020406-7/8/9			L1020406-22/23/24			L1020406-1/2/3			L1020406-13/14/15		
Matrix	Impinger			Impinger			Impinger			Impinger			Impinger			Impinger			Impinger			Impinger		
Sampling Date	8-Jun-11			8-Jun-11			9-Jun-11			9-Jun-11			8-Jun-11			8-Jun-11			9-Jun-11			9-Jun-11		
Date of Receipt	20-Jun-11			20-Jun-11			20-Jun-11			20-Jun-11			20-Jun-11			20-Jun-11			20-Jun-11			20-Jun-11		
VOC via Modified Method 18																								
	Data			Data			Data			Data			Data			Data			Data			Data		
	% Rec	Qualifier Source		% Rec	Qualifier Source		% Rec	Qualifier Source		% Rec	Qualifier Source		% Rec	Qualifier Source		% Rec	Qualifier Source		% Rec	Qualifier Source		% Rec	Qualifier Source	
Labelled Analyte Recoveries																								
1,3-Butadiene-d6	5	UI1-4	0	UI1-4	2	UI1-4	100	SI1-2	0	SI1-2	0	SI1-4	7	SI1-4	136	SI1-2								
Pentane-d12	11	UI1-4	0	UI1-4	7	UI1-4	100	SI1-2	0	SI1-2	2	SI1-4	18	SI1-4	151	SI1-2								
acrylonitrile-d3	85	UI1-4	60	UI1-4	88	UI1-4	100	SI1-2	89	SI1-2	90	SI1-4	81	SI1-4	47	SI1-2								
MTBE-d12	94	UI1-4	59	UI1-4	93	UI1-4	100	SI1-2	95	SI1-2	95	SI1-4	94	SI1-4	69	SI1-2								
n-Hexane-d14	83	UI1-4	11	UI1-4	60	UI1-4	100	SI1-2	33	SI1-2	49	SI1-4	94	SI1-4	149	SI1-2								
2,2,4-Trimethylpentane-d8	109	UI1-4	45	UI1-4	87	UI1-4	100	SI1-2	89	SI1-2	92	SI1-4	115	SI1-4	152	SI1-2								
Benzene-d6	104	UI1-4	73	UI1-4	97	UI1-4	100	SI1-2	103	SI1-2	101	SI1-4	111	SI1-4	104	SI1-2								
2-Nitropropane-d6	81	UI1-4	58	UI1-4	88	UI1-4	100	SI1-2	84	SI1-2	92	SI1-4	78	SI1-4	47	SI1-2								
1,2-Dibromoethane-d4	92	UI1-4	70	UI1-4	95	UI1-4	100	SI1-2	91	SI1-2	93	SI1-4	90	SI1-4	61	SI1-2								
Ethylbenzene-d10	100	UI1-4	87	UI1-4	99	UI1-4	100	SI1-2	94	SI1-2	94	SI1-4	107	SI1-4	99	SI1-2								
Styrene-d8	94	UI1-4	81	UI1-4	97	UI1-4	100	SI1-2	91	SI1-2	93	SI1-4	99	SI1-4	78	SI1-2								
Nitrobenzene-d5	82	UI1-4	58	UI1-4	123	UI1-4	100	SI1-2	86	SI1-2	102	SI1-4	88	SI1-4	40	SI1-2								
Native Analyte Recoveries																								
Acrolein	-	-	-	-	-	-	-	-	144	SI1-2	140	SI1-2	167	SI1-2	100	SI1-2								
Acetonitrile	-	-	-	-	-	-	-	-	111	SI1-2	160	SI1-2	157	SI1-2	100	SI1-2								
Trichloroethene	-	-	-	-	-	-	-	-	89	SI1-2	60	SI1-2	75	SI1-2	100	SI1-2								
Methyl iso-Butyl Ketone	-	-	-	-	-	-	-	-	136	SI1-2	137	SI1-2	122	SI1-2	100	SI1-2								
Toluene	-	-	-	-	-	-	-	-	128	SI1-2	68	SI1-2	77	SI1-2	100	SI1-2								

INT = Interference
 UI# = Impinger Number from the Unspiked Train
 SI# = Impinger Number from the Spiked Train

ALS Environmental

Instrument Run Date: 04-Jul-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	H44612 - IMPINGERS #1,2+CONDEN SOR RUN 3A	H44613 - IMPINGER #3 RUN 3A	H44614 - IMPINGER #4 RUN 3A	H44615 - IMPINGERS #1,2+CONDEN SOR RUN 3B	H44616 - IMPINGER #3 RUN 3B	H44617 - IMPINGER #4 RUN 3B	H44618 - IMPINGERS #1,2+CONDEN SOR RUN 1A	H44620 - IMPINGER #4 RUN 1A
ALS Sample ID	L1020406- 1;Rep1xEXT1	L1020406- 2;Rep1xEXT1	L1020406- 3;Rep1xEXT1	L1020406- 4;Rep1xEXT1	L1020406- 5;Rep1xEXT1	L1020406- 6;Rep1xEXT1	L1020406- 7;Rep1xEXT1	L1020406- 9;Rep1xEXT1
Instrument File #	1101011.D	1201012.D	1301013.D	1401014.D	1501015.D	1601016.D	1701017.D	1901019.D
Sample Volume (mL)	43	24	24	43	24	24	43	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	n/a	<2.4	<2.4	n/a	n/a	<2.4	n/a	n/a
Pentane	<4.3	<2.4	<2.4	n/a	<2.4	<2.4	n/a	n/a
Acrolein	5155	856	71.2	<4.3	<2.4	<2.4	3561	355
Acetone	2024	1337	1370.7	2276	1097	1459	152	61
Acetonitrile	4953	398	24.4	5.5 *	3.7 *	5.2 *	4032	108
Carbon Disulfide	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Methylene Chloride	38.1	15.6	14.2	32.1	12.1	20.2	14.2	5.2
Acrylonitrile	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Methyl t-Butyl Ether (MTBE)	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Hexane	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
2,2,4-Trimethylpentane	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Benzene	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Trichloroethene	2493	322	15.0	<4.3	<2.4	<2.4	1657	97
2-Nitropropane	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Methyl iso-Butyl Ketone	3670	80.6	2.8	<4.3	<2.4	3.8	3412	10.7
Toluene	1077	108	4.2	<4.3	<2.4	<2.4	860	24
Tetrachloroethene	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
1,2-Dibromoethane	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Chlorobenzene	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Ethylbenzene	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
m&p-Xylenes	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
o-Xylene	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Styrene	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Cumene (Isopropylbenzene)	<4.3	<2.4	<2.4	<4.3	<2.4	<2.4	<4.3	<2.4
Nitrobenzene	<21.5	<12	<12	<21.5	<12	<12	<21.5	<12
Labeled Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	3	4	0	0	2	0	0
Pentane-d12	3	7	8	0	3	3	0	0
acrylonitrile-d3	74	6	0	79	8	0	69	2
MTBE-d12	78	14	2	73	18	2	54	8
n-Hexane-d14	37	39	18	17	31	13	3	16
2,2,4-Trimethylpentane-d18	76	33	6	49	32	5	24	22
Benzene-d6	96	14	1	79	17	1	62	7
2-Nitropropane-d6	77	2	0	86	2	0	80	0
1,2-Dibromoethane-d4	88	2	0	93	2	0	85	0
Ethylbenzene-d10	103	3	1	95	4	1	85	1
Styrene-d8	98	1	0	96	1	0	87	0
Nitrobenzene-d5	84	3	1	119	4	1	83	2
Native Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
Acrolein	167	28	2	-	-	-	115	11
Acetonitrile	157	13	-	-	-	-	127	3
Trichloroethene	75	10	-	-	-	-	50	3
Methyl iso-Butyl Ketone	122	3	-	-	-	-	113	-
Toluene	77	8	-	-	-	-	61	2
P&T Surrogate Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,2-Dichloroethane-d4	89	105	99	84	97	99	86	101
Toluene-d8	80	97	97	78	96	100	82	98
4-Fluorobenzene	102	112	107	100	111	115	104	110

* Probable carry-over from prior run(s)

INT = Interference
 UI# = Impinger Number from the
 Unspiked Train
 SI# = Impinger Number from the
 Spiked Train

ALS Environmental								
ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS								
Instrument Run Date: 04-Jul-11	H44621 - IMPINGERS #1,2+CONDEN SOR RUN 1B	H44622 - IMPINGER #3 RUN 1B	H44623 - IMPINGER #4 RUN 1B	H44561 - IMPINGERS #1,2+CONDEN SOR BLANK A	H44560 - IMPINGERS #1,2+CONDEN SOR BLANK B	H44566 - IMPINGER #3 RUN 2A	H44565 - IMPINGERS #1,2+CONDEN SOR RUN 2A	H44567 - IMPINGERS #4 RUN 2A
Client Container ID:								
ALS Sample ID	L1020406- 10;Rep1xEXT1	L1020406- 11;Rep1xEXT1	L1020406- 12;Rep1xEXT1	L1020406- 13;Rep1xEXT1	L1020406- 16;Rep1xEXT1	L1020406- 20;Rep1xEXT1	L1020406- 19;Rep1xEXT1	L1020406- 21;Rep1xEXT1
Instrument File #	2001020.D	2201022.D	2301023.D	2401024.D	2501025.D	2601026.D	2701027.D	2801028.D
Sample Volume (mL)	43	24	24	43	43	24	43	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	n/a	<2.4	<2.4	<4.3	<4.3	n/a	n/a	n/a
Pentane	n/a	<2.4	<2.4	<4.3	<4.3	n/a	n/a	n/a
Acrolein	<4.3	<2.4	<2.4	3095	7.8 *	<2.4	<4.3	<2.4
Acetone	134	54.6	77.3	961	2344	1121	945	624
Acetonitrile	4.7 *	<2.4	<2.4	3164	18.5 *	4.1 *	6.8 *	<2.4
Carbon Disulfide	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Methylene Chloride	13.2	5.4	5.7	86.3	54.9	10.9	15.7	7.3
Acrylonitrile	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Methyl t-Butyl Ether (MTBE)	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Hexane	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
2,2,4-Trimethylpentane	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Benzene	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Trichloroethene	<4.3	<2.4	<2.4	3310	<4.3	<2.4	<4.3	<2.4
2-Nitropropane	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Methyl iso-Butyl Ketone	<4.3	<2.4	<2.4	3017	13.8 *	<2.4	<4.3	<2.4
Toluene	<4.3	<2.4	<2.4	1407	<4.3	<2.4	<4.3	<2.4
Tetrachloroethene	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
1,2-Dibromoethane	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Chlorobenzene	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Ethylbenzene	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
m&p-Xylenes	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
o-Xylene	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Styrene	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Cumene (Isopropylbenzene)	<4.3	<2.4	<2.4	<4.3	<4.3	<2.4	<4.3	<2.4
Nitrobenzene	<21.5	<12	<12	<21.5	<21.5	<12	<21.5	<12
Labeled Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d8	0	2	3	136	100	0	0	0
Pentane-d12	0	4	6	151	100	0	0	0
Acrylonitrile-d3	75	9	1	47	100	2	43	15
MTBE-d12	68	22	4	69	100	1	40	18
n-Hexane-d14	16	44	23	149	100	0	5	6
2,2,4-Trimethylpentane-d18	49	49	11	152	100	0	29	16
Benzene-d6	77	25	2	104	100	1	54	17
2-Nitropropane-d6	78	2	0	47	100	4	44	10
1,2-Dibromoethane-d4	88	3	0	61	100	5	55	11
Ethylbenzene-d10	94	5	1	99	100	7	69	12
Styrene-d8	92	2	0	78	100	6	65	10
Nitrobenzene-d5	80	1	1	40	100	9	37	11
Native Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
Acrolein	-	-	-	100	-	-	-	-
Acetonitrile	-	-	-	100	-	-	-	-
Trichloroethene	-	-	-	100	-	-	-	-
Methyl iso-Butyl Ketone	-	-	-	100	-	-	-	-
Toluene	-	-	-	100	-	-	-	-
P&T Surrogate Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,2-Dichloroethane-d4	86	96	104	80	91	94	90	103
Toluene-d8	78	96	95	91	77	95	83	92
4-Fluorobenzene	98	107	113	120	100	112	107	111
* Probable carry-over from prior run(s) INT = Interference UI# = Impinger Number from the Unspiked Train SI# = Impinger Number from the Spiked Train								

ALS Environmental				
ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS				
Instrument Run Date: 04-Jul-11	H44568 - IMPINGERS #1,2+CONDENSOR RUN 2B	H44569 - IMPINGER #3 RUN 2B	H44570 - IMPINGER #4 RUN 2B	H44619 - IMPINGER #3 RUN 1A
Client Container ID:				
ALS Sample ID	L1020406-22;Rep1xEXT1	L1020406-23;Rep1xEXT1	L1020406-24;Rep1xEXT1	L1020406-8;Rep1x
Instrument File #	2901029.D	3001030.D	3101031.D	6301009.D
Sample Volume (mL)	43	24	24	24
Dilution Factor	1	1	1	1
VOC via Modified Method 18				
	ug	ug	ug	ug
1,3-Butadiene	n/a	n/a	n/a	<2.4
Pentane	n/a	n/a	n/a	<2.4
Acrolein	4318	1513	152	1654
Acetone	1150	397	177	72
Acetonitrile	5075	833	54.6	928
Carbon Disulfide	<4.3	<2.4	<2.4	<2.4
Methylene Chloride	12.2	6.2	7.5	5.7
Acrylonitrile	<4.3	<2.4	<2.4	<2.4
Methyl t-Butyl Ether (MTBE)	<4.3	<2.4	<2.4	<2.4
Hexane	<4.3	<2.4	<2.4	<2.4
2,2,4-Trimethylpentane	<4.3	<2.4	<2.4	<2.4
Benzene	<4.3	<2.4	<2.4	<2.4
Trichloroethene	1994	674	68.3	750
2-Nitropropane	<4.3	<2.4	<2.4	<2.4
Methyl iso-Butyl Ketone	4144	190	5.3	205
Toluene	961	231	16.0	265
Tetrachloroethene	<4.3	<2.4	<2.4	<2.4
1,2-Dibromoethane	<4.3	<2.4	<2.4	<2.4
Chlorobenzene	<4.3	<2.4	<2.4	<2.4
Ethylbenzene	<4.3	<2.4	<2.4	<2.4
m&p-Xylenes	<4.3	<2.4	<2.4	<2.4
o-Xylene	<4.3	<2.4	<2.4	<2.4
Styrene	<4.3	<2.4	<2.4	<2.4
Cumene (Isopropylbenzene)	<4.3	<2.4	<2.4	<2.4
Nitrobenzene	<21.5	<12	<12	<12
Labeled Analyte Recoveries	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	0	0	0
Pentane-d12	0	0	1	0
acrylonitrile-d3	75	14	1	17
MTBE-d12	64	27	4	32
n-Hexane-d14	7	22	20	14
2,2,4-Trimethylpentane-d18	32	43	17	43
Benzene-d6	69	28	4	34
2-Nitropropane-d6	89	4	0	5
1,2-Dibromoethane-d4	88	5	0	6
Ethylbenzene-d10	87	6	1	8
Styrene-d8	90	3	0	3
Nitrobenzene-d5	96	5	1	1
Native Analyte Recoveries	% Rec	% Rec	% Rec	% Rec
Acrolein	140	49	5	53
Acetonitrile	160	26	2	29
Trichloroethene	60	20	2	23
Methyl iso-Butyl Ketone	137	6	-	7
Toluene	68	16	1	19
P&T Surrogate Recoveries	% Rec	% Rec	% Rec	% Rec
1,2-Dichloroethane-d4	90	109	89	106
Toluene-d8	83	95	106	94
4-Fluorobenzene	97	103	122	104
* Probable carry-over from prior run(s) INT = Interference UI# = Impinger Number from the Unspiked Train SI# = Impinger Number from the Spiked Train				

ALS Environmental

Instrument Run Date: 03-Jul-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	H44562 - IMPINGER #3 BLANK A	H44624 - IMPINGER #4 BLANK A	H44564 - IMPINGER #3 BLANK B	H44563 - IMPINGER #4 BLANK B
ALS Sample ID	L1020406-14;1xEXT1	L1020406-15;1xEXT1	L1020406-17;1xEXT1	L1020406-18;1xEXT1
Instrument File #	6001060.D	6301063.D	6501065.D	6601066.D
Sample Volume (mL)	24	24	24	24
Dilution Factor	1	1	1	1
VOC via Modified Method 18				
	ug	ug	ug	ug
1,3-Butadiene	<2.4	<2.4	<2.4	<2.4
Pentane	<2.4	<2.4	<2.4	<2.4
Acrolein	3.5	<2.4	<2.4	<2.4
Acetone	695	452	537	473
Acetonitrile	<2.4	<2.4	<2.4	<2.4
Carbon Disulfide	<2.4	<2.4	<2.4	<2.4
Methylene Chloride	44.3	56.4	42.4	48.0
Acrylonitrile	<2.4	<2.4	<2.4	<2.4
Methyl t-Butyl Ether (MTBE)	<2.4	<2.4	<2.4	<2.4
Hexane	<2.4	<2.4	<2.4	<2.4
2,2,4-Trimethylpentane	<2.4	<2.4	<2.4	<2.4
Benzene	<2.4	<2.4	<2.4	<2.4
Trichloroethene	3.7 *	2.6 *	<2.4	<2.4
2-Nitropropane	<2.4	<2.4	<2.4	<2.4
Methyl iso-Butyl Ketone	4.6	<2.4	<2.4	<2.4
Toluene	<2.4	<2.4	<2.4	<2.4
Tetrachloroethene	<2.4	<2.4	<2.4	<2.4
1,2-Dibromoethane	<2.4	<2.4	<2.4	<2.4
Chlorobenzene	<2.4	<2.4	<2.4	<2.4
Ethylbenzene	<2.4	<2.4	<2.4	<2.4
m&p-Xylenes	<2.4	<2.4	<2.4	<2.4
o-Xylene	<2.4	<2.4	<2.4	<2.4
Styrene	<2.4	<2.4	<2.4	<2.4
Cumene (Isopropylbenzene)	<2.4	<2.4	<2.4	<2.4
Nitrobenzene	<12	<12	<12	<12
Labeled Analyte Recoveries	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	0	0	0
Pentane-d12	0	0	0	0
acrylonitrile-d3	0	0	0	0
MTBE-d12	0	0	0	0
n-Hexane-d14	0	0	0	0
2,2,4-Trimethylpentane-d18	0	0	0	0
Benzene-d6	0	0	0	0
2-Nitropropane-d6	0	0	0	0
1,2-Dibromoethane-d4	0	0	0	0
Ethylbenzene-d10	0	0	0	0
Styrene-d8	0	0	0	0
Nitrobenzene-d5	0	0	0	0
Native Analyte Recoveries	% Rec	% Rec	% Rec	% Rec
Acrolein	-	-	-	-
Acetonitrile	-	-	-	-
Trichloroethene	-	-	-	-
Methyl iso-Butyl Ketone	-	-	-	-
Toluene	-	-	-	-
P&T Surrogate Recoveries	% Rec	% Rec	% Rec	% Rec
1,2-Dichloroethane-d4	110	108	106	105
Toluene-d8	100	102	102	102
4-Fluorobenzene	108	118	115	115

* Carry-over from prior run(s)

INT = Interference

UI# = Impinger Number from the

Unspiked Train

SI# = Impinger Number from the

Spiked Train

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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 Standards¹		
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 Standards²		
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.



ALS Environmental

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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#: L1021843
Date of Report: 12-Jul-11
Date of Sample Receipt: 20-Jun-11

Client Name: ARI Environmental Inc.
Client Address: 1710 Preston Road
Unit C
Pasadena, TX, 77503
Client Contact: D. Fitzgerald
Client Project ID: VALERO - FCCU-1241

COMMENTS:

Metals analysed via ICP-MS Method USEPA 6020A (MC 10-Jul-2011)
Sample Preparation via USEPA Method 29 (KC 08-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

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Sample Analysis Summary Report

Sample Name	RUN 1 => FCCU-29-1 H44702/H44 655/H44656	RUN 2 => FCCU-29-2 H44704/H44 672/H44673	RUN 3 => FCCU-29-3 H44703/H44 681/H44682	BLANK H44705/H44 664/H44665 /H44666/H4 4667
ALS Sample ID	L1021843-1	L1021843-2	L1021843-3	L1021843-4
Matrix	STACK	STACK	STACK	STACK
Analysis Type	Sample	Sample	Sample	Sample
Sampling Date	13-Jun-11	13-Jun-11	13-Jun-11	13-Jun-11
Date of Receipt	20-Jun-11	20-Jun-11	20-Jun-11	20-Jun-11

Multi-Metals via ICP-MS		LOR				
		ug	ug	ug	ug	ug
Front Half HF Fraction 1A						
Antimony	0.2	<	<	<	<	<
Arsenic	1	<	<	<	<	<
Beryllium	0.2	<	<	<	<	<
Cadmium	0.1	<	0.533	<	<	0.122
Chromium	1	2.77	3.39	3.82	1.35	<
Cobalt	0.2	0.224	0.311	0.376	<	<
Lead	0.5	1.05	1.30	1.21	<	<
Manganese	0.5	1.58	1.81	1.62	1.92	<
Nickel	0.2	6.72	8.68	7.95	1.58	<
Selenium	2	<	<	<	<	<
Back Half (HNO3 / H2O2) Fraction 2A						
Antimony	0.1	<	<	<	<	<
Arsenic	0.2	<	<	<	<	<
Beryllium	0.1	<	<	<	<	<
Cadmium	0.05	3.20	2.14	15.5	<	<
Chromium	0.15	1.32	1.91	2.31	0.302	<
Cobalt	0.1	0.441	0.503	0.504	<	<
Lead	0.05	1.30	1.68	0.694	0.109	<
Manganese	0.15	13.7	1.43	3.25	0.249	<
Nickel	0.1	3.13	3.89	5.09	0.921	<
Selenium	1	<	<	<	<	<

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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	Citbol	MDT	MDT	MDT	MDT
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	<	11.0	91	13.4	112
Arsenic	1	<	57.0	95	63.4	106
Beryllium	0.2	<	56.8	95	62.8	105
Cadmium	0.1	<	27.8	93	31.5	105
Chromium	1	<	56.8	94	62.9	105
Cobalt	0.2	<	56.6	94	62.3	104
Lead	0.5	<	57.5	96	63.6	106
Manganese	0.5	<	56.0	93	62.7	105
Nickel	0.2	<	55.1	92	63.1	105
Selenium	2	<	56.4	94	63.6	106
Back Half (HNO3 / H2O2) Fraction 2A						
Antimony	0.1	<	6.16	103	5.92	99
Arsenic	0.2	<	31.8	106	31.4	105
Beryllium	0.1	<	33.2	111	31.7	106
Cadmium	0.05	<	15.9	106	15.0	100
Chromium	0.15	<	32.5	108	31.0	103
Cobalt	0.1	<	31.4	105	31.2	104
Lead	0.05	<	32.5	108	31.6	105
Manganese	0.15	<	32.0	107	30.8	103
Nickel	0.1	<	32.2	107	31.2	104
Selenium	1	<	33.2	111	32.6	109

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Sample QC Summary Report

Sample Name	RUN 1 => FCCU-29-1 H44702/H44 655/H44656	RUN 1 => FCCU-29-1 H44702/H44 655/H44656	RUN 1 => FCCU-29-1 H44702/H44 655/H44656	RUN 1 => FCCU-29-1 H44702/H44 655/H44656	RUN 1 => FCCU-29-1 H44702/H44 655/H44656	RUN 1 => FCCU-29-1 H44702/H44 655/H44656
ALS Sample ID	L1021843-1	L1021843-1	MS	MS	MSD	MSD
Matrix	STACK	STACK	STACK	STACK	STACK	STACK
Analysis Type	Tbn qth	Evqjmbuf	NbusylTqjl f	NbusylTqjl f	NbusylTqjl f IEvq	NbusylTqjl f IEvq
Sampling Date	13-Jun-11	13-Jun-11	13-Jun-11	13-Jun-11	13-Jun-11	13-Jun-11
Date of Receipt	20-Jun-11	20-Jun-11	20-Jun-11	20-Jun-11	20-Jun-11	20-Jun-11

Multi-Metals via ICP-MS		LOR					
		ug	ug	ug	% Rec	ug	% Rec
Front Half HF Fraction 1A							
Antimony	0.2	<	<	25.0	104	24.2	101
Arsenic	1	<	<	123	102	119	99
Beryllium	0.2	<	<	121	101	122	102
Cadmium	0.1	<	<	62.2	103	61.3	102
Chromium	1	2.77	2.69	131	107	126	102
Cobalt	0.2	0.224	0.217	130	108	126	105
Lead	0.5	1.05	1.08	133	110	130	107
Manganese	0.5	1.58	2.05	132	109	127	105
Nickel	0.2	6.72	6.64	133	105	131	103
Selenium	2	<	<	122	103	119	100
Back Half (HNO3 / H2O2) Fraction 2A							
Antimony	0.1	<	<	11.7	97	11.9	99
Arsenic	0.2	<	<	58.7	98	59.7	99
Beryllium	0.1	<	<	63.2	105	62.8	105
Cadmium	0.05	3.20	3.13	32.2	97	33.1	100
Chromium	0.15	1.32	1.24	62.6	102	63.6	104
Cobalt	0.1	0.441	0.413	62.7	104	61.8	102
Lead	0.05	1.30	1.31	65.0	106	64.1	105
Manganese	0.15	13.7	13.9	75.8	104	74.5	101
Nickel	0.1	3.13	3.00	64.8	103	65.2	103
Selenium	1	<	<	60.2	100	62.3	103



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Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: ARI100
ALS WO#: L1022570
Date of Report: 5-Jul-11
Date of Sample Receipt: 20-Jun-11

Client Name: ARI Environmental, INC.
Client Address: 1710 Preston Road, Unit C
Pasadena TX 77503

Client Contact: Dan Fitzgerald
Client Project ID: Valero FCCU 1241

COMMENTS: **Hexavalent Chromium via SW846 Method 7199 on samples collected via 0061**

Samples were analyzed 1 to 4 days following the recommended hold times of 14 days.
Impact to data quality is anticipated to be minimal.

The Run 4 and 5 Probe and Water Rinses were submitted to the laboratory as separate bottles from the impinger contents.
Each bottle was analyzed separately. A composite of the Run 4 and Run 5 data are presented based upon summing the results from the two bottles for each source.

Sample L1022570-1 was received at a neutral pH as determined via pH paper.
Samples L1022570-4, -7 and -9 were strongly basic upon receipt.
The water and probe rinses (L1022570-3 and -6) were strongly acidic upon receipt.

Certified by: 

Ron McLeod, Ph.D.
General Manager and Technical Director

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ALS Environmental					
Sample Analysis Composite Report					
Sample Name	H44590 IMPINGER #1,2,3 + PROBE WASH RUN 3	H37510/H44676 IMPINGER #1,2,3, PROBE RINSE + WATER RINSE RUN 4	H44680/H37511 IMPINGER #1,2,3, PROBE RINSE + WATER RINSE RUN 5	H37506 - 0.5M KOH BLANK	H37507 - WATER BLANK
ALS Sample ID	L1022570-1	L1022570-3/4	L1022570-6/7	L1022570-9	L1022570-10
Matrix	QC	STACK	STACK	STACK	STACK
Sampling Date	10-Jun-11	13-Jun-11	14-Jun-11	13-Jun-11	13-Jun-11
Analysis Date	29-Jun-11	29-Jun-11	29-Jun-11	29-Jun-11	29-Jun-11
Target Analytes	ug/Sample	ug/Sample	ug/Sample	ug/Sample	ug/Sample
Cr (VI) via 7199	<2	<2	<2	<0.2	<0.2
Cr (VI) via 7199 - Duplicate	<2	<2	<2	<0.2	<0.2
	mL	mL	mL	mL	mL
Sample Volume Received	1070	1319	1380	300	210

ALS Environmental

Sample Analysis Summary Report

Sample Name	H44590 IMPINGER #1,2,3 + PROBE WASH RUN 3	H44676 PROBE RINSE + WATER RINSE RUN 4	H37510 IMPINGER #1,2,3 RUN 4	H37511 PROBE RINSE + WATER RINSE RUN 5	H44680 IMPINGER #1,2,3 RUN 5	H37506 - 0.5M KOH BLANK	H37507 - WATER BLANK	Laboratory Method Blank	Sample Matrix Spike	Laboratory Control Sample
ALS Sample ID	L1022570-1	L1022570-3	L1022570-4	L1022570-6	L1022570-7	L1022570-9	L1022570-10	WG1303767-1/ WG1304379-1	L1022570-9MS	WG1303767-2/ WG1304379-2
Matrix	QC	STACK	STACK	STACK	STACK	STACK	STACK	QC	QC	QC
Sampling Date	10-Jun-11	13-Jun-11	13-Jun-11	14-Jun-11	14-Jun-11	13-Jun-11	13-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	29-Jun-11	29-Jun-11
Target Analytes	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Cr (VI) via 7199	<2	<3	<1	<3	<1	<0.5	<0.5	<0.5	48.2	47.1
Cr (VI) via 7199 - Duplicate	<2	<3	<1	<3	<1	<0.5	<0.5	<0.5	82.2	40.6
	ug/Sample	ug/Sample	ug/Sample	ug/Sample	ug/Sample	ug/Sample	ug/Sample	ug/Sample	% Rec	% Rec
Cr (VI) via 7199	<2	<1	<2	<1	<2	<0.2	<0.2	-	103	81
Cr (VI) via 7199 - Duplicate	<2	<1	<2	<1	<2	<0.2	<0.2	-	-	-
	mL	mL	mL	mL	mL	mL	mL	mL	mL	mL
Sample Volume Received	1070	280	1039	330	1050	300	210	-	-	-



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Certificate of Analysis

ALS Project Contact: Steve Kennedy
ALS Project ID: ARI100
ALS WO#: L1033191
Date of Report 22-Jul-11
Date of Sample Receipt 20-Jun-11

Client Name: ARI Environmental Inc.
Client Address: 1710 Preston Rd. Unit C
Pasadena, TX. 77503

Client Contact: D. Fitzgerald
Client Project ID: Valero-FCCU-1241

COMMENTS:

Mercury Analysis via CVAA Method USEPA 7470A

MC1 20-07-11

Sample Preparation via ASTM D6784-02

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

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Sample Analysis Summary Report

Sample Name	RUN 1=>FCCU- OH-1	RUN 2=>FCCU- OH-2	RUN 3=>FCCU- OH-3	FIELD BLANK RUN	REAGENT BLANKS
ALS Sample ID	L1033191-1	L1033191-2	L1033191-3	L1033191-4	L1033191-5
Matrix	STACK	STACK	STACK	STACK	STACK
Analysis Type	Sample	Sample	Sample	Sample	Sample
Sampling Date	9-Jun-11	10-Jun-11	10-Jun-11	10-Jun-11	10-Jun-11
Date of Receipt	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11
Mercury via FIMS CVAA	LOR				
	ug	ug	ug	ug	ug
Filter	0.015	<	<	<	N/A
Probe Rinses	0.050	<	<	<	<
KCl	0.005	0.120	0.162	0.0822	<0.0160
5% HNO3/10% H2O2	0.025	<0.0685	<0.0540	<0.0520	<
4% KMNO4/10% H2SO4	0.025	0.870	0.871	1.00	0.238
10%HNO3 SOLUTION	0.025	-	-	-	-
10% HYDROXYLAMINE SOLUTION	0.025	-	-	-	-

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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	% Rec
Filter 0.02	<	0.0943	96	0.0954	97
Probe Rinses 0.050	<	0.104	94	0.109	98
KCl 0.01	<	1.02	95	1.03	96
5% HNO3/10% H2O2 0.03	<	1.04	98	1.06	100
4% KMNO4/10% H2SO4 0.03	<	0.489	98	0.501	101

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Sample QC Summary Report

Sample Name	RUN 1=> FCCU-OH-1	RUN 1=> FCCU-OH-1	RUN 1=> FCCU-OH-1	RUN 1=> FCCU-OH-1	RUN 1=> FCCU-OH-1	RUN 1=> FCCU-OH-1
ALS Sample ID	L1033191-1	L1033191-1	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	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11
Mercury via FIMS CVAA	LOR					
	ug	ug	ug	ug	% Rec	% Rec
Filter 0.02	<	<	0.101	101	0.103	102
Probe Rinses 0.050	<	<	0.176	97	0.175	97
KCl 0.01	0.120	0.137	1.20	100	1.19	99
5% HNO3/10% H2O2 0.03	<0.0685	<0.0685	1.40	99	1.43	101
4% KMNO4/10% H2SO4 0.03	0.870	0.828	1.36	97	1.28	81



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Certificate of Analysis

ALS Project Contact: Steve Kennedy
ALS Project ID: ARI100
ALS WO#: L1020857
Date of Report: 4-Jul-11
Date of Sample Receipt: 20-Jun-11

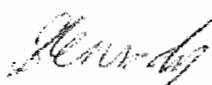
Client Name: ARI Environmental Inc.
Client Address: 1710 Preston Rd. Unit C
Pasadena, TX, 77503, U.S.

Client Contact: D. Fitzgerald
Client Project ID: Valero FCCU-1241

COMMENTS:

PCDD/F via EPA Method 23

Certified by:


Steve Kennedy
Laboratory Manager

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Sample Analysis Summary Report

Sample Name	Method Blank	BLANK - 47596/H44587/H4 4588/H44589/H44 632	FIELD BLANK - 47543/H44581/H4 4582/H44583	RUN 1 - 47653/H44557/H4 4558/H44559	RUN 2 - 47545/H44571/H4 4572/H44637	RUN 3 - 47536/H44573/H4 4574/H44580
ALS Sample ID	WG1300786-1	L1020857-5	L1020857-4	L1020857-1	L1020857-2	L1020857-3
Sample Size	1	1	1	1	1	1
Sample units	Train	Train	Train	Train	Train	Train
Moisture Content	n/a	n/a	n/a	n/a	n/a	n/a
Matrix	QC	STACK	STACK	STACK	STACK	STACK
Sampling Date	n/a	10-Jun-11	10-Jun-11	09-Jun-11	10-Jun-11	10-Jun-11
Extraction Date	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11
Target Analytes	pg	pg	pg	pg	pg	pg
2,3,7,8-TCDD	<0.63	<1.1	<0.57	<0.98	<0.87	<0.77
1,2,3,7,8-PeCDD	<1.5	<1.9	<1.3	<1.9	<1.7	<1.4
1,2,3,4,7,8-HxCDD	<0.91	<1.0	<0.73	<0.64	<0.80	<1.0
1,2,3,6,7,8-HxCDD	1.35	<1.0	<0.72	<0.64	<0.79	<0.98
1,2,3,7,8,9-HxCDD	1.16	<1.0	<0.71	<0.63	<0.78	<0.98
1,2,3,4,6,7,8-HpCDD	<1.5	<0.81	2.02	<1.8	<2.7	<1.7
OCDD	<8.5	9.68	<6.9	10.0	16.8	<11
2,3,7,8-TCDF	<0.75	<0.77	<0.59	<0.80	<1.5	<0.83
1,2,3,7,8-PeCDF	<1.4	<1.8	<1.2	<1.4	<1.4	<1.5
2,3,4,7,8-PeCDF	<1.4	<1.8	<1.2	<1.4	2.49	<1.5
1,2,3,4,7,8-HxCDF	1.46	<0.46	<0.57	<0.38	<0.90	<0.61
1,2,3,6,7,8-HxCDF	<0.58	<0.44	<0.55	<0.37	<1.1	<0.59
2,3,4,6,7,8-HxCDF	1.49	<0.46	0.936	<0.38	1.51	<0.61
1,2,3,7,8,9-HxCDF	<1.4	<0.51	<0.62	<0.42	<0.71	<0.67
1,2,3,4,6,7,8-HpCDF	<1.8	<0.62	1.40	<0.42	2.67	<0.70
1,2,3,4,7,8,9-HpCDF	2.06	<0.76	<0.99	<0.51	0.963	<0.60
OCDF	5.62	<1.4	<3.3	<1.3	<1.3	<1.2
Field Spike Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
37Cl4-2,3,7,8-TCDD	n/s	103	102	101	102	102
13C12-1,2,3,4,7,8-HxCDD	n/s	104	106	100	98	110
13C12-2,3,4,7,8-PeCDF	n/s	103	114	101	106	111
13C12-1,2,3,4,7,8-HxCDF	n/s	99	101	96	105	102
13C12-1,2,3,4,7,8,9-HpCDF	n/s	98	94	94	104	99
Extraction Standards						
13C12-2,3,7,8-TCDD	71	82	91	79	74	81
13C12-1,2,3,7,8-PeCDD	95	96	125	96	121	104
13C12-1,2,3,6,7,8-HxCDD	57	65	66	60	65	59
13C12-1,2,3,4,6,7,8-HpCDD	51	57	60	56	61	59
13C12-OCDD	41	43	48	44	48	47
13C12-2,3,7,8-TCDF	73	85	97	85	71	78
13C12-1,2,3,7,8-PeCDF	87	106	107	102	104	96
13C12-1,2,3,6,7,8-HxCDF	60	69	71	64	66	65
13C12-1,2,3,4,6,7,8-HpCDF	53	58	62	57	57	58
Cleanup Standards						
13C12-1,2,3,7,8,9-HxCDF	65	64	65	61	68	67
Homologue Group Totals	pg	pg	pg	pg	pg	pg
Total-TCDD	<0.63	<1.1	<0.57	4.80	<0.87	<0.77
Total-PeCDD	<1.5	<1.9	<1.3	<1.9	<1.7	<1.4
Total-HxCDD	2.52	<1.0	<0.73	<0.64	<0.80	<1.0
Total-HpCDD	1.19	<0.81	2.02	1.97	2.84	2.58
Total-TCDF	<0.75	<0.77	<0.59	<0.80	<1.5	<0.83
Total-PeCDF	<1.4	<1.8	<1.2	<1.4	4.19	<1.5
Total-HxCDF	2.94	<0.51	0.936	<0.42	4.15	<0.67
Total-HpCDF	2.06	<0.76	1.40	<0.51	3.64	<0.60
Toxic Equivalency NATO						
Lower Bound PCDD/F TEQ	0.572	0.00968	0.128	0.0100	1.45	0.00
Upper Bound PCDD/F TEQ	3.13	3.64	2.48	3.16	3.93	2.96

ALS Environmental

Laboratory Method Blank Analysis Report

Sample Name
ALS Sample ID
Analysis Method
Analysis Type
Sample Matrix

Method Blank
WG1300786-1
EPA M23
Blank
QC

Sampling Date n/a
Extraction Date 23-Jun-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
04-Jul-2011

Run Information

Run 1

Filename 1-110629A S:5
Run Date 29-Jun-11 11:21
Final Volume 20 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NATO
2,3,7,8-TCDD	NotFnd	<0.63	0.63	U	1
1,2,3,7,8-PeCDD	NotFnd	<1.5	1.5	U	0.5
1,2,3,4,7,8-HxCDD	NotFnd	<0.91	0.91	U	0.1
1,2,3,6,7,8-HxCDD	34:35	1.35	0.90	M J	0.1
1,2,3,7,8,9-HxCDD	34:45	1.16	0.89	M J	0.1
1,2,3,4,6,7,8-HpCDD	36:27	<1.5	0.60	M J R	0.01
OCDD	38:19	<8.5	2.1	M J R	0.001
2,3,7,8-TCDF	NotFnd	<0.75	0.75	U	0.1
1,2,3,7,8-PeCDF	31:37	<1.4	1.4	M U	0.05
2,3,4,7,8-PeCDF	NotFnd	<1.4	1.4	U	0.5
1,2,3,4,7,8-HxCDF	34:01	1.46	0.60	M J	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<0.58	0.58	U	0.1
2,3,4,6,7,8-HxCDF	34:27	1.49	0.60	M J	0.1
1,2,3,7,8,9-HxCDF	34:58	<1.4	0.66	M J R	0.1
1,2,3,4,6,7,8-HpCDF	35:49	<1.8	0.44	M J R	0.01
1,2,3,4,7,8,9-HpCDF	36:49	2.06	0.54	M J	0.01
OCDF	38:30	5.62	1.7	M J	0.001

Field Spike Standards

% Rec

Limits

37Cl4-2,3,7,8-TCDD
13C12-1,2,3,4,7,8-HxCDD
13C12-2,3,4,7,8-PeCDF
13C12-1,2,3,4,7,8-HxCDF
13C12-1,2,3,4,7,8,9-HpCDF

n/s
n/s
n/s
n/s
n/s

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD
13C12-1,2,3,7,8-PeCDD
13C12-1,2,3,6,7,8-HxCDD
13C12-1,2,3,4,6,7,8-HpCDD
13C12-OCDD
13C12-2,3,7,8-TCDF
13C12-1,2,3,7,8-PeCDF
13C12-1,2,3,6,7,8-HxCDF
13C12-1,2,3,4,6,7,8-HpCDF

27:47
32:24
34:34
36:27
38:19
26:26
31:36
34:05
35:49

71
95
57
51
41
73
87
60
53

40-130
40-130
40-130
25-130
25-130
40-130
40-130
40-130
25-130

Cleanup Standard

% Rec

13C12-1,2,3,7,8,9-HxCDF

34:58

65

40-130

Homologue Group Totals

peaks

Conc pg

EDL pg

Total-TCDD 0 <0.63 0.63
Total-PeCDD 0 <1.5 1.5
Total-HxCDD 2 2.52 0.91
Total-HpCDD 1 1.19 0.60
Total-TCDF 0 <0.75 0.75
Total-PeCDF 0 <1.4 1.4
Total-HxCDF 2 2.94 0.66
Total-HpCDF 1 2.06 0.54

Toxic Equivalency NATO

pg

Lower Bound PCDD/F TEQ

0.572

Upper Bound PCDD/F TEQ

3.13

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor
M Indicates that a peak has been manually integrated.
U Indicates that this compound was not detected above the MDL.
n/s Indicates that this compound was not spiked.
J indicates that a target analyte was detected below the LQL.
R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name	BLANK - 47596/H44587/H44588/H44589/H44632	Sampling Date	10-Jun-11	Approved: <i>C. de Haan</i> --e-signature-- 04-Jul-2011
ALS Sample ID	L1020857-5	Extraction Date	23-Jun-11	
Analysis Method	EPA M23	Sample Size	1 Train	
Analysis Type	Sample	Percent Moisture	n/a	
Sample Matrix	STACK	Split Ratio	2	

Run Information	Run 1
Filename	1-110701A S:7
Run Date	1-JUL-11 16:07:2
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NATO
2,3,7,8-TCDD	NotFnd	<1.1	1.1	U	1
1,2,3,7,8-PeCDD	NotFnd	<1.9	1.9	U	0.5
1,2,3,4,7,8-HxCDD	NotFnd	<1.0	1.0	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<1.0	1.0	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<1.0	1.0	U	0.1
1,2,3,4,6,7,8-HpCDD	NotFnd	<0.81	0.81	U	0.01
OCDD	38:24	9.68	3.2	M J	0.001
2,3,7,8-TCDF	NotFnd	<0.77	0.77	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<1.8	1.8	U	0.05
2,3,4,7,8-PeCDF	NotFnd	<1.8	1.8	U	0.5
1,2,3,4,7,8-HxCDF	NotFnd	<0.46	0.46	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<0.44	0.44	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<0.46	0.46	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<0.51	0.51	U	0.1
1,2,3,4,6,7,8-HpCDF	NotFnd	<0.62	0.62	U	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<0.76	0.76	U	0.01
OCDF	NotFnd	<1.4	1.4	U	0.001

Field Spike Standards	% Rec	Limits
37Cl4-2,3,7,8-TCDD	27:60 103	70-130
13C12-1,2,3,4,7,8-HxCDD	34:34 104	70-130
13C12-2,3,4,7,8-PeCDF	32:17 103	70-130
13C12-1,2,3,4,7,8-HxCDF	34:04 99	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:53 98	70-130

Extraction Standards	% Rec	Limits
13C12-2,3,7,8-TCDD	27:57 82	40-130
13C12-1,2,3,7,8-PeCDD	32:27 96	40-130
13C12-1,2,3,6,7,8-HxCDD	34:38 65	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:31 57	25-130
13C12-OCDD	38:24 43	25-130
13C12-2,3,7,8-TCDF	26:36 85	40-130
13C12-1,2,3,7,8-PeCDF	31:40 106	40-130
13C12-1,2,3,6,7,8-HxCDF	34:08 69	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:53 58	25-130

Cleanup Standard	% Rec	Limits
13C12-1,2,3,7,8,9-HxCDF	35:01 64	40-130

Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	0	<1.1	1.1
Total-PeCDD	0	<1.9	1.9
Total-HxCDD	0	<1.0	1.0
Total-HpCDD	0	<0.81	0.81
Total-TCDF	0	<0.77	0.77
Total-PeCDF	0	<1.8	1.8
Total-HxCDF	0	<0.51	0.51
Total-HpCDF	0	<0.76	0.76

Toxic Equivalency NATO	pg
Lower Bound PCDD/F TEQ	0.00968
Upper Bound PCDD/F TEQ	3.64

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.	TEQ	Indicates the Toxic Equivalency
TEF	Indicates the Toxic Equivalency Factor		
M	Indicates that a peak has been manually integrated.		
U	Indicates that this compound was not detected above the MDL.		
J	Indicates that a target analyte was detected below the LQL.		

ALS Environmental

Sample Analysis Report

Sample Name FIELD BLANK - 47543/H44581/H44582/H44583
ALS Sample ID L1020857-4
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 10-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
04-Jul-2011

Run Information

Run 1

Filename 1-110629A S:6
Run Date 29-Jun-11 12:04
Final Volume 20 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NATO
2,3,7,8-TCDD	NotFnd	<0.57	0.57	U	1
1,2,3,7,8-PeCDD	NotFnd	<1.3	1.3	U	0.5
1,2,3,4,7,8-HxCDD	NotFnd	<0.73	0.73	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<0.72	0.72	U	0.1
1,2,3,7,8,9-HxCDD	34:44	<0.71	0.71	M U	0.1
1,2,3,4,6,7,8-HpCDD	36:27	2.02	0.67	M J	0.01
OCDD	38:19	<6.9	1.8	M J R	0.001
2,3,7,8-TCDF	NotFnd	<0.59	0.59	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<1.2	1.2	U	0.05
2,3,4,7,8-PeCDF	NotFnd	<1.2	1.2	U	0.5
1,2,3,4,7,8-HxCDF	NotFnd	<0.57	0.57	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<0.55	0.55	U	0.1
2,3,4,6,7,8-HxCDF	34:26	0.936	0.56	M J B	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<0.62	0.62	U	0.1
1,2,3,4,6,7,8-HpCDF	35:50	1.40	0.39	M J	0.01
1,2,3,4,7,8,9-HpCDF	36:49	<0.99	0.48	M J R	0.01
OCDF	38:30	<3.3	0.78	M J R	0.001

Field Spike Standards	% Rec	Limits
37C14-2,3,7,8-TCDD	27:49 102	70-130
13C12-1,2,3,4,7,8-HxCDD	34:31 106	70-130
13C12-2,3,4,7,8-PeCDF	32:13 114	70-130
13C12-1,2,3,4,7,8-HxCDF	34:01 101	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:49 94	70-130

Extraction Standards	% Rec	Limits
13C12-2,3,7,8-TCDD	27:47 91	40-130
13C12-1,2,3,7,8-PeCDD	32:24 125	40-130
13C12-1,2,3,6,7,8-HxCDD	34:34 66	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:27 60	25-130
13C12-OCDD	38:19 48	25-130
13C12-2,3,7,8-TCDF	26:26 97	40-130
13C12-1,2,3,7,8-PeCDF	31:36 107	40-130
13C12-1,2,3,6,7,8-HxCDF	34:05 71	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:49 62	25-130

Cleanup Standard	% Rec	Limits
13C12-1,2,3,7,8,9-HxCDF	34:58 65	40-130

Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	0	<0.57	0.57
Total-PeCDD	0	<1.3	1.3
Total-HxCDD	0	<0.73	0.73
Total-HpCDD	1	2.02	0.67
Total-TCDF	0	<0.59	0.59
Total-PeCDF	0	<1.2	1.2
Total-HxCDF	1	0.936	0.62
Total-HpCDF	1	1.40	0.48

Toxic Equivalency NATO	pg
Lower Bound PCDD/F TEQ	0.128
Upper Bound PCDD/F TEQ	2.48

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
 M Indicates that a peak has been manually integrated.
 U Indicates that this compound was not detected above the MDL.
 J indicates that a target analyte was detected below the LQL.
 R Indicates that the Ion abundance ratio for this compound did not meet the acceptance criterion.
 B Indicates that this target was detected in the blank at greater than 10% of the sample concentration.

ALS Environmental

Sample Analysis Report

Sample Name RUN 1 - 47653/H44557/H44558/H44559
ALS Sample ID L1020857-1
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 9-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
04-Jul-2011

Run Information

Run 1

Filename 1-110701A S:8
Run Date 1-JUL-11 16:50:1
Final Volume 20 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NATO
2,3,7,8-TCDD	NotFnd	<0.98	0.98	U	1
1,2,3,7,8-PeCDD	NotFnd	<1.9	1.9	U	0.5
1,2,3,4,7,8-HxCDD	NotFnd	<0.64	0.64	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<0.64	0.64	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<0.63	0.63	U	0.1
1,2,3,4,6,7,8-HpCDD	36:31	<1.8	0.89	M J R	0.01
OCDD	38:24	10.0	1.9	M J	0.001
2,3,7,8-TCDF	NotFnd	<0.80	0.80	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<1.4	1.4	U	0.05
2,3,4,7,8-PeCDF	NotFnd	<1.4	1.4	U	0.5
1,2,3,4,7,8-HxCDF	NotFnd	<0.38	0.38	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<0.37	0.37	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<0.38	0.38	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<0.42	0.42	U	0.1
1,2,3,4,6,7,8-HpCDF	NotFnd	<0.42	0.42	U	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<0.51	0.51	U	0.01
OCDF	NotFnd	<1.3	1.3	U	0.001

Field Spike Standards	% Rec	Limits
37Cl4-2,3,7,8-TCDD	28:00 101	70-130
13C12-1,2,3,4,7,8-HxCDD	34:34 100	70-130
13C12-2,3,4,7,8-PeCDF	32:17 101	70-130
13C12-1,2,3,4,7,8-HxCDF	34:04 96	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:53 94	70-130

Extraction Standards	% Rec	Limits
13C12-2,3,7,8-TCDD	27:58 79	40-130
13C12-1,2,3,7,8-PeCDD	32:27 96	40-130
13C12-1,2,3,6,7,8-HxCDD	34:38 60	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:31 56	25-130
13C12-OCDD	38:24 44	25-130
13C12-2,3,7,8-TCDF	26:36 85	40-130
13C12-1,2,3,7,8-PeCDF	31:40 102	40-130
13C12-1,2,3,6,7,8-HxCDF	34:09 64	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:53 57	25-130

Cleanup Standard	% Rec	Limits
13C12-1,2,3,7,8,9-HxCDF	35:01 61	40-130

Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	1	4.80	0.98
Total-PeCDD	0	<1.9	1.9
Total-HxCDD	0	<0.64	0.64
Total-HpCDD	1	1.97	0.89
Total-TCDF	0	<0.80	0.80
Total-PeCDF	0	<1.4	1.4
Total-HxCDF	0	<0.42	0.42
Total-HpCDF	0	<0.51	0.51

Toxic Equivalency NATO	pg
Lower Bound PCDD/F TEQ	0.0100
Upper Bound PCDD/F TEQ	3.16

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 M Indicates that a peak has been manually integrated.
 U Indicates that this compound was not detected above the MDL.
 J indicates that a target analyte was detected below the LQL.
 R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name RUN 2 - 47545/H44571/H44572/H44637
ALS Sample ID L1020857-2
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 10-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
04-Jul-2011

Run Information

Run 1

Filename 1-110629A S:15
Run Date 29-Jun-11 18:30
Final Volume 20 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NATO
2,3,7,8-TCDD	NotFnd	<0.87	0.87	U	1
1,2,3,7,8-PeCDD	NotFnd	<1.7	1.7	U	0.5
1,2,3,4,7,8-HxCDD	NotFnd	<0.80	0.80	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<0.79	0.79	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<0.78	0.78	U	0.1
1,2,3,4,6,7,8-HpCDD	36:28	<2.7	0.53	M J R	0.01
OCDD	38:19	16.8	1.5	J	0.001
2,3,7,8-TCDF	NotFnd	<1.5	1.5	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<1.4	1.4	U	0.05
2,3,4,7,8-PeCDF	32:13	2.49	1.4	M J	0.5
1,2,3,4,7,8-HxCDF	34:01	<0.90	0.65	M J R	0.1
1,2,3,6,7,8-HxCDF	34:05	<1.1	0.62	M J R	0.1
2,3,4,6,7,8-HxCDF	34:26	1.51	0.64	M J B	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<0.71	0.71	U	0.1
1,2,3,4,6,7,8-HpCDF	35:50	2.67	0.44	M J	0.01
1,2,3,4,7,8,9-HpCDF	36:49	0.963	0.54	M J B	0.01
OCDF	38:29	<1.3	1.2	M J R	0.001

Field Spike Standards	% Rec	Limits
37C14-2,3,7,8-TCDD	27:49 102	70-130
13C12-1,2,3,4,7,8-HxCDD	34:30 98	70-130
13C12-2,3,4,7,8-PeCDF	32:13 106	70-130
13C12-1,2,3,4,7,8-HxCDF	34:00 105	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:49 104	70-130

Extraction Standards	% Rec	Limits
13C12-2,3,7,8-TCDD	27:46 74	40-130
13C12-1,2,3,7,8-PeCDD	32:24 121	40-130
13C12-1,2,3,6,7,8-HxCDD	34:34 65	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:27 61	25-130
13C12-OCDD	38:19 48	25-130
13C12-2,3,7,8-TCDF	26:25 71	40-130
13C12-1,2,3,7,8-PeCDF	31:36 104	40-130
13C12-1,2,3,6,7,8-HxCDF	34:05 66	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:49 57	25-130

Cleanup Standard	% Rec	Limits
13C12-1,2,3,7,8,9-HxCDF	34:57 68	40-130

Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	0	<0.87	0.87
Total-PeCDD	0	<1.7	1.7
Total-HxCDD	0	<0.80	0.80
Total-HpCDD	1	2.84	0.53
Total-TCDF	0	<1.5	1.5
Total-PeCDF	2	4.19	1.4
Total-HxCDF	2	4.15	0.71
Total-HpCDF	2	3.64	0.54

Toxic Equivalency NATO	pg
Lower Bound PCDD/F TEQ	1.45
Upper Bound PCDD/F TEQ	3.93

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
 M Indicates that a peak has been manually integrated.
 U Indicates that this compound was not detected above the MDL.
 J indicates that a target analyte was detected below the LQL.
 R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
 B Indicates that this target was detected in the blank at greater than 10% of the sample concentration.

ALS Environmental

Sample Analysis Report

Sample Name RUN 3 - 47536/H44573/H44574/H44580
ALS Sample ID L1020857-3
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 10-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
04-Jul-2011

Run Information

Run 1

Filename 1-110629A S:16
Run Date 29-Jun-11 19:13
Final Volume 20 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NATO
2,3,7,8-TCDD	NotFnd	<0.77	0.77	U	1
1,2,3,7,8-PeCDD	NotFnd	<1.4	1.4	U	0.5
1,2,3,4,7,8-HxCDD	NotFnd	<1.0	1.0	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<0.98	0.98	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<0.98	0.98	U	0.1
1,2,3,4,6,7,8-HpCDD	36:26	<1.7	0.56	M J R	0.01
OCDD	38:19	<11	1.7	J R	0.001
2,3,7,8-TCDF	NotFnd	<0.83	0.83	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<1.5	1.5	U	0.05
2,3,4,7,8-PeCDF	32:14	<1.5	1.5	U	0.5
1,2,3,4,7,8-HxCDF	NotFnd	<0.61	0.61	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<0.59	0.59	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<0.61	0.61	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<0.67	0.67	U	0.1
1,2,3,4,6,7,8-HpCDF	35:49	<0.70	0.49	M J R	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<0.60	0.60	U	0.01
OCDF	38:28	<1.2	1.1	M J R	0.001

Field Spike Standards

% Rec

Limits

37Cl4-2,3,7,8-TCDD	27:49	102	70-130
13C12-1,2,3,4,7,8-HxCDD	34:30	110	70-130
13C12-2,3,4,7,8-PeCDF	32:13	111	70-130
13C12-1,2,3,4,7,8-HxCDF	34:00	102	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:48	99	70-130

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD	27:46	81	40-130
13C12-1,2,3,7,8-PeCDD	32:24	104	40-130
13C12-1,2,3,6,7,8-HxCDD	34:34	59	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:27	59	25-130
13C12-OCDD	38:19	47	25-130
13C12-2,3,7,8-TCDF	26:25	78	40-130
13C12-1,2,3,7,8-PeCDF	31:36	96	40-130
13C12-1,2,3,6,7,8-HxCDF	34:05	65	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:49	58	25-130

Cleanup Standard

% Rec

13C12-1,2,3,7,8,9-HxCDF	34:57	67	40-130
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Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	0	<0.77	0.77
Total-PeCDD	0	<1.4	1.4
Total-HxCDD	0	<1.0	1.0
Total-HpCDD	1	2.58	0.56
Total-TCDF	0	<0.83	0.83
Total-PeCDF	0	<1.5	1.5
Total-HxCDF	0	<0.67	0.67
Total-HpCDF	0	<0.60	0.60

Toxic Equivalency NATO

pg

Lower Bound PCDD/F TEQ	0.00
Upper Bound PCDD/F TEQ	2.96

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 M Indicates that a peak has been manually integrated.
 U Indicates that this compound was not detected above the MDL.
 J Indicates that a target analyte was detected below the LQL.
 R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Laboratory Control Sample Analysis Report

Sample Name	Laboratory Control Sample	Sampling Date	n/a	Approved: C. de Haan --e-signature-- 04-Jul-2011
ALS Sample ID	WG1300786-2	Extraction Date	23-Jun-11	
Analysis Method	EPA M23	Sample Size	1 n/a	
Analysis Type	LCS	Percent Moisture	n/a	
Sample Matrix	QC	Split Ratio	2	

Run Information	Run 1
Filename	1-110629A S:3
Run Date	29-Jun-11 09:56
Final Volume	20 uL
Dilution Factor	1
Analysis Units	% Rec
Instrument - Column	HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	% Rec	Flags	Limits
2,3,7,8-TCDD	27:49	100		70-130
1,2,3,7,8-PeCDD	32:25	106		70-130
1,2,3,4,7,8-HxCDD	34:31	101		70-130
1,2,3,6,7,8-HxCDD	34:35	102		70-130
1,2,3,7,8,9-HxCDD	34:45	106		70-130
1,2,3,4,6,7,8-HpCDD	36:28	99		70-130
OCDD	38:20	104		70-130
2,3,7,8-TCDF	26:28	102		70-130
1,2,3,7,8-PeCDF	31:37	100		70-130
2,3,4,7,8-PeCDF	32:14	106		70-130
1,2,3,4,7,8-HxCDF	34:01	100		70-130
1,2,3,6,7,8-HxCDF	34:06	99		70-130
2,3,4,6,7,8-HxCDF	34:26	96		70-130
1,2,3,7,8,9-HxCDF	34:58	94		70-130
1,2,3,4,6,7,8-HpCDF	35:50	103		70-130
1,2,3,4,7,8,9-HpCDF	36:49	99		70-130
OCDF	38:30	109		70-130
Field Spike Standards		% Rec		Limits
37Cl4-2,3,7,8-TCDD		n/s		
13C12-1,2,3,4,7,8-HxCDD		n/s		
13C12-2,3,4,7,8-PeCDF		n/s		
13C12-1,2,3,4,7,8-HxCDF		n/s		
13C12-1,2,3,4,7,8,9-HpCDF		n/s		
Extraction Standards		% Rec		Limits
13C12-2,3,7,8-TCDD	27:47	54		40-130
13C12-1,2,3,7,8-PeCDD	32:24	63		40-130
13C12-1,2,3,6,7,8-HxCDD	34:34	41		40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:28	38		25-130
13C12-OCDD	38:19	31		25-130
13C12-2,3,7,8-TCDF	26:26	55		40-130
13C12-1,2,3,7,8-PeCDF	31:36	59		40-130
13C12-1,2,3,6,7,8-HxCDF	34:05	44		40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:49	39		25-130
Cleanup Standard		% Rec		
13C12-1,2,3,7,8,9-HxCDF	34:58	58		40-130

n/s Indicates that this compound was not spiked.



5420 Mainway Drive, Unit 5, Burlington ON, L7L 6A4
Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15779 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#: L1020857
Date of Sample Receipt: 20-Jun-11
Date of Report: 22-Jul-11

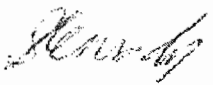
Client Name: ARI Environmental Inc.
Client Address: 1710 Preston Rd. Unit C
Pasadena, TX, 77503, U.S.

Client Contact: D. Fitzgerald
Client Project ID: Valero FCCU-1241

COMMENTS: Toxic PCB Congeners by GC/HRMS

Labeled ¹³C₁₂-PCB extraction standards were added after extraction. As a result values are not corrected for any losses incurred during extraction.

Certified by: _____


Steve Kennedy
Laboratory Manager

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	Method Blank	RUN 1 - 47653/H44557/H4 4558/H44559	RUN 2 - 47545/H44571/H4 4572/H44637	RUN 3 - 47536/H44573/H4 4574/H44580	FIELD BLANK - 47543/H44581/H4 4582/H44583	BLANK - 47596/H44587/H4 4588/H44589/H4 632
ALS Sample ID	WG1300786-1	L1020857-1	L1020857-2	L1020857-3	L1020857-4	L1020857-5
Sample Size	1	1	1	1	1	1
Sample units	train	train	train	train	train	train
Moisture Content	n/a	n/a	n/a	n/a	n/a	n/a
Matrix	qc	stack	stack	stack	stack	stack
Sampling Date	n/a	09-Jun-11	10-Jun-11	10-Jun-11	10-Jun-11	10-Jun-11
Extraction Date	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11
Target Analytes	pg/train	pg/train	pg/train	pg/train	pg/train	pg/train
PCB-81	<0.74	<0.52	<0.60	<0.40	<0.30	<0.49
PCB-77	<0.80	1.42	<1.2	<1.1	<0.81	<0.75
PCB-123	<0.47	<0.71	<0.77	<0.68	0.722	<0.51
PCB-118	<3.3	<7.1	<8.4	9.92	7.18	5.33
PCB-114	<0.43	<0.39	<0.46	<0.50	<0.30	<0.38
PCB-105	<1.3	2.91	3.98	<2.8	3.14	2.56
PCB-126	0.526	<0.39	<0.50	<1.5	<0.32	<0.59
PCB-167	<0.68	<0.67	<0.52	<0.48	<0.59	<0.63
PCB-156	<0.76	<0.71	<0.52	<0.88	<0.59	<0.65
PCB-157	<0.70	<0.70	0.859	<0.47	<0.60	<0.64
PCB-169	<0.71	<11	<12	<17	<15	<12
PCB-189	<0.44	<0.31	<0.38	<0.30	<0.25	<0.29

ALS Environmental

Laboratory Method Blank Analysis Report

Sample Name

ALS Sample ID

Analysis Method

Analysis Type

Sample Matrix

Method Blank

WG1300786-1

Mod. 1613B/1668A

Blank

qc

Sampling Date

23-Jun-11

Extraction Date

Sample Size

Percent Moisture

Split Ratio

n/a

23-Jun-11

1 train

n/a

1

Approved:

M. Ragavan

--e-signature--

21-Jul-2011

Run Information
Run 1

Filename

3-110720C S:5

Run Date

20-Jul-11 19:09

Final Volume

25 uL

Dilution Factor

1

Analysis Units

pg/train

Instrument - Column

HRMS-3 DB5MS #USB182112H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO (1998)
PCB-81	NotFnd	<0.74	0.74	U	0.0001
PCB-77	7:56	<0.80	0.80	M U	0.0001
PCB-123	NotFnd	<0.47	0.47	U	0.0001
PCB-118	8:22	<3.3	0.46	M J R	0.0001
PCB-114	NotFnd	<0.43	0.43	U	0.0005
PCB-105	8:50	<1.3	0.43	M J R	0.0001
PCB-126	9:27	0.526	0.50	M J	0.1
PCB-167	9:50	<0.68	0.68	U	0.00001
PCB-156	10:16	<0.76	0.76	M U	0.0005
PCB-157	NotFnd	<0.70	0.70	U	0.0005
PCB-169	NotFnd	<0.71	0.71	U	0.01
PCB-189	NotFnd	<0.44	0.44	U	0.0001

Extraction Standards	Ret. Time	% Rec	Limits
13C12-PCB-81	7:45	63	25-150
13C12-PCB-77	7:56	68	25-150
13C12-PCB-123	8:17	47	25-150
13C12-PCB-118	8:21	44	25-150
13C12-PCB-114	8:33	46	25-150
13C12-PCB-105	8:50	47	25-150
13C12-PCB-126	9:28	50	25-150
13C12-PCB-167	9:49	47	25-150
13C12-PCB-156	10:15	44	25-150
13C12-PCB-157	10:21	46	25-150
13C12-PCB-169	11:00	53	25-150
13C12-PCB-189	11:43	83	25-150

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample

M Indicates that a peak has been manually integrated

U Indicates that this compound was not detected above the EDL

J indicates that a target analyte was detected below the calibrated range but above the EDL

R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion

ALS Environmental

Sample Analysis Report

Sample Name RUN 1 - 47653/H44557/H44558/H44559
ALS Sample ID L1020857-1
Analysis Method Mod. 1613B/1668A
Analysis Type Sample
Sample Matrix stack

Sampling Date 09-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 train
Percent Moisture n/a
Split Ratio 1

Approved:
M. Ragavan
 --e-signature--
 21-Jul-2011

Run Information

Run 1

Filename 3-110720C S:18
Run Date 20-Jul-11 23:33
Final Volume 25 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-3 DB5MS #USB182112H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO (1998)
PCB-81	7:45	<0.52	0.52	M U	0.0001
PCB-77	7:56	1.42	0.51	J	0.0001
PCB-123	8:16	<0.71	0.45	M J R	0.0001
PCB-118	8:22	<7.1	0.39	J R	0.0001
PCB-114	NotFnd	<0.39	0.39	U	0.0005
PCB-105	8:50	2.91	0.37	J	0.0001
PCB-126	NotFnd	<0.39	0.39	U	0.1
PCB-167	NotFnd	<0.67	0.67	U	0.00001
PCB-156	10:16	<0.71	0.71	U R	0.0005
PCB-157	10:21	<0.70	0.70	M U	0.0005
PCB-169	11:02	<11	0.80	J R	0.01
PCB-189	NotFnd	<0.31	0.31	U	0.0001

Extraction Standards		% Rec	Limits
13C12-PCB-81	7:45	68	25-150
13C12-PCB-77	7:56	75	25-150
13C12-PCB-123	8:17	52	25-150
13C12-PCB-118	8:21	51	25-150
13C12-PCB-114	8:33	50	25-150
13C12-PCB-105	8:49	54	25-150
13C12-PCB-126	9:28	63	25-150
13C12-PCB-167	9:49	62	25-150
13C12-PCB-156	10:15	61	25-150
13C12-PCB-157	10:21	59	25-150
13C12-PCB-169	11:00	61	25-150
13C12-PCB-189	11:43	89	25-150

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample

M Indicates that a peak has been manually integrated

U Indicates that this compound was not detected above the EDL

J indicates that a target analyte was detected below the calibrated range but above the EDL

R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name RUN 2 - 47545/H44571/H44572/H44637
ALS Sample ID L1020857-2
Analysis Method Mod. 1613B/1668A
Analysis Type Sample
Sample Matrix stack

Sampling Date 10-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 train
Percent Moisture n/a
Split Ratio 1

Approved:
M. Ragavan
 --e-signature--
 21-Jul-2011

Run Information

Run 1

Filename 3-110720C S:19
Run Date 20-Jul-11 23:53
Final Volume 25 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-3 DB5MS #USB182112H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO (1998)
PCB-81	NotFnd	<0.60	0.60	U	0.0001
PCB-77	7:56	<1.2	0.67	M J R	0.0001
PCB-123	8:16	<0.77	0.51	J R	0.0001
PCB-118	8:22	<8.4	0.48	J R	0.0001
PCB-114	NotFnd	<0.46	0.46	U	0.0005
PCB-105	8:50	3.98	0.45	J	0.0001
PCB-126	9:28	<0.50	0.50	M U R	0.1
PCB-167	NotFnd	<0.52	0.52	U	0.00001
PCB-156	10:16	<0.52	0.52	U R	0.0005
PCB-157	10:21	0.859	0.52	J	0.0005
PCB-169	11:02	<12	0.55	J R	0.01
PCB-189	11:43	<0.38	0.38	M U	0.0001

Extraction Standards	% Rec	Limits
13C12-PCB-81	7:45 70	25-150
13C12-PCB-77	7:56 74	25-150
13C12-PCB-123	8:17 53	25-150
13C12-PCB-118	8:21 49	25-150
13C12-PCB-114	8:33 51	25-150
13C12-PCB-105	8:49 54	25-150
13C12-PCB-126	9:28 58	25-150
13C12-PCB-167	9:49 59	25-150
13C12-PCB-156	10:15 61	25-150
13C12-PCB-157	10:21 60	25-150
13C12-PCB-169	11:00 65	25-150
13C12-PCB-189	11:43 95	25-150

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample

M Indicates that a peak has been manually integrated

U Indicates that this compound was not detected above the EDL

J indicates that a target analyte was detected below the calibrated range but above the EDL

R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name RUN 3 - 47536/H44573/H44574/H44580
ALS Sample ID L1020857-3
Analysis Method Mod. 1613B/1668A
Analysis Type Sample
Sample Matrix stack

Sampling Date 10-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 train
Percent Moisture n/a
Split Ratio 1

Approved:
M. Ragavan
--e-signature--
 21-Jul-2011

Run Information

Run 1

Filename 3-110720C S:20
Run Date 21-Jul-11 00:13
Final Volume 25 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-3 DB5MS #USB182112H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO (1998)
PCB-81	NotFnd	<0.40	0.40	U	0.0001
PCB-77	7:56	<1.1	0.44	M J R	0.0001
PCB-123	8:16	<0.68	0.32	M J R	0.0001
PCB-118	8:22	9.92	0.28	M J	0.0001
PCB-114	8:33	<0.50	0.30	M J R	0.0005
PCB-105	8:50	<2.8	0.30	M J R	0.0001
PCB-126	9:28	<1.5	0.30	M J R	0.1
PCB-167	9:50	<0.48	0.48	M U R	0.00001
PCB-156	10:16	<0.88	0.49	M J R	0.0005
PCB-157	10:21	<0.47	0.47	U	0.0005
PCB-169	11:03	<17	0.52	R	0.01
PCB-189	NotFnd	<0.30	0.30	U	0.0001

Extraction Standards		% Rec	Limits
13C12-PCB-81	7:45	76	25-150
13C12-PCB-77	7:56	79	25-150
13C12-PCB-123	8:17	48	25-150
13C12-PCB-118	8:21	48	25-150
13C12-PCB-114	8:33	49	25-150
13C12-PCB-105	8:50	48	25-150
13C12-PCB-126	9:28	54	25-150
13C12-PCB-167	9:49	53	25-150
13C12-PCB-156	10:15	54	25-150
13C12-PCB-157	10:21	55	25-150
13C12-PCB-169	11:00	58	25-150
13C12-PCB-189	11:43	91	25-150

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample

M Indicates that a peak has been manually integrated

U Indicates that this compound was not detected above the EDL

J indicates that a target analyte was detected below the calibrated range but above the EDL

R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name FIELD BLANK - 47543/H44581/H44582/H44583
ALS Sample ID L1020857-4
Analysis Method Mod. 1613B/1668A
Analysis Type Sample
Sample Matrix stack

Sampling Date 10-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 train
Percent Moisture n/a
Split Ratio 1

Approved:
M. Ragavan
--e-signature--
21-Jul-2011

Run Information **Run 1**
Filename 3-110720C S:21
Run Date 21-Jul-11 00:34
Final Volume 25 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-3 DB5MS #USB182112H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO (1998)
PCB-81	NotFnd	<0.30	0.30	U	0.0001
PCB-77	7:56	<0.81	0.32	M J R	0.0001
PCB-123	8:16	0.722	0.37	M J	0.0001
PCB-118	8:22	7.18	0.31	J	0.0001
PCB-114	8:33	<0.30	0.30	M U	0.0005
PCB-105	8:50	3.14	0.32	J	0.0001
PCB-126	9:27	<0.32	0.32	M U R	0.1
PCB-167	9:49	<0.59	0.59	M U	0.00001
PCB-156	10:15	<0.59	0.59	M U R	0.0005
PCB-157	10:22	<0.60	0.60	M U	0.0005
PCB-169	11:03	<15	0.64	R	0.01
PCB-189	NotFnd	<0.25	0.25	U	0.0001

Extraction Standards	% Rec	Limits
13C12-PCB-81	7:45 75	25-150
13C12-PCB-77	7:56 80	25-150
13C12-PCB-123	8:17 52	25-150
13C12-PCB-118	8:21 53	25-150
13C12-PCB-114	8:33 55	25-150
13C12-PCB-105	8:50 54	25-150
13C12-PCB-126	9:28 62	25-150
13C12-PCB-167	9:49 58	25-150
13C12-PCB-156	10:15 60	25-150
13C12-PCB-157	10:21 58	25-150
13C12-PCB-169	11:00 63	25-150
13C12-PCB-189	11:43 88	25-150

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample

M Indicates that a peak has been manually integrated

U Indicates that this compound was not detected above the EDL

J indicates that a target analyte was detected below the calibrated range but above the EDL

R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name BLANK - 47596/H44587/H44588/H44589/H44632
ALS Sample ID L1020857-5
Analysis Method Mod. 1613B/1668A
Analysis Type Sample
Sample Matrix stack

Sampling Date 10-Jun-11
Extraction Date 23-Jun-11
Sample Size 1 train
Percent Moisture n/a
Split Ratio 1

Approved:
M. Ragavan
 --e-signature--
 21-Jul-2011

Run Information

Run 1

Filename 3-110720C S:22
Run Date 21-Jul-11 00:54
Final Volume 25 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-3 DB5MS #USB182112H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO (1998)
PCB-81	NotFnd	<0.49	0.49	U	0.0001
PCB-77	7:56	<0.75	0.50	M J R	0.0001
PCB-123	8:17	<0.51	0.42	M J R	0.0001
PCB-118	8:22	5.33	0.42	M J	0.0001
PCB-114	8:32	<0.38	0.38	U R	0.0005
PCB-105	8:50	2.56	0.40	J	0.0001
PCB-126	9:29	<0.59	0.40	M J R	0.1
PCB-167	NotFnd	<0.63	0.63	U	0.00001
PCB-156	NotFnd	<0.65	0.65	U	0.0005
PCB-157	NotFnd	<0.64	0.64	U	0.0005
PCB-169	11:02	<12	0.64	J R	0.01
PCB-189	NotFnd	<0.29	0.29	U	0.0001

Extraction Standards	% Rec	Limits
13C12-PCB-81	7:45 70	25-150
13C12-PCB-77	7:56 76	25-150
13C12-PCB-123	8:17 48	25-150
13C12-PCB-118	8:21 46	25-150
13C12-PCB-114	8:33 48	25-150
13C12-PCB-105	8:49 48	25-150
13C12-PCB-126	9:28 57	25-150
13C12-PCB-167	9:48 55	25-150
13C12-PCB-156	10:15 57	25-150
13C12-PCB-157	10:21 55	25-150
13C12-PCB-169	11:00 64	25-150
13C12-PCB-189	11:43 93	25-150

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample

M Indicates that a peak has been manually integrated

U Indicates that this compound was not detected above the EDL

J indicates that a target analyte was detected below the calibrated range but above the EDL

R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Laboratory Control Sample Analysis Report

Sample Name
ALS Sample ID
Analysis Method
Analysis Type
Sample Matrix

Laboratory Control Sample
WG1300786-2
Mod. 1613B/1668A
LCS
qc

Sampling Date
Extraction Date
Sample Size
Percent Moisture
Split Ratio

n/a
23-Jun-11
1 n/a
n/a
1

Approved:
M. Ragavan
--e-signature--
21-Jul-2011

Run Information

Run 1

Filename
Run Date
Final Volume
Dilution Factor
Analysis Units
Instrument - Column

3-110720C S:2
20-Jul-11 18:09
25 uL
1
% Rec
HRMS-3 DB5MS #USB182112H

Target Analytes	Ret. Time	% Rec	Flags	Limits
PCB-81	7:46	89		50-150
PCB-77	7:56	90		50-150
PCB-123	8:18	99		50-150
PCB-118	8:22	103		50-150
PCB-114	8:34	96		50-150
PCB-105	8:50	93		50-150
PCB-126	9:29	94		50-150
PCB-167	9:50	96		50-150
PCB-156	10:16	100		50-150
PCB-157	10:21	97		50-150
PCB-169	11:01	95		50-150
PCB-189	11:44	86		50-150
Extraction Standards		% Rec		Limits
13C12-PCB-81	7:45	60		30-140
13C12-PCB-77	7:56	62		30-140
13C12-PCB-123	8:17	42		30-140
13C12-PCB-118	8:21	42		30-140
13C12-PCB-114	8:33	45		30-140
13C12-PCB-105	8:50	46		30-140
13C12-PCB-126	9:28	51		30-140
13C12-PCB-167	9:49	47		30-140
13C12-PCB-156	10:15	49		30-140
13C12-PCB-157	10:21	50		30-140
13C12-PCB-169	11:00	55		30-140
13C12-PCB-189	11:43	75		30-140



ANALYTICAL REPORT

Project Name: FCCU WGS 3 Runs
Project Number: HS 453-314
Sample Location: Port Arthur, TX
Sample Date: 6/8/2011 & 6/9/11
Analysis Date: 6/10/11 & 6/11/11
Analytical Method: M-18 Methane & Ethane GC/FID

Prepared For:

ARI Environmental, Inc.
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Wauconda, IL 60084-1289
Project Manager: Dan Fitzgerald
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Prepared By:

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E-mail: jpresley@arienv.com

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- This report shall not be reproduced, except in full, without the expressed written approval of ARI Environmental, Inc.

ARI Environmental, Inc. Texas NELAP ID: T104704428-10-2



PROJECT NARRATIVE

This report contains the results of analyses performed on samples received under the project name referenced on the cover page and identified with the ARI Project Number HS 453-314. All analytical results reported under this report number apply only to the samples as received and properly identified in the signed chain-of-custody. The original chain of custody documentation is included with this report.

The samples were caught at Valero in Port Arthur, TX and received in good condition. They were logged in on 6/9/2011 and analyzed at the ARI Environmental, Inc. laboratory located in Pasadena, TX on 6/10/2011 & 6/11/11.

Unless otherwise noted in this project narrative, all test results reported in this analytical report meet all requirements of the NELAC standards and all requirements set forth in the applicable USEPA reference methods.


This report will be filed for a minimum of five years after which it may be destroyed without further notice, unless otherwise arranged by the sponsoring client. The samples received and described in this report will be filed for 60 days after which they may be properly disposed without further notice, unless otherwise arranged by the sponsoring client.

Sample Receipt Quality Assurance:

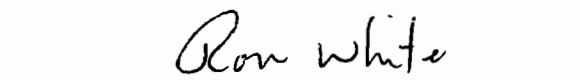
Unless otherwise noted, all sample receipt criteria listed on the ARI Sample Receipt Checklist were met.

Analytical Quality Assurance:

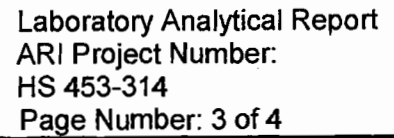
Unless otherwise noted, all sample analyses met the procedural requirements and QA/QC criteria contained in the test method(s), associated analytical standard operating procedure(s), and, where applicable, the project test plan.


Signature: Jim Presley, Senior Chemist

6-13-11
Date


Signature: Ron White, Lab Manager

6-22-2011
Date

[illegible]

- The analytical results of the samples listed above are presented on the following pages.

- All calculations are performed before rounding to avoid round-off errors in final results.
- Results noted as "ND" were not detected below the stated limit.
- This report shall not be reproduced, except in full, without the expressed written approval of ARI Environmental, Inc.



DATA FLAGGING CRITERIA

- X** Quality control deficiency observed and flagged as noted.
- B** A target analyte or common lab contaminant was identified in the blank which may indicate field or lab contamination.
- D** The sample(s) required dilution due to analyte detection over the highest calibration point. Test results are from a diluted sample.
- E** The results are reported as estimated since the data exceeds the upper calibration limit.
- J** Analyte was identified, but below the limit of quantitation (LOQ).
- U** Analyte was not detected (below the limit of detection).
- T** Sample(s) analyzed outside of maximum recommended holding time.

Client Valero
Location Port Arthur TX
Sample Date 6/8/11 & 6/9/11
Analysis Date 6/10/11 Samples, 6/11/11 Recovery Study
Project No: HS 453-314



M-18 Analysis Summary

<u>Lab No:</u>	<u>Sample No:</u>	<u>Description</u>	<u>Methane ppmv</u>	<u>Ethane ppmv</u>
H0611036	H44531	FCCU WGS M-18 Run 1	1.2	<1.0
H0611037	H44532	FCCU WGS M-18 Run 2	1.1	<1.0
H0611038	H44533	FCCU WGS M-18 Run 3	1.0	<1.0

M-18 Bias Calculations

<u>Lab No:</u>	<u>Sample No:</u>	<u>Description</u>	<u>Methane Analysis ppmv</u>	<u>Ethane Analysis ppmv</u>	<u>Methane % Rec</u>	<u>Ethane % Rec</u>	<u>Methane Recovery Correction</u>	<u>Ethane Recovery Correction</u>	<u>Moisture Correction</u>	<u>M-18 Methane ppmv</u>	<u>M-18 Ethane ppmv</u>
H0611036	H44531	FCCU WGS M-18 Run 1	1.1	0.0	109.9	101.6	1.00	1.00	0.9781	1.2	0.0
H0611037	H44532	FCCU WGS M-18 Run 2	1.1	0.0	109.9	101.6	1.00	1.00	0.9781	1.1	0.0
H0611038	H44533	FCCU WGS M-18 Run 3	0.98	0.0	109.9	101.6	1.00	1.00	0.9781	1.0	0.0
		MDL (Lowest Cal STD)	1.00	1.00	109.9	101.6	1.00	1.00	0.9781	1.02	1.02

Client
Location
Project No:

Valero
Port, Arthur, Tx
HS 453-314

Raw M-18 Analysis Results

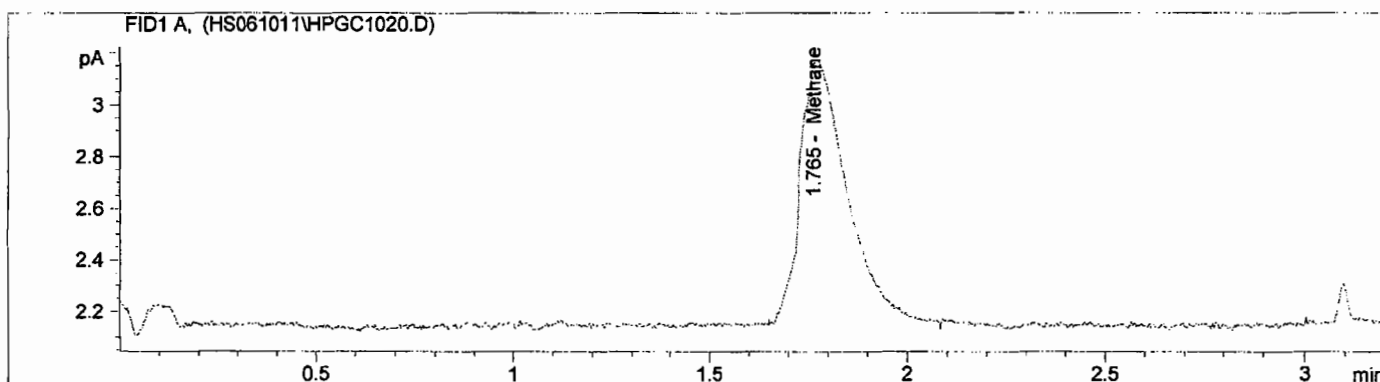
<u>Run Description</u>	<u>Lab No:</u>	<u>Sample No:</u>	<u>Methane ppmv</u>	<u>Ethane ppmv</u>
FCCU WGS R-1	H0611036	44531	1.2	0.0
FCCU WGS R-1	H0611036	44531	1.1	0.0
FCCU WGS R-1	H0611036	44531	1.1	0.0
Ave = 1.1				0.0
FCCU WGS R-2	H0611037	44532	0.87	0.0
FCCU WGS R-2	H0611037	44532	1.2	0.0
FCCU WGS R-2	H0611037	44532	1.2	0.0
Ave = 1.1				0.0
FCCU WGS R-3	H0611038	44533	0.98	0.0
FCCU WGS R-3	H0611038	44533	0.96	0.0
FCCU WGS R-3	H0611038	44533	0.99	0.0
Ave = 0.98				0.0
FCCU WGS R-3 Spike	H0611038	44533	6.4	5.1
FCCU WGS R-3 Spike	H0611038	44533	6.4	5.0
FCCU WGS R-3 Spike	H0611038	44533	6.4	5.1
Ave = 6.4				5.1
Recovered ppmv = 5.5				5.1
% Recovery = 109.9				101.6

FCCU WGS Run 1 Sampled 6-8-11

Lab No: H0611036 Sample No: 44531

No Dilution

```
=====
Injection Date   : 6/10/2011 6:38:23 PM
Sample Name      : FCCU R-1
Acq. Operator    : JP
Acq. Instrument  : Instrument 1
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/10/2011 6:44:14 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/10/2011 6:44:16 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.765	PP	8.45364	1.34730e-1	1.13896		Methane
2.170		-	-	-		Ethane

Totals : 1.13896

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

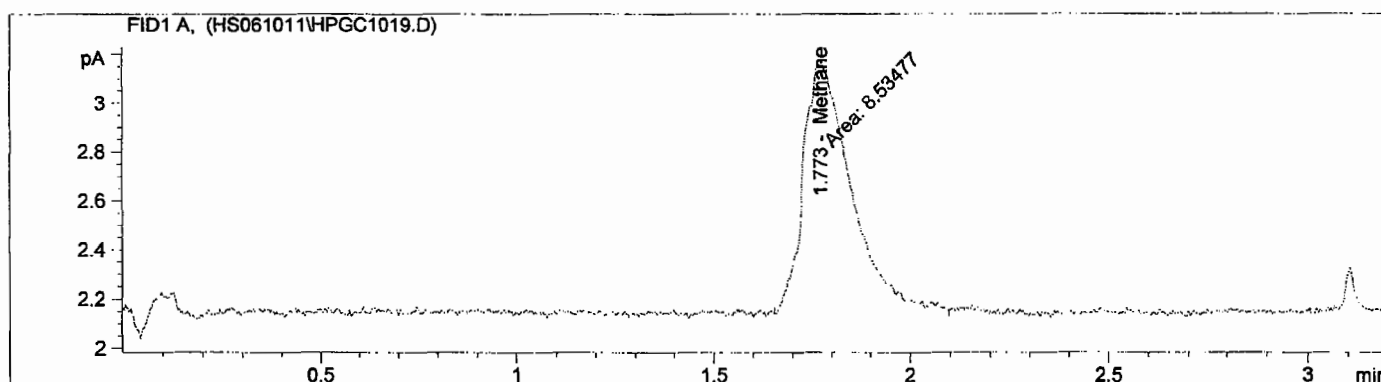
*** End of Report ***

FCCU WGS Run 1 Sampled 6-8-11

Lab No: H0611036 Sample No: 44531

No Dilution

=====
Injection Date : 6/10/2011 6:34:21 PM
Sample Name : FCCU R-1 Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 6:30:57 PM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 6:18:53 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.773	MM	8.53477	1.34730e-1	1.14989		Methane
2.170		-	-	-		Ethane

Totals : 1.14989

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

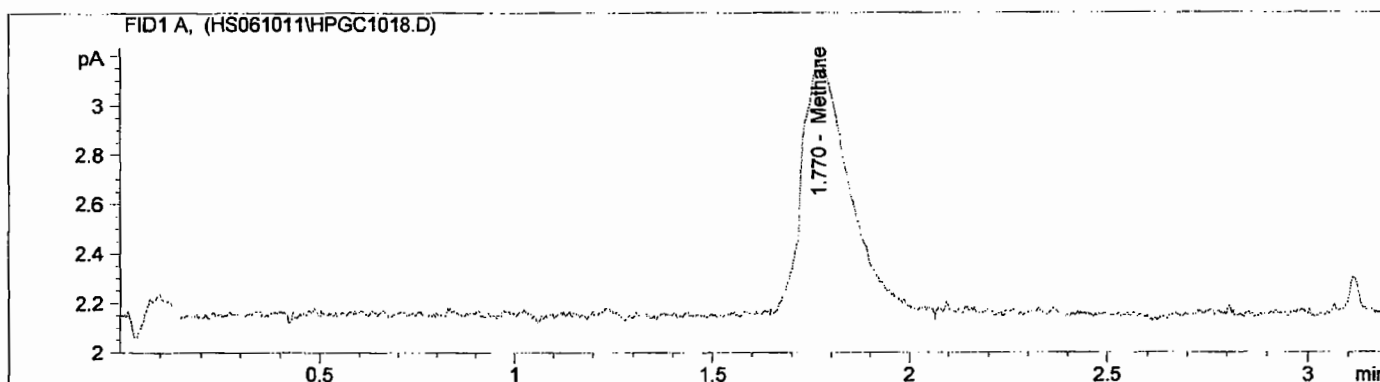
=====
*** End of Report ***
=====

FCCU WGS Run 1 Sampled 6-8-11

Lab No: H0611036 Sample No: 44531

No Dilution

```
=====
Injection Date   : 6/10/2011 6:29:57 PM
Sample Name      : FCCU R-1                      Location : -
Acq. Operator    : JP                          Inj : 1
Acq. Instrument  : Instrument 1                  Inj Volume : Manually
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/10/2011 6:30:57 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/10/2011 6:18:53 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.770	PP	8.55411	1.34730e-1	1.15250		Methane
2.170		-	-	-		Ethane

Totals : 1.15250

Results obtained with enhanced integrator!

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

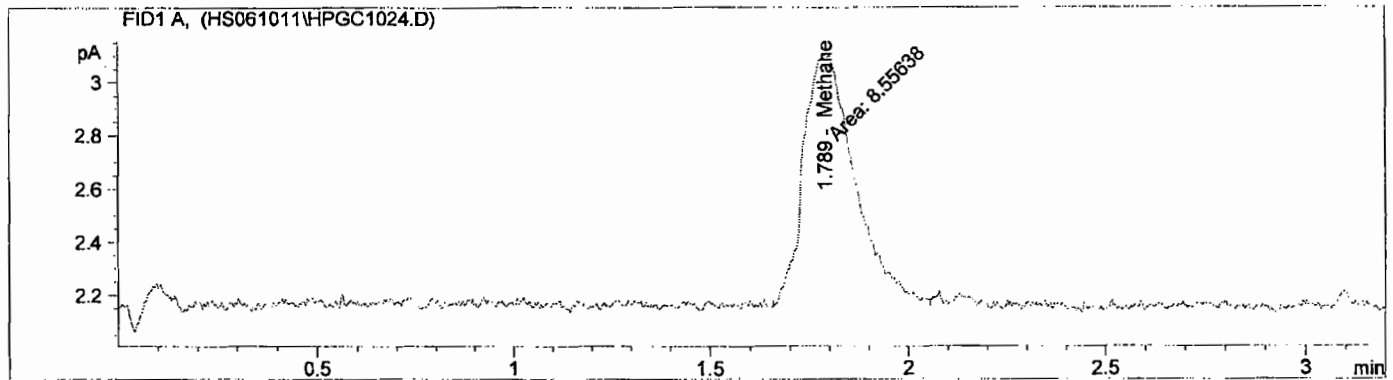
*** End of Report ***

FCCU WGS Run 2 Sampled 6-8-11

Lab No: H0611037 Sample No: 44532

No Dilution

```
=====
Injection Date   : 6/10/2011 6:50:46 PM
Sample Name      : FCCU R-2
Acq. Operator    : JP
Acq. Instrument  : Instrument 1
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/10/2011 6:44:14 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/10/2011 6:44:16 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.789	MM	8.55638	1.34730e-1	1.15280		Methane
2.170		-	-	-		Ethane

Totals : 1.15280

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

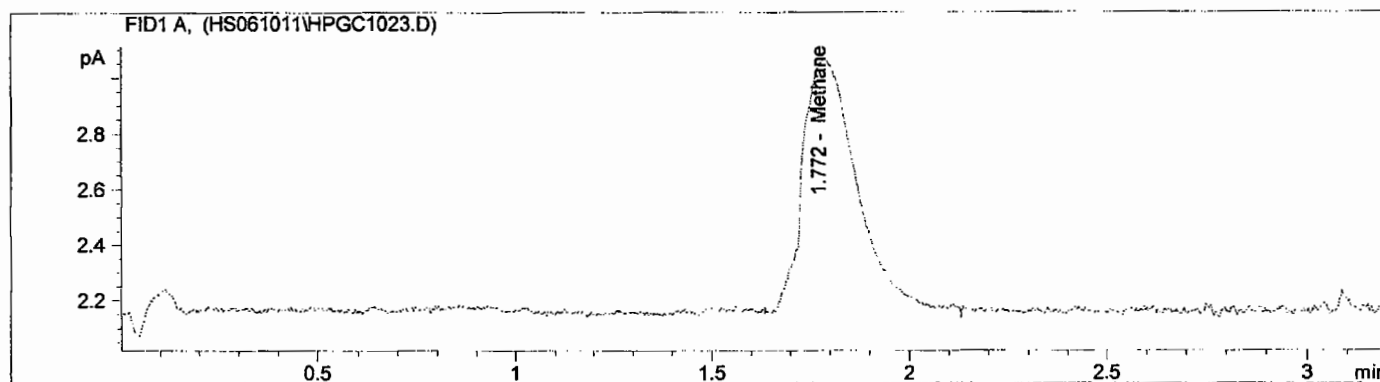
*** End of Report ***

FCCU WGS Run 2 Sampled 6-8-11

Lab No: H0611037 Sample No: 44532

No Dilution

```
=====
Injection Date   : 6/10/2011 6:47:01 PM
Sample Name     : FCCU R-2                      Location :   -
Acq. Operator   : JP                          Inj       :   1
Acq. Instrument : Instrument 1                  Inj Volume : Manually
Acq. Method     : C:\HPCHEM\1\METHODS\METHANE.M
Last changed    : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed    : 6/10/2011 6:44:14 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/10/2011 6:44:16 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.772	PP	8.67304	1.34730e-1	1.16852		Methane
2.170		-	-	-		Ethane

Totals : 1.16852

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

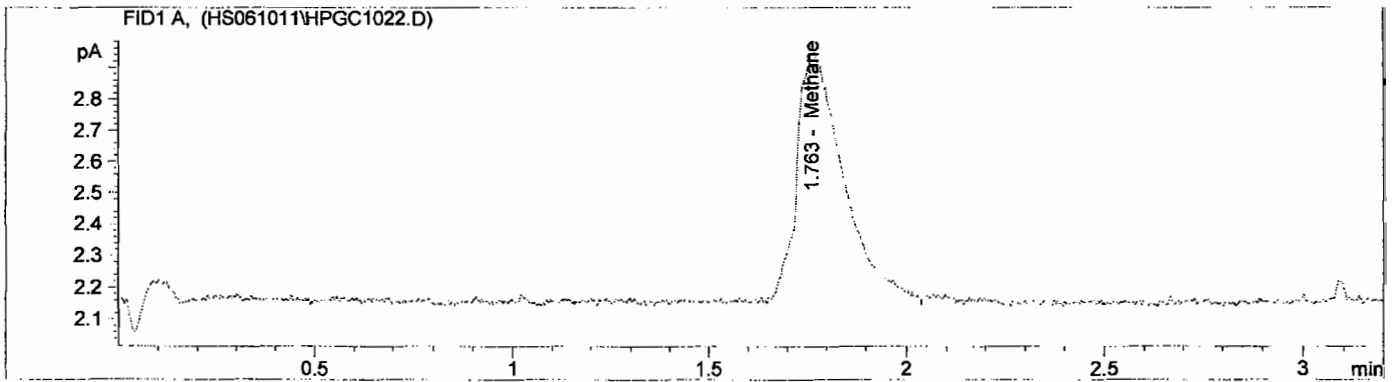
*** End of Report ***

FCCU WGS Run 2 Sampled 6-8-11

Lab No: H0611037 Sample No: 44532

No Dilution

```
=====
Injection Date   : 6/10/2011 6:42:53 PM
Sample Name      : FCCU R-2                      Location : -
Acq. Operator    : JP                          Inj : 1
Acq. Instrument  : Instrument 1                  Inj Volume : Manually
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/10/2011 6:44:14 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/10/2011 6:44:16 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.763	PP	6.45282	1.34730e-1	8.69389e-1		Methane
2.170		-	-	-		Ethane

Totals : 8.69389e-1

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

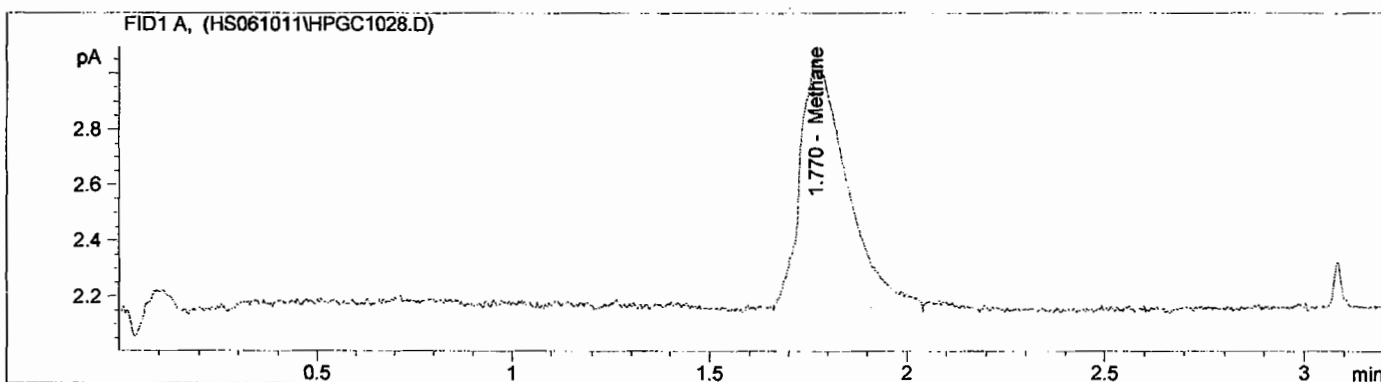
*** End of Report ***

FCCU WGS Run 3 Sampled 6-9-11

Lab No: H0611038 Sample No: 44533

No Dilution

=====
Injection Date : 6/10/2011 7:06:25 PM
Sample Name : FCCU R-3 Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 6:44:14 PM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 6:44:16 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.770	PP	7.38233	1.34730e-1	9.94622e-1		Methane
2.170		-	-	-		Ethane

Totals : 9.94622e-1

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

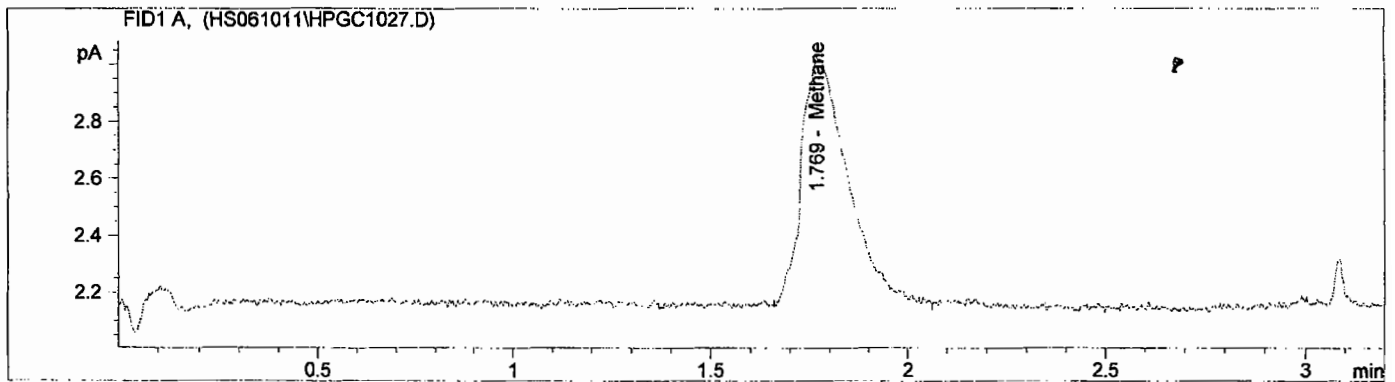
=====
*** End of Report ***
=====

FCCU WGS Run 3 Sampled 6-9-11

Lab No: H0611038 Sample No: 44533

No Dilution

```
=====
Injection Date   : 6/10/2011 7:02:44 PM
Sample Name      : FCCU R-3                Location : -
Acq. Operator    : JP                      Inj       : 1
Acq. Instrument  : Instrument 1             Inj Volume : Manually
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/10/2011 6:44:14 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/10/2011 6:44:16 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.769	BP	7.13734	1.34730e-1	9.61615e-1		Methane
2.170		-	-	-		Ethane

Totals : 9.61615e-1

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

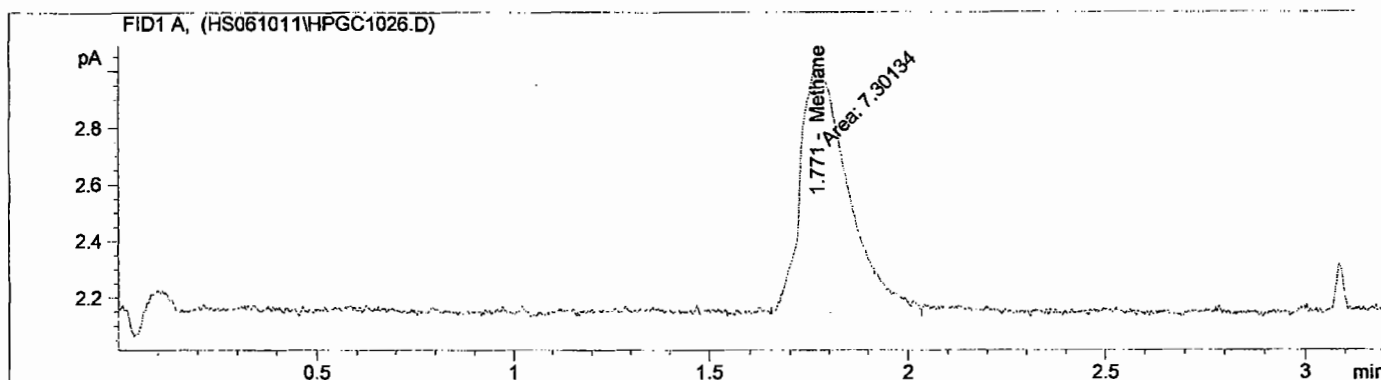
*** End of Report ***

FCCU WGS Run 3 Sampled 6-9-11

Lab No: H0611038 Sample No: 44533

No Dilution

=====
Injection Date : 6/10/2011 6:58:56 PM
Sample Name : FCCU R-3 Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 6:44:14 PM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 6:44:16 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.771	MM	7.30134	1.34730e-1	9.83712e-1		Methane
2.170		-	-	-		Ethane

Totals : 9.83712e-1

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

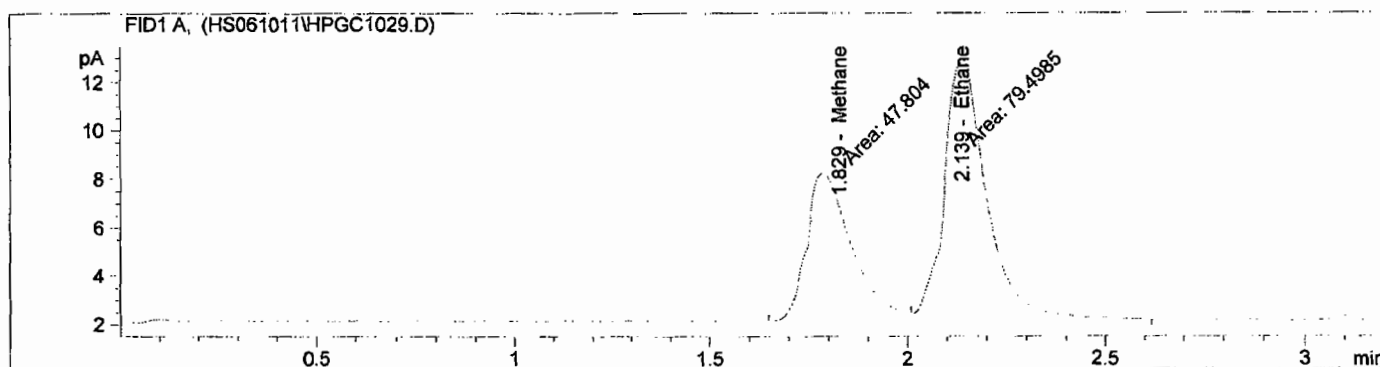
=====
*** End of Report ***
=====

FCCU WGS Run 3 Spike Sampled 6-9-11

Spiked 6/10/11 @ 8:00 pm

Lab No: H0611038 Sample No: 44533
1520 ml Sample * 80.0 ml STD @ 100 ppmv
Cylinder No: EB-0029967

=====
Injection Date : 6/11/2011 6:16:26 PM
Sample Name : FCCU R-3 Spike Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/11/2011 6:21:37 PM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:21:41 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.829	MF	47.80400	1.34730e-1	6.44064		Methane
2.139	FM	79.49850	6.41801e-2	5.10222		Ethane

Totals : 11.54286

Results obtained with enhanced integrator!

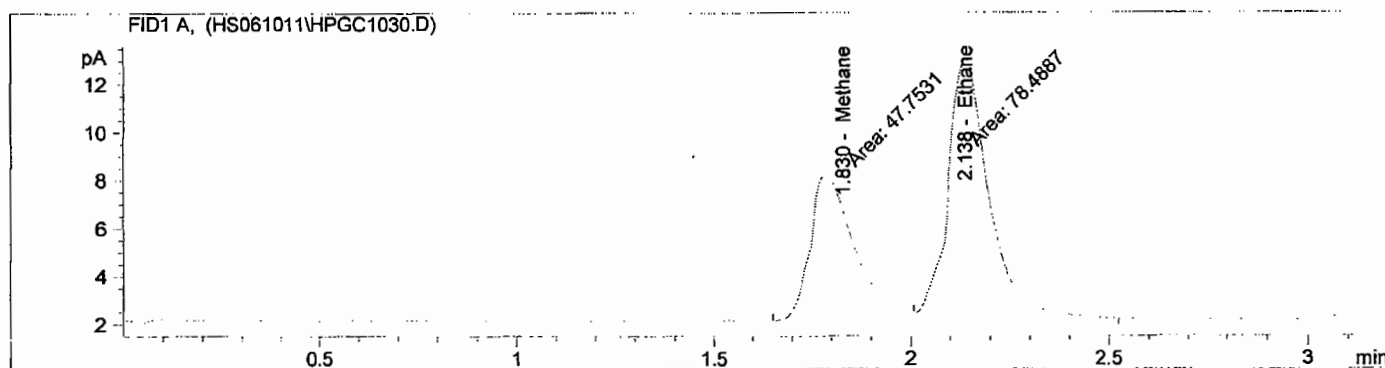
=====
*** End of Report ***

FCCU WGS Run 3 Spike Sampled 6-9-11

Spiked 6/10/11 @ 8:00 pm

Lab No: H0611038 Sample No: 44533
1520 ml Sample * 80.0 ml STD @ 100 ppmv
Cylinder No: EB-0029967

```
=====
Injection Date   : 6/11/2011 6:20:08 PM
Sample Name      : FCCU R-3 Spike          Location : -
Acq. Operator    : JP                      Inj       : 1
Acq. Instrument  : Instrument 1            Inj Volume : Manually
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/11/2011 6:21:37 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/11/2011 6:21:41 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.830	MF	47.75311	1.34730e-1	6.43379		Methane
2.138	FM	78.48868	6.41801e-2	5.03741		Ethane

Totals : 11.47120

Results obtained with enhanced integrator!

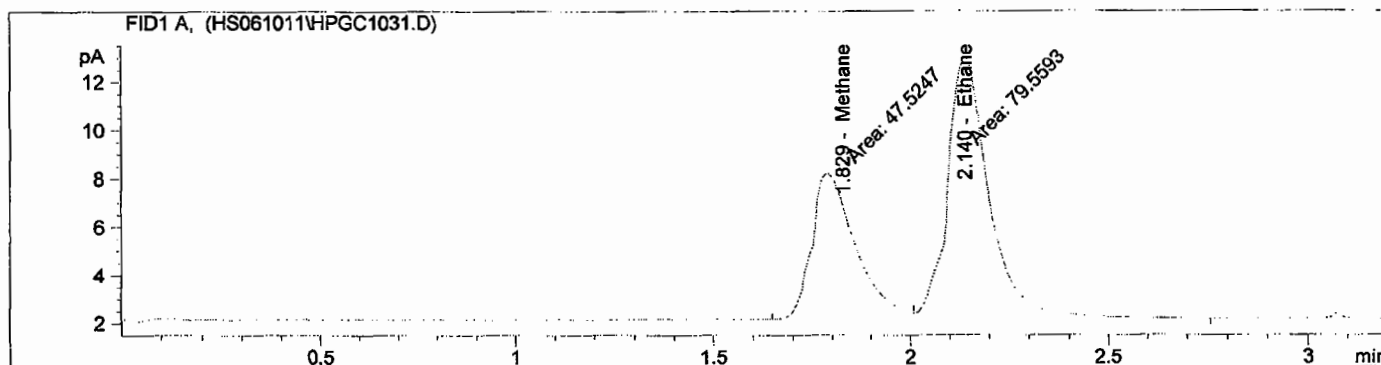
*** End of Report ***

FCCU WGS Run 3 Spike Sampled 6-9-11

Spiked 6/10/11 @ 8:00 pm

Lab No: H0611038 Sample No: 44533
1520 ml Sample * 80.0 ml STD @ 100 ppmv
Cylinder No: EB-0029967

```
=====
Injection Date   : 6/11/2011 6:23:49 PM
Sample Name      : FCCU R-3 Spike          Location   : -
Acq. Operator    : JP                     Inj         : 1
Acq. Instrument  : Instrument 1            Inj Volume  : Manually
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/11/2011 6:21:37 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
=====
Sorted By       : Signal
Calib. Data Modified : 6/11/2011 6:21:41 PM
Multiplier      : 1.0000
Dilution        : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.829	MF	47.52468	1.34730e-1	6.40301		Methane
2.140	FM	79.55928	6.41801e-2	5.10612		Ethane

Totals : 11.50913

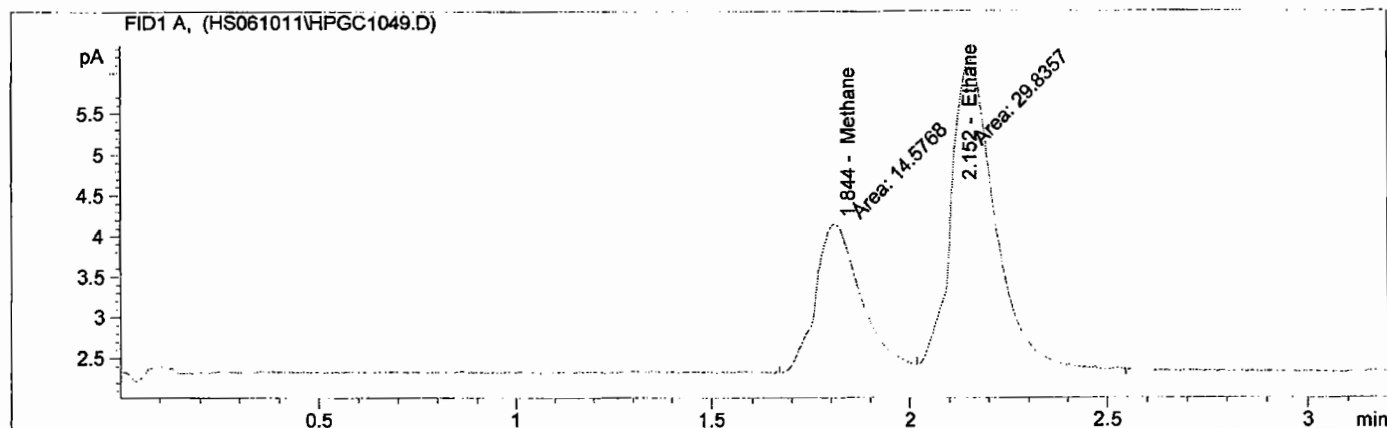
Results obtained with enhanced integrator!

*** End of Report ***

Precision & Accuracy Study 6/13/11

<u>Run Description</u>	<u>Methane ppmv</u>	<u>Ethane ppmv</u>
2.0 ppmv LCS 1	1.96	1.90
2.0 ppmv LCS 1	1.99	1.88
2.0 ppmv LCS 1	1.98	1.91
	Ave = 1.98	1.89
2.0 ppmv LCS 2	1.97	1.92
2.0 ppmv LCS 2	1.95	1.90
2.0 ppmv LCS 2	1.96	1.92
	Ave = 1.96	1.91
2.0 ppmv LCS 3	1.96	1.88
2.0 ppmv LCS 3	1.96	1.87
2.0 ppmv LCS 3	1.97	1.90
	Ave = 1.96	1.88
2.0 ppmv LCS 4	1.98	1.90
2.0 ppmv LCS 4	1.97	1.92
2.0 ppmv LCS 4	1.96	1.91
	Ave = 1.97	1.91
	Mean (ppmv) = 1.97	1.90
	SDEV = 0.0067	0.0148
	99% t- Factor = 4.541	
	Variance = 0.0305	0.0670
	99% UCL(ppmv) = 2.00	1.97
	99% LCL(ppmv) = 1.94	1.83
	99% UCL(% of True) = 99.9	98.3
	99% LCL(% of True) = 96.8	91.6

=====
Injection Date : 6/13/2011 12:36:00 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

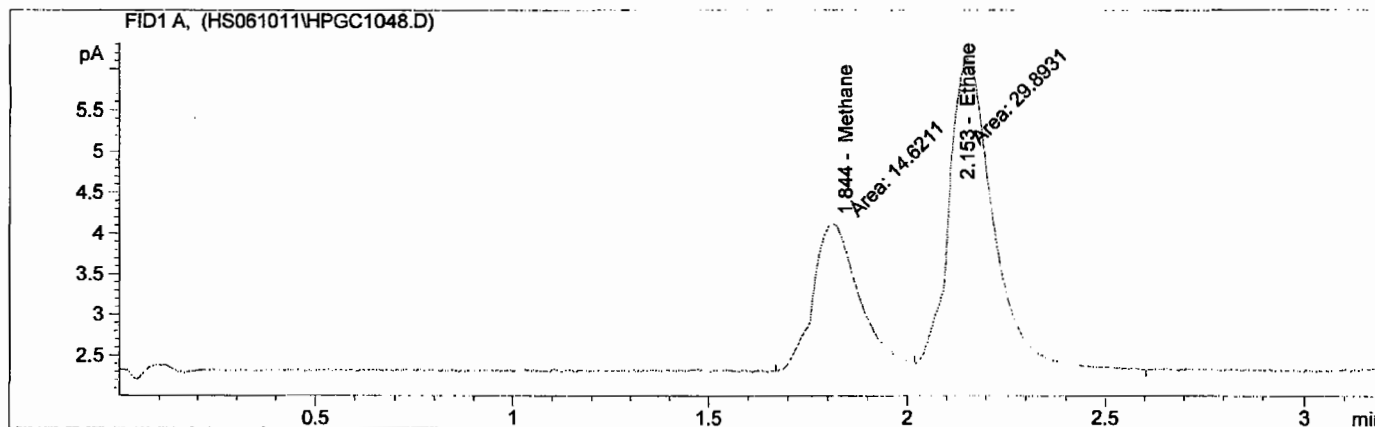
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.844	MF	14.57684	1.34730e-1	1.96394		Methane
2.152	FM	29.83566	6.41801e-2	1.91485		Ethane

Totals : 3.87880

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:32:20 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

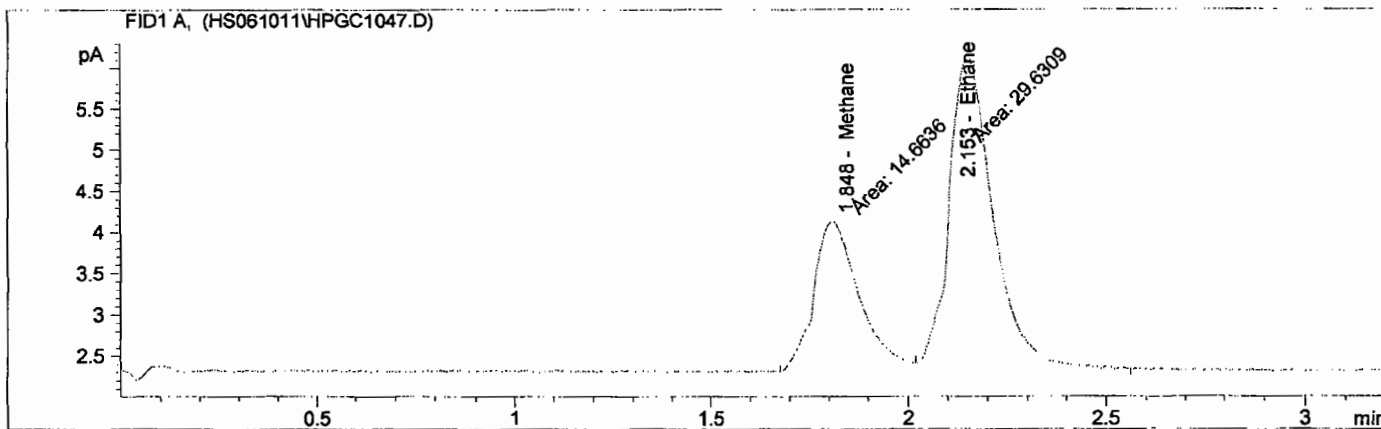
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.844	MF	14.62108	1.34730e-1	1.96990		Methane
2.153	FM	29.89310	6.41801e-2	1.91854		Ethane

Totals : 3.88844

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:28:36 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

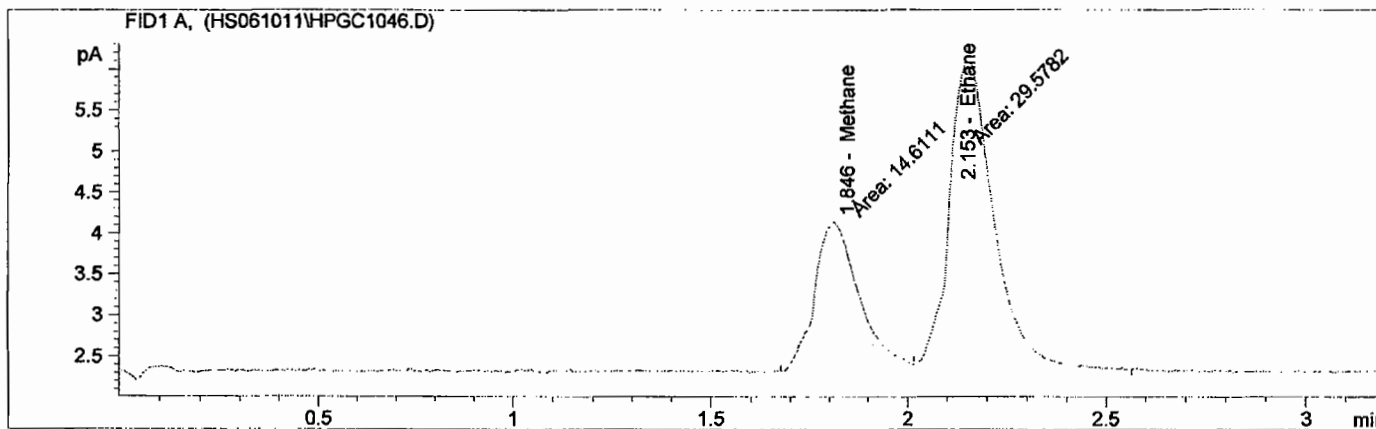
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.848	MF	14.66356	1.34730e-1	1.97562		Methane
2.153	FM	29.63086	6.41801e-2	1.90171		Ethane

Totals : 3.87733

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:24:45 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

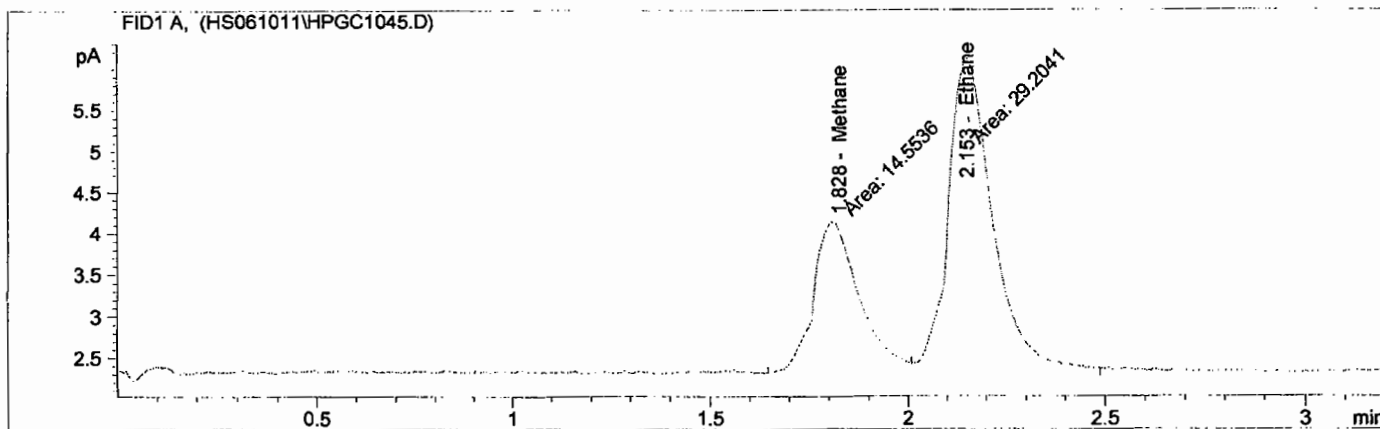
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.846	MF	14.61109	1.34730e-1	1.96856		Methane
2.153	FM	29.57821	6.41801e-2	1.89833		Ethane

Totals : 3.86689

Results obtained with enhanced integrator!

=====
*** End of Report ***

=====
Injection Date : 6/13/2011 12:21:04 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

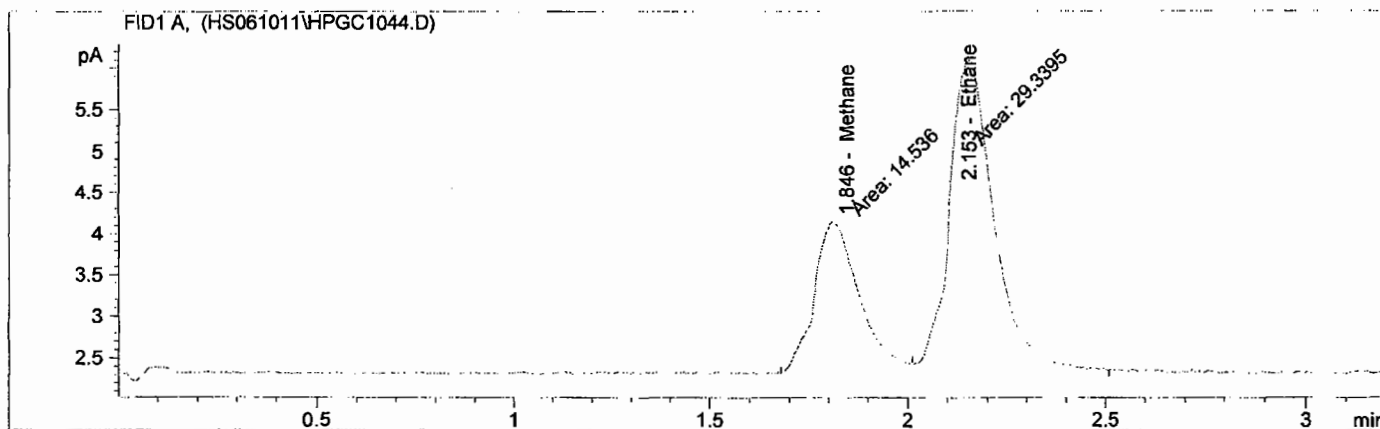
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.828	MF	14.55365	1.34730e-1	1.96082		Methane
2.153	FM	29.20411	6.41801e-2	1.87432		Ethane

Totals : 3.83514

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:17:26 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

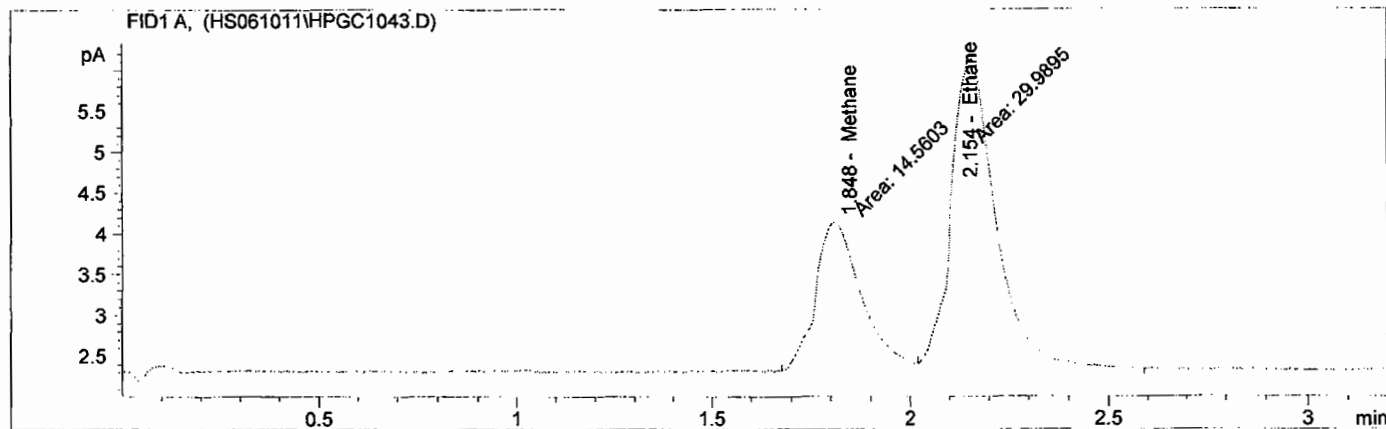
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.846	MF	14.53600	1.34730e-1	1.95844		Methane
2.153	FM	29.33953	6.41801e-2	1.88301		Ethane

Totals : 3.84145

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:13:47 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

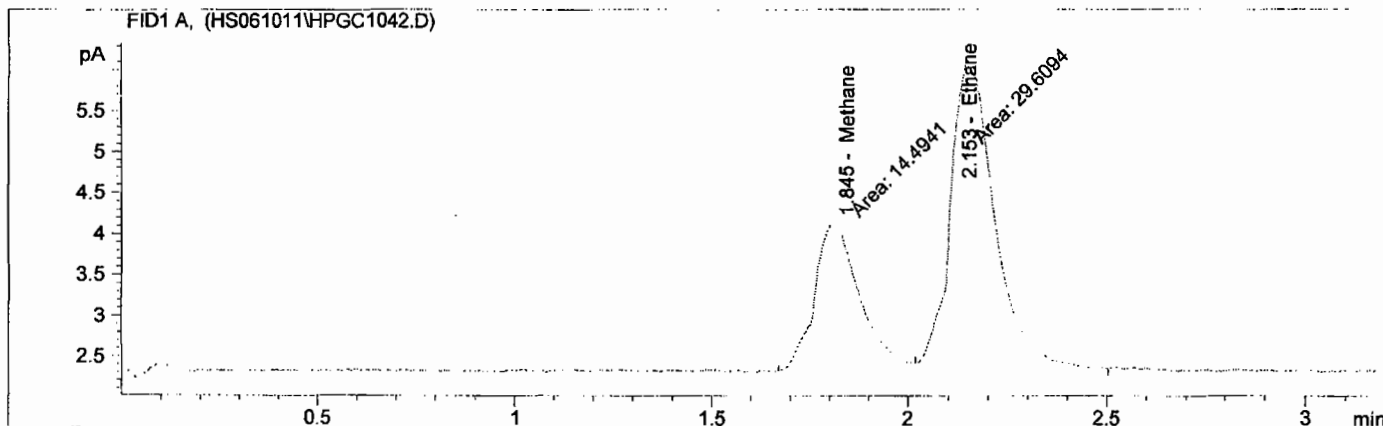
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.848	MF	14.56032	1.34730e-1	1.96172		Methane
2.154	FM	29.98945	6.41801e-2	1.92473		Ethane

Totals : 3.88644

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:10:08 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

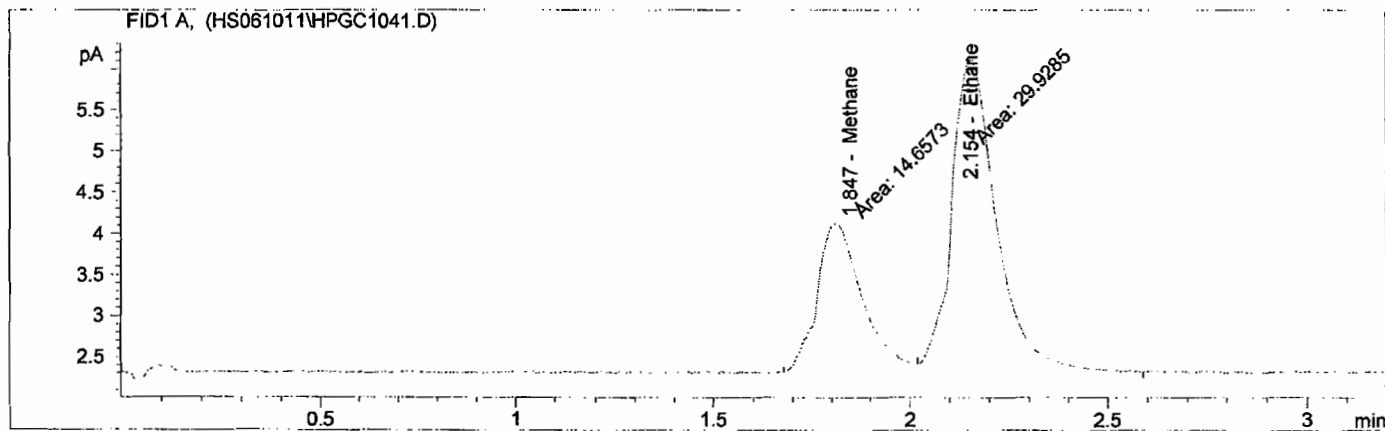
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.845	MF	14.49409	1.34730e-1	1.95279		Methane
2.153	FM	29.60937	6.41801e-2	1.90033		Ethane

Totals : 3.85312

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:06:03 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

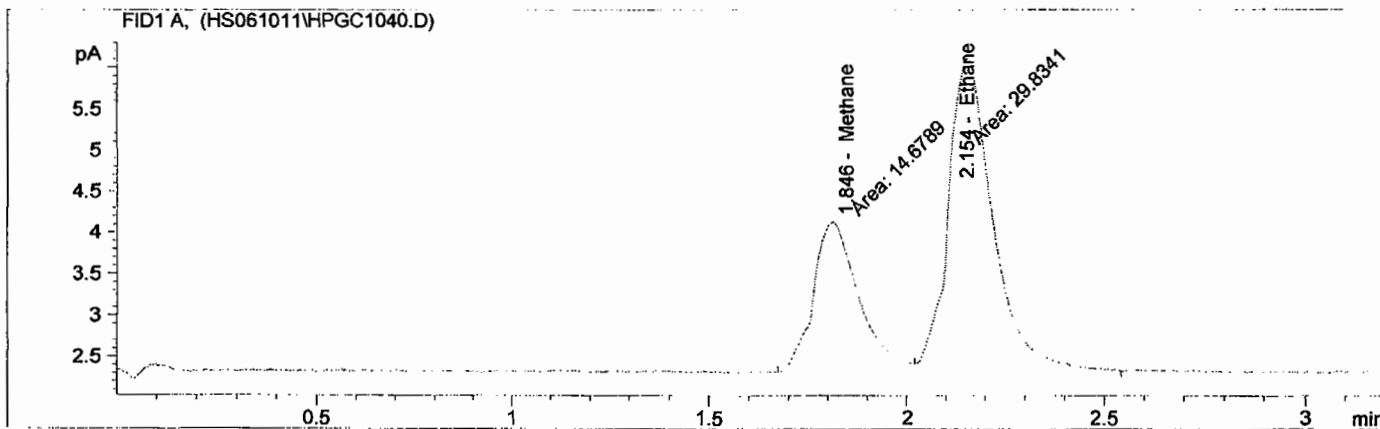
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.847	MF	14.65730	1.34730e-1	1.97478		Methane
2.154	FM	29.92854	6.41801e-2	1.92082		Ethane

Totals : 3.89560

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 12:02:24 PM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

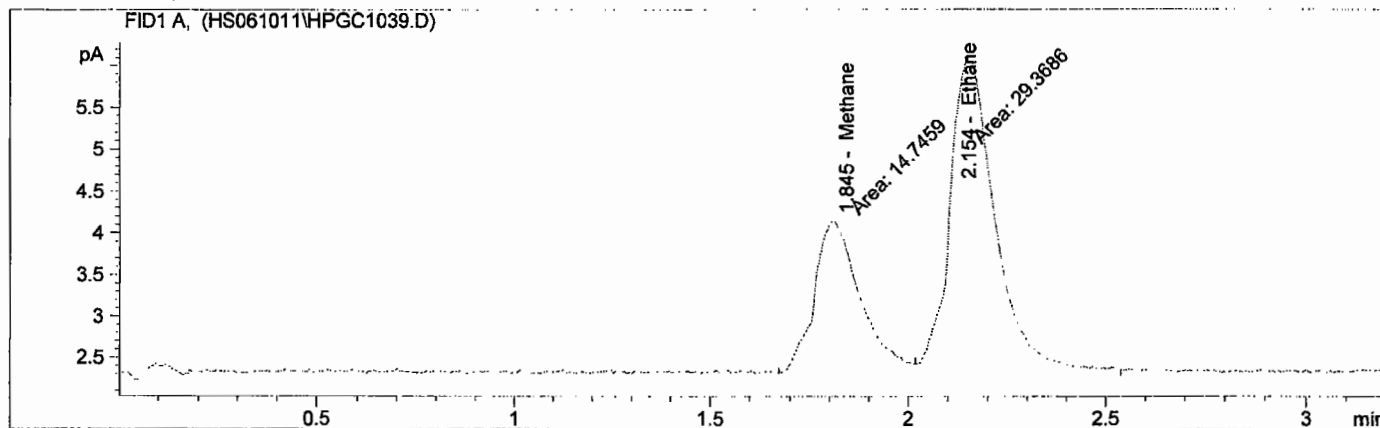
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.846	MF	14.67890	1.34730e-1	1.97769		Methane
2.154	FM	29.83407	6.41801e-2	1.91475		Ethane

Totals : 3.89244

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 11:58:44 AM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

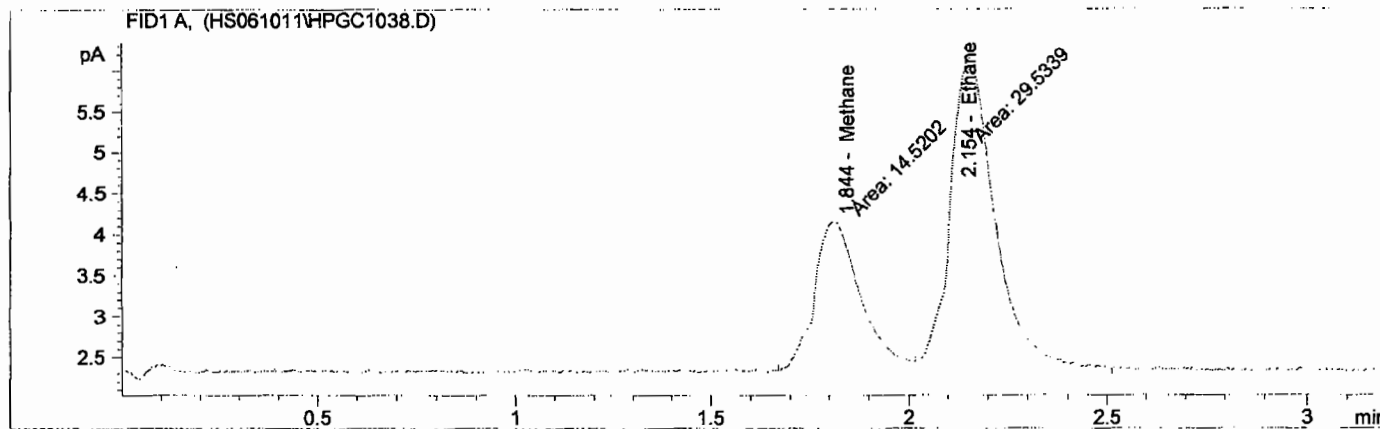
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.845	MF	14.74592	1.34730e-1	1.98672		Methane
2.154	FM	29.36857	6.41801e-2	1.88488		Ethane

Totals : 3.87160

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 11:54:34 AM
Sample Name : 2.0 ppmv LCS Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.844	MF	14.52023	1.34730e-1	1.95631		Methane
2.154	FM	29.53391	6.41801e-2	1.89549		Ethane

Totals : 3.85180

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

**USEPA Method 4
Relative Humidity and Moisture Calculation
Using Wet Bulb/Dry Bulb Measurements**



Client:	Valero
Location:	Port Arthur, TX
Source:	FCCU 1241
Sample Date:	6/8/11 & 6/9/11
Analysis Date:	6/10/11 Samples, 6/11/11 Recovery Study
Instrument	Agilent 6890 GC/FID

Data Input:

Barometric pressure (P_{bar}):	29.40	inches Hg
Dry bulb (t_d) or ambient (T_{amb}) temperature:	68.1	°F
Wet bulb temperature (t_w)	68.1	°F
Static Pressure (S_s):	0.0	inches H ₂ O

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

Absolute Pressure:

= 29.40 inches Hg

= 746.79 mm Hg

Saturated vapor pressure of t_d :

S_{vp} = 0.6899 inches Hg

Actual vapor pressure:

= 0.6899 inches Hg

Fractional moisture content:

= 0.0235 B_{wo}

Moisture content:

2.35 %

Fractional moisture content of gas at saturated conditions:

= 293.1 °Kelvin

where:

$A = 8.361$

$B = 1893.5$

$C = 27.65$

= 0.0219 B_{ws}

Percent moisture of saturated conditions:

= 2.19 %

Percent relative humidity:

= 100.00 %

Percent moisture used for emissions calculations:

For HRVOC Bag Calculations not Stacks = 2.19 %

Percent moisture used for emissions calculations:

= 0.0219 fractional

= 0.9781 correction

Calibration Date 6/10/11

Instrument ID Agilent # 1

Analyst JP

Cylinder No ALM020100

Initial Methane Calibration Summary Sheet

<u>Compound</u>	<u>Area (1)</u>	<u>Area (2)</u>	<u>Area (3)</u>	<u>Area (ave)</u>	<u>Area (1) % Dev</u>	<u>Area (2) % Dev</u>	<u>Area (3) % Dev</u>
Methane	7.5165	7.4086	7.2556	7.3936	1.7	0.2	1.9
Ethane	15.4490	15.5193	15.1244	15.3642	0.6	1.0	1.6

ppmv = 1.0

<u>Compound</u>	<u>Area (1)</u>	<u>Area (2)</u>	<u>Area (3)</u>	<u>Area (ave)</u>	<u>Area (1) % Dev</u>	<u>Area (2) % Dev</u>	<u>Area (3) % Dev</u>
Methane	14.9467	14.5528	14.5780	14.7	1.7	1.0	0.8
Ethane	31.5569	30.7385	30.5975	31.0	1.9	0.7	1.2

ppmv = 2.0

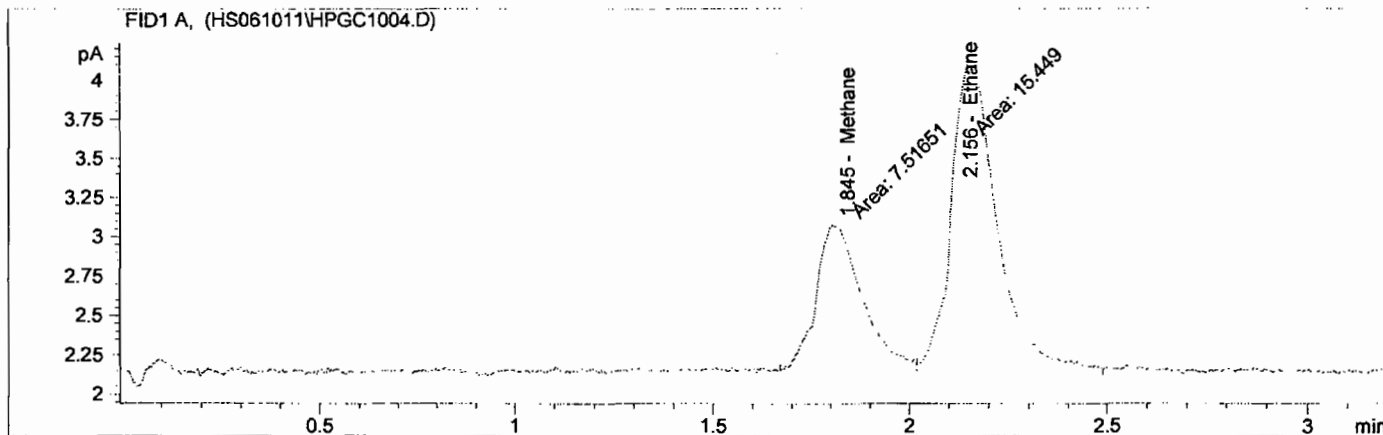
<u>Compound</u>	<u>Area (1)</u>	<u>Area (2)</u>	<u>Area (3)</u>	<u>Area (ave)</u>	<u>Area (1) % Dev</u>	<u>Area (2) % Dev</u>	<u>Area (3) % Dev</u>
Methane	37.0423	36.7532	37.1205	37.0	0.2	0.6	0.4
Ethane	77.6610	77.8784	77.9045	77.8	0.2	0.1	0.1

ppmv = 5.0

<u>Compound</u>	<u>Area (1)</u>	<u>Area (2)</u>	<u>Area (3)</u>	<u>Area (ave)</u>	<u>Area (1) % Dev</u>	<u>Area (2) % Dev</u>	<u>Area (3) % Dev</u>
Methane	76.0469	74.9149	75.6801	75.5	0.7	0.8	0.2
Ethane	160.3348	158.0523	159.0726	159.2	0.7	0.7	0.1

ppmv = 10.0

=====
Injection Date : 6/10/2011 5:24:34 PM
Sample Name : ~~10.0 ppmv STD~~ 1.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.845	MV	7.51651	0.00000	0.00000		Methane
2.156	VM	15.44903	0.00000	0.00000		Ethane

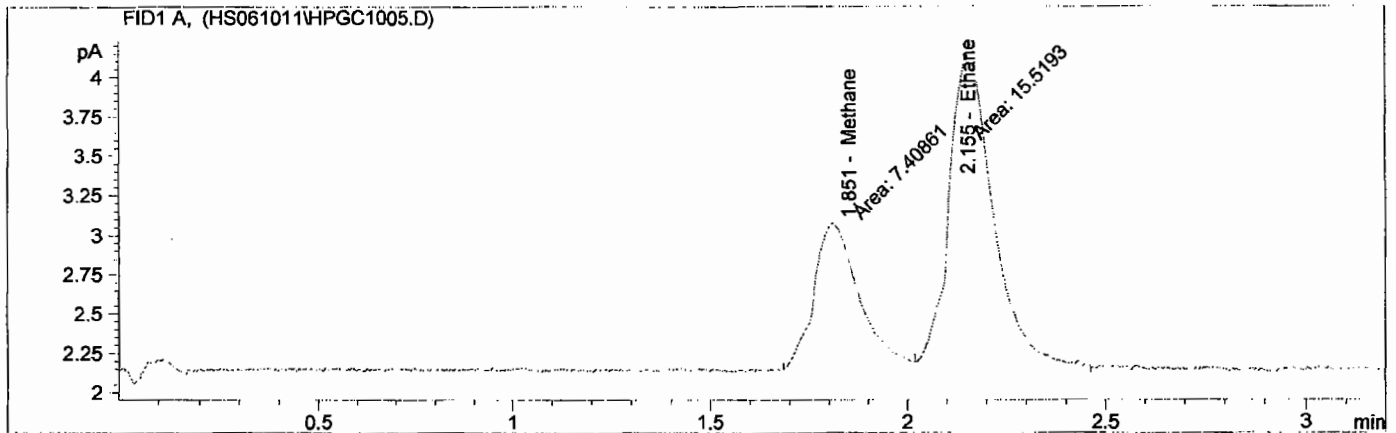
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:28:46 PM
Sample Name : 1.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.851	MF	7.40861	0.00000	0.00000		Methane
2.155	FM	15.51930	0.00000	0.00000		Ethane

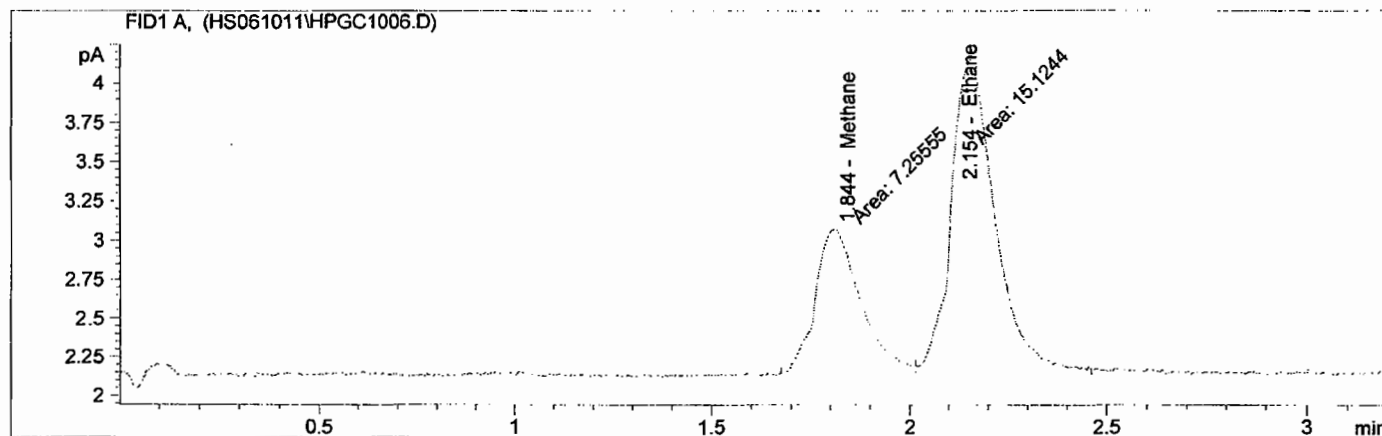
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:32:37 PM
Sample Name : 1.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.844	MF	7.25555	0.00000	0.00000		Methane
2.154	FM	15.12437	0.00000	0.00000		Ethane

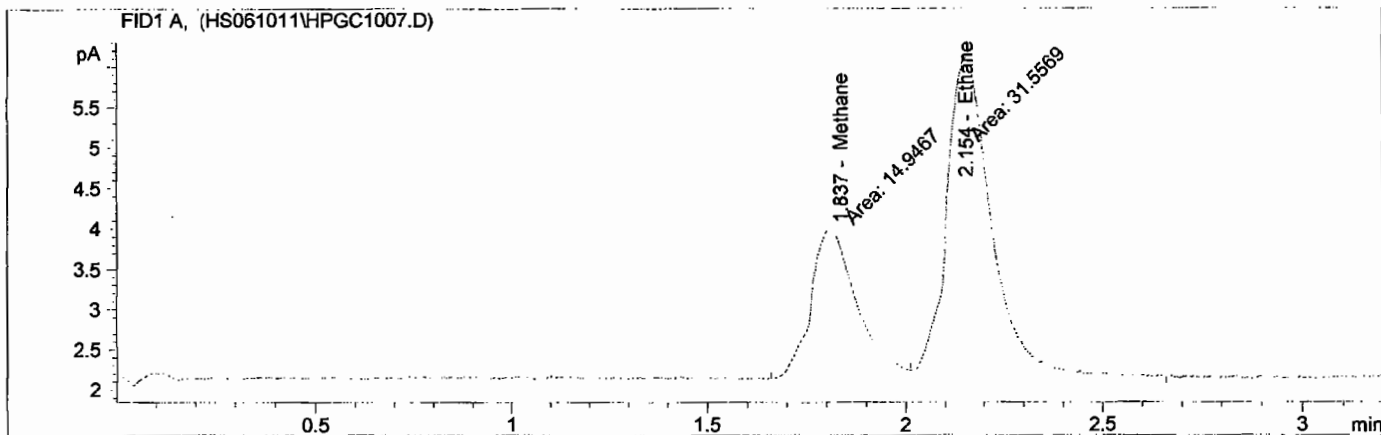
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:38:15 PM
Sample Name : 2.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.837	MF	14.94672	0.00000	0.00000		Methane
2.154	FM	31.55692	0.00000	0.00000		Ethane

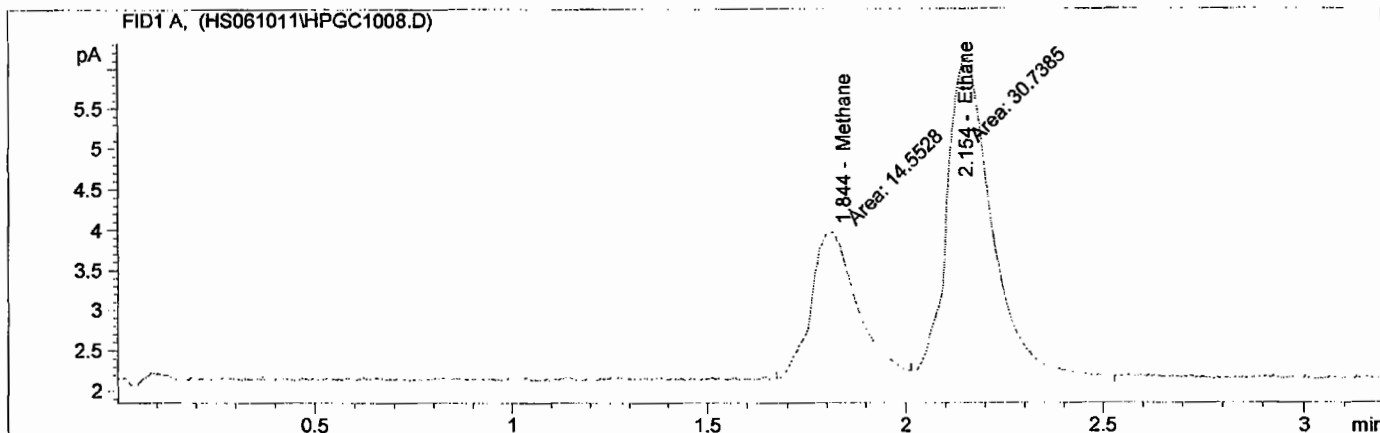
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:41:55 PM
Sample Name : 2.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.844	MF	14.55280	0.00000	0.00000		Methane
2.154	FM	30.73849	0.00000	0.00000		Ethane

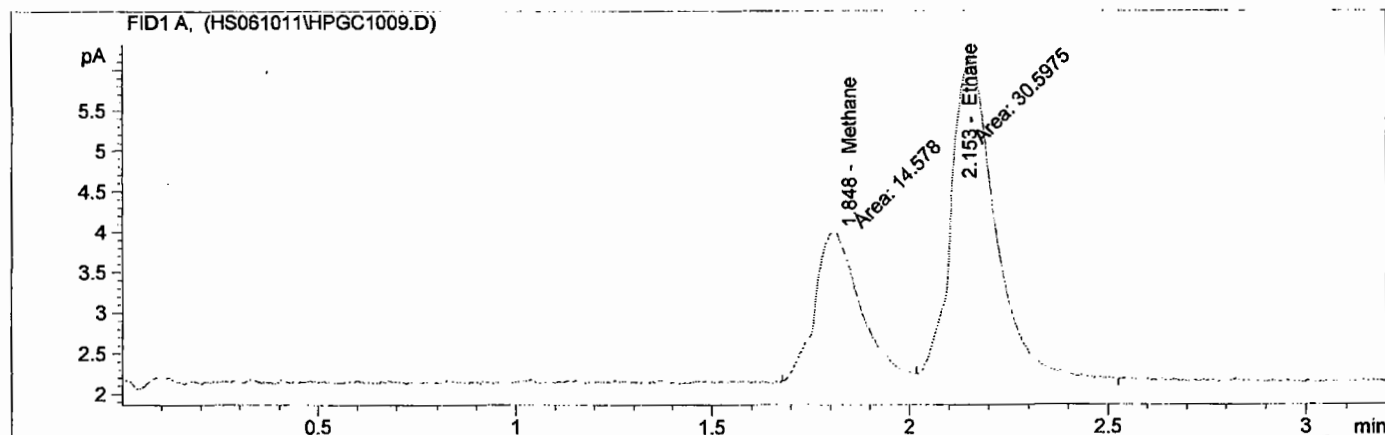
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:45:45 PM
Sample Name : 2.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.848	MF	14.57801	0.00000	0.00000		Methane
2.153	FM	30.59754	0.00000	0.00000		Ethane

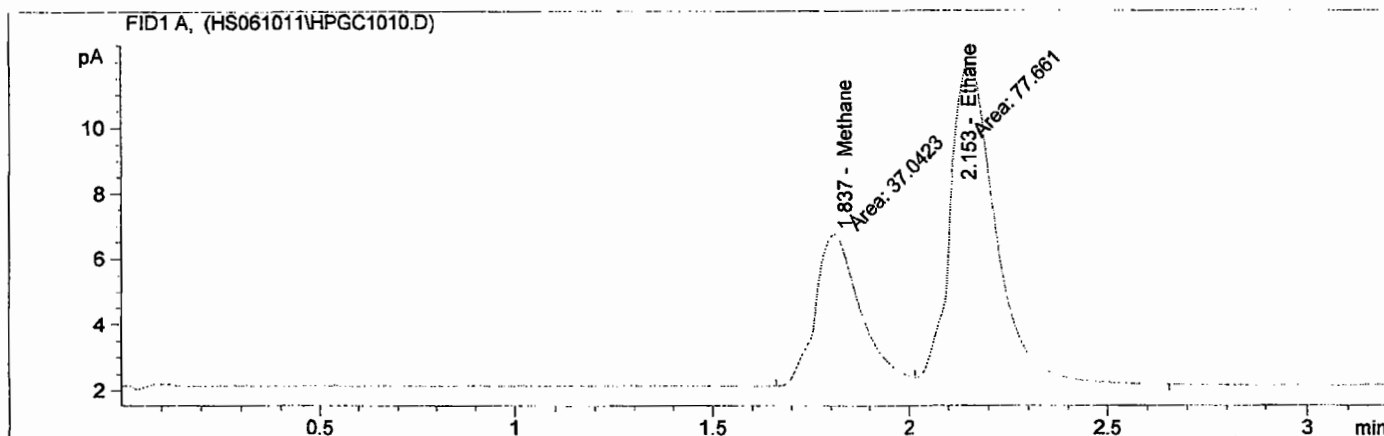
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:50:11 PM
Sample Name : 5.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.837	MF	37.04226	0.00000	0.00000		Methane
2.153	FM	77.66103	0.00000	0.00000		Ethane

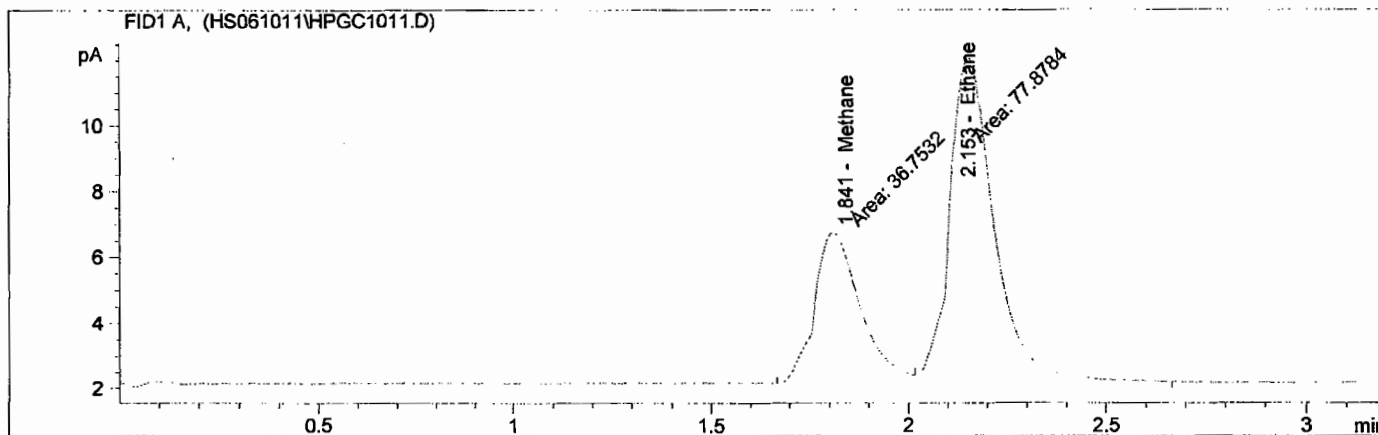
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:54:54 PM
Sample Name : 5.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.841	MF	36.75317	0.00000	0.00000		Methane
2.153	FM	77.87840	0.00000	0.00000		Ethane

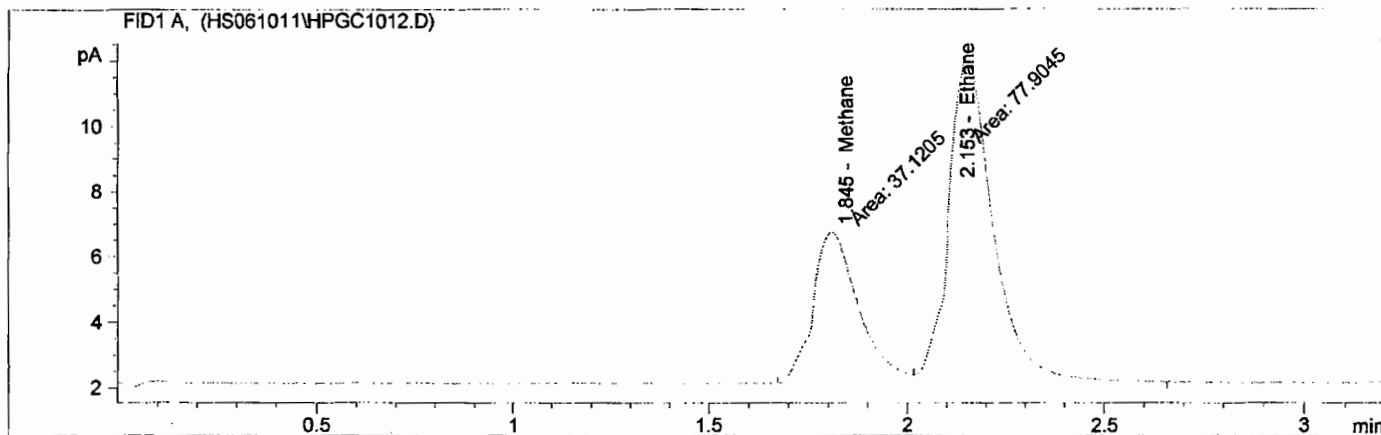
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 5:58:34 PM
Sample Name : 5.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



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External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.845	MF	37.12048	0.00000	0.00000		Methane
2.153	FM	77.90446	0.00000	0.00000		Ethane

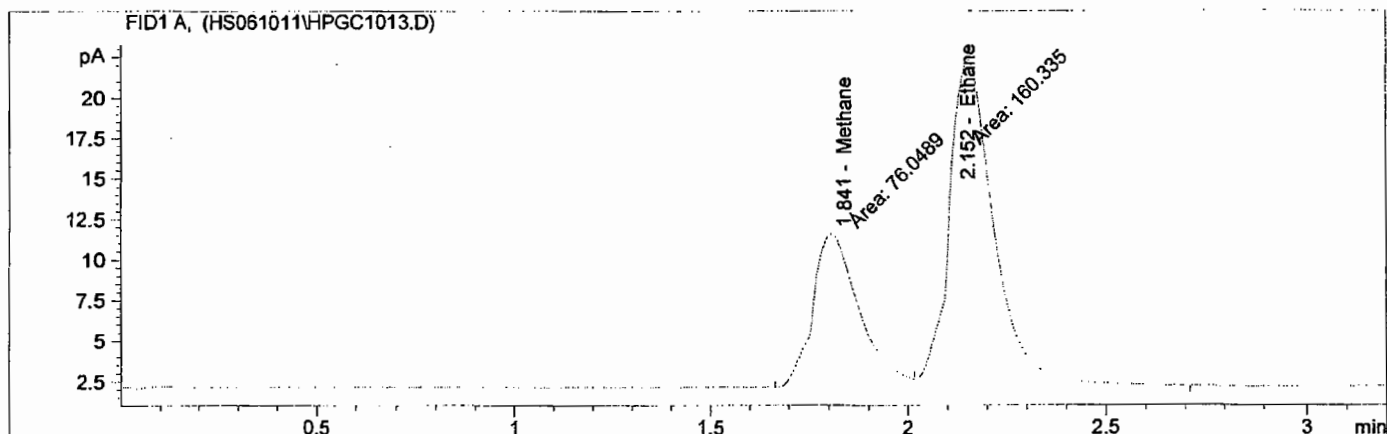
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

=====
Injection Date : 6/10/2011 6:02:39 PM
Sample Name : 10.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.841	MF	76.04891	0.00000	0.00000		Methane
2.152	FM	160.33476	0.00000	0.00000		Ethane

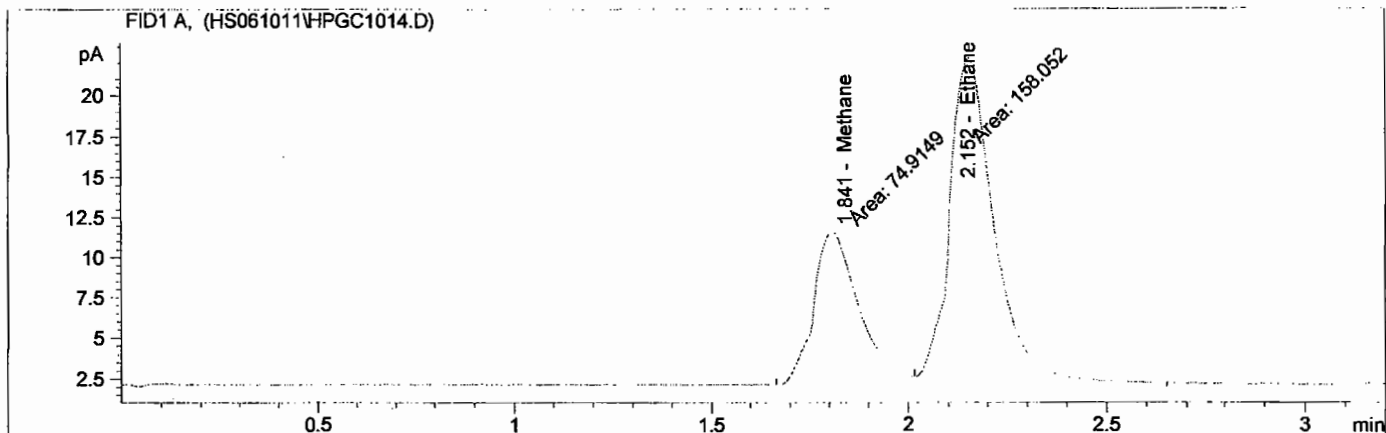
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

=====
*** End of Report ***
=====

```
=====
Injection Date   : 6/10/2011 6:06:28 PM
Sample Name      : 10.0 ppmv STD           Location : -
Acq. Operator    : JP                     Inj       : 1
Acq. Instrument  : Instrument 1           Inj Volume : Manually
Acq. Method      : C:\HPCHEM\1\METHODS\METHANE.M
Last changed     : 6/10/2011 5:18:34 PM by JP
Analysis Method  : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed     : 6/10/2011 5:30:07 PM by JP
                  (modified after loading)
Created 8-26-09
=====
```



External Standard Report

```
Sorted By           : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier          : 1.0000
Dilution            : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.841	MF	74.91491	0.00000	0.00000		Methane
2.152	FM	158.05228	0.00000	0.00000		Ethane

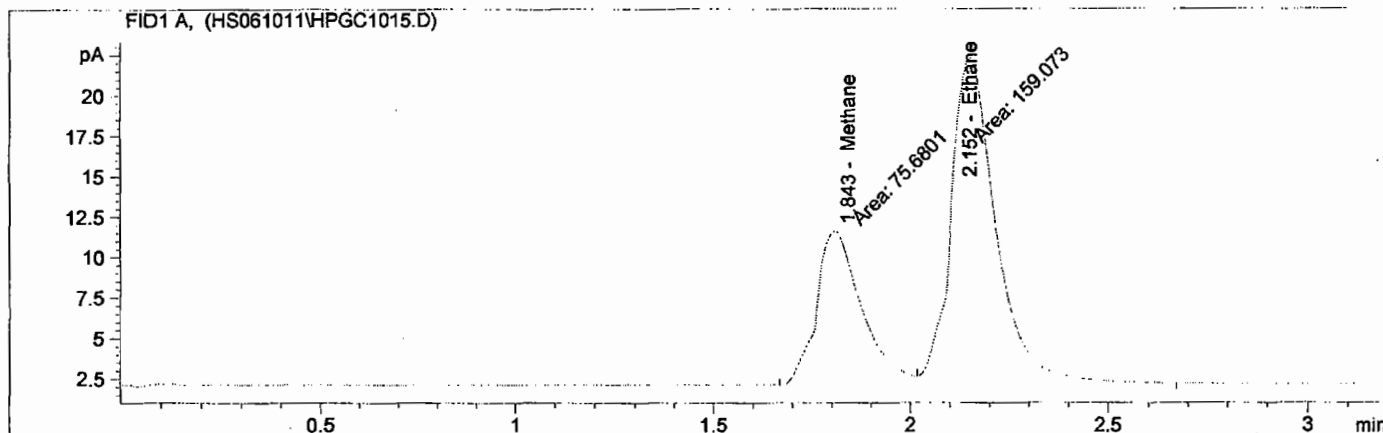
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

*** End of Report ***

=====
Injection Date : 6/10/2011 6:10:09 PM
Sample Name : 10.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/10/2011 5:30:07 PM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/10/2011 5:30:10 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.843	MF	75.68009	0.00000	0.00000		Methane
2.152	FM	159.07262	0.00000	0.00000		Ethane

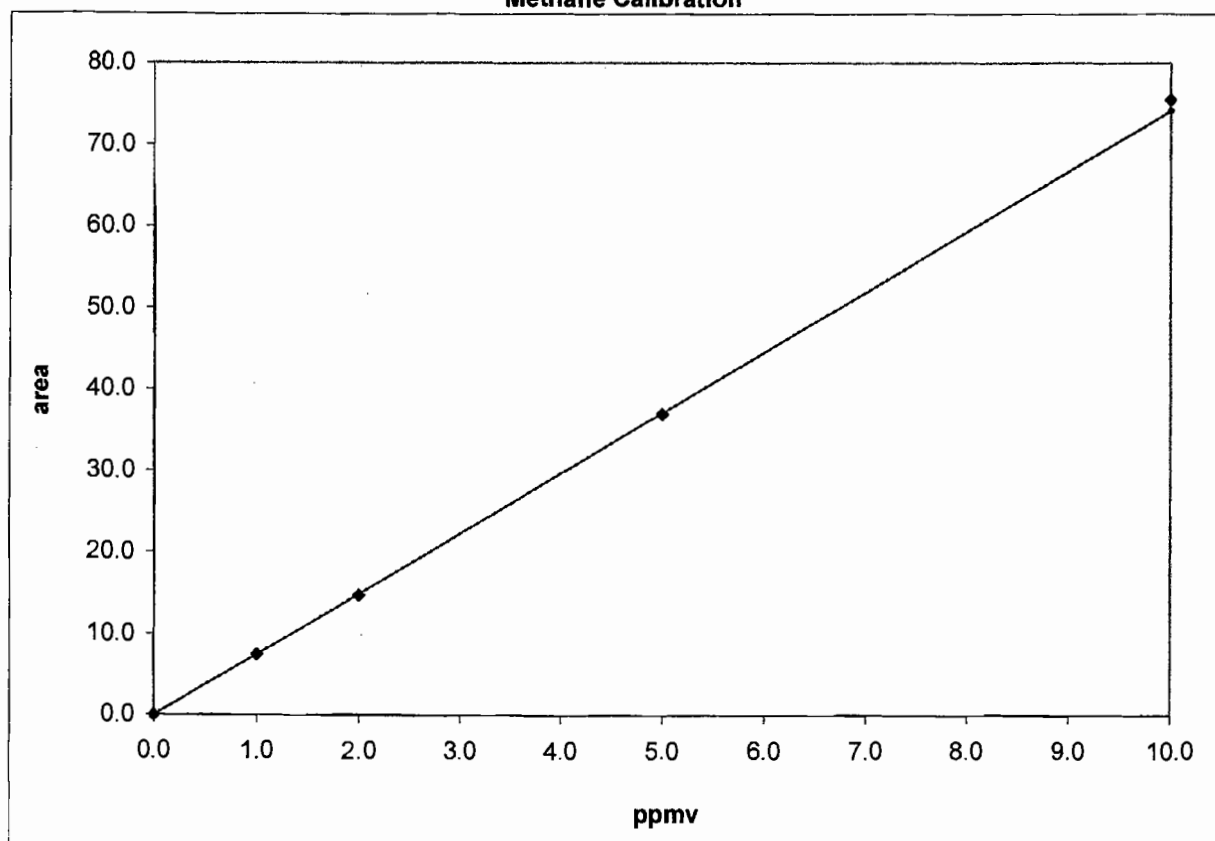
Totals : 0.00000

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Invalid calibration curve, (Methane)
Warning : Invalid calibration curve, (Ethane)

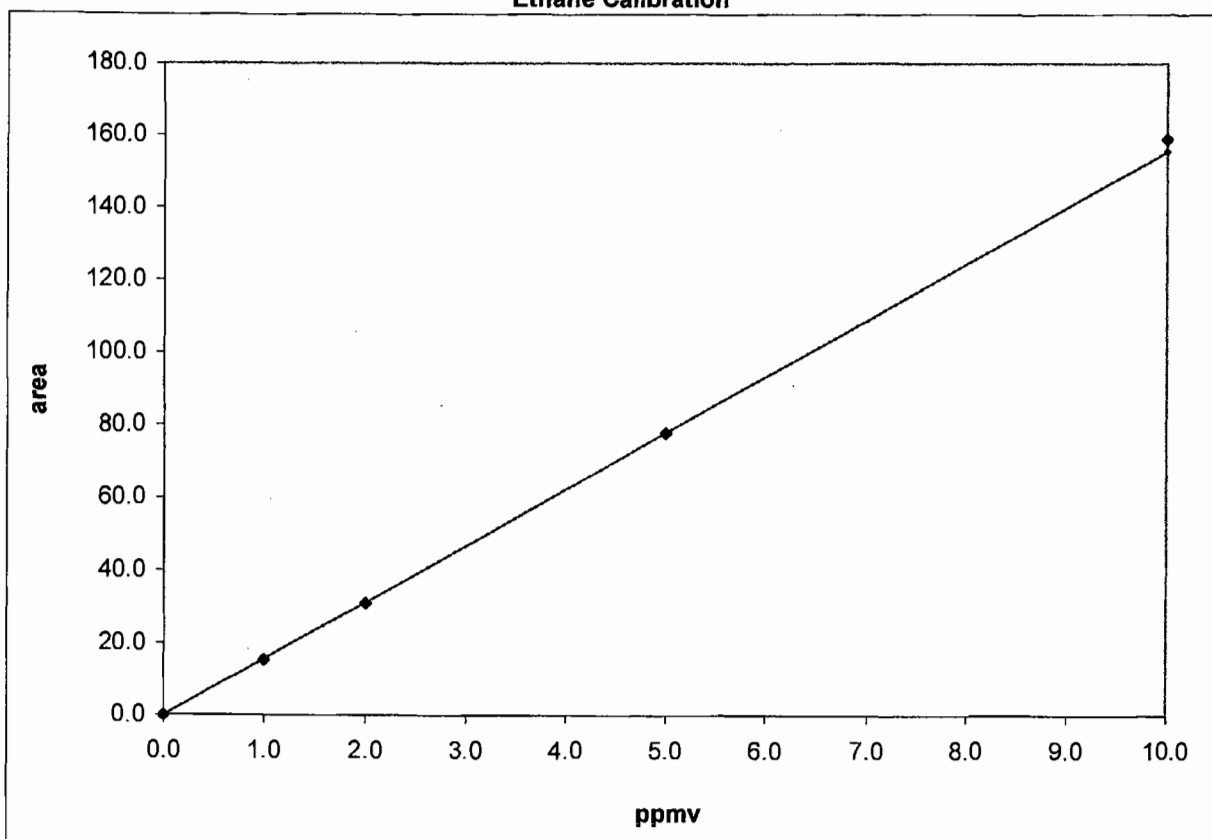
=====
*** End of Report ***
=====

Methane Calibration



<u>ppmv</u>	<u>area</u>	<u>Slope</u>	<u>Intercept</u>	<u>Corr</u>
0.0	0.0	7.4222	0.000	1.0000
1.0	7.4			
2.0	14.7			
5.0	37.0			
10.0	75.5			

Ethane Calibration



<u>ppmv</u>	<u>area</u>	<u>Slope</u>	<u>Intercept</u>	<u>Corr</u>
0.0	0.0	15.5812	0.000	1.0000
1.0	15.4			
2.0	31.0			
5.0	77.8			
10.0	159.2			

Calibration Date 6/10/11

Instrument ID Agilent 6890

Continuing Calibration Check

Analyst JP

Date & Time 6-13-11 @ 11:25 AM

Initial Cal Values

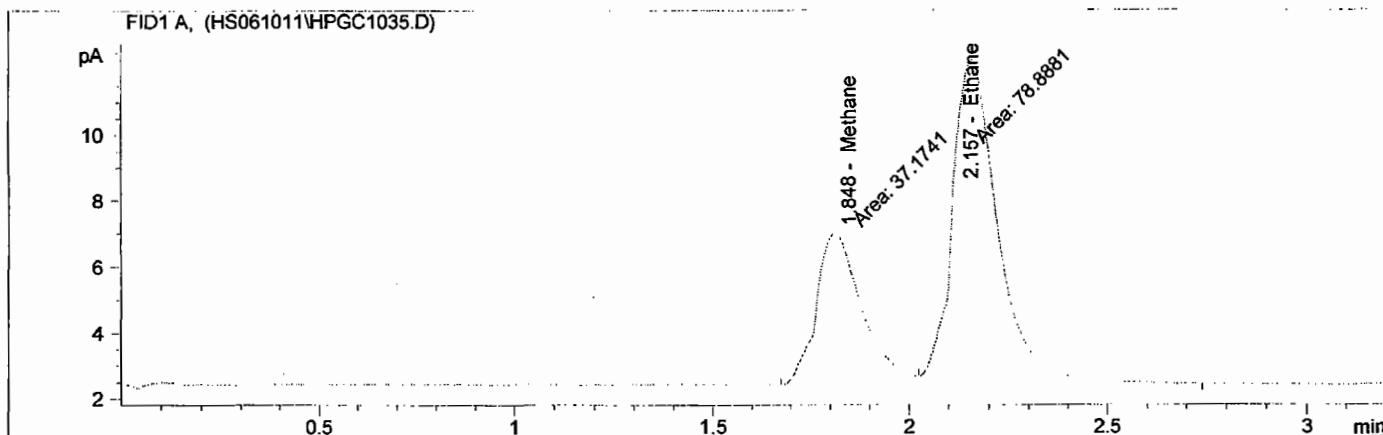
<u>Compound</u>	<u>Area (1)</u>	<u>Area (2)</u>	<u>Area (3)</u>	<u>Area (ave)</u>
Methane	37.0	36.8	37.1	37.0
Ethane	77.7	77.9	77.9	77.8

Continuing or End Cal Values

<u>Compound</u>	<u>Area (1)</u>	<u>Area (2)</u>	<u>Area (3)</u>	<u>Area (ave)</u>
Methane	37.17	37.55	37.47	37.40
Ethane	78.89	79.22	78.97	79.03

<u>Compound</u>	<u>Initial Area (ave)</u>	<u>Continuing or End Area (ave)</u>	<u>% Diff</u>	<u>M-18 QA/QC</u>
Methane	37.0	37.4	1.1	PASS
Ethane	77.8	79.0	1.5	PASS

=====
Injection Date : 6/13/2011 11:17:34 AM
Sample Name : 5.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 8:46:22 AM by JP
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

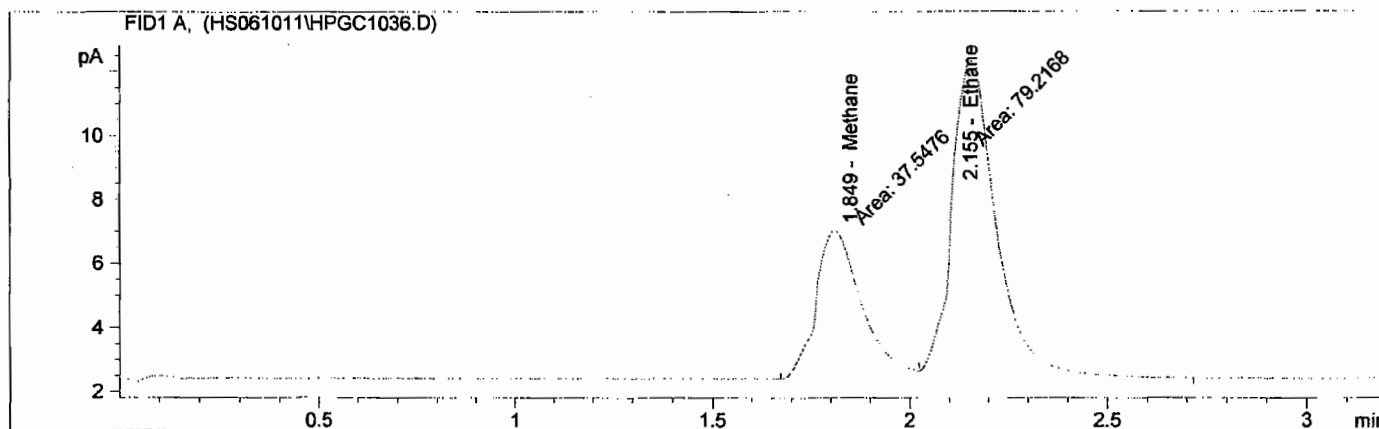
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.848	MF	37.17409	1.34730e-1	5.00847		Methane
2.157	FM	78.88813	6.41801e-2	5.06305		Ethane

Totals : 10.07152

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====

=====
Injection Date : 6/13/2011 11:21:27 AM
Sample Name : 5.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

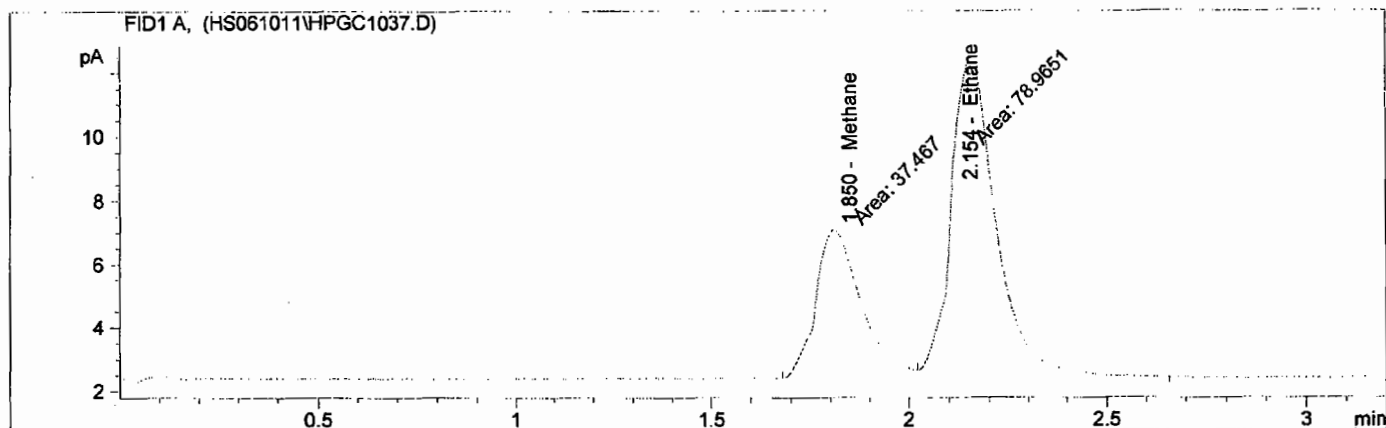
RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.849	MF	37.54758	1.34730e-1	5.05879		Methane
2.155	FM	79.21680	6.41801e-2	5.08414		Ethane

Totals : 10.14293

Results obtained with enhanced integrator!

=====
*** End of Report ***

=====
Injection Date : 6/13/2011 11:25:57 AM
Sample Name : 5.0 ppmv STD Location : -
Acq. Operator : JP Inj : 1
Acq. Instrument : Instrument 1 Inj Volume : Manually
Acq. Method : C:\HPCHEM\1\METHODS\METHANE.M
Last changed : 6/10/2011 5:18:34 PM by JP
Analysis Method : C:\HPCHEM\1\METHODS\METHANEE.M
Last changed : 6/13/2011 11:27:59 AM by JP
(modified after loading)
Created 8-26-09
=====



=====
External Standard Report
=====

Sorted By : Signal
Calib. Data Modified : 6/11/2011 6:46:03 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,

RetTime [min]	Type	Area [pA*s]	Amt/Area	Amount [ppm]	Grp	Name
1.850	MF	37.46700	1.34730e-1	5.04794		Methane
2.154	FM	78.96515	6.41801e-2	5.06799		Ethane

Totals : 10.11593

Results obtained with enhanced integrator!

=====
*** End of Report ***
=====



951 N. Old Rand Rd, Unit 106
Wauconda, Illinois 60084

ARI ENVIRONMENTAL, INC.

Chain of Custody Record H08006

1710 Preston Rd., Unit C
Pasadena, Texas 77503

[illegible]



951 Old Rand Road, Unit 106
Wauconda, Illinois 60084



1710 Preston Road, Unit C
Pasadena, Texas 77503

SAMPLE RECEIPT CHECKLIST

Client Name: ARI Stack Division

Site Location: Valero, Port Arthur, TX

ARI Project Manager: DF

Sample Collection Date(s): 6-8-11 to 6-9-11

Chain-of-Custody Number(s): H08006

Chain-of-Custody Form(s):

Custody release signatures, dates, and times present	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Preservation code noted	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Project information clearly identified	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Sample information clearly identified	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Analysis request clearly identified	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Report tier level noted	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

Sample Containers:

Custody seal(s) applied and intact	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Quantity of samples match number on COC	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Container label ID numbers and descriptions match COC	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
All containers received in good condition	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Liquid levels marked and no indications of leakage	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
All container labels are legible	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
All sample IDs are unique	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Samples received in correct type of container	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Samples received within the required holding time	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Samples received under the required preservation code	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

Non-Conformances and/or Corrective Actions Applied:

Samples Received by:

Jim Presley
Printed Name

[Signature]
Signature

Date and Time Received: 6-9-11 19:04



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#: L1021357

Date of Report: 3-Jul-11

Date of Sample Receipt: 20-Jun-11

Client Name: ARI Environmental Inc.

1710 Preston Rd. Unit C

Pasadena, TX 77503

USA

Client Contact: Dan Fitzgerald

Client Project ID: FCCU-1241 Wet Gas Scrubber

COMMENTS: PAH by CARB Method 429 (LR Option) - Isotope Dilution

Selected extraction standard recoveries were below the CARB429 target recovery limits of 50-150%. However, the CARB 429 method does accept lower extraction standard recoveries as valid for accurate determination of target analytes as long as the corresponding labeled instrument response is quantifiable and above 10:1 signal to noise.

Samples showed a low bias to acenaphthylene-d8, anthracene-d10, benzo(a)pyrene-d12 and perylene-d12 extraction standard recoveries. This represents a chemical loss of both the deuterated and the corresponding native targets, likely radical initiated. This pattern of losses has been observed for other samples and the sample susceptibility is related to the contents of the extract and therefore the sample matrix.

All extraction standard recoveries of greater than 5% showed a signal to noise of much greater than 10:1. Losses of the deuterium labeled extraction standards parallel the native target losses. Therefore the target analyte quantification is not compromised for those recoveries at or above 5%.

For extraction standard recoveries of less than 5%, the reliability of the extraction standard recoveries are poor and therefore target native quantification is not possible. Therefore on one sample, a value for benzo(a)pyrene is not available.

Similarly on two samples a value for perylene is not available.

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	FCCU-1241 BLANK H44536/H4453 9/H44631	FCCU-1241 FIELD BLANK 45819/H4453 4/H44535/H4 4547 L1021357-4	FCCU-1241 RUN 1 47534/H4453 8/H44537/H4 4540/H44548 L1021357-1	FCCU-1241 RUN 2 47006/H44541 /H44542/H445 43/H44550 L1021357-2	FCCU-1241 RUN 3 47547/H4454 6/H44544/H4 4545/H44551 L1021357-3	Laboratory Control Sample
ALS Sample ID	WG1301133-1	L1021357-5	L1021357-4	L1021357-1	L1021357-2	L1021357-3	WG1301133-2
Sample Size	1	1	1	1	1	1	1
Sample units	sample	sample	sample	sample	sample	sample	n/a
Matrix	QC	Stack	Stack	Stack	Stack	Stack	QC
Sampling Date	n/a	9-Jun-11	9-Jun-11	8-Jun-11	8-Jun-11	9-Jun-11	n/a
Extraction Date	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11
Target Analytes	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	% Recovery
Naphthalene	9.68	263	227	1150	3420	824	91
2-Methylnaphthalene	4.54	<11.2 R	<23.6 R	651	440	325	NS
Acenaphthylene	<4 U	<10.3 R	<4 U	<211 R	<2510 R	<25 R	69
Acenaphthene	<4	<511 R	<42.8 R	<1130 R	509	<479 R	103
Fluorene	<4 U	<225 R	9.98	543	101	<304 R	102
Phenanthrene	4.94	33.3	17.0	490	539	179	111
Anthracene	<4 U	32.6	<4 U	356	<57.5 R	17.2	110
Fluoranthene	<4 U	<5.62 R	<4 U	90.7	64.9	31.4	110
Pyrene	<4 U	<8.32 R	<4 U	<22.9 R	<8.78 R	11.4	89
Benzo(a)anthracene	<4 U	<4 U	<4 U	<4 U	<8.9 R	<4 U	120
Chrysene	<4 U	<4 U	<4 U	<10.9 R	<10.2 R	<4 U	116
Benzo(b)fluoranthene	<4 U	<4 U	<4 U	<4.94 R	<4 U	<4 U	115
Benzo(k)fluoranthene	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U	123
Benzo(e)pyrene	<4 U	<175 R	<9.6 EMPC	<4 U	<215 R	34	NS
Benzo(a)pyrene	<4 U	<10 R	<4 U	n/a	<100 U	<4 U	119
Perylene	<4 U	<4 U	<4 U	n/a	n/a	<4 U	NS
Indeno(1,2,3-cd)pyrene	<4 U	<4 U	<4 U	<4 U	<100 U	<4 U	112
Dibenzo(a,h,a,c)anthracene	<4 U	<4 U	<4 U	<4 U	<6 R	<4 U	123
Benzo(g,h,i)perylene	<4 U	<4 U	<4 U	<4 U	<50 U	4.76	116
Additional Analytes	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	% Recovery
2-Chloronaphthalene	<4 U	<4 U	<4 U	<15.8 R	<4	<16 R	NS
Biphenyl	164	<215 R	<184 R	<901 R	<482 R	<350 R	NS
7,12-Dimethylbenzo(a)anthracene	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U	NS
3-Methylcholanthrene	<4 U	<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	<4 U	NS
Field Sampling Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
d10-Fluorene	NS	70	68	76	55	72	NS
d14-Terphenyl	NS	77	72	85	89	71	NS
Extraction Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
d8-Naphthalene	100	83	92	51	80	111	96
d10-2-Methylnaphthalene	100	110	102	74	100	150	93
d8-Acenaphthylene	94	38	99	12	5	81	90
d10-Phenanthrene	106	122	102	94	91	110	100
d10-Anthracene	105	27	100	5	103	70	93
d10-Fluoranthene	102	110	100	105	93	109	96
d12-Benzo(a)anthracene	98	66	110	52	22	123	100
d12-Chrysene	94	97	90	117	99	104	94
d12-Benzo(b)fluoranthene	124	110	114	110	95	114	105
d12-Benzo(k)fluoranthene	101	68	97	71	52	95	99
d12-Benzo(a)pyrene	82	21	96	0	19	63	91
d12-Perylene	99	24	99	1	2	60	92
d12-Indeno(1,2,3-c-d)pyrene	82	61	117	75	13	102	86
d14-Dibenz(a,h)anthracene	74	62	98	63	41	92	77
d12-Benzo(ghi)perylene	76	58	88	58	6	77	78
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							



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#: L1021357
Date of Report: 3-Jul-11
Date of Sample Receipt: 20-Jun-11

Client Name: ARI Environmental Inc.
1710 Preston Rd. Unit C
Pasadena, TX 77503
USA
Client Contact: Dan Fitzgerald
Client Project ID: FCCU-1241 Wet Gas Scrubber


COMMENTS: **SVOC via SW846 Method 3542/8270D**

The Run 2 sample, L1021357-2, showed low recoveries for the more volatile extraction standards. This is likely from volatile losses in the extract during sample extract concentration. The more volatile native target analytes are likely impacted with low recoveries.

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	FCCU-1241 BLANK H44536/H44539/ H44631	FCCU-1241 FIELD BLANK 45819/H44534/ H44535/H44547	FCCU-1241 RUN 1 47534/H44538/ H44537/H44540/ H44548	FCCU-1241 RUN 2 47006/H44541/ H44542/H44543/ H44550	FCCU-1241 RUN 3 47547/H44546/ H44544/H44545/ H44551	Target Recovery Acceptance Limits
ALS Sample ID	WG1301133-1	L1021357-5	L1021357-4	L1021357-1	L1021357-2	L1021357-3	
Sample Size	1	1	1	1	1	1	
Sample units	sample	sample	sample	sample	sample	sample	
Moisture Content	n/a	n/a	n/a	n/a	n/a	n/a	
Matrix	QC	Stack	Stack	Stack	Stack	Stack	
Sampling Date	n/a	9-Jun-11	9-Jun-11	8-Jun-11	8-Jun-11	9-Jun-11	
Extraction Date	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	23-Jun-11	
Target Analytes	ug/sample	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, V	<1.85 U	
Phenol	<1.95 U	<4.05 R	<1.95 U	14.3	3.2 V	5.5	
2-Methylphenol	<2.1 U	5.45	<2.1 U	64.3	<2.1 U, V	14.2	
4-Methylphenol&3-Methylphenol	<5.65 U	<5.65 U	<5.65 U	<5.65 U	<5.65 U, V	<13.2 R	
o-Toluidine	<5 U	<5 U	<5 U	<5 U	<5 U, V	<5 U	
Nitrobenzene	<1.95 U	<1.95 U	<1.95 U	<1.95 U	<1.95 U, V	<1.95 U	
Isophorone	<2.25 U	<2.25 U	<2.25 U	<2.25 U	<2.25 U, V	<2.25 U	
2,4-Dimethylphenol	<2.6 U	<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	<2.3 U	
a,a-Dimethylphenethylamine	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	
1,4-Phenylenediamine	<18 U	<18 U	<18 U	<18 U	<18 U	<18 U	
Benzidine	<38 U	<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	<2.0 U	
3,3'-Dimethylbenzidine	<29 U	<29 U	<29 U	<29 U	<29 U	<29 U	
3,3'-Dimethoxybenzidine	<29 U	<29 U	<29 U	<29 U	<29 U	<29 U	
Extraction Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
2-Fluorophenol	25 M	45	28 M	30	6 L	31	25-121
d5-Phenol	40 M	45	45	39	9 L	45	24-113
d5-Nitrobenzene	70	68	77	68	7 L	75	23-120
2-Fluorobiphenyl	75	73	75	71	68	76	30-115
2,4,6-Tribromophenol	66	55	62	52	52	77	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 L Below target recovery limits V Value likely biased low due to losses of the more volatile targets							

ALS Laboratory Group 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-acidified 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 acidified by the source stack gases.				

ANALYTICAL SUMMARY

CLIENT:
LOCATION:
SAMPLE DATES:
ANALYSIS:
METHOD:

Valero
Port Arthur, TX
6/8/11, 6/9/11, 6/15/11, 6/16/11
Formaldehyde, FCCU-1241
8315A

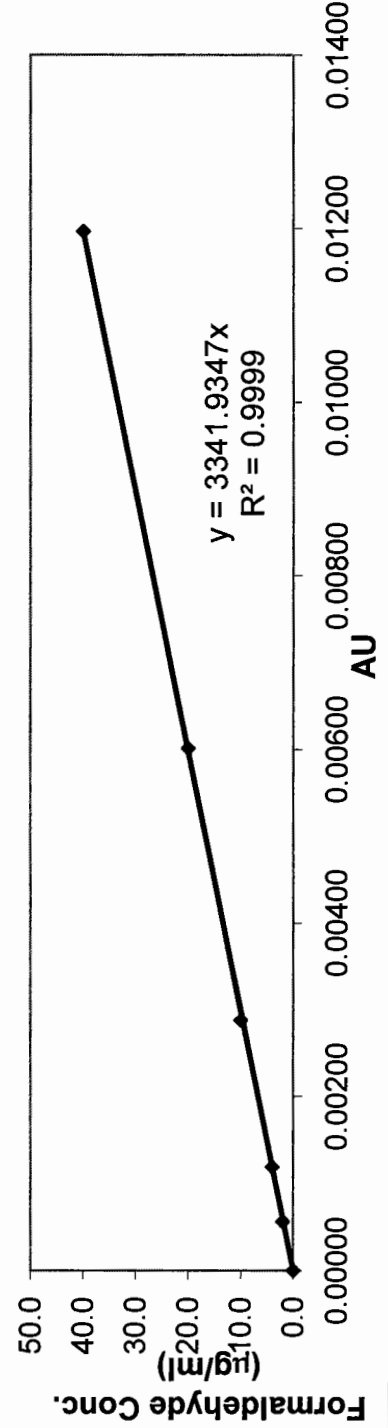
Analyst: J. Ruggaber
Date of Completion: 8/2/2011
Template Control ID: SW846-M0011-Aldehydes-Template-65T-Rev1

Std. (µg/ml)	Cal (AU*min)	<u>RE</u>	<u>Cal Conc</u>	<u>% Dif</u>	<u>CCVs</u>		
2.0	0.00056	0.00028	1.9	-6.43	Conc. (µg/ml)	Area (AU*min)	Cal Conc.
4.0	0.00119	0.00030	4.0	-0.58	9.99	0.00337	11.26
10.0	0.00288	0.00029	9.6	-3.76	9.99	0.00332	11.10
20.0	0.00601	0.00030	20.1	0.42	9.99	0.00338	11.30
40.0	0.01197	0.00030	40.8	2.12	19.98	0.00630	21.05
mean RF --> 0.00029					19.98	0.00592	19.78
							% Dif
							12.7
							11.1
							13.1
							5.4
							-1.0

Sample Concentration Calculations

ID	Analysis 1 (AU*min)	Analysis 2 (AU*min)	Average (AU*min)	Concentration (µg/ml)	Deviation (%)	Dilution Factor	Aliquot volume(ml)	Aliquot Mass (µg)	Sample Mass (µg)
FCCU-1241-1	0.00463	0.00491	0.00477	15.94	2.94	5	25	1992.6	4981.6
FCCU-1241-2	0.00496	0.00510	0.00503	16.81	1.39	5	25	2101.2	5253.1
FCCU-1241-3	0.00441	0.00449	0.00445	14.87	0.90	5	25	1859.0	4647.4
FCCU-1241-blank	0.00650	0.00641	0.00646	21.57	-0.70	5	25	2696.5	6741.3
DNPH blank	0.00125	0.00131	0.00128	4.28	2.34	1	-	-	-
HPLC water blank	<0.00011	<0.00011	<0.00011	<0.37	0.00	1	-	-	-
Lab acetonitrile blank	<0.00011	<0.00011	<0.00011	<0.37	0.00	1	-	-	-

Formaldehyde Calibration Curve



ANALYTICAL SUMMARY

CLIENT:
LOCATION:
SAMPLE DATES:
ANALYSIS:
METHOD:

Valero
 Port Arthur, TX
 6/8/11, 6/9/11, 6/15/11, 6/16/11
 Acetaldehyde, FCCU-1241
 8315A

Analyst: J. Ruggaber
 Date of Completion: 8/2/2011
 Template Control ID: SW846-M0011-Aldehydes-Template-65T-Rev1

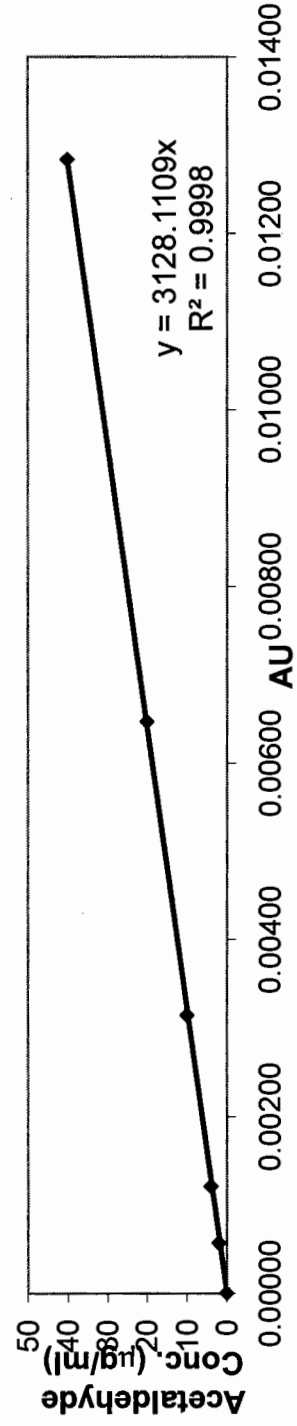
Std. (µg/ml)	Cal (AU*min)	RE	Cal Conc	% Dif	CCVs Conc. (µg/ml)	Area (AU*min)	Cal. Conc.	% Dif
2.0	0.00057	0.00028	1.8	-11.21	10.04	0.00336	10.51	4.7
4.0	0.00121	0.00030	3.8	-5.76	10.04	0.00358	11.20	11.5
10.0	0.00314	0.00031	9.8	-2.18	10.04	0.00351	10.98	9.4
20.1	0.00647	0.00032	20.2	0.78	20.08	0.00658	20.58	2.5
40.2	0.01284	0.00032	41.7	3.82	20.08	0.00624	19.52	-2.8

mean RF --> 0.00031

Sample Concentration Calculations

ID	Analysis 1 (AU*min)	Analysis 2 (AU*min)	Average (AU*min)	Concentration (µg/ml)	Deviation (%)	Dilution Factor	Aliquot volume(ml)	Aliquot Mass (µg)	Sample Mass (µg)
FCCU-1241-1	0.00105	0.00113	0.00109	3.41	3.67	5	25	426.2	1065.5
FCCU-1241-2	0.00108	0.00103	0.00106	3.30	-2.37	5	25	412.5	1031.3
FCCU-1241-3	0.00091	0.00092	0.00092	2.86	0.55	5	25	357.8	894.4
FCCU-1241-blank	0.00117	0.00117	0.00117	3.66	0.00	1	25	91.5	228.7
DNPH blank	0.00021	0.00023	0.00022	0.69	4.55	1	-	-	-
HPLC water blank	<0.00011	<0.00011	<0.00011	<0.37	0.00	1	-	-	-
Lab acetonitrile blank	<0.00011	<0.00011	<0.00011	<0.37	0.00	1	-	-	-

Acetaldehyde Calibration Curve



ANALYTICAL SUMMARY

CLIENT: Valero
LOCATION: Port Arthur, TX
SAMPLE DATES: 6/8/11, 6/9/11, 6/15/11, 6/16/11
ANALYSIS: Propanal, FCCU-1241
METHOD: 8315A

Analyst: J. Ruggaber
Date of Completion: 8/2/2011
Template Control ID: SW846-M0011-Aldehydes-Template-65T-Rev1

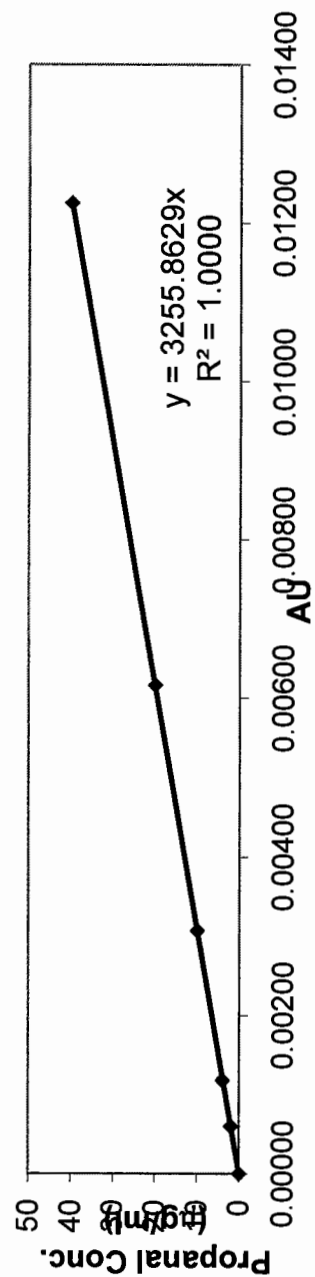
Std.	Cal	RE	Cal Conc	% Dif	Conc. (µg/ml)	Area (AU*min)	Cal. Conc.	% Dif
2.0	0.00060	0.00030	2.0	-2.04	9.98	0.00348	11.33	13.5
4.0	0.00118	0.00030	3.8	-3.67	9.98	0.00351	11.43	14.5
10.0	0.00307	0.00031	10.0	0.24	9.98	0.00350	11.40	14.2
20.0	0.00616	0.00031	20.1	0.57	19.96	0.00632	20.58	3.1
39.9	0.01225	0.00031	40.3	0.99	19.96	0.00604	19.67	-1.5

mean RF --> 0.00030

Sample Concentration Calculations

ID	Analysis 1 (AU*min)	Analysis 2 (AU*min)	Average (AU*min)	Concentration (µg/ml)	Deviation (%)	Dilution Factor	Aliquot volume(ml)	Aliquot Mass (µg)	Sample Mass (µg)
FCCU-1241-1	<0.00011	<0.00011	<0.00011	<0.36	0.00	1	25	<9.0	<22.4
FCCU-1241-2	0.00123	0.00112	0.00118	3.83	-4.68	1	25	95.6	239.1
FCCU-1241-3	0.00061	0.00051	0.00056	1.82	-8.93	1	25	45.6	114.0
FCCU-1241-blank	0.00025	0.00026	0.00026	0.83	1.96	1	25	20.8	51.9
DNPH blank	0.00021	0.00023	0.00022	0.72	4.55	1	-	-	-
HPLC water blank	<0.00011	<0.00011	<0.00011	<0.37	0.00	1	-	-	-
Lab acetonitrile blank	<0.00011	<0.00011	<0.00011	<0.37	0.00	1	-	-	-

Propanal Calibration Curve





8315A TASK SCHEDULE

Client: Valero

Location: Port Arthur, TX

Project Manager: D. Fitzgerald

Date Sampled: 6/8/11, 6/9/1, 6/15/11, 6/16/11

Lab Project #: 08-315, FCCU-1241 source

Spreadsheet Template ID: SW846-M0011-Aldehydes-Template-65T-Rev1

Analyst: J. Ruggaber

Eluent

Acetonitrile manufacturer and lot: Fisher HPLC grade, lot 11641

DI Water

Calibration Standard Identification

- 1) 2 ppm aldehyde std, 7/29/11
- 2) 4 ppm aldehyde std, 7/29/11
- 3) 10 ppm aldehyde std, 7/29/11
- 4) 20 ppm aldehyde std, 7/29/11
- 5) 40 ppm aldehyde std, 7/29/11

**8315A TASK SCHEDULE FORM**

Document Number: WL-8315ATask-Form-040A

Revision Number: 1

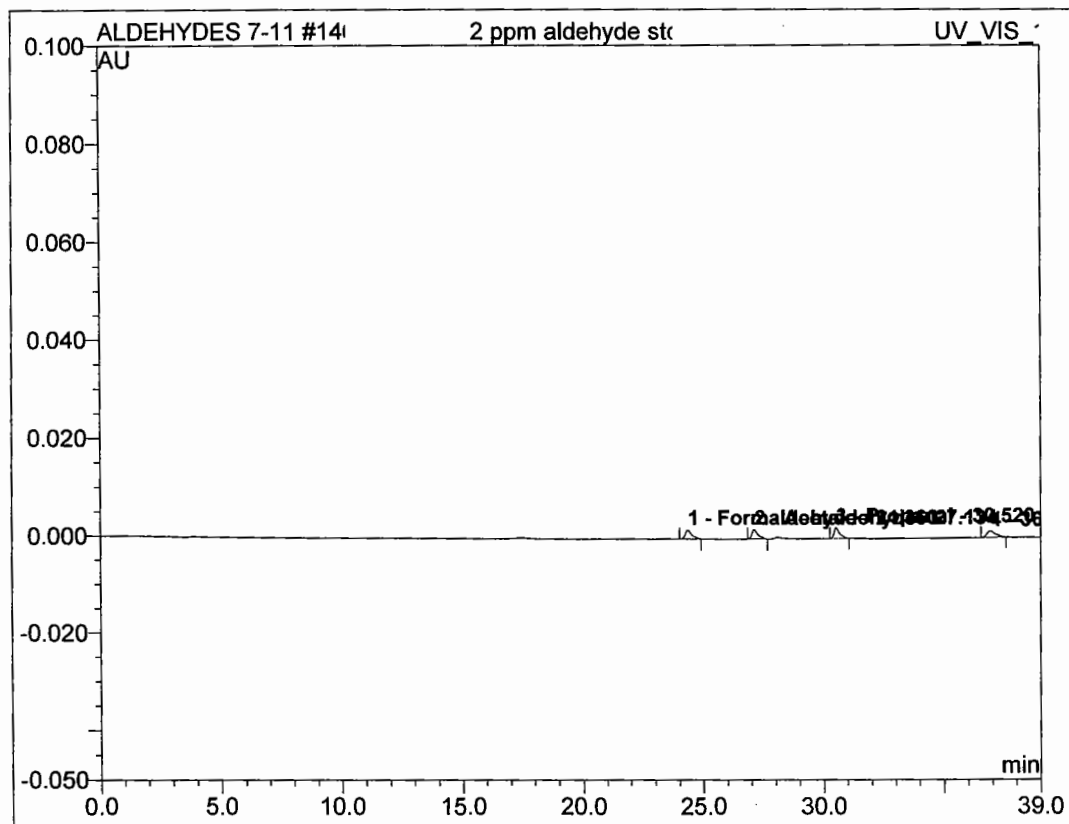
Effective Date: 8/2/11

Equipment: ICS 2500 with Acclaim 120 C18 column, 4.6x250 mm

DATE	TASK
7/25/11	Transfer each sample to a separatory flask, and drain out the methylene chloride portion. Extract the aqueous portion twice more with 20 mL of methylene chloride. Transfer all of the methylene chloride to a 250 mL (or larger, if needed) volumetric flask and dilute to volume with methylene chloride.
7/25/11 – 7/26/11	Remove a 100 mL aliquot, and use a condenser and hot water bath to condense the sample to ~10 mL. Add ~10 mL of acetonitrile, and condense again. Transfer to an appropriate size volumetric flask (10 or 25 mL), and dilute to volume with acetonitrile.
7/30/11	Equilibrate the instrument until a stable baseline is achieved.
7/30/11	Inject each standard solution once. Plot the standard injection areas against calibration standard concentrations to determine a calibration curve.
7/30/11- 8/2/11	Inject each sample solution in duplicate. Check that the area count for each duplicate injection is within 5% of the mean.
7/30/11 – 8/2/11	If necessary, dilute sample solutions if the peak areas are greater than the highest standard and re-inject in duplicate.
7/30/11 – 8/2/11	Inject a midpoint standard once after every 10 sample injections. Check that the midpoint standard is within 15% of the value generated by the initial calibration curve.
7/30/11 – 8/2/11	Inject a midpoint standard solution once at the end of the run. Check that the midpoint standard is within 15% of the value generated by the initial calibration curve.
8/2/11	Determine the concentration for each component in each sample using the calibration curve.
8/2/11	Prepare report
	Report QA review
	Report distribution

146 2 ppm aldehyde std

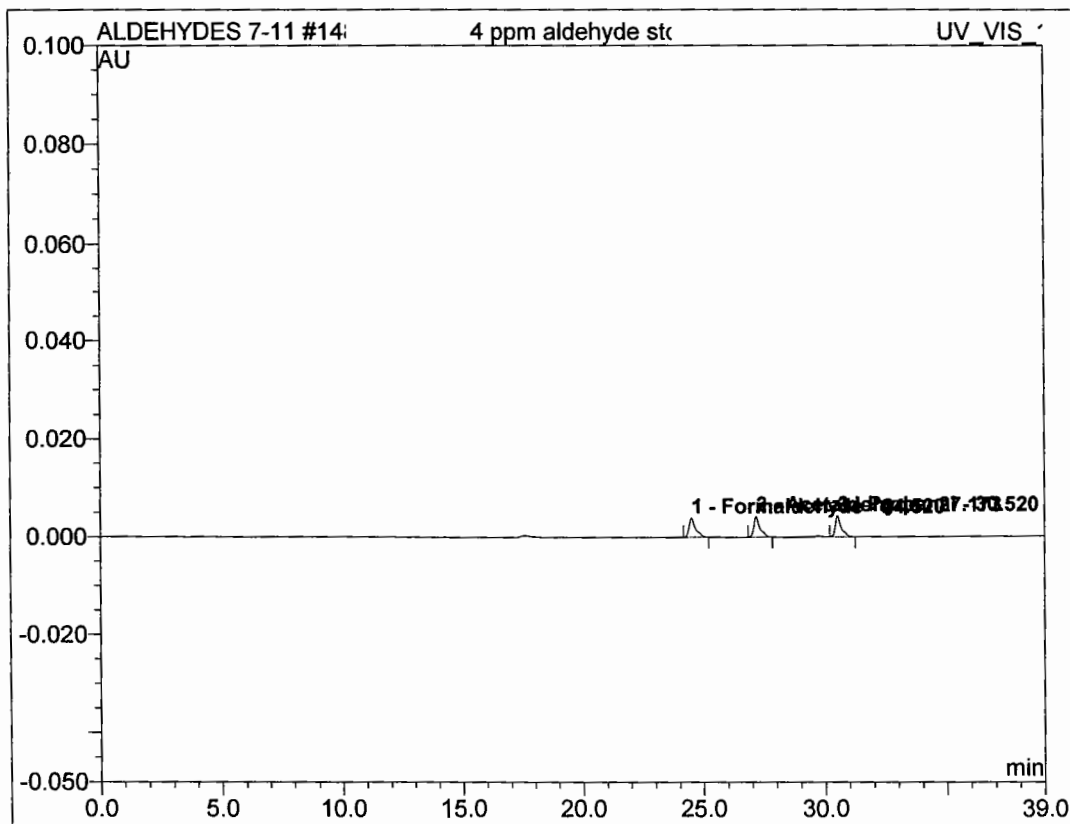
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/30/2011 13:30		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.36	Formaldehyde	0.0019	0.00056
2	27.13	Acetaldehyde	0.0019	0.00057
3	30.52	Propanal	0.0022	0.00060
Total:			0.006	0.350

148 4 ppm aldehyde std

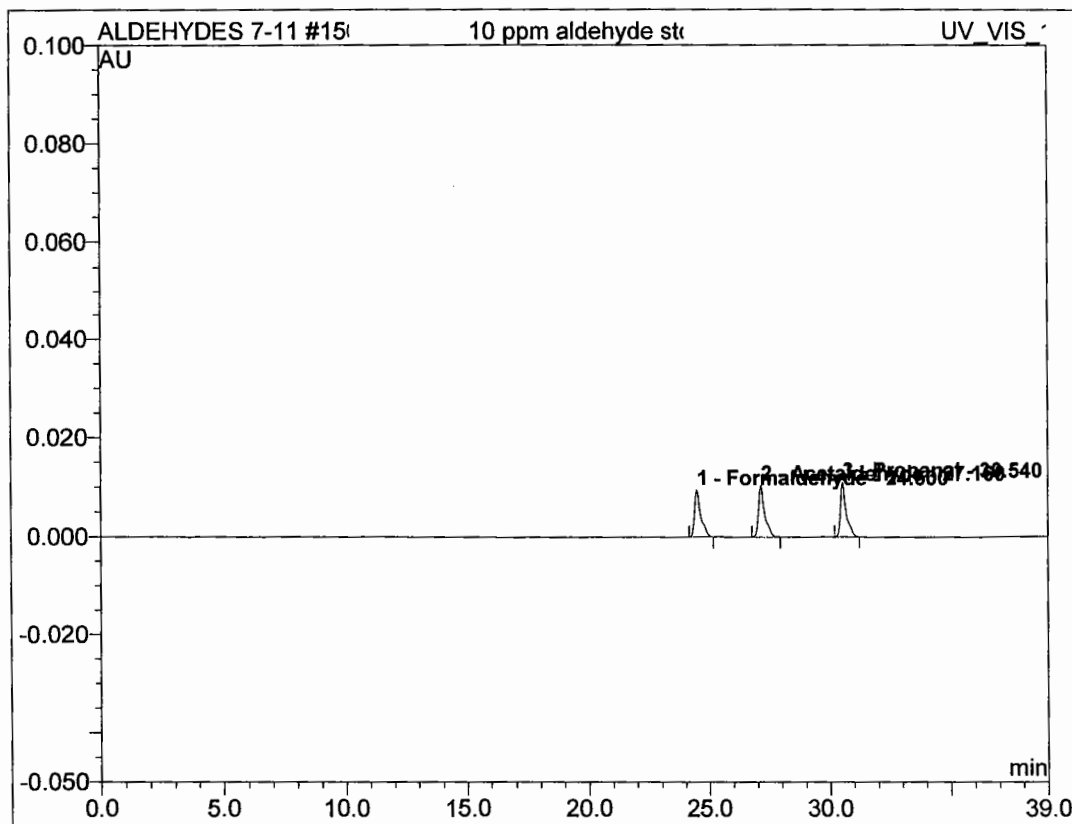
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Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/30/2011 14:58		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.52	Formaldehyde	0.0039	0.00119
2	27.17	Acetaldehyde	0.0042	0.00121
3	30.52	Propanal	0.0043	0.00118
Total:			0.012	0.781

150 10 ppm aldehyde std

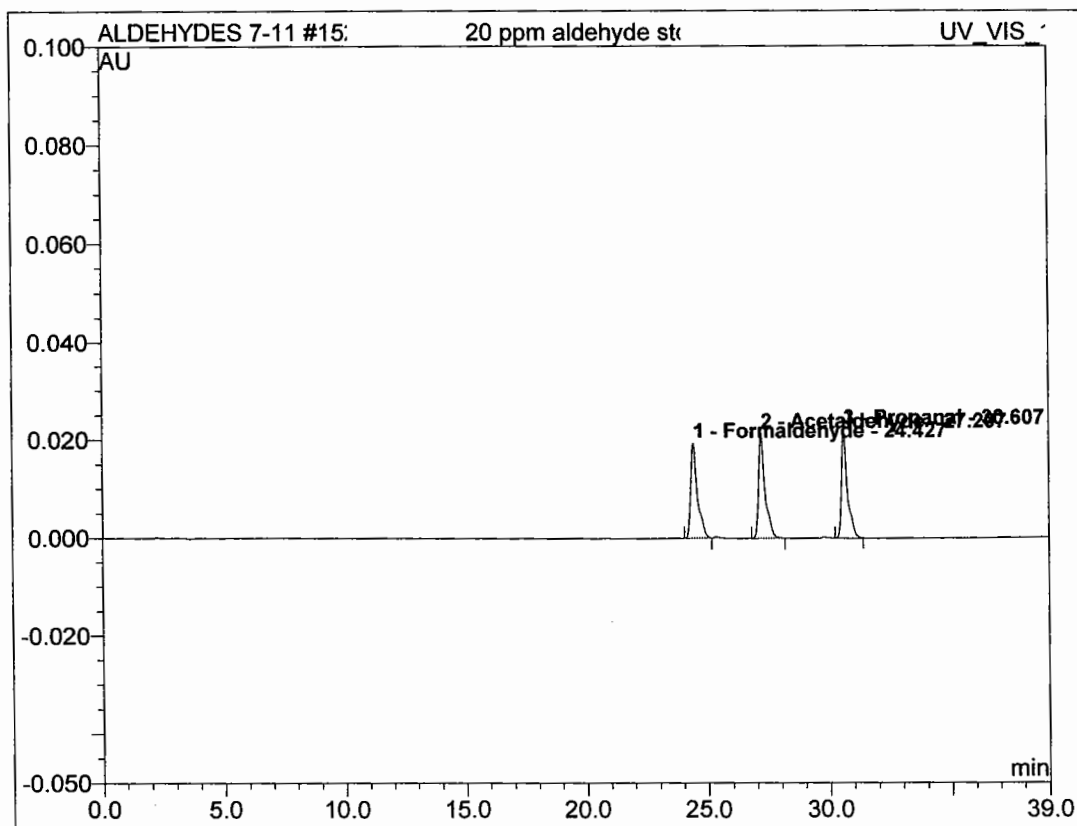
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Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/30/2011 16:26		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.50	Formaldehyde	0.0095	0.00288
2	27.16	Acetaldehyde	0.0103	0.00314
3	30.54	Propanal	0.0110	0.00307
Total:			0.031	1.981

152 20 ppm aldehyde std

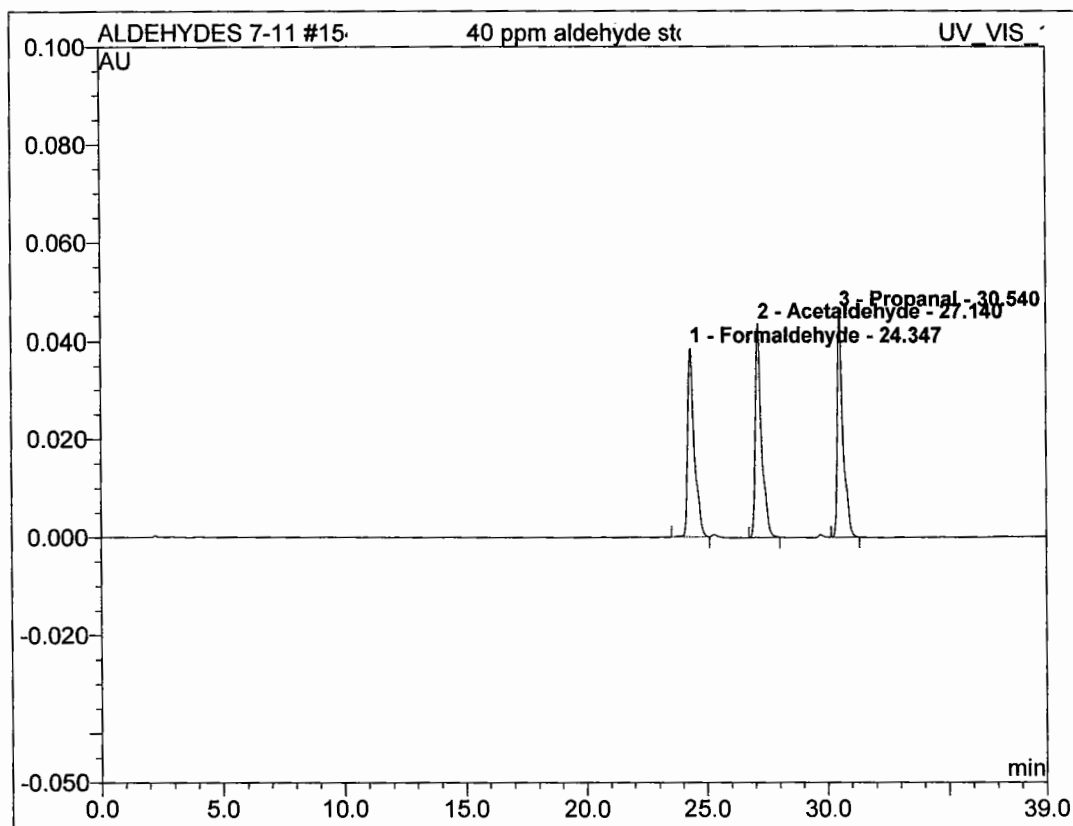
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Vial Number:	1		UV_VIS_1
Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Alddehydes		1.0000
Recording Time:	7/30/2011 17:55		1.0000
Run Time (min):	39.00		1.0000



No.	Ret. Time min	Peak Name	Height AU	Area AU*min
1	24.43	Formaldehyde	0.0194	0.00601
2	27.21	Acetaldehyde	0.0214	0.00647
3	30.61	Propanal	0.0221	0.00616
Total:			0.063	4.069

154 40 ppm aldehyde std

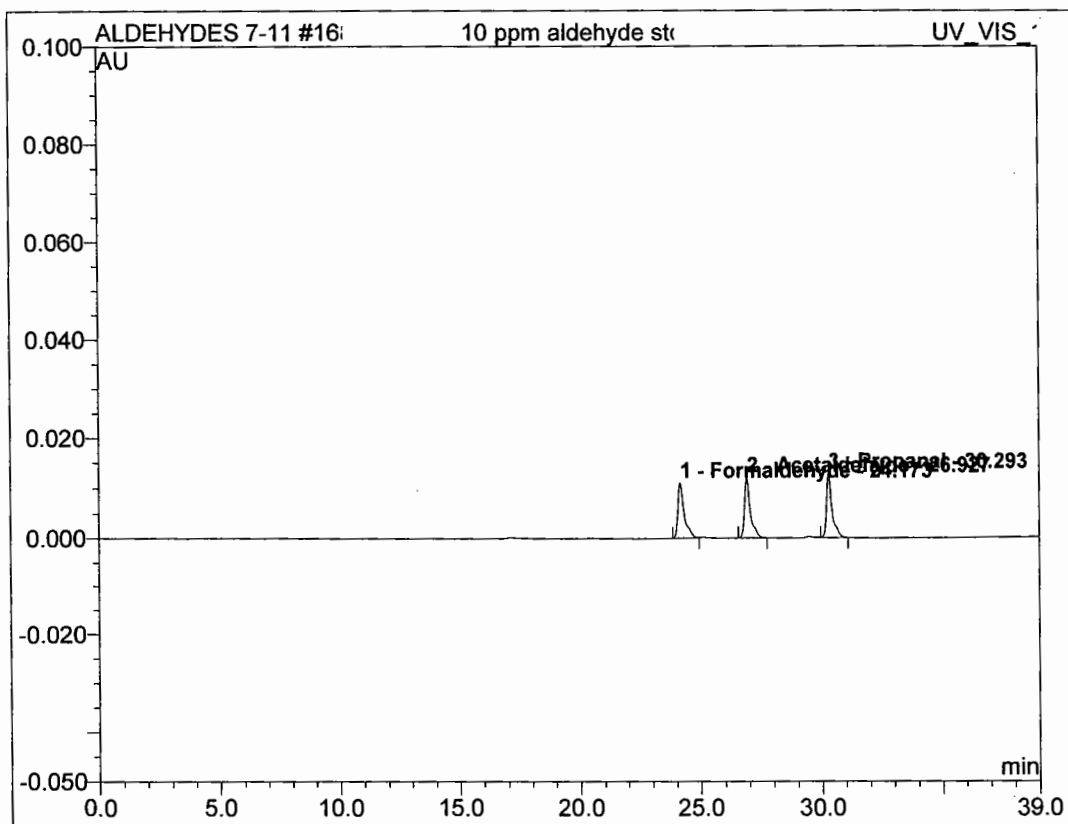
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Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/30/2011 19:23		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.35	Formaldehyde	0.0387	0.01197
2	27.14	Acetaldehyde	0.0436	0.01284
3	30.54	Propanal	0.0460	0.01225
Total:			0.128	8.089

168 10 ppm aldehyde std

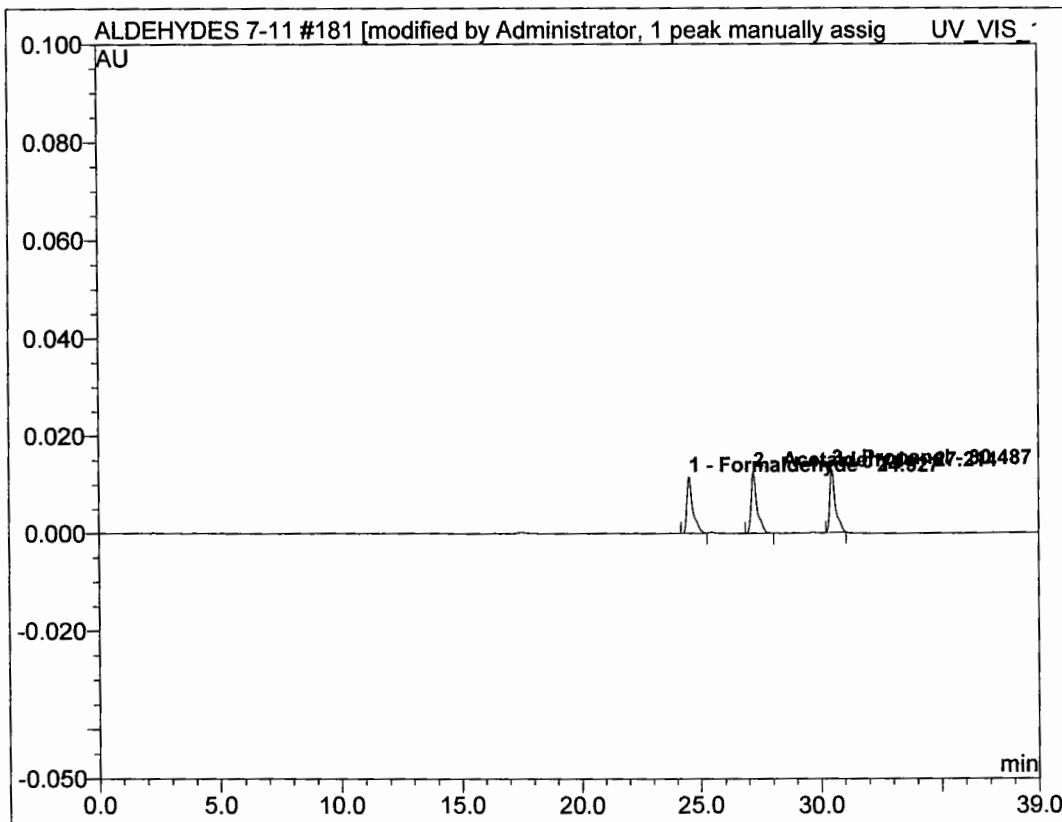
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Vial Number:	1		UV_VIS_1
Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Alddehydes		1.0000
Recording Time:	7/31/2011 5:40		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.17	Formaldehyde	0.0111	0.00337
2	26.93	Acetaldehyde	0.0121	0.00336
3	30.29	Propanal	0.0128	0.00348
Total:			0.036	2.084

181 10 ppm aldehyde std

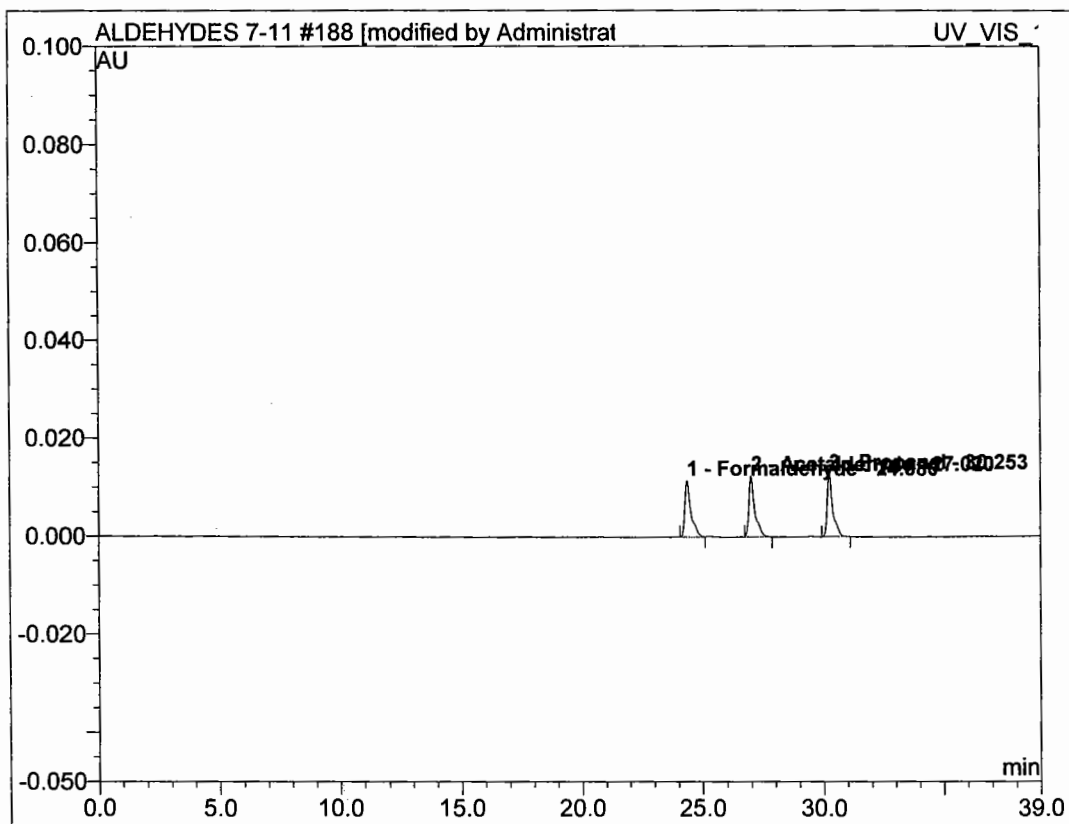
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Vial Number:	1		UV_VIS_1
Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 15:14		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.53	Formaldehyde	0.0116	0.00332
2	27.21	Acetaldehyde	0.0126	0.00358
3	30.49	Propanal	0.0129	0.00351
Total:			0.037	2.110

188 10 ppm aldehyde std

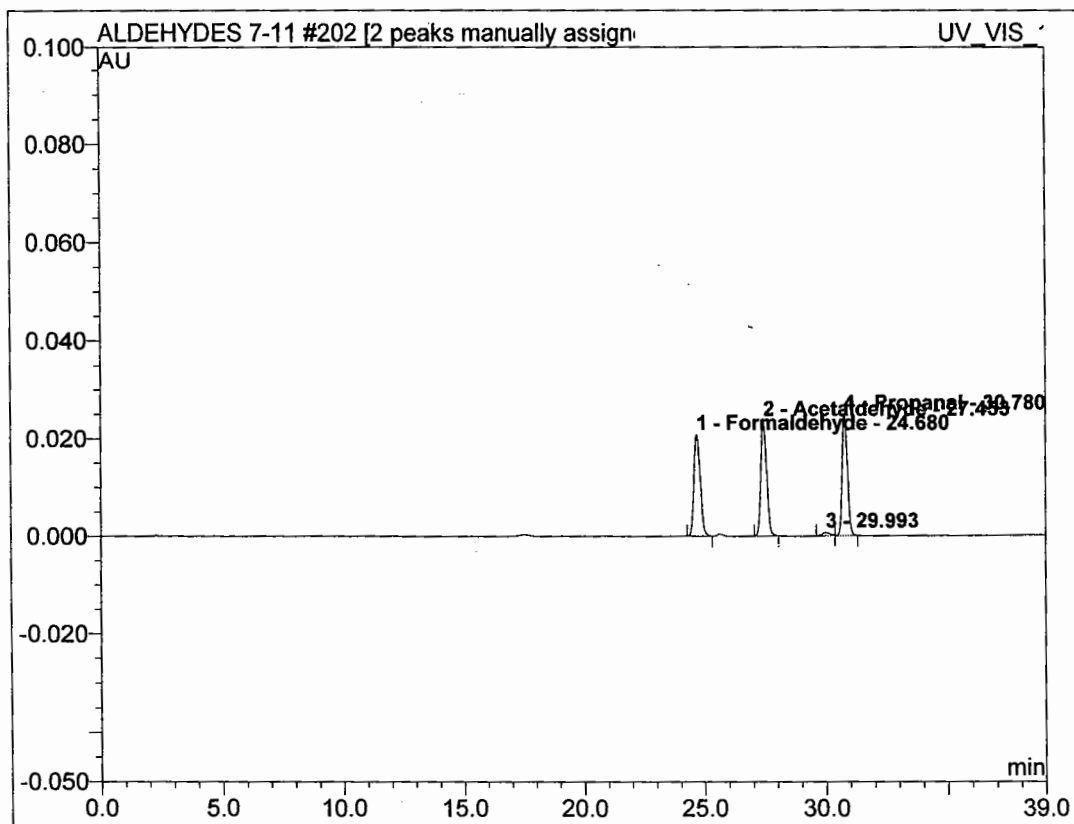
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Vial Number:	1		UV_VIS_1
Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 20:23		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.38	Formaldehyde	0.0114	0.00338
2	27.02	Acetaldehyde	0.0124	0.00351
3	30.25	Propanal	0.0128	0.00350
Total:			0.037	2.106

202 20 ppm aldehyde std

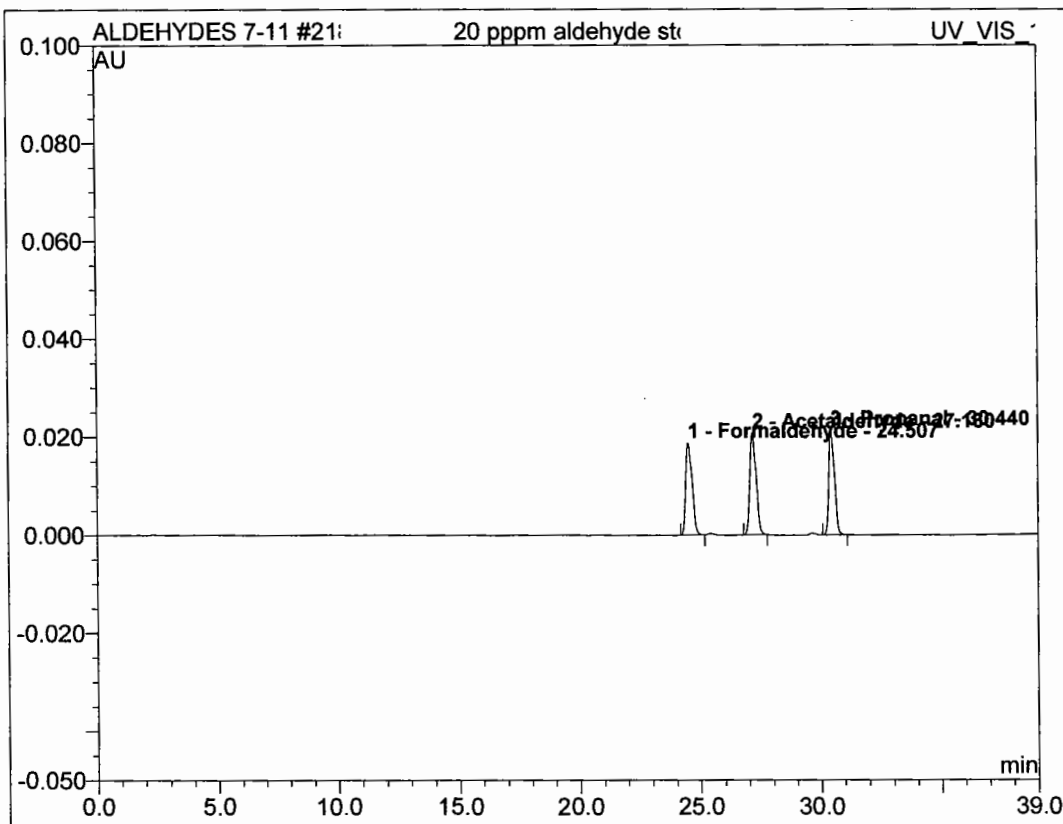
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Vial Number:	1		UV_VIS_1
Sample Type:	standard		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 19:01		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.68	Formaldehyde	0.0207	0.00630
2	27.45	Acetaldehyde	0.0235	0.00658
4	30.78	Propanal	0.0247	0.00632
Total:			0.069	3.907

218 20 ppm aldehyde std

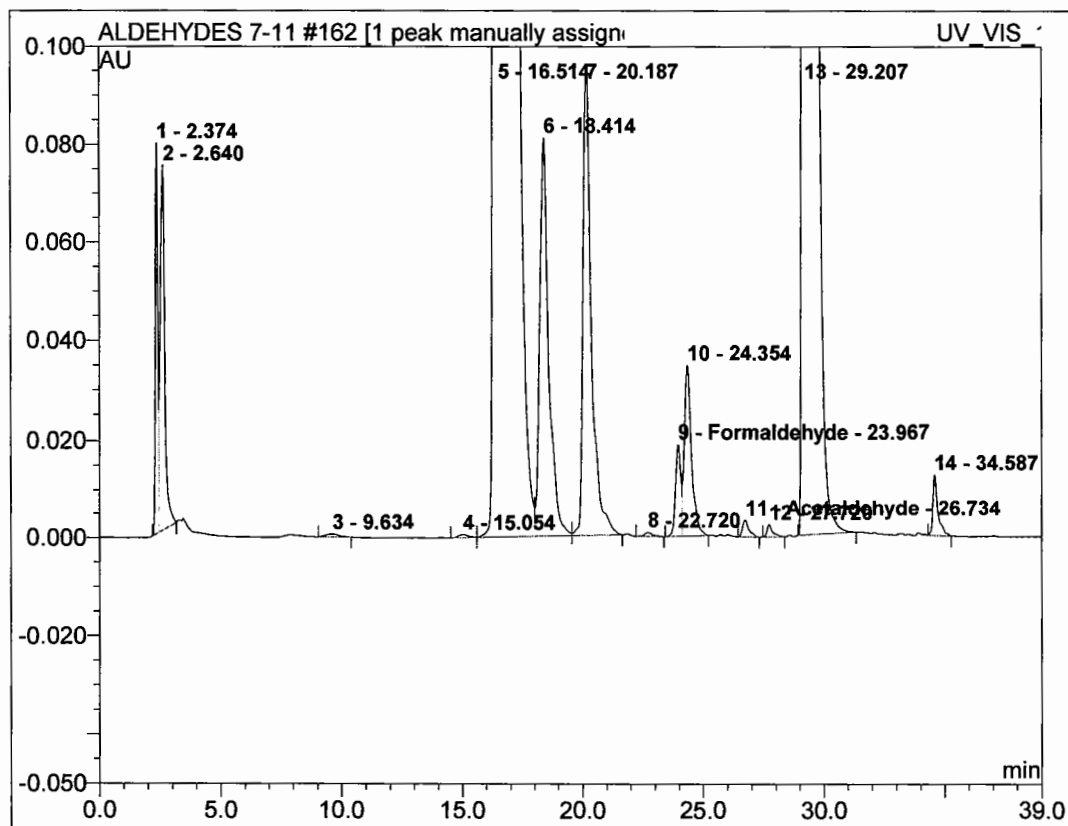
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Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/2/2011 12:26		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
1	24.51	Formaldehyde	0.0188	0.00592
2	27.16	Acetaldehyde	0.0207	0.00624
3	30.44	Propanal	0.0213	0.00604
Total:			0.061	3.690

162 FCCU-1241-1 5X

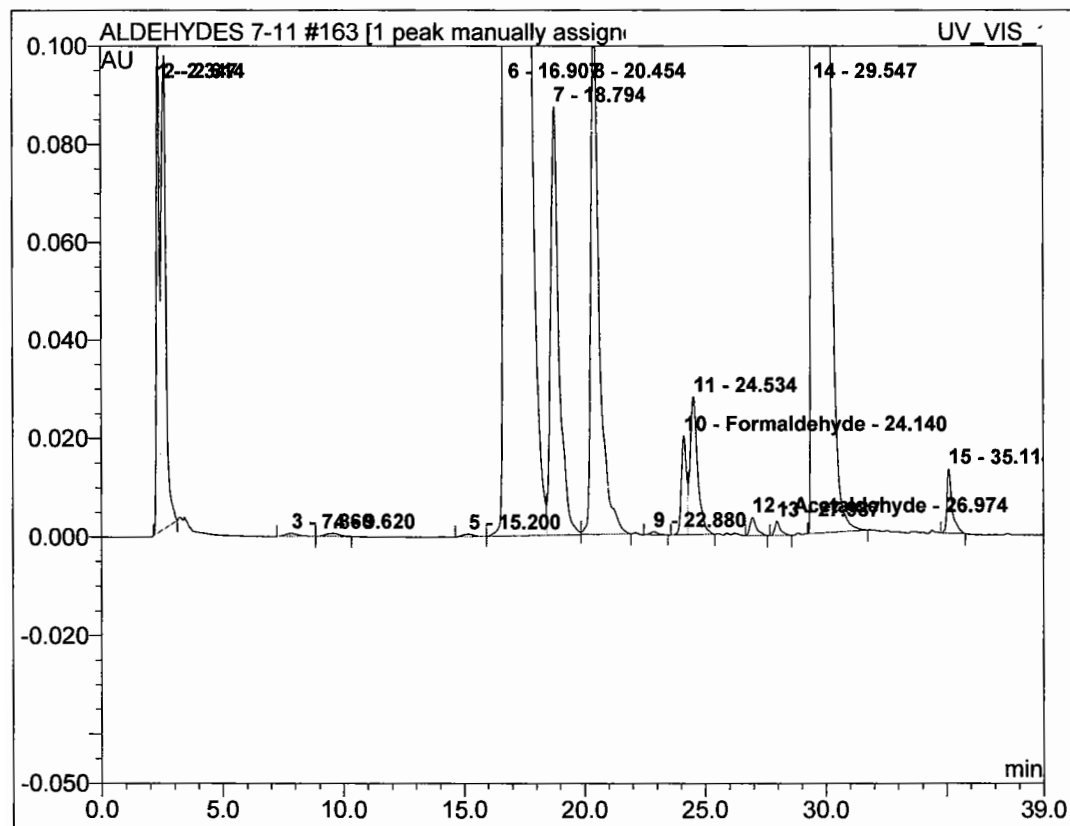
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Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldehydes		1.0000
Recording Time:	7/31/2011 1:16		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
9	23.97	Formaldehyde	0.0189	0.00463
11	26.73	Acetaldehyde	0.0035	0.00105
Total:			0.022	1.228

163 FCCU-1241-1 5X

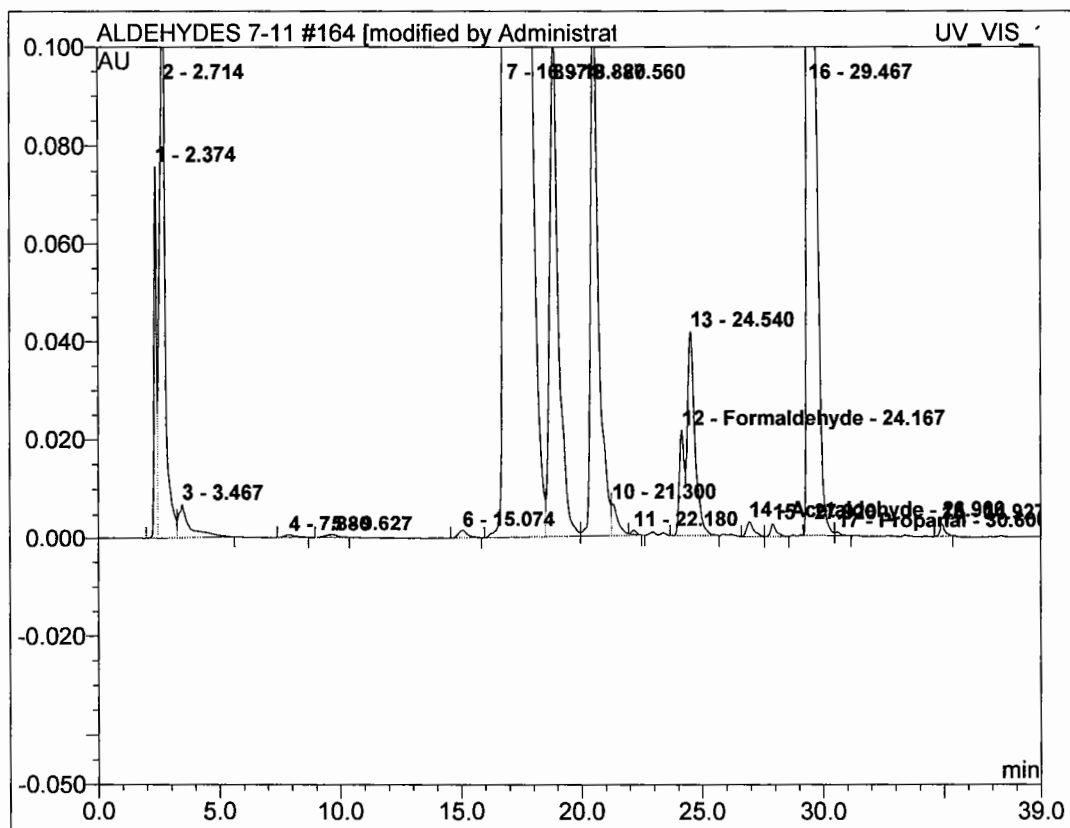
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Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 2:00		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
10	24.14	Formaldehyde	0.0201	0.00491
12	26.97	Acetaldehyde	0.0037	0.00113
Total:			0.024	1.305

164 FCCU-1241-2 5X

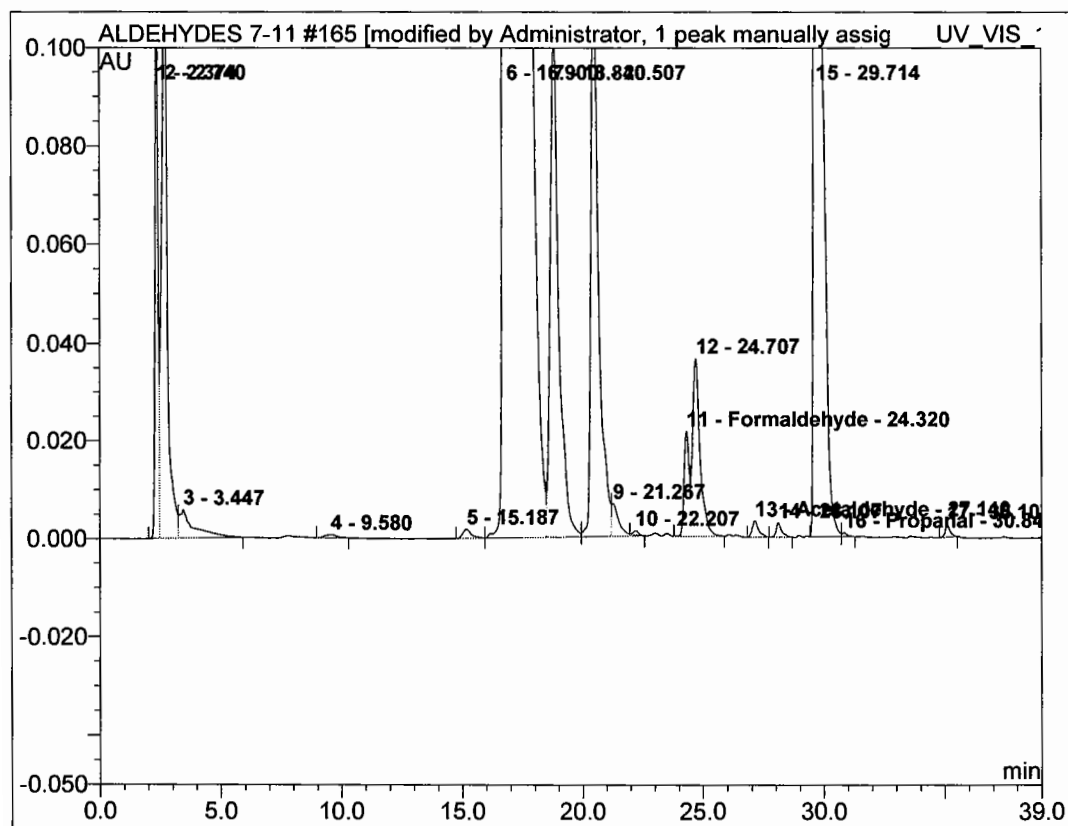
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Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 2:44		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
12	24.17	Formaldehyde	0.0214	0.00496
14	26.96	Acetaldehyde	0.0032	0.00108
17	30.60	Propanal	0.0008	0.00020
Total:			0.025	1.351

165 FCCU-1241-2 5X

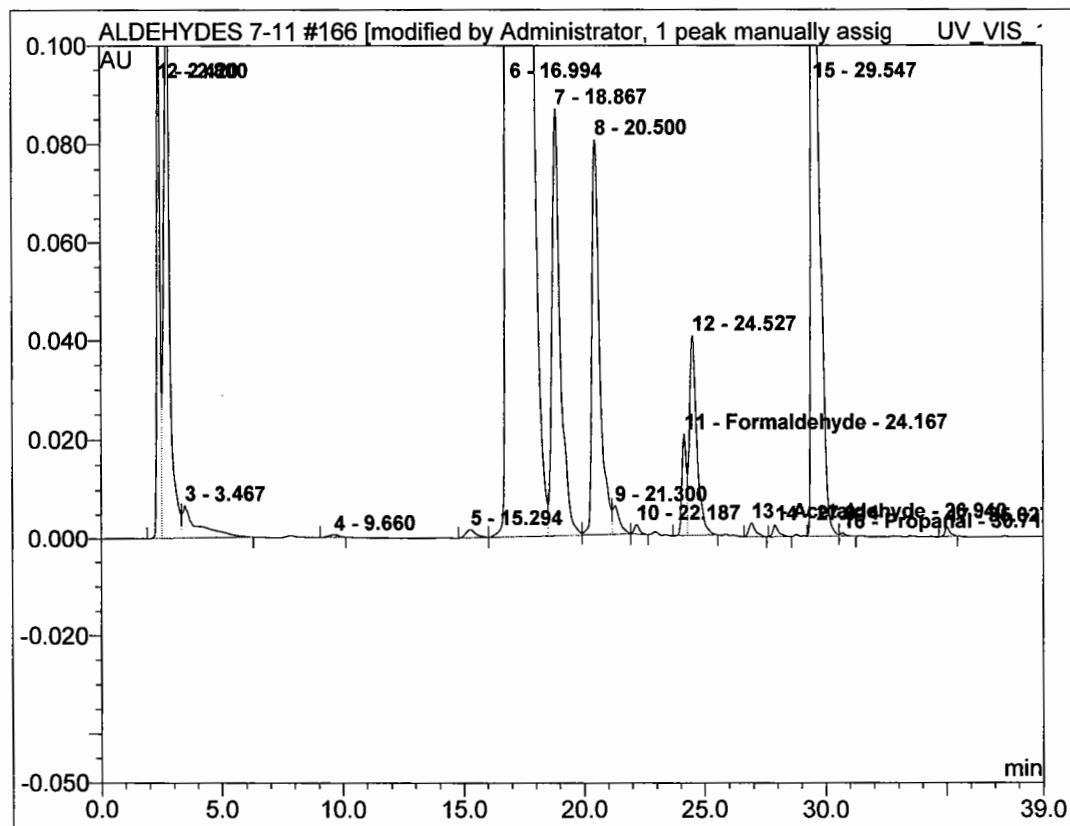
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Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 3:28		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
11	24.32	Formaldehyde	0.0214	0.00510
13	27.14	Acetaldehyde	0.0033	0.00103
16	30.85	Propanal	0.0008	0.00019
Total:			0.026	1.373

166 FCCU-1241-3 5X

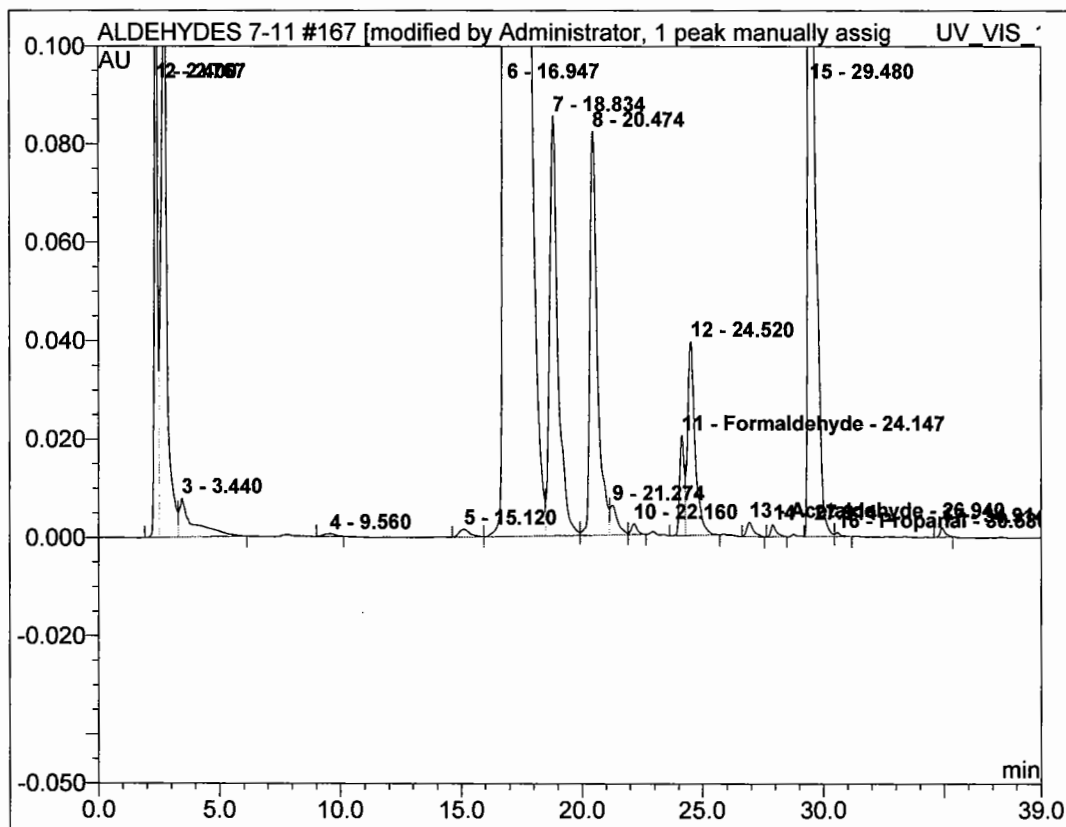
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Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 4:12		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
11	24.17	Formaldehyde	0.0205	0.00441
13	26.94	Acetaldehyde	0.0029	0.00091
16	30.71	Propional	0.0007	0.00017
Total:			0.024	1.193

167 FCCU-1241-3 5X

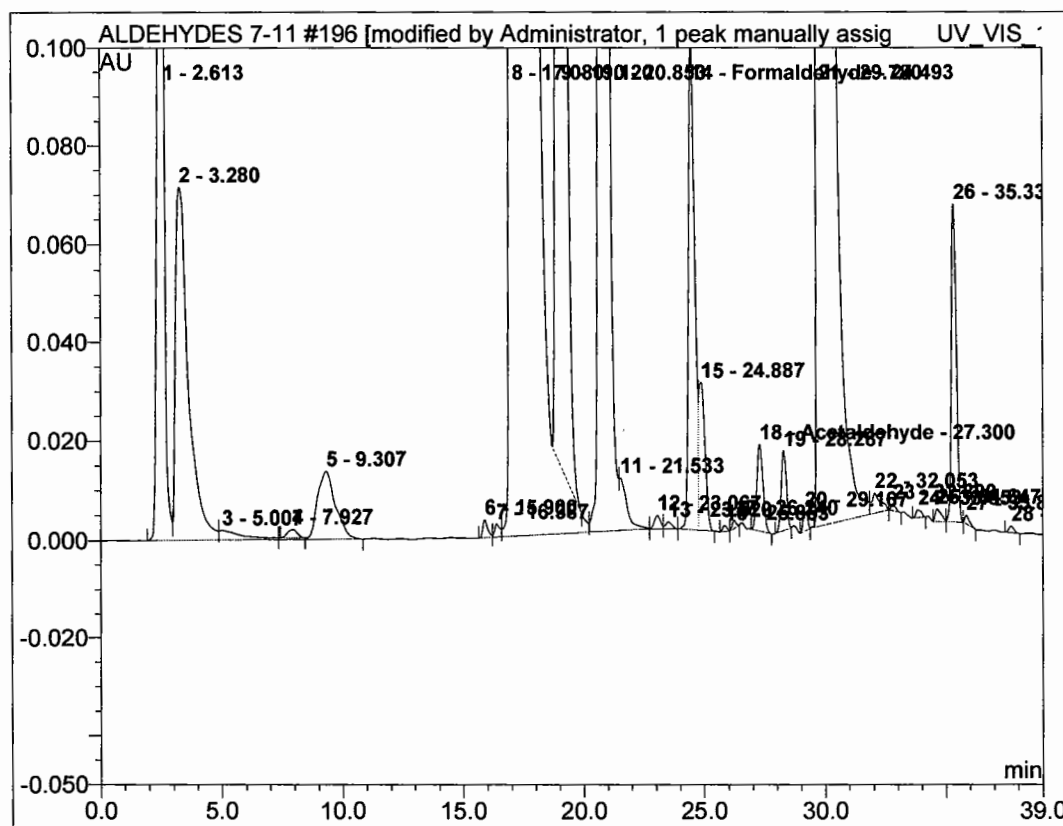
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Quantif. Method:	Alddehydes		1.0000
Recording Time:	7/31/2011 4:56		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
11	24.15	Formaldehyde	0.0204	0.00449
13	26.94	Acetaldehyde	0.0029	0.00092
16	30.58	Propanal	0.0008	0.00019
Total:			0.024	1.214

196 FCCU-1241-1

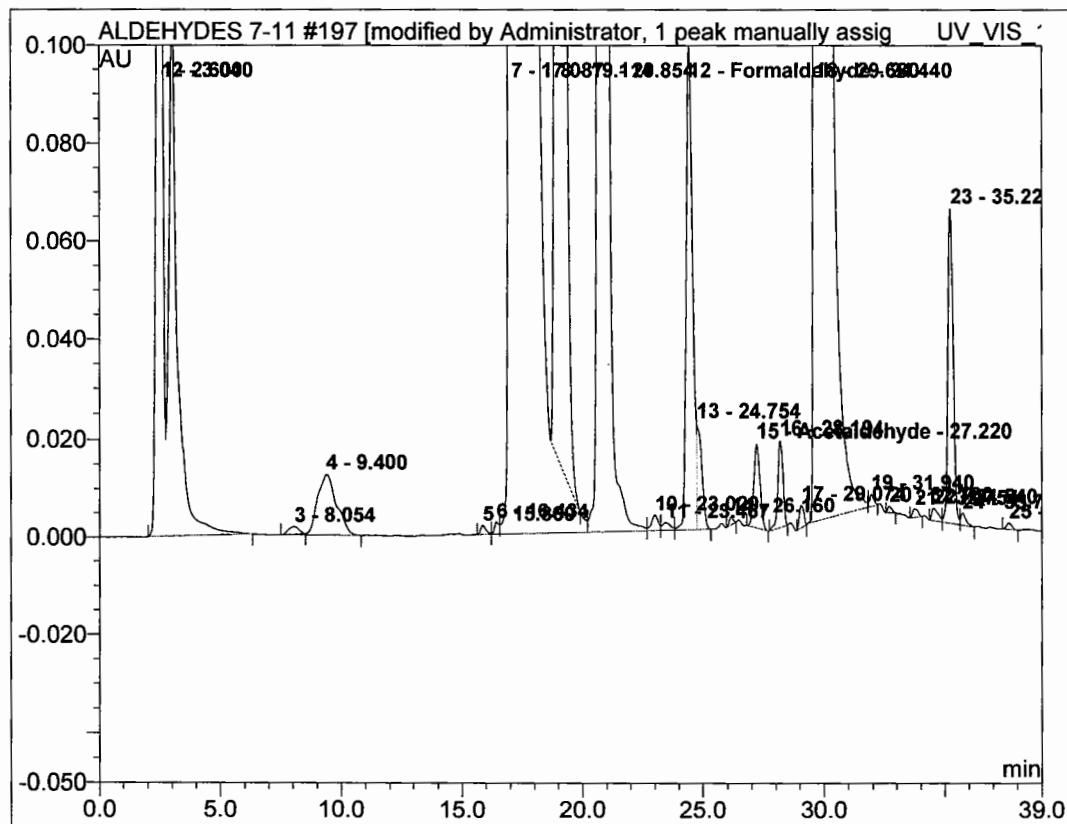
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Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 14:37		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
14	24.49	Formaldehyde	0.0991	0.02994
18	27.30	Acetaldehyde	0.0174	0.00517
Total:			0.117	7.667

197 FCCU-1241-1

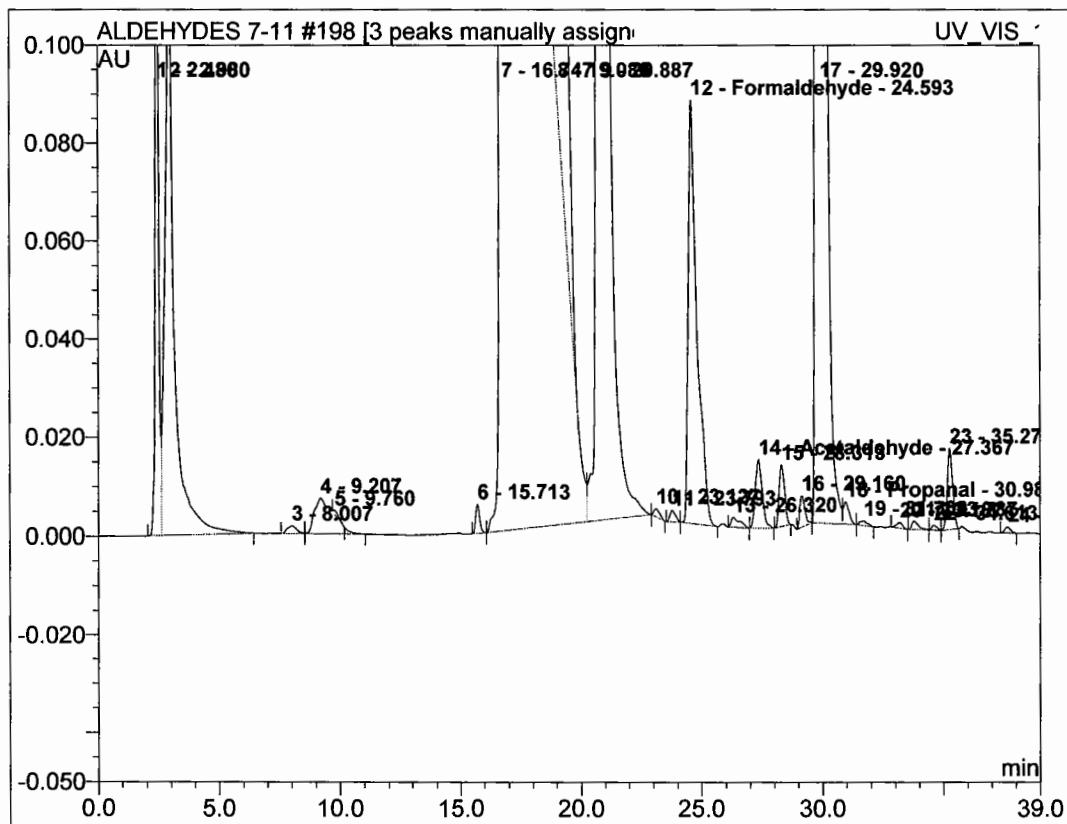
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Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 15:21		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
12	24.44	Formaldehyde	0.0983	0.03008
15	27.22	Acetaldehyde	0.0174	0.00520
Total:			0.116	7.704

198 FCCU-1241-2

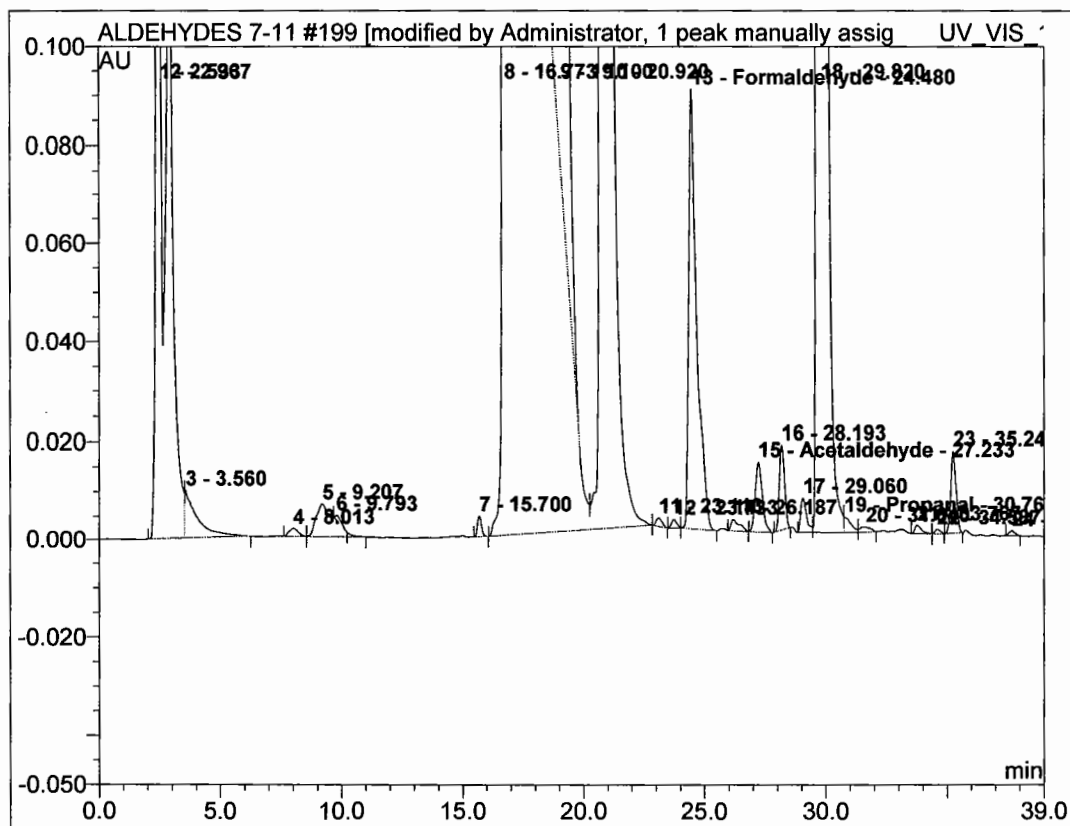
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Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 16:05		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
12	24.59	Formaldehyde	0.0862	0.03563
14	27.37	Acetaldehyde	0.0139	0.00467
18	30.98	Propanal	0.0046	0.00123
Total:			0.105	9.139

199 FCCU-1241-2

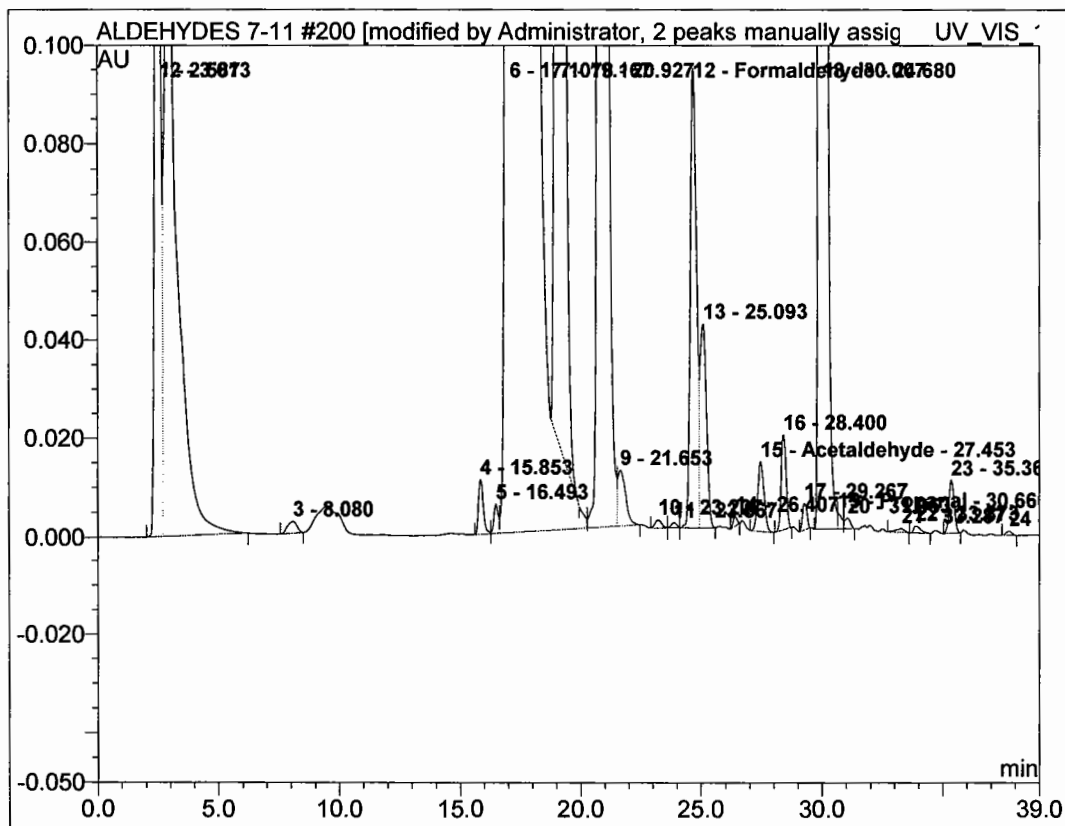
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Alddehydes		1.0000
Recording Time:	8/1/2011 16:49		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
13	24.48	Formaldehyde	0.0889	0.03381
15	27.23	Acetaldehyde	0.0143	0.00487
19	30.77	Propanal	0.0034	0.00112
Total:			0.107	8.735

200 FCCU-1241-3

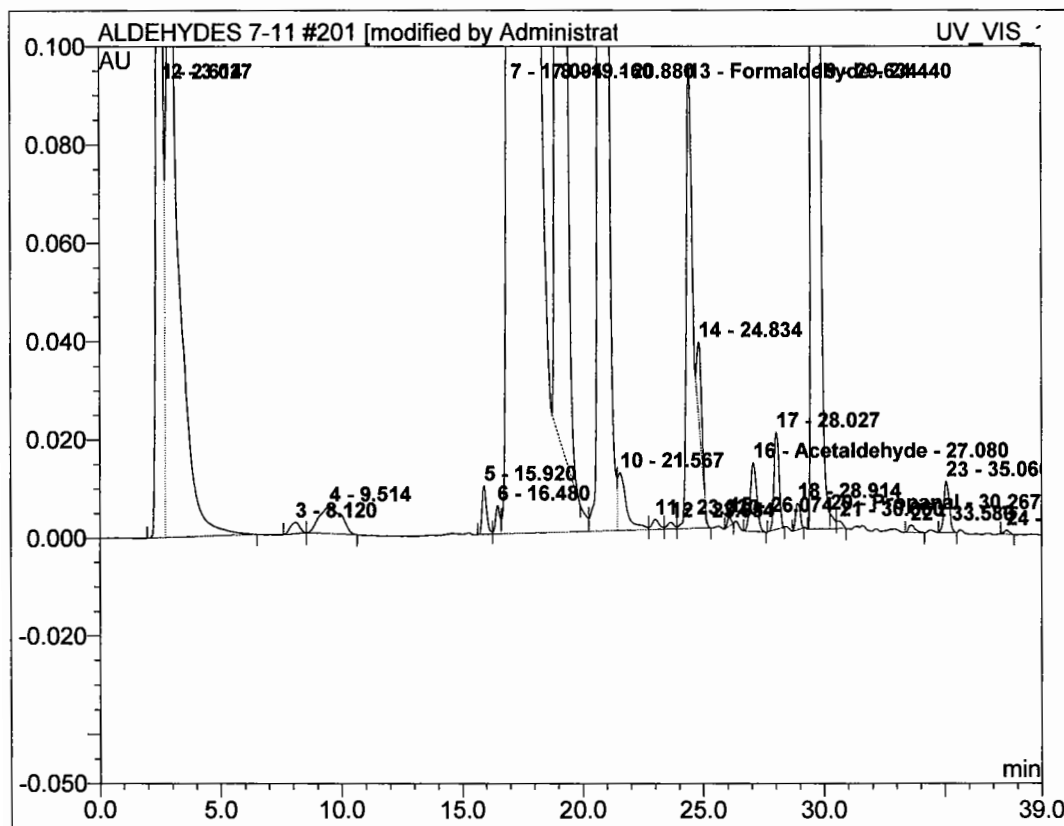
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 17:33		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
12	24.68	Formaldehyde	0.0934	0.02782
15	27.45	Acetaldehyde	0.0140	0.00428
19	30.66	Propanal	0.0032	0.00059
Total:			0.111	6.410

201 FCCU-1241-3

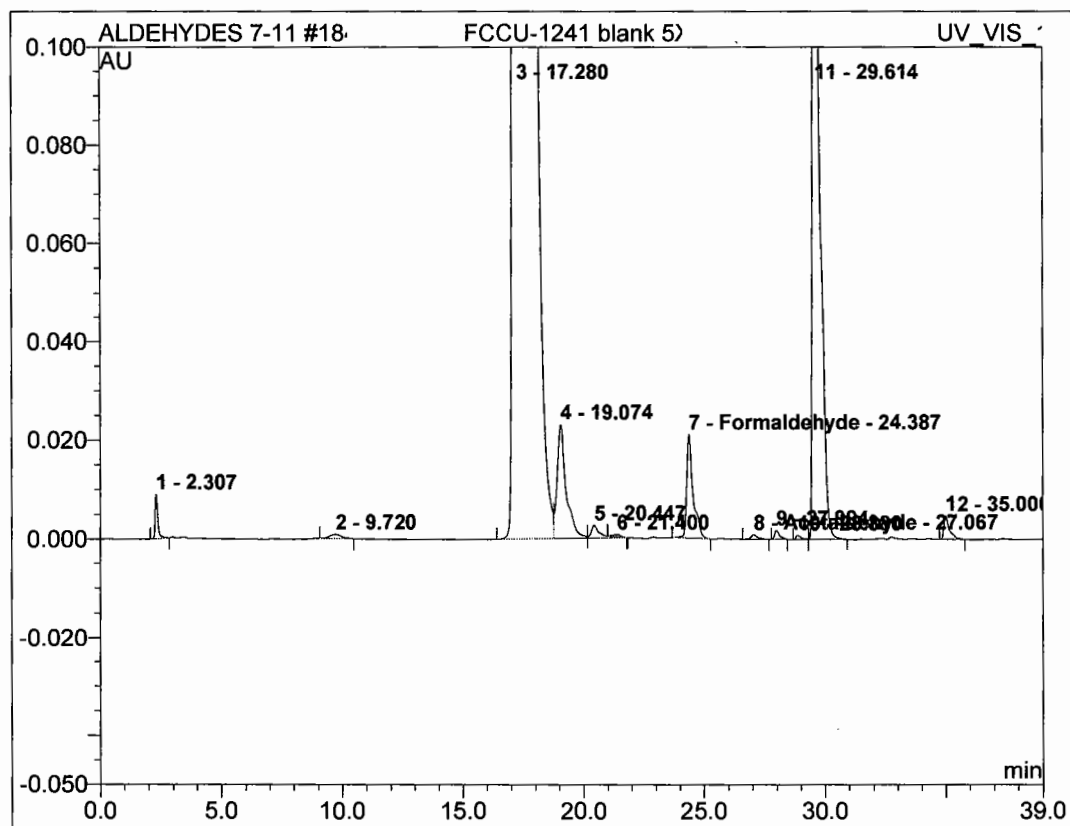
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 18:17		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
13	24.44	Formaldehyde	0.0944	0.03489
16	27.08	Acetaldehyde	0.0140	0.00432
20	30.27	Propanal	0.0029	0.00056
Total:			0.111	7.781

184 FCCU-1241 blank 5X

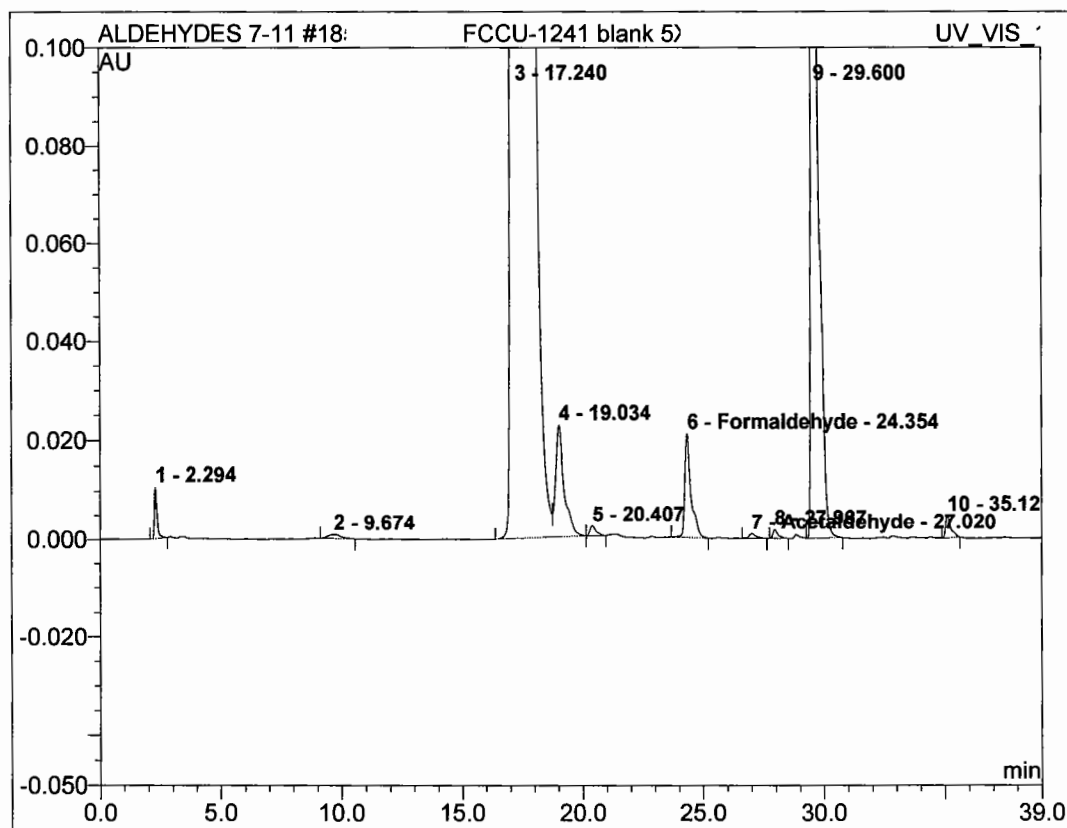
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 17:26		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
7	24.39	Formaldehyde	0.0210	0.00650
8	27.07	Acetaldehyde	0.0010	0.00032
Total:			0.022	1.529

185 FCCU-1241 blank 5X

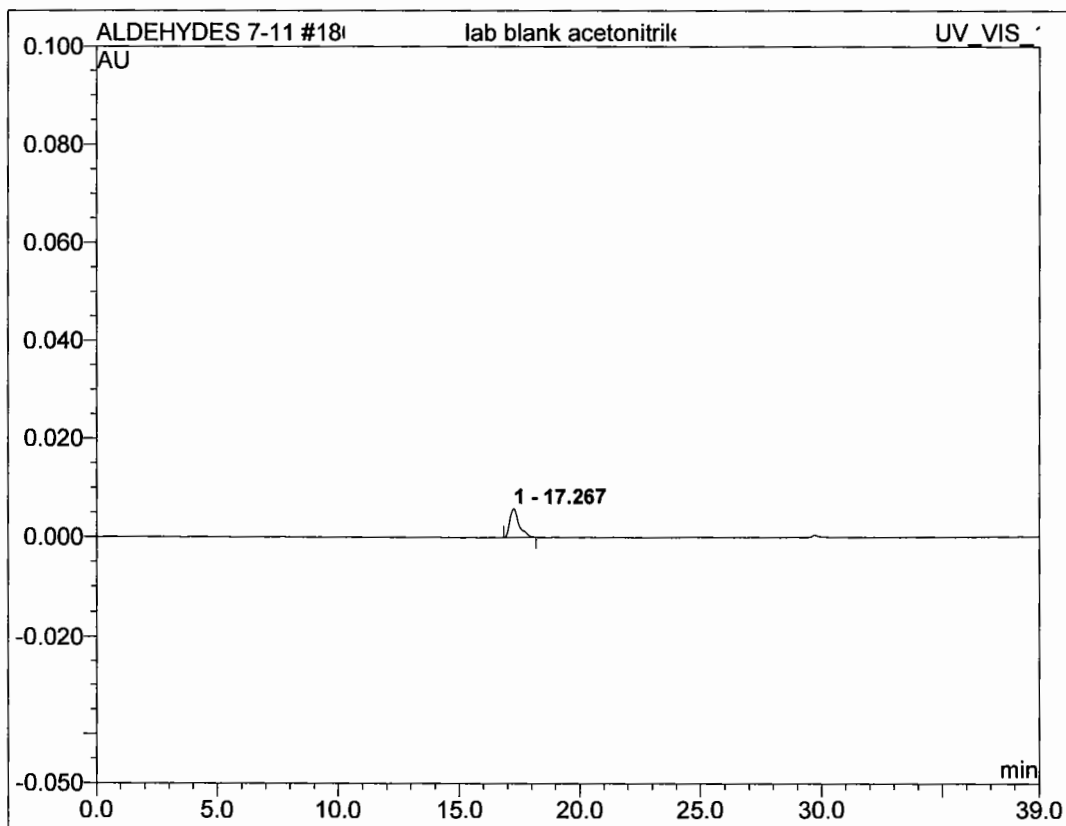
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 18:10		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
6	24.35	Formaldehyde	0.0210	0.00641
7	27.02	Acetaldehyde	0.0010	0.00034
Total:			0.022	1.511

186 lab blank acetonitrile

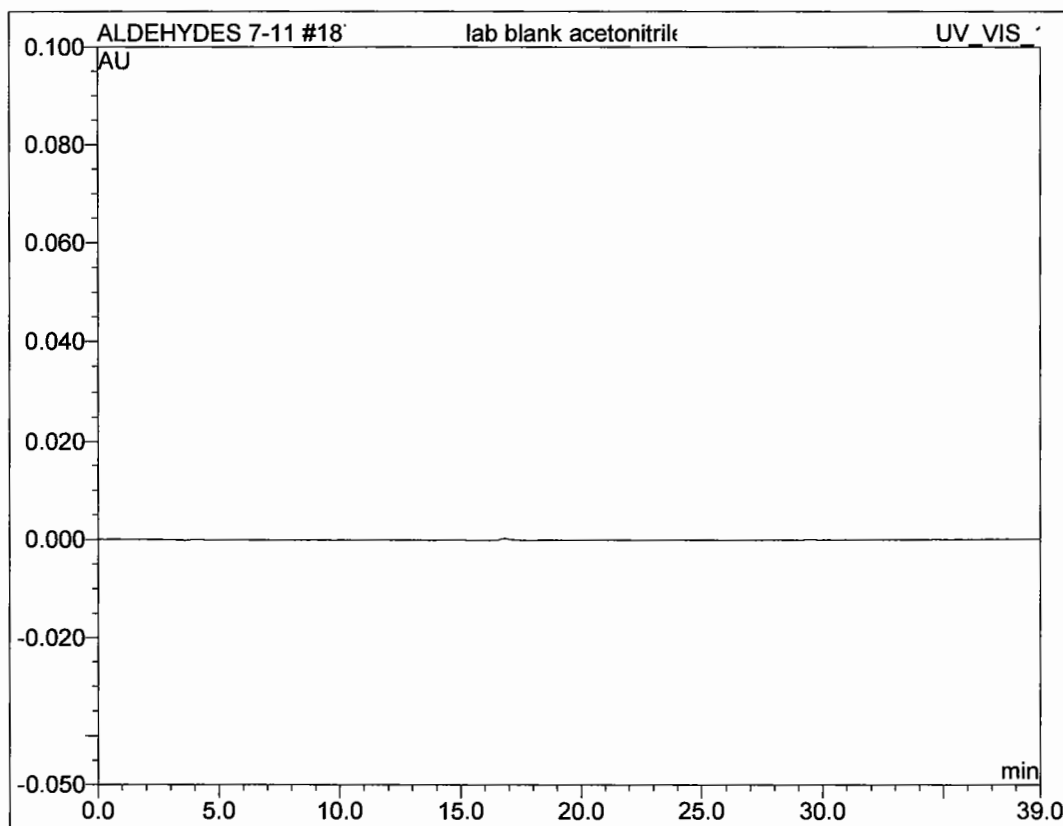
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 18:54		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
Total:			0.000	0.000

187 lab blank acetonitrile

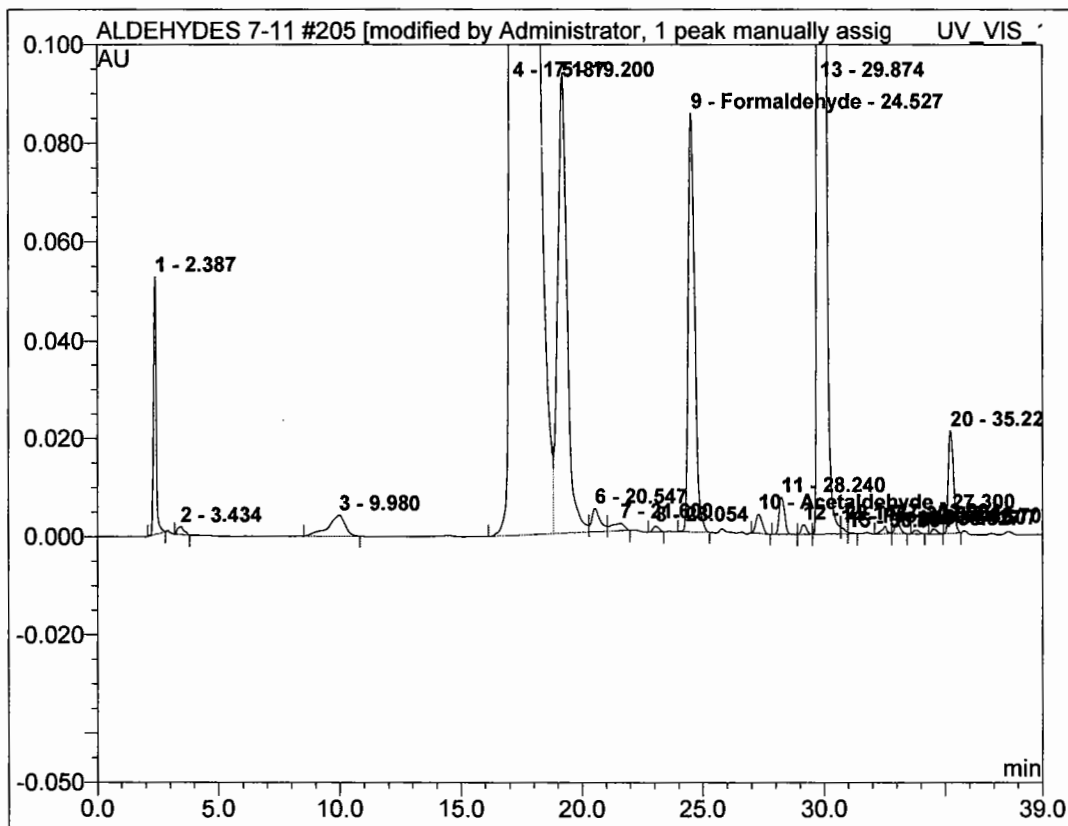
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	7/31/2011 19:38		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
Total:			0.000	0.000

205 FCCU-1241 blank

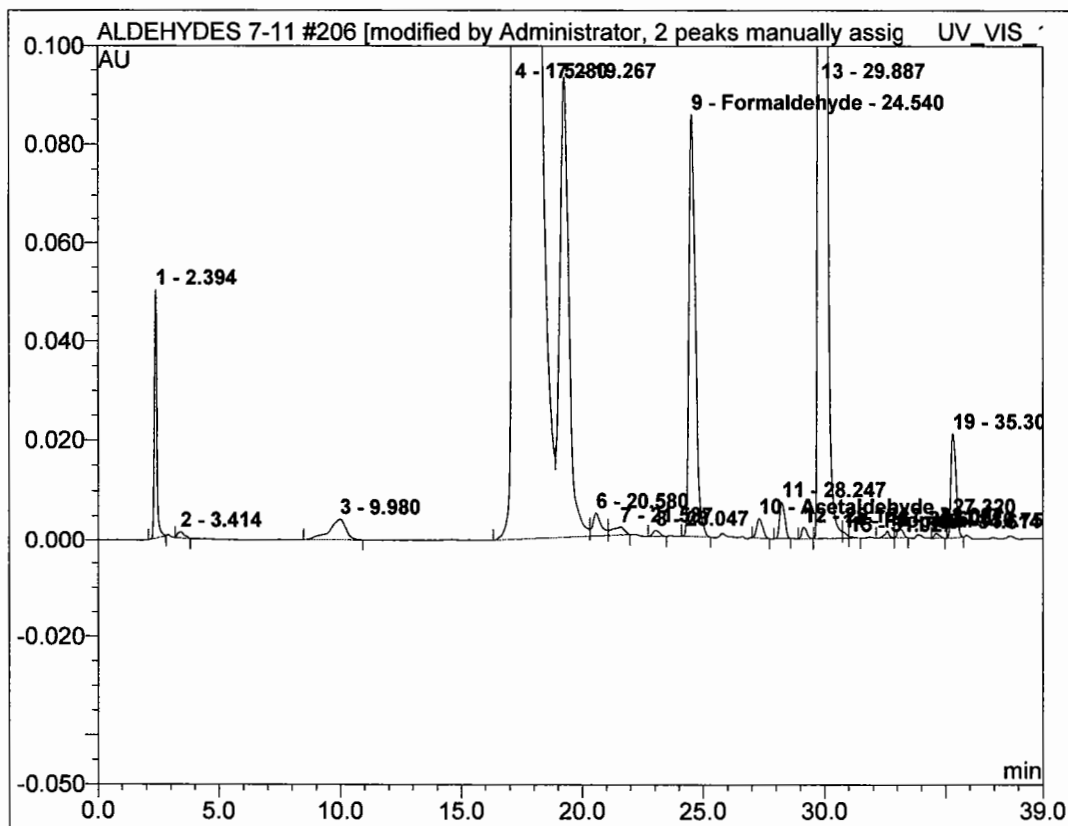
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldehydes		1.0000
Recording Time:	8/1/2011 21:14		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
9	24.53	Formaldehyde	0.0851	0.02618
10	27.30	Acetaldehyde	0.0039	0.00117
14	30.71	Propanal	0.0013	0.00025
Total:			0.090	6.191

206 FCCU-1241 blank

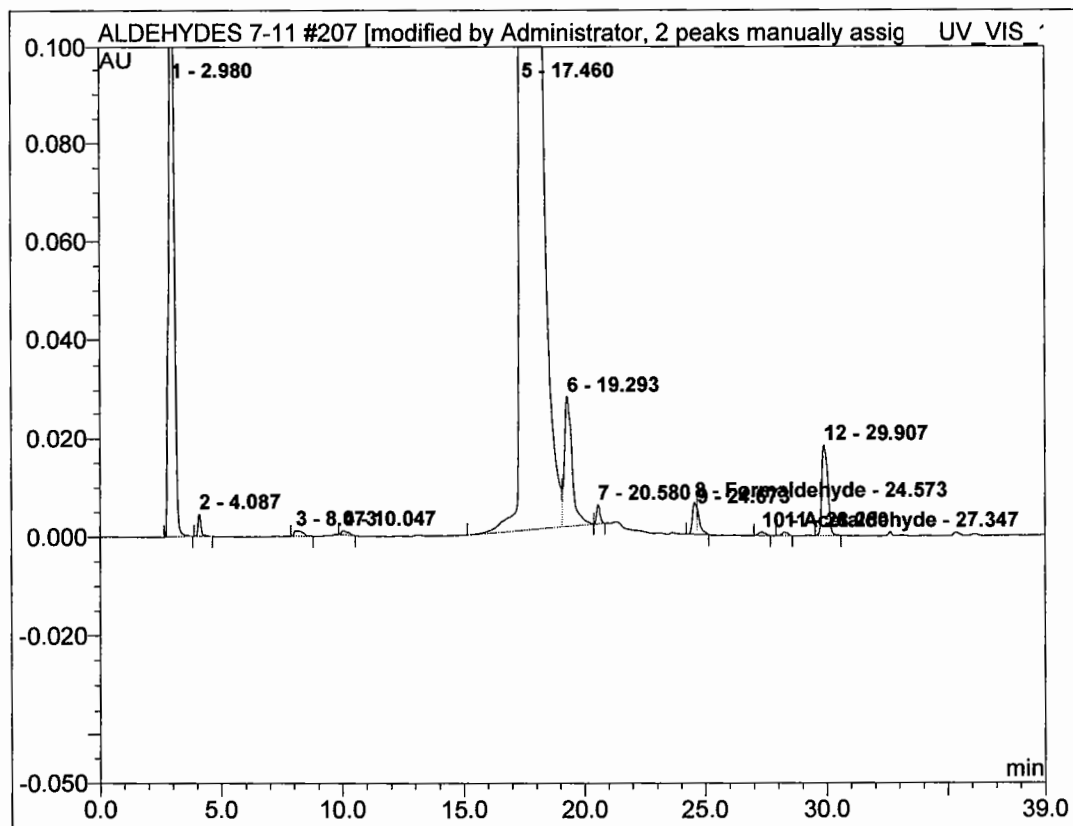
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 21:58		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
9	24.54	Formaldehyde	0.0851	0.02603
10	27.32	Acetaldehyde	0.0040	0.00117
14	30.75	Propanal	0.0013	0.00026
Total:			0.090	6.156

207 FCCU-1241 DNPH blank

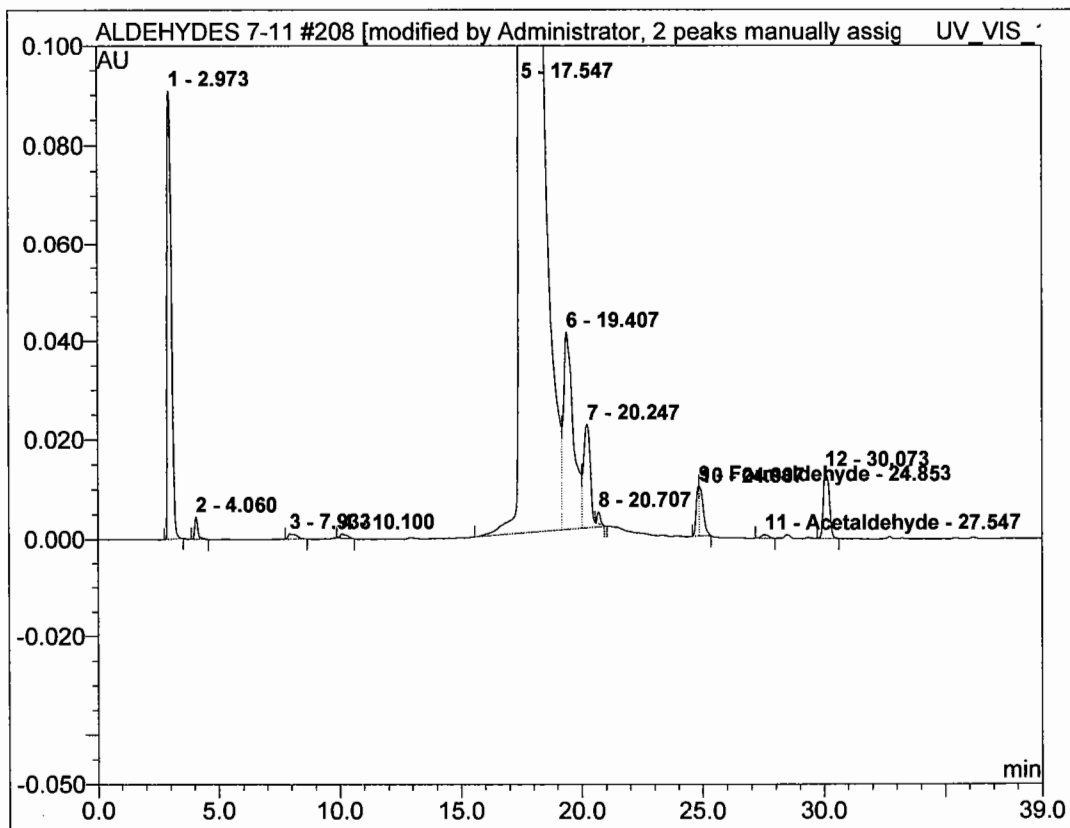
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/1/2011 22:42		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
8	24.57	Formaldehyde	0.0065	0.00125
10	27.35	Acetaldehyde	0.0007	0.00021
Total:			0.007	0.320

208 FCCU-1241 DNPH blank

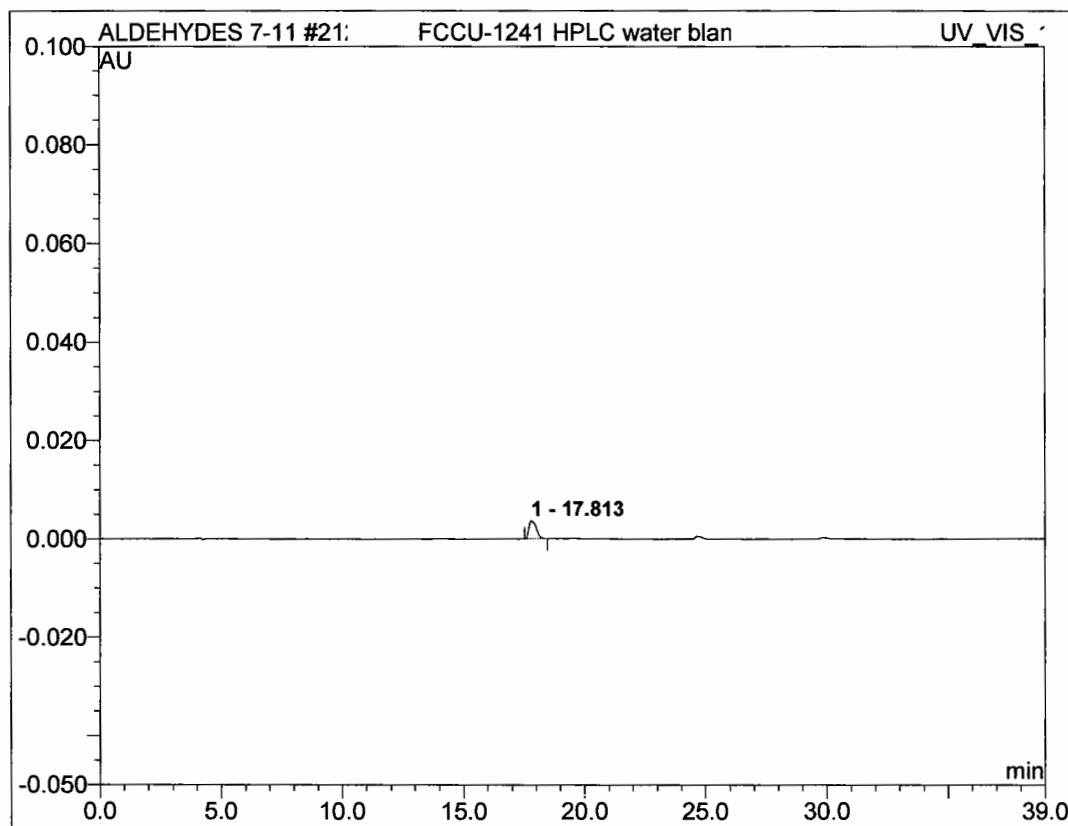
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Alddehydes		1.0000
Recording Time:	8/1/2011 23:26		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
9	24.85	Formaldehyde	0.0100	0.00131
11	27.55	Acetaldehyde	0.0007	0.00023
Total:			0.011	0.336

212 FCCU-1241 HPLC water blank

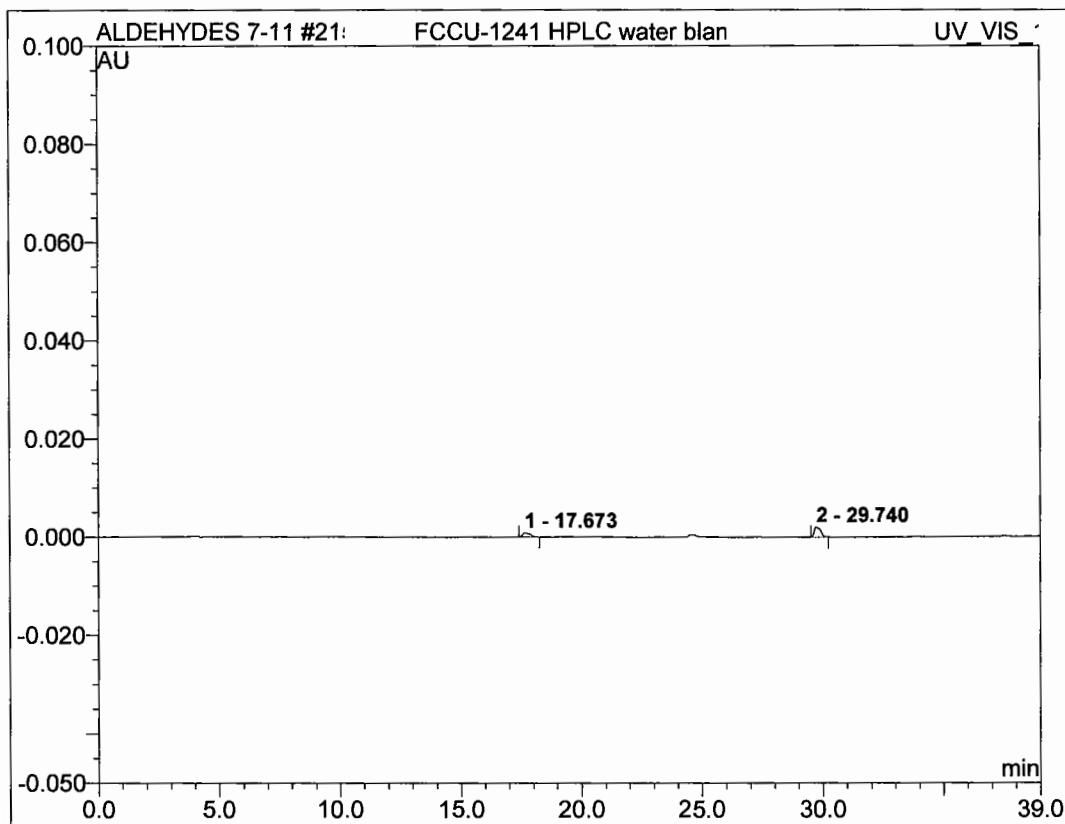
Client	Valero, PA	Unknown 13	Aldehyde C 35
Vial Number:	1		UV_VIS_1
Sample Type:	unknown		n.a.
Control Program:	ALDEHYDES 7-11		n.a.
Quantif. Method:	Aldedehydes		1.0000
Recording Time:	8/2/2011 2:22		1.0000
Run Time (min):	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
Total:			0.000	0.000

215 FCCU-1241 HPLC water blank

<i>Client</i>	Valero, PA	Unknown 13	Aldehyde C 35
<i>Vial Number:</i>	1		UV_VIS_1
<i>Sample Type:</i>	unknown		n.a.
<i>Control Program:</i>	ALDEHYDES 7-11		n.a.
<i>Quantif. Method:</i>	Aldedehydes		1.0000
<i>Recording Time:</i>	8/2/2011 10:14		1.0000
<i>Run Time (min):</i>	39.00		1.0000



No.	Ret.Time min	Peak Name	Height AU	Area AU*min
Total:			0.000	0.000

ANALYTICAL SUMMARY

page 1 of 2

CLIENT:

Valero

LOCATION:

Port Arthur, TX

SAMPLE DATES:

6/7/11-6/8/11

Analyst: J. Ruggaber

Date of Completion: 6/30/2011

ANALYSIS:

Hydrochloric Acid

METHOD:

USEPA Method 26

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. µg/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-->				
					5.0	0.6758	0.1309	5.06	1.17
					Second. Std.		N/A		

Sample Concentration Calculations

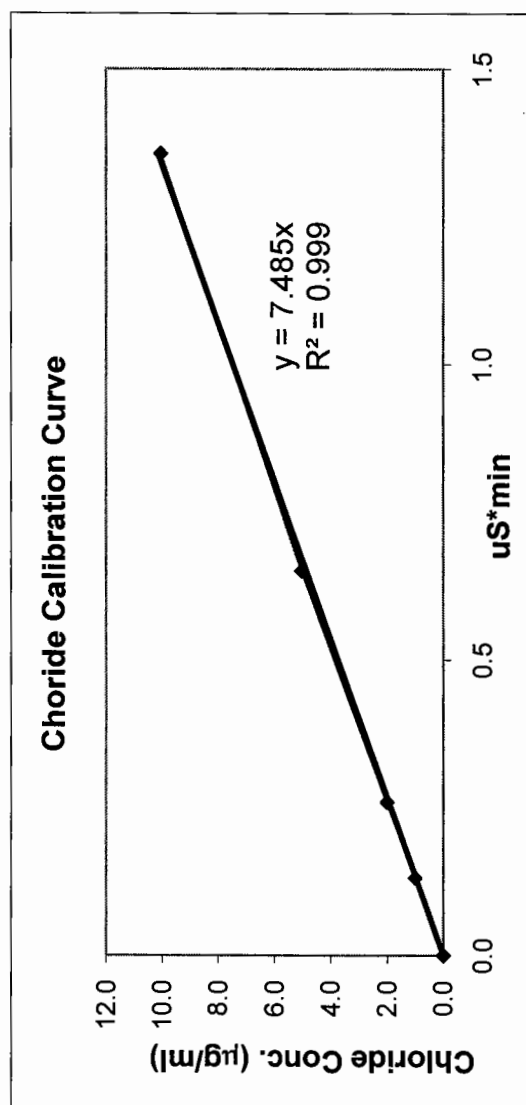
ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Diluted Conc. (µg/ml)	Dilution Factor	Sample volume(ml)	Total Mass HCl (µg)
FCCU-1241 Run 1	<0.031	<0.031	<0.031	0.00	<0.23	1	1000	<234
FCCU-1241 Run 2	<0.031	<0.031	<0.031	0.00	<0.23	1	1000	<234
FCCU-1241 Run 3	<0.031	<0.031	<0.031	0.00	<0.23	1	1000	<234
0.1 N H2SO4 Blank	<0.031	<0.031	<0.031	0.00	<0.23	1	1000	<234
Reagent DI Water Blank	<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	0.133	0.136	0.135	-1.08	1.01	1.01	100%	Pass
Run 2 spike	0.126	0.128	0.127	-0.75	0.95	1.01	93%	Pass

CLIENT:
LOCATION:
SAMPLE DATES:
ANALYSIS:
METHOD:

Valero
 Port Arthur, TX
 6/7/11-6/8/11
 Hydrochloric Acid
 USEPA Method 26

Analyst: J. Ruggaber
Date of Completion: 6/30/2011
Template Control ID: USEPA-M26-HCl-Template-052T-REV1



ANALYTICAL SUMMARY

page 1 of 2

CLIENT:

Valero

LOCATION:

Port Arthur, TX

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-HCI-Template-052T-REV1

Calibration Curve Calculation

Std. ($\mu\text{g/ml}$)	Pre Cal ($\mu\text{S}^*\text{min}$)	Post Cal ($\mu\text{S}^*\text{min}$)	Average ($\mu\text{S}^*\text{min}$)	Deviation (%)	Conc. $\mu\text{g/ml}$	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.	0.955	N/A	4.98	-1.16

Sample Concentration Calculations

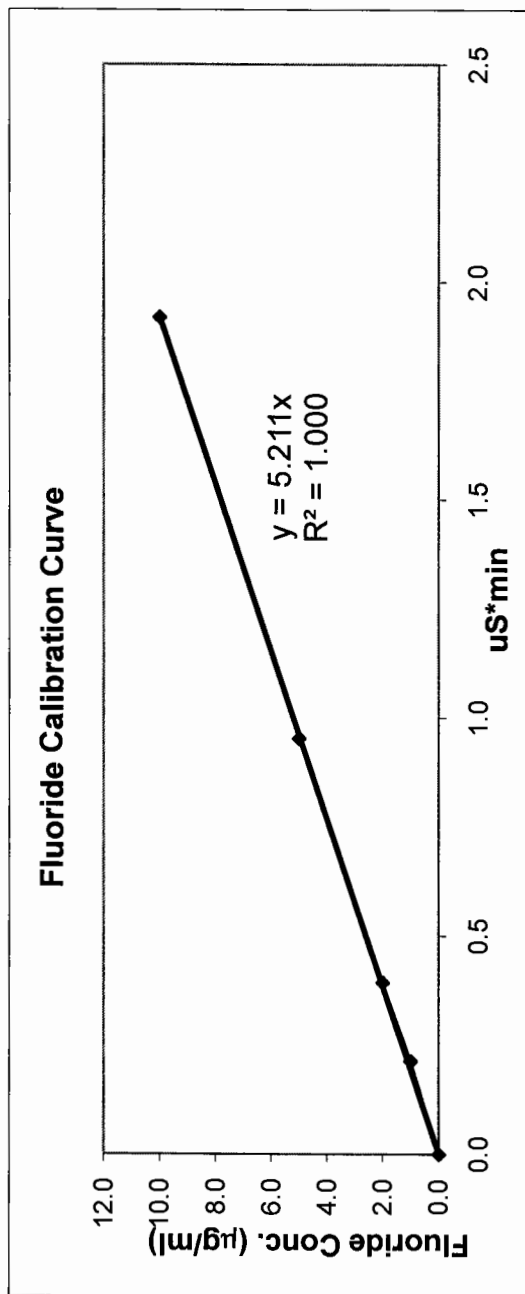
ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	Deviation (%)	Diluted Conc. ($\mu\text{g/ml}$)	Dilution Factor	Sample volume(ml)	Total Mass HF(μg)
FCCU-1241 Run 1	<0.006	<0.006	<0.006	0.00	<0.03	1	1000	<32
FCCU-1241 Run 2	<0.006	<0.006	<0.006	0.00	<0.03	1	1000	<32
FCCU-1241 Run 3	<0.006	<0.006	<0.006	0.00	<0.03	1	1000	<32
0.1 N H2SO4 Blank	<0.006	<0.006	<0.006	0.00	<0.03	1	1000	<32
Reagent DI Water Blank	<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. ($\mu\text{g/ml}$)	Target Conc. ($\mu\text{g/ml}$)	R (%)	Pass/Fail
Run 1 spike	0.019	0.018	0.019	2.14	0.10	0.10	97%	Pass
Run 2 spike	0.018	0.017	0.017	3.15	0.09	0.10	91%	Pass

CLIENT:
LOCATION:
SAMPLE DATES:
ANALYSIS:
METHOD:

Valero
 Port Arthur, TX
 6/7/11-6/8/11
 Hydrofluoric Acid
 USEPA Method 26

Analyst: J. Ruggaber
Date of Completion: 6/30/2011
Template Control ID: USEPA-M26-HCI-Template-052T-REV1



USEPA METHOD 26 TASK SCHEDULE

Client: Valero

Location: Port Arthur, TX

Project Manager: D. Fitzgerald

Date Sampled: 6/6/11 – 6/7/11

Lab Project #: 08-315

Spreadsheet Template ID: USEPA-M26-HCI-Template-052T-REV1

Analyst: J. Ruggaber

EluentSodium 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 6/22/11 check (prepared in 0.1 N H₂SO₄)

5.0 ppm Cl 6/22/11 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.

**USEPA METHOD 26 TASK SCHEDULE FORM**

Document Number: WL-M26TASK-FORM-023A

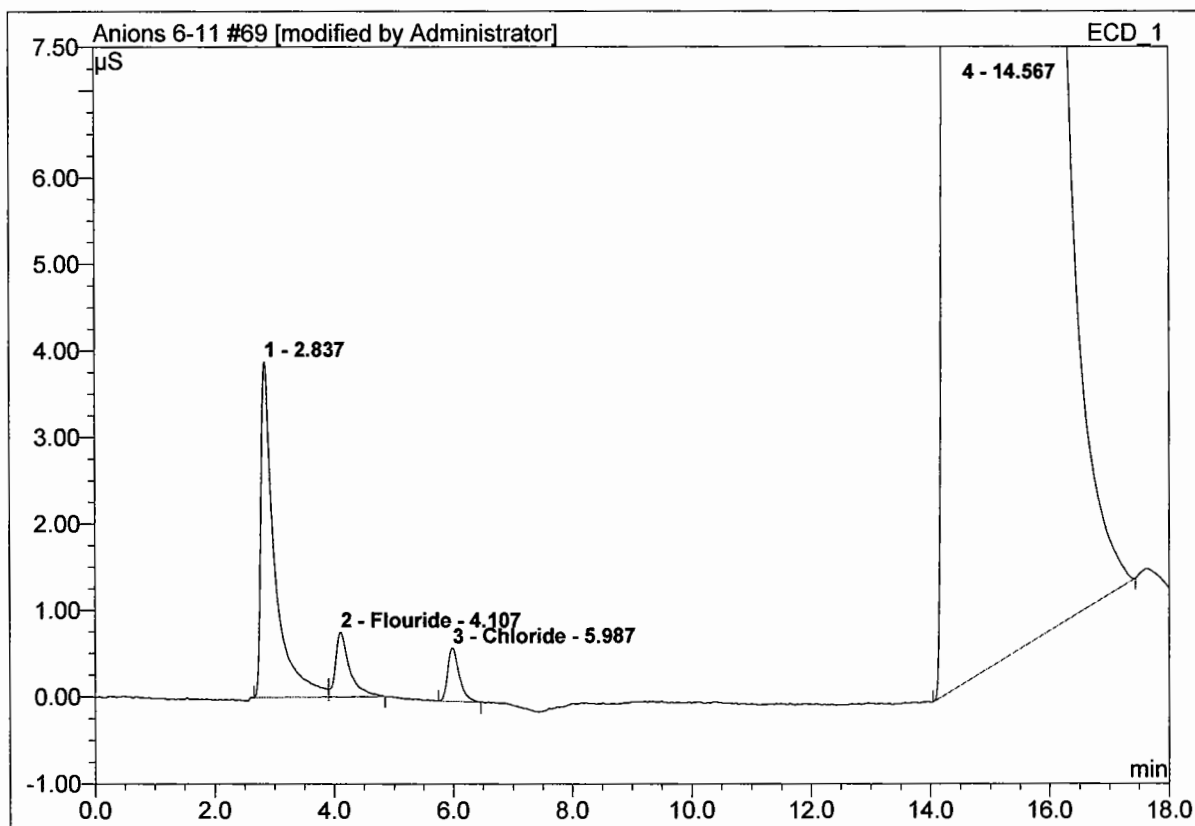
Revision Number: 1

Effective Date: 11/10/10

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

69 1.0 ppm F, Cl H2SO4-pre

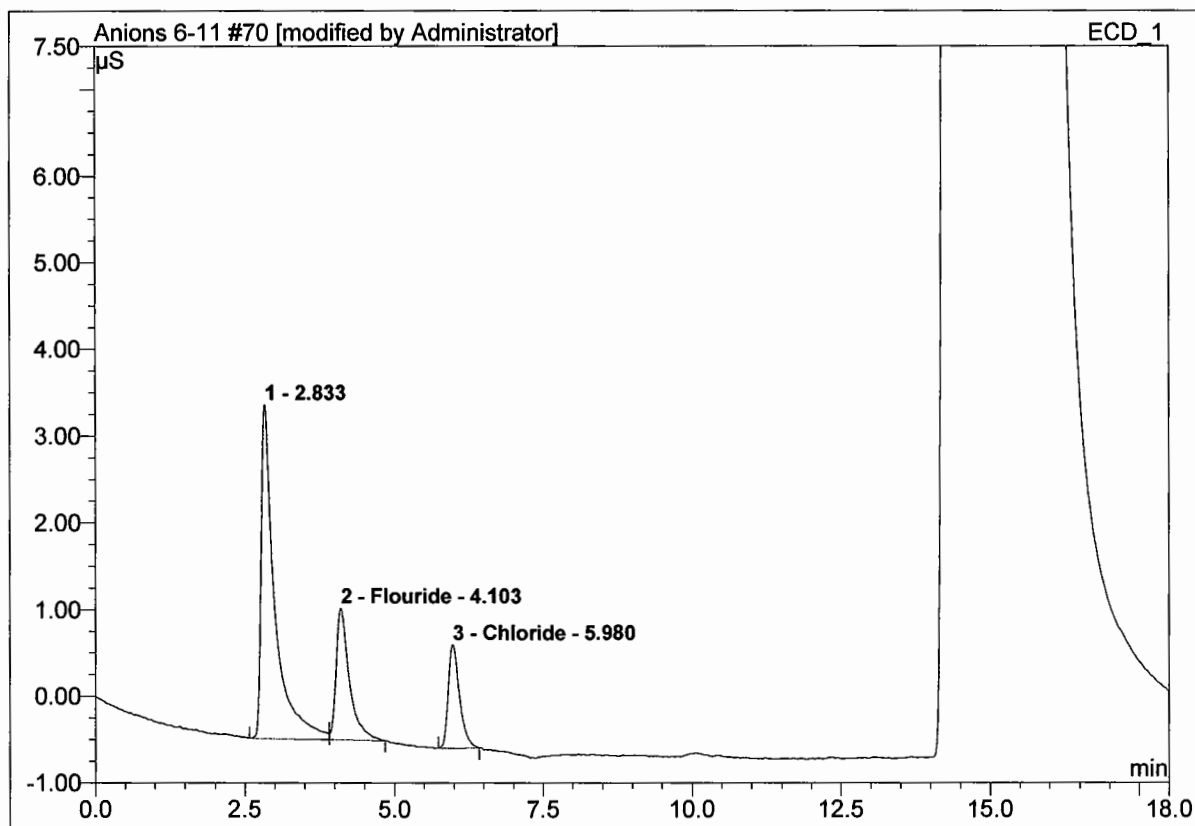
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/22/2011 15:41	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	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

70 2.0 ppm F, Cl H2SO4-pre

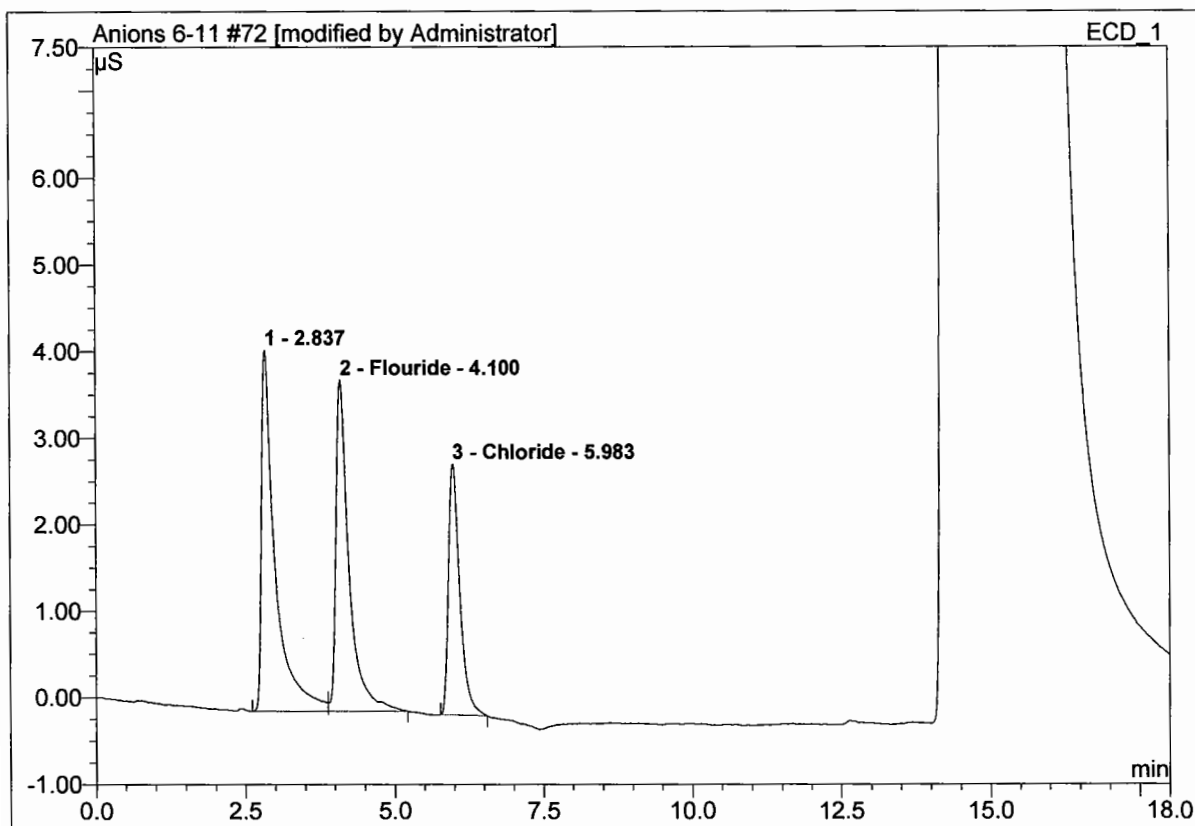
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/22/2011 16:00	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	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

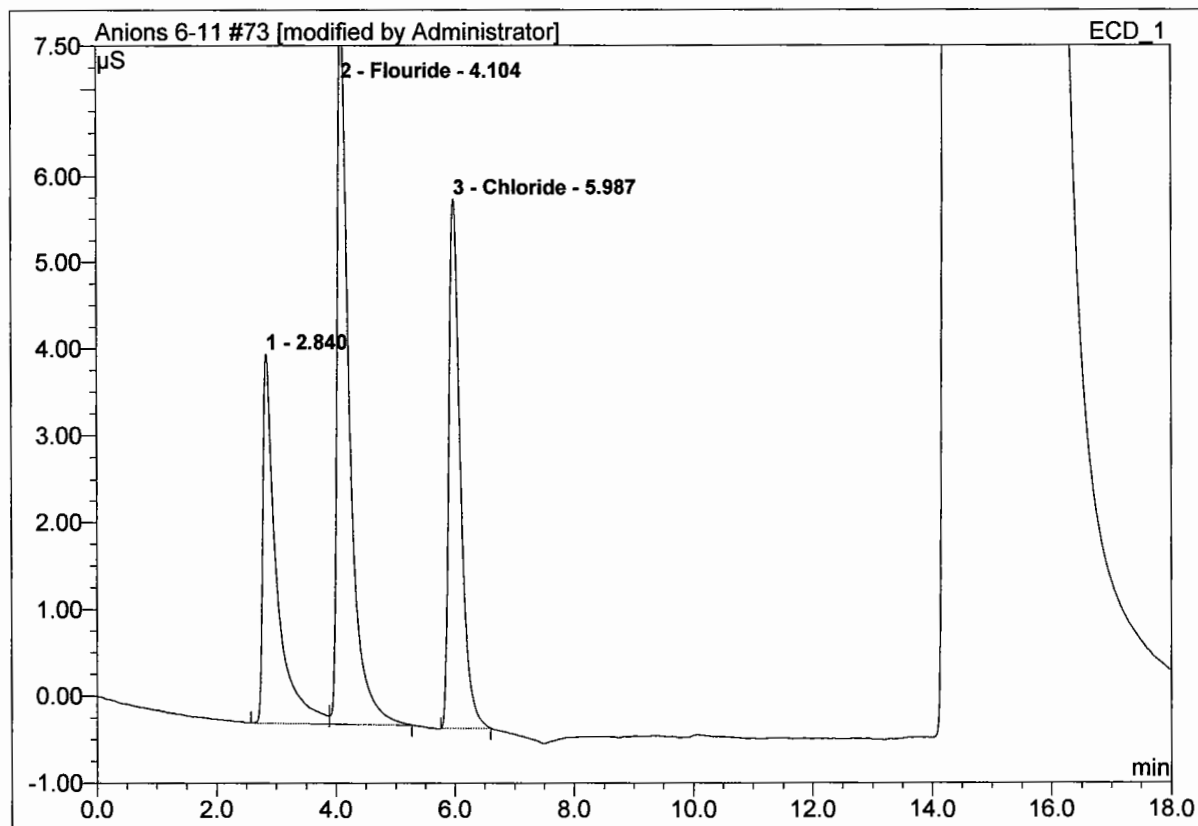
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/22/2011 16:40	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area $\mu\text{S}\cdot\text{min}$
2	4.10	Flouride	3.831	0.9738
3	5.98	Chloride	2.899	0.6495
Total:			6.730	1.623

73 10.0 ppm F, Cl H2SO4-pre

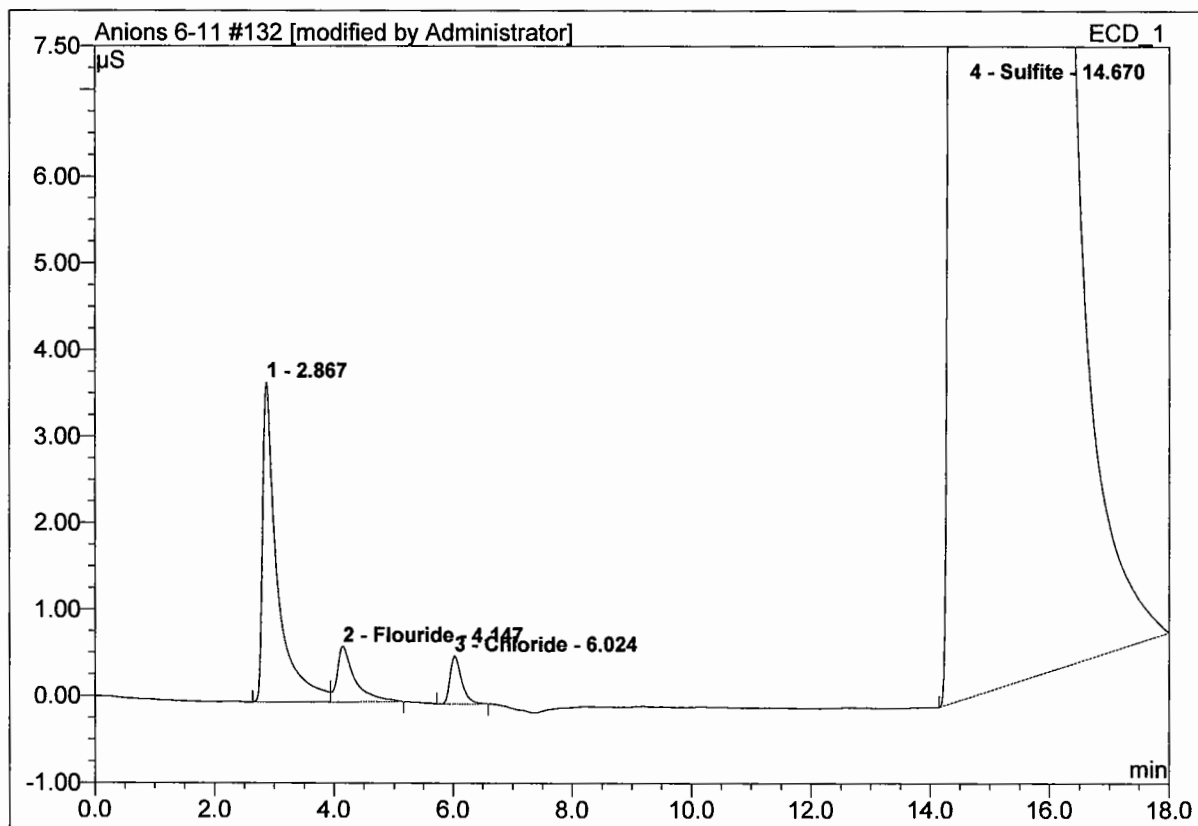
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/22/2011 16:59	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area $\mu\text{S}\cdot\text{min}$
2	4.10	Flouride	8.235	1.9670
3	5.99	Chloride	6.105	1.3556
Total:			14.339	3.323

132 1.0 ppm F, Cl H2SO4

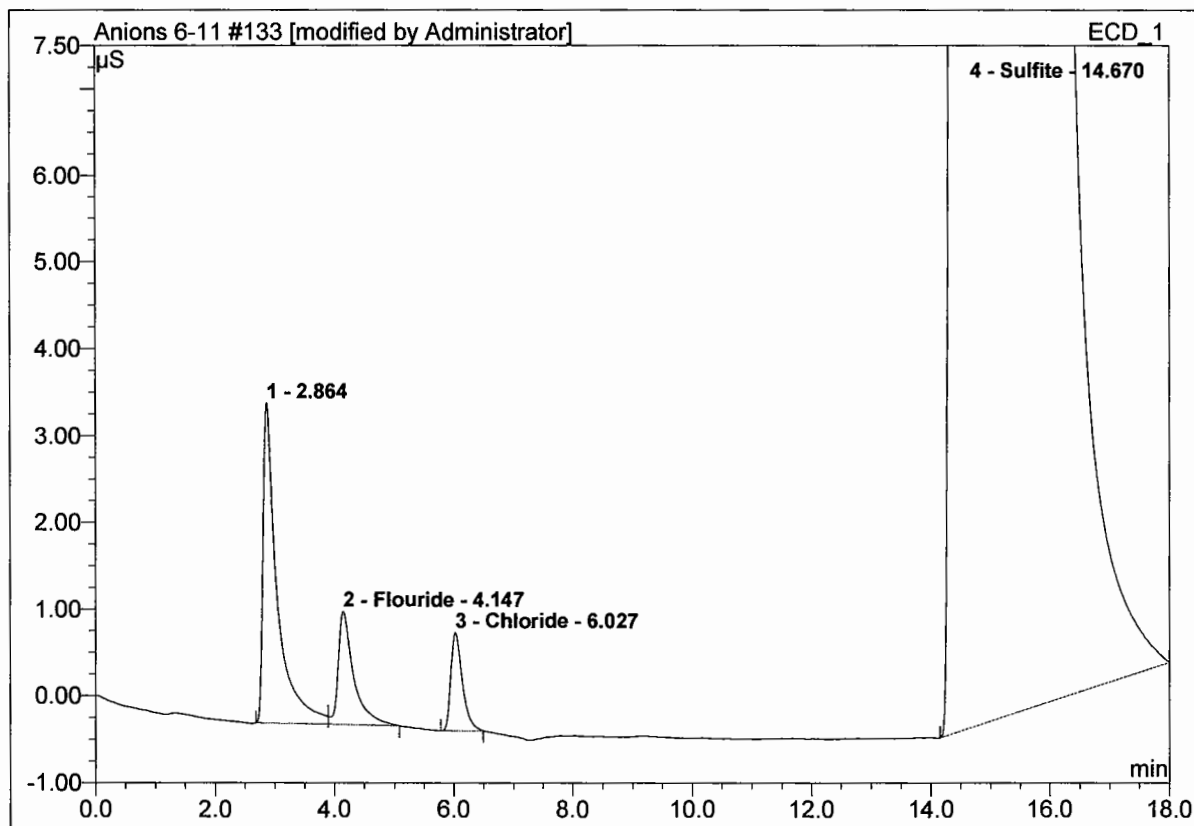
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/24/2011 0:09	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	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

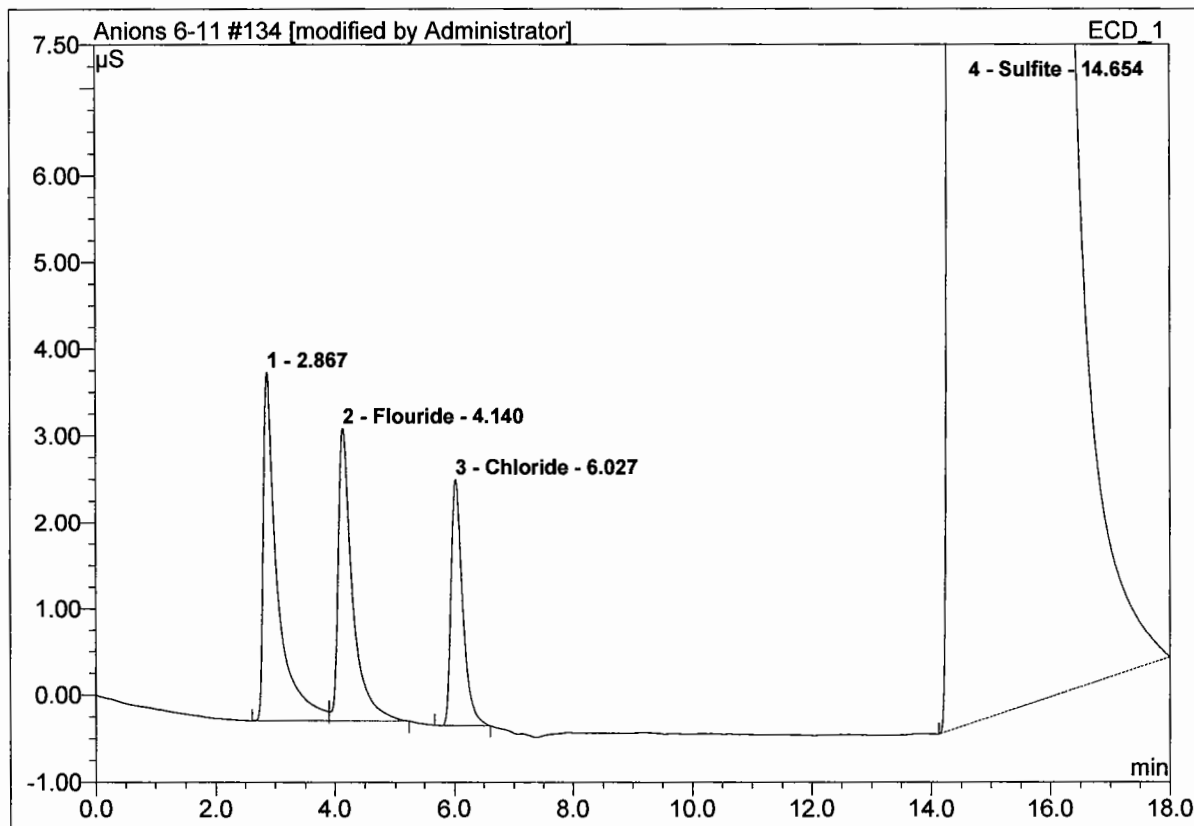
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/24/2011 0:29	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	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

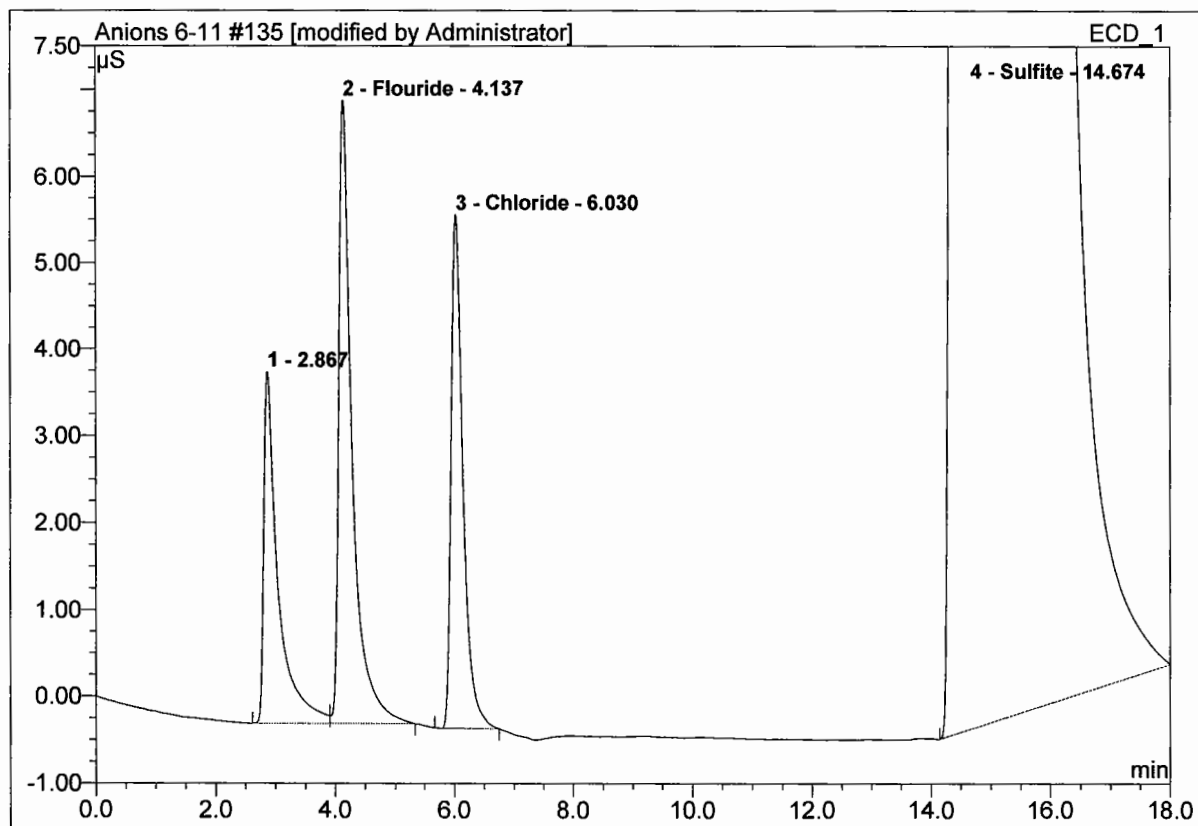
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/24/2011 0:48	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	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

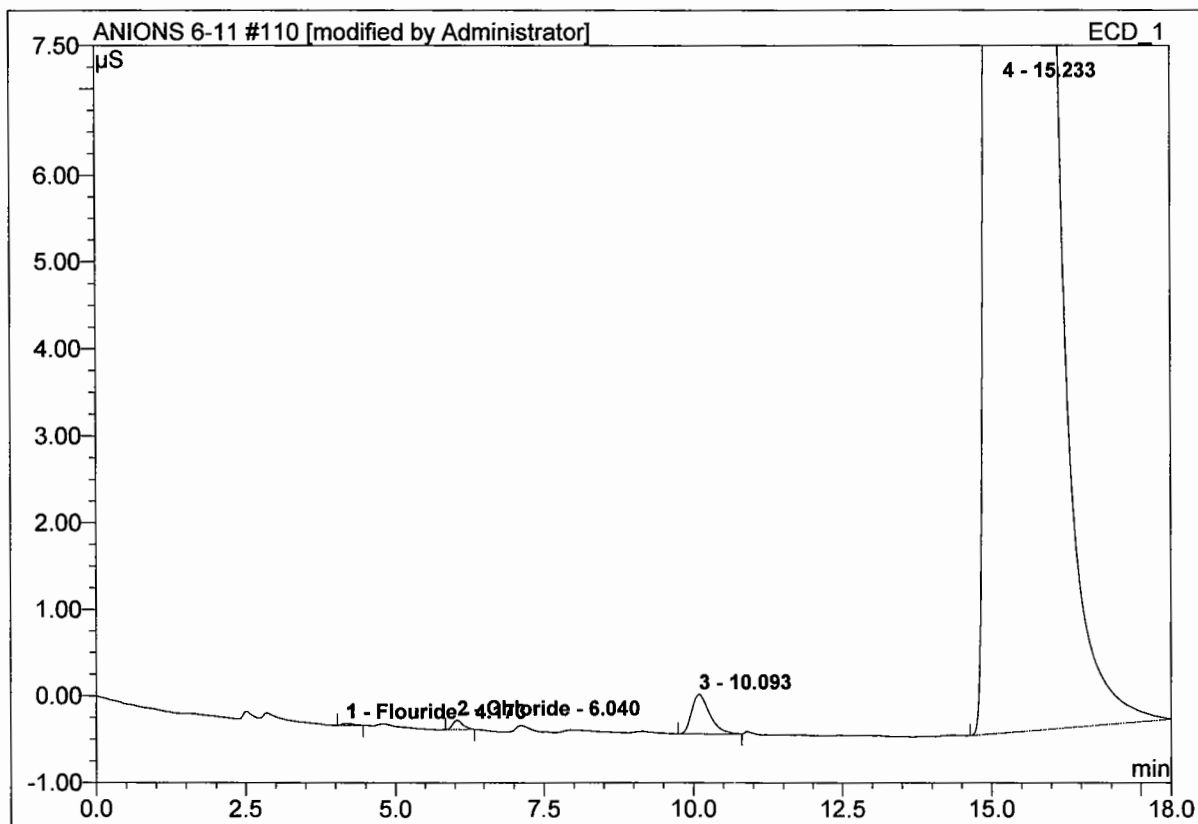
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/24/2011 1:07	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area $\mu\text{S}\cdot\text{min}$
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

110 Valero run 1 H2SO4

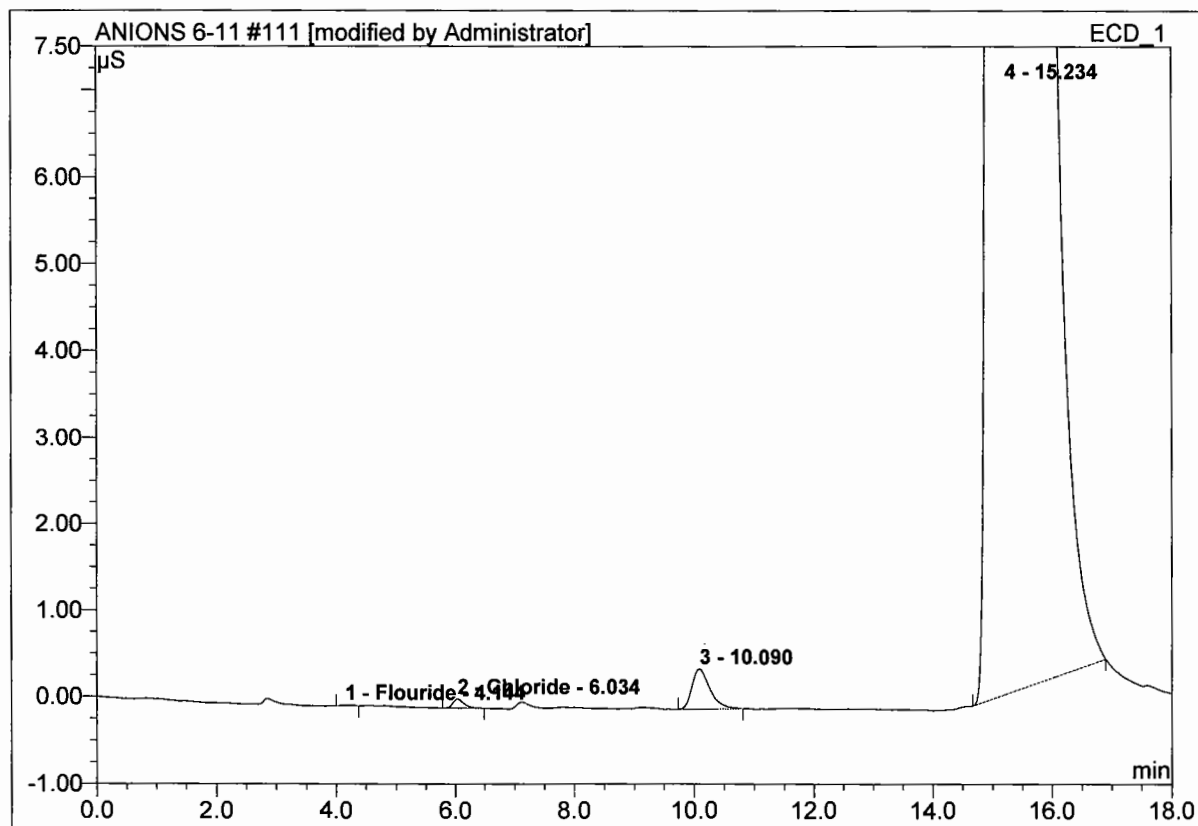
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 15:01	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.17	Flouride	0.023	0.0053
2	6.04	Chloride	0.106	0.0216
Total:			0.128	0.027

111 Valero run 1 H2SO4

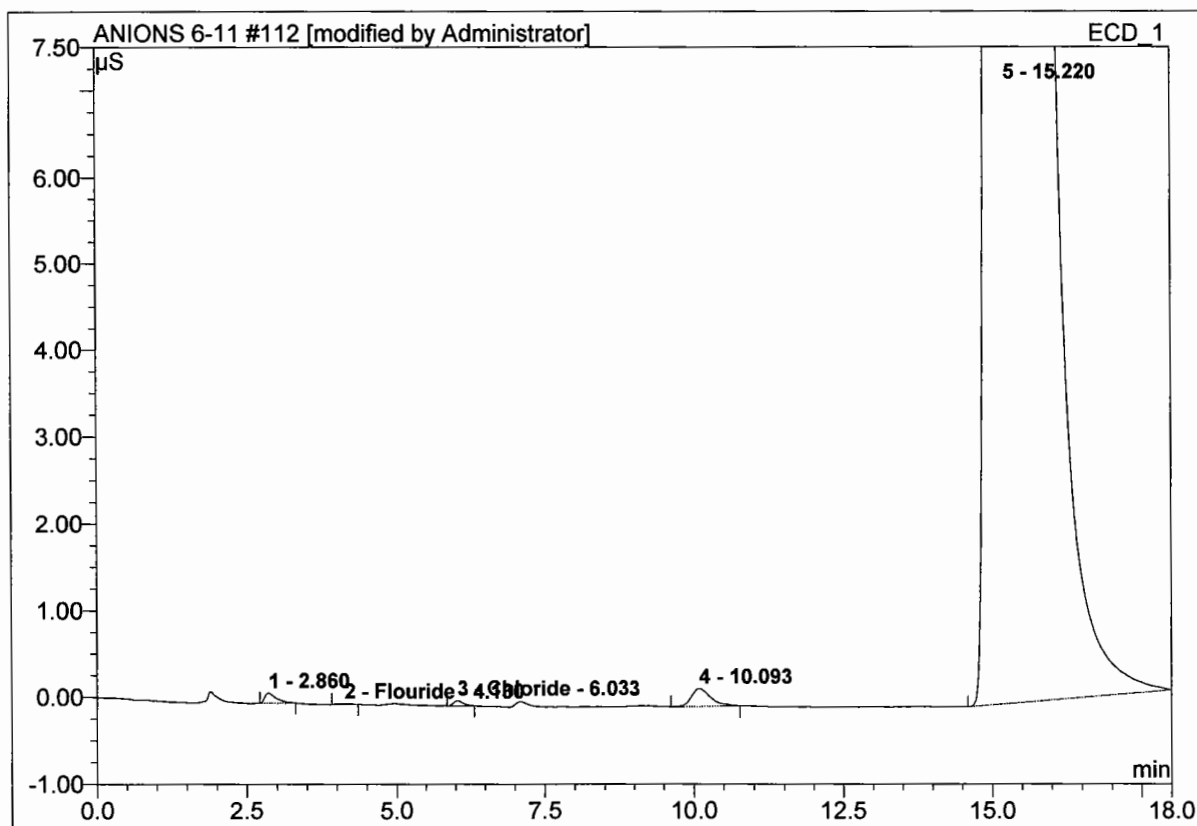
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 15:20	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.14	Flouride	0.012	0.0028
2	6.03	Chloride	0.107	0.0238
Total:			0.119	0.027

112 Valero run 2 H2SO4

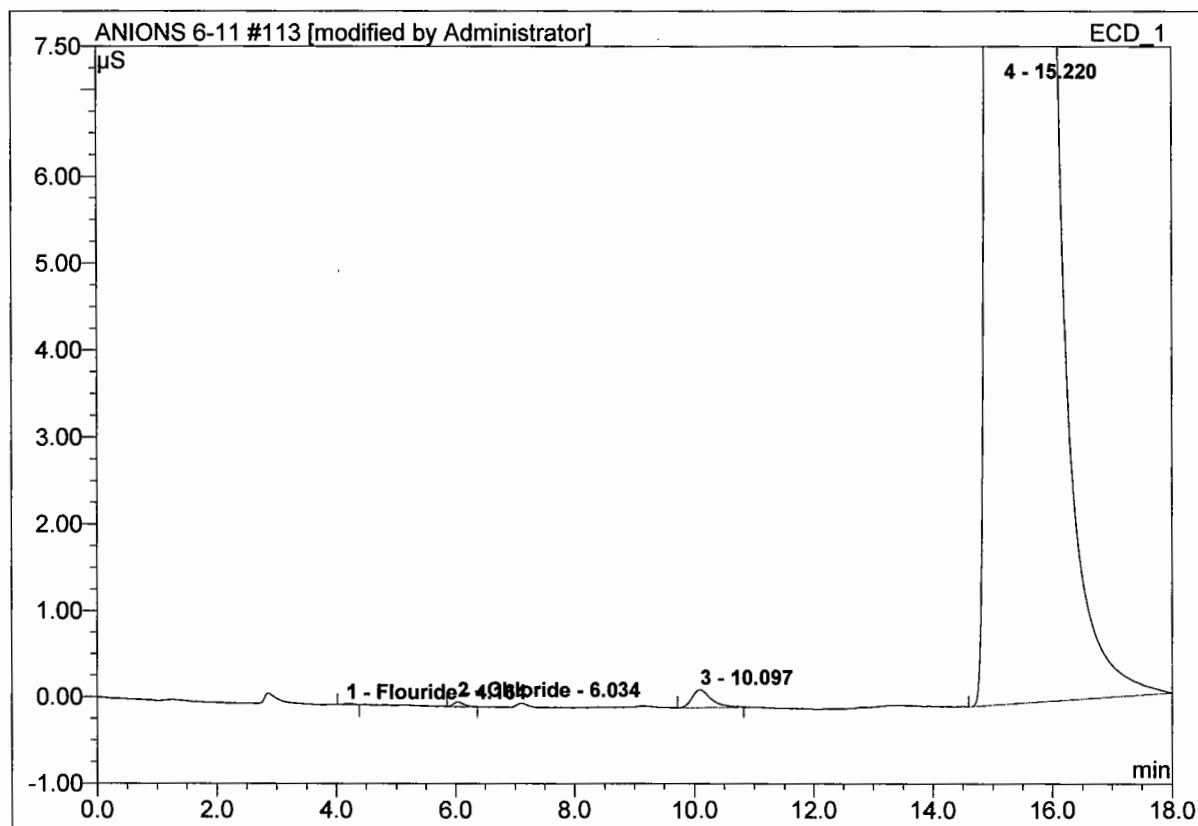
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 15:39	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
2	4.13	Flouride	0.011	0.0026
3	6.03	Chloride	0.059	0.0112
Total:			0.071	0.014

113 Valero run 2 H2SO4

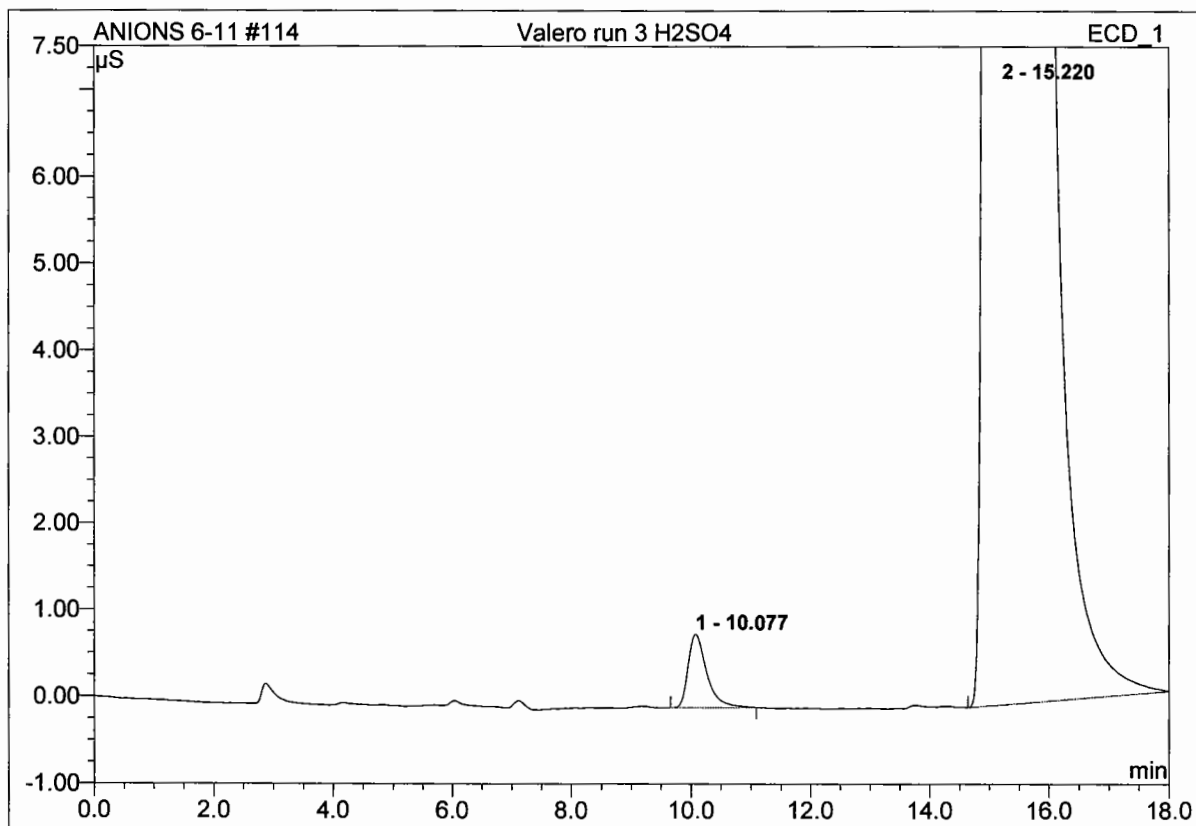
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 15:58	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.16	Flouride	0.008	0.0022
2	6.03	Chloride	0.053	0.0105
Total:			0.061	0.013

114 Valero run 3 H2SO4

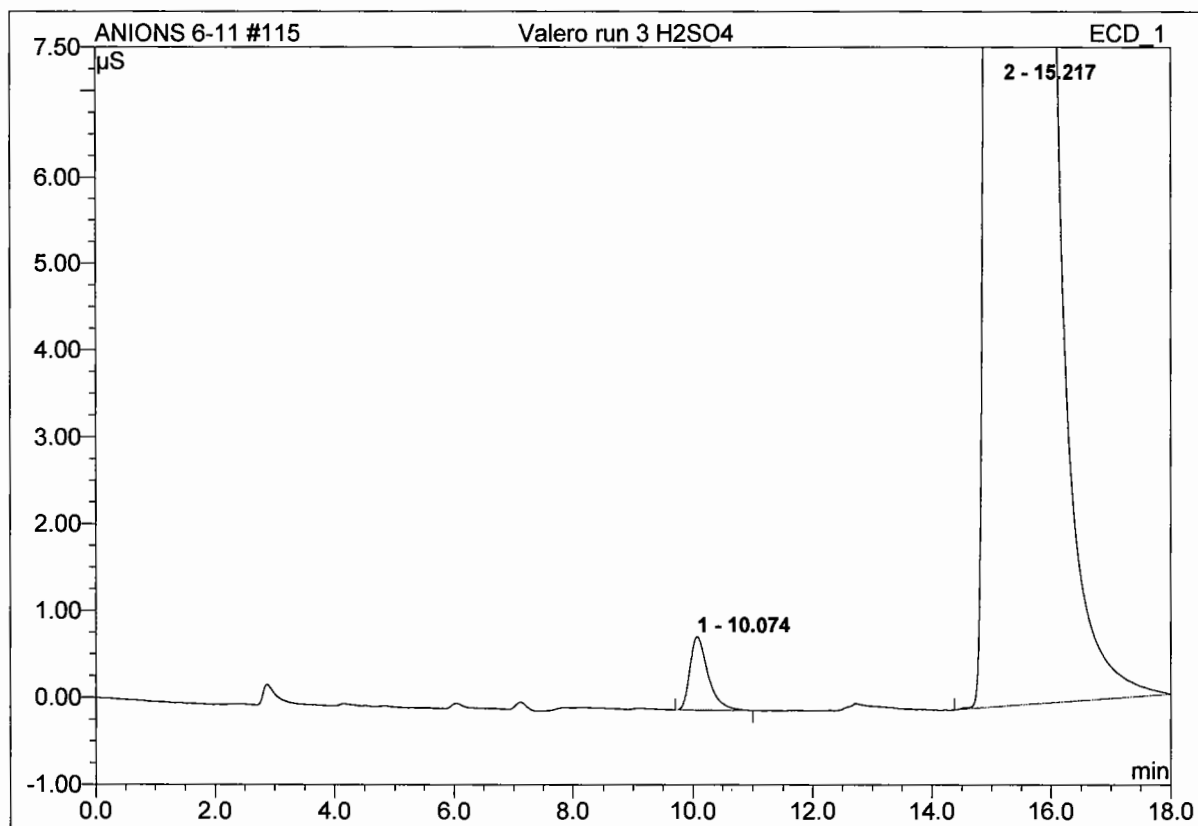
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 16:17	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
Total:			0.000	0.000

115 Valero run 3 H2SO4

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:	6/23/2011 16:36	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000

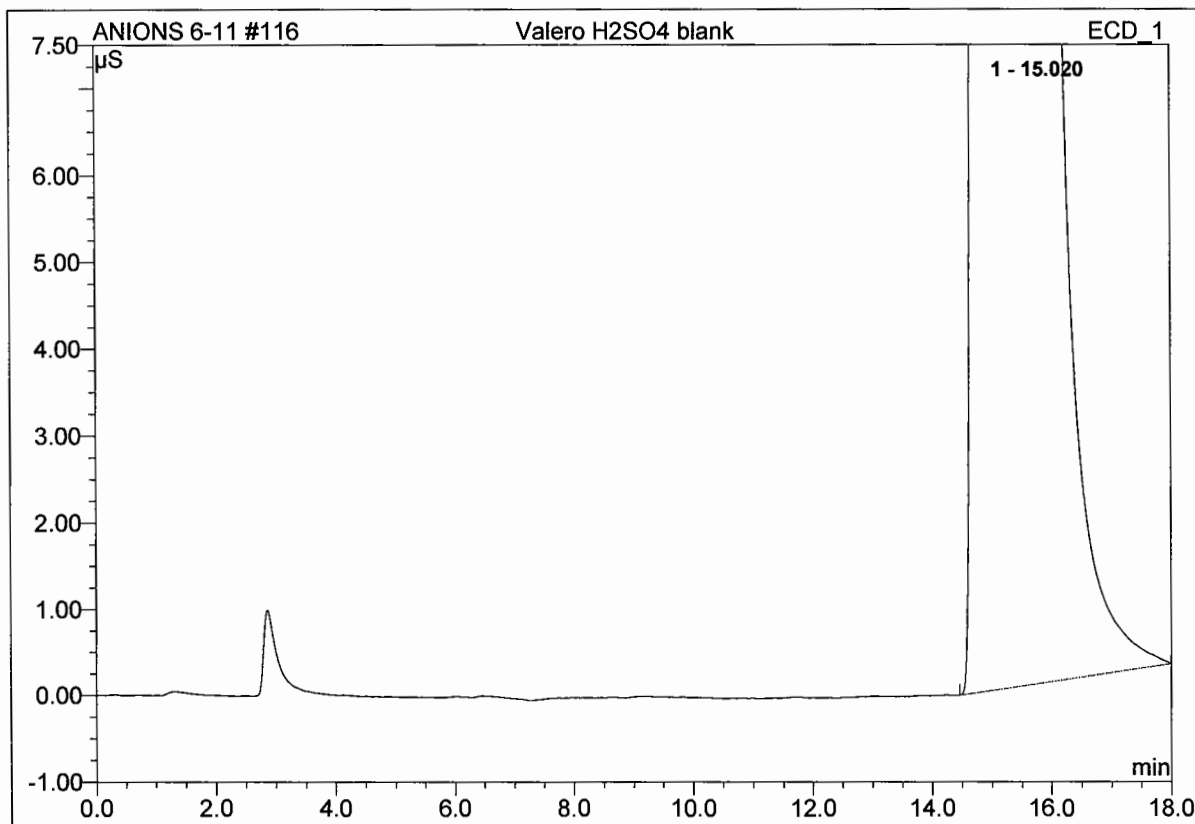


No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

116 Valero H2SO4 blank

Client: **Valero Port Arthur**
Vial Number: **1**
Sample Type: **unknown**
Control Program: **Anions 1000**
Quantif. Method: **ICS_1000_Anions**
Recording Time: **6/23/2011 19:04**
Run Time (min): **12.00**

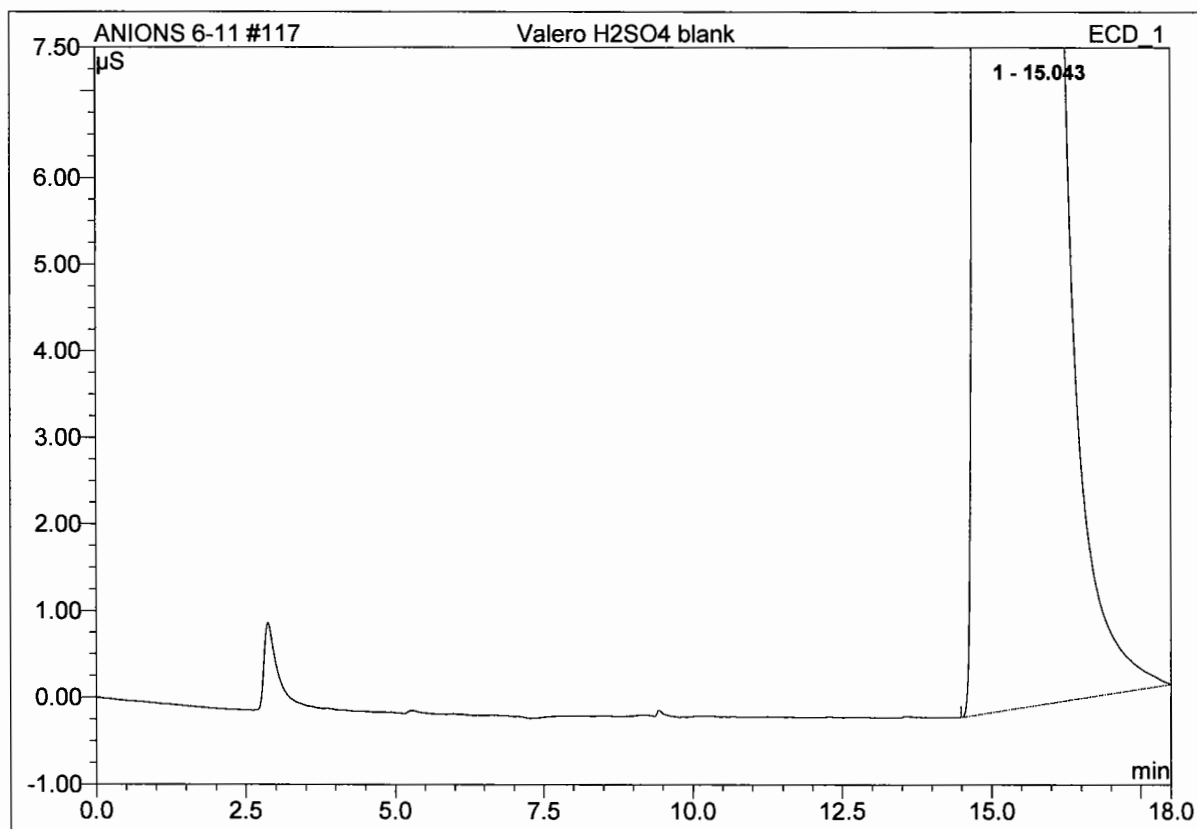
Injection Volume: **35.0**
Channel: **ECD_1**
Wavelength: **n.a.**
Bandwidth: **n.a.**
Dilution Factor: **1.0000**
Sample Weight: **1.0000**
Sample Amount: **1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

117 Valero H2SO4 blank

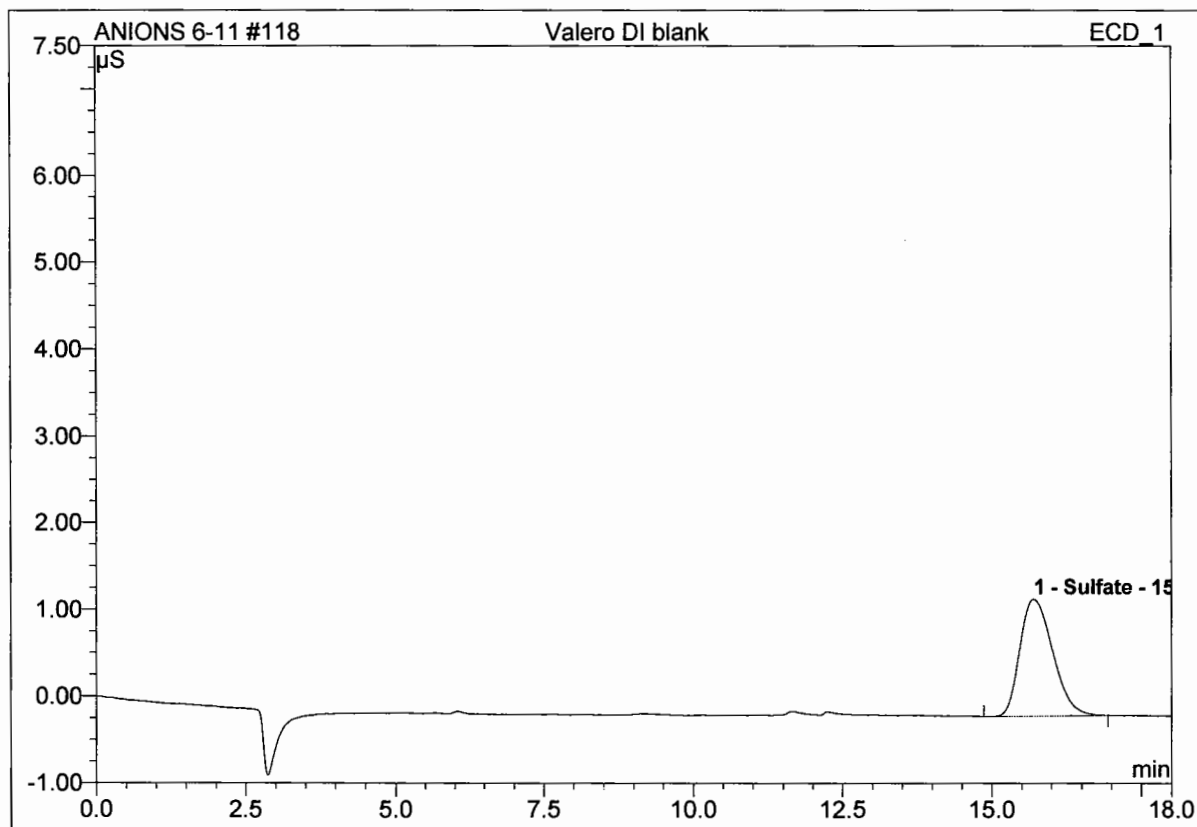
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 19:23	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

118 Valero DI blank

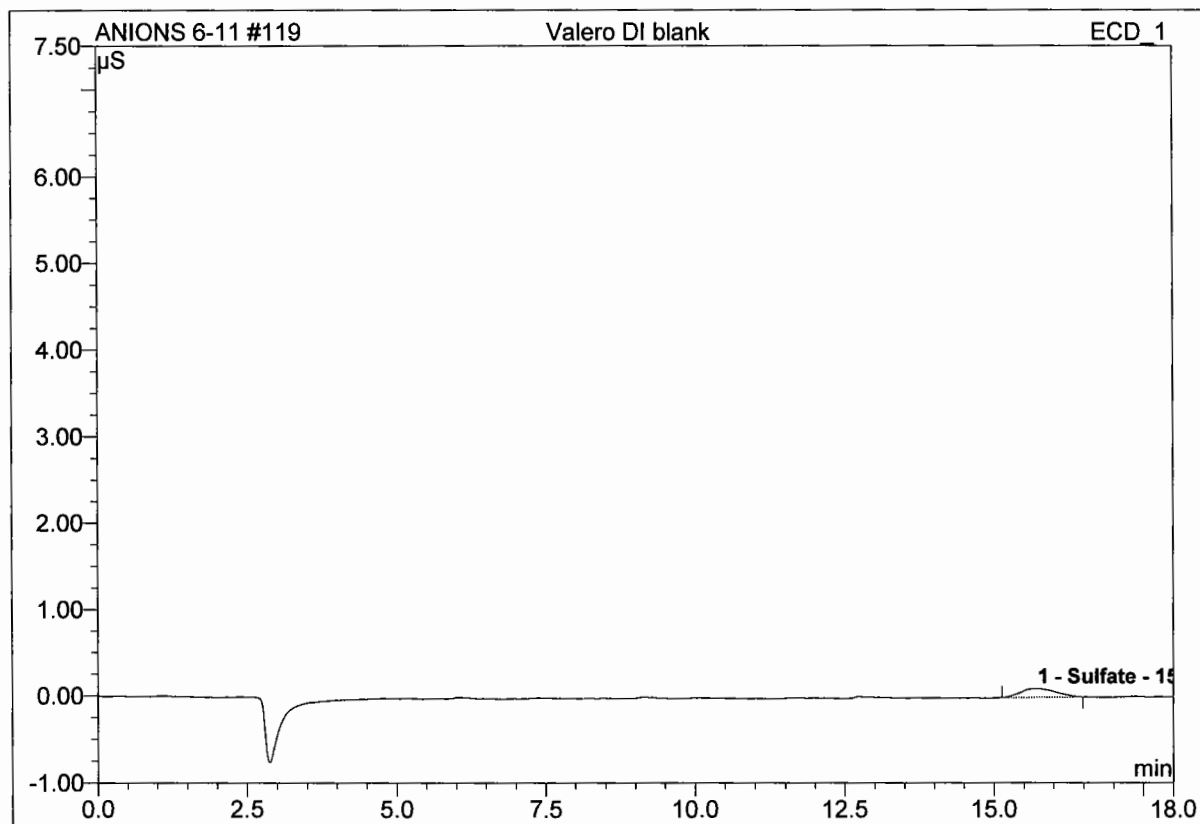
Client:	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 19:42	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	15.70	Sulfate	1.348	0.8623
Total:			1.348	0.862

119 Valero DI blank

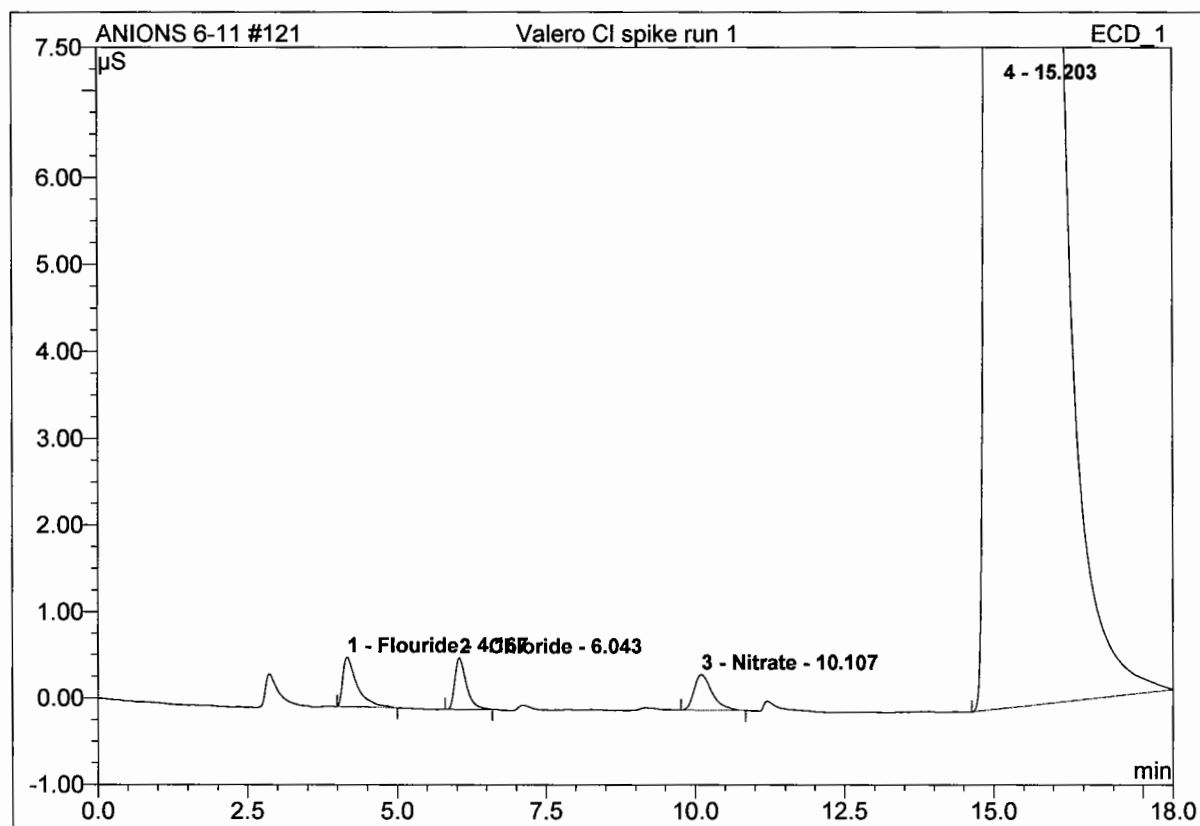
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 20:01	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	15.73	Sulfate	0.102	0.0691
Total:			0.102	0.069

121 Valero CI spike run 1

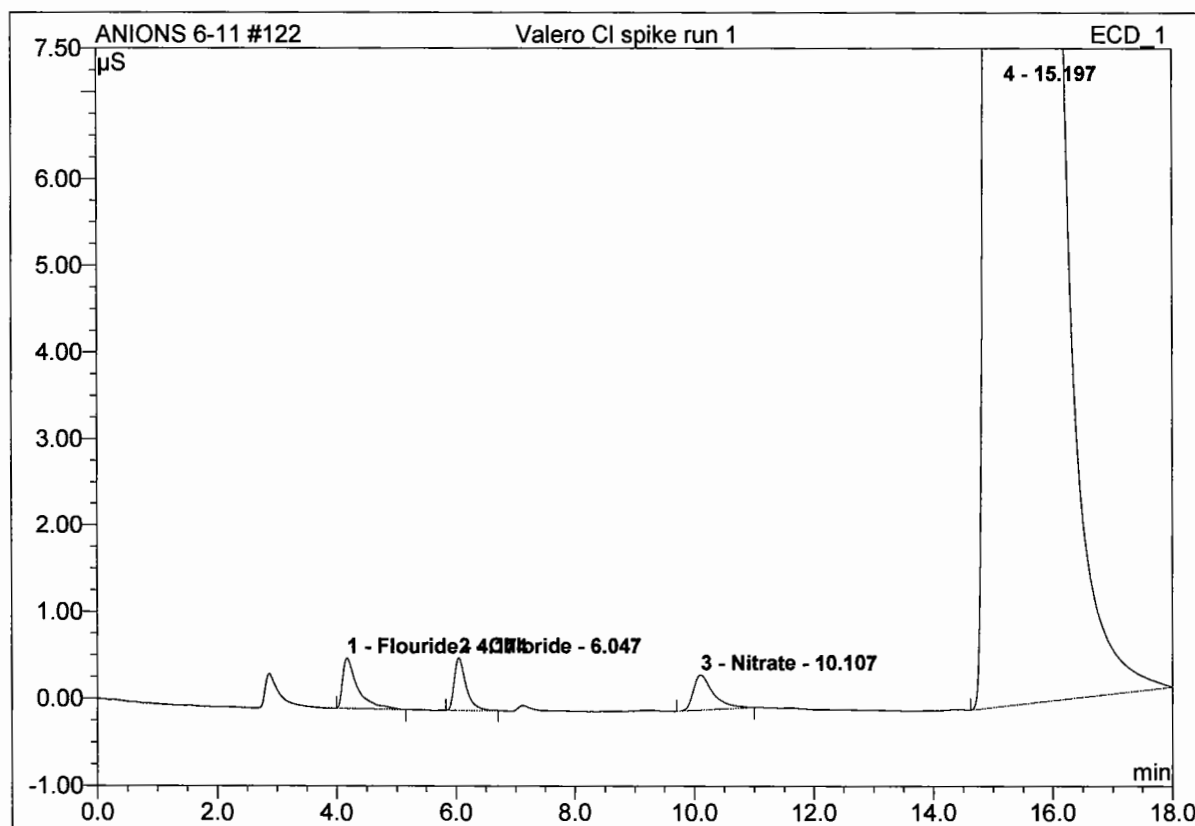
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 20:39	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.17	Fluoride	0.571	0.1569
2	6.04	Chloride	0.594	0.1334
3	10.11	Nitrate	0.410	0.1435
Total:			1.576	0.434

122 Valero Cl spike run 1

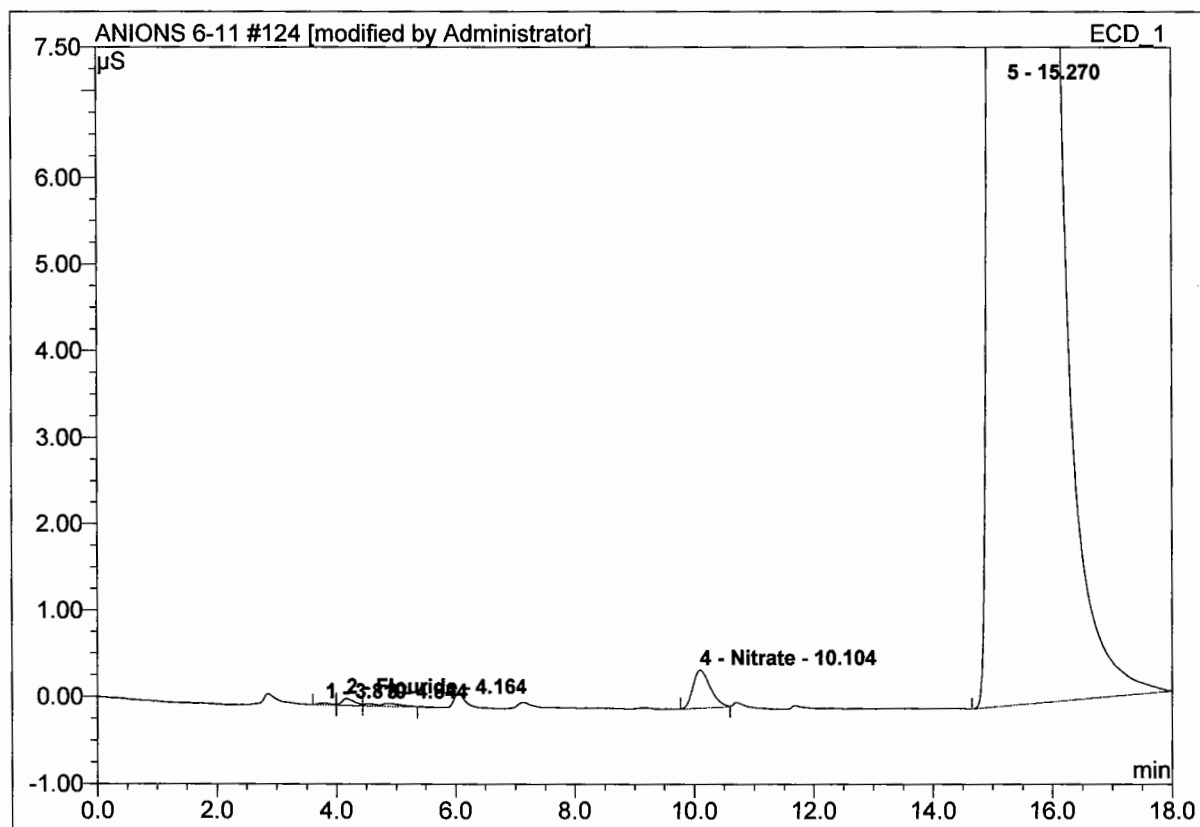
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 20:58	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.17	Flouride	0.579	0.1685
2	6.05	Chloride	0.602	0.1363
3	10.11	Nitrate	0.403	0.1567
Total:			1.584	0.462

124 Valero F spike run 1

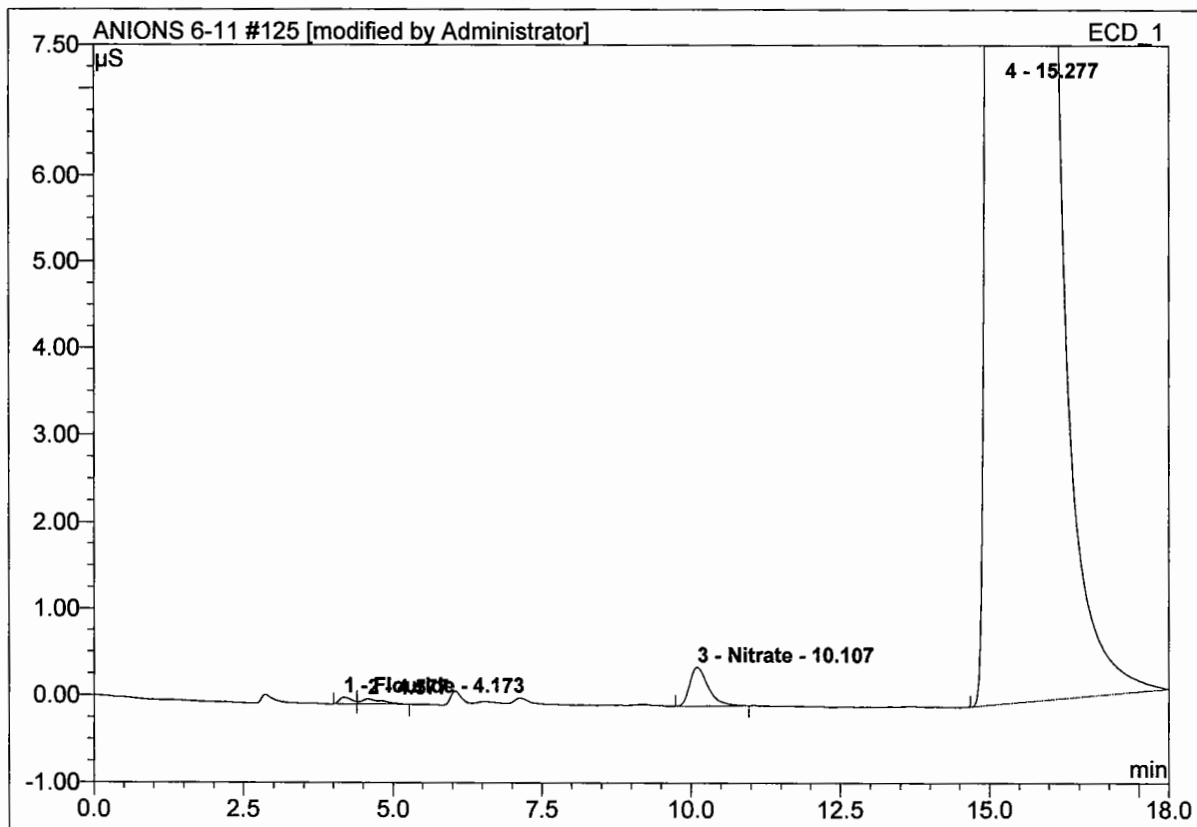
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 21:37	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height µS	Area µS*min
2	4.16	Flouride	0.079	0.0191
4	10.10	Nitrate	0.437	0.1453
Total:			0.516	0.164

125 Valero F spike run 1

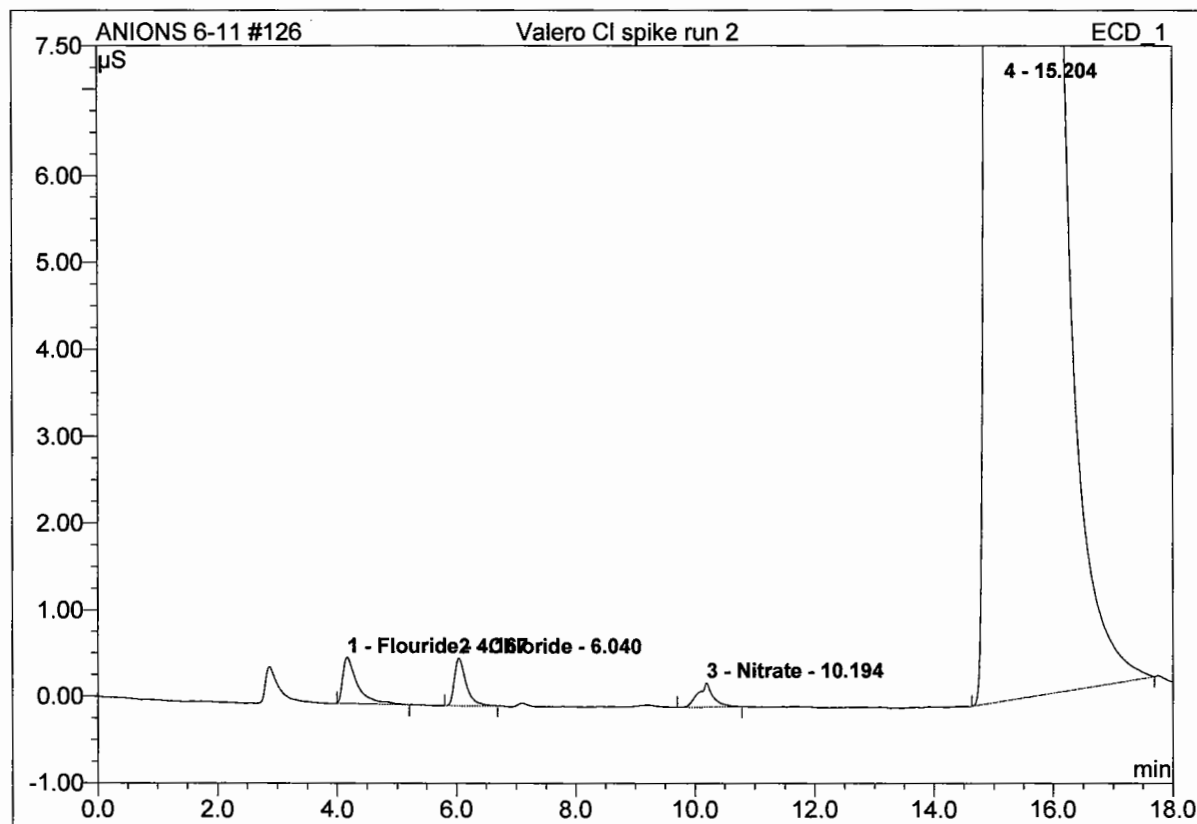
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 21:56	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.17	Fluoride	0.076	0.0183
3	10.11	Nitrate	0.447	0.1601
Total:			0.524	0.178

126 Valero Cl spike run 2

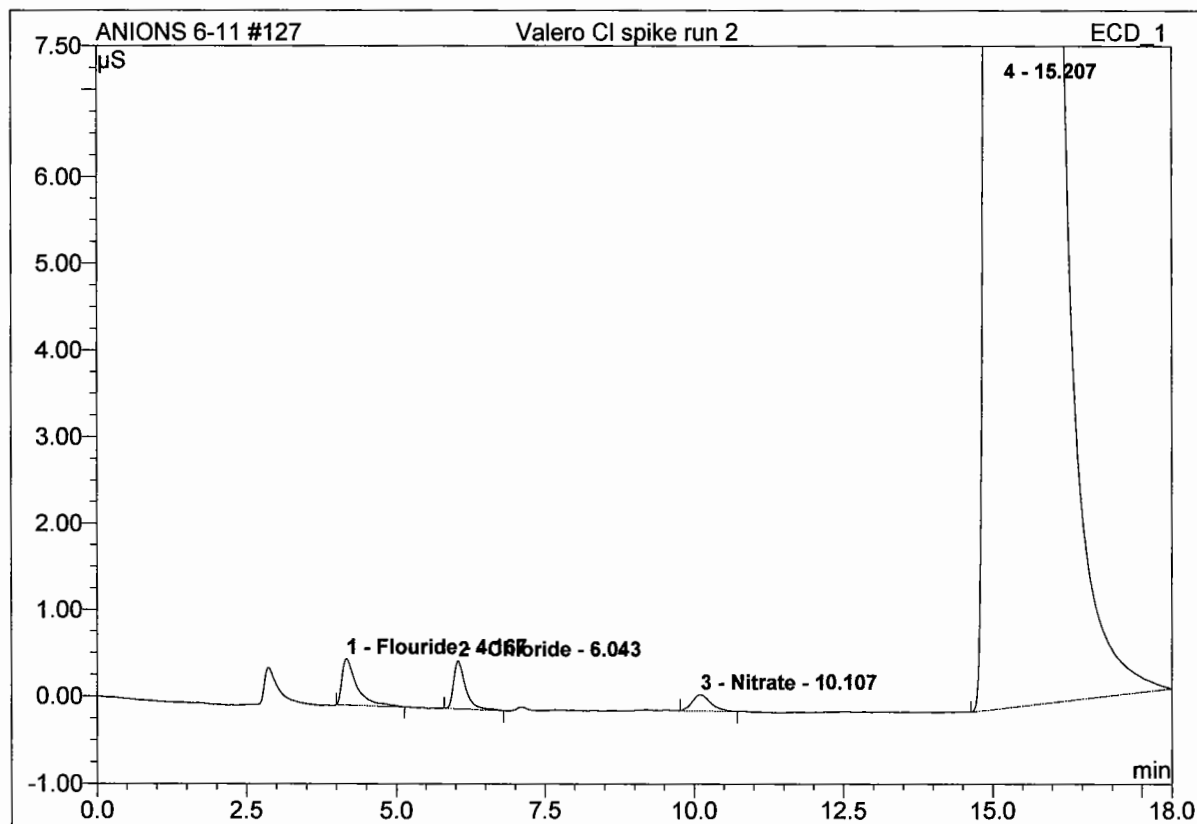
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 22:15	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.17	Fluoride	0.531	0.1498
2	6.04	Chloride	0.552	0.1257
3	10.19	Nitrate	0.279	0.0804
Total:			1.362	0.356

127 Valero Cl spike run 2

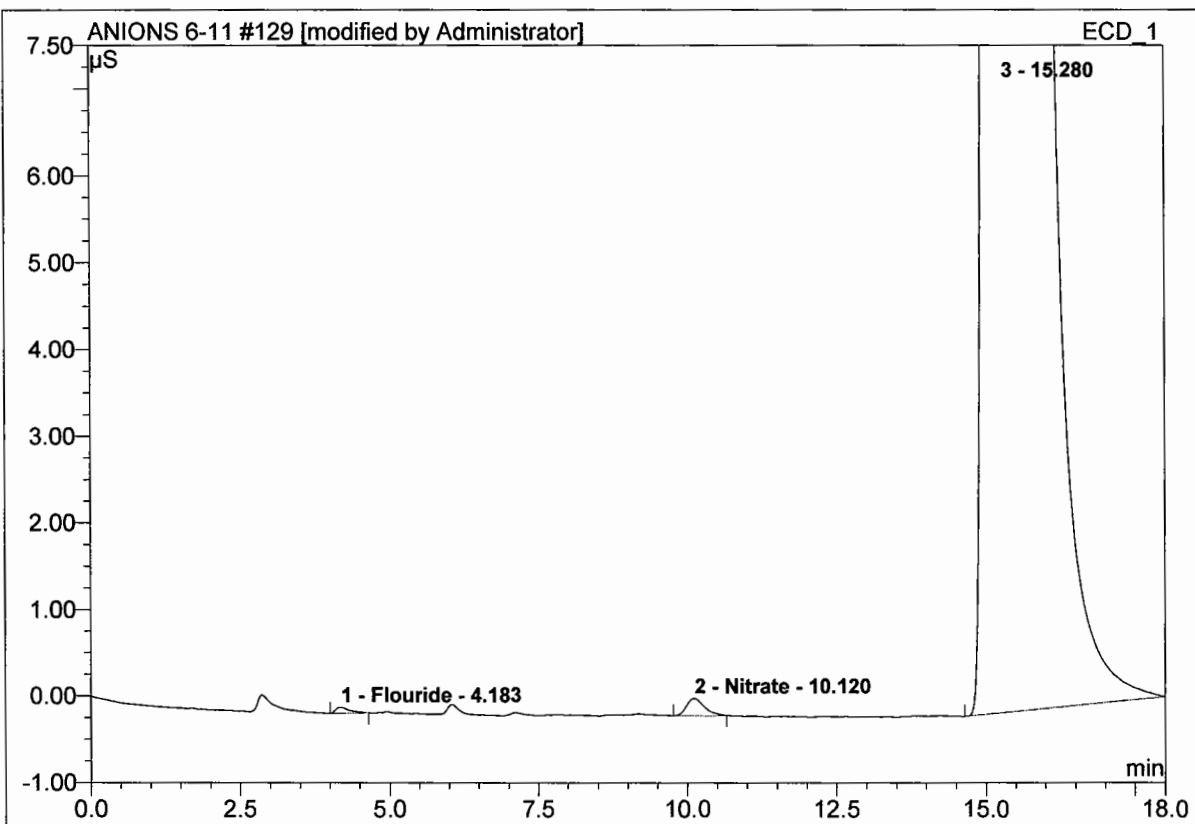
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 22:34	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.17	Flouride	0.533	0.1522
2	6.04	Chloride	0.549	0.1276
3	10.11	Nitrate	0.187	0.0682
Total:			1.269	0.348

129 Valero F spike run 2

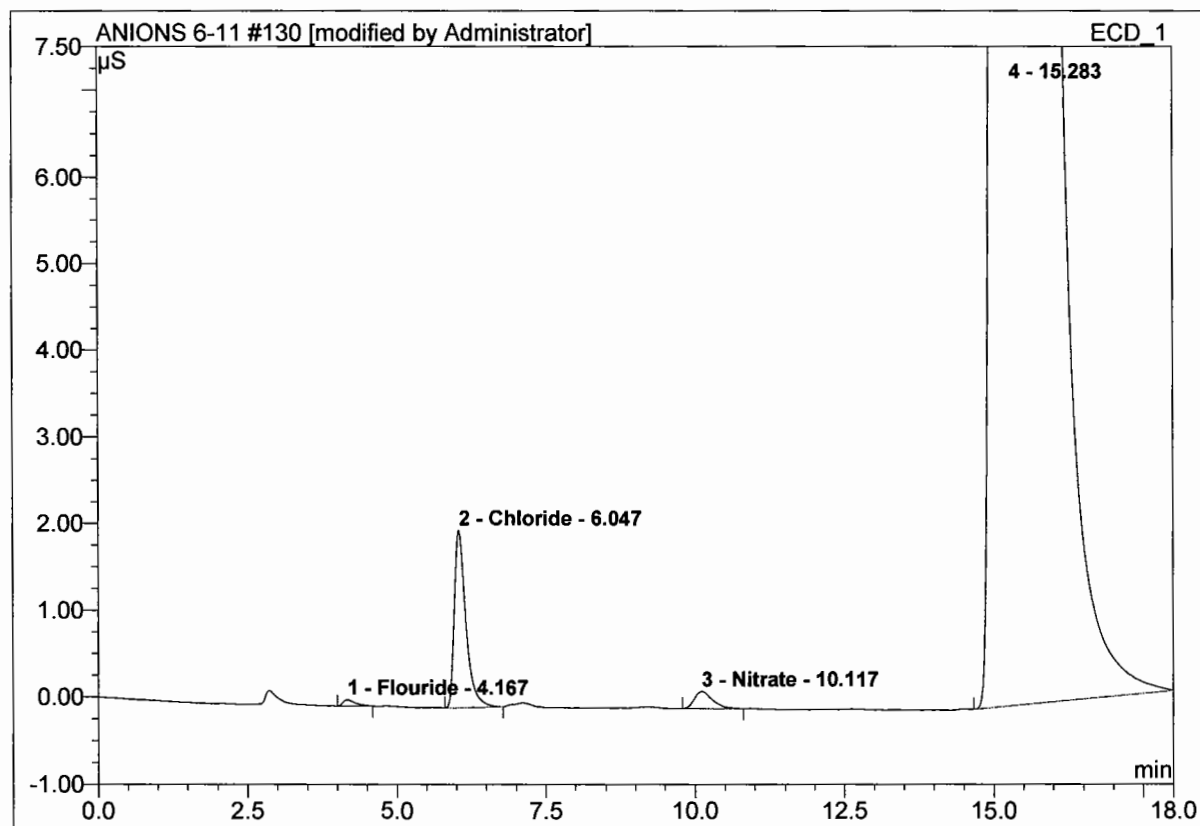
Client	Valero Port Arthur	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	6/23/2011 23:12	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.18	Flouride	0.069	0.0180
2	10.12	Nitrate	0.198	0.0684
Total:			0.267	0.086

130 Valero F spike run 2

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:	6/23/2011 23:31	Sample Weight:	1.0000
Run Time (min):	12.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μ S	Area μ S*min
1	4.17	Flouride	0.071	0.0169
2	6.05	Chloride	2.041	0.4583
3	10.12	Nitrate	0.198	0.0703
Total:			2.310	0.545

ANALYTICAL SUMMARY

CLIENT:
LOCATION:
SAMPLE DATES:
SOURCE:
ANALYSIS:
METHOD:

Valero
 Port Arthur, TX
 6/6/11-6/7/11
 FCCU-1241
 Chlorine
 USEPA Method 26A

Analyst: E. Vogt
 Date of Completion: 8/2/2011
 Template Control ID: USEPA-M26-HCl-Template-052T-REV1

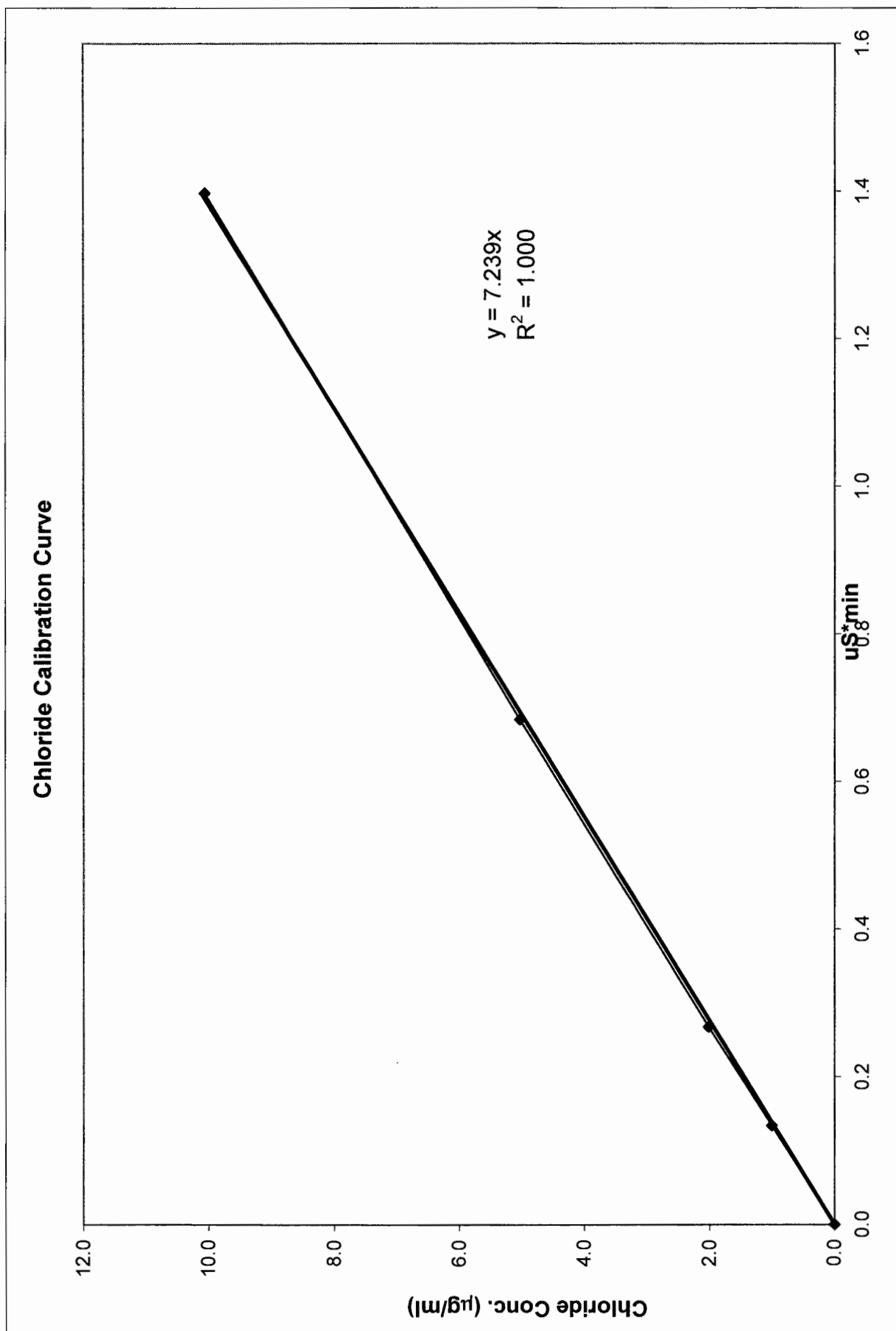
Calibration Curve Calculation

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	0.134	0.133	1.0	-1.41
1.0	0.137	0.131	0.134	2.12	2.0	0.268	0.133	2.0	-1.72
2.0	0.263	0.272	0.268	-1.63	5.0	0.684	0.136	5.1	0.51
5.0	0.686	0.683	0.684	0.26	10.1	1.397	0.139	10.3	2.62
10.1	1.410	1.385	1.397	0.87	mean RF ---				
				Second. Std.	5.0	0.6774	N/A	4.94	-1.19
				CCV	5.0	0.6866	N/A	5.01	-0.45

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 Cl ₂ (µg)
Run 1 Imps 3 & 4	<0.032	<0.032	<0.032	0.00	<0.23	1	500	<116
Run 2 Imps 3 & 4	<0.032	<0.032	<0.032	0.00	<0.23	1	500	<116
Run 3 Imps 3 & 4	<0.032	<0.032	<0.032	0.00	<0.23	1	500	<116
0.1 N NaOH Blank	<0.032	<0.032	<0.032	0.00	<0.23	1	500	<116
Lab DI Water Blank	<0.032	<0.032	<0.032	0.00	<0.23	1	-	-

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 2 Imps 3 & 4 + 1 ppm Cl	0.150	0.157	0.154	-2.18	1.11	1.01	111%	Pass
Run 3 Imps 3 & 4 + 1 ppm Cl	0.135	0.141	0.138	-2.11	1.00	1.01	99%	Pass



**USEPA METHOD 26 TASK SCHEDULE**

Client: Valero

Location: Port Arthur, TX – FCCU-1241

Project Manager: Dan Fitzgerald

Date Sampled: 6/6 – 6/7/11

Lab Project #: 08-315

Spreadsheet Template ID: USEPA-M26-HCI-Template-052T-REV1

Analyst: E. Vogt

EluentSodium Carbonate (Na_2CO_3) manufacturer and lot: Fisher lot # 095351

Batch Number	Amount weighed/2L	Date/Time Prepared
1	1.6961 g	8/1/11 9:00 a.m.
2	g	
3	g	

Sodium Bicarbonate (NaHCO_3) manufacturer and lot: Fisher lot # 103353

Batch Number	Amount weighed/2L	Date/Time Prepared
1	0.1683 g	8/1/11 9:00 a.m.
2	g	
3	g	



USEPA METHOD 26 TASK SCHEDULE FORM

Document Number: WL-M26TASK-FORM-023A

Revision Number: 1

Effective Date: 11/10/10

Standard Identification

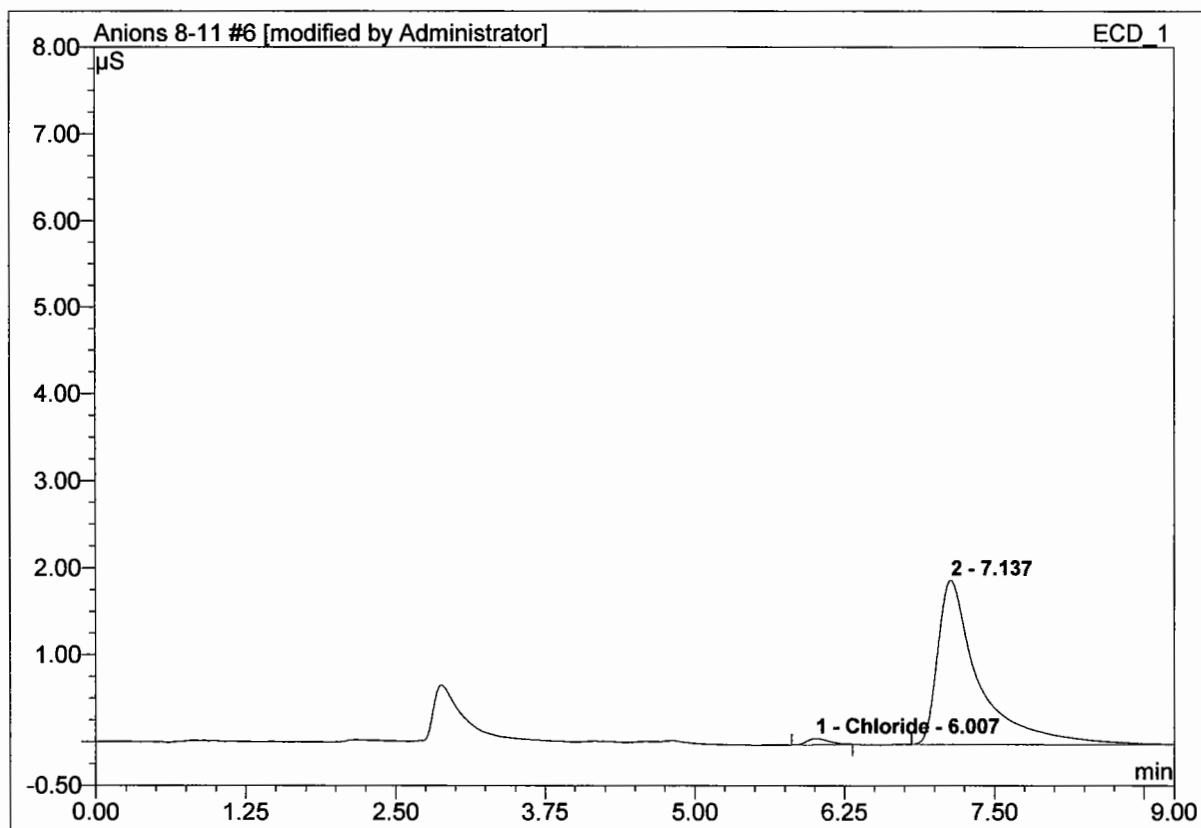
- 1) 1.0 ppm Cl, 8/1/11 (prepared in 0.04 N NaOH)
- 2) 2.0 ppm Cl, 8/1/11 (prepared in 0.04 N NaOH)
- 3) 5.0 ppm Cl, 8/1/11 (prepared in 0.04 N NaOH)
- 4) 10.1 ppm Cl, 8/1/11 (prepared in 0.04 N NaOH)

Secondary standard solution 5.0 ppm Cl, 8/1/11 (prepared in 0.04 N NaOH)

DATE	EQUIPMENT	TASK
6/24/11	-	Pour each sample into a 100 mL (or larger) volumetric flask. Dilute to volume with water.
8/1/11	ICS 1000 Anions	Equilibrate the instrument until a stable baseline is achieved.
8/1/11	ICS 1000 Anions	Inject each standard solution once. Plot the standard injection areas against calibration standard concentrations to determine an initial calibration curve.
8/2/11	ICS 1000 Anions	Inject secondary standard once. Check that the secondary standard is within 15% of the value generated by the initial calibration curve.
8/1/11	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.
8/2/11	ICS 1000 Anions	Spike two different sample aliquots with standard(s) being analyzed. Analyze each spiked aliquot in duplicate and calculate recovery. Recovery should be from 85-115%.
8/2/11	ICS 1000 Anions	Inject the midpoint standard once after every 20 sample injections. Check that the secondary standard is within 15% of the value generated by the initial calibration curve.
8/2/11	ICS 1000 Anions	Inject each standard solution once at the end of the run.
8/2/11	-	For each anion, plot the average of the standard injections against calibration standard concentrations to determine a final calibration curve.
8/2/11	-	Determine the concentrations of each anion in each sample using the calibration curve.
8/2/11	-	Prepare report
		Report QA review
		Report distribution

6 FCCU-1241 Run 26A-1 Imps 3 & 4

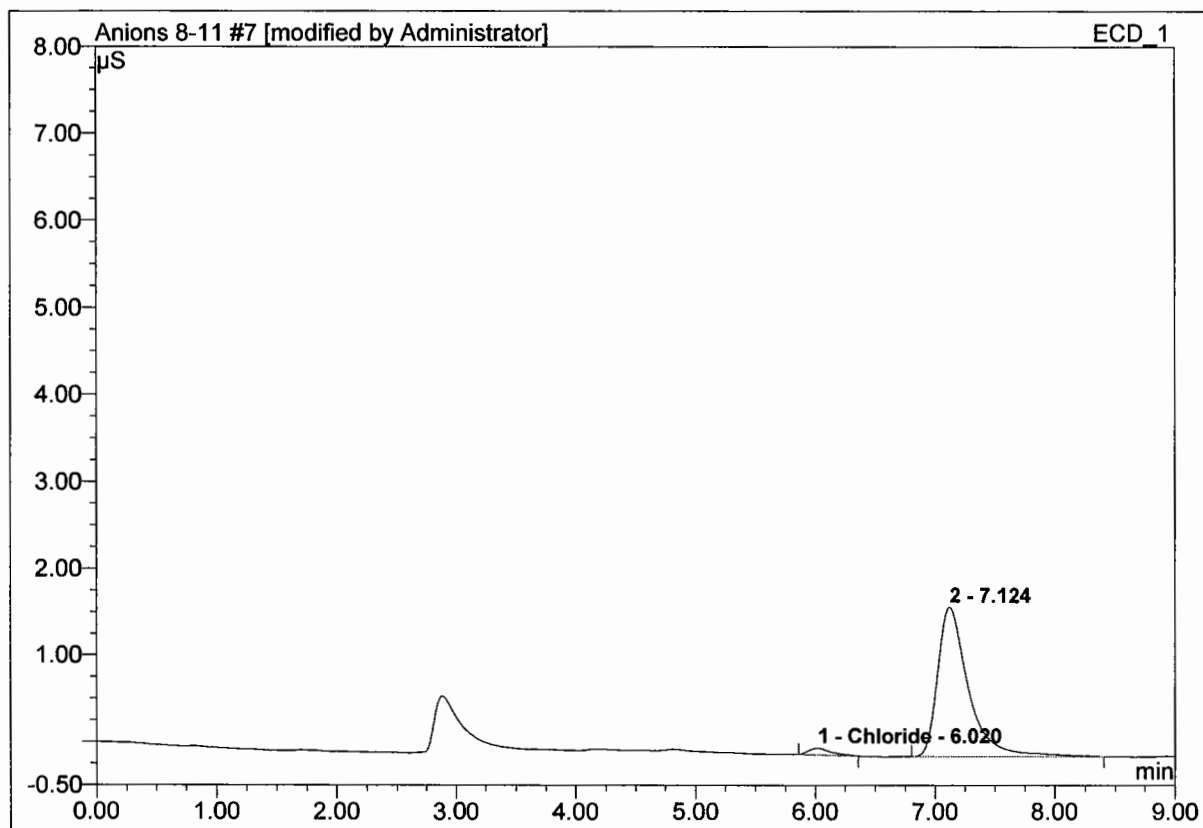
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 16:43	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.01	Chloride	0.071	0.0152
Total:			0.071	0.015

7 FCCU-1241 Run 26A-1 Imps 3 & 4

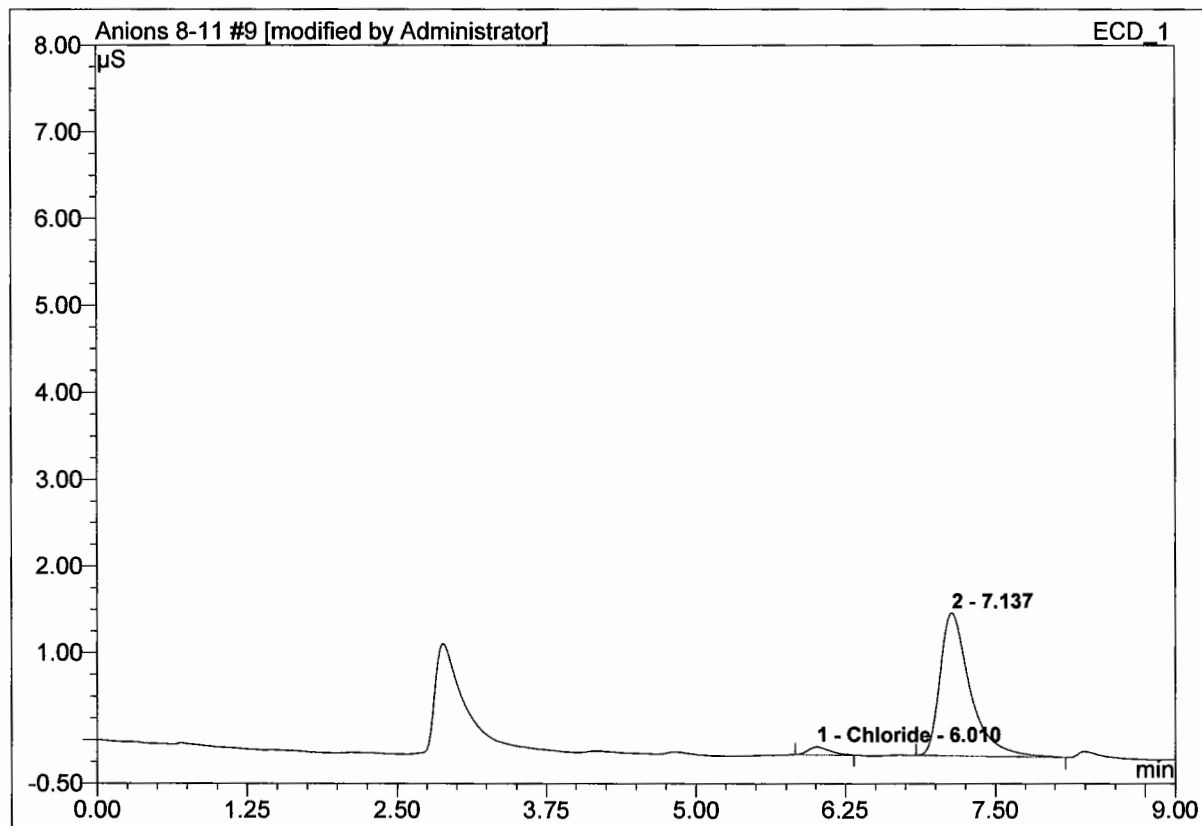
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 17:02	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.02	Chloride	0.077	0.0166
Total:			0.077	0.017

9 FCCU-1241 Run 26A-2 Imps 3 & 4

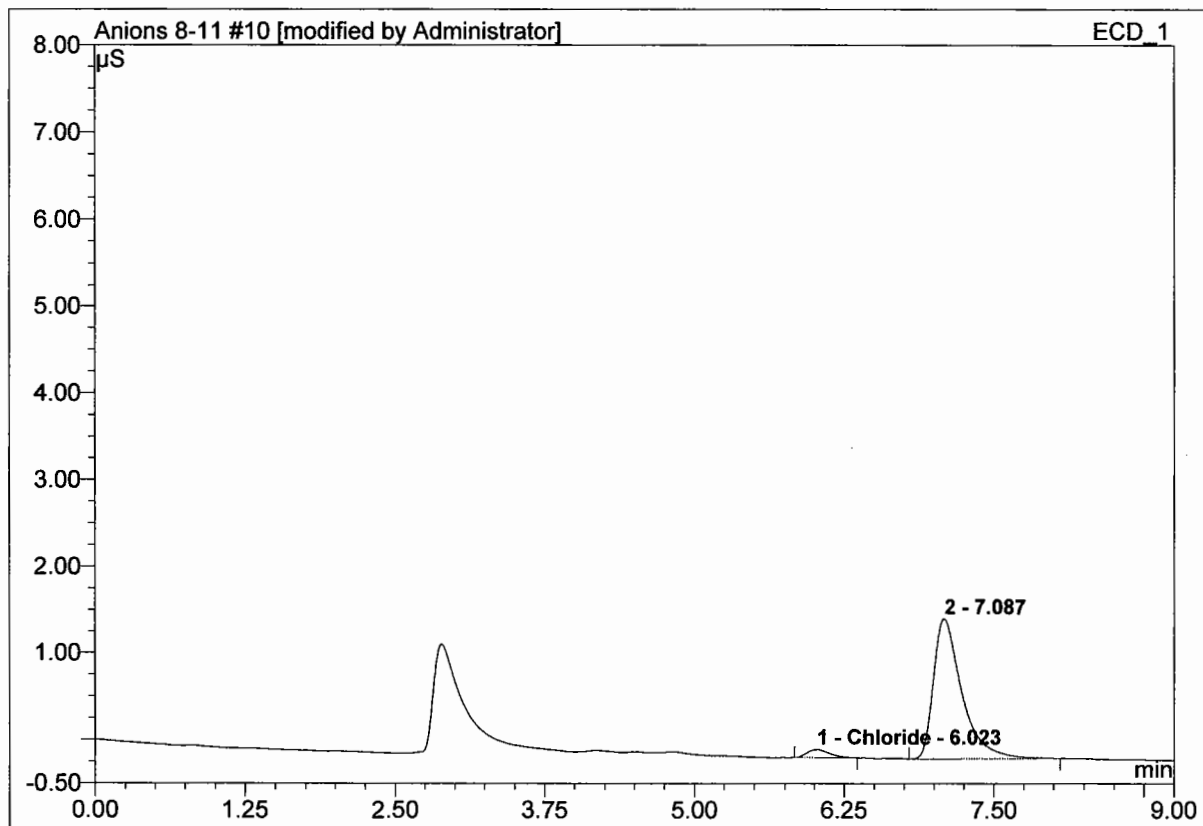
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 17:45	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.01	Chloride	0.090	0.0191
4	14.84	Sulfite	477.080	340.4713
Total:			477.171	340.490

10 FCCU-1241 Run 26A-2 Imps 3 & 4

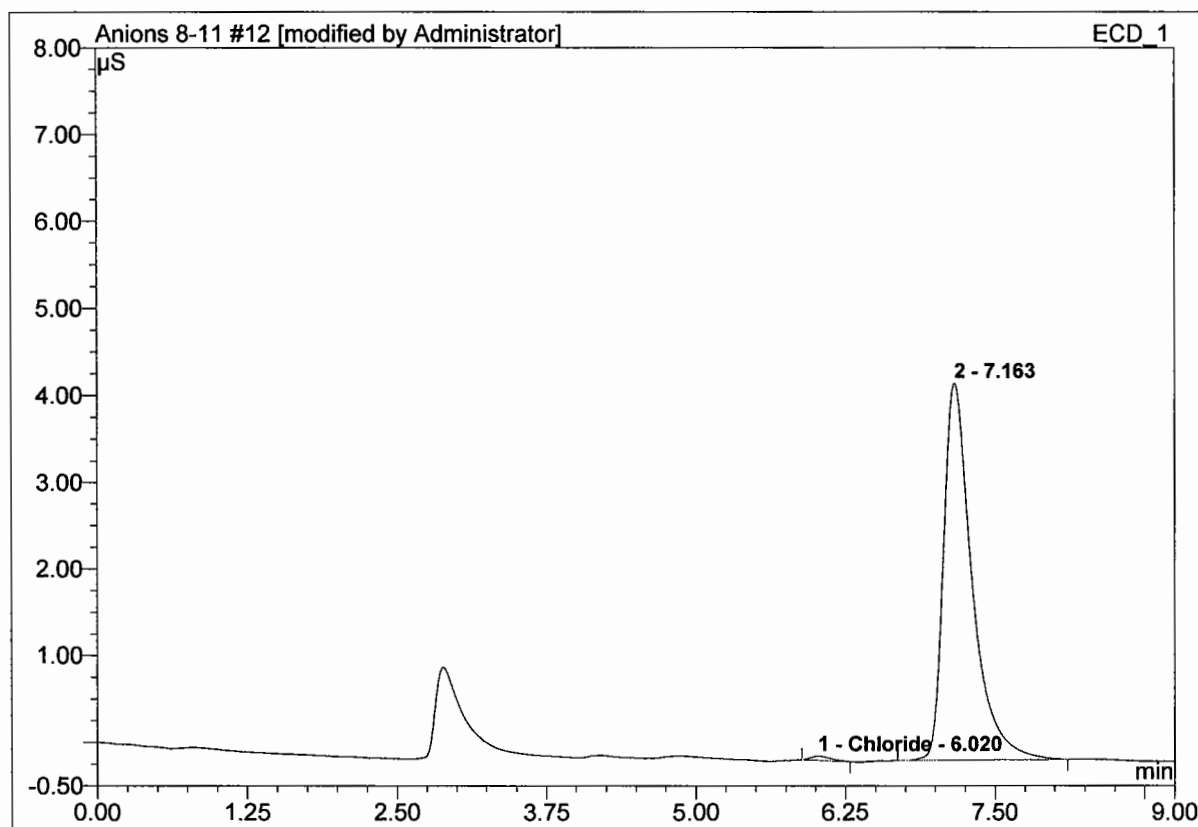
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 18:05	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.02	Chloride	0.093	0.0200
5	14.84	Sulfite	477.159	342.4488
Total:			477.252	342.469

12 FCCU-1241 Run 26A-3 Imps 3 & 4

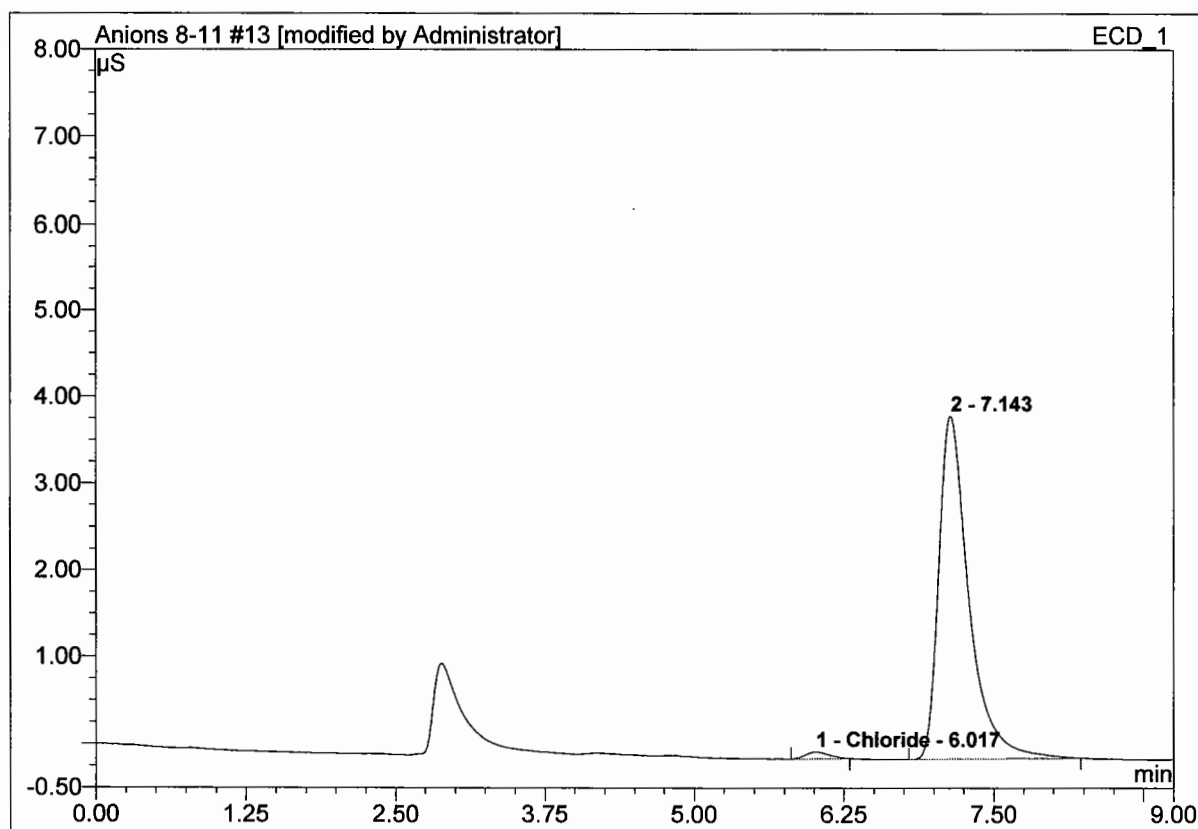
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 18:43	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.02	Chloride	0.049	0.0095
Total:			0.049	0.010

13 FCCU-1241 Run 26A-3 Imps 3 & 4

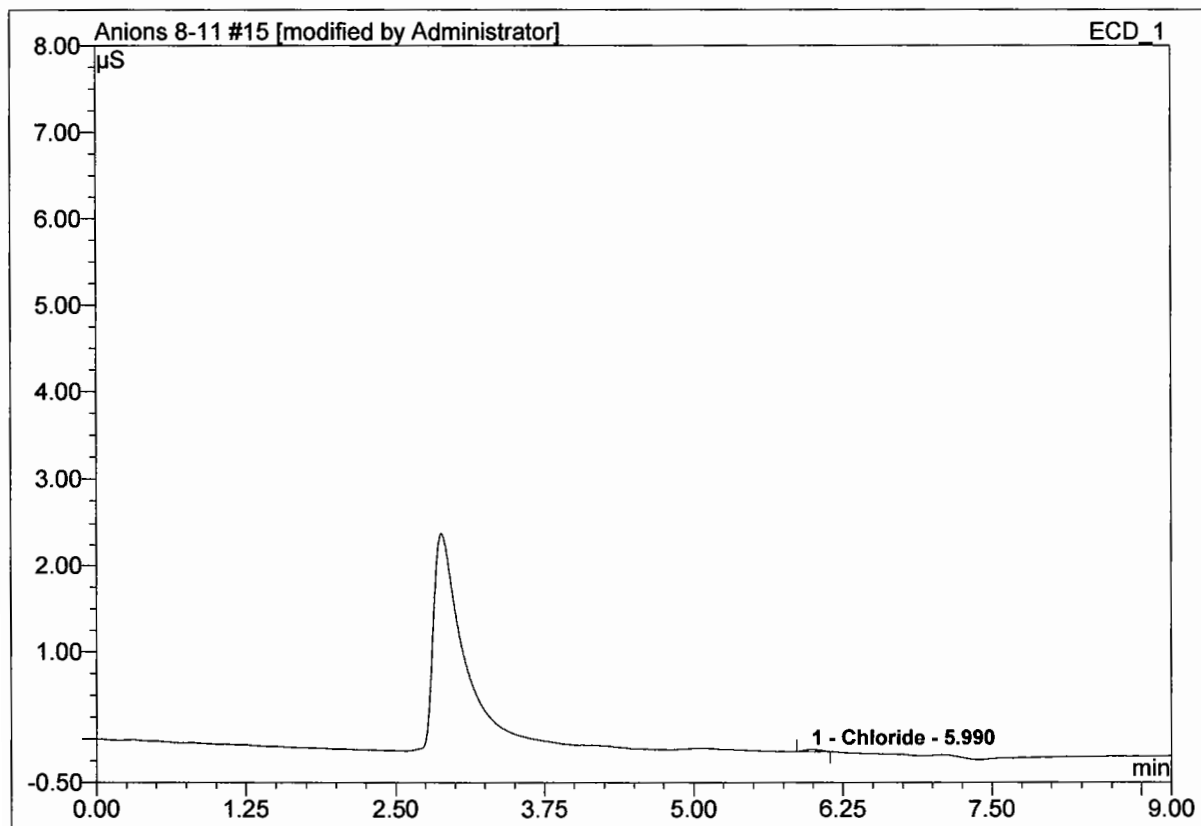
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 19:02	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.02	Chloride	0.078	0.0177
Total:			0.078	0.018

15 0.04 N NaOH Blank

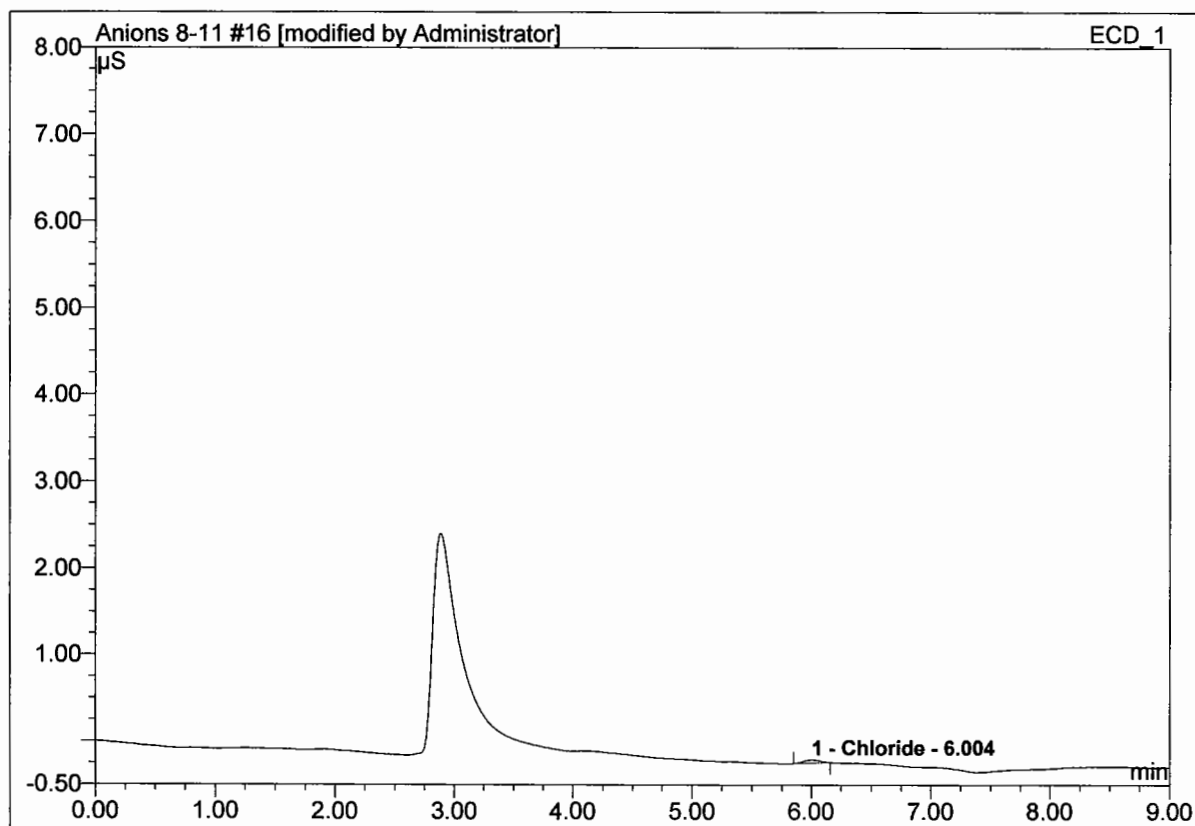
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 19:40	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height μS	Area μS*min
1	5.99	Chloride	0.022	0.0036
Total:			0.022	0.004

16 0.04 N NaOH Blank

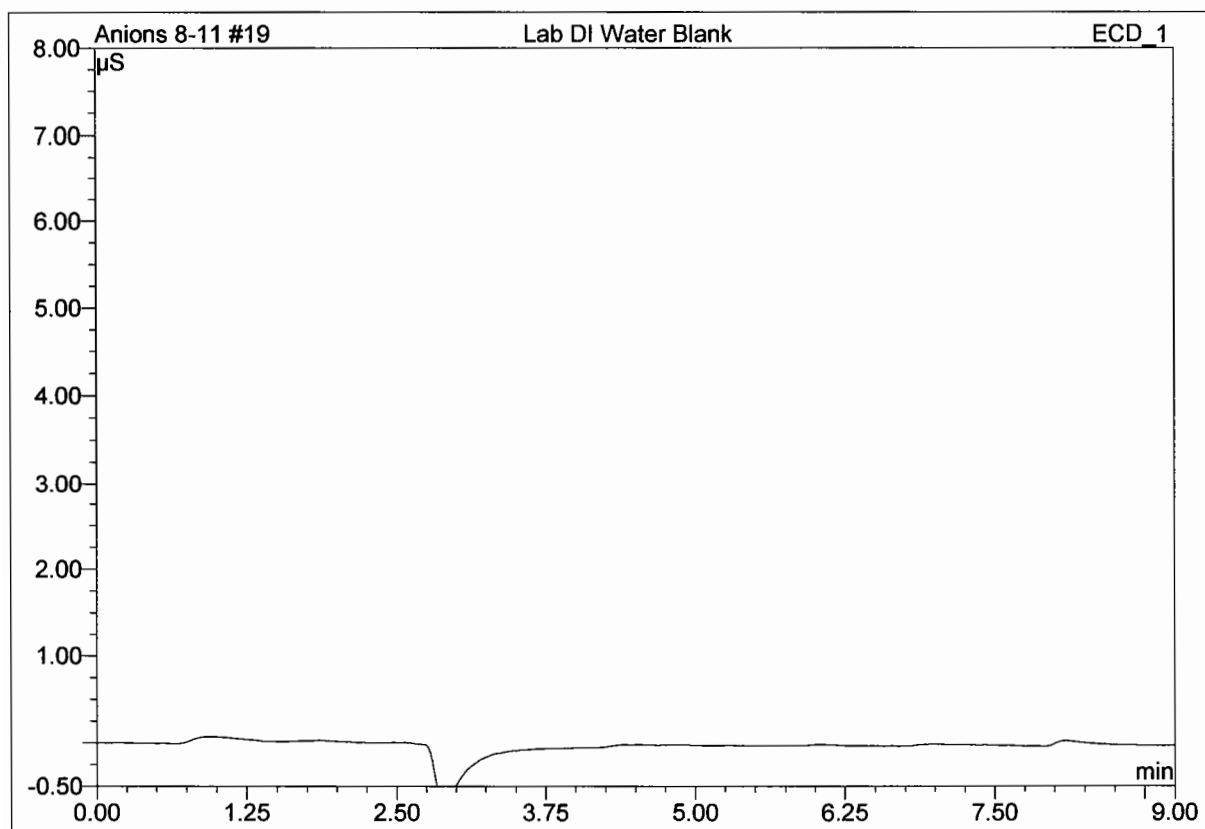
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 19:59	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	6.00	Chloride	0.035	0.0055
Total:			0.035	0.006

19 Lab DI Water Blank

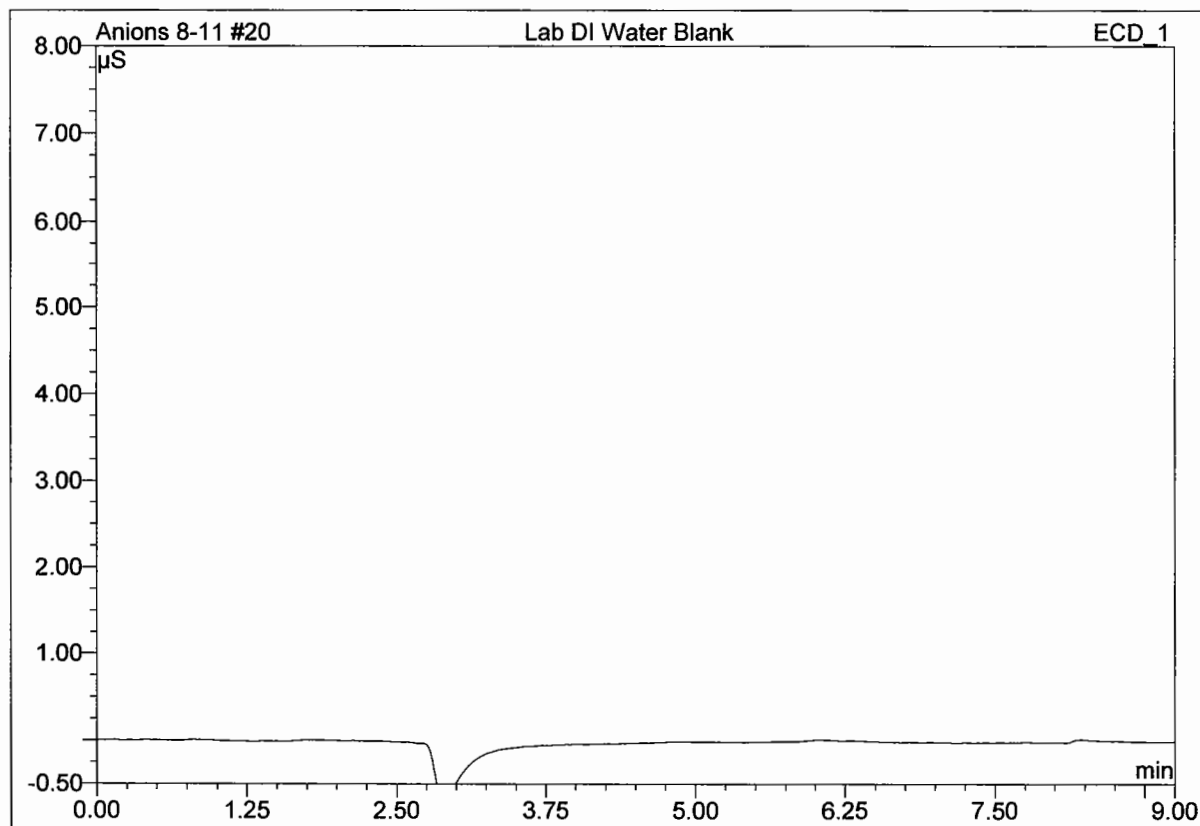
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 20:56	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

20 Lab DI Water Blank

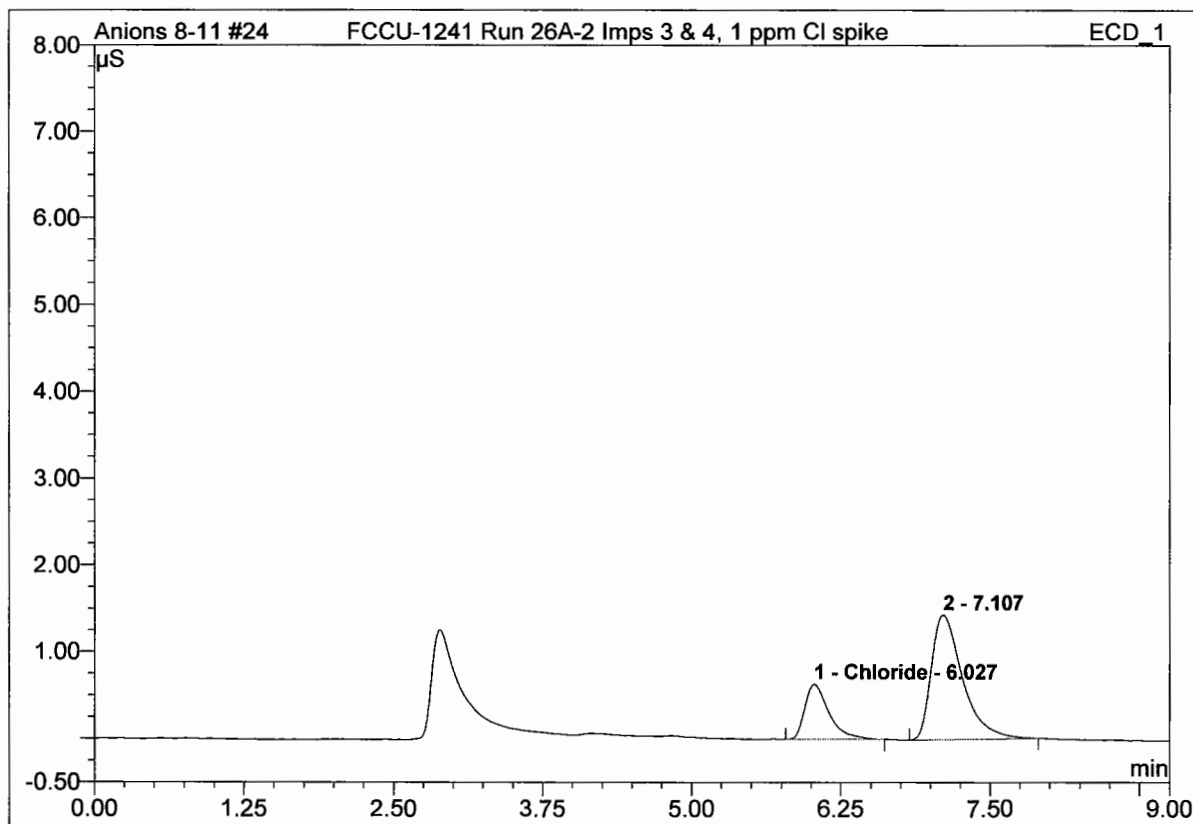
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 21:16	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
Total:			0.000	0.000

24 FCCU-1241 Run 26A-2 Imps 3 & 4, 1 ppm Cl spike

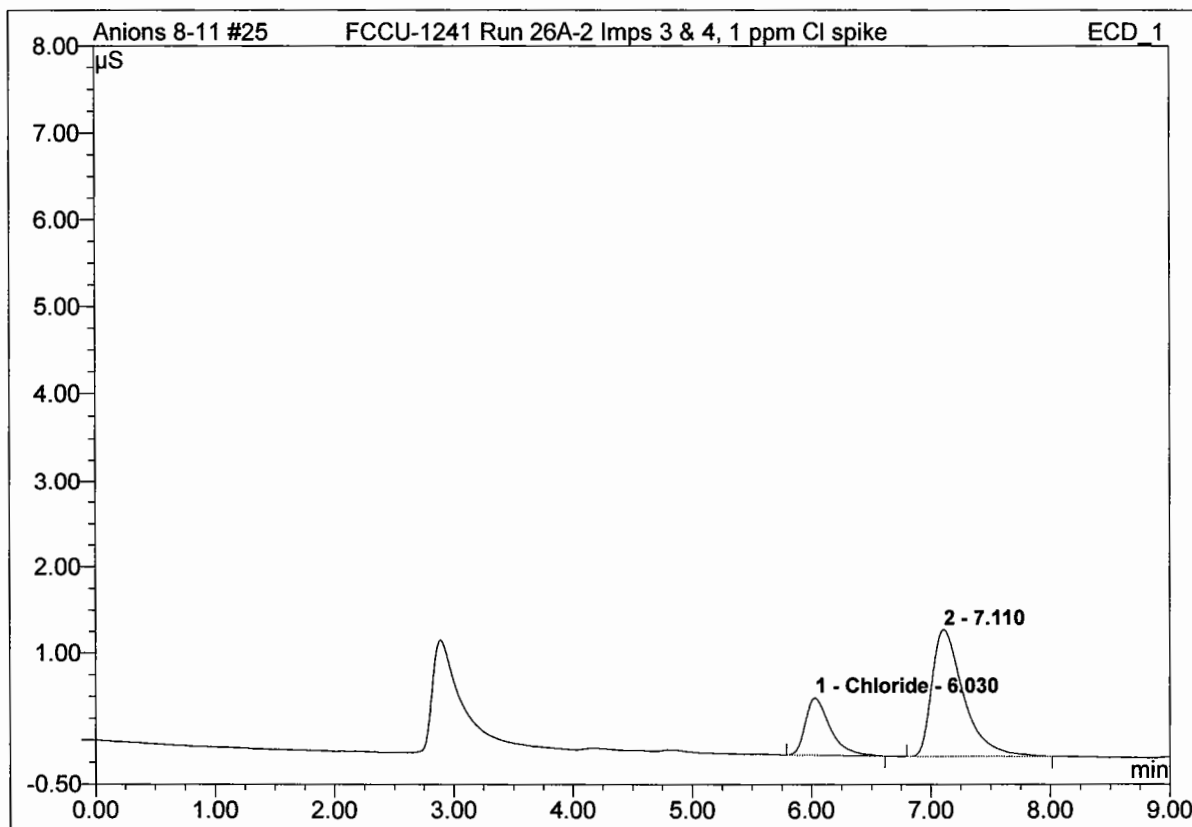
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 9:48	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	0.636	0.1504
4	14.87	Sulfite	470.201	336.6836
Total:			470.837	336.834

25 FCCU-1241 Run 26A-2 Imps 3 & 4, 1 ppm Cl spike

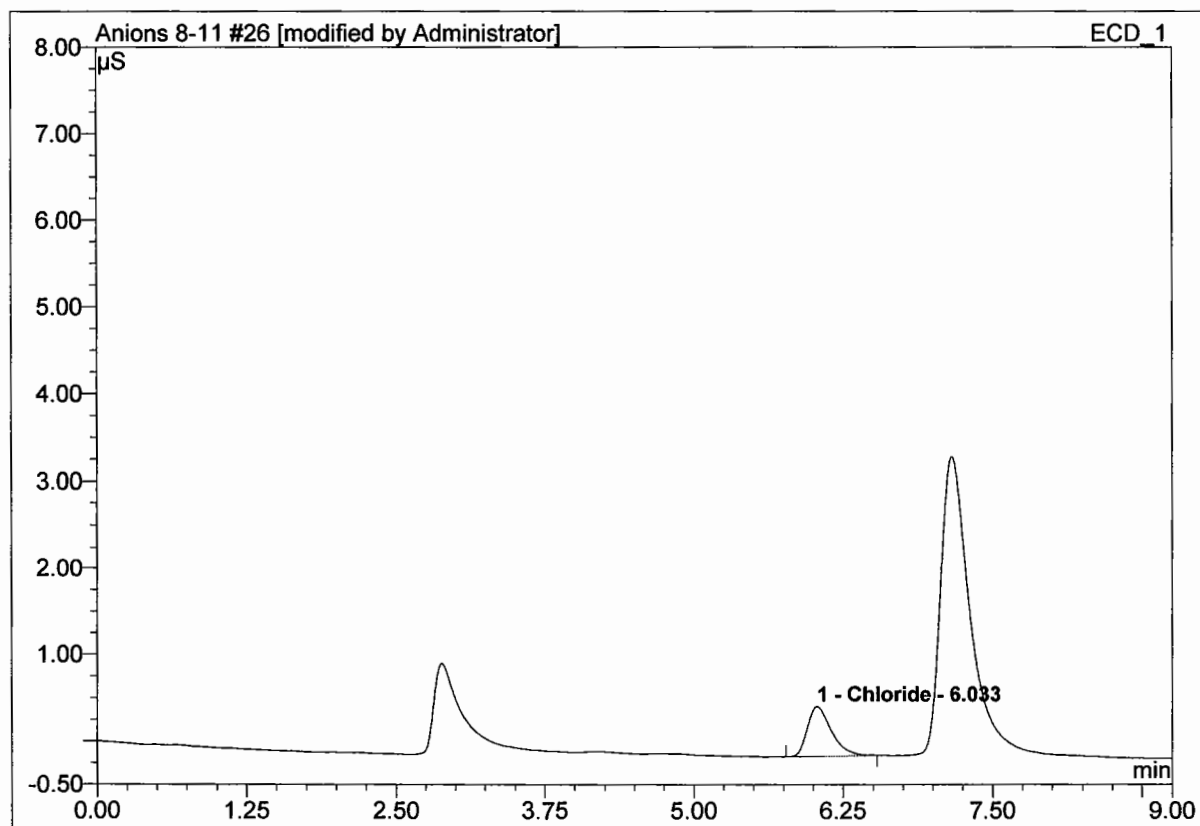
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 10:07	Sample Weight:	1.0000
Run Time (min):	12.91	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	0.658	0.1571
Total:			0.658	0.157

26 FCCU-1241 Run 26A-3 Imps 3 & 4, 1 ppm Cl spike

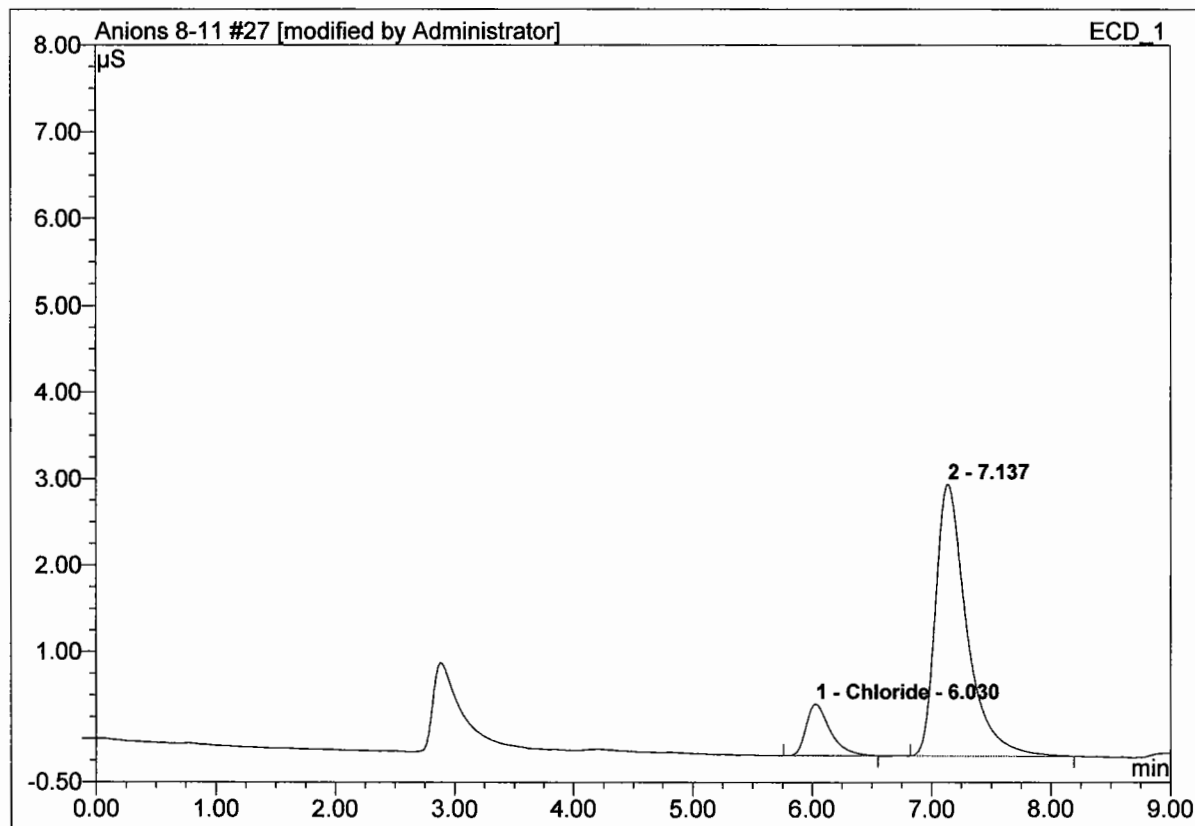
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 10:26	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	0.576	0.1348
Total:			0.576	0.135

27 FCCU-1241 Run 26A-3 Imps 3 & 4, 1 ppm Cl spike

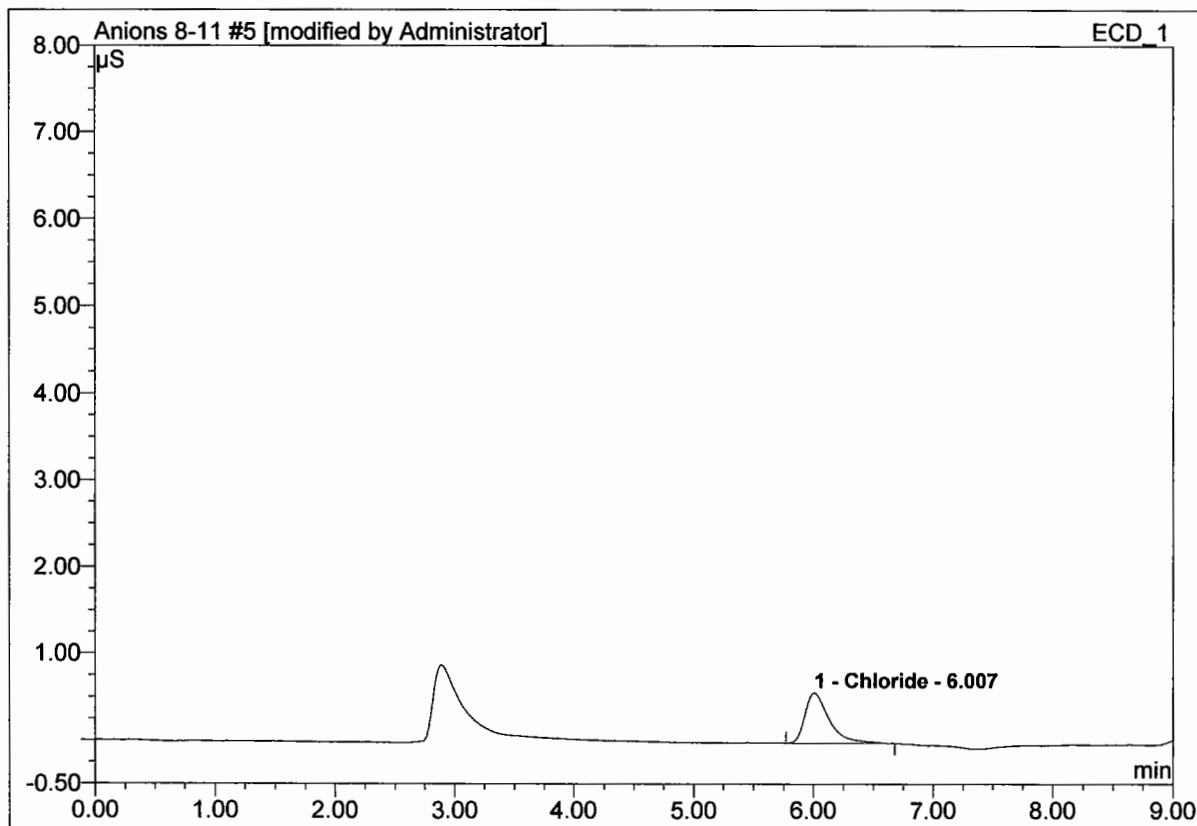
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 10:46	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	6.03	Chloride	0.596	0.1406
Total:			0.596	0.141

5 1.0 ppm Cl std. - pre

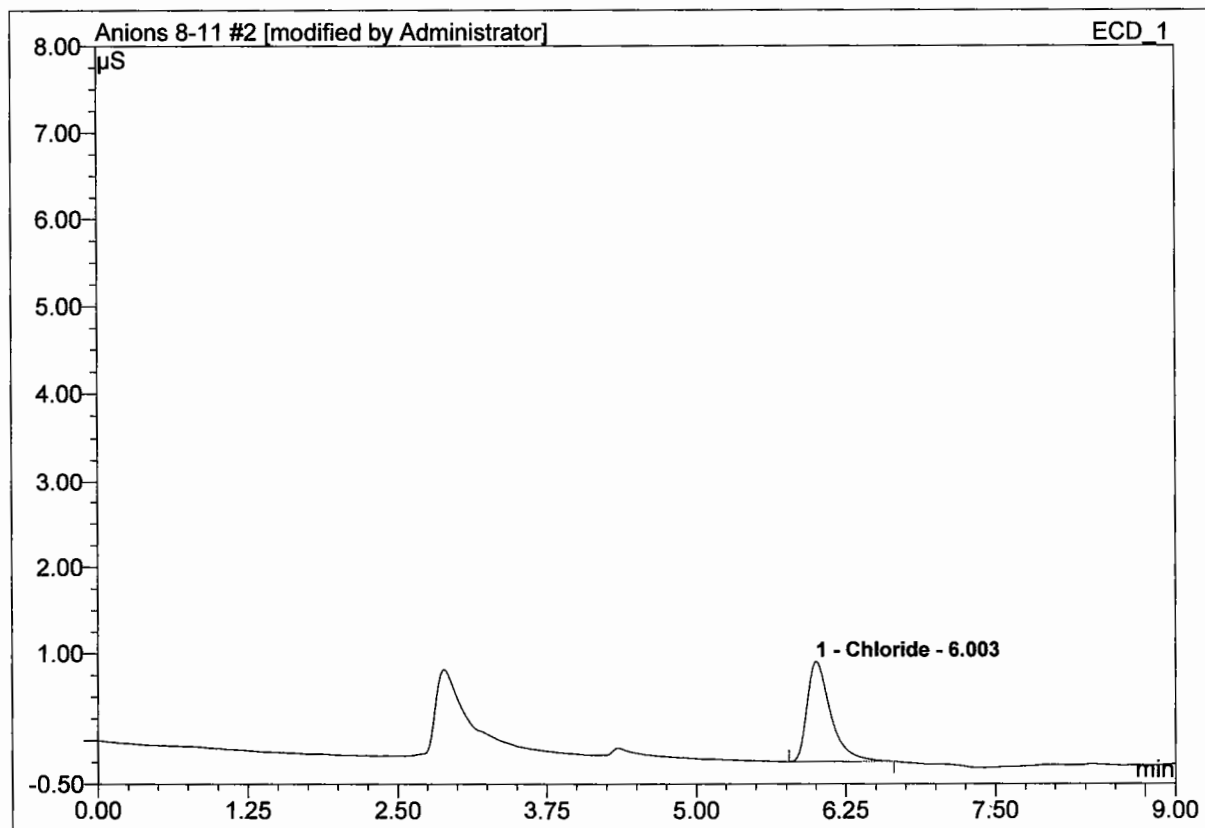
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 16:18	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.01	Chloride	0.580	0.1371
Total:			0.580	0.137

2 2.0 ppm Cl std. - pre

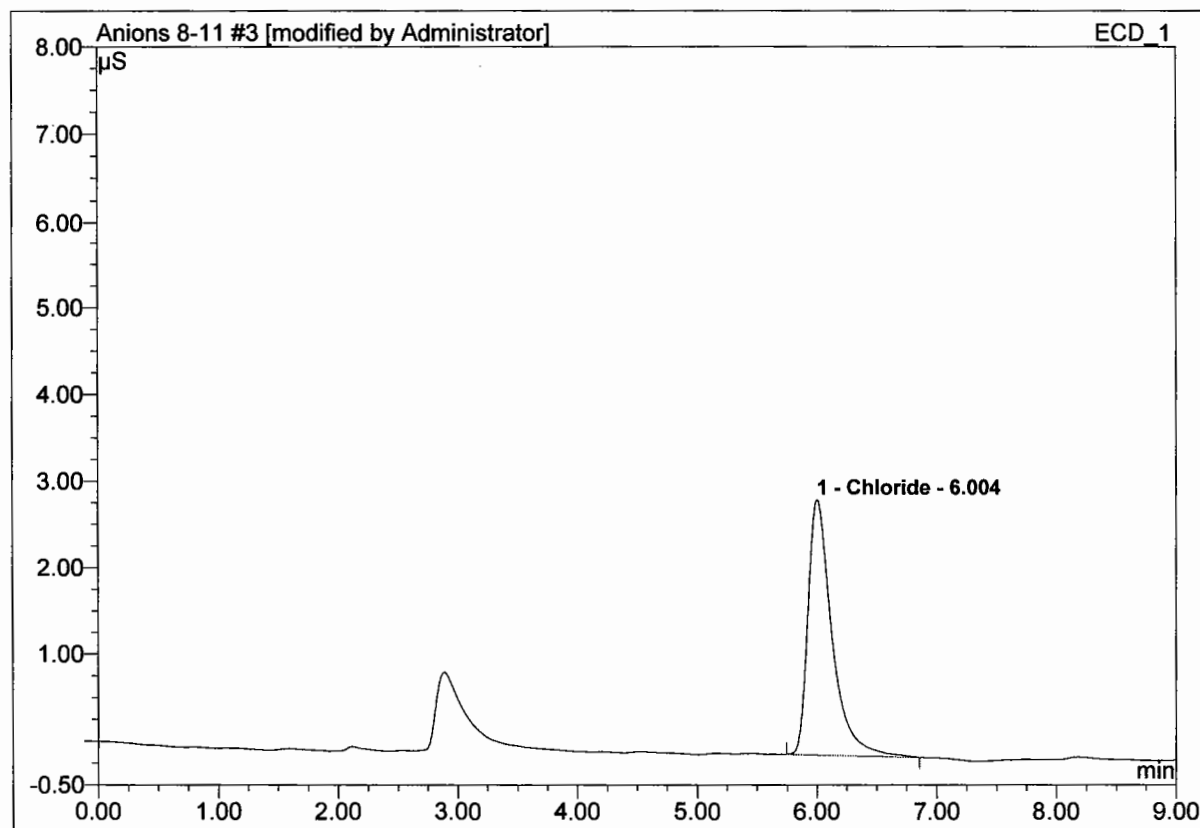
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/1/2011 15:12	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.00	Chloride	1.151	0.2633
Total:			1.151	0.263

3 5.0 ppm Cl std. - pre

Client	Valero, Port Arthur, TX	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:	8/1/2011 15:31	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000

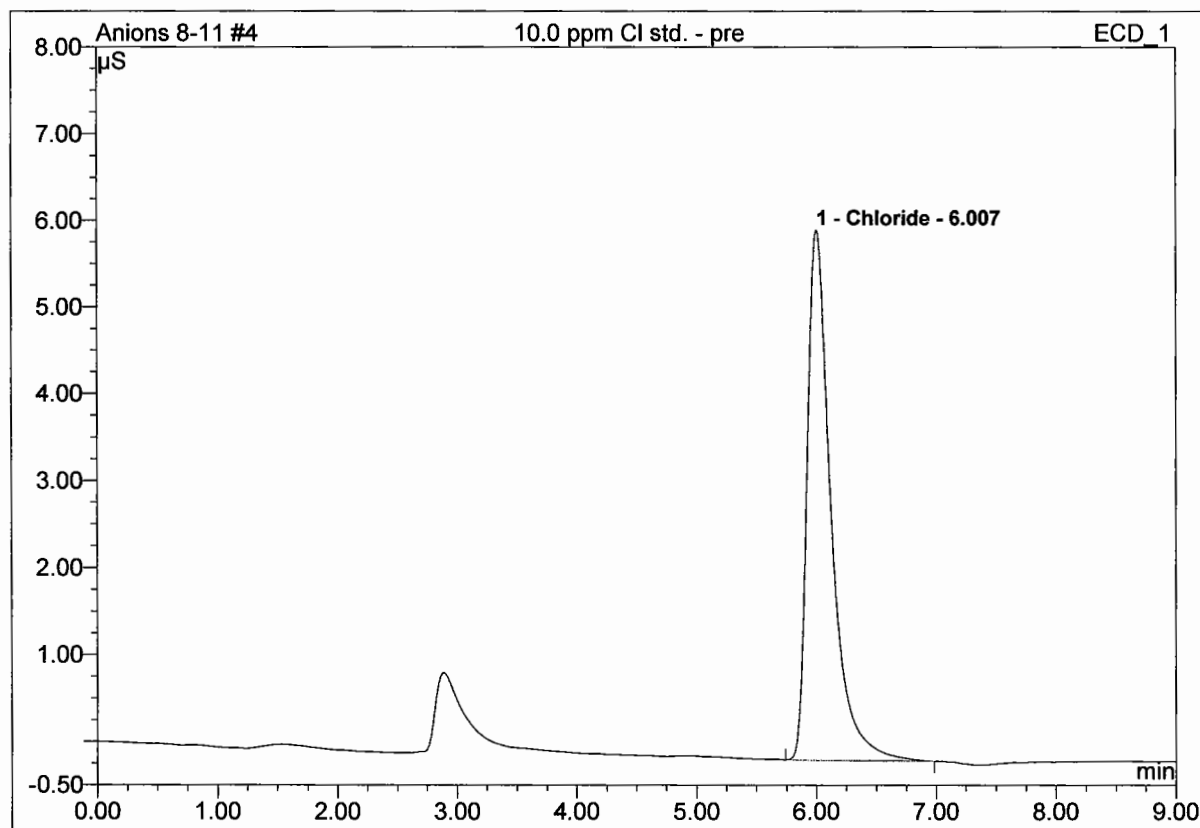


No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	6.00	Chloride	2.942	0.6861
Total:			2.942	0.686

4 10.0 ppm Cl std. - pre

Client **Valero, Port Arthur, TX**
Vial Number: **1**
Sample Type: **standard**
Control Program: **Anions 1000**
Quantif. Method: **ICS_1000_Anions**
Recording Time: **8/1/2011 15:50**
Run Time (min): **18.00**

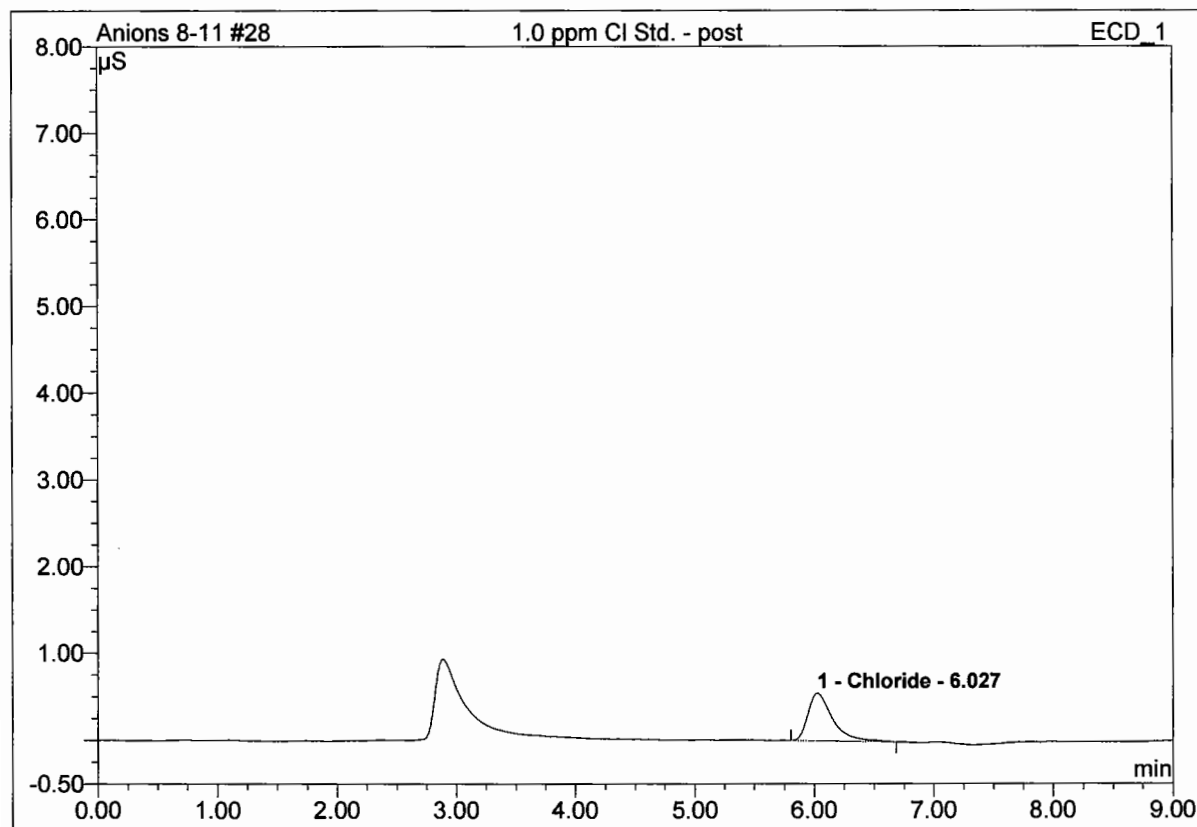
Injection Volume: **35.0**
Channel: **ECD_1**
Wavelength: **n.a.**
Bandwidth: **n.a.**
Dilution Factor: **1.0000**
Sample Weight: **1.0000**
Sample Amount: **1.0000**



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	6.01	Chloride	6.106	1.4095
Total:			6.106	1.409

28 1.0 ppm Cl Std. - post

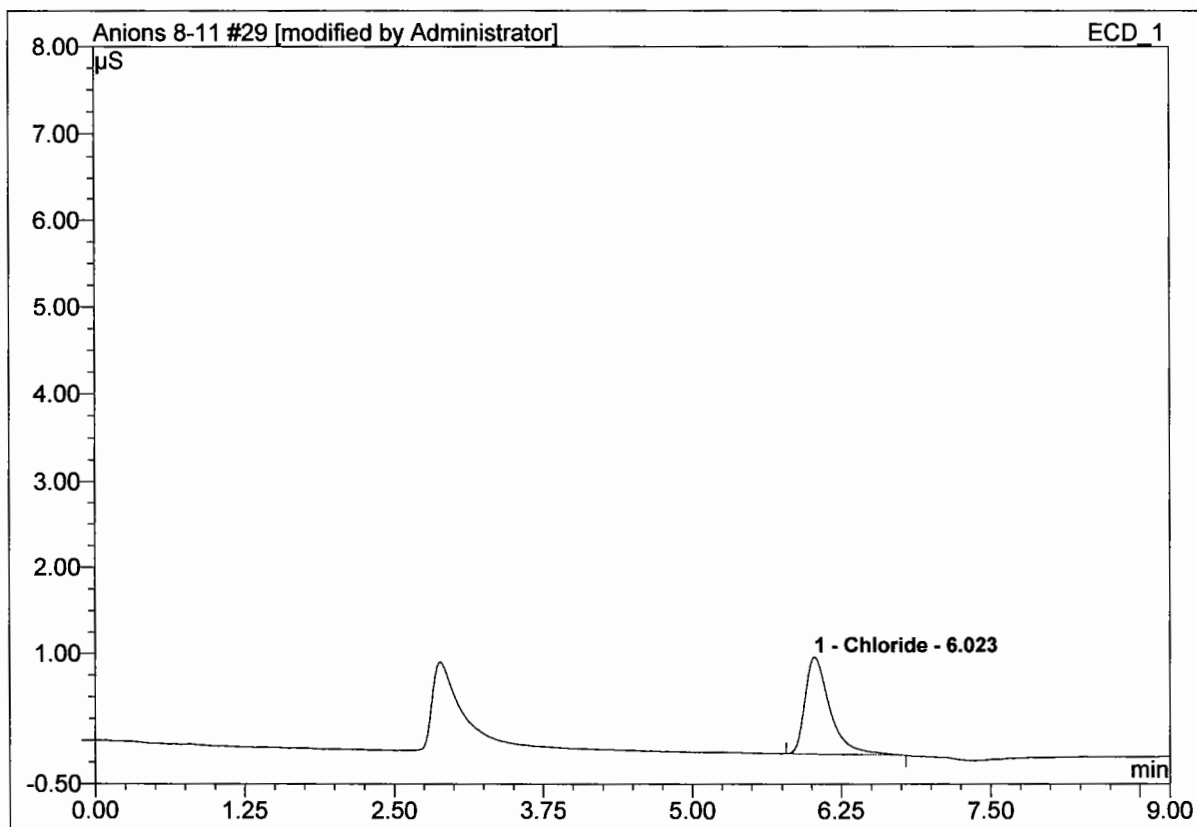
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 11:14	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	0.548	0.1314
Total:			0.548	0.131

29 2.0 ppm Cl Std. - post

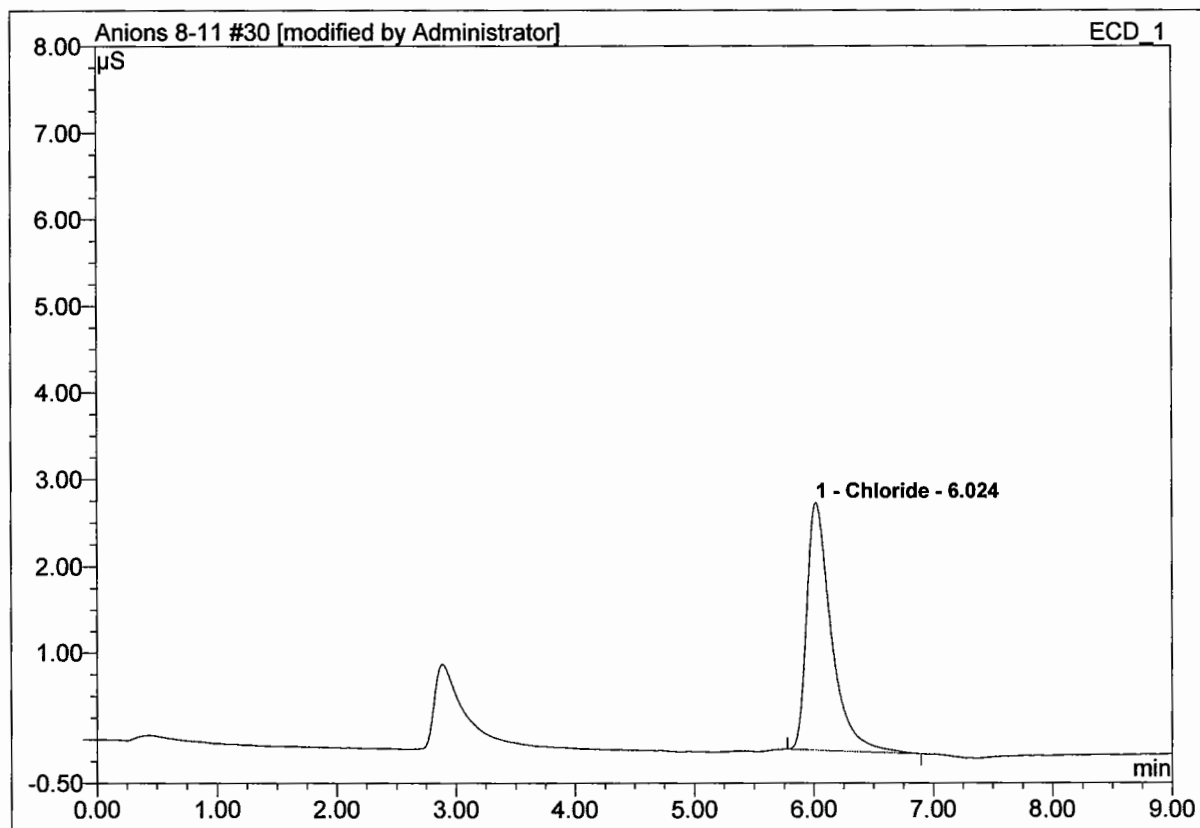
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 11:33	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	6.02	Chloride	1.120	0.2720
Total:			1.120	0.272

30 5.0 ppm Cl Std. - post

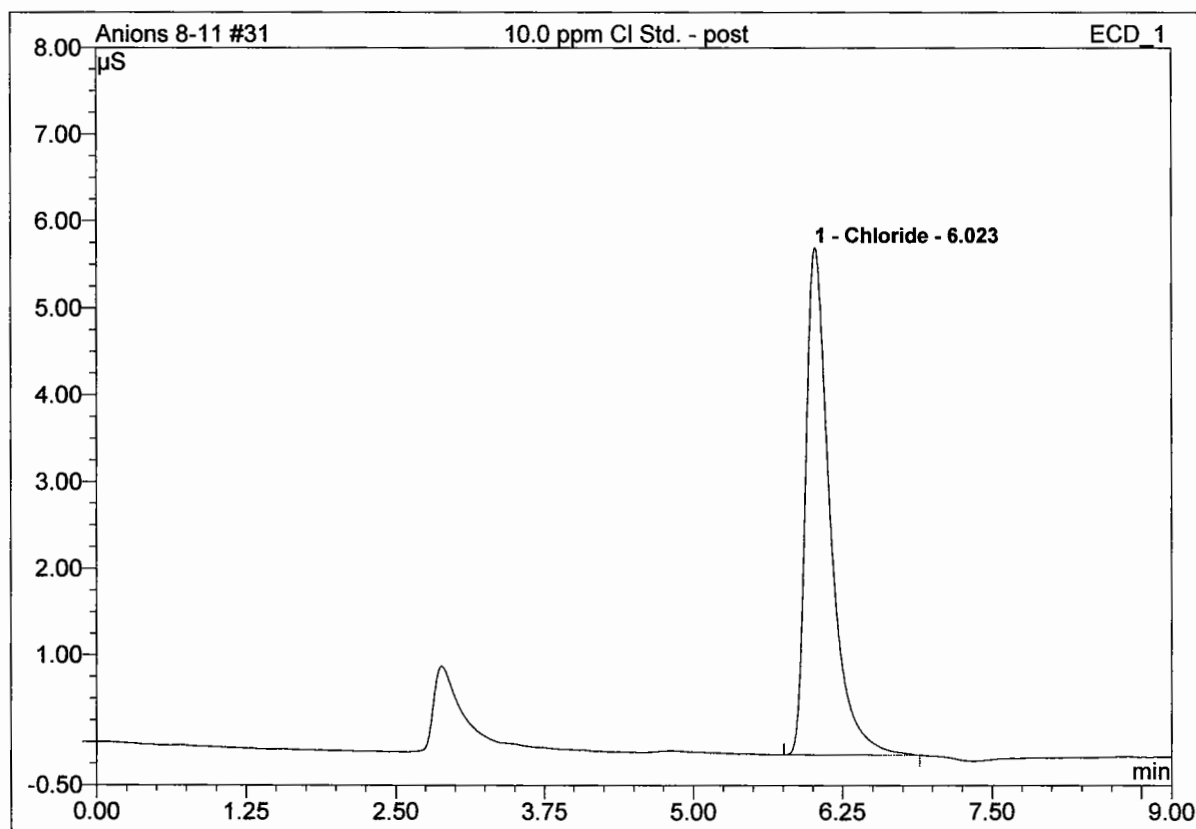
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 11:52	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.02	Chloride	2.852	0.6826
Total:			2.852	0.683

31 10.0 ppm Cl Std. - post

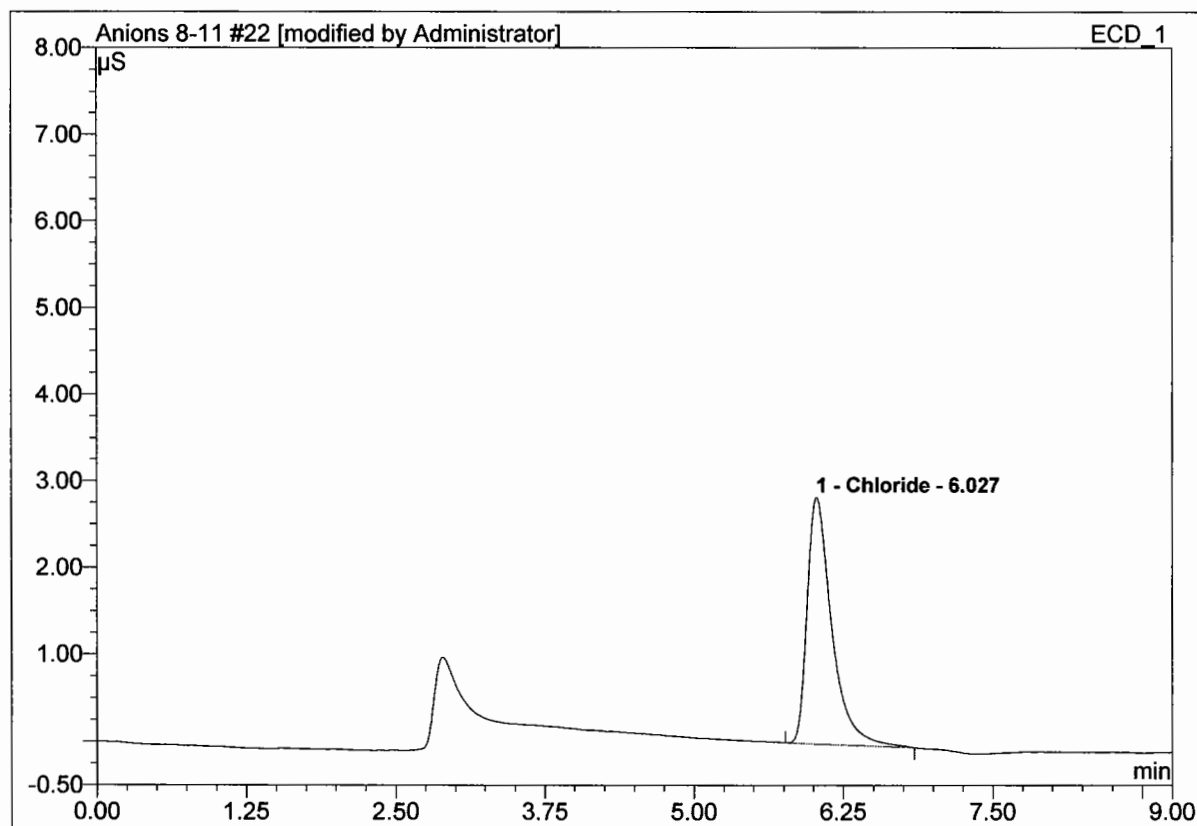
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 12:11	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	6.02	Chloride	5.849	1.3851
Total:			5.849	1.385

22 5.0 ppm Cl Secondary Std.

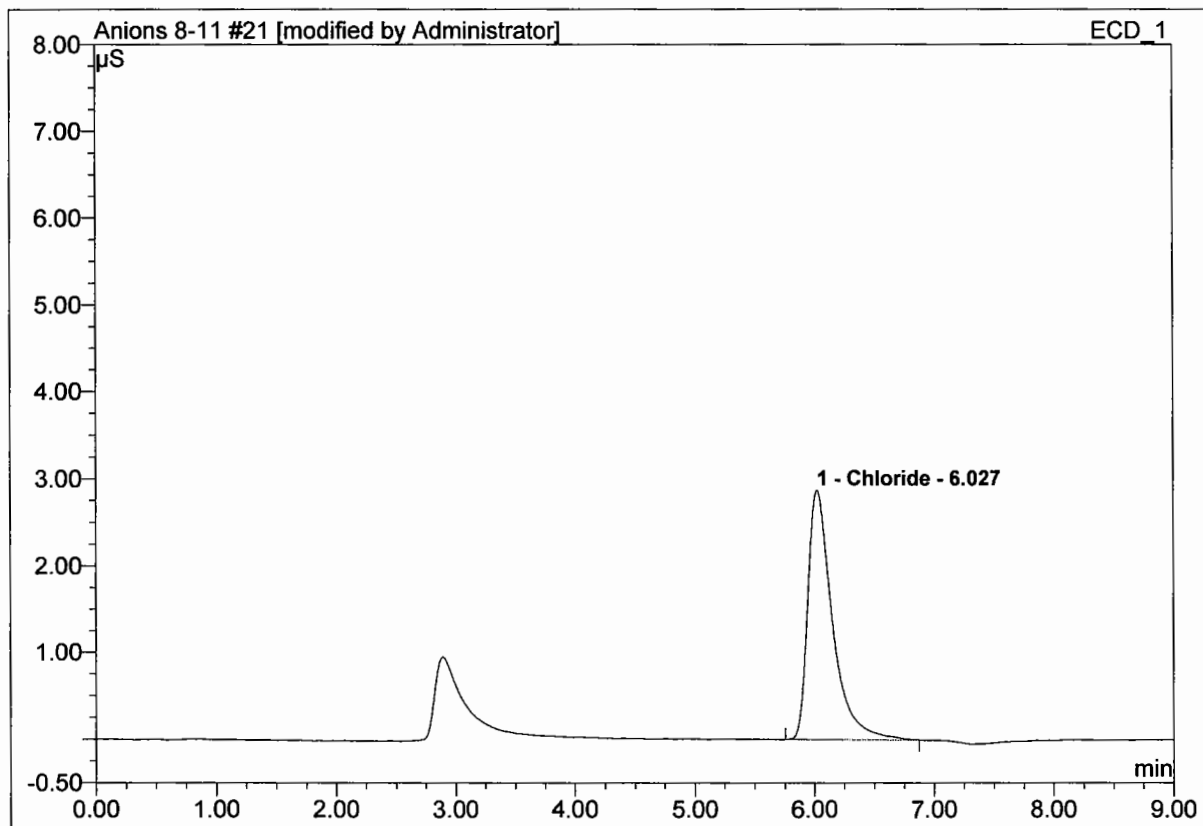
Client	Valero, Port Arthur, TX	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	Anions 1000	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Anions	Dilution Factor:	1.0000
Recording Time:	8/2/2011 8:56	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	2.839	0.6774
Total:			2.839	0.677

21 5.0 ppm Cl Std. - CCV

Client	Valero, Port Arthur, TX	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:	8/2/2011 8:37	Sample Weight:	1.0000
Run Time (min):	18.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	6.03	Chloride	2.868	0.6866
Total:			2.868	0.687

DAT Report

Data Analysis Technologies, Inc.

7715 Corporate Blvd.

Plain City, OH 43064

800-733-8644

Sample Analysis Certificate

Client: ARI Environmental, Inc.
Address: 1710 Preston Avenue, Suite C
Pasadena, TX 77503

Date: 8/3/2011
DAT Project ID: 0811002
Date Received: 8/1/2011
Date Analyzed: 8/2/2011

Attn: Greg Burch
Client Project: Valero Port Arthur, TX
Analysis: OTM -029


The following samples were received on 8/1/2011:

DAT Sample ID	Client Sample ID	Date Sampled	Matrix
0811002-01	H44510 Blank - 6N NaOH	6/6/2011	Liquid
0811002-02	H44511 Field Spike - 6N NaOH Recovered w/Spike	6/6/2011	Liquid
0811002-03	H44513 FCCU - 1241 Imp #1 thru 3 - R1	6/6/2011	Liquid
0811002-04	H44514 FCCU - 1241 Imp #4 - R1	6/6/2011	Liquid
0811002-05	H44515 FCCU - 1241 Imp #1 thru 3 - R2	6/6/2011	Liquid
0811002-06	H44516 FCCU - 1241 Imp #4 - R2	6/6/2011	Liquid
0811002-07	H44517 FCCU - 1241 Imp #1 thru 3 - R3	6/7/2011	Liquid
0811002-08	H44518 FCCU - 1241 Imp #4 - Contents R3	6/7/2011	Liquid

Results: See attached summary.

QC: Met the criteria for the method. See attached summary.

Reviewed and approved for release by:



Ronald K. Mitchum, Ph.D.
President, DAT

Date:

8/3/11

Data Analysis Technologies, Inc.
7715 Corporate Blvd.
Plain City, OH 43064

Data Summary Table

Client: ARI Environmental
Client Project: Valero Port Arthur, TX
Analysis: Cyanide by OTM-29
DAT Project: 0811002
Extraction Date: 6/6/11
Analysis Date: 8/2/11

Client ID	DAT ID		MDL	Total Cyanide	Q
			<i>ug</i>	Conc., ug	
Reagent Blank NaOH	0811002-	1	1.0	ND	
FCCU-1241 Imp. 1-3 R1	0811002-	3	277.0	53295	D
FCCU-1241 Imp. 4 R1	0811002-	4	1.2	145	
FCCU-1241 Imp. 1-3 R2	0811002-	5	271.5	48979	D
FCCU-1241 Imp. 4 R2	0811002-	6	1.2	187	
FCCU-1241 Imp. 1-3 R3	0811002-	7	275.0	23265	D
FCCU-1241 Imp. 4 R3	0811002-	8	1.2	ND	
Field Spike	0811002-	2	29.8	2047	D

D= Value from a dilution

Data Analysis Technologies, Inc.

7715 Corporate Blvd.

Plain City, OH 43064

QC Summary Table

Client: ARI Environmental
Client Project: Valero Port Arthur, TX
Analysis: Cyanide by OTM-29
DAT Project: 0811002
Extraction Date: 6/6/11
Analysis Date: 8/2/11
Spike Amt. Added, ug: 0.2

Client ID:	DAT ID:	Cyanide, ug/mL	Cyanide, ug	MDL ug/mL	% Rec	% RPD	Q
Cal Check Standard	ICV 0.2 ug/mL ()		0.21		106		
Instr Blank	NaOH Blank ()			0.001			
Sample	0811002-8		8				
Sample Duplicate	0811002-8 Dup		8			1	
Cal Check Standard	CCV 0.2 ug/mL ()		0.22		110		
Instr Blank	NaOH Blank ()			0.001			
Cal Check Standard	CCV 0.2 ug/mL ()		0.22		110		
Instr Blank	NaOH Blank ()			0.001			
Field Spike 1	0811002-2	0.344	2047		102		
Lab Spike	LS	0.197	0.197		99		
Lab Spike Duplicate	LSD	0.218	0.218		109	10	
Cal Check Standard	CCV 0.2 ug/mL ()		0.22		108		
Instr Blank	NaOH Blank ()		ND	0.001			

ND = Not detected at the reporting limit shown.

DOCUMENTATION

Chain of Custody Record H08002

[illegible]

DAT SAMPLE RECEIVING

7715 Corporate Blvd. Plain City, OH 43064.

Project Number: 0811002

Date Received: 8/1/2011

Client Name: ARI Environmental Pasa

Tracking number: 486408130964

Custody Seals ? No

Carrier: Fed-X Express

Analysis: OTM -029

Package Temp: 24.8°C (AMB-Room)

COC: ☒ check if COC from client

Sample Information

Client ID:	Laboratory ID	Date	Matrix	Container	Comment:
H44510 Blank - 6N NaOH	0811002-01	6/6/2011	Liquid	250ml Plastic WM Bottle	
H44511 Field Spike - 6N NaOH Recovered w/Spike	0811002-02	6/6/2011	Liquid	250ml Plastic WM Bottle	
H44513 FCCU - 1241 Imp #1 thru 3 - R1	0811002-03	6/6/2011	Liquid	500ml Plastic WM Bottle	
H44514 FCCU - 1241 Imp #4 - R1	0811002-04	6/6/2011	Liquid	250ml Plastic WM Bottle	
H44515 FCCU - 1241 Imp #1 thru 3 - R2	0811002-05	6/6/2011	Liquid	500ml Plastic WM Bottle	
H44516 FCCU - 1241 Imp #4 - R2	0811002-06	6/6/2011	Liquid	250ml Plastic WM Bottle	
H44517 FCCU - 1241 Imp #1 thru 3 - R3	0811002-07	6/7/2011	Liquid	500ml Plastic WM Bottle	


Laboratory Receiving Initials

0811002

8/1/2011 11:36:17 AM

DAT SAMPLE RECEIVING

7715 Corporate Blvd. Plain City, OH 43064.

Project Number: 0811002

Client ID:	Laboratory ID	Date	Matrix	Container:	Comment:
H44518 FCCU - 1241 Imp #4 - Contents R3	0811002-08	6/7/2011	Liquid	250ml Plastic WM Bottle	



Laboratory Receiving Initials

0811002

8/1/2011 11:36:17 AM

DAT Labs Inc. **Sample Receipt Report**

Client/Number: ARI Environmental (11571) Pasaden The client has been contacted. Yes ☐ No ☐

Custodian Initial: LE Date: 8-1-11

Secondary Review: Initials: _____ Date: _____

Upon receipt of samples, check if any of the following discrepancies have been noted.

Discrepancy Type	Specify applicable client ID or "all"
<input type="checkbox"/> COC and samples do not match	
<input type="checkbox"/> No unique sample identifications	
<input type="checkbox"/> Samples received outside of the required temp criteria. Receipt Temp: <u>24.2 C</u>	
<input type="checkbox"/> No preservation type was noted Correction Factor: <u>+0.6 C</u>	
<input type="checkbox"/> No date of collection stated Corrected Temp: <u>24.8 C</u> (<u>Amb-Room</u>)	
<input type="checkbox"/> No time of collection stated	
<input type="checkbox"/> The sample collector was not named	
<input type="checkbox"/> Sample containers were not appropriate	
<input type="checkbox"/> Sample labels were destroyed or unreadable	
<input type="checkbox"/> Samples were received outside of holding time	
<input type="checkbox"/> There was not enough sample to perform the requested analysis.	
<input type="checkbox"/> Samples showed sign of damage or contamination.	
<input type="checkbox"/> Aqueous samples for volatile analysis: Headspace? Y <input type="checkbox"/> N <input type="checkbox"/> If Yes, list sample ID(s) in details: _____	

Details: _____

Sample pH for nonvolatile aqueous samples and presence or absence of headspace (Y or N) for VOA aqueous samples shall be recorded at time of sample log-in. Under no circumstances shall VOA vials be opened at time of sample receipt.

Other Discrepancies:

Sample ID

Discrepancy

Container Return

Yes ☐ No ☒

Price:

Size:

Return Spl wt:

☒

Upon receipt, the samples met all of DAT's acceptance criteria.

DAT Project #

0811002

PLEASE FOLD THIS SHIPPING DOCUMENT IN HALF AND PLACE IT IN A WAYBILL POUCH AFFIXED TO YOUR SHIPMENT SO THAT THE BARCODE PORTION OF THE LABEL CAN BE READ AND SCANNED. ***WARNING: USE ONLY THE PRINTED ORIGINAL LABEL FOR SHIPPING. USING A PHOTOCOPY OF THIS LABEL FOR SHIPPING PURPOSES IS FRAUDULENT AND COULD RESULT IN ADDITIONAL BILLING CHARGES, ALONG WITH THE CANCELLATION OF YOUR FEDEX ACCOUNT NUMBER.

From: Origin ID: UGNA (847) 487-1580
ERIC VOGT
ARI ENVIRONMENTAL, INC.
951 OLD RAND ROAD
UNIT 106
WAUCONDA, IL 680841289



J18181009810223

SHIP TO: (800) 733-8644 **BILL SENDER**
RON MITCHUM
DAT, INC.
7715 CORPORATE BLVD.

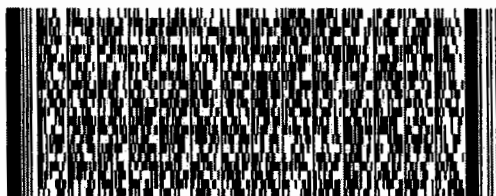
PLAIN CITY, OH 43064

Ship Date: 29JUL11
ActWgt: 37.0 LB MAN
CAD: 837327/CAFE2472

Delivery Address Bar Code



Ref #
Invoice #
PO #
Dept #



TRK# 4864 0813 0964
0201

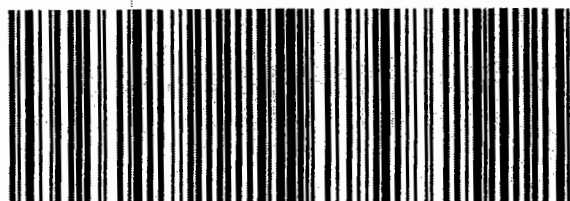
MON - 01 AUG A2
PRIORITY OVERNIGHT
ADG

43064

OH-US

LCK

TM CMHA



506C2F668DA41

ANALYTICAL SUMMARY

CLIENT:

Valero

page 1 of 2

LOCATION:

Port Arthur, TX

Analyst: J. Ruggaber

SAMPLE DATES:

6/13/11-6/14/11

Date of Completion: 7/19/2011

ANALYSIS:

Ammonia, Source FCCU-1241

METHOD:

CTM 027

Document Control No.: USEPA-CTM027-AMMON-TEMPLATE-63T-REV1

Calibration Curve Calculation

Std. (µg/ml)	Pre Cal (µS*min)	Post Cal (µS*min)	Average (µS*min)	Deviation (%)	Ammonia Conc. (µg/ml)	Peak Area	calc	% Dif
0.0	0.00	0.00	0.00	0.00	0.0	0.000	-0.031	
0.2	0.0634	0.060	0.062	2.76	0.2	0.062	0.204	2.05
0.5	0.1335	0.136	0.135	-0.82	0.5	0.135	0.493	1.26
1.0	0.2625	0.266	0.264	-0.61	1.0	0.264	1.038	3.96
2.0	0.4739	0.478	0.476	-0.39	2.0	0.476	2.014	0.91
5.0	0.9941	1.026	1.010	-1.56	5.0	1.010	4.955	0.69
10.0	1.6950	1.762	1.729	-1.95	10.0	1.729	9.991	0.11
					secondary std		4.951	1.77
					CCV		0.9956	2.44

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	% agreement	Diluted Conc. (µg/ml)	Dilution Factor	Sample volume(ml)	Total mass NH ₃ (µg)
Imp 1, Run 1	0.2202	0.2219	0.221	-0.38	0.85	1	500	402.1
Imp 1 Run 2	0.9268	0.9257	0.926	0.06	4.45	1	500	2100.4
Imp 1 Run 3	0.4759	0.4811	0.479	-0.54	2.03	1	500	957.0
Imps 2,3 Run 1	0.2377	0.2376	0.238	0.02	0.92	1	250	217.8
Imps 2,3 Run 2	0.2081	0.2003	0.204	1.91	0.78	1	250	184.2
Imps 2,3 Run 3	0.0243	0.0259	0.025	-3.19	0.06	1	250	15.0
Rinse Run 1	0.0204	0.0196	0.020	2.00	0.04	1	250	10.4
Rinse Run 2	0.2774	0.2773	0.277	0.02	1.10	1	250	258.5
Rinse Run 3	0.3714	0.3757	0.374	-0.58	1.53	1	250	360.9
Field Blank	<0.016	<0.016	0.016	0.00	<0.03	1	250	<6.8
Lab DI Water Blank	<0.016	<0.016	0.016	0.00	<0.03	1	250	<6.8

ID	Analysis 1 (area counts)	Analysis 2 (area counts)	Average (area counts)	% agreement	Diluted Conc. (µg/ml)	Theo Conc. (µg/ml)	% agreement	PASS/ FAIL
Imp 1-3 spiked	0.6199	0.6208	0.620	-0.07	2.74	2.82	-2.8	PASS
Imps 2,3 -2 spiked	0.2863	0.2861	0.286	0.03	1.13	1.15	-1.2	PASS

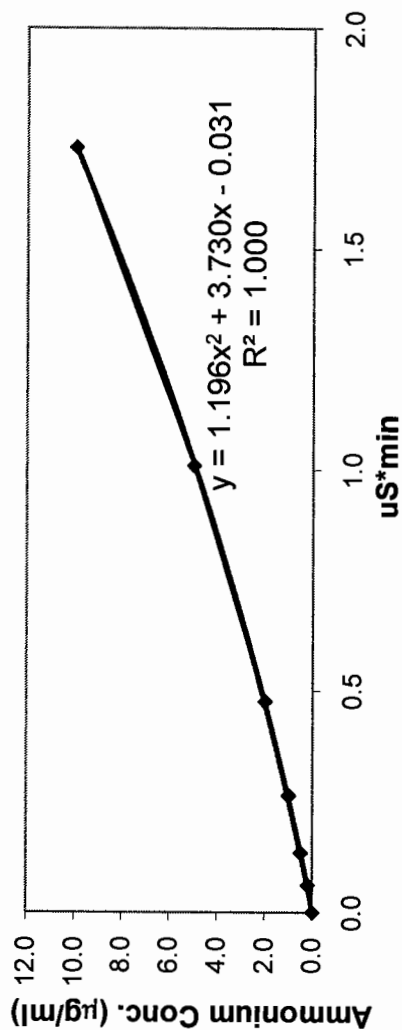
CLIENT: Valero
LOCATION: Port Arthur, TX
SAMPLE DATES: 6/13/11-6/14/11
ANALYSIS: Ammonium
METHOD: CTM 027

Analyst: J. Ruggaber
Date of Completion: 7/19/2011

Document Control No.: USEPA-CTM027-AMMON-TEMPLATE-63T-REV1

	Total NH ₃ (µg)
Run 1	630.3
Run 2	2543.2
Run 3	1332.9

Ammonium Calibration Curve



CLIENT:
LOCATION:
SAMPLE DATES:
ANALYSIS:
METHOD:

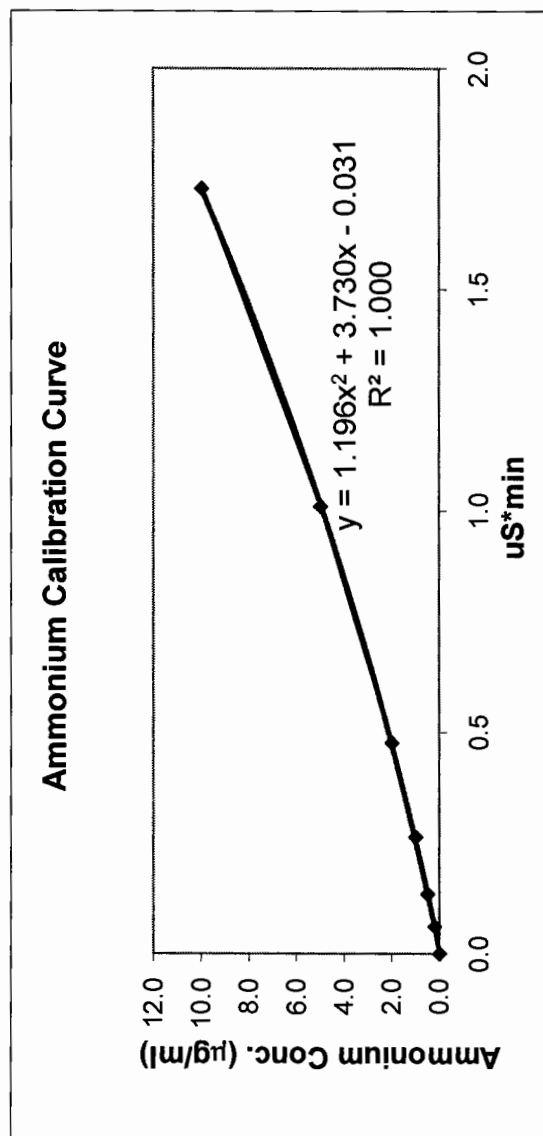
Valero
Port Arthur, TX
6/13/11-6/14/11
Ammonium
CTM 027

page 2 of 2

Analyst: J. Ruggaber

Date of Completion: 7/19/2011

Document Control No.: USEPA-CTM027-AMMON-TEMPLATE-63T-REV1





CTM-027 TASK SCHEDULE

Client: Valero

Location: Port Arthur, TX

Project Manager: D. Fitzgerald

Date Sampled: 6/13/11 – 6/14/11

Lab Project #: 08-315

Spreadsheet Template ID: USEPA-CTM027-AMMON-TEMPLATE-63T-REV1

Analyst: J. Ruggaber

Eluent

Sulfuric acid manufacturer and lot: Lot 3108112, Fisher

Batch Number	Amount measured/2L	Date/Time Prepared
1	2.44 mL	7/18/11 10:00
2	mL	
3	mL	

Calibration Standard Identification

- 1) 0.2 ppm NH₄ 7/18/11
- 2) 0.5 ppm NH₄ 7/18/11
- 3) 1.0 ppm NH₄ 7/18/11
- 4) 2.0 ppm NH₄ 7/18/11
- 5) 5.0 ppm NH₄ 7/18/11
- 6) 10.0 ppm NH₄ 7/18/11

Secondary source standard solution: 5.0 ppm NH₄ secondary std 7/18/11

**CTM-027 TASK SCHEDULE FORM**

Document Number: WL-027TASK-FORM-039A

Revision Number: 1

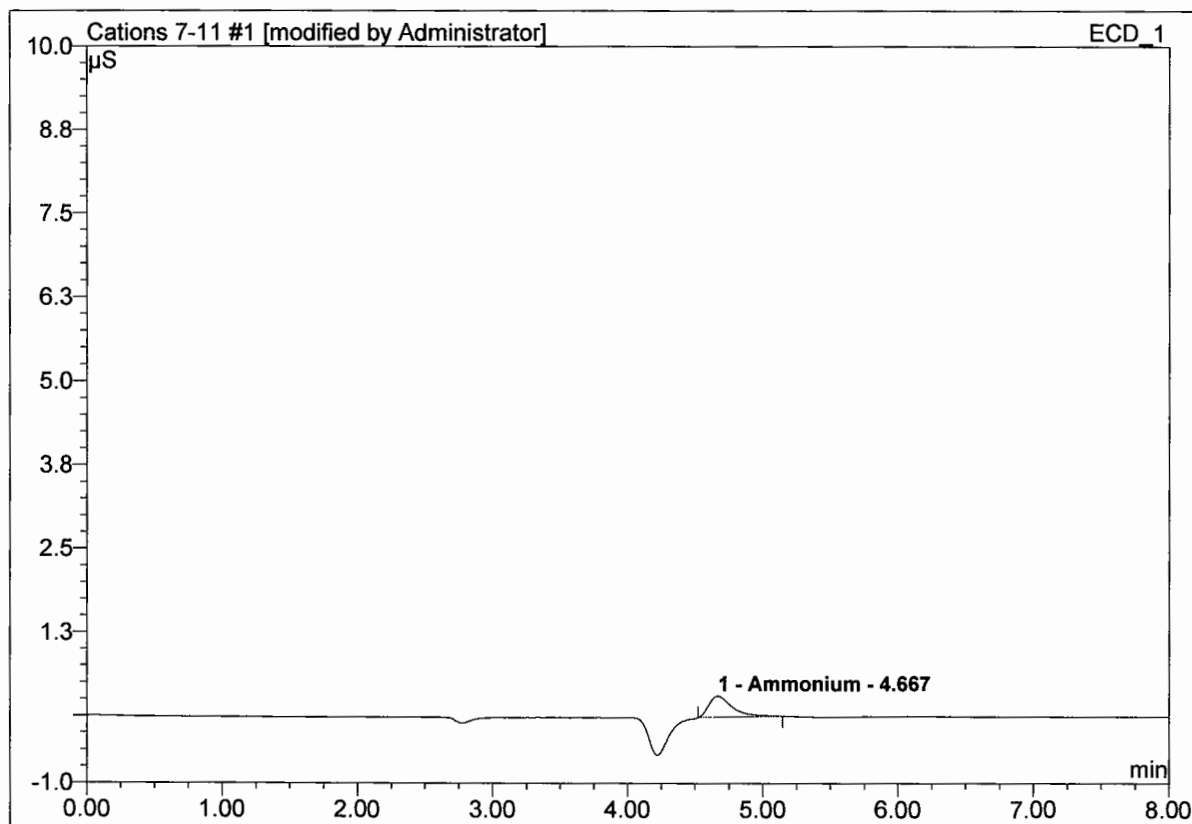
Effective Date: 07/19/11

Equipment : ICS 1000 cations

DATE	TASK
7/18/11	Pour each sample into a 250 mL (or larger) volumetric flask. Dilute to volume with water.
7/18/11	Equilibrate the instrument until a stable baseline is achieved.
7/18/11	Inject each standard solution once. Use a quadratic to plot the standard injection areas against calibration standard concentrations to determine an initial calibration curve.
7/18/11	Inject secondary standard once. Check that the secondary standard is within 15% of the value generated by the initial calibration curve.
7/18/11	Inject each sample solution in duplicate. Check that the area count for each anion/cation in each duplicate injection is within 5% of the mean.
7/18/11	If necessary, dilute sample solutions if the peak areas are greater than the highest standard and re-inject in duplicate.
7/18/11	Inject the midpoint standard once after every 20 sample injections. Check that the secondary standard is within 15% of the value generated by the initial calibration curve.
7/18/11	Prepare two spiked solutions from the samples. The spiked value should be roughly 150% of the initial value.
7/18/11	Inject each standard solution once at the end of the run.
7/18/11	Plot the average of the initial and final standard injections against calibration standard concentrations to determine a final calibration curve. Ensure that each point is within 15% of the calibration curve.
7/18/11	Determine the ammonia concentration in each sample using the final calibration curve.
7/28/11	Prepare report
	Report QA review
	Report distribution

1 0.2 ppm NH4 std-pre

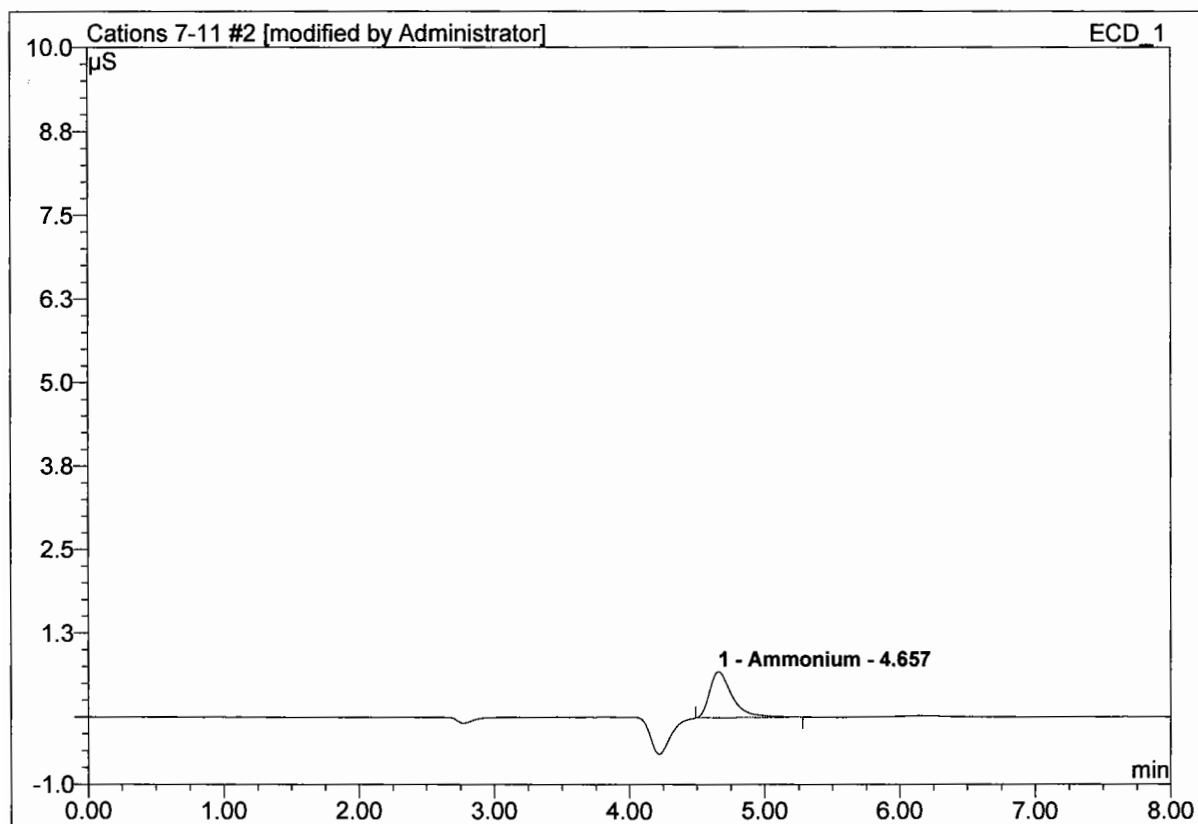
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 11:03	Sample Weight:	1.0000
Run Time (min):	5.90	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	0.314	0.0634
Total:			0.314	0.063

2 0.5 ppm NH4 std-pre

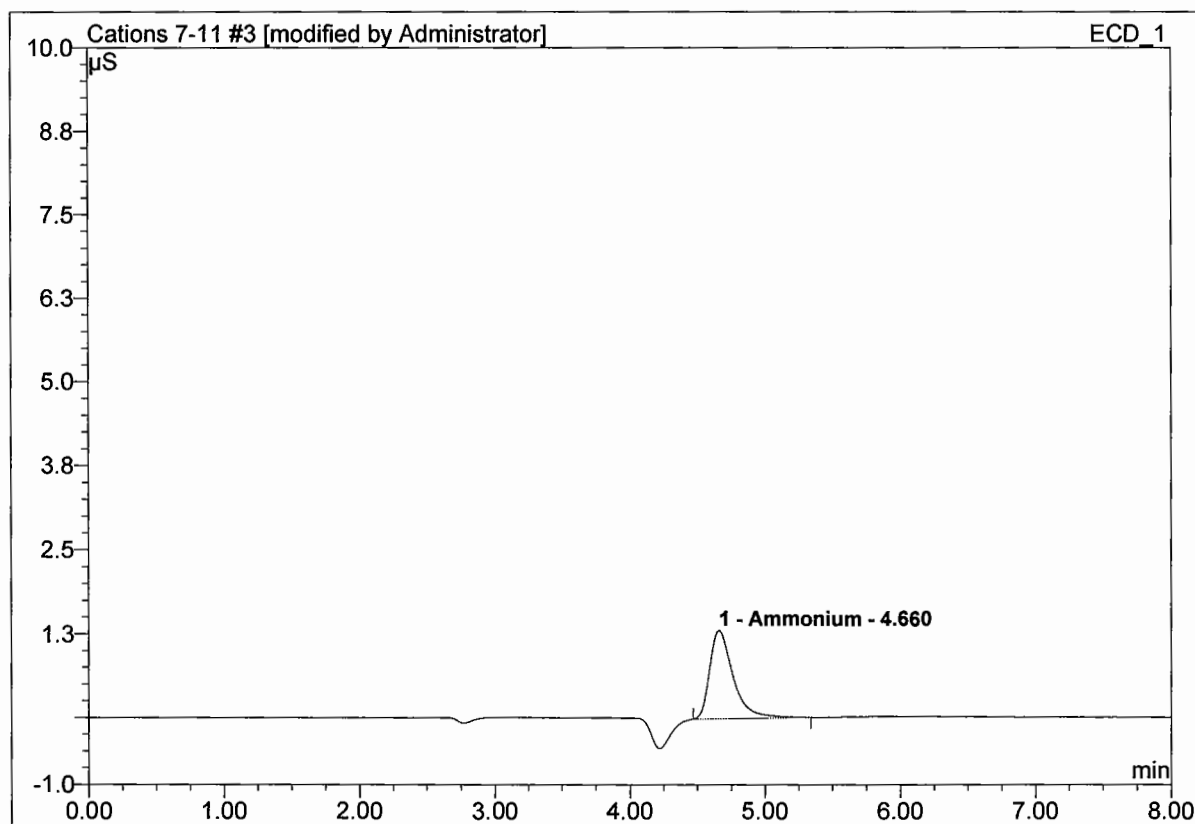
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Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 11:12	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	0.687	0.1335
Total:			0.687	0.133

3 1.0 ppm NH4 std-pre

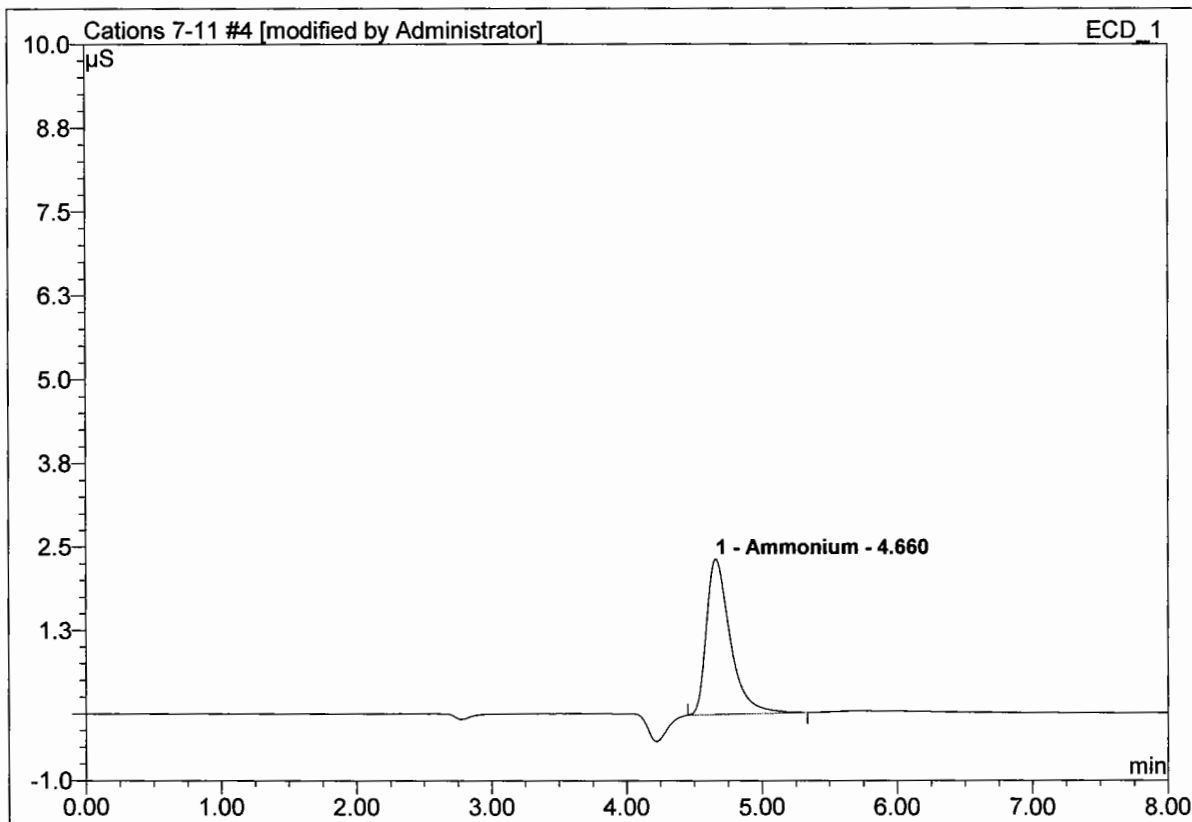
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Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 11:22	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	1.319	0.2625
Total:			1.319	0.262

4 2.0 ppm NH4 std-pre

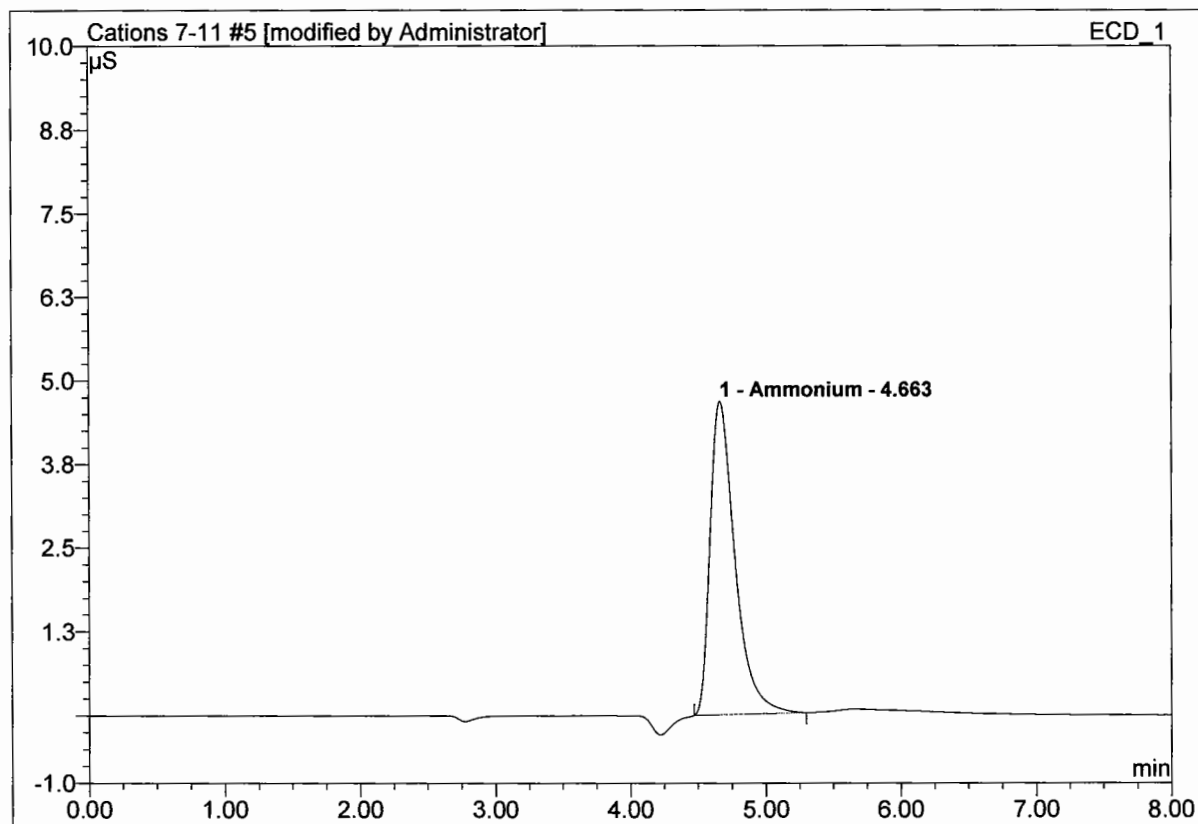
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Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 11:31	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	2.325	0.4739
Total:			2.325	0.474

5 5.0 ppm NH4 std-pre

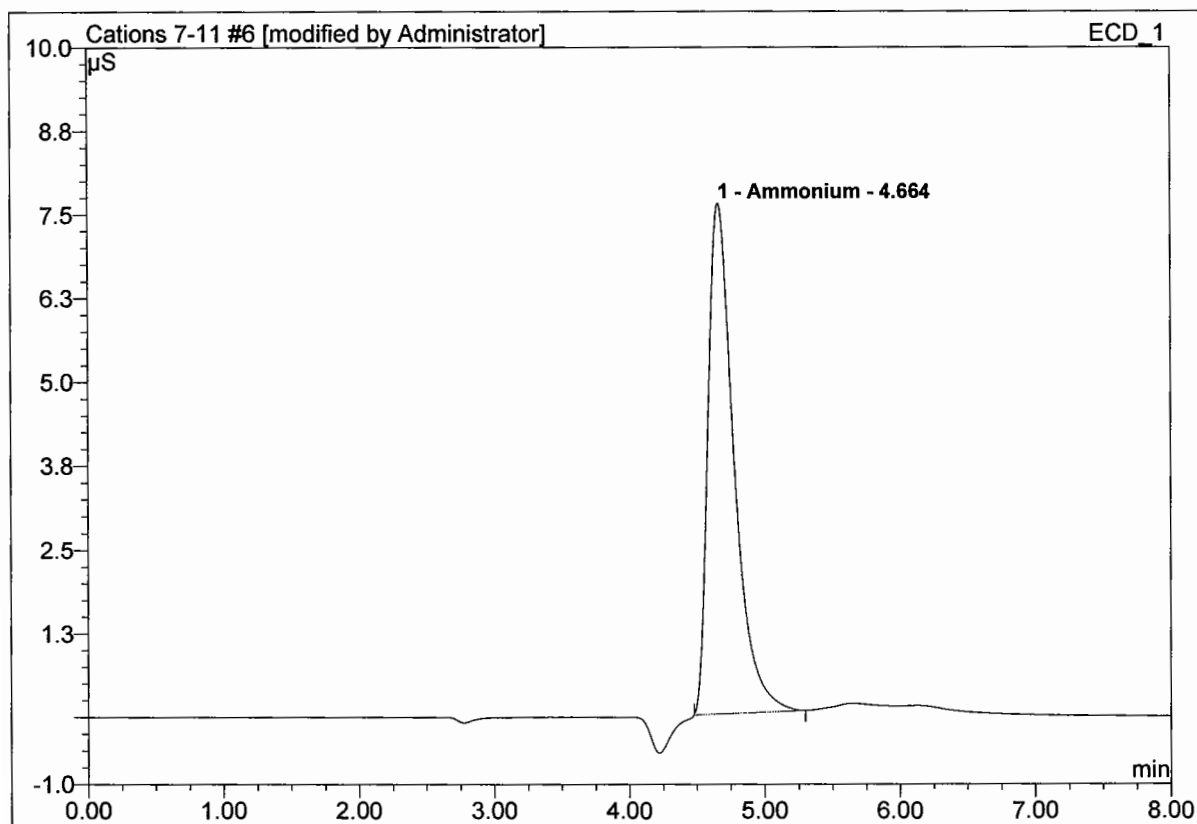
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Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 11:40	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	4.673	0.9941
Total:			4.673	0.994

6 10.0 ppm NH4 std-pre

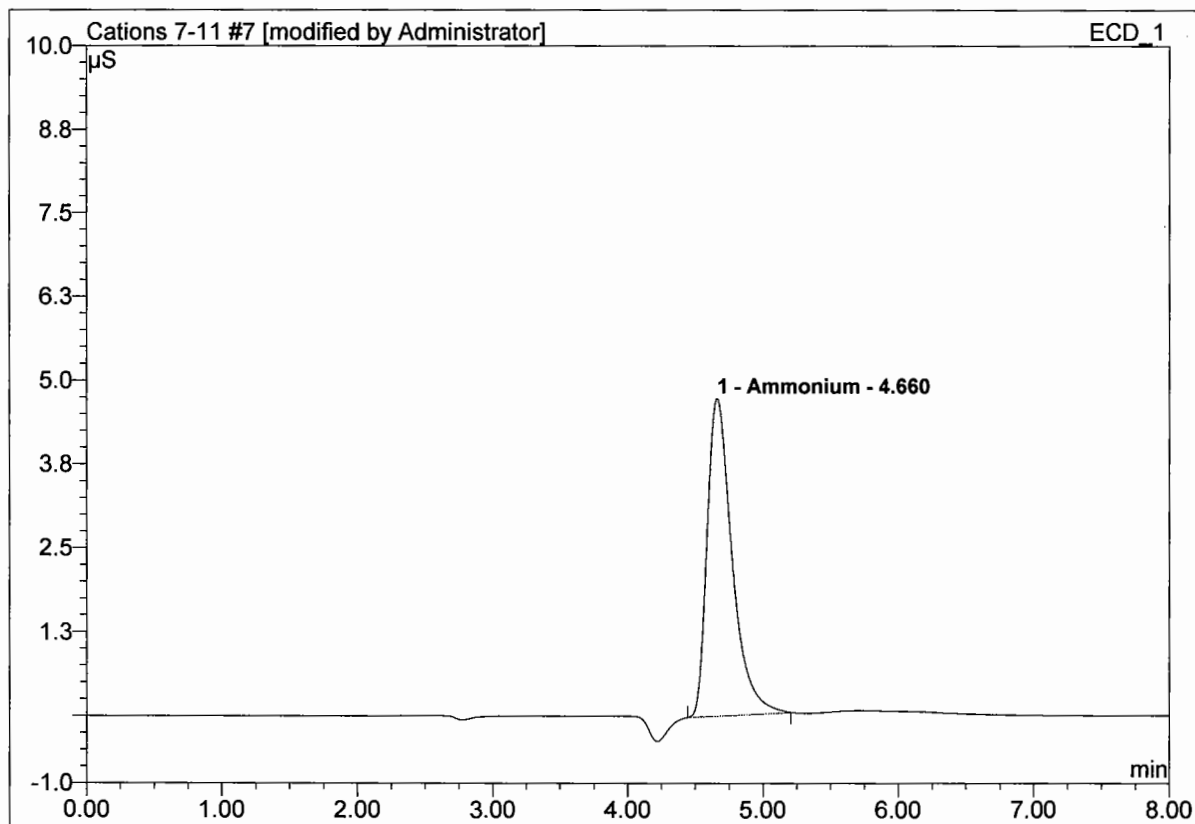
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Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 11:49	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	7.623	1.6950
Total:			7.623	1.695

7 5.0 ppm NH4 2nd std

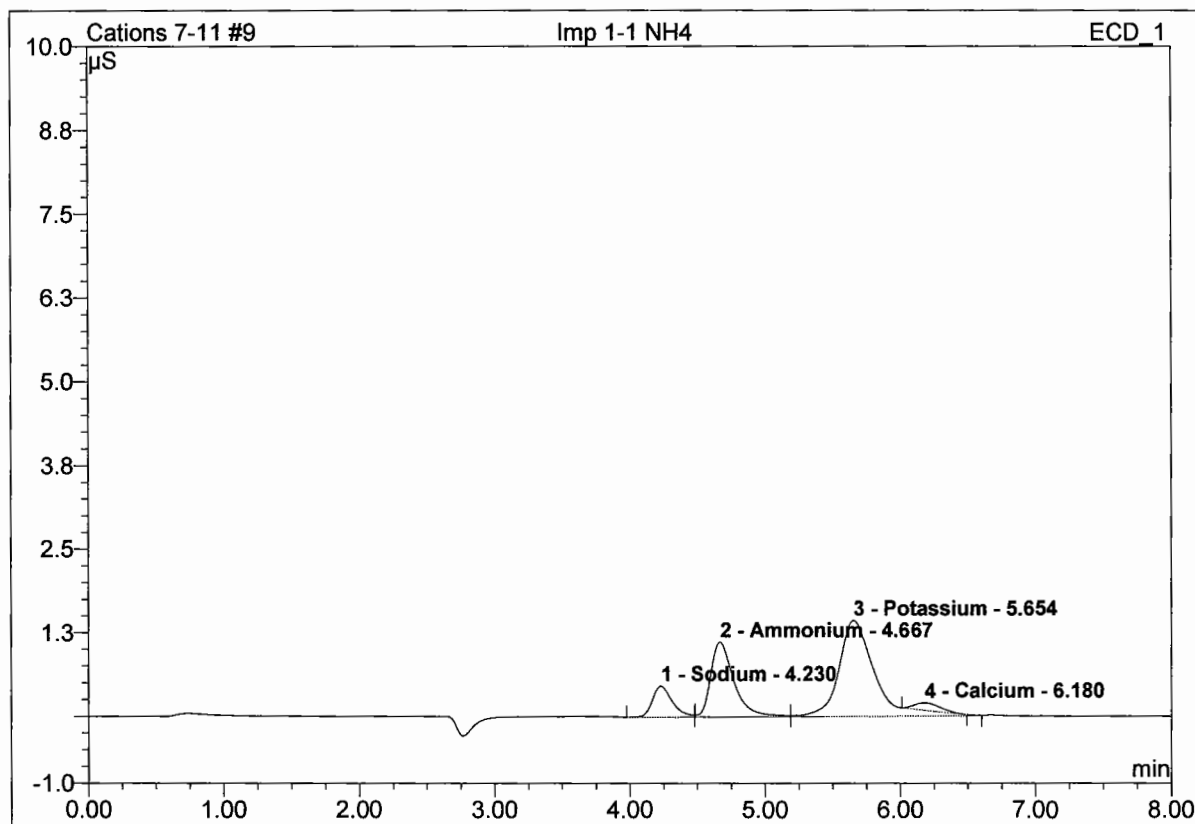
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Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 11:58	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	4.738	1.0091
Total:			4.738	1.009

9 Imp 1-1 NH4

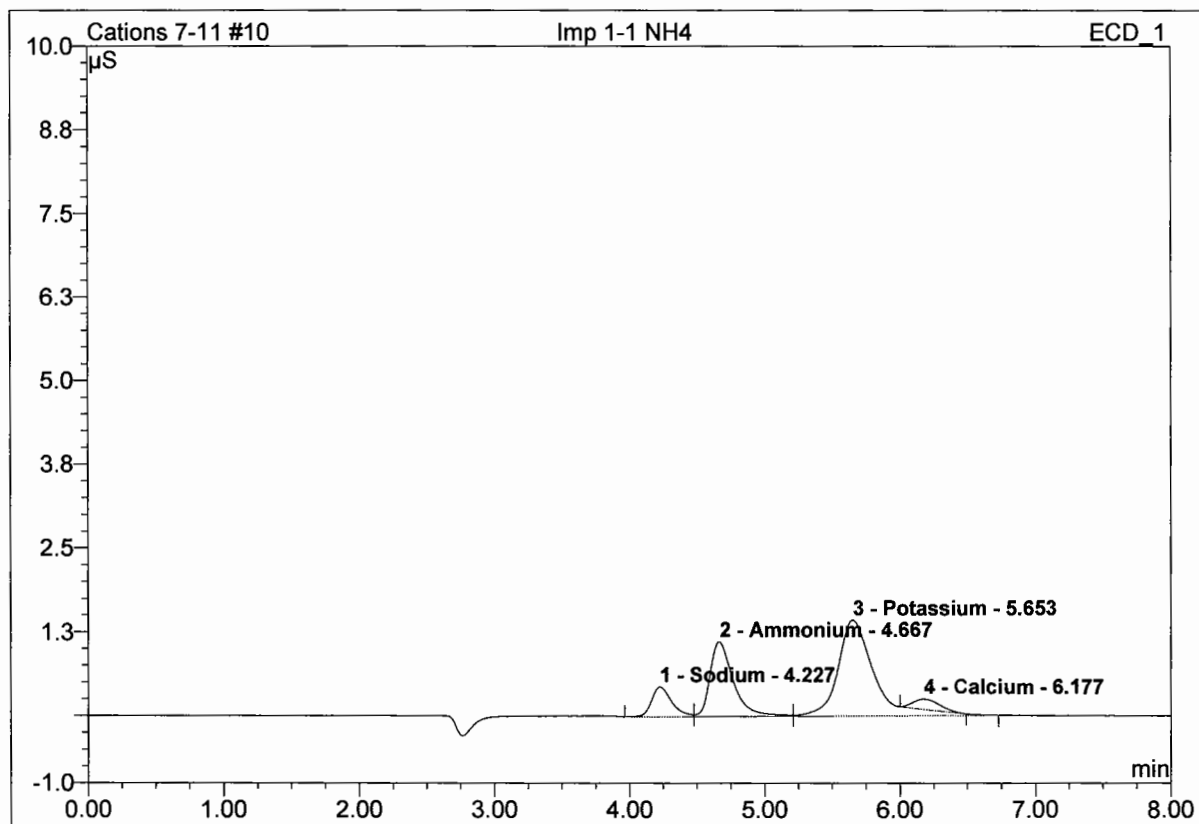
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Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 12:21	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.23	Sodium	0.463	0.0793
2	4.67	Ammonium	1.116	0.2202
3	5.65	Potassium	1.429	0.4382
4	6.18	Calcium	0.112	0.0248
Total:			3.120	0.762

10 Imp 1-1 NH4

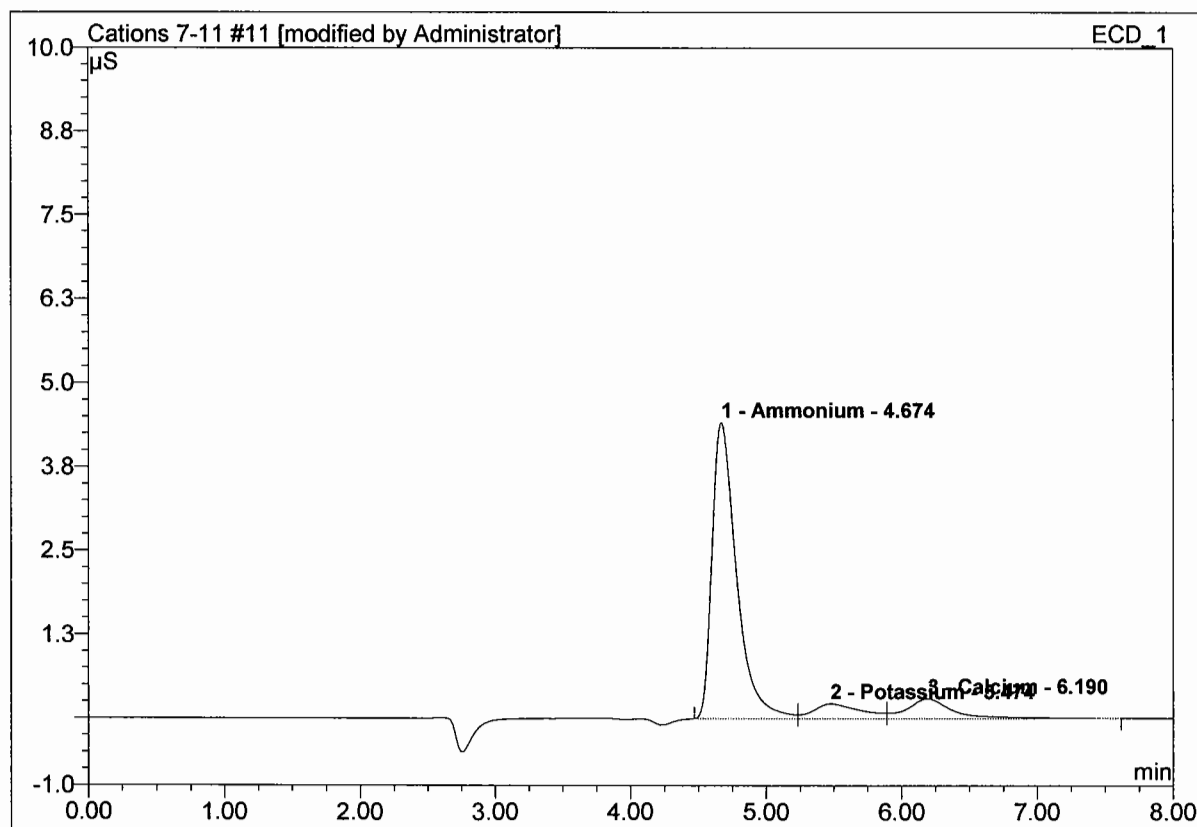
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Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 12:30	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.23	Sodium	0.445	0.0769
2	4.67	Ammonium	1.115	0.2219
3	5.65	Potassium	1.431	0.4483
4	6.18	Calcium	0.153	0.0351
Total:			3.143	0.782

11 Imp 1-2 NH4

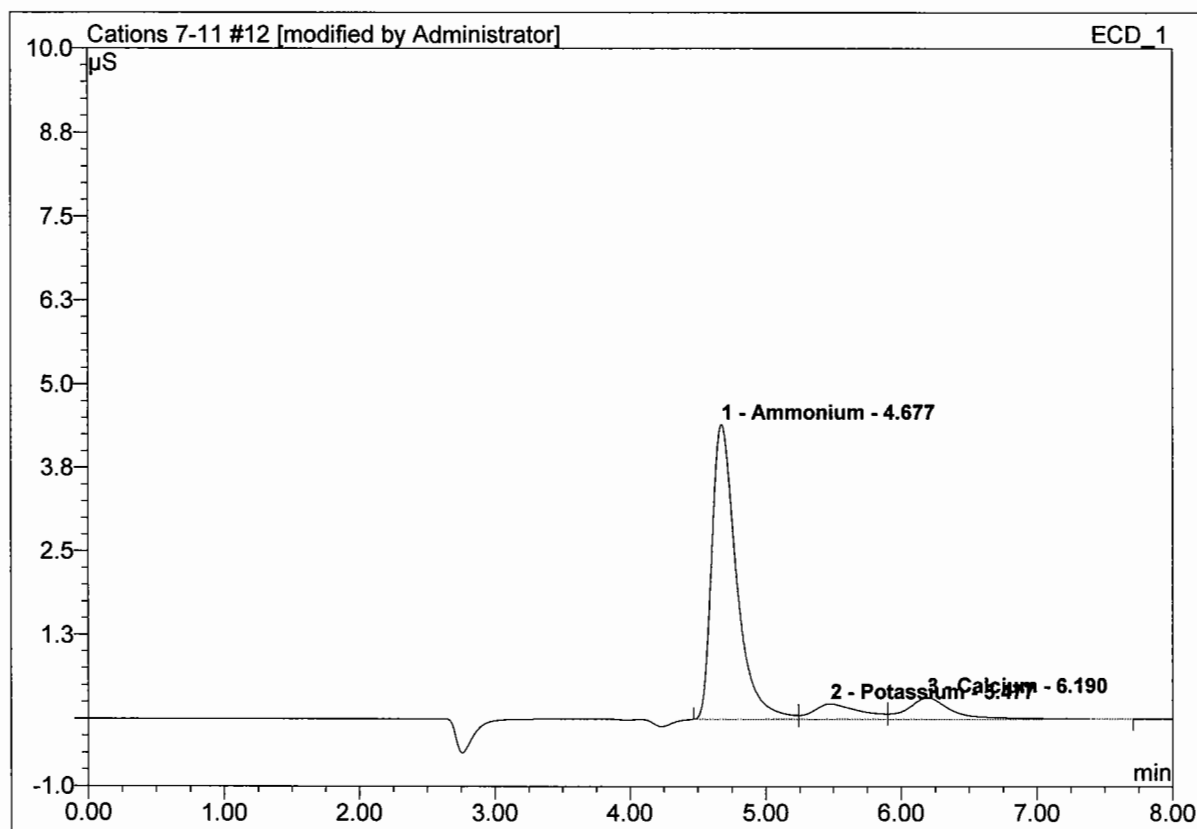
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Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 12:39	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	4.416	0.9268
2	5.47	Potassium	0.218	0.0874
3	6.19	Calcium	0.293	0.1127
Total:			4.926	1.127

12 Imp 1-2 NH4

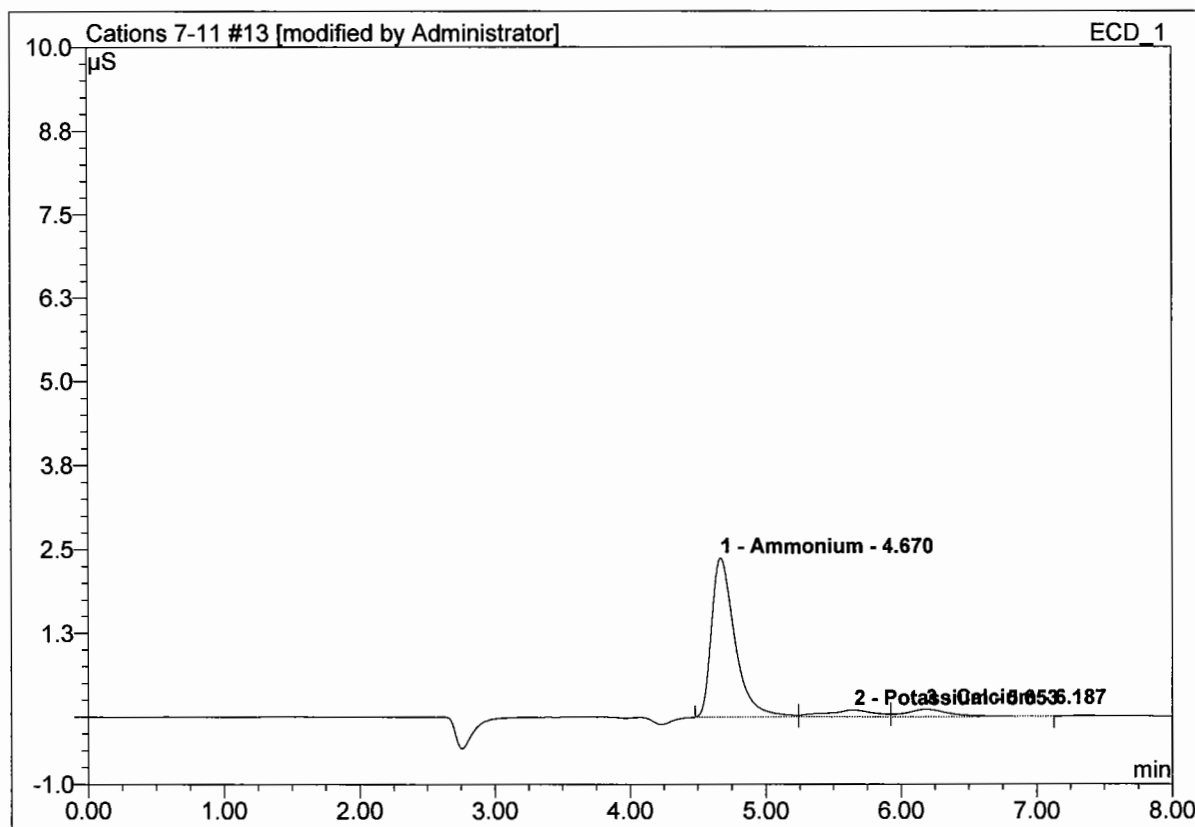
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 12:48	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.68	Ammonium	4.403	0.9257
2	5.48	Potassium	0.225	0.0899
3	6.19	Calcium	0.315	0.1194
Total:			4.942	1.135

13 Imp 1-3 NH4

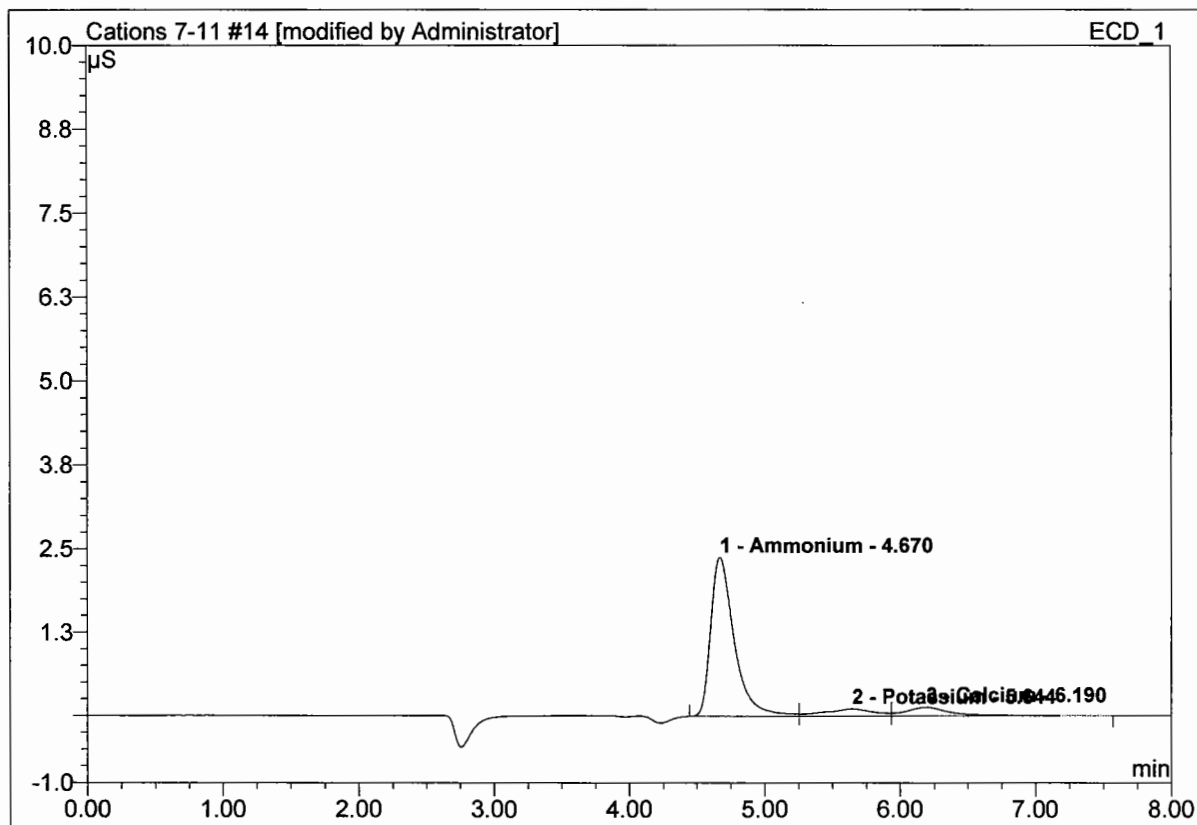
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 12:58	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.67	Ammonium	2.374	0.4759
2	5.65	Potassium	0.099	0.0405
3	6.19	Calcium	0.108	0.0390
Total:			2.582	0.555

14 Imp 1-3 NH4

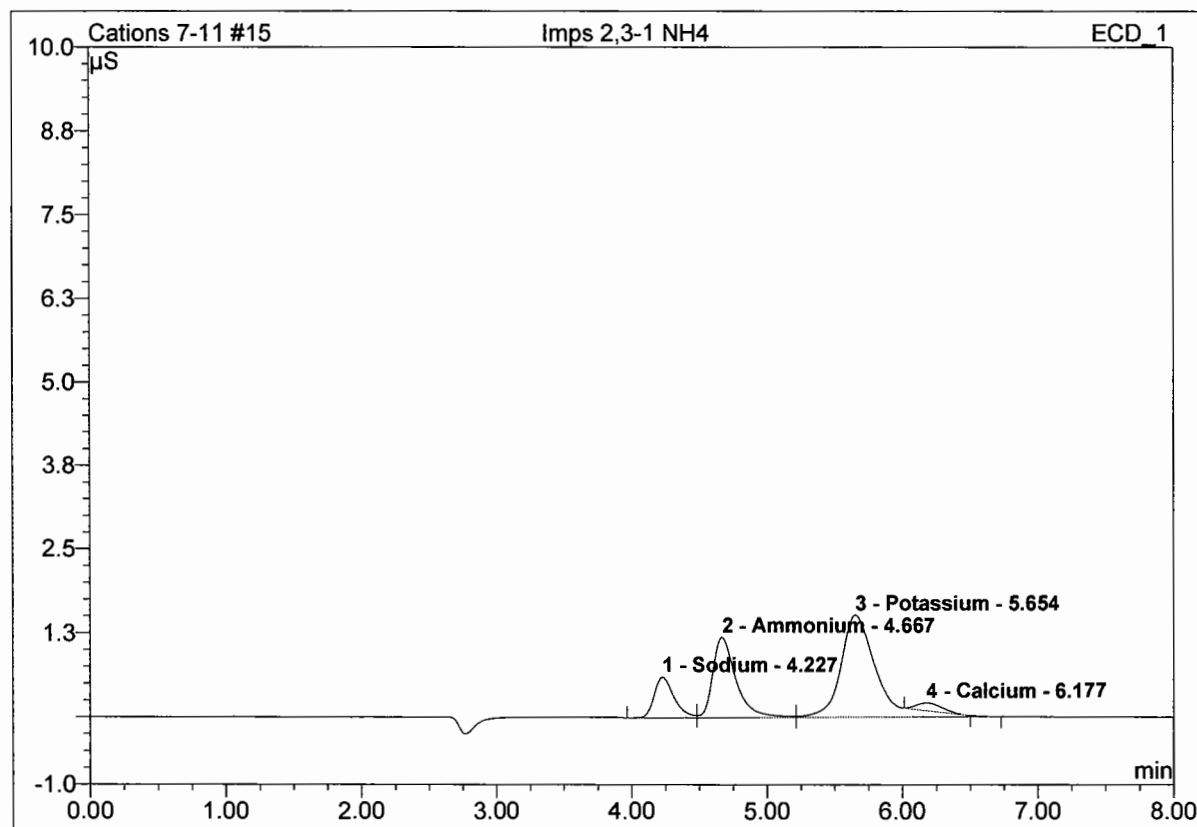
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 13:07	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.67	Ammonium	2.382	0.4811
2	5.64	Potassium	0.108	0.0441
3	6.19	Calcium	0.128	0.0500
Total:			2.618	0.575

15 Imps 2,3-1 NH4

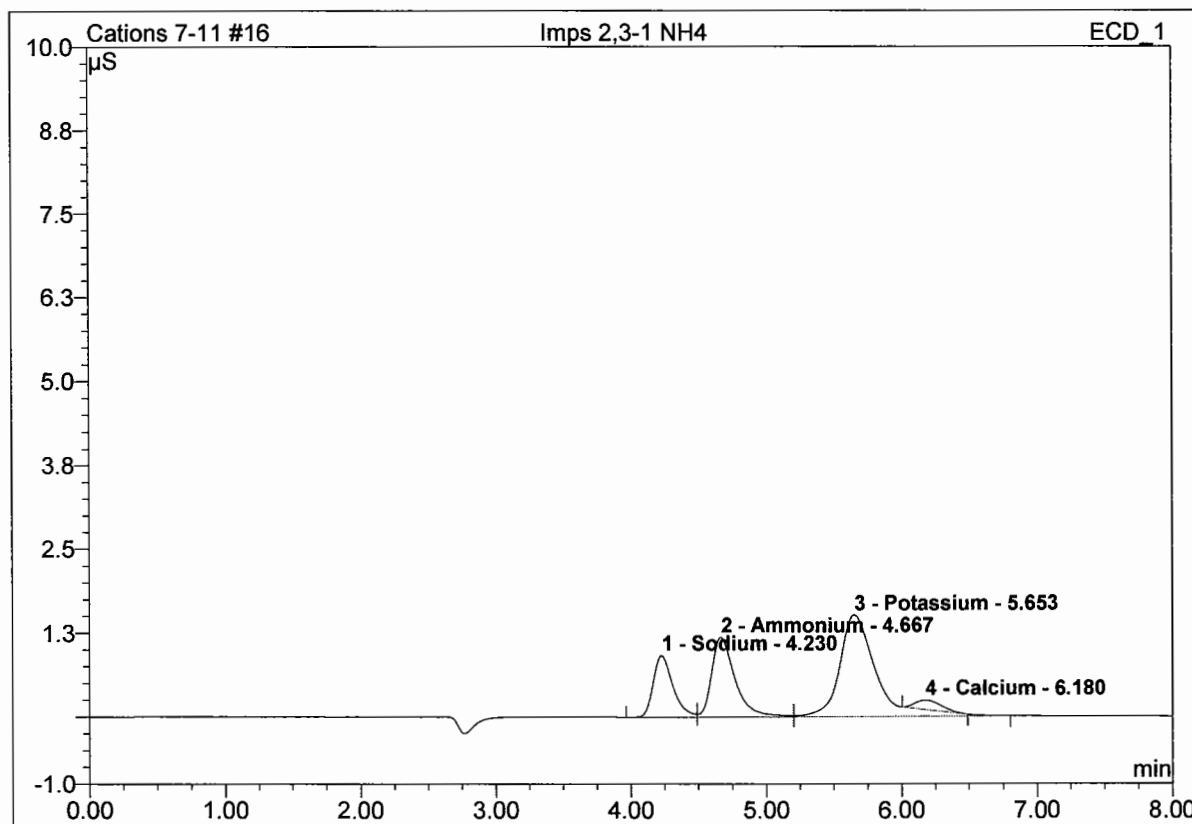
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 13:16	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.23	Sodium	0.605	0.1030
2	4.67	Ammonium	1.191	0.2377
3	5.65	Potassium	1.517	0.4692
4	6.18	Calcium	0.114	0.0254
Total:			3.427	0.835

16 Imps 2,3-1 NH4

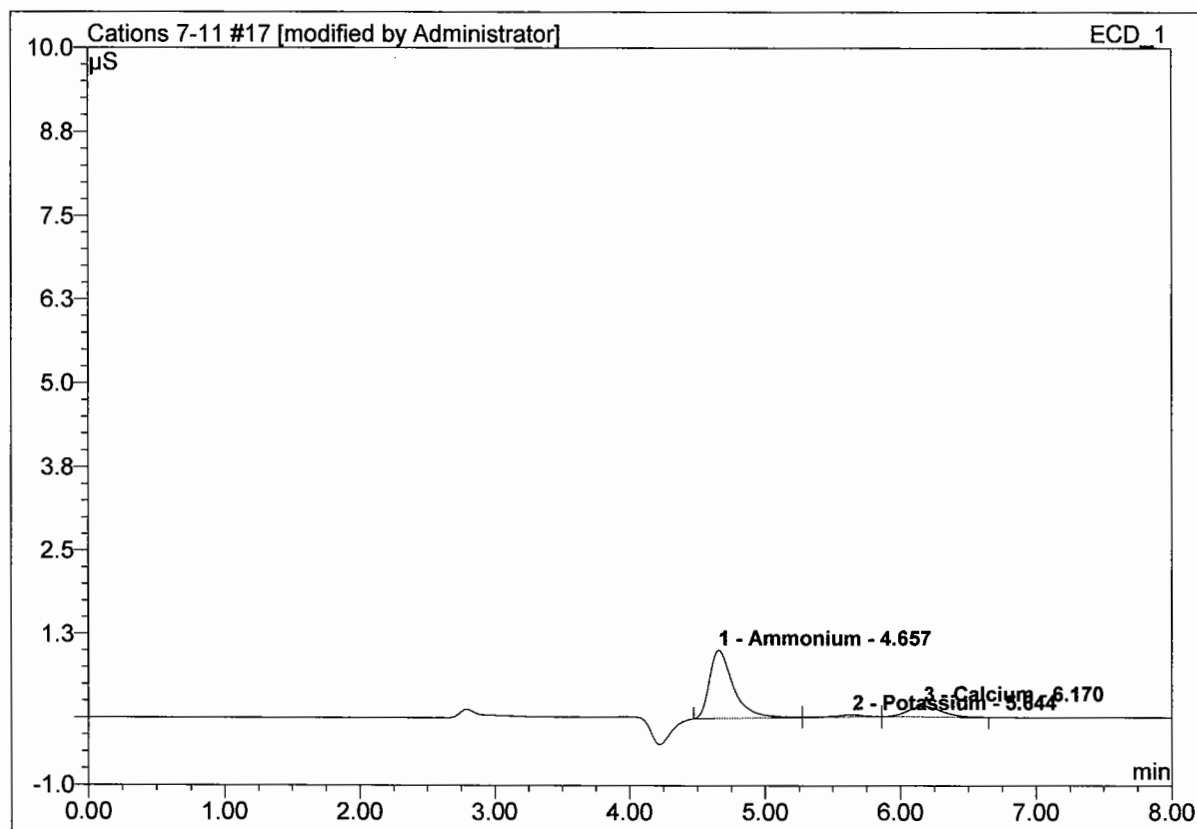
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 13:25	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.23	Sodium	0.923	0.1568
2	4.67	Ammonium	1.188	0.2376
3	5.65	Potassium	1.514	0.4727
4	6.18	Calcium	0.139	0.0313
Total:			3.764	0.898

17 Imps 2,3-2 NH4

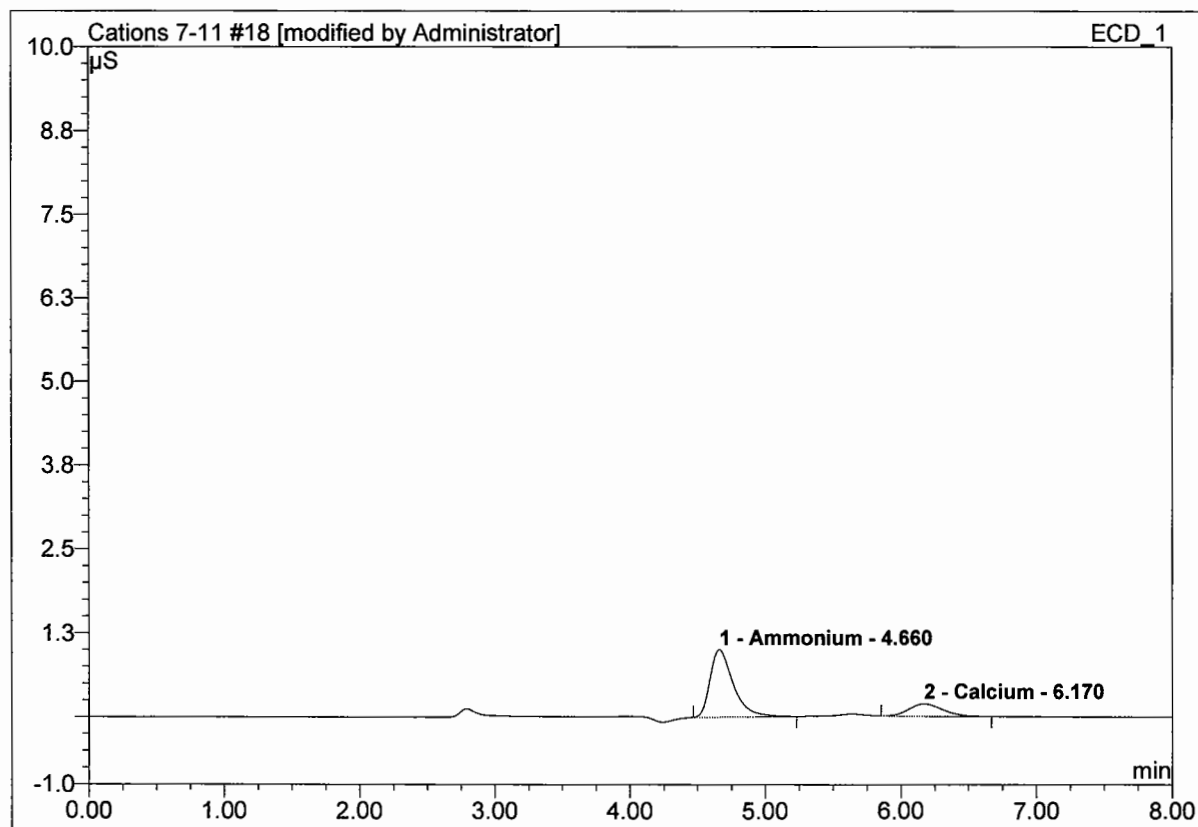
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 13:34	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.66	Ammonium	1.019	0.2081
2	5.64	Potassium	0.030	0.0076
3	6.17	Calcium	0.157	0.0455
Total:			1.207	0.261

18 Imps 2,3-2 NH4

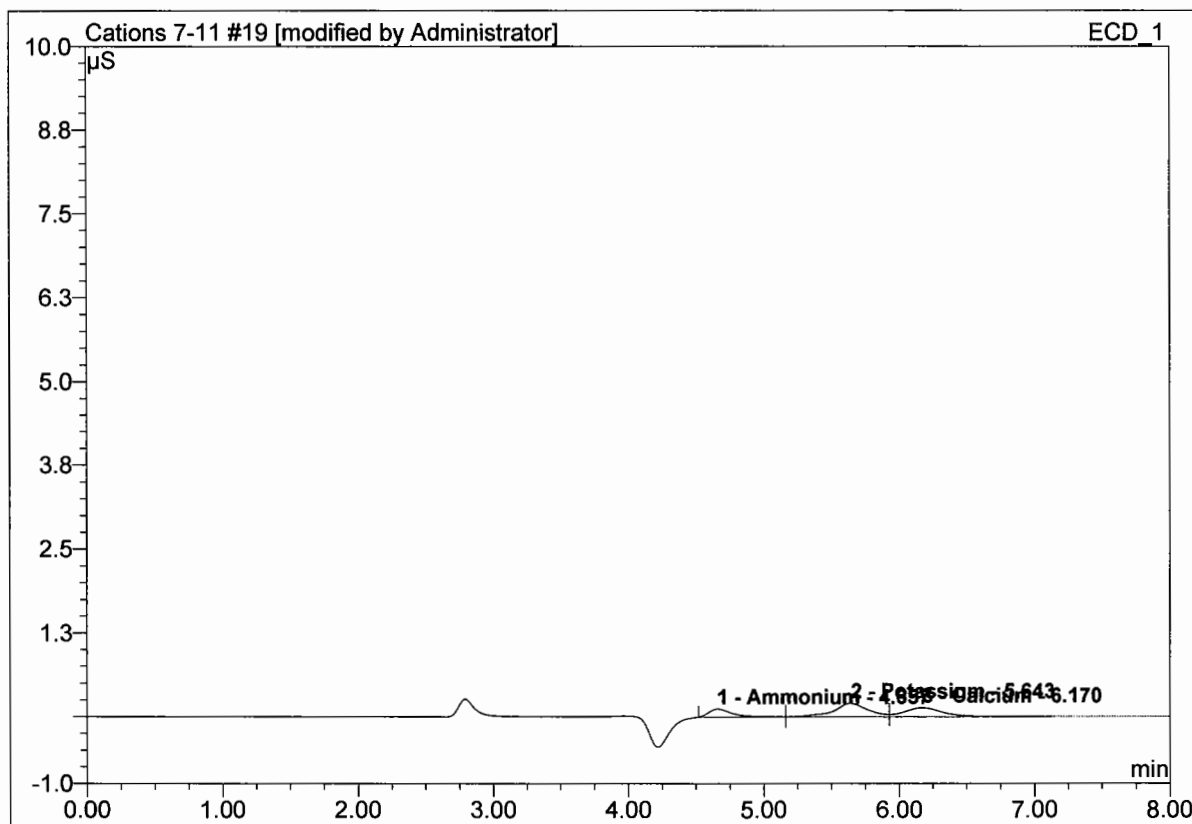
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 13:43	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	1.006	0.2003
2	6.17	Calcium	0.182	0.0531
Total:			1.188	0.253

19 Imps 2,3-3 NH4

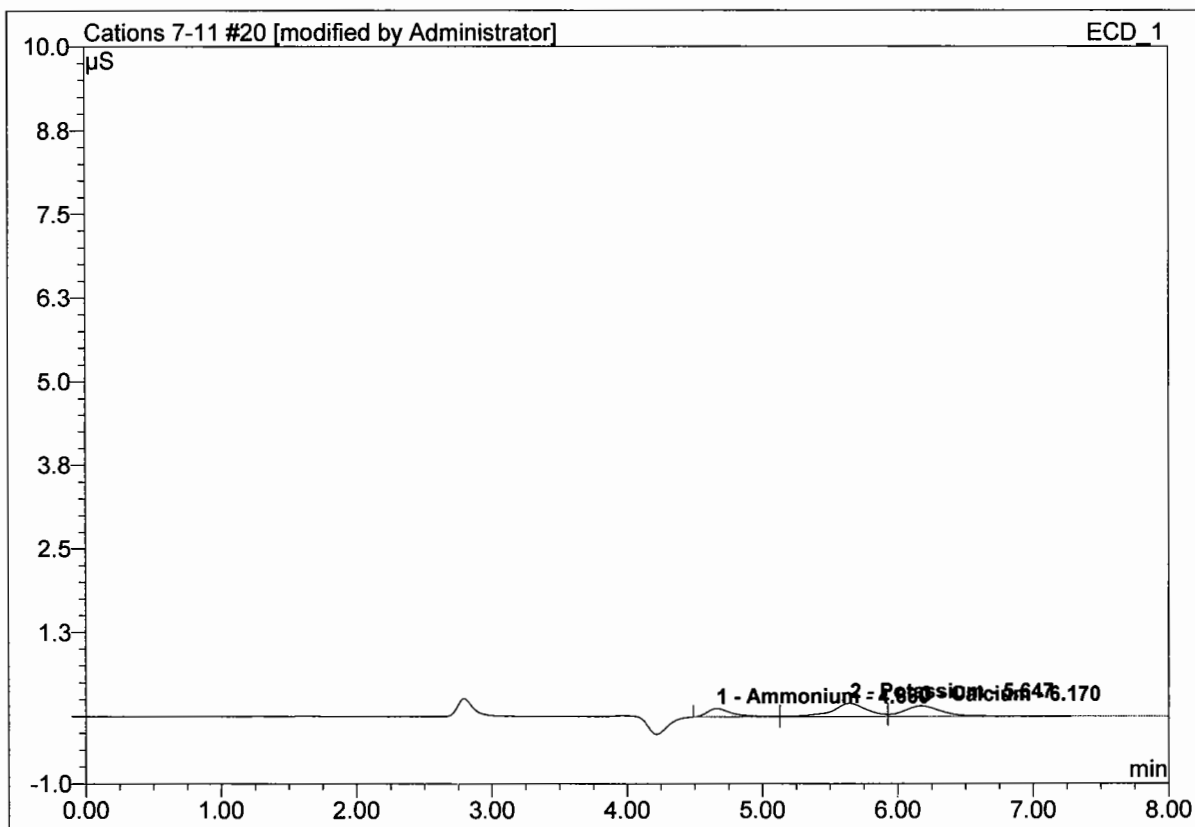
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 13:52	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.66	Ammonium	0.119	0.0243
2	5.64	Potassium	0.200	0.0587
3	6.17	Calcium	0.132	0.0450
Total:			0.451	0.128

20 Imps 2,3-3 NH4

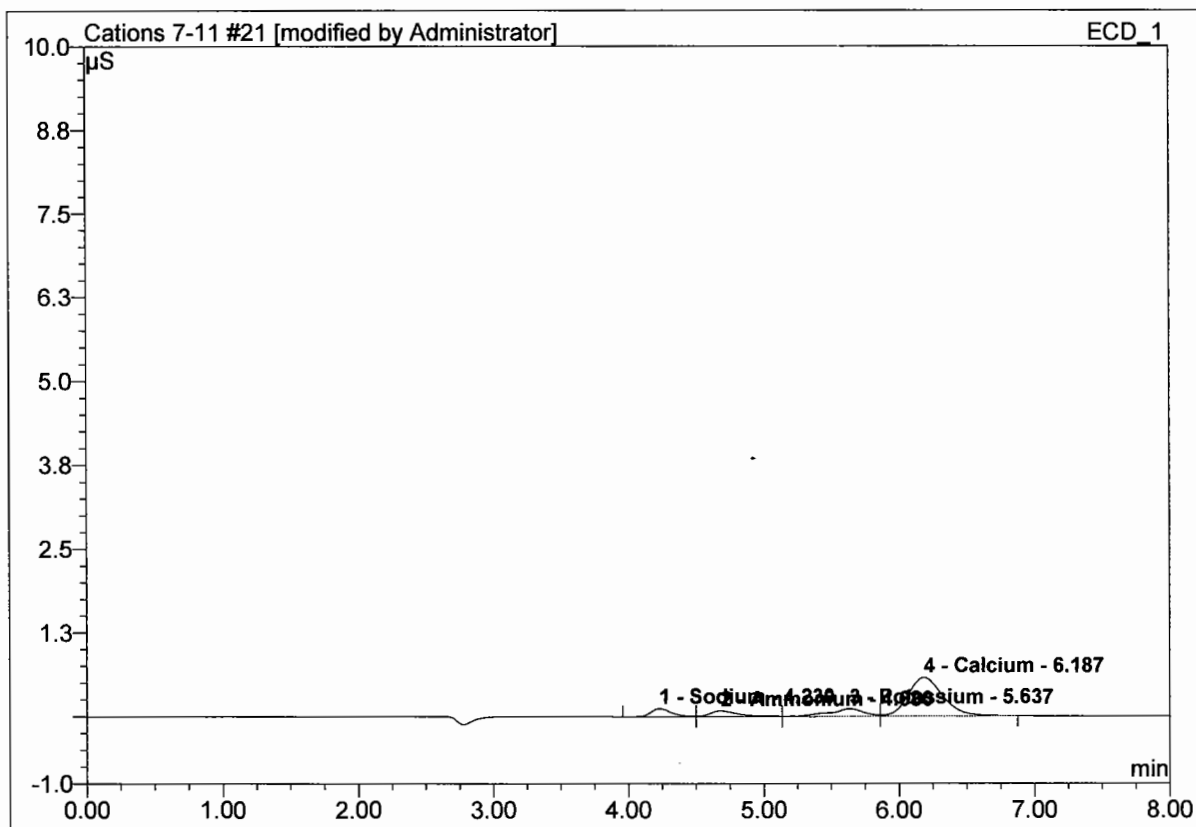
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 14:01	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.66	Ammonium	0.122	0.0259
2	5.65	Potassium	0.196	0.0580
3	6.17	Calcium	0.155	0.0518
Total:			0.473	0.136

21 rinse-1 NH4

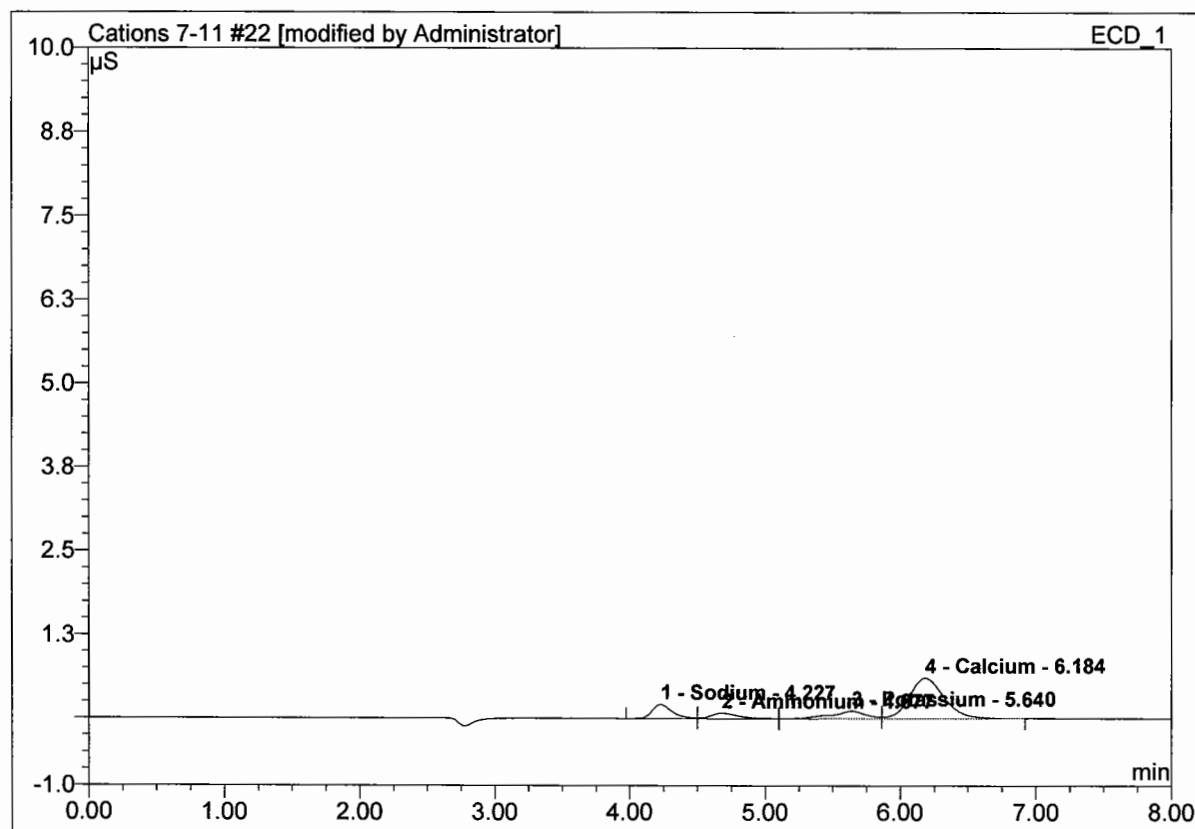
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 14:10	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.23	Sodium	0.122	0.0219
2	4.68	Ammonium	0.084	0.0204
3	5.64	Potassium	0.113	0.0338
4	6.19	Calcium	0.576	0.1712
Total:			0.895	0.247

22 rinse-1 NH4

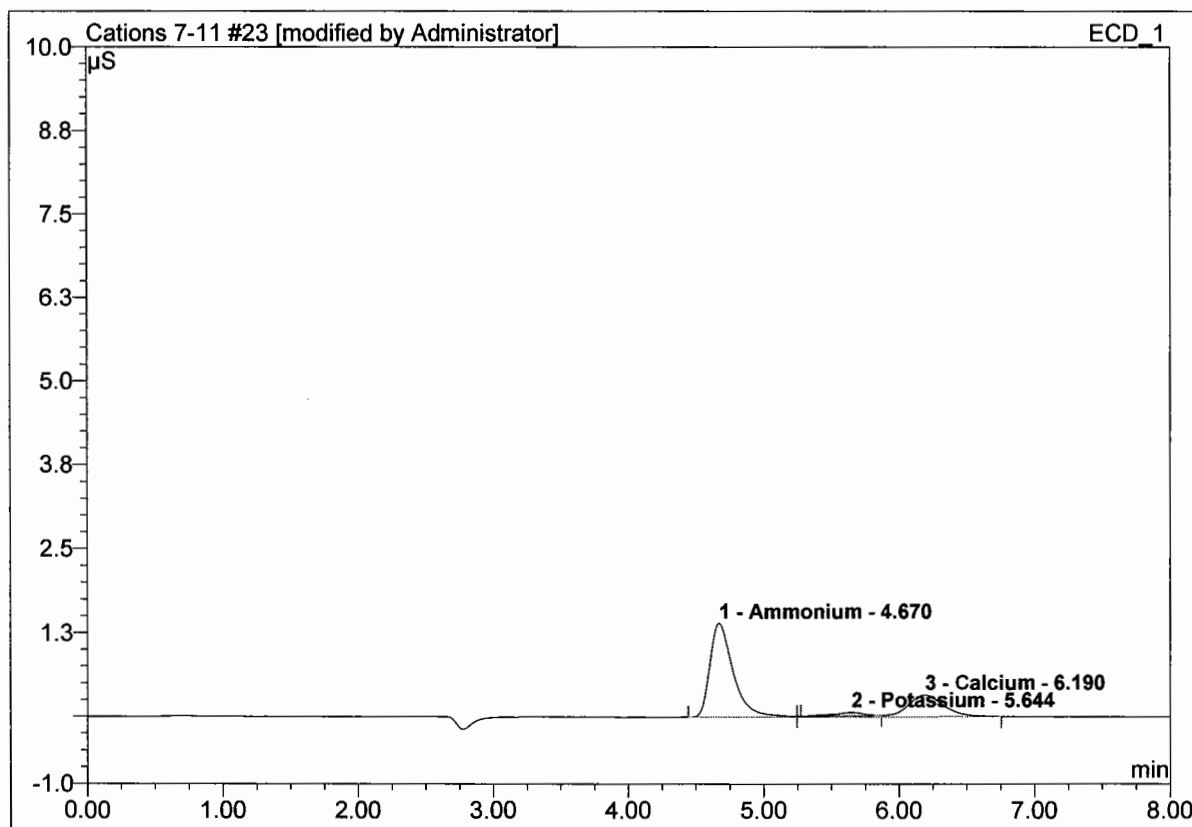
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 14:19	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.23	Sodium	0.214	0.0375
2	4.68	Ammonium	0.084	0.0196
3	5.64	Potassium	0.114	0.0342
4	6.18	Calcium	0.607	0.1815
Total:			1.019	0.273

23 rinse-2 NH4

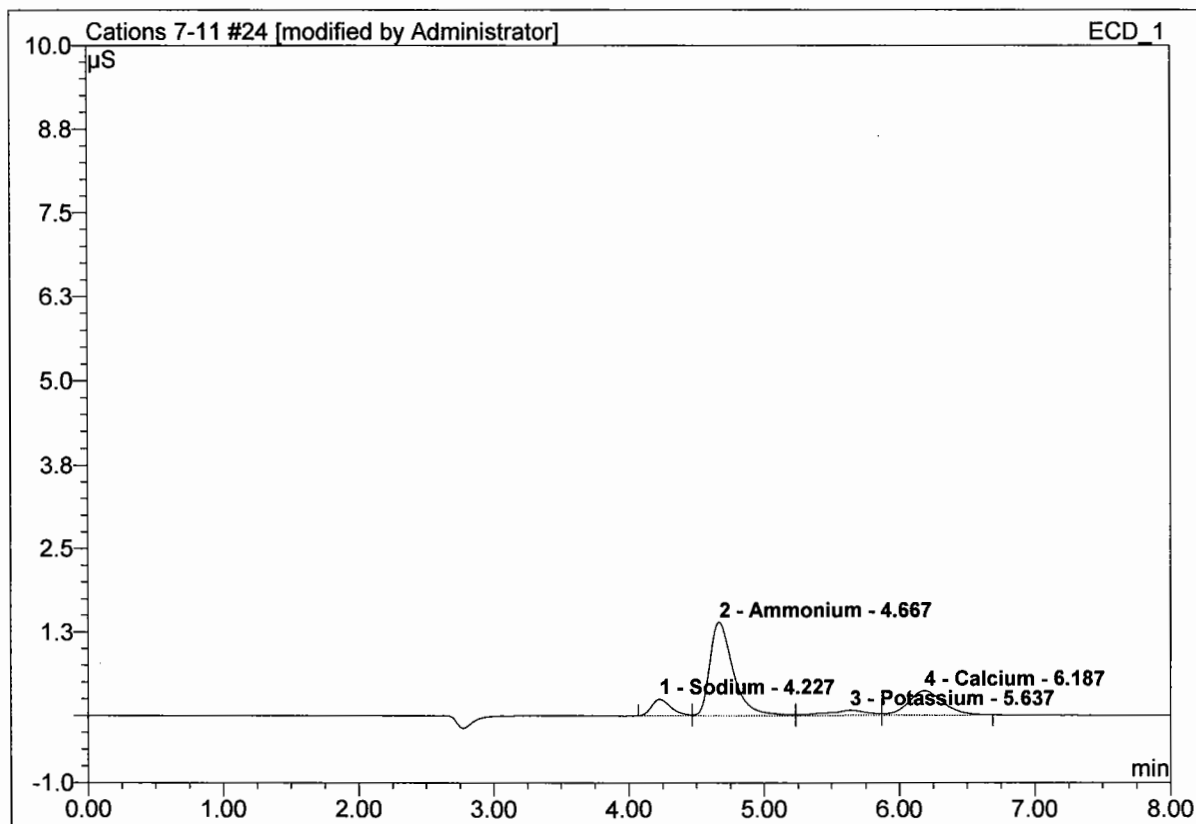
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 14:29	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	1.397	0.2774
2	5.64	Potassium	0.048	0.0121
3	6.19	Calcium	0.321	0.1069
Total:			1.766	0.396

24 rinse-2 NH4

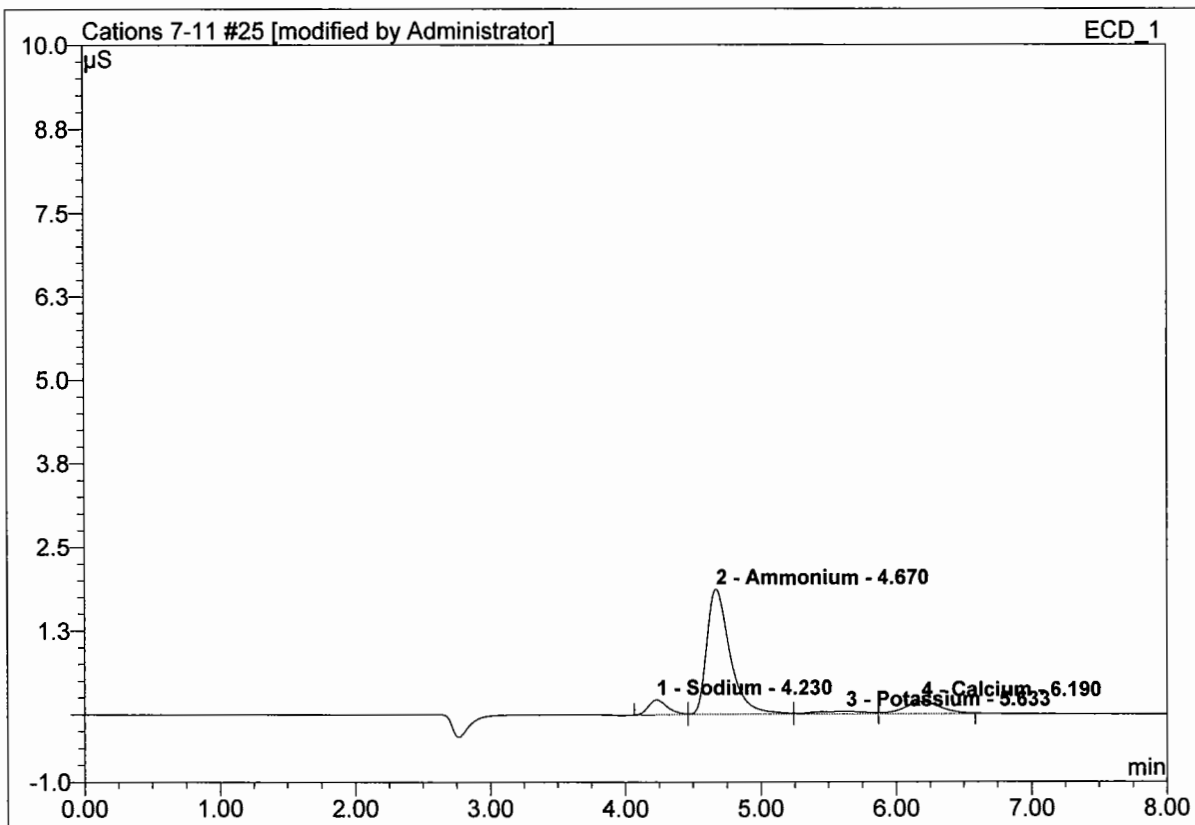
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 14:38	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.23	Sodium	0.245	0.0407
2	4.67	Ammonium	1.397	0.2773
3	5.64	Potassium	0.074	0.0238
4	6.19	Calcium	0.362	0.1082
Total:			2.079	0.450

25 rinse-3 NH4

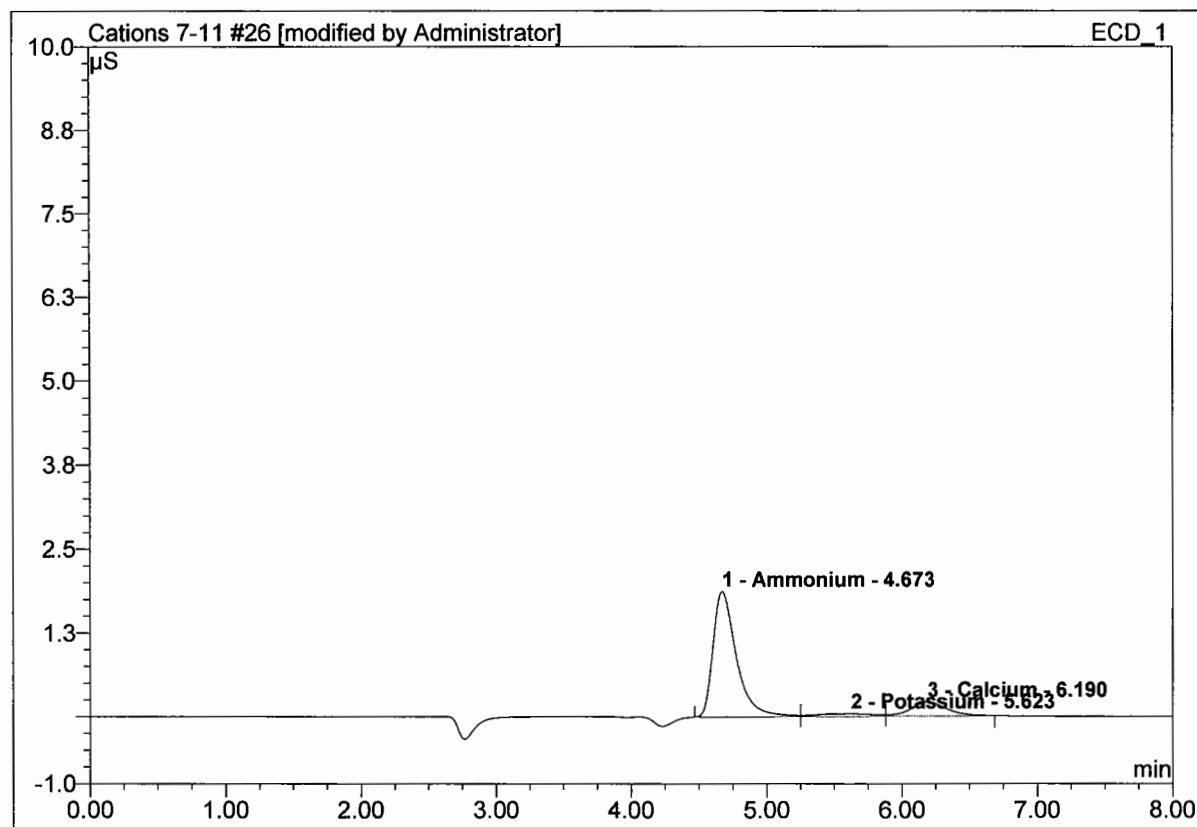
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 14:47	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.23	Sodium	0.219	0.0355
2	4.67	Ammonium	1.864	0.3714
3	5.63	Potassium	0.041	0.0187
4	6.19	Calcium	0.184	0.0589
Total:			2.309	0.485

26 rinse-3 NH4

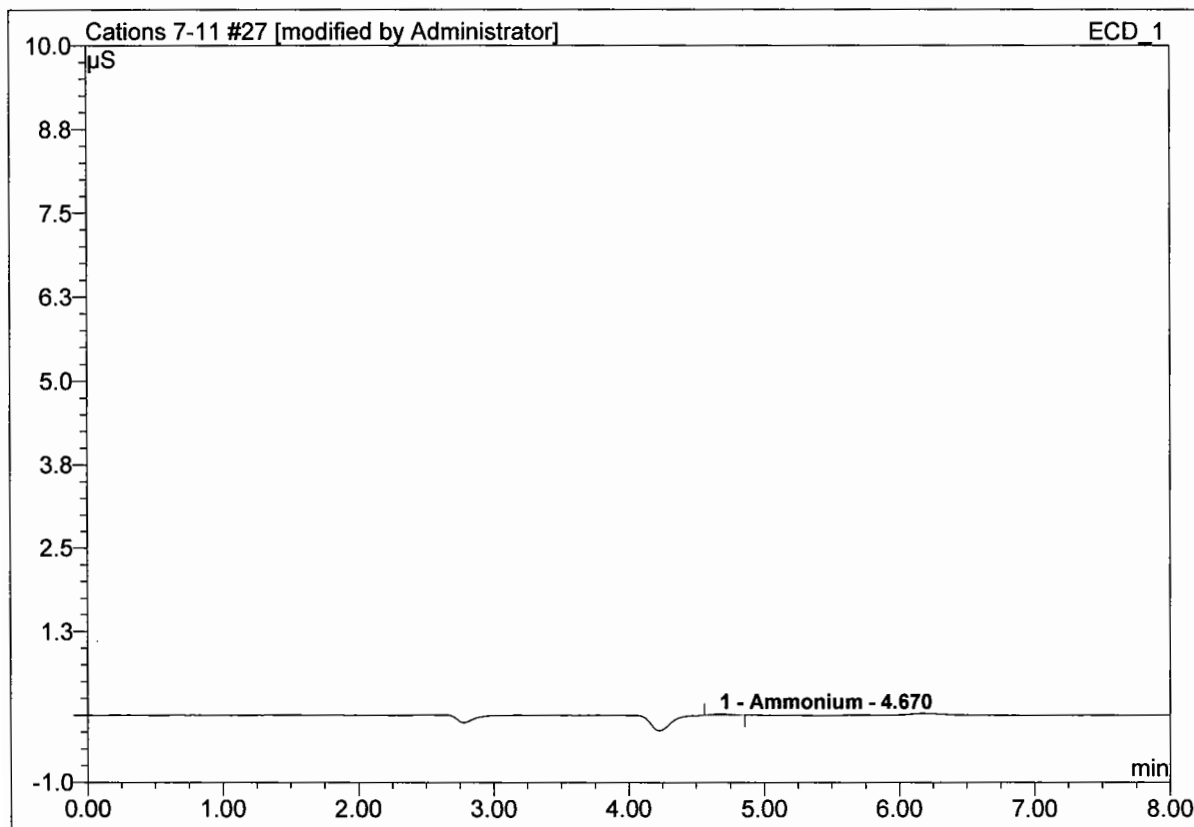
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 14:56	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	1.871	0.3757
2	5.62	Potassium	0.042	0.0196
3	6.19	Calcium	0.214	0.0660
Total:			2.127	0.461

27 field blank

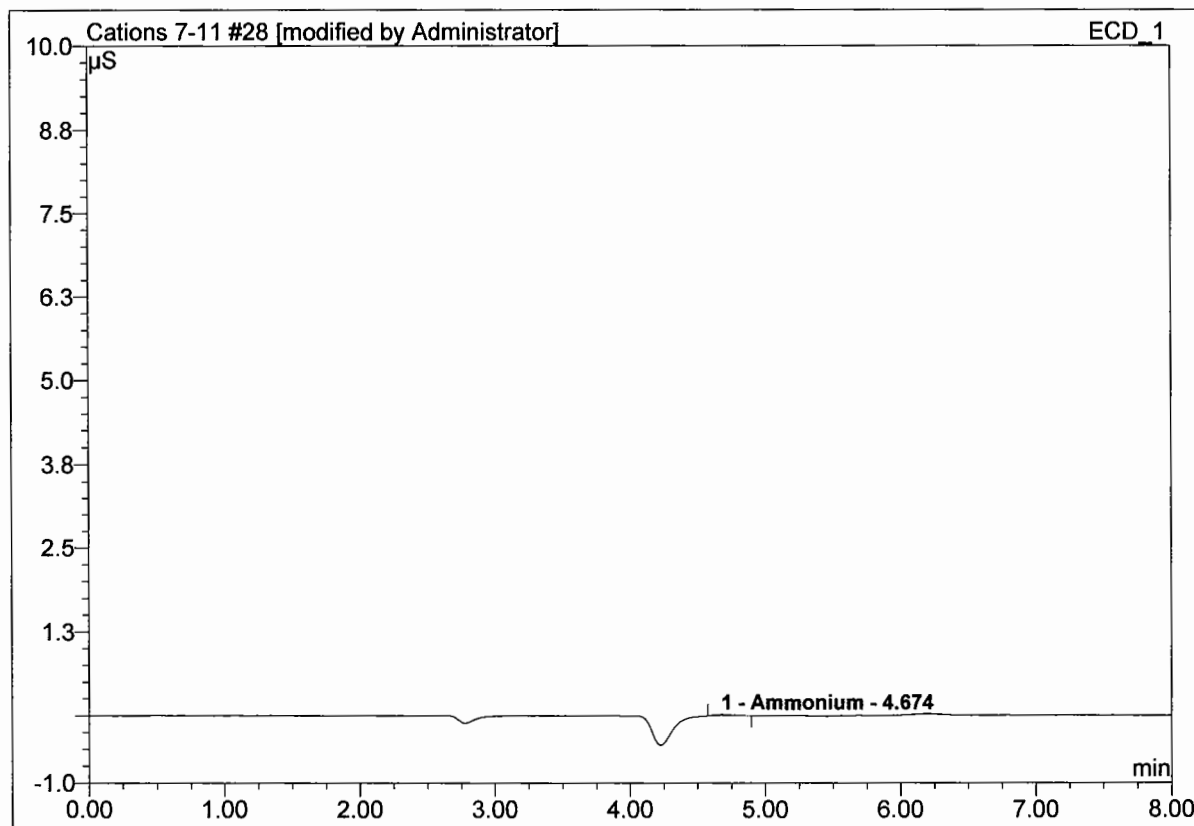
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 15:05	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.67	Ammonium	0.019	0.0028
Total:			0.019	0.003

28 field blank

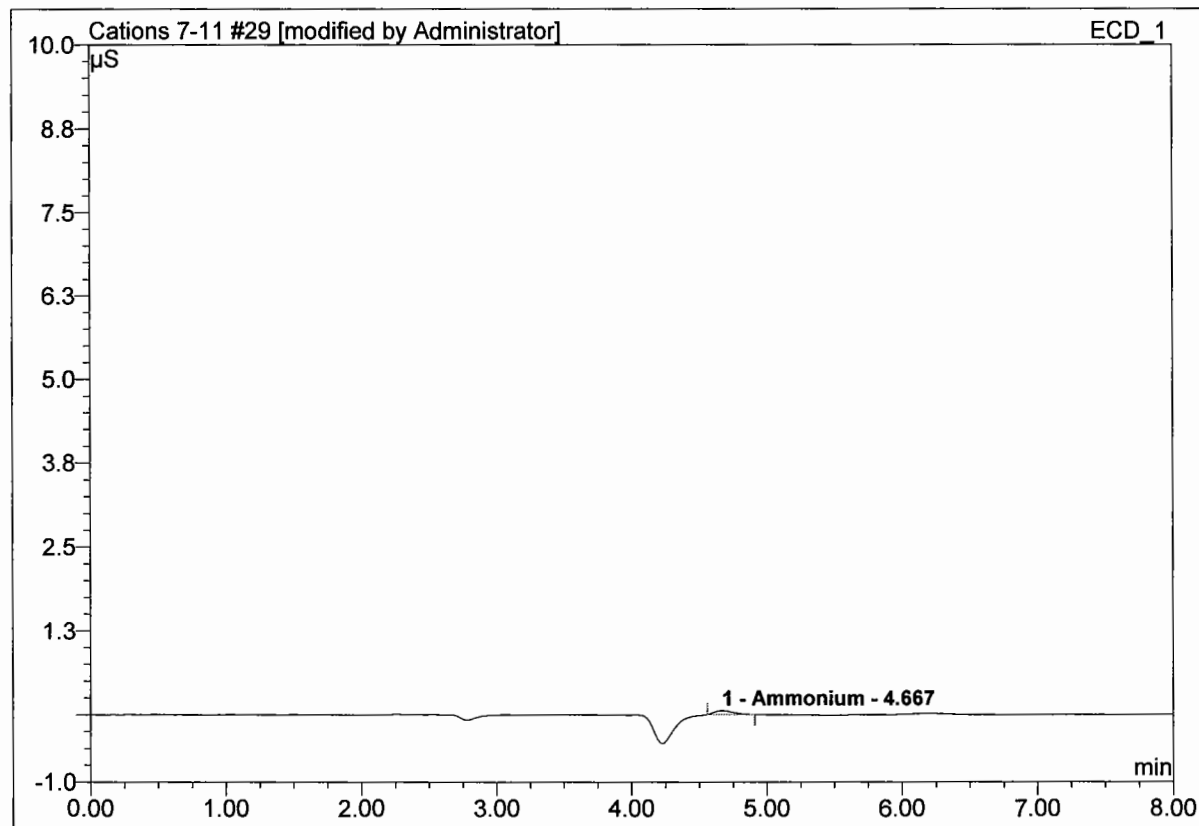
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 15:14	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.67	Ammonium	0.016	0.0025
Total:			0.016	0.003

29 lab blank

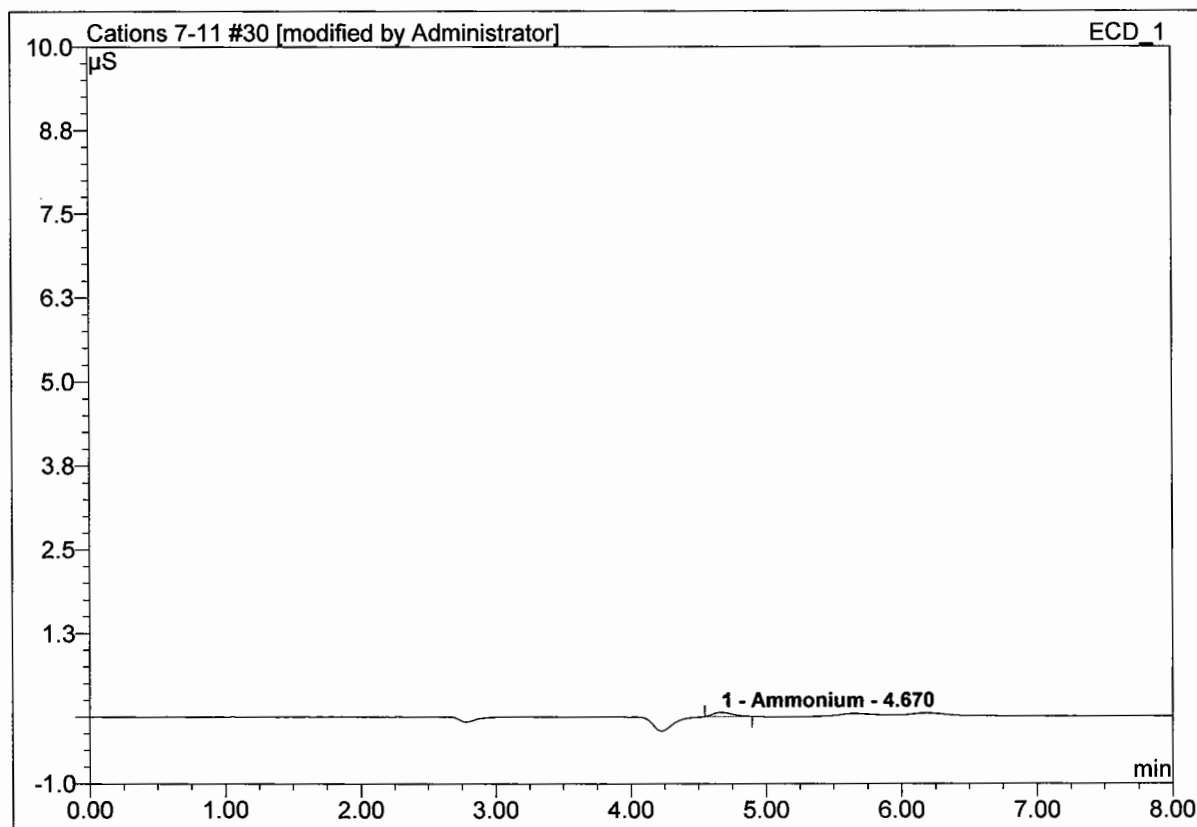
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 15:23	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	0.057	0.0092
Total:			0.057	0.009

30 lab blank

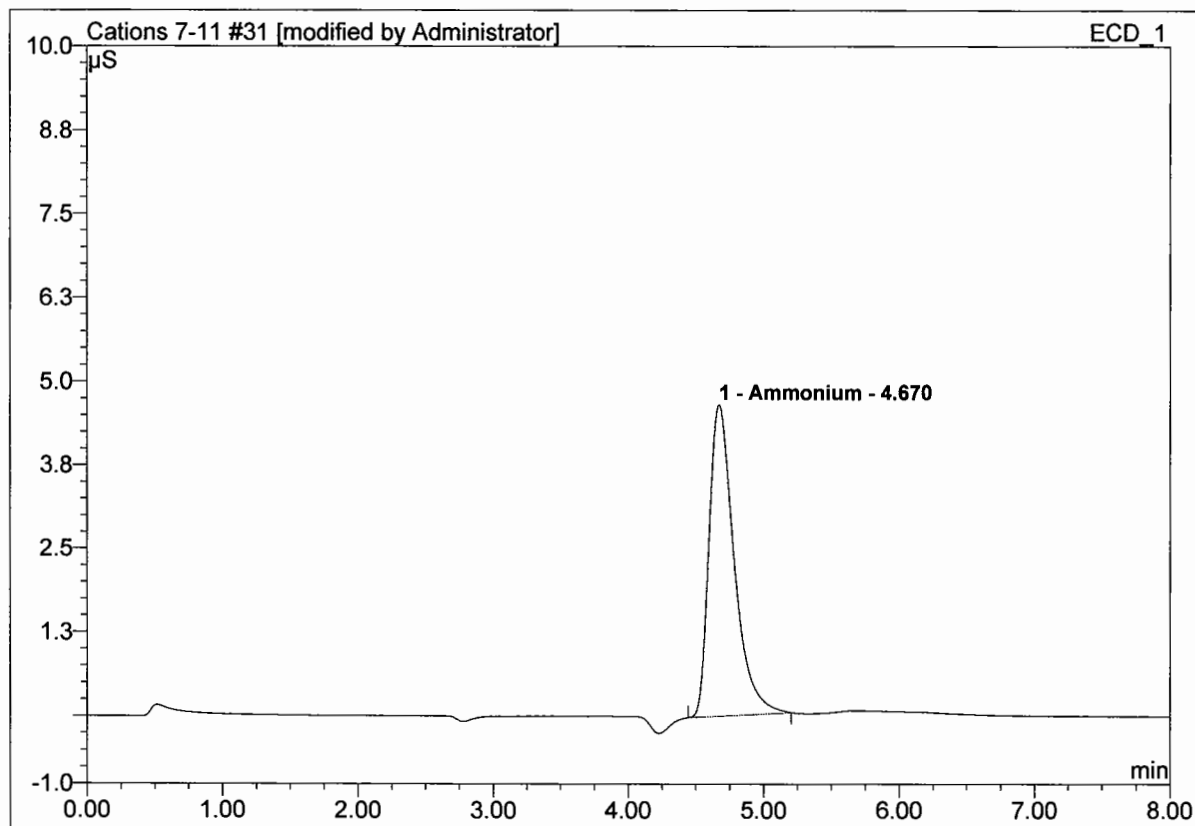
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 15:34	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	0.063	0.0102
Total:			0.063	0.010

31 5.0 ppm NH4 std

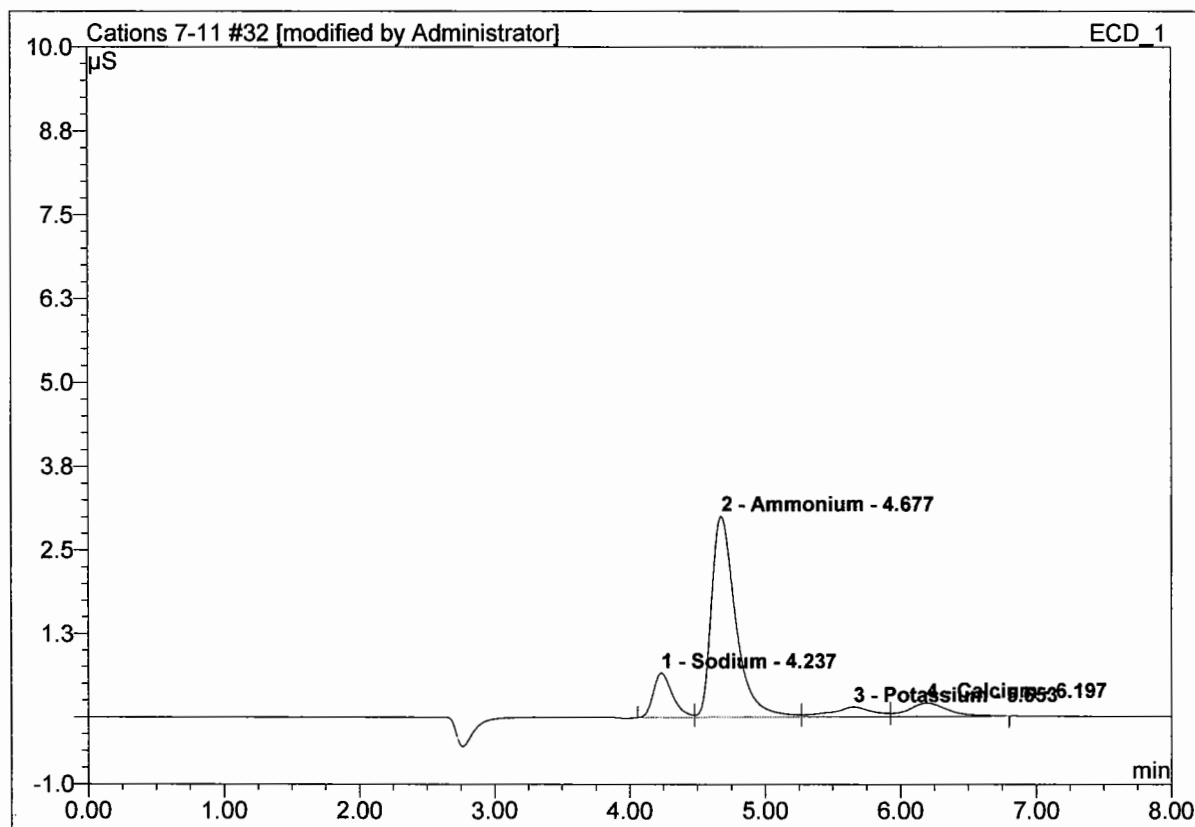
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 15:43	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	4.653	0.9956
Total:			4.653	0.996

32 Imp 1-3 spike

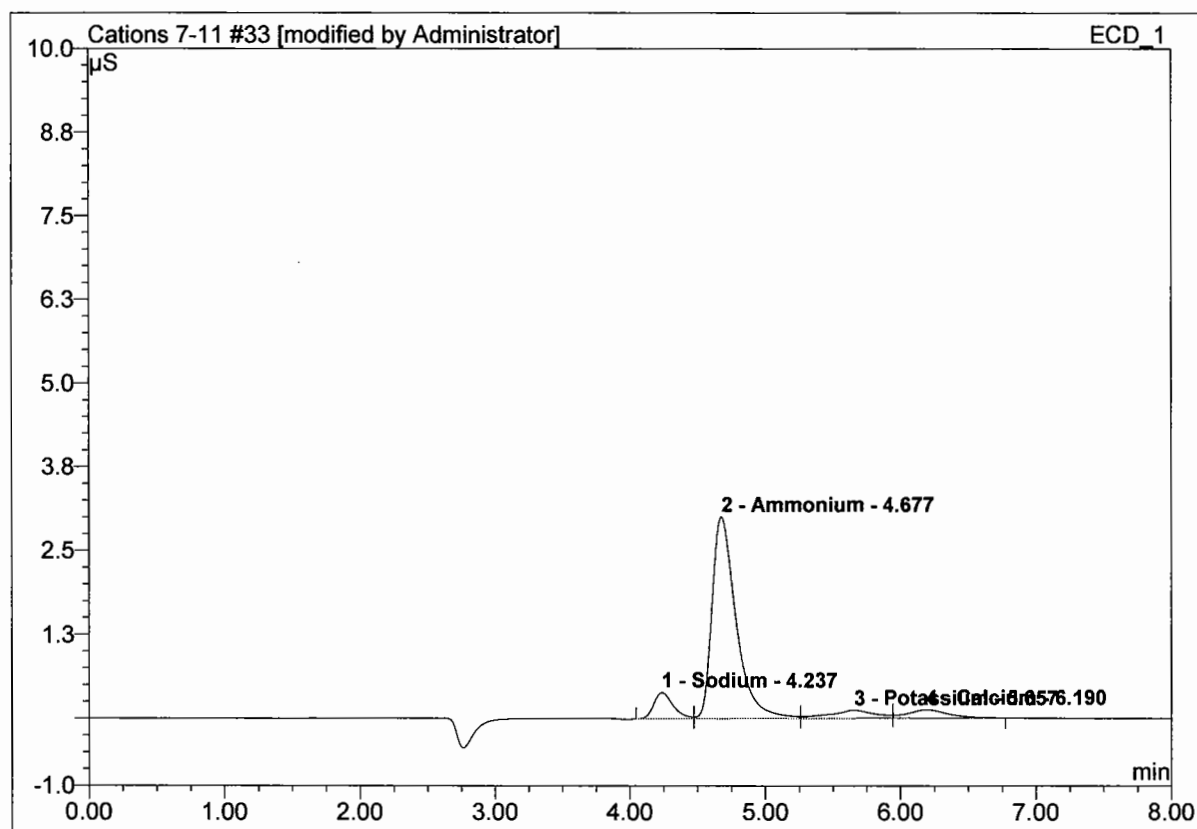
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 15:52	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.24	Sodium	0.662	0.1095
2	4.68	Ammonium	3.007	0.6199
3	5.65	Potassium	0.145	0.0510
4	6.20	Calcium	0.199	0.0662
Total:			4.013	0.847

33 Imp 1-3 spike

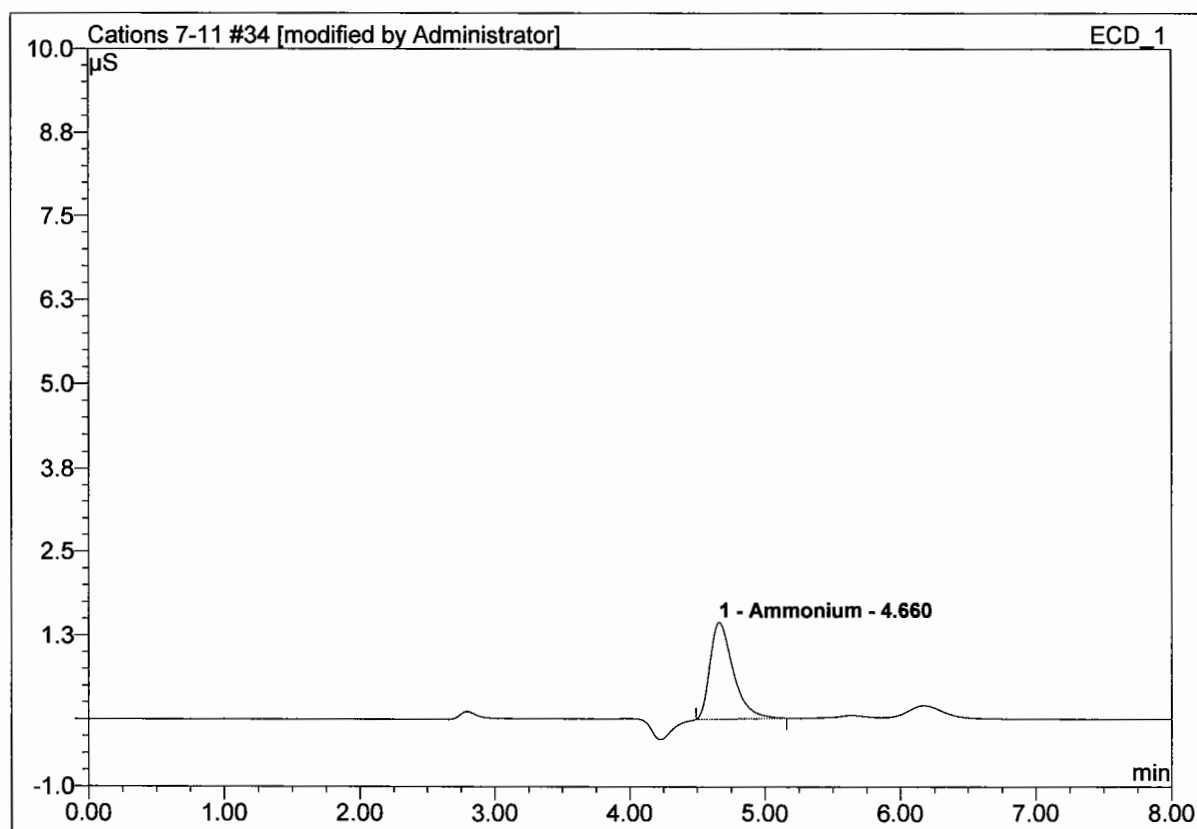
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 16:01	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height µS	Area µS*min
1	4.24	Sodium	0.393	0.0656
2	4.68	Ammonium	3.008	0.6208
3	5.66	Potassium	0.121	0.0469
4	6.19	Calcium	0.124	0.0429
Total:			3.647	0.776

34 Imp 2,3-2 spike

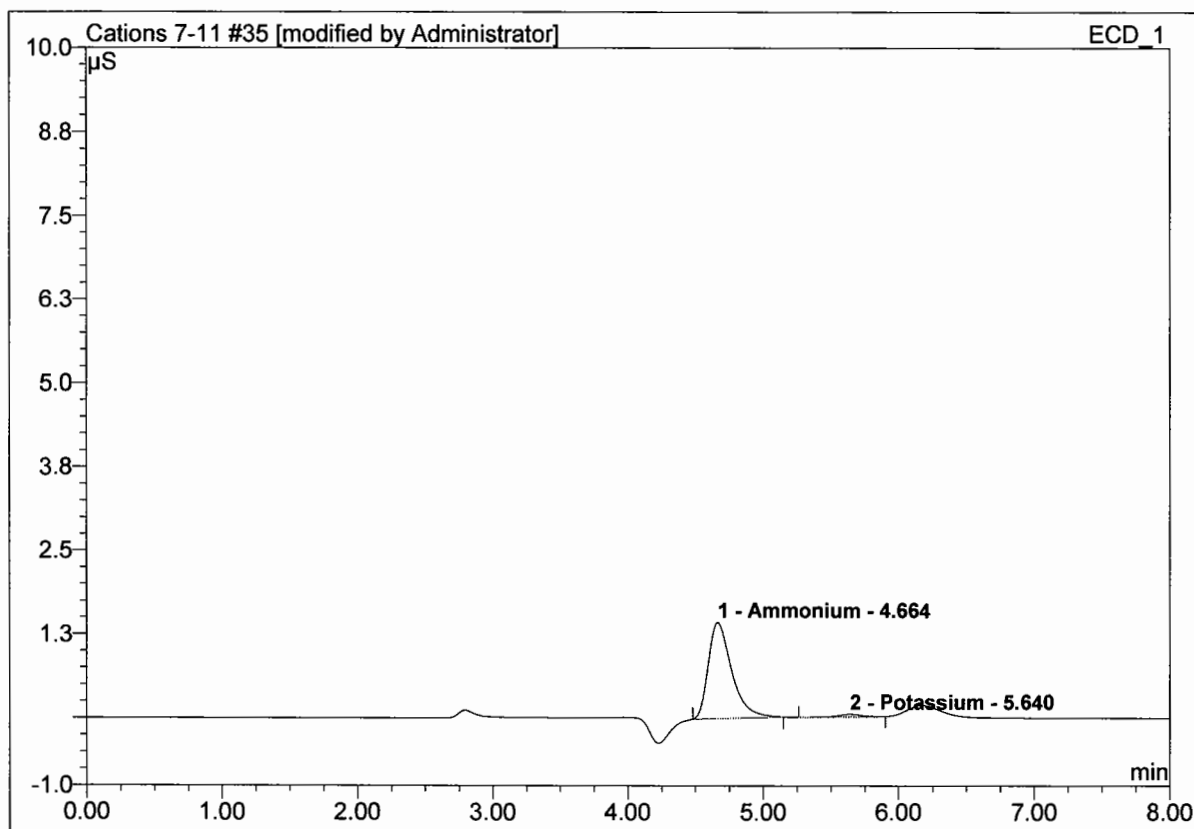
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 16:10	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	1.440	0.2863
Total:			1.440	0.286

35 Imp 2,3-2 spike

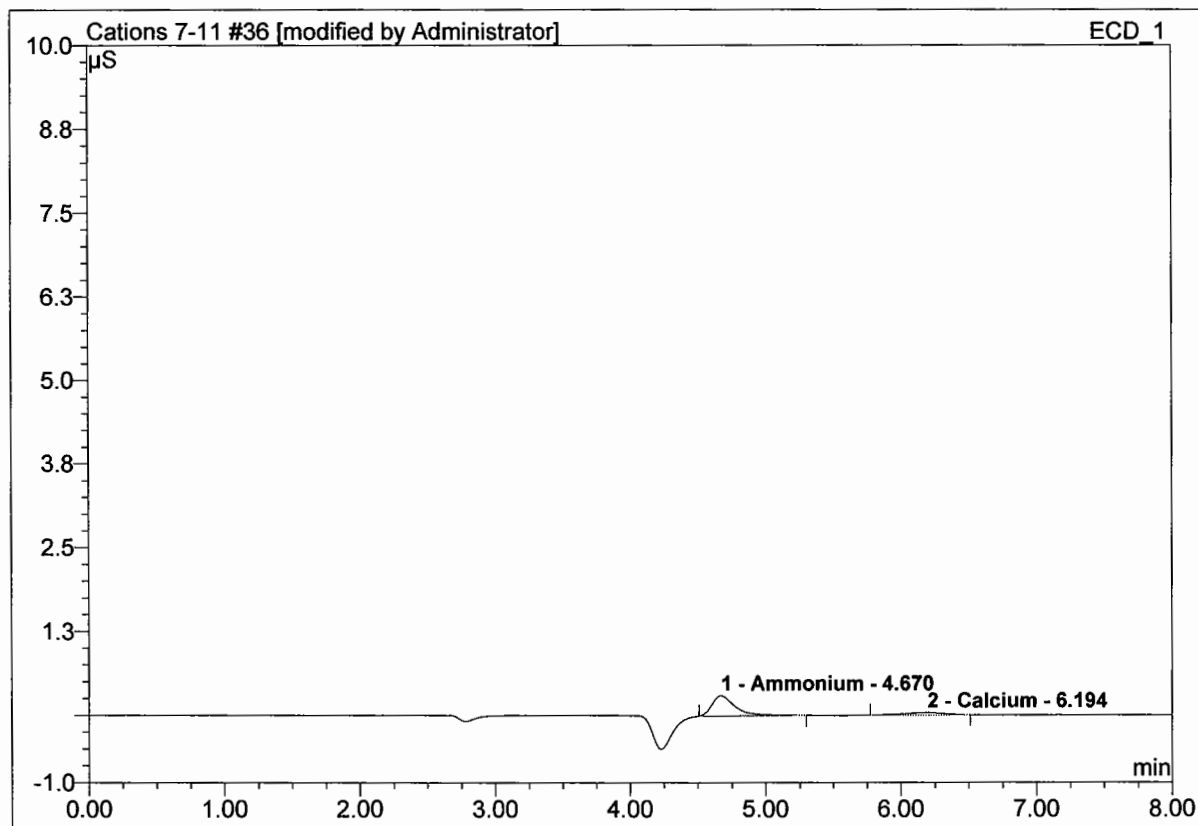
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	unknown	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 16:19	Sample Weight:	1.0000
Run Time (min):	5.90	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.66	Ammonium	1.431	0.2861
2	5.64	Potassium	0.036	0.0077
Total:			1.467	0.294

36 0.2 ppm NH4 std-post

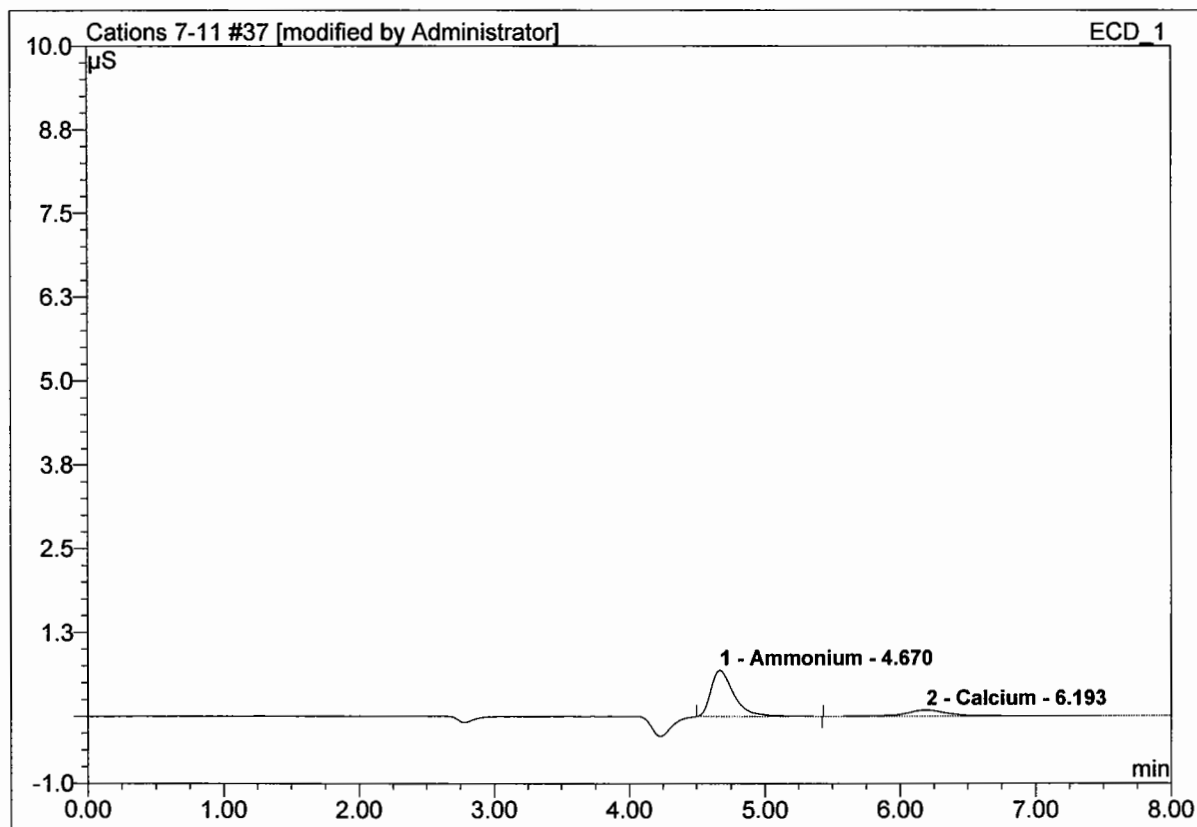
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 16:32	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	0.300	0.0600
2	6.19	Calcium	0.033	0.0109
Total:			0.333	0.071

37 0.5 ppm NH4 std-post

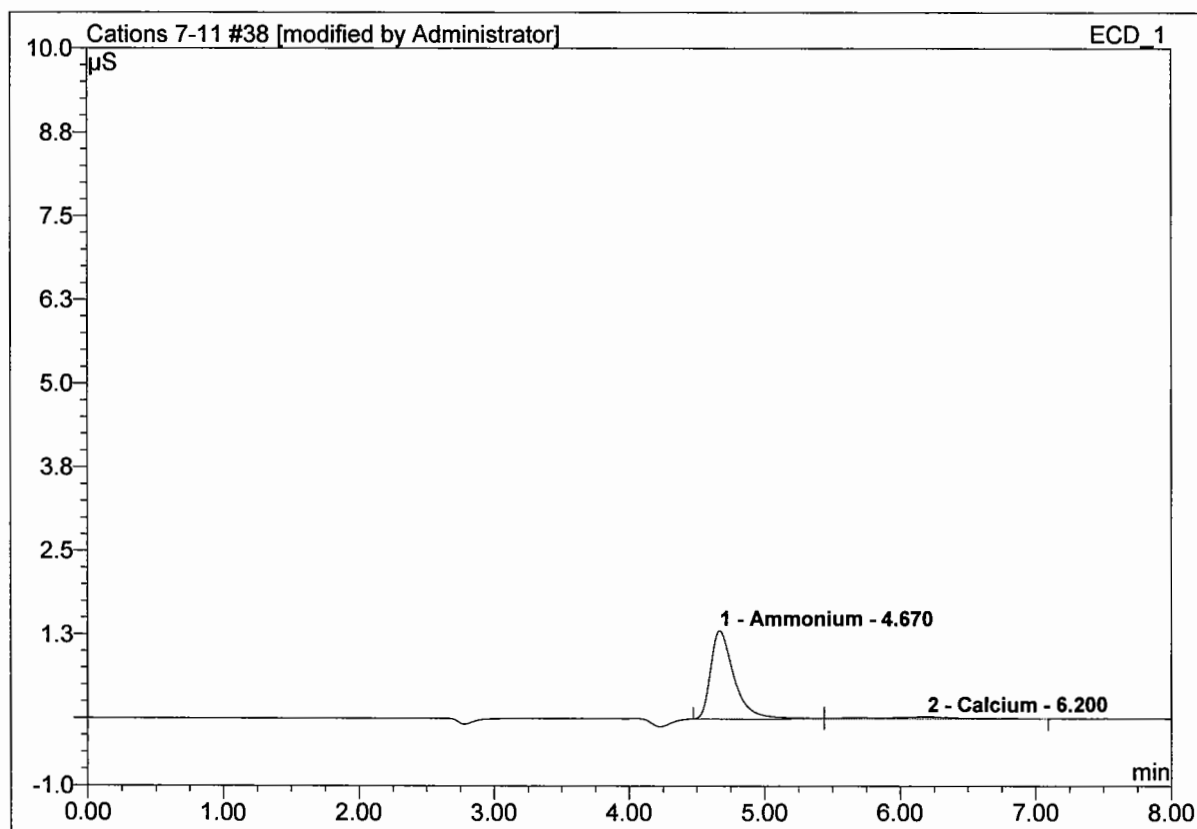
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 16:41	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	0.687	0.1357
2	6.19	Calcium	0.092	0.0371
Total:			0.779	0.173

38 1.0 ppm NH4 std-post

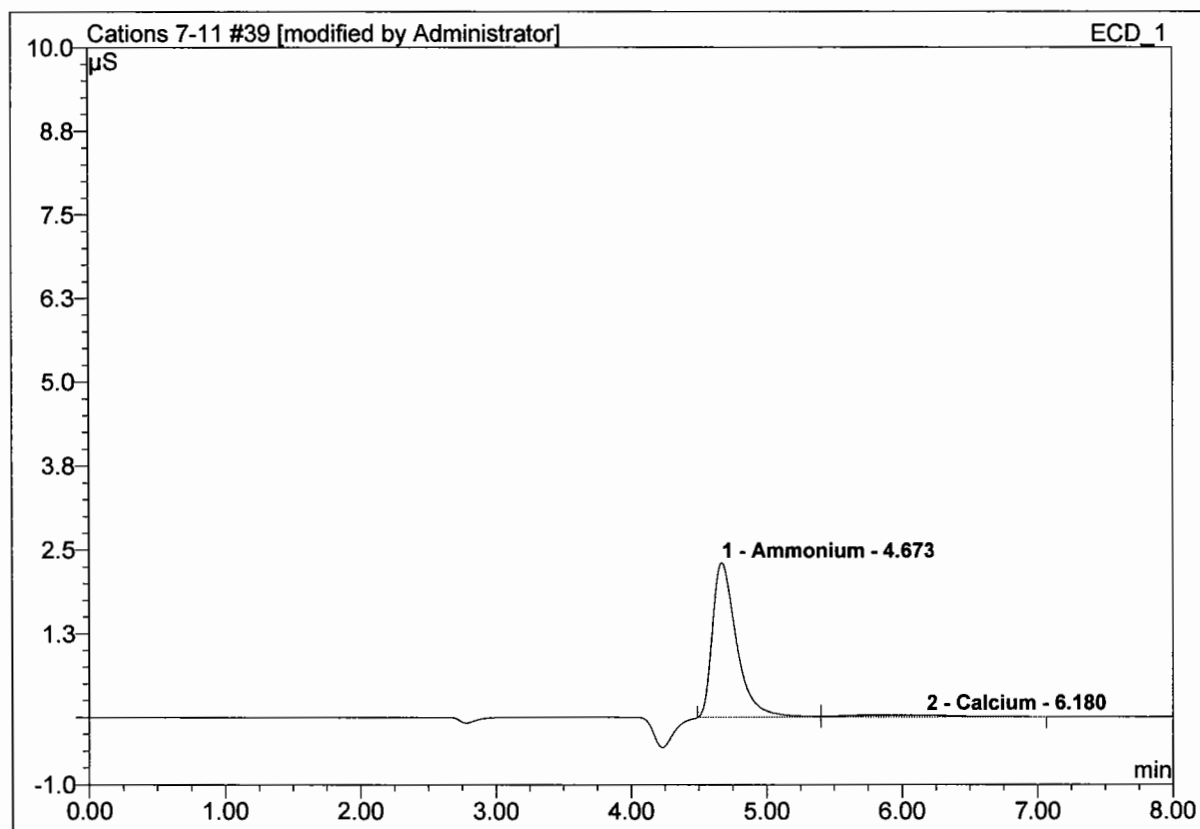
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 16:50	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	1.316	0.2657
2	6.20	Calcium	0.028	0.0201
Total:			1.344	0.286

39 2.0 ppm NH4 std-post

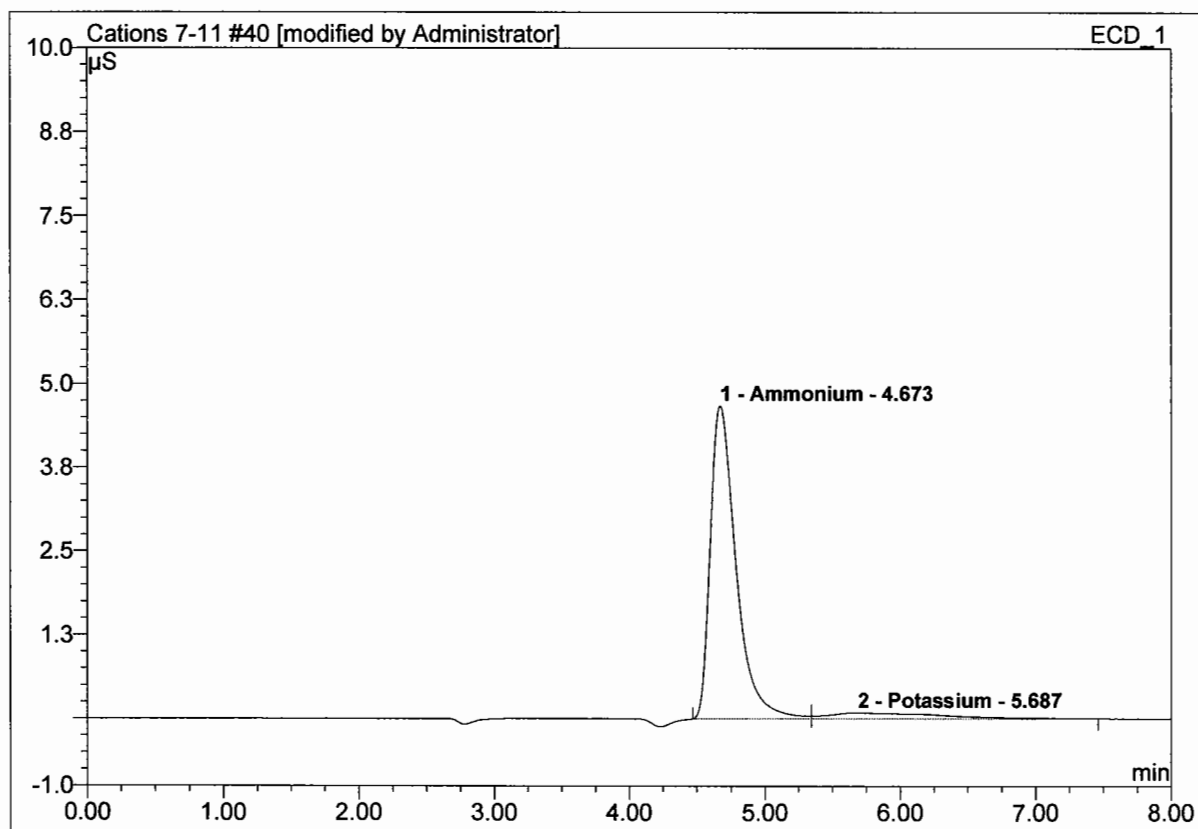
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 16:59	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	2.311	0.4776
2	6.18	Calcium	0.031	0.0289
Total:			2.342	0.506

40 5.0 ppm NH4 std-post

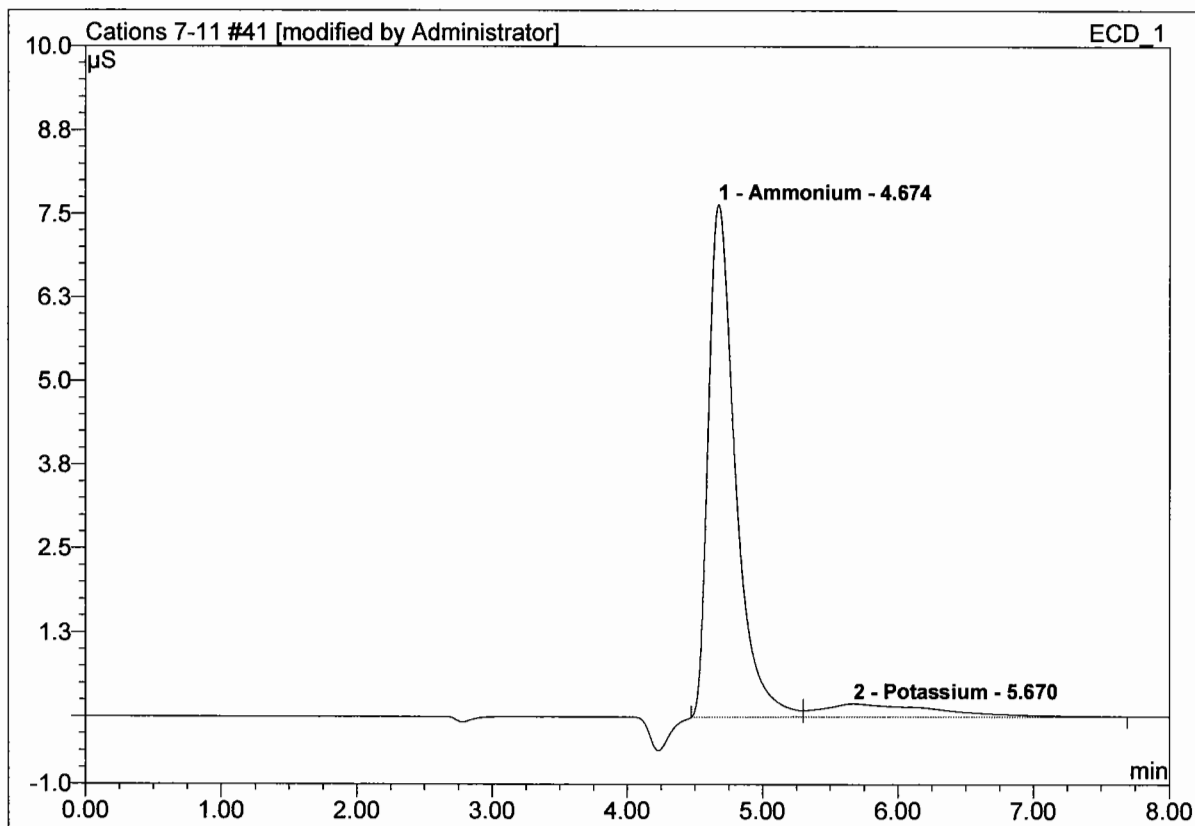
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 17:08	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	4.677	1.0256
2	5.69	Potassium	0.092	0.0872
Total:			4.769	1.113

41 10.0 ppm NH4 std-post

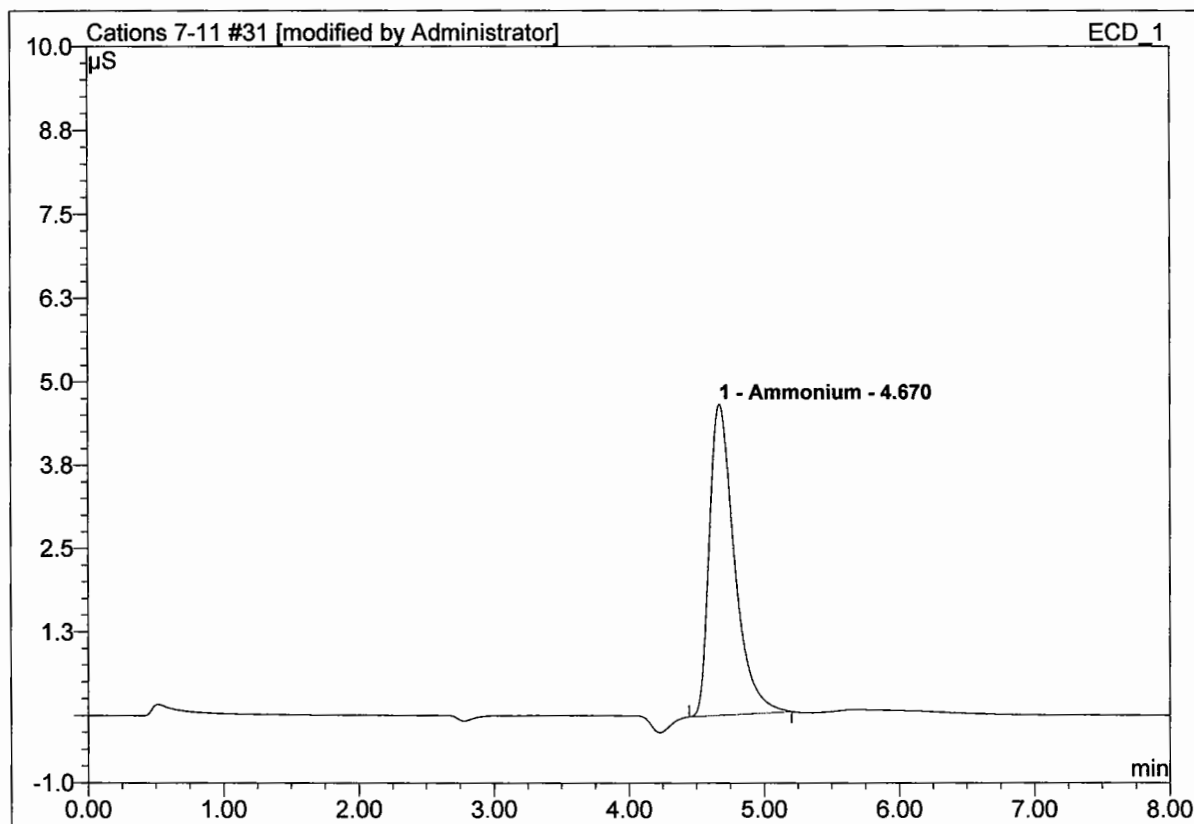
Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 17:17	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret. Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	7.648	1.7623
2	5.67	Potassium	0.198	0.1935
Total:			7.846	1.956

31 5.0 ppm NH4 std

Client	Valero PA	Injection Volume:	35.0
Vial Number:	1	Channel:	ECD_1
Sample Type:	standard	Wavelength:	n.a.
Control Program:	ICS_1000_Cations	Bandwidth:	n.a.
Quantif. Method:	ICS_1000_Cations	Dilution Factor:	1.0000
Recording Time:	7/18/2011 15:43	Sample Weight:	1.0000
Run Time (min):	8.00	Sample Amount:	1.0000



No.	Ret.Time min	Peak Name	Height μS	Area μS*min
1	4.67	Ammonium	4.653	0.9956
Total:			4.653	0.996

ANALYTICAL SUMMARY

CLIENT:

Valero

LOCATION:

Port Arthur, TX

SOURCE:

FCCU

SAMPLE DATE:

6/13/11 - 6/14/11

ANALYSIS:

Particulates

METHOD:

USEPA Methods 5/202

page 1 of 2

Analyst: J. Ruggaber

Date of Completion: 7/26/2011

Template Control ID: USEPA-NEW202-Partic-Template-060T-REV1

Identification	Solvent	Mass (g)	Tare	WT1	WT2	WT 1 - WT 2 (mg)	Particulate (mg)	Blank Corrected Particulate (mg)*	Total M5 Particulate (mg)
FCCU-1	FILTER	-	797.4	838.7	838.8	-0.10	41.35	-	49.83
	PW	132.4	110518.1	110528.1	110527.7	0.40	9.80	8.48	-
FCCU-2	FILTER	-	783.6	809.5	809.4	0.10	25.85	-	33.17
	PW	148.5	112693.3	112702.2	112702.0	0.20	8.80	7.32	-
FCCU-3	FILTER	-	787.3	808.5	808.5	0.00	21.20	-	24.54
	PW	131.5	108755.2	108760.1	108759.6	0.50	4.65	3.34	-
Acetone Blank	PW	60.7	108838.0	108840.1	108839.7	0.40	1.90	-	-
Filter Blank	Filter	-	780.1	783.8	784.0	-0.20	3.80	-	-

*The maximum value of 0.001% of the mass of the acetone used was used for the correction

Identification	Tare	WT1	WT2	WT 1 - WT 2 (mg)	Condensate (mg)
FCCU-1	99868.4	99874.5	99874.0	0.50	5.85
FCCU-2	102211.5	102218.3	102217.9	0.40	6.60
FCCU-3	104501.9	104506.7	104506.4	0.30	4.65
Acetone Blank	101974.0	101975.3	101975.2	0.10	1.25
Hexane Blank	104168.5	104169.8	104169.8	0.00	1.30

Identification	Tare	WT1	WT2	WT 1 - WT 2 (mg)	Condensate (mg)
FCCU-1	116264.6	116272.5	116272.0	0.50	7.65
FCCU-2	113428.1	113434.3	113433.8	0.50	5.95
FCCU-3	106865.2	106874.0	106874.0	0.00	8.80
DI Water Blank	111893.6	111894.5	111894.9	-0.40	1.10

LCS sample	PW	Volume	Tare	WT1	WT2	WT 1 - WT 2	Particulate	Target	% Recovery	PASS/FAIL
		100.0	106065.9	106166.9	106166.6	0.30	100.85	99.98	100.88	PASS

CLIENT: Valero
LOCATION: Port Arthur, TX
SOURCE: FCCU
SAMPLE DATE: 6/13/11 - 6/14/11
ANALYSIS: Particulates

Analyst: J. Ruggaber
 Date of Completion: 7/26/2011
 Template Control ID: USEPA-NEW202-Partic-Template-060T-REV1

Total Condensable Particulate Matter (TCPM)

Identification		Org. CPM (mg)	Inorg. CPM (mg)	Total CPM (mg)
FCCU-1	TCPM	5.85	7.65	13.50
FCCU-2	TCPM	6.60	5.95	12.55
FCCU-3	TCPM	4.65	8.80	13.45

**USEPA METHOD 5 TASK SCHEDULE FORM**

Document Number: WL-DRYING-FORM-020A

Revision Number: 1

Effective Date: 10/30/10

USEPA METHOD 5 TASK SCHEDULE

Client: Valero

Location: Port Arthur, TX

Project Manager: D. Fitzgerald

Date Sampled: 6/13/11 – 6/14/11

Lab Project #: 08-315

Spreadsheet Template ID: USEPA-M202-Partic-Template-055T-REV1

Analyst: J. Ruggaber

DATE	TIME	EQUIPMENT	TASK
6/29/11	15:35	Dessicator #2	Place labeled beakers in dessicator (store 24 hrs)
7/5/11	9:19	Dessicator #1	Place filters in dessicator (store min. 24 hours)
6/30/11	15:37	Ohaus Adventurer SL Analytical balance	Weigh conditioned beakers and record tares
6/30/11 – 7/1/11	-	N/A	Dry down probe washes in tared beakers
7/1/11	13:47	Dessicator #2	Place beakers in dessicator (store min. 24 hours)
7/5/11	8:47	Ohaus Adventurer SL Analytical balance	Beaker weighing #1
7/5/11	16:21	Ohaus Adventurer SL Analytical balance	Beaker weighing #2 (min. 6 hrs after weighing #1)
7/6/11	9:02	Ohaus Adventurer SL Analytical balance	Beaker weighing #3 (min. 6 hrs after weighing #2)
N/A	N/A	N/A	Beaker weighing #4 (min. 6 hrs after weighing #3)
7/5/11	9:19	Ohaus Adventurer SL Analytical balance	Filter weighing #1 (min. 24 hrs in dessicator)
7/5/11	16:21	Ohaus Adventurer SL Analytical 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)
7/26/11	N/A	N/A	Prepare report
	N/A	N/A	Report QA review
	N/A	N/A	Report distribution

USEPA METHOD 202 TASK SCHEDULE (1 of 3)

Client: Valero

Location: Port Arthur, TX

Project Manager: D. Fitzgerald

Date Sampled: 6/13/11- 6/14/11

Lab Project #: 08-315

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
6/30/11	12:58	Desiccator # 2	Label beakers for hexane rinse, imp samples, and LCS sample. Place beakers in dessicator (store 24 hrs).
7/1/11	13:00	Ohaus Adventurer SL balance	Weigh conditioned beakers and record tares.
7/1/11	-	-	Sonicate filter in water for at least two minutes. Add the water to the imp contents. Repeat 2 more times.
7/1/11	-	-	Sonicate filter in hexane for at least two minutes. Add the hexane to the hexane sample contents. Repeat 2 more times.
7/1/11	-	-	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.
7/1/11	-	-	Drain the water phase into the labeled and tared beaker.
7/1/11-7/3/11	-	-	Evaporate hexane beakers to dryness in a fume hood.
7/1/11			Transfer 100 mL of the sodium chloride solution into the tared LCS beaker.



USEPA METHOD 202 TASK SCHEDULE FORM

Document Number: WL-202TASK-FORM-025B

Revision Number: 2

Effective Date: 01/20/11

7/1/11-7/3/11		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.
7/3/11	15:30	Desiccator #2	Place beakers in dessicator (store min. 24 hours)
7/5/11	8:47	Ohaus Adventurer SL Balance	Hexane beaker weighing #1
7/5/11	16:21	Ohaus Adventurer SL Balance	Hexane beaker weighing #2 (min. 6 hrs after weighing #1)
7/6/11	9:01	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)
7/5/11	8:47	Ohaus Adventurer SL Balance	Water Phase and LCS beaker weighing #1
7/5/11	16:21	Ohaus Adventurer SL Balance	Water Phase and LCS beaker weighing #2 (min. 6 hrs after weighing #1)
7/6/11	9:01	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			
7/26/11	-	-	Prepare report
			Report QA review
			Report distribution

ANALYTICAL SUMMARY

CLIENT: Valero
LOCATION: Port Arthur, TX
SOURCE: 1241 FCCU
SAMPLE DATE: 6/13 - 6/14/2011
ANALYSIS: Total Suspended Solids and Total Dissolved Solids
METHOD: ASTM D5907-10

Total Dissolved Solids

Identification	Beaker Tare Mass (mg)	Final Beaker Mass (mg)	Beaker Mass Gain (mg)	Volume Filtered (L)	TDS (mg/L)
Run 1	100299.4	102992.9	2693.5	0.2	13467.5
Run 2	117342.9	120588.6	3245.7	0.2	16228.5
Run 3	105775.7	108937.2	3161.5	0.2	15807.5
Blank Beaker	113604.8	113605.2	0.4	-	-

Total Suspended Solids

Identification	Filter Tare Mass (mg)	Final Filter Mass (mg)	Filter Mass Gain (mg)	Volume Filtered (L)	TSS (mg/L)
Run 1	114.6	296.0	181.4	0.2	907.0
Run 2	114.6	232.6	118.0	0.2	590.0
Run 3	115.5	314.9	199.4	0.2	997.0
Blank Filter	115.0	114.8	-0.2	-	-

Analyst: E. Vogt
Date of Completion: 8/4/11

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	6.64	6.18	6.33	6.38						
5.0	15.24	14.89	14.87	15.00						
10.0	27.83	27.35	28.23	27.80	27.93	28.10	28.69	28.24	28.02	0.8
24.9	69.76	72.22	72.90	71.63						
49.8	135.23	136.25	139.34	136.94						
99.7	266.55	271.17	272.76	270.16						
199.3	538.33	538.13	536.47	537.64						

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)	Dilution Factor	Mass (µg)
Run 3 Imp Unspiked	2.75	2.63	1.86	2.41	0.89	50	1	45
Run 3 Tube No Spike	3.77	4.75	4.24	4.25	1.57	4	1	6
Run 3 Imp Spiked	12.32	12.06	12.38	12.25	4.53	50	1	227
Run 3 Tube Spiked	293.25	300.61	292.00	295.29	109.17	4	2	873
Run 4 Imp Unspiked	4.57	4.57	4.51	4.55	1.68	50	1	84
Run 4 Tube No Spike	5.57	4.70	4.83	5.04	1.86	4	1	7
Run 4 Imp Spiked	18.89	19.68	19.58	19.38	7.17	50	1	358
Run 4 Tube Spiked	11.15	11.07	11.64	11.29	4.17	4	1	17
Run 5 Imp Unspiked	1.02	1.11	0.97	1.03	0.38	50	1	19
Run 5 Tube No Spike	4.81	4.61	4.61	4.68	1.73	4	1	7
Run 5 Imp Spiked	14.04	14.01	14.69	14.25	5.27	50	1	263
Run 5 Tube Spiked	12.10	12.04	11.90	12.01	4.44	4	1	18
Non-Spiked Water Field Blank	<0.45	<0.45	<0.45	<0.45	<0.166	25.7	1	<4.3
Spiked Water Field Blank	27.94	29.30	28.79	28.68	10.60	25.5	1	270
Non-Spiked Water Reagent Blank	<0.45	<0.45	<0.45	<0.45	<0.166	-	-	-
Spiked Water Reagent Blank	32.75	37.78	41.51	37.35	13.81	-	-	-
3% n-propanol Blank	1.25	0.68	1.37	1.10	0.41	-	-	-
Spiked Silica Trap Blank	51.88	51.99	53.20	52.36	19.36	4	1	77.4
Non-spiked Silica Trap Blank	4.51	3.97	5.42	4.64	1.71	4	1	6.9

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	69.13	72.48	71.09	70.90	26.21	24.92	5.2	Yes

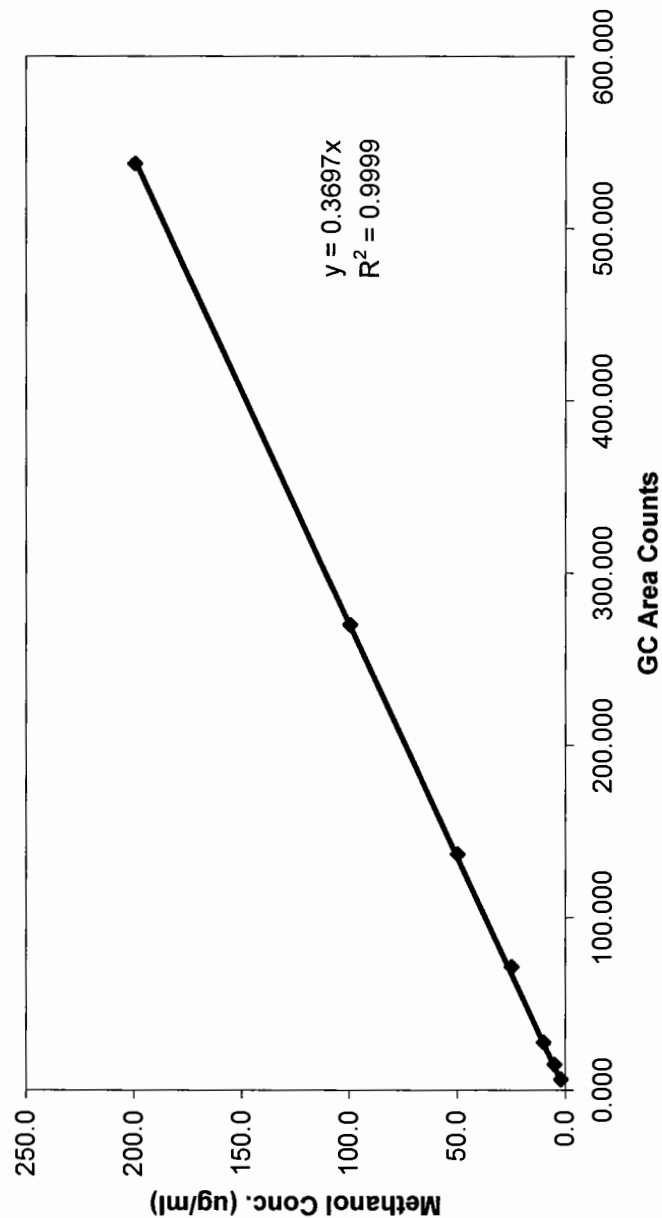
Sample Description	Analysis (area counts)	Pre Cal Average	% Difference
10 ppm Check Standard #232	27.49	27.80	-1.1
10 ppm Check Standard #255	28.41	27.80	2.2
10 ppm Check Standard #279	29.28	27.80	5.3
10 ppm Check Standard #305	29.62	27.80	6.5

Spike Amounts (µg): 316
Tubes: 1.8

Analyst: E. Vogt
Date: 7/27/11

Template Control ID: USEPA-M18-SORBENT-TEMPLATE-64T-REV1

Methanol Calibration Curve





**USEPA METHOD 18, ASTM 1945/1946 TASK
SCHEDULE FORM**

Document Number: WL-M18TASK-FORM-038A

Revision Number: 1

Effective Date: 04/26/11

Page No.: 1 of 3

USEPA METHOD 18 TASK SCHEDULE

Client: Valero

Location: Port Arthur TX – FCCU-1241

Project Manager: Dan Fitzgerald

Date Sampled: 6/8/11

Lab Project #: 08-315

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 µg/ml MeOH

7) 99.7 µg/ml MeOH

8) 199.3 µg/ml MeOH

9) _____



**USEPA METHOD 18, ASTM 1945/1946 TASK
SCHEDULE FORM**

Document Number: WL-M18TASK-FORM-038A

Revision Number: 1

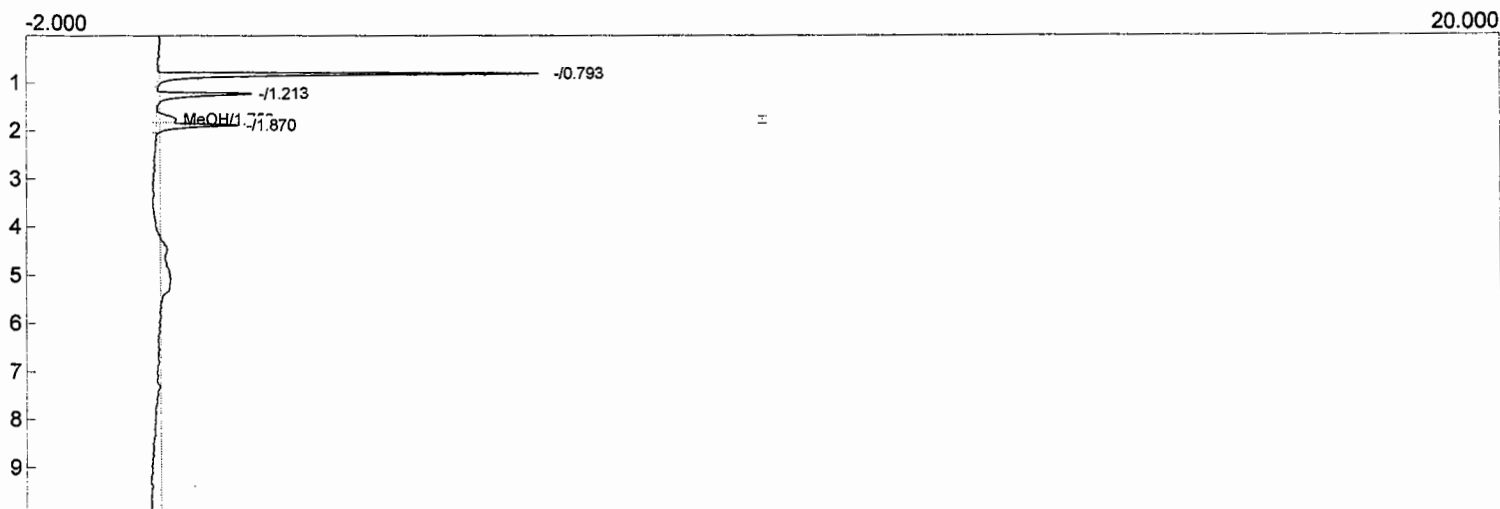
Effective Date: 04/26/11

Page No.: 2 of 3

Secondary standard: 996.6 $\mu\text{g/ml}$ MeOH Stock Standard made from Fisher Purge & Trap Grade Lot #104737, then diluted to 24.9 $\mu\text{g/ml}$

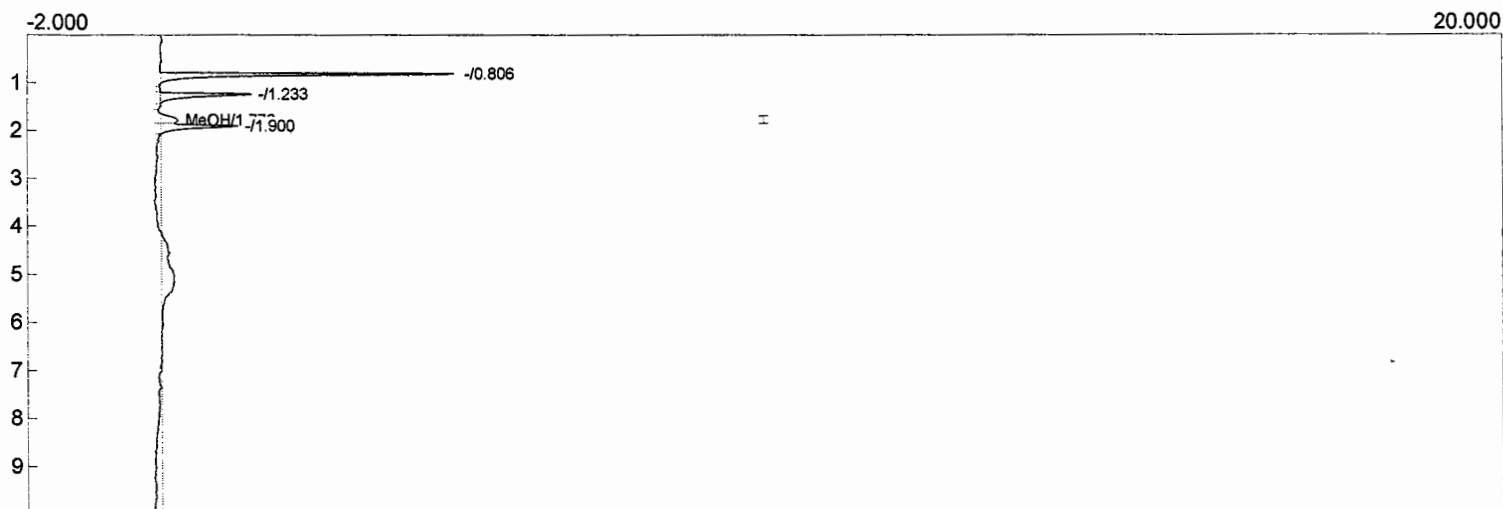
DATE	EQUIPMENT	TASK
7/19/11		Equilibrate the instrument until a stable baseline is achieved.
7/19/11	SRI GC #6	Inject each compound to be analyzed once. Establish the retention time windows for each compound. Adjust GC conditions if needed to ensure separation.
7/19/11	SRI GC #6	Inject each standard 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.
7/19 – 7/21/11	SRI GC #6	Inject each sample in triplicate.
7/20/11	SRI GC #6	If necessary, dilute samples if the peak areas are greater than the highest standard and re-inject in triplicate.
7/19 – 7/21/11	SRI GC #6	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.
7/24/11	SRI GC #6	Inject each secondary standard in triplicate at the end of the run.
7/25/11		For each analyte, plot the average of the standard injections against calibration standard concentrations to determine a final calibration curve.
7/25/11		Determine the concentrations of each analyte in each sample using the calibration curve.
7/27/11		Prepare report
7/28/11		Report QA review
		Report distribution

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/19/2011 21:37:20
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR196.chr () *40*
 Sample: FCCU-1241 Run *1* Unspiked Imp
 Operator: E. Vogt *2*



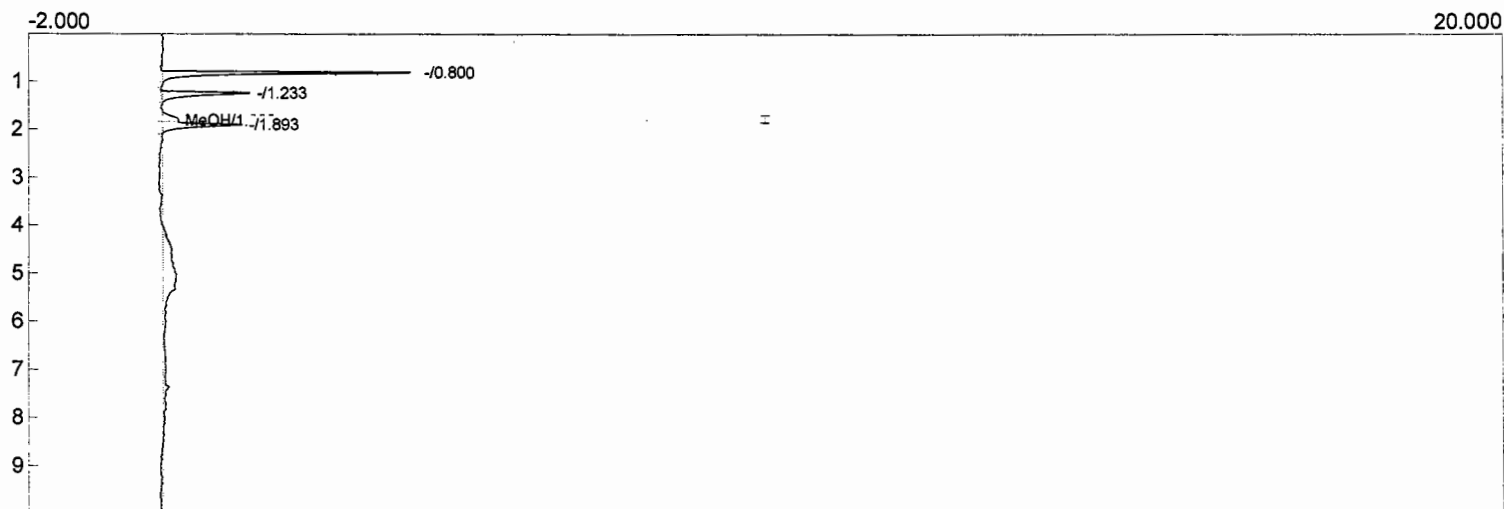
Component	Retention	Area
MeOH	1.753	2.7456
		2.7456

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 22:12:24
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR198.chr () 44
Sample: FCCU-1241 Run 1 Unspiked Imp
Operator: E. Vogt 3



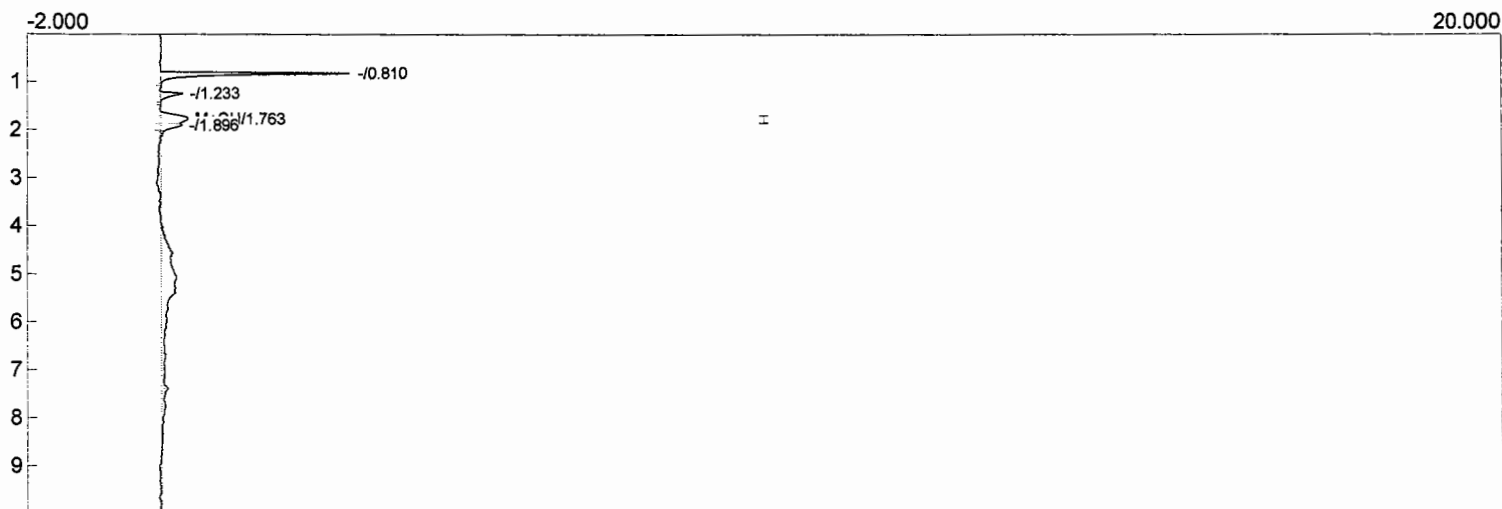
Component	Retention	Area
MeOH	1.776	2.6348
		2.6348

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 22:29:30
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR199.chr () *LC*
Sample: FCCU-1241 Run *1* Unspiked Imp
Operator: E. Vogt *3*



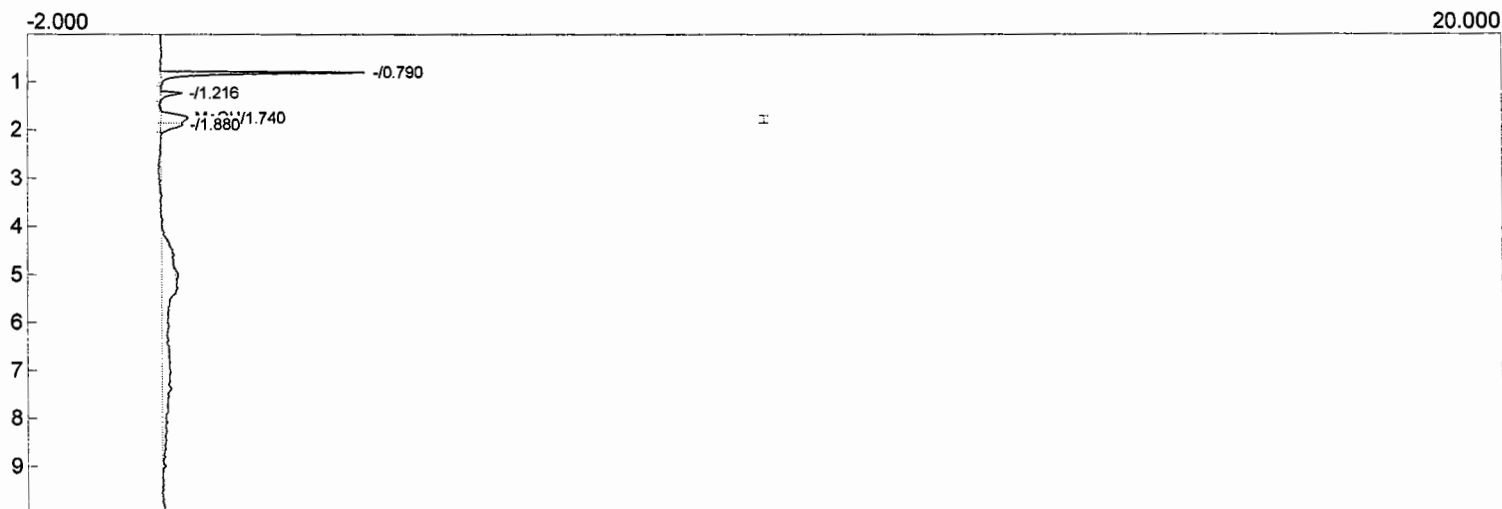
Component	Retention	Area
MeOH	1.806	1.8599
		1.8599

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 22:46:58
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR200.chr () 4C
Sample: FCCU-1241 Run 2 Unspiked Imp
Operator: E. Vogt 4



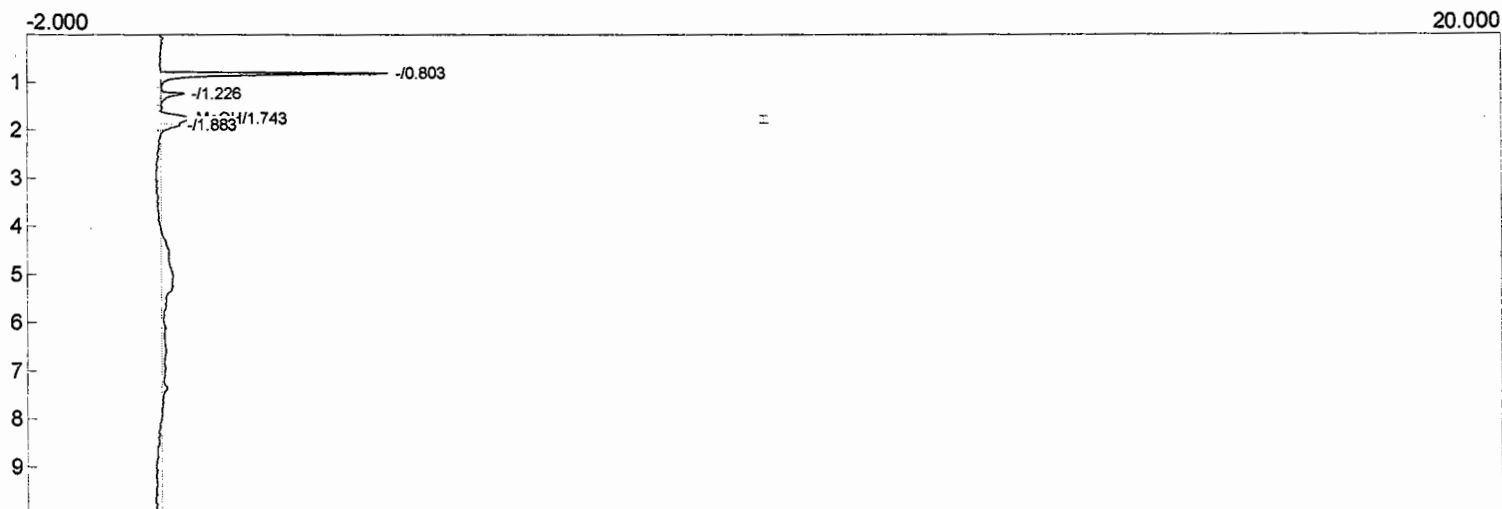
Component	Retention	Area
MeOH	1.763	4.5652
		4.5652

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 23:21:22
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR202.chr () *ll*
Sample: FCCU-1241 Run *2* Unspiked Imp
Operator: E. Vogt *4*



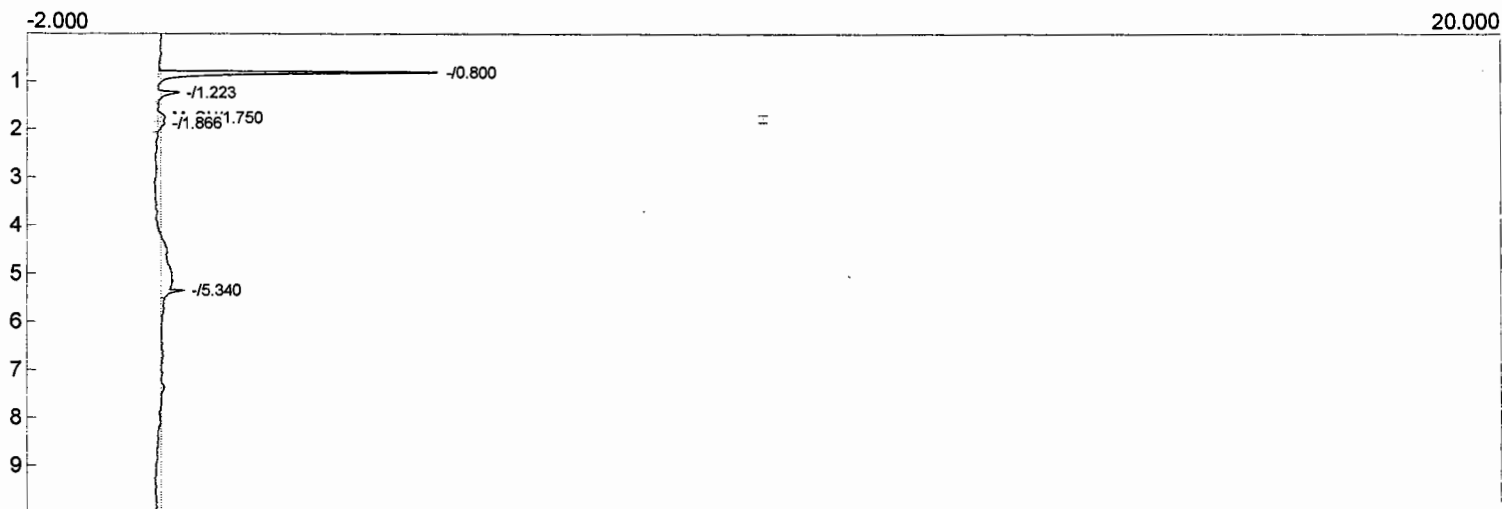
Component	Retention	Area
MeOH	1.740	4.5708
		4.5708

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 23:38:55
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR203.chr () 4C
Sample: FCCU-1241 Run 2 unspiked Imp
Operator: E. Vogt 4



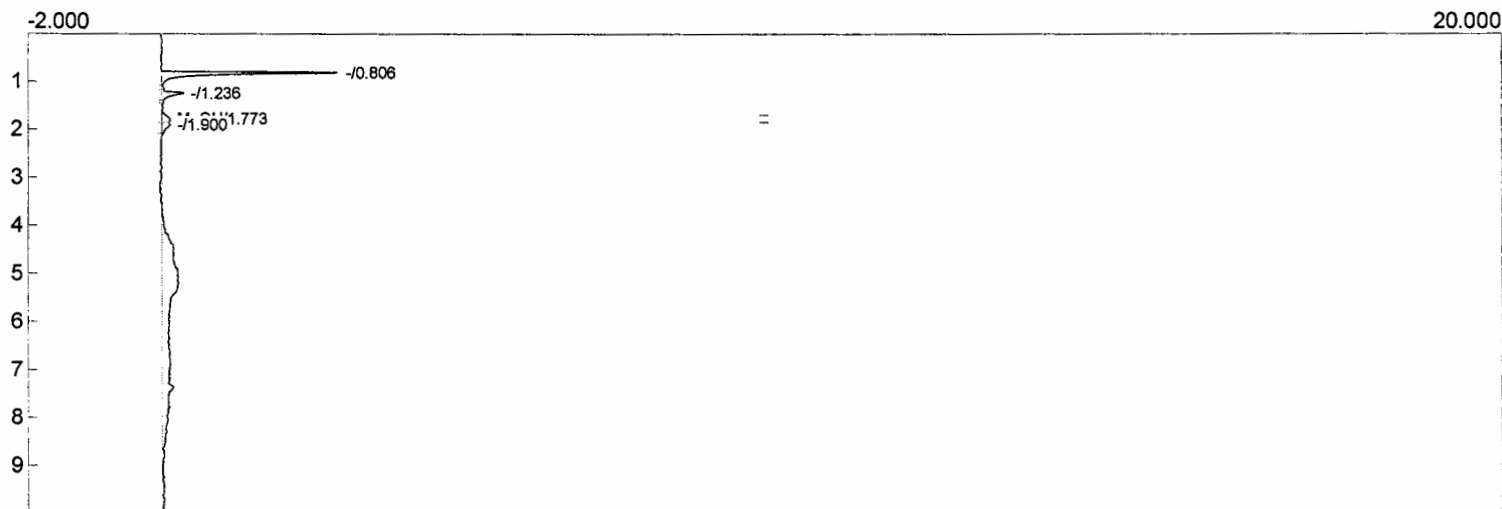
Component	Retention	Area
MeOH	1.743	4.5142
		4.5142

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 23:56:04
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR204.chr () *z*
Sample: FCCU-1241 Run *2* Unspiked Imp
Operator: E. Vogt *5*



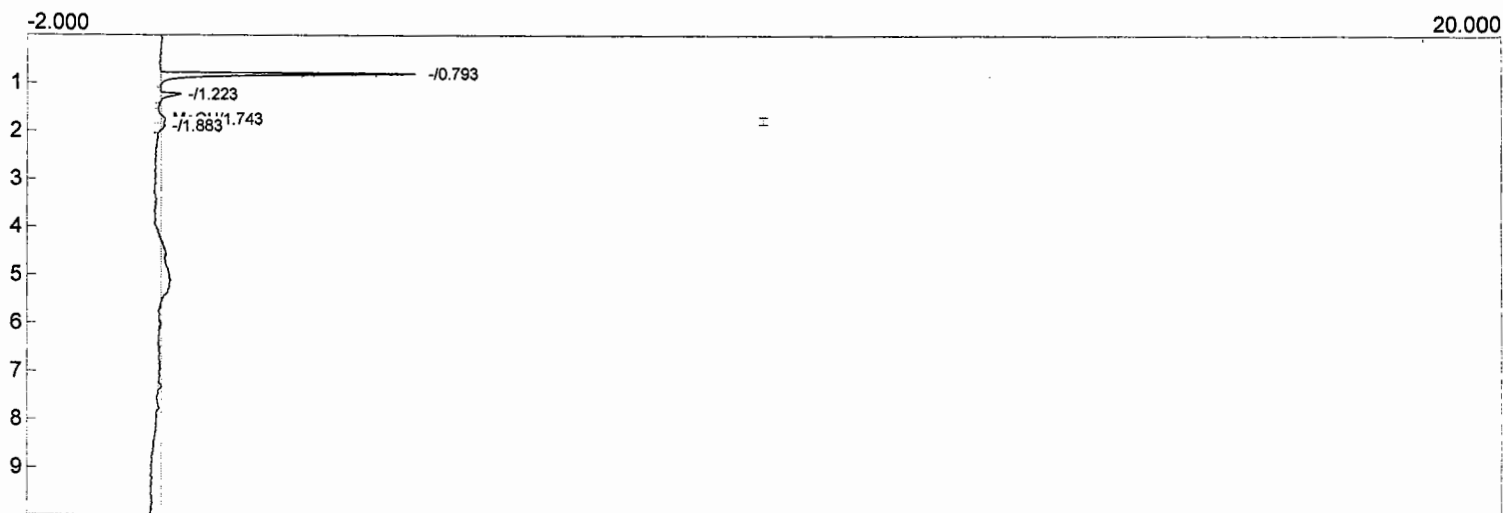
Component	Retention	Area
MeOH	1.750	1.0198
		1.0198

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/20/2011 00:13:34
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR205.chr () *ll*
Sample: FCCU-1241 Run ~~3~~ Unspiked Imp
Operator: E. Vogt *5*



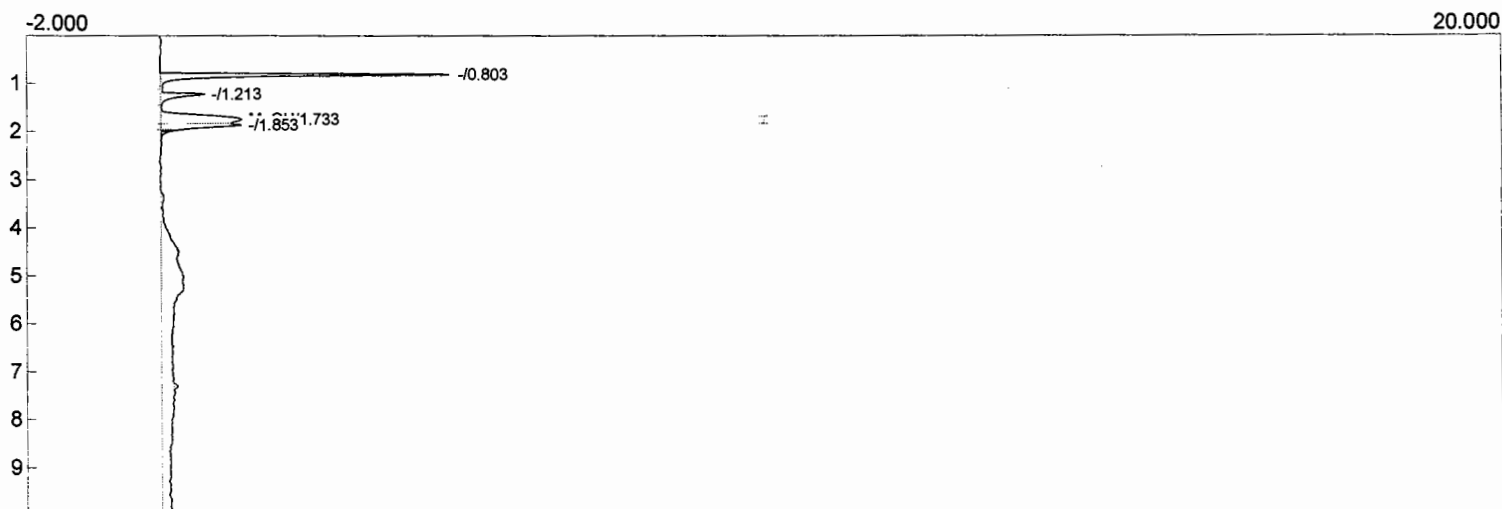
Component	Retention	Area
MeOH	1.773	1.1054
		1.1054

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/20/2011 00:31:13
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR206.CHR () *ec*
Sample: FCCU-1241 Run 3-Unspiked Imp
Operator: E. Vogt *5*



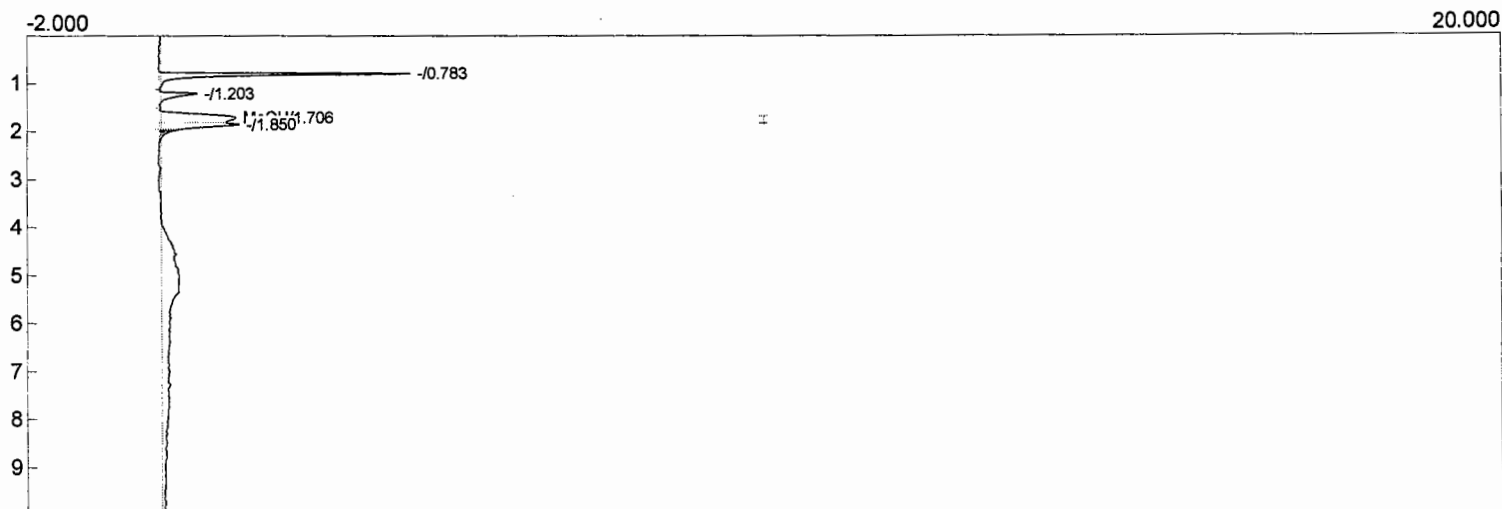
Component	Retention	Area
MeOH	1.743	0.9726
		0.9726

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 18:11:10
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR184.chr () 40
Sample: FCCU-1241 Run-4 Spiked Imp
Operator: E. Vogt 3



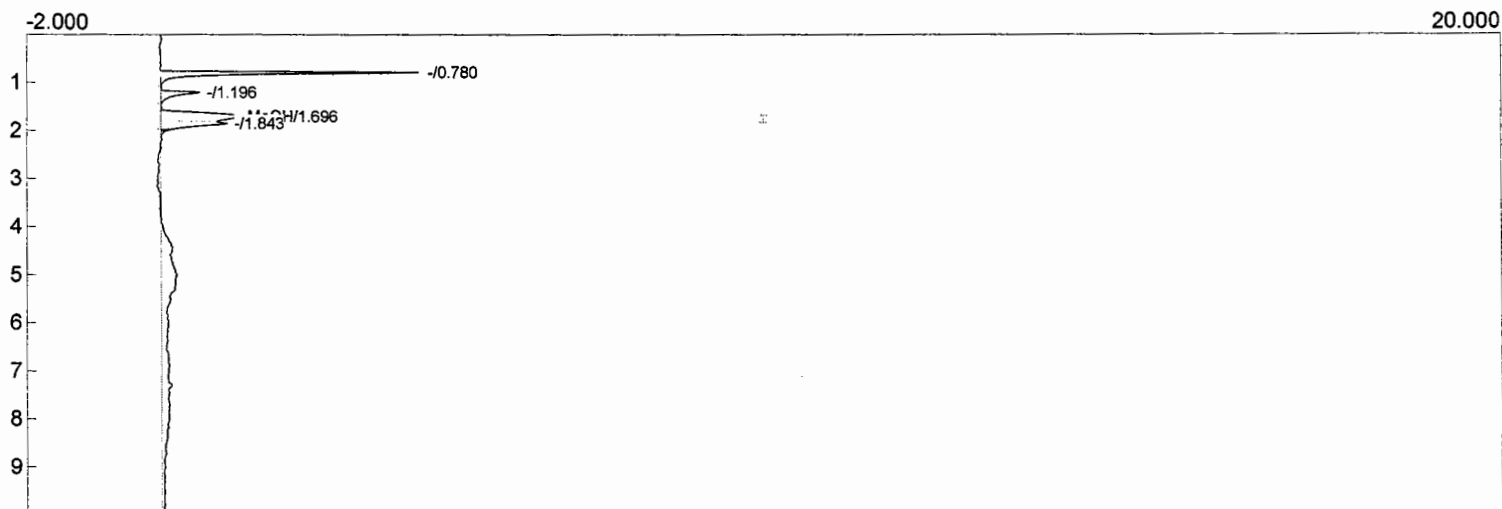
Component	Retention	Area
MeOH	1.733	12.3172
		12.3172

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 18:28:04
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR185.chr () 46
Sample: FCCU-1241 Run 4-Spiked Imp
Operator: E. Vogt 3



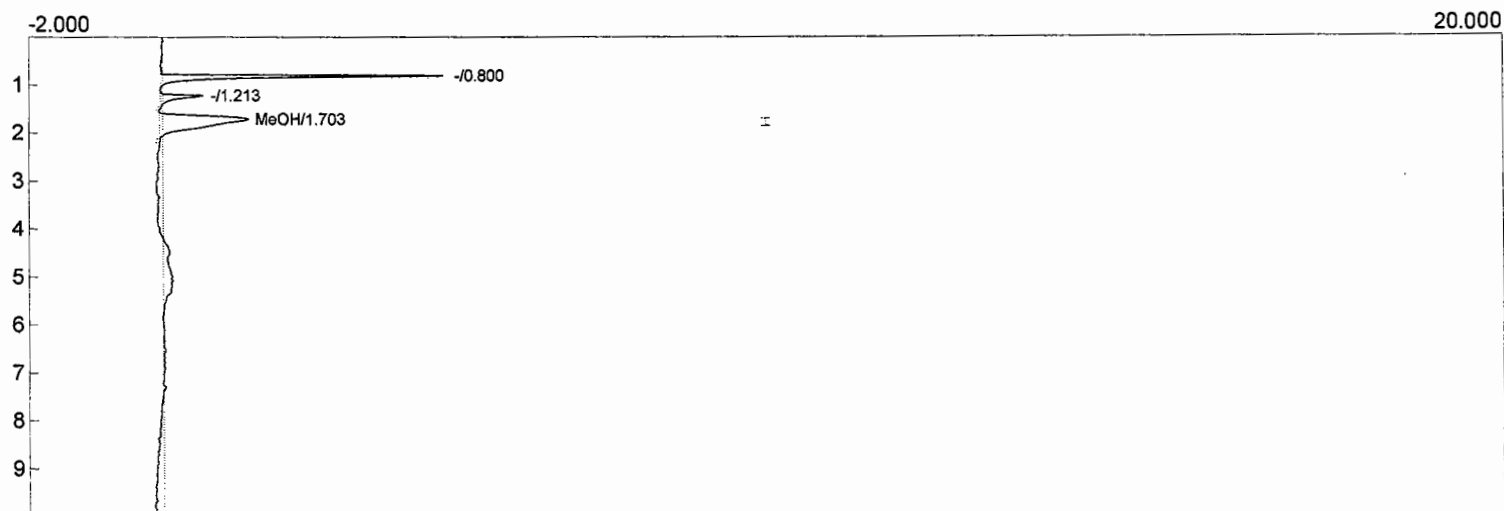
Component	Retention	Area
MeOH	1.706	12.0646
		12.0646

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 18:44:54
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR186.CHR () *4C*
Sample: FCCU-1241 Run ~~4~~ Spiked Imp
Operator: E. Vogt *3*



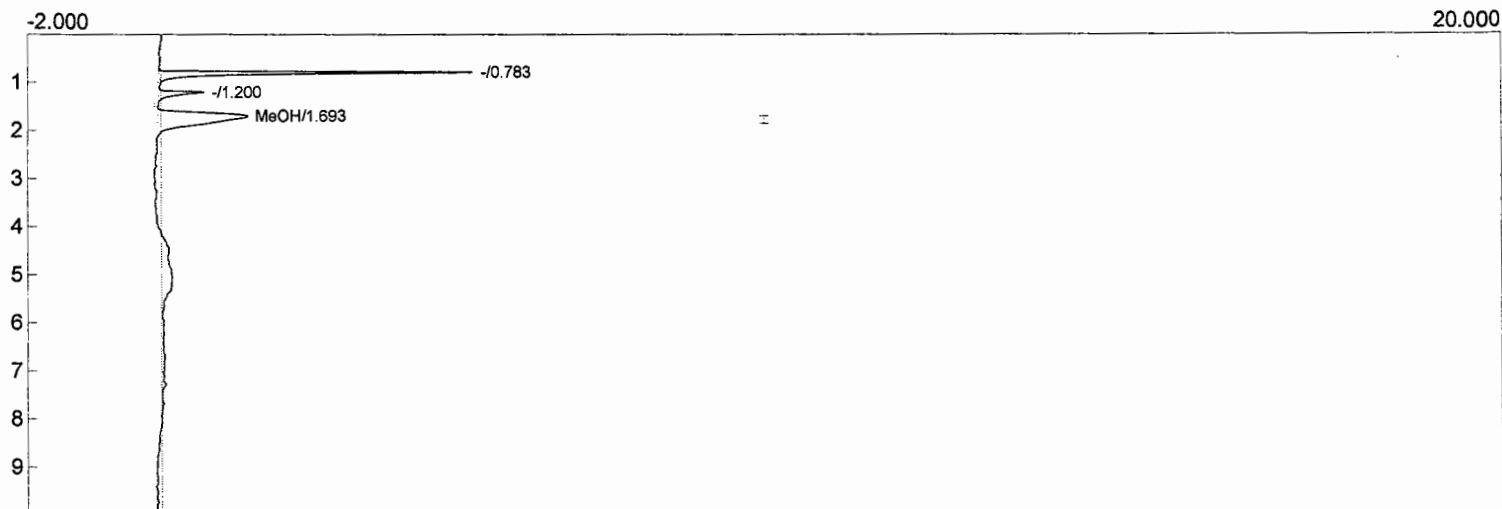
Component	Retention	Area
MeOH	1.696	12.3802
		12.3802

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 19:19:39
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR188.chr () *4L*
Sample: FCCU-1241 Run 2 ~~Spiked Imp~~
Operator: E. Vogt *4*



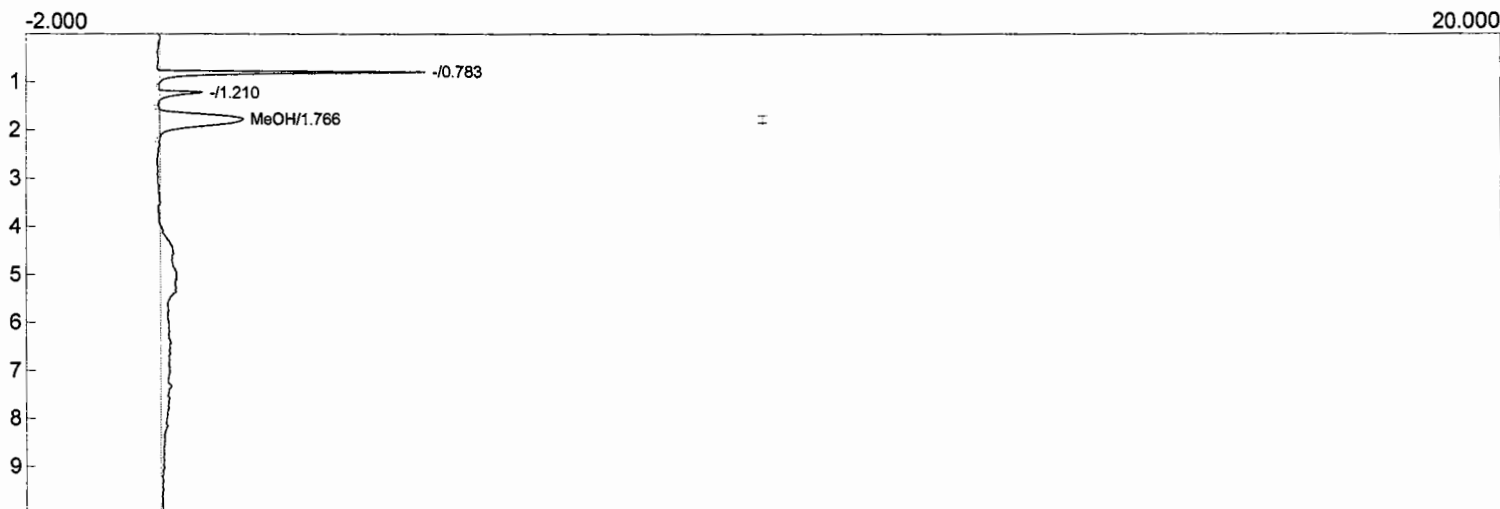
Component	Retention	Area
MeOH	1.703	18.8928
		18.8928

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 19:36:48
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR189.CHR () 46
Sample: FCCU-1241 Run-2 Spiked Imp
Operator: E. Vogt 4



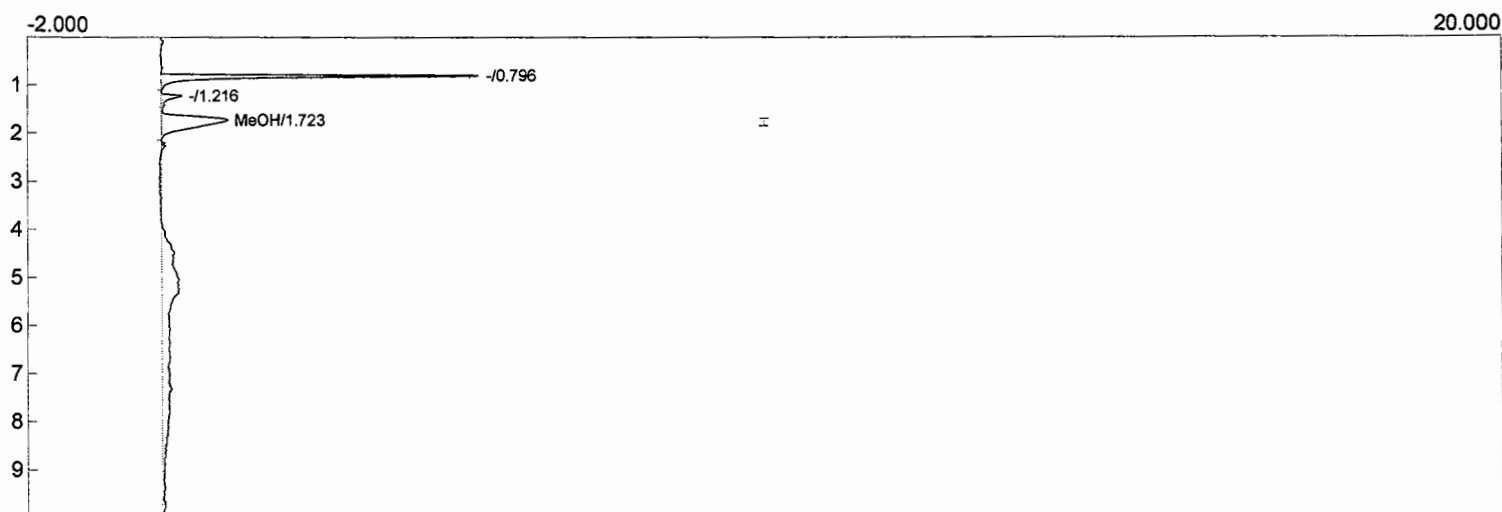
Component	Retention	Area
MeOH	1.693	19.6780
		19.6780

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 19:54:17
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR190.chr () ✓✓
Sample: FCCU-1241 Run 2 Spiked Imp
Operator: E. Vogt ✓



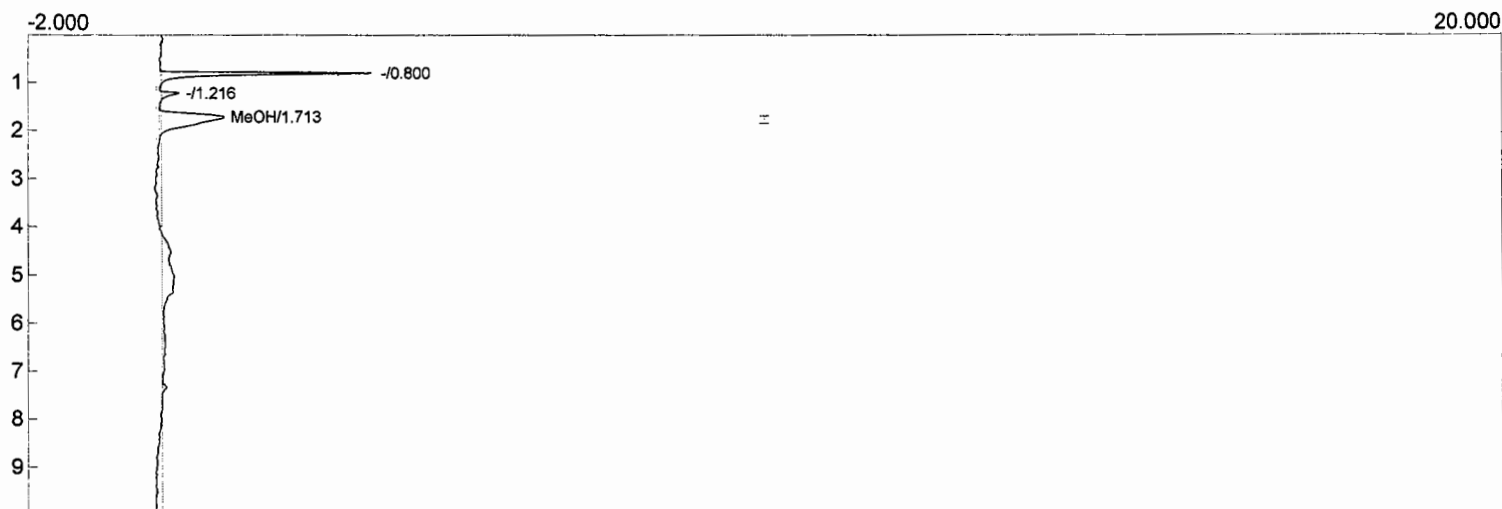
Component	Retention	Area
MeOH	1.766	19.5816
		19.5816

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/19/2011 20:28:28
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR192.chr () *42*
 Sample: FCCU-1241 Run-~~3~~ *5* Spiked Imp
 Operator: E. Vogt



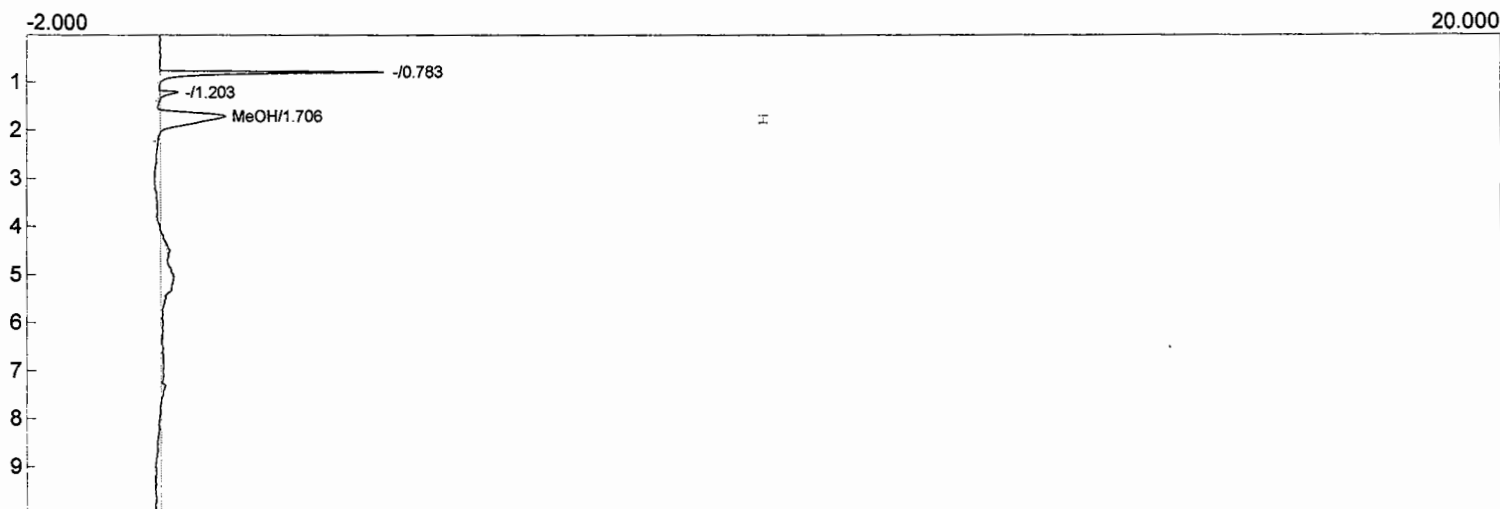
Component	Retention	Area
MeOH	1.723	14.0354
		14.0354

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 20:45:52
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR193.chr () 4c
Sample: FCCU-1241 Run-2 Spiked Imp
Operator: E. Vogt 5



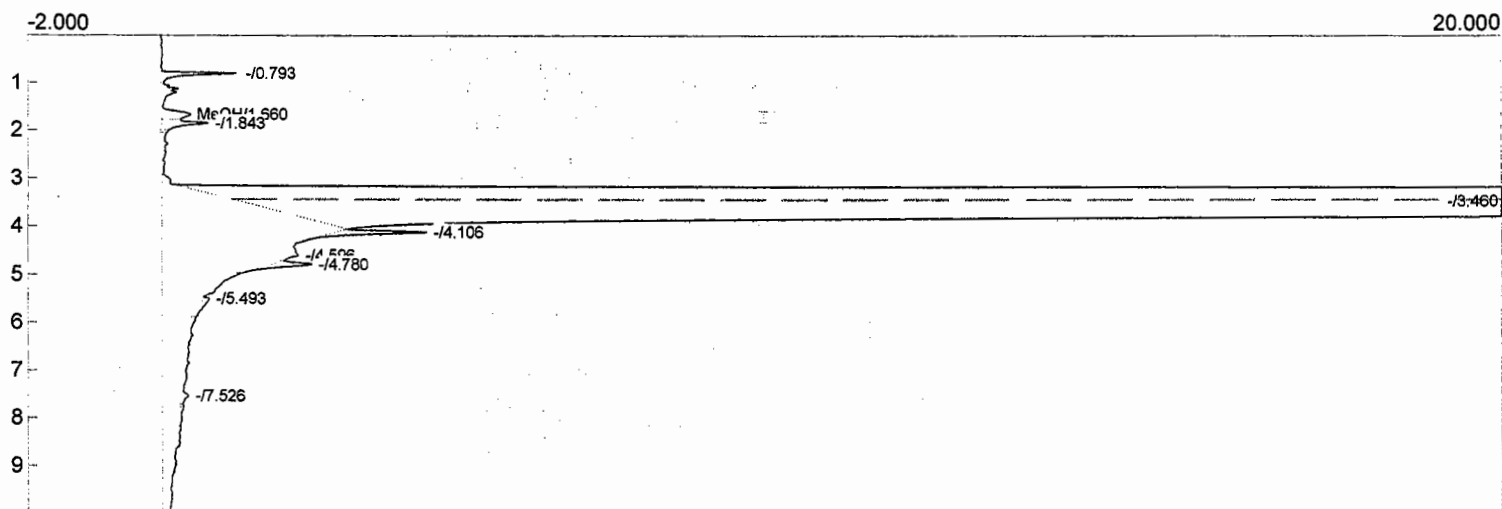
Component	Retention	Area
MeOH	1.713	14.0128
		14.0128

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 21:02:50
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR194.chr () 4C
Sample: FCCU-1241 Run 3 Spiked Imp
Operator: E. Vogt 5



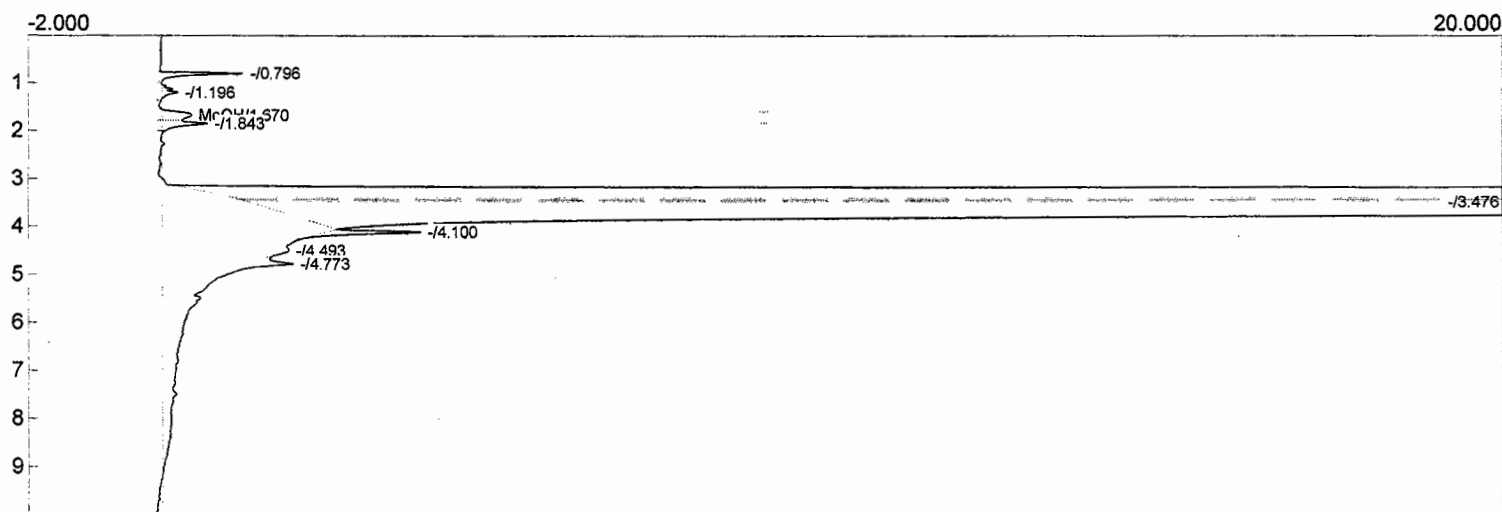
Component	Retention	Area
MeOH	1.706	14.6946
		14.6946

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/21/2011 09:02:14
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR257.CHR () *4C*
 Sample: FCCU-1241 Run *3* Unspiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



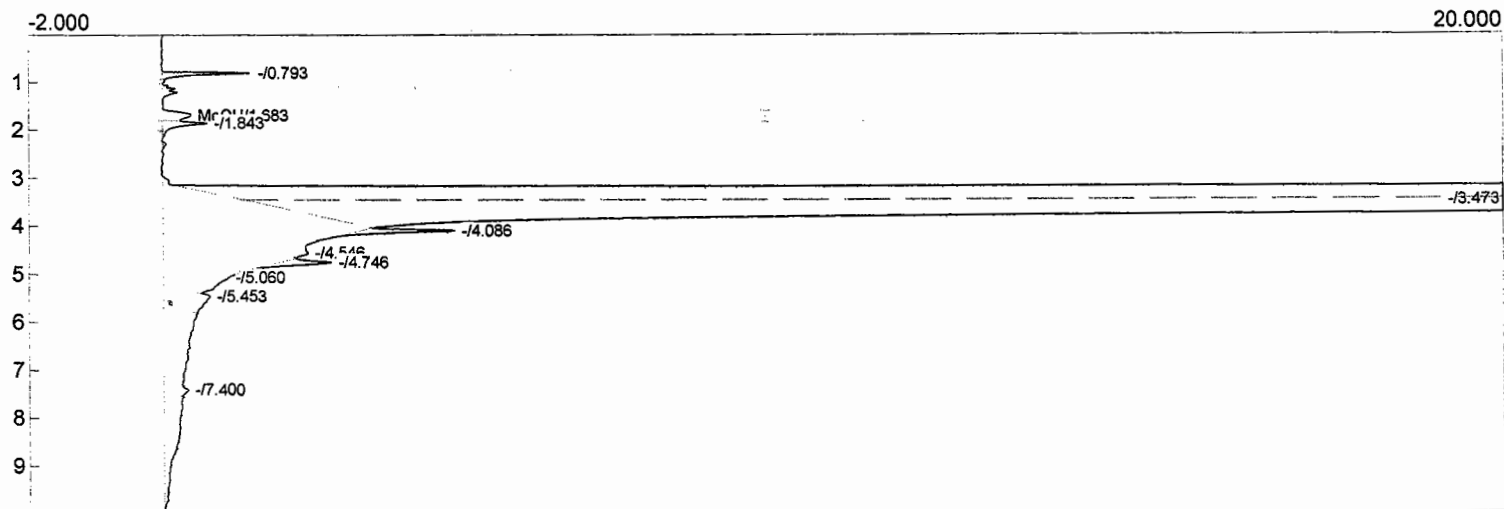
Component	Retention	Area
MeOH	1.660	3.7700
		3.7700

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/21/2011 09:21:32
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR258.CHR () *ll*
 Sample: FCCU-1241 Run *1* Unspiked Tube
 Operator: E. Vogt *3*
 Comments: 4 ml 3% n-propanol tube extraction volume



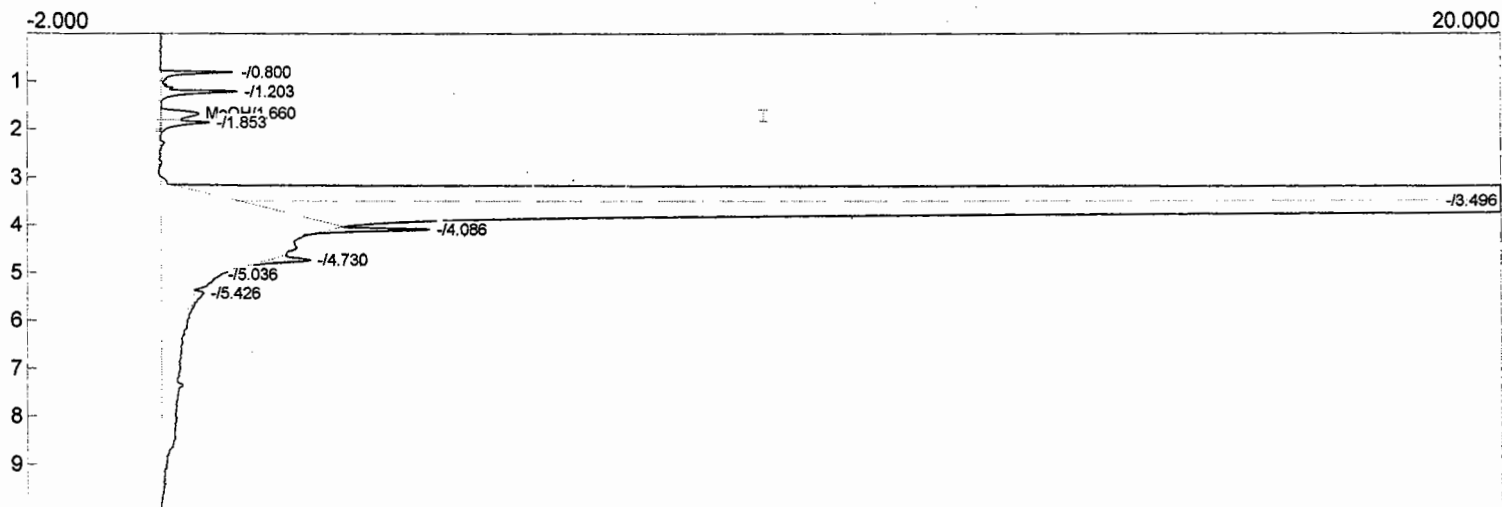
Component	Retention	Area
MeOH	1.670	4.7467
		4.7467

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/21/2011 09:38:19
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR259.CHR () *46*
 Sample: FCCU-1241 Run *3* Unspiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



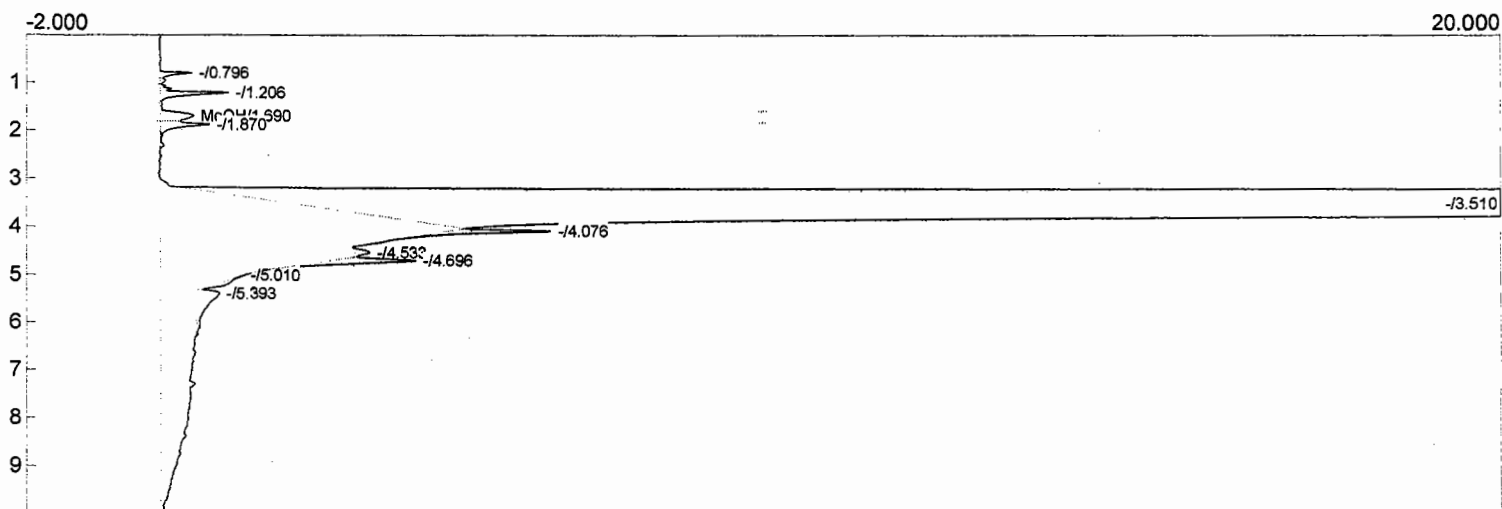
Component	Retention	Area
MeOH	1.683	4.2436
		4.2436

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 10:33:45
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR262.CHR ()
Sample: FCCU-1241 Run 4 Unspiked Tube
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



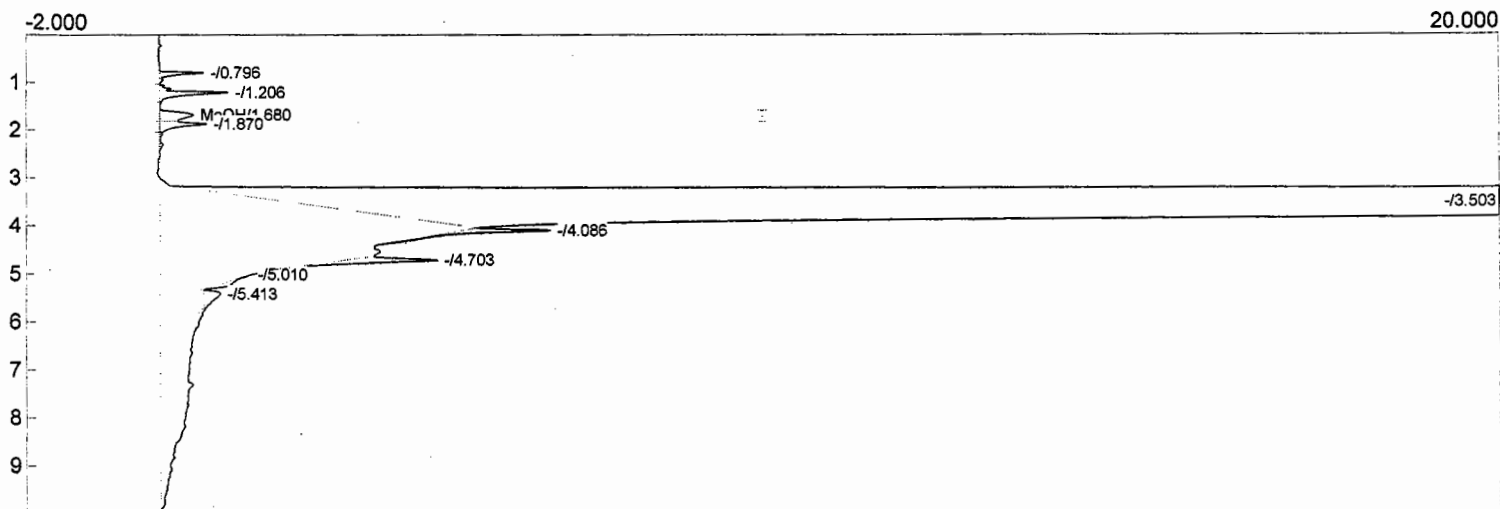
Component	Retention	Area
MeOH	1.660	5.5744
		5.5744

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/21/2011 10:50:53
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR263.CHR ()
 Sample: FCCU-1241 Run 4 Unspiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



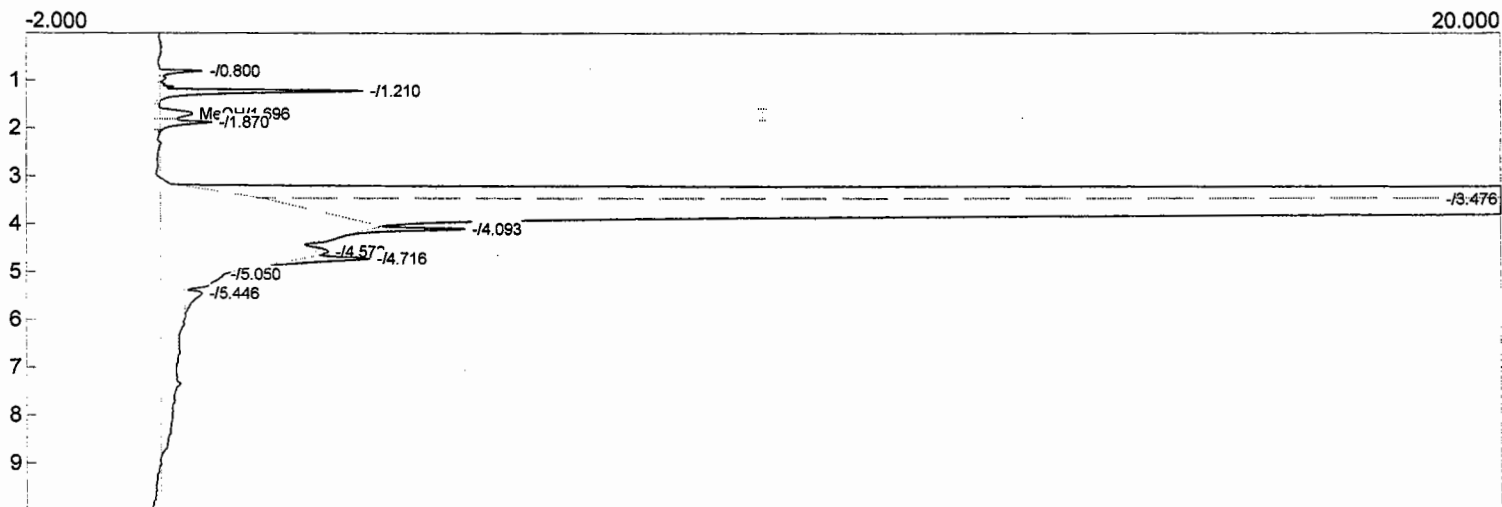
Component	Retention	Area
MeOH	1.690	4.7031
		4.7031

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/21/2011 11:30:03
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR265.CHR ()
 Sample: FCCU-1241 Run 4 Unspiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



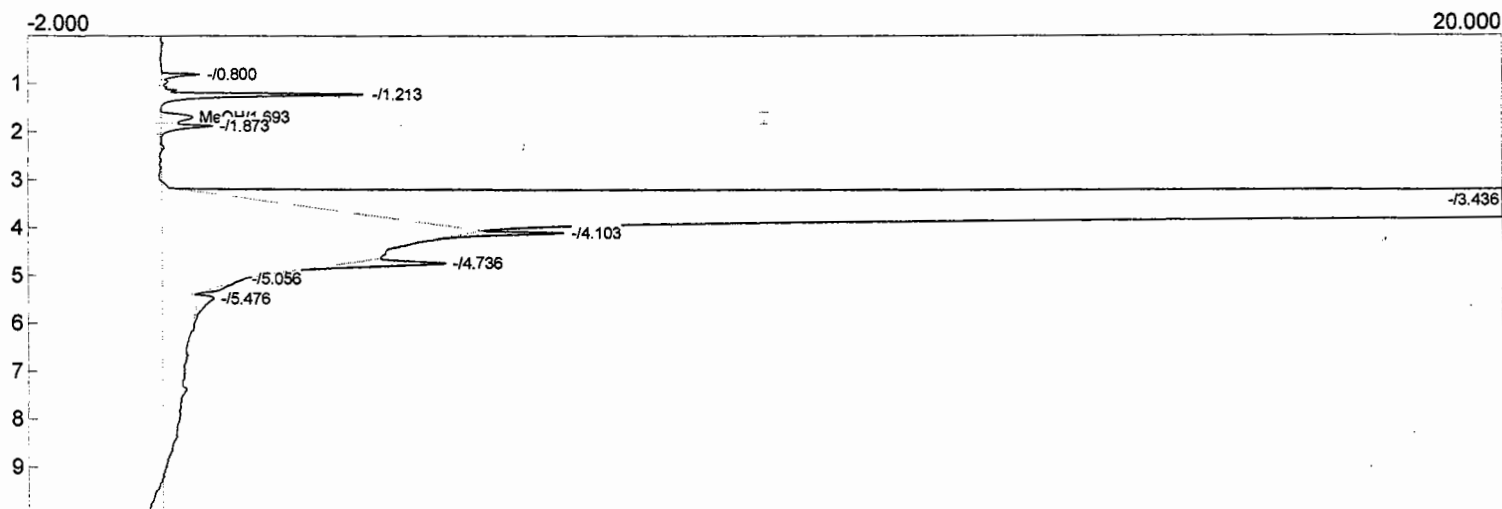
Component	Retention	Area
MeOH	1.680	4.8343
		4.8343

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/21/2011 11:47:31
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR266.CHR ()
 Sample: FCCU-1241 Run 5 Unspiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



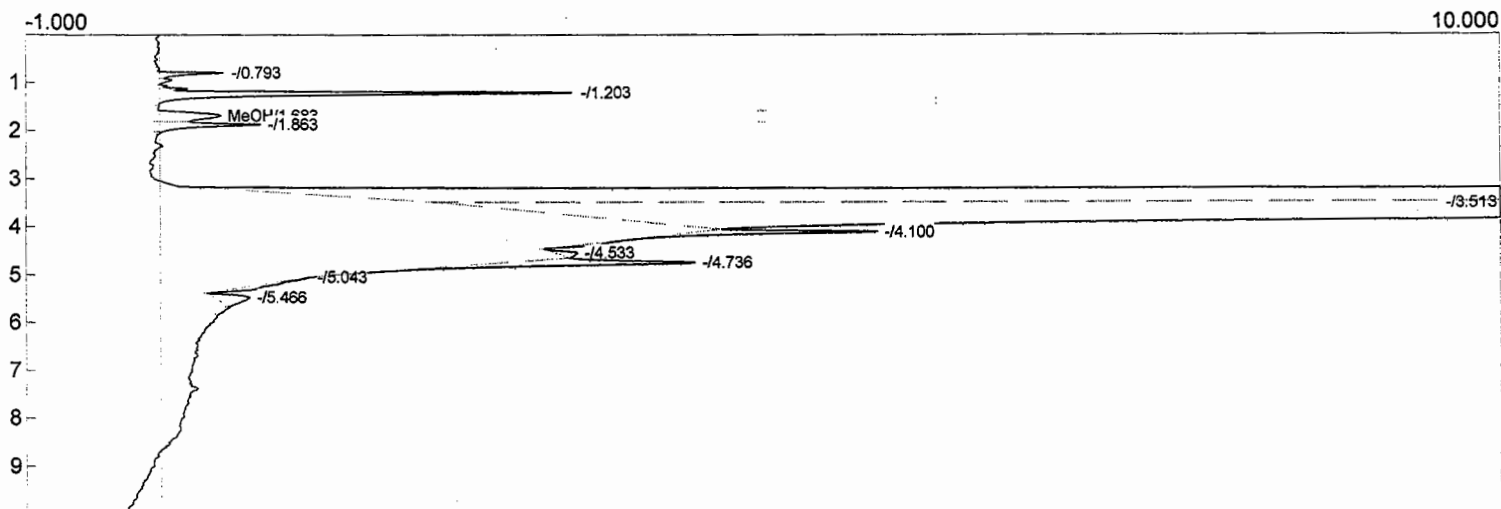
Component	Retention	Area
MeOH	1.696	4.8064
		4.8064

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 12:05:10
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR267.CHR ()
Sample: FCCU-1241 Run 5 Unspiked Tube
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



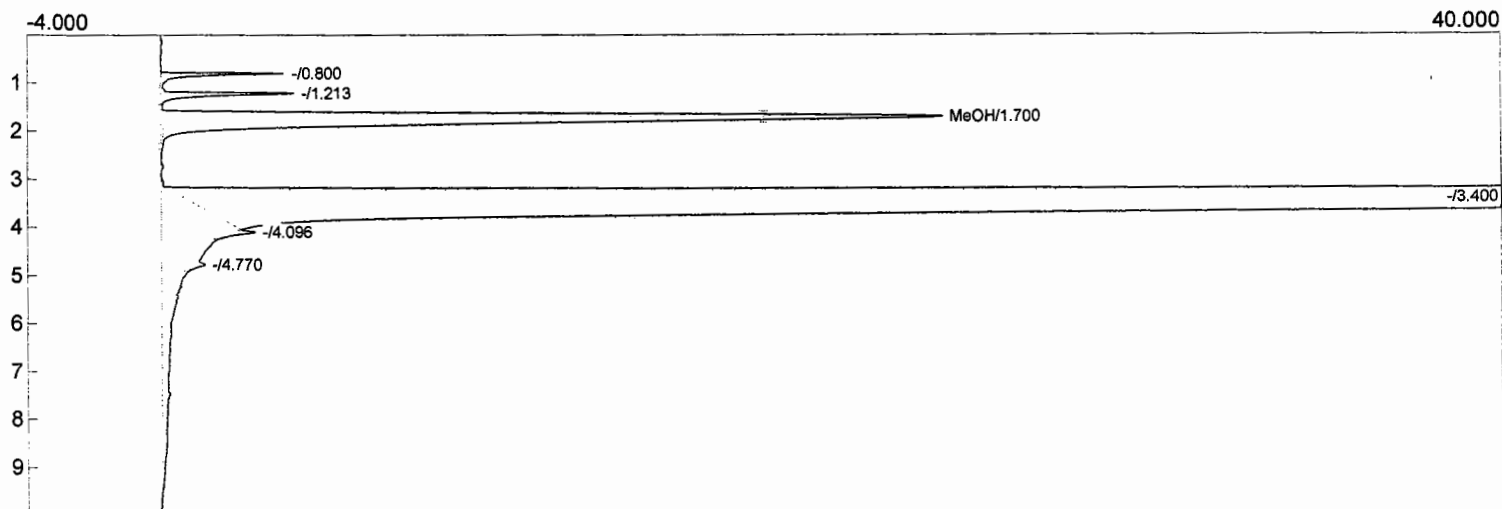
Component	Retention	Area
MeOH	1.693	4.6133
		4.6133

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/21/2011 12:22:36
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR268.CHR ()
 Sample: FCCU-1241 Run 5 Unspiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



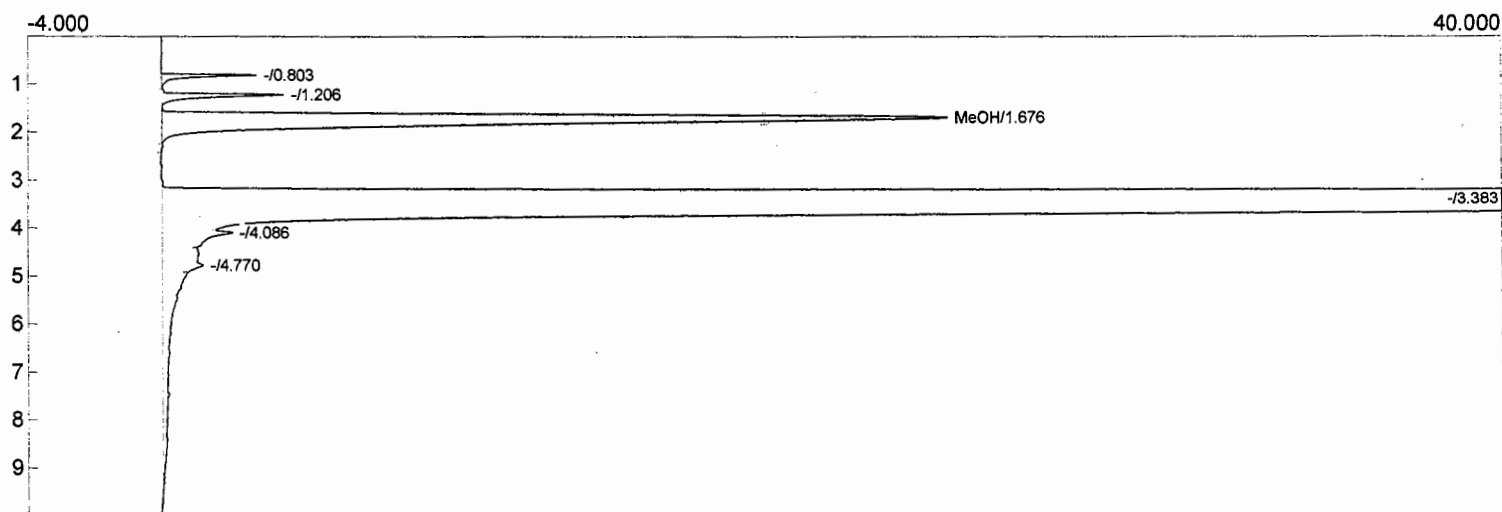
Component	Retention	Area
MeOH	1.683	4.6096
		4.6096

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/20/2011 11:31:28
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR235.CHR ()
Sample: FCCU-1241 Run 3 / Spiked Tube 2x dil.
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



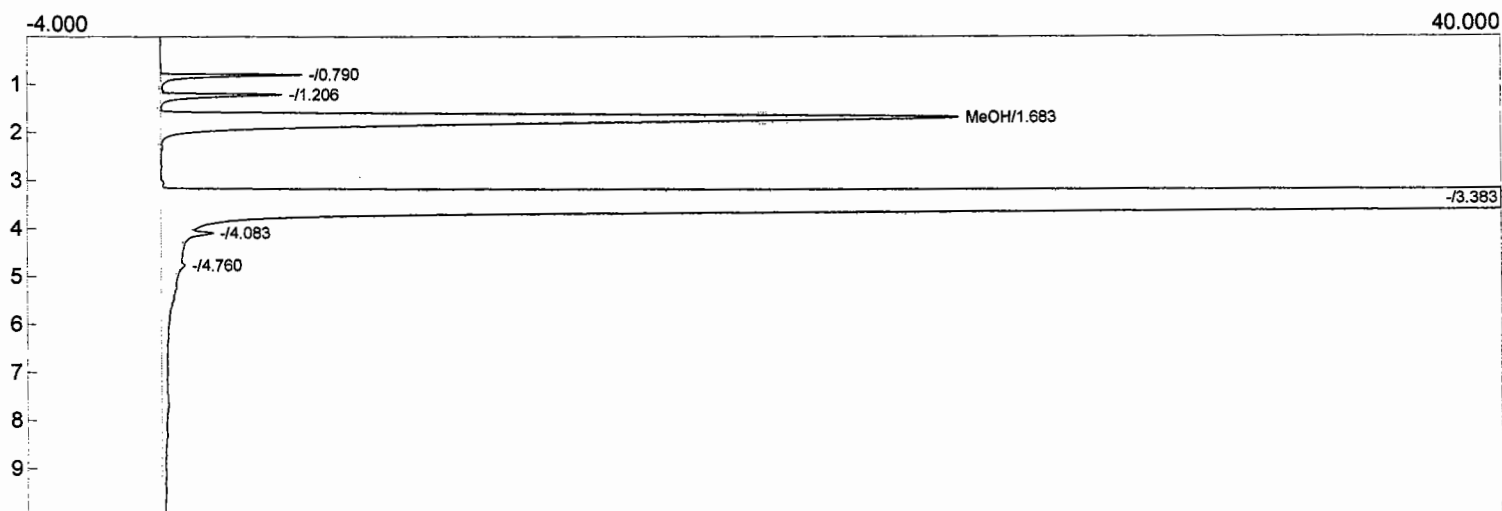
Component	Retention	Area
MeOH	1.700	293.2545
		293.2545

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/20/2011 11:54:55
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR236.CHR ()
Sample: FCCU-1241 Run 1 Spiked Tube 2x dil.
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



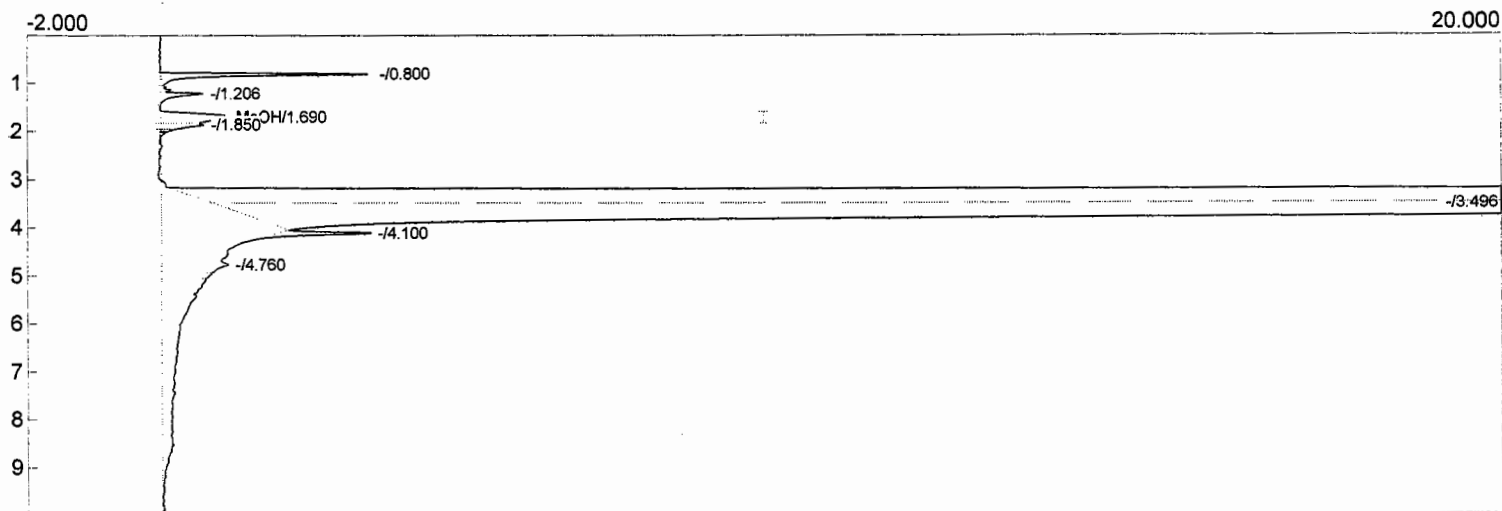
Component	Retention	Area
MeOH	1.676	300.6102
		300.6102

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/20/2011 12:12:13
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR237.CHR ()
Sample: FCCU-1241 Run 3 Spiked Tube 2x dil.
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



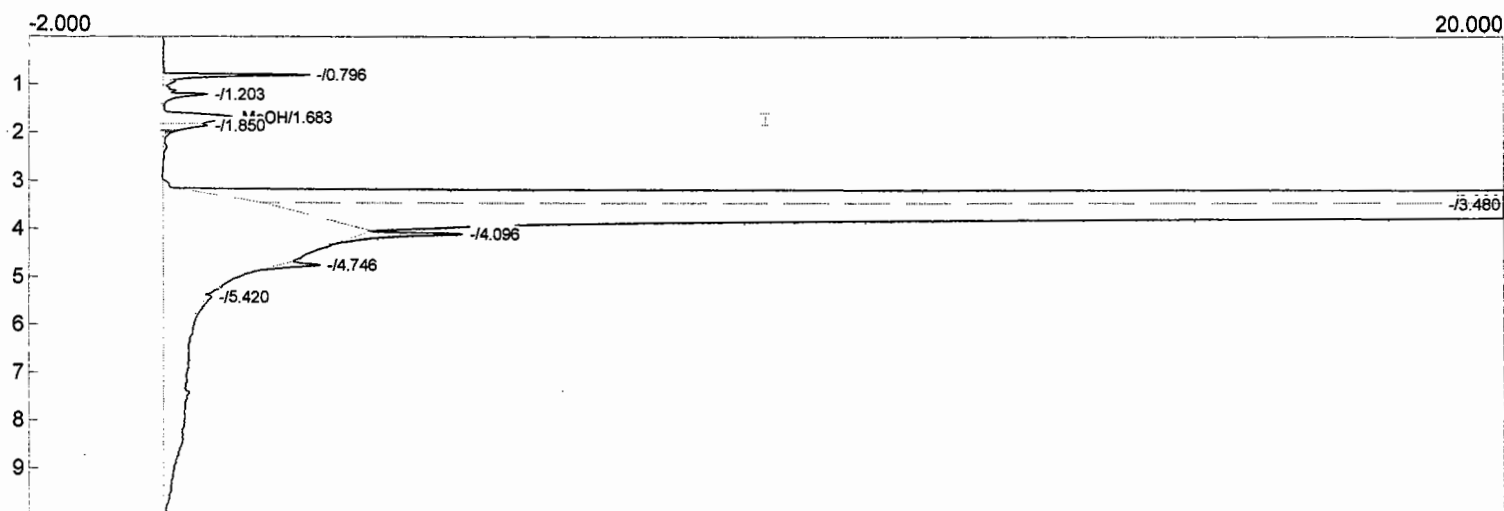
Component	Retention	Area
MeOH	1.683	291.9994
		291.9994

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/20/2011 12:29:26
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR238.CHR ()
 Sample: FCCU-1241 Run 4 Spiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



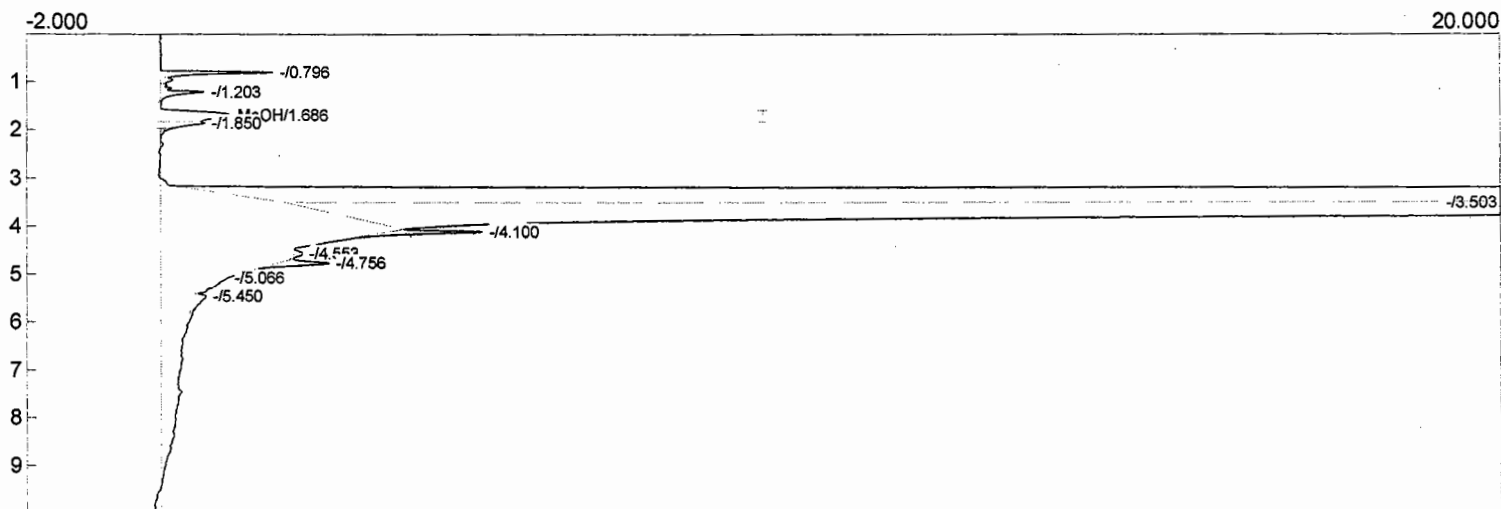
Component	Retention	Area
MeOH	1.690	11.1482
		11.1482

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/20/2011 12:46:39
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR239.CHR ()
Sample: FCCU-1241 Run 4 Spiked Tube
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



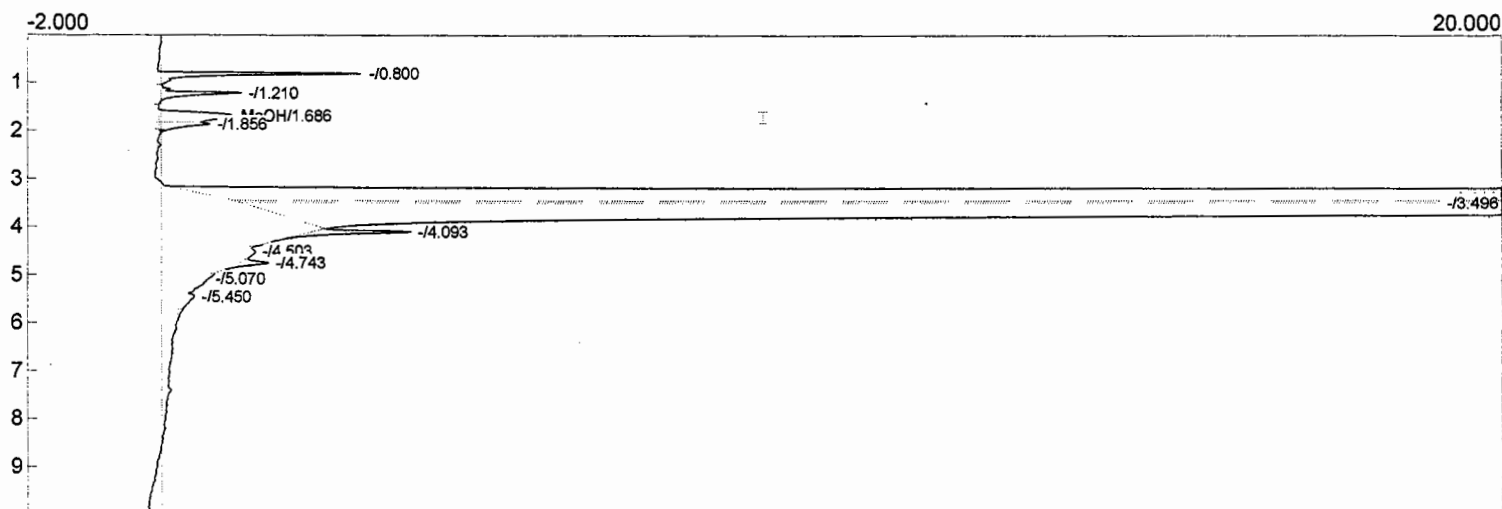
Component	Retention	Area
MeOH	1.683	11.0736
		11.0736

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/20/2011 13:04:11
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR240.CHR ()
 Sample: FCCU-1241 Run 4 Spiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



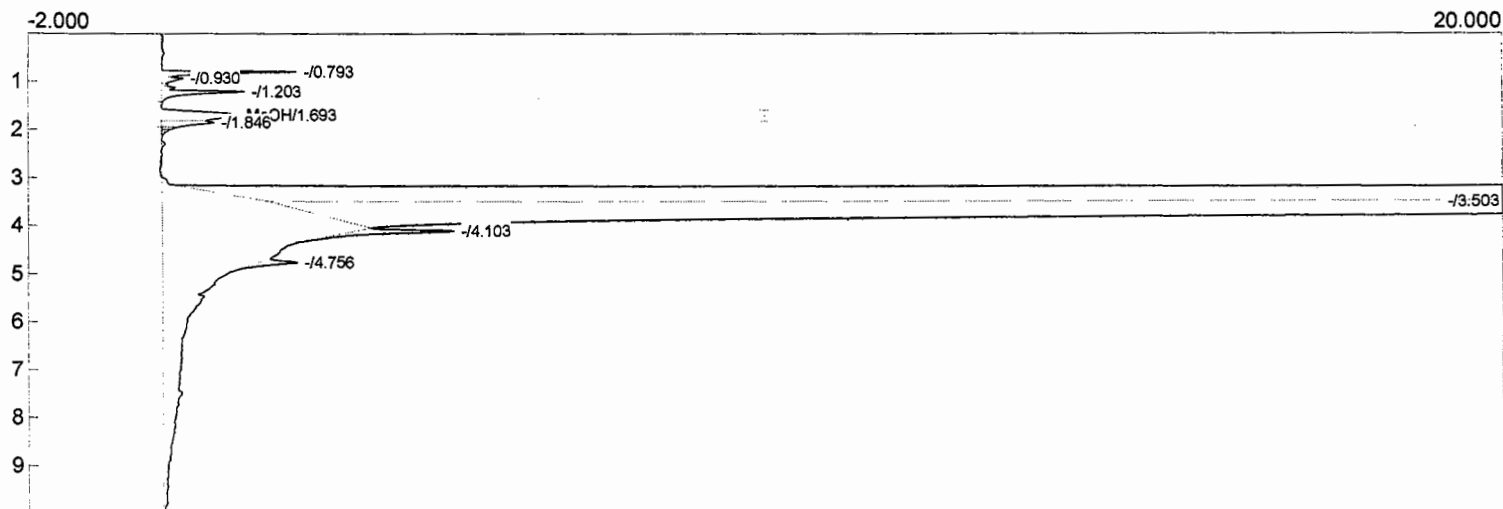
Component	Retention	Area
MeOH	1.686	11.6441
		11.6441

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/20/2011 13:22:44
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR241.CHR ()
 Sample: FCCU-1241 Run 5 Spiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



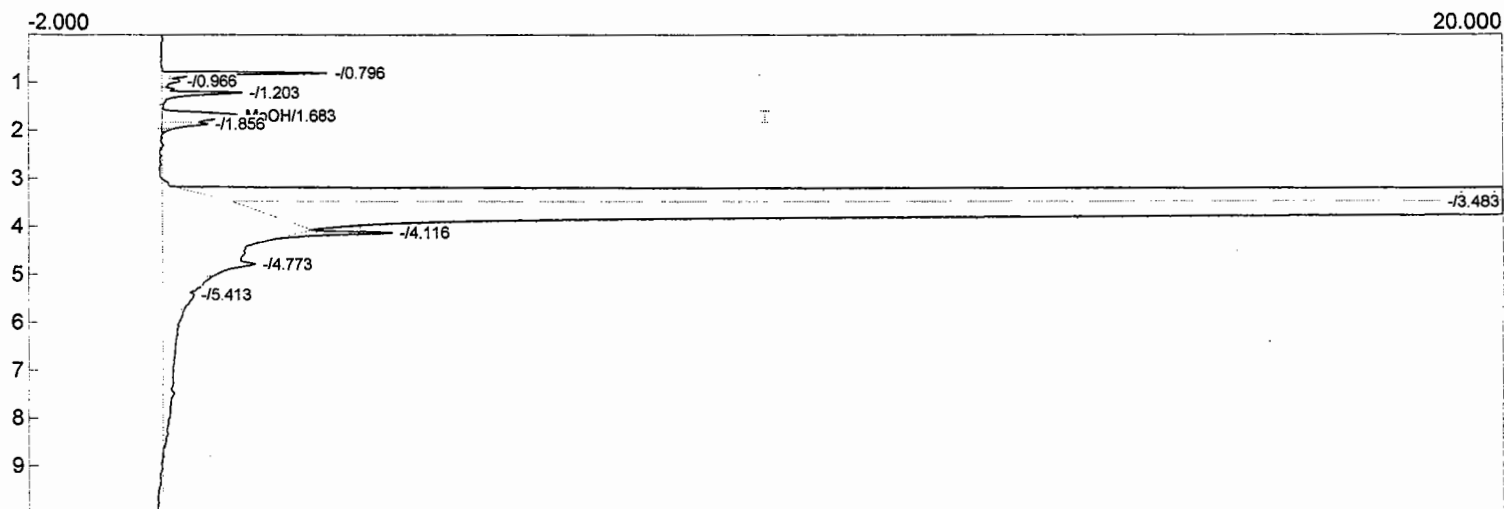
Component	Retention	Area
MeOH	1.686	12.0986
		12.0986

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/20/2011 13:40:27
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR242.CHR ()
 Sample: FCCU-1241 Run 5 Spiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



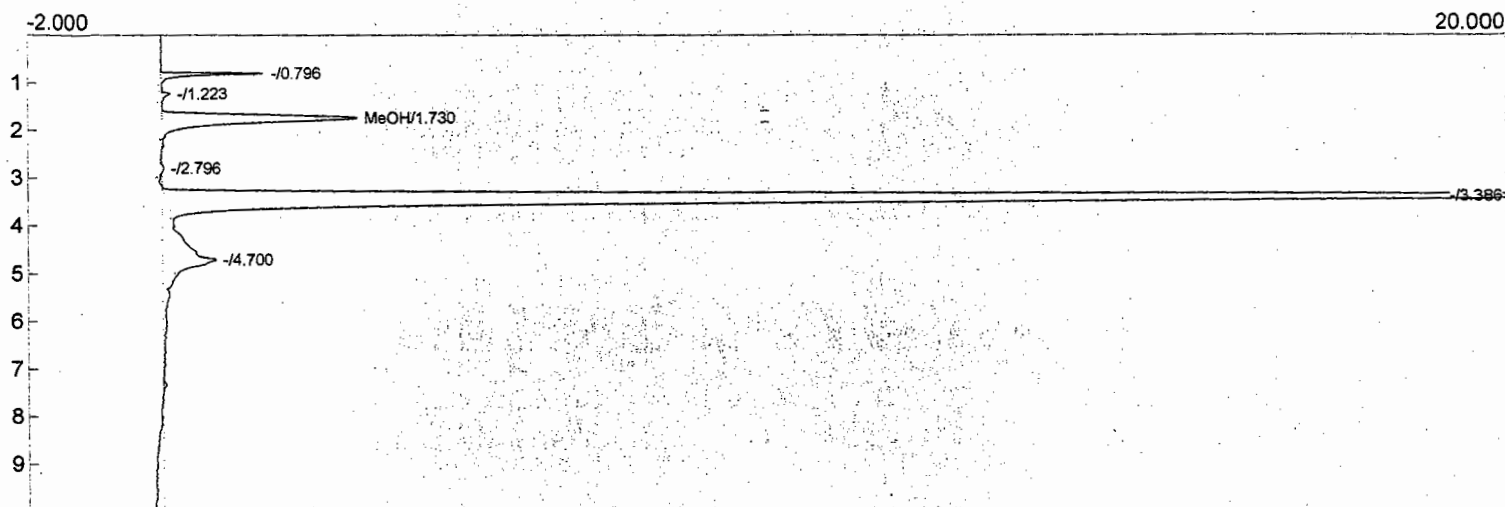
Component	Retention	Area
MeOH	1.693	12.0387
		12.0387

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/20/2011 13:58:04
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR243.CHR ()
 Sample: FCCU-1241 Run 5 Spiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



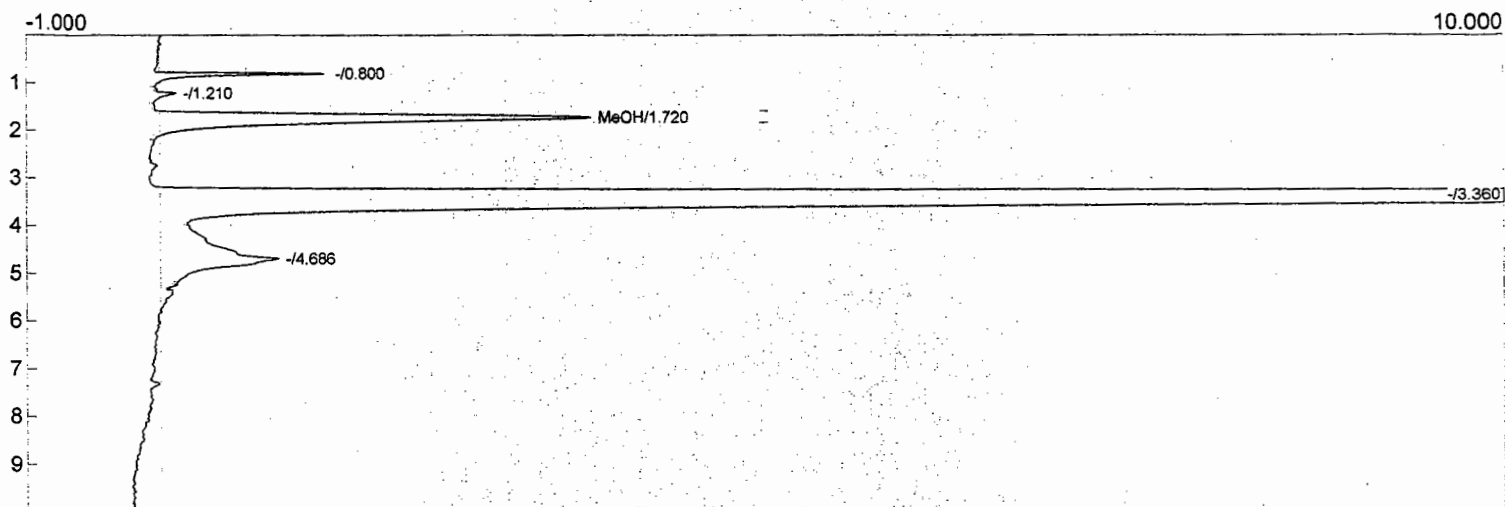
Component	Retention	Area
MeOH	1.683	11.9016
		11.9016

Lab Name: AM Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 22:34:42
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR300.chr ()
Sample: MeOH Spiked Reagent Blank
Operator: E. Vogt



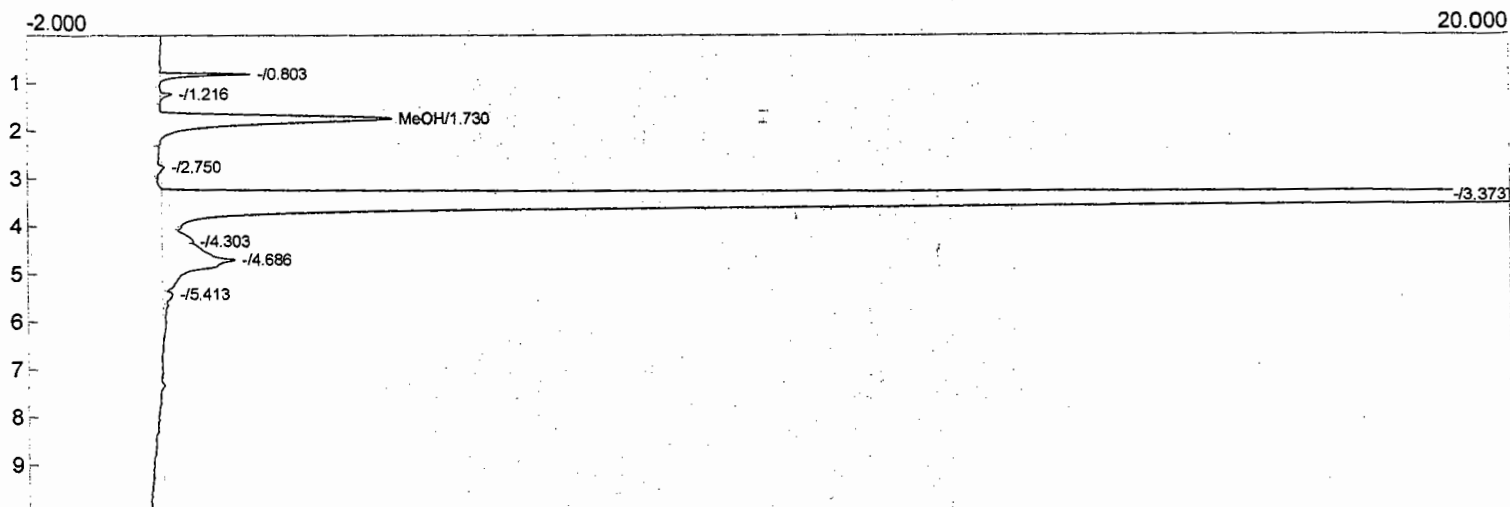
Component	Retention	Area
MeOH	1.730	32.7489
		32.7489

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 22:17:10
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR299.chr ()
Sample: MeOH Spiked Reagent Blank
Operator: E. Vogt



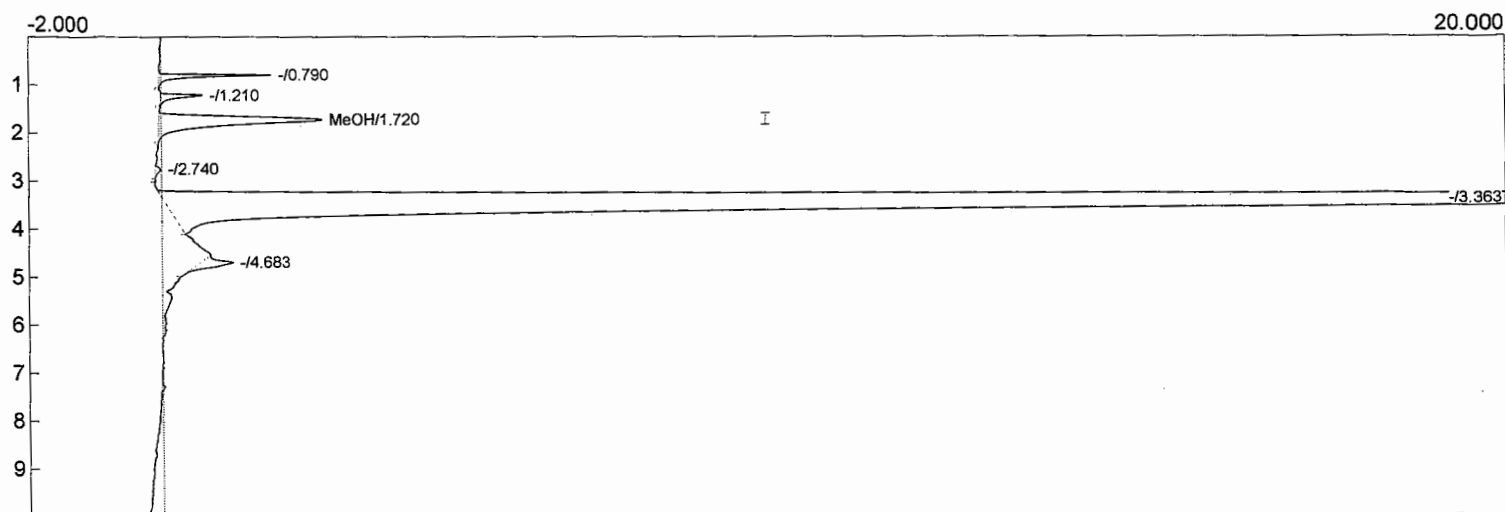
Component	Retention	Area
MeOH	1.720	37.7796
		37.7796

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 22:00:05
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR298.CHR ()
Sample: MeOH Spiked Reagent Blank
Operator: E. Vogt



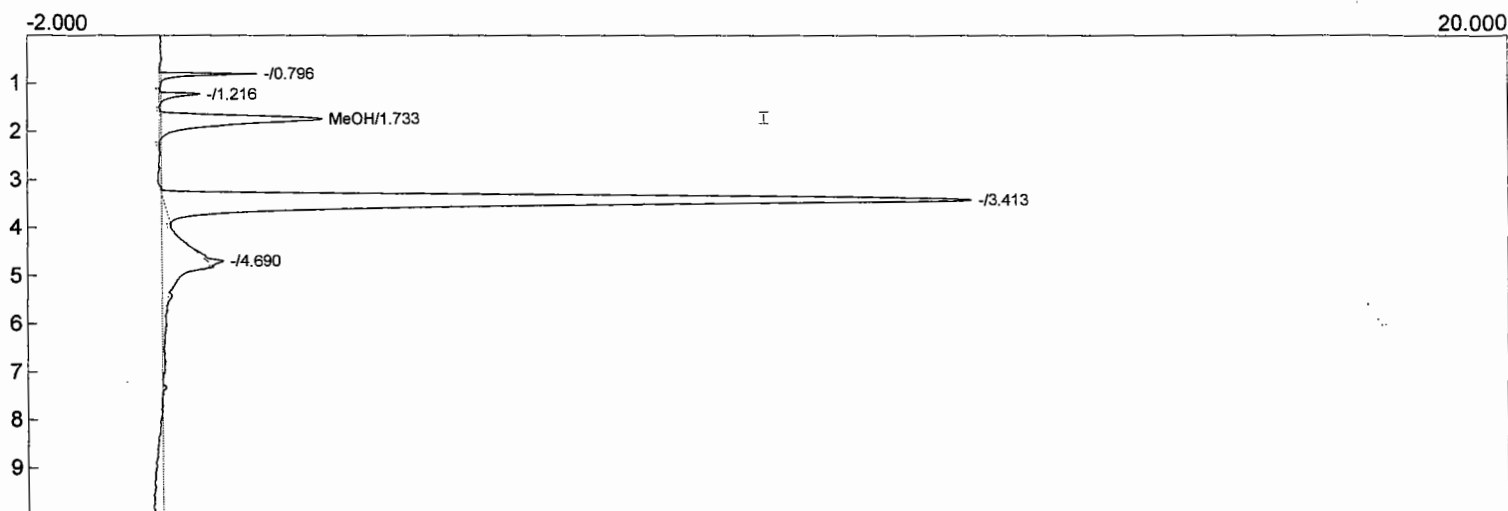
Component	Retention	Area
MeOH	1.730	41.5148
		41.5148

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 21:24:59
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR296.chr ()
Sample: MeOH Spiked Field Blank
Operator: E. Vogt



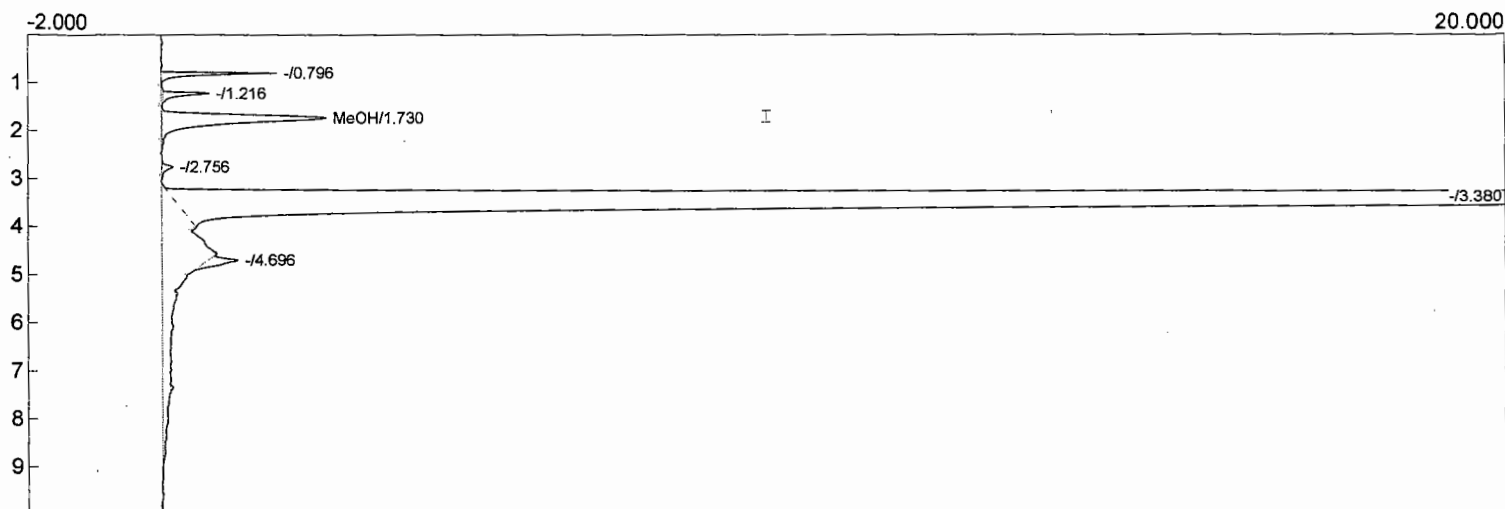
Component	Retention	Area
MeOH	1.720	27.9398
		27.9398

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 21:07:41
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR295.chr ()
Sample: MeOH Spiked Field Blank
Operator: E. Vogt



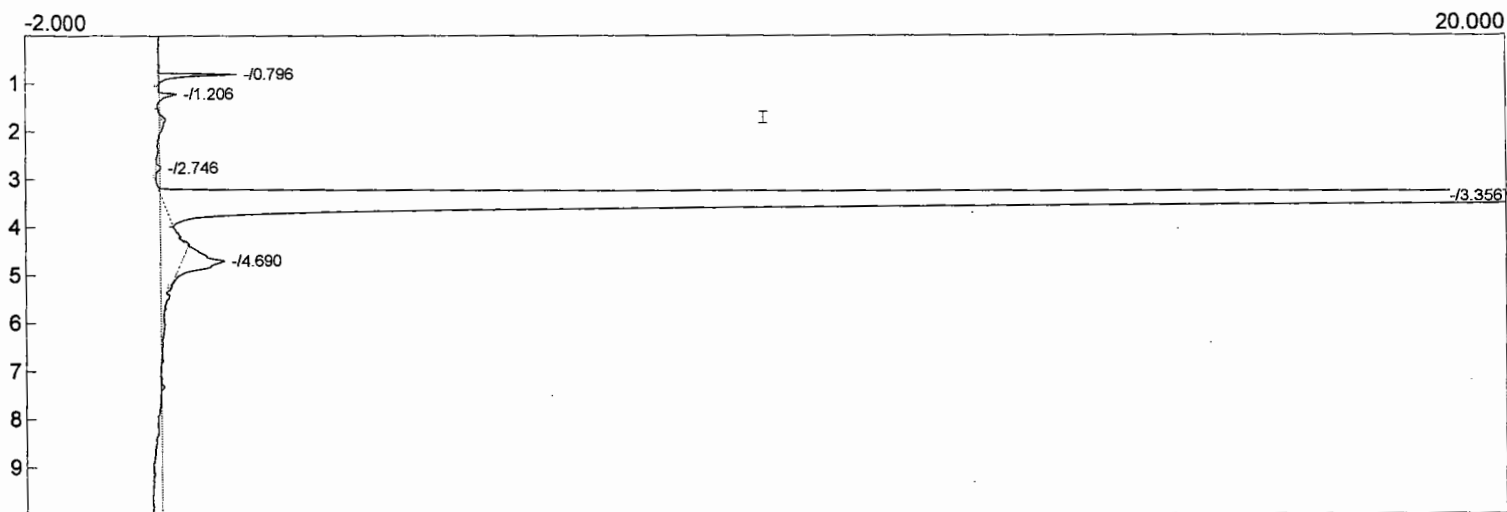
Component	Retention	Area
MeOH	1.733	29.3042
		29.3042

Lab name: AKI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 20:49:44
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR294.chr ()
Sample: MeOH Spiked Field Blank
Operator: E. Vogt



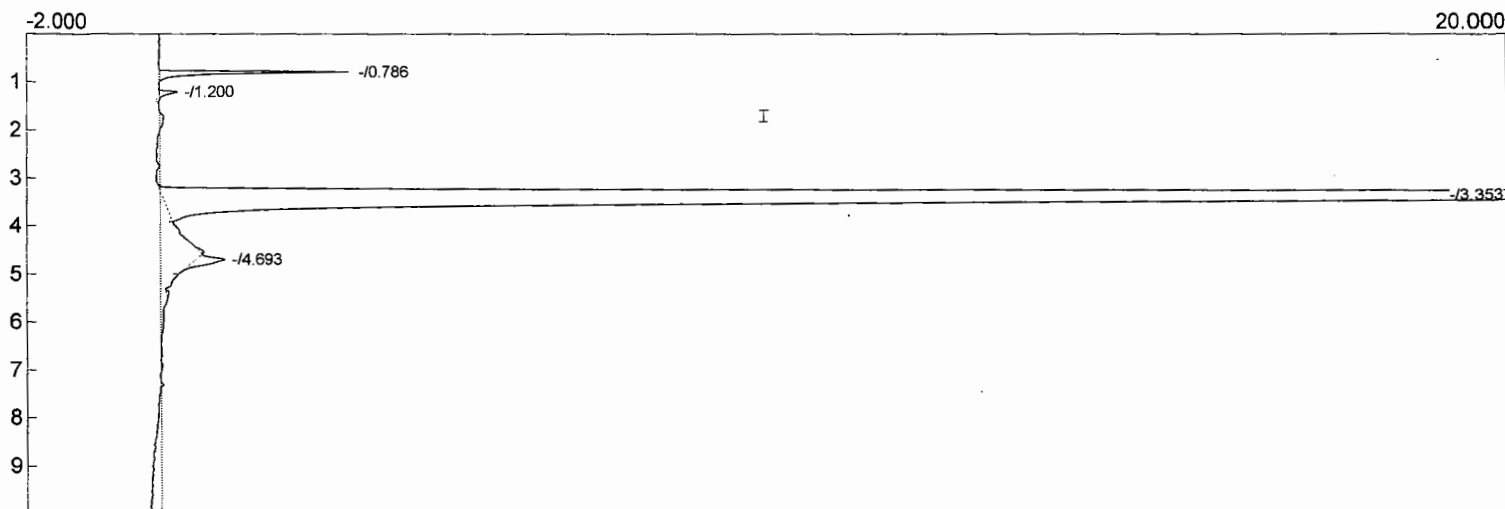
Component	Retention	Area
MeOH	1.730	28.7867
		28.7867

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 20:32:39
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR293.chr ()
Sample: Water Reagent Blank No spike
Operator: E. Vogt



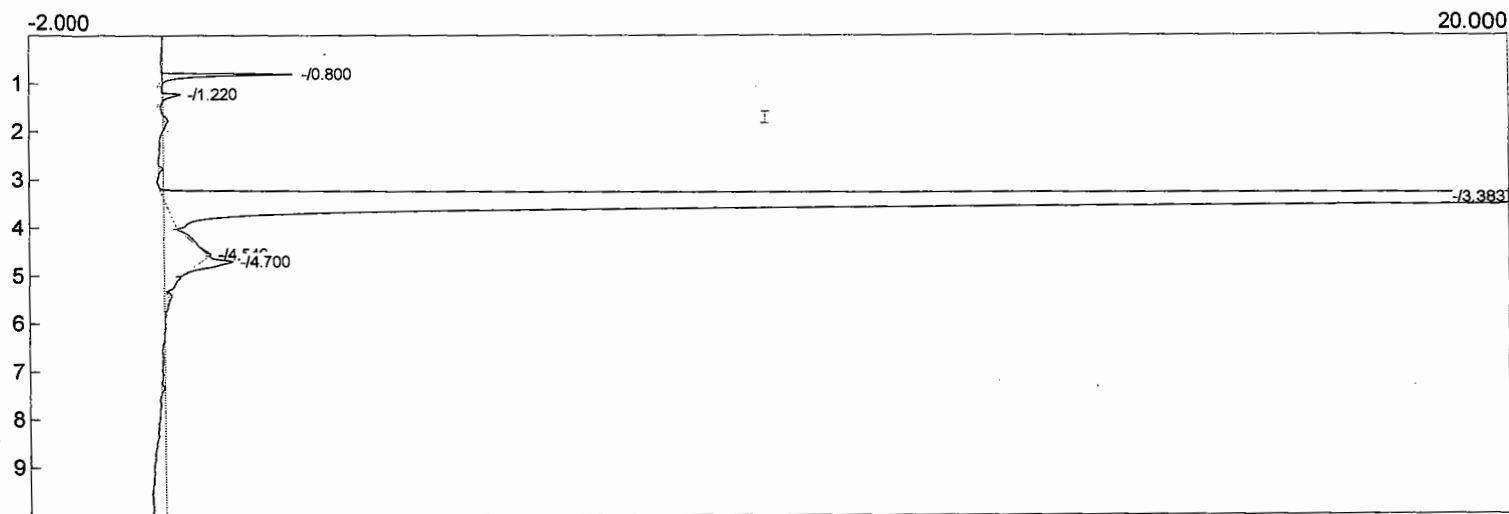
Component	Retention	Area
		0.0000

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 20:15:35
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR292.chr ()
Sample: Water Reagent Blank No Spike
Operator: E. Vogt



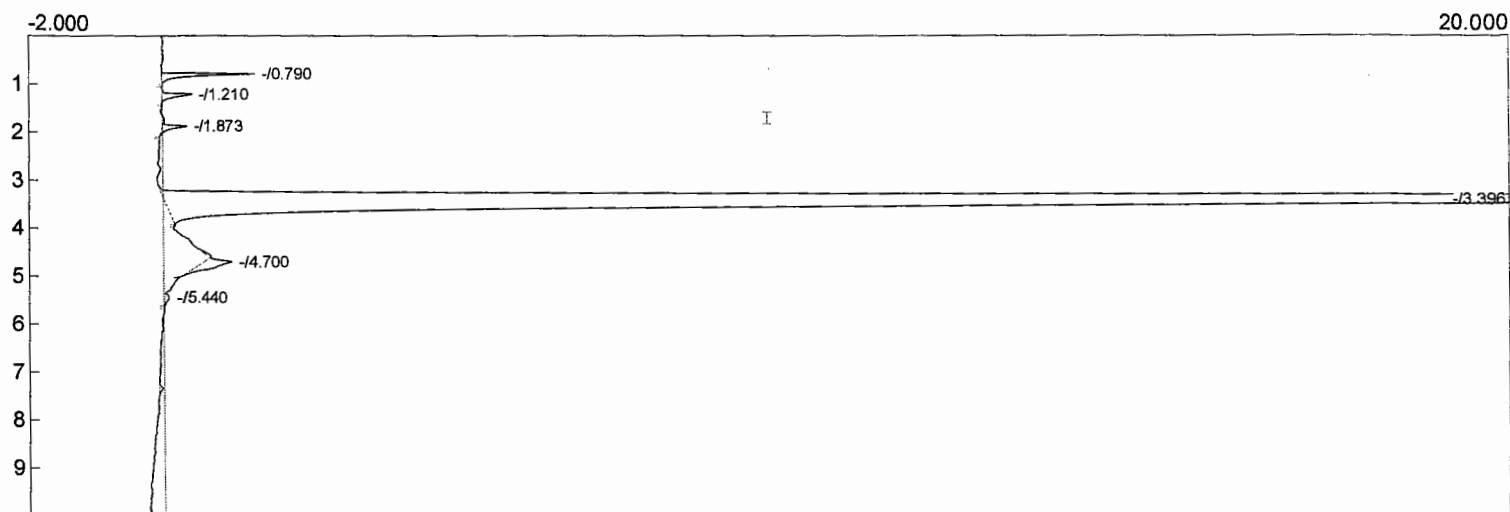
Component	Retention	Area
		0.0000

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 19:41:20
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR290.chr ()
Sample: Water Reagent Blank No Spike
Operator: E. Vogt



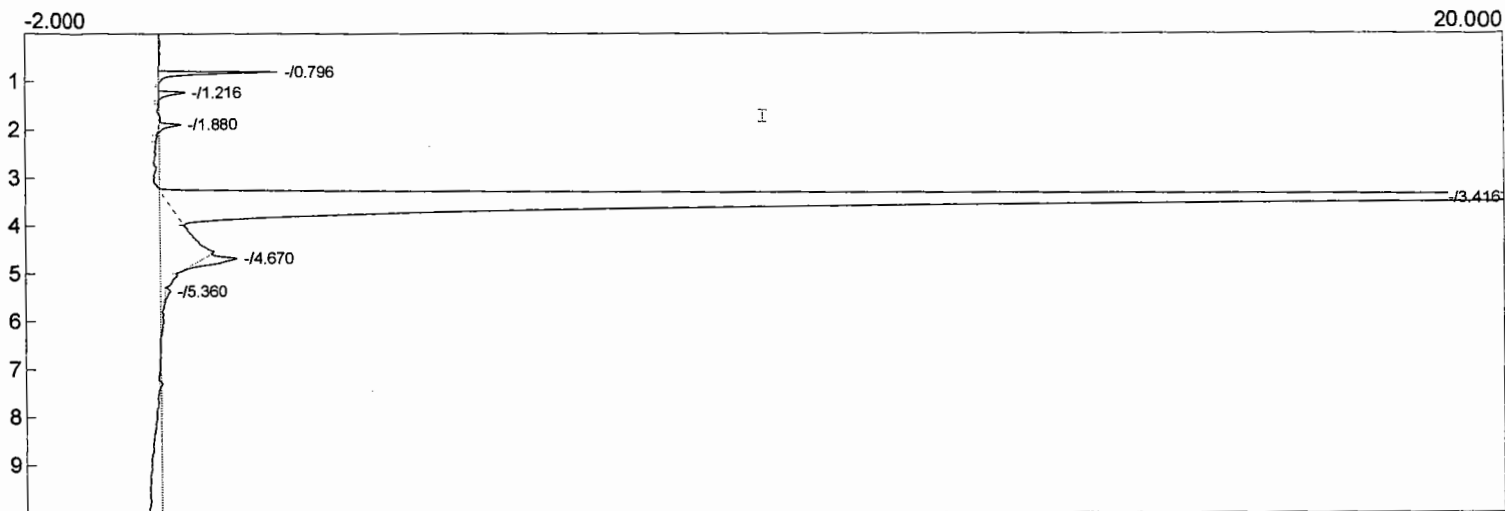
Component	Retention	Area
		0.0000

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 19:24:12
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR289.chr ()
Sample: Water Field Blank No spike
Operator: E. Vogt



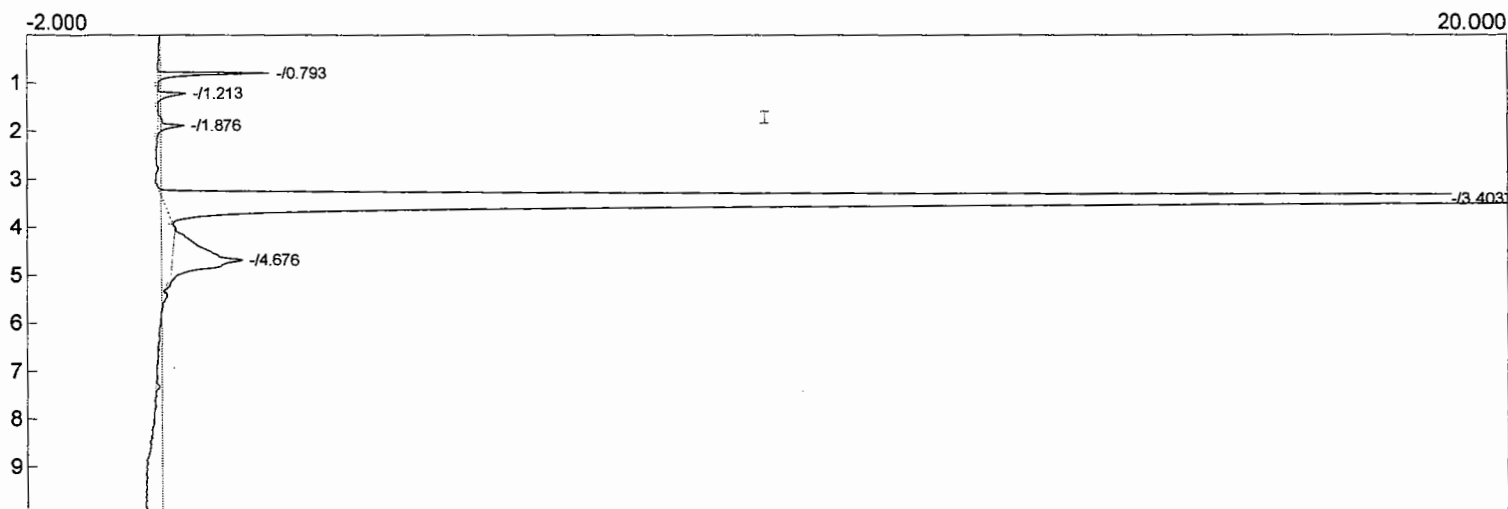
Component	Retention	Area
		0.0000

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 19:06:35
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR288.chr ()
Sample: Water Field Blank No Spike
Operator: E. Vogt



Component	Retention	Area
		0.0000

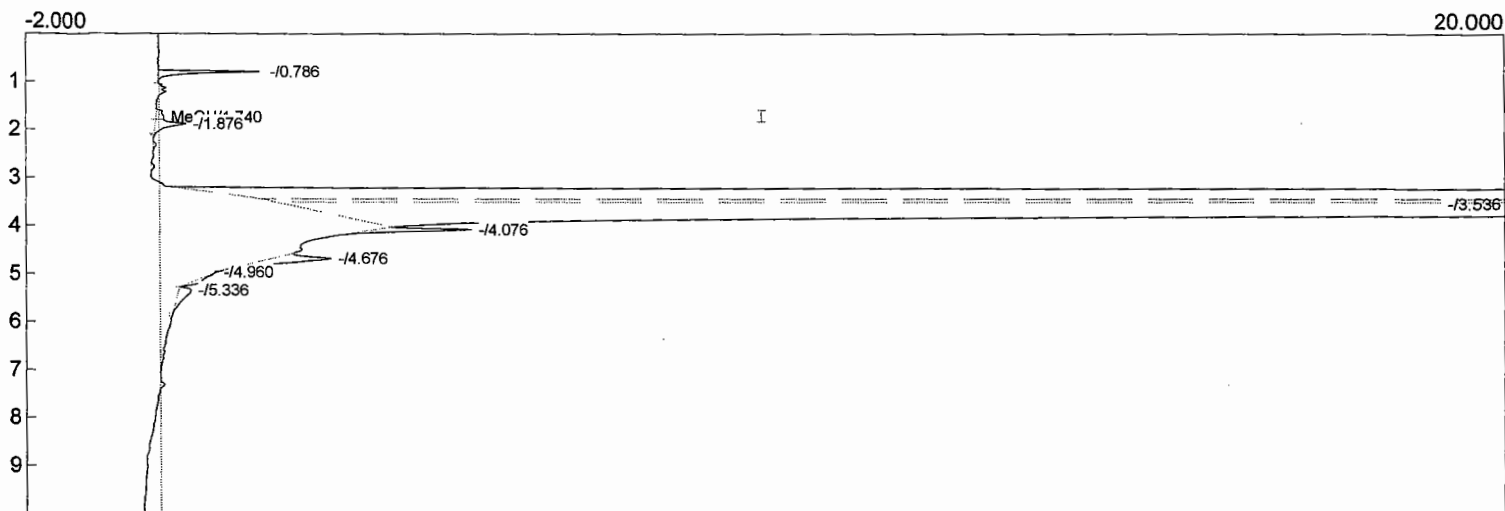
Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 18:48:54
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR287.chr ()
Sample: Water Field Blank No Spike
Operator: E. Vogt



Component	Retention	Area
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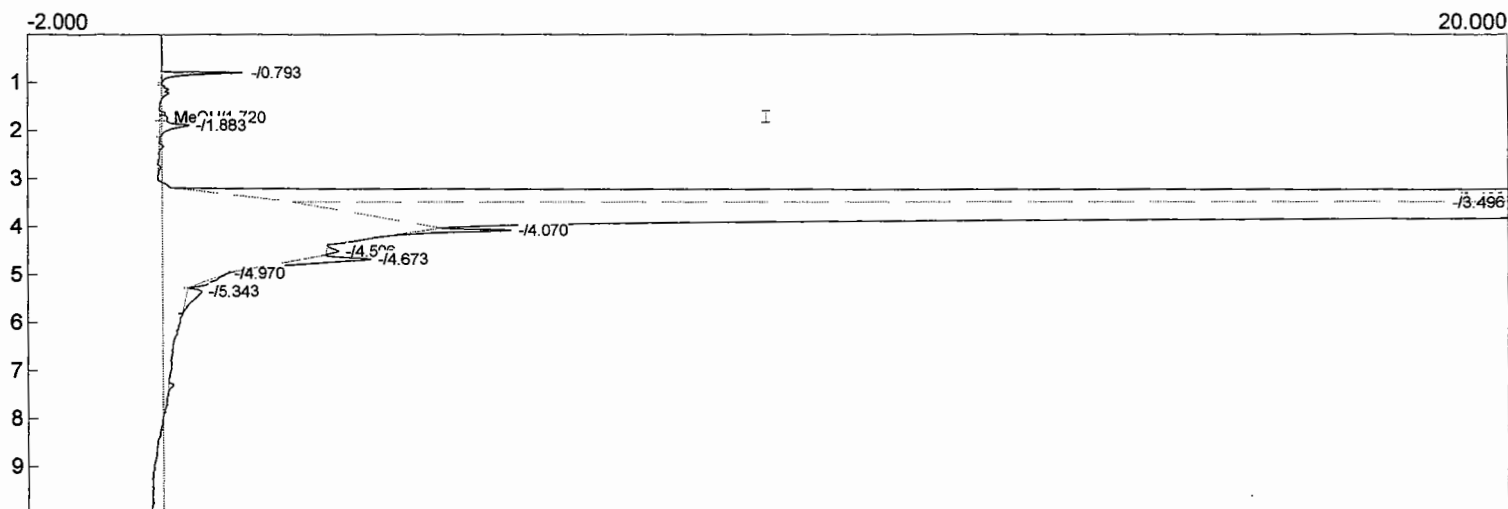
		0.0000
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Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 17:55:12
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR284.CHR ()
Sample: 3% n-propanol Blank
Operator: E. Vogt



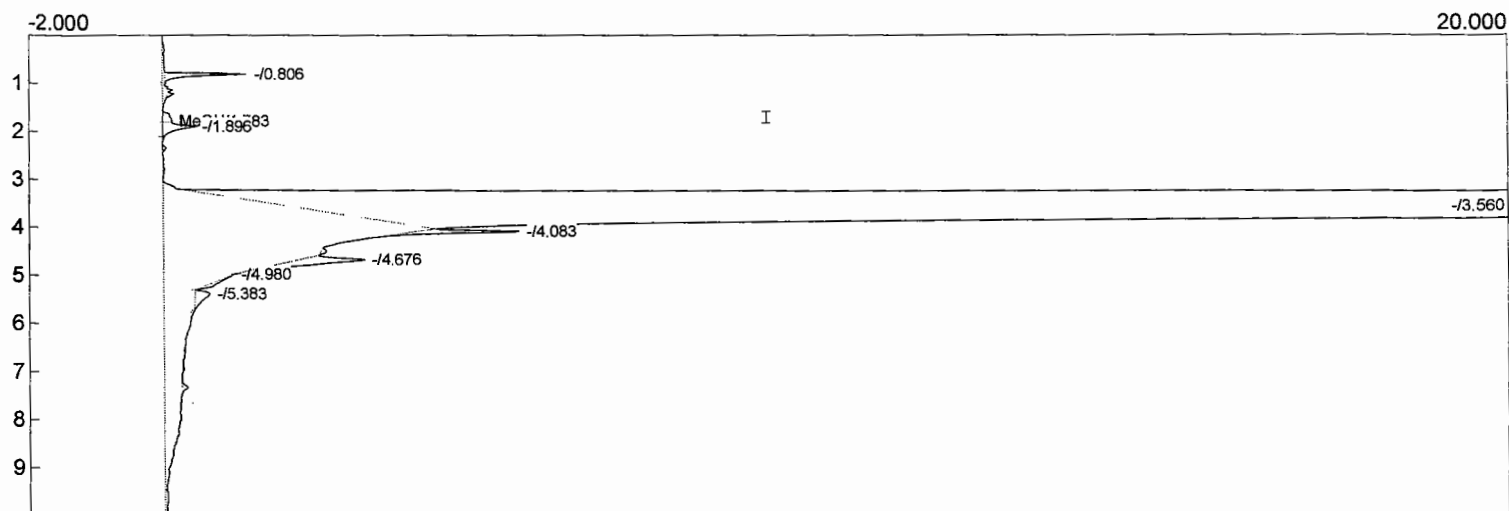
Component	Retention	Area
MeOH	1.740	1.2474
		1.2474

Lap name: AKI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 17:37:00
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR283.CHR ()
Sample: 3% n-propanol Blank
Operator: E. Vogt



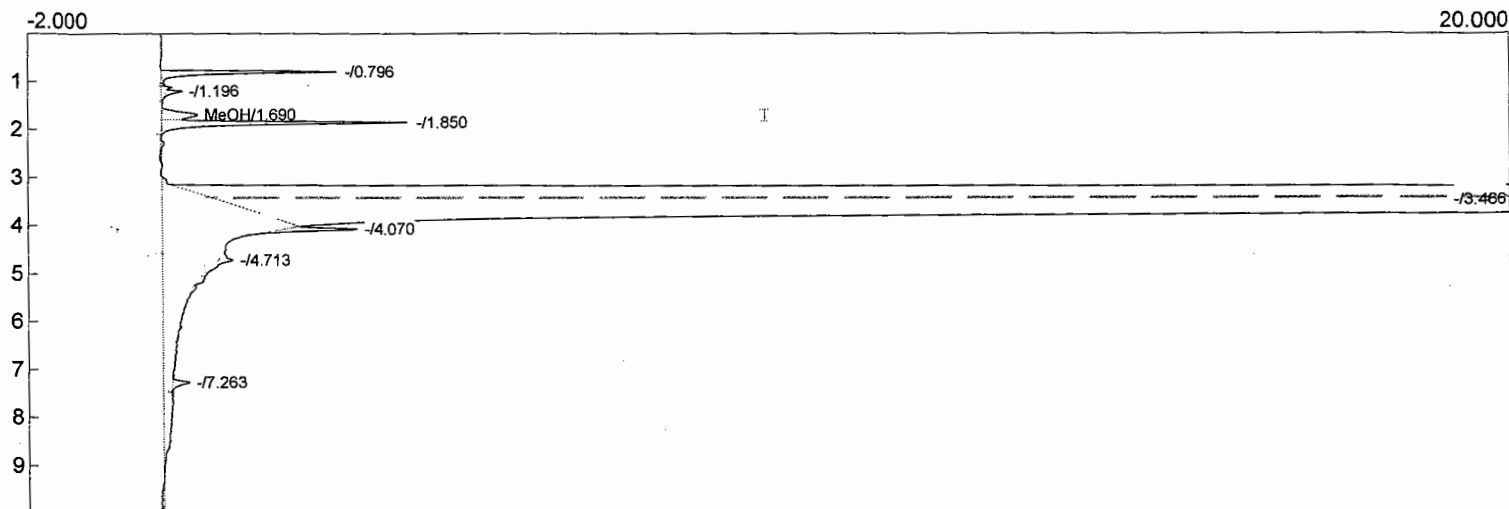
Component	Retention	Area
MeOH	1.720	0.6822
		0.6822

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 17:18:33
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR282.chr ()
Sample: 3% n-propanol Blank
Operator: E. Vogt



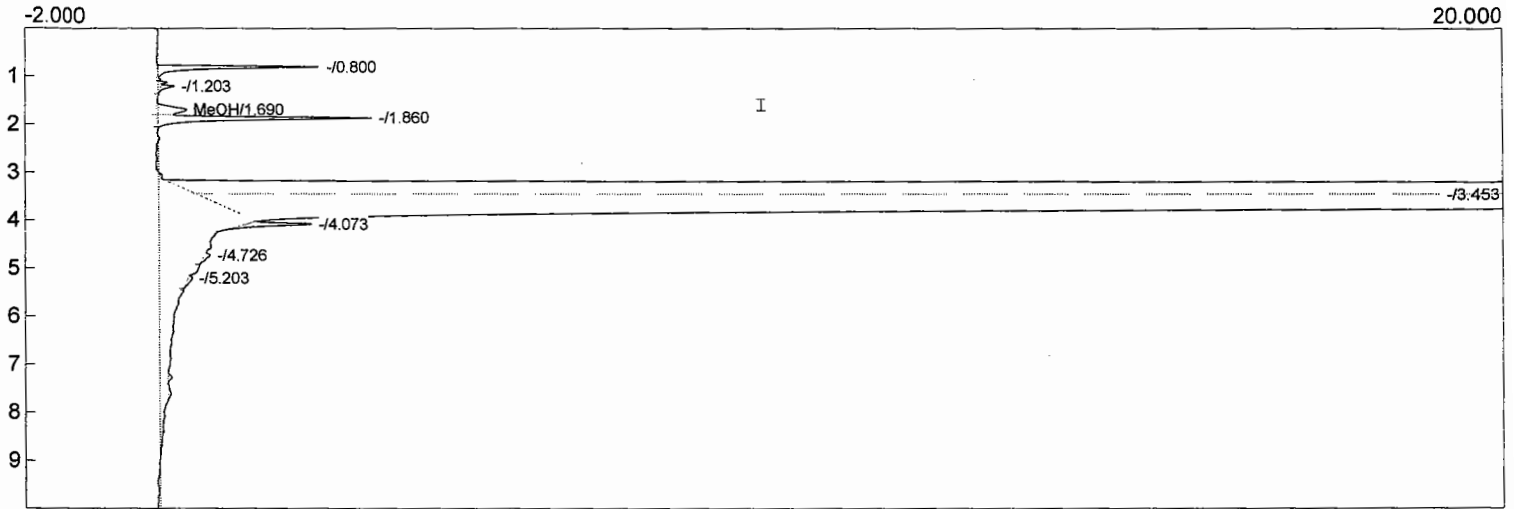
Component	Retention	Area
MeOH	1.783	1.3652
		1.3652

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/22/2011 10:04:45
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR302.CHR ()
Sample: Field Blank unspiked Tube
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



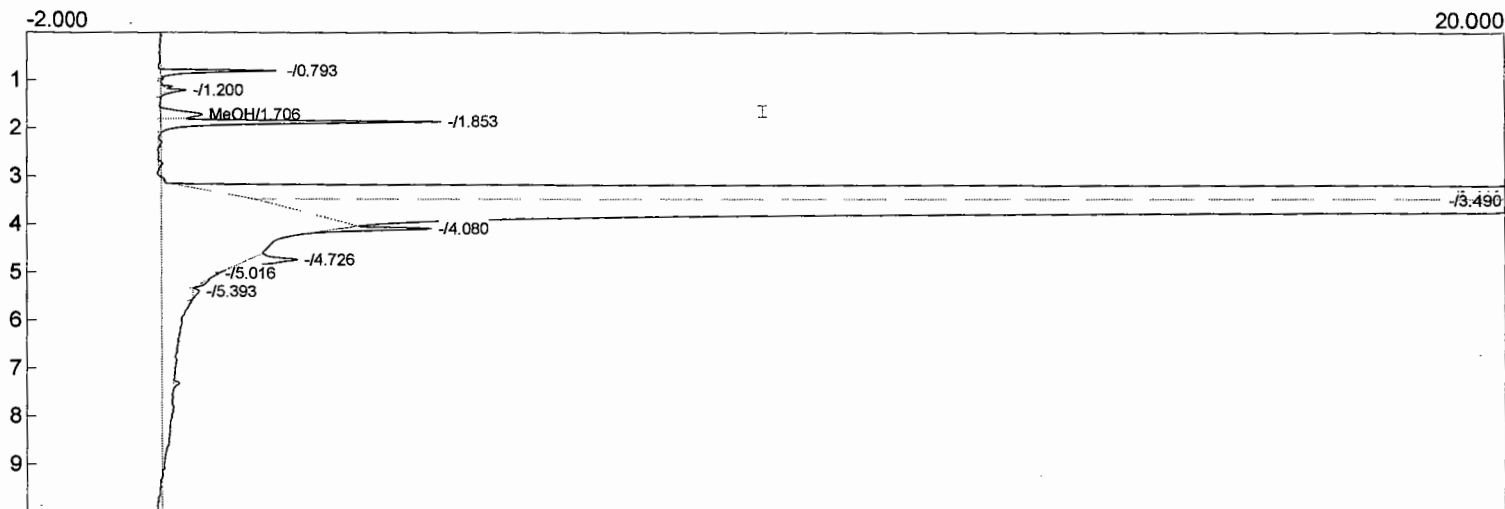
Component	Retention	Area
MeOH	1.690	4.5134
		4.5134

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/22/2011 10:21:32
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR303.CHR ()
Sample: Field Blank unspiked Tube
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



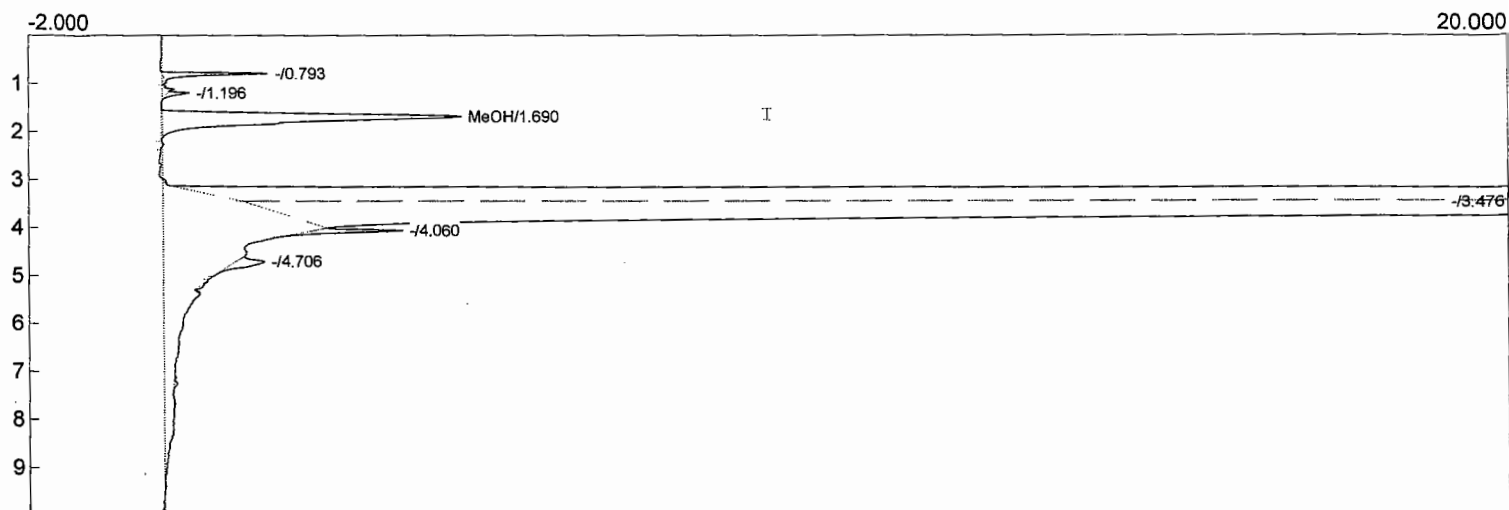
Component	Retention	Area
MeOH	1.690	3.9720
		3.9720

Lab name: ARI Environmental
 Client: Valero, Port Arthur TX
 Analysis date: 07/22/2011 10:39:38
 Method: Syringe Injection
 Description: GC FID
 Carrier: HELIUM
 Data file: MEOH ICR304.CHR ()
 Sample: Field Blank unspiked Tube
 Operator: E. Vogt
 Comments: 4 ml 3% n-propanol tube extraction volume



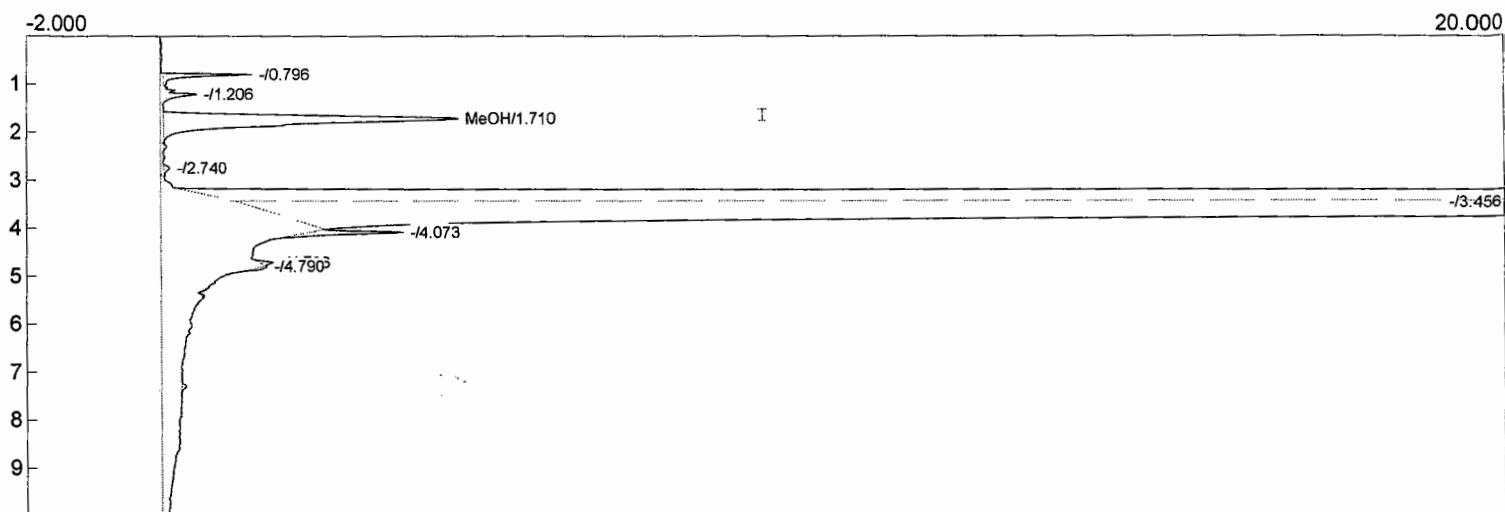
Component	Retention	Area
MeOH	1.706	5.4234
		5.4234

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/22/2011 11:25:04
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR307.CHR ()
Sample: Field Blank Tube Spiked
Operator: E. Vogt



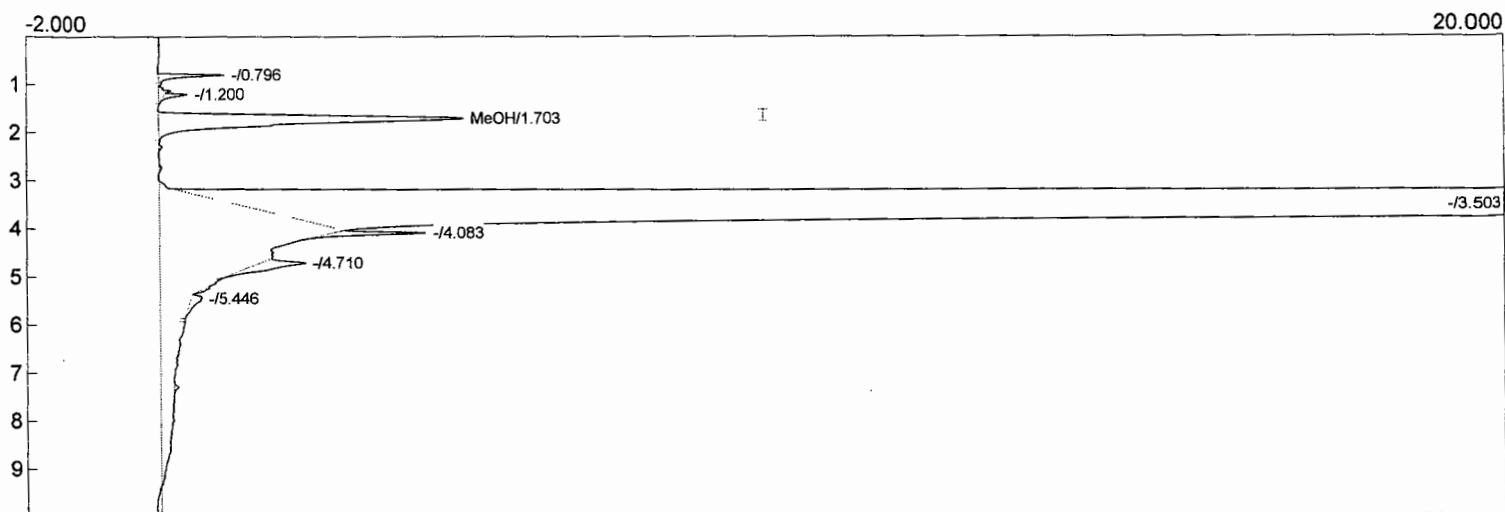
Component	Retention	Area
MeOH	1.690	51.8796
		51.8796

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/22/2011 11:42:02
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR308.CHR ()
Sample: Field Blank Tube Spiked
Operator: E. Vogt



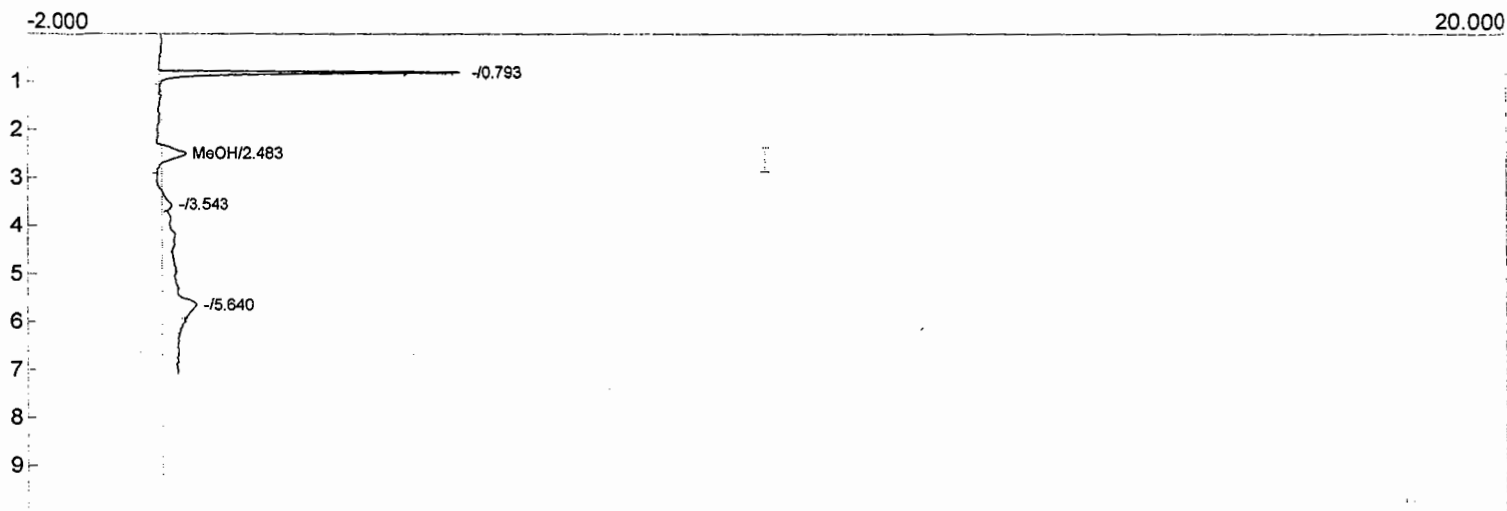
Component	Retention	Area
MeOH	1.710	51.9866
		51.9866

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/22/2011 11:59:35
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR309.CHR ()
Sample: Field Blank Tube Spiked
Operator: E. Vogt



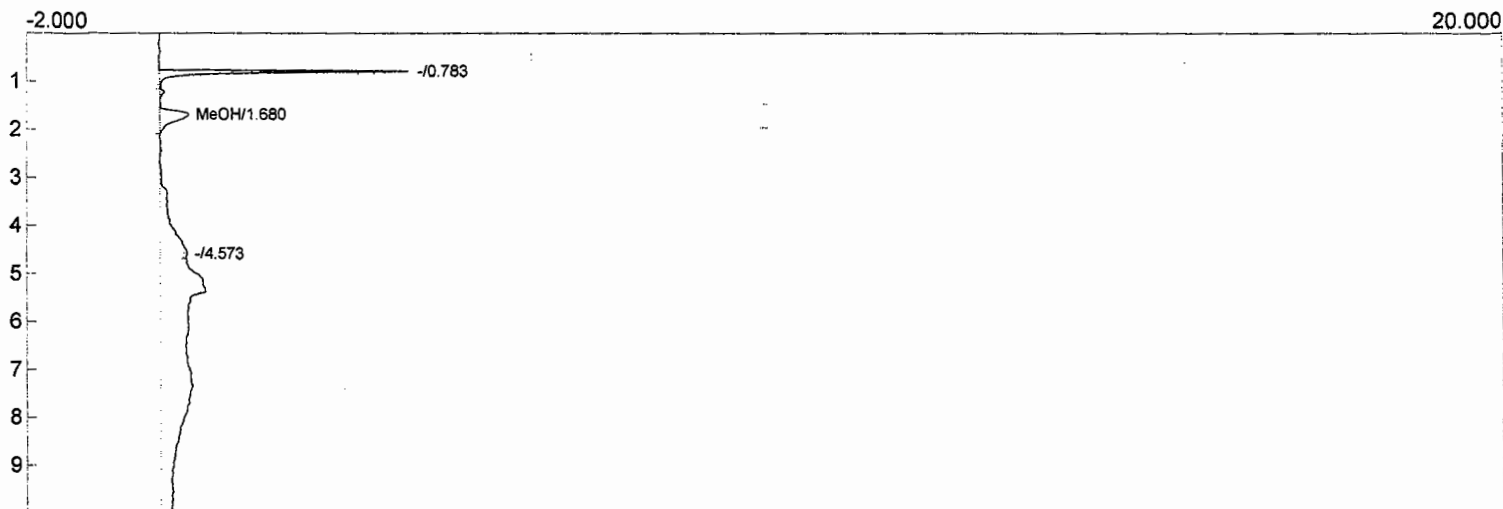
Component	Retention	Area
MeOH	1.703	53.2045
		53.2045

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 10:03:17
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR163.CHR ()
Sample: 2.0 ppm MeOH Std. - pre
Operator: E. Vogt



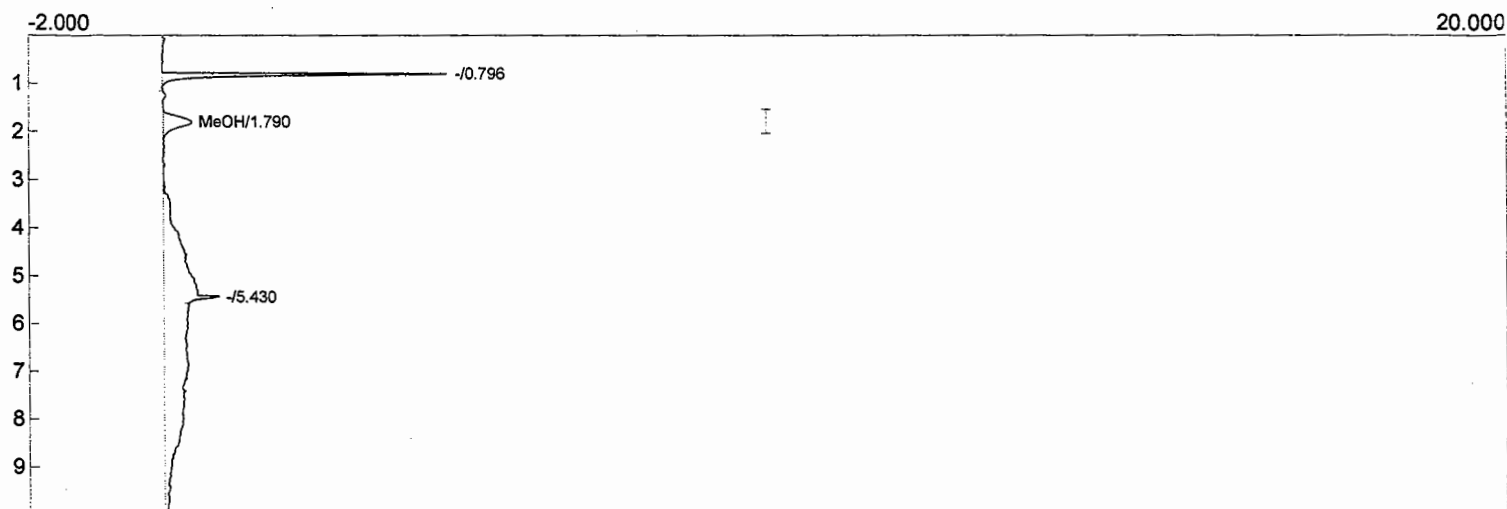
Component	Retention	Area
MeOH	2.483	6.6428
		6.6428

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 12:00:09
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR164.CHR ()
Sample: 2.0 ppm MeOH Std. - pre
Operator: E. Vogt



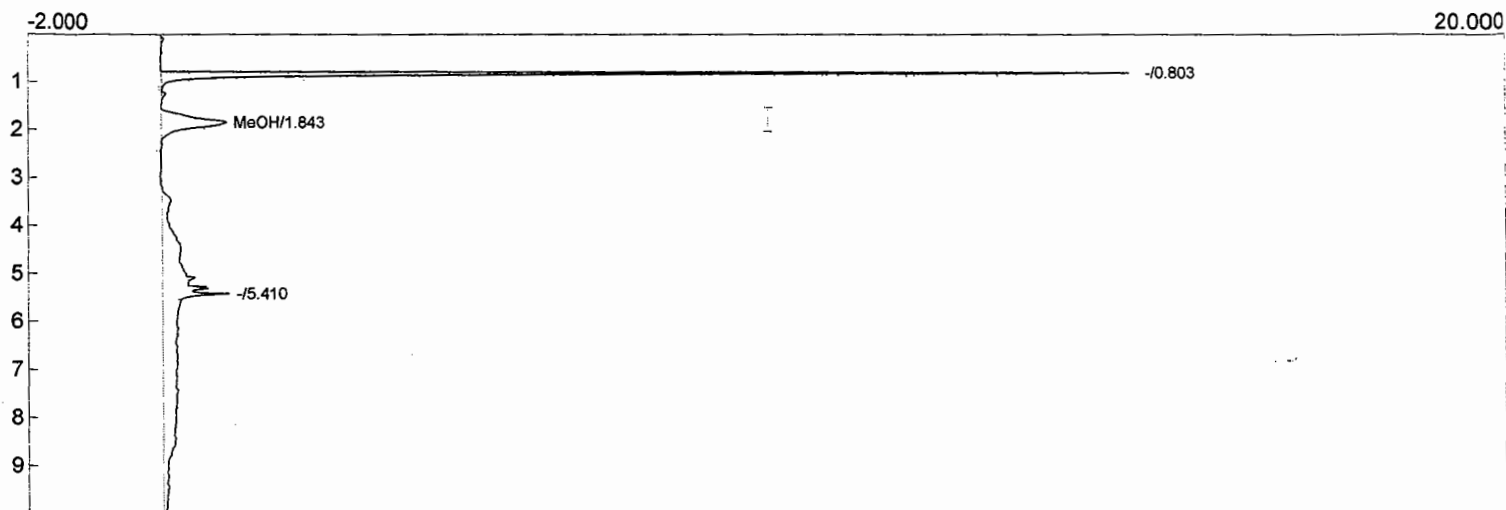
Component	Retention	Area
MeOH	1.680	6.1846
		6.1846

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 12:16:49
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR165.CHR ()
Sample: 2.0 ppm MeOH Std. - pre
Operator: E. Vogt



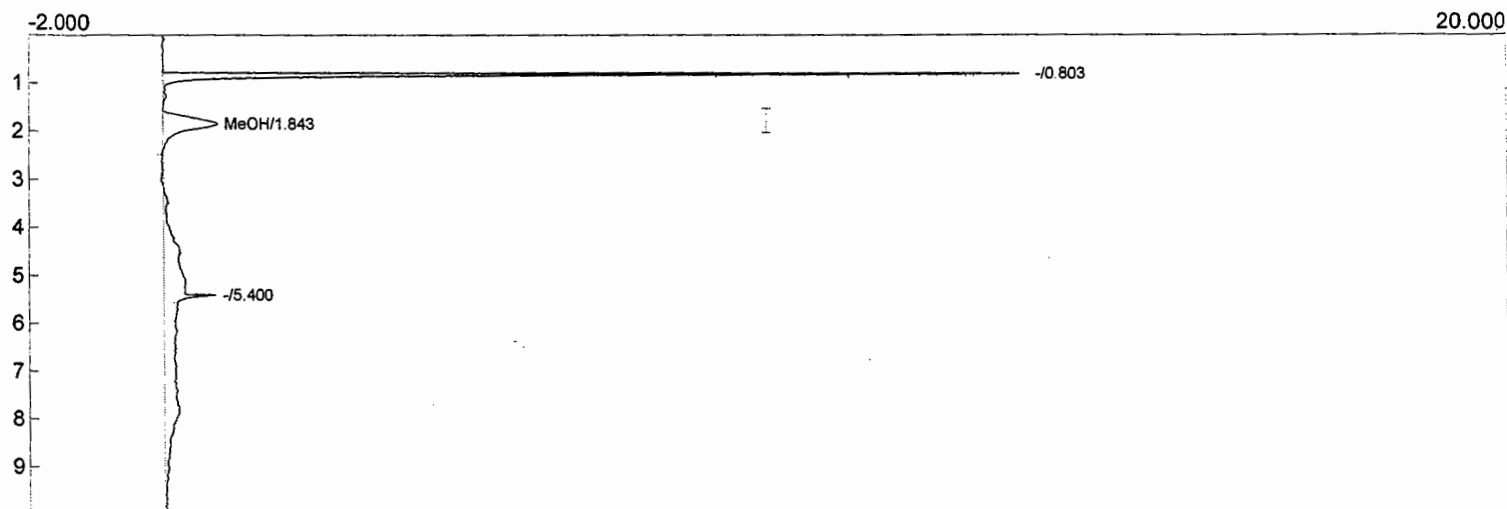
Component	Retention	Area
MeOH	1.790	6.3254
		6.3254

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 12:33:31
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR166.CHR ()
Sample: 5.0 ppm MeOH Std. - pre
Operator: E. Vogt



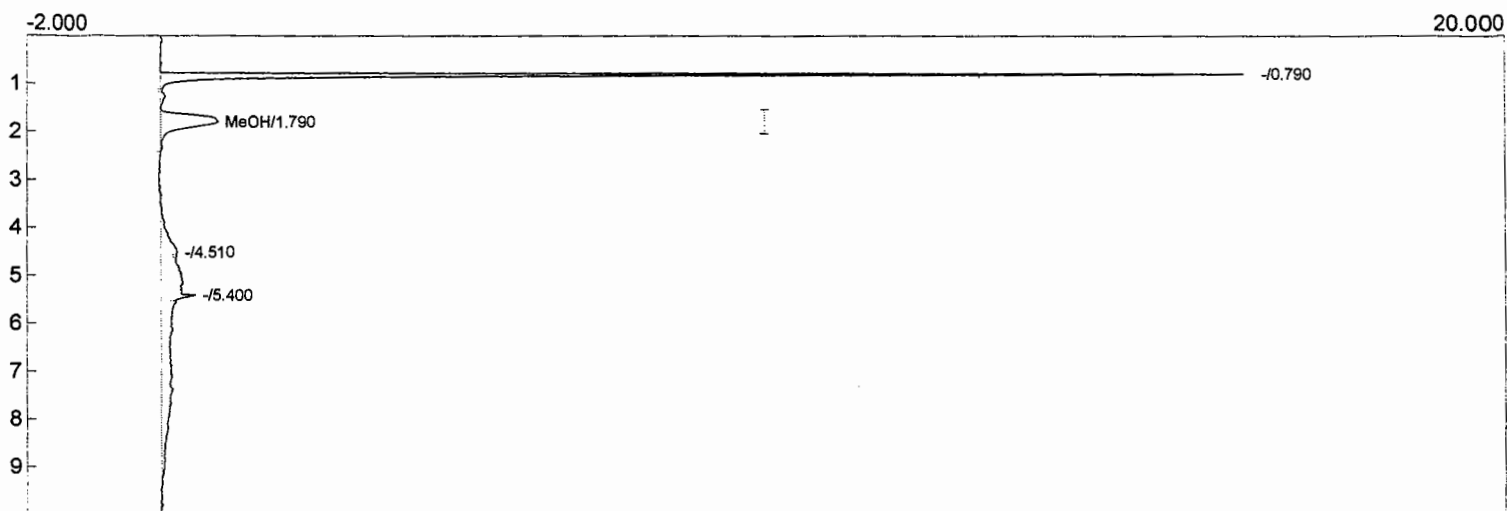
Component	Retention	Area
MeOH	1.843	15.2416
		15.2416

Lab Name: AM Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 12:50:29
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR167.CHR ()
Sample: 5.0 ppm MeOH Std. - pre
Operator: E. Vogt



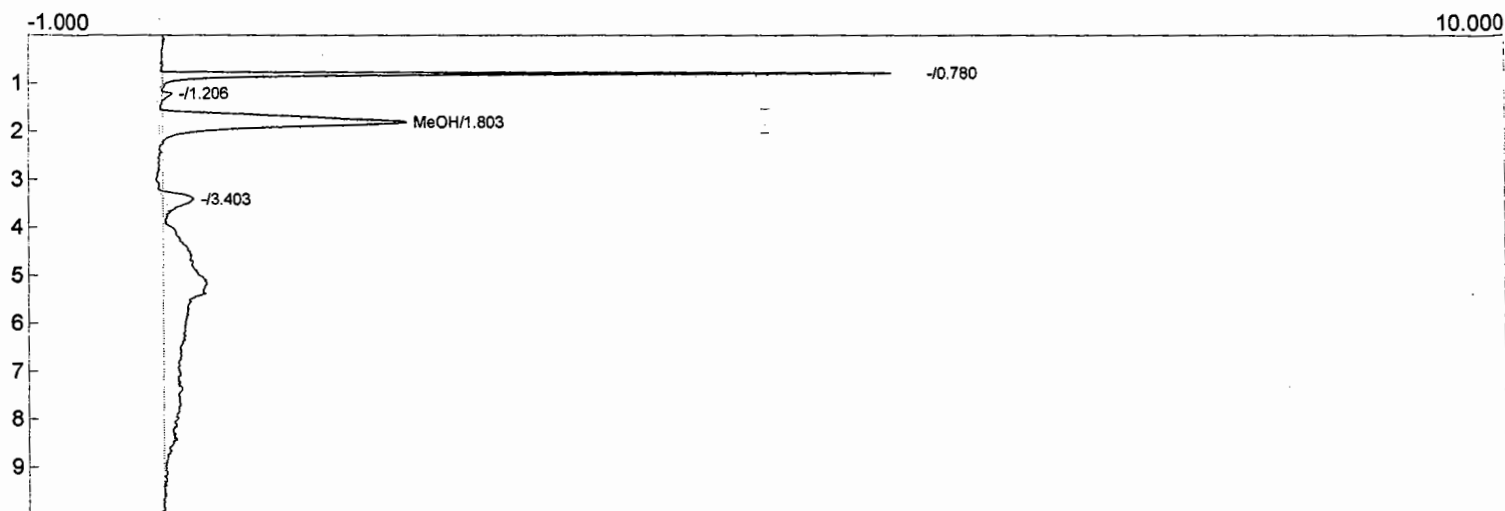
Component	Retention	Area
MeOH	1.843	14.8917
		14.8917

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 13:07:34
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR168.CHR ()
Sample: 5.0 ppm MeOH Std. - pre
Operator: E. Vogt



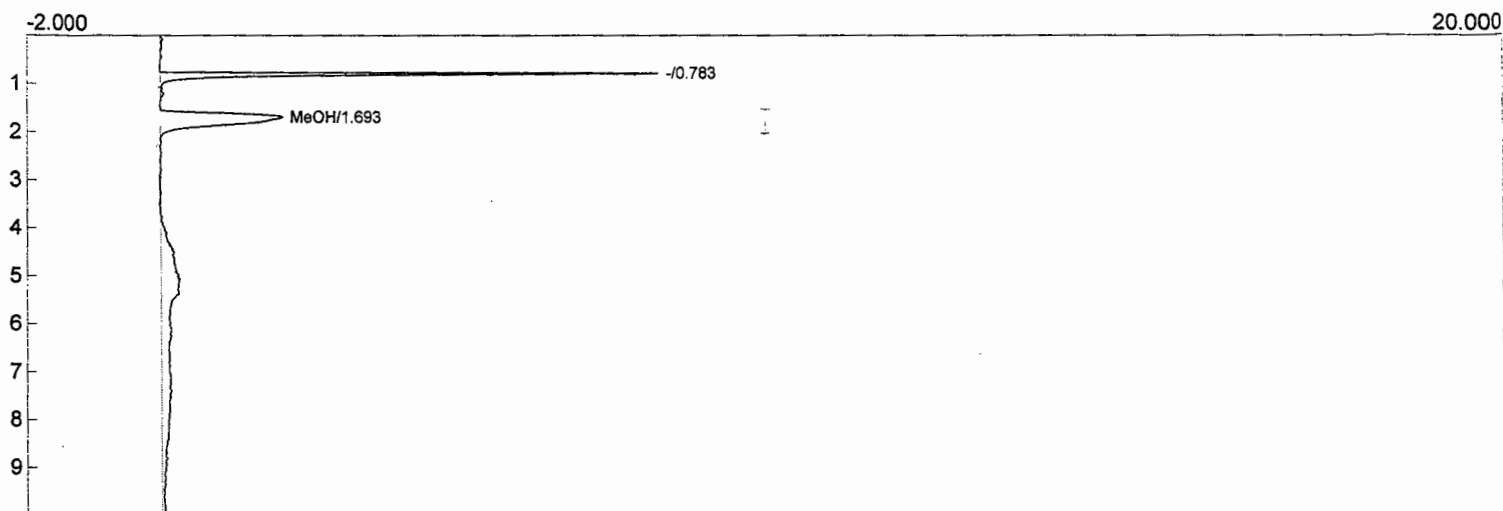
Component	Retention	Area
MeOH	1.790	14.8677
		14.8677

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 13:24:31
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR169.CHR ()
Sample: 10.0 ppm MeOH Std. - pre
Operator: E. Vogt



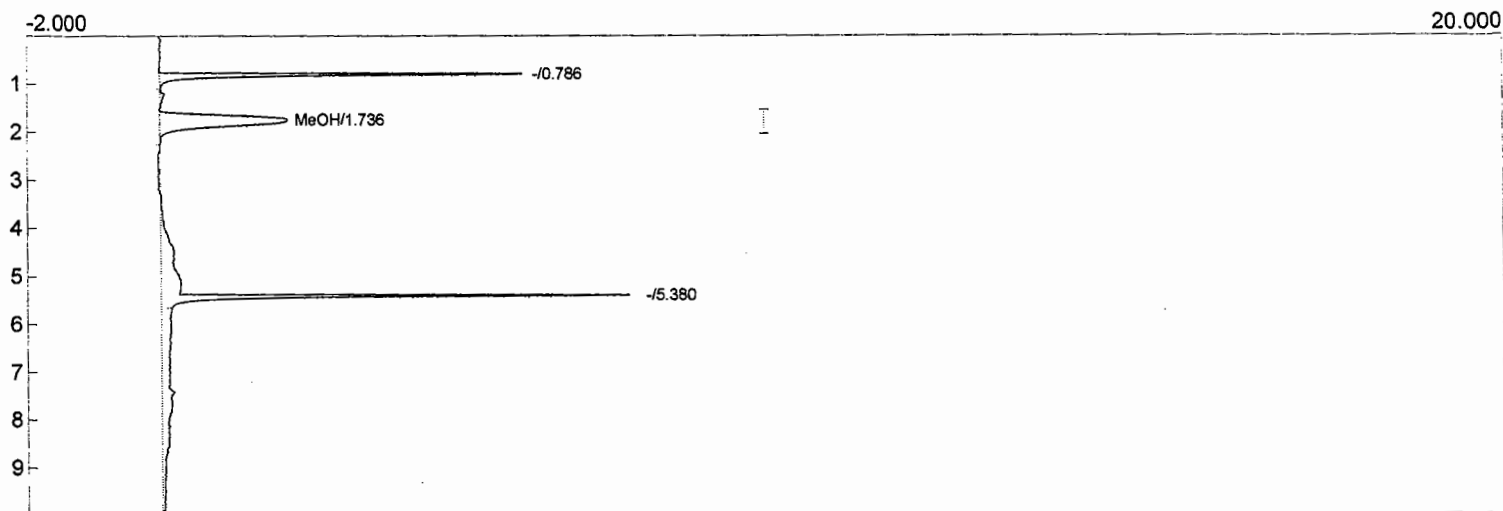
Component	Retention	Area
MeOH	1.803	27.8268
		27.8268

Lab Name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 13:41:31
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR170.CHR ()
Sample: 10.0 ppm MeOH Std. - pre
Operator: E. Vogt



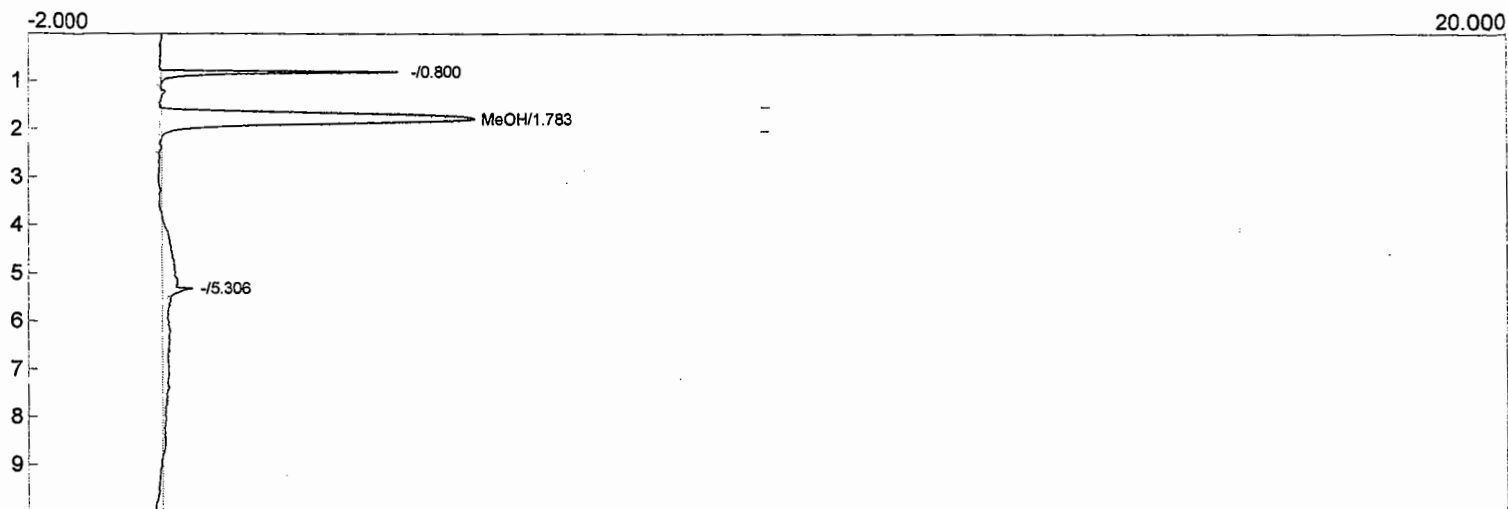
Component	Retention	Area
MeOH	1.693	27.3496
		27.3496

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 13:58:27
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR171.CHR ()
Sample: 10.0 ppm MeOH Std. - pre
Operator: E. Vogt



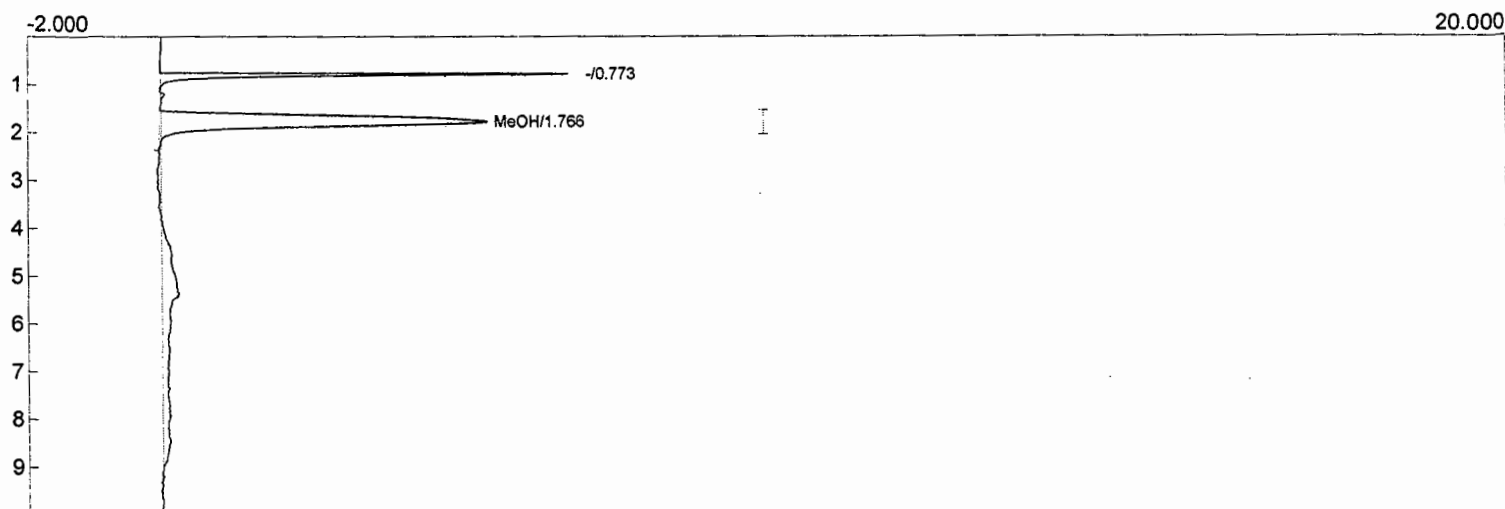
Component	Retention	Area
MeOH	1.736	28.2326
		28.2326

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 14:15:26
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR172.CHR ()
Sample: 25.0 ppm MeOH Std. - pre
Operator: E. Vogt



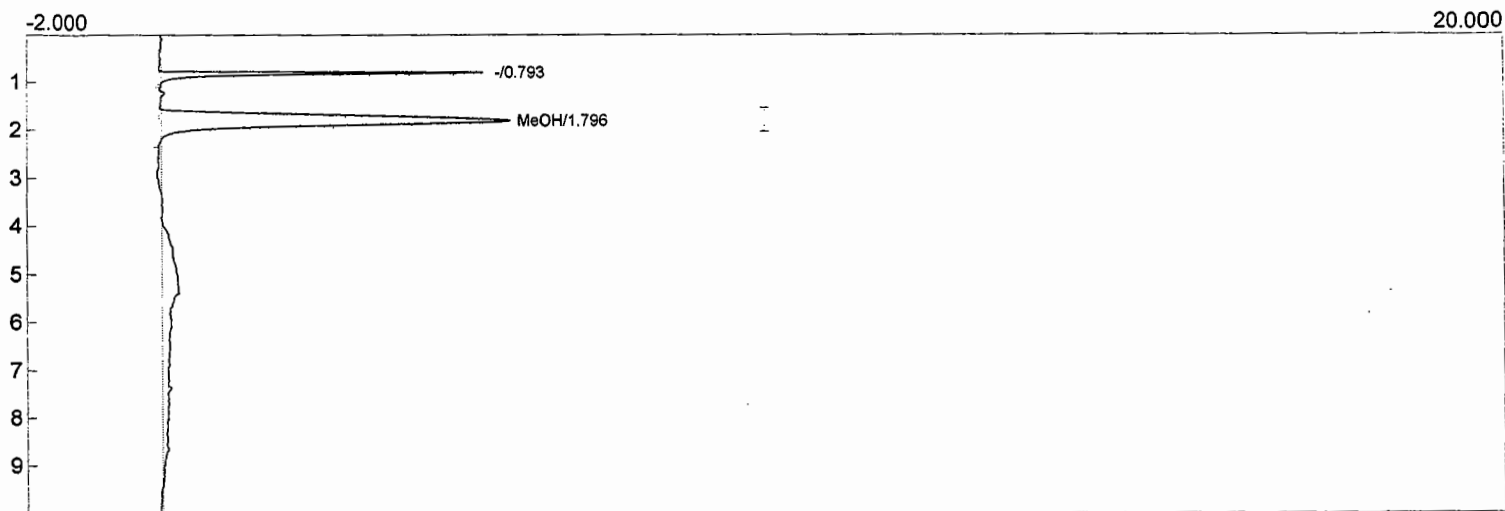
Component	Retention	Area
MeOH	1.783	69.7554
		69.7554

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 14:37:17
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR173.CHR ()
Sample: 25.0 ppm MeOH Std. - pre
Operator: E. Vogt



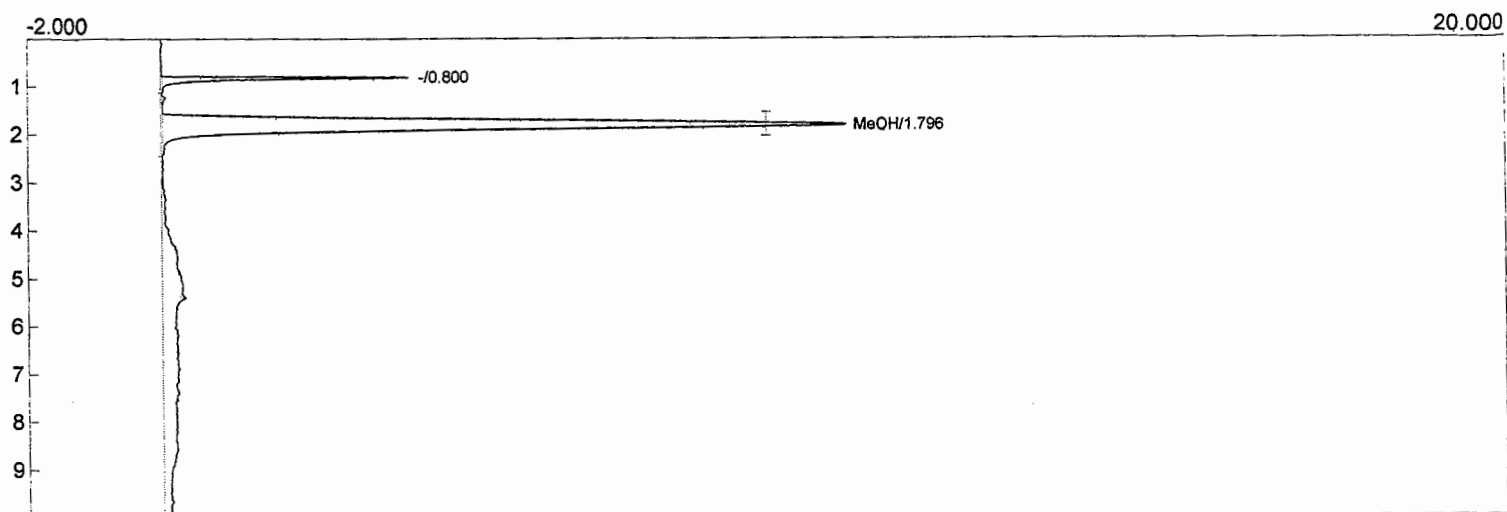
Component	Retention	Area
MeOH	1.766	72.2221
		72.2221

Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 14:54:10
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR174.CHR ()
Sample: 25.0 ppm MeOH Std. - pre
Operator: E. Vogt



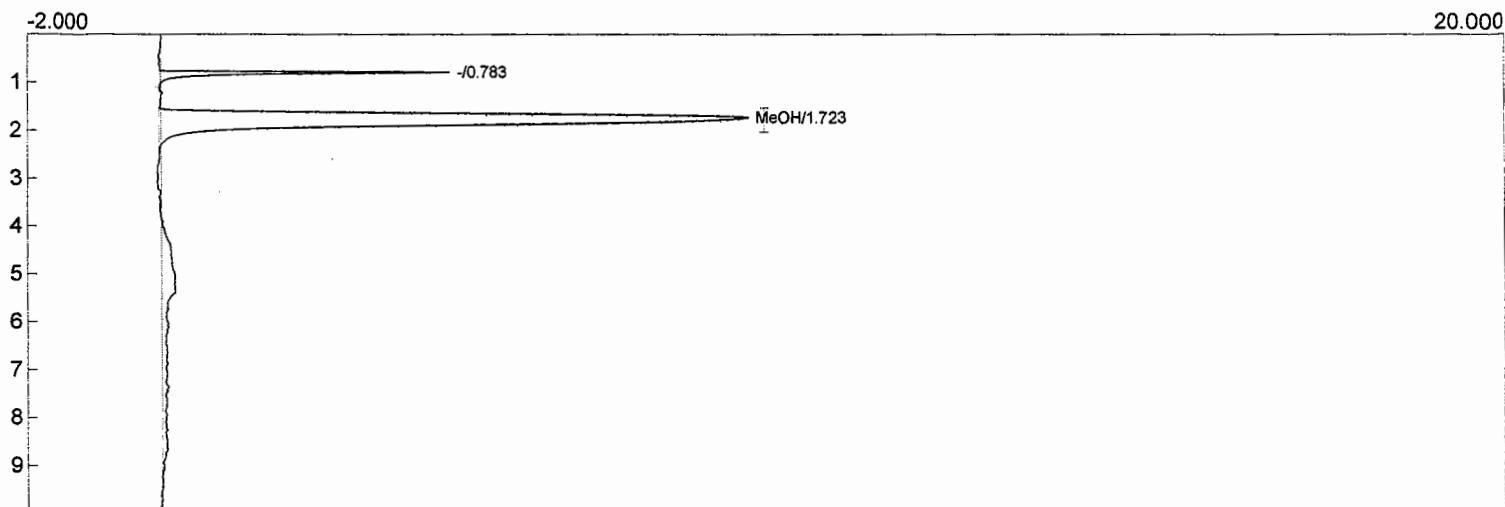
Component	Retention	Area
MeOH	1.796	72.9041
		72.9041

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 15:09:20
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR175.CHR ()
Sample: 50.0 ppm MeOH Std. - pre
Operator: E. Vogt



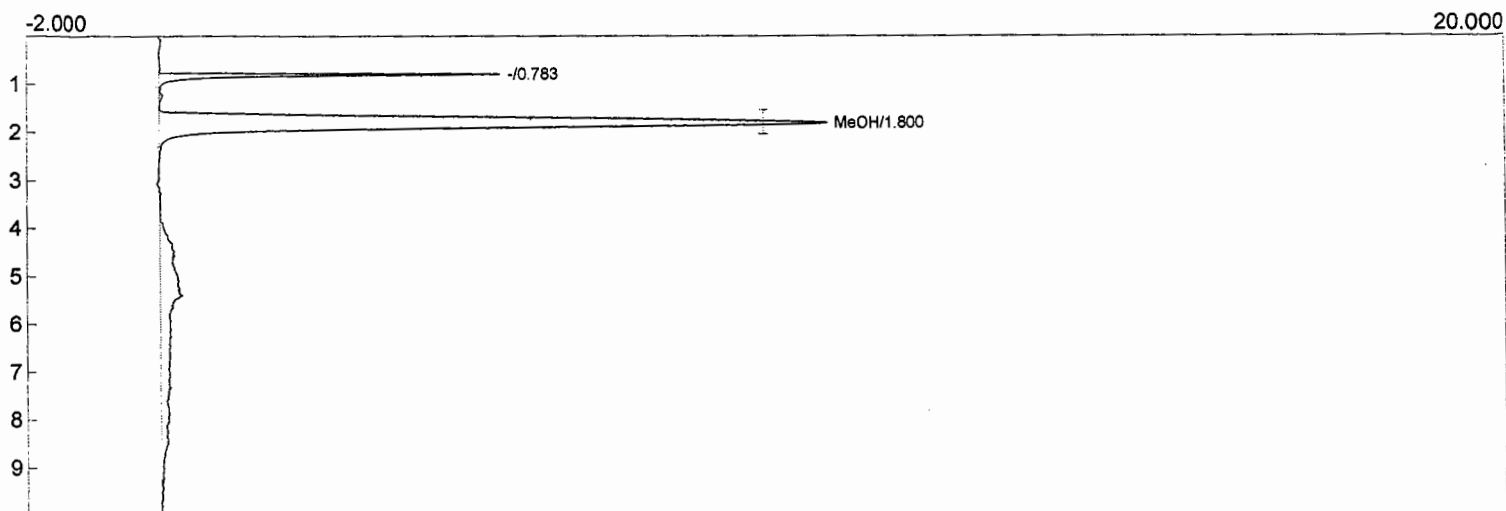
Component	Retention	Area
MeOH	1.796	135.2272
		135.2272

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 15:26:16
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR176.CHR ()
Sample: 50.0 ppm MeOH Std. - pre
Operator: E. Vogt



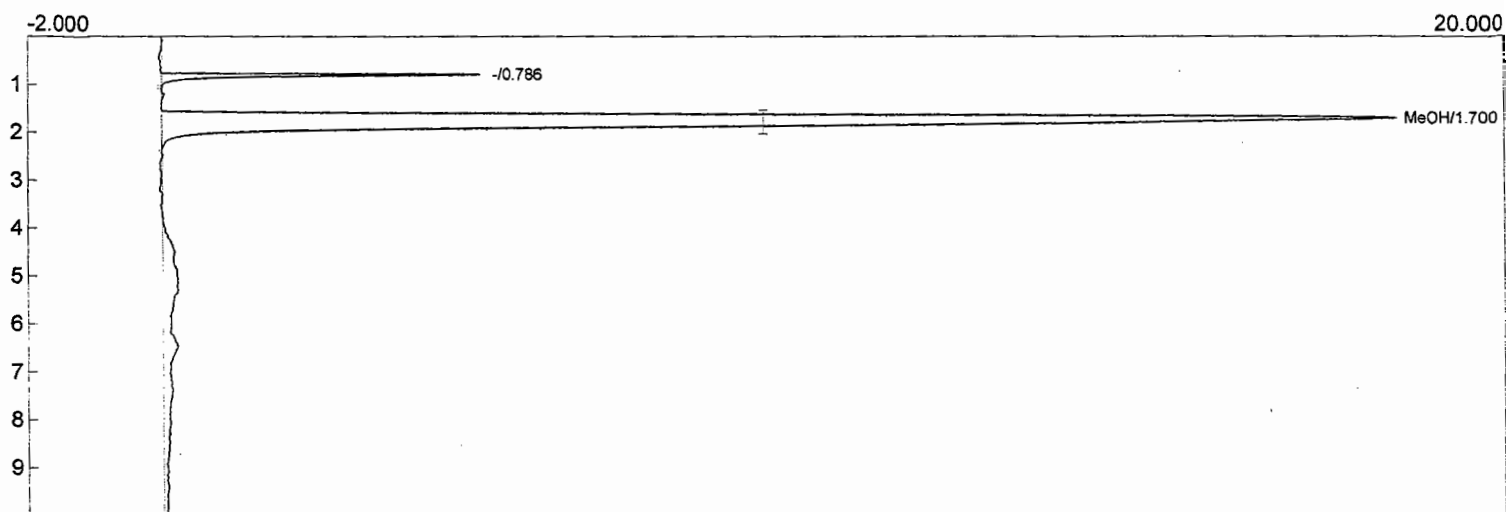
Component	Retention	Area
MeOH	1.723	136.2478
		136.2478

Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 15:44:04
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR177.CHR ()
Sample: 50.0 ppm MeOH Std. - pre
Operator: E. Vogt



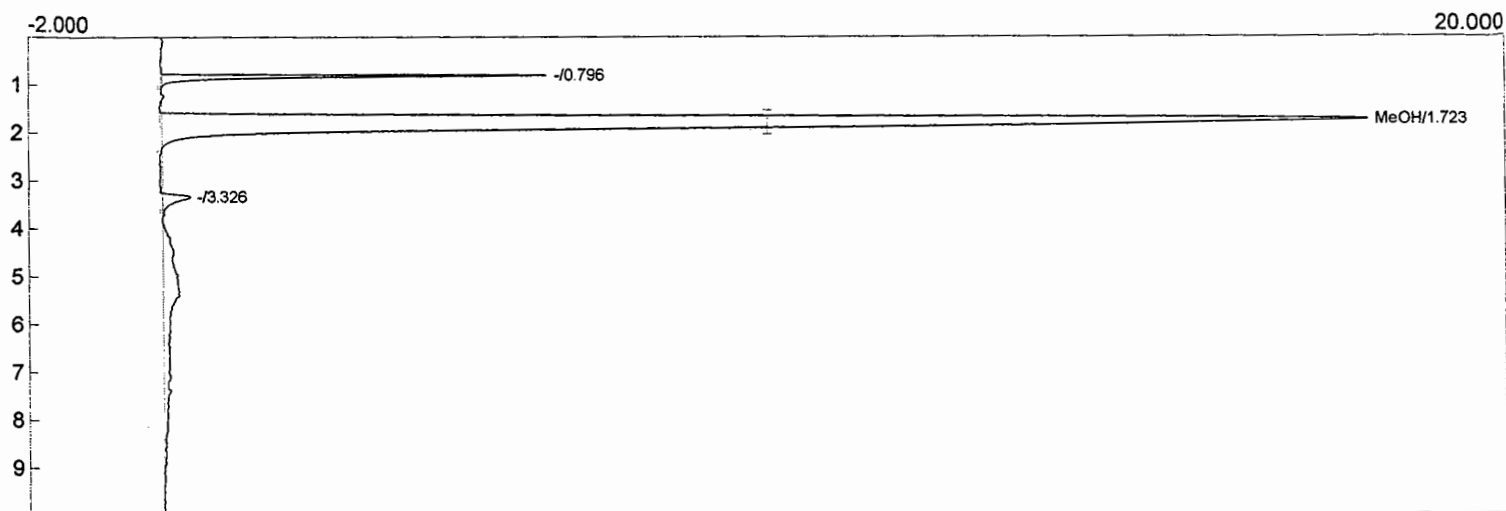
Component	Retention	Area
MeOH	1.800	139.3436
		139.3436

Lao name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 16:01:05
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR178.CHR ()
Sample: 100.0 ppm MeOH Std. - pre
Operator: E. Vogt



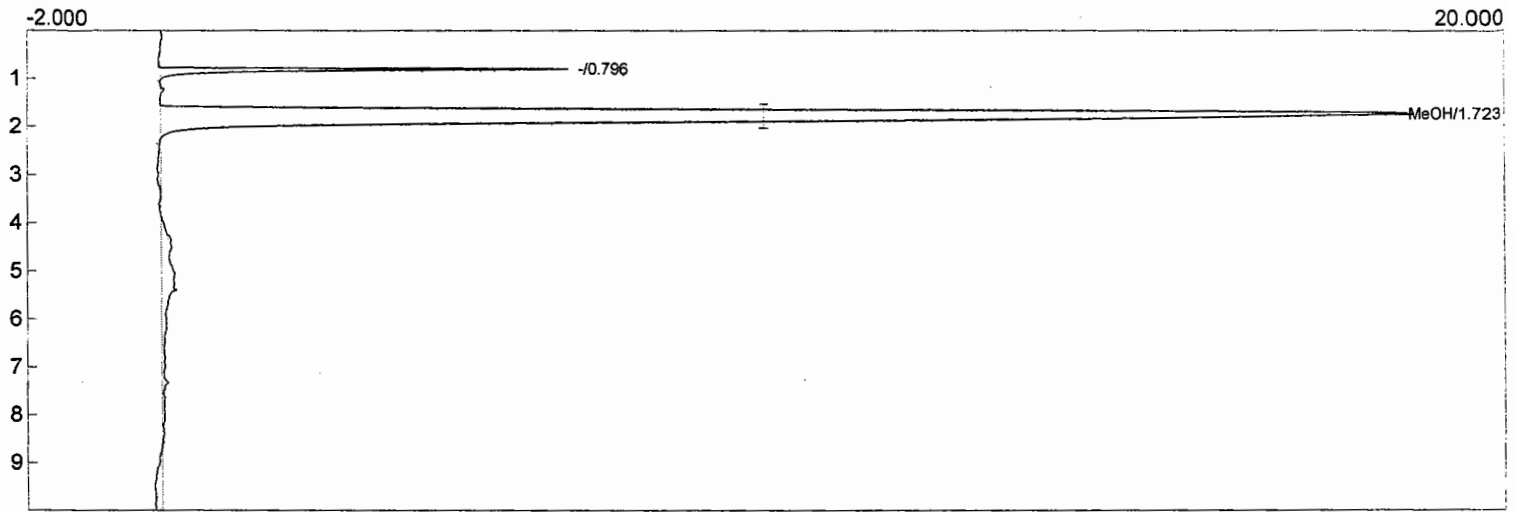
Component	Retention	Area
MeOH	1.700	266.5512
		266.5512

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 16:18:37
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR179.CHR ()
Sample: 100.0 ppm MeOH Std. - pre
Operator: E. Vogt



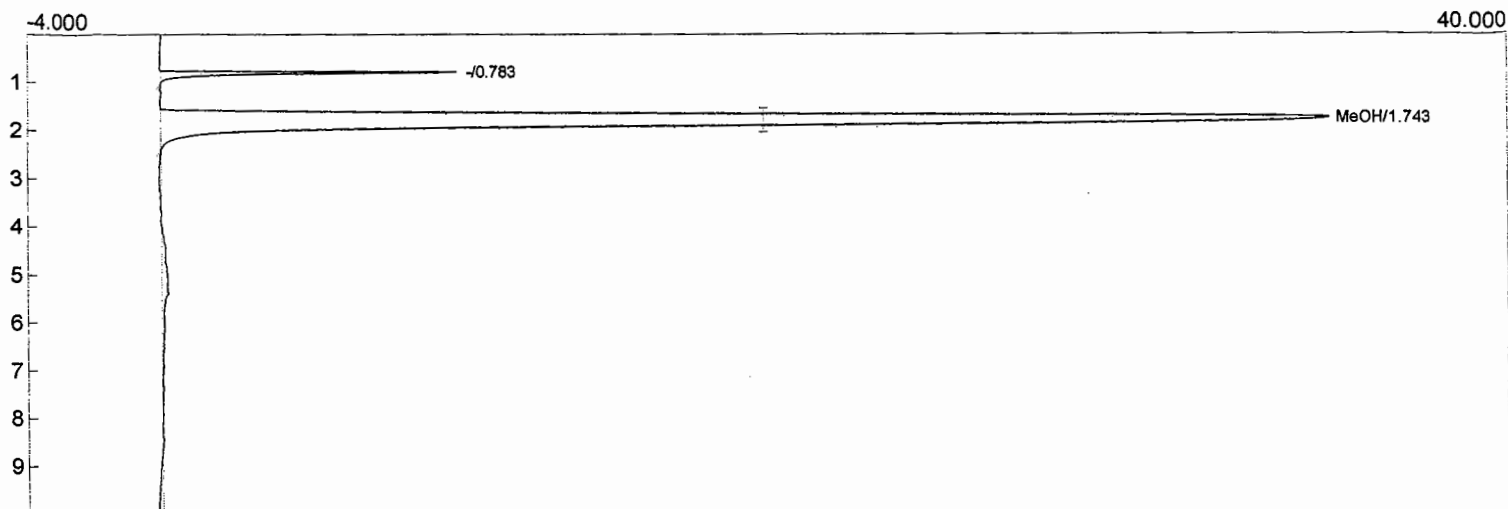
Component	Retention	Area
MeOH	1.723	271.1698
		271.1698

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 16:36:23
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR180.CHR ()
Sample: 100.0 ppm MeOH Std. - pre
Operator: E. Vogt



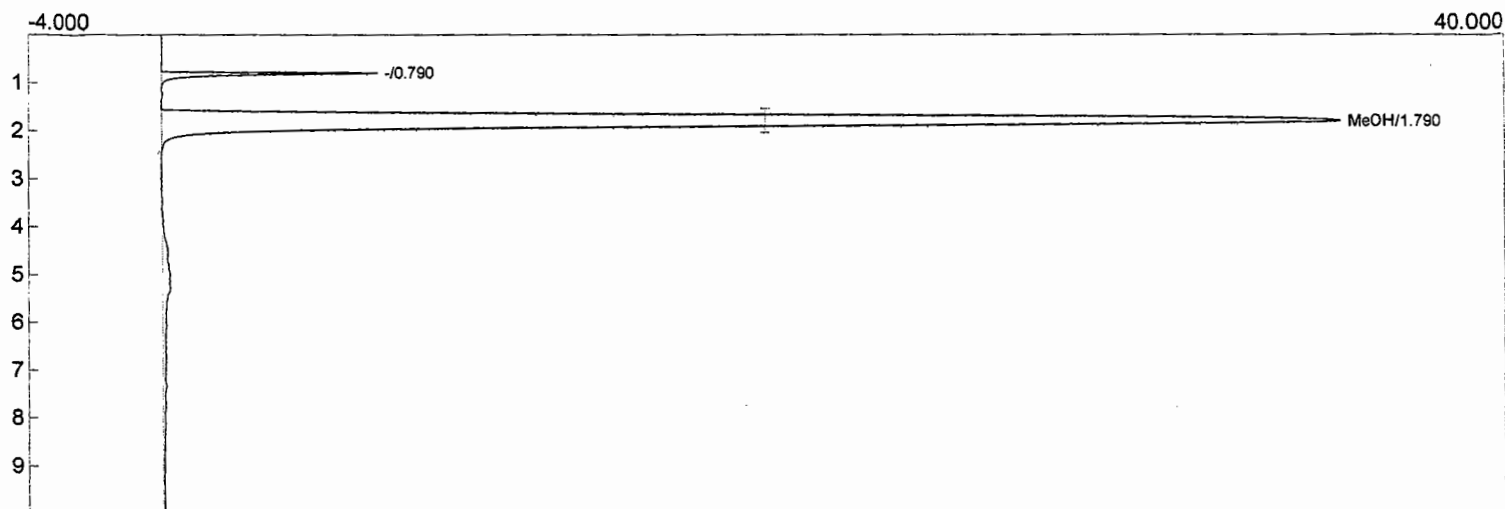
Component	Retention	Area
MeOH	1.723	272.7574
		272.7574

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 16:53:57
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR181.CHR ()
Sample: 200.0 ppm MeOH Std. - pre
Operator: E. Vogt



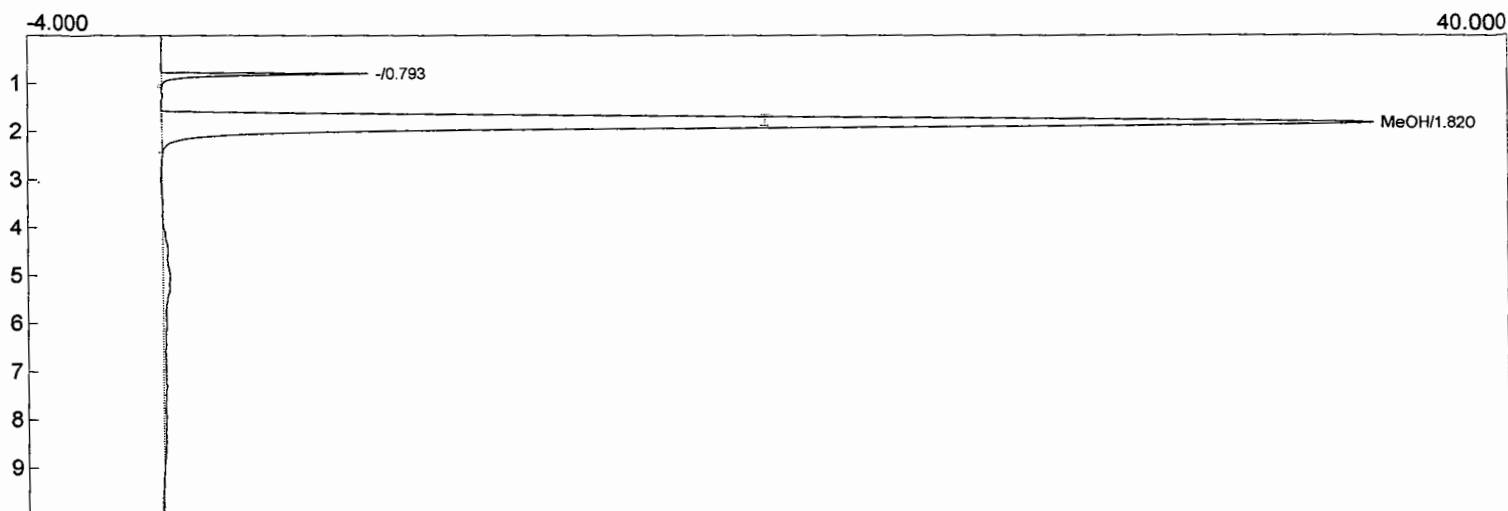
Component	Retention	Area
MeOH	1.743	538.3338
		538.3338

Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 17:12:59
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR182.CHR ()
Sample: 200.0 ppm MeOH Std. - pre
Operator: E. Vogt



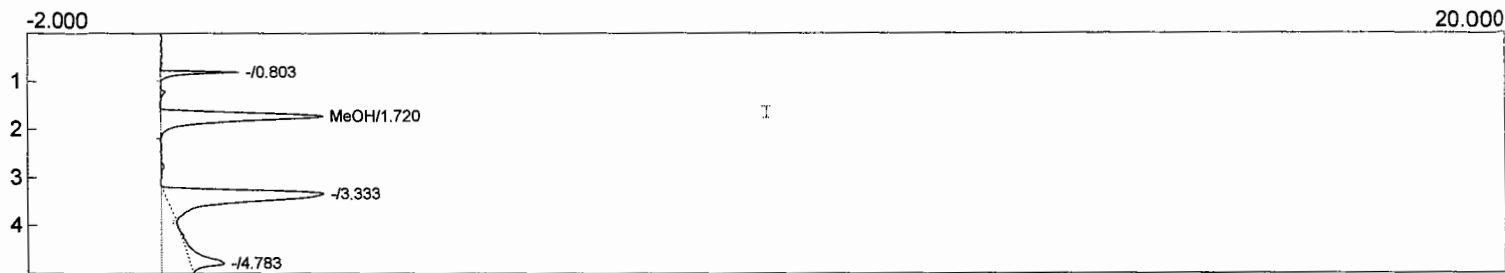
Component	Retention	Area
MeOH	1.790	538.1274
		538.1274

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/19/2011 17:30:16
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR183.chr ()
Sample: 200.0 ppm MeOH Std. - pre
Operator: E. Vogt



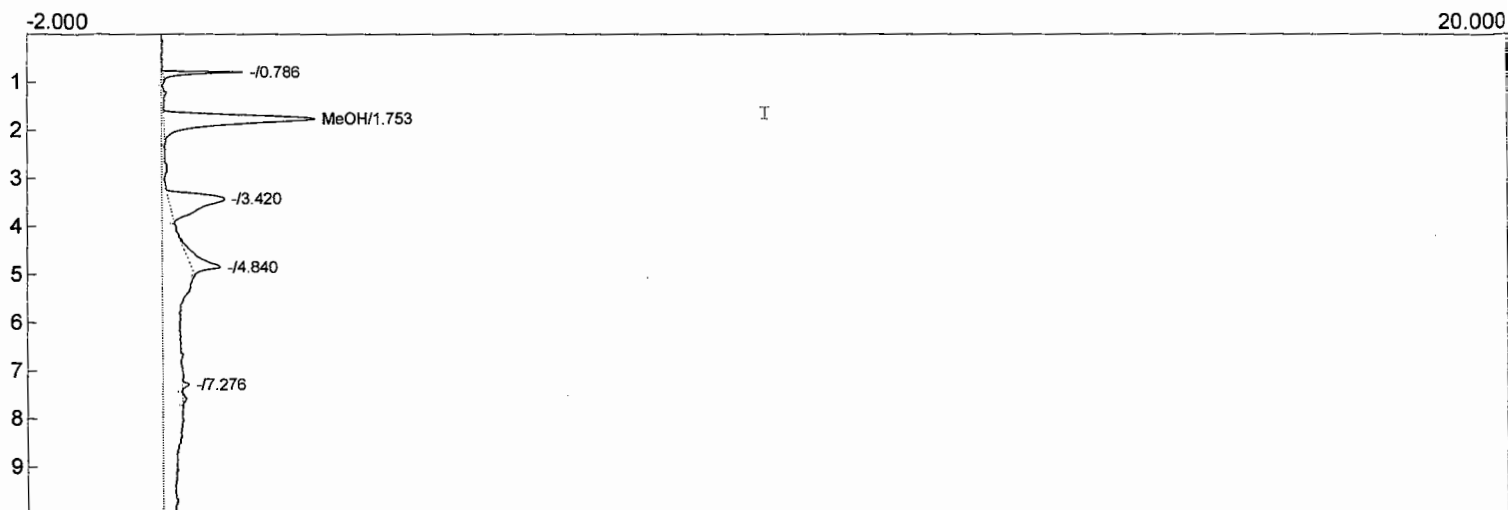
Component	Retention	Area
MeOH	1.820	536.4736
		536.4736

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/24/2011 11:13:26
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR310.CHR ()
Sample: 10 ppm MeOH Std. - Post
Operator: E. Vogt



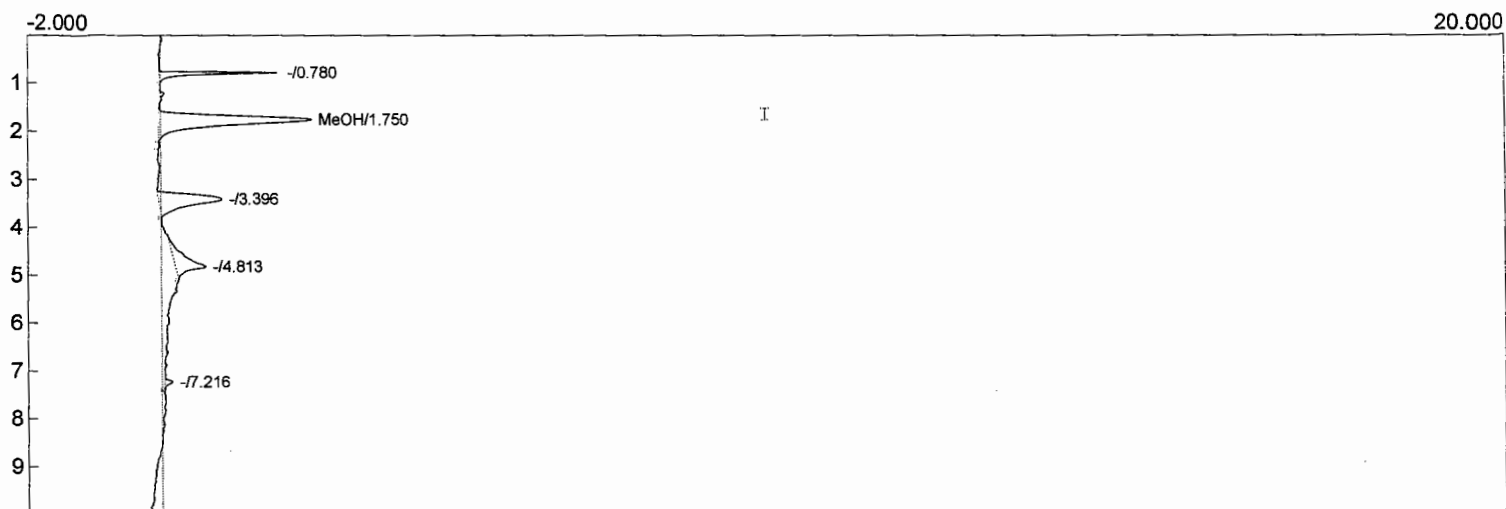
Component	Retention	Area
MeOH	1.720	27.9308
		27.9308

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/24/2011 11:30:10
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR311.CHR ()
Sample: 10 ppm MeOH Std. - Post
Operator: E. Vogt



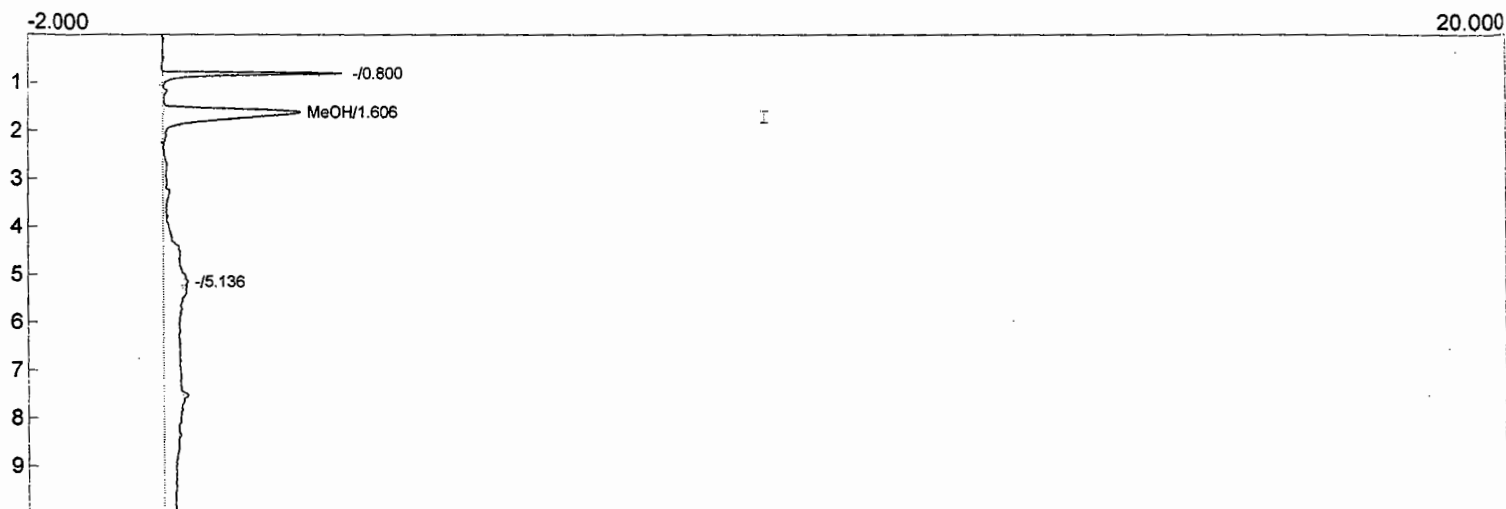
Component	Retention	Area
MeOH	1.753	28.1018
		28.1018

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/24/2011 11:47:22
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR312.CHR ()
Sample: 10 ppm MeOH Std. - Post
Operator: E. Vogt



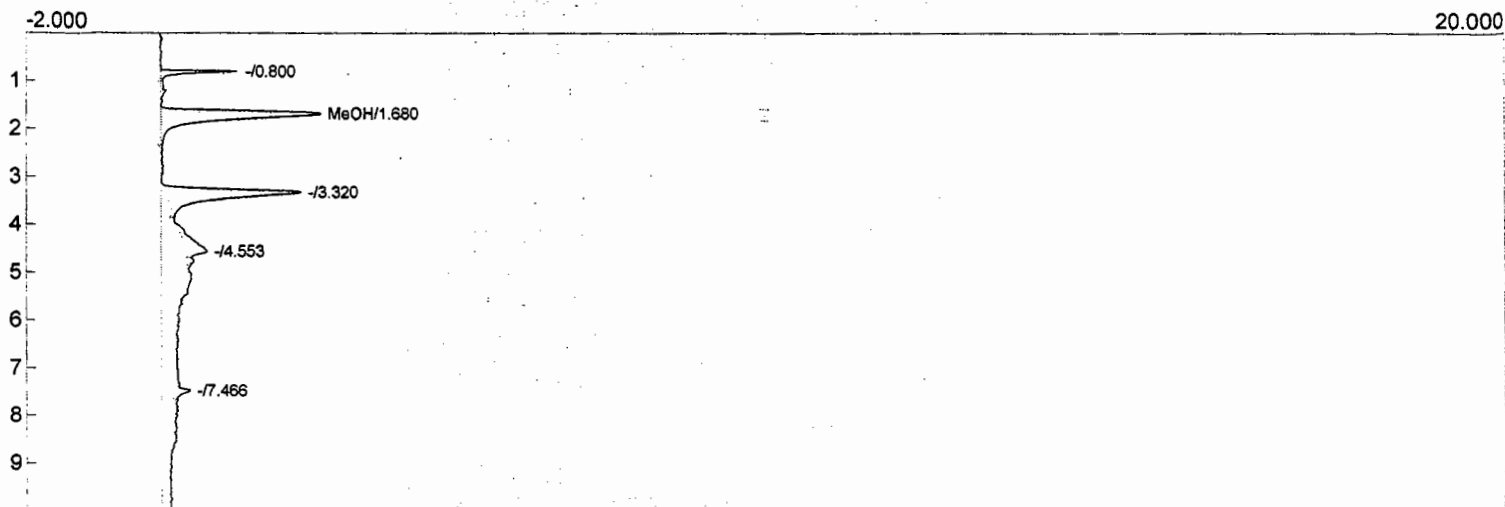
Component	Retention	Area
MeOH	1.750	28.6936
		28.6936

Client: Valero, Port Arthur TX
Analysis date: 07/20/2011 10:41:17
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR232.CHR ()
Sample: 10 ppm MeOH Check Std.
Operator: E. Vogt



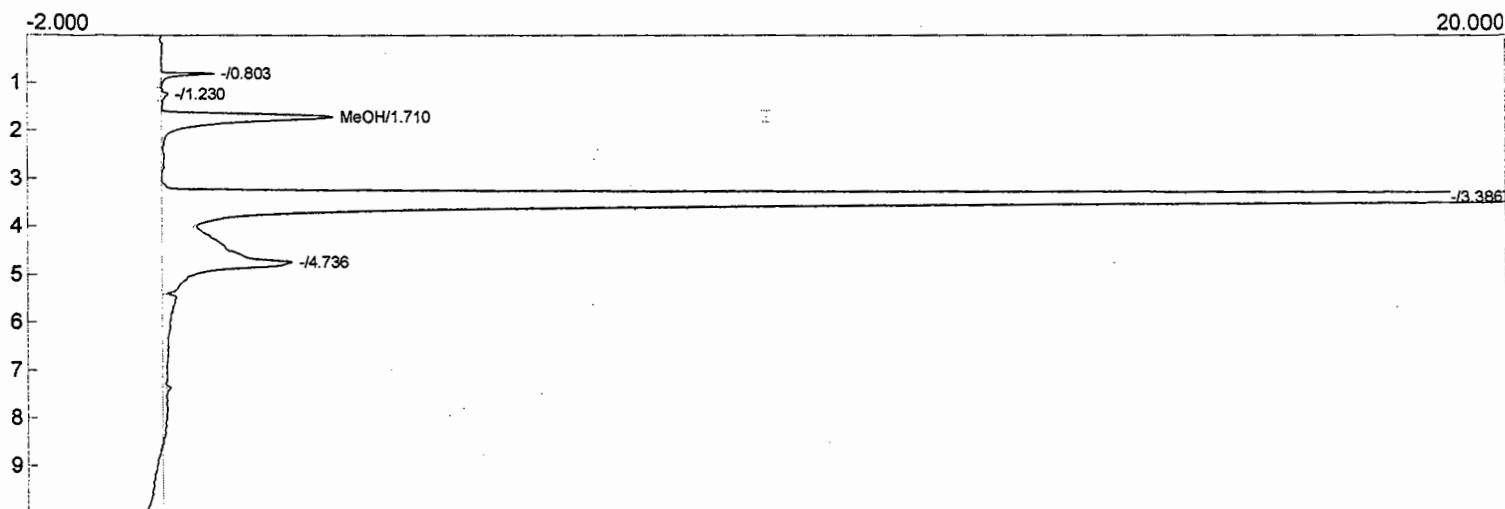
Component	Retention	Area
MeOH	1.606	27.4921
		27.4921

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 08:28:29
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR255.CHR ()
Sample: 10 ppm MeOH std. check
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



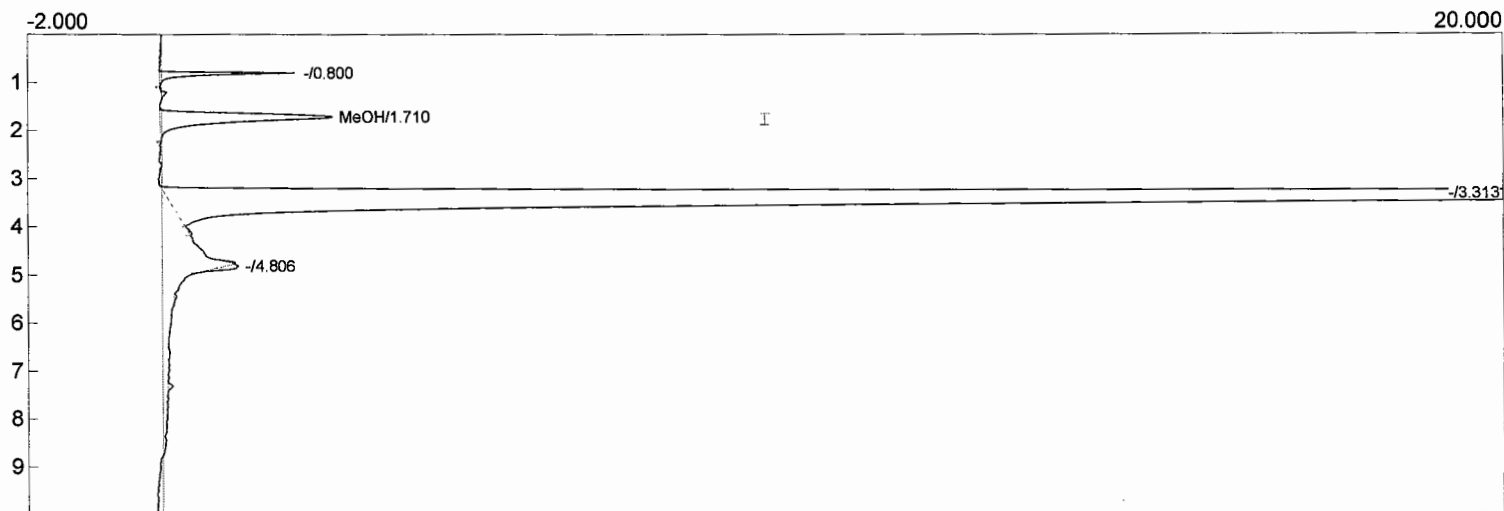
Component	Retention	Area
MeOH	1.680	28.4125
		28.4125

Lab name: AKI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/21/2011 16:02:53
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR279.CHR ()
Sample: 10 ppm MeOH Std. - check
Operator: E. Vogt
Comments: 4 ml 3% n-propanol tube extraction volume



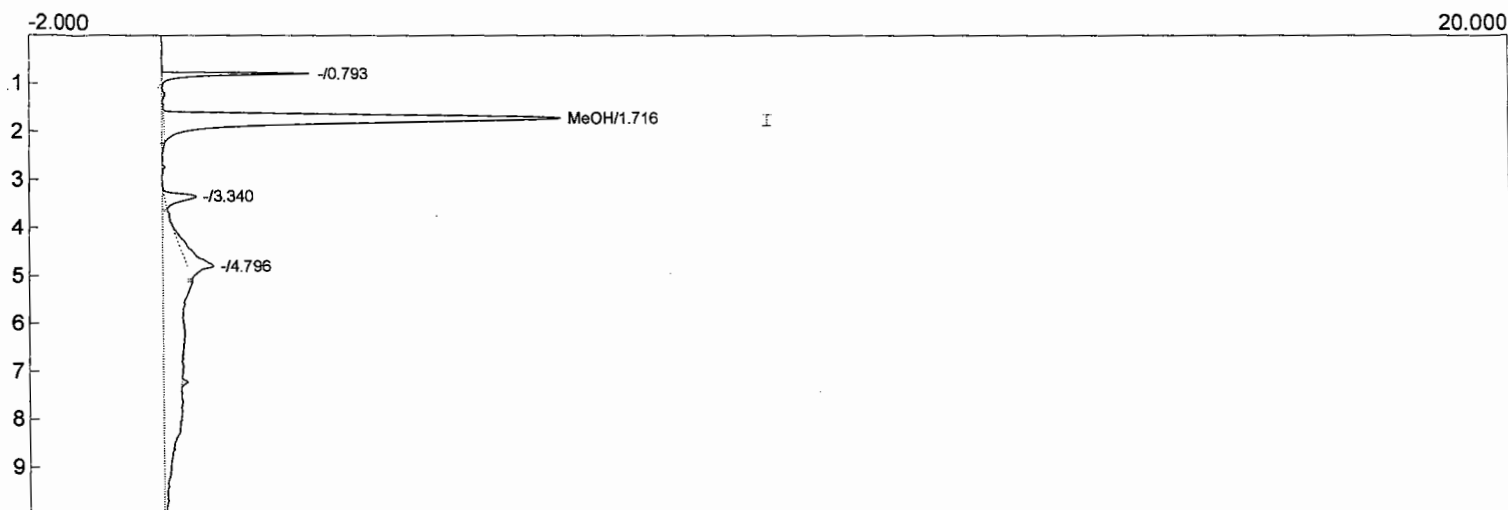
Component	Retention	Area
MeOH	1.710	29.2762
		29.2762

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/22/2011 10:57:17
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR305.chr ()
Sample: 10 ppm MeOH std. - check
Operator: E. Vogt



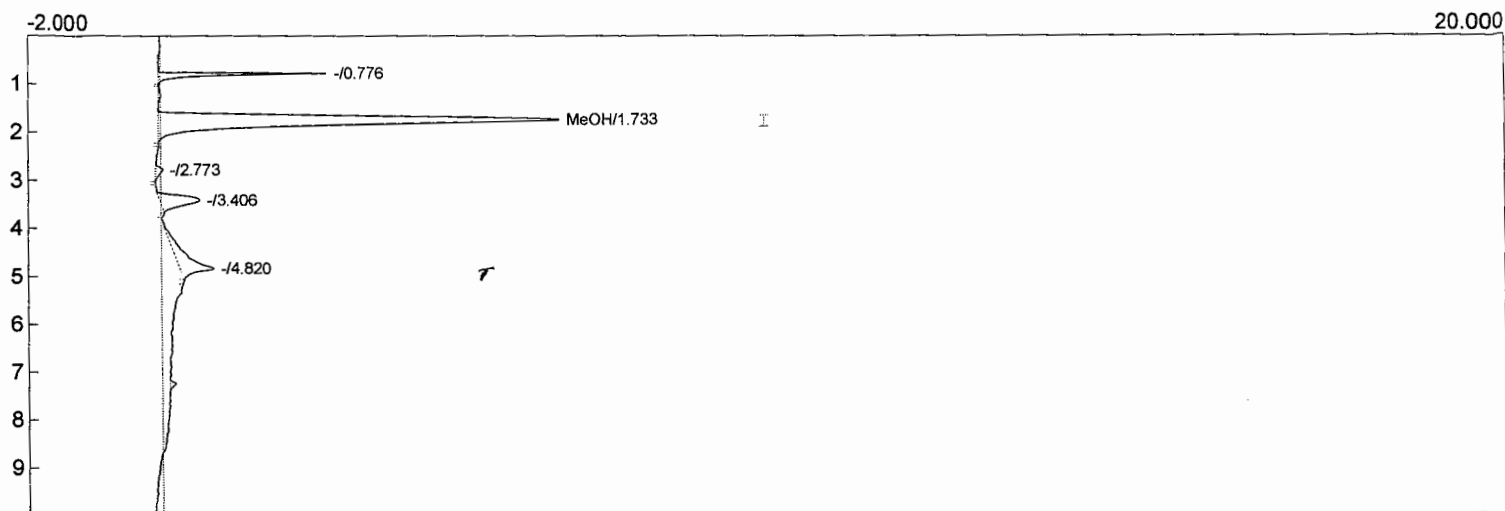
Component	Retention	Area
MeOH	1.710	29.6158
		29.6158

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/27/2011 16:26:51
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR316.CHR ()
Sample: 25 ppm MeOH Sec. Std
Operator: E. Vogt



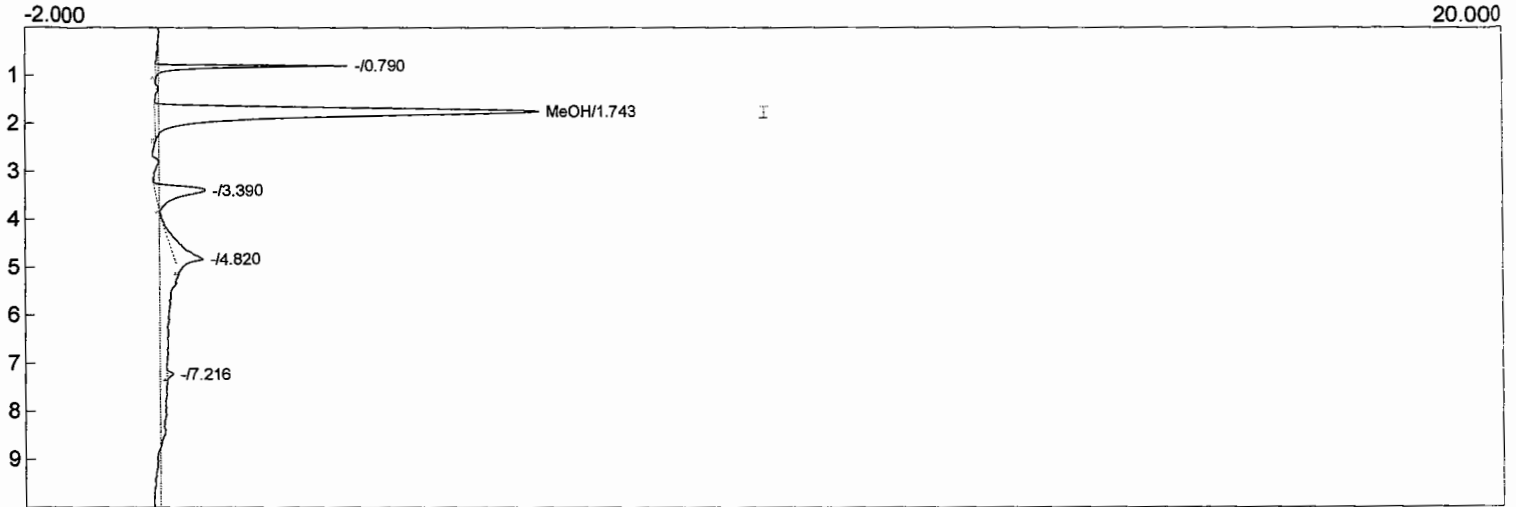
Component	Retention	Area
MeOH	1.716	69.1308
		69.1308

Client: Valero, Port Arthur TX
Analysis date: 07/27/2011 16:45:30
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR317.CHR ()
Sample: 25 ppm MeOH Sec. Std
Operator: E. Vogt



Component	Retention	Area
MeOH	1.733	72.4840
		72.4840

Lab name: ARI Environmental
Client: Valero, Port Arthur TX
Analysis date: 07/27/2011 17:03:42
Method: Syringe Injection
Description: GC FID
Carrier: HELIUM
Data file: MEOH ICR318.CHR ()
Sample: 25 ppm MeOH Sec. Std
Operator: E. Vogt



Component	Retention	Area
MeOH	1.743	71.0927
		71.0927



Valero Port Arthur Refinery
Source: FCCU-1241 Wet Gas Scrubber Stack
Test Dates: 6/6 - 6/14/11

APPENDIX D

ARI Reference Method Monitoring Data

Valero Port Arthur Refinery, Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 8:37:30	19.82	0.83	0.14	
6/6/11 8:37:45	19.89	0.79	0.14	
6/6/11 8:38:00	19.95	0.74	0.14	
6/6/11 8:38:15	20.01	0.70	0.14	
6/6/11 8:38:30	20.06	0.66	0.14	
6/6/11 8:38:45	20.12	0.62	0.14	
6/6/11 8:39:00	20.16	0.59	0.14	
6/6/11 8:39:15	20.20	0.55	0.14	
6/6/11 8:39:30	18.32	0.57	0.14	
6/6/11 8:39:45	7.53	0.31	0.14	
6/6/11 8:40:00	1.04	0.07	0.14	
6/6/11 8:40:15	0.20	0.04	0.14	
6/6/11 8:40:30	0.10	0.04	0.14	
6/6/11 8:40:45	0.06	0.04	0.15	
6/6/11 8:41:00	0.04	0.04	0.15	Calibration Error
6/6/11 8:41:15	0.03	0.04	0.15	O ₂ Stack CE Zero = 0.03 CO ₂ Stack CE Zero = 0.03
6/6/11 8:41:30	0.03	0.04	0.14	
6/6/11 8:41:45	0.03	0.03	0.14	
6/6/11 8:42:00	0.02	0.03	0.14	
6/6/11 8:42:15	0.02	0.03	0.14	
6/6/11 8:42:30	0.03	0.04	0.14	
6/6/11 8:42:45	4.04	2.13	0.14	
6/6/11 8:43:00	13.32	7.09	0.14	
6/6/11 8:43:15	18.89	12.64	0.14	
6/6/11 8:43:30	21.42	16.74	0.14	
6/6/11 8:43:45	22.41	18.92	0.14	
6/6/11 8:44:00	22.62	19.48	0.14	
6/6/11 8:44:15	22.65	19.56	0.14	
6/6/11 8:44:30	22.65	19.59	0.14	
6/6/11 8:44:45	22.66	19.61	0.14	Calibration Error
6/6/11 8:45:00	22.66	19.62	0.14	CO ₂ Stack CE Span = 19.62
6/6/11 8:45:15	22.66	19.63	0.14	
6/6/11 8:45:30	22.67	19.63	0.14	
6/6/11 8:45:45	22.67	19.61	0.14	
6/6/11 8:46:00	22.67	19.63	0.14	
6/6/11 8:46:15	22.63	19.29	0.14	
6/6/11 8:46:30	19.74	15.58	0.14	
6/6/11 8:46:45	14.62	11.90	0.14	
6/6/11 8:47:00	12.06	10.24	0.14	
6/6/11 8:47:15	11.65	10.05	0.14	Calibration Error
6/6/11 8:47:30	11.63	10.04	0.14	CO ₂ Stack CE Mid = 10.04
6/6/11 8:47:45	11.62	10.04	0.14	
6/6/11 8:48:00	11.62	10.03	0.14	
6/6/11 8:48:15	11.61	10.03	0.14	
6/6/11 8:48:30	11.61	10.03	0.14	
6/6/11 8:48:45	11.61	10.02	0.14	
6/6/11 8:49:00	11.61	10.03	0.14	
6/6/11 8:49:15	11.54	9.75	0.14	
6/6/11 8:49:30	9.77	8.13	0.14	
6/6/11 8:49:45	8.89	7.86	0.14	
6/6/11 8:50:00	8.98	7.96	0.14	
6/6/11 8:50:15	9.01	7.98	0.14	
6/6/11 8:50:30	9.01	7.98	0.14	Calibration Error
6/6/11 8:50:45	9.01	7.98	0.14	O ₂ Stack CE Span = 9.01
6/6/11 8:51:00	9.01	7.98	0.14	
6/6/11 8:51:15	9.01	7.98	0.14	
6/6/11 8:51:30	9.01	7.99	0.14	
6/6/11 8:51:45	9.01	7.99	0.15	
6/6/11 8:52:00	9.01	7.98	0.15	
6/6/11 8:52:15	8.05	6.76	0.15	
6/6/11 8:52:30	5.34	4.48	0.15	
6/6/11 8:52:45	4.55	4.04	0.14	
6/6/11 8:53:00	4.54	4.04	0.14	
6/6/11 8:53:15	4.54	4.04	0.14	Calibration Error
6/6/11 8:53:30	4.54	4.04	0.14	O ₂ Stack CE Mid = 4.54
6/6/11 8:53:45	4.54	4.04	0.14	
6/6/11 8:54:00	4.54	4.04	0.14	
6/6/11 8:54:15	4.54	4.03	0.14	
6/6/11 8:54:30	4.54	4.03	0.14	
6/6/11 8:54:45	4.54	4.03	0.14	
6/6/11 8:55:00	4.54	4.03	0.14	
6/6/11 8:55:15	4.54	4.03	0.14	
6/6/11 8:55:30	4.54	4.03	0.14	
6/6/11 8:55:45	4.86	3.93	0.14	
6/6/11 8:56:00	6.11	3.61	0.14	
6/6/11 8:56:15	8.06	3.16	0.14	
6/6/11 8:56:30	9.00	2.97	0.14	
6/6/11 8:56:45	9.47	2.84	0.14	
6/6/11 8:57:00	10.48	2.56	0.13	
6/6/11 8:57:15	12.01	2.20	0.13	
6/6/11 8:57:30	13.34	1.91	0.13	
6/6/11 8:57:45	14.07	1.74	0.13	
6/6/11 8:58:00	14.71	1.57	0.13	
6/6/11 8:58:15	15.52	1.34	0.15	
6/6/11 8:58:30	16.27	1.13	0.27	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 8:58:45	16.16	1.02	0.22	
6/6/11 8:59:00	13.27	0.93	0.12	
6/6/11 8:59:15	11.14	0.82	0.09	
6/6/11 8:59:30	10.60	0.73	0.09	
6/6/11 8:59:45	10.04	0.67	0.09	
6/6/11 9:00:00	8.72	0.61	0.09	
6/6/11 9:00:15	7.44	0.55	0.09	
6/6/11 9:00:30	6.77	0.49	0.09	
6/6/11 9:00:45	6.28	0.44	0.09	
6/6/11 9:01:00	5.58	0.40	0.09	
6/6/11 9:01:15	4.85	0.36	0.09	Calibration Error
6/6/11 9:01:30	4.38	2.73	0.08	CO ₂ Meter CE Zero = 0.08
6/6/11 9:01:45	4.56	8.23	0.08	
6/6/11 9:02:00	4.15	12.15	0.08	
6/6/11 9:02:15	2.87	14.96	0.08	
6/6/11 9:02:30	1.91	16.18	0.08	
6/6/11 9:02:45	1.64	16.46	0.08	
6/6/11 9:03:00	1.58	16.53	0.08	
6/6/11 9:03:15	1.58	16.53	0.08	
6/6/11 9:03:30	1.59	16.53	0.08	
6/6/11 9:03:45	1.62	16.51	0.08	
6/6/11 9:04:00	1.62	16.50	0.08	
6/6/11 9:04:15	1.67	16.44	3.47	
6/6/11 9:04:30	1.73	16.38	9.61	
6/6/11 9:04:45	1.83	16.30	13.66	
6/6/11 9:05:00	1.84	16.30	16.44	
6/6/11 9:05:15	1.80	16.32	18.27	
6/6/11 9:05:30	1.79	16.34	19.13	
6/6/11 9:05:45	1.68	16.44	19.39	
6/6/11 9:06:00	1.55	16.54	19.44	
6/6/11 9:06:15	1.54	16.56	19.45	
6/6/11 9:06:30	1.58	16.54	19.46	
6/6/11 9:06:45	1.65	16.47	19.48	
6/6/11 9:07:00	1.71	16.41	19.49	
6/6/11 9:07:15	1.77	16.36	19.49	
6/6/11 9:07:30	1.83	16.29	19.50	
6/6/11 9:07:45	1.85	16.28	19.51	
6/6/11 9:08:00	1.77	16.34	19.51	
6/6/11 9:08:15	1.82	16.29	19.51	
6/6/11 9:08:30	1.81	16.32	19.51	
6/6/11 9:08:45	1.70	16.40	19.52	
6/6/11 9:09:00	1.68	16.41	19.52	
6/6/11 9:09:15	1.70	16.40	19.62	Calibration Error
6/6/11 9:09:30	1.70	16.41	19.66	CO ₂ Meter CE Span = 19.66
6/6/11 9:09:45	1.67	16.45	19.65	
6/6/11 9:10:00	1.68	16.43	19.65	
6/6/11 9:10:15	1.72	16.40	19.66	
6/6/11 9:10:30	1.70	16.42	19.67	
6/6/11 9:10:45	1.69	16.43	19.67	
6/6/11 9:11:00	1.67	16.44	19.67	
6/6/11 9:11:15	1.67	16.43	19.53	
6/6/11 9:11:30	1.67	16.43	18.62	
6/6/11 9:11:45	1.66	16.45	15.82	
6/6/11 9:12:00	1.65	16.46	12.43	
6/6/11 9:12:15	1.65	16.46	10.15	
6/6/11 9:12:30	1.67	16.46	9.02	
6/6/11 9:12:45	1.64	16.48	8.86	
6/6/11 9:13:00	1.60	16.51	8.82	
6/6/11 9:13:15	1.57	16.52	8.81	
6/6/11 9:13:30	1.59	16.49	8.80	
6/6/11 9:13:45	1.61	16.49	8.79	
6/6/11 9:14:00	1.60	16.52	8.79	
6/6/11 9:14:15	1.61	16.50	8.78	
6/6/11 9:14:30	1.62	16.50	8.78	
6/6/11 9:14:45	1.62	16.50	8.77	
6/6/11 9:15:00	1.63	16.47	7.20	
6/6/11 9:15:15	1.69	16.42	3.31	
6/6/11 9:15:30	1.73	16.39	4.22	
6/6/11 9:15:45	1.75	16.37	7.40	
6/6/11 9:16:00	1.74	16.38	9.23	
6/6/11 9:16:15	1.72	16.39	9.96	
6/6/11 9:16:30	1.68	16.42	10.12	Calibration Error
6/6/11 9:16:45	1.61	16.48	10.15	CO ₂ Meter CE Mid = 10.16
6/6/11 9:17:00	1.57	16.52	10.16	
6/6/11 9:17:15	1.60	16.49	10.17	
6/6/11 9:17:30	1.66	16.45	10.17	
6/6/11 9:17:45	1.68	16.43	10.17	
6/6/11 9:18:00	1.69	16.43	10.17	
6/6/11 9:18:15	1.65	16.47	10.18	
6/6/11 9:18:30	1.65	16.45	10.17	
6/6/11 9:18:45	1.67	16.44	9.00	
6/6/11 9:19:00	1.68	16.44	5.13	
6/6/11 9:19:15	1.66	16.45	5.73	
6/6/11 9:19:30	1.66	16.45	7.46	
6/6/11 9:19:45	1.66	16.46	7.73	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 9:20:00	1.67	16.43	7.88	
6/6/11 9:20:15	1.71	16.38	7.93	
6/6/11 9:20:30	1.75	16.35	7.94	
6/6/11 9:20:45	1.77	16.35	7.94	
6/6/11 9:21:00	1.72	16.40	7.95	
6/6/11 9:21:15	1.64	16.47	7.94	
6/6/11 9:21:30	1.63	16.47	7.94	
6/6/11 9:21:45	1.66	16.46	7.94	
6/6/11 9:22:00	1.65	16.47	7.95	
6/6/11 9:22:15	1.64	16.46	7.95	
6/6/11 9:22:30	1.63	16.47	7.95	
6/6/11 9:22:45	1.61	16.49	7.95	
6/6/11 9:23:00	1.59	16.51	7.94	
6/6/11 9:23:15	1.63	16.48	6.93	
6/6/11 9:23:30	1.68	16.44	4.93	
6/6/11 9:23:45	1.71	16.41	4.04	
6/6/11 9:24:00	1.62	16.48	3.92	
6/6/11 9:24:15	1.52	16.56	3.91	
6/6/11 9:24:30	1.50	16.59	3.90	
6/6/11 9:24:45	1.50	16.58	3.89	
6/6/11 9:25:00	1.50	16.58	3.89	
6/6/11 9:25:15	1.48	16.62	3.89	
6/6/11 9:25:30	1.49	16.62	3.90	
6/6/11 9:25:45	1.54	16.59	3.90	
6/6/11 9:26:00	1.52	16.59	3.97	
6/6/11 9:26:15	1.51	16.60	2.61	
6/6/11 9:26:30	1.53	16.58	0.95	
6/6/11 9:26:45	1.56	16.56	0.23	
6/6/11 9:27:00	1.56	16.54	0.11	
6/6/11 9:27:15	1.59	16.51	0.10	
6/6/11 9:27:30	1.61	16.50	0.40	Introduce Mid CO ₂
6/6/11 9:27:45	1.59	16.52	1.81	
6/6/11 9:28:00	1.56	16.55	2.98	
6/6/11 9:28:15	1.50	16.61	3.21	
6/6/11 9:28:30	1.52	16.58	2.05	
6/6/11 9:28:45	1.60	16.51	1.75	CO ₂ Upscale RT = 120 seconds
6/6/11 9:29:00	1.60	16.51	5.28	
6/6/11 9:29:15	1.56	16.54	8.01	
6/6/11 9:29:30	1.54	16.55	9.48	
6/6/11 9:29:45	1.54	16.57	10.06	System Bias
6/6/11 9:30:00	1.56	16.55	10.17	
6/6/11 9:30:15	1.56	16.55	10.19	CO ₂ Meter Bias 1 Mid = 10.19
6/6/11 9:30:30	1.51	16.59	10.19	Introduce Zero
6/6/11 9:30:45	1.53	16.58	10.20	
6/6/11 9:31:00	1.61	16.52	10.20	
6/6/11 9:31:15	1.62	16.50	10.21	
6/6/11 9:31:30	1.60	16.49	10.21	
6/6/11 9:31:45	1.58	16.52	10.13	
6/6/11 9:32:00	1.53	16.57	7.46	CO ₂ Downscale RT = 120 seconds
6/6/11 9:32:15	1.54	16.57	3.68	
6/6/11 9:32:30	1.58	16.54	1.34	
6/6/11 9:32:45	1.56	16.54	0.39	
6/6/11 9:33:00	1.53	16.58	0.20	System Bias
6/6/11 9:33:15	1.51	16.59	0.17	
6/6/11 9:33:30	1.53	16.57	0.16	CO ₂ Meter Bias 1 Zero = 0.15
6/6/11 9:33:45	1.59	16.53	0.15	
6/6/11 9:34:00	1.63	16.50	0.14	
6/6/11 9:34:15	1.64	16.47	0.14	
6/6/11 9:34:30	1.63	16.48	0.13	
6/6/11 9:34:45	1.64	16.47	0.13	
6/6/11 9:35:00	1.66	16.44	0.15	
6/6/11 9:35:15	1.68	16.42	0.21	
6/6/11 9:35:30	1.64	16.47	1.39	
6/6/11 9:35:45	1.55	16.54	4.42	
6/6/11 9:36:00	1.50	16.58	6.51	
6/6/11 9:36:15	1.48	16.60	7.58	
6/6/11 9:36:30	1.48	16.60	7.84	
6/6/11 9:36:45	1.50	16.60	7.50	
6/6/11 9:37:00	1.51	16.59	5.53	
6/6/11 9:37:15	1.52	16.59	4.21	
6/6/11 9:37:30	1.51	16.58	3.90	
6/6/11 9:37:45	1.49	16.60	3.87	
6/6/11 9:38:00	1.46	16.63	3.86	
6/6/11 9:38:15	1.48	16.62	3.86	
6/6/11 9:38:30	1.54	16.58	3.87	
6/6/11 9:38:45	1.59	16.54	3.87	
6/6/11 9:39:00	1.66	16.48	3.87	
6/6/11 9:39:15	1.66	16.46	3.87	
6/6/11 9:39:30	1.62	16.48	3.87	
6/6/11 9:39:45	1.56	16.53	3.87	Introduce Zero
6/6/11 9:40:00	1.50	16.59	3.86	
6/6/11 9:40:15	1.46	16.59	3.04	
6/6/11 9:40:30	4.39	11.30	1.19	
6/6/11 9:40:45	4.85	4.78	0.41	
6/6/11 9:41:00	1.72	1.37	0.22	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 9:41:15	0.28	0.35	0.18	CO ₂ and O ₂ Downscale RT = 90 seconds
6/6/11 9:41:30	0.12	0.23	0.17	
6/6/11 9:41:45	0.11	0.19	0.17	
6/6/11 9:42:00	0.10	0.17	0.17	
6/6/11 9:42:15	0.09	0.15	0.17	
6/6/11 9:42:30	0.09	0.13	0.16	System Bias O ₂ Stack Bias 1 Zero = 0.09 CO ₂ Stack Bias 1 Zero = 0.11
6/6/11 9:42:45	0.09	0.12	0.16	
6/6/11 9:43:00	0.09	0.11	0.16	
6/6/11 9:43:15	0.08	0.10	0.16	
6/6/11 9:43:30	0.09	0.10	0.16	
6/6/11 9:43:45	0.08	0.09	0.16	Introduce Mid O ₂
6/6/11 9:44:00	0.08	0.09	0.16	
6/6/11 9:44:15	0.08	0.08	0.16	
6/6/11 9:44:30	0.08	0.08	0.16	
6/6/11 9:44:45	0.35	0.43	0.16	
6/6/11 9:45:00	1.77	1.81	0.16	O ₂ Upscale RT = 90 seconds
6/6/11 9:45:15	3.64	3.35	0.16	
6/6/11 9:45:30	4.36	3.86	0.16	
6/6/11 9:45:45	4.47	3.93	0.16	
6/6/11 9:46:00	4.50	3.95	0.16	
6/6/11 9:46:15	4.51	3.97	0.16	System Bias O ₂ Stack Bias 1 Mid = 4.52
6/6/11 9:46:30	4.52	3.98	0.16	
6/6/11 9:46:45	4.53	3.99	0.16	
6/6/11 9:47:00	4.53	3.99	0.16	
6/6/11 9:47:15	4.54	4.00	0.16	
6/6/11 9:47:30	4.54	4.00	0.16	Introduce Mid CO ₂
6/6/11 9:47:45	4.54	4.00	0.16	
6/6/11 9:48:00	4.54	4.01	0.16	
6/6/11 9:48:15	4.22	6.09	0.16	
6/6/11 9:48:30	4.67	8.27	0.16	
6/6/11 9:48:45	8.87	9.24	0.16	CO ₂ Upscale RT = 90 seconds
6/6/11 9:49:00	11.07	9.77	0.16	
6/6/11 9:49:15	11.45	9.88	0.16	
6/6/11 9:49:30	11.49	9.90	0.16	
6/6/11 9:49:45	11.51	9.92	0.15	
6/6/11 9:50:00	11.51	9.92	0.15	System Bias
6/6/11 9:50:15	11.52	9.93	0.15	
6/6/11 9:50:30	11.52	9.93	0.15	
6/6/11 9:50:45	11.53	9.94	0.15	
6/6/11 9:51:00	11.53	9.94	0.15	
6/6/11 9:51:15	11.53	9.94	0.15	CO ₂ Stack Bias 1 Mid = 9.94
6/6/11 9:51:30	11.53	9.94	0.15	
6/6/11 9:51:45	11.53	9.94	0.15	
6/6/11 9:52:00	11.53	9.94	0.15	
6/6/11 9:52:15	11.54	9.95	0.15	
6/6/11 9:52:30	11.54	9.95	0.15	
6/6/11 9:52:45	11.54	9.95	0.15	
6/6/11 9:53:00	10.45	11.03	0.15	
6/6/11 9:53:15	5.51	14.29	0.15	
6/6/11 9:53:30	2.47	15.92	0.15	
6/6/11 9:53:45	1.88	16.23	0.15	
6/6/11 9:54:00	1.87	16.25	0.15	
6/6/11 9:54:15	1.88	16.25	0.16	
6/6/11 9:54:30	1.87	16.25	0.16	
6/6/11 9:54:45	1.86	16.24	0.16	
6/6/11 9:55:00	1.87	16.23	0.16	
6/6/11 9:55:15	1.86	16.24	0.16	
6/6/11 9:55:30	1.84	16.27	0.16	
6/6/11 9:55:45	1.75	16.33	0.16	
6/6/11 9:56:00	1.71	16.37	0.16	
6/6/11 9:56:15	1.76	16.34	0.16	
6/6/11 9:56:30	1.82	16.30	0.16	
6/6/11 9:56:45	1.78	16.33	0.16	
6/6/11 9:57:00	1.74	16.36	0.16	
6/6/11 9:57:15	1.73	16.37	0.16	
6/6/11 9:57:30	1.70	16.40	0.16	
6/6/11 9:57:45	1.68	16.43	0.16	
6/6/11 9:58:00	1.70	16.42	0.16	
6/6/11 9:58:15	1.73	16.38	0.16	
6/6/11 9:58:30	1.80	16.32	0.16	
6/6/11 9:58:45	1.81	16.31	0.16	
6/6/11 9:59:00	1.83	16.29	0.16	
6/6/11 9:59:15	1.83	16.30	0.16	
6/6/11 9:59:30	1.82	16.30	0.16	
6/6/11 9:59:45	1.79	16.32	0.16	
6/6/11 10:00:00	1.78	16.33	0.15	
6/6/11 10:00:15	1.78	16.34	0.15	
6/6/11 10:00:30	1.77	16.35	0.15	
6/6/11 10:00:45	1.74	16.38	0.15	
6/6/11 10:01:00	1.70	16.41	0.15	
6/6/11 10:01:15	1.67	16.43	0.15	
6/6/11 10:01:30	1.62	16.47	0.15	
6/6/11 10:01:45	1.66	16.45	0.15	
6/6/11 10:02:00	1.69	16.43	0.15	
6/6/11 10:02:15	1.72	16.40	0.15	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 10:02:30	1.77	16.37	0.15	
6/6/11 10:02:45	1.76	16.37	0.15	
6/6/11 10:03:00	1.73	16.38	0.16	
6/6/11 10:03:15	1.66	16.43	0.16	
6/6/11 10:03:30	1.62	16.48	0.16	
6/6/11 10:03:45	1.59	16.51	0.16	
6/6/11 10:04:00	1.63	16.48	0.16	
6/6/11 10:04:15	1.67	16.45	0.16	
6/6/11 10:04:30	1.72	16.42	0.17	
6/6/11 10:04:45	1.69	16.44	0.16	
6/6/11 10:05:00	1.70	16.42	0.16	
6/6/11 10:05:15	1.70	16.42	0.16	
6/6/11 10:05:30	1.69	16.43	0.16	
6/6/11 10:05:45	1.64	16.48	0.16	
6/6/11 10:06:00	1.62	16.49	0.16	
6/6/11 10:06:15	1.65	16.45	0.16	
6/6/11 10:06:30	1.66	16.45	0.16	
6/6/11 10:06:45	1.64	16.46	0.16	
6/6/11 10:07:00	1.67	16.44	0.16	
6/6/11 10:07:15	1.73	16.39	0.16	
6/6/11 10:07:30	1.77	16.36	0.16	
6/6/11 10:07:45	1.76	16.36	0.15	
6/6/11 10:08:00	1.74	16.38	0.15	
6/6/11 10:08:15	1.70	16.40	0.15	
6/6/11 10:08:30	1.67	16.44	0.15	
6/6/11 10:08:45	1.66	16.44	0.15	
6/6/11 10:09:00	1.69	16.42	0.15	
6/6/11 10:09:15	1.67	16.44	0.15	
6/6/11 10:09:30	1.64	16.47	0.15	
6/6/11 10:09:45	1.66	16.45	0.15	
6/6/11 10:10:00	1.71	16.42	0.14	
6/6/11 10:10:15	1.68	16.43	0.14	
6/6/11 10:10:30	1.70	16.41	0.14	
6/6/11 10:10:45	1.72	16.39	0.14	
6/6/11 10:11:00	1.71	16.40	0.14	
6/6/11 10:11:15	1.68	16.43	0.14	
6/6/11 10:11:30	1.69	16.42	0.14	
6/6/11 10:11:45	1.69	16.42	0.13	
6/6/11 10:12:00	1.68	16.43	0.13	
6/6/11 10:12:15	1.70	16.42	0.16	
6/6/11 10:12:30	1.65	16.45	0.16	
6/6/11 10:12:45	1.65	16.45	0.15	
6/6/11 10:13:00	1.73	16.39	0.14	
6/6/11 10:13:15	1.75	16.38	0.13	
6/6/11 10:13:30	1.78	16.35	0.13	
6/6/11 10:13:45	1.75	16.38	0.13	
6/6/11 10:14:00	1.73	16.37	0.13	
6/6/11 10:14:15	1.75	16.36	0.13	
6/6/11 10:14:30	1.75	16.36	0.13	
6/6/11 10:14:45	1.72	16.38	0.13	
6/6/11 10:15:00	1.64	16.45	0.14	
6/6/11 10:15:15	1.60	16.48	0.14	
6/6/11 10:15:30	1.64	16.46	0.14	
6/6/11 10:15:45	1.69	16.42	0.14	
6/6/11 10:16:00	1.70	16.42	0.14	
6/6/11 10:16:15	1.66	16.45	0.14	
6/6/11 10:16:30	1.59	16.50	0.14	
6/6/11 10:16:45	1.57	16.52	0.14	
6/6/11 10:17:00	1.61	16.49	0.14	
6/6/11 10:17:15	1.66	16.45	0.14	
6/6/11 10:17:30	1.63	16.48	0.14	
6/6/11 10:17:45	1.60	16.50	0.14	
6/6/11 10:18:00	1.60	16.52	0.14	
6/6/11 10:18:15	1.61	16.51	0.14	
6/6/11 10:18:30	1.62	16.51	0.14	
6/6/11 10:18:45	1.59	16.53	0.14	
6/6/11 10:19:00	1.56	16.54	0.14	
6/6/11 10:19:15	1.55	16.55	0.14	
6/6/11 10:19:30	1.53	16.56	0.14	
6/6/11 10:19:45	1.55	16.53	0.14	
6/6/11 10:20:00	1.64	16.48	0.14	
6/6/11 10:20:15	1.67	16.46	0.14	
6/6/11 10:20:30	1.66	16.46	0.14	
6/6/11 10:20:45	1.62	16.49	0.14	
6/6/11 10:21:00	1.59	16.51	0.14	
6/6/11 10:21:15	1.62	16.50	0.13	
6/6/11 10:21:30	1.66	16.46	0.13	
6/6/11 10:21:45	1.69	16.43	0.13	
6/6/11 10:22:00	1.72	16.40	0.13	
6/6/11 10:22:15	1.76	16.36	0.13	
6/6/11 10:22:30	1.77	16.35	0.13	
6/6/11 10:22:45	1.73	16.37	0.13	
6/6/11 10:23:00	1.63	16.46	0.13	
6/6/11 10:23:15	1.57	16.53	0.13	
6/6/11 10:23:30	1.65	16.47	0.13	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 10:23:45	1.73	16.40	0.13	
6/6/11 10:24:00	1.78	16.34	0.13	
6/6/11 10:24:15	1.81	16.31	0.13	
6/6/11 10:24:30	1.83	16.28	0.13	
6/6/11 10:24:45	1.81	16.31	0.13	
6/6/11 10:25:00	1.74	16.37	0.13	
6/6/11 10:25:15	1.69	16.41	0.13	
6/6/11 10:25:30	1.63	16.47	0.13	
6/6/11 10:25:45	1.50	16.57	0.13	
6/6/11 10:26:00	1.50	16.58	0.13	
6/6/11 10:26:15	1.53	16.57	0.13	
6/6/11 10:26:30	1.54	16.56	0.14	
6/6/11 10:26:45	1.59	16.51	0.14	
6/6/11 10:27:00	1.61	16.50	0.14	
6/6/11 10:27:15	1.62	16.50	0.14	
6/6/11 10:27:30	1.61	16.51	0.14	
6/6/11 10:27:45	1.61	16.51	0.14	
6/6/11 10:28:00	1.66	16.46	0.14	
6/6/11 10:28:15	1.68	16.44	0.14	
6/6/11 10:28:30	1.66	16.45	0.14	
6/6/11 10:28:45	1.63	16.48	0.14	
6/6/11 10:29:00	1.64	16.49	0.14	
6/6/11 10:29:15	1.63	16.48	0.14	
6/6/11 10:29:30	1.66	16.43	0.14	
6/6/11 10:29:45	1.72	16.38	0.14	
6/6/11 10:30:00	1.73	16.38	0.14	
6/6/11 10:30:15	1.70	16.41	0.14	
6/6/11 10:30:30	1.67	16.43	0.14	
6/6/11 10:30:45	1.67	16.44	0.14	
6/6/11 10:31:00	1.68	16.43	0.14	
6/6/11 10:31:15	1.70	16.41	0.14	
6/6/11 10:31:30	1.68	16.44	0.13	
6/6/11 10:31:45	1.62	16.47	0.13	
6/6/11 10:32:00	1.69	16.41	0.13	
6/6/11 10:32:15	1.77	16.35	0.13	
6/6/11 10:32:30	1.80	16.33	0.13	
6/6/11 10:32:45	1.80	16.32	0.13	
6/6/11 10:33:00	1.82	16.30	0.13	
6/6/11 10:33:15	1.82	16.31	0.13	
6/6/11 10:33:30	1.81	16.30	0.13	
6/6/11 10:33:45	1.77	16.34	0.13	
6/6/11 10:34:00	1.72	16.37	0.13	
6/6/11 10:34:15	1.72	16.37	0.13	
6/6/11 10:34:30	1.65	16.43	0.13	
6/6/11 10:34:45	1.64	16.45	0.13	
6/6/11 10:35:00	1.65	16.46	0.13	
6/6/11 10:35:15	1.70	16.42	0.13	
6/6/11 10:35:30	1.75	16.37	0.13	
6/6/11 10:35:45	1.76	16.36	0.13	
6/6/11 10:36:00	1.68	16.43	0.13	
6/6/11 10:36:15	1.61	16.48	0.13	
6/6/11 10:36:30	1.65	16.43	0.13	
6/6/11 10:36:45	1.69	16.41	0.13	
6/6/11 10:37:00	1.68	16.43	0.13	
6/6/11 10:37:15	1.67	16.43	0.13	
6/6/11 10:37:30	1.75	16.35	0.13	
6/6/11 10:37:45	1.77	16.35	0.14	
6/6/11 10:38:00	1.70	16.42	0.14	
6/6/11 10:38:15	1.72	16.41	0.14	
6/6/11 10:38:30	1.79	16.34	0.14	
6/6/11 10:38:45	1.81	16.31	0.14	
6/6/11 10:39:00	1.79	16.34	0.14	
6/6/11 10:39:15	1.75	16.37	0.14	
6/6/11 10:39:30	1.72	16.39	0.14	
6/6/11 10:39:45	1.74	16.37	0.14	
6/6/11 10:40:00	1.75	16.37	0.14	
6/6/11 10:40:15	1.72	16.38	0.14	
6/6/11 10:40:30	1.73	16.39	0.14	
6/6/11 10:40:45	1.69	16.42	0.14	
6/6/11 10:41:00	1.61	16.48	0.14	
6/6/11 10:41:15	1.56	16.52	0.14	
6/6/11 10:41:30	1.63	16.47	0.13	
6/6/11 10:41:45	1.69	16.43	0.13	
6/6/11 10:42:00	1.68	16.43	0.13	
6/6/11 10:42:15	1.72	16.39	0.13	
6/6/11 10:42:30	1.75	16.37	0.13	
6/6/11 10:42:45	1.73	16.39	0.13	
6/6/11 10:43:00	1.71	16.40	0.13	
6/6/11 10:43:15	1.69	16.40	0.13	
6/6/11 10:43:30	1.69	16.40	0.13	
6/6/11 10:43:45	1.70	16.41	0.13	
6/6/11 10:44:00	1.68	16.45	0.13	
6/6/11 10:44:15	1.71	16.40	0.13	
6/6/11 10:44:30	1.81	16.32	0.13	
6/6/11 10:44:45	1.81	16.33	0.13	

**Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 10:45:00	1.72	16.39	0.13	
6/6/11 10:45:15	1.73	16.37	0.13	
6/6/11 10:45:30	1.74	16.36	0.13	
6/6/11 10:45:45	1.71	16.39	0.13	
6/6/11 10:46:00	1.69	16.42	0.13	
6/6/11 10:46:15	1.71	16.40	0.13	
6/6/11 10:46:30	1.72	16.38	0.13	
6/6/11 10:46:45	1.72	16.38	0.13	
6/6/11 10:47:00	1.73	16.38	0.13	
6/6/11 10:47:15	1.79	16.32	0.13	
6/6/11 10:47:30	1.83	16.31	0.13	
6/6/11 10:47:45	1.77	16.34	0.13	
6/6/11 10:48:00	1.75	16.35	0.13	
6/6/11 10:48:15	1.75	16.36	0.13	
6/6/11 10:48:30	1.73	16.38	0.14	
6/6/11 10:48:45	1.74	16.36	0.14	
6/6/11 10:49:00	1.76	16.35	0.14	
6/6/11 10:49:15	1.73	16.38	0.14	
6/6/11 10:49:30	1.68	16.42	0.14	
6/6/11 10:49:45	1.66	16.44	0.14	
6/6/11 10:50:00	1.66	16.45	0.14	
6/6/11 10:50:15	1.65	16.44	0.14	
6/6/11 10:50:30	1.67	16.42	0.14	
6/6/11 10:50:45	1.67	16.42	0.14	
6/6/11 10:51:00	1.66	16.45	0.14	
6/6/11 10:51:15	1.66	16.44	0.14	
6/6/11 10:51:30	1.62	16.47	0.14	
6/6/11 10:51:45	1.59	16.50	0.14	
6/6/11 10:52:00	1.63	16.48	0.14	
6/6/11 10:52:15	1.60	16.51	0.14	
6/6/11 10:52:30	1.65	16.45	0.13	
6/6/11 10:52:45	1.76	16.36	0.13	
6/6/11 10:53:00	1.76	16.36	0.13	
6/6/11 10:53:15	1.73	16.37	0.13	
6/6/11 10:53:30	1.72	16.37	0.13	
6/6/11 10:53:45	1.66	16.42	0.13	
6/6/11 10:54:00	1.63	16.45	0.13	
6/6/11 10:54:15	1.60	16.50	0.13	
6/6/11 10:54:30	1.60	16.49	0.13	
6/6/11 10:54:45	1.67	16.44	0.13	
6/6/11 10:55:00	1.72	16.41	0.13	
6/6/11 10:55:15	1.71	16.41	0.13	
6/6/11 10:55:30	1.70	16.41	0.13	
6/6/11 10:55:45	1.73	16.38	0.13	
6/6/11 10:56:00	1.77	16.35	0.13	
6/6/11 10:56:15	1.76	16.37	0.13	
6/6/11 10:56:30	1.71	16.41	0.13	
6/6/11 10:56:45	1.73	16.38	0.13	
6/6/11 10:57:00	1.76	16.35	0.13	
6/6/11 10:57:15	1.71	16.42	0.13	
6/6/11 10:57:30	1.63	16.47	0.13	
6/6/11 10:57:45	1.69	16.42	0.13	
6/6/11 10:58:00	1.78	16.34	0.13	
6/6/11 10:58:15	1.79	16.32	0.13	
6/6/11 10:58:30	1.75	16.34	0.13	
6/6/11 10:58:45	1.74	16.35	0.13	
6/6/11 10:59:00	1.75	16.35	0.13	
6/6/11 10:59:15	1.74	16.35	0.14	
6/6/11 10:59:30	1.72	16.37	0.14	
6/6/11 10:59:45	1.71	16.39	0.14	
6/6/11 11:00:00	1.69	16.42	0.14	
6/6/11 11:00:15	1.69	16.42	0.14	
6/6/11 11:00:30	1.71	16.41	0.14	
6/6/11 11:00:45	1.69	16.42	0.14	
6/6/11 11:01:00	1.67	16.43	0.14	
6/6/11 11:01:15	1.66	16.44	0.14	
6/6/11 11:01:30	1.67	16.43	0.14	
6/6/11 11:01:45	1.70	16.41	0.14	
6/6/11 11:02:00	1.67	16.42	0.14	
6/6/11 11:02:15	1.66	16.44	0.14	
6/6/11 11:02:30	1.63	16.50	0.14	
6/6/11 11:02:45	1.63	16.49	0.14	
6/6/11 11:03:00	1.66	16.46	0.13	
6/6/11 11:03:15	1.68	16.44	0.13	
6/6/11 11:03:30	1.72	16.40	0.13	
6/6/11 11:03:45	1.71	16.40	0.13	
6/6/11 11:04:00	1.72	16.39	0.13	
6/6/11 11:04:15	1.72	16.40	0.13	
6/6/11 11:04:30	1.69	16.43	0.13	
6/6/11 11:04:45	1.69	16.41	0.13	
6/6/11 11:05:00	1.70	16.41	0.13	
6/6/11 11:05:15	1.70	16.41	0.13	
6/6/11 11:05:30	1.74	16.37	0.13	
6/6/11 11:05:45	1.70	16.41	0.13	
6/6/11 11:06:00	1.64	16.45	0.13	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 11:06:15	1.67	16.42	0.13	
6/6/11 11:06:30	1.66	16.44	0.13	
6/6/11 11:06:45	1.59	16.49	0.13	
6/6/11 11:07:00	1.58	16.51	0.13	
6/6/11 11:07:15	1.61	16.49	0.13	
6/6/11 11:07:30	1.62	16.48	0.13	
6/6/11 11:07:45	1.61	16.49	0.13	
6/6/11 11:08:00	1.61	16.49	0.13	
6/6/11 11:08:15	1.62	16.48	0.13	
6/6/11 11:08:30	1.67	16.43	0.13	
6/6/11 11:08:45	1.74	16.37	0.13	
6/6/11 11:09:00	1.79	16.33	0.13	
6/6/11 11:09:15	1.73	16.37	0.13	
6/6/11 11:09:30	1.63	16.46	0.13	
6/6/11 11:09:45	1.61	16.48	0.14	
6/6/11 11:10:00	1.64	16.46	0.13	
6/6/11 11:10:15	1.62	16.50	0.14	
6/6/11 11:10:30	1.57	16.54	0.14	
6/6/11 11:10:45	1.57	16.52	0.14	
6/6/11 11:11:00	1.62	16.47	0.14	
6/6/11 11:11:15	1.67	16.43	0.14	
6/6/11 11:11:30	1.66	16.43	0.14	
6/6/11 11:11:45	1.60	16.47	0.14	
6/6/11 11:12:00	1.55	16.53	0.14	
6/6/11 11:12:15	1.49	16.59	0.14	
6/6/11 11:12:30	1.47	16.61	0.14	
6/6/11 11:12:45	1.49	16.59	0.14	
6/6/11 11:13:00	1.55	16.54	0.13	
6/6/11 11:13:15	1.61	16.50	0.13	
6/6/11 11:13:30	1.62	16.49	0.13	
6/6/11 11:13:45	1.62	16.47	0.13	
6/6/11 11:14:00	1.61	16.48	0.13	
6/6/11 11:14:15	1.58	16.51	0.13	
6/6/11 11:14:30	1.58	16.51	0.13	
6/6/11 11:14:45	1.60	16.50	0.13	
6/6/11 11:15:00	1.61	16.49	0.13	
6/6/11 11:15:15	1.59	16.49	0.13	
6/6/11 11:15:30	1.59	16.49	0.13	
6/6/11 11:15:45	1.54	16.55	0.13	
6/6/11 11:16:00	1.48	16.60	0.13	
6/6/11 11:16:15	1.50	16.59	0.13	
6/6/11 11:16:30	1.57	16.55	0.13	
6/6/11 11:16:45	1.61	16.49	0.13	
6/6/11 11:17:00	1.66	16.44	0.12	
6/6/11 11:17:15	1.64	16.46	0.12	
6/6/11 11:17:30	1.58	16.51	0.13	
6/6/11 11:17:45	1.55	16.54	0.13	
6/6/11 11:18:00	1.55	16.54	0.13	
6/6/11 11:18:15	1.61	16.50	0.13	
6/6/11 11:18:30	1.61	16.50	0.13	
6/6/11 11:18:45	1.60	16.50	0.13	
6/6/11 11:19:00	1.60	16.49	0.13	
6/6/11 11:19:15	1.62	16.47	0.13	
6/6/11 11:19:30	1.60	16.50	0.13	
6/6/11 11:19:45	1.59	16.50	0.13	
6/6/11 11:20:00	1.59	16.51	0.13	
6/6/11 11:20:15	1.59	16.51	0.13	
6/6/11 11:20:30	1.58	16.51	0.13	
6/6/11 11:20:45	1.56	16.53	0.13	
6/6/11 11:21:00	1.55	16.53	0.13	
6/6/11 11:21:15	1.58	16.51	0.14	
6/6/11 11:21:30	1.62	16.49	0.14	
6/6/11 11:21:45	1.63	16.48	0.14	
6/6/11 11:22:00	1.64	16.46	0.14	
6/6/11 11:22:15	1.62	16.48	0.14	
6/6/11 11:22:30	1.60	16.50	0.14	
6/6/11 11:22:45	1.54	16.55	0.14	
6/6/11 11:23:00	1.50	16.59	0.14	
6/6/11 11:23:15	1.50	16.59	0.14	
6/6/11 11:23:30	1.54	16.55	0.14	
6/6/11 11:23:45	1.57	16.53	0.13	
6/6/11 11:24:00	1.59	16.50	0.13	
6/6/11 11:24:15	1.57	16.52	0.13	
6/6/11 11:24:30	1.57	16.51	0.13	
6/6/11 11:24:45	1.60	16.49	0.13	
6/6/11 11:25:00	1.58	16.51	0.13	Begin Run 1
6/6/11 11:25:15	1.55	16.53	0.13	Meter CO ₂ Response
6/6/11 11:25:30	1.58	16.52	0.13	
6/6/11 11:25:45	1.55	16.54	0.13	
6/6/11 11:26:00	1.56	16.52	0.13	
6/6/11 11:26:15	1.56	16.54	0.13	
6/6/11 11:26:30	1.54	16.56	0.12	
6/6/11 11:26:45	1.55	16.54	0.24	
6/6/11 11:27:00	1.60	16.49	1.39	
6/6/11 11:27:15	1.61	16.48	3.79	

**Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 11:27:30	1.65	16.45	6.10	
6/6/11 11:27:45	1.65	16.46	7.66	
6/6/11 11:28:00	1.59	16.50	8.41	
6/6/11 11:28:15	1.56	16.52	8.73	
6/6/11 11:28:30	1.56	16.52	8.87	
6/6/11 11:28:45	1.58	16.51	8.95	
6/6/11 11:29:00	1.61	16.49	9.06	
6/6/11 11:29:15	1.64	16.46	9.21	
6/6/11 11:29:30	1.61	16.48	9.37	
6/6/11 11:29:45	1.63	16.47	9.50	
6/6/11 11:30:00	1.63	16.45	9.60	
6/6/11 11:30:15	1.64	16.44	9.64	
6/6/11 11:30:30	1.61	16.47	9.68	
6/6/11 11:30:45	1.60	16.48	9.76	
6/6/11 11:31:00	1.64	16.46	9.91	
6/6/11 11:31:15	1.67	16.43	10.08	
6/6/11 11:31:30	1.70	16.39	10.21	
6/6/11 11:31:45	1.71	16.40	10.33	
6/6/11 11:32:00	1.65	16.44	10.42	
6/6/11 11:32:15	1.56	16.52	10.47	
6/6/11 11:32:30	1.51	16.57	10.47	
6/6/11 11:32:45	1.51	16.58	10.47	
6/6/11 11:33:00	1.53	16.57	10.49	
6/6/11 11:33:15	1.58	16.52	10.30	
6/6/11 11:33:30	1.59	16.51	10.32	
6/6/11 11:33:45	1.58	16.51	10.51	
6/6/11 11:34:00	1.56	16.52	10.62	
6/6/11 11:34:15	1.52	16.57	10.75	
6/6/11 11:34:30	1.53	16.55	10.89	
6/6/11 11:34:45	1.61	16.50	11.01	
6/6/11 11:35:00	1.62	16.53	11.10	
6/6/11 11:35:15	1.57	16.54	11.15	
6/6/11 11:35:30	1.58	16.52	11.20	
6/6/11 11:35:45	1.59	16.50	11.23	
6/6/11 11:36:00	1.57	16.53	11.22	
6/6/11 11:36:15	1.52	16.57	11.23	
6/6/11 11:36:30	1.53	16.55	11.29	
6/6/11 11:36:45	1.62	16.48	11.33	
6/6/11 11:37:00	1.63	16.47	11.39	
6/6/11 11:37:15	1.63	16.46	11.45	
6/6/11 11:37:30	1.66	16.43	11.48	
6/6/11 11:37:45	1.65	16.44	11.51	
6/6/11 11:38:00	1.64	16.46	11.53	
6/6/11 11:38:15	1.64	16.45	11.56	
6/6/11 11:38:30	1.63	16.47	11.59	
6/6/11 11:38:45	1.58	16.51	11.61	
6/6/11 11:39:00	1.51	16.56	11.65	
6/6/11 11:39:15	1.52	16.56	11.68	
6/6/11 11:39:30	1.50	16.58	11.72	
6/6/11 11:39:45	1.48	16.59	11.77	
6/6/11 11:40:00	1.52	16.58	11.81	
6/6/11 11:40:15	1.55	16.56	11.81	
6/6/11 11:40:30	1.54	16.56	11.77	
6/6/11 11:40:45	1.54	16.56	11.74	
6/6/11 11:41:00	1.58	16.52	11.70	
6/6/11 11:41:15	1.62	16.49	9.13	
6/6/11 11:41:30	1.62	16.50	3.83	
6/6/11 11:41:45	1.59	16.51	0.99	
6/6/11 11:42:00	1.53	16.56	0.32	
6/6/11 11:42:15	1.47	16.61	0.23	
6/6/11 11:42:30	1.53	16.57	0.21	
6/6/11 11:42:45	1.58	16.54	0.20	
6/6/11 11:43:00	1.56	16.55	0.19	
6/6/11 11:43:15	1.55	16.54	0.18	
6/6/11 11:43:30	1.54	16.57	0.18	
6/6/11 11:43:45	1.57	16.54	0.18	
6/6/11 11:44:00	1.59	16.52	0.17	
6/6/11 11:44:15	1.59	16.52	0.17	
6/6/11 11:44:30	1.57	16.53	0.17	
6/6/11 11:44:45	1.59	16.51	0.16	
6/6/11 11:45:00	1.63	16.47	0.16	
6/6/11 11:45:15	1.63	16.47	0.16	
6/6/11 11:45:30	1.61	16.48	0.16	
6/6/11 11:45:45	1.64	16.47	0.15	
6/6/11 11:46:00	1.64	16.46	0.15	
6/6/11 11:46:15	1.63	16.46	0.15	
6/6/11 11:46:30	1.57	16.51	0.15	
6/6/11 11:46:45	1.52	16.57	0.15	
6/6/11 11:47:00	1.47	16.62	0.15	
6/6/11 11:47:15	1.45	16.63	0.14	
6/6/11 11:47:30	1.46	16.63	0.14	
6/6/11 11:47:45	1.45	16.64	0.14	
6/6/11 11:48:00	1.48	16.62	0.14	
6/6/11 11:48:15	1.48	16.63	0.14	
6/6/11 11:48:30	1.46	16.63	0.14	

Port Change OTM 029

Valero Port Arthur Refinery, Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 11:48:45	1.56	16.54	0.14	
6/6/11 11:49:00	1.62	16.49	0.14	
6/6/11 11:49:15	1.61	16.50	0.14	
6/6/11 11:49:30	1.58	16.52	0.14	
6/6/11 11:49:45	1.49	16.59	0.14	
6/6/11 11:50:00	1.51	16.57	0.14	Restart OTM 029
6/6/11 11:50:15	1.55	16.56	0.14	
6/6/11 11:50:30	1.53	16.57	0.14	
6/6/11 11:50:45	1.51	16.58	0.14	
6/6/11 11:51:00	1.47	16.63	0.22	
6/6/11 11:51:15	1.45	16.64	2.90	
6/6/11 11:51:30	1.47	16.62	7.24	
6/6/11 11:51:45	1.48	16.61	9.16	
6/6/11 11:52:00	1.46	16.64	8.96	
6/6/11 11:52:15	1.45	16.64	9.55	
6/6/11 11:52:30	1.45	16.64	10.81	
6/6/11 11:52:45	1.42	16.67	11.80	
6/6/11 11:53:00	1.41	16.68	12.46	
6/6/11 11:53:15	1.47	16.64	12.92	
6/6/11 11:53:30	1.53	16.58	13.16	
6/6/11 11:53:45	1.59	16.53	13.27	
6/6/11 11:54:00	1.56	16.54	13.30	
6/6/11 11:54:15	1.56	16.55	13.29	
6/6/11 11:54:30	1.56	16.55	13.29	
6/6/11 11:54:45	1.52	16.58	13.29	Port Change M26A
6/6/11 11:55:00	1.48	16.61	13.28	
6/6/11 11:55:15	1.48	16.61	13.26	
6/6/11 11:55:30	1.53	16.57	13.24	
6/6/11 11:55:45	1.52	16.58	13.22	
6/6/11 11:56:00	1.51	16.58	13.21	
6/6/11 11:56:15	1.55	16.54	13.20	
6/6/11 11:56:30	1.58	16.52	13.19	
6/6/11 11:56:45	1.57	16.53	13.18	
6/6/11 11:57:00	1.52	16.58	13.17	
6/6/11 11:57:15	1.50	16.59	13.15	
6/6/11 11:57:30	1.58	16.54	13.14	
6/6/11 11:57:45	1.64	16.49	13.13	
6/6/11 11:58:00	1.61	16.51	13.09	
6/6/11 11:58:15	1.56	16.53	13.04	
6/6/11 11:58:30	1.55	16.55	13.02	
6/6/11 11:58:45	1.55	16.55	13.04	
6/6/11 11:59:00	1.60	16.51	13.08	
6/6/11 11:59:15	1.61	16.50	13.10	
6/6/11 11:59:30	1.63	16.48	13.12	
6/6/11 11:59:45	1.63	16.48	13.13	
6/6/11 12:00:00	1.60	16.49	13.12	
6/6/11 12:00:15	1.58	16.50	13.11	
6/6/11 12:00:30	1.59	16.50	13.12	
6/6/11 12:00:45	1.56	16.52	13.15	
6/6/11 12:01:00	1.55	16.55	13.20	
6/6/11 12:01:15	1.58	16.54	13.25	
6/6/11 12:01:30	1.64	16.47	13.30	
6/6/11 12:01:45	1.62	16.48	13.36	
6/6/11 12:02:00	1.54	16.55	13.41	
6/6/11 12:02:15	1.49	16.58	13.45	
6/6/11 12:02:30	1.50	16.58	13.50	
6/6/11 12:02:45	1.51	16.58	13.57	
6/6/11 12:03:00	1.54	16.57	13.64	
6/6/11 12:03:15	1.54	16.57	13.68	
6/6/11 12:03:30	1.56	16.55	13.70	
6/6/11 12:03:45	1.56	16.54	13.73	
6/6/11 12:04:00	1.54	16.56	13.77	
6/6/11 12:04:15	1.56	16.55	13.80	
6/6/11 12:04:30	1.63	16.50	13.83	
6/6/11 12:04:45	1.63	16.48	13.87	
6/6/11 12:05:00	1.61	16.49	13.92	Port Change OTM 029
6/6/11 12:05:15	1.56	16.52	13.96	
6/6/11 12:05:30	1.56	16.51	13.98	
6/6/11 12:05:45	1.58	16.52	13.99	
6/6/11 12:06:00	1.54	16.55	14.00	
6/6/11 12:06:15	1.55	16.53	11.75	
6/6/11 12:06:30	1.60	16.49	5.93	
6/6/11 12:06:45	1.60	16.50	1.87	
6/6/11 12:07:00	1.60	16.49	0.51	
6/6/11 12:07:15	1.62	16.48	0.27	
6/6/11 12:07:30	1.59	16.52	0.23	
6/6/11 12:07:45	1.60	16.51	0.21	
6/6/11 12:08:00	1.59	16.51	0.20	
6/6/11 12:08:15	1.58	16.51	0.19	
6/6/11 12:08:30	1.56	16.53	0.18	
6/6/11 12:08:45	1.58	16.52	0.18	
6/6/11 12:09:00	1.62	16.50	0.17	
6/6/11 12:09:15	1.64	16.48	0.17	
6/6/11 12:09:30	1.63	16.48	0.17	
6/6/11 12:09:45	1.60	16.50	0.16	

**Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 12:10:00	1.59	16.50	0.16	
6/6/11 12:10:15	1.58	16.51	0.16	
6/6/11 12:10:30	1.54	16.54	0.16	
6/6/11 12:10:45	1.56	16.53	0.16	
6/6/11 12:11:00	1.56	16.54	0.15	
6/6/11 12:11:15	1.51	16.57	0.15	
6/6/11 12:11:30	1.50	16.58	0.15	
6/6/11 12:11:45	1.46	16.61	0.15	
6/6/11 12:12:00	1.47	16.60	0.15	
6/6/11 12:12:15	1.60	16.51	0.15	
6/6/11 12:12:30	1.69	16.43	0.15	
6/6/11 12:12:45	1.74	16.38	0.15	
6/6/11 12:13:00	1.74	16.39	0.15	
6/6/11 12:13:15	1.65	16.44	0.15	
6/6/11 12:13:30	1.63	16.45	0.15	
6/6/11 12:13:45	1.61	16.47	0.15	
6/6/11 12:14:00	1.59	16.51	0.15	
6/6/11 12:14:15	1.58	16.52	0.15	
6/6/11 12:14:30	1.62	16.48	0.15	
6/6/11 12:14:45	1.63	16.48	0.15	
6/6/11 12:15:00	1.61	16.48	0.15	
6/6/11 12:15:15	1.61	16.47	0.15	
6/6/11 12:15:30	1.59	16.48	0.15	
6/6/11 12:15:45	1.56	16.51	0.15	
6/6/11 12:16:00	1.54	16.54	0.15	
6/6/11 12:16:15	1.54	16.55	0.15	
6/6/11 12:16:30	1.53	16.57	0.15	
6/6/11 12:16:45	1.51	16.58	0.15	
6/6/11 12:17:00	1.54	16.56	0.15	
6/6/11 12:17:15	1.58	16.52	0.15	
6/6/11 12:17:30	1.63	16.48	0.14	
6/6/11 12:17:45	1.63	16.47	0.14	
6/6/11 12:18:00	1.64	16.46	0.14	
6/6/11 12:18:15	1.63	16.47	0.14	
6/6/11 12:18:30	1.61	16.49	0.14	
6/6/11 12:18:45	1.59	16.51	0.14	
6/6/11 12:19:00	1.60	16.50	0.14	
6/6/11 12:19:15	1.60	16.50	0.14	
6/6/11 12:19:30	1.59	16.49	0.14	
6/6/11 12:19:45	1.58	16.51	0.14	
6/6/11 12:20:00	1.61	16.48	0.14	
6/6/11 12:20:15	1.69	16.41	2.20	
6/6/11 12:20:30	1.71	16.40	6.22	
6/6/11 12:20:45	1.69	16.41	7.32	
6/6/11 12:21:00	1.65	16.45	4.92	
6/6/11 12:21:15	1.62	16.49	1.59	
6/6/11 12:21:30	1.61	16.49	1.29	
6/6/11 12:21:45	1.65	16.46	4.69	
6/6/11 12:22:00	1.66	16.46	6.76	
6/6/11 12:22:15	1.60	16.50	6.64	
6/6/11 12:22:30	1.58	16.51	7.95	
6/6/11 12:22:45	1.57	16.52	10.09	
6/6/11 12:23:00	1.52	16.54	11.76	
6/6/11 12:23:15	1.54	16.54	12.80	
6/6/11 12:23:30	1.56	16.53	13.46	
6/6/11 12:23:45	1.55	16.54	13.85	
6/6/11 12:24:00	1.52	16.56	14.10	
6/6/11 12:24:15	1.52	16.57	14.26	
6/6/11 12:24:30	1.57	16.53	14.37	
6/6/11 12:24:45	1.63	16.48	14.47	
6/6/11 12:25:00	1.62	16.49	14.54	
6/6/11 12:25:15	1.54	16.55	14.57	
6/6/11 12:25:30	1.51	16.58	14.59	
6/6/11 12:25:45	1.47	16.62	14.61	
6/6/11 12:26:00	1.42	16.66	14.64	
6/6/11 12:26:15	1.43	16.66	14.67	
6/6/11 12:26:30	1.49	16.60	14.71	
6/6/11 12:26:45	1.56	16.56	14.74	
6/6/11 12:27:00	1.55	16.57	14.75	
6/6/11 12:27:15	1.55	16.55	14.75	
6/6/11 12:27:30	1.57	16.53	14.75	
6/6/11 12:27:45	1.59	16.50	14.74	
6/6/11 12:28:00	1.64	16.46	14.72	
6/6/11 12:28:15	1.64	16.45	14.68	
6/6/11 12:28:30	1.61	16.47	14.67	
6/6/11 12:28:45	1.54	16.52	14.68	
6/6/11 12:29:00	1.50	16.57	14.69	
6/6/11 12:29:15	1.51	16.58	14.72	
6/6/11 12:29:30	1.53	16.57	14.75	
6/6/11 12:29:45	1.53	16.56	14.77	
6/6/11 12:30:00	1.49	16.60	14.78	
6/6/11 12:30:15	1.46	16.61	14.80	
6/6/11 12:30:30	1.51	16.58	14.81	
6/6/11 12:30:45	1.56	16.55	14.84	
6/6/11 12:31:00	1.58	16.53	14.88	

Restart OTM 029

**Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 12:31:15	1.57	16.53	14.89	
6/6/11 12:31:30	1.53	16.57	14.91	
6/6/11 12:31:45	1.50	16.58	14.93	
6/6/11 12:32:00	1.50	16.57	14.94	
6/6/11 12:32:15	1.51	16.57	14.96	
6/6/11 12:32:30	1.57	16.53	14.98	
6/6/11 12:32:45	1.63	16.49	14.98	
6/6/11 12:33:00	1.65	16.47	14.97	
6/6/11 12:33:15	1.68	16.42	14.94	
6/6/11 12:33:30	1.69	16.41	14.90	
6/6/11 12:33:45	1.67	16.43	14.88	
6/6/11 12:34:00	1.62	16.47	14.88	
6/6/11 12:34:15	1.65	16.44	14.87	
6/6/11 12:34:30	1.68	16.42	14.87	
6/6/11 12:34:45	1.69	16.41	14.87	
6/6/11 12:35:00	1.65	16.45	14.87	Port Change OTM 029
6/6/11 12:35:15	1.60	16.49	14.88	
6/6/11 12:35:30	1.59	16.50	14.90	
6/6/11 12:35:45	1.60	16.49	14.92	
6/6/11 12:36:00	1.60	16.49	14.95	
6/6/11 12:36:15	1.55	16.53	14.97	
6/6/11 12:36:30	1.55	16.54	12.70	
6/6/11 12:36:45	1.56	16.54	6.61	
6/6/11 12:37:00	1.58	16.51	2.22	
6/6/11 12:37:15	1.64	16.47	0.60	
6/6/11 12:37:30	1.65	16.45	0.29	
6/6/11 12:37:45	1.61	16.49	0.24	
6/6/11 12:38:00	1.53	16.55	0.22	
6/6/11 12:38:15	1.52	16.56	0.21	
6/6/11 12:38:30	1.49	16.59	0.20	
6/6/11 12:38:45	1.45	16.62	0.20	
6/6/11 12:39:00	1.43	16.65	0.19	
6/6/11 12:39:15	1.47	16.63	0.18	
6/6/11 12:39:30	1.52	16.59	0.18	
6/6/11 12:39:45	1.53	16.57	0.18	
6/6/11 12:40:00	1.55	16.54	0.17	
6/6/11 12:40:15	1.52	16.57	0.17	
6/6/11 12:40:30	1.48	16.60	0.16	
6/6/11 12:40:45	1.47	16.61	0.16	
6/6/11 12:41:00	1.46	16.62	0.16	
6/6/11 12:41:15	1.49	16.58	0.16	
6/6/11 12:41:30	1.53	16.56	0.15	
6/6/11 12:41:45	1.55	16.56	0.15	
6/6/11 12:42:00	1.59	16.51	0.15	
6/6/11 12:42:15	1.60	16.50	0.15	
6/6/11 12:42:30	1.55	16.53	0.15	
6/6/11 12:42:45	1.55	16.54	0.15	
6/6/11 12:43:00	1.56	16.53	0.15	
6/6/11 12:43:15	1.56	16.53	0.15	
6/6/11 12:43:30	1.59	16.52	0.15	
6/6/11 12:43:45	1.57	16.53	0.15	
6/6/11 12:44:00	1.55	16.54	0.14	Restart OTM 029
6/6/11 12:44:15	1.60	16.50	0.14	
6/6/11 12:44:30	1.62	16.49	0.14	
6/6/11 12:44:45	1.62	16.48	0.48	
6/6/11 12:45:00	1.57	16.51	2.79	
6/6/11 12:45:15	1.57	16.51	7.30	
6/6/11 12:45:30	1.61	16.49	7.36	
6/6/11 12:45:45	1.59	16.53	3.27	
6/6/11 12:46:00	1.54	16.56	1.40	
6/6/11 12:46:15	1.57	16.52	4.63	
6/6/11 12:46:30	1.59	16.49	7.55	
6/6/11 12:46:45	1.53	16.54	7.91	
6/6/11 12:47:00	1.50	16.57	8.61	
6/6/11 12:47:15	1.50	16.58	10.57	
6/6/11 12:47:30	1.49	16.60	12.22	
6/6/11 12:47:45	1.53	16.54	13.41	
6/6/11 12:48:00	1.59	16.50	14.11	
6/6/11 12:48:15	1.52	16.56	14.54	
6/6/11 12:48:30	1.47	16.61	14.80	
6/6/11 12:48:45	1.47	16.61	14.98	
6/6/11 12:49:00	1.53	16.58	15.12	
6/6/11 12:49:15	1.58	16.52	15.23	
6/6/11 12:49:30	1.58	16.52	15.30	
6/6/11 12:49:45	1.52	16.56	15.34	
6/6/11 12:50:00	1.49	16.58	15.36	
6/6/11 12:50:15	1.42	16.66	15.39	
6/6/11 12:50:30	1.40	16.67	15.42	
6/6/11 12:50:45	1.45	16.63	15.46	
6/6/11 12:51:00	1.53	16.57	15.50	
6/6/11 12:51:15	1.57	16.54	15.53	
6/6/11 12:51:30	1.59	16.51	15.56	
6/6/11 12:51:45	1.60	16.50	15.56	
6/6/11 12:52:00	1.57	16.52	15.57	
6/6/11 12:52:15	1.56	16.52	15.59	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 12:52:30	1.54	16.54	15.61	OTM 029 Run 1 Complete
6/6/11 12:52:45	1.53	16.55	15.64	
6/6/11 12:53:00	1.50	16.58	15.66	
6/6/11 12:53:15	1.46	16.61	15.68	
6/6/11 12:53:30	1.49	16.59	15.71	
6/6/11 12:53:45	1.51	16.59	15.74	
6/6/11 12:54:00	1.51	16.59	15.76	
6/6/11 12:54:15	1.57	16.54	15.76	
6/6/11 12:54:30	1.64	16.47	15.77	
6/6/11 12:54:45	1.64	16.46	15.77	
6/6/11 12:55:00	1.64	16.47	15.76	
6/6/11 12:55:15	1.62	16.49	15.73	
6/6/11 12:55:30	1.60	16.50	15.73	
6/6/11 12:55:45	1.61	16.47	15.75	
6/6/11 12:56:00	1.65	16.42	15.76	
6/6/11 12:56:15	1.65	16.43	15.77	
6/6/11 12:56:30	1.65	16.44	15.76	
6/6/11 12:56:45	1.65	16.44	15.75	
6/6/11 12:57:00	1.64	16.47	15.77	
6/6/11 12:57:15	1.62	16.47	15.76	
6/6/11 12:57:30	1.64	16.46	15.73	
6/6/11 12:57:45	1.66	16.44	15.73	
6/6/11 12:58:00	1.68	16.42	15.75	
6/6/11 12:58:15	1.69	16.39	15.79	
6/6/11 12:58:30	1.76	16.34	15.80	
6/6/11 12:58:45	1.80	16.31	15.81	
6/6/11 12:59:00	1.81	16.30	15.82	
6/6/11 12:59:15	1.79	16.31	15.82	
6/6/11 12:59:30	1.73	16.36	15.79	
6/6/11 12:59:45	1.66	16.41	15.77	
6/6/11 13:00:00	1.57	16.49	15.77	
6/6/11 13:00:15	1.52	16.55	15.79	
6/6/11 13:00:30	1.53	16.56	15.84	
6/6/11 13:00:45	1.53	16.56	15.61	
6/6/11 13:01:00	1.54	16.55	10.92	
6/6/11 13:01:15	1.57	16.52	4.99	
6/6/11 13:01:30	1.55	16.54	1.49	
6/6/11 13:01:45	1.56	16.52	0.44	
6/6/11 13:02:00	1.59	16.49	0.27	
6/6/11 13:02:15	1.62	16.48	0.23	
6/6/11 13:02:30	1.68	16.44	0.22	
6/6/11 13:02:45	1.69	16.43	0.21	
6/6/11 13:03:00	1.64	16.46	0.20	
6/6/11 13:03:15	1.64	16.45	0.19	
6/6/11 13:03:30	1.71	16.39	0.18	
6/6/11 13:03:45	1.71	16.38	0.19	
6/6/11 13:04:00	1.70	16.39	1.27	
6/6/11 13:04:15	1.75	16.34	5.78	
6/6/11 13:04:30	1.78	16.33	7.94	
6/6/11 13:04:45	1.73	16.38	4.49	
6/6/11 13:05:00	1.70	16.39	1.35	
6/6/11 13:05:15	1.69	16.40	0.36	
6/6/11 13:05:30	1.66	16.42	0.20	
6/6/11 13:05:45	1.67	16.42	0.18	
6/6/11 13:06:00	1.67	16.43	0.17	
6/6/11 13:06:15	1.70	16.40	0.17	
6/6/11 13:06:30	1.69	16.41	0.17	
6/6/11 13:06:45	1.68	16.40	0.16	
6/6/11 13:07:00	1.65	16.42	0.16	
6/6/11 13:07:15	1.62	16.45	0.16	
6/6/11 13:07:30	1.61	16.47	0.16	
6/6/11 13:07:45	1.61	16.47	0.16	
6/6/11 13:08:00	1.62	16.46	0.16	
6/6/11 13:08:15	1.65	16.43	0.16	
6/6/11 13:08:30	1.69	16.41	0.16	
6/6/11 13:08:45	1.70	16.39	0.16	
6/6/11 13:09:00	1.72	16.36	0.16	
6/6/11 13:09:15	1.67	16.40	0.16	
6/6/11 13:09:30	1.62	16.45	0.16	
6/6/11 13:09:45	1.62	16.44	0.15	
6/6/11 13:10:00	1.65	16.41	0.15	
6/6/11 13:10:15	1.70	16.37	0.15	
6/6/11 13:10:30	1.76	16.33	0.15	
6/6/11 13:10:45	1.77	16.32	0.15	
6/6/11 13:11:00	1.77	16.30	0.15	
6/6/11 13:11:15	1.73	16.34	0.15	
6/6/11 13:11:30	1.70	16.37	0.15	
6/6/11 13:11:45	1.73	16.35	0.15	
6/6/11 13:12:00	1.76	16.33	0.15	
6/6/11 13:12:15	1.72	16.37	0.14	
6/6/11 13:12:30	1.63	16.42	0.14	
6/6/11 13:12:45	1.67	16.39	0.14	
6/6/11 13:13:00	1.65	16.42	0.14	
6/6/11 13:13:15	1.60	16.47	0.14	
6/6/11 13:13:30	1.59	16.49	0.14	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 13:13:45	1.56	16.52	0.14	
6/6/11 13:14:00	1.56	16.52	0.14	
6/6/11 13:14:15	1.58	16.49	0.13	
6/6/11 13:14:30	1.58	16.51	0.13	
6/6/11 13:14:45	1.48	16.60	0.13	
6/6/11 13:15:00	1.46	16.60	0.13	
6/6/11 13:15:15	1.52	16.56	0.14	
6/6/11 13:15:30	1.50	16.56	0.13	
6/6/11 13:15:45	1.48	16.57	0.14	
6/6/11 13:16:00	1.49	16.57	0.14	
6/6/11 13:16:15	1.50	16.57	0.14	
6/6/11 13:16:30	1.49	16.59	0.14	
6/6/11 13:16:45	1.48	16.59	0.14	
6/6/11 13:17:00	1.49	16.58	0.14	
6/6/11 13:17:15	1.51	16.56	0.14	
6/6/11 13:17:30	1.47	16.61	0.14	
6/6/11 13:17:45	1.44	16.63	0.14	
6/6/11 13:18:00	1.52	16.56	0.14	
6/6/11 13:18:15	1.55	16.55	0.14	
6/6/11 13:18:30	1.50	16.58	0.14	
6/6/11 13:18:45	1.51	16.56	0.14	
6/6/11 13:19:00	1.55	16.54	0.14	
6/6/11 13:19:15	1.56	16.53	0.14	
6/6/11 13:19:30	1.54	16.55	0.14	
6/6/11 13:19:45	1.54	16.54	0.14	
6/6/11 13:20:00	1.61	16.48	0.14	
6/6/11 13:20:15	1.63	16.46	0.14	
6/6/11 13:20:30	1.61	16.48	0.14	
6/6/11 13:20:45	1.55	16.53	0.14	
6/6/11 13:21:00	1.54	16.54	0.14	
6/6/11 13:21:15	1.56	16.52	0.14	
6/6/11 13:21:30	1.56	16.52	0.14	
6/6/11 13:21:45	1.59	16.50	0.14	
6/6/11 13:22:00	1.59	16.51	0.14	
6/6/11 13:22:15	1.51	16.56	0.14	
6/6/11 13:22:30	1.51	16.57	0.14	
6/6/11 13:22:45	1.52	16.56	0.14	
6/6/11 13:23:00	1.55	16.53	0.13	
6/6/11 13:23:15	1.60	16.49	0.13	
6/6/11 13:23:30	1.57	16.51	0.13	
6/6/11 13:23:45	1.52	16.54	0.13	
6/6/11 13:24:00	1.50	16.55	1.71	
6/6/11 13:24:15	1.51	16.55	4.44	
6/6/11 13:24:30	1.58	16.49	2.94	
6/6/11 13:24:45	1.66	16.43	0.87	
6/6/11 13:25:00	1.61	16.48	0.25	
6/6/11 13:25:15	1.54	16.53	0.15	
6/6/11 13:25:30	1.53	16.54	0.14	
6/6/11 13:25:45	1.50	16.56	0.14	
6/6/11 13:26:00	1.50	16.57	0.13	
6/6/11 13:26:15	1.51	16.56	0.13	
6/6/11 13:26:30	1.56	16.53	0.13	
6/6/11 13:26:45	1.58	16.51	0.35	
6/6/11 13:27:00	1.60	16.49	2.03	
6/6/11 13:27:15	1.62	16.47	2.44	
6/6/11 13:27:30	1.62	16.48	1.58	
6/6/11 13:27:45	1.59	16.49	1.23	
6/6/11 13:28:00	1.57	16.50	0.45	
6/6/11 13:28:15	1.55	16.51	0.19	
6/6/11 13:28:30	1.56	16.52	0.15	
6/6/11 13:28:45	1.55	16.53	0.14	
6/6/11 13:29:00	1.48	16.59	0.14	
6/6/11 13:29:15	1.40	16.66	0.14	
6/6/11 13:29:30	1.45	16.63	0.14	
6/6/11 13:29:45	1.53	16.55	0.14	
6/6/11 13:30:00	1.58	16.51	0.14	
6/6/11 13:30:15	1.58	16.51	0.14	
6/6/11 13:30:30	1.56	16.54	0.14	
6/6/11 13:30:45	1.60	16.50	0.14	
6/6/11 13:31:00	1.71	16.41	0.14	
6/6/11 13:31:15	1.77	16.35	0.14	
6/6/11 13:31:30	1.76	16.36	0.14	
6/6/11 13:31:45	1.71	16.38	0.14	
6/6/11 13:32:00	1.75	16.35	0.14	
6/6/11 13:32:15	1.82	16.29	0.14	
6/6/11 13:32:30	1.85	16.27	0.14	
6/6/11 13:32:45	1.80	16.30	0.13	
6/6/11 13:33:00	1.78	16.32	0.13	
6/6/11 13:33:15	1.74	16.35	0.13	
6/6/11 13:33:30	1.70	16.39	0.13	
6/6/11 13:33:45	1.68	16.40	0.13	
6/6/11 13:34:00	1.73	16.36	0.13	
6/6/11 13:34:15	1.76	16.35	0.13	
6/6/11 13:34:30	1.78	16.32	0.13	
6/6/11 13:34:45	1.78	16.32	0.13	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 13:35:00	1.71	16.38	0.13	
6/6/11 13:35:15	1.74	16.34	0.13	
6/6/11 13:35:30	1.76	16.33	0.13	
6/6/11 13:35:45	1.73	16.35	0.13	
6/6/11 13:36:00	1.72	16.35	0.12	
6/6/11 13:36:15	1.76	16.34	0.12	
6/6/11 13:36:30	1.79	16.30	0.12	
6/6/11 13:36:45	1.85	16.25	0.12	
6/6/11 13:37:00	1.81	16.28	0.12	
6/6/11 13:37:15	1.75	16.33	0.12	
6/6/11 13:37:30	1.73	16.34	0.13	
6/6/11 13:37:45	1.68	16.39	0.13	
6/6/11 13:38:00	1.65	16.41	0.13	
6/6/11 13:38:15	1.67	16.39	0.13	
6/6/11 13:38:30	1.72	16.36	0.13	
6/6/11 13:38:45	1.73	16.34	0.13	
6/6/11 13:39:00	1.71	16.37	0.13	
6/6/11 13:39:15	1.65	16.41	0.13	
6/6/11 13:39:30	1.65	16.41	0.13	
6/6/11 13:39:45	1.73	16.35	0.13	
6/6/11 13:40:00	1.78	16.32	0.13	
6/6/11 13:40:15	1.68	16.40	0.13	
6/6/11 13:40:30	1.60	16.46	0.13	
6/6/11 13:40:45	1.58	16.47	0.13	
6/6/11 13:41:00	1.59	16.47	0.13	
6/6/11 13:41:15	1.58	16.49	0.13	
6/6/11 13:41:30	1.57	16.46	0.13	
6/6/11 13:41:45	4.22	13.33	0.13	
6/6/11 13:42:00	9.53	9.69	0.13	
6/6/11 13:42:15	11.23	9.11	0.13	
6/6/11 13:42:30	11.40	9.36	0.13	
6/6/11 13:42:45	11.47	9.80	0.13	System Bias
6/6/11 13:43:00	11.49	9.94	0.13	CO ₂ Stack Bias 2 Mid = 9.96
6/6/11 13:43:15	11.50	9.96	0.13	
6/6/11 13:43:30	11.50	9.96	0.13	
6/6/11 13:43:45	11.50	9.97	0.13	
6/6/11 13:44:00	11.51	9.97	0.13	
6/6/11 13:44:15	11.51	9.97	0.13	
6/6/11 13:44:30	11.51	9.97	0.13	
6/6/11 13:44:45	11.51	9.97	0.13	
6/6/11 13:45:00	10.98	10.49	0.13	
6/6/11 13:45:15	8.12	9.86	0.12	
6/6/11 13:45:30	4.94	5.60	0.12	
6/6/11 13:45:45	3.92	3.88	0.12	
6/6/11 13:46:00	4.42	4.02	0.12	
6/6/11 13:46:15	4.53	4.06	0.12	
6/6/11 13:46:30	4.54	4.06	0.12	System Bias
6/6/11 13:46:45	4.54	4.05	0.12	O ₂ Stack Bias 2 Mid = 4.54
6/6/11 13:47:00	4.54	4.05	0.12	
6/6/11 13:47:15	4.54	4.04	0.12	
6/6/11 13:47:30	4.54	4.04	0.12	
6/6/11 13:47:45	4.54	4.03	0.12	
6/6/11 13:48:00	4.54	4.03	0.12	
6/6/11 13:48:15	4.54	4.03	0.12	
6/6/11 13:48:30	4.52	3.99	0.12	
6/6/11 13:48:45	3.14	2.52	0.12	
6/6/11 13:49:00	0.81	0.62	0.12	
6/6/11 13:49:15	0.18	0.21	0.13	
6/6/11 13:49:30	0.11	0.15	0.13	System Bias
6/6/11 13:49:45	0.10	0.13	0.13	O ₂ Stack Bias 2 Zero = 0.09 CO ₂ Stack Bias 2 Zero = 0.12
6/6/11 13:50:00	0.10	0.12	0.13	
6/6/11 13:50:15	0.09	0.11	0.13	
6/6/11 13:50:30	0.09	0.10	0.13	
6/6/11 13:50:45	0.08	0.10	0.13	
6/6/11 13:51:00	0.08	0.10	0.13	
6/6/11 13:51:15	0.08	0.09	0.13	
6/6/11 13:51:30	0.12	1.07	0.14	
6/6/11 13:51:45	0.66	7.60	0.16	
6/6/11 13:52:00	1.19	12.49	0.13	
6/6/11 13:52:15	1.45	15.33	0.10	
6/6/11 13:52:30	1.55	16.21	0.09	
6/6/11 13:52:45	1.56	16.34	0.09	
6/6/11 13:53:00	1.52	16.41	0.08	System Bias
6/6/11 13:53:15	1.51	16.45	0.08	CO ₂ Meter Bias 2 Zero = 0.08
6/6/11 13:53:30	1.53	16.45	0.08	
6/6/11 13:53:45	1.53	16.46	0.08	
6/6/11 13:54:00	1.50	16.50	0.08	
6/6/11 13:54:15	1.52	16.48	0.11	
6/6/11 13:54:30	1.58	16.43	0.70	
6/6/11 13:54:45	1.63	16.41	1.95	
6/6/11 13:55:00	1.61	16.42	3.13	
6/6/11 13:55:15	1.64	16.40	3.63	
6/6/11 13:55:30	1.63	16.40	3.73	
6/6/11 13:55:45	1.61	16.42	3.76	
6/6/11 13:56:00	1.64	16.40	3.77	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 13:56:15	1.63	16.41	3.79	
6/6/11 13:56:30	1.64	16.40	3.81	
6/6/11 13:56:45	1.65	16.39	3.82	
6/6/11 13:57:00	1.60	16.44	3.78	
6/6/11 13:57:15	1.61	16.43	2.69	
6/6/11 13:57:30	1.65	16.40	2.91	
6/6/11 13:57:45	1.63	16.42	6.35	
6/6/11 13:58:00	1.59	16.45	8.64	
6/6/11 13:58:15	1.57	16.47	9.75	
6/6/11 13:58:30	1.57	16.48	10.07	System Bias
6/6/11 13:58:45	1.57	16.48	10.12	
6/6/11 13:59:00	1.62	16.44	10.14	CO ₂ Meter Bias 2 Mid = 10.14
6/6/11 13:59:15	1.66	16.41	10.15	
6/6/11 13:59:30	1.63	16.42	10.15	
6/6/11 13:59:45	1.56	16.48	10.15	
6/6/11 14:00:00	1.56	16.49	10.16	
6/6/11 14:00:15	1.60	16.46	10.13	
6/6/11 14:00:30	1.63	16.43	7.90	
6/6/11 14:00:45	1.63	16.43	3.41	Start Run 2
6/6/11 14:01:00	1.59	16.47	0.93	
6/6/11 14:01:15	1.55	16.49	0.30	
6/6/11 14:01:30	1.57	16.49	0.21	
6/6/11 14:01:45	1.58	16.48	0.19	
6/6/11 14:02:00	1.63	16.43	0.18	
6/6/11 14:02:15	1.67	16.39	0.17	
6/6/11 14:02:30	1.68	16.38	0.18	
6/6/11 14:02:45	1.64	16.42	0.72	
6/6/11 14:03:00	1.61	16.44	1.40	
6/6/11 14:03:15	1.58	16.48	1.82	
6/6/11 14:03:30	1.55	16.51	3.93	
6/6/11 14:03:45	1.58	16.48	6.59	
6/6/11 14:04:00	1.64	16.44	8.63	
6/6/11 14:04:15	1.61	16.45	9.99	
6/6/11 14:04:30	1.59	16.45	10.80	
6/6/11 14:04:45	1.61	16.46	11.22	
6/6/11 14:05:00	1.55	16.50	11.45	
6/6/11 14:05:15	1.53	16.52	11.58	
6/6/11 14:05:30	1.53	16.52	11.66	
6/6/11 14:05:45	1.55	16.50	11.69	
6/6/11 14:06:00	1.56	16.48	11.66	
6/6/11 14:06:15	1.57	16.47	11.62	
6/6/11 14:06:30	1.59	16.46	11.58	
6/6/11 14:06:45	1.63	16.43	11.52	
6/6/11 14:07:00	1.65	16.43	11.46	
6/6/11 14:07:15	1.64	16.43	11.42	
6/6/11 14:07:30	1.65	16.41	11.39	
6/6/11 14:07:45	1.61	16.45	11.37	
6/6/11 14:08:00	1.59	16.46	11.34	
6/6/11 14:08:15	1.57	16.48	11.31	
6/6/11 14:08:30	1.59	16.46	11.23	
6/6/11 14:08:45	1.62	16.47	11.15	
6/6/11 14:09:00	1.57	16.51	11.08	
6/6/11 14:09:15	1.57	16.48	11.03	
6/6/11 14:09:30	1.64	16.41	11.02	
6/6/11 14:09:45	1.64	16.42	11.02	
6/6/11 14:10:00	1.55	16.49	11.01	
6/6/11 14:10:15	1.53	16.50	11.00	
6/6/11 14:10:30	1.57	16.48	10.99	
6/6/11 14:10:45	1.58	16.48	10.99	
6/6/11 14:11:00	1.57	16.49	11.00	
6/6/11 14:11:15	1.55	16.50	11.00	
6/6/11 14:11:30	1.57	16.50	10.98	
6/6/11 14:11:45	1.60	16.48	10.95	
6/6/11 14:12:00	1.58	16.50	10.92	
6/6/11 14:12:15	1.58	16.48	10.90	
6/6/11 14:12:30	1.62	16.44	10.90	
6/6/11 14:12:45	1.67	16.39	10.90	
6/6/11 14:13:00	1.67	16.39	10.89	
6/6/11 14:13:15	1.66	16.39	10.88	
6/6/11 14:13:30	1.62	16.41	10.86	
6/6/11 14:13:45	1.57	16.46	10.87	
6/6/11 14:14:00	1.52	16.50	10.89	
6/6/11 14:14:15	1.50	16.53	10.91	
6/6/11 14:14:30	1.51	16.54	10.94	
6/6/11 14:14:45	1.53	16.53	10.97	
6/6/11 14:15:00	1.55	16.51	10.99	
6/6/11 14:15:15	1.53	16.53	11.00	
6/6/11 14:15:30	1.50	16.55	11.00	
6/6/11 14:15:45	1.54	16.50	10.99	
6/6/11 14:16:00	1.60	16.45	10.99	
6/6/11 14:16:15	1.54	16.50	10.99	
6/6/11 14:16:30	1.49	16.55	10.96	
6/6/11 14:16:45	1.56	16.50	10.92	Port Change M26A
6/6/11 14:17:00	1.62	16.45	10.90	
6/6/11 14:17:15	1.57	16.48	10.88	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 14:17:30	1.53	16.51	10.83	
6/6/11 14:17:45	1.50	16.55	8.15	
6/6/11 14:18:00	1.50	16.56	3.21	
6/6/11 14:18:15	1.54	16.52	0.82	
6/6/11 14:18:30	1.57	16.49	0.29	
6/6/11 14:18:45	1.61	16.46	0.22	
6/6/11 14:19:00	1.64	16.41	0.20	
6/6/11 14:19:15	1.68	16.37	0.19	
6/6/11 14:19:30	1.65	16.39	0.18	
6/6/11 14:19:45	1.60	16.43	0.18	
6/6/11 14:20:00	1.56	16.47	0.17	
6/6/11 14:20:15	1.59	16.45	0.17	
6/6/11 14:20:30	1.64	16.41	0.16	
6/6/11 14:20:45	1.63	16.42	0.16	
6/6/11 14:21:00	1.61	16.44	0.16	
6/6/11 14:21:15	1.60	16.45	0.16	
6/6/11 14:21:30	1.62	16.43	0.16	
6/6/11 14:21:45	1.60	16.46	0.15	
6/6/11 14:22:00	1.55	16.50	0.15	
6/6/11 14:22:15	1.54	16.50	0.16	
6/6/11 14:22:30	1.55	16.51	0.16	
6/6/11 14:22:45	1.59	16.47	0.15	
6/6/11 14:23:00	1.59	16.48	0.15	
6/6/11 14:23:15	1.59	16.46	0.19	
6/6/11 14:23:30	1.58	16.47	0.23	
6/6/11 14:23:45	1.59	16.47	0.18	
6/6/11 14:24:00	1.64	16.42	0.16	
6/6/11 14:24:15	1.67	16.39	0.22	
6/6/11 14:24:30	1.64	16.41	0.21	
6/6/11 14:24:45	1.64	16.39	0.16	
6/6/11 14:25:00	1.71	16.35	0.15	
6/6/11 14:25:15	1.70	16.36	0.18	
6/6/11 14:25:30	1.65	16.39	0.18	
6/6/11 14:25:45	1.60	16.44	0.16	
6/6/11 14:26:00	1.60	16.43	0.19	
6/6/11 14:26:15	1.64	16.41	0.26	
6/6/11 14:26:30	1.62	16.44	0.20	
6/6/11 14:26:45	1.62	16.43	0.17	
6/6/11 14:27:00	1.62	16.42	0.23	
6/6/11 14:27:15	1.60	16.44	0.21	
6/6/11 14:27:30	1.59	16.44	0.16	
6/6/11 14:27:45	1.59	16.45	0.15	
6/6/11 14:28:00	1.62	16.43	0.15	
6/6/11 14:28:15	1.61	16.43	0.15	
6/6/11 14:28:30	1.58	16.46	0.15	
6/6/11 14:28:45	1.61	16.46	0.15	
6/6/11 14:29:00	1.58	16.48	0.14	
6/6/11 14:29:15	1.56	16.48	0.16	
6/6/11 14:29:30	1.56	16.47	0.18	
6/6/11 14:29:45	1.53	16.51	0.15	
6/6/11 14:30:00	1.51	16.52	0.14	
6/6/11 14:30:15	1.60	16.45	0.14	
6/6/11 14:30:30	1.69	16.38	0.17	
6/6/11 14:30:45	1.69	16.37	0.21	
6/6/11 14:31:00	1.63	16.42	0.21	
6/6/11 14:31:15	1.51	16.51	0.25	
6/6/11 14:31:30	1.46	16.56	0.29	
6/6/11 14:31:45	1.43	16.59	0.23	
6/6/11 14:32:00	1.46	16.57	0.18	
6/6/11 14:32:15	1.54	16.51	0.15	
6/6/11 14:32:30	1.56	16.50	0.15	
6/6/11 14:32:45	1.52	16.53	0.15	
6/6/11 14:33:00	1.48	16.56	0.15	
6/6/11 14:33:15	1.45	16.58	0.15	
6/6/11 14:33:30	1.45	16.58	0.14	
6/6/11 14:33:45	1.50	16.55	0.14	
6/6/11 14:34:00	1.59	16.48	0.16	
6/6/11 14:34:15	1.62	16.45	0.16	
6/6/11 14:34:30	1.60	16.47	0.15	
6/6/11 14:34:45	1.60	16.46	0.14	
6/6/11 14:35:00	1.59	16.45	0.14	
6/6/11 14:35:15	1.59	16.46	0.16	
6/6/11 14:35:30	1.54	16.50	0.24	
6/6/11 14:35:45	1.53	16.51	0.23	
6/6/11 14:36:00	1.54	16.49	0.20	
6/6/11 14:36:15	1.58	16.46	0.23	
6/6/11 14:36:30	1.65	16.40	0.19	
6/6/11 14:36:45	1.68	16.38	0.17	
6/6/11 14:37:00	1.66	16.38	2.08	
6/6/11 14:37:15	1.63	16.40	6.20	
6/6/11 14:37:30	1.64	16.40	7.75	
6/6/11 14:37:45	1.67	16.38	4.09	
6/6/11 14:38:00	1.66	16.39	1.09	
6/6/11 14:38:15	1.63	16.41	0.29	
6/6/11 14:38:30	1.64	16.40	0.17	

**Valero Port Arthur Refinery, Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 14:38:45	1.64	16.40	0.15	
6/6/11 14:39:00	1.61	16.43	0.15	
6/6/11 14:39:15	1.58	16.46	0.14	
6/6/11 14:39:30	1.60	16.43	0.14	
6/6/11 14:39:45	1.63	16.41	0.14	
6/6/11 14:40:00	1.61	16.43	0.14	
6/6/11 14:40:15	1.60	16.44	0.14	
6/6/11 14:40:30	1.60	16.44	0.13	
6/6/11 14:40:45	1.61	16.42	0.13	
6/6/11 14:41:00	1.60	16.43	0.14	
6/6/11 14:41:15	1.62	16.41	0.13	
6/6/11 14:41:30	1.67	16.37	0.13	
6/6/11 14:41:45	1.66	16.37	0.13	
6/6/11 14:42:00	1.68	16.36	0.13	
6/6/11 14:42:15	1.68	16.36	0.13	
6/6/11 14:42:30	1.65	16.38	0.52	
6/6/11 14:42:45	1.55	16.48	2.11	
6/6/11 14:43:00	1.46	16.54	3.56	
6/6/11 14:43:15	1.50	16.51	2.12	
6/6/11 14:43:30	1.52	16.52	0.60	
6/6/11 14:43:45	1.48	16.54	0.23	
6/6/11 14:44:00	1.51	16.52	0.20	
6/6/11 14:44:15	1.53	16.53	0.18	
6/6/11 14:44:30	1.57	16.49	1.09	
6/6/11 14:44:45	1.56	16.49	3.54	
6/6/11 14:45:00	1.52	16.51	4.35	
6/6/11 14:45:15	1.50	16.52	4.18	
6/6/11 14:45:30	1.48	16.55	5.61	
6/6/11 14:45:45	1.52	16.50	7.84	
6/6/11 14:46:00	1.64	16.40	9.53	
6/6/11 14:46:15	1.67	16.39	10.74	
6/6/11 14:46:30	1.57	16.47	11.43	
6/6/11 14:46:45	1.44	16.57	11.83	
6/6/11 14:47:00	1.38	16.62	12.09	
6/6/11 14:47:15	1.44	16.59	12.29	
6/6/11 14:47:30	1.52	16.52	12.46	
6/6/11 14:47:45	1.58	16.45	12.54	
6/6/11 14:48:00	1.64	16.40	12.58	
6/6/11 14:48:15	1.69	16.35	12.56	
6/6/11 14:48:30	1.70	16.36	12.48	
6/6/11 14:48:45	1.64	16.42	12.34	
6/6/11 14:49:00	1.56	16.47	12.21	
6/6/11 14:49:15	1.53	16.50	12.14	
6/6/11 14:49:30	1.50	16.51	12.12	
6/6/11 14:49:45	1.52	16.49	12.12	
6/6/11 14:50:00	1.54	16.48	12.11	
6/6/11 14:50:15	1.51	16.52	12.10	
6/6/11 14:50:30	1.53	16.50	12.07	
6/6/11 14:50:45	1.61	16.45	12.04	
6/6/11 14:51:00	1.61	16.45	12.02	
6/6/11 14:51:15	1.62	16.41	12.01	
6/6/11 14:51:30	1.63	16.42	12.00	
6/6/11 14:51:45	1.58	16.45	12.00	
6/6/11 14:52:00	1.55	16.46	11.98	
6/6/11 14:52:15	1.52	16.49	11.97	
6/6/11 14:52:30	1.51	16.51	11.97	
6/6/11 14:52:45	1.52	16.50	11.98	
6/6/11 14:53:00	1.54	16.48	11.99	
6/6/11 14:53:15	1.51	16.52	12.01	
6/6/11 14:53:30	1.51	16.51	12.02	
6/6/11 14:53:45	1.49	16.54	12.03	
6/6/11 14:54:00	1.50	16.53	12.05	
6/6/11 14:54:15	1.56	16.48	12.06	
6/6/11 14:54:30	1.61	16.42	12.08	
6/6/11 14:54:45	1.60	16.43	12.09	
6/6/11 14:55:00	1.55	16.47	12.09	
6/6/11 14:55:15	1.54	16.48	12.08	
6/6/11 14:55:30	1.49	16.53	12.07	
6/6/11 14:55:45	1.46	16.55	12.07	
6/6/11 14:56:00	1.51	16.52	12.07	
6/6/11 14:56:15	1.53	16.51	12.09	
6/6/11 14:56:30	1.53	16.50	12.11	
6/6/11 14:56:45	1.54	16.49	12.14	
6/6/11 14:57:00	1.52	16.51	12.17	
6/6/11 14:57:15	1.49	16.54	12.19	
6/6/11 14:57:30	1.48	16.54	12.22	
6/6/11 14:57:45	1.54	16.49	12.25	
6/6/11 14:58:00	1.58	16.46	12.29	
6/6/11 14:58:15	1.55	16.48	12.32	
6/6/11 14:58:30	1.53	16.50	12.33	
6/6/11 14:58:45	1.52	16.50	12.32	
6/6/11 14:59:00	1.54	16.47	12.32	
6/6/11 14:59:15	1.55	16.47	12.36	
6/6/11 14:59:30	1.53	16.50	10.16	
6/6/11 14:59:45	1.56	16.48	4.68	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 15:00:00	1.58	16.46	1.30	
6/6/11 15:00:15	1.57	16.46	0.42	
6/6/11 15:00:30	1.51	16.50	0.28	
6/6/11 15:00:45	1.48	16.54	0.23	
6/6/11 15:01:00	1.51	16.51	0.22	
6/6/11 15:01:15	1.52	16.51	0.21	
6/6/11 15:01:30	1.55	16.48	0.21	
6/6/11 15:01:45	1.61	16.43	0.28	
6/6/11 15:02:00	1.65	16.40	0.39	
6/6/11 15:02:15	1.68	16.38	0.32	
6/6/11 15:02:30	1.63	16.42	0.23	
6/6/11 15:02:45	1.61	16.43	0.20	
6/6/11 15:03:00	1.60	16.43	0.19	
6/6/11 15:03:15	1.57	16.44	0.18	
6/6/11 15:03:30	1.58	16.44	0.17	
6/6/11 15:03:45	1.61	16.41	0.16	
6/6/11 15:04:00	1.62	16.42	0.16	
6/6/11 15:04:15	1.60	16.44	0.16	
6/6/11 15:04:30	1.66	16.39	0.16	
6/6/11 15:04:45	1.75	16.30	0.16	
6/6/11 15:05:00	1.76	16.27	0.17	
6/6/11 15:05:15	1.74	16.28	0.16	
6/6/11 15:05:30	1.73	16.30	0.15	
6/6/11 15:05:45	1.71	16.31	0.17	
6/6/11 15:06:00	1.66	16.35	0.20	
6/6/11 15:06:15	1.64	16.38	0.24	
6/6/11 15:06:30	1.64	16.40	0.19	
6/6/11 15:06:45	1.62	16.41	0.16	
6/6/11 15:07:00	1.63	16.40	0.17	
6/6/11 15:07:15	1.68	16.35	0.18	
6/6/11 15:07:30	1.66	16.36	0.22	
6/6/11 15:07:45	1.58	16.43	0.25	
6/6/11 15:08:00	1.55	16.46	0.23	
6/6/11 15:08:15	1.58	16.45	0.22	
6/6/11 15:08:30	1.60	16.44	0.22	
6/6/11 15:08:45	1.62	16.41	0.19	
6/6/11 15:09:00	1.65	16.38	0.19	
6/6/11 15:09:15	1.61	16.41	0.19	
6/6/11 15:09:30	1.60	16.42	0.20	
6/6/11 15:09:45	1.61	16.41	0.24	
6/6/11 15:10:00	1.62	16.41	0.20	
6/6/11 15:10:15	1.60	16.42	0.17	
6/6/11 15:10:30	1.56	16.44	0.16	
6/6/11 15:10:45	1.57	16.44	0.14	
6/6/11 15:11:00	1.62	16.42	0.14	
6/6/11 15:11:15	1.67	16.38	0.13	
6/6/11 15:11:30	1.69	16.36	0.13	
6/6/11 15:11:45	1.67	16.37	0.13	
6/6/11 15:12:00	1.66	16.36	0.13	
6/6/11 15:12:15	1.66	16.37	0.13	
6/6/11 15:12:30	1.66	16.38	0.13	
6/6/11 15:12:45	1.67	16.37	0.14	
6/6/11 15:13:00	1.66	16.36	0.14	
6/6/11 15:13:15	1.69	16.33	0.14	
6/6/11 15:13:30	1.68	16.35	0.14	
6/6/11 15:13:45	1.65	16.36	0.14	
6/6/11 15:14:00	1.64	16.36	0.14	
6/6/11 15:14:15	1.65	16.37	0.14	
6/6/11 15:14:30	1.64	16.38	0.20	
6/6/11 15:14:45	1.68	16.37	0.22	
6/6/11 15:15:00	1.67	16.37	0.22	
6/6/11 15:15:15	1.74	16.29	0.21	
6/6/11 15:15:30	1.81	16.23	0.19	
6/6/11 15:15:45	1.81	16.23	0.21	
6/6/11 15:16:00	1.76	16.27	0.19	
6/6/11 15:16:15	1.68	16.35	0.19	
6/6/11 15:16:30	1.66	16.36	0.23	
6/6/11 15:16:45	1.69	16.34	0.24	
6/6/11 15:17:00	1.68	16.34	0.21	
6/6/11 15:17:15	1.67	16.34	0.21	
6/6/11 15:17:30	1.64	16.38	0.19	
6/6/11 15:17:45	1.66	16.36	0.16	
6/6/11 15:18:00	1.66	16.38	0.15	
6/6/11 15:18:15	1.56	16.47	0.14	
6/6/11 15:18:30	1.52	16.50	0.15	
6/6/11 15:18:45	1.55	16.46	0.18	
6/6/11 15:19:00	1.59	16.44	0.19	
6/6/11 15:19:15	1.62	16.40	0.18	
6/6/11 15:19:30	1.63	16.39	0.16	
6/6/11 15:19:45	1.58	16.45	0.14	
6/6/11 15:20:00	1.52	16.49	0.14	
6/6/11 15:20:15	1.50	16.51	0.17	
6/6/11 15:20:30	1.48	16.53	0.16	
6/6/11 15:20:45	1.48	16.53	0.14	
6/6/11 15:21:00	1.47	16.55	0.15	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 15:21:15	1.48	16.54	0.15	
6/6/11 15:21:30	1.58	16.44	0.14	
6/6/11 15:21:45	1.68	16.37	0.13	
6/6/11 15:22:00	1.67	16.37	0.13	
6/6/11 15:22:15	1.66	16.36	0.13	
6/6/11 15:22:30	1.69	16.33	0.13	
6/6/11 15:22:45	1.67	16.35	0.13	
6/6/11 15:23:00	1.64	16.39	0.14	
6/6/11 15:23:15	1.60	16.42	0.13	
6/6/11 15:23:30	1.60	16.41	0.16	
6/6/11 15:23:45	1.67	16.36	0.22	
6/6/11 15:24:00	1.71	16.33	0.20	
6/6/11 15:24:15	1.70	16.33	0.76	
6/6/11 15:24:30	1.68	16.33	4.93	
6/6/11 15:24:45	1.68	16.34	8.68	
6/6/11 15:25:00	1.65	16.37	9.72	
6/6/11 15:25:15	1.66	16.36	9.82	
6/6/11 15:25:30	1.67	16.35	10.79	
6/6/11 15:25:45	1.75	16.29	11.74	
6/6/11 15:26:00	1.75	16.27	12.40	
6/6/11 15:26:15	1.73	16.29	12.89	
6/6/11 15:26:30	1.67	16.34	13.20	
6/6/11 15:26:45	1.61	16.38	13.33	
6/6/11 15:27:00	1.62	16.39	13.47	
6/6/11 15:27:15	1.63	16.39	13.68	
6/6/11 15:27:30	1.62	16.40	13.83	
6/6/11 15:27:45	1.64	16.38	13.95	
6/6/11 15:28:00	1.67	16.35	14.04	
6/6/11 15:28:15	1.69	16.33	14.08	
6/6/11 15:28:30	1.66	16.35	14.09	
6/6/11 15:28:45	1.58	16.43	14.10	
6/6/11 15:29:00	1.47	16.51	14.12	
6/6/11 15:29:15	1.49	16.50	14.15	
6/6/11 15:29:30	1.57	16.44	14.21	
6/6/11 15:29:45	1.66	16.38	14.25	
6/6/11 15:30:00	1.68	16.37	14.26	
6/6/11 15:30:15	1.67	16.35	14.24	
6/6/11 15:30:30	1.60	16.39	14.21	
6/6/11 15:30:45	1.53	16.43	14.19	
6/6/11 15:31:00	1.50	16.46	14.19	
6/6/11 15:31:15	1.49	16.50	14.20	
6/6/11 15:31:30	1.50	16.48	14.21	
6/6/11 15:31:45	1.55	16.45	14.23	
6/6/11 15:32:00	1.57	16.44	14.25	
6/6/11 15:32:15	1.63	16.38	14.26	
6/6/11 15:32:30	1.69	16.32	14.25	
6/6/11 15:32:45	1.67	16.34	14.21	
6/6/11 15:33:00	1.63	16.38	14.16	
6/6/11 15:33:15	1.62	16.40	14.11	
6/6/11 15:33:30	1.58	16.42	14.10	
6/6/11 15:33:45	1.55	16.45	14.10	
6/6/11 15:34:00	1.52	16.47	14.11	
6/6/11 15:34:15	1.61	16.41	14.13	
6/6/11 15:34:30	1.60	16.43	14.14	
6/6/11 15:34:45	1.54	16.47	14.15	
6/6/11 15:35:00	1.58	16.43	14.15	
6/6/11 15:35:15	1.60	16.42	14.16	
6/6/11 15:35:30	1.55	16.44	14.18	
6/6/11 15:35:45	1.55	16.45	14.18	
6/6/11 15:36:00	1.58	16.41	14.19	
6/6/11 15:36:15	1.63	16.37	14.19	
6/6/11 15:36:30	1.66	16.35	14.19	
6/6/11 15:36:45	1.66	16.36	14.17	
6/6/11 15:37:00	1.63	16.39	14.16	
6/6/11 15:37:15	1.56	16.45	14.15	
6/6/11 15:37:30	1.49	16.50	14.17	
6/6/11 15:37:45	1.47	16.51	14.20	
6/6/11 15:38:00	1.51	16.49	14.23	
6/6/11 15:38:15	1.51	16.49	14.25	
6/6/11 15:38:30	1.50	16.50	14.24	
6/6/11 15:38:45	1.48	16.53	14.22	
6/6/11 15:39:00	1.47	16.53	14.21	
6/6/11 15:39:15	1.49	16.52	13.33	
6/6/11 15:39:30	1.43	16.57	7.97	
6/6/11 15:39:45	1.44	16.56	2.96	
6/6/11 15:40:00	1.44	16.56	0.79	
6/6/11 15:40:15	1.42	16.58	0.32	
6/6/11 15:40:30	1.41	16.59	0.25	
6/6/11 15:40:45	1.44	16.56	0.24	
6/6/11 15:41:00	1.48	16.53	0.25	
6/6/11 15:41:15	1.43	16.57	0.22	
6/6/11 15:41:30	1.39	16.62	0.20	
6/6/11 15:41:45	1.35	16.66	0.20	
6/6/11 15:42:00	1.40	16.61	0.20	
6/6/11 15:42:15	1.47	16.55	0.22	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 15:42:30	1.46	16.55	0.22	
6/6/11 15:42:45	1.43	16.56	0.19	
6/6/11 15:43:00	1.43	16.55	0.17	
6/6/11 15:43:15	1.47	16.52	0.16	
6/6/11 15:43:30	1.52	16.49	1.09	
6/6/11 15:43:45	1.53	16.48	4.83	
6/6/11 15:44:00	1.54	16.48	8.24	
6/6/11 15:44:15	1.54	16.48	5.75	
6/6/11 15:44:30	1.52	16.49	1.92	
6/6/11 15:44:45	1.56	16.46	0.48	
6/6/11 15:45:00	1.55	16.47	0.23	
6/6/11 15:45:15	1.50	16.50	0.22	
6/6/11 15:45:30	1.48	16.52	0.18	
6/6/11 15:45:45	1.42	16.58	0.16	
6/6/11 15:46:00	1.41	16.60	0.15	
6/6/11 15:46:15	1.46	16.55	0.15	
6/6/11 15:46:30	1.50	16.53	0.15	
6/6/11 15:46:45	1.51	16.52	0.15	
6/6/11 15:47:00	1.47	16.54	0.15	
6/6/11 15:47:15	1.47	16.54	0.15	
6/6/11 15:47:30	1.51	16.50	0.15	
6/6/11 15:47:45	1.51	16.50	0.15	
6/6/11 15:48:00	1.53	16.47	0.15	
6/6/11 15:48:15	1.55	16.46	0.15	
6/6/11 15:48:30	1.60	16.43	0.17	
6/6/11 15:48:45	1.60	16.43	0.18	
6/6/11 15:49:00	1.51	16.50	0.24	
6/6/11 15:49:15	1.42	16.56	0.25	
6/6/11 15:49:30	1.41	16.59	0.20	
6/6/11 15:49:45	1.44	16.57	0.17	
6/6/11 15:50:00	1.52	16.51	0.16	
6/6/11 15:50:15	1.54	16.49	0.15	
6/6/11 15:50:30	1.53	16.50	0.15	
6/6/11 15:50:45	1.47	16.53	0.16	
6/6/11 15:51:00	1.42	16.57	0.16	
6/6/11 15:51:15	1.42	16.58	0.19	
6/6/11 15:51:30	1.44	16.56	0.23	
6/6/11 15:51:45	1.45	16.56	0.18	
6/6/11 15:52:00	1.47	16.55	0.15	
6/6/11 15:52:15	1.52	16.50	0.14	
6/6/11 15:52:30	1.55	16.47	0.14	
6/6/11 15:52:45	1.52	16.50	0.14	
6/6/11 15:53:00	1.50	16.49	0.14	
6/6/11 15:53:15	1.55	16.46	0.14	
6/6/11 15:53:30	1.54	16.49	0.14	
6/6/11 15:53:45	1.44	16.57	0.15	
6/6/11 15:54:00	1.40	16.60	0.16	
6/6/11 15:54:15	1.41	16.59	0.16	
6/6/11 15:54:30	1.48	16.54	0.14	
6/6/11 15:54:45	1.52	16.51	0.13	
6/6/11 15:55:00	1.48	16.55	0.13	
6/6/11 15:55:15	1.49	16.53	0.13	
6/6/11 15:55:30	1.50	16.52	0.13	
6/6/11 15:55:45	1.47	16.55	0.13	
6/6/11 15:56:00	1.46	16.54	0.13	
6/6/11 15:56:15	1.47	16.55	0.19	
6/6/11 15:56:30	1.45	16.59	0.22	
6/6/11 15:56:45	1.44	16.58	0.19	
6/6/11 15:57:00	1.48	16.54	0.15	
6/6/11 15:57:15	1.52	16.50	0.14	
6/6/11 15:57:30	1.54	16.49	0.13	
6/6/11 15:57:45	1.55	16.47	0.13	
6/6/11 15:58:00	1.53	16.49	0.13	
6/6/11 15:58:15	1.54	16.48	0.13	
6/6/11 15:58:30	1.58	16.46	0.13	
6/6/11 15:58:45	1.54	16.49	0.14	
6/6/11 15:59:00	1.49	16.54	0.14	
6/6/11 15:59:15	1.46	16.55	0.14	
6/6/11 15:59:30	1.52	16.50	0.28	
6/6/11 15:59:45	1.52	16.50	3.24	
6/6/11 16:00:00	1.56	16.46	7.03	
6/6/11 16:00:15	1.55	16.47	8.02	
6/6/11 16:00:30	1.52	16.49	7.72	
6/6/11 16:00:45	1.51	16.51	9.06	
6/6/11 16:01:00	1.51	16.51	11.01	
6/6/11 16:01:15	1.53	16.49	12.42	
6/6/11 16:01:30	1.53	16.49	13.42	
6/6/11 16:01:45	1.48	16.53	14.00	
6/6/11 16:02:00	1.45	16.56	14.35	
6/6/11 16:02:15	1.45	16.57	14.58	
6/6/11 16:02:30	1.50	16.53	14.75	
6/6/11 16:02:45	1.48	16.54	14.86	
6/6/11 16:03:00	1.44	16.56	14.93	
6/6/11 16:03:15	1.42	16.59	14.98	
6/6/11 16:03:30	1.44	16.58	15.03	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 16:03:45	1.42	16.61	15.08	
6/6/11 16:04:00	1.40	16.63	15.11	
6/6/11 16:04:15	1.40	16.62	15.14	
6/6/11 16:04:30	1.41	16.61	15.18	
6/6/11 16:04:45	1.43	16.59	15.22	
6/6/11 16:05:00	1.43	16.58	15.24	
6/6/11 16:05:15	1.44	16.58	15.25	
6/6/11 16:05:30	1.40	16.61	15.27	
6/6/11 16:05:45	1.39	16.62	15.28	
6/6/11 16:06:00	1.42	16.60	15.27	
6/6/11 16:06:15	1.48	16.55	15.27	
6/6/11 16:06:30	1.45	16.57	15.28	
6/6/11 16:06:45	1.39	16.62	15.29	
6/6/11 16:07:00	1.34	16.67	15.30	
6/6/11 16:07:15	1.34	16.67	15.33	
6/6/11 16:07:30	1.43	16.61	15.37	
6/6/11 16:07:45	1.47	16.58	15.40	
6/6/11 16:08:00	1.44	16.59	15.41	
6/6/11 16:08:15	1.50	16.52	15.42	
6/6/11 16:08:30	1.56	16.47	15.43	
6/6/11 16:08:45	1.51	16.52	15.43	
6/6/11 16:09:00	1.49	16.53	15.41	
6/6/11 16:09:15	1.54	16.48	15.40	
6/6/11 16:09:30	1.62	16.40	15.42	
6/6/11 16:09:45	1.65	16.37	15.42	
6/6/11 16:10:00	1.57	16.45	15.42	
6/6/11 16:10:15	1.52	16.49	15.40	
6/6/11 16:10:30	1.55	16.47	15.39	
6/6/11 16:10:45	1.58	16.45	15.41	
6/6/11 16:11:00	1.59	16.43	15.41	
6/6/11 16:11:15	1.58	16.44	15.43	
6/6/11 16:11:30	1.57	16.44	15.44	
6/6/11 16:11:45	1.59	16.43	15.45	
6/6/11 16:12:00	1.59	16.43	15.47	
6/6/11 16:12:15	1.57	16.45	15.48	
6/6/11 16:12:30	1.55	16.47	15.49	
6/6/11 16:12:45	1.57	16.47	15.50	
6/6/11 16:13:00	1.58	16.45	15.51	
6/6/11 16:13:15	1.57	16.45	15.52	
6/6/11 16:13:30	1.56	16.45	15.52	
6/6/11 16:13:45	1.64	16.39	15.51	
6/6/11 16:14:00	1.68	16.36	15.50	
6/6/11 16:14:15	1.58	16.45	15.50	
6/6/11 16:14:30	1.49	16.52	15.17	
6/6/11 16:14:45	1.51	16.50	10.29	
6/6/11 16:15:00	1.50	16.52	4.53	
6/6/11 16:15:15	1.39	16.61	1.29	
6/6/11 16:15:30	1.28	16.72	0.39	
6/6/11 16:15:45	1.24	16.76	0.26	
6/6/11 16:16:00	1.22	16.78	0.23	
6/6/11 16:16:15	1.20	16.80	1.24	
6/6/11 16:16:30	1.25	16.77	3.15	
6/6/11 16:16:45	1.28	16.76	5.33	
6/6/11 16:17:00	1.32	16.71	4.19	
6/6/11 16:17:15	1.42	16.62	1.37	
6/6/11 16:17:30	1.47	16.56	0.37	
6/6/11 16:17:45	1.47	16.57	0.21	
6/6/11 16:18:00	1.43	16.59	0.19	
6/6/11 16:18:15	1.47	16.56	0.18	
6/6/11 16:18:30	1.49	16.56	0.18	
6/6/11 16:18:45	1.55	16.51	0.18	
6/6/11 16:19:00	1.59	16.48	0.18	
6/6/11 16:19:15	1.55	16.49	0.18	
6/6/11 16:19:30	1.54	16.49	0.18	
6/6/11 16:19:45	1.53	16.51	0.18	
6/6/11 16:20:00	1.48	16.57	0.17	
6/6/11 16:20:15	1.39	16.64	0.16	
6/6/11 16:20:30	1.40	16.64	0.16	
6/6/11 16:20:45	1.35	16.69	0.16	
6/6/11 16:21:00	1.31	16.72	0.16	
6/6/11 16:21:15	1.33	16.70	0.16	
6/6/11 16:21:30	1.38	16.66	0.16	
6/6/11 16:21:45	1.41	16.64	0.18	
6/6/11 16:22:00	1.42	16.63	0.18	
6/6/11 16:22:15	1.38	16.66	0.17	
6/6/11 16:22:30	1.36	16.69	0.16	
6/6/11 16:22:45	1.35	16.70	0.16	
6/6/11 16:23:00	1.38	16.67	0.15	
6/6/11 16:23:15	1.40	16.65	0.15	
6/6/11 16:23:30	1.41	16.65	0.15	
6/6/11 16:23:45	1.42	16.64	0.14	
6/6/11 16:24:00	1.37	16.68	0.14	
6/6/11 16:24:15	1.33	16.70	0.14	
6/6/11 16:24:30	1.36	16.68	0.14	
6/6/11 16:24:45	1.50	16.56	0.14	

**Valero Port Arthur Refinery, Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 16:25:00	1.60	16.49	0.14	
6/6/11 16:25:15	1.57	16.51	0.13	
6/6/11 16:25:30	1.51	16.55	0.13	
6/6/11 16:25:45	1.44	16.61	0.13	
6/6/11 16:26:00	1.40	16.64	1.70	
6/6/11 16:26:15	1.45	16.60	5.51	
6/6/11 16:26:30	1.58	16.52	6.63	
6/6/11 16:26:45	1.65	16.48	6.03	
6/6/11 16:27:00	1.67	16.44	2.53	
6/6/11 16:27:15	1.70	16.41	0.66	
6/6/11 16:27:30	1.66	16.45	0.22	
6/6/11 16:27:45	1.64	16.45	0.16	
6/6/11 16:28:00	1.68	16.43	0.15	
6/6/11 16:28:15	1.71	16.41	0.15	
6/6/11 16:28:30	1.78	16.35	0.14	
6/6/11 16:28:45	1.88	16.25	0.14	
6/6/11 16:29:00	1.94	16.20	0.14	
6/6/11 16:29:15	1.98	16.16	0.14	
6/6/11 16:29:30	1.99	16.15	0.14	
6/6/11 16:29:45	1.93	16.20	0.21	
6/6/11 16:30:00	1.90	16.20	2.18	
6/6/11 16:30:15	1.98	16.14	5.88	
6/6/11 16:30:30	2.08	16.08	8.35	
6/6/11 16:30:45	2.17	16.01	9.19	
6/6/11 16:31:00	2.22	15.96	9.74	
6/6/11 16:31:15	2.21	15.95	10.05	
6/6/11 16:31:30	2.15	16.00	10.13	System Bias
6/6/11 16:31:45	2.12	16.03	10.16	CO ₂ Meter Bias 3 Mid = 10.17
6/6/11 16:32:00	2.15	16.01	10.17	
6/6/11 16:32:15	2.18	15.98	10.17	
6/6/11 16:32:30	2.23	15.94	10.18	
6/6/11 16:32:45	2.28	15.89	10.18	
6/6/11 16:33:00	2.28	15.89	10.18	
6/6/11 16:33:15	2.19	15.97	10.19	
6/6/11 16:33:30	2.14	16.01	10.19	
6/6/11 16:33:45	2.18	15.98	10.19	
6/6/11 16:34:00	2.23	15.93	10.12	
6/6/11 16:34:15	2.28	15.88	7.78	
6/6/11 16:34:30	2.31	15.86	6.08	
6/6/11 16:34:45	2.40	15.76	5.35	
6/6/11 16:35:00	2.43	15.74	3.89	
6/6/11 16:35:15	2.39	15.76	3.68	
6/6/11 16:35:30	2.40	15.74	3.83	
6/6/11 16:35:45	2.42	15.73	3.86	
6/6/11 16:36:00	2.40	15.76	3.87	
6/6/11 16:36:15	2.40	15.76	3.87	
6/6/11 16:36:30	2.40	15.76	3.87	
6/6/11 16:36:45	2.36	15.79	3.87	
6/6/11 16:37:00	2.30	15.85	3.87	
6/6/11 16:37:15	2.29	15.85	3.87	
6/6/11 16:37:30	2.31	15.82	3.87	
6/6/11 16:37:45	2.31	15.82	3.87	
6/6/11 16:38:00	2.33	15.81	3.87	
6/6/11 16:38:15	2.38	15.77	3.87	
6/6/11 16:38:30	2.39	15.75	3.87	
6/6/11 16:38:45	2.35	15.78	3.87	
6/6/11 16:39:00	2.35	15.77	3.87	
6/6/11 16:39:15	2.39	15.74	3.87	
6/6/11 16:39:30	2.46	15.69	3.87	
6/6/11 16:39:45	2.54	15.62	3.87	
6/6/11 16:40:00	2.59	15.58	3.87	
6/6/11 16:40:15	2.54	15.60	3.86	
6/6/11 16:40:30	2.53	15.62	3.86	
6/6/11 16:40:45	2.52	15.62	3.86	
6/6/11 16:41:00	2.52	15.62	3.86	
6/6/11 16:41:15	2.45	15.68	3.86	
6/6/11 16:41:30	2.31	15.79	3.86	
6/6/11 16:41:45	2.28	15.82	3.86	
6/6/11 16:42:00	2.28	15.83	3.86	
6/6/11 16:42:15	2.27	15.84	3.86	
6/6/11 16:42:30	2.28	15.83	3.86	
6/6/11 16:42:45	2.31	15.82	3.86	
6/6/11 16:43:00	2.30	15.81	3.86	
6/6/11 16:43:15	2.30	15.81	3.86	
6/6/11 16:43:30	2.35	15.78	3.84	
6/6/11 16:43:45	2.38	15.75	3.23	
6/6/11 16:44:00	2.37	15.77	2.65	
6/6/11 16:44:15	2.40	15.73	1.42	
6/6/11 16:44:30	2.44	15.70	0.49	
6/6/11 16:44:45	2.42	15.70	0.18	System Bias
6/6/11 16:45:00	2.40	15.71	0.14	CO ₂ Meter Bias 3 Zero = 0.12
6/6/11 16:45:15	2.36	15.77	0.12	
6/6/11 16:45:30	2.31	15.82	0.12	
6/6/11 16:45:45	2.34	15.78	0.11	
6/6/11 16:46:00	2.36	15.77	0.11	

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Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/6/11 16:46:15	2.31	15.80	0.10	
6/6/11 16:46:30	2.34	15.78	0.10	
6/6/11 16:46:45	2.46	14.48	0.11	
6/6/11 16:47:00	2.72	7.90	0.13	
6/6/11 16:47:15	1.38	2.99	0.14	
6/6/11 16:47:30	0.33	0.64	0.14	
6/6/11 16:47:45	0.11	0.28	0.14	
System Bias				
6/6/11 16:48:00	0.09	0.22	0.14	O ₂ Stack Bias 3 Zero = 0.08
6/6/11 16:48:15	0.08	0.18	0.14	CO ₂ Stack Bias 3 Zero = 0.18
6/6/11 16:48:30	0.08	0.16	0.14	
6/6/11 16:48:45	0.08	0.15	0.14	
6/6/11 16:49:00	0.08	0.13	0.14	
6/6/11 16:49:15	0.08	0.12	0.13	
6/6/11 16:49:30	0.07	0.12	0.13	
6/6/11 16:49:45	0.10	0.16	0.13	
6/6/11 16:50:00	0.85	0.94	0.13	
6/6/11 16:50:15	2.71	2.64	0.13	
6/6/11 16:50:30	4.12	3.71	0.14	
6/6/11 16:50:45	4.43	3.93	0.14	
System Bias				
6/6/11 16:51:00	4.48	3.96	0.14	O ₂ Stack Bias 3 Mid = 4.50
6/6/11 16:51:15	4.50	3.98	0.13	
6/6/11 16:51:30	4.51	3.99	0.13	
6/6/11 16:51:45	4.51	4.00	0.13	
6/6/11 16:52:00	4.52	4.01	0.14	
6/6/11 16:52:15	4.52	4.02	0.14	
6/6/11 16:52:30	4.53	4.02	0.14	
6/6/11 16:52:45	4.50	4.39	0.14	
6/6/11 16:53:00	3.85	8.30	0.14	
6/6/11 16:53:15	4.42	9.47	0.14	
6/6/11 16:53:30	8.83	9.45	0.14	
6/6/11 16:53:45	11.04	9.80	0.14	
6/6/11 16:54:00	11.42	9.89	0.14	
6/6/11 16:54:15	11.47	9.91	0.14	
6/6/11 16:54:30	11.48	9.92	0.14	
6/6/11 16:54:45	11.49	9.93	0.14	
6/6/11 16:55:00	11.49	9.93	0.14	
System Bias				
6/6/11 16:55:15	11.50	9.94	0.14	CO ₂ Stack Bias 3 Mid = 9.94
6/6/11 16:55:30	11.50	9.94	0.14	
6/6/11 16:55:45	11.50	9.94	0.13	
6/6/11 16:56:00	11.50	9.94	0.13	
6/6/11 16:56:15	11.50	9.95	0.13	
6/6/11 16:56:30	11.50	9.95	0.13	
6/6/11 16:56:45	11.03	10.47	0.13	
6/6/11 16:57:00	6.73	13.45	0.13	
6/6/11 16:57:15	3.14	15.39	0.13	
6/6/11 16:57:30	2.32	15.80	0.13	
6/6/11 16:57:45	2.19	15.91	0.13	
6/6/11 16:58:00	2.12	15.97	0.13	
6/6/11 16:58:15	2.10	15.98	0.13	
6/6/11 16:58:30	2.14	15.98	0.13	
6/6/11 16:58:45	2.12	16.00	0.13	
6/6/11 16:59:00	2.07	16.04	0.13	
6/6/11 16:59:15	2.07	16.05	0.13	
6/7/11 12:46:30	21.02	0.02	0.12	
6/7/11 12:46:45	21.02	0.02	0.12	
6/7/11 12:47:00	21.02	0.02	0.12	
6/7/11 12:47:15	21.02	0.02	0.12	
6/7/11 12:47:30	21.02	0.02	0.12	
6/7/11 12:47:45	21.02	0.02	0.12	
6/7/11 12:48:00	21.02	0.02	0.12	
6/7/11 12:48:15	21.02	0.02	0.12	
6/7/11 12:48:30	21.02	0.02	0.12	
6/7/11 12:48:45	18.34	0.02	0.12	
6/7/11 12:49:00	7.18	0.08	0.12	
6/7/11 12:49:15	4.30	2.59	0.12	
6/7/11 12:49:30	7.44	5.98	0.12	
6/7/11 12:49:45	8.86	7.56	0.12	
6/7/11 12:50:00	9.14	7.87	0.12	
6/7/11 12:50:15	9.16	8.05	0.13	
6/7/11 12:50:30	9.17	8.11	0.13	
6/7/11 12:50:45	9.16	8.13	0.13	
6/7/11 12:51:00	9.10	8.13	0.13	
6/7/11 12:51:15	9.08	8.14	0.13	
6/7/11 12:51:30	9.08	8.14	0.13	
6/7/11 12:51:45	9.09	8.14	0.13	
6/7/11 12:52:00	9.08	8.14	0.13	
6/7/11 12:52:15	9.09	8.14	0.13	
6/7/11 12:52:30	8.72	7.58	0.13	
6/7/11 12:52:45	6.27	5.27	0.13	
6/7/11 12:53:00	4.80	4.24	0.13	
6/7/11 12:53:15	4.60	4.14	0.13	
6/7/11 12:53:30	4.59	4.13	0.13	
6/7/11 12:53:45	4.59	4.13	0.13	
6/7/11 12:54:00	4.59	4.13	0.13	
6/7/11 12:54:15	4.59	4.13	0.13	

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Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 12:54:30	4.59	4.13	0.13	
6/7/11 12:54:45	4.59	4.13	0.13	
6/7/11 12:55:00	4.59	4.13	0.13	
6/7/11 12:55:15	4.93	4.25	0.13	
6/7/11 12:55:30	7.50	6.75	0.13	
6/7/11 12:55:45	8.31	8.33	0.13	
6/7/11 12:56:00	5.60	7.53	0.13	
6/7/11 12:56:15	3.54	4.85	0.13	
6/7/11 12:56:30	1.58	1.63	0.13	
6/7/11 12:56:45	0.39	0.37	0.13	
6/7/11 12:57:00	0.18	0.19	0.12	
6/7/11 12:57:15	0.15	0.15	0.12	
6/7/11 12:57:30	0.14	0.13	0.12	
6/7/11 12:57:45	0.14	0.12	0.12	
6/7/11 12:58:00	0.13	0.11	0.12	
6/7/11 12:58:15	0.12	0.10	0.12	
6/7/11 12:58:30	0.12	0.10	0.12	
6/7/11 12:58:45	0.12	0.09	0.12	
6/7/11 12:59:00	0.12	0.09	0.12	
6/7/11 12:59:15	0.12	0.08	0.12	
6/7/11 12:59:30	0.11	0.08	0.12	
6/7/11 12:59:45	0.11	0.08	0.12	
6/7/11 13:00:00	0.11	0.08	0.13	
6/7/11 13:00:15	0.11	0.07	0.13	
6/7/11 13:00:30	0.11	0.07	0.13	
6/7/11 13:00:45	0.11	0.07	0.13	
6/7/11 13:01:00	0.11	0.07	0.13	
6/7/11 13:01:15	0.11	0.07	0.13	
6/7/11 13:01:30	0.11	0.06	0.13	
6/7/11 13:01:45	0.11	0.06	0.13	
6/7/11 13:02:00	0.10	0.06	0.13	
6/7/11 13:02:15	0.10	0.06	0.13	
6/7/11 13:02:30	0.10	0.06	0.14	
6/7/11 13:02:45	0.10	0.06	0.13	
6/7/11 13:03:00	0.10	0.06	0.13	
6/7/11 13:03:15	0.10	0.06	0.13	
6/7/11 13:03:30	0.10	0.06	0.13	
6/7/11 13:03:45	0.10	0.06	0.14	
6/7/11 13:04:00	0.10	0.06	0.14	
6/7/11 13:04:15	0.10	0.06	0.14	
6/7/11 13:04:30	0.10	0.06	0.14	
6/7/11 13:04:45	0.10	0.06	0.14	
6/7/11 13:05:00	0.10	0.06	0.14	
6/7/11 13:05:15	0.10	0.06	0.14	
6/7/11 13:05:30	0.10	0.06	0.13	
6/7/11 13:05:45	0.09	0.06	0.13	
6/7/11 13:06:00	0.09	0.06	0.13	
6/7/11 13:06:15	0.08	0.06	0.13	
6/7/11 13:06:30	0.08	0.06	0.13	
6/7/11 13:06:45	0.08	0.06	0.13	
6/7/11 13:07:00	0.08	0.06	0.13	
6/7/11 13:07:15	0.32	1.58	0.13	
6/7/11 13:07:30	1.61	5.51	0.13	
6/7/11 13:07:45	2.04	4.66	0.12	
6/7/11 13:08:00	3.59	3.86	0.12	
6/7/11 13:08:15	4.42	4.00	0.12	
6/7/11 13:08:30	4.55	4.03	0.12	
6/7/11 13:08:45	4.57	4.03	0.12	
6/7/11 13:09:00	4.58	4.04	0.12	
6/7/11 13:09:15	4.58	4.06	0.12	
6/7/11 13:09:30	4.58	4.07	0.12	
6/7/11 13:09:45	4.59	4.07	0.13	System Bias
6/7/11 13:10:00	4.58	4.07	0.12	O ₂ Stack Bias 4 Mid = 4.59
6/7/11 13:10:15	4.59	4.08	0.12	
6/7/11 13:10:30	4.59	4.08	0.13	
6/7/11 13:10:45	4.59	4.08	0.13	
6/7/11 13:11:00	4.59	4.09	0.13	
6/7/11 13:11:15	4.58	5.13	0.13	
6/7/11 13:11:30	4.51	7.52	0.13	
6/7/11 13:11:45	3.54	4.51	0.13	
6/7/11 13:12:00	1.28	1.29	0.13	
6/7/11 13:12:15	0.27	0.27	0.13	
6/7/11 13:12:30	0.15	0.16	0.13	
6/7/11 13:12:45	0.14	0.14	0.13	
6/7/11 13:13:00	0.12	0.12	0.13	
6/7/11 13:13:15	0.12	0.11	0.13	
6/7/11 13:13:30	0.11	0.10	0.13	
6/7/11 13:13:45	0.11	0.09	0.13	
6/7/11 13:14:00	0.11	0.09	0.13	
6/7/11 13:14:15	0.10	0.09	0.13	
6/7/11 13:14:30	0.10	0.08	0.13	
6/7/11 13:14:45	0.10	0.08	0.13	System Bias
6/7/11 13:15:00	0.10	0.08	0.13	O ₂ Stack Bias 4 Zero = 0.10
6/7/11 13:15:15	0.10	0.08	0.13	
6/7/11 13:15:30	0.10	0.08	0.13	

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Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 13:15:45	0.10	0.08	0.13	
6/7/11 13:16:00	0.10	0.08	0.13	
6/7/11 13:16:15	0.09	0.08	0.13	
6/7/11 13:16:30	0.09	0.08	0.13	
6/7/11 13:16:45	0.09	0.08	0.13	
6/7/11 13:17:00	0.31	1.42	0.13	
6/7/11 13:17:15	2.01	7.28	0.13	
6/7/11 13:17:30	3.54	11.24	0.13	
6/7/11 13:17:45	4.30	13.29	0.13	
6/7/11 13:18:00	4.50	13.76	0.13	
6/7/11 13:18:15	4.49	13.87	0.12	
6/7/11 13:18:30	4.39	13.99	0.12	
6/7/11 13:18:45	4.32	14.06	0.12	
6/7/11 13:19:00	4.29	14.12	0.12	
6/7/11 13:19:15	4.26	14.16	0.12	
6/7/11 13:19:30	4.30	14.12	0.12	
6/7/11 13:19:45	4.39	14.06	0.12	
6/7/11 13:20:00	4.44	14.00	0.12	
6/7/11 13:20:15	4.48	13.97	0.12	
6/7/11 13:20:30	4.42	14.03	0.12	
6/7/11 13:20:45	4.35	14.10	0.13	
6/7/11 13:21:00	4.34	14.11	0.13	
6/7/11 13:21:15	4.35	14.10	0.13	
6/7/11 13:21:30	4.35	14.11	0.13	
6/7/11 13:21:45	4.37	14.09	0.13	
6/7/11 13:22:00	4.41	14.06	0.13	
6/7/11 13:22:15	4.46	14.02	0.13	
6/7/11 13:22:30	4.52	13.96	0.13	
6/7/11 13:22:45	4.52	13.95	0.13	
6/7/11 13:23:00	4.49	13.98	0.13	
6/7/11 13:23:15	4.46	14.02	0.13	
6/7/11 13:23:30	4.42	14.04	0.13	
6/7/11 13:23:45	4.47	13.99	0.13	
6/7/11 13:24:00	4.45	14.02	0.13	
6/7/11 13:24:15	4.37	14.10	0.13	
6/7/11 13:24:30	4.32	14.15	0.13	
6/7/11 13:24:45	4.29	14.17	0.13	
6/7/11 13:25:00	4.30	14.17	0.13	
6/7/11 13:25:15	4.33	14.14	0.13	
6/7/11 13:25:30	4.36	14.12	0.13	
6/7/11 13:25:45	4.40	14.07	0.13	
6/7/11 13:26:00	4.47	14.01	0.13	
6/7/11 13:26:15	4.50	13.99	0.13	
6/7/11 13:26:30	4.53	13.95	0.13	
6/7/11 13:26:45	4.57	13.92	0.13	
6/7/11 13:27:00	4.55	13.95	0.13	
6/7/11 13:27:15	4.49	13.99	0.13	
6/7/11 13:27:30	4.43	14.04	0.13	
6/7/11 13:27:45	4.42	14.05	0.13	
6/7/11 13:28:00	4.37	14.12	0.13	
6/7/11 13:28:15	4.25	14.21	0.13	
6/7/11 13:28:30	4.23	14.22	0.13	
6/7/11 13:28:45	4.34	14.15	0.13	
6/7/11 13:29:00	4.38	14.12	0.13	
6/7/11 13:29:15	4.38	14.11	0.12	
6/7/11 13:29:30	4.35	14.14	0.12	
6/7/11 13:29:45	4.29	14.19	0.12	
6/7/11 13:30:00	4.27	14.20	0.12	
6/7/11 13:30:15	4.35	14.12	0.13	
6/7/11 13:30:30	4.44	14.05	0.13	
6/7/11 13:30:45	4.40	14.09	0.13	
6/7/11 13:31:00	4.34	14.12	0.13	
6/7/11 13:31:15	4.33	14.14	0.13	
6/7/11 13:31:30	4.27	14.19	0.13	
6/7/11 13:31:45	4.23	14.22	0.13	
6/7/11 13:32:00	4.27	14.19	0.13	
6/7/11 13:32:15	4.32	14.16	0.13	
6/7/11 13:32:30	4.33	14.15	0.13	
6/7/11 13:32:45	4.41	14.09	0.13	
6/7/11 13:33:00	4.42	14.07	0.13	
6/7/11 13:33:15	4.41	14.07	0.13	
6/7/11 13:33:30	4.36	14.12	0.13	
6/7/11 13:33:45	4.31	14.16	0.13	
6/7/11 13:34:00	4.31	14.16	0.13	
6/7/11 13:34:15	4.36	14.12	0.13	
6/7/11 13:34:30	4.41	14.08	0.13	
6/7/11 13:34:45	4.40	14.09	0.14	
6/7/11 13:35:00	4.38	14.12	0.14	
6/7/11 13:35:15	4.35	14.14	0.14	
6/7/11 13:35:30	4.34	14.13	0.14	
6/7/11 13:35:45	4.44	14.04	0.14	
6/7/11 13:36:00	4.52	13.98	0.14	
6/7/11 13:36:15	4.45	14.05	0.13	
6/7/11 13:36:30	4.37	14.10	0.13	
6/7/11 13:36:45	4.41	14.07	0.13	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 13:37:00	4.41	14.07	0.13	
6/7/11 13:37:15	4.42	14.07	0.13	
6/7/11 13:37:30	4.39	14.10	0.13	
6/7/11 13:37:45	4.38	14.10	0.13	
6/7/11 13:38:00	4.44	14.05	0.13	
6/7/11 13:38:15	4.45	14.04	0.13	
6/7/11 13:38:30	4.40	14.08	0.13	
6/7/11 13:38:45	4.30	14.17	0.13	
6/7/11 13:39:00	4.25	14.21	0.13	
6/7/11 13:39:15	4.30	14.17	0.13	
6/7/11 13:39:30	4.38	14.11	0.13	
6/7/11 13:39:45	4.42	14.08	0.13	
6/7/11 13:40:00	4.39	14.11	0.13	
6/7/11 13:40:15	4.37	14.11	0.13	
6/7/11 13:40:30	4.45	14.04	0.13	
6/7/11 13:40:45	4.52	13.99	0.13	
6/7/11 13:41:00	4.48	14.03	0.13	
6/7/11 13:41:15	4.44	14.05	0.13	
6/7/11 13:41:30	4.39	14.10	0.13	
6/7/11 13:41:45	4.32	14.16	0.13	
6/7/11 13:42:00	4.24	14.22	0.13	
6/7/11 13:42:15	4.26	14.20	0.13	
6/7/11 13:42:30	4.31	14.16	0.17	
6/7/11 13:42:45	4.32	14.15	0.16	
6/7/11 13:43:00	4.31	14.16	0.14	
6/7/11 13:43:15	4.42	14.07	0.13	
6/7/11 13:43:30	4.52	13.99	0.13	
6/7/11 13:43:45	4.49	14.01	0.14	
6/7/11 13:44:00	4.38	14.12	0.16	
6/7/11 13:44:15	4.30	14.18	0.15	
6/7/11 13:44:30	4.40	14.08	0.14	
6/7/11 13:44:45	4.52	13.99	0.14	
6/7/11 13:45:00	4.58	13.93	0.14	
6/7/11 13:45:15	4.61	13.90	0.14	
6/7/11 13:45:30	4.57	13.93	0.14	
6/7/11 13:45:45	4.57	13.92	0.14	
6/7/11 13:46:00	4.56	13.94	0.14	
6/7/11 13:46:15	4.47	14.01	0.15	
6/7/11 13:46:30	4.45	14.03	0.15	
6/7/11 13:46:45	4.48	14.01	0.21	
6/7/11 13:47:00	4.53	13.97	0.22	
6/7/11 13:47:15	4.56	13.94	0.21	
6/7/11 13:47:30	4.55	13.95	0.26	
6/7/11 13:47:45	4.54	13.97	0.24	
6/7/11 13:48:00	4.54	13.95	0.20	
6/7/11 13:48:15	4.54	13.96	0.17	
6/7/11 13:48:30	4.58	13.94	0.15	
6/7/11 13:48:45	4.61	13.91	0.14	
6/7/11 13:49:00	4.59	13.92	0.14	
6/7/11 13:49:15	4.53	13.96	0.14	
6/7/11 13:49:30	4.53	13.96	0.14	
6/7/11 13:49:45	4.56	13.95	0.13	
6/7/11 13:50:00	4.63	13.89	0.13	
6/7/11 13:50:15	4.65	13.86	0.13	
6/7/11 13:50:30	4.72	13.79	0.14	
6/7/11 13:50:45	4.77	13.75	0.17	
6/7/11 13:51:00	4.86	13.65	0.17	
6/7/11 13:51:15	4.93	13.59	0.17	
6/7/11 13:51:30	4.85	13.67	0.15	
6/7/11 13:51:45	4.73	13.77	0.15	
6/7/11 13:52:00	4.66	13.84	0.14	
6/7/11 13:52:15	4.62	13.87	0.13	
6/7/11 13:52:30	4.71	13.79	0.13	
6/7/11 13:52:45	4.77	13.75	0.13	
6/7/11 13:53:00	4.72	13.80	0.13	
6/7/11 13:53:15	4.69	13.81	0.13	
6/7/11 13:53:30	4.75	13.77	0.13	
6/7/11 13:53:45	4.78	13.74	0.13	
6/7/11 13:54:00	4.77	13.76	0.13	
6/7/11 13:54:15	4.71	13.81	0.13	
6/7/11 13:54:30	4.66	13.85	0.13	
6/7/11 13:54:45	4.66	13.84	0.13	
6/7/11 13:55:00	4.68	13.83	0.14	
6/7/11 13:55:15	4.69	13.82	0.14	
6/7/11 13:55:30	4.74	13.77	0.14	
6/7/11 13:55:45	4.80	13.71	0.14	
6/7/11 13:56:00	4.82	13.70	0.14	
6/7/11 13:56:15	4.78	13.74	0.14	
6/7/11 13:56:30	4.75	13.76	0.14	
6/7/11 13:56:45	4.78	13.72	0.14	
6/7/11 13:57:00	4.78	13.74	0.14	
6/7/11 13:57:15	4.73	13.79	0.14	
6/7/11 13:57:30	4.76	13.75	0.14	
6/7/11 13:57:45	4.83	13.69	0.14	
6/7/11 13:58:00	4.80	13.71	0.14	

**Valero Port Arthur Refinery, Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 13:58:15	4.76	13.74	0.14	
6/7/11 13:58:30	4.74	13.77	0.14	
6/7/11 13:58:45	4.72	13.79	0.13	
6/7/11 13:59:00	4.74	13.78	0.13	
6/7/11 13:59:15	4.75	13.77	0.13	
6/7/11 13:59:30	4.68	13.82	0.14	
6/7/11 13:59:45	4.71	13.79	0.17	
6/7/11 14:00:00	4.85	13.67	0.18	
6/7/11 14:00:15	4.97	13.58	0.15	
6/7/11 14:00:30	5.05	13.50	0.13	
6/7/11 14:00:45	4.98	13.55	0.13	
6/7/11 14:01:00	4.85	13.64	0.13	
6/7/11 14:01:15	4.73	13.76	0.14	
6/7/11 14:01:30	4.66	13.83	0.13	
6/7/11 14:01:45	4.70	13.80	0.13	
6/7/11 14:02:00	4.74	13.79	0.13	
6/7/11 14:02:15	4.73	13.79	0.13	
6/7/11 14:02:30	4.75	13.77	0.13	
6/7/11 14:02:45	4.78	13.73	0.14	
6/7/11 14:03:00	4.78	13.74	0.17	
6/7/11 14:03:15	4.71	13.81	0.16	
6/7/11 14:03:30	4.69	13.83	0.14	
6/7/11 14:03:45	4.74	13.78	0.13	
6/7/11 14:04:00	4.86	13.66	0.13	
6/7/11 14:04:15	4.98	13.56	0.13	
6/7/11 14:04:30	5.01	13.54	0.13	
6/7/11 14:04:45	4.99	13.55	0.13	
6/7/11 14:05:00	4.96	13.57	0.14	
6/7/11 14:05:15	4.86	13.65	0.14	
6/7/11 14:05:30	4.77	13.72	0.14	
6/7/11 14:05:45	4.78	13.71	0.14	
6/7/11 14:06:00	4.86	13.66	0.14	
6/7/11 14:06:15	4.83	13.71	0.14	
6/7/11 14:06:30	4.74	13.78	0.14	
6/7/11 14:06:45	4.76	13.76	0.14	
6/7/11 14:07:00	4.78	13.76	0.14	
6/7/11 14:07:15	4.82	13.71	0.14	
6/7/11 14:07:30	4.96	13.57	0.14	
6/7/11 14:07:45	5.04	13.51	0.14	
6/7/11 14:08:00	4.97	13.57	0.14	
6/7/11 14:08:15	4.87	13.65	0.14	
6/7/11 14:08:30	4.86	13.65	0.14	
6/7/11 14:08:45	4.89	13.63	0.14	
6/7/11 14:09:00	4.87	13.64	0.14	
6/7/11 14:09:15	4.85	13.65	0.13	
6/7/11 14:09:30	4.79	13.72	0.13	
6/7/11 14:09:45	4.76	13.75	0.13	
6/7/11 14:10:00	4.79	13.72	0.13	
6/7/11 14:10:15	4.86	13.67	0.13	
6/7/11 14:10:30	4.80	13.72	0.13	
6/7/11 14:10:45	4.75	13.74	0.13	
6/7/11 14:11:00	4.77	13.73	0.13	
6/7/11 14:11:15	4.73	13.77	0.13	
6/7/11 14:11:30	4.67	13.84	0.14	
6/7/11 14:11:45	4.62	13.88	0.15	
6/7/11 14:12:00	4.65	13.85	0.15	
6/7/11 14:12:15	4.70	13.81	0.13	
6/7/11 14:12:30	4.66	13.87	0.13	
6/7/11 14:12:45	4.64	13.87	0.13	
6/7/11 14:13:00	4.69	13.83	0.13	
6/7/11 14:13:15	4.70	13.82	0.15	
6/7/11 14:13:30	4.72	13.79	0.16	
6/7/11 14:13:45	4.74	13.76	0.17	
6/7/11 14:14:00	4.73	13.77	0.18	
6/7/11 14:14:15	4.70	13.80	0.15	
6/7/11 14:14:30	4.69	13.81	0.15	
6/7/11 14:14:45	4.65	13.86	0.15	
6/7/11 14:15:00	4.60	13.89	0.14	
6/7/11 14:15:15	4.61	13.89	0.14	
6/7/11 14:15:30	4.57	13.94	0.14	
6/7/11 14:15:45	4.62	13.89	0.14	
6/7/11 14:16:00	4.76	13.76	0.14	
6/7/11 14:16:15	4.78	13.74	0.14	
6/7/11 14:16:30	4.72	13.79	0.14	
6/7/11 14:16:45	4.67	13.83	0.14	
6/7/11 14:17:00	4.65	13.86	0.14	
6/7/11 14:17:15	4.62	13.89	0.14	
6/7/11 14:17:30	4.59	13.90	0.14	
6/7/11 14:17:45	4.57	13.92	0.14	
6/7/11 14:18:00	4.56	13.92	0.14	
6/7/11 14:18:15	4.65	13.84	0.14	
6/7/11 14:18:30	4.79	13.72	0.14	
6/7/11 14:18:45	4.79	13.73	0.14	
6/7/11 14:19:00	4.69	13.82	0.14	
6/7/11 14:19:15	4.62	13.87	0.14	

Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 14:19:30	4.57	13.91	0.14	
6/7/11 14:19:45	4.53	13.96	0.14	
6/7/11 14:20:00	4.55	13.94	0.13	System Bias
6/7/11 14:20:15	4.64	13.86	0.13	CO ₂ Meter Bias 4 Zero = 0.14
6/7/11 14:20:30	4.71	13.80	0.13	
6/7/11 14:20:45	4.68	13.82	0.14	
6/7/11 14:21:00	4.69	13.80	0.14	
6/7/11 14:21:15	4.76	13.73	0.13	
6/7/11 14:21:30	4.77	13.73	0.13	
6/7/11 14:21:45	4.72	13.77	0.13	
6/7/11 14:22:00	4.63	13.85	0.13	
6/7/11 14:22:15	4.50	13.97	0.14	
6/7/11 14:22:30	4.40	14.07	0.15	
6/7/11 14:22:45	4.36	14.10	0.73	
6/7/11 14:23:00	4.40	14.08	4.15	
6/7/11 14:23:15	4.52	13.97	7.45	
6/7/11 14:23:30	4.66	13.85	9.07	
6/7/11 14:23:45	4.65	13.86	9.71	
6/7/11 14:24:00	4.53	13.96	9.90	
6/7/11 14:24:15	4.48	14.01	9.94	System Bias
6/7/11 14:24:30	4.47	14.03	9.96	CO ₂ Meter Bias 4 Mid = 9.97
6/7/11 14:24:45	4.42	14.08	9.97	
6/7/11 14:25:00	4.41	14.07	9.98	
6/7/11 14:25:15	4.49	14.00	9.98	
6/7/11 14:25:30	4.58	13.93	9.99	
6/7/11 14:25:45	4.62	13.89	9.12	
6/7/11 14:26:00	4.61	13.89	6.91	
6/7/11 14:26:15	4.58	13.91	7.45	
6/7/11 14:26:30	4.55	13.93	6.15	
6/7/11 14:26:45	4.60	13.89	4.50	
6/7/11 14:27:00	4.73	13.77	2.54	
6/7/11 14:27:15	4.84	13.68	0.89	
6/7/11 14:27:30	4.86	13.55	0.34	
6/7/11 14:27:45	4.52	10.34	0.23	
6/7/11 14:28:00	6.98	8.70	0.21	
6/7/11 14:28:15	10.40	9.64	0.20	
6/7/11 14:28:30	11.34	9.99	0.19	System Bias
6/7/11 14:28:45	11.46	10.03	0.18	CO ₂ Stack Bias 4 Mid = 10.04
6/7/11 14:29:00	11.48	10.04	0.18	
6/7/11 14:29:15	11.48	10.04	0.19	
6/7/11 14:29:30	11.49	10.04	0.18	
6/7/11 14:29:45	11.49	10.04	0.18	
6/7/11 14:30:00	11.49	10.04	0.18	
6/7/11 14:30:15	11.48	9.99	0.17	
6/7/11 14:30:30	8.84	7.03	0.16	
6/7/11 14:30:45	3.52	2.82	0.16	
6/7/11 14:31:00	0.73	0.62	0.16	
6/7/11 14:31:15	0.19	0.25	0.17	System Bias
6/7/11 14:31:30	0.14	0.20	0.18	CO ₂ Stack Bias 4 Zero = 0.17
6/7/11 14:31:45	0.13	0.17	0.19	
6/7/11 14:32:00	0.12	0.16	0.17	
6/7/11 14:32:15	0.12	0.15	0.16	
6/7/11 14:32:30	0.11	0.14	0.16	
6/7/11 14:32:45	0.13	0.35	0.17	
6/7/11 14:33:00	1.45	5.28	0.19	
6/7/11 14:33:15	3.37	9.94	0.18	
6/7/11 14:33:30	4.45	12.58	0.16	
6/7/11 14:33:45	4.78	13.47	0.15	
6/7/11 14:34:00	4.80	13.61	0.16	
6/7/11 14:34:15	4.80	13.64	0.16	
6/7/11 14:34:30	4.77	13.67	0.16	
6/7/11 14:34:45	4.75	13.71	0.16	
6/7/11 14:35:00	4.80	13.66	0.16	Begin Run 3 OTM 029 Response time
6/7/11 14:35:15	4.85	13.63	0.17	
6/7/11 14:35:30	4.81	13.66	0.17	
6/7/11 14:35:45	4.82	13.65	0.17	
6/7/11 14:36:00	4.89	13.60	0.17	
6/7/11 14:36:15	4.87	13.63	0.19	
6/7/11 14:36:30	4.81	13.69	0.22	
6/7/11 14:36:45	4.76	13.73	0.19	
6/7/11 14:37:00	4.78	13.71	0.43	
6/7/11 14:37:15	4.85	13.65	1.24	
6/7/11 14:37:30	4.91	13.60	1.35	
6/7/11 14:37:45	4.89	13.62	1.60	
6/7/11 14:38:00	4.89	13.61	3.26	
6/7/11 14:38:15	4.91	13.60	5.24	
6/7/11 14:38:30	4.85	13.65	6.92	
6/7/11 14:38:45	4.86	13.64	8.00	
6/7/11 14:39:00	4.92	13.59	8.60	
6/7/11 14:39:15	4.95	13.58	8.94	
6/7/11 14:39:30	4.87	13.65	9.15	
6/7/11 14:39:45	4.79	13.70	9.25	
6/7/11 14:40:00	4.81	13.68	9.31	
6/7/11 14:40:15	4.83	13.68	9.37	
6/7/11 14:40:30	4.86	13.65	9.40	

Valero Port Arthur Refinery, Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 14:40:45	4.91	13.60	9.37	
6/7/11 14:41:00	4.89	13.61	9.34	
6/7/11 14:41:15	4.86	13.64	9.33	
6/7/11 14:41:30	4.83	13.66	9.31	
6/7/11 14:41:45	4.80	13.69	9.29	
6/7/11 14:42:00	4.75	13.74	9.27	
6/7/11 14:42:15	4.77	13.72	9.30	
6/7/11 14:42:30	4.90	13.61	9.34	
6/7/11 14:42:45	5.02	13.50	9.35	
6/7/11 14:43:00	5.06	13.46	9.35	
6/7/11 14:43:15	5.03	13.49	9.29	
6/7/11 14:43:30	5.00	13.51	9.20	
6/7/11 14:43:45	4.99	13.51	9.12	
6/7/11 14:44:00	5.02	13.50	9.09	
6/7/11 14:44:15	5.04	13.48	9.08	
6/7/11 14:44:30	5.08	13.45	9.09	
6/7/11 14:44:45	5.05	13.47	9.08	
6/7/11 14:45:00	4.98	13.53	9.07	
6/7/11 14:45:15	4.86	13.66	9.06	
6/7/11 14:45:30	4.78	13.73	9.07	
6/7/11 14:45:45	4.78	13.73	9.09	
6/7/11 14:46:00	4.83	13.68	9.14	
6/7/11 14:46:15	4.84	13.69	9.19	
6/7/11 14:46:30	4.75	13.77	9.22	
6/7/11 14:46:45	4.64	13.86	9.23	
6/7/11 14:47:00	4.67	13.83	9.23	
6/7/11 14:47:15	4.77	13.74	9.25	
6/7/11 14:47:30	4.80	13.72	9.27	
6/7/11 14:47:45	4.77	13.74	9.28	
6/7/11 14:48:00	4.72	13.78	9.28	
6/7/11 14:48:15	4.69	13.80	9.28	
6/7/11 14:48:30	4.63	13.87	9.26	
6/7/11 14:48:45	4.59	13.90	9.24	
6/7/11 14:49:00	4.67	13.82	9.22	
6/7/11 14:49:15	4.80	13.72	9.23	
6/7/11 14:49:30	4.85	13.67	9.25	
6/7/11 14:49:45	4.88	13.64	9.27	
6/7/11 14:50:00	4.89	13.62	9.26	
6/7/11 14:50:15	4.99	13.52	9.25	
6/7/11 14:50:30	5.09	13.44	9.23	
6/7/11 14:50:45	5.12	13.42	9.20	
6/7/11 14:51:00	5.09	13.44	9.18	
6/7/11 14:51:15	5.03	13.49	9.15	
6/7/11 14:51:30	4.98	13.53	9.13	
6/7/11 14:51:45	4.93	13.57	9.12	
6/7/11 14:52:00	4.86	13.64	8.15	
6/7/11 14:52:15	4.84	13.67	3.89	
6/7/11 14:52:30	4.81	13.71	1.05	
6/7/11 14:52:45	4.78	13.74	0.37	
6/7/11 14:53:00	4.79	13.74	0.29	
6/7/11 14:53:15	4.81	13.70	0.29	
6/7/11 14:53:30	4.83	13.68	0.29	
6/7/11 14:53:45	4.82	13.70	0.24	
6/7/11 14:54:00	4.79	13.73	0.21	
6/7/11 14:54:15	4.80	13.72	0.21	
6/7/11 14:54:30	4.86	13.67	0.20	
6/7/11 14:54:45	4.85	13.68	0.20	
6/7/11 14:55:00	4.87	13.64	0.23	
6/7/11 14:55:15	4.97	13.56	0.22	
6/7/11 14:55:30	5.02	13.53	0.20	
6/7/11 14:55:45	5.00	13.54	0.18	
6/7/11 14:56:00	4.94	13.59	0.18	
6/7/11 14:56:15	4.89	13.62	0.18	
6/7/11 14:56:30	4.94	13.58	0.19	
6/7/11 14:56:45	4.97	13.56	0.99	
6/7/11 14:57:00	4.97	13.55	3.25	
6/7/11 14:57:15	5.03	13.50	5.84	
6/7/11 14:57:30	5.13	13.41	7.61	
6/7/11 14:57:45	5.16	13.40	6.42	
6/7/11 14:58:00	5.07	13.47	2.54	
6/7/11 14:58:15	5.02	13.50	0.67	
6/7/11 14:58:30	5.03	13.49	0.28	
6/7/11 14:58:45	5.00	13.52	0.27	
6/7/11 14:59:00	4.95	13.57	0.23	
6/7/11 14:59:15	4.97	13.55	0.20	
6/7/11 14:59:30	5.02	13.51	0.53	
6/7/11 14:59:45	5.03	13.50	2.07	
6/7/11 15:00:00	5.04	13.49	2.16	
6/7/11 15:00:15	5.02	13.49	0.77	
6/7/11 15:00:30	5.04	13.48	0.28	
6/7/11 15:00:45	5.01	13.51	0.23	
6/7/11 15:01:00	4.94	13.58	0.29	
6/7/11 15:01:15	4.93	13.58	1.64	
6/7/11 15:01:30	4.97	13.54	3.33	
6/7/11 15:01:45	4.95	13.56	3.45	

Port Change M26A

Valero Port Arthur Refinery, Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 15:02:00	4.96	13.56	4.05	
6/7/11 15:02:15	5.00	13.52	5.76	
6/7/11 15:02:30	5.04	13.49	7.42	
6/7/11 15:02:45	5.05	13.47	8.41	
6/7/11 15:03:00	4.99	13.52	8.97	
6/7/11 15:03:15	4.92	13.59	9.36	
6/7/11 15:03:30	4.90	13.60	9.61	
6/7/11 15:03:45	4.87	13.63	9.79	
6/7/11 15:04:00	4.83	13.67	9.90	
6/7/11 15:04:15	4.88	13.63	9.95	
6/7/11 15:04:30	5.06	13.47	9.97	
6/7/11 15:04:45	5.22	13.33	9.98	
6/7/11 15:05:00	5.27	13.27	9.94	
6/7/11 15:05:15	5.22	13.30	9.87	
6/7/11 15:05:30	5.16	13.36	9.79	
6/7/11 15:05:45	5.09	13.42	9.71	
6/7/11 15:06:00	5.07	13.44	9.67	Resume M26A
6/7/11 15:06:15	5.05	13.46	9.65	
6/7/11 15:06:30	5.01	13.51	9.66	
6/7/11 15:06:45	4.99	13.54	9.67	
6/7/11 15:07:00	4.96	13.57	9.68	
6/7/11 15:07:15	4.93	13.59	9.67	
6/7/11 15:07:30	4.92	13.58	9.64	
6/7/11 15:07:45	4.95	13.57	9.61	
6/7/11 15:08:00	4.95	13.57	9.59	
6/7/11 15:08:15	5.00	13.53	9.60	
6/7/11 15:08:30	5.07	13.46	9.62	
6/7/11 15:08:45	5.10	13.43	9.64	
6/7/11 15:09:00	5.06	13.47	9.66	
6/7/11 15:09:15	5.00	13.52	9.66	
6/7/11 15:09:30	4.98	13.53	9.64	
6/7/11 15:09:45	5.02	13.49	9.64	
6/7/11 15:10:00	5.08	13.45	9.64	
6/7/11 15:10:15	5.02	13.50	9.65	
6/7/11 15:10:30	4.97	13.55	9.64	
6/7/11 15:10:45	4.93	13.58	9.62	
6/7/11 15:11:00	4.89	13.63	9.62	
6/7/11 15:11:15	4.91	13.60	9.62	
6/7/11 15:11:30	5.06	13.46	9.64	
6/7/11 15:11:45	5.20	13.34	9.67	
6/7/11 15:12:00	5.16	13.38	9.69	
6/7/11 15:12:15	5.09	13.44	9.67	
6/7/11 15:12:30	5.08	13.43	9.60	
6/7/11 15:12:45	5.07	13.43	9.57	
6/7/11 15:13:00	5.10	13.41	9.57	
6/7/11 15:13:15	5.18	13.34	9.59	
6/7/11 15:13:30	5.19	13.33	9.61	
6/7/11 15:13:45	5.11	13.40	9.64	
6/7/11 15:14:00	4.98	13.52	9.64	
6/7/11 15:14:15	4.91	13.59	9.61	
6/7/11 15:14:30	4.93	13.57	9.58	
6/7/11 15:14:45	4.95	13.56	9.60	
6/7/11 15:15:00	4.97	13.55	9.67	
6/7/11 15:15:15	5.01	13.51	9.74	
6/7/11 15:15:30	5.06	13.45	9.80	
6/7/11 15:15:45	5.12	13.40	9.86	
6/7/11 15:16:00	5.14	13.37	9.64	
6/7/11 15:16:15	5.15	13.36	6.23	
6/7/11 15:16:30	5.20	13.31	2.10	
6/7/11 15:16:45	5.27	13.26	0.60	
6/7/11 15:17:00	5.23	13.30	0.30	
6/7/11 15:17:15	5.20	13.32	0.24	
6/7/11 15:17:30	5.16	13.35	0.22	
6/7/11 15:17:45	5.10	13.41	0.21	
6/7/11 15:18:00	5.05	13.46	0.21	
6/7/11 15:18:15	5.05	13.46	0.23	
6/7/11 15:18:30	5.11	13.41	0.21	
6/7/11 15:18:45	5.16	13.36	0.49	
6/7/11 15:19:00	5.15	13.36	3.52	
6/7/11 15:19:15	5.11	13.41	5.71	
6/7/11 15:19:30	5.05	13.47	4.09	
6/7/11 15:19:45	5.11	13.42	3.74	
6/7/11 15:20:00	5.18	13.35	1.92	
6/7/11 15:20:15	5.23	13.30	0.61	
6/7/11 15:20:30	5.36	13.19	0.34	
6/7/11 15:20:45	5.54	13.02	0.29	
6/7/11 15:21:00	5.68	12.88	0.91	
6/7/11 15:21:15	5.79	12.80	3.37	
6/7/11 15:21:30	5.87	12.74	4.56	
6/7/11 15:21:45	6.01	12.63	4.47	
6/7/11 15:22:00	6.09	12.57	5.51	
6/7/11 15:22:15	6.11	12.54	7.09	
6/7/11 15:22:30	6.11	12.54	8.17	
6/7/11 15:22:45	6.07	12.58	8.76	
6/7/11 15:23:00	6.02	12.61	9.10	

Valero Port Arthur Refinery, Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 15:23:15	6.00	12.63	9.33	
6/7/11 15:23:30	6.02	12.61	9.46	
6/7/11 15:23:45	6.06	12.58	9.55	
6/7/11 15:24:00	6.08	12.56	9.58	
6/7/11 15:24:15	6.08	12.55	9.58	
6/7/11 15:24:30	6.13	12.51	9.58	
6/7/11 15:24:45	6.14	12.52	9.58	
6/7/11 15:25:00	6.09	12.56	9.59	
6/7/11 15:25:15	6.08	12.56	9.58	
6/7/11 15:25:30	6.09	12.55	9.58	
6/7/11 15:25:45	6.13	12.51	9.60	
6/7/11 15:26:00	6.24	12.41	9.63	
6/7/11 15:26:15	6.28	12.39	9.65	
6/7/11 15:26:30	6.19	12.46	9.65	
6/7/11 15:26:45	6.10	12.55	9.61	
6/7/11 15:27:00	6.01	12.61	9.59	
6/7/11 15:27:15	6.08	12.55	9.59	
6/7/11 15:27:30	6.16	12.50	9.65	
6/7/11 15:27:45	6.19	12.46	9.71	
6/7/11 15:28:00	6.24	12.41	9.75	
6/7/11 15:28:15	6.27	12.38	9.78	
6/7/11 15:28:30	6.25	12.41	9.79	
6/7/11 15:28:45	6.19	12.45	9.79	
6/7/11 15:29:00	6.16	12.47	9.80	
6/7/11 15:29:15	6.15	12.48	9.83	
6/7/11 15:29:30	6.15	12.49	9.86	
6/7/11 15:29:45	6.20	12.45	9.87	
6/7/11 15:30:00	6.20	12.45	9.86	
6/7/11 15:30:15	6.22	12.43	9.86	
6/7/11 15:30:30	6.25	12.40	9.88	
6/7/11 15:30:45	6.29	12.37	9.89	
6/7/11 15:31:00	6.27	12.38	9.87	
6/7/11 15:31:15	6.22	12.43	9.86	
6/7/11 15:31:30	6.18	12.47	9.85	
6/7/11 15:31:45	6.16	12.48	9.85	
6/7/11 15:32:00	6.15	12.50	9.86	
6/7/11 15:32:15	6.17	12.47	9.88	
6/7/11 15:32:30	6.17	12.47	9.90	
6/7/11 15:32:45	6.06	12.56	9.92	
6/7/11 15:33:00	5.92	12.67	9.93	
6/7/11 15:33:15	5.89	12.69	9.94	
6/7/11 15:33:30	5.99	12.62	9.95	
6/7/11 15:33:45	6.06	12.56	10.00	
6/7/11 15:34:00	6.11	12.52	10.06	
6/7/11 15:34:15	6.15	12.48	10.10	
6/7/11 15:34:30	6.14	12.50	10.11	
6/7/11 15:34:45	6.11	12.52	10.10	
6/7/11 15:35:00	6.11	12.53	10.08	
6/7/11 15:35:15	6.09	12.54	10.06	
6/7/11 15:35:30	6.08	12.55	10.04	
6/7/11 15:35:45	6.06	12.57	10.03	
6/7/11 15:36:00	6.04	12.59	8.75	M26A Port Change
6/7/11 15:36:15	6.01	12.61	4.23	
6/7/11 15:36:30	6.01	12.60	1.21	
6/7/11 15:36:45	6.07	12.55	0.36	
6/7/11 15:37:00	6.09	12.54	0.24	
6/7/11 15:37:15	6.09	12.54	0.22	
6/7/11 15:37:30	6.12	12.52	0.21	
6/7/11 15:37:45	6.17	12.48	0.20	
6/7/11 15:38:00	6.21	12.45	0.20	
6/7/11 15:38:15	6.13	12.51	0.19	
6/7/11 15:38:30	6.01	12.59	0.19	
6/7/11 15:38:45	5.97	12.62	0.19	
6/7/11 15:39:00	6.02	12.60	0.18	
6/7/11 15:39:15	5.98	12.63	0.18	
6/7/11 15:39:30	5.90	12.69	0.19	
6/7/11 15:39:45	5.88	12.72	0.19	
6/7/11 15:40:00	5.86	12.72	0.24	
6/7/11 15:40:15	5.81	12.77	0.27	
6/7/11 15:40:30	5.77	12.79	0.22	
6/7/11 15:40:45	5.85	12.73	0.19	
6/7/11 15:41:00	5.93	12.68	0.18	
6/7/11 15:41:15	5.99	12.63	0.19	
6/7/11 15:41:30	6.08	12.55	0.20	
6/7/11 15:41:45	6.19	12.47	0.22	
6/7/11 15:42:00	6.18	12.49	1.86	
6/7/11 15:42:15	6.08	12.56	5.03	
6/7/11 15:42:30	6.03	12.58	5.21	
6/7/11 15:42:45	6.01	12.60	2.05	
6/7/11 15:43:00	5.99	12.62	0.54	
6/7/11 15:43:15	6.01	12.59	0.23	
6/7/11 15:43:30	6.10	12.53	0.23	
6/7/11 15:43:45	6.13	12.50	0.23	
6/7/11 15:44:00	6.07	12.55	0.21	Resume M26A
6/7/11 15:44:15	5.99	12.61	0.21	

Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 15:44:30	5.96	12.64	0.20	
6/7/11 15:44:45	5.92	12.68	0.17	
6/7/11 15:45:00	5.85	12.73	1.07	
6/7/11 15:45:15	5.89	12.70	4.29	
6/7/11 15:45:30	6.02	12.60	6.09	
6/7/11 15:45:45	6.10	12.54	5.96	
6/7/11 15:46:00	6.08	12.56	6.80	
6/7/11 15:46:15	6.01	12.61	8.05	
6/7/11 15:46:30	5.94	12.66	8.88	
6/7/11 15:46:45	5.87	12.71	9.46	
6/7/11 15:47:00	5.81	12.77	9.82	
6/7/11 15:47:15	5.79	12.79	10.07	
6/7/11 15:47:30	5.83	12.74	10.24	
6/7/11 15:47:45	5.90	12.69	10.37	
6/7/11 15:48:00	5.91	12.69	10.45	
6/7/11 15:48:15	5.92	12.69	10.49	
6/7/11 15:48:30	5.93	12.67	10.51	
6/7/11 15:48:45	5.92	12.69	10.53	
6/7/11 15:49:00	5.87	12.74	10.54	
6/7/11 15:49:15	5.89	12.72	10.53	
6/7/11 15:49:30	5.97	12.65	10.53	
6/7/11 15:49:45	6.05	12.57	10.54	
6/7/11 15:50:00	6.12	12.51	10.53	
6/7/11 15:50:15	6.17	12.47	10.50	
6/7/11 15:50:30	6.16	12.50	10.48	
6/7/11 15:50:45	6.08	12.56	10.44	
6/7/11 15:51:00	5.96	12.65	10.41	
6/7/11 15:51:15	5.86	12.72	10.38	
6/7/11 15:51:30	5.84	12.74	10.39	
6/7/11 15:51:45	5.88	12.71	10.43	
6/7/11 15:52:00	5.89	12.70	10.47	
6/7/11 15:52:15	5.88	12.71	10.50	
6/7/11 15:52:30	5.88	12.72	10.51	
6/7/11 15:52:45	5.88	12.72	10.51	
6/7/11 15:53:00	5.87	12.71	10.52	
6/7/11 15:53:15	5.89	12.70	10.54	
6/7/11 15:53:30	5.89	12.70	10.55	
6/7/11 15:53:45	5.89	12.71	10.54	
6/7/11 15:54:00	5.85	12.75	10.52	
6/7/11 15:54:15	5.79	12.79	10.51	
6/7/11 15:54:30	5.76	12.81	10.50	
6/7/11 15:54:45	5.78	12.79	10.51	
6/7/11 15:55:00	5.81	12.78	10.54	
6/7/11 15:55:15	5.82	12.76	10.57	
6/7/11 15:55:30	5.87	12.72	10.58	
6/7/11 15:55:45	5.86	12.73	10.58	
6/7/11 15:56:00	5.79	12.78	10.57	
6/7/11 15:56:15	5.77	12.79	10.55	
6/7/11 15:56:30	5.82	12.76	10.53	
6/7/11 15:56:45	5.84	12.74	10.53	
6/7/11 15:57:00	5.85	12.72	10.55	
6/7/11 15:57:15	5.88	12.71	10.55	
6/7/11 15:57:30	5.87	12.72	10.54	
6/7/11 15:57:45	5.82	12.76	10.53	
6/7/11 15:58:00	5.81	12.77	10.53	
6/7/11 15:58:15	5.87	12.72	10.53	
6/7/11 15:58:30	5.94	12.68	10.54	
6/7/11 15:58:45	5.94	12.67	10.56	
6/7/11 15:59:00	5.86	12.72	10.58	
6/7/11 15:59:15	5.83	12.75	10.57	
6/7/11 15:59:30	5.82	12.76	10.57	
6/7/11 15:59:45	5.83	12.75	10.59	
6/7/11 16:00:00	5.84	12.75	9.58	
6/7/11 16:00:15	5.85	12.73	5.00	
6/7/11 16:00:30	5.89	12.71	1.52	
6/7/11 16:00:45	5.87	12.73	0.44	
6/7/11 16:01:00	5.87	12.73	0.25	
6/7/11 16:01:15	5.92	12.69	0.22	
6/7/11 16:01:30	5.94	12.67	0.21	
6/7/11 16:01:45	5.97	12.65	0.40	
6/7/11 16:02:00	5.95	12.66	1.54	
6/7/11 16:02:15	5.86	12.73	2.87	
6/7/11 16:02:30	5.79	12.78	1.81	
6/7/11 16:02:45	5.77	12.81	0.59	
6/7/11 16:03:00	5.76	12.82	0.27	
6/7/11 16:03:15	5.80	12.78	0.22	
6/7/11 16:03:30	5.87	12.74	0.20	
6/7/11 16:03:45	5.89	12.72	0.19	
6/7/11 16:04:00	5.91	12.70	0.19	
6/7/11 16:04:15	5.90	12.71	0.19	
6/7/11 16:04:30	5.83	12.76	0.18	
6/7/11 16:04:45	5.84	12.73	0.17	
6/7/11 16:05:00	5.84	12.74	0.17	
6/7/11 16:05:15	5.79	12.78	0.17	
6/7/11 16:05:30	5.79	12.78	0.17	

Valero Port Arthur Refinery, Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 16:05:45	5.82	12.76	0.17	
6/7/11 16:06:00	5.81	12.77	0.17	
6/7/11 16:06:15	5.77	12.80	0.16	
6/7/11 16:06:30	5.80	12.78	0.16	
6/7/11 16:06:45	5.82	12.76	0.16	
6/7/11 16:07:00	5.79	12.79	0.16	
6/7/11 16:07:15	5.77	12.81	0.16	
6/7/11 16:07:30	5.79	12.79	0.15	
6/7/11 16:07:45	5.82	12.76	0.15	
6/7/11 16:08:00	5.86	12.73	0.15	
6/7/11 16:08:15	5.87	12.72	0.16	
6/7/11 16:08:30	5.84	12.74	0.16	
6/7/11 16:08:45	5.79	12.78	0.16	
6/7/11 16:09:00	5.72	12.84	0.19	
6/7/11 16:09:15	5.70	12.86	0.18	
6/7/11 16:09:30	5.73	12.85	0.18	
6/7/11 16:09:45	5.72	12.84	0.16	
6/7/11 16:10:00	5.72	12.84	0.15	
6/7/11 16:10:15	5.77	12.79	0.24	
6/7/11 16:10:30	5.86	12.74	0.90	
6/7/11 16:10:45	5.87	12.74	0.75	
6/7/11 16:11:00	5.87	12.73	0.35	
6/7/11 16:11:15	5.88	12.72	0.15	
6/7/11 16:11:30	5.80	12.78	0.12	
6/7/11 16:11:45	5.68	12.87	0.11	
6/7/11 16:12:00	5.64	12.90	0.11	
6/7/11 16:12:15	5.67	12.88	0.11	
6/7/11 16:12:30	5.69	12.87	0.11	
6/7/11 16:12:45	5.75	12.83	0.11	
6/7/11 16:13:00	5.78	12.81	0.11	
6/7/11 16:13:15	5.79	12.80	0.11	
6/7/11 16:13:30	5.79	12.81	0.11	
6/7/11 16:13:45	5.78	12.80	0.11	
6/7/11 16:14:00	5.81	12.79	0.11	M26A Port Change
6/7/11 16:14:15	5.79	12.79	0.11	
6/7/11 16:14:30	5.79	12.79	0.11	
6/7/11 16:14:45	5.79	12.79	0.11	
6/7/11 16:15:00	5.78	12.79	0.11	
6/7/11 16:15:15	5.82	12.76	0.11	
6/7/11 16:15:30	5.84	12.75	0.10	
6/7/11 16:15:45	5.88	12.72	0.10	Resume M26A
6/7/11 16:16:00	5.96	12.65	0.10	
6/7/11 16:16:15	6.01	12.62	0.10	
6/7/11 16:16:30	5.94	12.67	0.10	
6/7/11 16:16:45	5.83	12.75	0.10	
6/7/11 16:17:00	5.82	12.75	0.10	
6/7/11 16:17:15	5.85	12.73	0.10	
6/7/11 16:17:30	5.83	12.75	0.10	
6/7/11 16:17:45	5.78	12.80	0.10	
6/7/11 16:18:00	5.77	12.80	0.09	
6/7/11 16:18:15	5.81	12.76	0.09	
6/7/11 16:18:30	5.83	12.75	0.20	
6/7/11 16:18:45	5.83	12.76	0.64	
6/7/11 16:19:00	5.78	12.80	0.92	
6/7/11 16:19:15	5.74	12.83	1.01	
6/7/11 16:19:30	5.68	12.87	1.05	
6/7/11 16:19:45	5.66	12.89	1.04	
6/7/11 16:20:00	5.65	12.89	1.03	
6/7/11 16:20:15	5.71	12.86	1.02	
6/7/11 16:20:30	5.79	12.79	1.02	
6/7/11 16:20:45	5.85	12.74	1.02	
6/7/11 16:21:00	5.83	12.75	1.02	
6/7/11 16:21:15	5.79	12.79	1.03	
6/7/11 16:21:30	5.80	12.78	1.05	
6/7/11 16:21:45	5.78	12.79	1.06	
6/7/11 16:22:00	5.74	12.82	1.07	
6/7/11 16:22:15	5.75	12.82	1.07	
6/7/11 16:22:30	5.79	12.79	1.21	
6/7/11 16:22:45	5.78	12.79	3.84	
6/7/11 16:23:00	5.79	12.78	6.77	
6/7/11 16:23:15	5.87	12.72	8.67	
6/7/11 16:23:30	5.90	12.71	9.65	
6/7/11 16:23:45	5.84	12.74	9.91	
6/7/11 16:24:00	5.72	12.84	9.96	
6/7/11 16:24:15	5.61	12.92	9.97	
6/7/11 16:24:30	5.63	12.90	9.98	System Bias
6/7/11 16:24:45	5.76	12.80	9.98	
6/7/11 16:25:00	5.85	12.74	9.99	CO ₂ Meter Bias 5 Mid = 9.99
6/7/11 16:25:15	5.86	12.73	9.99	
6/7/11 16:25:30	5.87	12.72	9.99	
6/7/11 16:25:45	5.87	12.71	10.00	
6/7/11 16:26:00	5.85	12.73	10.00	
6/7/11 16:26:15	5.91	12.67	10.00	
6/7/11 16:26:30	5.97	12.64	10.00	
6/7/11 16:26:45	5.94	12.66	10.00	

**Valero Port Arthur Refinery, Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 16:27:00	5.92	12.67	8.50	
6/7/11 16:27:15	5.86	12.74	4.03	
6/7/11 16:27:30	5.79	12.80	1.18	
6/7/11 16:27:45	5.74	12.83	0.37	
6/7/11 16:28:00	5.68	12.87	0.25	
6/7/11 16:28:15	5.66	12.89	0.21	
6/7/11 16:28:30	5.71	12.85	0.23	
6/7/11 16:28:45	5.81	12.77	0.31	
6/7/11 16:29:00	5.89	12.71	0.31	System Bias
6/7/11 16:29:15	5.92	12.67	0.24	
6/7/11 16:29:30	5.89	12.70	0.22	CO ₂ Meter Bias 5 Zero = 0.24
6/7/11 16:29:45	5.81	12.76	0.25	
6/7/11 16:30:00	5.79	12.77	0.25	
6/7/11 16:30:15	5.82	12.77	0.22	
6/7/11 16:30:30	5.80	12.78	0.18	
6/7/11 16:30:45	5.74	12.82	0.17	
6/7/11 16:31:00	5.69	12.85	0.22	
6/7/11 16:31:15	5.71	12.85	0.21	
6/7/11 16:31:30	5.75	12.82	0.17	
6/7/11 16:31:45	5.83	12.75	0.18	
6/7/11 16:32:00	5.90	12.69	0.17	
6/7/11 16:32:15	5.84	12.75	0.16	
6/7/11 16:32:30	5.80	12.77	0.16	
6/7/11 16:32:45	5.86	12.73	0.16	
6/7/11 16:33:00	5.93	12.67	0.18	
6/7/11 16:33:15	5.92	12.67	0.21	
6/7/11 16:33:30	5.84	12.74	0.23	
6/7/11 16:33:45	5.79	12.77	0.24	
6/7/11 16:34:00	5.87	12.71	0.21	
6/7/11 16:34:15	5.98	12.63	0.18	
6/7/11 16:34:30	6.02	12.59	0.19	
6/7/11 16:34:45	6.05	12.57	0.20	
6/7/11 16:35:00	6.04	12.59	0.17	
6/7/11 16:35:15	5.94	12.66	0.19	
6/7/11 16:35:30	5.83	12.74	0.22	
6/7/11 16:35:45	5.80	12.77	0.20	
6/7/11 16:36:00	5.82	12.76	0.18	
6/7/11 16:36:15	5.87	12.72	0.17	
6/7/11 16:36:30	5.92	12.68	0.18	
6/7/11 16:36:45	5.91	12.68	0.20	
6/7/11 16:37:00	5.83	12.74	0.21	
6/7/11 16:37:15	5.77	12.79	0.18	
6/7/11 16:37:30	5.76	12.81	0.16	
6/7/11 16:37:45	5.72	12.83	0.17	
6/7/11 16:38:00	5.72	12.84	0.17	
6/7/11 16:38:15	5.76	12.81	0.18	
6/7/11 16:38:30	5.79	12.79	0.17	
6/7/11 16:38:45	5.77	12.81	0.16	
6/7/11 16:39:00	5.82	12.76	0.15	
6/7/11 16:39:15	5.84	12.75	0.14	
6/7/11 16:39:30	5.79	12.78	0.15	
6/7/11 16:39:45	5.81	12.76	0.15	
6/7/11 16:40:00	5.84	12.75	0.14	
6/7/11 16:40:15	5.80	12.78	0.14	
6/7/11 16:40:30	5.79	12.78	0.15	
6/7/11 16:40:45	5.85	12.74	0.16	
6/7/11 16:41:00	5.90	12.70	0.19	
6/7/11 16:41:15	5.92	12.68	0.20	
6/7/11 16:41:30	5.90	12.70	0.17	
6/7/11 16:41:45	5.84	12.74	0.22	
6/7/11 16:42:00	5.78	12.79	0.28	
6/7/11 16:42:15	5.76	12.81	0.24	
6/7/11 16:42:30	5.76	12.80	0.18	
6/7/11 16:42:45	5.78	12.79	0.15	
6/7/11 16:43:00	5.73	12.84	0.17	
6/7/11 16:43:15	5.70	12.86	0.21	
6/7/11 16:43:30	5.76	12.81	0.19	
6/7/11 16:43:45	5.86	12.73	0.19	
6/7/11 16:44:00	5.97	12.65	0.25	
6/7/11 16:44:15	5.97	12.63	0.24	
6/7/11 16:44:30	5.99	12.60	0.23	
6/7/11 16:44:45	6.03	12.59	0.21	
6/7/11 16:45:00	5.99	12.64	0.18	
6/7/11 16:45:15	5.91	12.68	0.17	
6/7/11 16:45:30	5.89	12.70	0.16	
6/7/11 16:45:45	5.84	12.74	0.15	
6/7/11 16:46:00	5.76	12.81	0.15	End M26A Run 3
6/7/11 16:46:15	5.69	12.85	0.15	
6/7/11 16:46:30	5.72	12.82	0.15	
6/7/11 16:46:45	5.81	12.77	0.15	
6/7/11 16:47:00	5.87	12.72	0.15	
6/7/11 16:47:15	5.94	12.66	0.15	
6/7/11 16:47:30	5.94	12.66	0.15	
6/7/11 16:47:45	5.91	12.68	0.15	
6/7/11 16:48:00	5.93	12.67	0.14	

**Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 16:48:15	5.94	12.66	0.14	
6/7/11 16:48:30	5.90	12.70	0.14	
6/7/11 16:48:45	5.85	12.73	0.14	
6/7/11 16:49:00	5.84	12.74	0.14	
6/7/11 16:49:15	5.84	12.75	0.14	
6/7/11 16:49:30	5.78	12.79	0.14	
6/7/11 16:49:45	5.79	12.77	0.14	
6/7/11 16:50:00	5.84	12.75	0.14	
6/7/11 16:50:15	5.82	12.76	0.15	
6/7/11 16:50:30	5.79	12.79	0.17	
6/7/11 16:50:45	5.76	12.80	0.18	
6/7/11 16:51:00	5.81	12.75	0.15	
6/7/11 16:51:15	5.89	12.69	0.14	
6/7/11 16:51:30	5.92	12.67	0.15	
6/7/11 16:51:45	5.93	12.66	0.17	
6/7/11 16:52:00	5.94	12.66	0.18	
6/7/11 16:52:15	5.98	12.64	0.17	
6/7/11 16:52:30	5.98	12.62	0.18	
6/7/11 16:52:45	5.98	12.62	0.16	
6/7/11 16:53:00	5.96	12.64	0.17	
6/7/11 16:53:15	5.97	12.64	0.16	
6/7/11 16:53:30	5.95	12.66	0.15	
6/7/11 16:53:45	5.95	12.66	0.15	
6/7/11 16:54:00	6.02	12.60	0.16	
6/7/11 16:54:15	6.03	12.60	0.15	
6/7/11 16:54:30	5.96	12.66	0.14	
6/7/11 16:54:45	5.91	12.69	0.14	
6/7/11 16:55:00	5.93	12.68	0.15	
6/7/11 16:55:15	5.99	12.64	0.15	
6/7/11 16:55:30	6.02	12.61	0.15	
6/7/11 16:55:45	6.04	12.58	0.15	
6/7/11 16:56:00	6.05	12.57	0.15	
6/7/11 16:56:15	6.04	12.57	0.15	
6/7/11 16:56:30	6.11	12.51	0.15	
6/7/11 16:56:45	6.12	12.51	0.15	
6/7/11 16:57:00	6.12	12.51	0.16	
6/7/11 16:57:15	6.11	12.54	0.16	
6/7/11 16:57:30	6.05	12.58	0.15	
6/7/11 16:57:45	6.06	12.57	0.15	
6/7/11 16:58:00	6.11	12.52	0.16	
6/7/11 16:58:15	6.14	12.49	0.15	
6/7/11 16:58:30	6.14	12.49	0.15	
6/7/11 16:58:45	6.13	12.50	0.15	
6/7/11 16:59:00	6.08	12.54	0.15	
6/7/11 16:59:15	6.06	12.56	0.16	
6/7/11 16:59:30	6.09	12.53	0.15	
6/7/11 16:59:45	6.18	12.48	0.15	
6/7/11 17:00:00	6.25	12.41	0.15	
6/7/11 17:00:15	6.26	12.39	0.17	
6/7/11 17:00:30	6.31	12.35	0.19	
6/7/11 17:00:45	6.37	12.30	0.16	
6/7/11 17:01:00	6.40	12.28	0.14	
6/7/11 17:01:15	6.33	12.35	0.14	
6/7/11 17:01:30	6.26	12.39	0.15	
6/7/11 17:01:45	6.28	12.38	0.15	
6/7/11 17:02:00	6.26	12.39	0.15	
6/7/11 17:02:15	6.21	12.43	0.17	
6/7/11 17:02:30	6.18	12.46	0.18	
6/7/11 17:02:45	6.16	12.06	0.19	
6/7/11 17:03:00	6.09	8.95	0.21	
6/7/11 17:03:15	8.89	8.70	0.21	
6/7/11 17:03:30	10.99	9.63	0.20	
6/7/11 17:03:45	11.43	9.90	0.25	
6/7/11 17:04:00	11.48	10.00	0.24	
6/7/11 17:04:15	11.48	10.03	0.22	
6/7/11 17:04:30	11.49	10.03	0.21	
6/7/11 17:04:45	11.49	10.04	0.20	
6/7/11 17:05:00	11.49	10.04	0.17	
6/7/11 17:05:15	11.49	10.04	0.17	
6/7/11 17:05:30	11.49	10.04	0.17	
6/7/11 17:05:45	11.50	10.04	0.18	
6/7/11 17:06:00	11.50	10.04	0.19	
6/7/11 17:06:15	11.50	10.04	0.20	
6/7/11 17:06:30	11.50	10.04	0.22	
6/7/11 17:06:45	11.50	10.04	0.23	
				System Bias
6/7/11 17:07:00	11.50	10.04	0.22	CO₂ Stack Bias 5 Mid = 10.04
6/7/11 17:07:15	11.50	10.04	0.16	
6/7/11 17:07:30	11.50	10.04	0.16	
6/7/11 17:07:45	11.50	10.04	0.18	
6/7/11 17:08:00	11.50	10.04	0.19	
6/7/11 17:08:15	11.50	10.04	0.19	
6/7/11 17:08:30	11.48	10.06	0.19	
6/7/11 17:08:45	10.07	10.92	0.21	
6/7/11 17:09:00	8.38	10.73	0.25	
6/7/11 17:09:15	7.33	7.20	0.26	

**Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 17:09:30	5.28	4.77	0.24	
6/7/11 17:09:45	4.69	4.24	0.20	
6/7/11 17:10:00	4.64	4.18	0.18	
6/7/11 17:10:15	4.63	4.16	0.18	
6/7/11 17:10:30	4.62	4.15	0.21	System Bias
6/7/11 17:10:45	4.62	4.15	0.23	O ₂ Stack Bias 5 Mid = 4.62
6/7/11 17:11:00	4.62	4.14	0.22	
6/7/11 17:11:15	4.62	4.14	0.18	
6/7/11 17:11:30	4.62	4.13	0.20	
6/7/11 17:11:45	4.62	4.13	0.23	
6/7/11 17:12:00	4.61	4.13	0.20	
6/7/11 17:12:15	4.61	4.13	0.21	
6/7/11 17:12:30	4.61	4.12	0.20	
6/7/11 17:12:45	4.62	4.26	0.19	
6/7/11 17:13:00	4.94	6.27	0.18	
6/7/11 17:13:15	4.45	5.09	0.17	
6/7/11 17:13:30	2.19	2.03	0.19	
6/7/11 17:13:45	0.62	0.51	0.17	
6/7/11 17:14:00	0.20	0.21	0.15	
6/7/11 17:14:15	0.14	0.16	0.16	
6/7/11 17:14:30	0.13	0.14	0.15	
6/7/11 17:14:45	0.12	0.12	0.15	
6/7/11 17:15:00	0.11	0.12	0.15	
6/7/11 17:15:15	0.11	0.11	0.15	System Bias
6/7/11 17:15:30	0.11	0.10	0.15	O ₂ Stack Bias 5 Zero = 0.10
6/7/11 17:15:45	0.11	0.10	0.16	CO ₂ Stack Bias 5 Zero = 0.10
6/7/11 17:16:00	0.10	0.10	0.16	
6/7/11 17:16:15	0.10	0.09	0.15	
6/7/11 17:16:30	0.10	0.09	0.14	
6/7/11 17:16:45	0.10	0.09	0.14	
6/7/11 17:17:00	0.10	0.08	0.14	
6/7/11 17:17:15	0.09	0.08	0.14	
6/7/11 17:17:30	0.09	0.08	0.15	
6/7/11 17:17:45	0.09	0.08	0.15	
6/7/11 17:18:00	0.09	0.08	0.17	
6/7/11 17:18:15	0.09	0.08	0.18	
6/7/11 17:18:30	0.09	0.08	0.15	
6/7/11 17:18:45	0.09	0.08	0.14	
6/7/11 17:19:00	0.08	0.08	0.14	
6/7/11 17:19:15	0.08	0.08	0.16	
6/7/11 17:19:30	0.08	0.08	0.17	
6/7/11 17:19:45	0.08	0.08	0.16	
6/7/11 17:20:00	0.08	0.07	0.16	
6/7/11 17:20:15	0.08	0.07	0.15	
6/7/11 17:20:30	0.08	0.07	0.14	
6/7/11 17:20:45	0.08	0.07	0.14	
6/7/11 17:21:00	0.08	0.07	0.15	
6/7/11 17:21:15	0.08	0.07	0.18	
6/7/11 17:21:30	0.08	0.07	0.19	
6/7/11 17:21:45	0.08	0.07	0.17	
6/7/11 17:22:00	0.08	0.07	0.17	
6/7/11 17:22:15	0.08	0.07	0.21	
6/7/11 17:22:30	0.08	0.07	0.21	
6/7/11 17:22:45	0.08	0.07	0.19	
6/7/11 17:23:00	0.08	0.07	0.18	
6/7/11 17:23:15	0.08	0.07	0.16	
6/7/11 17:23:30	0.08	0.07	0.15	
6/7/11 17:23:45	0.08	0.06	0.15	
6/7/11 17:24:00	0.08	0.06	0.17	
6/7/11 17:24:15	0.08	0.06	0.16	
6/7/11 17:24:30	0.08	0.06	0.15	
6/7/11 17:24:45	0.08	0.06	0.14	
6/7/11 17:25:00	0.08	0.06	0.14	
6/7/11 17:25:15	0.08	0.06	0.14	
6/7/11 17:25:30	0.08	0.06	0.14	
6/7/11 17:25:45	0.08	0.06	0.14	
6/7/11 17:26:00	0.08	0.06	0.14	
6/7/11 17:26:15	0.08	0.06	0.14	
6/7/11 17:26:30	0.08	0.06	0.15	
6/7/11 17:26:45	0.08	0.06	0.17	
6/7/11 17:27:00	0.08	0.05	0.19	
6/7/11 17:27:15	0.08	0.06	0.17	
6/7/11 17:27:30	0.08	0.06	0.17	
6/7/11 17:27:45	0.07	0.05	0.15	
6/7/11 17:28:00	0.07	0.06	0.15	
6/7/11 17:28:15	0.08	0.06	0.15	
6/7/11 17:28:30	0.82	2.22	0.17	
6/7/11 17:28:45	1.72	3.16	0.19	
6/7/11 17:29:00	0.85	1.05	0.17	
6/7/11 17:29:15	0.21	0.19	0.15	
6/7/11 17:29:30	0.09	0.08	0.15	
6/7/11 17:29:45	0.08	0.07	0.14	
6/7/11 17:30:00	0.07	0.06	0.15	
6/7/11 17:30:15	0.07	0.06	0.14	
6/7/11 17:30:30	0.07	0.06	0.14	

**Valero Port Arthur Refinery, Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ₂ (Meter) ppmv db	Comments
6/7/11 17:30:45	0.07	0.06	0.14	
6/7/11 17:31:00	0.07	0.06	0.14	
6/7/11 17:31:15	0.07	0.06	0.14	
6/7/11 17:31:30	0.07	0.06	0.15	
6/7/11 17:31:45	0.07	0.06	0.19	
6/7/11 17:32:00	0.07	0.06	0.22	
6/7/11 17:32:15	0.07	0.06	0.20	
6/7/11 17:32:30	0.07	0.06	0.18	
6/7/11 17:32:45	0.07	0.06	0.20	
6/7/11 17:33:00	0.07	0.06	0.22	
6/7/11 17:33:15	0.07	0.06	0.18	
6/7/11 17:33:30	0.07	0.06	0.20	
6/7/11 17:33:45	0.07	0.06	0.21	
6/7/11 17:34:00	0.07	0.06	0.22	
6/7/11 17:34:15	0.07	0.06	0.21	
6/7/11 17:34:30	0.07	0.05	0.20	
6/7/11 17:34:45	0.07	0.05	0.16	
6/7/11 17:35:00	0.07	0.05	0.15	
6/7/11 17:35:15	0.07	0.05	0.14	
6/7/11 17:35:30	0.07	0.05	0.14	
6/7/11 17:35:45	0.07	0.05	0.14	
6/7/11 17:36:00	0.07	0.05	0.14	
6/7/11 17:36:15	0.07	0.05	0.14	
6/7/11 17:36:30	0.07	0.05	0.17	
6/7/11 17:36:45	0.07	0.05	0.19	
6/7/11 17:37:00	0.07	0.05	0.18	
6/7/11 17:37:15	0.07	0.05	0.17	
6/7/11 17:37:30	0.07	0.05	0.17	
6/7/11 17:37:45	0.07	0.05	0.15	
6/7/11 17:38:00	0.07	0.05	0.15	
6/7/11 17:38:15	0.07	0.05	0.17	
6/7/11 17:38:30	0.07	0.05	0.18	
6/7/11 17:38:45	0.07	0.05	0.16	
6/7/11 17:39:00	0.07	0.05	0.15	
6/7/11 17:39:15	0.07	0.05	0.17	
6/7/11 17:39:30	0.07	0.05	0.17	
6/7/11 17:39:45	0.07	0.05	0.16	
6/7/11 17:40:00	0.07	0.05	0.17	
6/7/11 17:40:15	0.07	0.05	0.17	
6/7/11 17:40:30	0.07	0.05	0.18	
6/7/11 17:40:45	0.07	0.05	0.19	
6/7/11 17:41:00	0.07	0.05	0.19	
6/7/11 17:41:15	0.07	0.05	0.20	
6/7/11 17:41:30	0.07	0.05	0.17	
6/7/11 17:41:45	0.07	0.05	0.16	
6/7/11 17:42:00	0.07	0.06	0.16	
6/7/11 17:42:15	0.07	0.06	0.14	
6/7/11 17:42:30	0.07	0.05	0.14	
6/7/11 17:42:45	0.07	0.05	0.15	
6/7/11 17:43:00	0.07	0.05	0.15	
6/7/11 17:43:15	0.07	0.05	0.15	
6/7/11 17:43:30	0.07	0.05	0.15	
6/7/11 17:43:45	0.06	0.05	0.14	
6/7/11 17:44:00	0.07	0.05	0.14	
6/7/11 17:44:15	0.07	0.05	0.14	
6/7/11 17:44:30	0.07	0.05	0.16	
6/7/11 17:44:45	0.07	0.05	0.17	
6/7/11 17:45:00	0.07	0.05	0.16	
6/7/11 17:45:15	0.07	0.05	0.18	
6/7/11 17:45:30	0.07	0.05	0.19	
6/7/11 17:45:45	0.07	0.05	0.16	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 6:39:00	6.21	12.43	10.5	0.0	
6/8/11 6:39:15	6.12	12.50	10.6	0.0	
6/8/11 6:39:30	6.06	12.55	11.0	0.0	
6/8/11 6:39:45	6.04	12.56	11.3	0.0	
6/8/11 6:40:00	6.05	12.57	10.9	0.0	
6/8/11 6:40:15	6.02	12.59	10.3	0.0	
6/8/11 6:40:30	6.07	12.55	10.8	0.0	
6/8/11 6:40:45	6.17	12.47	11.3	0.0	
6/8/11 6:41:00	6.21	12.44	11.1	0.0	
6/8/11 6:41:15	6.22	12.42	10.5	0.0	
6/8/11 6:41:30	6.30	12.35	10.5	0.0	
6/8/11 6:41:45	6.38	12.29	11.2	0.0	
6/8/11 6:42:00	6.38	12.29	11.4	0.0	
6/8/11 6:42:15	6.34	12.32	10.8	0.0	
6/8/11 6:42:30	6.32	12.34	10.6	0.0	
6/8/11 6:42:45	6.23	12.41	11.2	0.0	
6/8/11 6:43:00	6.15	12.48	11.5	0.0	
6/8/11 6:43:15	6.17	12.47	11.1	0.0	
6/8/11 6:43:30	6.25	12.40	10.9	0.0	
6/8/11 6:43:45	6.29	12.38	11.6	0.0	
6/8/11 6:44:00	6.27	12.39	12.2	0.0	
6/8/11 6:44:15	6.26	12.40	12.2	0.0	
6/8/11 6:44:30	6.21	12.44	11.6	0.0	
6/8/11 6:44:45	6.21	12.41	11.3	0.0	
6/8/11 6:45:00	6.26	12.35	10.3	0.0	
6/8/11 6:45:15	8.95	8.99	5.5	0.0	
6/8/11 6:45:30	8.89	3.71	1.8	0.0	
6/8/11 6:45:45	3.06	1.01	-0.3	0.0	
6/8/11 6:46:00	1.62	0.34	-0.1	0.0	
6/8/11 6:46:15	8.66	0.82	0.6	0.0	
6/8/11 6:46:30	12.76	0.77	0.1	0.0	
6/8/11 6:46:45	12.85	0.39	-0.4	0.0	
6/8/11 6:47:00	14.37	0.39	-0.1	0.0	
6/8/11 6:47:15	16.50	0.45	0.4	0.0	
6/8/11 6:47:30	17.25	0.34	0.3	0.0	
6/8/11 6:47:45	17.68	0.27	-0.3	0.0	
6/8/11 6:48:00	18.44	0.28	-0.2	0.0	
6/8/11 6:48:15	18.98	0.26	0.4	0.0	
6/8/11 6:48:30	19.23	0.23	0.4	0.0	
6/8/11 6:48:45	19.49	0.21	-0.3	0.0	
6/8/11 6:49:00	19.74	0.21	-0.3	0.0	
6/8/11 6:49:15	19.90	0.19	0.2	0.0	
6/8/11 6:49:30	20.01	0.18	0.5	0.0	
6/8/11 6:49:45	18.36	0.17	-0.1	0.0	
6/8/11 6:50:00	7.59	0.10	-0.4	0.0	
6/8/11 6:50:15	0.92	0.06	0.0	0.0	
6/8/11 6:50:30	0.10	0.05	0.3	0.0	
6/8/11 6:50:45	0.04	0.05	0.2	0.0	
6/8/11 6:51:00	0.03	0.05	-0.3	0.0	Calibration Error
6/8/11 6:51:15	0.03	0.05	-0.2	0.0	O ₂ CE Zero = 0.02
6/8/11 6:51:30	0.03	0.05	0.2	0.0	CO ₂ CE Zero = 0.05
6/8/11 6:51:45	0.02	0.05	0.4	0.0	CO CE Zero = 0.1
6/8/11 6:52:00	0.02	0.05	-0.2	0.0	
6/8/11 6:52:15	0.02	0.05	-0.4	0.0	
6/8/11 6:52:30	0.02	0.05	0.1	0.0	
6/8/11 6:52:45	0.02	0.05	0.5	0.0	
6/8/11 6:53:00	0.02	0.05	0.2	0.0	
6/8/11 6:53:15	0.37	0.68	31.7	0.0	
6/8/11 6:53:30	7.51	6.63	88.0	0.0	
6/8/11 6:53:45	15.72	12.45	99.6	0.0	
6/8/11 6:54:00	20.08	16.58	99.6	0.0	
6/8/11 6:54:15	21.94	18.86	99.6	0.0	
6/8/11 6:54:30	22.38	19.50	99.6	0.0	
6/8/11 6:54:45	22.42	19.57	99.6	0.0	Calibration Error
6/8/11 6:55:00	22.43	19.59	99.6	0.0	
6/8/11 6:55:15	22.43	19.59	99.6	0.0	CO ₂ CE Span = 19.60
6/8/11 6:55:30	22.43	19.60	99.6	0.0	
6/8/11 6:55:45	22.44	19.61	99.6	0.0	
6/8/11 6:56:00	22.44	19.61	99.6	0.0	
6/8/11 6:56:15	22.44	19.61	99.6	0.0	
6/8/11 6:56:30	22.40	19.45	99.6	0.0	
6/8/11 6:56:45	19.35	15.88	99.6	0.0	
6/8/11 6:57:00	14.39	12.05	99.6	0.0	
6/8/11 6:57:15	12.04	10.36	99.6	0.0	
6/8/11 6:57:30	11.69	10.17	99.6	0.0	Calibration Error
6/8/11 6:57:45	11.68	10.16	99.6	0.0	
6/8/11 6:58:00	11.67	10.15	99.6	0.0	CO ₂ CE Mid = 10.15
6/8/11 6:58:15	11.67	10.15	99.6	0.0	
6/8/11 6:58:30	11.67	10.14	99.6	0.0	
6/8/11 6:58:45	11.67	10.14	98.8	0.0	
6/8/11 6:59:00	11.79	9.87	90.4	0.0	
6/8/11 6:59:15	12.71	7.88	79.4	0.0	
6/8/11 6:59:30	10.42	7.89	78.6	0.0	
6/8/11 6:59:45	9.29	8.14	79.5	0.0	
6/8/11 7:00:00	9.16	8.17	80.0	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 7:00:15	9.14	8.17	80.8	0.0	
6/8/11 7:00:30	9.08	8.17	80.9	0.0	
6/8/11 7:00:45	9.08	8.17	79.9	0.0	Calibration Error
6/8/11 7:01:00	9.06	8.17	79.9	0.0	O ₂ CE Span = 9.05
6/8/11 7:01:15	9.05	8.17	80.5	0.0	
6/8/11 7:01:30	9.05	8.17	80.7	0.0	CO CE Span = 80.3
6/8/11 7:01:45	9.05	8.17	80.0	0.0	
6/8/11 7:02:00	9.05	8.17	79.7	0.0	
6/8/11 7:02:15	9.05	8.17	76.3	0.0	
6/8/11 7:02:30	8.57	7.46	64.6	0.0	
6/8/11 7:02:45	6.00	5.08	47.3	0.0	
6/8/11 7:03:00	4.76	4.27	41.6	0.0	
6/8/11 7:03:15	4.62	4.19	40.8	0.0	Calibration Error
6/8/11 7:03:30	4.61	4.18	41.0	0.0	O ₂ CE Mid = 4.61
6/8/11 7:03:45	4.61	4.18	41.1	0.0	
6/8/11 7:04:00	4.61	4.18	40.6	0.0	CO CE Mid = 40.8
6/8/11 7:04:15	4.61	4.18	40.6	0.0	
6/8/11 7:04:30	4.61	4.18	40.9	0.0	
6/8/11 7:04:45	4.61	4.17	41.2	0.0	
6/8/11 7:05:00	4.61	4.17	38.2	0.0	
6/8/11 7:05:15	6.63	3.42	26.3	0.0	
6/8/11 7:05:30	12.40	2.10	19.7	0.0	
6/8/11 7:05:45	13.85	1.86	16.2	0.0	
6/8/11 7:06:00	14.39	1.66	13.4	0.0	
6/8/11 7:06:15	16.12	1.14	8.7	0.0	
6/8/11 7:06:30	17.41	0.87	7.1	0.0	
6/8/11 7:06:45	17.84	0.78	6.2	0.0	
6/8/11 7:07:00	18.34	0.66	4.9	0.0	
6/8/11 7:07:15	18.94	0.53	3.0	0.0	
6/8/11 7:07:30	19.28	0.47	2.4	0.0	
6/8/11 7:07:45	19.48	0.45	2.2	0.0	
6/8/11 7:08:00	19.70	0.41	1.7	0.0	
6/8/11 7:08:15	19.87	0.38	0.6	0.0	
6/8/11 7:08:30	19.97	0.36	0.4	0.0	
6/8/11 7:08:45	20.05	0.35	0.7	0.0	
6/8/11 7:09:00	20.12	0.34	0.7	0.0	
6/8/11 7:09:15	20.17	0.32	0.2	0.0	
6/8/11 7:09:30	20.21	0.31	-0.2	0.0	
6/8/11 7:09:45	20.24	0.31	0.2	0.0	
6/8/11 7:10:00	20.26	0.30	0.4	0.0	
6/8/11 7:10:15	20.28	0.30	0.1	0.0	
6/8/11 7:10:30	20.29	0.29	-0.3	0.0	
6/8/11 7:10:45	20.30	0.29	-0.1	0.0	
6/8/11 7:11:00	20.30	0.29	0.2	0.0	
6/8/11 7:11:15	20.31	0.28	-0.1	0.0	
6/8/11 7:11:30	20.31	0.28	-0.3	0.0	
6/8/11 7:11:45	20.32	0.27	0.0	0.0	
6/8/11 7:12:00	20.32	0.27	0.2	0.0	
6/8/11 7:12:15	20.32	0.27	-0.1	0.0	
6/8/11 7:12:30	20.32	0.27	-0.3	0.0	
6/8/11 7:12:45	20.32	0.26	-0.2	0.0	
6/8/11 7:13:00	20.32	0.26	0.0	0.0	
6/8/11 7:13:15	20.32	0.26	0.1	0.0	
6/8/11 7:13:30	20.32	0.26	-0.4	0.0	
6/8/11 7:13:45	20.32	0.26	-0.4	0.0	
6/8/11 7:14:00	20.32	0.26	0.2	0.0	
6/8/11 7:14:15	20.32	0.27	0.2	0.0	
6/8/11 7:14:30	20.32	0.26	-0.4	0.0	
6/8/11 7:14:45	20.32	0.26	-0.6	0.0	
6/8/11 7:15:00	20.31	0.26	0.0	0.0	
6/8/11 7:15:15	20.31	0.27	0.2	0.0	
6/8/11 7:15:30	20.31	0.27	-0.3	0.0	
6/8/11 7:15:45	20.31	0.26	-0.8	0.0	
6/8/11 7:16:00	20.31	0.26	-0.1	0.0	
6/8/11 7:16:15	20.31	0.26	0.3	0.1	
6/8/11 7:16:30	20.31	0.26	0.0	0.1	
6/8/11 7:16:45	20.31	0.26	-0.6	0.8	
6/8/11 7:17:00	20.31	0.26	-0.3	0.2	
6/8/11 7:17:15	20.30	0.26	0.2	0.2	
6/8/11 7:17:30	20.30	0.26	0.1	0.1	
6/8/11 7:17:45	20.30	0.26	-0.3	0.1	
6/8/11 7:18:00	20.30	0.26	0.4	0.1	
6/8/11 7:18:15	20.27	0.35	6.5	0.1	
6/8/11 7:18:30	16.91	4.40	13.8	0.1	
6/8/11 7:18:45	10.40	9.49	14.0	0.1	
6/8/11 7:19:00	7.14	11.78	11.4	0.1	
6/8/11 7:19:15	6.43	12.23	10.9	0.1	
6/8/11 7:19:30	6.29	12.33	10.9	0.1	
6/8/11 7:19:45	6.24	12.37	10.5	0.1	
6/8/11 7:20:00	6.21	12.40	10.0	0.1	
6/8/11 7:20:15	6.18	12.42	10.2	0.1	
6/8/11 7:20:30	6.17	12.43	10.4	0.1	
6/8/11 7:20:45	6.17	12.42	10.2	0.1	
6/8/11 7:21:00	6.18	12.43	9.8	0.1	
6/8/11 7:21:15	6.14	12.45	10.5	0.1	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 7:21:30	6.13	12.46	11.3	0.1	
6/8/11 7:21:45	6.14	12.44	11.2	0.1	
6/8/11 7:22:00	6.20	12.40	10.5	0.1	
6/8/11 7:22:15	6.29	12.33	10.5	0.1	
6/8/11 7:22:30	6.32	12.30	10.8	0.1	
6/8/11 7:22:45	6.30	12.32	10.5	0.1	
6/8/11 7:23:00	6.26	12.34	9.8	0.1	
6/8/11 7:23:15	6.24	12.36	9.9	0.1	
6/8/11 7:23:30	6.20	12.40	10.4	0.1	
6/8/11 7:23:45	6.17	12.43	10.3	0.1	
6/8/11 7:24:00	6.17	12.43	9.8	0.1	
6/8/11 7:24:15	6.16	12.44	9.7	0.1	
6/8/11 7:24:30	6.12	12.48	10.2	0.1	
6/8/11 7:24:45	6.05	12.53	14.3	0.1	
6/8/11 7:25:00	6.20	12.15	79.2	0.1	
6/8/11 7:25:15	7.85	7.92	99.6	0.1	
6/8/11 7:25:30	5.31	3.32	91.0	0.1	
6/8/11 7:25:45	1.64	0.91	43.1	83.4	
6/8/11 7:26:00	0.36	0.31	9.5	101.8	
6/8/11 7:26:15	0.19	0.22	3.6	102.5	
6/8/11 7:26:30	0.16	0.19	3.6	99.0	
6/8/11 7:26:45	0.14	0.17	3.7	95.2	
6/8/11 7:27:00	0.14	0.16	3.1	92.3	
6/8/11 7:27:15	0.13	0.15	2.9	89.0	
6/8/11 7:27:30	0.12	0.14	3.2	89.0	
6/8/11 7:27:45	0.12	0.14	3.5	89.8	
6/8/11 7:28:00	0.12	0.13	3.1	90.0	
6/8/11 7:28:15	0.11	0.13	2.7	90.1	
6/8/11 7:28:30	0.11	0.12	2.9	89.7	
6/8/11 7:28:45	0.11	0.12	3.4	89.4	
6/8/11 7:29:00	0.11	0.11	3.1	89.2	
6/8/11 7:29:15	0.11	0.11	2.7	88.9	
6/8/11 7:29:30	0.11	0.11	2.8	73.8	
6/8/11 7:29:45	0.10	0.11	3.3	52.2	
6/8/11 7:30:00	0.10	0.10	3.0	52.3	
6/8/11 7:30:15	0.10	0.10	2.4	52.4	
6/8/11 7:30:30	0.10	0.10	2.7	52.3	
6/8/11 7:30:45	0.10	0.10	3.3	52.3	
6/8/11 7:31:00	0.10	0.10	3.0	52.2	
6/8/11 7:31:15	0.10	0.09	2.3	52.1	
6/8/11 7:31:30	0.10	0.09	2.5	32.7	
6/8/11 7:31:45	0.10	0.09	3.1	4.8	
6/8/11 7:32:00	0.10	0.09	3.0	3.9	
6/8/11 7:32:15	0.09	0.09	2.4	3.8	
6/8/11 7:32:30	0.09	0.09	2.5	3.7	
6/8/11 7:32:45	0.09	0.09	3.0	3.7	
6/8/11 7:33:00	0.09	0.08	3.1	3.3	
6/8/11 7:33:15	0.09	0.08	2.6	0.3	Calibration Error C ₃ H ₈ CE Zero = 0.2
6/8/11 7:33:30	0.09	0.08	2.6	0.2	
6/8/11 7:33:45	0.09	0.08	3.0	0.1	
6/8/11 7:34:00	0.09	0.08	3.1	0.1	
6/8/11 7:34:15	0.09	0.08	2.7	0.1	
6/8/11 7:34:30	0.09	0.08	2.6	0.0	
6/8/11 7:34:45	0.09	0.08	3.0	0.3	
6/8/11 7:35:00	0.09	0.08	3.2	80.1	
6/8/11 7:35:15	0.09	0.08	2.9	84.1	
6/8/11 7:35:30	0.10	0.08	2.8	86.2	
6/8/11 7:35:45	0.10	0.08	3.2	90.0	Calibration Error C ₃ H ₈ CE Span = 90.3
6/8/11 7:36:00	0.09	0.08	3.4	90.2	
6/8/11 7:36:15	0.09	0.08	3.0	90.3	
6/8/11 7:36:30	0.09	0.08	2.8	90.6	
6/8/11 7:36:45	0.09	0.08	3.1	90.2	
6/8/11 7:37:00	0.09	0.08	3.3	89.4	
6/8/11 7:37:15	0.09	0.08	2.9	55.9	
6/8/11 7:37:30	0.09	0.08	2.6	51.2	Calibration Error C ₃ H ₈ CE Mid = 51.2
6/8/11 7:37:45	0.09	0.08	2.9	51.2	
6/8/11 7:38:00	0.09	0.08	3.3	51.2	
6/8/11 7:38:15	0.09	0.08	3.1	51.2	
6/8/11 7:38:30	0.09	0.08	2.6	51.1	
6/8/11 7:38:45	0.09	0.08	3.0	51.1	
6/8/11 7:39:00	0.09	0.08	3.2	51.0	
6/8/11 7:39:15	0.09	0.08	2.9	36.1	
6/8/11 7:39:30	0.09	0.08	2.6	31.4	
6/8/11 7:39:45	0.09	0.08	3.0	31.3	
6/8/11 7:40:00	0.09	0.08	3.3	31.4	
6/8/11 7:40:15	0.09	0.08	2.9	31.4	
6/8/11 7:40:30	0.08	0.08	2.4	31.0	
6/8/11 7:40:45	0.09	0.08	2.7	30.6	Calibration Error C ₃ H ₈ CE Low = 30.6
6/8/11 7:41:00	0.09	0.08	3.3	30.7	
6/8/11 7:41:15	0.09	0.08	3.2	30.6	
6/8/11 7:41:30	0.08	0.08	2.6	30.6	
6/8/11 7:41:45	0.09	0.08	2.8	30.6	
6/8/11 7:42:00	0.09	0.08	3.3	30.5	
6/8/11 7:42:15	0.09	0.08	3.0	30.6	
6/8/11 7:42:30	0.09	0.08	2.6	30.6	Introduce Zero

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 7:42:45	0.08	0.08	2.9	30.6	RT = 75 seconds
6/8/11 7:43:00	0.08	0.07	3.3	30.6	
6/8/11 7:43:15	0.08	0.07	3.1	29.9	
6/8/11 7:43:30	0.08	0.07	2.7	4.0	
6/8/11 7:43:45	0.08	0.07	3.0	0.0	
6/8/11 7:44:00	0.08	0.07	3.4	0.0	
6/8/11 7:44:15	0.08	0.07	3.2	0.0	
6/8/11 7:44:30	0.08	0.07	2.7	0.0	
6/8/11 7:44:45	0.08	0.07	2.9	0.0	Introduce Low
6/8/11 7:45:00	0.08	0.07	3.5	0.0	
6/8/11 7:45:15	0.08	0.07	3.5	0.0	RT = 75 seconds
6/8/11 7:45:30	0.08	0.07	2.9	0.0	
6/8/11 7:45:45	0.08	0.07	2.9	3.8	
6/8/11 7:46:00	0.08	0.07	3.4	30.5	Introduce Zero
6/8/11 7:46:15	0.08	0.07	3.4	31.5	
6/8/11 7:46:30	0.08	0.07	2.9	31.0	RT = 75 seconds
6/8/11 7:46:45	0.08	0.07	2.9	30.6	
6/8/11 7:47:00	0.08	0.07	3.4	14.9	
6/8/11 7:47:15	0.08	0.07	3.4	0.2	
6/8/11 7:47:30	0.08	0.07	2.8	0.0	Introduce Low
6/8/11 7:47:45	0.08	0.07	2.8	0.0	
6/8/11 7:48:00	0.08	0.07	3.2	0.0	
6/8/11 7:48:15	0.08	0.07	3.4	0.1	RT = 75 seconds
6/8/11 7:48:30	0.08	0.08	2.7	25.9	
6/8/11 7:48:45	0.08	0.08	2.6	30.9	
6/8/11 7:49:00	0.08	0.08	3.1	30.6	Introduce Zero
6/8/11 7:49:15	0.08	0.08	3.3	30.5	
6/8/11 7:49:30	0.08	0.08	2.8	30.4	
6/8/11 7:49:45	0.08	0.08	2.6	25.9	RT = 75 seconds
6/8/11 7:50:00	0.08	0.08	2.9	1.6	
6/8/11 7:50:15	0.08	0.08	3.3	0.0	
6/8/11 7:50:30	0.08	0.08	2.9	0.0	Introduce Low
6/8/11 7:50:45	0.08	0.08	2.6	0.0	
6/8/11 7:51:00	0.08	0.08	3.1	0.0	
6/8/11 7:51:15	0.08	0.08	3.2	0.0	RT = 75 seconds
6/8/11 7:51:30	0.08	0.08	2.8	14.3	
System Bias					
6/8/11 7:51:45	0.08	0.08	2.8	30.9	O ₂ Bias 1 Zero = 0.08
6/8/11 7:52:00	0.08	0.08	3.3	30.7	CO ₂ Bias 1 Zero = 0.08
6/8/11 7:52:15	0.08	0.08	3.4	30.5	CO Bias 1 Zero = 3.1
6/8/11 7:52:30	0.08	0.08	2.9	30.3	Introduce Mid O ₂ / CO
6/8/11 7:52:45	0.08	0.07	2.8	30.3	
6/8/11 7:53:00	0.08	0.07	3.2	26.8	
6/8/11 7:53:15	0.08	0.07	3.5	14.6	
6/8/11 7:53:30	0.54	1.62	4.3	29.2	
6/8/11 7:53:45	2.11	4.23	10.4	0.9	
6/8/11 7:54:00	2.52	3.41	26.2	0.1	
6/8/11 7:54:15	3.94	3.68	39.3	0.0	
6/8/11 7:54:30	4.49	3.95	42.7	0.0	
6/8/11 7:54:45	4.56	3.94	43.2	0.0	
6/8/11 7:55:00	4.57	3.95	43.6	0.0	
6/8/11 7:55:15	4.57	4.02	43.7	0.0	
6/8/11 7:55:30	4.57	4.07	43.2	0.0	System Bias
6/8/11 7:55:45	4.57	4.09	42.8	0.0	O ₂ Bias 1 Mid = 4.57
6/8/11 7:56:00	4.57	4.09	43.2	0.0	CO Bias 1 Mid = 43.1
6/8/11 7:56:15	4.57	4.09	43.4	0.0	
6/8/11 7:56:30	4.57	4.09	42.9	0.0	
6/8/11 7:56:45	4.57	4.10	42.6	0.0	
6/8/11 7:57:00	4.57	4.10	43.2	0.0	
6/8/11 7:57:15	4.57	4.10	43.5	0.0	
6/8/11 7:57:30	4.57	4.10	43.0	0.0	
6/8/11 7:57:45	4.57	4.10	42.7	0.0	
6/8/11 7:58:00	4.57	4.10	43.2	0.0	
6/8/11 7:58:15	4.58	4.10	43.4	0.0	
6/8/11 7:58:30	4.58	4.10	42.9	0.0	
6/8/11 7:58:45	4.58	4.10	42.7	0.0	
6/8/11 7:59:00	4.58	4.10	43.2	0.0	
6/8/11 7:59:15	4.58	4.10	43.5	0.0	
6/8/11 7:59:30	4.58	4.10	43.1	0.0	
6/8/11 7:59:45	4.58	4.10	42.7	0.0	
6/8/11 8:00:00	4.58	4.10	43.3	0.0	
6/8/11 8:00:15	4.58	4.10	42.6	1.0	
6/8/11 8:00:30	4.68	4.97	39.3	0.8	
6/8/11 8:00:45	5.24	6.98	51.4	0.0	
6/8/11 8:01:00	7.94	8.34	82.5	0.0	
6/8/11 8:01:15	10.60	9.62	97.6	0.0	
6/8/11 8:01:30	11.32	9.94	99.6	0.0	
6/8/11 8:01:45	11.40	9.99	99.6	0.0	
6/8/11 8:02:00	11.41	10.00	99.6	0.0	System Bias
6/8/11 8:02:15	11.42	10.01	99.6	0.0	CO ₂ Bias 1 Mid = 10.01
6/8/11 8:02:30	11.42	10.01	99.6	0.0	
6/8/11 8:02:45	11.42	10.01	99.6	0.0	
6/8/11 8:03:00	11.43	10.02	99.6	0.0	
6/8/11 8:03:15	11.42	10.02	99.6	0.0	
6/8/11 8:03:30	11.42	10.02	99.6	0.0	
6/8/11 8:03:45	11.43	10.02	99.6	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 8:04:00	11.43	10.02	98.5	0.2	
6/8/11 8:04:15	11.36	10.08	83.5	0.4	
6/8/11 8:04:30	9.47	11.13	38.9	0.5	
6/8/11 8:04:45	6.99	12.08	19.1	0.5	
6/8/11 8:05:00	6.33	12.31	12.0	0.6	
6/8/11 8:05:15	6.22	12.37	11.5	0.5	
6/8/11 8:05:30	6.22	12.37	10.7	0.6	
6/8/11 8:05:45	6.24	12.36	10.6	0.6	
6/8/11 8:06:00	6.27	12.33	11.1	0.6	
6/8/11 8:06:15	6.22	12.38	11.0	0.6	
6/8/11 8:06:30	6.13	12.44	10.4	0.7	
6/8/11 8:06:45	6.16	12.42	10.4	0.7	
6/8/11 8:07:00	6.18	12.42	11.0	0.7	
6/8/11 8:07:15	6.24	12.36	11.2	0.7	
6/8/11 8:07:30	6.32	12.30	10.5	0.7	
6/8/11 8:07:45	6.30	12.31	10.5	0.7	
6/8/11 8:08:00	6.21	12.39	11.0	0.7	
6/8/11 8:08:15	6.09	12.47	11.0	0.7	
6/8/11 8:08:30	6.05	12.51	10.4	0.7	
6/8/11 8:08:45	6.11	12.47	10.5	0.7	
6/8/11 8:09:00	6.17	12.43	11.1	0.6	
6/8/11 8:09:15	6.19	12.41	11.1	0.7	
6/8/11 8:09:30	6.15	12.45	10.6	0.7	
6/8/11 8:09:45	6.10	12.48	10.7	0.6	
6/8/11 8:10:00	6.11	12.47	11.1	0.6	
6/8/11 8:10:15	6.09	12.49	11.3	0.7	
6/8/11 8:10:30	6.09	12.49	10.6	0.6	
6/8/11 8:10:45	6.11	12.48	10.7	0.7	
6/8/11 8:11:00	6.12	12.47	11.2	0.6	
6/8/11 8:11:15	6.18	12.41	11.2	0.7	
6/8/11 8:11:30	6.22	12.39	10.5	0.6	
6/8/11 8:11:45	6.21	12.39	10.4	0.7	
6/8/11 8:12:00	6.19	12.41	10.9	0.6	
6/8/11 8:12:15	6.15	12.44	11.0	0.6	
6/8/11 8:12:30	6.15	12.44	10.4	0.6	
6/8/11 8:12:45	6.21	12.39	10.3	0.6	
6/8/11 8:13:00	6.21	12.40	10.9	0.6	
6/8/11 8:13:15	6.20	12.39	11.1	0.6	
6/8/11 8:13:30	6.21	12.39	10.7	0.7	
6/8/11 8:13:45	6.20	12.39	11.0	0.7	
6/8/11 8:14:00	6.18	12.42	11.9	0.6	
6/8/11 8:14:15	6.14	12.44	12.1	0.7	
6/8/11 8:14:30	6.15	12.44	11.0	0.7	
6/8/11 8:14:45	6.18	12.42	10.8	0.7	
6/8/11 8:15:00	6.14	12.45	11.3	0.6	
6/8/11 8:15:15	6.11	12.47	11.5	0.6	
6/8/11 8:15:30	6.14	12.45	11.0	0.6	
6/8/11 8:15:45	6.17	12.43	10.8	0.7	
6/8/11 8:16:00	6.15	12.45	11.3	0.6	Begin FCCU-0010-1
6/8/11 8:16:15	6.17	12.42	11.6	0.7	
6/8/11 8:16:30	6.22	12.39	10.9	0.7	
6/8/11 8:16:45	6.21	12.39	10.7	0.7	
6/8/11 8:17:00	6.25	12.35	11.2	0.7	
6/8/11 8:17:15	6.29	12.32	11.3	0.6	
6/8/11 8:17:30	6.29	12.33	10.7	0.7	
6/8/11 8:17:45	6.22	12.38	10.8	0.7	
6/8/11 8:18:00	6.15	12.44	11.3	0.6	
6/8/11 8:18:15	6.15	12.43	11.4	0.7	
6/8/11 8:18:30	6.18	12.42	10.8	0.6	
6/8/11 8:18:45	6.16	12.43	10.8	0.6	
6/8/11 8:19:00	6.17	12.42	11.5	0.6	
6/8/11 8:19:15	6.21	12.40	11.7	0.7	
6/8/11 8:19:30	6.26	12.35	11.1	0.7	
6/8/11 8:19:45	6.29	12.33	11.0	0.6	
6/8/11 8:20:00	6.32	12.29	11.2	0.7	
6/8/11 8:20:15	6.40	12.22	11.3	0.6	
6/8/11 8:20:30	6.45	12.18	10.7	0.6	
6/8/11 8:20:45	6.46	12.17	10.7	0.6	
6/8/11 8:21:00	6.44	12.19	10.9	0.7	
6/8/11 8:21:15	6.37	12.25	11.1	0.6	
6/8/11 8:21:30	6.26	12.34	10.4	0.6	
6/8/11 8:21:45	6.20	12.39	10.2	0.6	
6/8/11 8:22:00	6.21	12.38	10.7	0.6	
6/8/11 8:22:15	6.22	12.38	10.9	0.6	
6/8/11 8:22:30	6.24	12.36	10.4	0.6	
6/8/11 8:22:45	6.28	12.33	10.4	0.6	
6/8/11 8:23:00	6.28	12.33	11.0	0.6	
6/8/11 8:23:15	6.25	12.35	11.2	0.6	
6/8/11 8:23:30	6.25	12.35	10.3	0.6	
6/8/11 8:23:45	6.26	12.35	10.1	0.6	
6/8/11 8:24:00	6.21	12.39	10.8	0.6	
6/8/11 8:24:15	6.21	12.38	10.9	0.6	
6/8/11 8:24:30	6.30	12.30	10.3	0.5	
6/8/11 8:24:45	6.42	12.21	10.3	0.6	
6/8/11 8:25:00	6.46	12.18	10.7	0.6	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 8:25:15	6.38	12.24	10.9	0.6	
6/8/11 8:25:30	6.23	12.37	10.2	0.6	
6/8/11 8:25:45	6.09	12.48	10.5	0.7	
6/8/11 8:26:00	6.07	12.50	11.9	0.6	
6/8/11 8:26:15	6.11	12.47	12.3	0.6	Begin FCCU-0011-1
6/8/11 8:26:30	6.18	12.42	11.6	0.6	
6/8/11 8:26:45	6.24	12.37	11.3	0.7	
6/8/11 8:27:00	6.23	12.36	11.7	0.6	
6/8/11 8:27:15	6.24	12.35	11.7	0.6	
6/8/11 8:27:30	6.28	12.32	10.9	0.6	
6/8/11 8:27:45	6.36	12.27	10.8	0.6	
6/8/11 8:28:00	6.41	12.23	11.2	0.6	
6/8/11 8:28:15	6.39	12.24	11.4	0.6	
6/8/11 8:28:30	6.40	12.22	11.0	0.7	
6/8/11 8:28:45	6.39	12.23	10.7	0.6	
6/8/11 8:29:00	6.32	12.29	11.2	0.6	
6/8/11 8:29:15	6.29	12.32	11.5	0.6	
6/8/11 8:29:30	6.26	12.34	10.7	0.6	
6/8/11 8:29:45	6.25	12.35	10.5	0.6	
6/8/11 8:30:00	6.22	12.38	11.0	0.6	
6/8/11 8:30:15	6.17	12.41	11.2	0.6	
6/8/11 8:30:30	6.17	12.41	10.5	0.6	
6/8/11 8:30:45	6.16	12.43	10.4	0.6	
6/8/11 8:31:00	6.14	12.44	11.0	0.6	
6/8/11 8:31:15	6.15	12.44	11.2	0.6	
6/8/11 8:31:30	6.20	12.40	10.6	0.6	
6/8/11 8:31:45	6.26	12.35	10.4	0.6	
6/8/11 8:32:00	6.29	12.31	10.8	0.6	
6/8/11 8:32:15	6.30	12.30	11.0	0.6	
6/8/11 8:32:30	6.27	12.33	10.3	0.6	
6/8/11 8:32:45	6.26	12.34	10.1	0.6	
6/8/11 8:33:00	6.28	12.32	10.6	0.6	
6/8/11 8:33:15	6.32	12.29	10.9	0.6	
6/8/11 8:33:30	6.34	12.27	10.4	0.6	
6/8/11 8:33:45	6.35	12.27	10.2	0.6	
6/8/11 8:34:00	6.35	12.27	10.7	0.6	
6/8/11 8:34:15	6.26	12.35	10.9	0.6	
6/8/11 8:34:30	6.15	12.43	10.4	0.6	
6/8/11 8:34:45	6.14	12.44	10.5	0.6	
6/8/11 8:35:00	6.15	12.44	10.9	0.6	
6/8/11 8:35:15	6.20	12.40	11.1	0.6	
6/8/11 8:35:30	6.24	12.36	10.5	0.6	
6/8/11 8:35:45	6.23	12.37	10.6	0.6	
6/8/11 8:36:00	6.18	12.41	11.1	0.6	
6/8/11 8:36:15	6.19	12.40	11.2	0.6	
6/8/11 8:36:30	6.28	12.33	10.6	0.6	
6/8/11 8:36:45	6.29	12.32	10.8	0.6	
6/8/11 8:37:00	6.22	12.38	11.4	0.6	
6/8/11 8:37:15	6.20	12.40	11.2	0.6	
6/8/11 8:37:30	6.26	12.35	10.4	0.6	
6/8/11 8:37:45	6.31	12.30	10.5	0.5	
6/8/11 8:38:00	6.29	12.31	11.2	0.6	
6/8/11 8:38:15	6.23	12.37	11.0	0.6	
6/8/11 8:38:30	6.21	12.38	10.2	0.6	
6/8/11 8:38:45	6.24	12.35	10.4	0.6	
6/8/11 8:39:00	6.28	12.33	11.1	0.6	
6/8/11 8:39:15	6.29	12.32	11.2	0.6	
6/8/11 8:39:30	6.28	12.32	10.9	0.6	
6/8/11 8:39:45	6.28	12.33	11.2	0.6	
6/8/11 8:40:00	6.31	12.30	11.8	0.6	
6/8/11 8:40:15	6.36	12.26	11.5	0.6	
6/8/11 8:40:30	6.34	12.27	10.6	0.6	
6/8/11 8:40:45	6.30	12.30	10.8	0.6	
6/8/11 8:41:00	6.23	12.36	11.3	0.6	M0011 Port Change
6/8/11 8:41:15	6.19	12.41	11.0	0.6	
6/8/11 8:41:30	6.15	12.44	10.4	0.6	
6/8/11 8:41:45	6.10	12.48	10.7	0.6	
6/8/11 8:42:00	6.11	12.46	11.4	0.6	
6/8/11 8:42:15	6.13	12.45	11.1	0.6	
6/8/11 8:42:30	6.16	12.43	10.4	0.6	
6/8/11 8:42:45	6.17	12.43	10.8	0.5	
6/8/11 8:43:00	6.15	12.43	11.4	0.5	
6/8/11 8:43:15	6.17	12.42	11.1	0.5	
6/8/11 8:43:30	6.22	12.38	10.4	0.5	
6/8/11 8:43:45	6.23	12.38	10.6	0.5	
6/8/11 8:44:00	6.21	12.38	11.2	0.5	
6/8/11 8:44:15	6.20	12.39	11.1	0.5	
6/8/11 8:44:30	6.24	12.36	10.4	0.5	
6/8/11 8:44:45	6.30	12.32	10.8	0.5	
6/8/11 8:45:00	6.27	12.34	11.3	0.5	Resume M0011
6/8/11 8:45:15	6.25	12.35	11.2	0.5	
6/8/11 8:45:30	6.24	12.36	10.5	0.5	
6/8/11 8:45:45	6.24	12.36	10.8	0.5	
6/8/11 8:46:00	6.26	12.34	11.3	0.5	
6/8/11 8:46:15	6.27	12.33	11.0	0.5	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 8:46:30	6.24	12.36	10.2	0.5	
6/8/11 8:46:45	6.27	12.34	10.7	0.5	
6/8/11 8:47:00	6.28	12.33	11.0	0.5	
6/8/11 8:47:15	6.19	12.39	10.5	0.5	
6/8/11 8:47:30	6.17	12.41	10.0	0.5	
6/8/11 8:47:45	6.22	12.37	10.4	0.5	
6/8/11 8:48:00	6.22	12.37	10.9	0.5	
6/8/11 8:48:15	6.20	12.38	10.7	0.5	
6/8/11 8:48:30	6.22	12.38	10.2	0.5	
6/8/11 8:48:45	6.25	12.35	10.5	0.5	
6/8/11 8:49:00	6.23	12.36	11.0	0.5	
6/8/11 8:49:15	6.15	12.42	10.7	0.5	
6/8/11 8:49:30	6.11	12.46	10.1	0.5	
6/8/11 8:49:45	6.13	12.46	10.6	0.5	
6/8/11 8:50:00	6.18	12.41	11.0	0.5	
6/8/11 8:50:15	6.27	12.34	10.5	0.5	
6/8/11 8:50:30	6.32	12.30	10.1	0.5	
6/8/11 8:50:45	6.27	12.35	10.8	0.4	
6/8/11 8:51:00	6.16	12.43	11.3	0.5	
6/8/11 8:51:15	6.09	12.47	11.0	0.5	
6/8/11 8:51:30	6.15	12.43	10.5	0.5	
6/8/11 8:51:45	6.22	12.39	11.0	0.5	
6/8/11 8:52:00	6.20	12.40	11.5	0.5	
6/8/11 8:52:15	6.17	12.43	11.3	0.5	
6/8/11 8:52:30	6.14	12.44	10.9	0.5	
6/8/11 8:52:45	6.18	12.41	11.5	0.5	
6/8/11 8:53:00	6.24	12.36	11.9	0.5	
6/8/11 8:53:15	6.26	12.35	11.6	0.5	
6/8/11 8:53:30	6.23	12.38	11.0	0.5	
6/8/11 8:53:45	6.16	12.44	11.2	0.5	
6/8/11 8:54:00	6.08	12.50	11.5	0.5	
6/8/11 8:54:15	6.02	12.54	11.2	0.5	
6/8/11 8:54:30	5.99	12.57	10.8	0.5	
6/8/11 8:54:45	6.07	12.49	11.1	0.5	
6/8/11 8:55:00	6.21	12.39	11.3	0.5	
6/8/11 8:55:15	6.35	12.27	11.0	0.5	
6/8/11 8:55:30	6.41	12.21	10.6	0.5	
6/8/11 8:55:45	6.42	12.20	10.9	0.5	
6/8/11 8:56:00	6.44	12.18	11.4	0.5	
6/8/11 8:56:15	6.41	12.22	11.1	0.4	
6/8/11 8:56:30	6.33	12.29	10.5	0.5	
6/8/11 8:56:45	6.29	12.32	11.1	0.5	
6/8/11 8:57:00	6.26	12.34	11.2	0.5	
6/8/11 8:57:15	6.19	12.40	10.8	0.5	
6/8/11 8:57:30	6.17	12.41	10.4	0.5	
6/8/11 8:57:45	6.25	12.35	10.9	0.5	
6/8/11 8:58:00	6.30	12.31	11.3	0.5	
6/8/11 8:58:15	6.31	12.29	10.9	0.5	
6/8/11 8:58:30	6.32	12.29	10.4	0.5	
6/8/11 8:58:45	6.35	12.26	10.8	0.4	
6/8/11 8:59:00	6.39	12.22	11.2	0.5	
6/8/11 8:59:15	6.35	12.26	10.8	0.5	
6/8/11 8:59:30	6.23	12.36	10.4	0.5	
6/8/11 8:59:45	6.13	12.44	11.0	0.5	
6/8/11 9:00:00	6.06	12.51	11.3	0.5	M0011 Port Change
6/8/11 9:00:15	6.10	12.47	10.8	0.5	
6/8/11 9:00:30	6.28	12.34	10.3	0.5	
6/8/11 9:00:45	6.34	12.29	10.9	0.5	
6/8/11 9:01:00	6.32	12.29	11.1	0.5	
6/8/11 9:01:15	6.33	12.27	10.6	0.5	
6/8/11 9:01:30	6.35	12.26	10.1	0.5	
6/8/11 9:01:45	6.32	12.28	10.7	0.5	
6/8/11 9:02:00	6.26	12.32	11.1	0.5	
6/8/11 9:02:15	6.27	12.32	10.7	0.5	
6/8/11 9:02:30	6.31	12.30	10.3	0.5	
6/8/11 9:02:45	6.31	12.30	10.8	0.5	
6/8/11 9:03:00	6.26	12.34	11.2	0.5	
6/8/11 9:03:15	6.24	12.35	11.0	0.5	
6/8/11 9:03:30	6.30	12.30	10.6	0.5	
6/8/11 9:03:45	6.28	12.33	10.8	0.5	
6/8/11 9:04:00	6.25	12.35	11.4	0.5	
6/8/11 9:04:15	6.26	12.34	11.0	0.5	
6/8/11 9:04:30	6.33	12.28	10.6	0.5	
6/8/11 9:04:45	6.38	12.24	10.8	0.5	
6/8/11 9:05:00	6.36	12.26	11.3	0.5	
6/8/11 9:05:15	6.28	12.32	11.0	0.6	
6/8/11 9:05:30	6.24	12.34	10.5	0.5	
6/8/11 9:05:45	6.24	12.35	11.1	0.6	
6/8/11 9:06:00	6.28	12.32	11.9	0.6	
6/8/11 9:06:15	6.36	12.25	11.8	0.6	
6/8/11 9:06:30	6.36	12.25	11.1	0.6	
6/8/11 9:06:45	6.28	12.32	11.5	0.6	
6/8/11 9:07:00	6.25	12.35	11.6	0.6	
6/8/11 9:07:15	6.20	12.39	11.2	0.6	
6/8/11 9:07:30	6.15	12.43	10.8	0.6	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 9:07:45	6.15	12.42	10.9	0.6	
6/8/11 9:08:00	6.18	12.41	11.4	0.6	
6/8/11 9:08:15	6.22	12.38	11.1	0.6	
6/8/11 9:08:30	6.29	12.32	10.7	0.6	
6/8/11 9:08:45	6.33	12.28	10.9	0.6	
6/8/11 9:09:00	6.27	12.34	11.6	0.6	
6/8/11 9:09:15	6.17	12.42	11.2	0.6	
6/8/11 9:09:30	6.12	12.46	10.9	0.6	
6/8/11 9:09:45	6.11	12.47	11.2	0.6	
6/8/11 9:10:00	6.15	12.43	11.5	0.6	
6/8/11 9:10:15	6.16	12.43	11.0	0.6	
6/8/11 9:10:30	6.12	12.45	10.9	0.6	
6/8/11 9:10:45	6.16	12.41	11.4	0.6	
6/8/11 9:11:00	6.20	12.38	11.5	0.6	
6/8/11 9:11:15	6.25	12.35	11.1	0.6	
6/8/11 9:11:30	6.28	12.33	10.7	0.6	
6/8/11 9:11:45	6.26	12.35	11.2	0.6	
6/8/11 9:12:00	6.24	12.35	11.5	0.6	
6/8/11 9:12:15	6.20	12.39	11.1	0.6	
6/8/11 9:12:30	6.19	12.40	10.7	0.6	
6/8/11 9:12:45	6.28	12.32	11.3	0.6	
6/8/11 9:13:00	6.40	12.23	11.5	0.6	
6/8/11 9:13:15	6.39	12.24	10.7	0.6	
6/8/11 9:13:30	6.28	12.32	10.5	0.6	
6/8/11 9:13:45	6.20	12.38	11.1	0.6	
6/8/11 9:14:00	6.21	12.38	11.2	0.6	
6/8/11 9:14:15	6.24	12.36	10.4	0.6	
6/8/11 9:14:30	6.25	12.35	10.3	0.6	
6/8/11 9:14:45	6.28	12.32	10.9	0.6	
6/8/11 9:15:00	6.28	12.31	11.1	0.6	
6/8/11 9:15:15	6.29	12.31	10.4	0.6	
6/8/11 9:15:30	6.31	12.30	10.3	0.6	
6/8/11 9:15:45	6.20	12.40	10.7	0.6	
6/8/11 9:16:00	6.08	12.49	11.1	0.6	M0010 Port Change
6/8/11 9:16:15	6.06	12.51	10.8	0.6	
6/8/11 9:16:30	6.05	12.52	10.5	0.6	
6/8/11 9:16:45	6.09	12.49	10.9	0.6	
6/8/11 9:17:00	6.12	12.47	11.1	0.5	
6/8/11 9:17:15	6.14	12.45	10.6	0.6	
6/8/11 9:17:30	6.21	12.39	10.7	0.6	
6/8/11 9:17:45	6.29	12.32	11.3	0.5	
6/8/11 9:18:00	6.39	12.23	11.6	0.6	
6/8/11 9:18:15	6.44	12.19	11.2	0.6	
6/8/11 9:18:30	6.39	12.23	11.1	0.6	
6/8/11 9:18:45	6.32	12.28	11.7	0.6	
6/8/11 9:19:00	6.29	12.31	11.6	0.6	
6/8/11 9:19:15	6.24	12.36	11.1	0.6	
6/8/11 9:19:30	6.17	12.41	11.3	0.6	
6/8/11 9:19:45	6.11	12.46	11.9	0.6	
6/8/11 9:20:00	6.07	12.49	11.8	0.6	
6/8/11 9:20:15	6.11	12.46	11.2	0.6	
6/8/11 9:20:30	6.15	12.43	11.1	0.6	
6/8/11 9:20:45	6.19	12.40	11.4	0.6	
6/8/11 9:21:00	6.20	12.40	11.4	0.6	
6/8/11 9:21:15	6.23	12.37	10.8	0.6	
6/8/11 9:21:30	6.28	12.33	10.8	0.6	
6/8/11 9:21:45	6.31	12.30	11.3	0.5	
6/8/11 9:22:00	6.34	12.27	11.2	0.6	
6/8/11 9:22:15	6.37	12.24	10.6	0.5	
6/8/11 9:22:30	6.42	12.20	10.8	0.6	
6/8/11 9:22:45	6.43	12.19	11.3	0.6	
6/8/11 9:23:00	6.40	12.21	11.5	0.5	
6/8/11 9:23:15	6.37	12.24	10.7	0.5	
6/8/11 9:23:30	6.35	12.26	10.7	0.5	
6/8/11 9:23:45	6.30	12.30	11.3	0.6	
6/8/11 9:24:00	6.22	12.38	11.5	0.6	
6/8/11 9:24:15	6.13	12.45	10.8	0.6	
6/8/11 9:24:30	6.12	12.46	10.8	0.6	
6/8/11 9:24:45	6.16	12.43	11.3	0.6	
6/8/11 9:25:00	6.13	12.46	11.3	0.6	
6/8/11 9:25:15	6.11	12.46	10.8	0.6	
6/8/11 9:25:30	6.15	12.43	11.0	0.6	
6/8/11 9:25:45	6.19	12.40	11.5	0.6	
6/8/11 9:26:00	6.31	12.29	11.5	0.6	
6/8/11 9:26:15	6.41	12.21	10.9	0.6	
6/8/11 9:26:30	6.49	12.14	11.0	0.6	
6/8/11 9:26:45	6.55	12.09	11.4	0.5	
6/8/11 9:27:00	6.51	12.13	11.2	0.5	
6/8/11 9:27:15	6.39	12.22	10.7	0.5	
6/8/11 9:27:30	6.27	12.31	10.7	0.5	
6/8/11 9:27:45	6.30	12.30	11.1	0.6	
6/8/11 9:28:00	6.36	12.26	10.9	0.6	
6/8/11 9:28:15	6.33	12.29	10.3	0.6	
6/8/11 9:28:30	6.24	12.36	10.6	0.6	
6/8/11 9:28:45	6.20	12.38	11.2	0.6	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 9:29:00	6.24	12.35	11.2	0.5	Begin FCCU-18-1
6/8/11 9:29:15	6.28	12.32	10.6	0.6	
6/8/11 9:29:30	6.28	12.32	10.8	0.5	
6/8/11 9:29:45	6.27	12.34	11.1	0.6	
6/8/11 9:30:00	6.19	12.40	11.1	0.5	
6/8/11 9:30:15	6.13	12.44	10.5	0.6	
6/8/11 9:30:30	6.13	12.45	10.5	0.6	
6/8/11 9:30:45	6.14	12.44	11.2	0.6	
6/8/11 9:31:00	6.15	12.43	11.2	0.6	Restart M0010
6/8/11 9:31:15	6.14	12.44	10.6	0.6	Restart M0011
6/8/11 9:31:30	6.18	12.40	10.9	0.6	
6/8/11 9:31:45	6.25	12.34	11.7	0.6	
6/8/11 9:32:00	6.30	12.31	11.6	0.6	
6/8/11 9:32:15	6.25	12.35	10.9	0.6	
6/8/11 9:32:30	6.17	12.41	11.0	0.6	
6/8/11 9:32:45	6.08	12.49	11.6	0.6	
6/8/11 9:33:00	6.00	12.56	11.5	0.6	
6/8/11 9:33:15	6.00	12.55	10.8	0.6	
6/8/11 9:33:30	6.08	12.49	10.9	0.6	
6/8/11 9:33:45	6.14	12.44	11.3	0.6	
6/8/11 9:34:00	6.19	12.42	11.4	0.6	
6/8/11 9:34:15	6.20	12.41	10.9	0.6	
6/8/11 9:34:30	6.24	12.37	11.2	0.6	
6/8/11 9:34:45	6.22	12.38	11.6	0.6	
6/8/11 9:35:00	6.20	12.38	11.5	0.7	
6/8/11 9:35:15	6.23	12.37	10.9	0.6	
6/8/11 9:35:30	6.17	12.42	11.2	0.7	
6/8/11 9:35:45	6.07	12.50	11.7	0.6	
6/8/11 9:36:00	6.03	12.53	11.4	0.6	
6/8/11 9:36:15	6.10	12.47	10.9	0.6	
6/8/11 9:36:30	6.24	12.36	11.2	0.6	
6/8/11 9:36:45	6.34	12.28	11.7	0.6	
6/8/11 9:37:00	6.33	12.29	11.5	0.6	
6/8/11 9:37:15	6.26	12.35	10.9	0.6	
6/8/11 9:37:30	6.16	12.43	11.3	0.6	
6/8/11 9:37:45	6.13	12.46	11.7	0.6	
6/8/11 9:38:00	6.20	12.40	11.3	0.6	
6/8/11 9:38:15	6.27	12.34	10.8	0.6	
6/8/11 9:38:30	6.27	12.34	11.0	0.6	
6/8/11 9:38:45	6.25	12.35	11.4	0.6	
6/8/11 9:39:00	6.25	12.36	11.1	0.6	
6/8/11 9:39:15	6.23	12.37	10.5	0.6	
6/8/11 9:39:30	6.24	12.36	10.6	0.6	
6/8/11 9:39:45	6.25	12.34	11.1	0.6	
6/8/11 9:40:00	6.26	12.34	10.8	0.6	
6/8/11 9:40:15	6.22	12.37	10.3	0.6	
6/8/11 9:40:30	6.14	12.44	10.5	0.6	
6/8/11 9:40:45	6.11	12.46	11.1	0.6	
6/8/11 9:41:00	6.16	12.42	11.1	0.6	
6/8/11 9:41:15	6.24	12.37	10.5	0.6	
6/8/11 9:41:30	6.28	12.33	10.7	0.6	
6/8/11 9:41:45	6.32	12.31	11.1	0.6	
6/8/11 9:42:00	6.30	12.32	11.1	0.6	
6/8/11 9:42:15	6.27	12.33	10.6	0.7	
6/8/11 9:42:30	6.27	12.33	10.7	0.6	
6/8/11 9:42:45	6.29	12.30	11.1	0.6	
6/8/11 9:43:00	6.31	12.29	11.0	0.7	
6/8/11 9:43:15	6.31	12.29	10.4	0.6	
6/8/11 9:43:30	6.29	12.31	10.5	0.6	
6/8/11 9:43:45	6.23	12.36	11.0	0.6	
6/8/11 9:44:00	6.22	12.36	11.3	0.6	
6/8/11 9:44:15	6.26	12.34	10.8	0.6	
6/8/11 9:44:30	6.31	12.29	11.1	0.6	
6/8/11 9:44:45	6.33	12.29	11.7	0.6	
6/8/11 9:45:00	6.31	12.30	11.9	0.6	
6/8/11 9:45:15	6.30	12.30	11.4	0.7	
6/8/11 9:45:30	6.29	12.31	11.5	0.6	
6/8/11 9:45:45	6.27	12.32	11.7	0.6	
6/8/11 9:46:00	6.24	12.34	11.4	0.6	M0011 Port Change
6/8/11 9:46:15	6.21	12.38	10.9	0.7	
6/8/11 9:46:30	6.20	12.38	11.2	0.7	
6/8/11 9:46:45	6.19	12.40	11.8	0.6	
6/8/11 9:47:00	6.16	12.42	11.6	0.7	
6/8/11 9:47:15	6.16	12.43	10.9	0.6	
6/8/11 9:47:30	6.17	12.42	11.2	0.7	
6/8/11 9:47:45	6.24	12.36	11.4	0.6	
6/8/11 9:48:00	6.34	12.29	11.2	0.6	
6/8/11 9:48:15	6.39	12.23	10.7	0.6	
6/8/11 9:48:30	6.37	12.25	10.7	0.6	
6/8/11 9:48:45	6.30	12.30	11.2	0.6	
6/8/11 9:49:00	6.30	12.30	11.3	0.6	
6/8/11 9:49:15	6.30	12.31	10.7	0.6	
6/8/11 9:49:30	6.27	12.34	10.8	0.6	
6/8/11 9:49:45	6.23	12.37	11.2	0.6	
6/8/11 9:50:00	6.17	12.41	11.0	0.6	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 9:50:15	6.22	12.38	10.5	0.6	
6/8/11 9:50:30	6.30	12.31	10.7	0.6	
6/8/11 9:50:45	6.31	12.30	11.1	0.6	
6/8/11 9:51:00	6.25	12.35	10.8	0.6	
6/8/11 9:51:15	6.20	12.38	10.3	0.6	
6/8/11 9:51:30	6.19	12.39	10.6	0.6	
6/8/11 9:51:45	6.17	12.40	11.1	0.6	
6/8/11 9:52:00	6.13	12.43	11.2	0.6	Resume M0011
6/8/11 9:52:15	6.11	12.45	10.7	0.7	
6/8/11 9:52:30	6.10	12.47	10.8	0.6	
6/8/11 9:52:45	6.12	12.47	11.2	0.6	
6/8/11 9:53:00	6.16	12.43	11.1	0.6	
6/8/11 9:53:15	6.24	12.35	10.7	0.6	
6/8/11 9:53:30	6.31	12.30	10.9	0.6	
6/8/11 9:53:45	6.29	12.31	11.2	0.6	
6/8/11 9:54:00	6.27	12.34	11.1	0.6	
6/8/11 9:54:15	6.22	12.38	10.7	0.6	
6/8/11 9:54:30	6.22	12.37	10.8	0.6	
6/8/11 9:54:45	6.25	12.35	11.2	0.6	
6/8/11 9:55:00	6.29	12.32	11.3	0.7	
6/8/11 9:55:15	6.25	12.35	10.9	0.7	
6/8/11 9:55:30	6.19	12.39	11.0	0.6	
6/8/11 9:55:45	6.13	12.44	11.1	0.6	
6/8/11 9:56:00	6.11	12.46	11.0	0.6	
6/8/11 9:56:15	6.16	12.43	10.6	0.6	
6/8/11 9:56:30	6.22	12.38	10.7	0.6	
6/8/11 9:56:45	6.27	12.33	11.2	0.6	
6/8/11 9:57:00	6.28	12.32	11.5	0.7	
6/8/11 9:57:15	6.30	12.30	11.1	0.7	
6/8/11 9:57:30	6.31	12.29	11.3	0.7	
6/8/11 9:57:45	6.34	12.25	11.6	0.7	
6/8/11 9:58:00	6.39	12.22	11.5	0.7	
6/8/11 9:58:15	6.35	12.26	11.0	0.7	
6/8/11 9:58:30	6.27	12.32	11.0	0.7	
6/8/11 9:58:45	6.28	12.31	11.5	0.6	
6/8/11 9:59:00	6.36	12.24	11.3	0.7	
6/8/11 9:59:15	6.41	12.20	10.8	0.6	
6/8/11 9:59:30	6.43	12.19	10.8	0.6	
6/8/11 9:59:45	6.41	12.21	11.1	0.6	
6/8/11 10:00:00	6.35	12.26	11.0	0.6	
6/8/11 10:00:15	6.27	12.32	10.4	0.6	
6/8/11 10:00:30	6.25	12.33	10.7	0.7	
6/8/11 10:00:45	6.25	12.34	11.0	0.7	
6/8/11 10:01:00	6.21	12.37	10.7	0.6	
6/8/11 10:01:15	6.18	12.40	10.2	0.7	
6/8/11 10:01:30	6.15	12.43	10.3	0.6	
6/8/11 10:01:45	6.12	12.45	10.9	0.7	
6/8/11 10:02:00	6.10	12.46	10.8	0.6	
6/8/11 10:02:15	6.15	12.41	10.1	0.7	
6/8/11 10:02:30	6.20	12.37	10.1	0.7	
6/8/11 10:02:45	6.20	12.37	10.4	0.7	
6/8/11 10:03:00	6.22	12.36	10.4	0.7	
6/8/11 10:03:15	6.26	12.33	9.9	0.7	
6/8/11 10:03:30	6.27	12.31	9.9	0.7	
6/8/11 10:03:45	6.26	12.32	10.2	0.7	
6/8/11 10:04:00	6.23	12.35	10.2	0.7	
6/8/11 10:04:15	6.22	12.36	9.8	0.7	
6/8/11 10:04:30	6.24	12.34	9.6	0.7	
6/8/11 10:04:45	6.22	12.37	10.0	0.7	
6/8/11 10:05:00	6.05	12.50	10.2	0.7	
6/8/11 10:05:15	5.89	12.63	9.8	0.7	
6/8/11 10:05:30	5.83	12.67	9.7	0.7	
6/8/11 10:05:45	5.86	12.65	10.3	0.7	
6/8/11 10:06:00	5.89	12.64	10.4	0.7	
6/8/11 10:06:15	5.88	12.65	9.9	0.7	
6/8/11 10:06:30	5.84	12.69	9.8	0.7	
6/8/11 10:06:45	5.82	12.71	10.3	0.7	
6/8/11 10:07:00	5.84	12.69	10.7	0.7	End M0011 Run 1
6/8/11 10:07:15	5.84	12.69	10.4	0.7	
6/8/11 10:07:30	5.85	12.68	10.3	0.7	
6/8/11 10:07:45	5.86	12.67	10.8	0.8	
6/8/11 10:08:00	5.86	12.67	11.1	0.8	
6/8/11 10:08:15	5.86	12.68	10.7	0.7	
6/8/11 10:08:30	5.87	12.67	10.2	0.7	
6/8/11 10:08:45	5.92	12.62	10.7	0.7	
6/8/11 10:09:00	5.97	12.59	11.0	0.7	
6/8/11 10:09:15	5.95	12.61	10.3	0.7	
6/8/11 10:09:30	5.94	12.61	10.0	0.7	
6/8/11 10:09:45	6.04	12.52	10.4	0.7	
6/8/11 10:10:00	6.13	12.45	11.1	0.7	
6/8/11 10:10:15	6.13	12.45	10.8	0.7	
6/8/11 10:10:30	6.13	12.44	10.7	0.7	
6/8/11 10:10:45	6.12	12.46	10.8	0.7	
6/8/11 10:11:00	6.09	12.49	10.8	0.7	
6/8/11 10:11:15	6.11	12.46	10.3	0.7	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 10:32:45	5.84	12.69	9.6	0.7	
6/8/11 10:33:00	5.89	12.65	9.9	0.8	
6/8/11 10:33:15	5.96	12.59	10.4	0.7	
6/8/11 10:33:30	5.99	12.56	10.3	0.8	
6/8/11 10:33:45	5.99	12.57	9.8	0.8	
6/8/11 10:34:00	5.95	12.60	10.1	0.8	
6/8/11 10:34:15	5.92	12.63	10.5	0.8	
6/8/11 10:34:30	5.84	12.69	10.4	0.8	
6/8/11 10:34:45	5.78	12.73	9.9	0.8	
6/8/11 10:35:00	5.82	12.71	9.9	0.8	
6/8/11 10:35:15	5.96	12.60	10.4	0.8	
6/8/11 10:35:30	6.03	12.54	10.4	0.7	
6/8/11 10:35:45	6.01	12.56	10.0	0.8	
6/8/11 10:36:00	5.97	12.59	10.0	0.8	
6/8/11 10:36:15	6.01	12.55	10.4	0.8	
6/8/11 10:36:30	6.06	12.52	10.6	0.8	
6/8/11 10:36:45	5.98	12.58	10.0	0.8	
6/8/11 10:37:00	5.86	12.67	10.2	0.8	
6/8/11 10:37:15	5.85	12.68	10.7	0.8	
6/8/11 10:37:30	5.96	12.60	10.7	0.8	
6/8/11 10:37:45	6.01	12.56	10.1	0.8	
6/8/11 10:38:00	5.98	12.58	10.0	0.8	
6/8/11 10:38:15	5.98	12.56	10.4	0.8	
6/8/11 10:38:30	6.00	12.56	10.3	0.8	
6/8/11 10:38:45	5.92	12.62	9.7	0.8	
6/8/11 10:39:00	5.88	12.64	9.7	0.8	
6/8/11 10:39:15	5.91	12.62	10.1	0.8	
6/8/11 10:39:30	5.88	12.65	10.2	0.8	
6/8/11 10:39:45	5.85	12.68	9.5	0.8	
6/8/11 10:40:00	5.83	12.69	9.4	0.8	
6/8/11 10:40:15	5.90	12.63	9.9	0.8	
6/8/11 10:40:30	6.02	12.55	10.0	0.8	
6/8/11 10:40:45	6.03	12.54	9.3	0.8	
6/8/11 10:41:00	5.96	12.58	9.1	0.8	
6/8/11 10:41:15	5.93	12.60	9.5	0.8	
6/8/11 10:41:30	5.93	12.61	9.9	0.8	
6/8/11 10:41:45	5.93	12.60	9.7	0.8	
6/8/11 10:42:00	5.99	12.56	9.4	0.8	
6/8/11 10:42:15	6.03	12.53	9.8	0.8	
6/8/11 10:42:30	6.08	12.49	10.1	0.8	
6/8/11 10:42:45	6.14	12.43	9.7	0.8	
6/8/11 10:43:00	6.11	12.47	9.6	0.8	
6/8/11 10:43:15	5.98	12.57	10.2	0.9	
6/8/11 10:43:30	5.89	12.64	10.6	0.8	
6/8/11 10:43:45	5.84	12.68	10.1	0.8	
6/8/11 10:44:00	5.87	12.65	9.8	0.8	
6/8/11 10:44:15	5.96	12.59	10.1	0.8	
6/8/11 10:44:30	5.99	12.57	10.4	0.8	
6/8/11 10:44:45	5.89	12.65	10.0	0.8	
6/8/11 10:45:00	5.80	12.72	9.7	0.8	
6/8/11 10:45:15	5.86	12.67	10.0	0.8	
6/8/11 10:45:30	5.96	12.60	10.3	0.8	
6/8/11 10:45:45	6.00	12.56	9.8	0.8	
6/8/11 10:46:00	6.03	12.54	9.4	0.8	
6/8/11 10:46:15	6.07	12.50	9.6	0.8	
6/8/11 10:46:30	6.08	12.48	10.1	0.7	
6/8/11 10:46:45	6.10	12.47	9.6	0.8	
6/8/11 10:47:00	6.10	12.47	9.0	0.7	
6/8/11 10:47:15	6.03	12.54	9.1	0.7	
6/8/11 10:47:30	5.97	12.58	9.6	0.8	
6/8/11 10:47:45	5.97	12.58	9.4	0.8	
6/8/11 10:48:00	5.94	12.59	8.9	0.8	
6/8/11 10:48:15	5.85	12.66	9.4	0.8	
6/8/11 10:48:30	5.74	12.76	9.9	0.8	
6/8/11 10:48:45	5.71	12.78	9.6	0.8	
6/8/11 10:49:00	5.76	12.75	9.3	0.8	
6/8/11 10:49:15	5.78	12.75	9.6	0.8	
6/8/11 10:49:30	5.79	12.74	10.3	0.8	
6/8/11 10:49:45	5.78	12.75	10.2	0.8	
6/8/11 10:50:00	5.68	12.83	9.6	0.8	
6/8/11 10:50:15	5.58	12.89	9.6	0.9	
6/8/11 10:50:30	5.64	12.85	10.1	0.8	
6/8/11 10:50:45	5.73	12.79	9.9	0.9	
6/8/11 10:51:00	5.80	12.73	9.6	0.8	
6/8/11 10:51:15	5.80	12.72	9.7	0.9	
6/8/11 10:51:30	5.74	12.77	10.2	0.9	
6/8/11 10:51:45	5.68	12.81	10.2	0.9	
6/8/11 10:52:00	5.68	12.81	9.7	0.9	
6/8/11 10:52:15	5.74	12.77	9.7	0.8	
6/8/11 10:52:30	5.81	12.73	10.2	0.9	
6/8/11 10:52:45	5.79	12.75	10.2	0.9	
6/8/11 10:53:00	5.72	12.79	9.8	0.9	
6/8/11 10:53:15	5.76	12.77	10.1	0.9	
6/8/11 10:53:30	5.84	12.71	10.5	0.8	
6/8/11 10:53:45	5.87	12.68	10.3	0.8	

Restart M0010

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 10:11:30	6.14	12.43	9.9	0.7	
6/8/11 10:11:45	6.09	12.47	10.3	0.7	
6/8/11 10:12:00	5.97	12.58	10.8	0.7	
6/8/11 10:12:15	5.88	12.65	10.5	0.8	
6/8/11 10:12:30	5.85	12.68	10.0	0.7	
6/8/11 10:12:45	5.86	12.67	10.2	0.8	
6/8/11 10:13:00	5.86	12.67	10.6	0.7	
6/8/11 10:13:15	5.82	12.71	10.3	0.7	
6/8/11 10:13:30	5.77	12.74	9.7	0.7	
6/8/11 10:13:45	5.76	12.74	10.1	0.7	
6/8/11 10:14:00	5.81	12.71	10.4	0.7	
6/8/11 10:14:15	5.87	12.67	10.2	0.7	
6/8/11 10:14:30	5.91	12.63	9.7	0.7	
6/8/11 10:14:45	5.97	12.58	9.8	0.7	
6/8/11 10:15:00	5.98	12.58	10.4	0.7	
6/8/11 10:15:15	5.93	12.61	10.2	0.7	
6/8/11 10:15:30	5.90	12.63	9.5	0.8	
6/8/11 10:15:45	5.94	12.60	9.9	0.7	
6/8/11 10:16:00	5.96	12.58	10.4	0.7	
6/8/11 10:16:15	5.97	12.58	10.4	0.7	
6/8/11 10:16:30	5.99	12.56	9.8	0.7	
6/8/11 10:16:45	6.04	12.52	10.0	0.8	
6/8/11 10:17:00	6.08	12.49	10.6	0.7	
6/8/11 10:17:15	6.13	12.45	10.5	0.7	
6/8/11 10:17:30	6.12	12.47	9.8	0.7	
6/8/11 10:17:45	6.06	12.50	10.0	0.7	
6/8/11 10:18:00	6.01	12.54	10.6	0.7	
6/8/11 10:18:15	5.96	12.59	10.6	0.7	
6/8/11 10:18:30	5.94	12.61	9.9	0.7	
6/8/11 10:18:45	5.93	12.62	9.7	0.7	
6/8/11 10:19:00	5.92	12.63	10.5	0.7	
6/8/11 10:19:15	5.87	12.66	10.4	0.7	
6/8/11 10:19:30	5.89	12.64	9.6	0.8	
6/8/11 10:19:45	5.92	12.63	9.6	0.8	
6/8/11 10:20:00	5.91	12.63	10.2	0.7	
6/8/11 10:20:15	5.96	12.59	10.4	0.8	
6/8/11 10:20:30	5.99	12.56	9.7	0.8	
6/8/11 10:20:45	5.98	12.57	9.6	0.8	
6/8/11 10:21:00	5.98	12.57	10.2	0.8	
6/8/11 10:21:15	5.96	12.58	10.2	0.8	
6/8/11 10:21:30	5.88	12.65	9.5	0.8	
6/8/11 10:21:45	5.83	12.69	9.5	0.8	
6/8/11 10:22:00	5.84	12.69	10.1	0.7	
6/8/11 10:22:15	5.92	12.63	9.9	0.7	
6/8/11 10:22:30	5.95	12.60	9.4	0.8	
6/8/11 10:22:45	5.92	12.61	9.5	0.8	
6/8/11 10:23:00	5.87	12.65	9.9	0.7	
6/8/11 10:23:15	5.85	12.67	10.1	0.7	
6/8/11 10:23:30	5.84	12.67	9.8	0.8	
6/8/11 10:23:45	5.86	12.66	10.1	0.8	
6/8/11 10:24:00	5.97	12.57	10.9	0.8	
6/8/11 10:24:15	6.07	12.50	11.0	0.8	
6/8/11 10:24:30	6.07	12.50	10.4	0.8	
6/8/11 10:24:45	6.07	12.49	10.2	0.8	
6/8/11 10:25:00	6.05	12.51	10.4	0.8	
6/8/11 10:25:15	6.00	12.55	10.6	0.8	
6/8/11 10:25:30	6.06	12.50	10.1	0.8	
6/8/11 10:25:45	6.08	12.49	9.8	0.8	
6/8/11 10:26:00	6.06	12.50	10.4	0.8	
6/8/11 10:26:15	6.06	12.50	10.7	0.8	
6/8/11 10:26:30	6.10	12.47	10.3	0.8	
6/8/11 10:26:45	6.15	12.44	9.9	0.8	
6/8/11 10:27:00	6.18	12.41	10.2	0.8	
6/8/11 10:27:15	6.15	12.44	10.4	0.7	
6/8/11 10:27:30	6.06	12.51	9.9	0.8	
6/8/11 10:27:45	5.99	12.56	9.6	0.8	
6/8/11 10:28:00	5.91	12.62	9.9	0.8	
6/8/11 10:28:15	5.89	12.64	10.2	0.7	
6/8/11 10:28:30	6.00	12.55	9.9	0.8	
6/8/11 10:28:45	6.07	12.50	9.6	0.7	
6/8/11 10:29:00	6.02	12.53	9.9	0.8	End M18 Run 1
6/8/11 10:29:15	5.92	12.61	10.1	0.8	
6/8/11 10:29:30	5.88	12.65	9.8	0.8	
6/8/11 10:29:45	5.90	12.64	9.5	0.8	
6/8/11 10:30:00	5.94	12.60	9.9	0.8	
6/8/11 10:30:15	5.96	12.58	10.2	0.8	
6/8/11 10:30:30	5.96	12.59	9.9	0.7	
6/8/11 10:30:45	5.96	12.58	9.7	0.8	
6/8/11 10:31:00	5.94	12.60	9.9	0.8	M0010 Port Change
6/8/11 10:31:15	5.95	12.59	10.0	0.8	
6/8/11 10:31:30	5.92	12.63	9.8	0.8	
6/8/11 10:31:45	5.86	12.67	9.4	0.7	
6/8/11 10:32:00	5.85	12.67	9.5	0.8	
6/8/11 10:32:15	5.82	12.70	9.9	0.8	
6/8/11 10:32:30	5.81	12.71	9.8	0.8	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 10:54:00	5.89	12.65	9.5	0.8	
6/8/11 10:54:15	5.99	12.57	9.4	0.8	
6/8/11 10:54:30	6.08	12.51	9.9	0.8	
6/8/11 10:54:45	6.04	12.54	9.8	0.8	
6/8/11 10:55:00	5.95	12.60	9.3	0.8	
6/8/11 10:55:15	5.89	12.63	9.3	0.8	
6/8/11 10:55:30	5.86	12.66	9.7	0.8	
6/8/11 10:55:45	5.85	12.67	9.7	0.8	
6/8/11 10:56:00	5.78	12.73	9.3	0.8	
6/8/11 10:56:15	5.71	12.78	9.1	0.8	
6/8/11 10:56:30	5.76	12.75	9.5	0.8	
6/8/11 10:56:45	5.86	12.67	9.6	0.8	
6/8/11 10:57:00	5.86	12.68	9.1	0.8	
6/8/11 10:57:15	5.77	12.75	8.9	0.8	
6/8/11 10:57:30	5.69	12.81	9.3	0.8	
6/8/11 10:57:45	5.66	12.84	9.4	0.9	
6/8/11 10:58:00	5.69	12.80	9.1	0.8	
6/8/11 10:58:15	5.81	12.71	9.0	0.8	
6/8/11 10:58:30	5.85	12.68	9.4	0.8	
6/8/11 10:58:45	5.78	12.73	9.6	0.9	
6/8/11 10:59:00	5.76	12.75	9.3	0.8	
6/8/11 10:59:15	5.80	12.71	9.0	0.8	
6/8/11 10:59:30	5.84	12.68	9.3	0.8	
6/8/11 10:59:45	5.90	12.63	9.7	0.8	
6/8/11 11:00:00	5.97	12.58	9.5	0.8	
6/8/11 11:00:15	5.98	12.58	9.3	0.9	
6/8/11 11:00:30	5.94	12.61	9.6	0.9	
6/8/11 11:00:45	5.86	12.67	10.0	0.9	
6/8/11 11:01:00	5.77	12.75	10.0	0.8	
6/8/11 11:01:15	5.75	12.77	9.6	0.8	
6/8/11 11:01:30	5.76	12.76	9.8	0.9	
6/8/11 11:01:45	5.79	12.73	10.2	0.9	
6/8/11 11:02:00	5.82	12.72	10.3	0.8	
6/8/11 11:02:15	5.87	12.67	9.9	0.8	
6/8/11 11:02:30	5.98	12.59	10.1	0.9	
6/8/11 11:02:45	5.99	12.58	10.6	0.9	
6/8/11 11:03:00	5.93	12.62	10.5	0.9	
6/8/11 11:03:15	5.88	12.65	9.9	0.9	
6/8/11 11:03:30	5.90	12.64	9.5	0.9	
6/8/11 11:03:45	5.87	12.66	9.8	0.9	
6/8/11 11:04:00	5.82	12.68	9.9	0.9	
6/8/11 11:04:15	5.78	12.72	9.3	0.8	
6/8/11 11:04:30	5.75	12.76	9.1	0.9	
6/8/11 11:04:45	5.78	12.73	9.4	0.9	
6/8/11 11:05:00	5.85	12.67	9.6	0.8	
6/8/11 11:05:15	5.84	12.69	9.2	0.9	
6/8/11 11:05:30	5.83	12.69	9.0	0.9	
6/8/11 11:05:45	5.88	12.65	9.4	0.8	
6/8/11 11:06:00	5.96	12.59	9.6	0.8	
6/8/11 11:06:15	5.99	12.57	9.0	0.8	
6/8/11 11:06:30	5.97	12.58	8.7	0.8	
6/8/11 11:06:45	5.95	12.60	9.0	0.8	
6/8/11 11:07:00	5.88	12.65	9.3	0.8	
6/8/11 11:07:15	5.77	12.75	9.2	0.8	
6/8/11 11:07:30	5.77	12.74	9.0	0.8	
6/8/11 11:07:45	5.89	12.65	9.3	0.8	
6/8/11 11:08:00	5.95	12.60	9.7	0.8	
6/8/11 11:08:15	6.00	12.56	9.5	0.8	
6/8/11 11:08:30	6.06	12.50	9.0	0.8	
6/8/11 11:08:45	6.07	12.50	9.4	0.8	
6/8/11 11:09:00	5.97	12.59	10.0	0.8	
6/8/11 11:09:15	5.92	12.61	9.9	0.8	
6/8/11 11:09:30	5.93	12.60	9.3	0.8	
6/8/11 11:09:45	5.89	12.64	9.6	0.8	
6/8/11 11:10:00	5.81	12.72	10.3	0.8	
6/8/11 11:10:15	5.78	12.74	10.0	0.8	
6/8/11 11:10:30	5.78	12.75	9.5	0.8	
6/8/11 11:10:45	5.74	12.78	9.5	0.8	
6/8/11 11:11:00	5.77	12.76	10.0	0.8	
6/8/11 11:11:15	5.85	12.69	10.0	0.8	
6/8/11 11:11:30	5.90	12.65	9.4	0.9	
6/8/11 11:11:45	5.90	12.65	9.4	0.9	
6/8/11 11:12:00	5.93	12.63	9.7	0.8	
6/8/11 11:12:15	6.01	12.56	9.8	0.8	
6/8/11 11:12:30	6.04	12.54	9.2	0.8	
6/8/11 11:12:45	6.00	12.56	8.8	0.8	
6/8/11 11:13:00	5.92	12.62	9.3	0.8	
6/8/11 11:13:15	5.82	12.69	9.5	0.8	
6/8/11 11:13:30	5.80	12.71	9.1	0.8	
6/8/11 11:13:45	5.78	12.74	8.7	0.8	
6/8/11 11:14:00	5.71	12.79	9.1	0.9	
6/8/11 11:14:15	5.70	12.79	9.5	0.8	
6/8/11 11:14:30	5.74	12.76	9.2	0.8	
6/8/11 11:14:45	5.81	12.70	8.7	0.8	
6/8/11 11:15:00	5.89	12.64	8.9	0.9	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 11:15:15	5.91	12.64	9.2	0.9	
6/8/11 11:15:30	5.89	12.65	9.0	0.9	
6/8/11 11:15:45	5.85	12.68	8.9	0.9	
6/8/11 11:16:00	5.73	12.78	9.2	0.9	
6/8/11 11:16:15	5.59	12.88	9.7	0.9	
6/8/11 11:16:30	5.55	12.91	9.6	0.9	
6/8/11 11:16:45	5.57	12.91	9.0	0.9	
6/8/11 11:17:00	5.59	12.89	9.1	0.8	
6/8/11 11:17:15	5.66	12.84	9.5	0.9	
6/8/11 11:17:30	5.70	12.82	9.4	0.9	
6/8/11 11:17:45	5.67	12.84	8.8	0.9	
6/8/11 11:18:00	5.64	12.86	9.1	0.9	
6/8/11 11:18:15	5.63	12.95	9.7	0.8	
6/8/11 11:18:30	5.41	13.07	9.6	0.9	
6/8/11 11:18:45	5.42	13.06	8.9	0.9	
6/8/11 11:19:00	5.47	13.02	9.0	0.9	
6/8/11 11:19:15	5.45	13.04	9.5	0.9	
6/8/11 11:19:30	5.47	13.01	9.6	0.9	
6/8/11 11:19:45	5.58	12.92	9.1	0.8	
6/8/11 11:20:00	5.67	12.85	9.0	0.8	
6/8/11 11:20:15	5.68	12.85	9.4	0.9	
6/8/11 11:20:30	5.58	12.93	9.5	0.9	
6/8/11 11:20:45	5.48	13.02	9.1	0.9	
6/8/11 11:21:00	5.42	13.07	9.0	0.8	
6/8/11 11:21:15	5.43	13.06	9.4	0.8	
6/8/11 11:21:30	5.48	13.03	9.5	0.9	
6/8/11 11:21:45	5.50	13.02	8.9	0.9	
6/8/11 11:22:00	5.46	13.05	8.8	0.9	
6/8/11 11:22:15	5.42	13.08	9.3	0.9	
6/8/11 11:22:30	5.42	13.08	9.4	0.8	
6/8/11 11:22:45	5.48	13.02	8.8	0.8	
6/8/11 11:23:00	5.51	12.99	8.6	0.9	
6/8/11 11:23:15	5.51	12.98	9.0	0.9	
6/8/11 11:23:30	5.56	12.95	9.2	0.9	
6/8/11 11:23:45	5.61	12.90	8.6	0.8	
6/8/11 11:24:00	5.70	12.83	8.2	0.8	
6/8/11 11:24:15	5.79	12.76	8.5	0.8	
6/8/11 11:24:30	5.78	12.76	8.8	0.9	
6/8/11 11:24:45	5.68	12.83	8.6	0.8	
6/8/11 11:25:00	5.57	12.91	8.2	0.8	
6/8/11 11:25:15	5.60	12.89	8.5	0.8	
6/8/11 11:25:30	5.67	12.84	8.9	0.8	
6/8/11 11:25:45	5.70	12.81	8.3	0.8	
6/8/11 11:26:00	5.68	12.83	8.0	0.8	
6/8/11 11:26:15	5.61	12.88	8.4	0.8	
6/8/11 11:26:30	5.56	12.93	8.7	0.8	
6/8/11 11:26:45	5.51	12.99	8.7	0.8	
6/8/11 11:27:00	5.47	13.02	8.3	0.8	
6/8/11 11:27:15	5.50	12.98	8.6	0.8	
6/8/11 11:27:30	5.53	12.96	9.0	0.8	
6/8/11 11:27:45	5.54	12.95	9.2	0.8	
6/8/11 11:28:00	5.54	12.95	8.9	0.8	
6/8/11 11:28:15	5.55	12.94	8.9	0.8	
6/8/11 11:28:30	5.55	12.95	9.4	0.8	
6/8/11 11:28:45	5.53	12.98	9.7	0.9	
6/8/11 11:29:00	5.49	13.02	9.3	0.9	
6/8/11 11:29:15	5.48	13.03	9.5	0.9	
6/8/11 11:29:30	5.54	12.98	10.0	0.9	
6/8/11 11:29:45	5.63	12.90	9.8	0.9	
6/8/11 11:30:00	5.65	12.88	9.2	0.8	
6/8/11 11:30:15	5.66	12.87	8.7	0.9	
6/8/11 11:30:30	5.69	12.84	9.1	0.9	
6/8/11 11:30:45	5.72	12.81	9.2	0.9	
6/8/11 11:31:00	5.76	12.78	8.7	0.9	
6/8/11 11:31:15	5.72	12.81	8.5	0.8	
6/8/11 11:31:30	5.72	12.81	8.8	0.8	
6/8/11 11:31:45	5.76	12.78	9.0	0.8	
6/8/11 11:32:00	5.71	12.82	8.6	0.8	
6/8/11 11:32:15	5.63	12.87	8.2	0.8	
6/8/11 11:32:30	5.63	12.87	8.5	0.8	
6/8/11 11:32:45	5.68	12.83	9.1	0.8	
6/8/11 11:33:00	5.67	12.85	8.8	0.8	
6/8/11 11:33:15	5.62	12.89	8.1	0.8	
6/8/11 11:33:30	5.65	12.86	8.4	0.8	
6/8/11 11:33:45	5.73	12.79	9.0	0.8	
6/8/11 11:34:00	5.82	12.73	8.8	0.8	
6/8/11 11:34:15	5.85	12.70	8.3	0.8	
6/8/11 11:34:30	5.87	12.68	8.5	0.8	
6/8/11 11:34:45	5.86	12.69	8.8	0.8	
6/8/11 11:35:00	5.78	12.76	8.9	0.8	
6/8/11 11:35:15	5.71	12.81	8.5	0.8	
6/8/11 11:35:30	5.71	12.81	8.7	0.8	
6/8/11 11:35:45	5.73	12.80	9.3	0.8	
6/8/11 11:36:00	5.75	12.78	9.4	0.8	
6/8/11 11:36:15	5.76	12.78	8.5	0.8	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 11:36:30	5.79	12.76	8.7	0.8	
6/8/11 11:36:45	5.79	12.76	9.3	0.8	
6/8/11 11:37:00	5.78	12.77	9.3	0.8	
6/8/11 11:37:15	5.70	12.83	8.8	0.8	
6/8/11 11:37:30	5.68	12.83	8.9	0.8	
6/8/11 11:37:45	5.70	12.83	9.2	0.8	
6/8/11 11:38:00	5.69	12.85	9.3	0.8	
6/8/11 11:38:15	5.68	12.85	8.7	0.8	
6/8/11 11:38:30	5.72	12.82	8.5	0.8	
6/8/11 11:38:45	5.75	12.79	9.1	0.8	
6/8/11 11:39:00	5.77	12.77	9.0	0.8	
6/8/11 11:39:15	5.76	12.78	8.5	0.8	
6/8/11 11:39:30	5.81	12.74	8.2	0.8	
6/8/11 11:39:45	5.84	12.72	8.5	0.8	
6/8/11 11:40:00	5.76	12.77	8.7	0.7	
6/8/11 11:40:15	5.72	12.80	8.4	0.8	
6/8/11 11:40:30	5.73	12.81	8.1	0.8	
6/8/11 11:40:45	5.74	12.79	8.5	0.8	
6/8/11 11:41:00	5.77	12.77	8.8	0.8	
6/8/11 11:41:15	5.75	12.78	8.7	0.8	
6/8/11 11:41:30	5.71	12.81	8.4	0.8	
6/8/11 11:41:45	5.74	12.79	8.7	0.8	
6/8/11 11:42:00	5.77	12.77	9.0	0.8	
6/8/11 11:42:15	5.75	12.77	8.9	0.8	
6/8/11 11:42:30	5.86	12.69	8.5	0.8	
6/8/11 11:42:45	5.94	12.64	8.7	0.8	
6/8/11 11:43:00	5.90	12.67	8.9	0.8	
6/8/11 11:43:15	5.83	12.73	8.8	0.8	
6/8/11 11:43:30	5.78	12.75	8.3	0.8	
6/8/11 11:43:45	5.81	12.73	8.4	0.8	
6/8/11 11:44:00	5.81	12.73	9.0	0.8	
6/8/11 11:44:15	5.77	12.76	9.0	0.8	
6/8/11 11:44:30	5.73	12.80	8.4	0.8	
6/8/11 11:44:45	5.74	12.79	8.6	0.8	
6/8/11 11:45:00	5.78	12.75	9.0	0.8	
6/8/11 11:45:15	5.80	12.74	8.9	0.7	
6/8/11 11:45:30	5.84	12.71	8.2	0.8	
6/8/11 11:45:45	5.88	12.67	8.1	0.7	
6/8/11 11:46:00	5.88	12.67	8.6	0.7	
6/8/11 11:46:15	5.82	12.72	8.9	0.7	
6/8/11 11:46:30	5.79	12.75	8.4	0.7	
6/8/11 11:46:45	5.84	12.71	8.5	0.8	
6/8/11 11:47:00	5.90	12.66	8.9	0.7	M0010 Port Change
6/8/11 11:47:15	5.84	12.72	8.9	0.7	
6/8/11 11:47:30	5.71	12.81	8.5	0.8	
6/8/11 11:47:45	5.71	12.79	8.3	0.7	
6/8/11 11:48:00	5.81	12.72	8.6	0.8	
6/8/11 11:48:15	5.84	12.71	8.9	0.8	
6/8/11 11:48:30	5.84	12.71	8.4	0.8	
6/8/11 11:48:45	5.84	12.71	8.1	0.8	
6/8/11 11:49:00	5.84	12.71	8.6	0.7	
6/8/11 11:49:15	5.80	12.74	9.0	0.8	
6/8/11 11:49:30	5.79	12.75	8.7	0.8	
6/8/11 11:49:45	5.85	12.70	8.2	0.7	
6/8/11 11:50:00	5.89	12.67	8.5	0.8	
6/8/11 11:50:15	5.89	12.67	8.9	0.8	
6/8/11 11:50:30	5.92	12.64	8.7	0.7	
6/8/11 11:50:45	5.99	12.59	7.9	0.7	
6/8/11 11:51:00	5.99	12.59	8.1	0.8	
6/8/11 11:51:15	5.89	12.67	8.6	0.8	
6/8/11 11:51:30	5.79	12.74	8.4	0.7	
6/8/11 11:51:45	5.78	12.76	7.8	0.8	
6/8/11 11:52:00	5.79	12.75	8.0	0.8	
6/8/11 11:52:15	5.81	12.72	8.7	0.8	
6/8/11 11:52:30	5.85	12.70	8.6	0.8	
6/8/11 11:52:45	5.89	12.66	7.9	0.8	
6/8/11 11:53:00	5.96	12.59	8.0	0.8	Begin M308 Run 1
6/8/11 11:53:15	6.01	12.56	8.5	0.8	Restart M0010
6/8/11 11:53:30	5.97	12.59	8.7	0.7	
6/8/11 11:53:45	5.85	12.69	8.0	0.8	
6/8/11 11:54:00	5.78	12.74	8.1	0.8	
6/8/11 11:54:15	5.80	12.73	8.7	0.8	
6/8/11 11:54:30	5.85	12.70	9.0	0.8	
6/8/11 11:54:45	5.82	12.73	8.5	0.8	
6/8/11 11:55:00	5.79	12.75	8.4	0.8	
6/8/11 11:55:15	5.81	12.74	8.8	0.8	
6/8/11 11:55:30	5.82	12.72	9.0	0.8	
6/8/11 11:55:45	5.79	12.75	8.5	0.8	
6/8/11 11:56:00	5.73	12.80	8.4	0.8	
6/8/11 11:56:15	5.73	12.79	8.9	0.8	
6/8/11 11:56:30	5.77	12.76	9.2	0.8	
6/8/11 11:56:45	5.78	12.76	8.7	0.8	
6/8/11 11:57:00	5.79	12.75	8.6	0.8	
6/8/11 11:57:15	5.84	12.71	9.1	0.8	
6/8/11 11:57:30	5.84	12.73	9.2	0.8	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 11:57:45	5.77	12.77	8.8	0.8	
6/8/11 11:58:00	5.74	12.80	8.6	0.8	
6/8/11 11:58:15	5.77	12.77	8.9	0.8	
6/8/11 11:58:30	5.86	12.70	9.2	0.7	
6/8/11 11:58:45	5.94	12.64	8.9	0.8	
6/8/11 11:59:00	5.94	12.64	8.1	0.8	
6/8/11 11:59:15	5.86	12.69	8.2	0.8	
6/8/11 11:59:30	5.82	12.73	8.6	0.8	
6/8/11 11:59:45	5.81	12.74	8.3	0.7	
6/8/11 12:00:00	5.87	12.68	7.8	0.8	
6/8/11 12:00:15	5.93	12.64	8.0	0.7	
6/8/11 12:00:30	5.91	12.66	8.5	0.8	
6/8/11 12:00:45	5.88	12.68	8.3	0.7	
6/8/11 12:01:00	5.81	12.73	7.8	0.7	
6/8/11 12:01:15	5.70	12.81	8.2	0.8	
6/8/11 12:01:30	5.67	12.83	8.6	0.8	
6/8/11 12:01:45	5.73	12.79	8.7	0.7	
6/8/11 12:02:00	5.82	12.72	8.2	0.7	
6/8/11 12:02:15	5.88	12.67	8.2	0.8	
6/8/11 12:02:30	5.91	12.65	8.8	0.8	
6/8/11 12:02:45	5.92	12.64	8.8	0.8	
6/8/11 12:03:00	5.86	12.70	8.3	0.7	
6/8/11 12:03:15	5.77	12.76	8.2	0.8	
6/8/11 12:03:30	5.77	12.76	8.9	0.8	
6/8/11 12:03:45	5.80	12.75	9.2	0.8	
6/8/11 12:04:00	5.78	12.76	8.7	0.8	
6/8/11 12:04:15	5.75	12.78	8.7	0.8	
6/8/11 12:04:30	5.74	12.79	9.4	0.8	
6/8/11 12:04:45	5.84	12.71	9.4	0.8	
6/8/11 12:05:00	5.93	12.65	8.9	0.8	
6/8/11 12:05:15	5.89	12.68	8.2	0.8	
6/8/11 12:05:30	5.84	12.71	8.8	0.8	
6/8/11 12:05:45	5.80	12.73	9.1	0.8	
6/8/11 12:06:00	5.77	12.76	8.8	0.8	
6/8/11 12:06:15	5.82	12.73	8.4	0.8	
6/8/11 12:06:30	5.93	12.65	8.3	0.8	
6/8/11 12:06:45	5.98	12.60	8.8	0.8	
6/8/11 12:07:00	5.92	12.65	8.6	0.8	
6/8/11 12:07:15	5.82	12.72	8.2	0.8	
6/8/11 12:07:30	5.82	12.72	8.5	0.8	
6/8/11 12:07:45	5.84	12.71	9.1	0.8	
6/8/11 12:08:00	5.83	12.72	9.1	0.8	
6/8/11 12:08:15	5.82	12.73	8.6	0.8	
6/8/11 12:08:30	5.80	12.74	8.3	0.8	
6/8/11 12:08:45	5.76	12.77	8.7	0.8	
6/8/11 12:09:00	5.79	12.74	9.0	0.8	
6/8/11 12:09:15	5.82	12.73	8.5	0.8	
6/8/11 12:09:30	5.83	12.71	8.1	0.9	
6/8/11 12:09:45	5.89	12.66	8.6	0.8	
6/8/11 12:10:00	5.89	12.66	8.8	0.8	
6/8/11 12:10:15	5.85	12.70	8.5	0.8	
6/8/11 12:10:30	5.85	12.71	8.3	0.8	
6/8/11 12:10:45	5.89	12.67	8.7	0.8	
6/8/11 12:11:00	5.92	12.64	9.0	0.8	
6/8/11 12:11:15	5.90	12.65	8.7	0.8	
6/8/11 12:11:30	5.94	12.62	8.3	0.8	
6/8/11 12:11:45	5.97	12.60	8.4	0.8	
6/8/11 12:12:00	5.89	12.67	9.0	0.8	
6/8/11 12:12:15	5.85	12.69	8.8	0.8	
6/8/11 12:12:30	5.89	12.66	8.3	0.8	
6/8/11 12:12:45	5.92	12.63	8.8	0.8	
6/8/11 12:13:00	5.96	12.62	9.3	0.8	
6/8/11 12:13:15	5.98	12.60	9.2	0.8	
6/8/11 12:13:30	5.97	12.61	8.6	0.8	
6/8/11 12:13:45	5.95	12.63	8.4	0.8	
6/8/11 12:14:00	5.91	12.67	8.6	0.8	
6/8/11 12:14:15	5.81	12.75	8.8	0.8	
6/8/11 12:14:30	5.70	12.83	8.3	0.9	
6/8/11 12:14:45	5.69	12.84	8.2	0.9	
6/8/11 12:15:00	5.74	12.79	8.6	0.9	
6/8/11 12:15:15	5.85	12.70	8.8	0.8	
6/8/11 12:15:30	5.92	12.65	8.1	0.8	
6/8/11 12:15:45	5.89	12.67	7.9	0.8	
6/8/11 12:16:00	5.80	12.73	8.4	0.8	
6/8/11 12:16:15	5.72	12.80	8.7	0.9	
6/8/11 12:16:30	5.64	12.86	8.1	0.8	
6/8/11 12:16:45	5.63	12.87	7.8	0.8	
6/8/11 12:17:00	5.67	12.84	8.3	0.8	
6/8/11 12:17:15	5.70	12.82	8.8	0.8	
6/8/11 12:17:30	5.68	12.85	8.6	0.8	
6/8/11 12:17:45	5.70	12.83	8.0	0.8	
6/8/11 12:18:00	5.78	12.76	8.4	0.8	
6/8/11 12:18:15	5.86	12.69	8.8	0.8	
6/8/11 12:18:30	5.93	12.63	8.6	0.9	
6/8/11 12:18:45	5.98	12.59	8.2	0.9	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 12:19:00	5.96	12.61	8.3	0.9	
6/8/11 12:19:15	5.94	12.63	8.8	0.9	
6/8/11 12:19:30	5.92	12.65	8.8	0.9	
6/8/11 12:19:45	5.88	12.67	8.1	0.9	
6/8/11 12:20:00	5.83	12.70	8.2	0.9	
6/8/11 12:20:15	5.81	12.73	8.9	0.9	
6/8/11 12:20:30	5.81	12.72	8.9	0.9	
6/8/11 12:20:45	5.83	12.72	8.3	0.9	
6/8/11 12:21:00	5.80	12.74	8.6	0.9	
6/8/11 12:21:15	5.80	12.75	9.2	0.9	
6/8/11 12:21:30	5.76	12.79	9.4	1.0	
6/8/11 12:21:45	5.65	12.88	8.8	1.0	
6/8/11 12:22:00	5.63	12.89	8.5	1.0	
6/8/11 12:22:15	5.68	12.85	8.9	1.0	
6/8/11 12:22:30	5.70	12.83	9.2	1.0	
6/8/11 12:22:45	5.69	12.83	8.7	0.9	
6/8/11 12:23:00	5.75	12.78	8.2	1.0	
6/8/11 12:23:15	5.85	12.71	8.5	1.0	
6/8/11 12:23:30	5.90	12.68	8.7	0.9	
6/8/11 12:23:45	5.90	12.67	8.5	0.9	
6/8/11 12:24:00	5.89	12.67	8.3	0.9	
6/8/11 12:24:15	5.89	12.67	8.5	0.9	
6/8/11 12:24:30	5.89	12.67	9.0	0.9	
6/8/11 12:24:45	5.90	12.66	8.7	1.0	
6/8/11 12:25:00	5.91	12.66	8.1	1.0	
6/8/11 12:25:15	5.92	12.65	8.3	1.0	
6/8/11 12:25:30	5.91	12.67	8.8	0.9	
6/8/11 12:25:45	5.86	12.71	8.9	0.9	
6/8/11 12:26:00	5.87	12.68	8.2	0.9	
6/8/11 12:26:15	5.88	12.69	8.1	0.9	
6/8/11 12:26:30	5.80	12.75	8.6	1.0	
6/8/11 12:26:45	5.73	12.81	8.8	1.0	
6/8/11 12:27:00	5.73	12.80	8.2	0.9	
6/8/11 12:27:15	5.74	12.81	8.1	1.0	
6/8/11 12:27:30	5.74	12.80	8.7	0.9	
6/8/11 12:27:45	5.76	12.77	8.9	1.0	
6/8/11 12:28:00	5.82	12.72	8.4	1.0	
6/8/11 12:28:15	5.86	12.70	8.2	1.0	
6/8/11 12:28:30	5.91	12.65	8.6	1.0	
6/8/11 12:28:45	5.97	12.61	8.7	1.0	
6/8/11 12:29:00	5.96	12.61	8.1	0.9	
6/8/11 12:29:15	5.91	12.65	7.7	0.9	
6/8/11 12:29:30	5.82	12.71	8.1	0.9	
6/8/11 12:29:45	5.79	12.74	8.4	1.0	
6/8/11 12:30:00	5.78	12.75	8.2	0.9	
6/8/11 12:30:15	5.78	12.75	7.7	0.9	
6/8/11 12:30:30	5.75	12.78	8.1	0.9	
6/8/11 12:30:45	5.73	12.81	8.7	1.0	
6/8/11 12:31:00	5.70	12.83	8.6	1.0	
6/8/11 12:31:15	5.67	12.86	8.2	1.0	
6/8/11 12:31:30	5.62	12.88	8.4	1.0	
6/8/11 12:31:45	5.59	12.91	8.8	1.0	
6/8/11 12:32:00	5.63	12.88	8.9	0.9	
6/8/11 12:32:15	5.74	12.80	8.4	1.0	
6/8/11 12:32:30	5.84	12.72	8.4	0.9	
6/8/11 12:32:45	5.84	12.72	8.8	1.0	
6/8/11 12:33:00	5.81	12.74	9.1	1.0	
6/8/11 12:33:15	5.84	12.71	8.5	1.0	
6/8/11 12:33:30	5.90	12.66	8.5	1.0	
6/8/11 12:33:45	5.90	12.66	8.8	1.0	
6/8/11 12:34:00	5.82	12.73	9.1	0.9	
6/8/11 12:34:15	5.76	12.78	8.7	1.0	
6/8/11 12:34:30	5.75	12.79	8.5	1.0	
6/8/11 12:34:45	5.76	12.78	9.1	1.0	
6/8/11 12:35:00	5.75	12.79	9.3	0.9	
6/8/11 12:35:15	5.77	12.78	8.9	1.0	
6/8/11 12:35:30	5.87	12.69	8.4	0.9	
6/8/11 12:35:45	5.99	12.60	8.9	1.0	
6/8/11 12:36:00	5.98	12.60	9.2	1.0	
6/8/11 12:36:15	5.93	12.64	8.9	0.9	
6/8/11 12:36:30	5.93	12.64	8.2	0.9	
6/8/11 12:36:45	5.94	12.62	8.3	0.9	
6/8/11 12:37:00	6.01	12.57	8.7	0.9	
6/8/11 12:37:15	6.06	12.53	8.6	0.9	
6/8/11 12:37:30	6.06	12.53	8.0	0.9	
6/8/11 12:37:45	6.02	12.56	8.1	0.9	
6/8/11 12:38:00	5.96	12.59	8.7	0.9	
6/8/11 12:38:15	5.89	12.66	8.8	1.0	
6/8/11 12:38:30	5.82	12.72	8.2	1.0	
6/8/11 12:38:45	5.82	12.72	8.0	1.0	
6/8/11 12:39:00	5.79	12.75	8.6	1.0	
6/8/11 12:39:15	5.73	12.79	8.7	1.0	
6/8/11 12:39:30	5.66	12.86	8.1	1.0	
6/8/11 12:39:45	5.59	12.91	8.0	1.0	
6/8/11 12:40:00	5.63	12.88	8.7	1.0	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 12:40:15	5.71	12.83	8.8	1.0	
6/8/11 12:40:30	5.77	12.78	8.3	1.0	
6/8/11 12:40:45	5.78	12.77	8.0	1.0	
6/8/11 12:41:00	5.73	12.79	8.3	1.0	
6/8/11 12:41:15	5.70	12.82	8.8	1.0	
6/8/11 12:41:30	5.72	12.80	8.6	1.0	
6/8/11 12:41:45	5.79	12.75	8.2	1.0	
6/8/11 12:42:00	5.83	12.73	8.6	1.0	
6/8/11 12:42:15	5.83	12.72	9.0	1.0	
6/8/11 12:42:30	5.86	12.70	9.0	1.0	
6/8/11 12:42:45	5.86	12.71	8.4	1.0	
6/8/11 12:43:00	5.84	12.71	8.4	1.0	
6/8/11 12:43:15	5.81	12.74	9.1	1.0	
6/8/11 12:43:30	5.82	12.74	9.2	1.0	
6/8/11 12:43:45	5.87	12.69	8.7	1.0	
6/8/11 12:44:00	5.95	12.63	8.5	1.0	
6/8/11 12:44:15	6.02	12.58	8.9	1.0	
6/8/11 12:44:30	5.97	12.62	8.9	1.0	
6/8/11 12:44:45	5.87	12.69	8.3	1.0	
6/8/11 12:45:00	5.82	12.73	8.3	1.0	
6/8/11 12:45:15	5.76	12.79	8.8	1.0	
6/8/11 12:45:30	5.69	12.83	9.0	1.0	
6/8/11 12:45:45	5.71	12.83	8.9	1.0	
6/8/11 12:46:00	5.75	12.80	8.5	1.1	
6/8/11 12:46:15	5.78	12.77	8.8	1.0	
6/8/11 12:46:30	5.80	12.75	9.0	1.0	
6/8/11 12:46:45	5.80	12.74	8.6	1.0	
6/8/11 12:47:00	5.82	12.72	8.1	1.0	
6/8/11 12:47:15	5.88	12.68	8.4	1.0	
6/8/11 12:47:30	5.86	12.70	8.7	1.0	
6/8/11 12:47:45	5.79	12.75	8.6	1.0	
6/8/11 12:48:00	5.75	12.77	8.1	1.0	
6/8/11 12:48:15	5.77	12.76	8.0	1.0	
6/8/11 12:48:30	5.81	12.73	8.5	1.0	
6/8/11 12:48:45	5.85	12.70	8.8	1.0	
6/8/11 12:49:00	5.85	12.70	8.4	1.0	
6/8/11 12:49:15	5.78	12.76	8.2	1.0	
6/8/11 12:49:30	5.70	12.82	8.5	1.0	
6/8/11 12:49:45	5.68	12.84	8.8	1.0	
6/8/11 12:50:00	5.72	12.81	8.4	1.0	
6/8/11 12:50:15	5.78	12.76	7.9	1.0	
6/8/11 12:50:30	5.75	12.79	8.2	1.1	
6/8/11 12:50:45	5.66	12.86	8.9	1.0	
6/8/11 12:51:00	5.59	12.91	9.1	1.0	
6/8/11 12:51:15	5.61	12.90	8.5	1.0	
6/8/11 12:51:30	5.69	12.85	8.6	1.0	
6/8/11 12:51:45	5.69	12.85	9.1	1.1	
6/8/11 12:52:00	5.66	12.87	9.1	1.1	
6/8/11 12:52:15	5.68	12.85	8.7	1.0	
6/8/11 12:52:30	5.77	12.78	8.8	1.0	
6/8/11 12:52:45	5.84	12.73	9.4	1.0	
6/8/11 12:53:00	5.81	12.75	9.6	1.0	End M308 Run 1
6/8/11 12:53:15	5.76	12.78	8.8	1.0	End M0010 Run 1
6/8/11 12:53:30	5.81	12.74	8.4	1.0	
6/8/11 12:53:45	5.87	12.69	8.8	1.0	
6/8/11 12:54:00	5.87	12.70	9.2	1.0	
6/8/11 12:54:15	5.87	12.69	8.7	1.0	
6/8/11 12:54:30	5.87	12.69	8.2	1.0	
6/8/11 12:54:45	5.84	12.71	8.5	1.0	
6/8/11 12:55:00	5.86	12.69	8.8	1.0	
6/8/11 12:55:15	5.83	12.72	8.4	1.0	
6/8/11 12:55:30	5.78	12.76	7.8	1.0	
6/8/11 12:55:45	5.79	12.74	8.2	1.0	
6/8/11 12:56:00	5.78	12.75	8.6	1.0	
6/8/11 12:56:15	5.72	12.80	8.5	1.0	
6/8/11 12:56:30	5.72	12.81	8.0	1.1	
6/8/11 12:56:45	5.79	12.76	8.1	1.1	
6/8/11 12:57:00	5.77	12.79	8.6	1.0	
6/8/11 12:57:15	5.68	12.85	8.7	1.0	
6/8/11 12:57:30	5.65	12.86	8.3	1.0	
6/8/11 12:57:45	5.67	12.85	8.2	1.0	
6/8/11 12:58:00	5.65	12.86	8.5	1.0	
6/8/11 12:58:15	5.67	12.85	9.0	1.0	
6/8/11 12:58:30	5.69	12.83	8.8	1.0	
6/8/11 12:58:45	5.71	12.82	8.5	1.0	
6/8/11 12:59:00	5.71	12.82	8.8	1.1	
6/8/11 12:59:15	5.76	12.78	9.2	1.1	
6/8/11 12:59:30	5.82	12.74	8.8	1.1	
6/8/11 12:59:45	5.83	12.74	8.1	1.1	
6/8/11 13:00:00	5.81	12.75	8.5	1.1	
6/8/11 13:00:15	5.83	12.72	9.1	1.1	
6/8/11 13:00:30	5.84	12.72	9.0	1.1	
6/8/11 13:00:45	5.74	12.80	8.3	1.1	
6/8/11 13:01:00	5.60	12.90	8.4	1.1	
6/8/11 13:01:15	5.58	12.92	9.0	1.1	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 13:01:30	5.68	12.85	9.0	1.1	
6/8/11 13:01:45	5.80	12.76	8.5	1.0	
6/8/11 13:02:00	5.86	12.71	8.3	1.0	
6/8/11 13:02:15	5.83	12.73	8.9	1.0	
6/8/11 13:02:30	5.78	12.76	9.2	13.4	
6/8/11 13:02:45	5.73	12.80	41.8	20.5	
6/8/11 13:03:00	6.60	11.50	91.9	1.6	
6/8/11 13:03:15	10.12	8.95	99.6	0.8	
6/8/11 13:03:30	11.42	8.96	99.6	0.5	
6/8/11 13:03:45	11.43	9.30	99.6	0.3	
6/8/11 13:04:00	11.46	9.84	99.6	0.1	
6/8/11 13:04:15	11.46	10.00	99.6	0.1	
6/8/11 13:04:30	11.45	10.02	99.6	0.0	
6/8/11 13:04:45	11.45	10.03	99.6	0.0	
6/8/11 13:05:00	11.45	10.03	99.6	0.0	
6/8/11 13:05:15	11.45	10.03	99.6	0.0	
6/8/11 13:05:30	11.45	10.03	99.6	0.0	
6/8/11 13:05:45	11.45	10.03	99.6	0.0	
6/8/11 13:06:00	11.45	10.03	99.6	0.0	
6/8/11 13:06:15	11.45	10.03	99.6	0.0	
6/8/11 13:06:30	11.45	10.03	99.6	0.0	
6/8/11 13:06:45	11.45	10.04	99.6	0.0	
6/8/11 13:07:00	11.45	10.03	99.6	0.0	
6/8/11 13:07:15	11.45	10.03	99.6	0.0	
6/8/11 13:07:30	11.45	10.04	99.6	0.0	
6/8/11 13:07:45	11.45	10.03	99.6	0.0	
6/8/11 13:08:00	11.45	10.04	99.6	0.0	
6/8/11 13:08:15	11.46	10.04	99.6	0.0	
6/8/11 13:08:30	11.45	10.04	99.6	0.0	
6/8/11 13:08:45	11.46	10.04	99.6	0.0	
6/8/11 13:09:00	11.45	10.04	99.6	0.0	
6/8/11 13:09:15	11.46	10.04	99.6	0.0	
6/8/11 13:09:30	11.46	10.04	99.6	0.0	
6/8/11 13:09:45	11.45	10.04	99.6	0.0	
6/8/11 13:10:00	11.46	10.03	99.6	0.0	
6/8/11 13:10:15	11.46	10.04	99.6	0.0	
6/8/11 13:10:30	11.46	10.04	99.6	0.0	
6/8/11 13:10:45	11.46	10.04	99.6	0.0	
6/8/11 13:11:00	11.46	10.03	99.6	0.0	
6/8/11 13:11:15	11.46	10.03	99.6	0.0	
6/8/11 13:11:30	11.46	10.04	99.6	0.0	
6/8/11 13:11:45	11.46	10.03	99.6	0.0	
6/8/11 13:12:00	11.46	10.03	99.6	0.0	
6/8/11 13:12:15	11.46	10.04	99.6	0.0	
6/8/11 13:12:30	11.46	10.04	99.6	0.0	
6/8/11 13:12:45	11.46	10.04	99.6	0.0	
6/8/11 13:13:00	11.46	10.03	99.6	0.0	
6/8/11 13:13:15	11.46	10.03	99.6	0.0	
6/8/11 13:13:30	11.46	10.04	99.6	0.0	
6/8/11 13:13:45	11.46	10.03	99.6	0.0	
6/8/11 13:14:00	11.46	10.04	99.6	0.0	
6/8/11 13:14:15	11.46	10.03	99.6	0.0	
6/8/11 13:14:30	11.46	10.04	99.6	0.0	
6/8/11 13:14:45	11.46	10.03	99.6	0.0	
6/8/11 13:15:00	11.46	10.03	99.6	0.0	
6/8/11 13:15:15	11.45	10.03	99.6	0.0	
6/8/11 13:15:30	11.45	10.03	99.6	0.0	
6/8/11 13:15:45	11.45	10.03	99.6	0.0	
6/8/11 13:16:00	11.45	10.03	99.6	0.0	
6/8/11 13:16:15	11.45	10.03	99.6	0.0	
6/8/11 13:16:30	11.46	10.03	99.6	0.0	
6/8/11 13:16:45	11.46	10.03	99.6	0.0	
6/8/11 13:17:00	11.46	10.03	99.6	0.0	
6/8/11 13:17:15	11.46	10.03	99.6	0.0	
6/8/11 13:17:30	11.45	10.03	99.6	0.0	
6/8/11 13:17:45	11.46	10.03	99.6	0.0	
6/8/11 13:18:00	11.46	10.03	99.6	0.0	
6/8/11 13:18:15	11.45	10.03	99.6	0.0	
6/8/11 13:18:30	11.46	10.03	99.6	0.0	
6/8/11 13:18:45	11.46	10.03	99.6	0.0	
6/8/11 13:19:00	11.46	10.03	99.6	0.0	
6/8/11 13:19:15	11.45	10.03	99.6	0.0	
6/8/11 13:19:30	11.45	10.03	99.6	0.0	
6/8/11 13:19:45	11.45	10.03	99.6	0.0	
6/8/11 13:20:00	11.45	10.03	99.6	0.0	
6/8/11 13:20:15	11.45	10.03	99.6	0.0	
6/8/11 13:20:30	11.45	10.03	99.6	0.0	
6/8/11 13:20:45	11.45	10.03	99.6	0.0	
6/8/11 13:21:00	11.45	10.03	99.6	0.0	
6/8/11 13:21:15	11.45	10.03	99.6	0.0	
6/8/11 13:21:30	11.45	10.03	99.6	0.0	
6/8/11 13:21:45	11.45	10.03	99.6	0.0	
6/8/11 13:22:00	11.45	10.03	99.6	0.0	
6/8/11 13:22:15	11.45	10.03	99.6	0.0	
6/8/11 13:22:30	11.45	10.03	99.6	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 13:22:45	11.45	10.03	99.6	0.0	
6/8/11 13:23:00	11.45	10.03	99.6	0.0	
6/8/11 13:23:15	11.45	10.03	99.6	0.0	
6/8/11 13:23:30	11.45	10.03	99.6	0.0	
6/8/11 13:23:45	11.45	10.03	99.6	0.0	
6/8/11 13:24:00	11.45	10.03	99.6	0.0	
6/8/11 13:24:15	11.45	10.03	99.6	0.0	
6/8/11 13:24:30	11.45	10.03	99.6	0.0	
6/8/11 13:24:45	11.45	10.03	99.6	0.0	
6/8/11 13:25:00	11.45	10.03	99.6	0.0	
6/8/11 13:25:15	11.45	10.03	99.6	0.0	
6/8/11 13:25:30	11.45	10.03	99.6	0.0	
6/8/11 13:25:45	11.45	10.03	99.6	0.0	
6/8/11 13:26:00	11.45	10.03	99.6	0.0	
6/8/11 13:26:15	11.45	10.03	99.6	0.0	
6/8/11 13:26:30	11.45	10.03	99.6	0.0	
6/8/11 13:26:45	11.45	10.03	99.6	0.0	
6/8/11 13:27:00	11.45	10.03	99.6	0.0	
6/8/11 13:27:15	11.45	10.03	99.6	0.0	
6/8/11 13:27:30	11.45	10.03	99.6	0.0	
6/8/11 13:27:45	11.45	10.03	99.6	0.0	
6/8/11 13:28:00	11.45	10.03	99.6	0.0	
6/8/11 13:28:15	11.45	10.03	99.6	0.0	
6/8/11 13:28:30	11.45	10.03	99.6	0.0	
6/8/11 13:28:45	11.45	10.03	99.6	0.0	
6/8/11 13:29:00	11.45	10.03	99.6	0.0	
6/8/11 13:29:15	11.45	10.03	99.6	0.0	
6/8/11 13:29:30	11.45	10.03	99.6	0.0	
6/8/11 13:29:45	11.45	10.03	99.6	0.0	
6/8/11 13:30:00	11.45	10.03	99.6	0.0	
6/8/11 13:30:15	11.45	10.03	99.6	0.0	
6/8/11 13:30:30	11.45	10.03	99.6	0.0	
6/8/11 13:30:45	11.45	10.03	99.6	0.0	
6/8/11 13:31:00	11.45	10.03	99.6	0.0	
6/8/11 13:31:15	11.45	10.03	99.6	0.0	
6/8/11 13:31:30	11.45	10.03	99.6	0.0	
6/8/11 13:31:45	11.45	10.03	99.6	0.0	System Bias
6/8/11 13:32:00	11.45	10.03	99.6	0.0	CO ₂ Bias 2 Mid = 10.03
6/8/11 13:32:15	11.45	10.03	99.6	0.0	
6/8/11 13:32:30	11.45	10.03	99.6	0.0	
6/8/11 13:32:45	11.45	10.03	99.6	0.0	
6/8/11 13:33:00	11.45	10.03	99.6	0.0	
6/8/11 13:33:15	11.45	10.03	99.6	0.0	
6/8/11 13:33:30	11.45	10.03	99.6	0.0	
6/8/11 13:33:45	11.45	10.03	99.6	0.0	
6/8/11 13:34:00	11.45	10.03	99.6	0.0	
6/8/11 13:34:15	11.45	10.03	99.6	0.0	
6/8/11 13:34:30	11.45	10.03	99.6	0.0	
6/8/11 13:34:45	11.45	10.03	99.6	0.8	
6/8/11 13:35:00	11.38	10.09	82.2	0.9	
6/8/11 13:35:15	9.47	11.21	61.7	0.3	
6/8/11 13:35:30	8.25	10.28	56.1	0.1	
6/8/11 13:35:45	6.86	6.62	50.6	0.0	
6/8/11 13:36:00	5.06	4.58	45.2	0.0	
6/8/11 13:36:15	4.66	4.23	42.9	0.0	System Bias
6/8/11 13:36:30	4.63	4.19	43.2	0.0	O ₂ Bias 2 Mid = 4.62
6/8/11 13:36:45	4.62	4.17	43.6	0.0	CO Bias 2 Mid = 43.3
6/8/11 13:37:00	4.62	4.16	43.6	0.0	C ₃ H ₈ Bias 2 Zero = 0.0
6/8/11 13:37:15	4.62	4.16	42.9	0.0	
6/8/11 13:37:30	4.62	4.15	43.0	0.0	
6/8/11 13:37:45	4.61	4.15	43.5	0.0	
6/8/11 13:38:00	4.61	4.15	43.4	0.1	
6/8/11 13:38:15	4.61	4.18	40.2	7.2	
6/8/11 13:38:30	4.76	5.83	32.8	65.4	
6/8/11 13:38:45	4.34	5.11	22.2	83.8	
6/8/11 13:39:00	1.95	1.86	11.1	51.6	
6/8/11 13:39:15	0.47	0.43	4.5	34.6	
6/8/11 13:39:30	0.20	0.22	2.9	32.0	
6/8/11 13:39:45	0.15	0.18	3.0	31.5	
6/8/11 13:40:00	0.14	0.16	3.4	31.4	
6/8/11 13:40:15	0.13	0.15	3.3	31.3	System Bias
6/8/11 13:40:30	0.12	0.14	2.8	30.7	C ₃ H ₈ Bias 2 Low = 30.6
6/8/11 13:40:45	0.12	0.13	2.7	30.6	O ₂ Bias 2 Zero = 0.12
6/8/11 13:41:00	0.12	0.13	3.1	30.6	CO ₂ Bias 2 Zero = 0.13
6/8/11 13:41:15	0.12	0.12	3.5	30.5	CO Bias 2 Zero = 3.0
6/8/11 13:41:30	0.11	0.12	2.9	30.3	
6/8/11 13:41:45	0.11	0.11	2.6	30.2	
6/8/11 13:42:00	0.11	0.11	2.9	30.0	
6/8/11 13:42:15	0.11	0.11	3.2	6.5	
6/8/11 13:42:30	0.27	0.94	3.3	1.0	
6/8/11 13:42:45	2.27	6.34	4.0	1.0	
6/8/11 13:43:00	4.29	10.24	6.1	1.0	
6/8/11 13:43:15	5.29	12.30	7.7	1.0	
6/8/11 13:43:30	5.49	12.81	8.2	1.1	
6/8/11 13:43:45	5.47	12.90	8.1	1.0	

Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 13:44:00	5.47	12.92	7.9	1.0	
6/8/11 13:44:15	5.55	12.88	8.2	1.1	
6/8/11 13:44:30	5.59	12.86	8.5	1.1	
6/8/11 13:44:45	5.53	12.92	8.2	1.1	
6/8/11 13:45:00	5.47	12.97	7.9	1.1	
6/8/11 13:45:15	5.52	12.93	8.1	1.0	
6/8/11 13:45:30	5.60	12.88	8.5	1.1	
6/8/11 13:45:45	5.63	12.86	8.5	1.1	
6/8/11 13:46:00	5.64	12.85	7.9	1.1	
6/8/11 13:46:15	5.61	12.88	7.8	1.0	
6/8/11 13:46:30	5.56	12.91	8.2	1.1	
6/8/11 13:46:45	5.51	12.96	8.4	1.1	
6/8/11 13:47:00	5.48	12.98	8.1	1.1	
6/8/11 13:47:15	5.51	12.97	8.0	1.1	
6/8/11 13:47:30	5.52	12.96	8.3	1.1	
6/8/11 13:47:45	5.56	12.94	8.5	1.0	
6/8/11 13:48:00	5.56	12.94	8.2	1.1	
6/8/11 13:48:15	5.64	12.86	7.8	1.1	
6/8/11 13:48:30	5.76	12.77	7.9	1.1	
6/8/11 13:48:45	5.83	12.72	8.4	1.1	
6/8/11 13:49:00	5.81	12.73	8.2	1.1	
6/8/11 13:49:15	5.80	12.75	7.7	1.0	
6/8/11 13:49:30	5.82	12.73	7.6	1.0	
6/8/11 13:49:45	5.84	12.70	8.0	1.0	
6/8/11 13:50:00	5.86	12.70	8.3	1.0	
6/8/11 13:50:15	5.83	12.72	8.2	1.1	
6/8/11 13:50:30	5.78	12.76	7.8	1.1	
6/8/11 13:50:45	5.72	12.81	8.1	1.1	
6/8/11 13:51:00	5.66	12.87	8.8	1.1	
6/8/11 13:51:15	5.56	12.95	9.1	1.1	
6/8/11 13:51:30	5.50	13.00	8.6	1.1	
6/8/11 13:51:45	5.48	13.02	8.3	1.1	
6/8/11 13:52:00	5.49	13.02	8.6	1.1	
6/8/11 13:52:15	5.49	13.01	8.9	1.1	
6/8/11 13:52:30	5.51	12.99	8.7	1.1	
6/8/11 13:52:45	5.59	12.92	8.2	1.1	
6/8/11 13:53:00	5.69	12.84	8.2	1.0	
6/8/11 13:53:15	5.73	12.81	8.4	1.1	
6/8/11 13:53:30	5.75	12.78	8.4	1.1	
6/8/11 13:53:45	5.79	12.75	7.8	1.1	
6/8/11 13:54:00	5.80	12.76	7.4	1.1	
6/8/11 13:54:15	5.76	12.77	7.7	1.1	
6/8/11 13:54:30	5.69	12.82	8.0	1.1	
6/8/11 13:54:45	5.64	12.87	7.9	1.0	
6/8/11 13:55:00	5.63	12.89	7.8	1.0	
6/8/11 13:55:15	5.61	12.90	8.0	1.1	
6/8/11 13:55:30	5.58	12.92	8.3	1.0	
6/8/11 13:55:45	5.52	12.98	8.2	1.1	
6/8/11 13:56:00	5.45	13.05	7.6	1.1	
6/8/11 13:56:15	5.43	13.07	7.6	1.1	
6/8/11 13:56:30	5.47	13.04	8.0	1.1	
6/8/11 13:56:45	5.49	13.01	8.4	1.1	
6/8/11 13:57:00	5.51	12.99	7.8	1.0	
6/8/11 13:57:15	5.59	12.92	7.2	1.1	
6/8/11 13:57:30	5.63	12.89	7.7	1.1	
6/8/11 13:57:45	5.59	12.92	8.0	1.1	
6/8/11 13:58:00	5.54	12.96	7.8	1.1	
6/8/11 13:58:15	5.53	12.96	7.3	1.1	
6/8/11 13:58:30	5.54	12.96	7.4	1.1	
6/8/11 13:58:45	5.47	13.03	7.8	1.1	
6/8/11 13:59:00	5.38	13.11	8.0	1.1	
6/8/11 13:59:15	5.37	13.11	7.5	1.1	
6/8/11 13:59:30	5.44	13.06	7.4	1.0	
6/8/11 13:59:45	5.47	13.03	8.0	1.1	
6/8/11 14:00:00	5.48	13.03	8.2	1.1	
6/8/11 14:00:15	5.40	13.10	8.0	1.1	
6/8/11 14:00:30	5.33	13.15	7.6	1.1	
6/8/11 14:00:45	5.32	13.18	8.0	1.1	
6/8/11 14:01:00	5.39	13.13	8.5	1.1	
6/8/11 14:01:15	5.46	13.06	8.6	1.1	
6/8/11 14:01:30	5.51	13.02	8.1	1.1	
6/8/11 14:01:45	5.53	13.00	8.0	1.1	
6/8/11 14:02:00	5.50	13.03	8.3	1.1	Begin M0010 Run 2
6/8/11 14:02:15	5.48	13.05	8.4	1.0	
6/8/11 14:02:30	5.53	13.00	7.9	1.1	
6/8/11 14:02:45	5.55	12.99	7.5	1.1	
6/8/11 14:03:00	5.51	13.01	7.7	1.0	
6/8/11 14:03:15	5.45	13.07	8.1	1.0	
6/8/11 14:03:30	5.39	13.12	8.1	1.1	
6/8/11 14:03:45	5.41	13.11	7.5	1.1	
6/8/11 14:04:00	5.46	13.07	7.5	1.1	
6/8/11 14:04:15	5.45	13.08	8.0	1.1	
6/8/11 14:04:30	5.43	13.09	8.0	1.1	
6/8/11 14:04:45	5.39	13.13	7.8	1.1	
6/8/11 14:05:00	5.36	13.15	7.3	1.1	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 14:05:15	5.37	13.15	7.6	1.1	
6/8/11 14:05:30	5.38	13.13	7.9	1.1	
6/8/11 14:05:45	5.39	13.13	7.8	1.1	
6/8/11 14:06:00	5.35	13.17	7.3	1.1	
6/8/11 14:06:15	5.31	13.20	7.4	1.1	
6/8/11 14:06:30	5.32	13.20	7.9	1.1	
6/8/11 14:06:45	5.32	13.20	8.1	1.1	
6/8/11 14:07:00	5.27	13.25	7.7	1.1	
6/8/11 14:07:15	5.21	13.30	7.5	1.1	
6/8/11 14:07:30	5.20	13.31	7.9	1.1	
6/8/11 14:07:45	5.24	13.28	8.4	1.1	
6/8/11 14:08:00	5.27	13.26	8.1	1.1	
6/8/11 14:08:15	5.34	13.19	7.5	1.1	
6/8/11 14:08:30	5.40	13.15	7.8	1.0	
6/8/11 14:08:45	5.33	13.24	8.1	1.0	
6/8/11 14:09:00	5.30	13.26	7.9	1.0	
6/8/11 14:09:15	5.35	13.22	7.1	1.0	
6/8/11 14:09:30	5.43	13.17	6.7	1.0	
6/8/11 14:09:45	5.47	13.13	7.0	1.0	
6/8/11 14:10:00	5.51	13.07	7.1	0.9	
6/8/11 14:10:15	5.49	13.09	6.8	0.9	
6/8/11 14:10:30	5.39	13.18	6.4	0.9	
6/8/11 14:10:45	5.30	13.27	6.6	0.9	
6/8/11 14:11:00	5.26	13.30	7.0	0.9	
6/8/11 14:11:15	5.28	13.29	7.0	0.9	
6/8/11 14:11:30	5.35	13.22	6.6	0.9	
6/8/11 14:11:45	5.41	13.16	6.4	0.9	
6/8/11 14:12:00	5.45	13.13	6.7	0.9	
6/8/11 14:12:15	5.46	13.11	6.9	0.9	
6/8/11 14:12:30	5.42	13.15	6.4	0.9	
6/8/11 14:12:45	5.41	13.16	6.0	0.9	
6/8/11 14:13:00	5.45	13.13	6.4	0.9	
6/8/11 14:13:15	5.44	13.15	6.8	0.9	
6/8/11 14:13:30	5.35	13.22	6.5	0.9	
6/8/11 14:13:45	5.27	13.30	5.8	0.9	
6/8/11 14:14:00	5.27	13.30	5.9	0.9	
6/8/11 14:14:15	5.29	13.29	6.5	0.9	
6/8/11 14:14:30	5.25	13.33	6.7	0.9	
6/8/11 14:14:45	5.17	13.40	6.2	0.9	
6/8/11 14:15:00	5.17	13.39	6.1	0.9	
6/8/11 14:15:15	5.24	13.34	6.5	1.0	
6/8/11 14:15:30	5.29	13.30	6.7	0.9	
6/8/11 14:15:45	5.30	13.28	6.7	0.9	
6/8/11 14:16:00	5.35	13.22	6.4	1.0	
6/8/11 14:16:15	5.44	13.14	6.6	1.0	
6/8/11 14:16:30	5.43	13.15	6.9	1.0	
6/8/11 14:16:45	5.42	13.15	7.0	1.0	
6/8/11 14:17:00	5.49	13.08	6.4	1.0	
6/8/11 14:17:15	5.51	13.06	6.3	1.0	
6/8/11 14:17:30	5.45	13.12	6.6	0.9	
6/8/11 14:17:45	5.43	13.13	7.1	1.0	
6/8/11 14:18:00	5.43	13.13	6.9	0.9	
6/8/11 14:18:15	5.45	13.11	6.4	0.9	
6/8/11 14:18:30	5.50	13.07	6.5	0.9	
6/8/11 14:18:45	5.54	13.03	7.0	0.9	
6/8/11 14:19:00	5.48	13.10	7.0	0.9	
6/8/11 14:19:15	5.36	13.21	6.4	0.9	
6/8/11 14:19:30	5.34	13.23	6.3	0.9	
6/8/11 14:19:45	5.39	13.19	6.8	0.9	
6/8/11 14:20:00	5.43	13.15	6.8	0.9	
6/8/11 14:20:15	5.46	13.12	6.3	0.9	
6/8/11 14:20:30	5.51	13.07	6.1	0.9	
6/8/11 14:20:45	5.51	13.07	6.5	0.9	
6/8/11 14:21:00	5.44	13.13	6.7	0.9	
6/8/11 14:21:15	5.42	13.15	6.5	0.9	
6/8/11 14:21:30	5.45	13.12	5.8	1.0	
6/8/11 14:21:45	5.49	13.10	6.0	0.9	
6/8/11 14:22:00	5.45	13.14	6.7	0.9	
6/8/11 14:22:15	5.42	13.16	6.7	0.9	
6/8/11 14:22:30	5.40	13.17	5.9	0.9	
6/8/11 14:22:45	5.34	13.22	5.9	0.9	
6/8/11 14:23:00	5.35	13.22	6.3	0.9	
6/8/11 14:23:15	5.42	13.15	6.6	0.9	
6/8/11 14:23:30	5.44	13.13	6.3	1.0	
6/8/11 14:23:45	5.44	13.11	5.9	0.9	
6/8/11 14:24:00	5.51	13.04	5.8	0.9	
6/8/11 14:24:15	5.55	13.01	6.1	0.9	
6/8/11 14:24:30	5.54	13.02	6.2	0.9	
6/8/11 14:24:45	5.51	13.05	5.9	0.9	
6/8/11 14:25:00	5.49	13.06	5.5	0.9	
6/8/11 14:25:15	5.50	13.06	6.1	0.9	
6/8/11 14:25:30	5.49	13.07	6.6	0.9	
6/8/11 14:25:45	5.50	13.07	6.5	0.9	
6/8/11 14:26:00	5.52	13.06	6.1	0.9	
6/8/11 14:26:15	5.45	13.12	6.4	0.9	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 14:26:30	5.32	13.26	6.9	0.9	
6/8/11 14:26:45	5.25	13.32	6.9	0.9	
6/8/11 14:27:00	5.27	13.31	6.4	0.9	
6/8/11 14:27:15	5.28	13.29	6.3	0.9	
6/8/11 14:27:30	5.35	13.22	6.9	0.9	
6/8/11 14:27:45	5.45	13.13	6.9	0.9	
6/8/11 14:28:00	5.52	13.06	6.6	1.0	
6/8/11 14:28:15	5.57	13.01	6.3	1.0	
6/8/11 14:28:30	5.55	13.02	6.5	0.9	
6/8/11 14:28:45	5.53	13.04	6.7	0.9	
6/8/11 14:29:00	5.52	13.05	6.4	0.9	
6/8/11 14:29:15	5.56	13.00	5.8	0.8	
6/8/11 14:29:30	5.60	12.97	5.8	0.9	
6/8/11 14:29:45	5.61	12.97	6.2	0.9	
6/8/11 14:30:00	5.65	12.93	6.4	0.9	
6/8/11 14:30:15	5.64	12.94	6.1	0.9	
6/8/11 14:30:30	5.56	13.00	5.8	0.9	
6/8/11 14:30:45	5.46	13.10	5.9	0.9	
6/8/11 14:31:00	5.38	13.18	6.3	0.9	
6/8/11 14:31:15	5.30	13.26	6.1	0.9	
6/8/11 14:31:30	5.28	13.29	5.6	0.9	
6/8/11 14:31:45	5.30	13.27	5.7	0.9	
6/8/11 14:32:00	5.31	13.25	6.2	0.9	
6/8/11 14:32:15	5.37	13.19	6.3	0.9	
6/8/11 14:32:30	5.47	13.10	5.8	0.9	
6/8/11 14:32:45	5.48	13.10	5.6	0.8	
6/8/11 14:33:00	5.47	13.11	6.2	0.9	
6/8/11 14:33:15	5.53	13.05	6.5	0.8	
6/8/11 14:33:30	5.55	13.01	6.4	0.9	
6/8/11 14:33:45	5.50	13.06	6.1	0.8	
6/8/11 14:34:00	5.43	13.14	6.2	0.9	
6/8/11 14:34:15	5.39	13.17	6.6	0.9	Begin 0011 run 2
6/8/11 14:34:30	5.45	13.11	6.6	0.9	
6/8/11 14:34:45	5.54	13.03	6.3	0.9	
6/8/11 14:35:00	5.53	13.06	6.2	0.9	
6/8/11 14:35:15	5.47	13.11	6.6	0.8	
6/8/11 14:35:30	5.50	13.08	7.0	0.9	
6/8/11 14:35:45	5.52	13.06	6.6	0.8	
6/8/11 14:36:00	5.53	13.05	6.0	0.9	
6/8/11 14:36:15	5.56	13.02	6.2	0.9	
6/8/11 14:36:30	5.55	13.02	6.5	0.9	
6/8/11 14:36:45	5.53	13.04	6.5	0.8	
6/8/11 14:37:00	5.55	13.01	5.9	0.8	
6/8/11 14:37:15	5.59	12.97	5.9	0.8	
6/8/11 14:37:30	5.63	12.94	6.2	0.8	
6/8/11 14:37:45	5.59	12.98	6.4	0.8	
6/8/11 14:38:00	5.53	13.02	6.0	0.8	
6/8/11 14:38:15	5.46	13.09	5.6	0.8	
6/8/11 14:38:30	5.42	13.14	5.8	0.8	
6/8/11 14:38:45	5.39	13.17	6.0	0.9	
6/8/11 14:39:00	5.38	13.18	6.1	0.8	
6/8/11 14:39:15	5.41	13.15	5.6	0.8	
6/8/11 14:39:30	5.45	13.11	5.8	0.8	
6/8/11 14:39:45	5.47	13.09	6.2	0.8	
6/8/11 14:40:00	5.53	13.03	6.0	0.9	
6/8/11 14:40:15	5.57	13.00	5.7	0.8	
6/8/11 14:40:30	5.55	13.03	5.4	0.8	
6/8/11 14:40:45	5.49	13.07	5.8	0.8	
6/8/11 14:41:00	5.45	13.11	6.4	0.8	
6/8/11 14:41:15	5.41	13.15	6.3	0.9	
6/8/11 14:41:30	5.38	13.17	5.9	0.8	
6/8/11 14:41:45	5.42	13.14	6.2	0.9	
6/8/11 14:42:00	5.53	13.04	6.5	0.8	
6/8/11 14:42:15	5.58	12.99	6.6	0.9	
6/8/11 14:42:30	5.58	12.98	6.0	0.8	
6/8/11 14:42:45	5.55	13.01	6.1	0.8	
6/8/11 14:43:00	5.50	13.06	6.4	0.8	
6/8/11 14:43:15	5.46	13.11	6.6	0.9	
6/8/11 14:43:30	5.42	13.16	6.4	0.8	
6/8/11 14:43:45	5.41	13.16	6.0	0.8	
6/8/11 14:44:00	5.48	13.09	6.3	0.8	
6/8/11 14:44:15	5.57	12.99	6.6	0.8	
6/8/11 14:44:30	5.65	12.92	6.7	0.8	
6/8/11 14:44:45	5.69	12.89	6.1	0.9	
6/8/11 14:45:00	5.63	12.95	5.8	0.9	
6/8/11 14:45:15	5.48	13.09	6.2	0.8	
6/8/11 14:45:30	5.38	13.19	6.5	0.8	
6/8/11 14:45:45	5.34	13.22	6.1	0.8	
6/8/11 14:46:00	5.36	13.20	5.7	0.8	
6/8/11 14:46:15	5.42	13.15	5.9	0.9	
6/8/11 14:46:30	5.44	13.14	6.3	0.8	
6/8/11 14:46:45	5.43	13.14	6.3	0.8	
6/8/11 14:47:00	5.41	13.15	5.6	0.8	Begin M18 Run 2
6/8/11 14:47:15	5.39	13.17	5.6	0.8	
6/8/11 14:47:30	5.38	13.18	6.0	0.8	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 14:47:45	5.40	13.16	6.2	0.8	
6/8/11 14:48:00	5.40	13.16	5.8	0.8	
6/8/11 14:48:15	5.33	13.24	5.4	0.8	
6/8/11 14:48:30	5.33	13.23	5.7	0.8	
6/8/11 14:48:45	5.35	13.22	6.1	0.8	
6/8/11 14:49:00	5.32	13.24	5.9	0.8	M0011 Port Change
6/8/11 14:49:15	5.32	13.24	5.5	0.8	
6/8/11 14:49:30	5.33	13.23	5.7	0.8	
6/8/11 14:49:45	5.34	13.23	6.1	0.8	
6/8/11 14:50:00	5.31	13.26	6.2	0.8	
6/8/11 14:50:15	5.26	13.30	5.8	0.8	
6/8/11 14:50:30	5.30	13.27	5.5	0.8	
6/8/11 14:50:45	5.35	13.23	5.9	0.8	
6/8/11 14:51:00	5.38	13.20	6.3	0.8	
6/8/11 14:51:15	5.36	13.21	6.1	0.8	
6/8/11 14:51:30	5.30	13.27	5.5	0.8	
6/8/11 14:51:45	5.29	13.27	6.0	0.8	
6/8/11 14:52:00	5.36	13.21	6.5	0.8	
6/8/11 14:52:15	5.41	13.18	6.4	0.8	
6/8/11 14:52:30	5.35	13.22	5.9	0.8	
6/8/11 14:52:45	5.32	13.24	6.0	0.8	
6/8/11 14:53:00	5.34	13.23	6.4	0.8	
6/8/11 14:53:15	5.37	13.21	6.7	0.8	
6/8/11 14:53:30	5.37	13.20	6.2	0.8	
6/8/11 14:53:45	5.36	13.20	6.0	0.8	
6/8/11 14:54:00	5.37	13.18	6.5	0.9	
6/8/11 14:54:15	5.39	13.18	6.9	0.9	
6/8/11 14:54:30	5.39	13.19	6.7	0.8	
6/8/11 14:54:45	5.41	13.17	6.2	0.8	
6/8/11 14:55:00	5.50	13.07	6.2	0.8	
6/8/11 14:55:15	5.60	12.97	6.4	0.8	
6/8/11 14:55:30	5.63	12.93	6.4	0.8	
6/8/11 14:55:45	5.65	12.91	5.9	0.8	
6/8/11 14:56:00	5.64	12.92	5.6	0.8	
6/8/11 14:56:15	5.57	12.99	6.0	0.8	
6/8/11 14:56:30	5.52	13.03	6.1	0.8	
6/8/11 14:56:45	5.54	13.01	5.9	0.8	
6/8/11 14:57:00	5.54	13.02	5.3	0.7	
6/8/11 14:57:15	5.48	13.08	5.6	0.8	
6/8/11 14:57:30	5.43	13.13	6.1	0.8	
6/8/11 14:57:45	5.38	13.17	5.9	0.8	
6/8/11 14:58:00	5.34	13.22	5.3	0.8	
6/8/11 14:58:15	5.36	13.20	5.4	0.8	
6/8/11 14:58:30	5.46	13.10	5.9	0.8	
6/8/11 14:58:45	5.53	13.04	6.1	0.8	
6/8/11 14:59:00	5.50	13.05	5.3	0.8	
6/8/11 14:59:15	5.47	13.08	5.3	0.7	
6/8/11 14:59:30	5.42	13.13	5.9	0.8	
6/8/11 14:59:45	5.37	13.19	6.2	0.8	
6/8/11 15:00:00	5.30	13.25	6.0	0.8	
6/8/11 15:00:15	5.28	13.28	5.7	0.8	
6/8/11 15:00:30	5.26	13.31	6.1	0.8	
6/8/11 15:00:45	5.25	13.32	6.5	0.8	
6/8/11 15:01:00	5.29	13.29	6.5	0.8	
6/8/11 15:01:15	5.28	13.30	6.0	0.8	
6/8/11 15:01:30	5.30	13.28	5.8	0.8	
6/8/11 15:01:45	5.36	13.22	6.4	0.8	
6/8/11 15:02:00	5.35	13.23	6.7	0.8	M0010 Port Change
6/8/11 15:02:15	5.33	13.25	6.3	0.8	
6/8/11 15:02:30	5.33	13.26	5.7	0.8	
6/8/11 15:02:45	5.32	13.27	6.1	0.8	
6/8/11 15:03:00	5.27	13.31	6.3	0.8	
6/8/11 15:03:15	5.20	13.37	6.0	0.8	
6/8/11 15:03:30	5.18	13.38	5.3	0.8	
6/8/11 15:03:45	5.23	13.34	5.6	0.8	
6/8/11 15:04:00	5.34	13.23	6.0	0.8	
6/8/11 15:04:15	5.45	13.11	6.1	0.8	
6/8/11 15:04:30	5.52	13.02	5.6	0.7	
6/8/11 15:04:45	5.53	13.00	5.3	0.8	
6/8/11 15:05:00	5.56	12.99	5.7	0.7	
6/8/11 15:05:15	5.57	12.99	5.9	0.7	
6/8/11 15:05:30	5.57	12.99	5.6	0.8	
6/8/11 15:05:45	5.58	12.99	5.3	0.7	
6/8/11 15:06:00	5.55	13.02	5.3	0.8	
6/8/11 15:06:15	5.47	13.10	5.8	0.8	
6/8/11 15:06:30	5.39	13.18	5.9	0.8	
6/8/11 15:06:45	5.36	13.21	5.3	0.8	
6/8/11 15:07:00	5.36	13.20	5.2	0.8	
6/8/11 15:07:15	5.35	13.22	5.7	0.8	
6/8/11 15:07:30	5.31	13.26	6.0	0.8	
6/8/11 15:07:45	5.28	13.29	5.7	0.8	
6/8/11 15:08:00	5.28	13.28	5.3	0.8	
6/8/11 15:08:15	5.28	13.29	5.7	0.8	
6/8/11 15:08:30	5.30	13.26	6.2	0.8	
6/8/11 15:08:45	5.35	13.22	5.9	0.8	

**Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 15:09:00	5.31	13.25	5.6	0.8	
6/8/11 15:09:15	5.26	13.30	5.9	0.8	
6/8/11 15:09:30	5.28	13.28	6.4	0.8	
6/8/11 15:09:45	5.33	13.23	6.3	0.8	
6/8/11 15:10:00	5.42	13.15	5.8	0.8	
6/8/11 15:10:15	5.45	13.13	5.8	0.8	
6/8/11 15:10:30	5.38	13.20	6.1	0.8	
6/8/11 15:10:45	5.34	13.22	6.4	0.8	
6/8/11 15:11:00	5.38	13.19	5.9	0.8	
6/8/11 15:11:15	5.39	13.19	5.6	0.8	
6/8/11 15:11:30	5.38	13.18	5.8	0.8	
6/8/11 15:11:45	5.38	13.19	6.1	0.8	
6/8/11 15:12:00	5.34	13.21	5.8	0.8	Resume M0010
6/8/11 15:12:15	5.34	13.22	5.4	0.8	Resume M0011
6/8/11 15:12:30	5.34	13.23	5.7	0.8	
6/8/11 15:12:45	5.33	13.25	6.1	0.8	
6/8/11 15:13:00	5.34	13.24	6.1	0.8	
6/8/11 15:13:15	5.40	13.17	5.5	0.8	
6/8/11 15:13:30	5.43	13.13	5.3	0.8	
6/8/11 15:13:45	5.39	13.17	5.7	0.8	
6/8/11 15:14:00	5.34	13.21	6.0	0.8	
6/8/11 15:14:15	5.34	13.22	5.8	0.8	
6/8/11 15:14:30	5.34	13.22	5.2	0.8	
6/8/11 15:14:45	5.37	13.19	5.6	0.8	
6/8/11 15:15:00	5.36	13.22	5.9	0.8	
6/8/11 15:15:15	5.34	13.23	5.9	0.8	
6/8/11 15:15:30	5.37	13.20	5.3	0.8	
6/8/11 15:15:45	5.38	13.18	5.4	0.8	
6/8/11 15:16:00	5.44	13.12	5.8	0.7	
6/8/11 15:16:15	5.53	13.03	6.1	0.8	
6/8/11 15:16:30	5.56	13.01	5.5	0.8	
6/8/11 15:16:45	5.52	13.05	5.2	0.8	
6/8/11 15:17:00	5.51	13.05	5.7	0.8	
6/8/11 15:17:15	5.46	13.09	6.1	0.8	
6/8/11 15:17:30	5.43	13.12	5.8	0.8	
6/8/11 15:17:45	5.41	13.15	5.3	0.8	
6/8/11 15:18:00	5.35	13.21	5.7	0.8	
6/8/11 15:18:15	5.33	13.22	6.2	0.8	
6/8/11 15:18:30	5.41	13.15	6.2	0.8	
6/8/11 15:18:45	5.48	13.08	5.5	0.7	
6/8/11 15:19:00	5.54	13.02	5.3	0.8	
6/8/11 15:19:15	5.58	12.99	5.8	0.7	
6/8/11 15:19:30	5.56	13.00	6.0	0.7	
6/8/11 15:19:45	5.51	13.06	5.7	0.7	
6/8/11 15:20:00	5.49	13.08	5.3	0.7	
6/8/11 15:20:15	5.50	13.07	5.6	0.8	
6/8/11 15:20:30	5.52	13.04	6.2	0.8	
6/8/11 15:20:45	5.56	12.99	6.1	0.8	
6/8/11 15:21:00	5.56	13.00	5.3	0.8	
6/8/11 15:21:15	5.51	13.06	5.4	0.8	
6/8/11 15:21:30	5.42	13.15	5.9	0.8	
6/8/11 15:21:45	5.32	13.23	6.2	0.8	
6/8/11 15:22:00	5.32	13.23	5.5	0.8	
6/8/11 15:22:15	5.42	13.14	5.5	0.8	
6/8/11 15:22:30	5.44	13.13	5.9	0.8	
6/8/11 15:22:45	5.44	13.12	6.2	0.8	
6/8/11 15:23:00	5.48	13.08	5.8	0.8	
6/8/11 15:23:15	5.55	13.01	5.3	0.8	
6/8/11 15:23:30	5.53	13.03	5.5	0.8	
6/8/11 15:23:45	5.48	13.06	6.1	0.8	
6/8/11 15:24:00	5.53	13.01	5.7	0.8	
6/8/11 15:24:15	5.60	12.97	5.2	0.8	
6/8/11 15:24:30	5.53	13.04	5.4	0.8	
6/8/11 15:24:45	5.45	13.10	5.7	0.8	
6/8/11 15:25:00	5.43	13.12	5.9	0.8	
6/8/11 15:25:15	5.45	13.10	5.5	0.8	
6/8/11 15:25:30	5.47	13.09	5.2	0.8	
6/8/11 15:25:45	5.45	13.11	5.8	0.8	
6/8/11 15:26:00	5.44	13.12	6.2	0.7	
6/8/11 15:26:15	5.45	13.11	5.9	0.7	
6/8/11 15:26:30	5.45	13.10	5.4	0.7	
6/8/11 15:26:45	5.48	13.07	5.8	0.8	
6/8/11 15:27:00	5.49	13.07	6.2	0.7	M0011 Port Change
6/8/11 15:27:15	5.50	13.07	6.2	0.7	
6/8/11 15:27:30	5.45	13.11	5.5	0.7	
6/8/11 15:27:45	5.42	13.14	5.4	0.8	
6/8/11 15:28:00	5.41	13.15	5.7	0.7	
6/8/11 15:28:15	5.34	13.23	6.0	0.8	
6/8/11 15:28:30	5.28	13.28	5.5	0.7	
6/8/11 15:28:45	5.35	13.20	5.2	0.7	
6/8/11 15:29:00	5.45	13.11	5.5	0.7	
6/8/11 15:29:15	5.46	13.10	5.9	0.7	
6/8/11 15:29:30	5.45	13.10	5.6	0.7	
6/8/11 15:29:45	5.41	13.15	5.0	0.8	
6/8/11 15:30:00	5.31	13.25	5.4	0.8	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 15:30:15	5.24	13.31	5.8	0.8	
6/8/11 15:30:30	5.21	13.35	5.9	0.8	
6/8/11 15:30:45	5.18	13.37	5.3	0.8	
6/8/11 15:31:00	5.19	13.37	5.3	0.8	
6/8/11 15:31:15	5.17	13.39	5.8	0.8	
6/8/11 15:31:30	5.17	13.39	6.0	0.8	
6/8/11 15:31:45	5.17	13.39	5.4	0.8	
6/8/11 15:32:00	5.21	13.35	5.0	0.8	
6/8/11 15:32:15	5.22	13.35	5.6	0.8	
6/8/11 15:32:30	5.19	13.37	6.2	0.8	
6/8/11 15:32:45	5.22	13.34	6.3	0.8	
6/8/11 15:33:00	5.25	13.31	5.7	0.8	
6/8/11 15:33:15	5.31	13.26	5.9	0.8	
6/8/11 15:33:30	5.38	13.20	6.4	0.8	
6/8/11 15:33:45	5.43	13.15	6.6	0.8	
6/8/11 15:34:00	5.40	13.17	6.0	0.8	
6/8/11 15:34:15	5.38	13.18	5.7	0.8	
6/8/11 15:34:30	5.38	13.19	6.2	0.8	
6/8/11 15:34:45	5.42	13.13	6.5	0.8	
6/8/11 15:35:00	5.46	13.10	6.1	0.7	
6/8/11 15:35:15	5.47	13.09	5.4	0.7	
6/8/11 15:35:30	5.52	13.04	5.8	0.7	
6/8/11 15:35:45	5.56	13.00	6.2	0.7	
6/8/11 15:36:00	5.60	12.96	6.0	0.7	
6/8/11 15:36:15	5.57	13.01	5.4	0.7	
6/8/11 15:36:30	5.45	13.11	5.5	0.8	
6/8/11 15:36:45	5.36	13.19	6.1	0.7	
6/8/11 15:37:00	5.36	13.18	6.3	0.8	
6/8/11 15:37:15	5.42	13.14	5.7	0.7	
6/8/11 15:37:30	5.46	13.11	5.3	0.7	
6/8/11 15:37:45	5.47	13.09	5.5	0.7	
6/8/11 15:38:00	5.46	13.09	5.9	0.7	
6/8/11 15:38:15	5.41	13.14	5.8	0.7	
6/8/11 15:38:30	5.35	13.20	5.1	0.7	
6/8/11 15:38:45	5.38	13.17	5.4	0.7	
6/8/11 15:39:00	5.47	13.09	6.0	0.7	
6/8/11 15:39:15	5.45	13.12	5.8	0.7	
6/8/11 15:39:30	5.41	13.14	5.0	0.7	
6/8/11 15:39:45	5.48	13.07	4.8	0.7	
6/8/11 15:40:00	5.57	12.99	5.5	0.7	
6/8/11 15:40:15	5.64	12.91	5.8	0.7	
6/8/11 15:40:30	5.64	12.90	5.4	0.7	
6/8/11 15:40:45	5.59	12.95	5.1	0.7	
6/8/11 15:41:00	5.56	12.98	5.4	0.7	
6/8/11 15:41:15	5.54	13.00	5.9	0.7	
6/8/11 15:41:30	5.56	12.99	5.6	0.7	
6/8/11 15:41:45	5.63	12.93	5.0	0.7	
6/8/11 15:42:00	5.61	12.95	5.3	0.7	
6/8/11 15:42:15	5.52	13.04	5.7	0.7	
6/8/11 15:42:30	5.46	13.09	5.9	0.7	
6/8/11 15:42:45	5.53	13.01	5.4	0.7	
6/8/11 15:43:00	5.59	12.96	5.3	0.7	
6/8/11 15:43:15	5.55	13.00	5.8	0.7	
6/8/11 15:43:30	5.49	13.06	6.0	0.7	
6/8/11 15:43:45	5.44	13.12	5.8	0.7	
6/8/11 15:44:00	5.42	13.15	5.4	0.7	
6/8/11 15:44:15	5.44	13.12	5.8	0.7	
6/8/11 15:44:30	5.48	13.10	6.3	0.7	
6/8/11 15:44:45	5.52	13.06	6.2	0.7	
6/8/11 15:45:00	5.51	13.06	5.4	0.8	
6/8/11 15:45:15	5.47	13.10	5.9	0.8	
6/8/11 15:45:30	5.41	13.16	6.5	0.8	
6/8/11 15:45:45	5.32	13.24	6.5	0.8	
6/8/11 15:46:00	5.31	13.25	5.9	0.8	
6/8/11 15:46:15	5.35	13.22	5.8	0.7	
6/8/11 15:46:30	5.39	13.17	6.1	0.8	
6/8/11 15:46:45	5.48	13.10	6.2	0.8	
6/8/11 15:47:00	5.47	13.10	5.7	0.8	End M18 Run 2
6/8/11 15:47:15	5.41	13.15	5.3	0.8	
6/8/11 15:47:30	5.39	13.16	5.5	0.8	
6/8/11 15:47:45	5.39	13.16	6.0	0.8	
6/8/11 15:48:00	5.39	13.15	5.8	0.8	
6/8/11 15:48:15	5.40	13.15	5.2	0.7	
6/8/11 15:48:30	5.40	13.15	5.3	0.7	
6/8/11 15:48:45	5.41	13.15	5.7	0.7	
6/8/11 15:49:00	5.35	13.20	5.7	0.7	
6/8/11 15:49:15	5.31	13.24	5.3	0.8	
6/8/11 15:49:30	5.30	13.24	5.1	0.8	
6/8/11 15:49:45	5.32	13.22	5.6	0.7	
6/8/11 15:50:00	5.35	13.21	5.8	0.8	
6/8/11 15:50:15	5.32	13.25	5.7	0.8	
6/8/11 15:50:30	5.28	13.28	5.5	0.7	
6/8/11 15:50:45	5.28	13.27	5.6	0.7	
6/8/11 15:51:00	5.25	13.31	6.0	0.8	Resume M0011
6/8/11 15:51:15	5.19	13.36	6.0	0.8	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 15:51:30	5.11	13.44	5.6	0.8	
6/8/11 15:51:45	5.05	13.50	5.9	0.8	
6/8/11 15:52:00	5.07	13.49	6.4	0.8	
6/8/11 15:52:15	5.15	13.41	6.5	0.8	
6/8/11 15:52:30	5.21	13.36	6.0	0.8	
6/8/11 15:52:45	5.25	13.33	5.9	0.8	
6/8/11 15:53:00	5.35	13.23	6.3	0.8	
6/8/11 15:53:15	5.42	13.16	6.6	0.8	
6/8/11 15:53:30	5.41	13.16	6.1	0.7	
6/8/11 15:53:45	5.37	13.20	5.5	0.7	
6/8/11 15:54:00	5.32	13.24	5.9	0.8	
6/8/11 15:54:15	5.29	13.27	6.2	0.7	
6/8/11 15:54:30	5.27	13.30	6.0	0.7	
6/8/11 15:54:45	5.24	13.33	5.5	0.8	
6/8/11 15:55:00	5.22	13.35	5.5	0.8	
6/8/11 15:55:15	5.19	13.37	6.0	0.8	
6/8/11 15:55:30	5.17	13.39	6.2	0.7	
6/8/11 15:55:45	5.22	13.34	5.6	0.7	
6/8/11 15:56:00	5.29	13.27	5.3	0.7	
6/8/11 15:56:15	5.28	13.28	5.6	0.7	
6/8/11 15:56:30	5.22	13.35	6.0	0.7	
6/8/11 15:56:45	5.16	13.41	5.7	0.7	
6/8/11 15:57:00	5.15	13.42	5.4	0.7	
6/8/11 15:57:15	5.12	13.44	5.4	0.7	
6/8/11 15:57:30	5.08	13.47	6.0	0.8	
6/8/11 15:57:45	5.11	13.44	6.1	0.7	
6/8/11 15:58:00	5.15	13.41	5.5	0.8	
6/8/11 15:58:15	5.12	13.46	5.4	0.7	
6/8/11 15:58:30	5.09	13.48	6.0	0.8	
6/8/11 15:58:45	5.14	13.44	6.3	0.7	
6/8/11 15:59:00	5.16	13.42	5.8	0.7	
6/8/11 15:59:15	5.15	13.41	5.6	0.7	
6/8/11 15:59:30	5.21	13.35	5.9	0.8	
6/8/11 15:59:45	5.34	13.22	6.4	0.7	
6/8/11 16:00:00	5.43	13.14	6.1	0.7	
6/8/11 16:00:15	5.44	13.13	5.5	0.7	
6/8/11 16:00:30	5.41	13.16	5.8	0.8	
6/8/11 16:00:45	5.34	13.24	6.3	0.7	
6/8/11 16:01:00	5.23	13.34	6.3	0.7	
6/8/11 16:01:15	5.16	13.41	5.7	0.7	
6/8/11 16:01:30	5.15	13.42	5.7	0.7	
6/8/11 16:01:45	5.24	13.32	6.0	0.7	
6/8/11 16:02:00	5.37	13.20	6.3	0.7	
6/8/11 16:02:15	5.40	13.18	6.0	0.7	
6/8/11 16:02:30	5.39	13.17	5.3	0.7	
6/8/11 16:02:45	5.42	13.13	5.3	0.7	
6/8/11 16:03:00	5.49	13.08	6.1	0.7	
6/8/11 16:03:15	5.48	13.09	6.0	0.7	
6/8/11 16:03:30	5.42	13.13	5.1	0.7	
6/8/11 16:03:45	5.38	13.18	5.1	0.7	
6/8/11 16:04:00	5.34	13.22	5.6	0.7	
6/8/11 16:04:15	5.32	13.23	5.8	0.7	
6/8/11 16:04:30	5.32	13.23	5.2	0.7	
6/8/11 16:04:45	5.32	13.24	5.0	0.7	
6/8/11 16:05:00	5.27	13.29	5.4	0.7	
6/8/11 16:05:15	5.25	13.31	5.5	0.7	
6/8/11 16:05:30	5.27	13.29	5.4	0.7	
6/8/11 16:05:45	5.25	13.31	5.0	0.7	
6/8/11 16:06:00	5.23	13.32	5.3	0.7	
6/8/11 16:06:15	5.21	13.34	5.8	0.7	
6/8/11 16:06:30	5.22	13.33	6.0	0.7	
6/8/11 16:06:45	5.21	13.34	5.6	0.7	
6/8/11 16:07:00	5.20	13.35	5.7	0.7	
6/8/11 16:07:15	5.20	13.35	6.1	0.7	
6/8/11 16:07:30	5.22	13.35	6.5	0.7	
6/8/11 16:07:45	5.19	13.38	6.1	0.7	
6/8/11 16:08:00	5.17	13.41	5.8	0.7	
6/8/11 16:08:15	5.12	13.45	6.0	0.7	
6/8/11 16:08:30	5.10	13.47	6.4	0.7	
6/8/11 16:08:45	5.14	13.43	6.2	0.7	
6/8/11 16:09:00	5.27	13.31	5.6	0.7	
6/8/11 16:09:15	5.41	13.18	5.6	0.7	
6/8/11 16:09:30	5.48	13.11	6.2	0.7	
6/8/11 16:09:45	5.52	13.06	6.1	0.7	
6/8/11 16:10:00	5.53	13.03	5.4	0.6	
6/8/11 16:10:15	5.49	13.07	5.2	0.6	
6/8/11 16:10:30	5.43	13.13	5.7	0.6	
6/8/11 16:10:45	5.34	13.22	6.0	0.7	
6/8/11 16:11:00	5.23	13.33	5.5	0.7	
6/8/11 16:11:15	5.22	13.35	5.1	0.7	
6/8/11 16:11:30	5.22	13.34	5.5	0.7	
6/8/11 16:11:45	5.21	13.35	5.9	0.7	
6/8/11 16:12:00	5.23	13.34	5.7	0.7	
6/8/11 16:12:15	5.26	13.31	5.2	0.7	
6/8/11 16:12:30	5.23	13.34	5.3	0.7	

M0011 Port Change

M0010 Port Change

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 16:12:45	5.12	13.44	5.6	0.6	
6/8/11 16:13:00	5.11	13.45	5.7	0.7	
6/8/11 16:13:15	5.16	13.40	5.3	0.7	
6/8/11 16:13:30	5.20	13.36	5.2	0.7	
6/8/11 16:13:45	5.19	13.37	5.6	0.7	
6/8/11 16:14:00	5.25	13.32	6.0	0.7	
6/8/11 16:14:15	5.30	13.29	5.7	0.7	
6/8/11 16:14:30	5.24	13.34	5.3	0.7	
6/8/11 16:14:45	5.15	13.43	5.7	0.7	
6/8/11 16:15:00	5.11	13.46	6.1	0.7	
6/8/11 16:15:15	5.14	13.43	6.1	0.7	
6/8/11 16:15:30	5.14	13.44	5.4	0.7	
6/8/11 16:15:45	5.10	13.48	5.4	0.7	
6/8/11 16:16:00	5.14	13.44	5.9	0.7	
6/8/11 16:16:15	5.23	13.36	6.0	0.7	
6/8/11 16:16:30	5.34	13.23	5.5	0.7	
6/8/11 16:16:45	5.40	13.17	5.1	0.6	
6/8/11 16:17:00	5.41	13.15	5.5	0.6	
6/8/11 16:17:15	5.39	13.18	5.8	0.6	
6/8/11 16:17:30	5.35	13.22	5.7	0.6	
6/8/11 16:17:45	5.35	13.21	5.1	0.6	
6/8/11 16:18:00	5.32	13.25	5.1	0.6	
6/8/11 16:18:15	5.27	13.30	5.6	0.6	
6/8/11 16:18:30	5.23	13.34	5.7	0.6	
6/8/11 16:18:45	5.14	13.43	5.3	0.6	
6/8/11 16:19:00	5.04	13.52	5.0	0.6	Resume M0010
6/8/11 16:19:15	4.96	13.59	5.5	0.7	
6/8/11 16:19:30	4.95	13.60	5.9	0.7	
6/8/11 16:19:45	5.03	13.53	5.7	0.7	
6/8/11 16:20:00	5.09	13.48	5.2	0.7	
6/8/11 16:20:15	5.17	13.41	5.6	0.7	
6/8/11 16:20:30	5.17	13.41	6.1	0.6	
6/8/11 16:20:45	5.15	13.42	6.0	0.7	Resume M0011
6/8/11 16:21:00	5.18	13.39	5.4	0.7	
6/8/11 16:21:15	5.18	13.39	5.4	0.7	
6/8/11 16:21:30	5.12	13.46	5.8	0.7	
6/8/11 16:21:45	5.08	13.50	5.9	0.7	
6/8/11 16:22:00	5.11	13.47	5.5	0.7	
6/8/11 16:22:15	5.21	13.36	5.2	0.7	
6/8/11 16:22:30	5.31	13.27	5.6	0.6	
6/8/11 16:22:45	5.31	13.26	5.7	0.7	
6/8/11 16:23:00	5.31	13.25	5.2	0.7	
6/8/11 16:23:15	5.35	13.22	4.7	0.6	
6/8/11 16:23:30	5.33	13.23	5.2	0.6	
6/8/11 16:23:45	5.34	13.24	5.5	0.6	
6/8/11 16:24:00	5.38	13.20	5.4	0.6	
6/8/11 16:24:15	5.34	13.22	5.0	0.6	
6/8/11 16:24:30	5.24	13.30	5.1	0.6	
6/8/11 16:24:45	5.14	13.41	5.5	0.7	
6/8/11 16:25:00	5.06	13.49	5.9	0.7	
6/8/11 16:25:15	5.08	13.48	5.4	0.7	
6/8/11 16:25:30	5.12	13.45	5.0	0.6	
6/8/11 16:25:45	5.15	13.43	5.4	0.7	
6/8/11 16:26:00	5.13	13.45	5.7	0.6	
6/8/11 16:26:15	5.09	13.47	5.6	0.6	
6/8/11 16:26:30	5.16	13.40	5.2	0.6	
6/8/11 16:26:45	5.25	13.33	5.3	0.6	
6/8/11 16:27:00	5.22	13.35	5.9	0.7	
6/8/11 16:27:15	5.16	13.41	6.0	0.6	
6/8/11 16:27:30	5.15	13.43	5.5	0.6	
6/8/11 16:27:45	5.17	13.41	5.4	0.7	
6/8/11 16:28:00	5.20	13.38	5.8	0.7	
6/8/11 16:28:15	5.26	13.32	5.9	0.6	
6/8/11 16:28:30	5.28	13.31	5.5	0.6	
6/8/11 16:28:45	5.22	13.37	5.1	0.7	
6/8/11 16:29:00	5.14	13.44	5.4	0.6	
6/8/11 16:29:15	5.14	13.44	5.7	0.6	
6/8/11 16:29:30	5.18	13.39	5.5	0.6	
6/8/11 16:29:45	5.22	13.35	5.1	0.6	
6/8/11 16:30:00	5.19	13.39	5.2	0.6	
6/8/11 16:30:15	5.18	13.38	5.7	0.6	
6/8/11 16:30:30	5.26	13.30	5.7	0.6	
6/8/11 16:30:45	5.30	13.26	5.0	0.6	
6/8/11 16:31:00	5.26	13.31	4.8	0.6	
6/8/11 16:31:15	5.21	13.36	5.2	0.6	
6/8/11 16:31:30	5.17	13.38	5.6	0.6	
6/8/11 16:31:45	5.21	13.35	5.2	0.6	
6/8/11 16:32:00	5.28	13.30	4.8	0.6	
6/8/11 16:32:15	5.27	13.32	5.0	0.6	
6/8/11 16:32:30	5.23	13.36	5.5	0.6	
6/8/11 16:32:45	5.22	13.35	5.6	0.6	
6/8/11 16:33:00	5.25	13.32	4.8	0.6	
6/8/11 16:33:15	5.25	13.32	4.8	0.6	
6/8/11 16:33:30	5.26	13.30	5.5	0.6	
6/8/11 16:33:45	5.23	13.33	5.6	0.6	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 16:34:00	5.17	13.38	5.1	0.6	
6/8/11 16:34:15	5.17	13.39	4.9	0.6	
6/8/11 16:34:30	5.17	13.39	5.5	0.6	
6/8/11 16:34:45	5.15	13.43	5.8	0.6	
6/8/11 16:35:00	5.15	13.42	5.4	0.6	
6/8/11 16:35:15	5.24	13.32	5.1	0.6	
6/8/11 16:35:30	5.28	13.28	5.4	0.6	
6/8/11 16:35:45	5.23	13.33	5.7	0.6	
6/8/11 16:36:00	5.19	13.37	5.8	0.6	End M0011 Run 2
6/8/11 16:36:15	5.20	13.36	5.2	0.6	
6/8/11 16:36:30	5.23	13.33	5.2	0.6	
6/8/11 16:36:45	5.24	13.34	5.6	0.6	
6/8/11 16:37:00	5.21	13.38	5.9	0.6	
6/8/11 16:37:15	5.18	13.39	5.6	0.6	
6/8/11 16:37:30	5.24	13.33	5.1	0.6	
6/8/11 16:37:45	5.27	13.30	5.4	0.6	
6/8/11 16:38:00	5.28	13.30	5.8	0.6	
6/8/11 16:38:15	5.28	13.29	5.5	0.6	
6/8/11 16:38:30	5.30	13.27	5.0	0.6	
6/8/11 16:38:45	5.33	13.24	5.1	0.6	
6/8/11 16:39:00	5.38	13.19	5.6	0.6	
6/8/11 16:39:15	5.37	13.20	5.5	0.6	
6/8/11 16:39:30	5.29	13.28	4.9	0.6	
6/8/11 16:39:45	5.29	13.27	4.7	0.6	
6/8/11 16:40:00	5.30	13.26	5.2	0.6	
6/8/11 16:40:15	5.27	13.30	5.5	0.6	
6/8/11 16:40:30	5.26	13.29	5.2	0.6	
6/8/11 16:40:45	5.32	13.23	4.7	0.6	
6/8/11 16:41:00	5.32	13.25	5.0	0.6	
6/8/11 16:41:15	5.25	13.31	5.4	0.6	
6/8/11 16:41:30	5.18	13.38	5.4	0.6	
6/8/11 16:41:45	5.17	13.39	5.0	0.6	
6/8/11 16:42:00	5.17	13.40	5.0	0.6	
6/8/11 16:42:15	5.24	13.33	5.6	0.6	
6/8/11 16:42:30	5.31	13.26	5.8	0.6	
6/8/11 16:42:45	5.30	13.27	5.3	0.5	
6/8/11 16:43:00	5.26	13.30	4.9	0.6	
6/8/11 16:43:15	5.25	13.31	5.3	0.6	
6/8/11 16:43:30	5.29	13.27	5.8	0.6	
6/8/11 16:43:45	5.32	13.25	5.6	0.6	
6/8/11 16:44:00	5.29	13.29	4.9	0.6	
6/8/11 16:44:15	5.27	13.30	5.2	0.6	
6/8/11 16:44:30	5.31	13.25	5.6	0.6	
6/8/11 16:44:45	5.32	13.27	5.6	0.6	
6/8/11 16:45:00	5.26	13.31	5.2	0.6	
6/8/11 16:45:15	5.27	13.29	5.1	0.6	
6/8/11 16:45:30	5.34	13.23	5.4	0.6	
6/8/11 16:45:45	5.35	13.21	5.6	0.6	
6/8/11 16:46:00	5.34	13.22	5.2	0.6	
6/8/11 16:46:15	5.29	13.28	4.8	0.5	
6/8/11 16:46:30	5.24	13.32	5.1	0.6	
6/8/11 16:46:45	5.32	13.24	5.6	0.5	
6/8/11 16:47:00	5.38	13.20	5.4	0.5	
6/8/11 16:47:15	5.34	13.23	5.0	0.5	
6/8/11 16:47:30	5.31	13.26	5.2	0.6	
6/8/11 16:47:45	5.32	13.25	5.4	0.5	
6/8/11 16:48:00	5.34	13.22	5.3	0.6	
6/8/11 16:48:15	5.34	13.21	4.8	0.5	
6/8/11 16:48:30	5.35	13.20	4.8	0.5	
6/8/11 16:48:45	5.35	13.22	5.2	0.5	
6/8/11 16:49:00	5.31	13.26	5.3	0.5	
6/8/11 16:49:15	5.30	13.26	4.8	0.6	
6/8/11 16:49:30	5.27	13.30	4.6	0.5	
6/8/11 16:49:45	5.25	13.30	5.1	0.5	
6/8/11 16:50:00	5.29	13.26	5.6	0.5	
6/8/11 16:50:15	5.31	13.24	5.3	0.6	
6/8/11 16:50:30	5.32	13.24	4.6	0.6	
6/8/11 16:50:45	5.31	13.25	4.9	0.6	
6/8/11 16:51:00	5.27	13.28	5.4	0.6	
6/8/11 16:51:15	5.25	13.30	5.5	0.5	
6/8/11 16:51:30	5.23	13.32	5.1	0.6	
6/8/11 16:51:45	5.23	13.33	5.2	0.5	
6/8/11 16:52:00	5.24	13.31	5.7	0.6	
6/8/11 16:52:15	5.32	13.23	6.0	0.5	
6/8/11 16:52:30	5.35	13.22	5.7	0.6	
6/8/11 16:52:45	5.28	13.29	5.5	0.6	
6/8/11 16:53:00	5.28	13.29	5.8	0.6	
6/8/11 16:53:15	5.33	13.26	6.0	0.6	
6/8/11 16:53:30	5.33	13.26	5.6	0.6	
6/8/11 16:53:45	5.32	13.26	5.2	0.6	
6/8/11 16:54:00	5.32	13.25	5.5	0.6	
6/8/11 16:54:15	5.34	13.22	5.6	0.6	
6/8/11 16:54:30	5.38	13.19	5.6	0.6	
6/8/11 16:54:45	5.36	13.21	4.9	0.6	
6/8/11 16:55:00	5.39	13.17	4.9	0.5	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 16:55:15	5.52	13.03	5.4	0.5	
6/8/11 16:55:30	5.57	12.99	5.6	0.5	
6/8/11 16:55:45	5.54	13.01	4.9	0.5	
6/8/11 16:56:00	5.55	13.00	4.7	0.5	
6/8/11 16:56:15	5.54	13.02	5.0	0.5	
6/8/11 16:56:30	5.54	13.03	5.2	0.5	
6/8/11 16:56:45	5.56	13.01	4.9	0.5	
6/8/11 16:57:00	5.55	13.01	4.6	0.5	
6/8/11 16:57:15	5.49	13.06	4.8	0.5	
6/8/11 16:57:30	5.46	13.09	5.3	0.5	
6/8/11 16:57:45	5.39	13.17	5.0	0.5	
6/8/11 16:58:00	5.25	13.30	4.4	0.5	
6/8/11 16:58:15	5.08	13.47	4.7	0.6	
6/8/11 16:58:30	4.95	13.59	5.3	0.6	
6/8/11 16:58:45	4.91	13.63	5.6	0.6	
6/8/11 16:59:00	4.96	13.59	5.4	0.6	
6/8/11 16:59:15	4.98	13.58	5.3	0.6	
6/8/11 16:59:30	4.94	13.63	5.7	0.6	
6/8/11 16:59:45	4.93	13.64	5.9	0.6	
6/8/11 17:00:00	5.02	13.54	5.6	0.6	
6/8/11 17:00:15	5.14	13.42	5.3	0.6	
6/8/11 17:00:30	5.25	13.31	5.7	0.6	
6/8/11 17:00:45	5.36	13.20	6.0	0.6	
6/8/11 17:01:00	5.45	13.12	5.8	0.5	
6/8/11 17:01:15	5.43	13.15	5.2	0.6	
6/8/11 17:01:30	5.35	13.21	5.2	0.6	
6/8/11 17:01:45	5.33	13.24	5.7	0.6	Start M308 Run 2
6/8/11 17:02:00	5.32	13.24	5.8	0.5	
6/8/11 17:02:15	5.36	13.21	5.3	0.6	
6/8/11 17:02:30	5.41	13.16	5.1	0.6	
6/8/11 17:02:45	5.43	13.13	5.5	0.6	
6/8/11 17:03:00	5.40	13.16	5.8	0.6	
6/8/11 17:03:15	5.37	13.18	5.3	0.6	
6/8/11 17:03:30	5.34	13.23	4.8	0.6	
6/8/11 17:03:45	5.29	13.27	5.0	0.6	
6/8/11 17:04:00	5.26	13.32	5.4	0.6	
6/8/11 17:04:15	5.25	13.32	5.3	0.6	
6/8/11 17:04:30	5.25	13.32	4.6	0.6	
6/8/11 17:04:45	5.22	13.34	4.8	0.6	
6/8/11 17:05:00	5.18	13.38	5.2	0.6	
6/8/11 17:05:15	5.10	13.47	5.2	0.6	
6/8/11 17:05:30	5.03	13.52	5.0	0.6	
6/8/11 17:05:45	5.03	13.53	4.9	0.6	
6/8/11 17:06:00	5.04	13.52	5.3	0.6	
6/8/11 17:06:15	5.00	13.54	5.6	0.6	
6/8/11 17:06:30	5.04	13.51	5.4	0.6	
6/8/11 17:06:45	5.20	13.36	5.0	0.6	
6/8/11 17:07:00	5.29	13.27	5.2	0.6	
6/8/11 17:07:15	5.32	13.24	5.6	0.6	
6/8/11 17:07:30	5.34	13.22	5.5	0.6	
6/8/11 17:07:45	5.37	13.20	5.1	0.5	
6/8/11 17:08:00	5.32	13.25	5.2	0.6	
6/8/11 17:08:15	5.25	13.31	5.6	0.6	
6/8/11 17:08:30	5.26	13.30	5.7	0.6	
6/8/11 17:08:45	5.28	13.29	5.2	0.6	
6/8/11 17:09:00	5.25	13.32	5.1	0.6	
6/8/11 17:09:15	5.32	13.24	5.5	0.6	
6/8/11 17:09:30	5.41	13.16	5.8	0.6	
6/8/11 17:09:45	5.41	13.15	5.6	0.6	
6/8/11 17:10:00	5.44	13.13	5.3	0.6	
6/8/11 17:10:15	5.43	13.15	5.6	0.6	
6/8/11 17:10:30	5.34	13.23	6.0	0.6	
6/8/11 17:10:45	5.22	13.34	5.6	0.6	
6/8/11 17:11:00	5.19	13.37	5.0	0.6	
6/8/11 17:11:15	5.19	13.38	5.2	0.6	
6/8/11 17:11:30	5.20	13.38	5.7	0.6	
6/8/11 17:11:45	5.24	13.32	5.7	0.6	
6/8/11 17:12:00	5.30	13.27	5.1	0.6	
6/8/11 17:12:15	5.28	13.29	4.9	0.6	
6/8/11 17:12:30	5.24	13.31	5.4	0.6	
6/8/11 17:12:45	5.28	13.28	5.6	0.6	
6/8/11 17:13:00	5.28	13.28	5.1	0.6	
6/8/11 17:13:15	5.24	13.32	4.7	0.6	
6/8/11 17:13:30	5.20	13.36	5.1	0.6	
6/8/11 17:13:45	5.21	13.35	5.3	0.6	
6/8/11 17:14:00	5.33	13.24	5.2	0.6	
6/8/11 17:14:15	5.35	13.21	4.7	0.6	
6/8/11 17:14:30	5.30	13.26	4.8	0.6	
6/8/11 17:14:45	5.32	13.24	5.2	0.6	
6/8/11 17:15:00	5.35	13.21	5.4	0.6	
6/8/11 17:15:15	5.32	13.23	5.0	0.6	
6/8/11 17:15:30	5.30	13.24	4.9	0.6	
6/8/11 17:15:45	5.34	13.22	5.3	0.6	
6/8/11 17:16:00	5.33	13.22	5.6	0.6	
6/8/11 17:16:15	5.31	13.25	5.2	0.6	

Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 17:16:30	5.25	13.31	5.0	0.6	
6/8/11 17:16:45	5.20	13.35	5.3	0.6	
6/8/11 17:17:00	5.23	13.33	5.6	0.6	
6/8/11 17:17:15	5.24	13.32	5.4	0.6	
6/8/11 17:17:30	5.23	13.33	4.9	0.6	
6/8/11 17:17:45	5.21	13.34	5.2	0.6	
6/8/11 17:18:00	5.23	13.33	5.8	0.6	
6/8/11 17:18:15	5.23	13.33	5.8	0.6	
6/8/11 17:18:30	5.27	13.29	5.2	0.6	
6/8/11 17:18:45	5.27	13.29	5.0	0.6	
6/8/11 17:19:00	5.23	13.33	5.4	0.6	M0010 Port Change
6/8/11 17:19:15	5.26	13.30	5.6	0.6	
6/8/11 17:19:30	5.25	13.31	5.3	0.6	
6/8/11 17:19:45	5.24	13.32	4.9	0.6	
6/8/11 17:20:00	5.28	13.28	5.2	0.6	
6/8/11 17:20:15	5.30	13.27	5.5	0.6	
6/8/11 17:20:30	5.28	13.27	5.3	0.6	
6/8/11 17:20:45	5.35	13.19	5.0	0.6	
6/8/11 17:21:00	5.48	13.09	5.2	0.6	
6/8/11 17:21:15	5.52	13.06	5.3	0.6	
6/8/11 17:21:30	5.48	13.09	5.3	0.6	
6/8/11 17:21:45	5.41	13.16	4.6	0.6	
6/8/11 17:22:00	5.32	13.24	4.6	0.6	
6/8/11 17:22:15	5.25	13.31	5.2	0.6	
6/8/11 17:22:30	5.25	13.31	5.4	0.6	
6/8/11 17:22:45	5.29	13.26	4.8	0.6	
6/8/11 17:23:00	5.38	13.17	4.5	0.6	
6/8/11 17:23:15	5.38	13.18	5.0	0.6	
6/8/11 17:23:30	5.36	13.20	5.4	0.5	
6/8/11 17:23:45	5.37	13.18	5.1	0.6	
6/8/11 17:24:00	5.38	13.16	4.6	0.6	
6/8/11 17:24:15	5.33	13.23	4.8	0.6	
6/8/11 17:24:30	5.24	13.31	5.3	0.6	
6/8/11 17:24:45	5.18	13.36	5.3	0.6	
6/8/11 17:25:00	5.18	13.37	4.7	0.6	
6/8/11 17:25:15	5.20	13.36	5.0	0.6	
6/8/11 17:25:30	5.21	13.35	5.4	0.6	
6/8/11 17:25:45	5.25	13.32	5.5	0.6	
6/8/11 17:26:00	5.32	13.24	5.3	0.6	
6/8/11 17:26:15	5.40	13.15	5.0	0.6	
6/8/11 17:26:30	5.42	13.13	5.3	0.6	
6/8/11 17:26:45	5.40	13.15	5.6	0.6	
6/8/11 17:27:00	5.40	13.15	5.4	0.6	
6/8/11 17:27:15	5.39	13.17	5.0	0.6	
6/8/11 17:27:30	5.33	13.22	5.2	0.6	
6/8/11 17:27:45	5.30	13.25	5.6	0.5	
6/8/11 17:28:00	5.33	13.22	5.3	0.5	
6/8/11 17:28:15	5.34	13.22	4.6	0.5	
6/8/11 17:28:30	5.34	13.21	4.9	0.6	
6/8/11 17:28:45	5.38	13.17	5.5	0.5	
6/8/11 17:29:00	5.38	13.18	5.6	0.6	
6/8/11 17:29:15	5.33	13.23	5.0	0.6	
6/8/11 17:29:30	5.28	13.27	5.0	0.6	
6/8/11 17:29:45	5.24	13.32	5.5	0.6	
6/8/11 17:30:00	5.21	13.35	5.7	0.6	
6/8/11 17:30:15	5.23	13.33	5.2	0.6	
6/8/11 17:30:30	5.29	13.27	4.9	0.6	
6/8/11 17:30:45	5.36	13.19	5.3	0.5	
6/8/11 17:31:00	5.38	13.18	5.6	0.5	
6/8/11 17:31:15	5.40	13.15	5.2	0.6	
6/8/11 17:31:30	5.43	13.13	4.8	0.6	
6/8/11 17:31:45	5.47	13.10	5.2	0.6	
6/8/11 17:32:00	5.50	13.06	5.6	0.6	
6/8/11 17:32:15	5.48	13.08	5.5	0.6	
6/8/11 17:32:30	5.39	13.18	5.0	0.6	
6/8/11 17:32:45	5.25	13.30	5.1	0.5	
6/8/11 17:33:00	5.25	13.29	5.5	0.6	
6/8/11 17:33:15	5.29	13.26	5.6	0.6	
6/8/11 17:33:30	5.31	13.24	5.1	0.6	
6/8/11 17:33:45	5.33	13.23	5.2	0.6	
6/8/11 17:34:00	5.33	13.24	5.6	0.6	
6/8/11 17:34:15	5.29	13.27	5.6	0.6	
6/8/11 17:34:30	5.24	13.32	5.3	0.6	
6/8/11 17:34:45	5.23	13.32	4.9	0.5	
6/8/11 17:35:00	5.26	13.29	5.2	0.5	
6/8/11 17:35:15	5.32	13.23	5.7	0.5	
6/8/11 17:35:30	5.33	13.22	5.5	0.5	
6/8/11 17:35:45	5.34	13.19	4.9	0.6	
6/8/11 17:36:00	5.40	13.13	5.1	0.5	
6/8/11 17:36:15	5.39	13.15	5.5	0.5	
6/8/11 17:36:30	5.32	13.23	5.5	0.5	
6/8/11 17:36:45	5.35	13.20	4.8	0.5	
6/8/11 17:37:00	5.43	13.14	4.7	0.5	
6/8/11 17:37:15	5.44	13.12	5.1	0.5	
6/8/11 17:37:30	5.40	13.15	5.2	0.5	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 17:37:45	5.35	13.20	5.0	0.5	
6/8/11 17:38:00	5.29	13.25	4.7	0.5	
6/8/11 17:38:15	5.25	13.29	5.0	0.6	
6/8/11 17:38:30	5.19	13.36	5.3	0.5	
6/8/11 17:38:45	5.08	13.46	5.3	0.5	
6/8/11 17:39:00	5.04	13.51	4.9	0.5	Resume M0010
6/8/11 17:39:15	5.09	13.47	4.8	0.5	
6/8/11 17:39:30	5.19	13.37	5.3	0.5	
6/8/11 17:39:45	5.26	13.30	5.4	0.5	
6/8/11 17:40:00	5.31	13.25	5.0	0.5	
6/8/11 17:40:15	5.28	13.28	4.8	0.6	
6/8/11 17:40:30	5.18	13.37	5.3	0.5	
6/8/11 17:40:45	5.13	13.42	5.5	0.5	
6/8/11 17:41:00	5.09	13.47	5.3	0.5	
6/8/11 17:41:15	5.07	13.49	5.0	0.5	
6/8/11 17:41:30	5.13	13.43	5.7	0.5	
6/8/11 17:41:45	5.22	13.34	6.1	0.5	
6/8/11 17:42:00	5.28	13.29	5.9	0.5	
6/8/11 17:42:15	5.27	13.30	5.3	0.6	
6/8/11 17:42:30	5.23	13.32	5.6	0.5	
6/8/11 17:42:45	5.22	13.34	6.1	0.5	
6/8/11 17:43:00	5.26	13.30	6.2	0.5	
6/8/11 17:43:15	5.34	13.22	5.5	0.5	
6/8/11 17:43:30	5.38	13.19	5.2	0.5	
6/8/11 17:43:45	5.33	13.24	5.5	0.5	
6/8/11 17:44:00	5.30	13.25	5.7	0.5	
6/8/11 17:44:15	5.36	13.19	5.2	0.5	
6/8/11 17:44:30	5.34	13.23	5.0	0.5	
6/8/11 17:44:45	5.31	13.24	5.3	0.5	
6/8/11 17:45:00	5.41	13.14	5.6	0.5	
6/8/11 17:45:15	5.47	13.08	5.1	0.5	
6/8/11 17:45:30	5.52	13.03	4.8	0.5	
6/8/11 17:45:45	5.52	13.04	5.0	0.5	
6/8/11 17:46:00	5.45	13.10	5.4	0.5	
6/8/11 17:46:15	5.40	13.15	5.3	0.4	
6/8/11 17:46:30	5.36	13.19	4.6	0.5	
6/8/11 17:46:45	5.32	13.24	4.7	0.5	
6/8/11 17:47:00	5.24	13.32	5.2	0.5	
6/8/11 17:47:15	5.16	13.39	5.2	0.5	
6/8/11 17:47:30	5.14	13.41	4.8	0.5	
6/8/11 17:47:45	5.12	13.43	4.7	0.5	
6/8/11 17:48:00	5.10	13.44	5.0	0.5	
6/8/11 17:48:15	5.10	13.45	5.3	0.5	
6/8/11 17:48:30	5.14	13.40	5.0	0.5	
6/8/11 17:48:45	5.22	13.32	4.6	0.5	
6/8/11 17:49:00	5.27	13.28	4.9	0.5	
6/8/11 17:49:15	5.29	13.27	5.2	0.5	
6/8/11 17:49:30	5.27	13.28	5.1	0.5	
6/8/11 17:49:45	5.21	13.35	5.0	0.5	
6/8/11 17:50:00	5.18	13.37	5.1	0.5	
6/8/11 17:50:15	5.23	13.33	5.8	0.5	
6/8/11 17:50:30	5.29	13.27	5.8	0.5	
6/8/11 17:50:45	5.35	13.21	5.0	0.5	
6/8/11 17:51:00	5.43	13.13	5.2	0.4	
6/8/11 17:51:15	5.46	13.11	5.6	0.5	
6/8/11 17:51:30	5.46	13.11	5.7	0.5	
6/8/11 17:51:45	5.46	13.11	5.1	0.4	
6/8/11 17:52:00	5.46	13.11	4.8	0.5	
6/8/11 17:52:15	5.42	13.16	5.1	0.5	
6/8/11 17:52:30	5.33	13.22	5.4	0.5	
6/8/11 17:52:45	5.31	13.23	5.0	0.5	
6/8/11 17:53:00	5.30	13.26	4.7	0.4	
6/8/11 17:53:15	5.22	13.33	5.1	0.5	
6/8/11 17:53:30	5.18	13.36	5.4	0.4	
6/8/11 17:53:45	5.20	13.35	5.1	0.4	
6/8/11 17:54:00	5.21	13.34	4.7	0.4	
6/8/11 17:54:15	5.24	13.32	5.0	0.4	
6/8/11 17:54:30	5.25	13.30	5.4	0.5	
6/8/11 17:54:45	5.27	13.28	5.3	0.4	
6/8/11 17:55:00	5.30	13.25	4.8	0.5	
6/8/11 17:55:15	5.30	13.25	5.0	0.5	
6/8/11 17:55:30	5.30	13.25	5.3	0.5	
6/8/11 17:55:45	5.26	13.30	5.3	0.4	
6/8/11 17:56:00	5.21	13.34	5.0	0.4	
6/8/11 17:56:15	5.21	13.34	5.0	0.4	
6/8/11 17:56:30	5.26	13.30	5.4	0.4	
6/8/11 17:56:45	5.28	13.28	5.7	0.5	
6/8/11 17:57:00	5.26	13.30	5.3	0.4	
6/8/11 17:57:15	5.27	13.28	4.9	0.5	
6/8/11 17:57:30	5.33	13.23	5.3	0.5	
6/8/11 17:57:45	5.34	13.22	5.9	0.5	
6/8/11 17:58:00	5.31	13.25	5.6	0.5	
6/8/11 17:58:15	5.33	13.23	4.9	0.5	
6/8/11 17:58:30	5.35	13.21	5.1	0.4	
6/8/11 17:58:45	5.31	13.25	5.5	0.5	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 17:59:00	5.25	13.32	5.6	0.5	
6/8/11 17:59:15	5.22	13.34	5.1	0.5	
6/8/11 17:59:30	5.22	13.34	5.2	0.5	
6/8/11 17:59:45	5.24	13.33	5.7	0.5	
6/8/11 18:00:00	5.22	13.34	5.7	0.5	
6/8/11 18:00:15	5.18	13.37	5.2	0.4	
6/8/11 18:00:30	5.20	13.34	5.0	0.4	
6/8/11 18:00:45	5.31	13.25	5.5	0.5	
6/8/11 18:01:00	5.43	13.13	5.7	0.5	
6/8/11 18:01:15	5.52	13.05	5.0	0.4	
6/8/11 18:01:30	5.48	13.08	4.8	0.4	
6/8/11 18:01:45	5.40	13.15	5.3	0.4	
6/8/11 18:02:00	5.36	13.19	5.6	0.5	End M308 Run 2
6/8/11 18:02:15	5.35	13.20	5.1	0.4	
6/8/11 18:02:30	5.29	13.26	4.6	0.5	
6/8/11 18:02:45	5.26	13.28	4.9	0.5	
6/8/11 18:03:00	5.27	13.28	5.3	0.4	
6/8/11 18:03:15	5.27	13.27	5.1	0.4	
6/8/11 18:03:30	5.26	13.28	4.6	0.4	
6/8/11 18:03:45	5.26	13.28	4.7	0.4	
6/8/11 18:04:00	5.28	13.27	5.2	0.4	
6/8/11 18:04:15	5.30	13.25	5.2	0.4	
6/8/11 18:04:30	5.33	13.22	4.7	0.5	
6/8/11 18:04:45	5.33	13.23	4.8	0.4	
6/8/11 18:05:00	5.33	13.22	5.2	0.4	
6/8/11 18:05:15	5.35	13.21	5.3	0.4	
6/8/11 18:05:30	5.34	13.22	5.1	0.4	
6/8/11 18:05:45	5.29	13.26	4.9	0.4	
6/8/11 18:06:00	5.27	13.28	5.3	0.4	
6/8/11 18:06:15	5.24	13.31	5.6	0.5	
6/8/11 18:06:30	5.26	13.29	5.3	0.4	
6/8/11 18:06:45	5.30	13.27	5.1	0.5	
6/8/11 18:07:00	5.34	13.22	5.6	0.5	
6/8/11 18:07:15	5.35	13.23	5.9	0.5	
6/8/11 18:07:30	5.34	13.22	5.6	0.5	
6/8/11 18:07:45	5.40	13.15	5.0	0.5	
6/8/11 18:08:00	5.45	13.10	5.3	0.5	
6/8/11 18:08:15	5.47	13.07	5.7	0.4	
6/8/11 18:08:30	5.48	13.07	5.5	0.4	
6/8/11 18:08:45	5.44	13.11	4.9	0.4	
6/8/11 18:09:00	5.39	13.16	5.1	0.4	
6/8/11 18:09:15	5.33	13.22	5.7	0.4	
6/8/11 18:09:30	5.29	13.26	5.9	0.4	
6/8/11 18:09:45	5.29	13.24	5.0	0.5	
6/8/11 18:10:00	5.40	13.15	4.9	0.4	
6/8/11 18:10:15	5.45	13.11	5.3	0.4	
6/8/11 18:10:30	5.46	13.09	5.7	0.4	
6/8/11 18:10:45	5.41	13.15	5.1	0.4	
6/8/11 18:11:00	5.30	13.25	4.8	0.4	
6/8/11 18:11:15	5.27	13.27	5.3	0.4	
6/8/11 18:11:30	5.30	13.25	5.6	0.4	
6/8/11 18:11:45	5.27	13.28	4.9	0.4	
6/8/11 18:12:00	5.23	13.31	4.4	0.4	
6/8/11 18:12:15	5.19	13.36	4.9	0.4	
6/8/11 18:12:30	5.12	13.43	5.2	0.4	
6/8/11 18:12:45	5.14	13.41	5.0	0.4	
6/8/11 18:13:00	5.24	13.31	4.5	0.4	
6/8/11 18:13:15	5.29	13.26	4.7	0.4	
6/8/11 18:13:30	5.31	13.25	5.3	0.4	
6/8/11 18:13:45	5.29	13.27	5.3	0.4	
6/8/11 18:14:00	5.24	13.31	4.9	0.4	
6/8/11 18:14:15	5.24	13.32	5.1	0.4	
6/8/11 18:14:30	5.26	13.30	5.5	0.4	
6/8/11 18:14:45	5.28	13.28	5.8	0.4	
6/8/11 18:15:00	5.28	13.28	5.2	0.4	
6/8/11 18:15:15	5.23	13.33	4.9	0.4	
6/8/11 18:15:30	5.22	13.33	5.4	0.4	
6/8/11 18:15:45	5.16	13.40	5.8	0.4	
6/8/11 18:16:00	5.08	13.47	5.3	0.4	
6/8/11 18:16:15	5.07	13.48	4.9	0.4	
6/8/11 18:16:30	5.13	13.42	5.4	0.4	
6/8/11 18:16:45	5.20	13.37	5.9	0.4	
6/8/11 18:17:00	5.30	13.27	5.5	0.4	
6/8/11 18:17:15	5.46	13.11	5.1	0.4	
6/8/11 18:17:30	5.58	12.98	5.4	0.4	
6/8/11 18:17:45	5.55	13.02	5.9	0.4	
6/8/11 18:18:00	5.47	13.08	5.6	0.4	
6/8/11 18:18:15	5.46	13.09	5.0	0.4	
6/8/11 18:18:30	5.41	13.15	5.2	0.4	
6/8/11 18:18:45	5.30	13.25	5.6	0.4	
6/8/11 18:19:00	5.34	13.21	5.5	0.4	
6/8/11 18:19:15	5.40	13.15	4.9	0.4	
6/8/11 18:19:30	5.40	13.17	4.9	0.3	
6/8/11 18:19:45	5.35	13.21	5.4	0.4	
6/8/11 18:20:00	5.32	13.23	5.4	0.4	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 18:20:15	5.32	13.23	5.0	0.4	
6/8/11 18:20:30	5.33	13.23	4.9	0.4	
6/8/11 18:20:45	5.32	13.23	5.5	0.4	
6/8/11 18:21:00	5.29	13.26	5.6	0.4	
6/8/11 18:21:15	5.28	13.27	5.1	0.4	
6/8/11 18:21:30	5.27	13.28	4.7	0.4	
6/8/11 18:21:45	5.22	13.32	5.1	0.4	
6/8/11 18:22:00	5.19	13.35	5.5	0.4	
6/8/11 18:22:15	5.18	13.37	5.2	0.4	
6/8/11 18:22:30	5.20	13.37	4.9	0.4	
6/8/11 18:22:45	5.19	13.37	5.2	0.4	
6/8/11 18:23:00	5.19	13.36	5.6	0.3	
6/8/11 18:23:15	5.19	13.36	5.6	0.3	
6/8/11 18:23:30	5.19	13.35	5.0	0.4	
6/8/11 18:23:45	5.20	13.35	5.1	0.4	
6/8/11 18:24:00	5.21	13.35	5.8	0.4	
6/8/11 18:24:15	5.19	13.37	5.9	0.4	
6/8/11 18:24:30	5.18	13.36	5.3	0.4	
6/8/11 18:24:45	5.21	13.34	5.3	0.4	
6/8/11 18:25:00	5.24	13.31	5.9	0.4	
6/8/11 18:25:15	5.32	13.24	6.1	0.4	
6/8/11 18:25:30	5.41	13.15	5.6	0.4	
6/8/11 18:25:45	5.47	13.09	5.2	0.4	
6/8/11 18:26:00	5.48	13.07	5.5	0.4	
6/8/11 18:26:15	5.50	13.06	5.9	0.4	
6/8/11 18:26:30	5.54	13.03	5.5	0.3	
6/8/11 18:26:45	5.57	12.99	4.9	0.3	
6/8/11 18:27:00	5.54	13.02	5.1	0.4	
6/8/11 18:27:15	5.49	13.06	5.6	0.4	
6/8/11 18:27:30	5.48	13.06	5.4	0.4	
6/8/11 18:27:45	5.48	13.08	4.7	0.3	
6/8/11 18:28:00	5.44	13.12	4.9	0.3	
6/8/11 18:28:15	5.40	13.15	5.3	0.4	
6/8/11 18:28:30	5.32	13.23	5.4	0.4	
6/8/11 18:28:45	5.16	13.38	4.9	0.3	
6/8/11 18:29:00	5.08	13.45	4.8	0.3	
6/8/11 18:29:15	5.14	13.40	5.3	0.4	
6/8/11 18:29:30	5.21	13.34	5.3	0.4	
6/8/11 18:29:45	5.22	13.32	4.9	0.4	
6/8/11 18:30:00	5.21	13.33	4.9	0.4	
6/8/11 18:30:15	5.23	13.31	5.5	0.4	
6/8/11 18:30:30	5.31	13.23	5.8	0.4	
6/8/11 18:30:45	5.31	13.25	5.3	0.3	
6/8/11 18:31:00	5.31	13.24	4.9	0.3	
6/8/11 18:31:15	5.38	13.17	5.2	0.4	
6/8/11 18:31:30	5.42	13.13	5.6	0.3	
6/8/11 18:31:45	5.42	13.12	5.4	0.4	
6/8/11 18:32:00	5.41	13.15	5.1	0.4	
6/8/11 18:32:15	5.34	13.21	5.3	0.4	
6/8/11 18:32:30	5.35	13.20	5.8	0.4	
6/8/11 18:32:45	5.38	13.18	5.7	0.4	
6/8/11 18:33:00	5.34	13.22	5.1	0.4	
6/8/11 18:33:15	5.31	13.25	5.3	0.4	
6/8/11 18:33:30	5.26	13.30	5.9	0.3	
6/8/11 18:33:45	5.24	13.31	5.9	0.4	
6/8/11 18:34:00	5.27	13.29	5.3	0.4	
6/8/11 18:34:15	5.24	13.34	5.2	0.4	
6/8/11 18:34:30	5.20	13.36	5.7	0.4	
6/8/11 18:34:45	5.27	13.27	5.9	0.3	
6/8/11 18:35:00	5.40	13.14	5.3	0.4	
6/8/11 18:35:15	5.43	13.11	5.1	0.4	
6/8/11 18:35:30	5.40	13.15	5.5	0.3	
6/8/11 18:35:45	5.30	13.25	5.7	0.4	
6/8/11 18:36:00	5.24	13.30	5.5	0.4	
6/8/11 18:36:15	5.24	13.31	5.0	0.4	
6/8/11 18:36:30	5.24	13.31	5.3	0.4	
6/8/11 18:36:45	5.29	13.26	5.7	0.4	
6/8/11 18:37:00	5.40	13.14	5.5	0.4	
6/8/11 18:37:15	5.48	13.07	5.1	0.4	
6/8/11 18:37:30	5.49	13.06	5.1	0.3	
6/8/11 18:37:45	5.44	13.11	5.4	0.4	
6/8/11 18:38:00	5.35	13.20	5.4	0.4	
6/8/11 18:38:15	5.25	13.28	4.7	0.4	
6/8/11 18:38:30	5.21	13.33	4.7	0.4	
6/8/11 18:38:45	5.16	13.37	5.4	0.4	
6/8/11 18:39:00	5.11	13.43	5.7	0.3	End M0010 Run 2
6/8/11 18:39:15	5.13	13.41	5.1	0.4	
6/8/11 18:39:30	5.17	13.39	5.0	0.4	
6/8/11 18:39:45	5.19	13.36	5.4	0.4	
6/8/11 18:40:00	5.17	13.39	5.8	0.4	
6/8/11 18:40:15	5.15	13.39	5.4	0.4	
6/8/11 18:40:30	5.21	13.34	5.2	0.4	
6/8/11 18:40:45	5.30	13.25	5.8	0.4	
6/8/11 18:41:00	5.37	13.19	6.0	0.4	
6/8/11 18:41:15	5.39	13.18	5.5	0.4	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 18:41:30	5.35	13.21	5.1	0.4	
6/8/11 18:41:45	5.25	13.30	5.6	0.4	
6/8/11 18:42:00	5.14	13.40	5.9	0.4	
6/8/11 18:42:15	5.13	13.41	5.9	0.4	
6/8/11 18:42:30	5.18	13.37	5.3	0.4	
6/8/11 18:42:45	5.18	13.38	5.5	0.4	
6/8/11 18:43:00	5.23	13.32	6.0	0.4	
6/8/11 18:43:15	5.32	13.24	6.0	0.4	
6/8/11 18:43:30	5.34	13.23	5.1	0.4	
6/8/11 18:43:45	5.30	13.26	5.1	0.4	
6/8/11 18:44:00	5.29	13.26	5.5	0.4	
6/8/11 18:44:15	5.31	13.25	5.8	0.4	
6/8/11 18:44:30	5.28	13.28	5.3	0.4	
6/8/11 18:44:45	5.22	13.33	4.8	0.4	
6/8/11 18:45:00	5.17	13.37	5.2	0.4	
6/8/11 18:45:15	5.17	13.39	5.5	0.4	
6/8/11 18:45:30	5.18	13.38	5.3	0.4	
6/8/11 18:45:45	5.20	13.36	4.7	0.4	
6/8/11 18:46:00	5.15	13.42	5.1	0.4	
6/8/11 18:46:15	5.02	13.54	5.3	0.4	
6/8/11 18:46:30	4.94	13.60	5.6	0.4	
6/8/11 18:46:45	5.02	13.52	5.2	0.4	
6/8/11 18:47:00	5.13	13.42	5.0	0.4	
6/8/11 18:47:15	5.16	13.40	5.7	0.4	
6/8/11 18:47:30	5.14	13.41	6.0	0.4	
6/8/11 18:47:45	5.13	13.43	5.4	0.4	
6/8/11 18:48:00	5.11	13.44	5.1	0.4	
6/8/11 18:48:15	5.13	13.43	5.7	0.4	
6/8/11 18:48:30	5.14	13.42	6.0	0.4	
6/8/11 18:48:45	5.15	13.41	5.5	0.4	
6/8/11 18:49:00	5.19	13.36	5.2	0.4	
6/8/11 18:49:15	5.25	13.32	5.6	0.4	
6/8/11 18:49:30	5.25	13.32	5.9	0.4	
6/8/11 18:49:45	5.27	13.30	5.8	0.4	
6/8/11 18:50:00	5.25	13.33	5.3	0.4	
6/8/11 18:50:15	5.16	13.41	5.5	0.4	
6/8/11 18:50:30	5.14	13.42	6.0	0.4	
6/8/11 18:50:45	5.21	13.35	6.0	0.4	
6/8/11 18:51:00	5.22	13.34	5.3	0.4	
6/8/11 18:51:15	5.16	13.41	5.2	0.4	
6/8/11 18:51:30	5.13	13.44	5.5	0.4	
6/8/11 18:51:45	5.16	13.40	5.9	0.4	
6/8/11 18:52:00	5.22	13.34	5.3	0.4	
6/8/11 18:52:15	5.28	13.28	4.9	0.4	
6/8/11 18:52:30	5.38	13.18	5.3	0.4	
6/8/11 18:52:45	5.39	13.17	5.8	0.4	
6/8/11 18:53:00	5.29	13.26	5.5	0.4	
6/8/11 18:53:15	5.20	13.34	5.0	0.4	
6/8/11 18:53:30	5.13	13.41	5.2	0.4	
6/8/11 18:53:45	5.03	13.51	5.8	0.4	
6/8/11 18:54:00	4.97	13.57	5.6	0.4	
6/8/11 18:54:15	5.02	13.53	5.0	0.4	
6/8/11 18:54:30	5.05	13.52	5.2	0.4	
6/8/11 18:54:45	5.03	13.53	5.6	0.4	
6/8/11 18:55:00	5.12	13.43	5.7	0.4	
6/8/11 18:55:15	5.29	13.26	5.3	0.4	
6/8/11 18:55:30	5.40	13.15	5.0	0.4	
6/8/11 18:55:45	5.45	13.12	5.3	0.4	
6/8/11 18:56:00	5.39	13.18	5.6	0.4	
6/8/11 18:56:15	5.33	13.23	5.3	0.4	
6/8/11 18:56:30	5.32	13.24	4.9	0.4	
6/8/11 18:56:45	5.31	13.26	5.2	0.4	
6/8/11 18:57:00	5.26	13.31	5.8	0.3	
6/8/11 18:57:15	5.25	13.32	5.6	0.4	
6/8/11 18:57:30	5.29	13.28	5.0	0.4	
6/8/11 18:57:45	5.29	13.28	5.0	0.3	
6/8/11 18:58:00	5.24	13.33	5.8	0.3	
6/8/11 18:58:15	5.19	13.37	5.9	0.3	
6/8/11 18:58:30	5.19	13.36	5.1	0.4	
6/8/11 18:58:45	5.21	13.34	5.1	0.4	
6/8/11 18:59:00	5.20	13.36	5.9	0.4	
6/8/11 18:59:15	5.11	13.46	6.3	0.4	
6/8/11 18:59:30	5.02	13.54	5.9	0.4	
6/8/11 18:59:45	4.97	13.59	5.5	0.4	
6/8/11 19:00:00	5.00	13.56	5.8	0.4	
6/8/11 19:00:15	5.11	13.47	6.1	0.4	
6/8/11 19:00:30	5.23	13.34	5.9	0.4	
6/8/11 19:00:45	5.25	13.32	5.2	0.4	
6/8/11 19:01:00	5.16	13.40	5.4	0.4	
6/8/11 19:01:15	5.13	13.42	6.0	0.4	
6/8/11 19:01:30	5.17	13.39	5.9	0.4	
6/8/11 19:01:45	5.18	13.39	5.3	0.4	
6/8/11 19:02:00	5.19	13.38	5.2	0.4	
6/8/11 19:02:15	5.25	13.32	5.7	0.4	
6/8/11 19:02:30	5.32	13.25	6.0	0.4	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/8/11 19:02:45	5.30	13.27	5.4	0.4	
6/8/11 19:03:00	5.26	13.31	5.0	0.4	
6/8/11 19:03:15	5.25	13.31	5.3	0.3	
6/8/11 19:03:30	5.29	13.27	5.6	0.4	
6/8/11 19:03:45	5.30	13.26	5.2	0.4	
6/8/11 19:04:00	5.25	13.31	4.6	0.3	
6/8/11 19:04:15	5.17	13.39	5.1	0.3	
6/8/11 19:04:30	5.08	13.47	5.6	6.6	
6/8/11 19:04:45	5.02	13.52	21.8	36.3	
6/8/11 19:05:00	5.27	11.23	66.9	43.8	
6/8/11 19:05:15	4.18	6.23	56.2	34.0	
6/8/11 19:05:30	1.90	3.29	24.1	26.6	
6/8/11 19:05:45	0.15	2.54	5.8	24.1	
6/8/11 19:06:00	0.01	0.23	2.5	23.8	
6/8/11 19:06:15	0.05	0.28	2.2	23.8	
6/8/11 19:06:30	0.08	0.06	2.5	23.8	
6/8/11 19:06:45	0.07	0.16	2.6	23.7	
6/8/11 19:07:00	0.07	0.13	2.2	24.2	
System Bias					
6/8/11 19:07:15	0.07	0.13	1.9	29.2	C ₃ H ₈ Bias 3 Low = 29.4
6/8/11 19:07:30	0.06	0.24	2.3	29.6	O ₂ Bias 3 Zero = 0.06
6/8/11 19:07:45	0.06	0.24	2.7	29.5	CO ₂ Bias 3 Zero = 0.21
6/8/11 19:08:00	0.07	0.24	2.6	29.2	CO Bias 3 Zero = 2.4
6/8/11 19:08:15	0.10	0.24	2.1	27.8	
6/8/11 19:08:30	0.11	0.24	2.2	12.8	
6/8/11 19:08:45	0.60	1.98	3.7	31.7	
6/8/11 19:09:00	2.51	6.12	10.8	1.4	
6/8/11 19:09:15	3.10	4.92	27.0	0.3	
6/8/11 19:09:30	4.35	5.16	34.5	0.1	
6/8/11 19:09:45	4.65	5.22	37.9	0.1	
6/8/11 19:10:00	4.66	5.18	38.1	0.0	
6/8/11 19:10:15	4.67	5.50	36.3	0.0	
6/8/11 19:10:30	4.66	5.71	35.3	0.0	
6/8/11 19:10:45	4.65	5.77	35.8	0.0	
6/8/11 19:11:00	4.64	5.78	36.1	0.0	
6/8/11 19:11:15	4.64	5.80	35.8	0.0	
6/8/11 19:11:30	4.63	5.80	35.4	0.0	
6/8/11 19:11:45	4.65	5.77	35.6	0.0	
6/8/11 19:12:00	4.68	5.74	35.9	0.0	
6/8/11 19:12:15	4.69	5.73	36.1	0.0	
6/8/11 19:12:30	4.69	5.72	36.5	0.0	
6/8/11 19:12:45	4.67	5.29	39.4	0.0	
System Bias					
6/8/11 19:13:00	4.59	4.40	41.8	0.0	O ₂ Bias 3 Mid = 4.58
6/8/11 19:13:15	4.57	4.14	43.1	0.0	CO Bias 3 Mid = 42.7
6/8/11 19:13:30	4.57	4.11	43.0	0.0	C ₃ H ₈ Bias 3 Zero = 0.0
6/8/11 19:13:45	4.57	4.10	43.0	0.0	
6/8/11 19:14:00	4.58	4.10	43.2	0.0	
6/8/11 19:14:15	4.58	4.10	43.6	0.0	
6/8/11 19:14:30	4.58	4.10	43.4	0.0	
6/8/11 19:14:45	4.58	4.10	42.0	0.5	
6/8/11 19:15:00	4.59	4.46	38.3	1.7	
6/8/11 19:15:15	4.76	6.86	46.3	0.0	
6/8/11 19:15:30	6.38	7.92	69.3	0.0	
6/8/11 19:15:45	9.74	9.25	95.2	0.0	
6/8/11 19:16:00	11.16	9.84	99.6	0.0	
6/8/11 19:16:15	11.39	9.94	99.6	0.0	
System Bias					
6/8/11 19:16:30	11.42	9.96	99.6	0.0	CO ₂ Bias 3 Mid = 9.97
6/8/11 19:16:45	11.43	9.97	99.6	0.0	
6/8/11 19:17:00	11.43	9.97	99.6	0.0	
6/8/11 19:17:15	11.43	9.98	99.6	0.0	
6/8/11 19:17:30	11.43	9.98	99.6	0.0	
6/8/11 19:17:45	11.43	9.98	99.6	0.0	
6/8/11 19:18:00	11.43	9.99	99.6	0.0	
6/8/11 19:18:15	11.43	9.99	99.6	0.7	
6/8/11 19:18:30	11.44	9.99	99.6	2.9	
6/8/11 19:18:45	11.43	10.04	93.6	0.2	
6/8/11 19:19:00	10.59	9.94	69.7	0.0	
6/8/11 19:19:15	6.47	7.28	29.2	0.0	
6/8/11 19:19:30	2.80	4.61	12.5	0.0	
6/8/11 19:19:45	2.02	5.45	5.6	0.0	
6/8/11 19:20:00	3.48	9.55	5.1	0.0	
6/8/11 19:20:15	4.61	12.18	6.2	0.1	
6/8/11 19:20:30	5.03	13.12	7.0	0.2	
6/8/11 19:20:45	5.13	13.24	7.2	0.4	

Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 6:53:00	6.06	4.60	36.1	0.3	
6/9/11 6:53:15	1.78	1.27	8.2	0.3	
6/9/11 6:53:30	0.20	0.19	2.3	0.3	
6/9/11 6:53:45	0.05	0.10	1.2	0.3	
6/9/11 6:54:00	0.03	0.09	0.9	0.3	Calibration Error
6/9/11 6:54:15	0.03	0.09	0.0	0.3	O ₂ CE 2 Zero = 0.03
6/9/11 6:54:30	0.03	0.08	0.0	0.3	CO ₂ CE 2 Zero = 0.08
6/9/11 6:54:45	0.03	0.08	0.4	0.3	CO CE 2 Zero = 0.1
6/9/11 6:55:00	0.03	0.08	0.1	0.3	
6/9/11 6:55:15	0.03	0.08	-0.3	0.3	
6/9/11 6:55:30	0.03	0.08	0.0	0.3	
6/9/11 6:55:45	0.03	0.07	5.0	0.3	
6/9/11 6:56:00	1.26	1.88	25.6	0.3	
6/9/11 6:56:15	5.52	5.52	60.9	0.3	
6/9/11 6:56:30	8.21	7.55	73.8	0.3	
6/9/11 6:56:45	8.97	8.05	79.2	0.3	
6/9/11 6:57:00	9.04	8.11	79.3	0.2	
6/9/11 6:57:15	9.05	8.12	78.8	0.2	Calibration Error
6/9/11 6:57:30	9.05	8.12	79.0	0.2	O ₂ CE 2 Span = 9.05
6/9/11 6:57:45	9.05	8.13	79.5	0.2	
6/9/11 6:58:00	9.05	8.13	79.3	0.2	CO CE 2 Span = 79.2
6/9/11 6:58:15	9.05	8.13	78.8	0.2	
6/9/11 6:58:30	9.05	8.13	79.1	0.2	
6/9/11 6:58:45	9.04	8.10	72.2	0.2	
6/9/11 6:59:00	7.80	6.59	57.8	0.2	
6/9/11 6:59:15	5.27	4.50	42.7	0.2	Calibration Error
6/9/11 6:59:30	4.54	4.09	40.1	0.2	O ₂ CE 2 Mid = 4.52
6/9/11 6:59:45	4.51	4.08	40.2	0.3	
6/9/11 7:00:00	4.52	4.09	39.9	0.2	CO CE 2 Mid = 39.9
6/9/11 7:00:15	4.52	4.09	39.4	0.2	
6/9/11 7:00:30	4.53	4.09	39.7	0.2	
6/9/11 7:00:45	4.53	4.09	40.2	0.2	
6/9/11 7:01:00	4.53	4.09	39.8	0.2	
6/9/11 7:01:15	4.53	4.08	38.2	0.2	
6/9/11 7:01:30	4.88	3.93	30.9	0.2	
6/9/11 7:01:45	11.96	2.18	31.8	0.2	
6/9/11 7:02:00	18.42	7.79	76.9	0.2	
6/9/11 7:02:15	20.55	13.90	99.1	0.2	
6/9/11 7:02:30	21.75	17.65	99.1	0.2	
6/9/11 7:02:45	22.21	19.25	99.1	0.2	Calibration Error
6/9/11 7:03:00	22.28	19.50	99.1	0.2	
6/9/11 7:03:15	22.28	19.52	99.1	0.2	CO ₂ CE 2 Span = 19.52
6/9/11 7:03:30	22.28	19.53	99.1	0.2	
6/9/11 7:03:45	22.29	19.53	99.1	0.2	
6/9/11 7:04:00	22.29	19.53	99.1	0.2	
6/9/11 7:04:15	21.94	18.81	99.1	0.2	
6/9/11 7:04:30	17.66	14.48	99.1	0.2	
6/9/11 7:04:45	13.28	11.27	99.1	0.2	
6/9/11 7:05:00	11.75	10.20	99.1	0.2	
6/9/11 7:05:15	11.60	10.14	99.1	0.2	Calibration Error
6/9/11 7:05:30	11.59	10.13	99.1	0.2	
6/9/11 7:05:45	11.58	10.13	99.1	0.2	CO ₂ CE 2 Mid = 10.13
6/9/11 7:06:00	11.58	10.13	99.1	0.2	
6/9/11 7:06:15	11.58	10.13	99.1	0.1	
6/9/11 7:06:30	11.58	10.12	99.1	0.2	
6/9/11 7:06:45	11.58	10.11	96.1	0.1	
6/9/11 7:07:00	11.67	9.87	73.7	0.1	
6/9/11 7:07:15	9.64	11.01	30.6	0.0	
6/9/11 7:07:30	6.36	12.79	14.2	0.0	
6/9/11 7:07:45	5.41	13.29	7.8	3.7	
6/9/11 7:08:00	5.23	13.41	10.3	3.2	
6/9/11 7:08:15	5.47	13.09	37.6	0.3	
6/9/11 7:08:30	7.14	9.04	46.1	0.2	
6/9/11 7:08:45	4.14	3.95	24.8	0.1	
6/9/11 7:09:00	1.11	1.07	9.9	0.0	
6/9/11 7:09:15	0.27	0.38	3.6	0.0	Calibration Error
6/9/11 7:09:30	0.19	0.30	3.6	0.0	C ₃ H ₈ CE 2 Zero = 0.0
6/9/11 7:09:45	0.18	0.26	3.8	0.0	
6/9/11 7:10:00	0.17	0.23	3.4	0.0	
6/9/11 7:10:15	0.16	0.21	3.1	0.0	
6/9/11 7:10:30	0.16	0.20	3.5	0.0	
6/9/11 7:10:45	0.16	0.19	3.8	41.3	
6/9/11 7:11:00	0.15	0.18	3.3	102.5	
6/9/11 7:11:15	0.16	0.18	3.1	93.0	
6/9/11 7:11:30	0.21	0.18	3.5	89.9	Calibration Error
6/9/11 7:11:45	0.20	0.16	3.5	90.1	C ₃ H ₈ CE 2 Span = 90.0
6/9/11 7:12:00	0.15	0.15	3.1	90.2	
6/9/11 7:12:15	0.14	0.15	2.9	90.2	
6/9/11 7:12:30	0.14	0.14	3.4	89.6	
6/9/11 7:12:45	0.14	0.14	3.4	89.2	
6/9/11 7:13:00	0.14	0.14	2.9	88.7	
6/9/11 7:13:15	0.14	0.13	2.7	88.5	
6/9/11 7:13:30	0.13	0.13	3.2	88.5	
6/9/11 7:13:45	0.13	0.13	3.4	79.4	
6/9/11 7:14:00	0.13	0.13	2.9	50.9	Calibration Error

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 7:14:15	0.13	0.13	2.8	49.4	C ₃ H ₈ CE 2 Mid = 49.4
6/9/11 7:14:30	0.13	0.13	3.4	49.4	
6/9/11 7:14:45	0.13	0.12	3.5	49.4	
6/9/11 7:15:00	0.13	0.12	3.0	49.2	
6/9/11 7:15:15	0.13	0.12	2.8	49.2	
6/9/11 7:15:30	0.13	0.12	3.4	49.3	
6/9/11 7:15:45	0.12	0.12	3.5	49.2	
6/9/11 7:16:00	0.12	0.12	2.9	49.1	
6/9/11 7:16:15	0.12	0.12	3.0	34.0	Calibration Error C ₃ H ₈ CE 2 Low = 29.8
6/9/11 7:16:30	0.12	0.12	3.5	29.9	
6/9/11 7:16:45	0.12	0.12	3.7	29.8	
6/9/11 7:17:00	0.12	0.12	3.2	29.8	
6/9/11 7:17:15	0.12	0.11	3.0	29.8	
6/9/11 7:17:30	0.12	0.11	3.6	29.7	
6/9/11 7:17:45	0.12	0.11	3.8	29.7	
6/9/11 7:18:00	0.12	0.11	3.1	29.6	
6/9/11 7:18:15	0.12	0.11	3.0	29.6	
6/9/11 7:18:30	0.12	0.11	3.3	29.7	
6/9/11 7:18:45	0.12	0.11	3.5	19.8	
6/9/11 7:19:00	0.12	0.11	2.9	12.9	
6/9/11 7:19:15	0.51	1.84	3.2	11.2	
6/9/11 7:19:30	2.10	5.54	14.6	0.0	
6/9/11 7:19:45	3.89	6.30	51.6	0.0	
6/9/11 7:20:00	8.36	8.28	85.3	0.0	
6/9/11 7:20:15	10.81	9.54	96.6	0.0	
6/9/11 7:20:30	11.07	9.37	77.6	0.0	
6/9/11 7:20:45	6.95	5.37	39.4	0.0	
6/9/11 7:21:00	2.23	1.73	13.0	0.0	
6/9/11 7:21:15	0.40	0.36	4.4	0.0	
6/9/11 7:21:30	0.18	0.21	3.6	0.0	
6/9/11 7:21:45	0.15	0.17	3.6	0.0	
6/9/11 7:22:00	0.14	0.15	3.0	0.0	
6/9/11 7:22:15	0.14	0.14	-0.1	0.0	O ₂ Bias 4 Zero = 0.14 CO ₂ Bias 4 Zero = 0.14 CO Bias 4 Zero = 0.9
6/9/11 7:22:30	0.14	0.13	0.3	0.0	
6/9/11 7:22:45	0.13	0.13	0.3	0.2	
6/9/11 7:23:00	0.13	0.12	0.8	0.0	
6/9/11 7:23:15	0.50	0.81	20.2	0.0	
6/9/11 7:23:30	4.70	4.93	60.0	0.0	
6/9/11 7:23:45	8.95	8.14	86.9	0.0	
6/9/11 7:24:00	10.93	9.56	96.1	0.0	
6/9/11 7:24:15	11.35	9.85	98.0	0.0	System Bias CO ₂ Bias 4 Mid = 9.91
6/9/11 7:24:30	11.40	9.89	99.0	0.0	
6/9/11 7:24:45	11.42	9.91	99.1	0.0	
6/9/11 7:25:00	11.42	9.92	98.6	0.0	
6/9/11 7:25:15	11.43	9.93	98.6	0.0	
6/9/11 7:25:30	11.43	9.94	99.1	0.0	
6/9/11 7:25:45	11.43	9.94	94.9	0.0	
6/9/11 7:26:00	11.02	10.24	81.1	0.0	
6/9/11 7:26:15	9.61	9.91	64.9	0.0	
6/9/11 7:26:30	7.25	6.68	50.4	0.0	
6/9/11 7:26:45	5.15	4.58	42.3	0.0	
6/9/11 7:27:00	4.67	4.20	39.6	0.0	
6/9/11 7:27:15	4.62	4.14	39.2	0.0	O ₂ Bias 4 Mid = 4.63 CO Bias 4 Mid = 39.6
6/9/11 7:27:30	4.61	4.12	39.7	0.0	
6/9/11 7:27:45	4.61	4.11	39.9	0.0	
6/9/11 7:28:00	4.61	4.11	39.2	0.0	
6/9/11 7:28:15	4.61	4.11	39.1	0.0	
6/9/11 7:28:30	4.61	4.10	38.9	0.0	
6/9/11 7:28:45	4.62	4.71	31.5	0.0	
6/9/11 7:29:00	4.78	8.67	15.9	0.0	
6/9/11 7:29:15	4.94	11.74	6.2	0.0	
6/9/11 7:29:30	5.03	13.08	3.8	0.0	
6/9/11 7:29:45	5.09	13.28	3.5	0.0	
6/9/11 7:30:00	5.18	13.25	2.9	0.0	
6/9/11 7:30:15	5.27	13.19	2.8	0.0	
6/9/11 7:30:30	5.26	13.22	3.2	0.0	
6/9/11 7:30:45	5.12	13.35	3.4	0.0	
6/9/11 7:31:00	5.06	13.41	3.1	0.0	
6/9/11 7:31:15	5.15	13.32	3.1	0.0	
6/9/11 7:31:30	5.24	13.26	3.6	0.0	
6/9/11 7:31:45	5.28	13.23	3.7	0.0	
6/9/11 7:32:00	5.33	13.17	3.1	0.0	
6/9/11 7:32:15	5.34	13.16	3.0	0.0	
6/9/11 7:32:30	5.29	13.21	3.5	0.0	
6/9/11 7:32:45	5.19	13.33	3.7	0.0	
6/9/11 7:33:00	5.11	13.39	3.3	0.0	
6/9/11 7:33:15	5.17	13.33	3.4	0.0	
6/9/11 7:33:30	5.27	13.25	3.9	0.0	
6/9/11 7:33:45	5.30	13.22	3.9	0.0	
6/9/11 7:34:00	5.31	13.21	3.2	0.0	
6/9/11 7:34:15	5.30	13.22	3.1	0.0	Begin Run 3 0010
6/9/11 7:34:30	5.27	13.25	3.7	0.0	
6/9/11 7:34:45	5.23	13.28	3.7	0.0	
6/9/11 7:35:00	5.22	13.29	3.1	0.0	
6/9/11 7:35:15	5.19	13.32	2.9	0.0	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 7:35:30	5.19	13.31	3.5	0.0	
6/9/11 7:35:45	5.22	13.30	3.4	0.0	
6/9/11 7:36:00	5.17	13.35	2.8	0.0	
6/9/11 7:36:15	5.13	13.38	2.8	0.0	
6/9/11 7:36:30	5.13	13.38	3.4	0.0	
6/9/11 7:36:45	5.17	13.35	3.4	0.0	
6/9/11 7:37:00	5.16	13.36	2.8	0.0	
6/9/11 7:37:15	5.12	13.40	2.8	0.0	
6/9/11 7:37:30	5.06	13.45	3.4	0.0	
6/9/11 7:37:45	5.06	13.46	3.4	0.0	
6/9/11 7:38:00	5.07	13.44	2.8	0.0	
6/9/11 7:38:15	5.12	13.38	2.9	0.0	
6/9/11 7:38:30	5.22	13.30	3.5	0.0	
6/9/11 7:38:45	5.26	13.28	3.7	0.0	
6/9/11 7:39:00	5.23	13.30	3.1	0.0	
6/9/11 7:39:15	5.22	13.31	3.1	0.0	
6/9/11 7:39:30	5.24	13.29	3.7	0.0	
6/9/11 7:39:45	5.26	13.27	3.8	0.0	
6/9/11 7:40:00	5.23	13.31	3.3	0.0	
6/9/11 7:40:15	5.25	13.28	3.2	0.0	
6/9/11 7:40:30	5.30	13.24	3.6	0.0	
6/9/11 7:40:45	5.29	13.25	3.4	0.0	
6/9/11 7:41:00	5.26	13.27	2.8	0.0	
6/9/11 7:41:15	5.27	13.26	3.0	0.0	
6/9/11 7:41:30	5.24	13.30	3.5	0.0	
6/9/11 7:41:45	5.18	13.34	3.7	0.0	
6/9/11 7:42:00	5.19	13.32	3.1	0.0	
6/9/11 7:42:15	5.17	13.35	3.0	0.0	
6/9/11 7:42:30	5.15	13.37	3.4	0.0	
6/9/11 7:42:45	5.19	13.34	3.5	0.0	
6/9/11 7:43:00	5.18	13.35	3.1	0.0	
6/9/11 7:43:15	5.16	13.36	2.8	0.0	
6/9/11 7:43:30	5.19	13.33	3.4	0.0	
6/9/11 7:43:45	5.24	13.30	3.6	0.0	
6/9/11 7:44:00	5.20	13.34	2.8	0.0	
6/9/11 7:44:15	5.12	13.40	2.9	0.0	
6/9/11 7:44:30	5.08	13.44	3.6	0.0	
6/9/11 7:44:45	5.09	13.44	3.4	0.0	
6/9/11 7:45:00	5.05	13.47	2.8	0.0	
6/9/11 7:45:15	5.02	13.50	3.0	0.0	
6/9/11 7:45:30	5.03	13.49	3.7	0.0	
6/9/11 7:45:45	5.06	13.47	3.8	0.0	
6/9/11 7:46:00	5.04	13.50	3.2	0.0	
6/9/11 7:46:15	4.98	13.56	3.5	0.0	
6/9/11 7:46:30	4.94	13.59	4.0	0.0	
6/9/11 7:46:45	5.00	13.53	3.7	0.0	
6/9/11 7:47:00	5.08	13.47	3.1	0.0	
6/9/11 7:47:15	5.11	13.44	3.4	0.0	
6/9/11 7:47:30	5.11	13.44	3.9	0.0	
6/9/11 7:47:45	5.05	13.50	3.6	0.0	
6/9/11 7:48:00	5.07	13.47	3.0	0.0	
6/9/11 7:48:15	5.14	13.41	3.1	0.0	
6/9/11 7:48:30	5.09	13.47	3.4	0.0	
6/9/11 7:48:45	4.94	13.61	3.4	0.0	
6/9/11 7:49:00	4.87	13.66	2.8	0.0	
6/9/11 7:49:15	4.94	13.59	3.1	0.0	
6/9/11 7:49:30	5.03	13.51	3.7	0.0	
6/9/11 7:49:45	5.10	13.44	3.4	0.0	
6/9/11 7:50:00	5.14	13.40	2.7	0.0	
6/9/11 7:50:15	5.13	13.42	3.0	0.0	
6/9/11 7:50:30	5.05	13.49	3.5	0.0	
6/9/11 7:50:45	5.09	13.44	3.3	0.0	
6/9/11 7:51:00	5.18	13.36	2.8	0.0	
6/9/11 7:51:15	5.21	13.32	3.0	0.0	
6/9/11 7:51:30	5.25	13.27	3.6	0.0	
6/9/11 7:51:45	5.24	13.29	3.3	0.0	
6/9/11 7:52:00	5.16	13.37	2.7	0.0	
6/9/11 7:52:15	5.10	13.42	3.1	0.0	
6/9/11 7:52:30	5.12	13.40	3.7	0.0	
6/9/11 7:52:45	5.16	13.38	3.6	0.0	
6/9/11 7:53:00	5.19	13.35	3.0	0.0	
6/9/11 7:53:15	5.22	13.31	3.4	0.0	
6/9/11 7:53:30	5.24	13.31	3.9	0.0	
6/9/11 7:53:45	5.25	13.29	3.5	0.0	
6/9/11 7:54:00	5.32	13.21	3.1	0.0	
6/9/11 7:54:15	5.40	13.13	3.5	0.0	
6/9/11 7:54:30	5.47	13.07	3.7	0.0	
6/9/11 7:54:45	5.46	13.09	3.2	0.0	
6/9/11 7:55:00	5.38	13.17	2.7	0.0	
6/9/11 7:55:15	5.31	13.23	3.1	0.0	
6/9/11 7:55:30	5.31	13.23	3.4	0.0	
6/9/11 7:55:45	5.33	13.21	3.0	0.0	
6/9/11 7:56:00	5.24	13.31	2.7	0.0	
6/9/11 7:56:15	5.16	13.36	3.1	0.0	
6/9/11 7:56:30	5.20	13.33	3.4	0.0	

Start Run 3 0011

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 7:56:45	5.21	13.33	2.9	0.0	
6/9/11 7:57:00	5.20	13.34	2.5	0.0	
6/9/11 7:57:15	5.15	13.39	3.0	0.0	
6/9/11 7:57:30	5.17	13.37	3.6	0.0	
6/9/11 7:57:45	5.27	13.26	3.1	0.0	
6/9/11 7:58:00	5.34	13.19	2.6	0.0	
6/9/11 7:58:15	5.32	13.22	3.1	0.0	
6/9/11 7:58:30	5.25	13.28	3.6	0.0	
6/9/11 7:58:45	5.17	13.35	3.1	0.0	
6/9/11 7:59:00	5.15	13.37	2.8	0.0	
6/9/11 7:59:15	5.16	13.37	3.2	0.0	
6/9/11 7:59:30	5.18	13.36	3.7	0.0	
6/9/11 7:59:45	5.19	13.35	3.1	0.0	
6/9/11 8:00:00	5.20	13.33	3.1	0.0	
6/9/11 8:00:15	5.24	13.29	3.7	0.0	
6/9/11 8:00:30	5.27	13.26	4.0	0.0	
6/9/11 8:00:45	5.29	13.25	3.5	0.0	
6/9/11 8:01:00	5.26	13.28	3.3	0.0	
6/9/11 8:01:15	5.22	13.31	3.7	0.0	
6/9/11 8:01:30	5.23	13.31	3.8	0.0	
6/9/11 8:01:45	5.22	13.32	3.4	0.0	
6/9/11 8:02:00	5.20	13.34	3.2	0.0	
6/9/11 8:02:15	5.14	13.39	3.6	0.0	
6/9/11 8:02:30	5.13	13.40	3.7	0.0	
6/9/11 8:02:45	5.14	13.40	3.2	0.0	
6/9/11 8:03:00	5.17	13.37	3.0	0.0	
6/9/11 8:03:15	5.21	13.33	3.4	0.0	
6/9/11 8:03:30	5.20	13.34	3.5	0.0	
6/9/11 8:03:45	5.24	13.28	2.9	0.0	
6/9/11 8:04:00	5.32	13.21	2.8	0.0	
6/9/11 8:04:15	5.36	13.17	3.1	0.0	
6/9/11 8:04:30	5.35	13.19	3.3	0.0	
6/9/11 8:04:45	5.29	13.24	2.7	0.0	
6/9/11 8:05:00	5.29	13.24	2.8	0.0	
6/9/11 8:05:15	5.31	13.22	3.3	0.0	
6/9/11 8:05:30	5.32	13.21	3.4	0.0	
6/9/11 8:05:45	5.33	13.19	2.8	0.0	
6/9/11 8:06:00	5.33	13.20	2.7	0.0	
6/9/11 8:06:15	5.29	13.24	3.3	0.0	
6/9/11 8:06:30	5.25	13.29	3.5	0.0	
6/9/11 8:06:45	5.22	13.31	3.0	0.0	
6/9/11 8:07:00	5.20	13.33	2.9	0.0	
6/9/11 8:07:15	5.19	13.34	3.4	0.0	
6/9/11 8:07:30	5.17	13.36	3.6	0.0	
6/9/11 8:07:45	5.14	13.40	3.0	0.0	
6/9/11 8:08:00	5.10	13.43	3.0	0.0	
6/9/11 8:08:15	5.09	13.44	3.7	0.0	
6/9/11 8:08:30	5.15	13.38	3.9	0.0	
6/9/11 8:08:45	5.25	13.30	3.2	0.0	
6/9/11 8:09:00	5.29	13.25	3.3	0.0	
6/9/11 8:09:15	5.28	13.26	4.0	0.0	
6/9/11 8:09:30	5.27	13.27	4.1	0.0	
6/9/11 8:09:45	5.20	13.36	3.4	0.0	
6/9/11 8:10:00	5.08	13.46	3.4	0.0	
6/9/11 8:10:15	5.10	13.44	3.9	0.0	
6/9/11 8:10:30	5.15	13.39	3.8	0.0	
6/9/11 8:10:45	5.15	13.40	3.3	0.0	
6/9/11 8:11:00	5.09	13.45	3.4	0.0	
6/9/11 8:11:15	5.15	13.37	3.8	0.0	
6/9/11 8:11:30	5.24	13.29	3.6	0.0	
6/9/11 8:11:45	5.29	13.24	2.9	0.0	
6/9/11 8:12:00	5.33	13.20	2.8	0.0	
6/9/11 8:12:15	5.32	13.22	3.4	0.0	
6/9/11 8:12:30	5.28	13.25	3.4	0.0	
6/9/11 8:12:45	5.30	13.23	2.8	0.0	
6/9/11 8:13:00	5.29	13.26	2.8	0.0	
6/9/11 8:13:15	5.18	13.36	3.3	0.0	
6/9/11 8:13:30	5.11	13.42	3.4	0.0	
6/9/11 8:13:45	5.06	13.46	2.8	0.0	
6/9/11 8:14:00	5.04	13.48	3.0	0.0	
6/9/11 8:14:15	5.05	13.48	3.5	0.0	
6/9/11 8:14:30	5.08	13.46	3.5	0.0	
6/9/11 8:14:45	5.11	13.42	2.9	0.0	
6/9/11 8:15:00	5.13	13.41	3.1	0.0	
6/9/11 8:15:15	5.15	13.39	3.6	0.0	
6/9/11 8:15:30	5.17	13.37	3.7	0.0	
6/9/11 8:15:45	5.16	13.38	3.0	0.0	
6/9/11 8:16:00	5.13	13.40	3.1	0.0	
6/9/11 8:16:15	5.11	13.42	3.9	0.0	
6/9/11 8:16:30	5.09	13.45	4.0	0.0	
6/9/11 8:16:45	5.12	13.42	3.2	0.0	
6/9/11 8:17:00	5.22	13.32	3.3	0.0	
6/9/11 8:17:15	5.28	13.27	4.0	0.0	
6/9/11 8:17:30	5.24	13.30	3.9	0.0	
6/9/11 8:17:45	5.21	13.33	3.4	0.0	

Restart 0011

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 8:18:00	5.20	13.35	3.3	0.0	
6/9/11 8:18:15	5.22	13.33	3.6	0.0	
6/9/11 8:18:30	5.27	13.28	3.8	0.0	
6/9/11 8:18:45	5.28	13.27	3.2	0.0	
6/9/11 8:19:00	5.21	13.32	3.1	0.0	
6/9/11 8:19:15	5.16	13.38	3.5	0.0	
6/9/11 8:19:30	5.12	13.41	3.6	0.0	
6/9/11 8:19:45	5.09	13.44	3.0	0.0	
6/9/11 8:20:00	5.08	13.46	2.9	0.0	
6/9/11 8:20:15	5.11	13.43	3.5	0.0	
6/9/11 8:20:30	5.16	13.38	3.7	0.0	
6/9/11 8:20:45	5.15	13.39	2.9	0.0	
6/9/11 8:21:00	5.14	13.40	2.8	0.0	
6/9/11 8:21:15	5.16	13.37	3.5	0.0	
6/9/11 8:21:30	5.13	13.41	3.6	0.0	
6/9/11 8:21:45	5.02	13.51	2.9	0.0	
6/9/11 8:22:00	5.04	13.49	2.8	0.0	
6/9/11 8:22:15	5.10	13.43	3.5	0.0	
6/9/11 8:22:30	5.15	13.41	3.8	0.0	
6/9/11 8:22:45	5.18	13.37	3.1	0.0	
6/9/11 8:23:00	5.22	13.31	2.9	0.0	
6/9/11 8:23:15	5.22	13.33	3.4	0.0	
6/9/11 8:23:30	5.19	13.36	3.6	0.0	
6/9/11 8:23:45	5.20	13.34	3.2	0.0	
6/9/11 8:24:00	5.19	13.36	3.1	0.0	
6/9/11 8:24:15	5.21	13.33	3.7	0.0	
6/9/11 8:24:30	5.22	13.32	3.9	0.0	
6/9/11 8:24:45	5.18	13.35	3.4	0.0	
6/9/11 8:25:00	5.23	13.31	3.3	0.0	
6/9/11 8:25:15	5.31	13.24	3.8	0.0	
6/9/11 8:25:30	5.38	13.18	3.8	0.0	
6/9/11 8:25:45	5.34	13.21	3.2	0.0	
6/9/11 8:26:00	5.26	13.28	3.1	0.0	
6/9/11 8:26:15	5.21	13.31	3.5	0.0	
6/9/11 8:26:30	5.19	13.34	3.7	0.0	
6/9/11 8:26:45	5.19	13.33	3.2	0.0	
6/9/11 8:27:00	5.22	13.31	3.1	0.0	
6/9/11 8:27:15	5.22	13.31	3.5	0.0	
6/9/11 8:27:30	5.22	13.31	3.6	0.0	
6/9/11 8:27:45	5.22	13.32	3.1	0.0	
6/9/11 8:28:00	5.19	13.36	2.8	0.0	
6/9/11 8:28:15	5.21	13.32	3.2	0.0	
6/9/11 8:28:30	5.26	13.27	3.5	0.0	
6/9/11 8:28:45	5.25	13.29	3.1	0.0	
6/9/11 8:29:00	5.19	13.35	2.6	0.0	
6/9/11 8:29:15	5.15	13.38	3.1	0.0	
6/9/11 8:29:30	5.15	13.39	3.6	0.0	
6/9/11 8:29:45	5.15	13.38	3.3	0.0	
6/9/11 8:30:00	5.15	13.38	2.8	0.0	
6/9/11 8:30:15	5.12	13.42	3.4	0.0	
6/9/11 8:30:30	5.07	13.46	3.8	0.0	
6/9/11 8:30:45	5.14	13.39	3.4	0.0	
6/9/11 8:31:00	5.26	13.29	3.1	0.0	
6/9/11 8:31:15	5.40	13.16	3.5	0.0	
6/9/11 8:31:30	5.39	13.18	3.8	0.0	
6/9/11 8:31:45	5.29	13.26	3.3	0.0	
6/9/11 8:32:00	5.28	13.25	2.9	0.0	
6/9/11 8:32:15	5.30	13.23	3.2	0.0	
6/9/11 8:32:30	5.26	13.27	3.7	0.0	
6/9/11 8:32:45	5.27	13.27	3.3	0.0	
6/9/11 8:33:00	5.26	13.29	2.7	0.0	
6/9/11 8:33:15	5.26	13.29	3.1	0.0	
6/9/11 8:33:30	5.28	13.26	3.4	0.0	
6/9/11 8:33:45	5.25	13.29	3.0	0.0	
6/9/11 8:34:00	5.19	13.34	2.7	0.0	
6/9/11 8:34:15	5.10	13.43	3.2	0.0	
6/9/11 8:34:30	4.98	13.54	3.6	0.0	
6/9/11 8:34:45	4.91	13.62	3.3	0.0	
6/9/11 8:35:00	4.89	13.64	3.1	0.0	
6/9/11 8:35:15	4.96	13.57	3.4	0.0	
6/9/11 8:35:30	5.10	13.44	3.9	0.0	
6/9/11 8:35:45	5.17	13.37	3.4	0.0	
6/9/11 8:36:00	5.20	13.34	3.1	0.0	
6/9/11 8:36:15	5.22	13.31	3.3	0.0	
6/9/11 8:36:30	5.25	13.29	3.8	0.0	
6/9/11 8:36:45	5.24	13.31	3.5	0.0	
6/9/11 8:37:00	5.21	13.34	3.0	0.0	
6/9/11 8:37:15	5.14	13.41	3.3	0.0	
6/9/11 8:37:30	5.09	13.44	3.7	0.0	
6/9/11 8:37:45	5.10	13.44	3.6	0.0	
6/9/11 8:38:00	5.13	13.41	3.1	0.0	
6/9/11 8:38:15	5.19	13.35	3.3	0.0	
6/9/11 8:38:30	5.24	13.30	3.6	0.0	
6/9/11 8:38:45	5.33	13.22	3.4	0.0	
6/9/11 8:39:00	5.37	13.18	2.8	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 8:39:15	5.35	13.20	3.1	0.0	
6/9/11 8:39:30	5.31	13.23	3.3	0.0	
6/9/11 8:39:45	5.22	13.33	3.1	0.0	
6/9/11 8:40:00	5.08	13.46	2.6	0.0	
6/9/11 8:40:15	5.01	13.51	3.1	0.0	
6/9/11 8:40:30	5.09	13.44	3.4	0.0	
6/9/11 8:40:45	5.18	13.35	3.2	0.0	
6/9/11 8:41:00	5.21	13.34	2.7	0.0	
6/9/11 8:41:15	5.19	13.36	2.9	0.0	
6/9/11 8:41:30	5.19	13.35	3.1	0.0	
6/9/11 8:41:45	5.17	13.37	3.4	0.0	
6/9/11 8:42:00	5.11	13.43	3.0	0.0	
6/9/11 8:42:15	4.99	13.54	3.1	0.1	
6/9/11 8:42:30	4.95	13.58	3.5	0.0	
6/9/11 8:42:45	4.98	13.56	3.5	0.0	
6/9/11 8:43:00	5.06	13.48	2.9	0.0	
6/9/11 8:43:15	5.18	13.36	3.2	0.0	
6/9/11 8:43:30	5.24	13.32	3.8	0.0	
6/9/11 8:43:45	5.17	13.37	3.6	0.0	
6/9/11 8:44:00	5.09	13.43	3.1	0.1	
6/9/11 8:44:15	5.10	13.42	3.3	0.1	
6/9/11 8:44:30	5.18	13.35	3.8	0.0	
6/9/11 8:44:45	5.25	13.29	3.7	0.0	
6/9/11 8:45:00	5.27	13.26	3.2	0.1	
6/9/11 8:45:15	5.28	13.27	3.3	0.0	
6/9/11 8:45:30	5.26	13.28	3.6	0.0	
6/9/11 8:45:45	5.24	13.32	3.6	0.1	
6/9/11 8:46:00	5.19	13.36	3.0	0.1	
6/9/11 8:46:15	5.14	13.40	2.9	0.1	
6/9/11 8:46:30	5.08	13.45	3.4	0.0	
6/9/11 8:46:45	5.09	13.45	3.4	0.0	
6/9/11 8:47:00	5.11	13.43	2.9	0.0	
6/9/11 8:47:15	5.15	13.39	3.2	0.0	
6/9/11 8:47:30	5.20	13.33	3.5	0.1	
6/9/11 8:47:45	5.21	13.33	3.4	0.0	
6/9/11 8:48:00	5.23	13.30	2.8	0.0	
6/9/11 8:48:15	5.32	13.21	2.7	0.0	
6/9/11 8:48:30	5.38	13.17	3.1	0.1	
6/9/11 8:48:45	5.29	13.26	3.2	0.0	
6/9/11 8:49:00	5.16	13.37	2.8	0.1	
6/9/11 8:49:15	5.05	13.48	2.8	0.0	
6/9/11 8:49:30	4.93	13.58	3.2	0.0	
6/9/11 8:49:45	4.94	13.58	3.4	0.0	
6/9/11 8:50:00	4.96	13.58	3.0	0.1	
6/9/11 8:50:15	4.97	13.56	3.0	0.1	
6/9/11 8:50:30	5.03	13.50	3.6	0.1	
6/9/11 8:50:45	5.12	13.40	3.8	0.0	
6/9/11 8:51:00	5.21	13.33	3.3	0.1	
6/9/11 8:51:15	5.27	13.28	3.3	0.0	
6/9/11 8:51:30	5.30	13.26	3.8	0.1	
6/9/11 8:51:45	5.32	13.23	4.0	0.0	
6/9/11 8:52:00	5.32	13.23	3.4	0.0	
6/9/11 8:52:15	5.29	13.25	3.1	0.1	
6/9/11 8:52:30	5.30	13.24	3.5	0.1	
6/9/11 8:52:45	5.32	13.24	3.7	0.0	
6/9/11 8:53:00	5.32	13.24	3.3	0.1	
6/9/11 8:53:15	5.34	13.21	3.2	0.0	
6/9/11 8:53:30	5.35	13.19	3.4	0.1	
6/9/11 8:53:45	5.31	13.24	3.4	0.0	
6/9/11 8:54:00	5.26	13.29	2.8	0.1	
6/9/11 8:54:15	5.31	13.24	2.7	0.1	
6/9/11 8:54:30	5.41	13.15	3.1	0.0	
6/9/11 8:54:45	5.40	13.17	3.2	0.0	
6/9/11 8:55:00	5.30	13.26	3.0	0.0	
6/9/11 8:55:15	5.22	13.32	2.7	0.1	
6/9/11 8:55:30	5.18	13.36	3.1	0.0	
6/9/11 8:55:45	5.16	13.38	3.3	0.0	
6/9/11 8:56:00	5.17	13.37	2.8	0.0	
6/9/11 8:56:15	5.20	13.33	2.6	0.0	
6/9/11 8:56:30	5.26	13.28	3.0	0.0	
6/9/11 8:56:45	5.32	13.23	3.3	0.1	
6/9/11 8:57:00	5.29	13.26	2.8	0.0	
6/9/11 8:57:15	5.19	13.35	2.7	0.0	
6/9/11 8:57:30	5.13	13.41	3.1	0.0	
6/9/11 8:57:45	5.17	13.37	3.4	0.1	
6/9/11 8:58:00	5.21	13.34	3.0	0.0	
6/9/11 8:58:15	5.24	13.31	2.7	0.1	
6/9/11 8:58:30	5.29	13.27	3.1	0.0	
6/9/11 8:58:45	5.29	13.27	3.6	0.0	
6/9/11 8:59:00	5.28	13.27	3.4	0.0	
6/9/11 8:59:15	5.27	13.28	3.1	0.0	
6/9/11 8:59:30	5.28	13.26	3.6	0.0	
6/9/11 8:59:45	5.36	13.19	4.0	0.0	
6/9/11 9:00:00	5.42	13.13	3.7	0.0	
6/9/11 9:00:15	5.48	13.06	3.2	0.0	

Restart 0011, 010

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 9:00:30	5.56	12.99	3.2	0.0	
6/9/11 9:00:45	5.56	13.00	3.5	0.0	
6/9/11 9:01:00	5.50	13.05	3.3	0.0	
6/9/11 9:01:15	5.51	13.04	2.8	0.0	
6/9/11 9:01:30	5.49	13.05	3.0	0.0	
6/9/11 9:01:45	5.40	13.14	3.4	0.0	
6/9/11 9:02:00	5.37	13.17	3.1	0.0	
6/9/11 9:02:15	5.40	13.15	2.7	0.0	
6/9/11 9:02:30	5.38	13.17	3.0	0.0	
6/9/11 9:02:45	5.36	13.19	3.4	0.0	
6/9/11 9:03:00	5.35	13.19	3.2	0.0	
6/9/11 9:03:15	5.35	13.18	2.8	0.0	
6/9/11 9:03:30	5.33	13.21	2.9	0.0	
6/9/11 9:03:45	5.24	13.30	3.3	0.1	
6/9/11 9:04:00	5.19	13.34	3.0	0.0	End Run 3 0011
6/9/11 9:04:15	5.18	13.36	2.6	0.0	
6/9/11 9:04:30	5.16	13.38	3.1	0.1	
6/9/11 9:04:45	5.20	13.33	3.5	0.1	
6/9/11 9:05:00	5.26	13.28	3.1	0.1	
6/9/11 9:05:15	5.27	13.26	2.7	0.1	
6/9/11 9:05:30	5.27	13.27	3.1	0.1	
6/9/11 9:05:45	5.27	13.28	3.7	0.0	
6/9/11 9:06:00	5.27	13.29	3.5	0.0	
6/9/11 9:06:15	5.25	13.30	3.1	0.0	
6/9/11 9:06:30	5.23	13.31	3.3	0.0	
6/9/11 9:06:45	5.25	13.29	3.7	0.0	
6/9/11 9:07:00	5.27	13.27	3.7	0.0	
6/9/11 9:07:15	5.24	13.30	3.2	0.0	
6/9/11 9:07:30	5.26	13.28	3.3	0.0	
6/9/11 9:07:45	5.30	13.25	3.7	0.0	
6/9/11 9:08:00	5.36	13.19	3.6	0.0	
6/9/11 9:08:15	5.38	13.17	3.0	0.0	
6/9/11 9:08:30	5.38	13.16	3.0	0.0	
6/9/11 9:08:45	5.37	13.18	3.4	0.0	
6/9/11 9:09:00	5.36	13.18	3.5	0.0	
6/9/11 9:09:15	5.32	13.22	3.1	0.0	
6/9/11 9:09:30	5.34	13.19	3.0	0.0	
6/9/11 9:09:45	5.39	13.15	3.4	0.1	
6/9/11 9:10:00	5.34	13.20	3.4	0.0	
6/9/11 9:10:15	5.25	13.28	3.0	0.0	
6/9/11 9:10:30	5.23	13.29	3.0	0.0	
6/9/11 9:10:45	5.25	13.28	3.4	0.0	
6/9/11 9:11:00	5.32	13.21	3.4	0.1	
6/9/11 9:11:15	5.36	13.18	2.8	0.0	
6/9/11 9:11:30	5.32	13.21	2.7	0.1	
6/9/11 9:11:45	5.25	13.29	3.3	0.1	
6/9/11 9:12:00	5.16	13.38	3.5	0.0	
6/9/11 9:12:15	5.09	13.44	3.1	0.0	
6/9/11 9:12:30	5.09	13.44	2.9	0.0	
6/9/11 9:12:45	5.11	13.41	3.3	0.0	
6/9/11 9:13:00	5.19	13.34	3.6	0.0	
6/9/11 9:13:15	5.25	13.29	3.3	0.1	
6/9/11 9:13:30	5.26	13.29	3.1	0.1	
6/9/11 9:13:45	5.26	13.29	3.4	0.0	
6/9/11 9:14:00	5.26	13.29	3.6	0.1	
6/9/11 9:14:15	5.22	13.34	3.4	0.0	
6/9/11 9:14:30	5.13	13.41	3.1	0.0	
6/9/11 9:14:45	5.10	13.44	3.5	0.0	
6/9/11 9:15:00	5.16	13.38	3.9	0.1	
6/9/11 9:15:15	5.24	13.31	3.5	0.0	
6/9/11 9:15:30	5.23	13.33	3.1	0.0	
6/9/11 9:15:45	5.24	13.32	3.4	0.0	
6/9/11 9:16:00	5.30	13.25	3.7	0.0	
6/9/11 9:16:15	5.34	13.21	3.4	0.0	
6/9/11 9:16:30	5.35	13.19	3.0	0.0	
6/9/11 9:16:45	5.32	13.22	3.2	0.0	
6/9/11 9:17:00	5.26	13.27	3.6	0.0	
6/9/11 9:17:15	5.23	13.32	3.4	0.0	
6/9/11 9:17:30	5.28	13.25	2.9	0.1	
6/9/11 9:17:45	5.40	13.13	3.1	0.0	
6/9/11 9:18:00	5.48	13.06	3.4	0.1	
6/9/11 9:18:15	5.38	13.17	3.4	0.0	
6/9/11 9:18:30	5.22	13.31	2.9	0.0	
6/9/11 9:18:45	5.07	13.46	3.0	0.0	
6/9/11 9:19:00	4.99	13.54	3.5	0.0	
6/9/11 9:19:15	5.03	13.50	3.4	0.0	
6/9/11 9:19:30	5.11	13.43	3.1	0.1	
6/9/11 9:19:45	5.14	13.40	3.4	0.0	
6/9/11 9:20:00	5.14	13.40	3.8	0.1	
6/9/11 9:20:15	5.17	13.36	3.8	0.0	
6/9/11 9:20:30	5.21	13.33	3.2	0.0	
6/9/11 9:20:45	5.24	13.31	3.4	0.0	
6/9/11 9:21:00	5.27	13.27	3.9	0.0	
6/9/11 9:21:15	5.29	13.26	3.8	0.0	
6/9/11 9:21:30	5.31	13.25	3.3	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 9:21:45	5.30	13.26	3.3	0.1	
6/9/11 9:22:00	5.31	13.23	3.6	0.0	
6/9/11 9:22:15	5.37	13.17	3.8	0.0	
6/9/11 9:22:30	5.38	13.17	3.1	0.0	
6/9/11 9:22:45	5.30	13.24	2.9	0.0	
6/9/11 9:23:00	5.24	13.30	3.5	0.0	
6/9/11 9:23:15	5.26	13.28	3.8	0.0	
6/9/11 9:23:30	5.24	13.29	3.2	0.0	
6/9/11 9:23:45	5.19	13.34	3.0	0.1	
6/9/11 9:24:00	5.15	13.38	3.4	0.0	
6/9/11 9:24:15	5.14	13.40	3.7	0.0	
6/9/11 9:24:30	5.12	13.41	3.2	0.0	
6/9/11 9:24:45	5.05	13.48	2.8	0.0	
6/9/11 9:25:00	5.02	13.50	3.4	0.0	
6/9/11 9:25:15	5.10	13.44	3.7	0.0	
6/9/11 9:25:30	5.20	13.33	3.3	0.0	
6/9/11 9:25:45	5.30	13.25	2.9	0.0	
6/9/11 9:26:00	5.32	13.23	3.1	0.0	
6/9/11 9:26:15	5.24	13.31	3.6	0.1	
6/9/11 9:26:30	5.10	13.44	3.2	0.0	
6/9/11 9:26:45	5.01	13.52	3.1	0.1	
6/9/11 9:27:00	4.97	13.55	3.5	0.1	
6/9/11 9:27:15	4.94	13.58	3.9	0.1	
6/9/11 9:27:30	4.96	13.56	3.8	0.1	
6/9/11 9:27:45	5.09	13.45	3.4	0.1	
6/9/11 9:28:00	5.19	13.36	3.6	0.1	
6/9/11 9:28:15	5.21	13.35	4.1	0.1	
6/9/11 9:28:30	5.20	13.34	3.9	0.1	
6/9/11 9:28:45	5.19	13.35	3.4	0.1	
6/9/11 9:29:00	5.17	13.38	3.5	0.1	
6/9/11 9:29:15	5.19	13.35	3.9	0.1	
6/9/11 9:29:30	5.27	13.27	3.7	0.1	
6/9/11 9:29:45	5.37	13.18	3.2	0.1	
6/9/11 9:30:00	5.36	13.20	3.0	0.1	
6/9/11 9:30:15	5.22	13.32	3.4	0.1	
6/9/11 9:30:30	5.14	13.39	3.3	0.1	
6/9/11 9:30:45	5.09	13.43	2.8	0.1	
6/9/11 9:31:00	5.02	13.51	2.9	0.1	
6/9/11 9:31:15	4.99	13.52	3.5	0.1	
6/9/11 9:31:30	5.04	13.49	3.6	0.1	
6/9/11 9:31:45	5.06	13.47	3.1	0.1	
6/9/11 9:32:00	5.08	13.45	2.9	0.0	
6/9/11 9:32:15	5.11	13.43	3.3	0.1	
6/9/11 9:32:30	5.13	13.41	3.5	0.1	
6/9/11 9:32:45	5.12	13.42	3.2	0.0	
6/9/11 9:33:00	5.11	13.42	2.8	0.1	
6/9/11 9:33:15	5.11	13.43	3.1	0.0	
6/9/11 9:33:30	5.10	13.45	3.7	0.0	
6/9/11 9:33:45	5.10	13.43	3.6	0.0	
6/9/11 9:34:00	5.15	13.39	3.1	0.0	
6/9/11 9:34:15	5.19	13.35	3.5	0.0	
6/9/11 9:34:30	5.17	13.38	4.0	0.1	
6/9/11 9:34:45	5.12	13.42	3.8	0.0	
6/9/11 9:35:00	5.07	13.47	3.3	0.0	
6/9/11 9:35:15	5.00	13.55	3.5	0.0	
6/9/11 9:35:30	4.95	13.59	4.0	0.0	
6/9/11 9:35:45	5.02	13.51	3.9	0.0	
6/9/11 9:36:00	5.18	13.37	3.2	0.0	
6/9/11 9:36:15	5.28	13.27	3.3	0.0	
6/9/11 9:36:30	5.31	13.25	3.4	0.0	
6/9/11 9:36:45	5.30	13.26	3.6	0.0	
6/9/11 9:37:00	5.16	13.39	2.8	0.0	
6/9/11 9:37:15	4.99	13.54	2.9	0.0	
6/9/11 9:37:30	4.96	13.57	3.3	0.1	
6/9/11 9:37:45	4.98	13.57	3.5	0.0	
6/9/11 9:38:00	4.97	13.58	2.8	0.0	
6/9/11 9:38:15	5.00	13.53	2.6	0.0	
6/9/11 9:38:30	5.04	13.50	3.2	0.0	
6/9/11 9:38:45	5.01	13.53	3.4	0.0	
6/9/11 9:39:00	5.00	13.54	2.6	0.0	
6/9/11 9:39:15	5.03	13.51	2.5	0.0	
6/9/11 9:39:30	5.03	13.51	3.1	0.0	
6/9/11 9:39:45	4.97	13.57	3.3	0.0	
6/9/11 9:40:00	4.93	13.60	2.9	0.0	
6/9/11 9:40:15	4.94	13.58	2.9	0.0	
6/9/11 9:40:30	4.93	13.61	3.3	0.0	
6/9/11 9:40:45	4.93	13.62	3.7	0.1	
6/9/11 9:41:00	4.98	13.58	3.6	0.0	
6/9/11 9:41:15	4.99	13.56	3.2	0.0	
6/9/11 9:41:30	4.95	13.59	3.3	0.0	
6/9/11 9:41:45	5.02	13.52	3.7	0.0	
6/9/11 9:42:00	5.15	13.40	3.6	0.0	
6/9/11 9:42:15	5.26	13.29	3.1	0.0	
6/9/11 9:42:30	5.34	13.21	3.2	0.0	
6/9/11 9:42:45	5.37	13.19	3.6	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 9:43:00	5.35	13.20	3.6	0.0	
6/9/11 9:43:15	5.33	13.22	3.0	0.1	
6/9/11 9:43:30	5.26	13.29	2.8	0.1	
6/9/11 9:43:45	5.16	13.38	3.1	0.0	
6/9/11 9:44:00	5.12	13.42	3.6	0.1	
6/9/11 9:44:15	5.08	13.47	3.2	0.0	
6/9/11 9:44:30	5.08	13.46	2.9	0.1	
6/9/11 9:44:45	5.12	13.42	3.3	0.1	
6/9/11 9:45:00	5.12	13.43	3.4	0.1	
6/9/11 9:45:15	5.06	13.47	3.1	0.0	
6/9/11 9:45:30	5.01	13.52	2.7	0.1	
6/9/11 9:45:45	4.98	13.55	3.0	0.0	
6/9/11 9:46:00	4.98	13.56	3.4	0.0	
6/9/11 9:46:15	5.00	13.53	3.3	0.0	
6/9/11 9:46:30	5.01	13.52	2.7	0.0	
6/9/11 9:46:45	5.04	13.49	2.9	0.1	
6/9/11 9:47:00	5.07	13.48	3.7	0.0	End Run 3 308
6/9/11 9:47:15	5.02	13.53	3.8	0.0	
6/9/11 9:47:30	5.03	13.50	3.2	0.1	
6/9/11 9:47:45	5.12	13.43	3.3	0.1	
6/9/11 9:48:00	5.17	13.38	3.9	0.1	
6/9/11 9:48:15	5.15	13.40	3.8	0.1	
6/9/11 9:48:30	5.13	13.42	3.3	0.1	
6/9/11 9:48:45	5.15	13.40	3.0	0.0	
6/9/11 9:49:00	5.24	13.30	3.6	0.1	
6/9/11 9:49:15	5.31	13.25	3.9	0.1	
6/9/11 9:49:30	5.26	13.30	3.2	0.1	
6/9/11 9:49:45	5.13	13.42	2.9	0.1	
6/9/11 9:50:00	5.08	13.46	3.3	0.1	
6/9/11 9:50:15	5.18	13.37	3.6	0.1	
6/9/11 9:50:30	5.31	13.25	3.3	0.1	
6/9/11 9:50:45	5.30	13.25	2.8	0.0	
6/9/11 9:51:00	5.25	13.29	3.3	0.1	
6/9/11 9:51:15	5.25	13.29	3.7	0.1	
6/9/11 9:51:30	5.27	13.26	3.2	0.0	
6/9/11 9:51:45	5.34	13.21	2.8	0.1	
6/9/11 9:52:00	5.33	13.22	2.9	0.0	
6/9/11 9:52:15	5.30	13.24	3.4	0.1	
6/9/11 9:52:30	5.28	13.27	3.5	0.0	
6/9/11 9:52:45	5.21	13.34	3.0	0.0	
6/9/11 9:53:00	5.14	13.40	2.9	0.0	
6/9/11 9:53:15	5.16	13.38	3.3	0.0	
6/9/11 9:53:30	5.27	13.27	3.7	0.0	
6/9/11 9:53:45	5.34	13.21	3.4	0.0	
6/9/11 9:54:00	5.33	13.21	3.0	0.0	
6/9/11 9:54:15	5.30	13.24	3.4	0.0	
6/9/11 9:54:30	5.25	13.29	3.9	0.0	
6/9/11 9:54:45	5.28	13.26	3.6	0.0	
6/9/11 9:55:00	5.34	13.21	3.1	0.1	Restart 0010
6/9/11 9:55:15	5.34	13.21	3.4	0.0	
6/9/11 9:55:30	5.34	13.20	3.8	0.0	
6/9/11 9:55:45	5.39	13.18	3.6	0.0	
6/9/11 9:56:00	5.41	13.16	2.9	0.0	
6/9/11 9:56:15	5.37	13.19	3.0	0.0	
6/9/11 9:56:30	5.30	13.25	3.5	0.0	
6/9/11 9:56:45	5.31	13.24	3.7	0.0	
6/9/11 9:57:00	5.32	13.24	3.0	0.0	
6/9/11 9:57:15	5.29	13.27	2.9	0.0	
6/9/11 9:57:30	5.29	13.27	3.4	0.0	
6/9/11 9:57:45	5.35	13.20	3.6	0.0	
6/9/11 9:58:00	5.45	13.10	3.2	0.0	
6/9/11 9:58:15	5.49	13.06	2.9	0.0	
6/9/11 9:58:30	5.47	13.08	3.3	0.1	
6/9/11 9:58:45	5.42	13.13	3.4	0.0	
6/9/11 9:59:00	5.38	13.16	3.0	0.0	
6/9/11 9:59:15	5.31	13.24	2.7	0.0	
6/9/11 9:59:30	5.17	13.37	3.1	0.0	
6/9/11 9:59:45	5.06	13.47	3.4	0.0	
6/9/11 10:00:00	5.04	13.50	3.5	0.0	
6/9/11 10:00:15	5.10	13.45	3.0	0.0	
6/9/11 10:00:30	5.16	13.39	3.1	0.0	
6/9/11 10:00:45	5.19	13.37	3.5	0.0	
6/9/11 10:01:00	5.21	13.33	3.6	0.0	
6/9/11 10:01:15	5.24	13.31	3.4	0.0	
6/9/11 10:01:30	5.23	13.32	3.1	0.0	
6/9/11 10:01:45	5.19	13.36	3.5	0.0	
6/9/11 10:02:00	5.13	13.42	3.8	0.0	
6/9/11 10:02:15	5.16	13.39	3.6	0.0	
6/9/11 10:02:30	5.22	13.34	3.1	0.0	
6/9/11 10:02:45	5.23	13.33	3.5	0.0	
6/9/11 10:03:00	5.24	13.31	3.9	0.0	
6/9/11 10:03:15	5.29	13.26	3.6	0.0	
6/9/11 10:03:30	5.37	13.18	3.0	0.0	
6/9/11 10:03:45	5.37	13.18	3.2	0.0	
6/9/11 10:04:00	5.30	13.25	3.6	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 10:04:15	5.24	13.32	3.4	0.0	
6/9/11 10:04:30	5.17	13.38	2.7	0.0	
6/9/11 10:04:45	5.22	13.33	3.1	0.0	
6/9/11 10:05:00	5.31	13.24	3.4	0.0	
6/9/11 10:05:15	5.38	13.17	3.4	0.0	
6/9/11 10:05:30	5.41	13.14	2.7	0.0	
6/9/11 10:05:45	5.39	13.16	2.7	0.0	
6/9/11 10:06:00	5.36	13.19	3.2	0.0	
6/9/11 10:06:15	5.31	13.23	3.4	0.0	
6/9/11 10:06:30	5.23	13.31	2.9	0.0	
6/9/11 10:06:45	5.17	13.37	2.7	0.0	
6/9/11 10:07:00	5.15	13.39	3.3	0.0	
6/9/11 10:07:15	5.17	13.37	3.6	0.0	
6/9/11 10:07:30	5.22	13.32	3.3	0.0	
6/9/11 10:07:45	5.19	13.36	2.8	0.0	
6/9/11 10:08:00	5.14	13.40	3.1	0.0	
6/9/11 10:08:15	5.18	13.36	3.5	0.0	
6/9/11 10:08:30	5.23	13.32	3.4	0.0	
6/9/11 10:08:45	5.18	13.38	3.0	0.0	
6/9/11 10:09:00	5.09	13.46	3.4	0.1	
6/9/11 10:09:15	5.10	13.45	3.8	0.0	
6/9/11 10:09:30	5.13	13.43	3.9	0.0	
6/9/11 10:09:45	5.14	13.42	3.5	0.0	
6/9/11 10:10:00	5.18	13.38	3.3	0.0	
6/9/11 10:10:15	5.27	13.29	3.7	0.0	
6/9/11 10:10:30	5.33	13.23	3.9	0.0	
6/9/11 10:10:45	5.36	13.21	3.5	0.0	
6/9/11 10:11:00	5.35	13.21	3.1	0.0	
6/9/11 10:11:15	5.36	13.20	3.5	0.0	
6/9/11 10:11:30	5.33	13.23	3.7	0.0	
6/9/11 10:11:45	5.31	13.24	3.3	0.0	
6/9/11 10:12:00	5.35	13.20	2.7	0.0	
6/9/11 10:12:15	5.37	13.19	2.9	0.0	
6/9/11 10:12:30	5.32	13.24	3.2	0.0	
6/9/11 10:12:45	5.27	13.29	3.2	0.0	
6/9/11 10:13:00	5.28	13.27	2.6	0.0	
6/9/11 10:13:15	5.28	13.27	2.7	0.0	
6/9/11 10:13:30	5.23	13.32	3.1	0.0	
6/9/11 10:13:45	5.19	13.36	3.3	0.0	
6/9/11 10:14:00	5.18	13.36	2.8	0.0	
6/9/11 10:14:15	5.17	13.38	2.7	0.0	
6/9/11 10:14:30	5.18	13.35	3.1	0.0	
6/9/11 10:14:45	5.23	13.32	3.4	0.0	
6/9/11 10:15:00	5.19	13.37	2.8	0.0	
6/9/11 10:15:15	5.12	13.42	2.7	0.0	
6/9/11 10:15:30	5.16	13.38	3.2	0.0	
6/9/11 10:15:45	5.21	13.33	3.6	0.0	
6/9/11 10:16:00	5.22	13.33	3.2	0.0	
6/9/11 10:16:15	5.24	13.31	2.9	0.0	
6/9/11 10:16:30	5.26	13.29	3.3	0.0	
6/9/11 10:16:45	5.28	13.26	3.7	0.0	
6/9/11 10:17:00	5.29	13.25	3.5	0.0	
6/9/11 10:17:15	5.22	13.33	3.1	0.0	
6/9/11 10:17:30	5.20	13.35	3.5	0.0	
6/9/11 10:17:45	5.31	13.24	3.8	0.0	
6/9/11 10:18:00	5.43	13.13	3.6	0.0	
6/9/11 10:18:15	5.48	13.09	3.1	0.0	
6/9/11 10:18:30	5.40	13.15	3.1	0.0	
6/9/11 10:18:45	5.32	13.22	3.4	0.1	
6/9/11 10:19:00	5.25	13.30	3.3	0.0	
6/9/11 10:19:15	5.20	13.35	2.9	0.0	
6/9/11 10:19:30	5.22	13.33	2.8	0.0	
6/9/11 10:19:45	5.24	13.31	3.1	0.0	
6/9/11 10:20:00	5.24	13.31	3.4	0.0	
6/9/11 10:20:15	5.27	13.27	3.0	0.0	
6/9/11 10:20:30	5.31	13.24	2.5	0.0	
6/9/11 10:20:45	5.41	13.13	2.8	0.0	
6/9/11 10:21:00	5.45	13.10	3.2	0.0	
6/9/11 10:21:15	5.39	13.18	2.9	0.0	
6/9/11 10:21:30	5.26	13.30	2.3	0.0	
6/9/11 10:21:45	5.13	13.42	2.7	0.0	
6/9/11 10:22:00	5.10	13.44	3.3	0.0	
6/9/11 10:22:15	5.18	13.35	3.0	0.1	
6/9/11 10:22:30	5.25	13.30	2.7	0.0	
6/9/11 10:22:45	5.26	13.29	3.0	0.0	
6/9/11 10:23:00	5.28	13.27	3.5	0.0	
6/9/11 10:23:15	5.22	13.33	3.4	0.0	
6/9/11 10:23:30	5.16	13.38	2.9	0.0	
6/9/11 10:23:45	5.16	13.38	3.0	0.0	
6/9/11 10:24:00	5.24	13.31	3.3	0.0	
6/9/11 10:24:15	5.32	13.24	3.7	0.0	
6/9/11 10:24:30	5.35	13.20	3.2	0.1	
6/9/11 10:24:45	5.42	13.13	3.0	0.0	
6/9/11 10:25:00	5.43	13.14	3.5	0.0	
6/9/11 10:25:15	5.36	13.21	3.9	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 10:25:30	5.33	13.23	3.5	0.0	
6/9/11 10:25:45	5.35	13.21	3.0	0.1	
6/9/11 10:26:00	5.33	13.23	3.4	0.0	
6/9/11 10:26:15	5.30	13.27	3.5	0.1	
6/9/11 10:26:30	5.28	13.28	3.2	0.0	
6/9/11 10:26:45	5.33	13.22	2.7	0.0	
6/9/11 10:27:00	5.34	13.22	3.1	0.0	
6/9/11 10:27:15	5.31	13.25	3.6	0.0	
6/9/11 10:27:30	5.33	13.22	3.4	0.0	
6/9/11 10:27:45	5.41	13.14	2.8	0.1	
6/9/11 10:28:00	5.47	13.07	2.6	0.0	
6/9/11 10:28:15	5.41	13.15	3.0	0.0	
6/9/11 10:28:30	5.27	13.28	3.2	0.1	
6/9/11 10:28:45	5.17	13.36	2.8	0.1	
6/9/11 10:29:00	5.13	13.41	2.5	0.0	
6/9/11 10:29:15	5.11	13.44	3.1	0.0	
6/9/11 10:29:30	5.16	13.39	3.4	0.0	
6/9/11 10:29:45	5.23	13.32	2.9	0.0	
6/9/11 10:30:00	5.25	13.31	2.5	0.0	
6/9/11 10:30:15	5.20	13.35	3.1	0.0	
6/9/11 10:30:30	5.19	13.35	3.3	0.1	
6/9/11 10:30:45	5.19	13.35	3.1	0.0	
6/9/11 10:31:00	5.14	13.41	2.7	0.0	
6/9/11 10:31:15	5.13	13.42	3.2	0.0	
6/9/11 10:31:30	5.18	13.37	3.7	0.0	
6/9/11 10:31:45	5.27	13.29	3.8	0.0	
6/9/11 10:32:00	5.38	13.18	3.2	0.0	
6/9/11 10:32:15	5.46	13.11	3.2	0.0	
6/9/11 10:32:30	5.46	13.11	3.6	0.1	
6/9/11 10:32:45	5.45	13.11	3.7	0.1	
6/9/11 10:33:00	5.42	13.14	3.2	0.0	
6/9/11 10:33:15	5.38	13.17	2.9	0.0	
6/9/11 10:33:30	5.34	13.20	3.5	0.0	
6/9/11 10:33:45	5.29	13.26	3.7	0.0	
6/9/11 10:34:00	5.30	13.24	3.1	0.0	
6/9/11 10:34:15	5.35	13.20	2.8	0.0	
6/9/11 10:34:30	5.45	13.11	3.3	0.0	
6/9/11 10:34:45	5.57	12.99	3.6	0.0	
6/9/11 10:35:00	5.60	12.96	3.1	0.1	
6/9/11 10:35:15	5.49	13.07	2.6	0.0	
6/9/11 10:35:30	5.27	13.28	3.0	0.0	
6/9/11 10:35:45	5.13	13.39	3.5	0.1	
6/9/11 10:36:00	5.14	13.40	3.4	0.0	
6/9/11 10:36:15	5.19	13.36	2.8	0.0	
6/9/11 10:36:30	5.25	13.29	2.9	0.0	
6/9/11 10:36:45	5.26	13.30	3.4	0.0	
6/9/11 10:37:00	5.21	13.34	3.4	0.1	
6/9/11 10:37:15	5.20	13.34	2.8	0.0	
6/9/11 10:37:30	5.20	13.35	2.7	0.0	
6/9/11 10:37:45	5.16	13.39	3.3	0.0	
6/9/11 10:38:00	5.14	13.40	3.8	0.0	
6/9/11 10:38:15	5.19	13.36	3.4	0.0	
6/9/11 10:38:30	5.29	13.26	2.9	0.1	
6/9/11 10:38:45	5.36	13.20	3.1	0.0	
6/9/11 10:39:00	5.32	13.23	3.5	0.0	
6/9/11 10:39:15	5.23	13.33	3.2	0.0	
6/9/11 10:39:30	5.13	13.43	2.9	0.1	
6/9/11 10:39:45	5.12	13.44	3.2	0.0	
6/9/11 10:40:00	5.21	13.34	3.7	0.0	
6/9/11 10:40:15	5.35	13.21	3.6	0.0	
6/9/11 10:40:30	5.40	13.16	2.8	0.0	
6/9/11 10:40:45	5.42	13.13	2.9	0.0	
6/9/11 10:41:00	5.41	13.16	3.4	0.0	
6/9/11 10:41:15	5.32	13.25	3.6	0.0	
6/9/11 10:41:30	5.24	13.31	3.0	0.0	
6/9/11 10:41:45	5.23	13.31	2.8	0.0	
6/9/11 10:42:00	5.30	13.24	3.0	0.0	
6/9/11 10:42:15	5.32	13.24	3.3	0.0	
6/9/11 10:42:30	5.25	13.30	3.0	0.0	
6/9/11 10:42:45	5.22	13.32	2.9	0.0	
6/9/11 10:43:00	5.24	13.31	3.2	0.0	
6/9/11 10:43:15	5.28	13.27	3.6	0.0	
6/9/11 10:43:30	5.32	13.23	3.4	0.0	
6/9/11 10:43:45	5.32	13.24	2.8	0.0	
6/9/11 10:44:00	5.31	13.24	3.0	0.0	
6/9/11 10:44:15	5.33	13.23	3.6	0.0	
6/9/11 10:44:30	5.29	13.26	3.4	0.0	
6/9/11 10:44:45	5.23	13.32	2.9	0.0	
6/9/11 10:45:00	5.20	13.35	3.0	0.0	
6/9/11 10:45:15	5.22	13.33	3.4	0.0	
6/9/11 10:45:30	5.24	13.31	3.5	0.0	
6/9/11 10:45:45	5.32	13.22	3.1	0.0	
6/9/11 10:46:00	5.40	13.15	2.9	0.0	
6/9/11 10:46:15	5.40	13.16	3.4	0.0	
6/9/11 10:46:30	5.35	13.21	3.6	0.0	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 10:46:45	5.30	13.25	3.3	0.0	
6/9/11 10:47:00	5.30	13.24	2.9	0.1	
6/9/11 10:47:15	5.35	13.22	3.1	0.0	
6/9/11 10:47:30	5.36	13.20	3.4	0.0	
6/9/11 10:47:45	5.37	13.18	3.2	0.0	
6/9/11 10:48:00	5.42	13.14	2.6	0.1	
6/9/11 10:48:15	5.39	13.17	2.6	0.0	
6/9/11 10:48:30	5.27	13.28	3.2	0.0	
6/9/11 10:48:45	5.19	13.36	3.4	0.0	
6/9/11 10:49:00	5.24	13.30	2.7	0.0	
6/9/11 10:49:15	5.32	13.24	2.6	0.0	
6/9/11 10:49:30	5.29	13.27	3.0	0.0	
6/9/11 10:49:45	5.24	13.31	3.3	0.0	
6/9/11 10:50:00	5.21	13.34	2.9	0.0	
6/9/11 10:50:15	5.14	13.41	2.5	0.0	
6/9/11 10:50:30	5.03	13.52	3.0	0.0	
6/9/11 10:50:45	5.01	13.52	3.4	0.1	
6/9/11 10:51:00	5.07	13.47	3.2	0.0	
6/9/11 10:51:15	5.09	13.46	2.7	0.0	
6/9/11 10:51:30	5.10	13.44	3.1	0.0	
6/9/11 10:51:45	5.17	13.38	3.5	0.0	
6/9/11 10:52:00	5.25	13.30	3.6	0.0	
6/9/11 10:52:15	5.27	13.29	3.0	0.0	
6/9/11 10:52:30	5.21	13.35	3.2	0.0	
6/9/11 10:52:45	5.16	13.38	3.8	0.0	
6/9/11 10:53:00	5.22	13.33	3.9	0.0	
6/9/11 10:53:15	5.26	13.31	3.3	0.0	
6/9/11 10:53:30	5.28	13.28	2.9	0.0	
6/9/11 10:53:45	5.33	13.24	3.4	0.0	
6/9/11 10:54:00	5.35	13.22	3.7	0.0	
6/9/11 10:54:15	5.34	13.21	3.3	0.0	
6/9/11 10:54:30	5.29	13.28	2.9	0.0	
6/9/11 10:54:45	5.19	13.38	3.2	0.0	
6/9/11 10:55:00	5.14	13.42	3.6	0.0	
6/9/11 10:55:15	5.16	13.38	3.3	0.0	
6/9/11 10:55:30	5.21	13.34	2.5	0.0	
6/9/11 10:55:45	5.20	13.35	2.7	0.0	
6/9/11 10:56:00	5.20	13.35	3.0	0.0	
6/9/11 10:56:15	5.29	13.26	3.3	0.0	
6/9/11 10:56:30	5.44	13.10	2.8	0.0	
6/9/11 10:56:45	5.55	12.99	2.7	0.0	
6/9/11 10:57:00	5.56	12.99	3.1	0.0	
6/9/11 10:57:15	5.42	13.15	3.2	0.0	
6/9/11 10:57:30	5.21	13.34	2.9	0.0	
6/9/11 10:57:45	5.04	13.52	2.6	0.0	
6/9/11 10:58:00	4.93	13.60	2.8	0.0	
6/9/11 10:58:15	4.91	13.62	3.4	0.0	
6/9/11 10:58:30	4.93	13.62	3.3	0.0	
6/9/11 10:58:45	5.02	13.53	3.0	0.0	
6/9/11 10:59:00	5.14	13.42	3.2	0.0	
6/9/11 10:59:15	5.15	13.41	3.7	0.0	
6/9/11 10:59:30	5.15	13.40	3.7	0.0	
6/9/11 10:59:45	5.22	13.33	3.4	0.0	
6/9/11 11:00:00	5.34	13.22	3.4	0.0	
6/9/11 11:00:15	5.39	13.18	3.7	0.0	
6/9/11 11:00:30	5.34	13.23	3.9	0.0	
6/9/11 11:00:45	5.28	13.29	3.5	0.0	
6/9/11 11:01:00	5.25	13.31	3.2	0.0	
6/9/11 11:01:15	5.25	13.31	3.6	0.0	
6/9/11 11:01:30	5.27	13.30	3.8	0.0	
6/9/11 11:01:45	5.33	13.24	3.5	0.0	
6/9/11 11:02:00	5.36	13.20	2.7	0.0	
6/9/11 11:02:15	5.35	13.21	2.8	0.0	
6/9/11 11:02:30	5.37	13.19	3.1	0.0	
6/9/11 11:02:45	5.35	13.21	3.2	0.0	
6/9/11 11:03:00	5.29	13.25	2.6	0.0	
6/9/11 11:03:15	5.20	13.33	2.6	0.0	
6/9/11 11:03:30	5.13	13.42	3.0	0.0	
6/9/11 11:03:45	5.09	13.46	3.3	0.0	
6/9/11 11:04:00	5.12	13.43	2.8	0.0	
6/9/11 11:04:15	5.15	13.40	2.4	0.0	
6/9/11 11:04:30	5.21	13.34	2.7	0.0	
6/9/11 11:04:45	5.28	13.27	3.1	0.0	
6/9/11 11:05:00	5.27	13.28	3.0	0.0	
6/9/11 11:05:15	5.27	13.29	2.5	0.0	
6/9/11 11:05:30	5.24	13.32	2.8	0.0	
6/9/11 11:05:45	5.16	13.38	3.2	0.0	
6/9/11 11:06:00	5.07	13.47	3.4	0.0	
6/9/11 11:06:15	5.05	13.49	3.2	0.0	
6/9/11 11:06:30	5.19	13.36	3.1	0.0	
6/9/11 11:06:45	5.33	13.23	3.5	0.0	
6/9/11 11:07:00	5.39	13.18	3.8	0.0	
6/9/11 11:07:15	5.34	13.24	3.4	0.0	
6/9/11 11:07:30	5.27	13.30	3.1	0.0	
6/9/11 11:07:45	5.26	13.30	3.5	0.0	

0010 Restart

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 11:08:00	5.33	13.24	4.0	0.0	
6/9/11 11:08:15	5.41	13.16	3.6	0.0	
6/9/11 11:08:30	5.42	13.15	2.9	0.0	
6/9/11 11:08:45	5.40	13.16	3.0	0.0	
6/9/11 11:09:00	5.38	13.18	3.4	0.0	
6/9/11 11:09:15	5.35	13.21	3.5	0.0	
6/9/11 11:09:30	5.32	13.25	3.0	0.0	
6/9/11 11:09:45	5.28	13.28	2.8	0.0	
6/9/11 11:10:00	5.23	13.34	3.2	0.0	
6/9/11 11:10:15	5.19	13.37	3.4	0.0	
6/9/11 11:10:30	5.22	13.35	2.8	0.0	
6/9/11 11:10:45	5.28	13.28	2.6	0.0	
6/9/11 11:11:00	5.33	13.23	2.9	0.0	
6/9/11 11:11:15	5.31	13.25	3.1	0.0	
6/9/11 11:11:30	5.29	13.26	3.0	0.0	
6/9/11 11:11:45	5.25	13.31	2.6	0.0	
6/9/11 11:12:00	5.23	13.32	2.8	0.0	
6/9/11 11:12:15	5.26	13.29	3.1	0.0	
6/9/11 11:12:30	5.27	13.28	3.1	0.0	
6/9/11 11:12:45	5.24	13.31	2.8	0.0	
6/9/11 11:13:00	5.20	13.35	2.9	0.0	
6/9/11 11:13:15	5.23	13.33	3.3	0.0	
6/9/11 11:13:30	5.34	13.22	3.6	0.0	
6/9/11 11:13:45	5.41	13.15	3.2	0.0	
6/9/11 11:14:00	5.39	13.18	2.8	0.0	
6/9/11 11:14:15	5.31	13.25	3.0	0.0	
6/9/11 11:14:30	5.25	13.30	3.6	0.0	
6/9/11 11:14:45	5.27	13.28	3.6	0.0	
6/9/11 11:15:00	5.31	13.25	2.9	0.0	
6/9/11 11:15:15	5.32	13.25	2.8	0.0	
6/9/11 11:15:30	5.28	13.29	3.4	0.0	
6/9/11 11:15:45	5.25	13.30	3.7	0.0	
6/9/11 11:16:00	5.30	13.25	3.0	0.0	
6/9/11 11:16:15	5.37	13.18	2.7	0.0	
6/9/11 11:16:30	5.43	13.14	3.2	0.0	
6/9/11 11:16:45	5.45	13.09	3.3	0.0	
6/9/11 11:17:00	5.49	13.06	3.0	0.0	
6/9/11 11:17:15	5.44	13.11	2.5	0.0	
6/9/11 11:17:30	5.35	13.21	2.9	0.1	
6/9/11 11:17:45	5.29	13.27	3.4	0.0	
6/9/11 11:18:00	5.31	13.24	3.4	0.1	
6/9/11 11:18:15	5.27	13.29	2.7	0.0	
6/9/11 11:18:30	5.18	13.37	2.8	0.0	
6/9/11 11:18:45	5.13	13.41	3.1	0.0	
6/9/11 11:19:00	5.14	13.41	3.3	0.0	
6/9/11 11:19:15	5.13	13.43	2.8	0.0	
6/9/11 11:19:30	5.11	13.44	2.6	0.0	
6/9/11 11:19:45	5.10	13.45	2.9	0.0	
6/9/11 11:20:00	5.10	13.44	3.2	0.0	
6/9/11 11:20:15	5.09	13.45	3.0	0.0	
6/9/11 11:20:30	5.11	13.43	2.6	0.0	
6/9/11 11:20:45	5.15	13.40	2.9	0.0	
6/9/11 11:21:00	5.22	13.34	3.4	0.0	
6/9/11 11:21:15	5.30	13.27	3.3	0.0	
6/9/11 11:21:30	5.35	13.21	2.8	0.0	
6/9/11 11:21:45	5.38	13.19	3.1	0.0	
6/9/11 11:22:00	5.39	13.17	3.5	0.1	
6/9/11 11:22:15	5.42	13.14	3.5	0.0	
6/9/11 11:22:30	5.47	13.10	2.9	0.0	
6/9/11 11:22:45	5.45	13.11	2.7	0.0	
6/9/11 11:23:00	5.38	13.18	3.1	0.1	
6/9/11 11:23:15	5.30	13.26	3.5	0.1	
6/9/11 11:23:30	5.28	13.29	2.9	0.0	
6/9/11 11:23:45	5.31	13.26	2.5	0.0	
6/9/11 11:24:00	5.29	13.29	2.9	0.0	
6/9/11 11:24:15	5.21	13.36	3.3	0.0	
6/9/11 11:24:30	5.19	13.36	3.4	0.1	
6/9/11 11:24:45	5.21	13.34	2.8	0.1	
6/9/11 11:25:00	5.22	13.34	3.0	0.0	
6/9/11 11:25:15	5.25	13.31	3.2	0.0	
6/9/11 11:25:30	5.30	13.27	3.4	0.0	
6/9/11 11:25:45	5.30	13.26	2.8	0.0	
6/9/11 11:26:00	5.28	13.28	2.6	0.0	
6/9/11 11:26:15	5.21	13.34	3.0	0.0	
6/9/11 11:26:30	5.18	13.37	3.4	0.0	
6/9/11 11:26:45	5.18	13.37	3.1	0.1	
6/9/11 11:27:00	5.17	13.38	2.6	0.0	
6/9/11 11:27:15	5.22	13.33	2.7	0.0	
6/9/11 11:27:30	5.27	13.29	3.2	0.0	
6/9/11 11:27:45	5.28	13.28	3.2	0.0	
6/9/11 11:28:00	5.23	13.33	2.7	0.0	
6/9/11 11:28:15	5.15	13.41	2.8	0.0	
6/9/11 11:28:30	5.11	13.44	3.2	0.0	
6/9/11 11:28:45	5.12	13.44	3.4	0.0	
6/9/11 11:29:00	5.16	13.41	2.9	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 11:29:15	5.17	13.39	2.7	0.0	
6/9/11 11:29:30	5.23	13.33	3.2	0.0	
6/9/11 11:29:45	5.29	13.27	3.5	0.0	
6/9/11 11:30:00	5.35	13.21	3.4	0.0	
6/9/11 11:30:15	5.46	13.10	2.9	0.0	
6/9/11 11:30:30	5.52	13.05	3.1	0.0	
6/9/11 11:30:45	5.48	13.09	3.6	0.0	
6/9/11 11:31:00	5.47	13.09	3.3	0.0	
6/9/11 11:31:15	5.50	13.06	2.6	0.0	
6/9/11 11:31:30	5.49	13.09	2.5	0.0	
6/9/11 11:31:45	5.42	13.15	2.9	0.0	
6/9/11 11:32:00	5.37	13.20	3.0	0.0	
6/9/11 11:32:15	5.31	13.25	2.6	0.0	
6/9/11 11:32:30	5.26	13.31	2.3	0.0	
6/9/11 11:32:45	5.21	13.36	2.8	0.0	
6/9/11 11:33:00	5.18	13.38	3.2	0.0	
6/9/11 11:33:15	5.14	13.41	3.1	0.0	
6/9/11 11:33:30	5.11	13.44	2.5	0.0	
6/9/11 11:33:45	5.09	13.47	2.7	0.0	
6/9/11 11:34:00	5.07	13.48	3.2	0.0	
6/9/11 11:34:15	5.06	13.50	3.3	0.0	
6/9/11 11:34:30	5.04	13.51	3.0	0.0	
6/9/11 11:34:45	5.12	13.44	2.8	0.0	
6/9/11 11:35:00	5.25	13.30	3.3	0.0	
6/9/11 11:35:15	5.42	13.13	3.6	0.0	
6/9/11 11:35:30	5.53	13.03	3.3	0.0	
6/9/11 11:35:45	5.49	13.09	2.9	0.0	
6/9/11 11:36:00	5.36	13.21	3.1	0.0	
6/9/11 11:36:15	5.26	13.30	3.5	0.0	
6/9/11 11:36:30	5.27	13.29	3.4	0.0	
6/9/11 11:36:45	5.35	13.21	2.9	0.0	
6/9/11 11:37:00	5.44	13.14	2.9	0.0	
6/9/11 11:37:15	5.47	13.11	3.4	0.0	
6/9/11 11:37:30	5.47	13.12	3.5	0.0	
6/9/11 11:37:45	5.39	13.19	2.9	0.0	
6/9/11 11:38:00	5.34	13.22	2.6	0.0	
6/9/11 11:38:15	5.41	13.16	2.9	0.0	
6/9/11 11:38:30	5.45	13.14	3.1	0.0	
6/9/11 11:38:45	5.47	13.10	3.0	0.0	
6/9/11 11:39:00	5.49	13.09	2.4	0.0	
6/9/11 11:39:15	5.40	13.17	2.5	0.0	
6/9/11 11:39:30	5.28	13.28	3.1	0.1	
6/9/11 11:39:45	5.24	13.32	3.1	0.0	
6/9/11 11:40:00	5.31	13.26	2.5	0.0	
6/9/11 11:40:15	5.35	13.22	2.4	0.0	
6/9/11 11:40:30	5.37	13.20	2.9	0.0	
6/9/11 11:40:45	5.37	13.19	3.0	0.0	
6/9/11 11:41:00	5.34	13.22	3.0	0.0	
6/9/11 11:41:15	5.28	13.28	2.5	0.0	
6/9/11 11:41:30	5.25	13.31	2.7	0.0	
6/9/11 11:41:45	5.25	13.30	3.0	0.0	
6/9/11 11:42:00	5.23	13.33	2.9	0.0	
6/9/11 11:42:15	5.14	13.41	2.6	0.0	
6/9/11 11:42:30	5.14	13.41	2.7	0.0	
6/9/11 11:42:45	5.21	13.35	3.2	0.0	
6/9/11 11:43:00	5.29	13.28	3.5	0.0	
6/9/11 11:43:15	5.35	13.22	3.4	0.0	
6/9/11 11:43:30	5.39	13.19	2.9	0.0	
6/9/11 11:43:45	5.38	13.20	3.0	0.0	
6/9/11 11:44:00	5.36	13.21	3.5	0.0	
6/9/11 11:44:15	5.39	13.18	3.6	0.0	
6/9/11 11:44:30	5.44	13.14	2.9	0.0	
6/9/11 11:44:45	5.44	13.13	2.8	0.0	
6/9/11 11:45:00	5.43	13.14	3.3	0.0	
6/9/11 11:45:15	5.43	13.14	3.4	0.0	
6/9/11 11:45:30	5.40	13.17	2.9	0.0	
6/9/11 11:45:45	5.33	13.24	2.4	0.0	
6/9/11 11:46:00	5.23	13.33	2.9	0.0	
6/9/11 11:46:15	5.22	13.35	3.3	0.0	
6/9/11 11:46:30	5.27	13.29	3.0	0.0	
6/9/11 11:46:45	5.35	13.21	2.4	0.0	
6/9/11 11:47:00	5.34	13.22	2.7	0.0	
6/9/11 11:47:15	5.26	13.30	3.0	0.0	
6/9/11 11:47:30	5.23	13.32	2.9	0.0	
6/9/11 11:47:45	5.27	13.30	2.5	0.0	
6/9/11 11:48:00	5.27	13.30	2.3	0.0	
6/9/11 11:48:15	5.23	13.33	2.8	0.0	
6/9/11 11:48:30	5.25	13.31	3.1	0.0	
6/9/11 11:48:45	5.29	13.27	2.9	0.0	
6/9/11 11:49:00	5.34	13.21	2.4	0.0	
6/9/11 11:49:15	5.37	13.19	2.7	0.0	
6/9/11 11:49:30	5.35	13.22	3.0	0.0	
6/9/11 11:49:45	5.30	13.27	3.1	0.0	
6/9/11 11:50:00	5.19	13.37	2.7	0.0	
6/9/11 11:50:15	5.15	13.40	2.7	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 11:50:30	5.18	13.39	3.4	0.0	
6/9/11 11:50:45	5.21	13.36	3.6	0.0	
6/9/11 11:51:00	5.27	13.31	3.2	0.0	
6/9/11 11:51:15	5.30	13.28	2.9	0.0	
6/9/11 11:51:30	5.32	13.26	3.4	0.0	
6/9/11 11:51:45	5.37	13.19	3.8	0.0	
6/9/11 11:52:00	5.49	13.08	3.5	0.0	
6/9/11 11:52:15	5.52	13.06	2.9	0.0	
6/9/11 11:52:30	5.46	13.11	3.0	0.0	
6/9/11 11:52:45	5.40	13.17	3.2	0.0	
6/9/11 11:53:00	5.31	13.25	3.1	0.0	
6/9/11 11:53:15	5.27	13.29	2.6	0.0	
6/9/11 11:53:30	5.33	13.23	2.7	0.0	
6/9/11 11:53:45	5.48	13.08	3.0	0.0	
6/9/11 11:54:00	5.62	12.96	3.2	0.0	
6/9/11 11:54:15	5.65	12.92	2.7	0.0	
6/9/11 11:54:30	5.54	13.02	2.3	0.0	
6/9/11 11:54:45	5.42	13.12	2.6	0.0	
6/9/11 11:55:00	5.36	13.19	3.0	0.0	
6/9/11 11:55:15	5.34	13.23	2.8	0.0	
6/9/11 11:55:30	5.31	13.26	2.1	0.0	
6/9/11 11:55:45	5.27	13.29	2.3	0.0	
6/9/11 11:56:00	5.22	13.34	2.9	0.0	
6/9/11 11:56:15	5.18	13.38	3.0	0.0	
6/9/11 11:56:30	5.18	13.38	2.5	0.0	
6/9/11 11:56:45	5.29	13.27	2.5	0.0	
6/9/11 11:57:00	5.40	13.17	3.0	0.0	
6/9/11 11:57:15	5.36	13.22	3.3	0.0	
6/9/11 11:57:30	5.21	13.36	3.1	0.0	
6/9/11 11:57:45	5.12	13.43	2.8	0.0	
6/9/11 11:58:00	5.17	13.39	3.2	0.0	
6/9/11 11:58:15	5.22	13.35	3.6	0.0	
6/9/11 11:58:30	5.31	13.27	3.6	0.0	
6/9/11 11:58:45	5.40	13.18	3.0	0.0	
6/9/11 11:59:00	5.39	13.19	2.9	0.0	
6/9/11 11:59:15	5.34	13.24	3.3	0.0	
6/9/11 11:59:30	5.33	13.25	3.5	0.0	
6/9/11 11:59:45	5.41	13.16	2.9	0.0	
6/9/11 12:00:00	5.51	13.07	2.6	0.0	
6/9/11 12:00:15	5.53	13.05	2.8	0.0	
6/9/11 12:00:30	5.48	13.09	3.1	0.0	
6/9/11 12:00:45	5.43	13.14	3.0	0.0	
6/9/11 12:01:00	5.33	13.24	2.5	0.0	
6/9/11 12:01:15	5.22	13.35	2.7	0.0	
6/9/11 12:01:30	5.22	13.34	3.1	0.0	
6/9/11 12:01:45	5.29	13.28	3.0	0.0	
6/9/11 12:02:00	5.31	13.27	2.5	0.0	
6/9/11 12:02:15	5.28	13.30	2.4	0.0	
6/9/11 12:02:30	5.20	13.38	2.9	0.0	
6/9/11 12:02:45	5.12	13.45	3.2	0.0	
6/9/11 12:03:00	5.12	13.45	2.8	0.0	
6/9/11 12:03:15	5.13	13.44	2.5	0.0	
6/9/11 12:03:30	5.17	13.39	2.8	0.0	
6/9/11 12:03:45	5.18	13.40	3.1	0.0	
6/9/11 12:04:00	5.13	13.44	3.1	0.0	
6/9/11 12:04:15	5.14	13.42	2.8	0.0	
6/9/11 12:04:30	5.14	13.42	2.9	0.0	
6/9/11 12:04:45	5.19	13.38	3.3	0.0	
6/9/11 12:05:00	5.33	13.25	3.5	0.0	
6/9/11 12:05:15	5.47	13.12	2.9	0.0	
6/9/11 12:05:30	5.52	13.07	2.6	0.0	
6/9/11 12:05:45	5.51	13.07	3.0	0.0	
6/9/11 12:06:00	5.45	13.12	3.4	0.0	
6/9/11 12:06:15	5.35	13.22	3.2	0.0	
6/9/11 12:06:30	5.29	13.28	2.6	0.0	
6/9/11 12:06:45	5.25	13.32	2.8	0.0	
6/9/11 12:07:00	5.24	13.33	3.2	0.0	
6/9/11 12:07:15	5.30	13.27	3.2	0.0	
6/9/11 12:07:30	5.39	13.18	2.7	0.0	
6/9/11 12:07:45	5.49	13.09	2.6	0.0	
6/9/11 12:08:00	5.47	13.10	2.9	0.0	
6/9/11 12:08:15	5.44	13.12	3.2	0.0	
6/9/11 12:08:30	5.45	13.12	3.0	0.0	
6/9/11 12:08:45	5.46	13.11	2.4	0.0	
6/9/11 12:09:00	5.44	13.15	2.8	0.0	
6/9/11 12:09:15	5.36	13.23	3.1	0.0	
6/9/11 12:09:30	5.35	13.23	3.1	0.0	
6/9/11 12:09:45	5.36	13.21	2.5	0.0	
6/9/11 12:10:00	5.39	13.18	2.3	0.0	
6/9/11 12:10:15	5.33	13.24	2.8	0.0	
6/9/11 12:10:30	5.20	13.36	3.1	0.0	
6/9/11 12:10:45	5.14	13.42	2.9	0.0	
6/9/11 12:11:00	5.13	13.44	2.6	0.0	
6/9/11 12:11:15	5.18	13.39	2.9	0.0	
6/9/11 12:11:30	5.28	13.29	3.3	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 12:11:45	5.40	13.17	3.3	0.0	
6/9/11 12:12:00	5.43	13.15	2.7	0.0	
6/9/11 12:12:15	5.40	13.17	2.7	0.0	
6/9/11 12:12:30	5.34	13.25	3.2	0.0	
6/9/11 12:12:45	5.29	13.29	3.5	0.0	
6/9/11 12:13:00	5.29	13.29	3.3	0.0	
6/9/11 12:13:15	5.30	13.29	2.8	0.0	
6/9/11 12:13:30	5.28	13.30	2.9	0.0	
6/9/11 12:13:45	5.27	13.30	3.3	0.0	
6/9/11 12:14:00	5.33	13.24	3.3	0.0	End Run 3 0010
6/9/11 12:14:15	5.44	13.13	2.7	0.0	
6/9/11 12:14:30	5.58	13.00	2.7	0.0	
6/9/11 12:14:45	5.63	12.94	3.1	0.0	
6/9/11 12:15:00	5.57	13.00	3.1	0.0	
6/9/11 12:15:15	5.43	13.15	2.6	0.0	
6/9/11 12:15:30	5.29	13.28	2.5	0.0	
6/9/11 12:15:45	5.24	13.33	2.9	0.0	
6/9/11 12:16:00	5.31	13.25	3.3	0.0	
6/9/11 12:16:15	5.42	13.16	3.0	0.0	
6/9/11 12:16:30	5.46	13.12	2.5	0.0	
6/9/11 12:16:45	5.36	13.23	2.6	0.0	
6/9/11 12:17:00	5.25	13.31	3.1	0.0	
6/9/11 12:17:15	5.30	13.27	6.6	0.0	
6/9/11 12:17:30	5.36	13.08	36.2	0.0	
6/9/11 12:17:45	6.30	9.78	81.3	0.0	
6/9/11 12:18:00	6.31	5.75	81.0	0.0	
6/9/11 12:18:15	5.11	4.09	55.8	0.0	
6/9/11 12:18:30	4.68	3.79	42.7	0.0	System Bias
6/9/11 12:18:45	4.62	3.88	39.8	0.0	O ₂ Bias 5 Mid = 4.61
6/9/11 12:19:00	4.62	4.08	39.1	0.0	CO Bias 5 Mid = 39.3
6/9/11 12:19:15	4.60	4.13	39.1	0.0	C ₃ H ₈ Bias 5 Zero = 0.0
6/9/11 12:19:30	4.59	4.14	39.2	0.0	
6/9/11 12:19:45	4.59	4.13	38.6	0.0	
6/9/11 12:20:00	4.59	4.13	38.4	0.0	
6/9/11 12:20:15	4.59	4.13	38.6	0.0	
6/9/11 12:20:30	4.59	4.13	36.7	0.0	
6/9/11 12:20:45	4.68	5.71	32.1	0.0	
6/9/11 12:21:00	5.04	7.88	43.7	0.0	
6/9/11 12:21:15	7.50	8.53	72.4	0.0	
6/9/11 12:21:30	10.42	9.58	92.3	0.0	System Bias
6/9/11 12:21:45	11.30	9.92	97.6	0.0	CO ₂ Bias 5 Mid = 9.97
6/9/11 12:22:00	11.42	9.97	98.1	0.0	
6/9/11 12:22:15	11.43	9.98	97.9	0.0	
6/9/11 12:22:30	11.44	9.99	98.2	0.0	
6/9/11 12:22:45	11.44	9.99	98.5	0.0	
6/9/11 12:23:00	11.44	10.00	98.5	0.0	
6/9/11 12:23:15	11.45	10.00	98.0	0.0	
6/9/11 12:23:30	11.45	10.00	95.4	0.0	
6/9/11 12:23:45	11.29	10.15	79.9	0.0	
6/9/11 12:24:00	9.51	10.91	58.6	0.0	
6/9/11 12:24:15	6.95	7.29	33.0	0.0	
6/9/11 12:24:30	3.00	2.91	11.7	0.0	
6/9/11 12:24:45	0.72	0.68	2.8	0.0	
6/9/11 12:25:00	0.24	0.30	0.4	0.0	
6/9/11 12:25:15	0.18	0.24	-0.1	0.0	
6/9/11 12:25:30	0.16	0.21	-0.6	0.0	
6/9/11 12:25:45	0.15	0.19	-0.4	0.0	
6/9/11 12:26:00	0.14	0.18	-0.2	0.0	
6/9/11 12:26:15	0.14	0.17	0.0	0.0	
6/9/11 12:26:30	0.13	0.16	-0.4	0.0	
6/9/11 12:26:45	0.13	0.15	-0.8	0.0	
6/9/11 12:27:00	0.13	0.14	-0.6	0.0	
6/9/11 12:27:15	0.12	0.14	-0.2	0.3	
6/9/11 12:27:30	0.12	0.14	-0.1	0.4	
6/9/11 12:27:45	0.12	0.13	-0.7	0.4	
6/9/11 12:28:00	0.12	0.13	-0.8	0.3	
6/9/11 12:28:15	0.12	0.13	-0.4	0.3	
6/9/11 12:28:30	0.12	0.12	-0.2	16.4	
6/9/11 12:28:45	0.11	0.12	-0.6	39.3	
6/9/11 12:29:00	0.11	0.12	-1.1	33.8	
6/9/11 12:29:15	0.11	0.12	-0.7	32.0	System Bias
6/9/11 12:29:30	0.11	0.12	-0.3	30.6	C ₃ H ₈ Bias 5 Low = 30.6
6/9/11 12:29:45	0.11	0.12	-0.5	30.1	O ₂ Bias 5 Zero = 0.11
6/9/11 12:30:00	0.11	0.12	-1.1	30.8	CO ₂ Bias 5 Zero = 0.12
6/9/11 12:30:15	0.11	0.11	-0.9	30.8	CO Bias 5 Zero = -0.7
6/9/11 12:30:30	0.11	0.11	-0.4	30.8	
6/9/11 12:30:45	0.11	0.11	-0.2	30.7	
6/9/11 12:31:00	0.11	0.11	-0.7	30.2	
6/9/11 12:31:15	0.11	0.11	-1.1	30.2	
6/9/11 12:31:30	0.11	0.11	-0.7	30.6	
6/9/11 12:31:45	0.45	1.70	-0.3	30.5	
6/9/11 12:32:00	2.51	7.20	0.5	30.2	
6/9/11 12:32:15	4.26	10.83	1.6	30.8	
6/9/11 12:32:30	5.05	12.68	2.6	19.8	
6/9/11 12:32:45	5.17	13.13	3.4	11.7	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 12:33:00	5.12	13.28	3.8	3.4	
6/9/11 12:33:15	5.12	13.30	3.3	0.3	
6/9/11 12:33:30	5.21	13.25	2.9	0.1	
6/9/11 12:33:45	5.29	13.19	3.4	0.0	
6/9/11 12:34:00	5.34	13.14	3.8	0.1	
6/9/11 12:34:15	5.40	13.09	3.6	0.0	
6/9/11 12:34:30	5.39	13.12	2.9	0.0	
6/9/11 12:34:45	5.30	13.21	2.7	0.0	
6/9/11 12:35:00	5.26	13.24	3.0	0.0	
6/9/11 12:35:15	5.22	13.28	3.2	0.0	
6/9/11 12:35:30	5.20	13.31	3.1	0.0	
6/9/11 12:35:45	5.15	13.37	2.6	0.0	
6/9/11 12:36:00	5.11	13.41	2.9	0.0	
6/9/11 12:36:15	5.14	13.37	3.2	0.0	
6/9/11 12:36:30	5.20	13.33	3.3	0.0	
6/9/11 12:36:45	5.20	13.34	2.6	0.0	
6/9/11 12:37:00	5.20	13.33	2.5	0.0	
6/9/11 12:37:15	5.21	13.32	2.9	0.0	
6/9/11 12:37:30	5.18	13.35	3.3	0.0	
6/9/11 12:37:45	5.14	13.39	3.1	0.0	
6/9/11 12:38:00	5.15	13.39	2.5	0.0	
6/9/11 12:38:15	5.12	13.42	2.8	0.0	
6/9/11 12:38:30	5.01	13.53	3.2	0.0	
6/9/11 12:38:45	4.98	13.55	3.5	0.0	
6/9/11 12:39:00	5.04	13.50	3.2	0.0	
6/9/11 12:39:15	5.04	13.51	3.0	0.0	
6/9/11 12:39:30	5.07	13.46	3.3	0.0	
6/9/11 12:39:45	5.23	13.32	3.6	0.0	
6/9/11 12:40:00	5.36	13.20	3.6	0.0	
6/9/11 12:40:15	5.44	13.13	2.8	0.0	
6/9/11 12:40:30	5.45	13.12	2.9	0.0	
6/9/11 12:40:45	5.42	13.14	3.3	0.0	
6/9/11 12:41:00	5.36	13.20	3.6	0.0	
6/9/11 12:41:15	5.29	13.26	3.1	0.0	
6/9/11 12:41:30	5.27	13.27	2.6	0.0	
6/9/11 12:41:45	5.29	13.25	3.0	0.0	
6/9/11 12:42:00	5.35	13.20	3.5	0.0	
6/9/11 12:42:15	5.40	13.17	3.3	0.0	
6/9/11 12:42:30	5.38	13.18	2.8	0.0	
6/9/11 12:42:45	5.31	13.24	2.8	0.0	
6/9/11 12:43:00	5.24	13.30	3.2	0.0	
6/9/11 12:43:15	5.23	13.30	3.5	0.0	
6/9/11 12:43:30	5.27	13.29	3.1	0.0	
6/9/11 12:43:45	5.24	13.32	2.7	0.1	
6/9/11 12:44:00	5.21	13.34	3.1	0.0	
6/9/11 12:44:15	5.14	13.42	3.3	0.0	
6/9/11 12:44:30	5.06	13.50	3.2	0.0	
6/9/11 12:44:45	5.05	13.50	2.6	0.0	
6/9/11 12:45:00	5.11	13.44	2.6	0.0	
6/9/11 12:45:15	5.14	13.40	3.2	0.0	
6/9/11 12:45:30	5.14	13.41	3.3	0.0	
6/9/11 12:45:45	5.17	13.37	3.1	0.0	
6/9/11 12:46:00	5.27	13.29	2.8	0.0	
6/9/11 12:46:15	5.32	13.24	3.0	0.0	
6/9/11 12:46:30	5.31	13.25	3.4	0.0	
6/9/11 12:46:45	5.25	13.31	3.6	0.0	
6/9/11 12:47:00	5.23	13.33	3.1	0.0	
6/9/11 12:47:15	5.25	13.31	2.9	0.0	
6/9/11 12:47:30	5.28	13.28	3.4	0.0	
6/9/11 12:47:45	5.37	13.19	3.7	0.0	
6/9/11 12:48:00	5.44	13.14	3.3	0.0	
6/9/11 12:48:15	5.43	13.14	2.7	0.0	
6/9/11 12:48:30	5.35	13.21	2.9	0.0	
6/9/11 12:48:45	5.25	13.31	3.3	0.0	
6/9/11 12:49:00	5.20	13.36	3.3	0.0	
6/9/11 12:49:15	5.23	13.34	2.6	0.0	
6/9/11 12:49:30	5.30	13.26	2.6	0.0	
6/9/11 12:49:45	5.33	13.25	3.0	0.0	
6/9/11 12:50:00	5.29	13.27	3.3	0.0	
6/9/11 12:50:15	5.31	13.26	3.2	0.0	
6/9/11 12:50:30	5.34	13.23	2.8	0.0	
6/9/11 12:50:45	5.36	13.21	2.9	0.0	
6/9/11 12:51:00	5.34	13.22	3.2	0.0	
6/9/11 12:51:15	5.27	13.29	3.2	0.0	
6/9/11 12:51:30	5.20	13.35	3.0	0.0	
6/9/11 12:51:45	5.14	13.41	2.5	0.0	
6/9/11 12:52:00	5.13	13.42	3.0	0.0	
6/9/11 12:52:15	5.18	13.37	3.3	0.0	
6/9/11 12:52:30	5.23	13.33	3.2	0.0	
6/9/11 12:52:45	5.26	13.30	2.6	0.0	
6/9/11 12:53:00	5.23	13.34	2.7	0.0	
6/9/11 12:53:15	5.16	13.41	3.1	0.0	
6/9/11 12:53:30	5.16	13.41	3.2	0.0	
6/9/11 12:53:45	5.17	13.40	2.9	0.0	
6/9/11 12:54:00	5.18	13.38	2.6	0.0	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 12:54:15	5.23	13.33	3.1	0.0	
6/9/11 12:54:30	5.29	13.28	3.5	0.0	
6/9/11 12:54:45	5.28	13.29	3.3	0.0	
6/9/11 12:55:00	5.24	13.32	2.7	0.0	
6/9/11 12:55:15	5.22	13.34	2.8	0.0	
6/9/11 12:55:30	5.24	13.33	3.3	0.0	
6/9/11 12:55:45	5.28	13.28	3.3	0.0	
6/9/11 12:56:00	5.34	13.23	3.0	0.0	
6/9/11 12:56:15	5.40	13.17	2.8	0.0	
6/9/11 12:56:30	5.46	13.12	3.2	0.0	
6/9/11 12:56:45	5.43	13.15	3.3	0.0	
6/9/11 12:57:00	5.35	13.22	3.2	0.0	
6/9/11 12:57:15	5.33	13.22	2.6	0.0	
6/9/11 12:57:30	5.31	13.24	2.8	0.0	
6/9/11 12:57:45	5.24	13.32	3.3	0.0	
6/9/11 12:58:00	5.18	13.38	3.3	0.0	
6/9/11 12:58:15	5.18	13.38	2.9	0.0	
6/9/11 12:58:30	5.19	13.36	2.6	0.0	
6/9/11 12:58:45	5.22	13.33	3.1	0.0	
6/9/11 12:59:00	5.33	13.22	3.4	0.0	
6/9/11 12:59:15	5.43	13.14	3.0	0.0	
6/9/11 12:59:30	5.44	13.13	2.5	0.0	
6/9/11 12:59:45	5.36	13.21	2.5	0.0	
6/9/11 13:00:00	5.26	13.30	2.9	0.0	
6/9/11 13:00:15	5.21	13.34	3.0	0.0	
6/9/11 13:00:30	5.20	13.36	2.6	0.0	
6/9/11 13:00:45	5.25	13.31	2.4	0.0	
6/9/11 13:01:00	5.35	13.21	2.8	0.0	
6/9/11 13:01:15	5.43	13.14	3.2	0.0	
6/9/11 13:01:30	5.37	13.21	3.0	0.0	
6/9/11 13:01:45	5.28	13.27	2.6	0.0	
6/9/11 13:02:00	5.29	13.26	2.8	0.0	
6/9/11 13:02:15	5.30	13.26	3.4	0.0	
6/9/11 13:02:30	5.32	13.23	3.6	0.1	
6/9/11 13:02:45	5.34	13.23	2.9	0.0	
6/9/11 13:03:00	5.32	13.25	2.6	0.0	
6/9/11 13:03:15	5.30	13.26	3.2	0.0	
6/9/11 13:03:30	5.31	13.26	3.4	0.0	
6/9/11 13:03:45	5.37	13.19	3.0	0.0	
6/9/11 13:04:00	5.46	13.11	2.5	0.0	
6/9/11 13:04:15	5.48	13.10	2.6	0.0	
6/9/11 13:04:30	5.46	13.10	2.8	0.0	
6/9/11 13:04:45	5.43	13.11	3.1	0.0	
6/9/11 13:05:00	5.37	13.18	2.4	0.0	
6/9/11 13:05:15	5.30	13.24	2.2	0.0	
6/9/11 13:05:30	5.32	13.23	2.6	0.0	
6/9/11 13:05:45	5.28	13.28	3.0	0.0	
6/9/11 13:06:00	5.22	13.32	2.9	0.0	
6/9/11 13:06:15	5.23	13.32	2.2	0.0	
6/9/11 13:06:30	5.26	13.30	2.4	0.0	
6/9/11 13:06:45	5.32	13.23	3.1	0.0	
6/9/11 13:07:00	5.33	13.21	3.1	0.0	
6/9/11 13:07:15	5.31	13.24	2.6	0.0	
6/9/11 13:07:30	5.28	13.27	2.4	0.0	
6/9/11 13:07:45	5.30	13.25	2.9	0.0	
6/9/11 13:08:00	5.29	13.27	3.3	0.0	
6/9/11 13:08:15	5.20	13.36	3.3	0.0	
6/9/11 13:08:30	5.11	13.44	2.9	0.0	
6/9/11 13:08:45	5.10	13.45	3.1	0.0	
6/9/11 13:09:00	5.17	13.38	3.5	0.0	
6/9/11 13:09:15	5.27	13.30	3.6	0.0	
6/9/11 13:09:30	5.32	13.25	3.2	0.0	
6/9/11 13:09:45	5.34	13.23	2.9	0.0	
6/9/11 13:10:00	5.31	13.26	3.3	0.0	
6/9/11 13:10:15	5.23	13.33	3.6	0.0	
6/9/11 13:10:30	5.18	13.38	3.5	0.0	
6/9/11 13:10:45	5.16	13.41	2.7	0.0	
6/9/11 13:11:00	5.23	13.33	2.7	0.0	
6/9/11 13:11:15	5.32	13.25	3.2	0.0	
6/9/11 13:11:30	5.39	13.18	3.3	0.0	
6/9/11 13:11:45	5.46	13.10	2.6	0.0	
6/9/11 13:12:00	5.55	13.01	2.3	0.0	
6/9/11 13:12:15	5.56	13.01	2.7	0.0	
6/9/11 13:12:30	5.39	13.17	3.0	0.0	
6/9/11 13:12:45	5.24	13.31	2.9	0.0	
6/9/11 13:13:00	5.16	13.38	2.3	0.0	
6/9/11 13:13:15	5.12	13.44	2.3	0.0	
6/9/11 13:13:30	5.12	13.42	2.9	0.0	
6/9/11 13:13:45	5.22	13.33	3.0	0.0	
6/9/11 13:14:00	5.28	13.27	2.7	0.0	
6/9/11 13:14:15	5.29	13.26	2.3	0.0	
6/9/11 13:14:30	5.24	13.31	2.6	0.0	
6/9/11 13:14:45	5.17	13.38	3.1	0.0	
6/9/11 13:15:00	5.13	13.42	3.3	0.0	
6/9/11 13:15:15	5.15	13.40	2.8	0.1	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 13:15:30	5.27	13.29	3.0	0.0	
6/9/11 13:15:45	5.36	13.21	3.2	0.0	
6/9/11 13:16:00	5.31	13.25	3.6	0.0	
6/9/11 13:16:15	5.28	13.26	3.0	0.0	
6/9/11 13:16:30	5.24	13.31	2.7	0.0	
6/9/11 13:16:45	5.19	13.37	3.2	0.0	
6/9/11 13:17:00	5.15	13.41	3.5	0.0	
6/9/11 13:17:15	5.20	13.35	3.6	0.0	
6/9/11 13:17:30	5.32	13.24	3.0	0.0	
6/9/11 13:17:45	5.39	13.17	2.9	0.0	
6/9/11 13:18:00	5.39	13.20	3.2	0.0	
6/9/11 13:18:15	5.37	13.20	3.4	0.0	
6/9/11 13:18:30	5.38	13.18	3.1	0.0	
6/9/11 13:18:45	5.36	13.20	2.5	0.0	
6/9/11 13:19:00	5.33	13.23	2.9	0.0	
6/9/11 13:19:15	5.31	13.25	3.0	0.0	
6/9/11 13:19:30	5.29	13.25	3.0	0.0	
6/9/11 13:19:45	5.30	13.24	2.4	0.0	
6/9/11 13:20:00	5.29	13.25	2.4	0.0	
6/9/11 13:20:15	5.25	13.30	2.8	0.0	
6/9/11 13:20:30	5.19	13.36	3.0	0.0	
6/9/11 13:20:45	5.19	13.35	2.7	0.0	
6/9/11 13:21:00	5.20	13.35	2.3	0.0	
6/9/11 13:21:15	5.19	13.36	2.4	0.0	
6/9/11 13:21:30	5.18	13.37	2.9	0.0	
6/9/11 13:21:45	5.16	13.38	3.1	0.0	
6/9/11 13:22:00	5.20	13.35	2.6	0.0	
6/9/11 13:22:15	5.26	13.29	2.4	0.0	
6/9/11 13:22:30	5.26	13.29	2.9	0.0	
6/9/11 13:22:45	5.21	13.34	3.2	0.0	
6/9/11 13:23:00	5.25	13.30	3.0	0.0	
6/9/11 13:23:15	5.30	13.25	2.6	0.0	
6/9/11 13:23:30	5.29	13.27	2.9	0.0	
6/9/11 13:23:45	5.29	13.26	3.5	0.0	
6/9/11 13:24:00	5.28	13.27	3.6	0.0	
6/9/11 13:24:15	5.26	13.28	3.1	0.0	
6/9/11 13:24:30	5.27	13.29	2.8	0.0	
6/9/11 13:24:45	5.29	13.27	3.2	0.0	
6/9/11 13:25:00	5.29	13.27	3.7	0.0	
6/9/11 13:25:15	5.30	13.26	3.3	0.0	
6/9/11 13:25:30	5.39	13.18	2.8	0.0	
6/9/11 13:25:45	5.45	13.13	3.0	0.0	
6/9/11 13:26:00	5.37	13.20	3.3	0.0	
6/9/11 13:26:15	5.30	13.26	3.2	0.0	
6/9/11 13:26:30	5.27	13.28	2.6	0.0	
6/9/11 13:26:45	5.24	13.31	2.4	0.0	
6/9/11 13:27:00	5.21	13.34	2.8	0.0	
6/9/11 13:27:15	5.25	13.30	3.2	0.0	
6/9/11 13:27:30	5.31	13.25	2.9	0.0	
6/9/11 13:27:45	5.29	13.26	2.4	0.1	
6/9/11 13:28:00	5.21	13.34	2.7	0.0	
6/9/11 13:28:15	5.18	13.37	3.0	0.0	
6/9/11 13:28:30	5.19	13.36	3.0	0.0	
6/9/11 13:28:45	5.22	13.32	2.3	0.0	
6/9/11 13:29:00	5.22	13.32	2.4	0.0	
6/9/11 13:29:15	5.20	13.33	2.7	0.1	
6/9/11 13:29:30	5.25	13.29	2.8	0.0	
6/9/11 13:29:45	5.24	13.31	2.3	0.0	
6/9/11 13:30:00	5.24	13.30	2.4	0.0	
6/9/11 13:30:15	5.29	13.26	3.0	0.0	
6/9/11 13:30:30	5.26	13.29	3.3	0.0	
6/9/11 13:30:45	5.23	13.32	2.7	0.0	
6/9/11 13:31:00	5.19	13.36	2.5	0.0	
6/9/11 13:31:15	5.16	13.39	2.8	0.0	
6/9/11 13:31:30	5.17	13.37	3.2	0.0	
6/9/11 13:31:45	5.28	13.26	3.1	0.0	
6/9/11 13:32:00	5.37	13.19	2.6	0.0	
6/9/11 13:32:15	5.37	13.20	2.8	0.0	
6/9/11 13:32:30	5.35	13.21	3.3	0.0	
6/9/11 13:32:45	5.37	13.19	3.2	0.0	
6/9/11 13:33:00	5.38	13.18	2.5	0.0	
6/9/11 13:33:15	5.34	13.22	2.4	0.0	
6/9/11 13:33:30	5.25	13.31	2.8	0.0	
6/9/11 13:33:45	5.19	13.35	3.1	0.0	
6/9/11 13:34:00	5.28	13.26	2.6	0.0	
6/9/11 13:34:15	5.36	13.19	2.3	0.0	
6/9/11 13:34:30	5.35	13.20	2.7	0.0	
6/9/11 13:34:45	5.27	13.27	3.1	0.0	
6/9/11 13:35:00	5.25	13.30	2.8	0.0	
6/9/11 13:35:15	5.30	13.25	2.3	0.0	
6/9/11 13:35:30	5.31	13.24	2.6	0.0	
6/9/11 13:35:45	5.24	13.32	2.9	0.0	
6/9/11 13:36:00	5.22	13.32	2.9	0.0	
6/9/11 13:36:15	5.25	13.29	2.1	0.0	
6/9/11 13:36:30	5.23	13.32	2.2	0.0	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 13:36:45	5.16	13.37	2.7	0.0	
6/9/11 13:37:00	5.20	13.34	3.0	0.0	
6/9/11 13:37:15	5.21	13.33	2.6	0.0	
6/9/11 13:37:30	5.20	13.35	2.3	0.0	
6/9/11 13:37:45	5.22	13.33	2.6	0.0	
6/9/11 13:38:00	5.24	13.31	3.0	0.0	
6/9/11 13:38:15	5.26	13.30	2.8	0.0	
6/9/11 13:38:30	5.24	13.31	2.5	0.0	
6/9/11 13:38:45	5.20	13.34	2.8	0.0	
6/9/11 13:39:00	5.23	13.31	3.4	0.0	
6/9/11 13:39:15	5.26	13.29	3.1	0.0	
6/9/11 13:39:30	5.21	13.33	2.5	0.0	
6/9/11 13:39:45	5.17	13.38	2.6	0.0	
6/9/11 13:40:00	5.22	13.34	3.2	0.0	
6/9/11 13:40:15	5.31	13.24	3.4	0.0	
6/9/11 13:40:30	5.43	13.12	2.5	0.0	
6/9/11 13:40:45	5.52	13.04	2.4	0.0	
6/9/11 13:41:00	5.53	13.03	2.7	0.0	
6/9/11 13:41:15	5.46	13.10	2.9	0.0	
6/9/11 13:41:30	5.34	13.21	2.6	0.0	
6/9/11 13:41:45	5.28	13.25	2.2	0.0	
6/9/11 13:42:00	5.27	13.27	2.5	0.0	
6/9/11 13:42:15	5.25	13.29	3.0	0.0	
6/9/11 13:42:30	5.23	13.32	2.7	0.0	
6/9/11 13:42:45	5.16	13.40	2.2	0.0	
6/9/11 13:43:00	5.13	13.41	2.3	0.0	
6/9/11 13:43:15	5.16	13.38	2.6	0.0	
6/9/11 13:43:30	5.17	13.37	2.9	0.0	
6/9/11 13:43:45	5.15	13.40	2.2	0.0	
6/9/11 13:44:00	5.17	13.36	2.2	0.0	
6/9/11 13:44:15	5.19	13.36	2.5	0.0	
6/9/11 13:44:30	5.18	13.35	2.8	0.0	
6/9/11 13:44:45	5.18	13.35	2.4	0.0	
6/9/11 13:45:00	5.21	13.34	2.1	0.0	
6/9/11 13:45:15	5.26	13.28	2.6	0.0	
6/9/11 13:45:30	5.34	13.21	3.1	0.0	
6/9/11 13:45:45	5.35	13.21	3.0	0.0	
6/9/11 13:46:00	5.32	13.23	2.5	0.0	
6/9/11 13:46:15	5.34	13.20	2.5	0.0	
6/9/11 13:46:30	5.39	13.17	3.0	0.0	
6/9/11 13:46:45	5.42	13.14	3.0	0.0	
6/9/11 13:47:00	5.37	13.19	2.4	0.0	
6/9/11 13:47:15	5.32	13.22	2.3	0.0	
6/9/11 13:47:30	5.33	13.21	3.0	0.0	
6/9/11 13:47:45	5.34	13.20	3.2	0.0	
6/9/11 13:48:00	5.37	13.17	2.7	0.0	
6/9/11 13:48:15	5.34	13.21	2.4	0.0	
6/9/11 13:48:30	5.26	13.28	2.5	0.0	
6/9/11 13:48:45	5.22	13.32	2.8	0.0	
6/9/11 13:49:00	5.20	13.35	2.6	0.0	
6/9/11 13:49:15	5.24	13.32	2.1	0.0	
6/9/11 13:49:30	5.21	13.36	2.4	0.0	
6/9/11 13:49:45	5.17	13.37	2.8	0.0	
6/9/11 13:50:00	5.26	13.28	3.1	0.0	
6/9/11 13:50:15	5.35	13.19	2.3	0.0	
6/9/11 13:50:30	5.35	13.20	2.2	0.0	
6/9/11 13:50:45	5.28	13.28	2.6	0.0	
6/9/11 13:51:00	5.22	13.32	3.0	0.0	
6/9/11 13:51:15	5.22	13.31	2.5	0.0	
6/9/11 13:51:30	5.23	13.31	2.2	0.0	
6/9/11 13:51:45	5.22	13.33	2.7	0.0	
6/9/11 13:52:00	5.17	13.36	3.1	0.0	
6/9/11 13:52:15	5.14	13.39	2.9	0.0	
6/9/11 13:52:30	5.15	13.39	2.3	0.0	
6/9/11 13:52:45	5.20	13.35	2.8	0.0	
6/9/11 13:53:00	5.22	13.34	3.1	0.0	
6/9/11 13:53:15	5.25	13.30	3.1	0.0	
6/9/11 13:53:30	5.30	13.25	2.8	0.0	
6/9/11 13:53:45	5.34	13.22	2.7	0.1	
6/9/11 13:54:00	5.36	13.20	3.1	0.1	
6/9/11 13:54:15	5.37	13.19	3.3	0.0	
6/9/11 13:54:30	5.37	13.19	2.6	0.1	
6/9/11 13:54:45	5.34	13.22	2.4	0.0	
6/9/11 13:55:00	5.31	13.25	2.5	0.0	
6/9/11 13:55:15	5.32	13.23	2.9	0.0	
6/9/11 13:55:30	5.34	13.21	2.6	0.0	
6/9/11 13:55:45	5.31	13.24	2.2	0.0	
6/9/11 13:56:00	5.19	13.35	2.5	-4.7	
6/9/11 13:56:15	5.12	13.40	3.0	0.5	
6/9/11 13:56:30	5.18	13.36	3.0	0.3	
6/9/11 13:56:45	5.31	13.22	2.8	0.3	
6/9/11 13:57:00	5.39	13.14	3.2	0.3	
6/9/11 13:57:15	5.37	13.16	3.9	0.3	
6/9/11 13:57:30	5.35	13.15	4.1	0.3	
6/9/11 13:57:45	5.60	12.90	3.7	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 13:58:00	5.84	12.73	3.4	0.3	
6/9/11 13:58:15	5.86	12.73	3.8	0.3	
6/9/11 13:58:30	5.83	12.75	4.1	0.3	
6/9/11 13:58:45	5.84	12.73	4.0	0.3	
6/9/11 13:59:00	5.90	12.68	3.4	0.3	
6/9/11 13:59:15	5.98	12.62	3.8	0.3	
6/9/11 13:59:30	5.98	12.64	4.3	0.3	
6/9/11 13:59:45	5.88	12.71	4.2	0.3	
6/9/11 14:00:00	5.86	12.72	3.7	0.3	
6/9/11 14:00:15	5.95	12.65	3.8	0.3	
6/9/11 14:00:30	5.97	12.65	4.3	0.3	
6/9/11 14:00:45	5.92	12.67	4.6	0.3	
6/9/11 14:01:00	5.97	12.62	4.2	0.3	
6/9/11 14:01:15	6.05	12.55	4.1	0.3	
6/9/11 14:01:30	6.06	12.55	4.2	0.3	
6/9/11 14:01:45	6.01	12.60	4.5	0.3	
6/9/11 14:02:00	5.94	12.65	4.2	0.3	
6/9/11 14:02:15	5.91	12.67	3.5	0.3	
6/9/11 14:02:30	5.91	12.68	3.7	0.3	
6/9/11 14:02:45	5.89	12.69	4.1	0.3	
6/9/11 14:03:00	5.90	12.67	4.1	0.3	
6/9/11 14:03:15	5.91	12.66	3.5	0.3	
6/9/11 14:03:30	5.90	12.67	3.6	0.3	
6/9/11 14:03:45	5.84	12.73	4.1	0.3	
6/9/11 14:04:00	5.78	12.77	4.2	0.3	
6/9/11 14:04:15	5.79	12.76	3.8	0.3	
6/9/11 14:04:30	5.85	12.70	3.5	0.3	
6/9/11 14:04:45	5.89	12.67	3.7	0.3	
6/9/11 14:05:00	5.95	12.62	4.0	0.3	
6/9/11 14:05:15	5.91	12.67	3.8	0.3	
6/9/11 14:05:30	5.80	12.76	3.4	0.3	
6/9/11 14:05:45	5.78	12.76	3.8	0.3	
6/9/11 14:06:00	5.79	12.76	4.3	0.3	
6/9/11 14:06:15	5.76	12.79	4.4	0.3	
6/9/11 14:06:30	5.73	12.82	3.7	0.3	
6/9/11 14:06:45	5.69	12.85	3.7	0.3	
6/9/11 14:07:00	5.63	12.90	4.3	0.3	
6/9/11 14:07:15	5.58	12.94	4.7	0.3	
6/9/11 14:07:30	5.57	12.95	4.5	0.3	
6/9/11 14:07:45	5.60	12.93	4.2	0.3	
6/9/11 14:08:00	5.64	12.90	4.5	0.3	
6/9/11 14:08:15	5.67	12.87	4.7	0.3	
6/9/11 14:08:30	5.76	12.79	4.5	0.3	
6/9/11 14:08:45	5.86	12.71	3.8	0.3	
6/9/11 14:09:00	5.94	12.64	3.8	0.3	
6/9/11 14:09:15	5.95	12.64	4.2	0.3	
6/9/11 14:09:30	5.93	12.65	4.2	0.3	
6/9/11 14:09:45	5.87	12.70	3.6	0.3	
6/9/11 14:10:00	5.79	12.76	3.3	0.3	
6/9/11 14:10:15	5.80	12.75	3.6	0.3	
6/9/11 14:10:30	5.85	12.70	3.9	0.3	
6/9/11 14:10:45	5.85	12.71	3.9	0.3	
6/9/11 14:11:00	5.73	12.82	3.3	0.3	
6/9/11 14:11:15	5.60	12.92	3.5	0.3	
6/9/11 14:11:30	5.55	12.96	3.9	0.3	
6/9/11 14:11:45	5.53	12.97	4.0	0.3	
6/9/11 14:12:00	5.50	13.01	3.5	0.3	
6/9/11 14:12:15	5.50	13.00	3.5	0.3	
6/9/11 14:12:30	5.57	12.94	3.9	0.3	
6/9/11 14:12:45	5.66	12.87	4.3	0.3	
6/9/11 14:13:00	5.79	12.76	4.1	0.3	
6/9/11 14:13:15	5.85	12.72	3.6	0.3	
6/9/11 14:13:30	5.81	12.75	4.0	0.3	
6/9/11 14:13:45	5.77	12.78	4.3	0.3	
6/9/11 14:14:00	5.76	12.79	4.4	0.3	
6/9/11 14:14:15	5.80	12.76	4.0	0.3	
6/9/11 14:14:30	5.84	12.73	3.8	0.3	
6/9/11 14:14:45	5.86	12.71	4.4	0.3	
6/9/11 14:15:00	5.90	12.68	4.4	0.3	
6/9/11 14:15:15	5.87	12.71	4.0	0.3	
6/9/11 14:15:30	5.81	12.74	3.6	0.3	
6/9/11 14:15:45	5.78	12.76	4.0	0.3	
6/9/11 14:16:00	5.77	12.77	4.5	0.3	
6/9/11 14:16:15	5.74	12.81	4.2	0.3	
6/9/11 14:16:30	5.67	12.86	3.6	0.3	
6/9/11 14:16:45	5.67	12.85	3.7	0.3	
6/9/11 14:17:00	5.72	12.82	4.0	0.3	
6/9/11 14:17:15	5.67	12.86	4.2	0.3	
6/9/11 14:17:30	5.61	12.90	3.7	0.3	
6/9/11 14:17:45	5.62	12.88	3.4	0.3	
6/9/11 14:18:00	5.68	12.85	3.8	0.3	
6/9/11 14:18:15	5.71	12.82	4.2	0.3	
6/9/11 14:18:30	5.73	12.81	3.8	0.3	
6/9/11 14:18:45	5.70	12.84	3.2	0.3	
6/9/11 14:19:00	5.63	12.89	3.5	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 14:19:15	5.61	12.90	3.9	0.3	
6/9/11 14:19:30	5.65	12.86	4.0	0.3	
6/9/11 14:19:45	5.67	12.86	3.2	0.3	
6/9/11 14:20:00	5.64	12.88	3.3	0.3	
6/9/11 14:20:15	5.65	12.87	3.9	0.3	
6/9/11 14:20:30	5.68	12.85	4.1	0.3	
6/9/11 14:20:45	5.63	12.90	3.6	0.3	
6/9/11 14:21:00	5.57	12.94	3.5	0.3	
6/9/11 14:21:15	5.58	12.93	4.2	0.3	
6/9/11 14:21:30	5.59	12.91	4.6	0.3	
6/9/11 14:21:45	5.72	12.82	4.2	0.3	
6/9/11 14:22:00	5.74	12.82	3.9	0.3	
6/9/11 14:22:15	5.73	12.82	4.1	0.3	
6/9/11 14:22:30	5.76	12.79	4.2	0.3	
6/9/11 14:22:45	5.76	12.79	4.2	0.3	
6/9/11 14:23:00	5.73	12.81	3.8	0.3	
6/9/11 14:23:15	5.67	12.88	3.9	0.3	
6/9/11 14:23:30	5.61	12.91	4.2	0.3	
6/9/11 14:23:45	5.63	12.90	4.3	0.3	
6/9/11 14:24:00	5.70	12.84	3.9	0.3	
6/9/11 14:24:15	5.72	12.82	3.6	0.3	
6/9/11 14:24:30	5.69	12.84	4.0	0.3	
6/9/11 14:24:45	5.62	12.89	4.1	0.3	
6/9/11 14:25:00	5.55	12.96	3.9	0.3	
6/9/11 14:25:15	5.52	12.98	3.3	0.3	
6/9/11 14:25:30	5.51	12.99	3.7	0.3	
6/9/11 14:25:45	5.51	12.99	4.2	0.3	
6/9/11 14:26:00	5.56	12.95	4.2	0.3	
6/9/11 14:26:15	5.61	12.91	3.7	0.3	
6/9/11 14:26:30	5.58	12.93	3.6	0.3	
6/9/11 14:26:45	5.50	13.00	3.8	0.3	
6/9/11 14:27:00	5.46	13.04	4.1	0.3	
6/9/11 14:27:15	5.41	13.09	3.8	0.3	
6/9/11 14:27:30	5.38	13.13	3.5	0.3	
6/9/11 14:27:45	5.35	13.16	4.1	0.3	
6/9/11 14:28:00	5.37	13.13	4.4	0.3	
6/9/11 14:28:15	5.41	13.10	4.2	0.3	
6/9/11 14:28:30	5.49	13.01	3.7	0.3	
6/9/11 14:28:45	5.62	12.90	4.0	0.3	
6/9/11 14:29:00	5.70	12.83	4.4	0.3	
6/9/11 14:29:15	5.70	12.83	4.4	0.3	
6/9/11 14:29:30	5.62	12.90	3.9	0.3	
6/9/11 14:29:45	5.54	12.96	3.7	0.3	
6/9/11 14:30:00	5.59	12.92	4.2	0.3	
6/9/11 14:30:15	5.57	12.95	4.4	0.3	
6/9/11 14:30:30	5.49	13.03	4.2	0.3	
6/9/11 14:30:45	5.45	13.06	3.7	0.3	
6/9/11 14:31:00	5.49	13.02	3.9	0.3	
6/9/11 14:31:15	5.56	12.95	4.1	0.3	
6/9/11 14:31:30	5.63	12.90	3.9	0.3	
6/9/11 14:31:45	5.63	12.90	3.3	0.3	
6/9/11 14:32:00	5.58	12.94	3.5	0.3	
6/9/11 14:32:15	5.57	12.93	4.0	0.3	
6/9/11 14:32:30	5.58	12.92	4.2	0.3	
6/9/11 14:32:45	5.57	12.93	3.6	0.3	
6/9/11 14:33:00	5.54	12.96	3.4	0.3	
6/9/11 14:33:15	5.52	12.97	4.0	0.3	
6/9/11 14:33:30	5.57	12.93	4.2	0.3	
6/9/11 14:33:45	5.54	12.96	3.9	0.3	
6/9/11 14:34:00	5.49	13.01	3.4	0.3	
6/9/11 14:34:15	5.44	13.06	3.8	0.3	
6/9/11 14:34:30	5.42	13.08	4.1	0.3	
6/9/11 14:34:45	5.42	13.08	3.7	0.3	
6/9/11 14:35:00	5.45	13.05	3.2	0.3	
6/9/11 14:35:15	5.47	13.03	3.6	0.3	
6/9/11 14:35:30	5.44	13.06	4.0	0.3	
6/9/11 14:35:45	5.38	13.13	4.1	0.3	
6/9/11 14:36:00	5.39	13.12	3.7	0.3	
6/9/11 14:36:15	5.46	13.06	3.7	0.3	
6/9/11 14:36:30	5.50	13.01	4.2	0.3	
6/9/11 14:36:45	5.58	12.94	4.3	0.3	
6/9/11 14:37:00	5.60	12.93	3.8	0.3	
6/9/11 14:37:15	5.54	12.98	3.6	0.3	
6/9/11 14:37:30	5.54	12.96	3.9	0.3	
6/9/11 14:37:45	5.59	12.92	4.2	0.3	
6/9/11 14:38:00	5.66	12.86	3.9	0.3	
6/9/11 14:38:15	5.67	12.87	3.3	0.3	
6/9/11 14:38:30	5.54	12.97	3.5	0.3	
6/9/11 14:38:45	5.62	12.86	3.9	0.3	
6/9/11 14:39:00	5.73	12.81	4.0	0.3	
6/9/11 14:39:15	5.66	12.89	3.4	0.3	
6/9/11 14:39:30	5.56	12.97	3.6	0.3	
6/9/11 14:39:45	5.34	13.18	3.9	0.3	
6/9/11 14:40:00	5.21	13.28	4.0	0.3	
6/9/11 14:40:15	5.33	13.12	3.7	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 14:40:30	5.53	12.97	3.3	0.3	
6/9/11 14:40:45	5.55	12.99	3.9	0.3	
6/9/11 14:41:00	5.55	12.97	4.1	0.3	
6/9/11 14:41:15	5.51	12.99	3.7	0.3	
6/9/11 14:41:30	5.45	13.04	3.2	0.3	
6/9/11 14:41:45	5.43	13.06	3.7	0.3	
6/9/11 14:42:00	5.42	13.08	4.3	0.3	
6/9/11 14:42:15	5.43	13.07	4.3	0.3	
6/9/11 14:42:30	5.45	13.05	3.8	0.3	
6/9/11 14:42:45	5.45	13.05	3.9	0.3	
6/9/11 14:43:00	5.49	13.00	4.2	0.3	
6/9/11 14:43:15	5.61	12.89	4.5	0.3	
6/9/11 14:43:30	5.71	12.83	4.0	0.3	
6/9/11 14:43:45	5.72	12.83	3.8	0.3	
6/9/11 14:44:00	5.67	12.87	3.9	0.3	
6/9/11 14:44:15	5.59	12.92	4.1	0.3	
6/9/11 14:44:30	5.56	12.95	3.8	0.3	
6/9/11 14:44:45	5.57	12.94	3.1	0.3	
6/9/11 14:45:00	5.56	12.94	3.2	0.3	
6/9/11 14:45:15	5.51	12.99	3.8	0.3	
6/9/11 14:45:30	5.43	13.06	3.6	0.3	
6/9/11 14:45:45	5.48	13.01	3.0	0.3	
6/9/11 14:46:00	5.51	12.99	3.1	0.3	
6/9/11 14:46:15	5.46	13.04	3.8	0.3	
6/9/11 14:46:30	5.46	13.03	3.9	0.3	
6/9/11 14:46:45	5.55	12.93	3.3	0.3	
6/9/11 14:47:00	5.65	12.87	3.2	0.3	Begin Run 1
6/9/11 14:47:15	5.58	12.92	3.6	0.3	FCCU-OH-1
6/9/11 14:47:30	5.48	13.02	3.8	0.3	FCCU-23-1
6/9/11 14:47:45	5.42	13.08	3.5	0.3	
6/9/11 14:48:00	5.41	13.09	3.3	0.3	
6/9/11 14:48:15	5.42	13.08	3.7	0.3	
6/9/11 14:48:30	5.44	13.05	4.1	0.3	
6/9/11 14:48:45	5.43	13.07	3.9	0.3	
6/9/11 14:49:00	5.40	13.10	3.4	0.3	
6/9/11 14:49:15	5.48	13.01	3.9	0.3	
6/9/11 14:49:30	5.55	12.96	4.4	0.3	
6/9/11 14:49:45	5.54	12.96	4.2	0.3	
6/9/11 14:50:00	5.54	12.97	3.8	0.3	
6/9/11 14:50:15	5.49	13.01	3.7	0.3	
6/9/11 14:50:30	5.53	12.97	4.1	0.3	
6/9/11 14:50:45	5.57	12.93	4.2	0.3	
6/9/11 14:51:00	5.58	12.93	3.8	0.3	
6/9/11 14:51:15	5.59	12.92	3.5	0.3	
6/9/11 14:51:30	5.54	12.97	3.9	0.3	
6/9/11 14:51:45	5.48	13.03	4.2	0.3	
6/9/11 14:52:00	5.45	13.06	3.7	0.3	
6/9/11 14:52:15	5.43	13.07	3.4	0.3	
6/9/11 14:52:30	5.46	13.03	3.6	0.3	
6/9/11 14:52:45	5.50	13.00	4.0	0.3	
6/9/11 14:53:00	5.48	13.02	3.8	0.3	
6/9/11 14:53:15	5.42	13.07	3.2	0.3	
6/9/11 14:53:30	5.33	13.17	3.3	0.3	
6/9/11 14:53:45	5.27	13.23	3.8	0.3	
6/9/11 14:54:00	5.29	13.21	3.9	0.3	
6/9/11 14:54:15	5.32	13.18	3.2	0.3	
6/9/11 14:54:30	5.35	13.16	3.2	0.3	
6/9/11 14:54:45	5.32	13.19	3.7	0.3	
6/9/11 14:55:00	5.22	13.27	3.9	0.3	
6/9/11 14:55:15	5.19	13.29	3.3	0.3	
6/9/11 14:55:30	5.21	13.29	3.1	0.3	
6/9/11 14:55:45	5.24	13.26	4.0	0.3	
6/9/11 14:56:00	5.40	13.09	4.2	0.3	
6/9/11 14:56:15	5.46	13.07	3.9	0.3	
6/9/11 14:56:30	5.33	13.18	3.5	0.3	
6/9/11 14:56:45	5.25	13.24	3.9	0.3	
6/9/11 14:57:00	5.22	13.28	4.3	0.3	
6/9/11 14:57:15	5.20	13.30	4.2	0.3	
6/9/11 14:57:30	5.25	13.25	3.8	0.3	
6/9/11 14:57:45	5.34	13.17	3.9	0.3	
6/9/11 14:58:00	5.43	13.08	4.2	0.3	
6/9/11 14:58:15	5.52	12.98	4.2	0.3	
6/9/11 14:58:30	5.60	12.90	3.5	0.3	
6/9/11 14:58:45	5.56	12.94	3.4	0.3	
6/9/11 14:59:00	5.49	13.00	3.8	0.3	
6/9/11 14:59:15	5.44	13.05	3.9	0.3	
6/9/11 14:59:30	5.38	13.11	3.5	0.3	
6/9/11 14:59:45	5.38	13.11	3.1	0.3	
6/9/11 15:00:00	5.41	13.09	3.5	0.3	
6/9/11 15:00:15	5.43	13.07	3.9	0.3	
6/9/11 15:00:30	5.43	13.08	3.5	0.3	
6/9/11 15:00:45	5.38	13.12	3.1	0.3	
6/9/11 15:01:00	5.37	13.11	3.4	0.3	
6/9/11 15:01:15	5.37	13.12	3.7	0.3	
6/9/11 15:01:30	5.32	13.17	3.6	0.3	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 15:01:45	5.31	13.18	3.0	0.3	
6/9/11 15:02:00	5.33	13.16	3.3	0.3	
6/9/11 15:02:15	5.35	13.15	3.8	0.3	
6/9/11 15:02:30	5.33	13.15	4.0	0.3	
6/9/11 15:02:45	5.30	13.20	3.5	0.3	
6/9/11 15:03:00	5.25	13.24	3.6	0.3	
6/9/11 15:03:15	5.26	13.23	4.0	0.3	
6/9/11 15:03:30	5.28	13.21	4.1	0.3	
6/9/11 15:03:45	5.37	13.12	3.7	0.3	
6/9/11 15:04:00	5.49	13.00	3.5	0.3	
6/9/11 15:04:15	5.58	12.93	4.0	0.3	
6/9/11 15:04:30	5.57	12.93	4.2	0.3	
6/9/11 15:04:45	5.58	12.93	3.5	0.3	
6/9/11 15:05:00	5.55	12.96	3.1	0.3	
6/9/11 15:05:15	5.50	13.00	3.6	0.3	
6/9/11 15:05:30	5.45	13.04	4.0	0.3	
6/9/11 15:05:45	5.36	13.13	3.7	0.3	
6/9/11 15:06:00	5.29	13.20	3.2	0.3	
6/9/11 15:06:15	5.27	13.22	3.5	0.3	
6/9/11 15:06:30	5.25	13.24	4.0	0.3	
6/9/11 15:06:45	5.24	13.25	3.9	0.3	
6/9/11 15:07:00	5.25	13.24	3.4	0.3	
6/9/11 15:07:15	5.33	13.16	3.4	0.3	
6/9/11 15:07:30	5.45	13.04	3.8	0.3	
6/9/11 15:07:45	5.47	13.02	3.8	0.3	
6/9/11 15:08:00	5.44	13.07	3.3	0.3	
6/9/11 15:08:15	5.27	13.24	3.4	0.3	
6/9/11 15:08:30	5.12	13.36	4.0	0.3	
6/9/11 15:08:45	5.09	13.37	4.2	0.3	
6/9/11 15:09:00	5.21	13.27	3.7	0.3	
6/9/11 15:09:15	5.31	13.18	3.3	0.3	
6/9/11 15:09:30	5.37	13.12	3.9	0.3	
6/9/11 15:09:45	5.44	13.06	4.3	0.3	
6/9/11 15:10:00	5.43	13.07	4.0	0.3	
6/9/11 15:10:15	5.41	13.08	3.6	0.3	
6/9/11 15:10:30	5.39	13.10	3.8	0.3	
6/9/11 15:10:45	5.36	13.13	4.2	0.3	
6/9/11 15:11:00	5.31	13.18	4.0	0.3	
6/9/11 15:11:15	5.30	13.19	3.5	0.3	
6/9/11 15:11:30	5.35	13.14	3.6	0.3	
6/9/11 15:11:45	5.47	13.02	3.8	0.3	
6/9/11 15:12:00	5.60	12.90	3.7	0.3	
6/9/11 15:12:15	5.72	12.80	3.0	0.3	
6/9/11 15:12:30	5.76	12.78	3.0	0.3	
6/9/11 15:12:45	5.72	12.80	3.4	0.3	
6/9/11 15:13:00	5.61	12.88	3.6	0.3	
6/9/11 15:13:15	5.48	13.00	3.1	0.3	
6/9/11 15:13:30	5.37	13.11	3.0	0.3	
6/9/11 15:13:45	5.33	13.14	3.6	0.3	
6/9/11 15:14:00	5.32	13.15	3.9	0.3	
6/9/11 15:14:15	5.27	13.21	3.5	0.3	
6/9/11 15:14:30	5.19	13.29	3.3	0.3	
6/9/11 15:14:45	5.16	13.31	3.8	0.3	
6/9/11 15:15:00	5.15	13.33	4.1	0.3	
6/9/11 15:15:15	5.12	13.37	3.9	0.3	
6/9/11 15:15:30	5.14	13.35	3.7	0.3	
6/9/11 15:15:45	5.24	13.26	4.0	0.3	
6/9/11 15:16:00	5.27	13.24	4.5	0.3	
6/9/11 15:16:15	5.24	13.26	4.5	0.3	
6/9/11 15:16:30	5.25	13.24	4.0	0.3	
6/9/11 15:16:45	5.31	13.18	4.1	0.3	
6/9/11 15:17:00	5.40	13.10	4.4	0.3	
6/9/11 15:17:15	5.43	13.09	4.2	0.3	
6/9/11 15:17:30	5.44	13.06	3.6	0.3	
6/9/11 15:17:45	5.52	12.97	3.4	0.3	
6/9/11 15:18:00	5.49	13.01	3.8	0.3	
6/9/11 15:18:15	5.41	13.09	4.0	0.3	
6/9/11 15:18:30	5.31	13.19	3.4	0.3	
6/9/11 15:18:45	5.30	13.19	3.2	0.3	
6/9/11 15:19:00	5.41	13.08	3.7	0.3	
6/9/11 15:19:15	5.43	13.06	4.1	0.3	
6/9/11 15:19:30	5.39	13.09	3.6	0.3	
6/9/11 15:19:45	5.41	13.07	3.1	0.3	
6/9/11 15:20:00	5.40	13.10	3.4	0.3	
6/9/11 15:20:15	5.36	13.12	3.7	0.3	
6/9/11 15:20:30	5.35	13.12	3.6	0.3	
6/9/11 15:20:45	5.39	13.08	3.2	0.3	
6/9/11 15:21:00	5.40	13.09	3.4	0.3	
6/9/11 15:21:15	5.31	13.18	3.9	0.3	
6/9/11 15:21:30	5.26	13.22	4.0	0.3	
6/9/11 15:21:45	5.23	13.25	3.7	0.3	
6/9/11 15:22:00	5.23	13.26	3.8	0.3	
6/9/11 15:22:15	5.28	13.21	4.4	0.3	
6/9/11 15:22:30	5.38	13.12	4.4	0.3	
6/9/11 15:22:45	5.41	13.09	4.0	0.3	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 15:23:00	5.41	13.09	3.8	0.3	Resume Run 1
6/9/11 15:23:15	5.42	13.09	4.2	0.3	
6/9/11 15:23:30	5.44	13.06	4.4	0.3	
6/9/11 15:23:45	5.50	12.99	4.1	0.3	
6/9/11 15:24:00	5.55	12.94	3.5	0.3	
6/9/11 15:24:15	5.62	12.88	3.6	0.3	
6/9/11 15:24:30	5.69	12.84	3.9	0.3	
6/9/11 15:24:45	5.61	12.89	3.8	0.3	
6/9/11 15:25:00	5.49	13.00	3.2	0.3	
6/9/11 15:25:15	5.36	13.13	3.3	0.3	
6/9/11 15:25:30	5.30	13.18	3.8	0.3	
6/9/11 15:25:45	5.33	13.15	3.8	0.3	
6/9/11 15:26:00	5.35	13.15	3.3	0.3	
6/9/11 15:26:15	5.30	13.20	3.2	0.3	
6/9/11 15:26:30	5.30	13.19	3.6	0.3	
6/9/11 15:26:45	5.27	13.21	3.8	0.3	
6/9/11 15:27:00	5.20	13.28	3.4	0.3	
6/9/11 15:27:15	5.12	13.34	3.2	0.3	
6/9/11 15:27:30	5.18	13.29	3.8	0.3	
6/9/11 15:27:45	5.29	13.20	4.3	0.3	
6/9/11 15:28:00	5.39	13.10	3.9	0.3	Start M308 Run 5
6/9/11 15:28:15	5.46	13.03	3.5	0.3	
6/9/11 15:28:30	5.47	13.02	3.8	0.3	
6/9/11 15:28:45	5.43	13.06	4.2	0.3	
6/9/11 15:29:00	5.37	13.11	4.1	0.3	
6/9/11 15:29:15	5.37	13.10	3.5	0.3	
6/9/11 15:29:30	5.42	13.05	3.6	0.3	
6/9/11 15:29:45	5.59	12.91	4.0	0.3	
6/9/11 15:30:00	5.57	12.95	3.9	0.3	
6/9/11 15:30:15	5.53	12.97	3.4	0.3	
6/9/11 15:30:30	5.61	12.89	3.5	0.3	
6/9/11 15:30:45	5.62	12.90	3.8	0.3	
6/9/11 15:31:00	5.55	12.95	3.8	0.3	
6/9/11 15:31:15	5.46	13.02	3.4	0.3	
6/9/11 15:31:30	5.36	13.12	3.3	0.3	
6/9/11 15:31:45	5.33	13.14	3.7	0.3	
6/9/11 15:32:00	5.32	13.17	3.9	0.3	
6/9/11 15:32:15	5.24	13.25	3.6	0.3	
6/9/11 15:32:30	5.33	13.11	3.3	0.3	
6/9/11 15:32:45	5.55	12.94	3.7	0.3	
6/9/11 15:33:00	5.47	13.06	3.9	0.3	
6/9/11 15:33:15	5.37	13.14	3.7	0.3	
6/9/11 15:33:30	5.30	13.18	3.2	0.3	
6/9/11 15:33:45	5.30	13.19	3.4	0.3	
6/9/11 15:34:00	5.27	13.21	4.0	0.3	
6/9/11 15:34:15	5.31	13.17	4.1	0.3	
6/9/11 15:34:30	5.37	13.11	3.6	0.3	
6/9/11 15:34:45	5.39	13.09	3.7	0.3	
6/9/11 15:35:00	5.37	13.12	4.2	0.3	
6/9/11 15:35:15	5.28	13.21	4.2	0.3	
6/9/11 15:35:30	5.25	13.24	3.6	0.3	
6/9/11 15:35:45	5.33	13.16	3.5	0.3	
6/9/11 15:36:00	5.46	13.04	4.1	0.3	
6/9/11 15:36:15	5.51	12.98	4.1	0.3	
6/9/11 15:36:30	5.52	12.97	3.4	0.3	
6/9/11 15:36:45	5.56	12.92	3.2	0.3	
6/9/11 15:37:00	5.61	12.88	3.5	0.3	
6/9/11 15:37:15	5.58	12.92	3.6	0.3	
6/9/11 15:37:30	5.46	13.03	3.2	0.3	
6/9/11 15:37:45	5.35	13.12	3.0	0.3	
6/9/11 15:38:00	5.31	13.16	3.4	0.3	
6/9/11 15:38:15	5.28	13.19	3.9	0.3	
6/9/11 15:38:30	5.22	13.25	3.5	0.3	
6/9/11 15:38:45	5.22	13.25	3.1	0.3	
6/9/11 15:39:00	5.25	13.22	3.4	0.3	
6/9/11 15:39:15	5.30	13.19	3.9	0.3	
6/9/11 15:39:30	5.32	13.16	3.7	0.3	
6/9/11 15:39:45	5.45	13.00	3.2	0.3	
6/9/11 15:40:00	5.60	12.91	3.5	0.3	
6/9/11 15:40:15	5.54	12.95	4.1	0.3	
6/9/11 15:40:30	5.54	12.95	4.1	0.3	
6/9/11 15:40:45	5.47	13.01	4.0	0.3	
6/9/11 15:41:00	5.39	13.11	3.6	0.4	
6/9/11 15:41:15	5.33	13.17	3.9	0.3	
6/9/11 15:41:30	5.28	13.20	4.3	0.3	
6/9/11 15:41:45	5.31	13.17	4.2	0.3	
6/9/11 15:42:00	5.36	13.13	3.7	0.3	
6/9/11 15:42:15	5.43	13.06	3.7	0.3	
6/9/11 15:42:30	5.54	12.95	4.1	0.3	
6/9/11 15:42:45	5.57	12.93	4.1	0.3	
6/9/11 15:43:00	5.49	13.00	3.4	0.2	
6/9/11 15:43:15	5.43	13.05	3.2	0.3	
6/9/11 15:43:30	5.43	13.06	3.7	0.3	
6/9/11 15:43:45	5.40	13.08	3.7	0.3	
6/9/11 15:44:00	5.42	13.06	3.2	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 15:44:15	5.49	12.98	3.1	0.3	
6/9/11 15:44:30	5.57	12.91	3.6	0.3	
6/9/11 15:44:45	5.55	12.93	3.8	0.3	
6/9/11 15:45:00	5.42	13.08	3.5	0.3	
6/9/11 15:45:15	5.26	13.22	3.3	0.3	
6/9/11 15:45:30	5.18	13.29	3.5	0.3	
6/9/11 15:45:45	5.13	13.34	3.8	0.3	
6/9/11 15:46:00	5.06	13.40	3.9	0.2	
6/9/11 15:46:15	5.07	13.39	3.5	0.3	
6/9/11 15:46:30	5.16	13.31	3.7	0.3	
6/9/11 15:46:45	5.30	13.18	4.1	0.3	
6/9/11 15:47:00	5.38	13.12	4.0	0.3	
6/9/11 15:47:15	5.40	13.09	3.6	0.3	
6/9/11 15:47:30	5.48	13.01	3.9	0.3	
6/9/11 15:47:45	5.59	12.91	4.4	0.3	
6/9/11 15:48:00	5.63	12.87	4.4	0.3	
6/9/11 15:48:15	5.57	12.92	3.9	0.3	
6/9/11 15:48:30	5.51	12.97	3.8	0.3	
6/9/11 15:48:45	5.45	13.03	4.2	0.3	
6/9/11 15:49:00	5.37	13.11	4.3	0.3	
6/9/11 15:49:15	5.34	13.14	3.8	0.3	
6/9/11 15:49:30	5.34	13.15	3.7	0.3	
6/9/11 15:49:45	5.35	13.13	4.1	0.3	
6/9/11 15:50:00	5.37	13.11	4.3	0.3	
6/9/11 15:50:15	5.43	13.05	3.8	0.3	
6/9/11 15:50:30	5.52	12.97	3.5	0.3	
6/9/11 15:50:45	5.52	12.97	3.9	0.3	
6/9/11 15:51:00	5.52	12.96	4.1	0.3	
6/9/11 15:51:15	5.54	12.94	3.5	0.3	
6/9/11 15:51:30	5.52	12.96	3.2	0.3	
6/9/11 15:51:45	5.47	13.01	3.7	0.3	
6/9/11 15:52:00	5.42	13.07	4.1	0.3	
6/9/11 15:52:15	5.41	13.07	3.6	0.3	
6/9/11 15:52:30	5.39	13.09	3.2	0.3	
6/9/11 15:52:45	5.34	13.14	3.6	0.3	
6/9/11 15:53:00	5.29	13.19	4.0	0.3	
6/9/11 15:53:15	5.22	13.26	3.9	0.4	
6/9/11 15:53:30	5.20	13.28	3.5	0.3	
6/9/11 15:53:45	5.28	13.20	3.8	0.3	
6/9/11 15:54:00	5.37	13.12	4.2	0.3	
6/9/11 15:54:15	5.37	13.12	4.0	0.3	
6/9/11 15:54:30	5.36	13.13	3.6	0.3	
6/9/11 15:54:45	5.42	13.06	3.9	0.3	
6/9/11 15:55:00	5.49	13.00	4.3	0.3	
6/9/11 15:55:15	5.51	12.97	4.2	0.3	
6/9/11 15:55:30	5.55	12.94	3.8	0.3	
6/9/11 15:55:45	5.59	12.91	3.7	0.3	
6/9/11 15:56:00	5.59	12.90	4.0	0.3	
6/9/11 15:56:15	5.60	12.88	4.1	0.3	
6/9/11 15:56:30	5.60	12.89	3.7	0.3	
6/9/11 15:56:45	5.55	12.95	3.5	0.3	
6/9/11 15:57:00	5.40	13.09	4.0	0.3	
6/9/11 15:57:15	5.31	13.16	4.3	0.3	
6/9/11 15:57:30	5.35	13.12	4.0	0.3	
6/9/11 15:57:45	5.38	13.10	3.5	0.3	
6/9/11 15:58:00	5.34	13.14	3.9	0.3	
6/9/11 15:58:15	5.32	13.14	4.3	0.3	
6/9/11 15:58:30	5.39	13.07	3.9	0.3	
6/9/11 15:58:45	5.43	13.05	3.5	0.3	
6/9/11 15:59:00	5.37	13.10	3.8	0.3	
6/9/11 15:59:15	5.31	13.15	4.2	0.3	
6/9/11 15:59:30	5.36	13.11	4.0	0.3	
6/9/11 15:59:45	5.42	13.07	3.6	0.3	
6/9/11 16:00:00	5.44	13.05	3.7	0.3	
6/9/11 16:00:15	5.47	13.01	4.2	0.3	
6/9/11 16:00:30	5.54	12.95	4.2	0.3	
6/9/11 16:00:45	5.51	12.97	3.7	0.3	
6/9/11 16:01:00	5.44	13.04	3.8	0.3	
6/9/11 16:01:15	5.41	13.06	4.2	0.3	
6/9/11 16:01:30	5.44	13.04	4.4	0.3	
6/9/11 16:01:45	5.46	13.02	3.7	0.3	
6/9/11 16:02:00	5.45	13.03	3.8	0.3	
6/9/11 16:02:15	5.45	13.03	4.3	0.3	
6/9/11 16:02:30	5.49	13.01	4.3	0.3	
6/9/11 16:02:45	5.48	13.02	3.8	0.3	
6/9/11 16:03:00	5.52	12.97	3.8	0.3	
6/9/11 16:03:15	5.63	12.87	4.0	0.3	
6/9/11 16:03:30	5.67	12.84	4.2	0.3	
6/9/11 16:03:45	5.58	12.91	3.6	0.3	
6/9/11 16:04:00	5.51	12.97	3.4	0.3	
6/9/11 16:04:15	5.48	12.99	3.9	0.3	
6/9/11 16:04:30	5.41	13.07	4.1	0.3	
6/9/11 16:04:45	5.31	13.16	3.8	0.3	
6/9/11 16:05:00	5.32	13.16	3.6	0.3	
6/9/11 16:05:15	5.41	13.07	4.0	0.3	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 16:05:30	5.49	13.00	4.3	0.3	
6/9/11 16:05:45	5.50	13.00	4.1	0.3	
6/9/11 16:06:00	5.38	13.11	3.6	0.3	
6/9/11 16:06:15	5.24	13.24	3.9	0.3	
6/9/11 16:06:30	5.20	13.27	4.6	0.3	
6/9/11 16:06:45	5.25	13.22	4.4	0.3	
6/9/11 16:07:00	5.34	13.15	3.9	0.3	
6/9/11 16:07:15	5.43	13.07	4.2	0.3	
6/9/11 16:07:30	5.46	13.04	4.5	0.3	
6/9/11 16:07:45	5.50	12.99	4.7	0.3	
6/9/11 16:08:00	5.57	12.92	4.2	0.3	
6/9/11 16:08:15	5.65	12.86	4.1	0.3	
6/9/11 16:08:30	5.68	12.84	4.4	0.3	
6/9/11 16:08:45	5.73	12.79	4.5	0.3	
6/9/11 16:09:00	5.76	12.77	3.8	0.3	
6/9/11 16:09:15	5.72	12.81	3.5	0.3	
6/9/11 16:09:30	5.64	12.86	3.9	0.3	
6/9/11 16:09:45	5.59	12.89	4.3	0.3	
6/9/11 16:10:00	5.60	12.88	4.0	0.3	
6/9/11 16:10:15	5.64	12.85	3.5	0.3	
6/9/11 16:10:30	5.71	12.79	3.8	0.3	
6/9/11 16:10:45	5.79	12.74	4.2	0.3	
6/9/11 16:11:00	5.74	12.79	3.7	0.3	
6/9/11 16:11:15	5.63	12.86	3.2	0.3	
6/9/11 16:11:30	5.58	12.90	3.6	0.3	
6/9/11 16:11:45	5.48	13.01	4.2	0.3	
6/9/11 16:12:00	5.36	13.13	4.0	0.3	
6/9/11 16:12:15	5.34	13.15	3.6	0.3	
6/9/11 16:12:30	5.36	13.13	4.0	0.3	
6/9/11 16:12:45	5.37	13.11	4.6	0.3	
6/9/11 16:13:00	5.43	13.06	4.5	0.3	
6/9/11 16:13:15	5.53	12.96	4.1	0.3	
6/9/11 16:13:30	5.61	12.89	4.3	0.3	
6/9/11 16:13:45	5.64	12.86	4.6	0.3	
6/9/11 16:14:00	5.71	12.81	4.4	0.3	
6/9/11 16:14:15	5.82	12.73	4.1	0.3	
6/9/11 16:14:30	5.80	12.74	4.2	0.3	
6/9/11 16:14:45	5.70	12.82	4.5	0.3	
6/9/11 16:15:00	5.60	12.90	4.4	0.3	
6/9/11 16:15:15	5.57	12.92	3.8	0.3	
6/9/11 16:15:30	5.60	12.90	3.7	0.3	
6/9/11 16:15:45	5.60	12.90	4.3	0.3	
6/9/11 16:16:00	5.59	12.90	4.4	0.3	
6/9/11 16:16:15	5.63	12.87	3.8	0.3	
6/9/11 16:16:30	5.63	12.88	3.6	0.3	
6/9/11 16:16:45	5.57	12.93	4.2	0.3	
6/9/11 16:17:00	5.53	12.96	4.4	0.3	
6/9/11 16:17:15	5.56	12.93	3.9	0.3	
6/9/11 16:17:30	5.61	12.89	3.6	0.3	
6/9/11 16:17:45	5.56	12.95	4.1	0.3	
6/9/11 16:18:00	5.50	13.01	4.4	0.3	
6/9/11 16:18:15	5.42	13.07	4.0	0.3	
6/9/11 16:18:30	5.40	13.08	3.6	0.3	
6/9/11 16:18:45	5.42	13.07	3.9	0.3	
6/9/11 16:19:00	5.46	13.02	4.3	0.3	
6/9/11 16:19:15	5.54	12.95	4.1	0.3	
6/9/11 16:19:30	5.58	12.91	3.5	0.3	
6/9/11 16:19:45	5.56	12.93	3.9	0.3	
6/9/11 16:20:00	5.54	12.94	4.2	0.3	
6/9/11 16:20:15	5.54	12.96	4.2	0.3	
6/9/11 16:20:30	5.50	13.00	3.8	0.3	
6/9/11 16:20:45	5.54	12.95	3.9	0.3	
6/9/11 16:21:00	5.67	12.85	4.4	0.3	
6/9/11 16:21:15	5.69	12.84	4.6	0.3	
6/9/11 16:21:30	5.59	12.91	4.1	0.3	
6/9/11 16:21:45	5.61	12.89	4.2	0.3	
6/9/11 16:22:00	5.70	12.82	4.5	0.2	
6/9/11 16:22:15	5.80	12.75	4.7	0.3	
6/9/11 16:22:30	5.87	12.68	4.2	0.3	
6/9/11 16:22:45	5.88	12.67	3.8	0.3	
6/9/11 16:23:00	5.90	12.65	4.2	0.3	
6/9/11 16:23:15	5.87	12.68	4.4	0.3	
6/9/11 16:23:30	5.73	12.79	4.0	0.3	
6/9/11 16:23:45	5.58	12.90	3.6	0.3	
6/9/11 16:24:00	5.48	13.01	3.9	0.3	
6/9/11 16:24:15	5.46	13.03	4.4	0.3	
6/9/11 16:24:30	5.56	12.94	4.1	0.3	
6/9/11 16:24:45	5.73	12.79	3.7	0.3	
6/9/11 16:25:00	5.83	12.72	3.8	0.3	
6/9/11 16:25:15	5.73	12.80	4.1	0.3	
6/9/11 16:25:30	5.58	12.92	3.9	0.2	
6/9/11 16:25:45	5.43	13.04	3.5	0.2	
6/9/11 16:26:00	5.37	13.09	3.7	0.3	
6/9/11 16:26:15	5.40	13.07	4.4	0.3	
6/9/11 16:26:30	5.46	13.03	4.3	0.3	

Restart

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 16:26:45	5.53	12.95	3.6	0.3	
6/9/11 16:27:00	5.57	12.93	3.8	0.3	
6/9/11 16:27:15	5.54	12.95	4.6	0.3	
6/9/11 16:27:30	5.57	12.92	4.5	0.3	
6/9/11 16:27:45	5.63	12.88	3.9	0.3	
6/9/11 16:28:00	5.65	12.86	4.0	0.3	
6/9/11 16:28:15	5.60	12.90	4.5	0.3	
6/9/11 16:28:30	5.54	12.95	4.7	0.3	
6/9/11 16:28:45	5.60	12.90	4.0	0.3	
6/9/11 16:29:00	5.72	12.81	3.9	0.3	
6/9/11 16:29:15	5.83	12.72	4.3	0.3	
6/9/11 16:29:30	5.89	12.67	4.3	0.3	
6/9/11 16:29:45	5.88	12.67	3.7	0.3	
6/9/11 16:30:00	5.81	12.73	3.6	0.3	
6/9/11 16:30:15	5.71	12.81	4.0	0.3	
6/9/11 16:30:30	5.69	12.82	4.2	0.3	
6/9/11 16:30:45	5.69	12.83	3.8	0.3	
6/9/11 16:31:00	5.67	12.83	3.7	0.3	
6/9/11 16:31:15	5.68	12.83	4.0	0.3	
6/9/11 16:31:30	5.68	12.83	4.2	0.3	
6/9/11 16:31:45	5.63	12.87	3.7	0.3	
6/9/11 16:32:00	5.59	12.89	3.5	0.3	
6/9/11 16:32:15	5.63	12.86	4.0	0.3	
6/9/11 16:32:30	5.64	12.87	4.3	0.3	
6/9/11 16:32:45	5.57	12.93	4.1	0.3	
6/9/11 16:33:00	5.53	12.96	3.7	0.3	
6/9/11 16:33:15	5.59	12.90	4.0	0.3	
6/9/11 16:33:30	5.69	12.83	4.5	0.3	
6/9/11 16:33:45	5.70	12.83	4.3	0.3	
6/9/11 16:34:00	5.69	12.83	3.9	0.3	
6/9/11 16:34:15	5.70	12.81	4.2	0.3	
6/9/11 16:34:30	5.75	12.77	4.5	0.3	
6/9/11 16:34:45	5.77	12.77	4.4	0.2	
6/9/11 16:35:00	5.78	12.76	3.8	0.3	
6/9/11 16:35:15	5.82	12.72	4.1	0.3	
6/9/11 16:35:30	5.85	12.70	4.4	0.4	
6/9/11 16:35:45	5.85	12.70	4.1	0.3	
6/9/11 16:36:00	5.80	12.74	3.7	0.3	
6/9/11 16:36:15	5.73	12.78	3.8	0.3	
6/9/11 16:36:30	5.68	12.83	4.3	0.3	
6/9/11 16:36:45	5.65	12.85	4.2	0.3	
6/9/11 16:37:00	5.76	12.76	3.7	0.3	
6/9/11 16:37:15	5.81	12.73	3.8	0.3	
6/9/11 16:37:30	5.77	12.76	4.2	0.3	
6/9/11 16:37:45	5.76	12.76	4.3	0.3	
6/9/11 16:38:00	5.80	12.74	3.8	0.2	
6/9/11 16:38:15	5.83	12.71	3.6	0.3	
6/9/11 16:38:30	5.89	12.66	4.1	0.3	
6/9/11 16:38:45	5.88	12.67	4.3	0.3	
6/9/11 16:39:00	5.81	12.72	3.9	0.3	
6/9/11 16:39:15	5.73	12.79	3.6	0.3	
6/9/11 16:39:30	5.64	12.86	4.1	0.3	
6/9/11 16:39:45	5.60	12.89	4.4	0.3	
6/9/11 16:40:00	5.61	12.89	3.9	0.3	
6/9/11 16:40:15	5.60	12.89	3.7	0.3	
6/9/11 16:40:30	5.58	12.91	4.3	0.2	
6/9/11 16:40:45	5.62	12.87	4.7	0.3	
6/9/11 16:41:00	5.74	12.78	4.3	0.3	
6/9/11 16:41:15	5.79	12.75	4.0	0.3	
6/9/11 16:41:30	5.78	12.75	4.5	0.3	
6/9/11 16:41:45	5.79	12.74	4.8	0.3	
6/9/11 16:42:00	5.83	12.70	4.3	0.3	
6/9/11 16:42:15	5.85	12.69	3.9	0.3	
6/9/11 16:42:30	5.85	12.70	4.3	0.3	
6/9/11 16:42:45	5.78	12.75	4.7	0.3	
6/9/11 16:43:00	5.77	12.75	4.2	0.3	
6/9/11 16:43:15	5.82	12.71	3.6	0.3	
6/9/11 16:43:30	5.64	12.69	4.2	0.3	
6/9/11 16:43:45	5.89	12.66	4.3	0.3	
6/9/11 16:44:00	5.90	12.66	3.9	0.3	
6/9/11 16:44:15	5.86	12.68	3.6	0.3	
6/9/11 16:44:30	5.84	12.70	4.0	0.3	
6/9/11 16:44:45	5.82	12.72	4.2	0.3	
6/9/11 16:45:00	5.78	12.74	3.5	0.3	
6/9/11 16:45:15	5.78	12.74	3.4	0.3	
6/9/11 16:45:30	5.75	12.77	3.8	0.3	
6/9/11 16:45:45	5.71	12.80	4.0	0.3	
6/9/11 16:46:00	5.73	12.77	3.5	0.3	
6/9/11 16:46:15	5.74	12.77	3.4	0.3	
6/9/11 16:46:30	5.68	12.82	4.0	0.3	
6/9/11 16:46:45	5.60	12.89	4.1	0.3	
6/9/11 16:47:00	5.56	12.93	3.8	0.3	
6/9/11 16:47:15	5.60	12.89	3.5	0.3	
6/9/11 16:47:30	5.69	12.82	4.0	0.4	
6/9/11 16:47:45	5.73	12.80	4.4	0.3	

End 308 - 5

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 16:48:00	5.71	12.80	4.2	0.3	
6/9/11 16:48:15	5.76	12.75	3.7	0.3	
6/9/11 16:48:30	5.84	12.70	4.2	0.3	
6/9/11 16:48:45	5.93	12.62	4.5	0.3	
6/9/11 16:49:00	5.98	12.59	4.4	0.2	
6/9/11 16:49:15	5.94	12.62	4.0	0.3	
6/9/11 16:49:30	5.88	12.67	4.2	0.3	
6/9/11 16:49:45	5.84	12.70	4.5	0.3	
6/9/11 16:50:00	5.82	12.71	4.1	0.3	
6/9/11 16:50:15	5.84	12.69	3.5	0.3	
6/9/11 16:50:30	5.87	12.67	4.0	0.3	
6/9/11 16:50:45	5.90	12.65	4.3	0.3	
6/9/11 16:51:00	5.90	12.64	4.0	0.3	
6/9/11 16:51:15	5.93	12.60	3.5	0.3	
6/9/11 16:51:30	5.87	12.68	3.7	0.3	
6/9/11 16:51:45	5.76	12.76	4.1	0.3	
6/9/11 16:52:00	5.68	12.82	4.0	0.3	
6/9/11 16:52:15	5.64	12.86	3.6	0.3	
6/9/11 16:52:30	5.64	12.85	3.8	0.4	
6/9/11 16:52:45	5.63	12.87	4.1	0.3	
6/9/11 16:53:00	5.62	12.88	3.9	0.3	
6/9/11 16:53:15	5.63	12.87	3.4	0.3	
6/9/11 16:53:30	5.60	12.90	3.5	0.3	
6/9/11 16:53:45	5.55	12.92	4.1	0.3	
6/9/11 16:54:00	5.57	12.91	4.2	0.3	
6/9/11 16:54:15	5.61	12.89	3.7	0.3	
6/9/11 16:54:30	5.64	12.87	3.8	0.3	
6/9/11 16:54:45	5.63	12.87	4.3	0.2	
6/9/11 16:55:00	5.65	12.86	4.4	0.3	
6/9/11 16:55:15	5.71	12.81	3.9	0.3	
6/9/11 16:55:30	5.74	12.80	3.9	0.3	
6/9/11 16:55:45	5.72	12.80	4.4	0.3	
6/9/11 16:56:00	5.73	12.78	4.6	0.3	
6/9/11 16:56:15	5.80	12.73	4.1	0.3	
6/9/11 16:56:30	5.88	12.66	3.9	0.3	
6/9/11 16:56:45	5.94	12.62	4.4	0.3	
6/9/11 16:57:00	5.93	12.63	4.5	0.3	
6/9/11 16:57:15	5.90	12.64	4.1	0.3	
6/9/11 16:57:30	5.92	12.62	3.8	0.3	
6/9/11 16:57:45	5.99	12.55	4.2	0.3	
6/9/11 16:58:00	6.05	12.51	4.3	0.4	
6/9/11 16:58:15	6.02	12.56	4.0	0.3	
6/9/11 16:58:30	5.93	12.62	3.7	0.3	
6/9/11 16:58:45	5.91	12.63	4.0	0.3	
6/9/11 16:59:00	5.87	12.68	4.2	0.3	
6/9/11 16:59:15	5.80	12.73	3.8	0.3	
6/9/11 16:59:30	5.79	12.73	3.6	0.3	
6/9/11 16:59:45	5.74	12.77	3.9	0.3	
6/9/11 17:00:00	5.66	12.82	4.3	0.3	
6/9/11 17:00:15	5.67	12.82	3.9	0.3	
6/9/11 17:00:30	5.71	12.80	3.5	0.3	
6/9/11 17:00:45	5.69	12.82	4.0	0.3	
6/9/11 17:01:00	5.69	12.82	4.4	0.3	
6/9/11 17:01:15	5.73	12.78	4.2	0.3	
6/9/11 17:01:30	5.78	12.75	3.9	0.3	
6/9/11 17:01:45	5.80	12.73	4.4	0.3	
6/9/11 17:02:00	5.81	12.72	4.7	0.3	
6/9/11 17:02:15	5.88	12.65	4.4	0.3	
6/9/11 17:02:30	5.90	12.66	4.0	0.3	
6/9/11 17:02:45	5.87	12.67	4.2	0.3	
6/9/11 17:03:00	5.92	12.64	4.5	0.3	
6/9/11 17:03:15	5.99	12.58	4.2	0.3	
6/9/11 17:03:30	6.05	12.53	3.6	0.3	
6/9/11 17:03:45	6.05	12.52	3.9	0.3	
6/9/11 17:04:00	5.98	12.58	4.3	0.3	
6/9/11 17:04:15	5.90	12.65	4.1	0.3	
6/9/11 17:04:30	5.86	12.68	3.4	0.3	
6/9/11 17:04:45	5.86	12.67	3.8	0.3	
6/9/11 17:05:00	5.83	12.69	4.3	0.3	
6/9/11 17:05:15	5.73	12.78	4.1	0.3	
6/9/11 17:05:30	5.63	12.86	3.6	0.3	
6/9/11 17:05:45	5.63	12.85	3.9	0.3	
6/9/11 17:06:00	5.71	12.79	4.4	0.3	
6/9/11 17:06:15	5.80	12.73	4.3	0.3	
6/9/11 17:06:30	5.89	12.65	3.8	0.3	
6/9/11 17:06:45	5.92	12.63	3.9	0.3	
6/9/11 17:07:00	5.86	12.68	4.3	0.3	
6/9/11 17:07:15	5.78	12.74	4.2	0.3	
6/9/11 17:07:30	5.75	12.76	4.0	0.3	
6/9/11 17:07:45	5.69	12.81	4.4	0.3	
6/9/11 17:08:00	5.69	12.80	4.8	0.3	
6/9/11 17:08:15	5.76	12.76	4.6	0.3	
6/9/11 17:08:30	5.80	12.73	3.9	0.3	
6/9/11 17:08:45	5.79	12.75	4.2	0.3	
6/9/11 17:09:00	5.80	12.73	4.5	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 17:09:15	5.86	12.68	4.3	0.3	
6/9/11 17:09:30	5.89	12.67	3.8	0.3	
6/9/11 17:09:45	5.88	12.68	4.0	0.3	
6/9/11 17:10:00	5.90	12.65	4.4	0.3	
6/9/11 17:10:15	5.90	12.64	4.2	0.3	
6/9/11 17:10:30	5.86	12.67	3.7	0.3	
6/9/11 17:10:45	5.91	12.64	3.7	0.3	
6/9/11 17:11:00	5.95	12.61	4.2	0.3	
6/9/11 17:11:15	5.95	12.61	4.1	0.3	
6/9/11 17:11:30	5.95	12.59	3.5	0.3	
6/9/11 17:11:45	5.93	12.62	3.9	0.3	
6/9/11 17:12:00	5.85	12.68	4.2	0.3	
6/9/11 17:12:15	5.78	12.74	3.9	0.3	
6/9/11 17:12:30	5.74	12.77	3.4	0.3	
6/9/11 17:12:45	5.74	12.77	3.8	0.3	
6/9/11 17:13:00	5.78	12.74	4.4	0.3	
6/9/11 17:13:15	5.80	12.72	4.5	0.3	
6/9/11 17:13:30	5.83	12.70	4.0	0.3	
6/9/11 17:13:45	5.90	12.64	3.9	0.3	
6/9/11 17:14:00	5.99	12.56	4.3	0.2	
6/9/11 17:14:15	5.96	12.60	4.5	0.3	
6/9/11 17:14:30	5.83	12.69	4.1	0.3	
6/9/11 17:14:45	5.81	12.70	4.1	0.3	
6/9/11 17:15:00	5.84	12.68	4.7	0.3	
6/9/11 17:15:15	5.88	12.66	5.0	0.3	
6/9/11 17:15:30	5.91	12.63	4.3	0.3	
6/9/11 17:15:45	5.92	12.62	4.1	0.3	
6/9/11 17:16:00	5.94	12.61	4.6	0.3	
6/9/11 17:16:15	5.98	12.57	4.9	0.3	
6/9/11 17:16:30	5.99	12.56	4.5	0.4	
6/9/11 17:16:45	6.03	12.54	4.1	0.3	
6/9/11 17:17:00	6.02	12.55	4.5	0.2	
6/9/11 17:17:15	5.97	12.59	4.7	0.3	
6/9/11 17:17:30	5.94	12.61	4.3	0.3	
6/9/11 17:17:45	5.97	12.58	3.8	0.3	
6/9/11 17:18:00	6.02	12.54	4.1	0.3	
6/9/11 17:18:15	6.05	12.52	4.5	0.3	
6/9/11 17:18:30	5.98	12.57	4.1	0.3	Restart
6/9/11 17:18:45	5.88	12.64	3.6	0.3	
6/9/11 17:19:00	5.84	12.68	4.0	0.3	
6/9/11 17:19:15	5.78	12.74	4.2	0.3	
6/9/11 17:19:30	5.75	12.76	4.3	0.2	
6/9/11 17:19:45	5.74	12.77	3.7	0.3	
6/9/11 17:20:00	5.79	12.72	3.6	0.3	
6/9/11 17:20:15	5.85	12.68	4.0	0.3	
6/9/11 17:20:30	5.86	12.68	4.2	0.3	
6/9/11 17:20:45	5.84	12.69	3.7	0.3	
6/9/11 17:21:00	5.86	12.68	3.7	0.3	
6/9/11 17:21:15	5.82	12.71	4.2	0.3	
6/9/11 17:21:30	5.72	12.79	4.6	0.3	
6/9/11 17:21:45	5.67	12.82	4.0	0.3	
6/9/11 17:22:00	5.74	12.76	4.0	0.3	
6/9/11 17:22:15	5.85	12.68	4.6	0.3	
6/9/11 17:22:30	5.94	12.61	4.9	0.3	
6/9/11 17:22:45	5.97	12.60	4.6	0.3	
6/9/11 17:23:00	5.92	12.63	4.2	0.3	
6/9/11 17:23:15	5.83	12.71	4.5	0.2	
6/9/11 17:23:30	5.78	12.74	5.0	0.3	
6/9/11 17:23:45	5.82	12.71	4.7	0.3	
6/9/11 17:24:00	5.90	12.65	4.2	0.3	
6/9/11 17:24:15	5.99	12.57	4.4	0.2	
6/9/11 17:24:30	6.07	12.50	4.7	0.2	
6/9/11 17:24:45	6.09	12.47	4.4	0.2	
6/9/11 17:25:00	6.11	12.47	3.6	0.3	
6/9/11 17:25:15	5.96	12.60	3.8	0.3	
6/9/11 17:25:30	5.81	12.72	4.3	0.3	
6/9/11 17:25:45	5.75	12.76	4.5	0.3	
6/9/11 17:26:00	5.82	12.71	3.9	0.3	
6/9/11 17:26:15	5.88	12.66	3.9	0.3	
6/9/11 17:26:30	5.89	12.65	4.3	0.3	
6/9/11 17:26:45	5.83	12.69	4.2	0.3	
6/9/11 17:27:00	5.80	12.70	3.5	0.3	
6/9/11 17:27:15	5.79	12.73	3.6	0.3	
6/9/11 17:27:30	5.72	12.81	4.3	0.3	
6/9/11 17:27:45	5.72	12.80	4.4	0.3	
6/9/11 17:28:00	5.74	12.77	3.9	0.3	
6/9/11 17:28:15	5.77	12.75	4.0	0.2	
6/9/11 17:28:30	5.83	12.70	4.5	0.3	
6/9/11 17:28:45	5.90	12.63	4.7	0.3	
6/9/11 17:29:00	5.99	12.56	4.2	0.3	
6/9/11 17:29:15	6.01	12.55	4.1	0.3	
6/9/11 17:29:30	5.92	12.63	4.4	0.3	
6/9/11 17:29:45	5.89	12.65	4.7	0.3	
6/9/11 17:30:00	5.98	12.57	4.4	0.3	
6/9/11 17:30:15	6.08	12.49	4.2	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 17:30:30	6.15	12.44	4.5	0.3	
6/9/11 17:30:45	6.15	12.44	4.6	0.3	
6/9/11 17:31:00	6.10	12.48	4.0	0.3	
6/9/11 17:31:15	6.02	12.55	3.7	0.3	
6/9/11 17:31:30	5.95	12.60	4.2	0.3	
6/9/11 17:31:45	5.88	12.66	4.3	0.3	
6/9/11 17:32:00	5.86	12.67	4.0	0.3	
6/9/11 17:32:15	5.91	12.63	3.6	0.3	
6/9/11 17:32:30	5.93	12.62	3.9	0.3	
6/9/11 17:32:45	5.88	12.66	4.3	0.3	
6/9/11 17:33:00	5.84	12.69	4.1	0.3	
6/9/11 17:33:15	5.81	12.72	3.7	0.3	
6/9/11 17:33:30	5.83	12.69	4.1	0.3	
6/9/11 17:33:45	5.88	12.66	4.4	0.3	
6/9/11 17:34:00	5.87	12.67	4.1	0.3	
6/9/11 17:34:15	5.81	12.71	3.8	0.3	
6/9/11 17:34:30	5.82	12.71	4.3	0.3	
6/9/11 17:34:45	5.88	12.65	4.7	0.3	
6/9/11 17:35:00	5.93	12.61	4.3	0.2	
6/9/11 17:35:15	5.94	12.61	4.1	0.3	
6/9/11 17:35:30	5.95	12.60	4.3	0.3	
6/9/11 17:35:45	5.97	12.60	4.5	0.3	
6/9/11 17:36:00	5.99	12.58	4.2	0.3	
6/9/11 17:36:15	5.98	12.59	3.9	0.3	
6/9/11 17:36:30	5.95	12.61	4.0	0.3	
6/9/11 17:36:45	5.90	12.64	4.5	0.3	
6/9/11 17:37:00	5.93	12.62	4.3	0.3	
6/9/11 17:37:15	5.96	12.59	3.5	0.3	
6/9/11 17:37:30	5.99	12.57	3.7	0.3	
6/9/11 17:37:45	5.99	12.58	4.2	0.3	
6/9/11 17:38:00	6.00	12.56	4.1	0.3	
6/9/11 17:38:15	6.09	12.48	3.6	0.3	
6/9/11 17:38:30	6.10	12.48	3.9	0.3	
6/9/11 17:38:45	6.07	12.49	4.3	0.3	
6/9/11 17:39:00	6.06	12.50	4.4	0.3	
6/9/11 17:39:15	6.00	12.56	3.7	0.3	
6/9/11 17:39:30	5.86	12.67	3.7	0.3	
6/9/11 17:39:45	5.75	12.76	4.4	0.3	
6/9/11 17:40:00	5.77	12.74	4.5	0.3	
6/9/11 17:40:15	5.83	12.70	3.9	0.3	
6/9/11 17:40:30	5.83	12.70	4.0	0.3	
6/9/11 17:40:45	5.84	12.69	4.5	0.3	
6/9/11 17:41:00	5.89	12.65	4.6	0.3	
6/9/11 17:41:15	5.97	12.59	4.2	0.3	
6/9/11 17:41:30	6.01	12.56	4.1	0.3	
6/9/11 17:41:45	5.93	12.61	4.7	0.3	
6/9/11 17:42:00	5.89	12.64	4.8	0.3	
6/9/11 17:42:15	5.91	12.63	4.3	0.3	
6/9/11 17:42:30	5.94	12.60	4.2	0.3	
6/9/11 17:42:45	5.98	12.58	4.8	0.3	
6/9/11 17:43:00	5.95	12.61	4.9	0.3	
6/9/11 17:43:15	5.94	12.60	4.1	0.3	
6/9/11 17:43:30	6.00	12.55	4.0	0.3	
6/9/11 17:43:45	6.05	12.52	4.4	0.3	
6/9/11 17:44:00	6.02	12.54	4.6	0.3	
6/9/11 17:44:15	5.92	12.62	3.9	0.3	
6/9/11 17:44:30	5.87	12.66	3.5	0.3	
6/9/11 17:44:45	5.93	12.60	4.2	0.3	
6/9/11 17:45:00	6.01	12.55	4.3	0.3	
6/9/11 17:45:15	6.01	12.55	3.6	0.3	
6/9/11 17:45:30	5.98	12.57	3.4	0.3	
6/9/11 17:45:45	5.97	12.58	4.0	0.3	
6/9/11 17:46:00	5.89	12.64	4.3	0.3	
6/9/11 17:46:15	5.88	12.65	3.8	0.3	
6/9/11 17:46:30	5.91	12.63	3.5	0.3	
6/9/11 17:46:45	5.89	12.65	4.1	0.2	
6/9/11 17:47:00	5.86	12.67	4.2	0.2	
6/9/11 17:47:15	5.85	12.67	3.8	0.3	
6/9/11 17:47:30	5.81	12.71	3.6	0.3	
6/9/11 17:47:45	5.75	12.76	4.2	0.3	
6/9/11 17:48:00	5.70	12.80	4.7	0.3	
6/9/11 17:48:15	5.70	12.80	4.5	0.3	
6/9/11 17:48:30	5.82	12.70	4.2	0.3	
6/9/11 17:48:45	5.97	12.58	4.5	0.3	
6/9/11 17:49:00	6.03	12.54	4.8	0.3	
6/9/11 17:49:15	6.03	12.53	4.5	0.3	
6/9/11 17:49:30	6.09	12.48	4.1	0.3	
6/9/11 17:49:45	6.12	12.46	4.4	0.3	
6/9/11 17:50:00	6.12	12.46	4.7	0.3	
6/9/11 17:50:15	6.11	12.47	4.2	0.3	
6/9/11 17:50:30	6.09	12.48	3.7	0.3	
6/9/11 17:50:45	6.01	12.55	4.1	0.3	
6/9/11 17:51:00	5.91	12.63	4.4	0.3	
6/9/11 17:51:15	5.92	12.62	3.9	0.3	
6/9/11 17:51:30	5.97	12.58	3.4	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 17:51:45	6.04	12.51	3.9	0.3	
6/9/11 17:52:00	6.10	12.47	4.4	0.3	
6/9/11 17:52:15	6.06	12.50	3.9	0.3	
6/9/11 17:52:30	5.94	12.59	3.5	0.3	
6/9/11 17:52:45	5.87	12.64	3.7	0.3	
6/9/11 17:53:00	5.88	12.65	4.2	0.3	
6/9/11 17:53:15	5.89	12.64	4.2	0.3	
6/9/11 17:53:30	5.86	12.67	3.6	0.3	
6/9/11 17:53:45	5.86	12.66	3.9	0.3	
6/9/11 17:54:00	5.94	12.60	4.4	0.3	
6/9/11 17:54:15	5.96	12.60	4.3	0.3	
6/9/11 17:54:30	5.88	12.65	4.0	0.3	
6/9/11 17:54:45	5.89	12.64	4.2	0.3	
6/9/11 17:55:00	5.93	12.60	4.7	0.3	
6/9/11 17:55:15	5.97	12.58	4.6	0.3	
6/9/11 17:55:30	5.95	12.60	4.2	0.3	
6/9/11 17:55:45	5.94	12.60	4.2	0.3	
6/9/11 17:56:00	5.94	12.60	4.8	0.3	
6/9/11 17:56:15	5.93	12.61	4.8	0.3	
6/9/11 17:56:30	5.91	12.63	4.3	0.3	
6/9/11 17:56:45	5.89	12.65	4.3	0.3	
6/9/11 17:57:00	5.94	12.60	4.7	0.3	
6/9/11 17:57:15	6.12	12.46	4.8	0.3	
6/9/11 17:57:30	6.19	12.40	4.4	0.3	
6/9/11 17:57:45	6.13	12.44	3.9	0.3	
6/9/11 17:58:00	6.06	12.50	4.4	0.3	
6/9/11 17:58:15	5.98	12.56	4.7	0.3	
6/9/11 17:58:30	6.00	12.54	4.3	0.3	
6/9/11 17:58:45	6.04	12.50	3.8	0.3	
6/9/11 17:59:00	6.01	12.53	4.0	0.3	
6/9/11 17:59:15	5.98	12.56	4.7	0.3	
6/9/11 17:59:30	6.01	12.53	4.5	0.3	
6/9/11 17:59:45	5.97	12.57	3.9	0.3	
6/9/11 18:00:00	5.87	12.64	4.0	0.3	
6/9/11 18:00:15	5.83	12.67	4.6	0.3	
6/9/11 18:00:30	5.81	12.70	4.5	0.3	
6/9/11 18:00:45	5.80	12.70	4.0	0.3	
6/9/11 18:01:00	5.88	12.63	4.1	0.3	
6/9/11 18:01:15	5.96	12.58	4.7	0.3	
6/9/11 18:01:30	6.01	12.54	4.9	0.3	
6/9/11 18:01:45	6.06	12.50	4.4	0.3	
6/9/11 18:02:00	6.11	12.46	4.2	0.3	
6/9/11 18:02:15	6.13	12.44	4.7	0.3	
6/9/11 18:02:30	6.16	12.40	4.9	0.3	
6/9/11 18:02:45	6.15	12.42	4.5	0.3	
6/9/11 18:03:00	6.11	12.46	4.2	0.3	End Run 1
6/9/11 18:03:15	6.02	12.53	4.5	0.3	
6/9/11 18:03:30	5.97	12.56	4.8	0.3	
6/9/11 18:03:45	6.00	12.54	4.2	0.3	
6/9/11 18:04:00	6.01	12.54	3.7	0.3	
6/9/11 18:04:15	6.03	12.52	4.2	0.3	
6/9/11 18:04:30	6.05	12.50	4.4	0.3	
6/9/11 18:04:45	6.11	12.45	4.3	0.3	
6/9/11 18:05:00	6.16	12.41	4.0	0.3	
6/9/11 18:05:15	6.09	12.46	4.2	0.3	
6/9/11 18:05:30	5.98	12.56	4.6	0.3	
6/9/11 18:05:45	5.91	12.61	4.5	0.3	
6/9/11 18:06:00	5.93	12.59	3.9	0.3	
6/9/11 18:06:15	6.01	12.53	4.0	0.3	
6/9/11 18:06:30	6.04	12.51	4.4	0.3	
6/9/11 18:06:45	5.97	12.57	4.5	0.3	
6/9/11 18:07:00	5.93	12.60	4.2	0.3	
6/9/11 18:07:15	5.95	12.59	4.1	0.3	
6/9/11 18:07:30	5.96	12.59	4.4	0.3	
6/9/11 18:07:45	5.92	12.61	4.8	0.3	
6/9/11 18:08:00	5.93	12.59	4.4	0.3	
6/9/11 18:08:15	6.00	12.54	4.2	0.3	
6/9/11 18:08:30	6.06	12.49	4.6	0.3	
6/9/11 18:08:45	6.11	12.46	4.8	0.3	
6/9/11 18:09:00	6.16	12.41	4.6	0.3	
6/9/11 18:09:15	6.24	12.34	4.2	0.3	
6/9/11 18:09:30	6.21	12.36	4.5	0.3	
6/9/11 18:09:45	6.12	12.44	4.7	0.3	
6/9/11 18:10:00	6.08	12.47	4.4	0.3	
6/9/11 18:10:15	6.05	12.50	3.9	0.3	
6/9/11 18:10:30	5.98	12.57	4.2	0.3	
6/9/11 18:10:45	5.99	12.55	4.7	0.3	
6/9/11 18:11:00	6.04	12.51	4.4	0.3	
6/9/11 18:11:15	6.01	12.53	3.9	0.3	
6/9/11 18:11:30	5.98	12.55	4.2	0.3	
6/9/11 18:11:45	6.02	12.51	4.6	0.3	
6/9/11 18:12:00	6.10	12.44	4.4	0.3	
6/9/11 18:12:15	6.18	12.39	3.8	0.3	
6/9/11 18:12:30	6.11	12.46	3.9	0.3	
6/9/11 18:12:45	6.03	12.52	4.4	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 18:13:00	6.02	12.53	4.5	0.3	
6/9/11 18:13:15	6.01	12.54	3.8	0.3	
6/9/11 18:13:30	5.99	12.55	3.9	0.3	
6/9/11 18:13:45	5.95	12.59	4.4	0.3	
6/9/11 18:14:00	5.86	12.67	4.5	0.3	
6/9/11 18:14:15	5.80	12.71	4.0	0.3	
6/9/11 18:14:30	5.76	12.74	3.9	0.3	
6/9/11 18:14:45	5.77	12.73	4.6	0.3	
6/9/11 18:15:00	5.81	12.70	4.8	0.3	
6/9/11 18:15:15	5.85	12.67	4.4	0.3	
6/9/11 18:15:30	5.96	12.58	4.4	0.3	
6/9/11 18:15:45	6.06	12.51	5.0	0.3	
6/9/11 18:16:00	6.12	12.45	4.9	0.3	
6/9/11 18:16:15	6.19	12.39	4.3	0.3	
6/9/11 18:16:30	6.20	12.38	4.3	0.3	
6/9/11 18:16:45	6.11	12.45	4.8	0.3	
6/9/11 18:17:00	6.04	12.50	4.9	0.3	
6/9/11 18:17:15	6.08	12.48	4.4	0.3	
6/9/11 18:17:30	6.14	12.44	4.1	0.3	
6/9/11 18:17:45	6.15	12.42	4.3	0.3	
6/9/11 18:18:00	6.15	12.42	4.5	0.3	
6/9/11 18:18:15	6.16	12.40	4.0	0.3	
6/9/11 18:18:30	6.17	12.40	3.9	0.3	
6/9/11 18:18:45	6.10	12.46	4.4	0.3	
6/9/11 18:19:00	5.99	12.56	4.5	0.3	
6/9/11 18:19:15	5.92	12.60	4.1	0.3	
6/9/11 18:19:30	5.98	12.55	3.7	0.3	
6/9/11 18:19:45	5.97	12.56	4.0	0.3	
6/9/11 18:20:00	5.93	12.59	4.3	0.3	
6/9/11 18:20:15	5.97	12.57	4.1	0.3	
6/9/11 18:20:30	5.98	12.56	3.8	0.3	
6/9/11 18:20:45	5.99	12.55	4.1	0.3	
6/9/11 18:21:00	6.09	12.46	4.4	0.3	
6/9/11 18:21:15	6.11	12.45	4.2	0.3	
6/9/11 18:21:30	6.01	12.53	3.8	0.3	
6/9/11 18:21:45	5.94	12.59	4.1	0.3	
6/9/11 18:22:00	5.92	12.60	4.6	0.3	
6/9/11 18:22:15	5.92	12.61	4.5	0.3	
6/9/11 18:22:30	5.94	12.59	4.2	0.3	
6/9/11 18:22:45	5.99	12.55	4.2	0.3	
6/9/11 18:23:00	6.04	12.51	4.7	0.3	
6/9/11 18:23:15	6.07	12.50	4.9	0.3	
6/9/11 18:23:30	6.06	12.50	4.4	0.3	
6/9/11 18:23:45	6.07	12.48	4.5	0.3	
6/9/11 18:24:00	6.06	12.49	4.9	0.3	
6/9/11 18:24:15	6.07	12.48	4.9	0.3	
6/9/11 18:24:30	6.08	12.47	4.4	0.3	
6/9/11 18:24:45	6.06	12.50	4.2	0.3	
6/9/11 18:25:00	6.07	12.48	4.7	0.3	
6/9/11 18:25:15	6.13	12.44	4.7	0.3	
6/9/11 18:25:30	6.15	12.43	4.2	0.3	
6/9/11 18:25:45	6.12	12.44	4.0	0.3	
6/9/11 18:26:00	6.17	12.39	4.2	0.3	
6/9/11 18:26:15	6.16	12.41	4.3	0.3	
6/9/11 18:26:30	6.07	12.48	4.3	0.3	
6/9/11 18:26:45	5.98	12.54	17.6	0.3	
6/9/11 18:27:00	6.23	10.62	59.4	0.3	
6/9/11 18:27:15	5.46	5.35	63.1	0.3	
6/9/11 18:27:30	2.78	1.77	28.6	0.3	
6/9/11 18:27:45	1.39	0.51	5.4	0.3	
6/9/11 18:28:00	1.17	0.35	1.4	0.3	
6/9/11 18:28:15	1.14	0.30	1.1	0.3	
6/9/11 18:28:30	1.13	0.27	0.7	0.3	
6/9/11 18:28:45	1.13	0.25	0.3	0.3	
6/9/11 18:29:00	1.11	0.23	0.7	0.3	
6/9/11 18:29:15	1.11	0.22	1.1	0.3	
6/9/11 18:29:30	1.11	0.21	0.7	0.3	
6/9/11 18:29:45	1.11	0.20	0.3	0.3	
6/9/11 18:30:00	1.11	0.19	0.7	0.3	
6/9/11 18:30:15	1.11	0.19	1.3	0.3	
6/9/11 18:30:30	1.10	0.18	1.1	0.3	
6/9/11 18:30:45	1.11	0.17	0.6	0.3	
6/9/11 18:31:00	1.10	0.17	0.8	0.3	
6/9/11 18:31:15	1.10	0.17	1.2	0.3	
6/9/11 18:31:30	1.10	0.16	1.1	0.3	
6/9/11 18:31:45	1.09	0.16	0.6	0.3	
6/9/11 18:32:00	1.09	0.16	0.7	0.3	
6/9/11 18:32:15	1.09	0.15	1.1	0.3	
6/9/11 18:32:30	1.08	0.15	1.2	0.3	
6/9/11 18:32:45	1.08	0.15	0.6	0.3	
6/9/11 18:33:00	1.09	0.15	0.5	0.3	
6/9/11 18:33:15	1.09	0.14	1.0	0.3	
6/9/11 18:33:30	1.09	0.14	1.1	0.3	
6/9/11 18:33:45	1.09	0.14	0.7	0.3	
6/9/11 18:34:00	1.09	0.14	0.7	0.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	CO ppmv db	C ₃ H ₈ ppmv wb	Comments
6/9/11 18:34:15	1.09	0.14	1.1	0.3	
6/9/11 18:34:30	1.09	0.13	1.1	0.3	
6/9/11 18:34:45	1.09	0.13	0.7	0.3	
6/9/11 18:35:00	1.08	0.13	0.4	0.3	
6/9/11 18:35:15	1.09	0.13	0.8	0.3	
6/9/11 18:35:30	1.09	0.13	1.0	0.3	
6/9/11 18:35:45	1.09	0.13	0.6	0.3	
6/9/11 18:36:00	1.09	0.13	0.4	0.3	
6/9/11 18:36:15	1.09	0.13	0.7	0.3	
6/9/11 18:36:30	1.08	0.12	1.1	0.3	
6/9/11 18:36:45	1.09	0.12	0.8	0.3	
6/9/11 18:37:00	1.09	0.12	0.5	0.3	
6/9/11 18:37:15	1.09	0.12	0.7	0.3	
6/9/11 18:37:30	1.09	0.12	0.9	0.3	
6/9/11 18:37:45	1.09	0.12	1.0	0.3	
6/9/11 18:38:00	1.09	0.12	0.4	0.3	
6/9/11 18:38:15	1.06	0.12	0.6	0.3	
6/9/11 18:38:30	1.03	0.12	1.3	0.3	
6/9/11 18:38:45	1.07	0.12	1.4	0.3	
6/9/11 18:39:00	1.09	0.12	0.8	0.3	
6/9/11 18:39:15	1.09	0.12	0.8	0.3	
6/9/11 18:39:30	1.10	0.12	1.0	0.3	
6/9/11 18:39:45	1.09	0.12	1.2	0.3	
6/9/11 18:40:00	1.09	0.12	0.8	0.3	
6/9/11 18:40:15	1.08	0.12	0.5	0.3	
6/9/11 18:40:30	1.08	0.12	1.0	0.3	
6/9/11 18:40:45	1.08	0.12	1.3	4.2	
6/9/11 18:41:00	1.08	0.12	1.0	3.6	
6/9/11 18:41:15	1.08	0.12	0.5	1.8	
6/9/11 18:41:30	1.08	0.12	0.6	1.2	
6/9/11 18:41:45	0.84	0.20	0.8	0.9	
6/9/11 18:42:00	1.36	4.21	0.5	0.8	
6/9/11 18:42:15	3.26	8.46	0.2	0.7	
6/9/11 18:42:30	2.88	6.45	-0.1	0.7	
6/9/11 18:42:45	1.08	2.26	-0.3	0.6	
6/9/11 18:43:00	0.24	0.41	-0.3	0.6	
6/9/11 18:43:15	0.11	0.17	-0.7	0.6	
6/9/11 18:43:30	0.10	0.13	-0.6	0.6	
6/9/11 18:43:45	0.10	0.12	-0.2	0.6	
6/9/11 18:44:00	0.09	0.12	-0.1	0.6	
6/9/11 18:44:15	0.10	0.11	-0.6	0.6	System Bias
6/9/11 18:44:30	0.10	0.11	-0.6	0.6	O ₂ Bias 6 Zero = 0.10
6/9/11 18:44:45	0.10	0.11	-0.2	0.6	CO ₂ Bias 6 Zero = 0.11
6/9/11 18:45:00	0.10	0.10	-0.1	0.6	
6/9/11 18:45:15	0.10	0.10	-0.6	0.6	
6/9/11 18:45:30	0.10	0.10	-0.7	0.6	
6/9/11 18:45:45	0.10	0.10	-0.3	0.6	
6/9/11 18:46:00	0.10	0.10	0.7	0.7	
6/9/11 18:46:15	0.14	0.16	7.2	0.7	
6/9/11 18:46:30	1.55	1.29	23.4	0.6	
6/9/11 18:46:45	3.73	2.90	36.5	0.7	
6/9/11 18:47:00	4.43	3.38	40.7	0.6	
6/9/11 18:47:15	4.52	3.55	40.3	0.6	
6/9/11 18:47:30	4.56	3.88	39.0	0.6	
6/9/11 18:47:45	4.55	4.00	38.8	0.6	
6/9/11 18:48:00	4.55	4.03	39.1	0.7	System Bias
6/9/11 18:48:15	4.55	4.04	38.8	0.6	O ₂ Bias 6 Mid = 4.55
6/9/11 18:48:30	4.55	4.04	38.4	0.6	
6/9/11 18:48:45	4.55	4.05	38.7	0.6	
6/9/11 18:49:00	4.55	4.05	39.1	0.6	
6/9/11 18:49:15	4.55	4.05	39.0	0.5	
6/9/11 18:49:30	4.55	4.06	38.4	0.6	
6/9/11 18:49:45	4.55	4.06	37.2	0.6	
6/9/11 18:50:00	4.61	5.16	35.8	0.6	
6/9/11 18:50:15	5.05	7.11	49.7	0.6	
6/9/11 18:50:30	7.95	8.41	76.0	0.6	
6/9/11 18:50:45	10.59	9.55	92.9	0.6	
6/9/11 18:51:00	11.29	9.85	97.5	0.6	
6/9/11 18:51:15	11.38	9.90	98.4	0.6	
6/9/11 18:51:30	11.39	9.91	97.9	0.6	
6/9/11 18:51:45	11.40	9.92	97.8	0.6	
6/9/11 18:52:00	11.40	9.93	98.5	0.6	
6/9/11 18:52:15	11.40	9.93	98.5	0.6	
6/9/11 18:52:30	11.41	9.94	97.8	0.6	
6/9/11 18:52:45	11.41	9.94	97.6	0.7	
6/9/11 18:53:00	11.41	9.94	98.1	0.6	
6/9/11 18:53:15	11.41	9.94	98.5	0.7	
6/9/11 18:53:30	11.41	9.94	97.9	0.7	
6/9/11 18:53:45	11.41	9.95	97.7	0.7	System Bias
6/9/11 18:54:00	11.41	9.95	98.3	0.7	
6/9/11 18:54:15	11.41	9.95	98.5	0.7	CO ₂ Bias 6 Mid = 9.95
6/9/11 18:54:30	11.41	9.95	97.8	0.7	
6/9/11 18:54:45	11.41	9.95	97.5	0.7	
6/9/11 18:55:00	11.41	9.95	98.0	0.7	
6/9/11 18:55:15	11.41	9.95	98.4	0.7	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 7:06:00	20.20	0.22	
6/10/11 7:06:15	20.20	0.21	
6/10/11 7:06:30	20.21	0.21	
6/10/11 7:06:45	20.19	0.21	
6/10/11 7:07:00	15.62	0.21	
6/10/11 7:07:15	4.31	0.10	
6/10/11 7:07:30	0.41	0.06	Calibration Error
6/10/11 7:07:45	0.08	0.05	O ₂ CE Zero = 0.05
6/10/11 7:08:00	0.05	0.05	
6/10/11 7:08:15	0.04	0.05	CO ₂ CE Zero = 0.05
6/10/11 7:08:30	0.04	0.05	
6/10/11 7:08:45	0.03	0.05	
6/10/11 7:09:00	1.61	2.67	
6/10/11 7:09:15	10.03	10.33	
6/10/11 7:09:30	16.73	15.18	
6/10/11 7:09:45	20.51	18.16	
6/10/11 7:10:00	21.96	19.39	
6/10/11 7:10:15	22.18	19.56	Calibration Error
6/10/11 7:10:30	22.20	19.58	CO ₂ CE Span = 19.59
6/10/11 7:10:45	22.21	19.59	
6/10/11 7:11:00	22.21	19.59	
6/10/11 7:11:15	22.22	19.60	
6/10/11 7:11:30	22.22	19.60	
6/10/11 7:11:45	22.22	19.60	
6/10/11 7:12:00	20.61	17.26	
6/10/11 7:12:15	15.50	12.93	
6/10/11 7:12:30	12.31	10.61	
6/10/11 7:12:45	11.60	10.16	
6/10/11 7:13:00	11.55	10.14	Calibration Error
6/10/11 7:13:15	11.54	10.14	CO ₂ CE Mid = 10.14
6/10/11 7:13:30	11.54	10.14	
6/10/11 7:13:45	11.54	10.14	
6/10/11 7:14:00	11.54	10.14	
6/10/11 7:14:15	11.54	10.14	
6/10/11 7:14:30	11.54	10.14	
6/10/11 7:14:45	11.54	10.13	
6/10/11 7:15:00	11.54	10.12	
6/10/11 7:15:15	11.82	9.60	
6/10/11 7:15:30	14.01	6.89	
6/10/11 7:15:45	11.59	7.51	
6/10/11 7:16:00	9.40	8.08	
6/10/11 7:16:15	9.07	8.15	Calibration Error
6/10/11 7:16:30	9.04	8.15	O ₂ CE Span = 9.04
6/10/11 7:16:45	9.04	8.15	
6/10/11 7:17:00	9.04	8.15	
6/10/11 7:17:15	9.03	8.15	
6/10/11 7:17:30	9.03	8.15	
6/10/11 7:17:45	9.03	8.15	
6/10/11 7:18:00	9.03	8.15	
6/10/11 7:18:15	8.85	7.83	
6/10/11 7:18:30	6.61	5.53	
6/10/11 7:18:45	4.82	4.28	
6/10/11 7:19:00	4.60	4.17	Calibration Error
6/10/11 7:19:15	4.58	4.16	O ₂ CE Mid = 4.58
6/10/11 7:19:30	4.58	4.16	
6/10/11 7:19:45	4.58	4.16	
6/10/11 7:20:00	4.58	4.16	
6/10/11 7:20:15	4.58	4.16	Introduce Zero
6/10/11 7:20:30	4.63	4.52	
6/10/11 7:20:45	5.74	7.59	
6/10/11 7:21:00	7.38	9.76	Downscale RT = 90 Seconds
6/10/11 7:21:15	8.38	10.05	
6/10/11 7:21:30	9.14	6.79	
6/10/11 7:21:45	4.78	2.96	
6/10/11 7:22:00	1.12	0.74	
6/10/11 7:22:15	0.23	0.28	System Bias
6/10/11 7:22:30	0.15	0.22	O ₂ Bias 1 Zero = 0.13
6/10/11 7:22:45	0.14	0.19	CO ₂ Bias 1 Zero = 0.19
6/10/11 7:23:00	0.13	0.17	Introduce Mid CO ₂
6/10/11 7:23:15	0.12	0.16	
6/10/11 7:23:30	0.11	0.16	
6/10/11 7:23:45	0.11	0.15	
6/10/11 7:24:00	0.31	1.05	
6/10/11 7:24:15	1.52	3.63	Upscale RT = 90 Seconds
6/10/11 7:24:30	5.25	6.36	
6/10/11 7:24:45	9.43	8.85	
6/10/11 7:25:00	11.11	9.81	Introduce Mid O ₂
6/10/11 7:25:15	11.38	9.96	System Bias
6/10/11 7:25:30	11.41	9.98	
6/10/11 7:25:45	11.41	9.99	CO ₂ Bias 1 Mid = 10.01
6/10/11 7:26:00	11.42	10.00	
6/10/11 7:26:15	11.35	10.07	
6/10/11 7:26:30	10.23	10.43	
6/10/11 7:26:45	8.23	7.76	
6/10/11 7:27:00	5.59	4.99	

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Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 7:27:15	4.70	4.25	
6/10/11 7:27:30	4.61	4.17	
6/10/11 7:27:45	4.59	4.16	System Bias
6/10/11 7:28:00	4.59	4.15	O ₂ Bias 1 Mid = 4.59
6/10/11 7:28:15	4.59	4.14	
6/10/11 7:28:30	4.59	4.14	
6/10/11 7:28:45	4.58	4.14	
6/10/11 7:29:00	4.58	4.13	
6/10/11 7:29:15	4.58	4.13	
6/10/11 7:29:30	4.58	4.18	
6/10/11 7:29:45	4.74	7.09	
6/10/11 7:30:00	5.12	10.70	
6/10/11 7:30:15	5.38	12.58	
6/10/11 7:30:30	5.43	13.00	
6/10/11 7:30:45	5.37	13.11	
6/10/11 7:31:00	5.35	13.15	
6/10/11 7:31:15	5.38	13.14	
6/10/11 7:31:30	5.36	13.17	
6/10/11 7:31:45	5.28	13.24	
6/10/11 7:32:00	5.24	13.29	Begin Run FCCU-23-2
6/10/11 7:32:15	5.28	13.24	FCCU-OH-2
6/10/11 7:32:30	5.39	13.15	
6/10/11 7:32:45	5.44	13.10	
6/10/11 7:33:00	5.47	13.07	
6/10/11 7:33:15	5.53	13.02	
6/10/11 7:33:30	5.47	13.09	
6/10/11 7:33:45	5.30	13.24	
6/10/11 7:34:00	5.24	13.29	
6/10/11 7:34:15	5.28	13.26	
6/10/11 7:34:30	5.39	13.16	
6/10/11 7:34:45	5.48	13.08	
6/10/11 7:35:00	5.54	13.02	
6/10/11 7:35:15	5.60	12.96	
6/10/11 7:35:30	5.61	12.96	
6/10/11 7:35:45	5.56	13.01	
6/10/11 7:36:00	5.48	13.08	
6/10/11 7:36:15	5.43	13.12	
6/10/11 7:36:30	5.39	13.17	
6/10/11 7:36:45	5.38	13.18	
6/10/11 7:37:00	5.40	13.15	
6/10/11 7:37:15	5.41	13.16	
6/10/11 7:37:30	5.36	13.21	
6/10/11 7:37:45	5.32	13.25	
6/10/11 7:38:00	5.32	13.24	
6/10/11 7:38:15	5.33	13.23	
6/10/11 7:38:30	5.36	13.20	
6/10/11 7:38:45	5.34	13.22	
6/10/11 7:39:00	5.29	13.26	
6/10/11 7:39:15	5.25	13.30	
6/10/11 7:39:30	5.26	13.30	
6/10/11 7:39:45	5.28	13.30	
6/10/11 7:40:00	5.23	13.34	
6/10/11 7:40:15	5.18	13.38	
6/10/11 7:40:30	5.19	13.36	
6/10/11 7:40:45	5.28	13.28	
6/10/11 7:41:00	5.38	13.18	
6/10/11 7:41:15	5.38	13.20	
6/10/11 7:41:30	5.33	13.23	
6/10/11 7:41:45	5.35	13.23	
6/10/11 7:42:00	5.39	13.19	
6/10/11 7:42:15	5.46	13.11	
6/10/11 7:42:30	5.56	13.01	
6/10/11 7:42:45	5.61	12.98	
6/10/11 7:43:00	5.50	13.09	
6/10/11 7:43:15	5.37	13.20	
6/10/11 7:43:30	5.36	13.21	
6/10/11 7:43:45	5.37	13.20	
6/10/11 7:44:00	5.39	13.17	
6/10/11 7:44:15	5.50	13.06	
6/10/11 7:44:30	5.57	13.00	
6/10/11 7:44:45	5.51	13.06	
6/10/11 7:45:00	5.42	13.15	
6/10/11 7:45:15	5.35	13.22	
6/10/11 7:45:30	5.29	13.27	
6/10/11 7:45:45	5.23	13.34	
6/10/11 7:46:00	5.24	13.32	
6/10/11 7:46:15	5.23	13.34	
6/10/11 7:46:30	5.18	13.38	
6/10/11 7:46:45	5.16	13.39	
6/10/11 7:47:00	5.19	13.37	
6/10/11 7:47:15	5.24	13.34	
6/10/11 7:47:30	5.29	13.28	
6/10/11 7:47:45	5.29	13.29	
6/10/11 7:48:00	5.21	13.36	
6/10/11 7:48:15	5.23	13.34	

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Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 7:48:30	5.30	13.28	
6/10/11 7:48:45	5.35	13.24	
6/10/11 7:49:00	5.42	13.16	
6/10/11 7:49:15	5.49	13.10	
6/10/11 7:49:30	5.51	13.08	
6/10/11 7:49:45	5.50	13.07	
6/10/11 7:50:00	5.49	13.09	
6/10/11 7:50:15	5.41	13.18	
6/10/11 7:50:30	5.34	13.24	
6/10/11 7:50:45	5.30	13.28	
6/10/11 7:51:00	5.27	13.30	
6/10/11 7:51:15	5.30	13.26	
6/10/11 7:51:30	5.36	13.21	
6/10/11 7:51:45	5.36	13.22	
6/10/11 7:52:00	5.36	13.22	
6/10/11 7:52:15	5.36	13.22	
6/10/11 7:52:30	5.42	13.16	
6/10/11 7:52:45	5.45	13.13	
6/10/11 7:53:00	5.45	13.12	
6/10/11 7:53:15	5.49	13.07	
6/10/11 7:53:30	5.45	13.11	
6/10/11 7:53:45	5.35	13.23	
6/10/11 7:54:00	5.24	13.33	
6/10/11 7:54:15	5.22	13.34	
6/10/11 7:54:30	5.30	13.27	
6/10/11 7:54:45	5.34	13.25	
6/10/11 7:55:00	5.29	13.30	
6/10/11 7:55:15	5.18	13.40	
6/10/11 7:55:30	5.12	13.44	
6/10/11 7:55:45	5.13	13.44	
6/10/11 7:56:00	5.15	13.43	
6/10/11 7:56:15	5.21	13.37	
6/10/11 7:56:30	5.33	13.26	
6/10/11 7:56:45	5.46	13.13	
6/10/11 7:57:00	5.53	13.06	
6/10/11 7:57:15	5.55	13.04	
6/10/11 7:57:30	5.51	13.08	
6/10/11 7:57:45	5.44	13.15	
6/10/11 7:58:00	5.35	13.24	
6/10/11 7:58:15	5.31	13.27	
6/10/11 7:58:30	5.31	13.27	
6/10/11 7:58:45	5.29	13.28	
6/10/11 7:59:00	5.33	13.24	
6/10/11 7:59:15	5.38	13.20	
6/10/11 7:59:30	5.38	13.21	
6/10/11 7:59:45	5.34	13.24	
6/10/11 8:00:00	5.30	13.28	
6/10/11 8:00:15	5.20	13.37	
6/10/11 8:00:30	5.17	13.40	
6/10/11 8:00:45	5.23	13.35	
6/10/11 8:01:00	5.37	13.21	
6/10/11 8:01:15	5.44	13.15	
6/10/11 8:01:30	5.35	13.23	
6/10/11 8:01:45	5.25	13.33	
6/10/11 8:02:00	5.18	13.40	
6/10/11 8:02:15	5.21	13.37	
6/10/11 8:02:30	5.37	13.22	
6/10/11 8:02:45	5.46	13.14	
6/10/11 8:03:00	5.42	13.18	
6/10/11 8:03:15	5.38	13.21	
6/10/11 8:03:30	5.41	13.18	
6/10/11 8:03:45	5.45	13.14	
6/10/11 8:04:00	5.45	13.15	
6/10/11 8:04:15	5.43	13.15	
6/10/11 8:04:30	5.43	13.15	
6/10/11 8:04:45	5.42	13.16	
6/10/11 8:05:00	5.38	13.21	
6/10/11 8:05:15	5.30	13.27	
6/10/11 8:05:30	5.32	13.25	
6/10/11 8:05:45	5.33	13.25	
6/10/11 8:06:00	5.29	13.28	
6/10/11 8:06:15	5.26	13.31	
6/10/11 8:06:30	5.24	13.31	
6/10/11 8:06:45	5.28	13.29	
6/10/11 8:07:00	5.29	13.28	
6/10/11 8:07:15	5.37	13.21	
6/10/11 8:07:30	5.39	13.20	
6/10/11 8:07:45	5.36	13.22	
6/10/11 8:08:00	5.38	13.21	
6/10/11 8:08:15	5.37	13.23	
6/10/11 8:08:30	5.31	13.29	
6/10/11 8:08:45	5.27	13.32	
6/10/11 8:09:00	5.27	13.31	
6/10/11 8:09:15	5.31	13.27	
6/10/11 8:09:30	5.33	13.26	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 8:09:45	5.36	13.23	
6/10/11 8:10:00	5.38	13.21	
6/10/11 8:10:15	5.39	13.20	
6/10/11 8:10:30	5.40	13.19	
6/10/11 8:10:45	5.41	13.18	
6/10/11 8:11:00	5.36	13.24	
6/10/11 8:11:15	5.37	13.21	
6/10/11 8:11:30	5.43	13.16	
6/10/11 8:11:45	5.46	13.12	
6/10/11 8:12:00	5.45	13.13	
6/10/11 8:12:15	5.38	13.21	
6/10/11 8:12:30	5.21	13.38	
6/10/11 8:12:45	5.12	13.44	
6/10/11 8:13:00	5.20	13.37	
6/10/11 8:13:15	5.23	13.35	
6/10/11 8:13:30	5.21	13.37	
6/10/11 8:13:45	5.23	13.36	
6/10/11 8:14:00	5.26	13.33	
6/10/11 8:14:15	5.30	13.29	
6/10/11 8:14:30	5.29	13.29	
6/10/11 8:14:45	5.25	13.33	
6/10/11 8:15:00	5.20	13.37	
6/10/11 8:15:15	5.23	13.34	
6/10/11 8:15:30	5.29	13.30	
6/10/11 8:15:45	5.32	13.27	
6/10/11 8:16:00	5.40	13.19	
6/10/11 8:16:15	5.53	13.06	
6/10/11 8:16:30	5.60	12.99	
6/10/11 8:16:45	5.66	12.92	
6/10/11 8:17:00	5.70	12.89	
6/10/11 8:17:15	5.65	12.95	
6/10/11 8:17:30	5.53	13.06	
6/10/11 8:17:45	5.49	13.09	
6/10/11 8:18:00	5.49	13.09	
6/10/11 8:18:15	5.44	13.15	
6/10/11 8:18:30	5.36	13.22	
6/10/11 8:18:45	5.28	13.29	
6/10/11 8:19:00	5.26	13.32	
6/10/11 8:19:15	5.29	13.29	
6/10/11 8:19:30	5.38	13.20	
6/10/11 8:19:45	5.50	13.09	
6/10/11 8:20:00	5.56	13.03	
6/10/11 8:20:15	5.49	13.10	
6/10/11 8:20:30	5.39	13.19	
6/10/11 8:20:45	5.29	13.28	
6/10/11 8:21:00	5.19	13.39	
6/10/11 8:21:15	5.21	13.36	
6/10/11 8:21:30	5.29	13.29	
6/10/11 8:21:45	5.33	13.25	
6/10/11 8:22:00	5.32	13.26	
6/10/11 8:22:15	5.26	13.32	
6/10/11 8:22:30	5.21	13.38	
6/10/11 8:22:45	5.22	13.36	
6/10/11 8:23:00	5.38	13.20	
6/10/11 8:23:15	5.54	13.05	
6/10/11 8:23:30	5.59	13.00	
6/10/11 8:23:45	5.62	12.97	
6/10/11 8:24:00	5.63	12.97	
6/10/11 8:24:15	5.52	13.08	
6/10/11 8:24:30	5.32	13.26	
6/10/11 8:24:45	5.21	13.36	
6/10/11 8:25:00	5.23	13.33	
6/10/11 8:25:15	5.29	13.29	
6/10/11 8:25:30	5.34	13.25	
6/10/11 8:25:45	5.33	13.25	
6/10/11 8:26:00	5.34	13.25	
6/10/11 8:26:15	5.34	13.25	
6/10/11 8:26:30	5.33	13.25	
6/10/11 8:26:45	5.32	13.25	
6/10/11 8:27:00	5.30	13.28	
6/10/11 8:27:15	5.29	13.30	
6/10/11 8:27:30	5.31	13.28	
6/10/11 8:27:45	5.33	13.26	
6/10/11 8:28:00	5.35	13.23	Restart after Port Change
6/10/11 8:28:15	5.38	13.20	
6/10/11 8:28:30	5.36	12.67	
6/10/11 8:28:45	5.46	9.49	Cal gas inadvertently turned on
6/10/11 8:29:00	4.48	6.56	
6/10/11 8:29:15	2.35	4.52	
6/10/11 8:29:30	1.69	4.08	
6/10/11 8:29:45	1.65	4.07	
6/10/11 8:30:00	1.67	4.08	
6/10/11 8:30:15	1.67	4.08	
6/10/11 8:30:30	1.68	4.06	
6/10/11 8:30:45	1.69	4.05	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 8:31:00	1.68	4.05	
6/10/11 8:31:15	1.69	4.04	
6/10/11 8:31:30	1.70	4.03	
6/10/11 8:31:45	1.68	4.01	
6/10/11 8:32:00	1.63	3.86	
6/10/11 8:32:15	1.50	3.66	
6/10/11 8:32:30	1.63	3.99	
6/10/11 8:32:45	1.77	4.28	
6/10/11 8:33:00	1.75	4.22	
6/10/11 8:33:15	1.69	4.12	
6/10/11 8:33:30	1.65	4.10	
6/10/11 8:33:45	1.64	4.09	
6/10/11 8:34:00	1.63	4.09	
6/10/11 8:34:15	1.63	4.11	
6/10/11 8:34:30	1.61	4.10	
6/10/11 8:34:45	1.60	4.09	
6/10/11 8:35:00	1.63	4.07	
6/10/11 8:35:15	1.66	4.05	
6/10/11 8:35:30	1.65	4.06	
6/10/11 8:35:45	1.62	4.09	
6/10/11 8:36:00	1.59	4.10	
6/10/11 8:36:15	1.61	4.07	
6/10/11 8:36:30	1.63	4.06	
6/10/11 8:36:45	1.62	4.07	
6/10/11 8:37:00	1.61	4.09	
6/10/11 8:37:15	1.60	4.10	
6/10/11 8:37:30	1.61	4.08	
6/10/11 8:37:45	1.63	4.06	
6/10/11 8:38:00	1.65	4.05	
6/10/11 8:38:15	1.67	4.02	
6/10/11 8:38:30	1.68	4.02	
6/10/11 8:38:45	1.67	4.02	
6/10/11 8:39:00	1.67	4.02	
6/10/11 8:39:15	1.69	4.01	
6/10/11 8:39:30	1.70	4.01	
6/10/11 8:39:45	1.68	4.00	
6/10/11 8:40:00	1.68	4.00	
6/10/11 8:40:15	1.69	3.99	
6/10/11 8:40:30	1.69	4.00	
6/10/11 8:40:45	1.65	4.03	
6/10/11 8:41:00	1.63	4.05	
6/10/11 8:41:15	1.63	4.04	
6/10/11 8:41:30	1.66	4.02	
6/10/11 8:41:45	1.68	4.02	
6/10/11 8:42:00	1.67	4.04	
6/10/11 8:42:15	1.66	4.03	
6/10/11 8:42:30	1.67	4.04	
6/10/11 8:42:45	1.65	4.05	
6/10/11 8:43:00	1.63	4.06	
6/10/11 8:43:15	1.61	4.06	
6/10/11 8:43:30	1.60	4.07	
6/10/11 8:43:45	1.60	4.08	
6/10/11 8:44:00	1.60	4.08	
6/10/11 8:44:15	1.60	4.09	
6/10/11 8:44:30	1.61	4.08	
6/10/11 8:44:45	1.79	4.88	
6/10/11 8:45:00	3.33	8.89	
6/10/11 8:45:15	4.77	11.71	
6/10/11 8:45:30	5.34	12.84	
6/10/11 8:45:45	5.43	13.01	
6/10/11 8:46:00	5.47	13.02	
6/10/11 8:46:15	5.46	13.05	
6/10/11 8:46:30	5.43	13.08	
6/10/11 8:46:45	5.45	13.07	
6/10/11 8:47:00	5.49	13.04	
6/10/11 8:47:15	5.49	13.04	
6/10/11 8:47:30	5.42	13.11	
6/10/11 8:47:45	5.38	13.14	
6/10/11 8:48:00	5.37	13.18	
6/10/11 8:48:15	5.37	13.18	
6/10/11 8:48:30	5.42	13.12	
6/10/11 8:48:45	5.41	13.14	
6/10/11 8:49:00	5.27	13.28	
6/10/11 8:49:15	5.19	13.35	
6/10/11 8:49:30	5.21	13.33	
6/10/11 8:49:45	5.25	13.30	
6/10/11 8:50:00	5.28	13.28	
6/10/11 8:50:15	5.25	13.30	
6/10/11 8:50:30	5.26	13.29	
6/10/11 8:50:45	5.34	13.22	
6/10/11 8:51:00	5.38	13.19	
6/10/11 8:51:15	5.37	13.20	
6/10/11 8:51:30	5.36	13.22	
6/10/11 8:51:45	5.26	13.32	
6/10/11 8:52:00	5.20	13.36	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 8:52:15	5.25	13.31	
6/10/11 8:52:30	5.32	13.26	
6/10/11 8:52:45	5.38	13.20	
6/10/11 8:53:00	5.33	13.25	
6/10/11 8:53:15	5.27	13.30	
6/10/11 8:53:30	5.29	13.29	
6/10/11 8:53:45	5.33	13.24	
6/10/11 8:54:00	5.39	13.19	
6/10/11 8:54:15	5.40	13.18	
6/10/11 8:54:30	5.35	13.22	
6/10/11 8:54:45	5.30	13.27	
6/10/11 8:55:00	5.25	13.32	
6/10/11 8:55:15	5.20	13.37	
6/10/11 8:55:30	5.17	13.40	
6/10/11 8:55:45	5.14	13.43	
6/10/11 8:56:00	5.11	13.46	
6/10/11 8:56:15	5.09	13.49	
6/10/11 8:56:30	5.07	13.50	
6/10/11 8:56:45	5.10	13.48	
6/10/11 8:57:00	5.13	13.44	
6/10/11 8:57:15	5.16	13.42	
6/10/11 8:57:30	5.24	13.34	
6/10/11 8:57:45	5.32	13.26	
6/10/11 8:58:00	5.35	13.24	
6/10/11 8:58:15	5.34	13.24	
6/10/11 8:58:30	5.37	13.22	
6/10/11 8:58:45	5.40	13.19	
6/10/11 8:59:00	5.47	13.11	
6/10/11 8:59:15	5.57	13.01	
6/10/11 8:59:30	5.60	13.00	
6/10/11 8:59:45	5.53	13.06	
6/10/11 9:00:00	5.47	13.11	
6/10/11 9:00:15	5.37	13.21	
6/10/11 9:00:30	5.33	13.24	
6/10/11 9:00:45	5.32	13.27	
6/10/11 9:01:00	5.24	13.35	
6/10/11 9:01:15	5.17	13.40	
6/10/11 9:01:30	5.15	13.41	
6/10/11 9:01:45	5.10	13.47	
6/10/11 9:02:00	5.09	13.48	
6/10/11 9:02:15	5.15	13.43	
6/10/11 9:02:30	5.19	13.39	
6/10/11 9:02:45	5.18	13.40	
6/10/11 9:03:00	5.21	13.37	
6/10/11 9:03:15	5.31	13.29	
6/10/11 9:03:30	5.33	13.28	
6/10/11 9:03:45	5.29	13.32	
6/10/11 9:04:00	5.26	13.34	
6/10/11 9:04:15	5.30	13.28	
6/10/11 9:04:30	5.42	13.18	
6/10/11 9:04:45	5.46	13.14	
6/10/11 9:05:00	5.47	13.13	
6/10/11 9:05:15	5.43	13.17	
6/10/11 9:05:30	5.34	13.25	
6/10/11 9:05:45	5.32	13.27	
6/10/11 9:06:00	5.32	13.27	
6/10/11 9:06:15	5.34	13.24	
6/10/11 9:06:30	5.33	13.26	
6/10/11 9:06:45	5.33	13.26	
6/10/11 9:07:00	5.38	13.20	
6/10/11 9:07:15	5.47	13.10	
6/10/11 9:07:30	5.55	13.03	
6/10/11 9:07:45	5.52	13.06	
6/10/11 9:08:00	5.41	13.17	
6/10/11 9:08:15	5.37	13.21	
6/10/11 9:08:30	5.35	13.23	
6/10/11 9:08:45	5.29	13.30	
6/10/11 9:09:00	5.22	13.36	
6/10/11 9:09:15	5.21	13.38	
6/10/11 9:09:30	5.18	13.41	
6/10/11 9:09:45	5.15	13.44	
6/10/11 9:10:00	5.21	13.37	
6/10/11 9:10:15	5.35	13.23	
6/10/11 9:10:30	5.45	13.15	
6/10/11 9:10:45	5.44	13.15	
6/10/11 9:11:00	5.44	13.15	
6/10/11 9:11:15	5.46	13.13	
6/10/11 9:11:30	5.46	13.14	
6/10/11 9:11:45	5.37	13.23	
6/10/11 9:12:00	5.30	13.29	
6/10/11 9:12:15	5.32	13.27	
6/10/11 9:12:30	5.34	13.26	
6/10/11 9:12:45	5.30	13.30	
6/10/11 9:13:00	5.27	13.32	
6/10/11 9:13:15	5.27	13.34	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 9:13:30	5.27	13.33	
6/10/11 9:13:45	5.31	13.28	
6/10/11 9:14:00	5.33	13.27	
6/10/11 9:14:15	5.30	13.28	
6/10/11 9:14:30	5.29	13.29	
6/10/11 9:14:45	5.29	13.29	
6/10/11 9:15:00	5.32	13.28	
6/10/11 9:15:15	5.31	13.28	
6/10/11 9:15:30	5.34	13.25	
6/10/11 9:15:45	5.40	13.20	
6/10/11 9:16:00	5.37	13.23	
6/10/11 9:16:15	5.27	13.31	
6/10/11 9:16:30	5.20	13.38	
6/10/11 9:16:45	5.26	13.31	
6/10/11 9:17:00	5.36	13.24	
6/10/11 9:17:15	5.34	13.27	
6/10/11 9:17:30	5.28	13.33	
6/10/11 9:17:45	5.31	13.29	
6/10/11 9:18:00	5.40	13.20	
6/10/11 9:18:15	5.42	13.18	
6/10/11 9:18:30	5.40	13.20	
6/10/11 9:18:45	5.43	13.17	
6/10/11 9:19:00	5.44	13.16	
6/10/11 9:19:15	5.42	13.17	
6/10/11 9:19:30	5.45	13.15	
6/10/11 9:19:45	5.47	13.13	
6/10/11 9:20:00	5.44	13.16	
6/10/11 9:20:15	5.43	13.16	Restart Run 2
6/10/11 9:20:30	5.43	13.16	
6/10/11 9:20:45	5.41	13.19	
6/10/11 9:21:00	5.33	13.26	
6/10/11 9:21:15	5.26	13.33	
6/10/11 9:21:30	5.22	13.37	
6/10/11 9:21:45	5.23	13.36	
6/10/11 9:22:00	5.26	13.33	
6/10/11 9:22:15	5.28	13.31	
6/10/11 9:22:30	5.29	13.31	
6/10/11 9:22:45	5.30	13.30	
6/10/11 9:23:00	5.35	13.25	
6/10/11 9:23:15	5.31	13.30	
6/10/11 9:23:30	5.24	13.35	
6/10/11 9:23:45	5.21	13.37	
6/10/11 9:24:00	5.18	13.41	
6/10/11 9:24:15	5.20	13.38	
6/10/11 9:24:30	5.25	13.35	
6/10/11 9:24:45	5.27	13.33	
6/10/11 9:25:00	5.32	13.27	
6/10/11 9:25:15	5.40	13.20	
6/10/11 9:25:30	5.49	13.12	
6/10/11 9:25:45	5.54	13.07	
6/10/11 9:26:00	5.60	13.01	
6/10/11 9:26:15	5.62	12.99	
6/10/11 9:26:30	5.57	13.04	
6/10/11 9:26:45	5.45	13.15	
6/10/11 9:27:00	5.37	13.22	
6/10/11 9:27:15	5.41	13.18	
6/10/11 9:27:30	5.44	13.16	
6/10/11 9:27:45	5.40	13.21	
6/10/11 9:28:00	5.35	13.24	
6/10/11 9:28:15	5.37	13.22	
6/10/11 9:28:30	5.39	13.20	
6/10/11 9:28:45	5.44	13.14	
6/10/11 9:29:00	5.48	13.11	
6/10/11 9:29:15	5.46	13.13	
6/10/11 9:29:30	5.37	13.21	
6/10/11 9:29:45	5.28	13.30	
6/10/11 9:30:00	5.21	13.37	
6/10/11 9:30:15	5.19	13.39	
6/10/11 9:30:30	5.26	13.32	
6/10/11 9:30:45	5.34	13.26	
6/10/11 9:31:00	5.33	13.27	
6/10/11 9:31:15	5.30	13.28	
6/10/11 9:31:30	5.31	13.28	
6/10/11 9:31:45	5.30	13.29	
6/10/11 9:32:00	5.30	13.29	
6/10/11 9:32:15	5.29	13.29	
6/10/11 9:32:30	5.32	13.28	
6/10/11 9:32:45	5.37	13.24	
6/10/11 9:33:00	5.44	13.16	
6/10/11 9:33:15	5.45	13.16	
6/10/11 9:33:30	5.43	13.17	
6/10/11 9:33:45	5.42	13.18	
6/10/11 9:34:00	5.42	13.19	
6/10/11 9:34:15	5.40	13.21	
6/10/11 9:34:30	5.40	13.19	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 9:34:45	5.42	13.18	
6/10/11 9:35:00	5.39	13.21	
6/10/11 9:35:15	5.36	13.24	
6/10/11 9:35:30	5.43	13.15	
6/10/11 9:35:45	5.55	13.03	
6/10/11 9:36:00	5.55	13.05	
6/10/11 9:36:15	5.41	13.18	
6/10/11 9:36:30	5.30	13.28	
6/10/11 9:36:45	5.29	13.29	
6/10/11 9:37:00	5.32	13.26	
6/10/11 9:37:15	5.30	13.28	
6/10/11 9:37:30	5.30	13.29	
6/10/11 9:37:45	5.31	13.29	
6/10/11 9:38:00	5.25	13.33	
6/10/11 9:38:15	5.26	13.33	
6/10/11 9:38:30	5.29	13.30	
6/10/11 9:38:45	5.35	13.24	
6/10/11 9:39:00	5.40	13.19	
6/10/11 9:39:15	5.39	13.22	
6/10/11 9:39:30	5.35	13.26	
6/10/11 9:39:45	5.33	13.27	
6/10/11 9:40:00	5.33	13.27	
6/10/11 9:40:15	5.34	13.25	
6/10/11 9:40:30	5.40	13.20	
6/10/11 9:40:45	5.49	13.11	
6/10/11 9:41:00	5.52	13.09	
6/10/11 9:41:15	5.47	13.12	
6/10/11 9:41:30	5.44	13.14	
6/10/11 9:41:45	5.37	13.22	
6/10/11 9:42:00	5.24	13.34	
6/10/11 9:42:15	5.18	13.39	
6/10/11 9:42:30	5.23	13.35	
6/10/11 9:42:45	5.25	13.34	
6/10/11 9:43:00	5.28	13.32	
6/10/11 9:43:15	5.34	13.26	
6/10/11 9:43:30	5.38	13.22	
6/10/11 9:43:45	5.32	13.27	
6/10/11 9:44:00	5.32	13.28	
6/10/11 9:44:15	5.40	13.21	
6/10/11 9:44:30	5.41	13.20	
6/10/11 9:44:45	5.37	13.22	
6/10/11 9:45:00	5.35	13.23	
6/10/11 9:45:15	5.30	13.29	
6/10/11 9:45:30	5.23	13.36	
6/10/11 9:45:45	5.15	13.43	
6/10/11 9:46:00	5.16	13.42	
6/10/11 9:46:15	5.23	13.35	
6/10/11 9:46:30	5.29	13.30	
6/10/11 9:46:45	5.33	13.27	
6/10/11 9:47:00	5.40	13.21	
6/10/11 9:47:15	5.46	13.15	
6/10/11 9:47:30	5.48	13.11	
6/10/11 9:47:45	5.49	13.11	
6/10/11 9:48:00	5.49	13.11	
6/10/11 9:48:15	5.57	13.03	
6/10/11 9:48:30	5.62	12.98	
6/10/11 9:48:45	5.59	13.00	
6/10/11 9:49:00	5.50	13.09	
6/10/11 9:49:15	5.44	13.14	
6/10/11 9:49:30	5.44	13.15	
6/10/11 9:49:45	5.43	13.17	
6/10/11 9:50:00	5.34	13.25	
6/10/11 9:50:15	5.29	13.30	
6/10/11 9:50:30	5.31	13.26	
6/10/11 9:50:45	5.46	13.13	
6/10/11 9:51:00	5.52	13.09	
6/10/11 9:51:15	5.45	13.15	
6/10/11 9:51:30	5.36	13.22	
6/10/11 9:51:45	5.35	13.24	
6/10/11 9:52:00	5.38	13.20	
6/10/11 9:52:15	5.37	13.21	
6/10/11 9:52:30	5.32	13.26	
6/10/11 9:52:45	5.32	13.26	
6/10/11 9:53:00	5.35	13.24	
6/10/11 9:53:15	5.38	13.21	
6/10/11 9:53:30	5.45	13.14	
6/10/11 9:53:45	5.48	13.12	
6/10/11 9:54:00	5.46	13.13	
6/10/11 9:54:15	5.41	13.18	
6/10/11 9:54:30	5.38	13.21	
6/10/11 9:54:45	5.37	13.22	
6/10/11 9:55:00	5.38	13.22	
6/10/11 9:55:15	5.34	13.25	
6/10/11 9:55:30	5.35	13.24	
6/10/11 9:55:45	5.36	13.24	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 9:58:00	5.34	13.26	
6/10/11 9:58:15	5.37	13.22	
6/10/11 9:58:30	5.42	13.17	
6/10/11 9:58:45	5.41	13.18	
6/10/11 9:57:00	5.39	13.22	
6/10/11 9:57:15	5.31	13.28	
6/10/11 9:57:30	5.26	13.32	
6/10/11 9:57:45	5.25	13.35	
6/10/11 9:58:00	5.28	13.31	
6/10/11 9:58:15	5.31	13.28	
6/10/11 9:58:30	5.32	13.27	
6/10/11 9:58:45	5.33	13.27	
6/10/11 9:59:00	5.28	13.30	
6/10/11 9:59:15	5.29	13.30	
6/10/11 9:59:30	5.28	13.31	
6/10/11 9:59:45	5.27	13.31	
6/10/11 10:00:00	5.31	13.28	
6/10/11 10:00:15	5.39	13.20	
6/10/11 10:00:30	5.43	13.17	
6/10/11 10:00:45	5.39	13.21	
6/10/11 10:01:00	5.36	13.24	
6/10/11 10:01:15	5.34	13.25	
6/10/11 10:01:30	5.39	13.20	
6/10/11 10:01:45	5.46	13.13	
6/10/11 10:02:00	5.52	13.07	
6/10/11 10:02:15	5.56	13.05	
6/10/11 10:02:30	5.55	13.05	
6/10/11 10:02:45	5.56	13.03	
6/10/11 10:03:00	5.56	13.03	
6/10/11 10:03:15	5.51	13.08	
6/10/11 10:03:30	5.40	13.19	
6/10/11 10:03:45	5.28	13.30	
6/10/11 10:04:00	5.30	13.28	
6/10/11 10:04:15	5.34	13.27	
6/10/11 10:04:30	5.28	13.32	
6/10/11 10:04:45	5.23	13.35	
6/10/11 10:05:00	5.18	13.40	
6/10/11 10:05:15	5.10	13.48	
6/10/11 10:05:30	5.12	13.45	
6/10/11 10:05:45	5.18	13.40	
6/10/11 10:06:00	5.19	13.39	
6/10/11 10:06:15	5.27	13.30	
6/10/11 10:06:30	5.35	13.24	
6/10/11 10:06:45	5.34	13.25	
6/10/11 10:07:00	5.35	13.23	
6/10/11 10:07:15	5.41	13.18	
6/10/11 10:07:30	5.41	13.18	
6/10/11 10:07:45	5.33	13.26	
6/10/11 10:08:00	5.28	13.30	
6/10/11 10:08:15	5.28	13.31	
6/10/11 10:08:30	5.26	13.34	
6/10/11 10:08:45	5.25	13.35	
6/10/11 10:09:00	5.30	13.31	
6/10/11 10:09:15	5.37	13.23	
6/10/11 10:09:30	5.40	13.21	
6/10/11 10:09:45	5.39	13.22	
6/10/11 10:10:00	5.42	13.17	
6/10/11 10:10:15	5.51	13.08	
6/10/11 10:10:30	5.52	13.08	
6/10/11 10:10:45	5.50	13.09	
6/10/11 10:11:00	5.49	13.11	
6/10/11 10:11:15	5.44	13.14	
6/10/11 10:11:30	5.42	13.17	
6/10/11 10:11:45	5.33	13.26	
6/10/11 10:12:00	5.25	13.33	
6/10/11 10:12:15	5.26	13.32	
6/10/11 10:12:30	5.30	13.28	
6/10/11 10:12:45	5.33	13.25	
6/10/11 10:13:00	5.34	13.25	
6/10/11 10:13:15	5.37	13.22	
6/10/11 10:13:30	5.37	13.22	
6/10/11 10:13:45	5.28	13.30	
6/10/11 10:14:00	5.24	13.34	
6/10/11 10:14:15	5.21	13.38	
6/10/11 10:14:30	5.21	13.38	
6/10/11 10:14:45	5.31	13.28	
6/10/11 10:15:00	5.45	13.15	
6/10/11 10:15:15	5.56	13.05	
6/10/11 10:15:30	5.55	13.06	
6/10/11 10:15:45	5.50	13.10	
6/10/11 10:16:00	5.49	13.09	
6/10/11 10:16:15	5.47	13.11	
6/10/11 10:16:30	5.46	13.12	
6/10/11 10:16:45	5.48	13.12	
6/10/11 10:17:00	5.46	13.14	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 10:17:15	5.40	13.20	
6/10/11 10:17:30	5.30	13.29	
6/10/11 10:17:45	5.31	13.27	
6/10/11 10:18:00	5.36	13.24	
6/10/11 10:18:15	5.35	13.25	
6/10/11 10:18:30	5.31	13.28	
6/10/11 10:18:45	5.31	13.28	
6/10/11 10:19:00	5.36	13.23	
6/10/11 10:19:15	5.42	13.16	
6/10/11 10:19:30	5.37	13.22	
6/10/11 10:19:45	5.25	13.33	
6/10/11 10:20:00	5.24	13.33	
6/10/11 10:20:15	5.33	13.25	
6/10/11 10:20:30	5.37	13.23	
6/10/11 10:20:45	5.32	13.27	
6/10/11 10:21:00	5.32	13.27	
6/10/11 10:21:15	5.41	13.18	
6/10/11 10:21:30	5.43	13.15	
6/10/11 10:21:45	5.42	13.17	
6/10/11 10:22:00	5.40	13.20	
6/10/11 10:22:15	5.39	13.20	
6/10/11 10:22:30	5.40	13.19	
6/10/11 10:22:45	5.39	13.20	
6/10/11 10:23:00	5.41	13.17	
6/10/11 10:23:15	5.42	13.17	
6/10/11 10:23:30	5.41	13.17	
6/10/11 10:23:45	5.44	13.15	
6/10/11 10:24:00	5.48	13.11	
6/10/11 10:24:15	5.49	13.11	
6/10/11 10:24:30	5.47	13.12	
6/10/11 10:24:45	5.47	13.11	
6/10/11 10:25:00	5.46	13.12	
6/10/11 10:25:15	5.49	13.09	
6/10/11 10:25:30	5.57	13.02	
6/10/11 10:25:45	5.57	13.02	
6/10/11 10:26:00	5.51	13.06	
6/10/11 10:26:15	5.45	13.13	
6/10/11 10:26:30	5.36	13.23	
6/10/11 10:26:45	5.29	13.29	
6/10/11 10:27:00	5.28	13.32	
6/10/11 10:27:15	5.26	13.33	
6/10/11 10:27:30	5.25	13.34	
6/10/11 10:27:45	5.26	13.33	
6/10/11 10:28:00	5.27	13.31	
6/10/11 10:28:15	5.27	13.30	
6/10/11 10:28:30	5.28	13.29	
6/10/11 10:28:45	5.26	13.33	
6/10/11 10:29:00	5.22	13.36	
6/10/11 10:29:15	5.24	13.34	
6/10/11 10:29:30	5.24	13.35	
6/10/11 10:29:45	5.23	13.36	
6/10/11 10:30:00	5.25	13.34	
6/10/11 10:30:15	5.31	13.28	
6/10/11 10:30:30	5.44	13.15	
6/10/11 10:30:45	5.53	13.07	
6/10/11 10:31:00	5.51	13.09	
6/10/11 10:31:15	5.44	13.17	
6/10/11 10:31:30	5.39	13.21	
6/10/11 10:31:45	5.36	13.24	
6/10/11 10:32:00	5.35	13.23	
6/10/11 10:32:15	5.39	13.19	
6/10/11 10:32:30	5.38	13.21	
6/10/11 10:32:45	5.33	13.26	
6/10/11 10:33:00	5.27	13.31	
6/10/11 10:33:15	5.33	13.25	
6/10/11 10:33:30	5.42	13.16	
6/10/11 10:33:45	5.39	13.20	
6/10/11 10:34:00	5.27	13.32	
6/10/11 10:34:15	5.15	13.43	
6/10/11 10:34:30	5.11	13.47	
6/10/11 10:34:45	5.18	13.41	
6/10/11 10:35:00	5.21	13.37	
6/10/11 10:35:15	5.24	13.35	
6/10/11 10:35:30	5.25	13.35	
6/10/11 10:35:45	5.24	13.35	
6/10/11 10:36:00	5.24	13.35	
6/10/11 10:36:15	5.24	13.35	
6/10/11 10:36:30	5.26	13.34	
6/10/11 10:36:45	5.27	13.32	
6/10/11 10:37:00	5.31	13.29	
6/10/11 10:37:15	5.28	13.32	
6/10/11 10:37:30	5.24	13.36	
6/10/11 10:37:45	5.23	13.36	
6/10/11 10:38:00	5.29	13.29	
6/10/11 10:38:15	5.36	13.22	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 10:38:30	5.45	13.14	
6/10/11 10:38:45	5.54	13.07	
6/10/11 10:39:00	5.55	13.05	
6/10/11 10:39:15	5.50	13.09	
6/10/11 10:39:30	5.47	13.13	
6/10/11 10:39:45	5.41	13.19	
6/10/11 10:40:00	5.37	13.22	
6/10/11 10:40:15	5.39	13.19	
6/10/11 10:40:30	5.43	13.16	
6/10/11 10:40:45	5.38	13.21	
6/10/11 10:41:00	5.32	13.26	
6/10/11 10:41:15	5.33	13.26	
6/10/11 10:41:30	5.34	13.25	
6/10/11 10:41:45	5.30	13.29	
6/10/11 10:42:00	5.25	13.34	
6/10/11 10:42:15	5.24	13.34	
6/10/11 10:42:30	5.26	13.31	
6/10/11 10:42:45	5.34	13.24	
6/10/11 10:43:00	5.28	13.32	
6/10/11 10:43:15	5.20	13.37	
6/10/11 10:43:30	5.19	13.38	
6/10/11 10:43:45	5.23	13.34	
6/10/11 10:44:00	5.29	13.30	
6/10/11 10:44:15	5.30	13.30	
6/10/11 10:44:30	5.33	13.26	
6/10/11 10:44:45	5.40	13.20	
6/10/11 10:45:00	5.42	13.17	
6/10/11 10:45:15	5.41	13.18	
6/10/11 10:45:30	5.46	13.13	
6/10/11 10:45:45	5.59	13.00	
6/10/11 10:46:00	5.65	12.95	
6/10/11 10:46:15	5.60	13.00	
6/10/11 10:46:30	5.45	13.14	
6/10/11 10:46:45	5.32	13.25	
6/10/11 10:47:00	5.28	13.29	
6/10/11 10:47:15	5.29	13.28	
6/10/11 10:47:30	5.32	13.27	
6/10/11 10:47:45	5.32	13.27	
6/10/11 10:48:00	5.32	13.25	
6/10/11 10:48:15	5.38	13.20	
6/10/11 10:48:30	5.47	13.11	
6/10/11 10:48:45	5.52	13.08	
6/10/11 10:49:00	5.50	13.09	
6/10/11 10:49:15	5.50	13.09	
6/10/11 10:49:30	5.42	13.15	
6/10/11 10:49:45	5.30	13.26	
6/10/11 10:50:00	5.22	13.36	
6/10/11 10:50:15	5.18	13.41	
6/10/11 10:50:30	5.22	13.35	
6/10/11 10:50:45	5.36	13.23	
6/10/11 10:51:00	5.46	13.14	
6/10/11 10:51:15	5.45	13.15	
6/10/11 10:51:30	5.41	13.19	
6/10/11 10:51:45	5.43	13.16	
6/10/11 10:52:00	5.50	13.08	
6/10/11 10:52:15	5.53	13.06	
6/10/11 10:52:30	5.47	13.13	
6/10/11 10:52:45	5.35	13.24	
6/10/11 10:53:00	5.19	13.39	
6/10/11 10:53:15	5.16	13.41	
6/10/11 10:53:30	5.24	13.34	
6/10/11 10:53:45	5.22	13.36	
6/10/11 10:54:00	5.23	13.35	
6/10/11 10:54:15	5.29	13.29	
6/10/11 10:54:30	5.36	13.23	
6/10/11 10:54:45	5.35	13.24	End FCCU-23-2
6/10/11 10:55:00	5.33	13.25	FCCU-OH-2
6/10/11 10:55:15	5.35	13.22	
6/10/11 10:55:30	5.37	13.21	
6/10/11 10:55:45	5.39	13.19	
6/10/11 10:56:00	5.36	13.23	
6/10/11 10:56:15	5.21	13.37	
6/10/11 10:56:30	5.10	13.47	
6/10/11 10:56:45	5.11	13.46	
6/10/11 10:57:00	5.22	13.37	
6/10/11 10:57:15	5.35	13.24	
6/10/11 10:57:30	5.44	13.16	
6/10/11 10:57:45	5.45	13.16	
6/10/11 10:58:00	5.48	13.12	
6/10/11 10:58:15	5.57	13.02	
6/10/11 10:58:30	5.58	13.03	
6/10/11 10:58:45	5.52	13.08	
6/10/11 10:59:00	5.52	13.07	
6/10/11 10:59:15	5.57	13.03	
6/10/11 10:59:30	5.52	13.06	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 10:59:45	5.35	11.34	
6/10/11 11:00:00	3.75	5.72	
6/10/11 11:00:15	1.39	1.79	
6/10/11 11:00:30	0.28	0.41	
6/10/11 11:00:45	0.12	0.25	
6/10/11 11:01:00	0.11	0.22	
6/10/11 11:01:15	0.10	0.20	
6/10/11 11:01:30	0.10	0.18	
6/10/11 11:01:45	0.09	0.17	
6/10/11 11:02:00	0.09	0.16	
6/10/11 11:02:15	0.09	0.15	
6/10/11 11:02:30	0.09	0.15	
6/10/11 11:02:45	0.09	0.14	
6/10/11 11:03:00	0.09	0.14	
6/10/11 11:03:15	0.09	0.13	
6/10/11 11:03:30	0.08	0.13	
6/10/11 11:03:45	0.08	0.13	
6/10/11 11:04:00	0.08	0.12	
6/10/11 11:04:15	0.08	0.12	
6/10/11 11:04:30	0.08	0.12	
6/10/11 11:04:45	0.08	0.12	
6/10/11 11:05:00	0.08	0.11	
6/10/11 11:05:15	0.08	0.11	
6/10/11 11:05:30	0.08	0.11	
6/10/11 11:05:45	0.08	0.11	
6/10/11 11:06:00	0.08	0.10	System Bias
6/10/11 11:06:15	0.08	0.10	O ₂ Bias 2 Zero = 0.08
6/10/11 11:06:30	0.08	0.10	CO ₂ Bias 2 Zero = 0.10
6/10/11 11:06:45	0.08	0.10	
6/10/11 11:07:00	0.08	0.10	
6/10/11 11:07:15	0.08	0.10	
6/10/11 11:07:30	0.08	0.10	
6/10/11 11:07:45	0.08	0.10	
6/10/11 11:08:00	0.08	0.10	
6/10/11 11:08:15	0.07	0.10	
6/10/11 11:08:30	0.07	0.09	
6/10/11 11:08:45	0.08	0.09	
6/10/11 11:09:00	0.08	0.09	
6/10/11 11:09:15	0.08	0.09	
6/10/11 11:09:30	0.08	0.09	
6/10/11 11:09:45	0.08	0.09	
6/10/11 11:10:00	0.07	0.09	
6/10/11 11:10:15	0.07	0.09	
6/10/11 11:10:30	0.08	0.09	
6/10/11 11:10:45	0.07	0.09	
6/10/11 11:11:00	0.07	0.09	
6/10/11 11:11:15	0.08	0.09	
6/10/11 11:11:30	0.08	0.09	
6/10/11 11:11:45	0.07	0.09	
6/10/11 11:12:00	0.08	0.09	
6/10/11 11:12:15	0.07	0.09	
6/10/11 11:12:30	0.07	0.09	
6/10/11 11:12:45	0.07	0.09	
6/10/11 11:13:00	0.07	0.09	
6/10/11 11:13:15	0.07	0.09	
6/10/11 11:13:30	0.08	0.09	
6/10/11 11:13:45	0.07	0.09	
6/10/11 11:14:00	0.08	0.09	
6/10/11 11:14:15	0.07	0.09	
6/10/11 11:14:30	0.07	0.09	
6/10/11 11:14:45	0.07	0.09	
6/10/11 11:15:00	0.07	0.09	
6/10/11 11:15:15	0.07	0.09	
6/10/11 11:15:30	0.09	0.14	
6/10/11 11:15:45	1.35	1.58	
6/10/11 11:16:00	3.52	3.22	
6/10/11 11:16:15	2.90	2.13	
6/10/11 11:16:30	0.73	0.48	
6/10/11 11:16:45	0.19	0.26	
6/10/11 11:17:00	1.77	1.88	
6/10/11 11:17:15	3.81	3.52	
6/10/11 11:17:30	4.44	3.98	
6/10/11 11:17:45	4.53	4.04	
6/10/11 11:18:00	4.54	4.06	
6/10/11 11:18:15	4.55	4.07	
6/10/11 11:18:30	4.55	4.08	
6/10/11 11:18:45	4.55	4.09	
6/10/11 11:19:00	4.56	4.09	
6/10/11 11:19:15	4.56	4.10	
6/10/11 11:19:30	4.56	4.10	
6/10/11 11:19:45	4.56	4.10	
6/10/11 11:20:00	4.57	4.11	
6/10/11 11:20:15	4.57	4.11	
6/10/11 11:20:30	4.57	4.11	System Bias
6/10/11 11:20:45	4.57	4.11	O ₂ Bias 2 Mid = 4.57

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 11:21:00	4.57	4.11	
6/10/11 11:21:15	4.57	4.11	
6/10/11 11:21:30	4.58	4.12	
6/10/11 11:21:45	4.58	4.12	
6/10/11 11:22:00	4.58	4.12	
6/10/11 11:22:15	4.58	4.12	
6/10/11 11:22:30	4.58	4.12	
6/10/11 11:22:45	4.58	4.12	
6/10/11 11:23:00	4.59	4.31	
6/10/11 11:23:15	4.78	7.12	
6/10/11 11:23:30	5.51	8.00	
6/10/11 11:23:45	8.90	8.98	
6/10/11 11:24:00	10.93	9.79	
6/10/11 11:24:15	11.32	9.94	
6/10/11 11:24:30	11.36	9.97	
6/10/11 11:24:45	11.37	9.98	
6/10/11 11:25:00	11.37	9.98	System Bias
6/10/11 11:25:15	11.38	9.98	
6/10/11 11:25:30	11.38	9.99	CO ₂ Bias 2 Mid = 9.99
6/10/11 11:25:45	11.38	9.99	
6/10/11 11:26:00	11.38	9.99	
6/10/11 11:26:15	11.38	9.99	
6/10/11 11:26:30	11.38	10.00	
6/10/11 11:26:45	11.39	10.00	
6/10/11 11:27:00	11.38	10.00	
6/10/11 11:27:15	11.39	10.00	
6/10/11 11:27:30	11.39	10.00	
6/10/11 11:27:45	11.39	10.00	
6/10/11 11:28:00	10.99	10.36	
6/10/11 11:28:15	8.06	12.06	
6/10/11 11:28:30	6.00	12.84	
6/10/11 11:28:45	5.62	12.99	
6/10/11 11:29:00	5.54	13.04	
6/10/11 11:29:15	5.50	13.06	
6/10/11 11:29:30	5.47	13.09	
6/10/11 11:29:45	5.49	13.07	
6/10/11 11:30:00	5.53	13.03	
6/10/11 11:30:15	5.52	13.05	
6/10/11 11:30:30	5.42	13.15	
6/10/11 11:30:45	5.28	13.27	
6/10/11 11:31:00	5.19	13.36	
6/10/11 11:31:15	5.17	13.38	
6/10/11 11:31:30	5.19	13.38	
6/10/11 11:31:45	5.20	13.35	
6/10/11 11:32:00	5.20	13.36	
6/10/11 11:32:15	5.21	13.35	
6/10/11 11:32:30	5.25	13.32	
6/10/11 11:32:45	5.33	13.24	
6/10/11 11:33:00	5.37	13.21	
6/10/11 11:33:15	5.34	13.24	
6/10/11 11:33:30	5.33	13.23	
6/10/11 11:33:45	5.37	13.20	
6/10/11 11:34:00	5.45	13.12	
6/10/11 11:34:15	5.52	13.06	
6/10/11 11:34:30	5.48	13.11	
6/10/11 11:34:45	5.44	13.13	
6/10/11 11:35:00	5.43	13.14	
6/10/11 11:35:15	5.43	13.14	
6/10/11 11:35:30	5.49	13.08	
6/10/11 11:35:45	5.54	13.04	
6/10/11 11:36:00	5.53	13.04	
6/10/11 11:36:15	5.48	13.09	
6/10/11 11:36:30	5.40	13.17	
6/10/11 11:36:45	5.34	13.23	
6/10/11 11:37:00	5.34	13.22	
6/10/11 11:37:15	5.34	13.22	
6/10/11 11:37:30	5.35	13.22	
6/10/11 11:37:45	5.39	13.19	
6/10/11 11:38:00	5.37	13.20	
6/10/11 11:38:15	5.37	13.20	
6/10/11 11:38:30	5.36	13.21	
6/10/11 11:38:45	5.32	13.26	
6/10/11 11:39:00	5.32	13.25	
6/10/11 11:39:15	5.38	13.17	
6/10/11 11:39:30	5.46	13.11	
6/10/11 11:39:45	5.46	13.12	
6/10/11 11:40:00	5.40	13.17	
6/10/11 11:40:15	5.40	13.17	
6/10/11 11:40:30	5.44	13.14	
6/10/11 11:40:45	5.42	13.16	
6/10/11 11:41:00	5.41	13.15	
6/10/11 11:41:15	5.43	13.15	
6/10/11 11:41:30	5.37	13.21	
6/10/11 11:41:45	5.36	13.22	
6/10/11 11:42:00	5.41	13.16	

Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 11:42:15	5.49	13.10	
6/10/11 11:42:30	5.47	13.12	
6/10/11 11:42:45	5.41	13.18	
6/10/11 11:43:00	5.35	13.21	
6/10/11 11:43:15	5.39	13.18	
6/10/11 11:43:30	5.43	13.15	
6/10/11 11:43:45	5.41	13.17	
6/10/11 11:44:00	5.42	13.14	
6/10/11 11:44:15	5.51	13.06	
6/10/11 11:44:30	5.54	13.03	
6/10/11 11:44:45	5.50	13.08	
6/10/11 11:45:00	5.41	13.15	
6/10/11 11:45:15	5.37	13.19	
6/10/11 11:45:30	5.36	13.21	
6/10/11 11:45:45	5.34	13.24	
6/10/11 11:46:00	5.33	13.25	
6/10/11 11:46:15	5.31	13.26	
6/10/11 11:46:30	5.28	13.30	
6/10/11 11:46:45	5.28	13.28	
6/10/11 11:47:00	5.37	13.20	
6/10/11 11:47:15	5.42	13.17	
6/10/11 11:47:30	5.36	13.23	
6/10/11 11:47:45	5.28	13.29	
6/10/11 11:48:00	5.27	13.31	
6/10/11 11:48:15	5.30	13.28	
6/10/11 11:48:30	5.36	13.23	
6/10/11 11:48:45	5.38	13.21	
6/10/11 11:49:00	5.33	13.25	
6/10/11 11:49:15	5.32	13.25	
6/10/11 11:49:30	5.35	13.23	
6/10/11 11:49:45	5.42	13.17	
6/10/11 11:50:00	5.50	13.08	
6/10/11 11:50:15	5.57	13.02	
6/10/11 11:50:30	5.57	13.02	
6/10/11 11:50:45	5.52	13.06	
6/10/11 11:51:00	5.46	13.13	
6/10/11 11:51:15	5.35	13.23	
6/10/11 11:51:30	5.27	13.30	
6/10/11 11:51:45	5.28	13.28	
6/10/11 11:52:00	5.30	13.28	
6/10/11 11:52:15	5.31	13.27	
6/10/11 11:52:30	5.32	13.27	
6/10/11 11:52:45	5.30	13.28	
6/10/11 11:53:00	5.22	13.36	
6/10/11 11:53:15	5.16	13.40	
6/10/11 11:53:30	5.16	13.40	
6/10/11 11:53:45	5.16	13.42	
6/10/11 11:54:00	5.17	13.41	
6/10/11 11:54:15	5.27	13.31	
6/10/11 11:54:30	5.34	13.25	
6/10/11 11:54:45	5.34	13.25	
6/10/11 11:55:00	5.37	13.22	
6/10/11 11:55:15	5.40	13.19	
6/10/11 11:55:30	5.39	13.20	
6/10/11 11:55:45	5.37	13.22	
6/10/11 11:56:00	5.34	13.24	
6/10/11 11:56:15	5.32	13.26	
6/10/11 11:56:30	5.35	13.23	
6/10/11 11:56:45	5.42	13.16	
6/10/11 11:57:00	5.51	13.07	
6/10/11 11:57:15	5.56	13.03	
6/10/11 11:57:30	5.53	13.07	
6/10/11 11:57:45	5.46	13.12	
6/10/11 11:58:00	5.45	13.13	
6/10/11 11:58:15	5.51	13.07	
6/10/11 11:58:30	5.51	13.09	
6/10/11 11:58:45	5.42	13.16	
6/10/11 11:59:00	5.33	13.24	
6/10/11 11:59:15	5.24	13.33	
6/10/11 11:59:30	5.17	13.40	
6/10/11 11:59:45	5.21	13.36	
6/10/11 12:00:00	5.27	13.31	
6/10/11 12:00:15	5.20	13.39	
6/10/11 12:00:30	5.13	13.45	
6/10/11 12:00:45	5.11	13.47	
6/10/11 12:01:00	5.15	13.43	
6/10/11 12:01:15	5.21	13.38	
6/10/11 12:01:30	5.19	13.39	
6/10/11 12:01:45	5.20	13.37	
6/10/11 12:02:00	5.31	13.26	
6/10/11 12:02:15	5.45	13.13	
6/10/11 12:02:30	5.51	13.09	
6/10/11 12:02:45	5.47	13.12	
6/10/11 12:03:00	5.46	13.13	
6/10/11 12:03:15	5.42	13.18	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂	CO ₂	Comments
	% db by vol.	% db by vol.	
6/10/11 12:03:30	5.38	13.21	
6/10/11 12:03:45	5.41	13.18	
6/10/11 12:04:00	5.42	13.17	
6/10/11 12:04:15	5.41	13.18	
6/10/11 12:04:30	5.45	13.14	
6/10/11 12:04:45	5.48	13.12	
6/10/11 12:05:00	5.42	13.17	
6/10/11 12:05:15	5.35	13.22	
6/10/11 12:05:30	5.38	13.18	
6/10/11 12:05:45	5.46	13.11	
6/10/11 12:06:00	5.43	13.14	
6/10/11 12:06:15	5.39	13.18	
6/10/11 12:06:30	5.36	13.22	
6/10/11 12:06:45	5.32	13.26	
6/10/11 12:07:00	5.28	13.29	
6/10/11 12:07:15	5.28	13.30	
6/10/11 12:07:30	5.27	13.30	
6/10/11 12:07:45	5.32	13.24	
6/10/11 12:08:00	5.36	13.22	
6/10/11 12:08:15	5.35	13.23	
6/10/11 12:08:30	5.36	13.22	
6/10/11 12:08:45	5.40	13.18	
6/10/11 12:09:00	5.42	13.16	
6/10/11 12:09:15	5.33	13.26	
6/10/11 12:09:30	5.19	13.38	
6/10/11 12:09:45	5.17	13.40	
6/10/11 12:10:00	5.25	13.33	
6/10/11 12:10:15	5.36	13.23	
6/10/11 12:10:30	5.44	13.15	
6/10/11 12:10:45	5.48	13.11	
6/10/11 12:11:00	5.45	13.14	
6/10/11 12:11:15	5.40	13.18	
6/10/11 12:11:30	5.39	13.19	
6/10/11 12:11:45	5.45	13.13	
6/10/11 12:12:00	5.44	13.14	
6/10/11 12:12:15	5.41	13.16	
6/10/11 12:12:30	5.46	13.12	
6/10/11 12:12:45	5.50	13.08	
6/10/11 12:13:00	5.48	13.10	
6/10/11 12:13:15	5.45	13.13	
6/10/11 12:13:30	5.42	13.15	
6/10/11 12:13:45	5.42	13.15	
6/10/11 12:14:00	5.40	13.17	
6/10/11 12:14:15	5.36	13.21	
6/10/11 12:14:30	5.28	13.29	
6/10/11 12:14:45	5.20	13.37	
6/10/11 12:15:00	5.20	13.37	
6/10/11 12:15:15	5.23	13.34	
6/10/11 12:15:30	5.25	13.32	
6/10/11 12:15:45	5.24	13.33	
6/10/11 12:16:00	5.25	13.31	
6/10/11 12:16:15	5.32	13.25	
6/10/11 12:16:30	5.38	13.20	
6/10/11 12:16:45	5.49	13.10	
6/10/11 12:17:00	5.59	13.00	
6/10/11 12:17:15	5.58	13.02	
6/10/11 12:17:30	5.53	13.05	
6/10/11 12:17:45	5.52	13.06	
6/10/11 12:18:00	5.45	13.13	
6/10/11 12:18:15	5.33	13.25	
6/10/11 12:18:30	5.34	13.23	
6/10/11 12:18:45	5.48	13.09	
6/10/11 12:19:00	5.57	13.02	
6/10/11 12:19:15	5.56	13.02	
6/10/11 12:19:30	5.57	13.01	
6/10/11 12:19:45	5.50	13.08	
6/10/11 12:20:00	5.38	13.19	
6/10/11 12:20:15	5.34	13.23	
6/10/11 12:20:30	5.33	13.25	
6/10/11 12:20:45	5.32	13.24	
6/10/11 12:21:00	5.41	13.16	
6/10/11 12:21:15	5.40	13.17	
6/10/11 12:21:30	5.34	13.23	
6/10/11 12:21:45	5.34	13.23	
6/10/11 12:22:00	5.34	13.24	
6/10/11 12:22:15	5.35	13.22	
6/10/11 12:22:30	5.37	13.21	
6/10/11 12:22:45	5.32	13.26	
6/10/11 12:23:00	5.26	13.31	
6/10/11 12:23:15	5.27	13.31	
6/10/11 12:23:30	5.30	13.28	
6/10/11 12:23:45	5.34	13.24	
6/10/11 12:24:00	5.39	13.19	
6/10/11 12:24:15	5.45	13.14	
6/10/11 12:24:30	5.46	13.13	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 12:24:45	5.41	13.18	
6/10/11 12:25:00	5.37	13.20	
6/10/11 12:25:15	5.37	13.21	
6/10/11 12:25:30	5.37	13.22	
6/10/11 12:25:45	5.39	13.19	
6/10/11 12:26:00	5.43	13.14	
6/10/11 12:26:15	5.45	13.12	
6/10/11 12:26:30	5.45	13.13	
6/10/11 12:26:45	5.42	13.16	
6/10/11 12:27:00	5.42	13.15	
6/10/11 12:27:15	5.37	13.20	
6/10/11 12:27:30	5.29	13.27	
6/10/11 12:27:45	5.20	13.37	Start Run 3
6/10/11 12:28:00	5.14	13.42	
6/10/11 12:28:15	5.17	13.39	
6/10/11 12:28:30	5.27	13.31	
6/10/11 12:28:45	5.32	13.27	
6/10/11 12:29:00	5.30	13.28	
6/10/11 12:29:15	5.27	13.31	
6/10/11 12:29:30	5.26	13.31	
6/10/11 12:29:45	5.26	13.32	
6/10/11 12:30:00	5.23	13.35	
6/10/11 12:30:15	5.21	13.36	
6/10/11 12:30:30	5.21	13.37	
6/10/11 12:30:45	5.25	13.33	
6/10/11 12:31:00	5.32	13.25	
6/10/11 12:31:15	5.41	13.17	
6/10/11 12:31:30	5.46	13.11	
6/10/11 12:31:45	5.49	13.09	
6/10/11 12:32:00	5.45	13.14	
6/10/11 12:32:15	5.43	13.15	
6/10/11 12:32:30	5.50	13.08	
6/10/11 12:32:45	5.54	13.05	
6/10/11 12:33:00	5.52	13.06	
6/10/11 12:33:15	5.51	13.07	
6/10/11 12:33:30	5.48	13.09	
6/10/11 12:33:45	5.43	13.14	
6/10/11 12:34:00	5.37	13.19	
6/10/11 12:34:15	5.33	13.25	
6/10/11 12:34:30	5.29	13.29	
6/10/11 12:34:45	5.28	13.29	
6/10/11 12:35:00	5.23	13.34	
6/10/11 12:35:15	5.21	13.35	
6/10/11 12:35:30	5.24	13.33	
6/10/11 12:35:45	5.23	13.35	
6/10/11 12:36:00	5.19	13.39	
6/10/11 12:36:15	5.14	13.43	
6/10/11 12:36:30	5.17	13.38	
6/10/11 12:36:45	5.25	13.30	
6/10/11 12:37:00	5.35	13.21	
6/10/11 12:37:15	5.39	13.19	
6/10/11 12:37:30	5.36	13.22	
6/10/11 12:37:45	5.35	13.24	
6/10/11 12:38:00	5.35	13.23	
6/10/11 12:38:15	5.37	13.20	
6/10/11 12:38:30	5.38	13.20	
6/10/11 12:38:45	5.42	13.17	
6/10/11 12:39:00	5.42	13.17	
6/10/11 12:39:15	5.37	13.22	
6/10/11 12:39:30	5.37	13.21	
6/10/11 12:39:45	5.40	13.19	
6/10/11 12:40:00	5.38	13.19	
6/10/11 12:40:15	5.35	13.22	
6/10/11 12:40:30	5.30	13.27	
6/10/11 12:40:45	5.32	13.24	
6/10/11 12:41:00	5.40	13.18	
6/10/11 12:41:15	5.43	13.16	
6/10/11 12:41:30	5.38	13.19	
6/10/11 12:41:45	5.33	13.23	
6/10/11 12:42:00	5.32	13.24	
6/10/11 12:42:15	5.36	13.20	
6/10/11 12:42:30	5.37	13.19	
6/10/11 12:42:45	5.34	13.23	
6/10/11 12:43:00	5.29	13.29	
6/10/11 12:43:15	5.24	13.33	
6/10/11 12:43:30	5.23	13.34	
6/10/11 12:43:45	5.24	13.33	
6/10/11 12:44:00	5.23	13.35	
6/10/11 12:44:15	5.15	13.43	
6/10/11 12:44:30	5.07	13.51	
6/10/11 12:44:45	5.07	13.49	
6/10/11 12:45:00	5.19	13.39	
6/10/11 12:45:15	5.30	13.28	
6/10/11 12:45:30	5.41	13.18	
6/10/11 12:45:45	5.49	13.10	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 12:46:00	5.53	13.06	
6/10/11 12:46:15	5.49	13.10	
6/10/11 12:46:30	5.49	13.08	
6/10/11 12:46:45	5.53	13.05	
6/10/11 12:47:00	5.56	13.02	
6/10/11 12:47:15	5.57	13.02	
6/10/11 12:47:30	5.50	13.07	
6/10/11 12:47:45	5.41	13.16	
6/10/11 12:48:00	5.30	13.26	
6/10/11 12:48:15	5.23	13.33	
6/10/11 12:48:30	5.25	13.31	
6/10/11 12:48:45	5.30	13.27	
6/10/11 12:49:00	5.37	13.20	
6/10/11 12:49:15	5.47	13.09	
6/10/11 12:49:30	5.50	13.07	
6/10/11 12:49:45	5.37	13.20	
6/10/11 12:50:00	5.26	13.32	
6/10/11 12:50:15	5.21	13.36	
6/10/11 12:50:30	5.23	13.34	
6/10/11 12:50:45	5.25	13.33	
6/10/11 12:51:00	5.27	13.30	
6/10/11 12:51:15	5.33	13.24	
6/10/11 12:51:30	5.31	13.27	
6/10/11 12:51:45	5.24	13.33	
6/10/11 12:52:00	5.27	13.29	
6/10/11 12:52:15	5.39	13.19	
6/10/11 12:52:30	5.44	13.14	
6/10/11 12:52:45	5.47	13.11	
6/10/11 12:53:00	5.53	13.06	
6/10/11 12:53:15	5.54	13.06	
6/10/11 12:53:30	5.47	13.11	
6/10/11 12:53:45	5.44	13.13	
6/10/11 12:54:00	5.43	13.15	
6/10/11 12:54:15	5.38	13.19	
6/10/11 12:54:30	5.39	13.18	
6/10/11 12:54:45	5.39	13.19	
6/10/11 12:55:00	5.33	13.25	
6/10/11 12:55:15	5.29	13.28	
6/10/11 12:55:30	5.26	13.32	
6/10/11 12:55:45	5.28	13.29	
6/10/11 12:56:00	5.34	13.22	
6/10/11 12:56:15	5.36	13.21	
6/10/11 12:56:30	5.38	13.20	
6/10/11 12:56:45	5.33	13.25	
6/10/11 12:57:00	5.28	13.29	
6/10/11 12:57:15	5.28	13.29	
6/10/11 12:57:30	5.36	13.20	
6/10/11 12:57:45	5.41	13.18	
6/10/11 12:58:00	5.34	13.24	
6/10/11 12:58:15	5.29	13.27	
6/10/11 12:58:30	5.27	13.29	
6/10/11 12:58:45	5.27	13.30	
6/10/11 12:59:00	5.32	13.26	
6/10/11 12:59:15	5.38	13.19	
6/10/11 12:59:30	5.45	13.12	
6/10/11 12:59:45	5.56	13.01	
6/10/11 13:00:00	5.67	12.90	
6/10/11 13:00:15	5.69	12.90	
6/10/11 13:00:30	5.62	12.96	
6/10/11 13:00:45	5.54	13.03	
6/10/11 13:01:00	5.47	13.12	
6/10/11 13:01:15	5.35	13.23	
6/10/11 13:01:30	5.29	13.29	
6/10/11 13:01:45	5.33	13.24	
6/10/11 13:02:00	5.43	13.15	
6/10/11 13:02:15	5.47	13.11	
6/10/11 13:02:30	5.45	13.13	
6/10/11 13:02:45	5.40	13.17	
6/10/11 13:03:00	5.44	13.12	
6/10/11 13:03:15	5.47	13.12	
6/10/11 13:03:30	5.40	13.19	
6/10/11 13:03:45	5.33	13.24	
6/10/11 13:04:00	5.26	13.30	
6/10/11 13:04:15	5.18	13.38	
6/10/11 13:04:30	5.13	13.43	
6/10/11 13:04:45	5.14	13.42	
6/10/11 13:05:00	5.21	13.34	
6/10/11 13:05:15	5.27	13.29	
6/10/11 13:05:30	5.32	13.26	
6/10/11 13:05:45	5.36	13.22	
6/10/11 13:06:00	5.35	13.23	
6/10/11 13:06:15	5.31	13.26	
6/10/11 13:06:30	5.36	13.21	
6/10/11 13:06:45	5.46	13.13	
6/10/11 13:07:00	5.43	13.15	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 13:07:15	5.36	13.21	
6/10/11 13:07:30	5.37	13.19	
6/10/11 13:07:45	5.45	13.11	
6/10/11 13:08:00	5.55	13.03	
6/10/11 13:08:15	5.56	13.01	
6/10/11 13:08:30	5.58	12.99	
6/10/11 13:08:45	5.59	12.99	
6/10/11 13:09:00	5.48	13.10	
6/10/11 13:09:15	5.42	13.16	
6/10/11 13:09:30	5.40	13.18	
6/10/11 13:09:45	5.39	13.18	
6/10/11 13:10:00	5.34	13.23	
6/10/11 13:10:15	5.33	13.24	
6/10/11 13:10:30	5.44	13.14	
6/10/11 13:10:45	5.53	13.05	
6/10/11 13:11:00	5.52	13.06	
6/10/11 13:11:15	5.42	13.17	
6/10/11 13:11:30	5.33	13.25	
6/10/11 13:11:45	5.30	13.28	
6/10/11 13:12:00	5.33	13.24	
6/10/11 13:12:15	5.41	13.16	
6/10/11 13:12:30	5.45	13.14	
6/10/11 13:12:45	5.32	13.26	
6/10/11 13:13:00	5.17	13.39	
6/10/11 13:13:15	5.12	13.44	
6/10/11 13:13:30	5.17	13.39	
6/10/11 13:13:45	5.26	13.31	
6/10/11 13:14:00	5.32	13.25	
6/10/11 13:14:15	5.37	13.20	
6/10/11 13:14:30	5.41	13.17	
6/10/11 13:14:45	5.38	13.20	
6/10/11 13:15:00	5.34	13.25	
6/10/11 13:15:15	5.36	13.22	
6/10/11 13:15:30	5.41	13.18	
6/10/11 13:15:45	5.39	13.20	
6/10/11 13:16:00	5.40	13.18	
6/10/11 13:16:15	5.49	13.10	
6/10/11 13:16:30	5.52	13.07	
6/10/11 13:16:45	5.51	13.09	
6/10/11 13:17:00	5.49	13.10	
6/10/11 13:17:15	5.51	13.08	
6/10/11 13:17:30	5.50	13.09	
6/10/11 13:17:45	5.47	13.11	
6/10/11 13:18:00	5.49	13.08	
6/10/11 13:18:15	5.50	13.07	
6/10/11 13:18:30	5.41	13.16	
6/10/11 13:18:45	5.33	13.23	
6/10/11 13:19:00	5.32	13.24	
6/10/11 13:19:15	5.37	13.20	
6/10/11 13:19:30	5.43	13.14	
6/10/11 13:19:45	5.48	13.10	
6/10/11 13:20:00	5.50	13.07	
6/10/11 13:20:15	5.52	13.06	
6/10/11 13:20:30	5.49	13.08	
6/10/11 13:20:45	5.39	13.19	
6/10/11 13:21:00	5.23	13.34	
6/10/11 13:21:15	5.18	13.37	
6/10/11 13:21:30	5.24	13.33	
6/10/11 13:21:45	5.31	13.27	
6/10/11 13:22:00	5.36	13.21	
6/10/11 13:22:15	5.40	13.18	Restart Run 3
6/10/11 13:22:30	5.36	13.22	
6/10/11 13:22:45	5.34	13.23	
6/10/11 13:23:00	5.42	13.15	
6/10/11 13:23:15	5.52	13.06	
6/10/11 13:23:30	5.55	13.04	
6/10/11 13:23:45	5.54	13.03	
6/10/11 13:24:00	5.54	13.04	
6/10/11 13:24:15	5.52	13.06	
6/10/11 13:24:30	5.51	13.07	
6/10/11 13:24:45	5.50	13.09	
6/10/11 13:25:00	5.44	13.15	
6/10/11 13:25:15	5.35	13.23	
6/10/11 13:25:30	5.30	13.25	
6/10/11 13:25:45	5.37	13.19	
6/10/11 13:26:00	5.45	13.12	
6/10/11 13:26:15	5.48	13.11	
6/10/11 13:26:30	5.46	13.12	
6/10/11 13:26:45	5.49	13.07	
6/10/11 13:27:00	5.53	13.04	
6/10/11 13:27:15	5.48	13.10	
6/10/11 13:27:30	5.41	13.16	
6/10/11 13:27:45	5.39	13.17	
6/10/11 13:28:00	5.40	13.17	
6/10/11 13:28:15	5.41	13.16	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 13:28:30	5.40	13.18	
6/10/11 13:28:45	5.38	13.19	
6/10/11 13:29:00	5.33	13.25	
6/10/11 13:29:15	5.27	13.29	
6/10/11 13:29:30	5.26	13.30	
6/10/11 13:29:45	5.26	13.30	
6/10/11 13:30:00	5.32	13.26	
6/10/11 13:30:15	5.36	13.23	
6/10/11 13:30:30	5.35	13.23	
6/10/11 13:30:45	5.35	13.23	
6/10/11 13:31:00	5.39	13.19	
6/10/11 13:31:15	5.41	13.18	
6/10/11 13:31:30	5.38	13.21	
6/10/11 13:31:45	5.36	13.22	
6/10/11 13:32:00	5.39	13.19	
6/10/11 13:32:15	5.38	13.20	
6/10/11 13:32:30	5.37	13.20	
6/10/11 13:32:45	5.36	13.21	
6/10/11 13:33:00	5.37	13.19	
6/10/11 13:33:15	5.39	13.18	
6/10/11 13:33:30	5.33	13.25	
6/10/11 13:33:45	5.28	13.28	
6/10/11 13:34:00	5.26	13.30	
6/10/11 13:34:15	5.26	13.30	
6/10/11 13:34:30	5.30	13.28	
6/10/11 13:34:45	5.31	13.27	
6/10/11 13:35:00	5.30	13.28	
6/10/11 13:35:15	5.28	13.29	
6/10/11 13:35:30	5.26	13.31	
6/10/11 13:35:45	5.23	13.34	
6/10/11 13:36:00	5.27	13.30	
6/10/11 13:36:15	5.32	13.25	
6/10/11 13:36:30	5.36	13.21	
6/10/11 13:36:45	5.38	13.20	
6/10/11 13:37:00	5.41	13.17	
6/10/11 13:37:15	5.45	13.14	
6/10/11 13:37:30	5.46	13.13	
6/10/11 13:37:45	5.45	13.14	
6/10/11 13:38:00	5.45	13.13	
6/10/11 13:38:15	5.53	13.05	
6/10/11 13:38:30	5.58	13.01	
6/10/11 13:38:45	5.52	13.06	
6/10/11 13:39:00	5.42	13.16	
6/10/11 13:39:15	5.38	13.19	
6/10/11 13:39:30	5.42	13.14	
6/10/11 13:39:45	5.43	13.15	
6/10/11 13:40:00	5.38	13.20	
6/10/11 13:40:15	5.34	13.23	
6/10/11 13:40:30	5.31	13.27	
6/10/11 13:40:45	5.24	13.33	
6/10/11 13:41:00	5.30	13.27	
6/10/11 13:41:15	5.32	13.27	
6/10/11 13:41:30	5.24	13.33	
6/10/11 13:41:45	5.21	13.35	
6/10/11 13:42:00	5.23	13.33	
6/10/11 13:42:15	5.23	13.34	
6/10/11 13:42:30	5.21	13.37	
6/10/11 13:42:45	5.21	13.37	
6/10/11 13:43:00	5.29	13.29	
6/10/11 13:43:15	5.37	13.22	
6/10/11 13:43:30	5.35	13.24	
6/10/11 13:43:45	5.26	13.32	
6/10/11 13:44:00	5.25	13.32	
6/10/11 13:44:15	5.35	13.23	
6/10/11 13:44:30	5.45	13.13	
6/10/11 13:44:45	5.55	13.03	
6/10/11 13:45:00	5.56	13.03	
6/10/11 13:45:15	5.51	13.08	
6/10/11 13:45:30	5.45	13.12	
6/10/11 13:45:45	5.40	13.17	
6/10/11 13:46:00	5.34	13.22	
6/10/11 13:46:15	5.33	13.23	
6/10/11 13:46:30	5.31	13.25	
6/10/11 13:46:45	5.27	13.29	
6/10/11 13:47:00	5.24	13.33	
6/10/11 13:47:15	5.24	13.33	
6/10/11 13:47:30	5.31	13.26	
6/10/11 13:47:45	5.39	13.18	
6/10/11 13:48:00	5.44	13.13	
6/10/11 13:48:15	5.45	13.12	
6/10/11 13:48:30	5.41	13.18	
6/10/11 13:48:45	5.33	13.25	
6/10/11 13:49:00	5.22	13.36	
6/10/11 13:49:15	5.15	13.42	
6/10/11 13:49:30	5.15	13.41	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 13:49:45	5.12	13.45	
6/10/11 13:50:00	5.14	13.42	
6/10/11 13:50:15	5.29	13.27	
6/10/11 13:50:30	5.44	13.14	
6/10/11 13:50:45	5.49	13.11	
6/10/11 13:51:00	5.51	13.08	
6/10/11 13:51:15	5.53	13.05	
6/10/11 13:51:30	5.50	13.08	
6/10/11 13:51:45	5.43	13.14	
6/10/11 13:52:00	5.38	13.19	
6/10/11 13:52:15	5.39	13.19	
6/10/11 13:52:30	5.41	13.18	
6/10/11 13:52:45	5.40	13.18	
6/10/11 13:53:00	5.38	13.20	
6/10/11 13:53:15	5.36	13.22	
6/10/11 13:53:30	5.35	13.23	
6/10/11 13:53:45	5.33	13.24	
6/10/11 13:54:00	5.36	13.21	
6/10/11 13:54:15	5.37	13.20	
6/10/11 13:54:30	5.34	13.23	
6/10/11 13:54:45	5.32	13.24	
6/10/11 13:55:00	5.31	13.27	
6/10/11 13:55:15	5.33	13.26	
6/10/11 13:55:30	5.31	13.27	
6/10/11 13:55:45	5.21	13.36	
6/10/11 13:56:00	5.14	13.41	
6/10/11 13:56:15	5.19	13.36	
6/10/11 13:56:30	5.26	13.30	
6/10/11 13:56:45	5.28	13.29	
6/10/11 13:57:00	5.26	13.32	
6/10/11 13:57:15	5.23	13.34	
6/10/11 13:57:30	5.25	13.32	
6/10/11 13:57:45	5.32	13.26	
6/10/11 13:58:00	5.36	13.22	
6/10/11 13:58:15	5.32	13.26	
6/10/11 13:58:30	5.30	13.28	
6/10/11 13:58:45	5.30	13.28	
6/10/11 13:59:00	5.35	13.24	
6/10/11 13:59:15	5.37	13.22	
6/10/11 13:59:30	5.39	13.20	
6/10/11 13:59:45	5.46	13.12	
6/10/11 14:00:00	5.58	12.99	
6/10/11 14:00:15	5.63	12.95	
6/10/11 14:00:30	5.54	13.03	
6/10/11 14:00:45	5.41	13.15	
6/10/11 14:01:00	5.38	13.17	
6/10/11 14:01:15	5.39	13.17	
6/10/11 14:01:30	5.38	13.19	
6/10/11 14:01:45	5.32	13.25	
6/10/11 14:02:00	5.25	13.30	
6/10/11 14:02:15	5.22	13.34	
6/10/11 14:02:30	5.24	13.32	
6/10/11 14:02:45	5.22	13.35	
6/10/11 14:03:00	5.19	13.38	
6/10/11 14:03:15	5.18	13.39	
6/10/11 14:03:30	5.23	13.34	
6/10/11 14:03:45	5.26	13.31	
6/10/11 14:04:00	5.25	13.33	
6/10/11 14:04:15	5.23	13.36	
6/10/11 14:04:30	5.22	13.35	
6/10/11 14:04:45	5.28	13.30	
6/10/11 14:05:00	5.36	13.23	
6/10/11 14:05:15	5.41	13.17	
6/10/11 14:05:30	5.41	13.17	
6/10/11 14:05:45	5.41	13.17	
6/10/11 14:06:00	5.42	13.16	
6/10/11 14:06:15	5.41	13.17	
6/10/11 14:06:30	5.41	13.17	
6/10/11 14:06:45	5.47	13.12	
6/10/11 14:07:00	5.47	13.12	
6/10/11 14:07:15	5.40	13.18	
6/10/11 14:07:30	5.34	13.24	
6/10/11 14:07:45	5.27	13.30	
6/10/11 14:08:00	5.25	13.31	
6/10/11 14:08:15	5.23	13.32	
6/10/11 14:08:30	5.23	13.32	
6/10/11 14:08:45	5.30	13.26	
6/10/11 14:09:00	5.36	13.22	
6/10/11 14:09:15	5.34	13.25	
6/10/11 14:09:30	5.31	13.28	
6/10/11 14:09:45	5.27	13.30	
6/10/11 14:10:00	5.28	13.29	
6/10/11 14:10:15	5.33	13.25	
6/10/11 14:10:30	5.35	13.23	
6/10/11 14:10:45	5.35	13.22	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 14:11:00	5.38	13.18	
6/10/11 14:11:15	5.38	13.20	
6/10/11 14:11:30	5.36	13.22	
6/10/11 14:11:45	5.36	13.23	
6/10/11 14:12:00	5.38	13.19	
6/10/11 14:12:15	5.49	13.09	
6/10/11 14:12:30	5.56	13.02	
6/10/11 14:12:45	5.52	13.06	
6/10/11 14:13:00	5.46	13.11	
6/10/11 14:13:15	5.41	13.17	
6/10/11 14:13:30	5.37	13.20	
6/10/11 14:13:45	5.40	13.16	
6/10/11 14:14:00	5.46	13.11	
6/10/11 14:14:15	5.48	13.10	
6/10/11 14:14:30	5.50	13.07	
6/10/11 14:14:45	5.50	13.07	
6/10/11 14:15:00	5.46	13.11	
6/10/11 14:15:15	5.40	13.16	
6/10/11 14:15:30	5.33	13.24	
6/10/11 14:15:45	5.21	13.36	
6/10/11 14:16:00	5.12	13.45	
6/10/11 14:16:15	5.11	13.46	
6/10/11 14:16:30	5.17	13.39	
6/10/11 14:16:45	5.25	13.32	
6/10/11 14:17:00	5.31	13.26	
6/10/11 14:17:15	5.36	13.21	
6/10/11 14:17:30	5.39	13.19	
6/10/11 14:17:45	5.42	13.15	
6/10/11 14:18:00	5.43	13.15	
6/10/11 14:18:15	5.37	13.21	
6/10/11 14:18:30	5.39	13.18	
6/10/11 14:18:45	5.47	13.10	
6/10/11 14:19:00	5.48	13.10	
6/10/11 14:19:15	5.47	13.11	
6/10/11 14:19:30	5.47	13.10	
6/10/11 14:19:45	5.47	13.10	
6/10/11 14:20:00	5.40	13.17	
6/10/11 14:20:15	5.29	13.27	
6/10/11 14:20:30	5.29	13.28	
6/10/11 14:20:45	5.30	13.28	
6/10/11 14:21:00	5.35	13.22	
6/10/11 14:21:15	5.40	13.18	
6/10/11 14:21:30	5.41	13.16	
6/10/11 14:21:45	5.45	13.13	
6/10/11 14:22:00	5.45	13.13	
6/10/11 14:22:15	5.41	13.16	
6/10/11 14:22:30	5.39	13.17	
6/10/11 14:22:45	5.38	13.17	
6/10/11 14:23:00	5.30	13.26	
6/10/11 14:23:15	5.18	13.37	
6/10/11 14:23:30	5.18	13.38	
6/10/11 14:23:45	5.23	13.33	
6/10/11 14:24:00	5.29	13.27	
6/10/11 14:24:15	5.40	13.16	
6/10/11 14:24:30	5.46	13.11	
6/10/11 14:24:45	5.42	13.15	
6/10/11 14:25:00	5.37	13.19	
6/10/11 14:25:15	5.36	13.21	
6/10/11 14:25:30	5.33	13.23	
6/10/11 14:25:45	5.33	13.23	
6/10/11 14:26:00	5.38	13.19	
6/10/11 14:26:15	5.37	13.21	
6/10/11 14:26:30	5.41	13.16	
6/10/11 14:26:45	5.48	13.10	
6/10/11 14:27:00	5.49	13.09	
6/10/11 14:27:15	5.45	13.12	
6/10/11 14:27:30	5.40	13.16	
6/10/11 14:27:45	5.35	13.20	
6/10/11 14:28:00	5.35	13.20	
6/10/11 14:28:15	5.41	13.16	
6/10/11 14:28:30	5.40	13.18	
6/10/11 14:28:45	5.27	13.29	
6/10/11 14:29:00	5.20	13.35	
6/10/11 14:29:15	5.20	13.35	
6/10/11 14:29:30	5.25	13.32	
6/10/11 14:29:45	5.23	13.35	
6/10/11 14:30:00	5.22	13.35	
6/10/11 14:30:15	5.25	13.31	
6/10/11 14:30:30	5.26	13.30	
6/10/11 14:30:45	5.25	13.31	
6/10/11 14:31:00	5.30	13.26	
6/10/11 14:31:15	5.35	13.22	
6/10/11 14:31:30	5.35	13.22	
6/10/11 14:31:45	5.40	13.16	
6/10/11 14:32:00	5.48	13.08	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 14:32:15	5.48	13.10	
6/10/11 14:32:30	5.44	13.13	
6/10/11 14:32:45	5.48	13.09	
6/10/11 14:33:00	5.58	13.00	
6/10/11 14:33:15	5.58	13.01	
6/10/11 14:33:30	5.46	13.12	
6/10/11 14:33:45	5.40	13.17	
6/10/11 14:34:00	5.40	13.17	
6/10/11 14:34:15	5.35	13.22	
6/10/11 14:34:30	5.27	13.30	
6/10/11 14:34:45	5.21	13.34	
6/10/11 14:35:00	5.22	13.33	
6/10/11 14:35:15	5.24	13.32	
6/10/11 14:35:30	5.19	13.36	
6/10/11 14:35:45	5.20	13.34	
6/10/11 14:36:00	5.30	13.26	
6/10/11 14:36:15	5.37	13.19	
6/10/11 14:36:30	5.46	13.10	
6/10/11 14:36:45	5.55	13.03	
6/10/11 14:37:00	5.53	13.04	
6/10/11 14:37:15	5.42	13.15	
6/10/11 14:37:30	5.24	13.32	
6/10/11 14:37:45	5.14	13.41	
6/10/11 14:38:00	5.23	13.32	
6/10/11 14:38:15	5.37	13.20	
6/10/11 14:38:30	5.42	13.15	
6/10/11 14:38:45	5.49	13.07	
6/10/11 14:39:00	5.51	13.06	
6/10/11 14:39:15	5.45	13.12	
6/10/11 14:39:30	5.41	13.15	
6/10/11 14:39:45	5.42	13.15	
6/10/11 14:40:00	5.40	13.16	
6/10/11 14:40:15	5.38	13.20	
6/10/11 14:40:30	5.32	13.25	
6/10/11 14:40:45	5.30	13.26	
6/10/11 14:41:00	5.38	13.19	
6/10/11 14:41:15	5.44	13.13	
6/10/11 14:41:30	5.48	13.09	
6/10/11 14:41:45	5.51	13.06	
6/10/11 14:42:00	5.46	13.11	
6/10/11 14:42:15	5.39	13.17	
6/10/11 14:42:30	5.30	13.25	
6/10/11 14:42:45	5.23	13.33	
6/10/11 14:43:00	5.16	13.40	
6/10/11 14:43:15	5.16	13.40	
6/10/11 14:43:30	5.21	13.35	
6/10/11 14:43:45	5.26	13.31	
6/10/11 14:44:00	5.28	13.28	
6/10/11 14:44:15	5.28	13.28	
6/10/11 14:44:30	5.23	13.33	
6/10/11 14:44:45	5.20	13.35	
6/10/11 14:45:00	5.24	13.32	
6/10/11 14:45:15	5.23	13.34	
6/10/11 14:45:30	5.25	13.31	
6/10/11 14:45:45	5.34	13.22	
6/10/11 14:46:00	5.43	13.14	
6/10/11 14:46:15	5.43	13.15	
6/10/11 14:46:30	5.37	13.20	
6/10/11 14:46:45	5.37	13.19	
6/10/11 14:47:00	5.43	13.14	
6/10/11 14:47:15	5.45	13.12	
6/10/11 14:47:30	5.41	13.17	
6/10/11 14:47:45	5.31	13.26	
6/10/11 14:48:00	5.28	13.28	
6/10/11 14:48:15	5.28	13.28	
6/10/11 14:48:30	5.28	13.27	
6/10/11 14:48:45	5.33	13.22	
6/10/11 14:49:00	5.34	13.21	
6/10/11 14:49:15	5.33	13.23	
6/10/11 14:49:30	5.31	13.24	
6/10/11 14:49:45	5.32	13.22	
6/10/11 14:50:00	5.32	13.24	
6/10/11 14:50:15	5.23	13.34	
6/10/11 14:50:30	5.18	13.37	
6/10/11 14:50:45	5.27	13.28	
6/10/11 14:51:00	5.41	13.15	
6/10/11 14:51:15	5.43	13.14	
6/10/11 14:51:30	5.35	13.22	
6/10/11 14:51:45	5.29	13.27	
6/10/11 14:52:00	5.24	13.32	
6/10/11 14:52:15	5.18	13.37	
6/10/11 14:52:30	5.23	13.31	
6/10/11 14:52:45	5.30	13.27	
6/10/11 14:53:00	5.34	13.22	
6/10/11 14:53:15	5.45	13.12	

Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 14:53:30	5.54	13.05	
6/10/11 14:53:45	5.58	13.01	
6/10/11 14:54:00	5.55	13.03	
6/10/11 14:54:15	5.46	13.11	
6/10/11 14:54:30	5.38	13.18	
6/10/11 14:54:45	5.37	13.20	
6/10/11 14:55:00	5.41	13.17	
6/10/11 14:55:15	5.45	13.12	
6/10/11 14:55:30	5.40	13.17	
6/10/11 14:55:45	5.30	13.25	
6/10/11 14:56:00	5.26	13.29	
6/10/11 14:56:15	5.23	13.31	
6/10/11 14:56:30	5.27	13.28	
6/10/11 14:56:45	5.30	13.25	
6/10/11 14:57:00	5.36	13.20	
6/10/11 14:57:15	5.40	13.17	
6/10/11 14:57:30	5.41	13.15	
6/10/11 14:57:45	5.40	13.17	
6/10/11 14:58:00	5.32	13.23	
6/10/11 14:58:15	5.31	13.24	
6/10/11 14:58:30	5.34	13.23	
6/10/11 14:58:45	5.33	13.25	
6/10/11 14:59:00	5.33	13.23	
6/10/11 14:59:15	5.37	13.18	
6/10/11 14:59:30	5.38	13.18	
6/10/11 14:59:45	5.35	13.21	
6/10/11 15:00:00	5.32	13.23	
6/10/11 15:00:15	5.33	13.23	
6/10/11 15:00:30	5.42	13.15	
6/10/11 15:00:45	5.47	13.10	
6/10/11 15:01:00	5.45	13.11	
6/10/11 15:01:15	5.49	13.07	
6/10/11 15:01:30	5.55	13.01	
6/10/11 15:01:45	5.57	13.00	
6/10/11 15:02:00	5.55	13.02	
6/10/11 15:02:15	5.53	13.03	
6/10/11 15:02:30	5.49	13.07	
6/10/11 15:02:45	5.42	13.13	
6/10/11 15:03:00	5.36	13.20	
6/10/11 15:03:15	5.32	13.23	
6/10/11 15:03:30	5.33	13.23	
6/10/11 15:03:45	5.34	13.22	
6/10/11 15:04:00	5.33	13.23	
6/10/11 15:04:15	5.32	13.23	
6/10/11 15:04:30	5.35	13.21	
6/10/11 15:04:45	5.33	13.23	
6/10/11 15:05:00	5.26	13.30	
6/10/11 15:05:15	5.18	13.37	
6/10/11 15:05:30	5.20	13.34	
6/10/11 15:05:45	5.26	13.30	
6/10/11 15:06:00	5.23	13.33	
6/10/11 15:06:15	5.26	13.28	
6/10/11 15:06:30	5.35	13.21	
6/10/11 15:06:45	5.37	13.20	
6/10/11 15:07:00	5.39	13.16	
6/10/11 15:07:15	5.49	13.06	
6/10/11 15:07:30	5.57	13.00	
6/10/11 15:07:45	5.50	13.06	
6/10/11 15:08:00	5.44	13.11	
6/10/11 15:08:15	5.42	13.13	
6/10/11 15:08:30	5.43	13.13	
6/10/11 15:08:45	5.45	13.11	
6/10/11 15:09:00	5.45	13.10	
6/10/11 15:09:15	5.46	13.10	
6/10/11 15:09:30	5.45	13.11	
6/10/11 15:09:45	5.44	13.12	
6/10/11 15:10:00	5.37	13.18	
6/10/11 15:10:15	5.33	13.22	
6/10/11 15:10:30	5.36	13.19	
6/10/11 15:10:45	5.43	13.13	
6/10/11 15:11:00	5.41	13.15	
6/10/11 15:11:15	5.34	13.21	
6/10/11 15:11:30	5.29	13.25	
6/10/11 15:11:45	5.32	13.22	
6/10/11 15:12:00	5.36	13.20	
6/10/11 15:12:15	5.34	13.22	
6/10/11 15:12:30	5.35	13.20	
6/10/11 15:12:45	5.37	13.17	
6/10/11 15:13:00	5.33	13.22	
6/10/11 15:13:15	5.28	13.27	
6/10/11 15:13:30	5.32	13.23	
6/10/11 15:13:45	5.31	13.25	
6/10/11 15:14:00	5.25	13.29	
6/10/11 15:14:15	5.26	13.28	
6/10/11 15:14:30	5.29	13.26	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 15:14:45	5.38	13.17	
6/10/11 15:15:00	5.47	13.10	
6/10/11 15:15:15	5.44	13.13	
6/10/11 15:15:30	5.38	13.18	
6/10/11 15:15:45	5.39	13.15	
6/10/11 15:16:00	5.46	13.09	
6/10/11 15:16:15	5.45	13.11	
6/10/11 15:16:30	5.49	13.07	
6/10/11 15:16:45	5.55	13.02	
6/10/11 15:17:00	5.52	13.05	
6/10/11 15:17:15	5.42	13.12	
6/10/11 15:17:30	5.39	13.16	
6/10/11 15:17:45	5.32	13.23	
6/10/11 15:18:00	5.26	13.29	
6/10/11 15:18:15	5.21	13.33	
6/10/11 15:18:30	5.22	13.32	
6/10/11 15:18:45	5.25	13.30	
6/10/11 15:19:00	5.28	13.26	
6/10/11 15:19:15	5.33	13.22	
6/10/11 15:19:30	5.34	13.21	
6/10/11 15:19:45	5.34	13.21	
6/10/11 15:20:00	5.35	13.19	
6/10/11 15:20:15	5.35	13.19	
6/10/11 15:20:30	5.29	13.25	
6/10/11 15:20:45	5.29	13.24	
6/10/11 15:21:00	5.33	13.21	
6/10/11 15:21:15	5.39	13.17	
6/10/11 15:21:30	5.40	13.16	
6/10/11 15:21:45	5.41	13.13	
6/10/11 15:22:00	5.46	13.08	
6/10/11 15:22:15	5.45	13.11	
6/10/11 15:22:30	5.42	13.15	
6/10/11 15:22:45	5.46	13.10	
6/10/11 15:23:00	5.50	13.06	
6/10/11 15:23:15	5.45	13.11	
6/10/11 15:23:30	5.37	13.17	
6/10/11 15:23:45	5.32	13.23	
6/10/11 15:24:00	5.24	13.30	
6/10/11 15:24:15	5.21	13.32	
6/10/11 15:24:30	5.20	13.34	
6/10/11 15:24:45	5.23	13.31	
6/10/11 15:25:00	5.28	13.27	
6/10/11 15:25:15	5.22	13.32	
6/10/11 15:25:30	5.12	13.42	
6/10/11 15:25:45	5.08	13.47	
6/10/11 15:26:00	5.03	13.52	
6/10/11 15:26:15	5.01	13.53	
6/10/11 15:26:30	5.07	13.47	
6/10/11 15:26:45	5.19	13.37	
6/10/11 15:27:00	5.28	13.28	
6/10/11 15:27:15	5.35	13.21	
6/10/11 15:27:30	5.36	13.20	
6/10/11 15:27:45	5.35	13.21	
6/10/11 15:28:00	5.35	13.20	
6/10/11 15:28:15	5.40	13.16	
6/10/11 15:28:30	5.45	13.12	
6/10/11 15:28:45	5.45	13.12	
6/10/11 15:29:00	5.43	13.15	Restart Run 3
6/10/11 15:29:15	5.35	13.22	
6/10/11 15:29:30	5.32	13.24	
6/10/11 15:29:45	5.35	13.21	
6/10/11 15:30:00	5.34	13.22	
6/10/11 15:30:15	5.33	13.23	
6/10/11 15:30:30	5.36	13.19	
6/10/11 15:30:45	5.41	13.14	
6/10/11 15:31:00	5.43	13.13	
6/10/11 15:31:15	5.43	13.12	
6/10/11 15:31:30	5.40	13.17	
6/10/11 15:31:45	5.31	13.25	
6/10/11 15:32:00	5.25	13.29	
6/10/11 15:32:15	5.25	13.29	
6/10/11 15:32:30	5.24	13.30	
6/10/11 15:32:45	5.21	13.33	
6/10/11 15:33:00	5.19	13.36	
6/10/11 15:33:15	5.18	13.36	
6/10/11 15:33:30	5.23	13.31	
6/10/11 15:33:45	5.28	13.28	
6/10/11 15:34:00	5.28	13.29	
6/10/11 15:34:15	5.24	13.32	
6/10/11 15:34:30	5.18	13.37	
6/10/11 15:34:45	5.19	13.36	
6/10/11 15:35:00	5.29	13.27	
6/10/11 15:35:15	5.41	13.16	
6/10/11 15:35:30	5.46	13.11	
6/10/11 15:35:45	5.44	13.12	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 15:36:00	5.42	13.14	
6/10/11 15:36:15	5.40	13.16	
6/10/11 15:36:30	5.37	13.20	
6/10/11 15:36:45	5.34	13.23	
6/10/11 15:37:00	5.40	13.15	
6/10/11 15:37:15	5.55	13.01	
6/10/11 15:37:30	5.56	13.01	
6/10/11 15:37:45	5.48	13.08	
6/10/11 15:38:00	5.39	13.16	
6/10/11 15:38:15	5.35	13.20	
6/10/11 15:38:30	5.35	13.20	
6/10/11 15:38:45	5.33	13.22	
6/10/11 15:39:00	5.31	13.24	
6/10/11 15:39:15	5.39	13.16	
6/10/11 15:39:30	5.44	13.12	
6/10/11 15:39:45	5.42	13.14	
6/10/11 15:40:00	5.32	13.23	
6/10/11 15:40:15	5.22	13.32	
6/10/11 15:40:30	5.27	13.27	
6/10/11 15:40:45	5.37	13.19	
6/10/11 15:41:00	5.42	13.14	
6/10/11 15:41:15	5.46	13.12	
6/10/11 15:41:30	5.42	13.14	
6/10/11 15:41:45	5.39	13.17	
6/10/11 15:42:00	5.36	13.19	
6/10/11 15:42:15	5.43	13.12	
6/10/11 15:42:30	5.50	13.07	
6/10/11 15:42:45	5.42	13.14	
6/10/11 15:43:00	5.35	13.20	
6/10/11 15:43:15	5.38	13.18	
6/10/11 15:43:30	5.49	13.07	
6/10/11 15:43:45	5.54	13.02	
6/10/11 15:44:00	5.48	13.07	
6/10/11 15:44:15	5.40	13.15	
6/10/11 15:44:30	5.31	13.24	
6/10/11 15:44:45	5.29	13.25	
6/10/11 15:45:00	5.31	13.24	
6/10/11 15:45:15	5.30	13.26	
6/10/11 15:45:30	5.29	13.26	
6/10/11 15:45:45	5.26	13.29	
6/10/11 15:46:00	5.21	13.34	
6/10/11 15:46:15	5.16	13.40	
6/10/11 15:46:30	5.15	13.39	
6/10/11 15:46:45	5.20	13.35	
6/10/11 15:47:00	5.30	13.24	
6/10/11 15:47:15	5.43	13.13	
6/10/11 15:47:30	5.51	13.06	
6/10/11 15:47:45	5.51	13.05	
6/10/11 15:48:00	5.50	13.06	
6/10/11 15:48:15	5.48	13.08	
6/10/11 15:48:30	5.52	13.03	
6/10/11 15:48:45	5.51	13.06	
6/10/11 15:49:00	5.45	13.11	
6/10/11 15:49:15	5.46	13.10	
6/10/11 15:49:30	5.48	13.07	
6/10/11 15:49:45	5.47	13.09	
6/10/11 15:50:00	5.40	13.15	
6/10/11 15:50:15	5.34	13.20	
6/10/11 15:50:30	5.28	13.26	
6/10/11 15:50:45	5.27	13.27	
6/10/11 15:51:00	5.34	13.19	
6/10/11 15:51:15	5.45	13.09	
6/10/11 15:51:30	5.50	13.05	
6/10/11 15:51:45	5.43	13.13	
6/10/11 15:52:00	5.31	13.24	
6/10/11 15:52:15	5.21	13.33	
6/10/11 15:52:30	5.17	13.36	
6/10/11 15:52:45	5.18	13.35	
6/10/11 15:53:00	5.18	13.36	
6/10/11 15:53:15	5.18	13.36	
6/10/11 15:53:30	5.26	13.29	
6/10/11 15:53:45	5.35	13.21	
6/10/11 15:54:00	5.39	13.15	
6/10/11 15:54:15	5.45	13.10	
6/10/11 15:54:30	5.45	13.11	
6/10/11 15:54:45	5.40	13.15	
6/10/11 15:55:00	5.39	13.15	
6/10/11 15:55:15	5.43	13.13	
6/10/11 15:55:30	5.42	13.14	
6/10/11 15:55:45	5.45	13.10	
6/10/11 15:56:00	5.49	13.05	
6/10/11 15:56:15	5.50	13.04	
6/10/11 15:56:30	5.52	13.04	
6/10/11 15:56:45	5.52	13.03	
6/10/11 15:57:00	5.47	13.08	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 15:57:15	5.39	13.15	
6/10/11 15:57:30	5.39	13.15	
6/10/11 15:57:45	5.40	13.16	
6/10/11 15:58:00	5.44	13.12	
6/10/11 15:58:15	5.39	13.17	
6/10/11 15:58:30	5.19	13.35	
6/10/11 15:58:45	5.06	13.46	
6/10/11 15:59:00	5.01	13.51	
6/10/11 15:59:15	5.03	13.49	
6/10/11 15:59:30	5.12	13.42	
6/10/11 15:59:45	5.18	13.36	
6/10/11 16:00:00	5.22	13.33	
6/10/11 16:00:15	5.31	13.23	
6/10/11 16:00:30	5.38	13.17	
6/10/11 16:00:45	5.37	13.19	
6/10/11 16:01:00	5.32	13.23	
6/10/11 16:01:15	5.32	13.22	
6/10/11 16:01:30	5.39	13.16	
6/10/11 16:01:45	5.48	13.08	
6/10/11 16:02:00	5.54	13.02	
6/10/11 16:02:15	5.54	13.02	
6/10/11 16:02:30	5.51	13.04	
6/10/11 16:02:45	5.45	13.08	
6/10/11 16:03:00	5.40	13.14	
6/10/11 16:03:15	5.34	13.20	
6/10/11 16:03:30	5.32	13.22	
6/10/11 16:03:45	5.31	13.23	
6/10/11 16:04:00	5.27	13.28	
6/10/11 16:04:15	5.20	13.33	
6/10/11 16:04:30	5.18	13.36	
6/10/11 16:04:45	5.14	13.40	
6/10/11 16:05:00	5.17	13.37	
6/10/11 16:05:15	5.25	13.29	
6/10/11 16:05:30	5.33	13.21	
6/10/11 16:05:45	5.37	13.18	
6/10/11 16:06:00	5.37	13.17	
6/10/11 16:06:15	5.42	13.13	
6/10/11 16:06:30	5.49	13.06	
6/10/11 16:06:45	5.53	13.03	
6/10/11 16:07:00	5.52	13.04	
6/10/11 16:07:15	5.45	13.10	
6/10/11 16:07:30	5.43	13.12	
6/10/11 16:07:45	5.46	13.09	
6/10/11 16:08:00	5.52	13.04	
6/10/11 16:08:15	5.54	13.02	
6/10/11 16:08:30	5.47	13.10	
6/10/11 16:08:45	5.34	13.21	
6/10/11 16:09:00	5.28	13.27	
6/10/11 16:09:15	5.26	13.29	
6/10/11 16:09:30	5.30	13.24	
6/10/11 16:09:45	5.38	13.16	
6/10/11 16:10:00	5.39	13.16	
6/10/11 16:10:15	5.39	13.16	
6/10/11 16:10:30	5.39	13.17	
6/10/11 16:10:45	5.33	13.22	
6/10/11 16:11:00	5.21	13.33	
6/10/11 16:11:15	5.19	13.34	
6/10/11 16:11:30	5.25	13.29	
6/10/11 16:11:45	5.33	13.21	
6/10/11 16:12:00	5.42	13.13	
6/10/11 16:12:15	5.48	13.07	
6/10/11 16:12:30	5.44	13.13	
6/10/11 16:12:45	5.34	13.22	
6/10/11 16:13:00	5.26	13.29	
6/10/11 16:13:15	5.26	13.29	
6/10/11 16:13:30	5.29	13.26	
6/10/11 16:13:45	5.32	13.23	
6/10/11 16:14:00	5.38	13.17	
6/10/11 16:14:15	5.47	13.09	
6/10/11 16:14:30	5.53	13.03	
6/10/11 16:14:45	5.49	13.07	
6/10/11 16:15:00	5.41	13.15	
6/10/11 16:15:15	5.33	13.21	
6/10/11 16:15:30	5.34	13.20	End Run 3 Dioxin and Mercury
6/10/11 16:15:45	5.44	13.11	
6/10/11 16:16:00	5.54	13.00	
6/10/11 16:16:15	5.59	12.95	
6/10/11 16:16:30	5.55	13.00	
6/10/11 16:16:45	5.46	13.08	
6/10/11 16:17:00	5.39	13.14	
6/10/11 16:17:15	5.34	13.19	
6/10/11 16:17:30	5.28	13.25	
6/10/11 16:17:45	5.26	13.28	
6/10/11 16:18:00	5.25	13.28	
6/10/11 16:18:15	5.27	13.27	

Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 16:18:30	5.28	13.27	
6/10/11 16:18:45	5.25	13.29	
6/10/11 16:19:00	5.24	13.30	
6/10/11 16:19:15	5.28	13.25	
6/10/11 16:19:30	5.36	13.18	
6/10/11 16:19:45	5.37	13.18	
6/10/11 16:20:00	5.36	13.19	
6/10/11 16:20:15	5.40	13.15	
6/10/11 16:20:30	5.46	13.09	
6/10/11 16:20:45	5.51	13.04	
6/10/11 16:21:00	5.52	13.03	
6/10/11 16:21:15	5.49	13.06	
6/10/11 16:21:30	5.42	13.14	
6/10/11 16:21:45	5.30	13.25	
6/10/11 16:22:00	5.27	13.27	
6/10/11 16:22:15	5.31	13.23	
6/10/11 16:22:30	5.40	13.15	
6/10/11 16:22:45	5.46	13.10	
6/10/11 16:23:00	5.44	13.10	
6/10/11 16:23:15	5.41	13.13	
6/10/11 16:23:30	5.39	13.15	
6/10/11 16:23:45	5.38	13.16	
6/10/11 16:24:00	5.37	13.17	
6/10/11 16:24:15	5.27	13.27	
6/10/11 16:24:30	5.21	13.32	
6/10/11 16:24:45	5.26	13.28	
6/10/11 16:25:00	5.30	13.25	
6/10/11 16:25:15	5.25	13.30	
6/10/11 16:25:30	5.24	13.30	
6/10/11 16:25:45	5.27	13.28	
6/10/11 16:26:00	5.27	13.28	
6/10/11 16:26:15	5.30	13.25	
6/10/11 16:26:30	5.31	13.23	
6/10/11 16:26:45	5.32	13.22	
6/10/11 16:27:00	5.35	13.20	
6/10/11 16:27:15	5.39	13.16	
6/10/11 16:27:30	5.39	13.16	
6/10/11 16:27:45	5.34	13.20	
6/10/11 16:28:00	5.33	13.22	
6/10/11 16:28:15	5.40	13.16	
6/10/11 16:28:30	5.46	13.10	
6/10/11 16:28:45	5.52	13.03	
6/10/11 16:29:00	5.56	12.99	
6/10/11 16:29:15	5.51	13.04	
6/10/11 16:29:30	5.43	13.11	
6/10/11 16:29:45	5.43	13.10	
6/10/11 16:30:00	5.45	13.09	
6/10/11 16:30:15	5.42	13.12	
6/10/11 16:30:30	5.42	13.12	
6/10/11 16:30:45	5.42	13.13	
6/10/11 16:31:00	5.43	13.11	
6/10/11 16:31:15	5.47	13.07	
6/10/11 16:31:30	5.46	13.07	
6/10/11 16:31:45	5.42	13.12	
6/10/11 16:32:00	5.34	13.20	
6/10/11 16:32:15	5.37	13.15	
6/10/11 16:32:30	5.40	13.14	
6/10/11 16:32:45	5.35	13.20	End 0061 Run 3
6/10/11 16:33:00	5.29	13.24	
6/10/11 16:33:15	5.28	13.26	
6/10/11 16:33:30	5.29	13.24	
6/10/11 16:33:45	5.32	13.21	
6/10/11 16:34:00	5.33	13.20	
6/10/11 16:34:15	5.37	13.17	
6/10/11 16:34:30	5.79	12.45	
6/10/11 16:34:45	8.50	9.41	
6/10/11 16:35:00	10.53	9.41	
6/10/11 16:35:15	11.23	9.90	System Bias
6/10/11 16:35:30	11.35	9.99	
6/10/11 16:35:45	11.36	10.00	CO ₂ Bias 3 Mid = 10.00
6/10/11 16:36:00	11.36	10.00	
6/10/11 16:36:15	11.37	10.00	
6/10/11 16:36:30	11.37	10.01	
6/10/11 16:36:45	10.55	10.58	
6/10/11 16:37:00	9.02	9.65	
6/10/11 16:37:15	6.69	6.22	
6/10/11 16:37:30	4.93	4.46	
6/10/11 16:37:45	4.61	4.21	System Bias
6/10/11 16:38:00	4.58	4.17	O ₂ Bias 3 Mid = 4.58
6/10/11 16:38:15	4.58	4.16	
6/10/11 16:38:30	4.57	4.15	
6/10/11 16:38:45	4.57	4.14	
6/10/11 16:39:00	4.57	4.13	
6/10/11 16:39:15	4.57	4.13	
6/10/11 16:39:30	4.57	4.13	

**Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	Comments
6/10/11 16:39:45	4.57	4.12	
6/10/11 16:40:00	4.57	4.12	
6/10/11 16:40:15	4.52	4.03	
6/10/11 16:40:30	2.95	2.34	
6/10/11 16:40:45	0.72	0.56	
6/10/11 16:41:00	0.18	0.23	System Bias
6/10/11 16:41:15	0.13	0.18	O ₂ Bias 3 Zero = 0.11
6/10/11 16:41:30	0.12	0.16	CO ₂ Bias 3 Zero = 0.16
6/10/11 16:41:45	0.11	0.15	
6/10/11 16:42:00	0.11	0.15	
6/10/11 16:42:15	0.10	0.14	
6/10/11 16:42:30	0.10	0.13	
6/10/11 16:42:45	0.10	0.13	
6/10/11 16:43:00	0.10	0.13	
6/10/11 16:43:15	0.10	0.12	
6/10/11 16:43:30	0.09	0.12	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 7:35:00	3.33	15.12	-1.4	15.70	
6/13/11 7:35:15	2.23	15.90	-1.4	15.77	
6/13/11 7:35:30	2.10	16.02	-1.0	16.41	
6/13/11 7:35:45	2.05	16.07	-1.1	16.62	
6/13/11 7:36:00	1.98	16.14	-1.1	16.74	
6/13/11 7:36:15	1.92	16.18	-1.1	11.88	
6/13/11 7:36:30	2.13	15.71	-1.1	15.08	
6/13/11 7:36:45	5.76	11.93	-0.9	12.50	
6/13/11 7:37:00	7.88	9.84	-0.7	8.70	
6/13/11 7:37:15	12.63	5.88	-0.8	2.58	
6/13/11 7:37:30	14.88	3.44	-1.3	1.17	
6/13/11 7:37:45	8.01	1.28	-1.7	1.13	
6/13/11 7:38:00	1.44	0.25	-1.7	0.97	
6/13/11 7:38:15	0.14	0.09	-1.3	0.80	
6/13/11 7:38:30	0.05	0.08	0.0	0.65	
6/13/11 7:38:45	0.04	0.07	-0.1	0.55	
6/13/11 7:39:00	0.04	0.07	0.0	0.49	
6/13/11 7:39:15	0.03	0.07	-0.1	0.44	Calibration Error
6/13/11 7:39:30	0.03	0.07	-0.3	0.42	O ₂ CE Zero = 0.03
6/13/11 7:39:45	0.03	0.07	-0.4	0.37	CO ₂ CE Zero = 0.07
6/13/11 7:40:00	0.03	0.06	-0.4	0.36	SO ₂ CE Zero = -0.3
6/13/11 7:40:15	0.03	0.06	-0.3	0.34	NO _x CE Zero = 0.4
6/13/11 7:40:30	0.02	0.06	-0.2	0.33	
6/13/11 7:40:45	0.02	0.06	-0.2	0.33	
6/13/11 7:41:00	0.02	0.06	-0.2	0.33	
6/13/11 7:41:15	0.02	0.06	-0.3	0.37	
6/13/11 7:41:30	0.02	0.06	0.2	0.49	
6/13/11 7:41:45	2.68	1.68	-0.3	0.39	
6/13/11 7:42:00	12.01	9.16	-0.1	0.32	
6/13/11 7:42:15	17.85	14.49	-0.2	0.32	
6/13/11 7:42:30	20.90	17.88	-0.1	0.30	
6/13/11 7:42:45	22.04	19.35	-0.3	0.31	
6/13/11 7:43:00	22.22	19.59	-0.3	0.33	
6/13/11 7:43:15	22.24	19.61	-0.2	0.32	Calibration Error
6/13/11 7:43:30	22.24	19.62	-0.3	0.30	
6/13/11 7:43:45	22.25	19.63	-0.2	0.31	CO ₂ CE Span = 19.63
6/13/11 7:44:00	22.25	19.63	-0.3	0.30	
6/13/11 7:44:15	22.25	19.63	-0.4	0.30	
6/13/11 7:44:30	20.58	17.23	-0.4	0.33	
6/13/11 7:44:45	15.48	12.92	-0.3	0.30	
6/13/11 7:45:00	12.32	10.60	-0.3	0.30	
6/13/11 7:45:15	11.60	10.16	-0.4	0.30	Calibration Error
6/13/11 7:45:30	11.55	10.14	-0.3	0.30	
6/13/11 7:45:45	11.55	10.14	-0.3	0.30	CO ₂ CE Mid = 10.14
6/13/11 7:46:00	11.55	10.14	-0.3	0.29	
6/13/11 7:46:15	11.55	10.14	-0.3	0.29	
6/13/11 7:46:30	11.55	10.14	-0.4	0.31	
6/13/11 7:46:45	11.55	10.14	0.1	0.31	
6/13/11 7:47:00	11.59	10.04	0.0	0.30	
6/13/11 7:47:15	11.67	8.89	-0.1	0.29	
6/13/11 7:47:30	9.82	8.21	-0.3	0.30	
6/13/11 7:47:45	9.10	8.14	-0.3	0.30	Calibration Error
6/13/11 7:48:00	9.02	8.13	-0.3	0.30	O ₂ CE Span = 9.01
6/13/11 7:48:15	9.01	8.13	-0.3	0.29	
6/13/11 7:48:30	9.01	8.13	0.0	0.29	
6/13/11 7:48:45	9.01	8.13	-0.3	0.30	
6/13/11 7:49:00	9.01	8.13	-0.2	0.29	
6/13/11 7:49:15	8.75	7.68	-0.3	0.30	
6/13/11 7:49:30	6.38	5.35	-0.3	0.30	
6/13/11 7:49:45	4.81	4.27	-0.3	0.30	Calibration Error
6/13/11 7:50:00	4.62	4.18	-0.3	0.29	O ₂ CE Mid = 4.61
6/13/11 7:50:15	4.61	4.18	-0.4	0.32	
6/13/11 7:50:30	4.61	4.17	-0.4	0.30	
6/13/11 7:50:45	4.61	4.17	-0.4	0.30	
6/13/11 7:51:00	4.61	4.17	-0.2	0.32	
6/13/11 7:51:15	4.61	4.17	2.1	0.43	
6/13/11 7:51:30	4.95	3.82	16.4	0.30	
6/13/11 7:51:45	3.83	1.63	50.5	0.32	
6/13/11 7:52:00	1.19	0.31	59.6	0.32	
6/13/11 7:52:15	0.26	0.11	59.8	0.32	
6/13/11 7:52:30	0.09	0.09	58.8	0.33	
6/13/11 7:52:45	0.07	0.08	57.5	0.33	
6/13/11 7:53:00	0.06	0.08	56.1	0.33	
6/13/11 7:53:15	0.06	0.08	55.2	0.34	
6/13/11 7:53:30	0.06	0.07	55.4	0.35	
6/13/11 7:53:45	0.06	0.07	56.7	0.34	
6/13/11 7:54:00	0.05	0.07	58.7	0.35	
6/13/11 7:54:15	0.05	0.07	61.6	0.35	
6/13/11 7:54:30	0.05	0.07	64.8	0.33	
6/13/11 7:54:45	0.04	0.07	67.9	0.33	
6/13/11 7:55:00	0.04	0.07	70.8	0.33	
6/13/11 7:55:15	0.03	0.07	73.3	0.33	
6/13/11 7:55:30	0.03	0.06	84.5	0.33	
6/13/11 7:55:45	0.04	0.10	100.8	0.33	
6/13/11 7:56:00	0.19	0.23	100.8	0.32	

**Valero Port Arthur Refinery: Port Arthur, Texas
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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 7:56:15	0.10	0.11	100.8	0.32	
6/13/11 7:56:30	0.03	0.07	100.8	0.30	
6/13/11 7:56:45	0.02	0.06	94.5	0.30	
6/13/11 7:57:00	0.02	0.06	87.8	0.30	
6/13/11 7:57:15	0.01	0.06	88.2	0.30	
6/13/11 7:57:30	0.01	0.06	88.9	0.30	
6/13/11 7:57:45	0.01	0.06	89.3	0.30	
6/13/11 7:58:00	0.01	0.06	89.9	0.30	
6/13/11 7:58:15	0.01	0.06	90.6	0.30	
6/13/11 7:58:30	0.01	0.06	90.9	0.30	
6/13/11 7:58:45	0.01	0.06	91.3	0.31	
6/13/11 7:59:00	0.01	0.06	91.5	0.30	
6/13/11 7:59:15	0.01	0.06	91.7	0.30	
6/13/11 7:59:30	0.01	0.06	91.9	0.30	
6/13/11 7:59:45	0.01	0.06	92.1	0.30	
6/13/11 8:00:00	0.01	0.06	91.4	0.30	
6/13/11 8:00:15	0.01	0.06	91.3	0.30	
6/13/11 8:00:30	0.01	0.06	91.4	0.30	
6/13/11 8:00:45	0.00	0.06	91.4	0.30	
6/13/11 8:01:00	0.00	0.06	89.7	0.30	
6/13/11 8:01:15	0.00	0.06	61.4	0.29	
6/13/11 8:01:30	0.00	0.06	47.9	0.27	
6/13/11 8:01:45	0.00	0.06	46.8	0.28	
6/13/11 8:02:00	0.00	0.06	46.7	0.30	
6/13/11 8:02:15	0.00	0.06	46.7	0.29	
6/13/11 8:02:30	0.00	0.06	46.8	0.31	
6/13/11 8:02:45	0.00	0.06	51.7	0.30	
6/13/11 8:03:00	0.00	0.06	81.6	0.30	
6/13/11 8:03:15	0.00	0.05	90.8	0.30	
6/13/11 8:03:30	0.00	0.05	91.3	0.30	
6/13/11 8:03:45	0.00	0.05	91.5	0.30	
6/13/11 8:04:00	0.00	0.05	91.7	0.30	
6/13/11 8:04:15	0.00	0.05	91.8	0.30	
6/13/11 8:04:30	0.00	0.05	91.0	0.30	Calibration Error
6/13/11 8:04:45	0.00	0.05	90.4	0.34	
6/13/11 8:05:00	0.00	0.05	90.4	0.30	
6/13/11 8:05:15	0.00	0.05	90.4	0.30	SO ₂ CE Span = 90.4
6/13/11 8:05:30	0.00	0.05	90.4	0.30	
6/13/11 8:05:45	0.00	0.05	78.4	0.30	
6/13/11 8:06:00	0.00	0.05	51.1	0.30	
6/13/11 8:06:15	0.00	0.05	46.6	0.30	
6/13/11 8:06:30	0.00	0.05	46.3	0.30	Calibration Error
6/13/11 8:06:45	0.00	0.05	46.4	0.30	
6/13/11 8:07:00	0.00	0.05	46.2	0.30	
6/13/11 8:07:15	0.00	0.05	46.2	0.30	SO ₂ CE Mid = 46.2
6/13/11 8:07:30	0.00	0.05	46.2	0.30	
6/13/11 8:07:45	0.00	0.05	46.2	0.30	
6/13/11 8:08:00	0.00	0.05	42.4	0.43	
6/13/11 8:08:15	0.27	0.06	27.4	33.51	
6/13/11 8:08:30	2.46	0.09	4.6	76.26	
6/13/11 8:08:45	1.62	0.08	0.8	79.07	
6/13/11 8:09:00	0.31	0.06	0.4	78.85	
6/13/11 8:09:15	0.05	0.05	0.3	79.38	
6/13/11 8:09:30	0.02	0.05	0.1	81.88	
6/13/11 8:09:45	0.01	0.05	0.1	85.02	
6/13/11 8:10:00	0.01	0.05	0.0	86.56	
6/13/11 8:10:15	0.01	0.06	0.0	86.75	
6/13/11 8:10:30	0.01	0.06	0.1	86.27	
6/13/11 8:10:45	0.01	0.06	0.2	85.75	
6/13/11 8:11:00	0.01	0.06	0.2	85.03	
6/13/11 8:11:15	0.00	0.06	0.1	84.37	
6/13/11 8:11:30	0.00	0.05	0.1	83.89	
6/13/11 8:11:45	0.00	0.06	0.0	83.54	
6/13/11 8:12:00	0.00	0.05	0.0	83.27	
6/13/11 8:12:15	0.00	0.05	0.1	83.33	
6/13/11 8:12:30	0.00	0.05	0.1	83.47	
6/13/11 8:12:45	0.00	0.05	0.1	83.76	
6/13/11 8:13:00	0.00	0.05	0.0	84.10	
6/13/11 8:13:15	0.00	0.05	-0.1	84.70	
6/13/11 8:13:30	0.00	0.05	0.0	85.72	
6/13/11 8:13:45	0.00	0.05	0.1	86.98	
6/13/11 8:14:00	0.00	0.05	0.0	88.09	
6/13/11 8:14:15	0.00	0.05	0.0	89.20	
6/13/11 8:14:30	0.00	0.05	-0.1	90.38	
6/13/11 8:14:45	0.00	0.05	0.0	91.27	
6/13/11 8:15:00	0.00	0.05	0.0	91.46	
6/13/11 8:15:15	0.00	0.05	0.0	90.59	
6/13/11 8:15:30	0.00	0.05	-0.2	91.25	
6/13/11 8:15:45	0.00	0.05	-0.1	91.58	
6/13/11 8:16:00	0.00	0.05	-0.2	90.87	Calibration Error
6/13/11 8:16:15	0.00	0.05	-0.3	90.38	
6/13/11 8:16:30	0.00	0.05	-0.3	90.56	
6/13/11 8:16:45	0.00	0.05	-0.1	90.68	
6/13/11 8:17:00	0.00	0.05	-0.4	90.73	NO _x CE Span = 90.6
6/13/11 8:17:15	0.00	0.05	-0.3	58.63	

Valero Port Arthur Refinery: Port Arthur, Texas

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 8:17:30	0.00	0.05	-0.4	47.28	
6/13/11 8:17:45	0.00	0.05	-0.4	47.10	
6/13/11 8:18:00	0.00	0.05	-0.3	46.91	
6/13/11 8:18:15	0.00	0.05	-0.2	46.79	Calibration Error
6/13/11 8:18:30	0.00	0.05	-0.3	46.77	
6/13/11 8:18:45	0.00	0.05	-0.3	46.79	
6/13/11 8:19:00	0.00	0.05	-0.4	46.83	
6/13/11 8:19:15	0.00	0.05	-0.3	46.85	NO _x CE Mid = 46.8
6/13/11 8:19:30	0.00	0.05	-0.3	48.10	
6/13/11 8:19:45	0.00	0.05	0.5	49.58	
6/13/11 8:20:00	0.08	0.05	1.1	30.90	
6/13/11 8:20:15	3.98	0.10	0.6	27.68	
6/13/11 8:20:30	14.13	0.09	0.2	28.87	
6/13/11 8:20:45	19.66	0.06	0.2	27.60	
6/13/11 8:21:00	20.57	0.05	0.3	25.17	
6/13/11 8:21:15	20.64	0.05	0.2	24.44	
6/13/11 8:21:30	20.64	0.05	0.2	24.62	
6/13/11 8:21:45	20.64	0.05	0.3	27.47	
6/13/11 8:22:00	20.65	0.05	0.1	35.38	
6/13/11 8:22:15	20.66	0.05	0.2	37.35	
6/13/11 8:22:30	20.67	0.05	0.2	38.57	
6/13/11 8:22:45	20.68	0.05	0.2	39.49	
6/13/11 8:23:00	20.69	0.05	0.2	40.15	
6/13/11 8:23:15	20.69	0.05	0.3	40.72	
6/13/11 8:23:30	20.70	0.05	0.4	41.14	
6/13/11 8:23:45	20.70	0.05	0.3	41.52	
6/13/11 8:24:00	20.70	0.05	0.5	41.84	
6/13/11 8:24:15	20.70	0.05	0.4	42.19	
6/13/11 8:24:30	20.70	0.05	0.3	42.44	
6/13/11 8:24:45	20.70	0.05	0.4	42.65	
6/13/11 8:25:00	20.70	0.05	0.4	42.87	
6/13/11 8:25:15	20.71	0.05	0.4	43.00	
6/13/11 8:25:30	20.71	0.05	0.5	43.17	
6/13/11 8:25:45	20.71	0.05	0.4	43.30	
6/13/11 8:26:00	20.71	0.05	0.4	43.50	
6/13/11 8:26:15	20.71	0.05	0.3	43.65	
6/13/11 8:26:30	20.71	0.05	0.5	43.75	
6/13/11 8:26:45	20.71	0.05	0.6	43.89	
6/13/11 8:27:00	20.71	0.05	0.5	43.99	
6/13/11 8:27:15	20.72	0.05	0.6	44.17	
6/13/11 8:27:30	20.72	0.05	0.6	44.29	
6/13/11 8:27:45	20.72	0.05	0.6	44.45	
6/13/11 8:28:00	20.72	0.05	0.7	44.59	
6/13/11 8:28:15	20.72	0.05	0.7	44.70	
6/13/11 8:28:30	20.72	0.05	0.4	44.81	
6/13/11 8:28:45	20.72	0.05	0.7	44.90	NO ₂ Converter Efficiency Check
6/13/11 8:29:00	20.72	0.05	0.8	44.95	Cyl AAL13927
6/13/11 8:29:15	20.72	0.05	0.6	45.04	Conc. = 49.8
6/13/11 8:29:30	20.72	0.05	0.5	45.12	Response = 45.1
6/13/11 8:29:45	20.72	0.05	0.7	45.21	90.5%
6/13/11 8:30:00	20.72	0.05	0.7	45.28	
6/13/11 8:30:15	20.72	0.05	0.7	45.40	
6/13/11 8:30:30	20.72	0.05	0.6	34.47	
6/13/11 8:30:45	20.55	0.46	0.8	17.15	
6/13/11 8:31:00	15.55	5.54	2.3	16.17	
6/13/11 8:31:15	8.73	10.38	3.0	18.52	
6/13/11 8:31:30	5.47	11.58	2.8	38.28	
6/13/11 8:31:45	8.31	6.30	2.4	38.89	Introduce Mid SO ₂
6/13/11 8:32:00	16.73	1.46	2.2	37.34	
6/13/11 8:32:15	20.19	0.31	2.0	11.99	
6/13/11 8:32:30	18.76	0.20	2.0	5.47	
6/13/11 8:32:45	7.96	0.16	9.2	4.74	
6/13/11 8:33:00	1.22	0.14	51.7	4.61	
6/13/11 8:33:15	0.32	0.13	97.5	4.16	
6/13/11 8:33:30	0.22	0.12	100.9	3.44	
6/13/11 8:33:45	0.19	0.11	100.8	2.97	
6/13/11 8:34:00	0.18	0.10	100.8	2.67	
6/13/11 8:34:15	0.17	0.10	99.8	2.29	
6/13/11 8:34:30	0.16	0.09	81.4	2.06	
6/13/11 8:34:45	0.15	0.09	64.8	1.88	
6/13/11 8:35:00	0.15	0.08	55.8	1.74	SO ₂ Upscale RT = 195 Seconds
6/13/11 8:35:15	0.14	0.08	51.0	1.64	
6/13/11 8:35:30	0.14	0.08	48.0	1.54	
6/13/11 8:35:45	0.14	0.08	45.9	1.45	
6/13/11 8:36:00	0.14	0.07	44.8	1.42	
6/13/11 8:36:15	0.13	0.07	44.0	1.37	
6/13/11 8:36:30	0.13	0.07	43.4	1.33	
6/13/11 8:36:45	0.13	0.07	43.0	1.33	System Bias
6/13/11 8:37:00	0.13	0.07	42.8	1.35	O ₂ Bias 1 Zero = 0.13
6/13/11 8:37:15	0.13	0.07	42.6	1.38	CO ₂ Bias 1 Zero = 0.07
6/13/11 8:37:30	0.12	0.06	42.6	1.43	SO ₂ Bias 1 Mid = 42.7
6/13/11 8:37:45	0.12	0.06	42.7	1.48	NO _x Bias 1 Zero = 1.4
6/13/11 8:38:00	0.12	0.06	42.6	1.53	
6/13/11 8:38:15	0.12	0.06	42.5	1.54	Introduce Mid NO _x
6/13/11 8:38:30	0.12	0.06	42.4	1.54	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 8:38:45	0.12	0.06	42.3	1.55	
6/13/11 8:39:00	0.12	0.06	42.4	1.55	
6/13/11 8:39:15	0.12	0.06	42.4	1.54	
6/13/11 8:39:30	0.12	0.06	42.5	1.51	
6/13/11 8:39:45	0.12	0.06	42.5	1.50	
6/13/11 8:40:00	0.12	0.06	42.8	1.50	
6/13/11 8:40:15	0.12	0.06	42.8	1.48	
6/13/11 8:40:30	0.12	0.06	42.6	1.47	
6/13/11 8:40:45	0.12	0.06	42.8	1.68	
6/13/11 8:41:00	0.12	0.06	43.5	6.46	NO _x Upscale RT = 195 Seconds
6/13/11 8:41:15	0.23	2.40	42.9	12.65	
6/13/11 8:41:30	0.43	4.01	37.9	36.36	
6/13/11 8:41:45	0.26	1.43	27.9	40.42	
6/13/11 8:42:00	0.14	0.23	19.5	40.56	
6/13/11 8:42:15	0.12	0.10	14.4	40.55	
6/13/11 8:42:30	0.11	0.08	10.9	41.11	SO ₂ Downscale RT = 195 Seconds
6/13/11 8:42:45	0.11	0.08	8.6	41.83	
6/13/11 8:43:00	0.11	0.07	7.0	42.38	
6/13/11 8:43:15	0.11	0.07	5.8	42.81	System Bias
6/13/11 8:43:30	0.11	0.07	5.0	43.07	NO _x Bias 1 Mid = 43.1
6/13/11 8:43:45	0.11	0.07	4.3	43.17	
6/13/11 8:44:00	0.11	0.07	3.7	43.16	
6/13/11 8:44:15	0.11	0.07	3.3	43.06	
6/13/11 8:44:30	0.11	0.07	3.1	42.99	
6/13/11 8:44:45	0.11	0.06	2.8	42.88	
6/13/11 8:45:00	0.11	0.06	2.4	42.77	Introduce Mid O ₂
6/13/11 8:45:15	0.11	0.06	2.5	42.72	
6/13/11 8:45:30	0.11	0.06	2.1	37.91	
6/13/11 8:45:45	0.20	2.01	2.3	30.34	
6/13/11 8:46:00	0.48	4.41	2.7	5.94	
6/13/11 8:46:15	1.96	3.43	3.2	5.17	
6/13/11 8:46:30	4.02	3.71	3.0	4.96	
6/13/11 8:46:45	4.50	3.84	2.9	4.79	
6/13/11 8:47:00	4.58	3.83	2.6	4.42	
6/13/11 8:47:15	4.58	3.90	2.4	3.64	System Bias
6/13/11 8:47:30	4.57	4.00	2.1	2.57	O ₂ Bias 1 Mid = 4.57
6/13/11 8:47:45	4.57	4.04	2.0	1.79	
6/13/11 8:48:00	4.57	4.05	2.0	1.45	
6/13/11 8:48:15	4.57	4.05	1.9	1.31	
6/13/11 8:48:30	4.57	4.06	1.7	1.20	
6/13/11 8:48:45	4.57	4.06	1.7	1.14	Introduce CO ₂
6/13/11 8:49:00	4.57	4.06	1.7	1.08	
6/13/11 8:49:15	4.57	4.06	1.4	5.17	
6/13/11 8:49:30	4.50	4.64	1.4	2.54	
6/13/11 8:49:45	4.03	7.04	1.3	0.93	
6/13/11 8:50:00	6.76	8.25	1.5	0.94	
6/13/11 8:50:15	10.23	9.51	1.4	0.94	
6/13/11 8:50:30	11.27	9.89	1.4	0.98	System Bias
6/13/11 8:50:45	11.39	9.95	1.3	1.28	
6/13/11 8:51:00	11.41	9.96	1.2	1.18	CO ₂ Bias 1 Mid = 9.96
6/13/11 8:51:15	11.41	9.97	1.2	0.98	SO ₂ Bias 1 Zero = 1.3
6/13/11 8:51:30	11.42	9.97	1.5	0.91	
6/13/11 8:51:45	11.42	9.98	1.4	0.90	
6/13/11 8:52:00	11.42	9.98	1.2	0.87	
6/13/11 8:52:15	11.42	9.98	1.0	0.87	
6/13/11 8:52:30	11.43	9.98	1.0	3.16	
6/13/11 8:52:45	11.42	10.00	0.9	12.78	
6/13/11 8:53:00	9.66	11.71	0.8	13.12	
6/13/11 8:53:15	4.54	15.02	0.8	13.07	
6/13/11 8:53:30	1.98	16.38	1.2	13.15	
6/13/11 8:53:45	1.53	16.61	1.1	13.24	
6/13/11 8:54:00	1.49	16.63	1.0	13.64	
6/13/11 8:54:15	1.49	16.63	1.0	14.20	
6/13/11 8:54:30	1.51	16.62	1.0	14.53	
6/13/11 8:54:45	1.52	16.62	1.0	14.74	
6/13/11 8:55:00	1.52	16.63	0.8	14.83	
6/13/11 8:55:15	1.50	16.64	1.0	14.86	
6/13/11 8:55:30	1.49	16.63	1.1	14.85	
6/13/11 8:55:45	1.50	16.63	1.0	14.93	
6/13/11 8:56:00	1.49	16.64	0.9	15.07	
6/13/11 8:56:15	1.50	16.64	0.9	15.17	
6/13/11 8:56:30	1.52	16.61	0.9	15.31	
6/13/11 8:56:45	1.53	16.59	0.9	15.26	
6/13/11 8:57:00	1.52	16.60	0.9	15.26	
6/13/11 8:57:15	1.51	16.62	0.9	15.30	
6/13/11 8:57:30	1.50	16.64	0.9	15.28	
6/13/11 8:57:45	1.51	16.64	1.0	15.30	
6/13/11 8:58:00	1.52	16.63	1.0	15.41	
6/13/11 8:58:15	1.53	16.62	0.9	15.36	
6/13/11 8:58:30	1.54	16.61	1.0	15.32	
6/13/11 8:58:45	1.56	16.60	0.9	15.49	
6/13/11 8:59:00	1.55	16.60	1.0	15.61	
6/13/11 8:59:15	1.55	16.59	1.1	15.59	
6/13/11 8:59:30	1.58	16.58	1.0	15.85	
6/13/11 8:59:45	1.58	16.59	0.9	15.46	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 9:00:00	1.55	16.60	0.8	15.42	
6/13/11 9:00:15	1.55	16.60	0.8	15.53	
6/13/11 9:00:30	1.54	16.60	1.0	15.55	
6/13/11 9:00:45	1.55	16.60	0.9	15.58	
6/13/11 9:01:00	1.56	16.60	0.9	15.55	
6/13/11 9:01:15	1.57	16.59	0.8	15.46	
6/13/11 9:01:30	1.57	16.59	0.9	15.62	
6/13/11 9:01:45	1.56	16.59	0.8	15.86	
6/13/11 9:02:00	1.58	16.57	0.9	15.82	
6/13/11 9:02:15	1.63	16.53	0.9	15.76	
6/13/11 9:02:30	1.63	16.54	0.7	16.12	
6/13/11 9:02:45	1.61	16.55	0.8	16.42	
6/13/11 9:03:00	1.63	16.53	0.8	15.92	
6/13/11 9:03:15	1.64	16.52	0.9	15.80	
6/13/11 9:03:30	1.63	16.52	0.7	15.68	
6/13/11 9:03:45	1.61	16.53	0.8	15.80	
6/13/11 9:04:00	1.60	16.54	0.7	15.85	
6/13/11 9:04:15	1.63	16.53	0.8	15.95	
6/13/11 9:04:30	1.64	16.52	0.9	15.98	
6/13/11 9:04:45	1.64	16.51	0.8	16.00	
6/13/11 9:05:00	1.64	16.51	0.7	16.06	
6/13/11 9:05:15	1.64	16.51	0.8	16.21	
6/13/11 9:05:30	1.66	16.51	0.7	16.12	
6/13/11 9:05:45	1.68	16.49	0.8	16.09	
6/13/11 9:06:00	1.67	16.49	0.7	15.99	
6/13/11 9:06:15	1.67	16.49	0.7	15.99	
6/13/11 9:06:30	1.68	16.48	0.8	15.90	
6/13/11 9:06:45	1.67	16.49	0.7	15.98	
6/13/11 9:07:00	1.64	16.51	0.9	16.09	
6/13/11 9:07:15	1.63	16.53	0.9	16.03	
6/13/11 9:07:30	1.64	16.52	0.8	16.07	
6/13/11 9:07:45	1.65	16.51	0.9	16.18	
6/13/11 9:08:00	1.66	16.50	0.9	16.34	
6/13/11 9:08:15	1.66	16.50	0.7	16.39	
6/13/11 9:08:30	1.69	16.49	0.6	16.28	
6/13/11 9:08:45	1.71	16.46	0.8	16.03	
6/13/11 9:09:00	1.71	16.45	0.7	16.08	
6/13/11 9:09:15	1.66	16.49	0.5	16.22	
6/13/11 9:09:30	1.65	16.50	0.6	16.31	
6/13/11 9:09:45	1.67	16.49	0.6	16.12	
6/13/11 9:10:00	1.69	16.47	0.8	15.89	
6/13/11 9:10:15	1.69	16.47	0.8	15.81	
6/13/11 9:10:30	1.69	16.47	0.9	15.77	
6/13/11 9:10:45	1.67	16.48	0.7	15.85	
6/13/11 9:11:00	1.66	16.50	0.7	15.75	
6/13/11 9:11:15	1.68	16.48	0.7	15.76	
6/13/11 9:11:30	1.69	16.47	0.6	15.76	
6/13/11 9:11:45	1.69	16.46	0.8	15.71	
6/13/11 9:12:00	1.69	16.47	0.7	15.60	
6/13/11 9:12:15	1.68	16.48	0.6	15.70	
6/13/11 9:12:30	1.66	16.49	0.5	15.75	
6/13/11 9:12:45	1.67	16.48	0.6	15.78	
6/13/11 9:13:00	1.69	16.47	0.6	15.85	
6/13/11 9:13:15	1.71	16.45	0.7	15.76	
6/13/11 9:13:30	1.73	16.43	0.8	15.65	
6/13/11 9:13:45	1.73	16.44	0.7	15.64	
6/13/11 9:14:00	1.71	16.46	0.7	15.61	
6/13/11 9:14:15	1.69	16.47	0.7	15.52	
6/13/11 9:14:30	1.68	16.47	0.7	15.43	
6/13/11 9:14:45	1.68	16.47	0.7	15.38	
6/13/11 9:15:00	1.68	16.47	0.7	15.32	
6/13/11 9:15:15	1.68	16.47	0.6	15.24	
6/13/11 9:15:30	1.66	16.48	0.5	15.14	
6/13/11 9:15:45	1.64	16.50	0.6	15.11	
6/13/11 9:16:00	1.63	16.51	0.4	15.04	
6/13/11 9:16:15	1.63	16.51	0.6	15.07	
6/13/11 9:16:30	1.62	16.53	0.6	15.19	
6/13/11 9:16:45	1.61	16.54	0.6	15.21	
6/13/11 9:17:00	1.61	16.54	0.7	15.09	
6/13/11 9:17:15	1.61	16.53	0.6	15.09	
6/13/11 9:17:30	1.62	16.52	0.6	15.13	
6/13/11 9:17:45	1.62	16.53	0.6	15.06	
6/13/11 9:18:00	1.62	16.54	0.6	14.87	
6/13/11 9:18:15	1.59	16.56	0.9	14.79	
6/13/11 9:18:30	1.57	16.57	0.7	14.77	
6/13/11 9:18:45	1.57	16.57	0.8	14.96	
6/13/11 9:19:00	1.58	16.57	0.7	15.05	
6/13/11 9:19:15	1.59	16.56	0.7	15.00	
6/13/11 9:19:30	1.59	16.56	0.8	14.94	
6/13/11 9:19:45	1.58	16.57	0.6	14.84	
6/13/11 9:20:00	1.57	16.58	0.6	14.91	
6/13/11 9:20:15	1.55	16.59	0.7	15.02	
6/13/11 9:20:30	1.54	16.60	0.8	15.06	
6/13/11 9:20:45	1.58	16.57	0.8	15.00	
6/13/11 9:21:00	1.58	16.57	0.6	14.99	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 9:21:15	1.57	16.58	0.7	15.11	
6/13/11 9:21:30	1.57	16.58	0.7	15.26	
6/13/11 9:21:45	1.57	16.57	0.7	15.39	
6/13/11 9:22:00	1.57	16.58	0.7	15.58	
6/13/11 9:22:15	1.58	16.58	0.7	15.65	
6/13/11 9:22:30	1.61	16.56	0.7	15.66	
6/13/11 9:22:45	1.63	16.54	0.7	15.71	
6/13/11 9:23:00	1.63	16.53	0.7	15.63	
6/13/11 9:23:15	1.64	16.52	0.6	15.75	
6/13/11 9:23:30	1.63	16.53	0.6	15.71	
6/13/11 9:23:45	1.63	16.54	0.8	15.70	
6/13/11 9:24:00	1.61	16.55	0.8	15.59	
6/13/11 9:24:15	1.60	16.55	0.6	15.51	
6/13/11 9:24:30	1.60	16.54	0.4	15.56	
6/13/11 9:24:45	1.60	16.54	0.6	15.61	
6/13/11 9:25:00	1.60	16.54	0.7	15.93	
6/13/11 9:25:15	1.60	16.56	0.7	15.92	
6/13/11 9:25:30	1.62	16.54	0.8	15.94	
6/13/11 9:25:45	1.64	16.53	0.6	16.06	
6/13/11 9:26:00	1.63	16.54	0.7	16.21	
6/13/11 9:26:15	1.64	16.53	0.7	16.28	
6/13/11 9:26:30	1.66	16.52	0.8	16.22	
6/13/11 9:26:45	1.67	16.52	0.7	16.21	
6/13/11 9:27:00	1.66	16.53	0.7	16.31	
6/13/11 9:27:15	1.65	16.53	0.6	16.31	
6/13/11 9:27:30	1.65	16.53	0.7	16.30	
6/13/11 9:27:45	1.67	16.51	0.7	16.35	
6/13/11 9:28:00	1.68	16.50	0.8	16.34	
6/13/11 9:28:15	1.68	16.50	0.9	16.36	
6/13/11 9:28:30	1.66	16.50	0.7	16.36	
6/13/11 9:28:45	1.65	16.51	0.7	16.34	
6/13/11 9:29:00	1.67	16.51	0.8	16.34	Begin Run 1 - M29
6/13/11 9:29:15	1.67	16.51	0.7	17.06	
6/13/11 9:29:30	1.67	16.50	0.8	16.76	
6/13/11 9:29:45	1.68	16.52	1.0	16.75	
6/13/11 9:30:00	1.68	16.51	0.9	16.87	
6/13/11 9:30:15	1.69	16.49	0.7	17.36	
6/13/11 9:30:30	1.70	16.51	0.9	17.81	
6/13/11 9:30:45	1.72	16.52	0.9	17.39	
6/13/11 9:31:00	1.75	16.46	0.8	17.25	
6/13/11 9:31:15	1.78	16.43	0.6	17.05	
6/13/11 9:31:30	1.78	16.42	0.8	17.10	
6/13/11 9:31:45	1.76	16.43	0.7	17.22	
6/13/11 9:32:00	1.73	16.45	0.7	17.36	Start M5B - Ruun 1
6/13/11 9:32:15	1.72	16.46	0.8	17.30	
6/13/11 9:32:30	1.71	16.47	0.7	17.18	
6/13/11 9:32:45	1.72	16.45	0.7	17.04	
6/13/11 9:33:00	1.75	16.44	0.9	17.00	
6/13/11 9:33:15	1.75	16.44	0.7	17.15	
6/13/11 9:33:30	1.75	16.44	0.7	17.08	
6/13/11 9:33:45	1.76	16.44	0.7	16.88	
6/13/11 9:34:00	1.77	16.42	0.7	16.87	
6/13/11 9:34:15	1.75	16.42	1.0	16.95	
6/13/11 9:34:30	1.74	16.41	0.9	17.05	
6/13/11 9:34:45	1.77	16.39	1.0	17.09	
6/13/11 9:35:00	1.80	16.37	1.0	17.02	
6/13/11 9:35:15	1.80	16.38	0.7	16.97	
6/13/11 9:35:30	1.79	16.39	0.7	17.08	
6/13/11 9:35:45	1.77	16.40	0.8	17.09	
6/13/11 9:36:00	1.77	16.41	1.0	17.20	
6/13/11 9:36:15	1.78	16.41	0.8	17.28	
6/13/11 9:36:30	1.77	16.40	0.6	17.28	
6/13/11 9:36:45	1.78	16.39	0.7	17.18	
6/13/11 9:37:00	1.79	16.37	0.7	17.03	
6/13/11 9:37:15	1.78	16.39	0.6	17.00	
6/13/11 9:37:30	1.75	16.42	0.9	17.08	
6/13/11 9:37:45	1.73	16.43	0.8	17.15	
6/13/11 9:38:00	1.75	16.41	0.5	17.09	
6/13/11 9:38:15	1.77	16.38	0.6	17.08	
6/13/11 9:38:30	1.79	16.36	0.5	17.11	
6/13/11 9:38:45	1.79	16.38	0.7	17.14	
6/13/11 9:39:00	1.79	16.37	0.8	17.00	
6/13/11 9:39:15	1.81	16.36	0.6	16.87	
6/13/11 9:39:30	1.79	16.37	0.6	16.78	
6/13/11 9:39:45	1.78	16.38	0.6	16.81	
6/13/11 9:40:00	1.77	16.37	0.7	16.61	
6/13/11 9:40:15	1.78	16.37	0.6	16.39	
6/13/11 9:40:30	1.78	16.39	0.8	16.18	
6/13/11 9:40:45	1.74	16.41	0.7	16.13	
6/13/11 9:41:00	1.70	16.42	0.6	16.30	
6/13/11 9:41:15	1.70	16.43	0.6	16.14	
6/13/11 9:41:30	1.72	16.43	0.8	16.00	
6/13/11 9:41:45	1.71	16.44	0.7	15.97	
6/13/11 9:42:00	1.70	16.44	0.9	15.81	
6/13/11 9:42:15	1.70	16.43	0.7	15.68	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 9:42:30	1.70	16.44	0.6	15.57	
6/13/11 9:42:45	1.67	16.46	0.6	15.47	
6/13/11 9:43:00	1.66	16.47	0.9	15.51	
6/13/11 9:43:15	1.63	16.48	0.8	15.53	
6/13/11 9:43:30	1.61	16.50	0.7	15.57	
6/13/11 9:43:45	1.62	16.50	0.6	15.53	
6/13/11 9:44:00	1.65	16.48	0.6	15.37	
6/13/11 9:44:15	1.67	16.48	0.6	15.34	
6/13/11 9:44:30	1.67	16.47	0.7	15.29	
6/13/11 9:44:45	1.68	16.46	0.6	15.14	
6/13/11 9:45:00	1.68	16.46	0.4	15.14	
6/13/11 9:45:15	1.62	16.51	0.8	15.10	
6/13/11 9:45:30	1.59	16.54	0.6	14.86	
6/13/11 9:45:45	1.58	16.53	0.7	14.85	
6/13/11 9:46:00	1.56	16.54	0.6	14.76	
6/13/11 9:46:15	1.54	16.56	0.6	14.67	
6/13/11 9:46:30	1.53	16.58	0.5	14.55	
6/13/11 9:46:45	1.50	16.60	0.8	14.55	
6/13/11 9:47:00	1.49	16.61	0.8	14.64	
6/13/11 9:47:15	1.50	16.61	0.6	14.59	
6/13/11 9:47:30	1.53	16.60	0.6	14.60	
6/13/11 9:47:45	1.51	16.61	0.6	14.49	
6/13/11 9:48:00	1.50	16.62	0.7	14.46	
6/13/11 9:48:15	1.49	16.63	0.8	14.40	
6/13/11 9:48:30	1.48	16.64	0.7	14.33	
6/13/11 9:48:45	1.46	16.65	0.9	14.45	
6/13/11 9:49:00	1.43	16.67	0.7	14.55	
6/13/11 9:49:15	1.44	16.67	0.5	14.64	
6/13/11 9:49:30	1.46	16.66	0.7	14.69	
6/13/11 9:49:45	1.48	16.65	0.8	14.61	
6/13/11 9:50:00	1.49	16.64	0.5	14.57	
6/13/11 9:50:15	1.47	16.66	0.6	14.50	
6/13/11 9:50:30	1.46	16.66	0.7	14.66	
6/13/11 9:50:45	1.44	16.67	0.7	14.93	
6/13/11 9:51:00	1.44	16.68	0.7	14.95	
6/13/11 9:51:15	1.47	16.67	0.7	14.98	
6/13/11 9:51:30	1.50	16.66	0.7	14.98	
6/13/11 9:51:45	1.51	16.64	0.9	14.97	
6/13/11 9:52:00	1.50	16.64	0.9	15.03	
6/13/11 9:52:15	1.49	16.65	0.7	15.14	
6/13/11 9:52:30	1.50	16.65	0.7	15.21	
6/13/11 9:52:45	1.51	16.63	0.7	15.07	
6/13/11 9:53:00	1.52	16.62	0.8	15.11	
6/13/11 9:53:15	1.50	16.63	0.6	15.23	
6/13/11 9:53:30	1.50	16.63	0.8	15.28	
6/13/11 9:53:45	1.50	16.65	1.0	15.45	
6/13/11 9:54:00	1.51	16.63	0.8	15.39	
6/13/11 9:54:15	1.54	16.61	0.8	15.23	
6/13/11 9:54:30	1.53	16.62	0.8	15.15	
6/13/11 9:54:45	1.50	16.64	0.7	15.08	
6/13/11 9:55:00	1.47	16.66	0.5	15.11	
6/13/11 9:55:15	1.47	16.68	0.5	15.14	
6/13/11 9:55:30	1.48	16.67	0.7	15.16	
6/13/11 9:55:45	1.48	16.66	0.6	15.17	
6/13/11 9:56:00	1.49	16.65	0.6	15.09	
6/13/11 9:56:15	1.50	16.64	0.8	14.89	
6/13/11 9:56:30	1.49	16.65	0.6	14.87	
6/13/11 9:56:45	1.47	16.67	0.7	14.85	
6/13/11 9:57:00	1.46	16.68	0.6	14.79	
6/13/11 9:57:15	1.47	16.67	0.7	14.75	
6/13/11 9:57:30	1.45	16.67	0.8	14.58	
6/13/11 9:57:45	1.43	16.69	0.7	14.61	
6/13/11 9:58:00	1.43	16.70	0.7	14.40	
6/13/11 9:58:15	1.39	16.72	0.8	14.42	
6/13/11 9:58:30	1.35	16.75	0.8	14.17	
6/13/11 9:58:45	1.34	16.75	0.8	14.08	
6/13/11 9:59:00	1.33	16.77	0.7	14.34	
6/13/11 9:59:15	1.31	16.77	0.6	14.11	
6/13/11 9:59:30	1.34	16.76	0.7	14.01	
6/13/11 9:59:45	1.35	16.76	0.6	13.87	
6/13/11 10:00:00	1.33	16.77	0.6	13.73	Start CTM 027
6/13/11 10:00:15	1.31	16.79	0.6	13.74	
6/13/11 10:00:30	1.29	16.80	0.7	13.71	
6/13/11 10:00:45	1.28	16.81	0.6	13.94	
6/13/11 10:01:00	1.28	16.81	0.6	14.00	
6/13/11 10:01:15	1.30	16.80	0.7	14.00	
6/13/11 10:01:30	1.33	16.79	0.9	13.78	
6/13/11 10:01:45	1.33	16.79	0.9	13.71	
6/13/11 10:02:00	1.30	16.80	0.9	13.69	
6/13/11 10:02:15	1.29	16.80	0.7	13.44	
6/13/11 10:02:30	1.29	16.80	0.7	13.31	
6/13/11 10:02:45	1.26	16.83	0.7	13.21	
6/13/11 10:03:00	1.24	16.85	0.6	13.26	
6/13/11 10:03:15	1.21	16.88	0.7	13.36	
6/13/11 10:03:30	1.20	16.88	0.8	13.24	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 10:03:45	1.21	16.88	0.8	13.29	
6/13/11 10:04:00	1.21	16.89	0.6	13.31	
6/13/11 10:04:15	1.22	16.88	0.6	13.22	
6/13/11 10:04:30	1.22	16.87	0.7	13.18	
6/13/11 10:04:45	1.21	16.88	0.7	13.12	
6/13/11 10:05:00	1.21	16.88	0.5	13.00	
6/13/11 10:05:15	1.21	16.89	0.6	12.92	
6/13/11 10:05:30	1.20	16.89	0.7	12.72	
6/13/11 10:05:45	1.18	16.92	0.8	12.72	
6/13/11 10:06:00	1.14	16.95	0.8	12.52	
6/13/11 10:06:15	1.13	16.95	0.7	12.89	
6/13/11 10:06:30	1.11	16.97	0.8	12.93	
6/13/11 10:06:45	1.10	16.98	0.8	12.65	
6/13/11 10:07:00	1.12	16.96	0.8	12.66	Restart M5B
6/13/11 10:07:15	1.11	16.97	0.7	12.63	
6/13/11 10:07:30	1.11	16.97	0.7	12.42	
6/13/11 10:07:45	1.12	16.97	0.8	12.29	
6/13/11 10:08:00	1.10	16.99	0.7	12.21	
6/13/11 10:08:15	1.08	16.99	0.6	12.12	
6/13/11 10:08:30	1.07	16.99	0.7	12.30	
6/13/11 10:08:45	1.05	17.00	0.6	12.39	
6/13/11 10:09:00	1.06	17.01	0.6	12.20	
6/13/11 10:09:15	1.06	17.03	0.7	12.03	
6/13/11 10:09:30	1.04	17.05	0.6	12.12	
6/13/11 10:09:45	1.01	17.06	0.6	11.99	
6/13/11 10:10:00	1.04	17.04	0.7	11.81	
6/13/11 10:10:15	1.05	17.04	0.7	11.83	
6/13/11 10:10:30	1.00	17.07	0.8	11.87	
6/13/11 10:10:45	1.00	17.08	0.8	11.93	
6/13/11 10:11:00	1.01	17.08	0.7	11.91	
6/13/11 10:11:15	1.02	17.08	0.7	11.94	
6/13/11 10:11:30	1.01	17.08	0.8	11.99	
6/13/11 10:11:45	1.01	17.09	0.8	12.11	
6/13/11 10:12:00	1.01	17.09	0.7	12.09	
6/13/11 10:12:15	1.04	17.06	0.8	12.07	
6/13/11 10:12:30	1.07	17.05	0.8	12.04	
6/13/11 10:12:45	1.06	17.05	0.6	12.03	
6/13/11 10:13:00	1.05	17.05	0.7	11.91	
6/13/11 10:13:15	1.05	17.03	0.7	11.89	
6/13/11 10:13:30	1.04	17.04	0.8	11.94	
6/13/11 10:13:45	1.02	17.05	0.8	12.01	FCCU-29-1 Port Change
6/13/11 10:14:00	1.02	17.06	0.5	11.93	
6/13/11 10:14:15	1.04	17.05	0.5	11.82	
6/13/11 10:14:30	1.02	17.07	0.7	11.84	
6/13/11 10:14:45	0.99	17.09	0.6	11.81	
6/13/11 10:15:00	0.99	17.09	0.6	11.96	
6/13/11 10:15:15	1.00	17.09	0.5	12.09	
6/13/11 10:15:30	1.03	17.07	0.7	11.90	
6/13/11 10:15:45	1.04	17.05	0.7	11.74	
6/13/11 10:16:00	1.03	17.05	0.6	11.79	
6/13/11 10:16:15	1.01	17.06	0.6	11.93	
6/13/11 10:16:30	1.02	17.05	0.6	12.06	
6/13/11 10:16:45	1.03	17.06	0.4	11.96	
6/13/11 10:17:00	1.04	17.07	0.5	11.97	
6/13/11 10:17:15	1.03	17.07	0.6	11.94	
6/13/11 10:17:30	1.03	17.08	0.6	11.99	
6/13/11 10:17:45	1.03	17.08	0.8	12.00	
6/13/11 10:18:00	1.04	17.07	0.7	11.93	
6/13/11 10:18:15	1.05	17.06	0.6	11.84	
6/13/11 10:18:30	1.05	17.06	0.7	11.75	
6/13/11 10:18:45	1.03	17.06	0.6	11.64	
6/13/11 10:19:00	1.00	17.07	0.5	11.54	
6/13/11 10:19:15	0.96	17.10	0.7	11.54	
6/13/11 10:19:30	0.95	17.11	0.6	11.48	
6/13/11 10:19:45	0.95	17.11	0.6	11.57	
6/13/11 10:20:00	0.94	17.12	0.7	11.65	
6/13/11 10:20:15	0.94	17.12	0.7	11.75	
6/13/11 10:20:30	0.95	17.12	0.6	11.76	
6/13/11 10:20:45	0.96	17.13	0.6	11.78	
6/13/11 10:21:00	0.98	17.12	0.7	11.72	
6/13/11 10:21:15	0.98	17.11	0.6	11.68	
6/13/11 10:21:30	0.96	17.12	0.6	11.54	
6/13/11 10:21:45	0.96	17.13	0.6	11.55	
6/13/11 10:22:00	0.94	17.13	0.6	11.45	Restart M29 & CTM 027
6/13/11 10:22:15	0.92	17.15	0.7	11.59	
6/13/11 10:22:30	0.91	17.16	0.7	11.57	
6/13/11 10:22:45	0.95	17.13	0.6	11.56	
6/13/11 10:23:00	0.96	17.12	0.5	11.38	
6/13/11 10:23:15	0.95	17.13	0.5	11.33	
6/13/11 10:23:30	0.92	17.15	0.5	11.23	
6/13/11 10:23:45	0.89	17.17	0.5	11.30	
6/13/11 10:24:00	0.87	17.19	0.5	11.35	
6/13/11 10:24:15	0.88	17.18	0.5	11.19	
6/13/11 10:24:30	0.90	17.17	0.5	11.04	
6/13/11 10:24:45	0.88	17.19	0.4	11.04	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 10:25:00	0.85	17.22	0.6	11.22	
6/13/11 10:25:15	0.85	17.22	0.6	11.18	
6/13/11 10:25:30	0.88	17.20	0.7	11.15	
6/13/11 10:25:45	0.90	17.18	0.6	11.14	
6/13/11 10:26:00	0.90	17.17	0.6	11.07	
6/13/11 10:26:15	0.89	17.17	0.6	11.05	
6/13/11 10:26:30	0.88	17.19	0.7	11.20	
6/13/11 10:26:45	0.87	17.19	0.5	11.12	
6/13/11 10:27:00	0.89	17.19	0.5	11.02	
6/13/11 10:27:15	0.88	17.18	0.4	11.05	
6/13/11 10:27:30	0.86	17.18	0.5	11.07	
6/13/11 10:27:45	0.86	17.18	0.5	11.20	
6/13/11 10:28:00	0.86	17.19	0.6	11.14	
6/13/11 10:28:15	0.87	17.19	0.5	11.11	
6/13/11 10:28:30	0.88	17.18	0.6	11.04	
6/13/11 10:28:45	0.88	17.19	0.6	10.99	
6/13/11 10:29:00	0.86	17.20	0.5	10.87	
6/13/11 10:29:15	0.85	17.21	0.4	10.93	
6/13/11 10:29:30	0.84	17.22	0.4	10.93	
6/13/11 10:29:45	0.83	17.22	0.5	11.02	
6/13/11 10:30:00	0.84	17.21	0.7	11.01	
6/13/11 10:30:15	0.86	17.20	0.6	10.88	
6/13/11 10:30:30	0.86	17.20	0.3	10.85	
6/13/11 10:30:45	0.83	17.22	0.4	10.78	
6/13/11 10:31:00	0.82	17.24	0.5	10.81	
6/13/11 10:31:15	0.81	17.25	0.5	10.86	
6/13/11 10:31:30	0.82	17.24	0.6	10.84	
6/13/11 10:31:45	0.83	17.23	0.6	10.70	
6/13/11 10:32:00	0.82	17.23	0.6	10.87	
6/13/11 10:32:15	0.80	17.25	0.5	10.90	
6/13/11 10:32:30	0.81	17.23	0.5	10.78	
6/13/11 10:32:45	0.82	17.24	0.5	10.81	
6/13/11 10:33:00	0.81	17.26	0.4	10.74	
6/13/11 10:33:15	0.80	17.26	0.4	10.78	
6/13/11 10:33:30	0.79	17.28	0.4	10.79	
6/13/11 10:33:45	0.79	17.28	0.5	10.75	
6/13/11 10:34:00	0.80	17.27	0.6	10.64	
6/13/11 10:34:15	0.80	17.26	0.4	10.60	
6/13/11 10:34:30	0.79	17.27	0.5	10.56	
6/13/11 10:34:45	0.78	17.27	0.5	10.49	
6/13/11 10:35:00	0.78	17.27	0.4	10.50	
6/13/11 10:35:15	0.78	17.27	0.6	10.42	
6/13/11 10:35:30	0.79	17.26	0.5	10.37	
6/13/11 10:35:45	0.79	17.26	0.5	10.17	
6/13/11 10:36:00	0.78	17.27	0.7	10.06	
6/13/11 10:36:15	0.76	17.30	0.7	10.15	
6/13/11 10:36:30	0.74	17.31	0.6	10.20	
6/13/11 10:36:45	0.75	17.29	0.6	10.11	
6/13/11 10:37:00	0.78	17.26	0.6	10.06	
6/13/11 10:37:15	0.77	17.27	0.5	9.97	
6/13/11 10:37:30	0.75	17.28	0.5	9.68	
6/13/11 10:37:45	0.74	17.30	0.5	9.65	
6/13/11 10:38:00	0.71	17.34	0.6	9.69	
6/13/11 10:38:15	0.70	17.34	0.5	9.73	
6/13/11 10:38:30	0.72	17.34	0.4	9.87	
6/13/11 10:38:45	0.73	17.33	0.5	9.95	
6/13/11 10:39:00	0.75	17.33	0.3	9.94	
6/13/11 10:39:15	0.76	17.31	0.4	9.78	
6/13/11 10:39:30	0.77	17.30	0.5	9.59	
6/13/11 10:39:45	0.74	17.32	0.4	9.68	
6/13/11 10:40:00	0.71	17.33	0.4	9.78	
6/13/11 10:40:15	0.71	17.32	0.4	9.75	
6/13/11 10:40:30	0.72	17.32	0.5	9.64	
6/13/11 10:40:45	0.72	17.32	0.4	9.61	
6/13/11 10:41:00	0.71	17.33	0.2	9.63	
6/13/11 10:41:15	0.70	17.36	0.5	9.65	
6/13/11 10:41:30	0.71	17.39	0.7	9.65	
6/13/11 10:41:45	0.73	17.38	0.4	9.62	
6/13/11 10:42:00	0.73	17.39	0.4	9.56	
6/13/11 10:42:15	0.73	17.40	0.6	9.65	
6/13/11 10:42:30	0.71	17.42	0.5	9.73	
6/13/11 10:42:45	0.70	17.43	0.6	9.70	
6/13/11 10:43:00	0.70	17.43	0.5	9.69	
6/13/11 10:43:15	0.71	17.43	0.5	9.78	
6/13/11 10:43:30	0.69	17.44	0.5	9.79	
6/13/11 10:43:45	0.70	17.42	0.4	9.71	
6/13/11 10:44:00	0.70	17.42	0.6	9.67	
6/13/11 10:44:15	0.69	17.42	0.5	9.70	
6/13/11 10:44:30	0.69	17.43	0.6	9.80	
6/13/11 10:44:45	0.69	17.44	0.4	9.86	
6/13/11 10:45:00	0.71	17.42	0.5	9.77	
6/13/11 10:45:15	0.72	17.42	0.5	9.80	
6/13/11 10:45:30	0.71	17.43	0.5	9.87	
6/13/11 10:45:45	0.71	17.43	0.5	10.04	
6/13/11 10:46:00	0.71	17.42	0.5	10.12	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 10:46:15	0.73	17.41	0.5	9.87	
6/13/11 10:46:30	0.75	17.41	0.5	9.96	
6/13/11 10:46:45	0.73	17.42	0.5	10.13	
6/13/11 10:47:00	0.73	17.42	0.4	10.07	
6/13/11 10:47:15	0.75	17.41	0.5	10.06	
6/13/11 10:47:30	0.73	17.40	0.5	9.97	
6/13/11 10:47:45	0.71	17.41	0.6	10.14	
6/13/11 10:48:00	0.70	17.42	0.8	10.02	
6/13/11 10:48:15	0.72	17.42	0.6	9.93	
6/13/11 10:48:30	0.72	17.42	0.5	10.05	
6/13/11 10:48:45	0.70	17.43	0.5	9.99	
6/13/11 10:49:00	0.71	17.43	0.5	10.05	
6/13/11 10:49:15	0.72	17.43	0.5	10.13	
6/13/11 10:49:30	0.72	17.43	0.5	10.08	
6/13/11 10:49:45	0.73	17.42	0.6	10.10	
6/13/11 10:50:00	0.74	17.42	0.5	10.20	
6/13/11 10:50:15	0.75	17.41	0.4	10.29	
6/13/11 10:50:30	0.76	17.40	0.5	10.35	
6/13/11 10:50:45	0.78	17.37	0.5	10.47	
6/13/11 10:51:00	0.80	17.36	0.4	10.46	
6/13/11 10:51:15	0.81	17.36	0.4	10.49	
6/13/11 10:51:30	0.81	17.37	0.5	10.62	
6/13/11 10:51:45	0.81	17.36	0.3	10.69	
6/13/11 10:52:00	0.82	17.34	0.4	10.66	
6/13/11 10:52:15	0.84	17.34	0.6	10.58	
6/13/11 10:52:30	0.84	17.34	0.7	10.51	
6/13/11 10:52:45	0.83	17.34	0.4	10.40	
6/13/11 10:53:00	0.80	17.35	0.5	10.54	
6/13/11 10:53:15	0.79	17.36	0.7	10.63	
6/13/11 10:53:30	0.81	17.35	0.6	10.77	
6/13/11 10:53:45	0.83	17.33	0.8	10.79	
6/13/11 10:54:00	0.86	17.31	0.6	10.77	
6/13/11 10:54:15	0.88	17.30	0.5	10.70	
6/13/11 10:54:30	0.87	17.30	0.3	10.68	
6/13/11 10:54:45	0.86	17.30	0.4	10.72	
6/13/11 10:55:00	0.85	17.31	0.5	10.80	
6/13/11 10:55:15	0.85	17.31	0.4	10.75	
6/13/11 10:55:30	0.87	17.29	0.4	10.83	
6/13/11 10:55:45	0.88	17.28	0.3	10.95	
6/13/11 10:56:00	0.88	17.29	0.5	11.11	
6/13/11 10:56:15	0.90	17.29	0.5	11.09	
6/13/11 10:56:30	0.93	17.27	0.5	11.12	
6/13/11 10:56:45	0.93	17.26	0.6	11.20	
6/13/11 10:57:00	0.93	17.26	0.3	11.39	
6/13/11 10:57:15	0.93	17.27	0.4	11.43	
6/13/11 10:57:30	0.95	17.24	0.3	11.27	
6/13/11 10:57:45	0.98	17.21	0.5	11.25	
6/13/11 10:58:00	0.97	17.22	0.6	11.39	
6/13/11 10:58:15	0.94	17.24	0.5	11.59	
6/13/11 10:58:30	0.95	17.25	0.6	11.58	
6/13/11 10:58:45	0.99	17.22	0.7	11.49	
6/13/11 10:59:00	1.00	17.21	0.3	11.51	
6/13/11 10:59:15	0.99	17.20	0.3	11.49	
6/13/11 10:59:30	1.00	17.19	0.5	11.74	
6/13/11 10:59:45	0.99	17.20	0.4	11.86	
6/13/11 11:00:00	1.02	17.17	0.4	11.81	
6/13/11 11:00:15	1.06	17.14	0.4	11.80	
6/13/11 11:00:30	1.05	17.14	0.4	11.64	
6/13/11 11:00:45	1.04	17.14	0.6	11.48	
6/13/11 11:01:00	1.03	17.15	0.5	11.54	
6/13/11 11:01:15	1.02	17.16	0.5	11.72	
6/13/11 11:01:30	1.03	17.16	0.4	11.80	
6/13/11 11:01:45	1.04	17.15	0.3	11.86	
6/13/11 11:02:00	1.07	17.13	0.6	11.90	
6/13/11 11:02:15	1.09	17.10	0.5	11.95	
6/13/11 11:02:30	1.10	17.10	0.6	11.90	
6/13/11 11:02:45	1.12	17.09	0.4	11.90	
6/13/11 11:03:00	1.12	17.09	0.6	11.81	Restart FCCU-027-1
6/13/11 11:03:15	1.11	17.09	0.5	11.84	
6/13/11 11:03:30	1.09	17.11	0.5	11.88	
6/13/11 11:03:45	1.09	17.11	0.3	11.91	
6/13/11 11:04:00	1.10	17.11	0.4	12.07	
6/13/11 11:04:15	1.09	17.11	0.4	12.07	
6/13/11 11:04:30	1.10	17.10	0.5	12.01	
6/13/11 11:04:45	1.09	17.11	0.5	11.93	
6/13/11 11:05:00	1.08	17.11	0.4	11.73	
6/13/11 11:05:15	1.09	17.12	0.5	11.61	
6/13/11 11:05:30	1.07	17.13	0.4	11.64	
6/13/11 11:05:45	1.04	17.14	0.7	11.72	
6/13/11 11:06:00	1.03	17.15	0.6	11.95	
6/13/11 11:06:15	1.03	17.15	0.4	12.06	
6/13/11 11:06:30	1.05	17.14	0.5	11.90	
6/13/11 11:06:45	1.08	17.13	0.5	11.90	FCCU-29-1 Port Change
6/13/11 11:07:00	1.05	17.15	0.4	11.81	
6/13/11 11:07:15	1.04	17.16	0.4	11.82	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 11:07:30	1.03	17.17	0.5	11.86	
6/13/11 11:07:45	1.04	17.16	0.5	11.75	
6/13/11 11:08:00	1.07	17.14	0.5	11.84	
6/13/11 11:08:15	1.08	17.13	0.5	12.04	
6/13/11 11:08:30	1.08	17.12	0.5	12.12	
6/13/11 11:08:45	1.10	17.11	0.5	12.14	
6/13/11 11:09:00	1.11	17.09	0.6	12.12	
6/13/11 11:09:15	1.12	17.08	0.3	12.15	
6/13/11 11:09:30	1.13	17.08	0.4	12.30	
6/13/11 11:09:45	1.14	17.07	0.3	12.29	
6/13/11 11:10:00	1.16	17.04	0.5	12.23	
6/13/11 11:10:15	1.18	17.02	0.6	12.16	
6/13/11 11:10:30	1.18	17.02	0.4	12.32	
6/13/11 11:10:45	1.17	17.03	0.5	12.35	
6/13/11 11:11:00	1.17	17.02	0.3	12.30	
6/13/11 11:11:15	1.17	17.03	0.5	12.36	
6/13/11 11:11:30	1.16	17.03	0.5	12.34	
6/13/11 11:11:45	1.17	17.04	0.5	12.31	
6/13/11 11:12:00	1.17	17.03	0.6	12.33	
6/13/11 11:12:15	1.17	17.02	0.5	12.32	
6/13/11 11:12:30	1.18	17.00	0.5	12.40	
6/13/11 11:12:45	1.19	17.00	0.4	12.43	
6/13/11 11:13:00	1.20	17.00	0.5	12.43	Restart FCCU-29-1
6/13/11 11:13:15	1.21	17.00	0.4	12.49	
6/13/11 11:13:30	1.21	17.00	0.6	12.59	
6/13/11 11:13:45	1.22	16.99	0.5	12.50	
6/13/11 11:14:00	1.21	16.97	0.4	12.44	
6/13/11 11:14:15	1.19	16.99	0.4	12.57	
6/13/11 11:14:30	1.17	17.01	0.6	12.59	
6/13/11 11:14:45	1.20	17.00	0.5	12.50	
6/13/11 11:15:00	1.22	16.98	0.4	12.48	
6/13/11 11:15:15	1.22	16.97	0.5	12.51	
6/13/11 11:15:30	1.22	16.97	0.6	12.55	
6/13/11 11:15:45	1.24	16.95	0.3	12.47	
6/13/11 11:16:00	1.25	16.94	0.4	12.51	
6/13/11 11:16:15	1.23	16.96	0.3	12.63	
6/13/11 11:16:30	1.21	16.97	0.2	12.51	
6/13/11 11:16:45	1.20	16.98	0.4	12.56	
6/13/11 11:17:00	1.20	16.98	0.4	12.72	
6/13/11 11:17:15	1.22	16.96	0.4	12.61	
6/13/11 11:17:30	1.25	16.94	0.4	12.74	
6/13/11 11:17:45	1.26	16.93	0.5	12.82	
6/13/11 11:18:00	1.28	16.92	0.5	12.77	
6/13/11 11:18:15	1.30	16.89	0.5	12.72	
6/13/11 11:18:30	1.28	16.90	0.6	12.79	
6/13/11 11:18:45	1.25	16.93	0.6	12.84	
6/13/11 11:19:00	1.24	16.94	0.7	12.68	
6/13/11 11:19:15	1.26	16.93	0.7	12.67	
6/13/11 11:19:30	1.25	16.94	0.6	12.85	
6/13/11 11:19:45	1.23	16.94	0.6	12.88	
6/13/11 11:20:00	1.24	16.93	0.6	13.00	
6/13/11 11:20:15	1.24	16.95	0.7	12.92	
6/13/11 11:20:30	1.25	16.94	0.5	12.88	
6/13/11 11:20:45	1.24	16.94	0.6	12.80	
6/13/11 11:21:00	1.23	16.95	0.5	12.67	
6/13/11 11:21:15	1.22	16.95	0.5	12.63	
6/13/11 11:21:30	1.22	16.95	0.6	12.71	
6/13/11 11:21:45	1.23	16.95	0.8	12.70	
6/13/11 11:22:00	1.23	16.95	0.7	12.51	
6/13/11 11:22:15	1.22	16.96	0.4	12.53	
6/13/11 11:22:30	1.18	16.99	0.6	12.60	
6/13/11 11:22:45	1.18	16.99	0.7	12.65	
6/13/11 11:23:00	1.20	17.00	0.7	12.49	
6/13/11 11:23:15	1.21	17.02	0.6	12.40	
6/13/11 11:23:30	1.20	17.04	0.6	12.38	
6/13/11 11:23:45	1.18	17.06	0.6	12.24	
6/13/11 11:24:00	1.17	17.09	0.6	12.20	
6/13/11 11:24:15	1.15	17.13	0.8	12.22	
6/13/11 11:24:30	1.14	17.15	0.7	12.30	
6/13/11 11:24:45	1.16	17.14	0.8	12.32	
6/13/11 11:25:00	1.16	17.14	0.6	12.24	
6/13/11 11:25:15	1.16	17.15	0.7	12.32	
6/13/11 11:25:30	1.16	17.14	0.8	12.26	
6/13/11 11:25:45	1.18	17.13	0.7	12.12	
6/13/11 11:26:00	1.17	17.13	0.5	12.15	
6/13/11 11:26:15	1.15	17.14	0.7	12.09	
6/13/11 11:26:30	1.14	17.16	0.7	12.01	
6/13/11 11:26:45	1.13	17.18	0.7	11.99	
6/13/11 11:27:00	1.12	17.19	0.5	12.04	
6/13/11 11:27:15	1.10	17.20	0.7	11.93	
6/13/11 11:27:30	1.09	17.20	0.6	12.10	
6/13/11 11:27:45	1.09	17.20	0.5	12.18	
6/13/11 11:28:00	1.10	17.20	0.6	12.18	
6/13/11 11:28:15	1.12	17.19	0.7	12.03	
6/13/11 11:28:30	1.13	17.18	0.8	11.91	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 11:28:45	1.13	17.18	0.8	12.11	
6/13/11 11:29:00	1.12	17.18	0.7	12.17	
6/13/11 11:29:15	1.14	17.15	0.9	12.10	
6/13/11 11:29:30	1.15	17.14	0.9	12.27	
6/13/11 11:29:45	1.12	17.15	0.8	12.43	
6/13/11 11:30:00	1.11	17.16	0.6	12.34	
6/13/11 11:30:15	1.14	17.15	0.7	12.32	
6/13/11 11:30:30	1.16	17.13	0.7	12.28	
6/13/11 11:30:45	1.18	17.11	0.7	12.15	
6/13/11 11:31:00	1.18	17.09	0.8	12.02	
6/13/11 11:31:15	1.17	17.11	0.8	11.91	
6/13/11 11:31:30	1.15	17.12	0.8	11.82	
6/13/11 11:31:45	1.14	17.13	0.7	11.50	
6/13/11 11:32:00	1.13	17.13	0.9	11.37	
6/13/11 11:32:15	1.09	17.15	0.6	11.31	
6/13/11 11:32:30	1.04	17.18	0.4	11.43	
6/13/11 11:32:45	1.02	17.19	0.6	11.52	
6/13/11 11:33:00	1.05	17.19	0.8	11.32	
6/13/11 11:33:15	1.06	17.19	0.8	11.16	
6/13/11 11:33:30	1.04	17.21	0.9	11.21	
6/13/11 11:33:45	1.01	17.23	0.8	11.06	
6/13/11 11:34:00	1.01	17.23	0.8	11.03	
6/13/11 11:34:15	0.99	17.24	0.8	11.14	
6/13/11 11:34:30	0.97	17.24	0.7	11.24	
6/13/11 11:34:45	0.98	17.24	0.6	11.23	
6/13/11 11:35:00	0.99	17.25	0.8	11.06	
6/13/11 11:35:15	0.99	17.26	0.9	11.00	
6/13/11 11:35:30	0.97	17.26	0.9	10.93	
6/13/11 11:35:45	0.94	17.26	0.8	10.85	
6/13/11 11:36:00	0.92	17.27	0.7	10.78	
6/13/11 11:36:15	0.90	17.29	0.8	10.76	
6/13/11 11:36:30	0.88	17.31	0.8	10.71	
6/13/11 11:36:45	0.87	17.31	1.0	10.59	
6/13/11 11:37:00	0.87	17.32	0.8	10.53	
6/13/11 11:37:15	0.85	17.34	0.9	10.46	
6/13/11 11:37:30	0.84	17.35	0.8	10.43	
6/13/11 11:37:45	0.82	17.36	0.8	10.50	
6/13/11 11:38:00	0.82	17.37	1.0	10.51	
6/13/11 11:38:15	0.84	17.37	1.0	10.54	
6/13/11 11:38:30	0.85	17.36	1.1	10.44	
6/13/11 11:38:45	0.85	17.35	1.0	10.41	
6/13/11 11:39:00	0.85	17.35	1.0	10.32	
6/13/11 11:39:15	0.84	17.36	1.1	10.22	
6/13/11 11:39:30	0.83	17.37	1.0	10.05	
6/13/11 11:39:45	0.81	17.39	0.8	9.91	
6/13/11 11:40:00	0.79	17.42	0.9	9.92	
6/13/11 11:40:15	0.76	17.44	1.0	9.96	
6/13/11 11:40:30	0.75	17.46	0.9	9.77	
6/13/11 11:40:45	0.75	17.45	1.0	9.64	
6/13/11 11:41:00	0.74	17.46	1.1	9.69	
6/13/11 11:41:15	0.72	17.47	1.0	9.72	
6/13/11 11:41:30	0.72	17.49	1.0	9.70	
6/13/11 11:41:45	0.72	17.50	1.1	9.72	
6/13/11 11:42:00	0.72	17.50	1.2	9.69	
6/13/11 11:42:15	0.72	17.48	1.2	9.49	
6/13/11 11:42:30	0.72	17.47	1.0	9.35	
6/13/11 11:42:45	0.70	17.50	1.1	9.39	
6/13/11 11:43:00	0.66	17.52	1.0	9.47	
6/13/11 11:43:15	0.66	17.53	1.0	9.37	
6/13/11 11:43:30	0.66	17.54	1.1	9.36	
6/13/11 11:43:45	0.65	17.56	0.9	9.35	
6/13/11 11:44:00	0.66	17.55	1.1	9.26	
6/13/11 11:44:15	0.67	17.54	1.0	9.28	
6/13/11 11:44:30	0.65	17.54	1.1	9.47	
6/13/11 11:44:45	0.65	17.54	1.1	9.34	
6/13/11 11:45:00	0.67	17.53	1.0	9.18	
6/13/11 11:45:15	0.66	17.54	1.1	9.00	
6/13/11 11:45:30	0.63	17.56	1.2	9.00	
6/13/11 11:45:45	0.60	17.58	1.2	8.96	
6/13/11 11:46:00	0.59	17.60	1.0	8.86	
6/13/11 11:46:15	0.58	17.61	1.2	8.82	
6/13/11 11:46:30	0.57	17.62	1.2	8.74	
6/13/11 11:46:45	0.56	17.61	1.0	8.73	
6/13/11 11:47:00	0.56	17.61	1.0	8.73	
6/13/11 11:47:15	0.56	17.61	1.1	8.74	
6/13/11 11:47:30	0.56	17.61	1.1	8.45	
6/13/11 11:47:45	0.56	17.62	1.2	8.46	
6/13/11 11:48:00	0.54	17.64	1.0	8.37	
6/13/11 11:48:15	0.53	17.65	0.9	8.25	
6/13/11 11:48:30	0.52	17.65	1.1	8.19	
6/13/11 11:48:45	0.50	17.66	1.1	8.14	
6/13/11 11:49:00	0.49	17.67	1.1	8.19	
6/13/11 11:49:15	0.49	17.68	1.1	8.13	
6/13/11 11:49:30	0.49	17.69	1.2	8.06	
6/13/11 11:49:45	0.49	17.70	1.2	8.02	

FCCU-027-1 Complete

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 11:50:00	0.48	17.71	1.2	8.13	
6/13/11 11:50:15	0.47	17.72	1.2	8.12	
6/13/11 11:50:30	0.48	17.71	1.2	7.97	
6/13/11 11:50:45	0.48	17.71	1.2	7.76	
6/13/11 11:51:00	0.47	17.73	1.2	7.76	
6/13/11 11:51:15	0.45	17.74	1.3	7.91	
6/13/11 11:51:30	0.45	17.73	1.2	8.04	
6/13/11 11:51:45	0.46	17.72	1.0	7.89	
6/13/11 11:52:00	0.48	17.72	1.3	7.91	
6/13/11 11:52:15	0.47	17.72	1.0	8.00	
6/13/11 11:52:30	0.47	17.72	1.1	8.14	
6/13/11 11:52:45	0.48	17.71	1.2	7.96	
6/13/11 11:53:00	0.50	17.70	1.1	7.94	
6/13/11 11:53:15	0.49	17.72	1.2	7.88	
6/13/11 11:53:30	0.47	17.73	1.4	7.89	
6/13/11 11:53:45	0.47	17.73	1.4	7.91	
6/13/11 11:54:00	0.47	17.73	1.4	7.73	
6/13/11 11:54:15	0.47	17.73	1.2	7.45	
6/13/11 11:54:30	0.46	17.74	1.2	7.32	
6/13/11 11:54:45	0.43	17.76	1.3	7.47	
6/13/11 11:55:00	0.41	17.77	1.2	7.53	
6/13/11 11:55:15	0.42	17.77	1.1	7.69	
6/13/11 11:55:30	0.44	17.76	1.3	7.83	
6/13/11 11:55:45	0.47	17.74	1.3	7.84	
6/13/11 11:56:00	0.50	17.72	1.1	7.73	
6/13/11 11:56:15	0.51	17.71	1.1	7.61	
6/13/11 11:56:30	0.50	17.71	1.3	7.55	
6/13/11 11:56:45	0.48	17.71	1.1	7.66	
6/13/11 11:57:00	0.47	17.71	1.0	7.54	
6/13/11 11:57:15	0.47	17.72	1.1	7.57	
6/13/11 11:57:30	0.47	17.73	1.2	7.52	
6/13/11 11:57:45	0.46	17.73	1.3	7.44	
6/13/11 11:58:00	0.47	17.74	1.3	7.49	FCCU-29-1 Port Change
6/13/11 11:58:15	0.46	17.74	1.1	7.51	
6/13/11 11:58:30	0.45	17.73	1.2	7.48	
6/13/11 11:58:45	0.46	17.74	1.3	7.57	
6/13/11 11:59:00	0.46	17.75	1.3	7.68	
6/13/11 11:59:15	0.47	17.74	1.3	7.57	
6/13/11 11:59:30	0.48	17.73	1.4	7.66	
6/13/11 11:59:45	0.47	17.73	1.2	7.74	
6/13/11 12:00:00	0.48	17.73	1.2	7.66	
6/13/11 12:00:15	0.49	17.73	1.4	7.93	
6/13/11 12:00:30	0.48	17.74	1.3	7.95	
6/13/11 12:00:45	0.49	17.73	1.4	7.71	
6/13/11 12:01:00	0.50	17.72	1.4	7.78	
6/13/11 12:01:15	0.48	17.73	1.3	7.83	
6/13/11 12:01:30	0.47	17.74	1.5	7.67	
6/13/11 12:01:45	0.48	17.73	1.4	7.70	
6/13/11 12:02:00	0.47	17.73	1.3	7.85	
6/13/11 12:02:15	0.47	17.73	1.4	7.88	
6/13/11 12:02:30	0.48	17.73	1.4	7.85	
6/13/11 12:02:45	0.48	17.74	1.5	7.64	
6/13/11 12:03:00	0.48	17.74	1.5	7.49	
6/13/11 12:03:15	0.46	17.74	1.4	7.55	
6/13/11 12:03:30	0.44	17.76	1.3	7.61	
6/13/11 12:03:45	0.44	17.77	1.4	7.82	
6/13/11 12:04:00	0.46	17.76	1.5	7.94	Restart FCCU-29-1
6/13/11 12:04:15	0.48	17.75	1.5	7.80	
6/13/11 12:04:30	0.50	17.73	1.3	8.02	
6/13/11 12:04:45	0.49	17.73	1.4	8.13	
6/13/11 12:05:00	0.50	17.72	1.3	8.08	
6/13/11 12:05:15	0.51	17.71	1.2	8.13	
6/13/11 12:05:30	0.51	17.72	1.3	7.94	
6/13/11 12:05:45	0.50	17.73	1.3	8.28	
6/13/11 12:06:00	0.49	17.73	1.5	8.15	
6/13/11 12:06:15	0.51	17.70	1.3	7.80	
6/13/11 12:06:30	0.51	17.70	1.4	7.78	
6/13/11 12:06:45	0.48	17.72	1.4	7.98	
6/13/11 12:07:00	0.47	17.75	1.3	7.94	
6/13/11 12:07:15	0.48	17.76	1.2	8.08	
6/13/11 12:07:30	0.47	17.76	1.4	7.97	
6/13/11 12:07:45	0.48	17.75	1.5	8.07	
6/13/11 12:08:00	0.50	17.74	1.6	8.52	
6/13/11 12:08:15	0.52	17.72	1.6	8.64	
6/13/11 12:08:30	0.56	17.68	1.6	8.61	
6/13/11 12:08:45	0.59	17.67	1.5	8.60	
6/13/11 12:09:00	0.59	17.67	1.3	8.62	
6/13/11 12:09:15	0.58	17.67	1.3	8.82	
6/13/11 12:09:30	0.58	17.69	1.6	8.83	
6/13/11 12:09:45	0.59	17.67	1.5	8.88	
6/13/11 12:10:00	0.60	17.66	1.4	8.99	
6/13/11 12:10:15	0.60	17.66	1.5	9.02	
6/13/11 12:10:30	0.61	17.65	1.5	9.06	
6/13/11 12:10:45	0.61	17.64	1.5	9.00	
6/13/11 12:11:00	0.62	17.64	1.5	9.30	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 12:11:15	0.61	17.65	1.4	9.28	
6/13/11 12:11:30	0.63	17.63	1.5	9.27	
6/13/11 12:11:45	0.65	17.61	1.4	9.20	
6/13/11 12:12:00	0.65	17.60	1.3	9.34	
6/13/11 12:12:15	0.65	17.60	1.5	9.65	
6/13/11 12:12:30	0.66	17.59	1.4	9.92	
6/13/11 12:12:45	0.68	17.58	1.4	9.82	
6/13/11 12:13:00	0.71	17.57	1.4	9.85	
6/13/11 12:13:15	0.71	17.56	1.4	9.98	
6/13/11 12:13:30	0.71	17.56	1.4	10.13	
6/13/11 12:13:45	0.72	17.55	1.5	10.29	
6/13/11 12:14:00	0.72	17.54	1.3	10.36	
6/13/11 12:14:15	0.75	17.52	1.2	10.24	
6/13/11 12:14:30	0.76	17.50	1.2	10.34	
6/13/11 12:14:45	0.75	17.50	1.4	10.29	
6/13/11 12:15:00	0.76	17.49	1.4	10.30	
6/13/11 12:15:15	0.76	17.50	1.6	10.53	
6/13/11 12:15:30	0.76	17.52	1.7	10.62	
6/13/11 12:15:45	0.79	17.51	1.9	10.59	
6/13/11 12:16:00	0.83	17.48	1.8	10.49	
6/13/11 12:16:15	0.84	17.47	1.6	10.45	
6/13/11 12:16:30	0.84	17.47	1.5	10.50	
6/13/11 12:16:45	0.83	17.46	1.3	10.65	
6/13/11 12:17:00	0.83	17.44	1.3	10.69	
6/13/11 12:17:15	0.85	17.43	1.4	10.60	
6/13/11 12:17:30	0.88	17.42	1.5	10.66	
6/13/11 12:17:45	0.87	17.42	1.6	10.66	
6/13/11 12:18:00	0.87	17.42	1.5	10.58	
6/13/11 12:18:15	0.87	17.42	1.4	10.63	
6/13/11 12:18:30	0.85	17.43	1.5	10.77	
6/13/11 12:18:45	0.85	17.43	1.7	10.88	
6/13/11 12:19:00	0.88	17.41	1.6	10.79	
6/13/11 12:19:15	0.91	17.40	1.6	10.89	
6/13/11 12:19:30	0.91	17.40	1.7	11.15	
6/13/11 12:19:45	0.92	17.39	1.5	11.28	
6/13/11 12:20:00	0.95	17.36	1.7	11.18	
6/13/11 12:20:15	0.97	17.36	1.6	11.21	
6/13/11 12:20:30	0.95	17.37	1.6	11.27	
6/13/11 12:20:45	0.94	17.37	1.4	11.32	
6/13/11 12:21:00	0.95	17.36	1.4	11.13	
6/13/11 12:21:15	0.97	17.34	1.6	11.10	
6/13/11 12:21:30	0.96	17.34	1.6	11.25	
6/13/11 12:21:45	0.95	17.33	1.7	11.42	
6/13/11 12:22:00	0.97	17.32	1.6	11.43	
6/13/11 12:22:15	0.99	17.30	1.6	11.33	
6/13/11 12:22:30	0.99	17.31	1.6	11.29	
6/13/11 12:22:45	0.97	17.32	1.5	11.29	
6/13/11 12:23:00	0.97	17.33	1.5	11.39	
6/13/11 12:23:15	0.97	17.34	1.6	11.61	
6/13/11 12:23:30	0.97	17.34	1.5	11.76	
6/13/11 12:23:45	0.99	17.32	1.5	11.76	
6/13/11 12:24:00	1.02	17.30	1.5	11.73	
6/13/11 12:24:15	1.04	17.29	1.7	11.75	
6/13/11 12:24:30	1.05	17.27	1.8	11.67	
6/13/11 12:24:45	1.06	17.26	1.7	11.70	
6/13/11 12:25:00	1.06	17.25	1.6	11.74	
6/13/11 12:25:15	1.05	17.24	1.7	11.70	
6/13/11 12:25:30	1.04	17.25	1.6	11.77	
6/13/11 12:25:45	1.03	17.26	1.6	11.87	
6/13/11 12:26:00	1.04	17.26	1.7	11.75	
6/13/11 12:26:15	1.06	17.25	1.4	11.76	
6/13/11 12:26:30	1.04	17.26	1.7	12.08	
6/13/11 12:26:45	1.03	17.26	1.7	12.02	
6/13/11 12:27:00	1.07	17.25	1.6	12.16	
6/13/11 12:27:15	1.07	17.25	1.5	12.15	
6/13/11 12:27:30	1.09	17.23	1.6	12.14	
6/13/11 12:27:45	1.11	17.20	1.6	12.29	
6/13/11 12:28:00	1.11	17.19	1.6	12.34	
6/13/11 12:28:15	1.12	17.19	1.5	12.21	
6/13/11 12:28:30	1.12	17.20	1.5	12.23	
6/13/11 12:28:45	1.10	17.21	1.7	12.31	
6/13/11 12:29:00	1.10	17.20	1.8	12.21	
6/13/11 12:29:15	1.11	17.19	1.7	11.96	
6/13/11 12:29:30	1.10	17.19	1.6	12.02	
6/13/11 12:29:45	1.07	17.21	1.6	11.98	
6/13/11 12:30:00	1.05	17.22	1.6	12.12	
6/13/11 12:30:15	1.02	17.25	1.6	12.22	
6/13/11 12:30:30	1.04	17.24	1.8	12.21	
6/13/11 12:30:45	1.07	17.23	1.7	11.97	
6/13/11 12:31:00	1.08	17.24	1.5	11.83	
6/13/11 12:31:15	1.07	17.24	1.6	11.98	
6/13/11 12:31:30	1.05	17.24	1.8	12.21	
6/13/11 12:31:45	1.07	17.23	1.7	12.17	
6/13/11 12:32:00	1.08	17.21	1.7	12.27	
6/13/11 12:32:15	1.08	17.22	1.5	12.15	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 12:32:30	1.08	17.22	1.6	11.99	
6/13/11 12:32:45	1.06	17.24	1.7	11.93	
6/13/11 12:33:00	1.05	17.25	1.8	11.87	
6/13/11 12:33:15	1.05	17.25	1.7	11.91	
6/13/11 12:33:30	1.05	17.25	1.8	11.92	
6/13/11 12:33:45	1.03	17.26	1.7	11.93	
6/13/11 12:34:00	1.01	17.27	1.8	11.88	
6/13/11 12:34:15	1.00	17.27	1.6	11.73	
6/13/11 12:34:30	1.02	17.26	1.5	11.78	
6/13/11 12:34:45	1.02	17.26	1.6	11.74	
6/13/11 12:35:00	1.03	17.25	1.7	11.80	
6/13/11 12:35:15	1.02	17.25	1.8	11.77	
6/13/11 12:35:30	1.03	17.25	1.7	11.70	
6/13/11 12:35:45	1.03	17.25	1.7	11.60	
6/13/11 12:36:00	1.02	17.26	1.8	11.61	
6/13/11 12:36:15	1.01	17.27	1.7	11.71	
6/13/11 12:36:30	0.99	17.28	1.8	11.72	
6/13/11 12:36:45	0.99	17.28	1.8	11.77	
6/13/11 12:37:00	1.00	17.28	1.7	11.60	
6/13/11 12:37:15	1.01	17.27	1.6	11.46	
6/13/11 12:37:30	1.00	17.28	1.8	11.55	
6/13/11 12:37:45	0.98	17.28	1.6	11.49	
6/13/11 12:38:00	0.98	17.28	1.5	11.49	
6/13/11 12:38:15	0.98	17.30	1.8	11.62	
6/13/11 12:38:30	0.98	17.30	1.8	11.59	
6/13/11 12:38:45	1.00	17.30	1.8	11.53	
6/13/11 12:39:00	1.01	17.28	1.7	11.52	
6/13/11 12:39:15	1.01	17.27	1.7	11.58	
6/13/11 12:39:30	1.00	17.27	1.6	11.61	
6/13/11 12:39:45	1.00	17.28	1.8	11.73	
6/13/11 12:40:00	1.00	17.28	1.8	11.85	
6/13/11 12:40:15	1.02	17.27	1.6	11.82	
6/13/11 12:40:30	1.04	17.25	1.8	11.73	
6/13/11 12:40:45	1.04	17.25	1.8	11.72	
6/13/11 12:41:00	1.04	17.24	1.7	11.78	
6/13/11 12:41:15	1.03	17.23	1.8	11.63	
6/13/11 12:41:30	1.05	17.23	1.7	11.44	
6/13/11 12:41:45	1.04	17.23	1.6	11.57	
6/13/11 12:42:00	1.01	17.25	1.6	11.70	
6/13/11 12:42:15	1.01	17.26	1.5	11.63	
6/13/11 12:42:30	1.02	17.27	1.4	11.52	
6/13/11 12:42:45	1.01	17.27	1.6	11.58	
6/13/11 12:43:00	1.00	17.28	1.8	11.57	
6/13/11 12:43:15	1.00	17.28	1.8	11.48	
6/13/11 12:43:30	1.00	17.29	1.8	11.51	
6/13/11 12:43:45	1.01	17.30	1.8	11.49	
6/13/11 12:44:00	1.01	17.29	1.5	11.46	
6/13/11 12:44:15	1.02	17.26	1.8	11.50	
6/13/11 12:44:30	1.02	17.26	1.4	11.54	
6/13/11 12:44:45	1.01	17.27	1.8	11.54	
6/13/11 12:45:00	1.01	17.26	1.8	11.46	
6/13/11 12:45:15	1.02	17.26	1.9	11.48	
6/13/11 12:45:30	1.03	17.26	1.8	11.40	
6/13/11 12:45:45	1.04	17.25	1.8	11.31	
6/13/11 12:46:00	1.03	17.25	1.6	11.40	
6/13/11 12:46:15	1.02	17.25	1.8	11.39	
6/13/11 12:46:30	1.03	17.25	1.8	11.52	
6/13/11 12:46:45	1.02	17.27	1.8	11.50	
6/13/11 12:47:00	1.01	17.28	1.7	11.48	
6/13/11 12:47:15	1.03	17.27	1.9	11.38	
6/13/11 12:47:30	1.05	17.25	1.8	11.28	
6/13/11 12:47:45	1.05	17.24	1.6	11.38	
6/13/11 12:48:00	1.03	17.25	1.7	11.24	
6/13/11 12:48:15	1.04	17.24	1.8	11.25	
6/13/11 12:48:30	1.04	17.24	1.8	11.37	
6/13/11 12:48:45	1.04	17.24	1.7	11.46	End FCCU-29-1
6/13/11 12:49:00	1.04	17.23	1.8	11.73	
6/13/11 12:49:15	1.05	17.24	1.8	11.70	
6/13/11 12:49:30	1.06	17.23	1.7	11.58	
6/13/11 12:49:45	1.07	17.23	1.7	11.70	
6/13/11 12:50:00	1.08	17.22	1.8	11.95	
6/13/11 12:50:15	1.10	17.21	1.9	11.97	
6/13/11 12:50:30	1.11	17.20	1.8	12.01	
6/13/11 12:50:45	1.13	17.18	1.9	12.22	
6/13/11 12:51:00	1.14	17.18	1.8	12.34	
6/13/11 12:51:15	1.14	17.17	1.8	12.37	
6/13/11 12:51:30	1.15	17.15	1.7	12.46	
6/13/11 12:51:45	1.17	17.13	1.8	12.46	
6/13/11 12:52:00	1.19	17.11	1.8	12.46	
6/13/11 12:52:15	1.19	17.12	1.8	12.43	
6/13/11 12:52:30	1.16	17.14	1.7	12.42	
6/13/11 12:52:45	1.14	17.14	1.7	12.37	
6/13/11 12:53:00	1.15	17.13	1.9	12.42	
6/13/11 12:53:15	1.16	17.13	1.9	12.42	
6/13/11 12:53:30	1.17	17.11	1.8	12.56	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 12:53:45	1.17	17.11	1.8	13.17	
6/13/11 12:54:00	1.18	17.11	1.8	13.50	
6/13/11 12:54:15	1.21	17.09	1.8	13.34	
6/13/11 12:54:30	1.22	17.08	1.8	13.24	
6/13/11 12:54:45	1.22	17.07	1.9	13.21	
6/13/11 12:55:00	1.23	17.06	2.0	13.16	
6/13/11 12:55:15	1.21	17.07	1.8	13.20	
6/13/11 12:55:30	1.20	17.09	1.9	13.15	
6/13/11 12:55:45	1.18	17.10	1.8	13.29	
6/13/11 12:56:00	1.17	17.12	1.9	13.52	
6/13/11 12:56:15	1.19	17.11	1.7	13.35	
6/13/11 12:56:30	1.23	17.07	1.5	13.16	
6/13/11 12:56:45	1.23	17.07	1.8	13.05	
6/13/11 12:57:00	1.19	17.09	1.9	13.19	
6/13/11 12:57:15	1.19	17.10	1.8	13.24	
6/13/11 12:57:30	1.20	17.08	1.8	13.25	
6/13/11 12:57:45	1.21	17.08	1.9	13.25	
6/13/11 12:58:00	1.21	17.10	1.8	13.21	
6/13/11 12:58:15	1.22	17.08	2.1	13.10	
6/13/11 12:58:30	1.23	17.06	2.0	13.29	
6/13/11 12:58:45	1.22	17.07	1.9	13.50	
6/13/11 12:59:00	1.21	17.08	1.8	13.21	
6/13/11 12:59:15	1.22	17.08	1.7	13.02	
6/13/11 12:59:30	1.21	17.08	1.8	12.81	
6/13/11 12:59:45	1.21	17.07	1.9	12.77	
6/13/11 13:00:00	1.19	17.08	2.0	12.91	
6/13/11 13:00:15	1.18	17.09	2.0	12.99	
6/13/11 13:00:30	1.18	17.09	1.8	12.75	
6/13/11 13:00:45	1.18	17.11	1.9	12.65	
6/13/11 13:01:00	1.15	17.14	1.8	12.58	
6/13/11 13:01:15	1.13	17.15	1.7	12.45	
6/13/11 13:01:30	1.13	17.15	1.8	12.57	
6/13/11 13:01:45	1.12	17.14	1.7	12.75	
6/13/11 13:02:00	1.11	17.15	2.0	12.85	
6/13/11 13:02:15	1.12	17.14	2.0	12.73	
6/13/11 13:02:30	1.16	17.12	1.9	12.47	
6/13/11 13:02:45	1.17	17.11	1.9	12.52	
6/13/11 13:03:00	1.15	17.11	2.0	12.65	
6/13/11 13:03:15	1.15	17.09	1.8	12.77	
6/13/11 13:03:30	1.17	17.09	1.8	12.93	
6/13/11 13:03:45	1.17	17.10	1.8	12.87	
6/13/11 13:04:00	1.18	17.10	2.0	13.09	
6/13/11 13:04:15	1.17	17.11	1.9	13.02	
6/13/11 13:04:30	1.18	17.09	1.8	12.85	
6/13/11 13:04:45	1.19	17.09	1.8	12.91	
6/13/11 13:05:00	1.17	17.10	1.9	12.83	
6/13/11 13:05:15	1.17	17.10	1.9	12.73	
6/13/11 13:05:30	1.17	17.09	2.1	12.70	
6/13/11 13:05:45	1.17	17.10	2.0	12.60	
6/13/11 13:06:00	1.16	17.11	2.0	12.41	
6/13/11 13:06:15	1.15	17.11	2.1	12.33	
6/13/11 13:06:30	1.11	17.14	2.0	12.57	
6/13/11 13:06:45	1.10	17.15	1.9	12.57	
6/13/11 13:07:00	1.12	17.15	2.0	12.54	
6/13/11 13:07:15	1.11	17.16	1.8	12.42	
6/13/11 13:07:30	1.10	17.16	2.0	12.27	
6/13/11 13:07:45	1.10	17.17	1.8	12.37	
6/13/11 13:08:00	1.09	17.17	1.9	12.52	
6/13/11 13:08:15	1.10	17.17	1.7	12.45	
6/13/11 13:08:30	1.13	17.14	1.8	12.43	
6/13/11 13:08:45	1.13	17.15	2.0	12.24	
6/13/11 13:09:00	1.12	17.15	1.9	11.94	
6/13/11 13:09:15	1.11	17.16	1.8	11.87	
6/13/11 13:09:30	1.07	17.19	1.9	12.02	
6/13/11 13:09:45	1.06	17.19	1.8	11.92	
6/13/11 13:10:00	1.07	17.18	1.6	12.16	
6/13/11 13:10:15	1.06	17.20	1.6	12.12	
6/13/11 13:10:30	1.08	17.18	1.8	12.09	
6/13/11 13:10:45	1.09	17.17	1.8	11.82	
6/13/11 13:11:00	1.08	17.17	2.0	11.91	
6/13/11 13:11:15	1.02	17.21	2.0	12.10	
6/13/11 13:11:30	0.98	17.23	1.8	11.89	
6/13/11 13:11:45	0.99	17.24	1.9	11.88	
6/13/11 13:12:00	0.99	17.26	2.0	12.00	
6/13/11 13:12:15	0.99	17.26	1.9	11.97	
6/13/11 13:12:30	1.01	17.24	1.9	11.81	
6/13/11 13:12:45	1.02	17.24	1.9	11.82	
6/13/11 13:13:00	1.01	17.23	2.0	11.86	
6/13/11 13:13:15	1.02	17.21	2.0	11.80	
6/13/11 13:13:30	1.04	17.20	1.8	11.73	
6/13/11 13:13:45	1.03	17.21	1.8	11.62	
6/13/11 13:14:00	1.01	17.22	1.9	11.34	
6/13/11 13:14:15	1.00	17.23	1.9	11.23	
6/13/11 13:14:30	0.97	17.25	1.8	11.20	
6/13/11 13:14:45	0.92	17.27	1.9	11.14	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 13:15:00	0.91	17.28	2.1	11.11	
6/13/11 13:15:15	0.90	17.30	2.0	11.09	
6/13/11 13:15:30	0.89	17.31	1.9	10.95	
6/13/11 13:15:45	0.91	17.30	1.8	10.79	
6/13/11 13:16:00	0.88	17.33	1.9	10.87	
6/13/11 13:16:15	0.84	17.36	2.0	10.93	
6/13/11 13:16:30	0.84	17.36	1.9	10.86	
6/13/11 13:16:45	0.86	17.35	1.9	10.92	
6/13/11 13:17:00	0.86	17.35	1.9	10.94	
6/13/11 13:17:15	0.88	17.34	1.9	10.86	
6/13/11 13:17:30	0.89	17.33	2.1	10.82	
6/13/11 13:17:45	0.89	17.33	2.0	10.76	Begin M29-2
6/13/11 13:18:00	0.87	17.32	1.9	10.67	
6/13/11 13:18:15	0.85	17.34	1.7	10.73	
6/13/11 13:18:30	0.84	17.36	1.8	10.55	
6/13/11 13:18:45	0.84	17.37	1.9	10.71	
6/13/11 13:19:00	0.82	17.39	2.0	10.78	
6/13/11 13:19:15	0.83	17.38	2.0	10.75	
6/13/11 13:19:30	0.85	17.37	2.1	10.84	
6/13/11 13:19:45	0.84	17.38	2.1	10.76	
6/13/11 13:20:00	0.84	17.38	2.0	10.62	
6/13/11 13:20:15	0.84	17.38	2.1	10.54	
6/13/11 13:20:30	0.83	17.40	2.2	10.48	
6/13/11 13:20:45	0.80	17.40	2.0	10.43	
6/13/11 13:21:00	0.79	17.41	1.9	10.29	
6/13/11 13:21:15	0.77	17.43	1.8	10.34	
6/13/11 13:21:30	0.75	17.45	1.9	10.40	
6/13/11 13:21:45	0.76	17.44	1.9	10.45	
6/13/11 13:22:00	0.78	17.43	1.9	10.40	
6/13/11 13:22:15	0.78	17.42	1.9	10.23	
6/13/11 13:22:30	0.78	17.42	1.9	10.20	
6/13/11 13:22:45	0.76	17.44	1.8	10.12	
6/13/11 13:23:00	0.74	17.45	1.7	10.26	
6/13/11 13:23:15	0.73	17.46	1.8	10.37	
6/13/11 13:23:30	0.74	17.46	1.7	10.28	
6/13/11 13:23:45	0.77	17.44	1.9	10.04	
6/13/11 13:24:00	0.76	17.46	1.9	10.07	
6/13/11 13:24:15	0.72	17.50	1.9	10.13	
6/13/11 13:24:30	0.70	17.51	1.9	10.01	
6/13/11 13:24:45	0.72	17.49	1.8	9.94	
6/13/11 13:25:00	0.72	17.49	1.9	9.95	
6/13/11 13:25:15	0.71	17.48	1.9	10.08	
6/13/11 13:25:30	0.71	17.47	1.8	10.05	
6/13/11 13:25:45	0.73	17.46	2.0	9.89	
6/13/11 13:26:00	0.73	17.47	1.9	9.74	
6/13/11 13:26:15	0.71	17.49	2.0	9.77	
6/13/11 13:26:30	0.68	17.49	2.0	9.84	
6/13/11 13:26:45	0.67	17.50	1.8	9.96	
6/13/11 13:27:00	0.68	17.50	1.8	9.90	
6/13/11 13:27:15	0.69	17.51	1.9	9.80	
6/13/11 13:27:30	0.70	17.52	2.0	9.79	
6/13/11 13:27:45	0.69	17.51	2.0	9.71	
6/13/11 13:28:00	0.69	17.50	2.1	9.77	
6/13/11 13:28:15	0.68	17.51	2.2	9.97	
6/13/11 13:28:30	0.68	17.52	2.1	10.01	
6/13/11 13:28:45	0.70	17.51	2.0	9.71	
6/13/11 13:29:00	0.71	17.50	2.0	9.65	
6/13/11 13:29:15	0.68	17.51	1.9	9.79	
6/13/11 13:29:30	0.66	17.52	1.8	9.77	
6/13/11 13:29:45	0.66	17.51	2.1	9.49	
6/13/11 13:30:00	0.66	17.52	1.8	9.52	
6/13/11 13:30:15	0.64	17.54	2.0	9.61	
6/13/11 13:30:30	0.64	17.54	2.1	9.51	
6/13/11 13:30:45	0.66	17.54	2.0	9.48	
6/13/11 13:31:00	0.65	17.54	1.9	9.29	
6/13/11 13:31:15	0.65	17.52	1.8	9.46	
6/13/11 13:31:30	0.63	17.54	1.9	9.59	
6/13/11 13:31:45	0.63	17.55	1.9	9.56	
6/13/11 13:32:00	0.65	17.55	1.8	9.62	
6/13/11 13:32:15	0.66	17.55	1.9	9.59	
6/13/11 13:32:30	0.67	17.53	2.0	9.68	
6/13/11 13:32:45	0.67	17.54	2.0	9.65	
6/13/11 13:33:00	0.67	17.54	1.8	9.71	
6/13/11 13:33:15	0.66	17.56	1.8	9.77	
6/13/11 13:33:30	0.66	17.55	1.9	9.73	
6/13/11 13:33:45	0.68	17.53	2.0	9.31	
6/13/11 13:34:00	0.68	17.52	1.9	8.98	
6/13/11 13:34:15	0.63	17.54	1.8	8.91	
6/13/11 13:34:30	0.57	17.57	1.9	9.23	
6/13/11 13:34:45	0.55	17.58	2.0	9.32	
6/13/11 13:35:00	0.58	17.58	2.0	9.53	
6/13/11 13:35:15	0.61	17.59	2.0	9.79	
6/13/11 13:35:30	0.65	17.57	1.8	10.05	
6/13/11 13:35:45	0.70	17.54	2.0	10.00	
6/13/11 13:36:00	0.74	17.51	1.9	10.20	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 13:36:15	0.75	17.50	1.7	10.38	
6/13/11 13:36:30	0.77	17.47	1.9	10.31	
6/13/11 13:36:45	0.80	17.44	2.1	10.13	
6/13/11 13:37:00	0.79	17.43	2.1	9.96	
6/13/11 13:37:15	0.75	17.46	2.0	9.87	
6/13/11 13:37:30	0.70	17.50	2.1	9.96	
6/13/11 13:37:45	0.68	17.51	2.0	9.96	
6/13/11 13:38:00	0.69	17.49	1.8	9.86	
6/13/11 13:38:15	0.69	17.49	1.8	9.70	
6/13/11 13:38:30	0.68	17.49	1.8	9.55	
6/13/11 13:38:45	0.66	17.50	1.9	9.39	
6/13/11 13:39:00	0.65	17.52	1.9	9.27	
6/13/11 13:39:15	0.63	17.53	1.9	9.27	
6/13/11 13:39:30	0.62	17.54	2.0	9.29	
6/13/11 13:39:45	0.62	17.55	2.0	9.20	Start M5B-2
6/13/11 13:40:00	0.63	17.54	1.9	9.19	
6/13/11 13:40:15	0.63	17.53	2.0	9.29	
6/13/11 13:40:30	0.62	17.53	1.9	9.18	
6/13/11 13:40:45	0.63	17.53	1.8	9.21	
6/13/11 13:41:00	0.63	17.53	1.9	9.42	
6/13/11 13:41:15	0.64	17.53	1.9	9.38	
6/13/11 13:41:30	0.66	17.51	2.0	9.31	
6/13/11 13:41:45	0.67	17.51	1.9	9.46	
6/13/11 13:42:00	0.66	17.51	2.0	9.51	
6/13/11 13:42:15	0.67	17.50	1.8	9.58	
6/13/11 13:42:30	0.68	17.50	2.0	9.46	
6/13/11 13:42:45	0.70	17.50	2.1	9.53	
6/13/11 13:43:00	0.70	17.51	1.9	9.46	
6/13/11 13:43:15	0.70	17.49	2.1	9.26	
6/13/11 13:43:30	0.69	17.50	2.1	9.24	
6/13/11 13:43:45	0.67	17.51	2.0	9.18	
6/13/11 13:44:00	0.66	17.52	2.2	9.19	
6/13/11 13:44:15	0.66	17.53	2.1	9.12	
6/13/11 13:44:30	0.65	17.53	2.1	9.16	
6/13/11 13:44:45	0.64	17.53	2.1	9.20	
6/13/11 13:45:00	0.64	17.53	1.9	9.13	
6/13/11 13:45:15	0.64	17.53	2.0	9.35	
6/13/11 13:45:30	0.64	17.53	1.9	9.55	
6/13/11 13:45:45	0.66	17.53	1.9	9.45	
6/13/11 13:46:00	0.69	17.51	2.0	9.28	
6/13/11 13:46:15	0.69	17.51	2.1	9.39	
6/13/11 13:46:30	0.67	17.52	2.1	9.56	
6/13/11 13:46:45	0.68	17.51	2.0	9.48	
6/13/11 13:47:00	0.70	17.49	2.1	9.44	
6/13/11 13:47:15	0.70	17.49	2.1	9.47	
6/13/11 13:47:30	0.68	17.50	2.1	9.49	
6/13/11 13:47:45	0.68	17.50	2.0	9.37	
6/13/11 13:48:00	0.68	17.50	2.2	9.20	
6/13/11 13:48:15	0.67	17.50	2.1	9.25	
6/13/11 13:48:30	0.65	17.50	2.0	9.35	
6/13/11 13:48:45	0.64	17.52	1.8	9.25	
6/13/11 13:49:00	0.65	17.53	1.8	9.17	
6/13/11 13:49:15	0.65	17.54	2.1	9.01	
6/13/11 13:49:30	0.65	17.53	2.0	8.86	
6/13/11 13:49:45	0.63	17.53	1.9	8.79	
6/13/11 13:50:00	0.61	17.55	1.9	8.89	
6/13/11 13:50:15	0.59	17.57	2.1	8.95	
6/13/11 13:50:30	0.59	17.57	2.1	8.70	
6/13/11 13:50:45	0.60	17.56	1.9	8.70	
6/13/11 13:51:00	0.59	17.57	2.0	8.63	
6/13/11 13:51:15	0.59	17.57	2.0	8.76	
6/13/11 13:51:30	0.59	17.57	2.0	8.74	
6/13/11 13:51:45	0.60	17.56	2.1	8.75	
6/13/11 13:52:00	0.60	17.57	1.9	9.12	
6/13/11 13:52:15	0.60	17.57	1.8	9.16	
6/13/11 13:52:30	0.63	17.55	1.9	9.19	
6/13/11 13:52:45	0.65	17.53	1.9	9.25	
6/13/11 13:53:00	0.66	17.53	1.8	9.25	
6/13/11 13:53:15	0.68	17.52	1.8	9.37	
6/13/11 13:53:30	0.68	17.51	1.8	9.67	
6/13/11 13:53:45	0.69	17.50	1.9	9.79	Start FCCU-027-2
6/13/11 13:54:00	0.71	17.50	2.0	9.82	
6/13/11 13:54:15	0.74	17.49	1.9	10.02	
6/13/11 13:54:30	0.75	17.47	1.9	10.21	
6/13/11 13:54:45	0.78	17.46	1.9	10.25	
6/13/11 13:55:00	0.81	17.45	2.0	10.23	
6/13/11 13:55:15	0.82	17.44	2.0	10.26	
6/13/11 13:55:30	0.82	17.43	1.9	10.39	
6/13/11 13:55:45	0.82	17.43	1.9	10.45	
6/13/11 13:56:00	0.82	17.42	1.9	10.45	
6/13/11 13:56:15	0.82	17.42	1.8	10.49	
6/13/11 13:56:30	0.83	17.40	2.0	10.60	
6/13/11 13:56:45	0.85	17.40	1.8	10.54	
6/13/11 13:57:00	0.87	17.38	1.9	10.53	
6/13/11 13:57:15	0.87	17.38	1.9	10.69	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 13:57:30	0.86	17.38	1.9	10.70	
6/13/11 13:57:45	0.86	17.37	2.0	10.64	
6/13/11 13:58:00	0.85	17.38	1.9	10.65	
6/13/11 13:58:15	0.84	17.40	2.0	10.70	
6/13/11 13:58:30	0.84	17.40	1.8	10.81	
6/13/11 13:58:45	0.85	17.39	1.8	10.84	
6/13/11 13:59:00	0.86	17.38	2.0	10.92	
6/13/11 13:59:15	0.87	17.37	2.0	10.90	
6/13/11 13:59:30	0.88	17.37	1.8	10.96	
6/13/11 13:59:45	0.88	17.36	1.8	10.97	
6/13/11 14:00:00	0.89	17.35	1.9	11.04	
6/13/11 14:00:15	0.90	17.34	1.9	11.13	
6/13/11 14:00:30	0.91	17.33	2.0	11.13	
6/13/11 14:00:45	0.93	17.31	1.9	11.17	
6/13/11 14:01:00	0.92	17.31	2.0	11.21	
6/13/11 14:01:15	0.91	17.32	1.9	11.18	
6/13/11 14:01:30	0.91	17.31	2.0	11.20	
6/13/11 14:01:45	0.91	17.32	2.1	11.24	
6/13/11 14:02:00	0.92	17.31	2.0	11.37	
6/13/11 14:02:15	0.93	17.29	1.7	11.55	
6/13/11 14:02:30	0.95	17.28	1.9	11.59	
6/13/11 14:02:45	0.97	17.26	2.0	11.62	
6/13/11 14:03:00	0.99	17.25	1.9	11.73	
6/13/11 14:03:15	1.00	17.24	1.9	11.88	
6/13/11 14:03:30	1.00	17.25	1.8	12.06	
6/13/11 14:03:45	1.00	17.26	1.9	11.93	
6/13/11 14:04:00	1.01	17.24	1.9	11.66	
6/13/11 14:04:15	1.02	17.23	2.1	11.65	
6/13/11 14:04:30	1.00	17.24	1.7	11.83	
6/13/11 14:04:45	0.99	17.25	1.8	11.89	
6/13/11 14:05:00	0.99	17.24	1.8	11.99	
6/13/11 14:05:15	1.00	17.24	2.0	11.91	
6/13/11 14:05:30	1.03	17.22	1.9	11.76	
6/13/11 14:05:45	1.03	17.22	1.8	11.79	
6/13/11 14:06:00	1.02	17.22	2.0	12.03	
6/13/11 14:06:15	1.02	17.21	1.9	12.20	
6/13/11 14:06:30	1.05	17.18	1.9	12.19	
6/13/11 14:06:45	1.07	17.17	2.0	12.23	
6/13/11 14:07:00	1.07	17.17	2.1	12.24	
6/13/11 14:07:15	1.09	17.17	2.2	12.30	
6/13/11 14:07:30	1.09	17.16	2.3	12.32	
6/13/11 14:07:45	1.09	17.16	2.1	12.40	
6/13/11 14:08:00	1.10	17.16	2.0	12.64	
6/13/11 14:08:15	1.11	17.14	2.0	12.90	
6/13/11 14:08:30	1.15	17.11	2.2	12.93	
6/13/11 14:08:45	1.19	17.09	2.0	12.83	
6/13/11 14:09:00	1.21	17.07	1.8	12.71	
6/13/11 14:09:15	1.18	17.08	1.8	12.73	
6/13/11 14:09:30	1.16	17.10	2.0	12.85	
6/13/11 14:09:45	1.16	17.08	2.0	12.97	
6/13/11 14:10:00	1.18	17.06	2.0	13.21	
6/13/11 14:10:15	1.20	17.05	1.9	13.31	
6/13/11 14:10:30	1.22	17.04	1.9	13.18	
6/13/11 14:10:45	1.22	17.04	1.9	13.09	
6/13/11 14:11:00	1.21	17.04	1.9	13.11	
6/13/11 14:11:15	1.20	17.03	2.2	13.07	
6/13/11 14:11:30	1.21	17.03	2.0	13.13	
6/13/11 14:11:45	1.20	17.04	1.9	13.19	
6/13/11 14:12:00	1.21	17.04	2.1	13.15	
6/13/11 14:12:15	1.20	17.04	2.1	12.97	
6/13/11 14:12:30	1.20	17.04	2.0	13.00	
6/13/11 14:12:45	1.20	17.03	1.9	13.37	
6/13/11 14:13:00	1.21	17.02	2.0	13.31	
6/13/11 14:13:15	1.23	17.01	2.1	13.32	
6/13/11 14:13:30	1.23	17.01	2.0	13.15	
6/13/11 14:13:45	1.25	16.99	2.1	13.07	
6/13/11 14:14:00	1.24	17.00	2.1	12.98	
6/13/11 14:14:15	1.22	17.02	2.1	13.03	
6/13/11 14:14:30	1.21	17.03	1.8	13.08	
6/13/11 14:14:45	1.21	17.01	1.9	12.97	
6/13/11 14:15:00	1.23	16.99	1.8	12.85	
6/13/11 14:15:15	1.22	17.01	1.9	13.02	
6/13/11 14:15:30	1.21	17.03	1.9	13.20	
6/13/11 14:15:45	1.22	17.01	2.0	13.24	
6/13/11 14:16:00	1.25	16.98	2.0	13.25	
6/13/11 14:16:15	1.25	16.98	2.1	13.21	
6/13/11 14:16:30	1.24	17.00	2.1	13.29	
6/13/11 14:16:45	1.23	17.02	1.9	13.39	
6/13/11 14:17:00	1.22	17.02	2.0	13.52	
6/13/11 14:17:15	1.23	17.00	1.9	13.46	
6/13/11 14:17:30	1.27	16.97	1.9	13.34	
6/13/11 14:17:45	1.29	16.94	1.9	13.24	
6/13/11 14:18:00	1.29	16.93	2.0	13.20	
6/13/11 14:18:15	1.27	16.95	2.2	13.34	
6/13/11 14:18:30	1.26	16.95	2.1	13.27	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 14:18:45	1.28	16.94	1.8	13.13	
6/13/11 14:19:00	1.30	16.94	1.9	13.16	
6/13/11 14:19:15	1.27	16.95	2.0	12.99	
6/13/11 14:19:30	1.26	16.95	2.0	12.98	
6/13/11 14:19:45	1.24	16.98	1.8	13.15	
6/13/11 14:20:00	1.22	16.99	1.8	13.33	
6/13/11 14:20:15	1.24	16.97	2.0	13.06	Restart FCCU-0061-4
6/13/11 14:20:30	1.27	16.95	1.9	13.28	FCCU-29-2
6/13/11 14:20:45	1.25	16.97	1.9	13.37	
6/13/11 14:21:00	1.25	16.98	2.0	13.32	
6/13/11 14:21:15	1.27	16.97	2.0	13.28	
6/13/11 14:21:30	1.27	16.96	2.2	13.22	
6/13/11 14:21:45	1.26	16.97	2.2	13.08	
6/13/11 14:22:00	1.24	16.98	2.0	13.12	
6/13/11 14:22:15	1.23	16.99	1.9	13.13	
6/13/11 14:22:30	1.22	17.00	1.9	13.00	
6/13/11 14:22:45	1.22	17.00	2.0	12.87	
6/13/11 14:23:00	1.20	17.01	2.0	12.81	
6/13/11 14:23:15	1.17	17.02	2.0	12.88	
6/13/11 14:23:30	1.17	17.02	1.8	12.99	
6/13/11 14:23:45	1.18	17.02	1.8	12.86	
6/13/11 14:24:00	1.18	17.02	2.0	12.67	
6/13/11 14:24:15	1.16	17.04	2.0	12.65	
6/13/11 14:24:30	1.13	17.06	2.0	12.56	
6/13/11 14:24:45	1.12	17.06	2.1	12.65	
6/13/11 14:25:00	1.10	17.08	2.0	12.67	
6/13/11 14:25:15	1.10	17.08	1.8	12.71	
6/13/11 14:25:30	1.10	17.08	2.0	12.85	
6/13/11 14:25:45	1.12	17.07	1.9	12.94	
6/13/11 14:26:00	1.15	17.06	1.9	12.82	
6/13/11 14:26:15	1.16	17.06	2.0	12.88	
6/13/11 14:26:30	1.15	17.07	2.0	12.95	
6/13/11 14:26:45	1.14	17.06	1.8	13.01	
6/13/11 14:27:00	1.16	17.06	1.9	13.19	
6/13/11 14:27:15	1.17	17.05	2.0	13.21	
6/13/11 14:27:30	1.19	17.04	2.0	13.15	
6/13/11 14:27:45	1.21	17.01	2.0	13.07	
6/13/11 14:28:00	1.22	17.00	2.0	13.05	
6/13/11 14:28:15	1.21	16.98	2.0	13.10	
6/13/11 14:28:30	1.20	16.98	2.0	13.10	
6/13/11 14:28:45	1.21	16.98	2.1	13.14	
6/13/11 14:29:00	1.22	16.97	1.9	13.16	
6/13/11 14:29:15	1.23	16.96	2.1	13.12	
6/13/11 14:29:30	1.23	16.96	1.9	12.94	
6/13/11 14:29:45	1.22	16.98	2.0	12.87	
6/13/11 14:30:00	1.19	17.00	2.1	12.78	
6/13/11 14:30:15	1.18	17.01	2.0	12.97	
6/13/11 14:30:30	1.18	17.02	2.1	13.09	
6/13/11 14:30:45	1.21	16.99	2.1	13.03	
6/13/11 14:31:00	1.24	16.96	2.1	12.97	
6/13/11 14:31:15	1.24	16.97	2.2	12.70	
6/13/11 14:31:30	1.21	16.98	2.1	12.53	
6/13/11 14:31:45	1.17	17.00	2.1	12.43	
6/13/11 14:32:00	1.14	17.03	1.9	12.55	
6/13/11 14:32:15	1.13	17.04	1.9	12.58	
6/13/11 14:32:30	1.14	17.04	2.1	12.66	
6/13/11 14:32:45	1.15	17.04	2.1	12.64	
6/13/11 14:33:00	1.16	17.03	1.9	12.40	
6/13/11 14:33:15	1.16	17.03	2.0	12.26	
6/13/11 14:33:30	1.14	17.04	2.0	12.24	
6/13/11 14:33:45	1.13	17.05	2.0	12.49	
6/13/11 14:34:00	1.13	17.04	2.0	12.53	
6/13/11 14:34:15	1.15	17.03	1.8	12.39	
6/13/11 14:34:30	1.16	17.03	1.9	12.40	
6/13/11 14:34:45	1.13	17.05	1.8	12.59	Restart FCCU-5B-2
6/13/11 14:35:00	1.12	17.05	1.9	12.83	
6/13/11 14:35:15	1.13	17.05	1.8	12.89	
6/13/11 14:35:30	1.14	17.03	1.9	12.73	
6/13/11 14:35:45	1.15	17.04	1.9	12.61	
6/13/11 14:36:00	1.14	17.07	1.9	12.61	
6/13/11 14:36:15	1.14	17.08	1.8	12.66	
6/13/11 14:36:30	1.13	17.06	1.9	12.67	
6/13/11 14:36:45	1.13	17.05	1.7	12.73	
6/13/11 14:37:00	1.14	17.04	1.8	12.58	
6/13/11 14:37:15	1.17	17.04	1.9	12.29	
6/13/11 14:37:30	1.16	17.04	2.1	12.07	
6/13/11 14:37:45	1.12	17.06	2.1	12.06	
6/13/11 14:38:00	1.08	17.07	2.0	12.06	
6/13/11 14:38:15	1.08	17.07	2.0	12.13	
6/13/11 14:38:30	1.08	17.07	1.9	12.14	
6/13/11 14:38:45	1.08	17.07	2.0	12.03	
6/13/11 14:39:00	1.09	17.08	2.0	11.89	
6/13/11 14:39:15	1.09	17.08	2.1	11.94	
6/13/11 14:39:30	1.07	17.08	2.1	11.89	
6/13/11 14:39:45	1.08	17.07	1.9	11.90	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 14:40:00	1.08	17.08	2.0	11.69	
6/13/11 14:40:15	1.07	17.09	1.8	11.67	
6/13/11 14:40:30	1.04	17.11	2.0	11.70	
6/13/11 14:40:45	1.02	17.13	2.0	11.78	
6/13/11 14:41:00	1.01	17.14	2.2	11.59	
6/13/11 14:41:15	1.01	17.13	2.0	11.46	
6/13/11 14:41:30	0.99	17.15	2.2	11.64	
6/13/11 14:41:45	0.98	17.16	2.0	11.76	
6/13/11 14:42:00	1.00	17.14	1.7	11.69	
6/13/11 14:42:15	1.00	17.14	1.9	11.58	
6/13/11 14:42:30	0.98	17.16	2.1	11.59	
6/13/11 14:42:45	0.97	17.17	2.1	11.56	
6/13/11 14:43:00	0.99	17.15	1.9	11.57	
6/13/11 14:43:15	1.02	17.14	1.9	11.56	
6/13/11 14:43:30	1.02	17.15	1.9	11.64	
6/13/11 14:43:45	1.02	17.15	1.9	11.79	
6/13/11 14:44:00	1.03	17.13	2.2	11.81	
6/13/11 14:44:15	1.06	17.12	1.8	11.54	
6/13/11 14:44:30	1.06	17.11	1.8	11.45	
6/13/11 14:44:45	1.03	17.12	1.9	11.58	
6/13/11 14:45:00	1.01	17.14	1.9	11.68	
6/13/11 14:45:15	1.01	17.14	1.8	11.80	
6/13/11 14:45:30	1.02	17.14	1.9	11.66	
6/13/11 14:45:45	1.04	17.13	2.0	11.55	
6/13/11 14:46:00	1.04	17.13	2.0	11.54	
6/13/11 14:46:15	1.02	17.14	1.9	11.59	
6/13/11 14:46:30	1.00	17.15	2.0	11.86	
6/13/11 14:46:45	1.01	17.15	2.0	11.83	
6/13/11 14:47:00	1.03	17.13	2.1	11.59	
6/13/11 14:47:15	1.04	17.13	2.1	11.54	
6/13/11 14:47:30	1.02	17.14	2.2	11.54	
6/13/11 14:47:45	1.01	17.15	2.1	11.73	
6/13/11 14:48:00	1.00	17.15	2.1	12.06	
6/13/11 14:48:15	1.01	17.13	2.0	11.98	
6/13/11 14:48:30	1.04	17.11	2.1	11.77	
6/13/11 14:48:45	1.05	17.11	2.0	11.72	
6/13/11 14:49:00	1.04	17.14	1.8	11.64	
6/13/11 14:49:15	1.03	17.14	2.1	11.67	
6/13/11 14:49:30	1.02	17.14	2.2	11.62	
6/13/11 14:49:45	1.00	17.14	2.0	11.64	
6/13/11 14:50:00	0.99	17.15	2.2	11.61	
6/13/11 14:50:15	1.01	17.15	2.0	11.57	Restart FCCU-027-2
6/13/11 14:50:30	1.02	17.15	2.0	11.54	
6/13/11 14:50:45	1.02	17.16	1.9	11.46	
6/13/11 14:51:00	1.01	17.17	1.9	11.46	
6/13/11 14:51:15	1.00	17.17	2.0	11.49	
6/13/11 14:51:30	1.00	17.17	2.2	11.57	
6/13/11 14:51:45	1.00	17.17	2.2	11.66	
6/13/11 14:52:00	1.02	17.15	2.1	11.48	
6/13/11 14:52:15	1.04	17.14	1.9	11.34	
6/13/11 14:52:30	1.03	17.15	1.8	11.30	
6/13/11 14:52:45	1.00	17.17	1.9	11.26	
6/13/11 14:53:00	0.98	17.18	1.9	11.18	
6/13/11 14:53:15	0.97	17.20	2.0	11.19	
6/13/11 14:53:30	0.94	17.22	2.0	11.12	
6/13/11 14:53:45	0.93	17.22	1.9	10.97	
6/13/11 14:54:00	0.94	17.22	2.0	10.91	
6/13/11 14:54:15	0.93	17.23	2.0	10.94	
6/13/11 14:54:30	0.92	17.24	2.0	10.89	
6/13/11 14:54:45	0.91	17.25	1.9	10.75	
6/13/11 14:55:00	0.90	17.24	2.0	10.99	
6/13/11 14:55:15	0.87	17.26	2.1	11.10	
6/13/11 14:55:30	0.88	17.27	2.0	11.20	
6/13/11 14:55:45	0.89	17.27	2.0	11.15	
6/13/11 14:56:00	0.92	17.25	2.0	11.19	
6/13/11 14:56:15	0.94	17.24	2.0	11.22	
6/13/11 14:56:30	0.96	17.23	2.2	11.11	
6/13/11 14:56:45	0.96	17.22	2.3	11.22	
6/13/11 14:57:00	0.95	17.23	2.1	11.28	
6/13/11 14:57:15	0.95	17.21	1.9	11.23	
6/13/11 14:57:30	0.96	17.20	2.0	11.36	
6/13/11 14:57:45	0.95	17.22	2.0	11.70	
6/13/11 14:58:00	0.96	17.21	1.9	11.74	
6/13/11 14:58:15	1.00	17.18	2.0	11.73	
6/13/11 14:58:30	1.02	17.17	1.9	11.65	
6/13/11 14:58:45	1.03	17.17	1.9	11.59	
6/13/11 14:59:00	1.03	17.16	1.9	11.61	
6/13/11 14:59:15	1.01	17.17	2.0	11.66	
6/13/11 14:59:30	1.01	17.16	1.9	11.64	
6/13/11 14:59:45	1.02	17.14	2.0	11.67	
6/13/11 15:00:00	1.02	17.14	2.1	11.64	
6/13/11 15:00:15	1.04	17.15	2.1	11.29	
6/13/11 15:00:30	1.04	17.15	2.1	11.09	
6/13/11 15:00:45	0.99	17.17	2.1	11.28	
6/13/11 15:01:00	0.94	17.19	2.1	11.24	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 15:01:15	0.95	17.18	2.0	11.13	
6/13/11 15:01:30	0.95	17.19	1.9	11.03	
6/13/11 15:01:45	0.94	17.20	1.7	11.04	
6/13/11 15:02:00	0.92	17.22	2.0	11.01	
6/13/11 15:02:15	0.92	17.22	2.2	11.00	
6/13/11 15:02:30	0.93	17.22	2.2	10.94	
6/13/11 15:02:45	0.92	17.22	2.2	10.89	
6/13/11 15:03:00	0.91	17.23	2.1	11.00	
6/13/11 15:03:15	0.90	17.24	2.1	11.00	
6/13/11 15:03:30	0.91	17.24	2.0	10.99	
6/13/11 15:03:45	0.91	17.23	2.0	10.81	
6/13/11 15:04:00	0.90	17.23	1.7	10.71	
6/13/11 15:04:15	0.88	17.25	1.9	10.76	
6/13/11 15:04:30	0.86	17.27	2.1	10.89	
6/13/11 15:04:45	0.87	17.28	1.9	10.95	
6/13/11 15:05:00	0.89	17.26	2.0	10.99	
6/13/11 15:05:15	0.92	17.23	2.1	11.06	
6/13/11 15:05:30	0.94	17.21	1.9	10.97	
6/13/11 15:05:45	0.95	17.20	2.0	10.81	
6/13/11 15:06:00	0.95	17.21	1.8	10.73	
6/13/11 15:06:15	0.92	17.24	2.1	10.87	
6/13/11 15:06:30	0.89	17.25	2.1	10.80	
6/13/11 15:06:45	0.89	17.24	2.2	10.67	
6/13/11 15:07:00	0.89	17.25	2.0	10.76	
6/13/11 15:07:15	0.88	17.24	1.9	10.68	
6/13/11 15:07:30	0.88	17.23	1.8	10.73	
6/13/11 15:07:45	0.87	17.25	2.0	10.82	
6/13/11 15:08:00	0.86	17.26	2.1	10.67	
6/13/11 15:08:15	0.89	17.27	1.9	10.52	
6/13/11 15:08:30	0.87	17.28	2.0	10.38	
6/13/11 15:08:45	0.84	17.29	2.0	10.33	
6/13/11 15:09:00	0.82	17.30	2.0	10.30	
6/13/11 15:09:15	0.82	17.30	2.0	10.23	
6/13/11 15:09:30	0.82	17.31	1.9	10.27	
6/13/11 15:09:45	0.81	17.32	2.1	10.39	
6/13/11 15:10:00	0.81	17.32	2.1	10.24	
6/13/11 15:10:15	0.82	17.30	2.0	9.96	
6/13/11 15:10:30	0.81	17.30	2.1	9.85	
6/13/11 15:10:45	0.77	17.33	2.0	9.96	
6/13/11 15:11:00	0.74	17.35	2.1	10.07	
6/13/11 15:11:15	0.74	17.32	2.0	10.08	
6/13/11 15:11:30	0.76	17.32	2.1	9.99	
6/13/11 15:11:45	0.77	17.33	2.0	9.92	
6/13/11 15:12:00	0.76	17.35	2.0	9.95	
6/13/11 15:12:15	0.75	17.35	2.0	9.90	
6/13/11 15:12:30	0.76	17.35	2.1	9.71	
6/13/11 15:12:45	0.76	17.36	2.1	9.70	
6/13/11 15:13:00	0.73	17.38	1.9	9.64	
6/13/11 15:13:15	0.72	17.37	1.8	9.51	
6/13/11 15:13:30	0.71	17.38	1.9	9.37	
6/13/11 15:13:45	0.69	17.39	1.7	9.09	
6/13/11 15:14:00	0.66	17.41	1.8	8.96	
6/13/11 15:14:15	0.63	17.45	1.8	9.07	
6/13/11 15:14:30	0.62	17.46	1.9	9.13	
6/13/11 15:14:45	0.63	17.44	2.1	9.25	
6/13/11 15:15:00	0.64	17.44	2.0	9.12	
6/13/11 15:15:15	0.65	17.44	2.0	9.14	Restart FCCU-29-2
6/13/11 15:15:30	0.65	17.44	2.0	9.15	Restart FCCU-0061-4
6/13/11 15:15:45	0.65	17.44	2.0	8.90	
6/13/11 15:16:00	0.66	17.44	1.9	8.84	
6/13/11 15:16:15	0.63	17.45	1.9	9.00	
6/13/11 15:16:30	0.62	17.46	2.1	9.02	
6/13/11 15:16:45	0.63	17.44	1.9	8.85	
6/13/11 15:17:00	0.64	17.45	2.2	8.79	
6/13/11 15:17:15	0.63	17.47	2.0	8.73	
6/13/11 15:17:30	0.61	17.47	1.9	8.27	
6/13/11 15:17:45	0.61	17.48	2.0	8.15	
6/13/11 15:18:00	0.56	17.52	2.1	8.04	
6/13/11 15:18:15	0.53	17.54	1.9	8.18	
6/13/11 15:18:30	0.52	17.56	1.9	8.39	
6/13/11 15:18:45	0.52	17.57	2.0	8.43	
6/13/11 15:19:00	0.55	17.54	2.2	8.37	
6/13/11 15:19:15	0.56	17.53	1.9	8.23	
6/13/11 15:19:30	0.56	17.54	1.9	8.34	
6/13/11 15:19:45	0.55	17.53	2.0	8.45	
6/13/11 15:20:00	0.55	17.53	1.8	8.55	
6/13/11 15:20:15	0.57	17.52	1.9	8.42	
6/13/11 15:20:30	0.58	17.52	2.0	8.42	
6/13/11 15:20:45	0.58	17.53	1.7	8.18	
6/13/11 15:21:00	0.57	17.54	1.8	8.06	
6/13/11 15:21:15	0.55	17.55	2.1	7.97	
6/13/11 15:21:30	0.53	17.56	2.1	7.74	
6/13/11 15:21:45	0.51	17.58	2.1	7.97	
6/13/11 15:22:00	0.49	17.59	1.8	8.15	
6/13/11 15:22:15	0.51	17.58	1.7	8.16	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 15:22:30	0.53	17.57	2.0	8.19	
6/13/11 15:22:45	0.54	17.56	1.9	7.94	
6/13/11 15:23:00	0.55	17.56	1.9	7.77	
6/13/11 15:23:15	0.53	17.58	2.1	7.88	
6/13/11 15:23:30	0.51	17.59	2.0	8.02	
6/13/11 15:23:45	0.52	17.59	1.8	8.12	
6/13/11 15:24:00	0.53	17.58	1.7	7.91	
6/13/11 15:24:15	0.54	17.57	1.8	7.81	
6/13/11 15:24:30	0.53	17.58	2.0	7.84	
6/13/11 15:24:45	0.51	17.59	2.1	7.95	
6/13/11 15:25:00	0.52	17.59	1.9	8.01	
6/13/11 15:25:15	0.53	17.57	2.0	7.82	
6/13/11 15:25:30	0.53	17.57	1.8	7.95	
6/13/11 15:25:45	0.52	17.58	1.9	7.89	
6/13/11 15:26:00	0.52	17.58	1.8	7.72	
6/13/11 15:26:15	0.52	17.58	2.0	7.68	
6/13/11 15:26:30	0.51	17.59	1.9	7.87	
6/13/11 15:26:45	0.50	17.60	1.7	7.88	
6/13/11 15:27:00	0.52	17.59	1.7	8.02	
6/13/11 15:27:15	0.53	17.58	1.7	8.18	
6/13/11 15:27:30	0.55	17.56	1.9	8.11	
6/13/11 15:27:45	0.57	17.55	1.9	8.24	
6/13/11 15:28:00	0.57	17.55	1.8	8.17	
6/13/11 15:28:15	0.57	17.55	1.9	8.42	
6/13/11 15:28:30	0.57	17.55	1.9	8.44	
6/13/11 15:28:45	0.59	17.53	1.9	8.28	
6/13/11 15:29:00	0.60	17.53	2.1	8.34	
6/13/11 15:29:15	0.58	17.53	1.9	8.54	
6/13/11 15:29:30	0.58	17.53	2.0	8.46	
6/13/11 15:29:45	0.60	17.53	1.9	8.31	
6/13/11 15:30:00	0.60	17.53	2.1	8.21	Restart FCCU-5b-2
6/13/11 15:30:15	0.59	17.53	2.1	8.23	
6/13/11 15:30:30	0.58	17.53	2.1	8.36	
6/13/11 15:30:45	0.57	17.53	2.0	8.26	
6/13/11 15:31:00	0.58	17.54	2.0	8.42	
6/13/11 15:31:15	0.58	17.54	1.9	8.60	
6/13/11 15:31:30	0.59	17.53	2.0	8.62	
6/13/11 15:31:45	0.61	17.52	2.1	8.67	
6/13/11 15:32:00	0.61	17.50	2.0	8.43	
6/13/11 15:32:15	0.61	17.50	2.1	8.07	
6/13/11 15:32:30	0.60	17.53	1.9	7.93	
6/13/11 15:32:45	0.56	17.56	1.9	7.97	
6/13/11 15:33:00	0.54	17.57	1.8	7.78	
6/13/11 15:33:15	0.54	17.56	2.0	8.00	
6/13/11 15:33:30	0.53	17.56	1.9	7.91	
6/13/11 15:33:45	0.53	17.55	1.9	7.68	
6/13/11 15:34:00	0.53	17.55	1.8	7.77	
6/13/11 15:34:15	0.52	17.56	1.9	7.63	
6/13/11 15:34:30	0.53	17.57	1.9	7.54	
6/13/11 15:34:45	0.52	17.59	1.8	7.60	
6/13/11 15:35:00	0.51	17.59	1.8	7.81	
6/13/11 15:35:15	0.52	17.58	1.8	7.79	
6/13/11 15:35:30	0.54	17.56	1.8	7.61	
6/13/11 15:35:45	0.56	17.56	1.8	7.63	
6/13/11 15:36:00	0.54	17.57	1.9	7.49	
6/13/11 15:36:15	0.54	17.57	1.9	7.23	
6/13/11 15:36:30	0.52	17.59	1.9	7.18	
6/13/11 15:36:45	0.50	17.61	1.9	6.93	
6/13/11 15:37:00	0.48	17.62	1.8	6.73	
6/13/11 15:37:15	0.46	17.62	1.8	6.82	
6/13/11 15:37:30	0.44	17.63	1.8	7.29	
6/13/11 15:37:45	0.44	17.63	1.8	7.37	
6/13/11 15:38:00	0.49	17.60	1.8	7.37	
6/13/11 15:38:15	0.51	17.60	1.9	7.30	
6/13/11 15:38:30	0.51	17.60	2.0	7.45	
6/13/11 15:38:45	0.51	17.60	2.1	7.57	
6/13/11 15:39:00	0.51	17.59	2.1	7.32	
6/13/11 15:39:15	0.52	17.57	2.0	7.17	
6/13/11 15:39:30	0.51	17.58	1.9	7.30	
6/13/11 15:39:45	0.49	17.59	1.8	7.28	
6/13/11 15:40:00	0.50	17.60	2.0	7.39	
6/13/11 15:40:15	0.51	17.60	2.2	7.32	
6/13/11 15:40:30	0.51	17.58	1.9	6.97	
6/13/11 15:40:45	0.51	17.57	1.7	6.82	
6/13/11 15:41:00	0.48	17.59	2.0	6.72	
6/13/11 15:41:15	0.46	17.62	1.8	7.00	
6/13/11 15:41:30	0.45	17.64	1.7	7.17	
6/13/11 15:41:45	0.47	17.63	1.6	6.82	
6/13/11 15:42:00	0.49	17.61	1.9	6.45	
6/13/11 15:42:15	0.47	17.61	1.9	6.52	
6/13/11 15:42:30	0.43	17.63	2.1	6.73	
6/13/11 15:42:45	0.43	17.63	2.0	6.42	
6/13/11 15:43:00	0.44	17.63	2.1	6.43	
6/13/11 15:43:15	0.43	17.65	1.9	6.39	
6/13/11 15:43:30	0.42	17.66	1.9	6.34	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 15:43:45	0.42	17.66	2.1	6.44	
6/13/11 15:44:00	0.42	17.66	2.0	6.68	
6/13/11 15:44:15	0.42	17.65	1.9	6.53	
6/13/11 15:44:30	0.44	17.64	2.0	6.47	
6/13/11 15:44:45	0.44	17.65	1.9	6.27	
6/13/11 15:45:00	0.43	17.66	2.0	6.01	
6/13/11 15:45:15	0.42	17.67	2.1	6.22	Restart FCCU-027-2
6/13/11 15:45:30	0.39	17.68	2.0	6.26	
6/13/11 15:45:45	0.39	17.67	1.9	6.22	
6/13/11 15:46:00	0.38	17.67	2.1	5.90	
6/13/11 15:46:15	0.36	17.69	2.1	6.19	
6/13/11 15:46:30	0.34	17.71	2.0	6.15	
6/13/11 15:46:45	0.35	17.71	1.9	5.95	
6/13/11 15:47:00	0.35	17.71	1.9	5.74	
6/13/11 15:47:15	0.34	17.73	2.0	5.49	
6/13/11 15:47:30	0.32	17.76	2.0	5.68	
6/13/11 15:47:45	0.30	17.77	1.9	6.23	
6/13/11 15:48:00	0.30	17.76	2.0	6.42	
6/13/11 15:48:15	0.34	17.73	2.1	6.65	
6/13/11 15:48:30	0.37	17.70	2.1	6.92	
6/13/11 15:48:45	0.40	17.68	2.1	7.48	
6/13/11 15:49:00	0.43	17.64	2.2	7.88	
6/13/11 15:49:15	0.48	17.60	2.2	8.15	
6/13/11 15:49:30	0.52	17.57	2.1	8.36	
6/13/11 15:49:45	0.55	17.54	2.1	8.44	
6/13/11 15:50:00	0.57	17.52	2.1	8.55	
6/13/11 15:50:15	0.57	17.50	2.0	8.62	
6/13/11 15:50:30	0.58	17.51	1.9	8.54	
6/13/11 15:50:45	0.59	17.52	2.1	8.52	
6/13/11 15:51:00	0.58	17.54	2.1	8.34	
6/13/11 15:51:15	0.57	17.54	2.0	8.38	
6/13/11 15:51:30	0.55	17.55	2.1	8.46	
6/13/11 15:51:45	0.54	17.56	2.2	8.36	
6/13/11 15:52:00	0.54	17.55	2.1	8.56	
6/13/11 15:52:15	0.53	17.56	2.1	8.68	
6/13/11 15:52:30	0.54	17.57	2.0	8.70	
6/13/11 15:52:45	0.56	17.55	1.8	8.65	
6/13/11 15:53:00	0.56	17.55	1.9	8.72	
6/13/11 15:53:15	0.56	17.55	2.1	8.78	
6/13/11 15:53:30	0.57	17.55	2.0	8.61	
6/13/11 15:53:45	0.57	17.55	1.9	8.58	
6/13/11 15:54:00	0.56	17.56	2.1	8.63	
6/13/11 15:54:15	0.55	17.56	2.1	8.40	
6/13/11 15:54:30	0.55	17.56	1.9	8.42	
6/13/11 15:54:45	0.54	17.56	2.0	8.37	
6/13/11 15:55:00	0.54	17.56	2.1	8.30	
6/13/11 15:55:15	0.54	17.58	2.0	8.18	
6/13/11 15:55:30	0.53	17.58	2.0	8.32	
6/13/11 15:55:45	0.51	17.58	1.9	8.47	
6/13/11 15:56:00	0.52	17.58	2.0	8.21	
6/13/11 15:56:15	0.53	17.58	2.0	8.20	
6/13/11 15:56:30	0.52	17.59	2.0	8.29	
6/13/11 15:56:45	0.50	17.59	2.1	8.30	
6/13/11 15:57:00	0.51	17.59	2.1	8.22	
6/13/11 15:57:15	0.52	17.60	2.1	8.40	
6/13/11 15:57:30	0.52	17.60	1.8	8.63	
6/13/11 15:57:45	0.53	17.59	1.9	8.73	
6/13/11 15:58:00	0.56	17.58	2.0	8.73	
6/13/11 15:58:15	0.57	17.57	2.1	8.46	
6/13/11 15:58:30	0.57	17.57	2.1	8.54	
6/13/11 15:58:45	0.55	17.59	2.0	8.72	
6/13/11 15:59:00	0.55	17.59	2.0	8.64	
6/13/11 15:59:15	0.57	17.58	2.0	8.57	
6/13/11 15:59:30	0.56	17.58	2.1	8.63	
6/13/11 15:59:45	0.55	17.58	2.0	8.61	
6/13/11 16:00:00	0.55	17.58	2.0	8.49	
6/13/11 16:00:15	0.55	17.58	2.0	8.53	
6/13/11 16:00:30	0.53	17.60	2.2	8.91	
6/13/11 16:00:45	0.54	17.59	2.0	9.09	
6/13/11 16:01:00	0.59	17.55	1.9	9.02	
6/13/11 16:01:15	0.61	17.53	2.1	8.96	
6/13/11 16:01:30	0.62	17.51	2.0	8.81	
6/13/11 16:01:45	0.61	17.52	2.0	8.88	
6/13/11 16:02:00	0.60	17.53	2.2	8.75	
6/13/11 16:02:15	0.60	17.53	2.2	8.76	
6/13/11 16:02:30	0.59	17.55	2.1	8.85	
6/13/11 16:02:45	0.58	17.55	2.2	8.78	
6/13/11 16:03:00	0.58	17.55	2.0	8.99	
6/13/11 16:03:15	0.58	17.55	1.9	8.95	
6/13/11 16:03:30	0.59	17.55	1.9	8.98	
6/13/11 16:03:45	0.59	17.55	2.2	9.08	
6/13/11 16:04:00	0.59	17.54	2.2	8.96	
6/13/11 16:04:15	0.60	17.54	2.2	8.90	
6/13/11 16:04:30	0.60	17.55	2.2	9.48	
6/13/11 16:04:45	0.59	17.55	2.1	9.64	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 16:05:00	0.63	17.52	2.1	9.62	
6/13/11 16:05:15	0.66	17.49	2.2	9.50	
6/13/11 16:05:30	0.67	17.49	2.0	9.29	
6/13/11 16:05:45	0.66	17.50	2.1	9.19	
6/13/11 16:06:00	0.64	17.51	2.0	9.58	
6/13/11 16:06:15	0.62	17.52	2.1	9.62	
6/13/11 16:06:30	0.65	17.52	2.0	9.47	
6/13/11 16:06:45	0.66	17.52	1.9	9.59	
6/13/11 16:07:00	0.64	17.52	1.9	9.80	
6/13/11 16:07:15	0.65	17.49	2.0	9.75	
6/13/11 16:07:30	0.68	17.47	2.0	9.57	
6/13/11 16:07:45	0.68	17.48	1.8	9.61	
6/13/11 16:08:00	0.67	17.49	2.1	9.63	
6/13/11 16:08:15	0.67	17.48	2.2	9.40	
6/13/11 16:08:30	0.67	17.48	2.1	9.38	
6/13/11 16:08:45	0.64	17.51	2.0	9.62	
6/13/11 16:09:00	0.63	17.52	2.1	9.68	
6/13/11 16:09:15	0.65	17.50	2.1	9.75	
6/13/11 16:09:30	0.66	17.49	2.0	9.79	
6/13/11 16:09:45	0.68	17.49	2.0	9.71	
6/13/11 16:10:00	0.68	17.49	1.8	9.94	
6/13/11 16:10:15	0.67	17.49	1.9	9.92	
6/13/11 16:10:30	0.70	17.47	1.9	9.84	
6/13/11 16:10:45	0.71	17.46	2.0	9.99	
6/13/11 16:11:00	0.70	17.47	2.1	10.18	
6/13/11 16:11:15	0.70	17.47	2.1	10.36	
6/13/11 16:11:30	0.73	17.44	2.2	10.12	
6/13/11 16:11:45	0.76	17.42	2.1	9.73	
6/13/11 16:12:00	0.74	17.44	2.3	9.50	
6/13/11 16:12:15	0.68	17.48	2.3	9.54	
6/13/11 16:12:30	0.64	17.51	2.1	9.71	
6/13/11 16:12:45	0.64	17.51	2.2	9.60	
6/13/11 16:13:00	0.66	17.49	2.1	9.68	
6/13/11 16:13:15	0.66	17.47	2.0	9.42	
6/13/11 16:13:30	0.66	17.46	2.1	9.31	
6/13/11 16:13:45	0.64	17.48	2.1	9.59	
6/13/11 16:14:00	0.63	17.50	2.0	9.58	
6/13/11 16:14:15	0.65	17.50	2.0	9.65	
6/13/11 16:14:30	0.66	17.49	1.9	9.81	
6/13/11 16:14:45	0.67	17.49	1.9	9.76	
6/13/11 16:15:00	0.69	17.47	2.0	9.59	
6/13/11 16:15:15	0.69	17.47	1.9	9.74	
6/13/11 16:15:30	0.67	17.49	2.0	9.89	
6/13/11 16:15:45	0.67	17.50	2.0	9.83	
6/13/11 16:16:00	0.70	17.49	2.1	9.98	
6/13/11 16:16:15	0.70	17.47	2.0	9.98	
6/13/11 16:16:30	0.71	17.45	2.1	10.08	
6/13/11 16:16:45	0.70	17.46	2.0	10.26	
6/13/11 16:17:00	0.70	17.46	1.9	10.33	
6/13/11 16:17:15	0.72	17.45	2.1	10.35	
6/13/11 16:17:30	0.74	17.44	2.1	10.45	
6/13/11 16:17:45	0.75	17.43	1.9	10.53	
6/13/11 16:18:00	0.76	17.43	2.0	10.65	
6/13/11 16:18:15	0.77	17.41	2.1	10.68	Restart FCCU-29-2
6/13/11 16:18:30	0.79	17.39	2.0	10.64	Restart FCCU-29-2
6/13/11 16:18:45	0.81	17.39	2.0	10.58	
6/13/11 16:19:00	0.80	17.40	2.0	10.65	
6/13/11 16:19:15	0.79	17.39	2.0	10.60	
6/13/11 16:19:30	0.79	17.38	2.2	10.63	
6/13/11 16:19:45	0.78	17.38	2.1	10.60	
6/13/11 16:20:00	0.78	17.38	2.0	10.53	
6/13/11 16:20:15	0.78	17.38	2.1	10.58	
6/13/11 16:20:30	0.77	17.40	2.0	10.63	
6/13/11 16:20:45	0.77	17.39	1.9	10.52	
6/13/11 16:21:00	0.77	17.40	1.8	10.62	
6/13/11 16:21:15	0.76	17.41	2.0	10.57	
6/13/11 16:21:30	0.77	17.39	2.0	10.55	
6/13/11 16:21:45	0.78	17.39	1.9	10.70	
6/13/11 16:22:00	0.77	17.40	1.8	10.60	
6/13/11 16:22:15	0.78	17.39	1.9	10.46	
6/13/11 16:22:30	0.78	17.40	2.1	10.53	
6/13/11 16:22:45	0.76	17.41	2.0	10.42	
6/13/11 16:23:00	0.76	17.41	2.0	10.53	
6/13/11 16:23:15	0.75	17.41	2.0	10.77	
6/13/11 16:23:30	0.75	17.41	2.0	10.65	
6/13/11 16:23:45	0.79	17.38	2.0	10.56	
6/13/11 16:24:00	0.79	17.39	2.1	10.53	
6/13/11 16:24:15	0.76	17.40	2.0	10.66	
6/13/11 16:24:30	0.76	17.41	2.0	10.75	
6/13/11 16:24:45	0.78	17.40	2.1	10.60	
6/13/11 16:25:00	0.80	17.38	1.9	10.53	
6/13/11 16:25:15	0.78	17.39	1.9	10.94	
6/13/11 16:25:30	0.76	17.40	1.9	11.15	
6/13/11 16:25:45	0.80	17.37	2.0	10.95	
6/13/11 16:26:00	0.85	17.34	2.1	10.87	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 16:26:15	0.86	17.33	2.1	11.00	
6/13/11 16:26:30	0.84	17.33	1.8	11.12	
6/13/11 16:26:45	0.85	17.31	2.0	11.03	
6/13/11 16:27:00	0.87	17.30	2.1	10.93	
6/13/11 16:27:15	0.87	17.32	1.9	11.02	
6/13/11 16:27:30	0.85	17.33	1.7	11.06	
6/13/11 16:27:45	0.86	17.33	1.9	10.95	
6/13/11 16:28:00	0.86	17.32	2.0	10.98	
6/13/11 16:28:15	0.85	17.32	2.0	11.09	
6/13/11 16:28:30	0.85	17.32	2.1	11.16	
6/13/11 16:28:45	0.86	17.31	2.0	11.07	
6/13/11 16:29:00	0.87	17.30	2.0	11.06	
6/13/11 16:29:15	0.86	17.32	1.8	11.00	
6/13/11 16:29:30	0.86	17.32	2.0	10.86	
6/13/11 16:29:45	0.86	17.32	2.1	10.67	Restart FCCU-5B-2
6/13/11 16:30:00	0.83	17.33	1.8	10.56	
6/13/11 16:30:15	0.80	17.35	1.8	10.65	
6/13/11 16:30:30	0.76	17.36	2.0	10.73	
6/13/11 16:30:45	0.76	17.36	2.1	10.73	
6/13/11 16:31:00	0.78	17.37	2.0	10.86	
6/13/11 16:31:15	0.79	17.37	2.2	10.93	
6/13/11 16:31:30	0.81	17.36	2.1	11.19	
6/13/11 16:31:45	0.83	17.34	2.0	11.36	
6/13/11 16:32:00	0.87	17.31	2.0	11.30	
6/13/11 16:32:15	0.91	17.28	1.9	11.08	
6/13/11 16:32:30	0.92	17.28	2.0	11.00	
6/13/11 16:32:45	0.89	17.30	2.1	10.96	
6/13/11 16:33:00	0.87	17.30	2.0	10.95	
6/13/11 16:33:15	0.85	17.31	2.1	11.12	
6/13/11 16:33:30	0.83	17.33	2.0	11.09	
6/13/11 16:33:45	0.85	17.32	1.9	10.92	
6/13/11 16:34:00	0.87	17.31	1.9	10.97	
6/13/11 16:34:15	0.85	17.32	2.1	11.07	
6/13/11 16:34:30	0.84	17.33	2.0	11.13	
6/13/11 16:34:45	0.84	17.33	2.1	11.16	
6/13/11 16:35:00	0.87	17.32	2.1	11.11	
6/13/11 16:35:15	0.89	17.31	2.0	11.10	
6/13/11 16:35:30	0.89	17.29	2.0	11.36	
6/13/11 16:35:45	0.88	17.29	2.0	11.42	
6/13/11 16:36:00	0.88	17.30	2.1	11.32	
6/13/11 16:36:15	0.89	17.29	2.1	11.46	
6/13/11 16:36:30	0.88	17.28	1.9	11.36	
6/13/11 16:36:45	0.89	17.26	2.0	11.21	
6/13/11 16:37:00	0.90	17.27	2.1	11.12	
6/13/11 16:37:15	0.87	17.30	2.0	11.32	
6/13/11 16:37:30	0.85	17.31	2.0	11.29	
6/13/11 16:37:45	0.88	17.27	2.1	11.16	
6/13/11 16:38:00	0.89	17.26	2.1	11.14	
6/13/11 16:38:15	0.87	17.28	1.9	11.06	
6/13/11 16:38:30	0.85	17.30	2.1	11.10	
6/13/11 16:38:45	0.84	17.32	2.1	10.99	
6/13/11 16:39:00	0.85	17.32	1.9	10.83	
6/13/11 16:39:15	0.85	17.32	1.8	10.87	
6/13/11 16:39:30	0.84	17.32	1.9	10.98	
6/13/11 16:39:45	0.84	17.32	2.0	10.82	
6/13/11 16:40:00	0.84	17.31	2.1	10.70	
6/13/11 16:40:15	0.83	17.31	2.2	10.78	
6/13/11 16:40:30	0.80	17.34	2.1	10.92	
6/13/11 16:40:45	0.80	17.34	2.1	10.98	
6/13/11 16:41:00	0.82	17.34	2.0	11.03	
6/13/11 16:41:15	0.84	17.33	2.0	11.04	
6/13/11 16:41:30	0.84	17.33	2.0	10.96	
6/13/11 16:41:45	0.85	17.32	1.8	11.07	
6/13/11 16:42:00	0.85	17.31	1.8	10.95	
6/13/11 16:42:15	0.87	17.29	2.1	10.79	
6/13/11 16:42:30	0.85	17.31	2.1	10.93	
6/13/11 16:42:45	0.82	17.33	2.1	11.03	
6/13/11 16:43:00	0.82	17.33	2.1	11.06	
6/13/11 16:43:15	0.83	17.32	2.1	10.96	
6/13/11 16:43:30	0.85	17.31	2.1	10.97	
6/13/11 16:43:45	0.86	17.31	2.2	11.02	
6/13/11 16:44:00	0.85	17.32	2.1	11.04	
6/13/11 16:44:15	0.86	17.31	2.1	11.03	
6/13/11 16:44:30	0.87	17.29	2.2	10.99	
6/13/11 16:44:45	0.87	17.31	2.1	10.84	
6/13/11 16:45:00	0.84	17.31	1.8	10.87	
6/13/11 16:45:15	0.82	17.32	1.8	10.76	
6/13/11 16:45:30	0.80	17.34	2.0	10.65	
6/13/11 16:45:45	0.80	17.35	2.0	10.58	
6/13/11 16:46:00	0.79	17.36	2.0	10.69	
6/13/11 16:46:15	0.78	17.37	1.9	10.55	
6/13/11 16:46:30	0.78	17.37	2.1	10.48	
6/13/11 16:46:45	0.78	17.37	1.9	10.49	
6/13/11 16:47:00	0.77	17.37	2.1	10.51	
6/13/11 16:47:15	0.77	17.36	2.0	10.45	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 16:47:30	0.77	17.36	2.1	10.40	
6/13/11 16:47:45	0.77	17.38	2.0	10.36	
6/13/11 16:48:00	0.76	17.38	2.1	10.33	Restart FCCU-027-2
6/13/11 16:48:15	0.76	17.39	2.0	10.18	
6/13/11 16:48:30	0.75	17.39	2.1	10.14	
6/13/11 16:48:45	0.73	17.40	2.1	10.24	
6/13/11 16:49:00	0.71	17.40	2.0	10.28	
6/13/11 16:49:15	0.73	17.39	1.9	10.18	
6/13/11 16:49:30	0.74	17.40	2.1	10.20	
6/13/11 16:49:45	0.73	17.42	1.8	10.18	
6/13/11 16:50:00	0.73	17.42	1.8	10.08	
6/13/11 16:50:15	0.73	17.42	1.9	10.07	
6/13/11 16:50:30	0.72	17.42	2.1	10.04	
6/13/11 16:50:45	0.71	17.42	2.1	9.96	
6/13/11 16:51:00	0.71	17.43	2.0	9.90	
6/13/11 16:51:15	0.70	17.45	1.8	9.75	
6/13/11 16:51:30	0.68	17.47	2.0	9.88	
6/13/11 16:51:45	0.66	17.48	2.3	9.86	
6/13/11 16:52:00	0.68	17.46	2.0	10.01	
6/13/11 16:52:15	0.69	17.45	2.0	10.03	
6/13/11 16:52:30	0.71	17.44	1.8	10.08	
6/13/11 16:52:45	0.73	17.43	1.8	10.04	
6/13/11 16:53:00	0.73	17.41	1.9	10.06	
6/13/11 16:53:15	0.72	17.42	2.0	10.10	
6/13/11 16:53:30	0.72	17.43	2.2	10.01	
6/13/11 16:53:45	0.72	17.42	2.0	9.90	
6/13/11 16:54:00	0.71	17.43	1.9	9.94	
6/13/11 16:54:15	0.69	17.45	2.0	10.10	
6/13/11 16:54:30	0.69	17.44	1.9	10.16	
6/13/11 16:54:45	0.71	17.42	1.9	10.01	
6/13/11 16:55:00	0.73	17.42	1.7	10.06	
6/13/11 16:55:15	0.71	17.44	1.9	9.85	
6/13/11 16:55:30	0.71	17.44	2.0	9.93	
6/13/11 16:55:45	0.70	17.45	2.0	10.02	
6/13/11 16:56:00	0.70	17.44	1.9	10.01	
6/13/11 16:56:15	0.71	17.43	1.9	10.13	
6/13/11 16:56:30	0.71	17.43	1.9	10.23	
6/13/11 16:56:45	0.72	17.43	1.9	10.23	
6/13/11 16:57:00	0.74	17.42	1.9	10.20	
6/13/11 16:57:15	0.76	17.42	2.0	10.23	
6/13/11 16:57:30	0.76	17.42	2.0	10.39	
6/13/11 16:57:45	0.76	17.42	2.0	10.27	
6/13/11 16:58:00	0.77	17.40	1.8	10.13	
6/13/11 16:58:15	0.77	17.40	1.9	10.13	
6/13/11 16:58:30	0.75	17.41	1.9	10.17	
6/13/11 16:58:45	0.73	17.42	1.7	10.20	
6/13/11 16:59:00	0.72	17.42	1.9	10.37	
6/13/11 16:59:15	0.72	17.42	1.8	10.39	
6/13/11 16:59:30	0.74	17.40	1.9	10.40	
6/13/11 16:59:45	0.76	17.40	2.1	10.15	
6/13/11 17:00:00	0.76	17.40	2.0	9.98	
6/13/11 17:00:15	0.74	17.42	2.1	10.17	
6/13/11 17:00:30	0.71	17.44	2.0	10.25	
6/13/11 17:00:45	0.72	17.43	2.0	10.14	
6/13/11 17:01:00	0.73	17.42	2.0	10.07	
6/13/11 17:01:15	0.72	17.43	2.2	10.03	
6/13/11 17:01:30	0.71	17.43	2.0	10.03	
6/13/11 17:01:45	0.70	17.43	1.9	9.92	
6/13/11 17:02:00	0.69	17.44	2.0	9.99	
6/13/11 17:02:15	0.68	17.45	1.9	10.06	
6/13/11 17:02:30	0.69	17.45	1.8	10.17	
6/13/11 17:02:45	0.70	17.44	2.0	10.26	Run 2 Complete
6/13/11 17:03:00	0.72	17.43	1.8	10.19	
6/13/11 17:03:15	0.75	17.41	1.7	10.17	
6/13/11 17:03:30	0.76	17.41	1.8	10.12	
6/13/11 17:03:45	0.76	17.40	1.8	10.21	
6/13/11 17:04:00	0.76	17.39	1.9	10.21	
6/13/11 17:04:15	0.76	17.39	2.0	9.99	
6/13/11 17:04:30	0.75	17.40	1.9	9.88	
6/13/11 17:04:45	0.73	17.44	2.1	9.78	
6/13/11 17:05:00	0.70	17.46	1.8	9.74	
6/13/11 17:05:15	0.69	17.44	1.7	9.84	
6/13/11 17:05:30	0.68	17.44	1.9	9.91	
6/13/11 17:05:45	0.70	17.42	2.1	7.76	
6/13/11 17:06:00	0.96	16.84	2.0	5.50	
6/13/11 17:06:15	5.80	11.48	1.9	2.17	
6/13/11 17:06:30	10.74	8.51	1.9	2.15	
6/13/11 17:06:45	11.40	8.59	1.9	2.04	
6/13/11 17:07:00	11.35	9.56	1.8	1.82	
6/13/11 17:07:15	11.34	9.94	1.8	1.57	
6/13/11 17:07:30	11.34	10.01	2.0	1.43	
6/13/11 17:07:45	11.34	10.02	2.0	1.34	
6/13/11 17:08:00	11.35	10.02	1.9	1.21	
6/13/11 17:08:15	11.35	10.02	1.7	1.17	
6/13/11 17:08:30	11.35	10.02	2.0	1.10	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 17:08:45	11.36	10.03	1.9	1.06	System Bias
6/13/11 17:09:00	11.36	10.03	1.7	1.07	
6/13/11 17:09:15	11.36	10.02	2.0	1.00	CO ₂ Bias 2 Mid = 10.03
6/13/11 17:09:30	11.36	10.03	1.8	0.99	SO ₂ Bias 2 Zero = 1.9
6/13/11 17:09:45	11.36	10.03	1.9	0.97	
6/13/11 17:10:00	11.36	10.03	2.0	0.95	
6/13/11 17:10:15	11.36	10.02	1.8	0.94	
6/13/11 17:10:30	11.37	10.02	1.9	0.91	
6/13/11 17:10:45	11.37	10.02	1.9	0.88	
6/13/11 17:11:00	11.37	10.02	1.8	0.87	
6/13/11 17:11:15	11.37	10.02	1.8	0.85	
6/13/11 17:11:30	11.37	10.02	1.9	0.83	
6/13/11 17:11:45	11.37	10.02	1.8	0.82	
6/13/11 17:12:00	11.37	10.02	1.9	0.81	
6/13/11 17:12:15	11.37	10.02	1.9	0.81	
6/13/11 17:12:30	11.37	10.02	2.0	0.80	
6/13/11 17:12:45	11.37	10.02	2.0	0.77	
6/13/11 17:13:00	11.37	10.02	1.8	0.77	
6/13/11 17:13:15	11.37	10.02	1.9	0.78	
6/13/11 17:13:30	11.37	10.02	2.0	0.78	
6/13/11 17:13:45	11.37	10.02	1.9	0.75	
6/13/11 17:14:00	11.37	10.03	1.8	0.76	
6/13/11 17:14:15	11.38	10.03	1.9	0.73	
6/13/11 17:14:30	11.37	10.02	1.6	0.74	
6/13/11 17:14:45	11.37	10.02	1.8	0.73	
6/13/11 17:15:00	11.38	10.02	1.9	0.72	
6/13/11 17:15:15	11.38	10.02	1.9	0.72	
6/13/11 17:15:30	11.38	10.02	1.8	0.69	
6/13/11 17:15:45	11.38	10.02	1.7	0.71	
6/13/11 17:16:00	11.38	10.02	1.9	0.70	
6/13/11 17:16:15	11.38	10.02	2.1	0.70	
6/13/11 17:16:30	11.38	10.02	1.8	0.70	
6/13/11 17:16:45	11.38	10.02	2.1	0.69	
6/13/11 17:17:00	11.38	10.02	2.0	0.69	
6/13/11 17:17:15	11.38	10.02	2.0	0.67	
6/13/11 17:17:30	11.38	10.02	1.9	0.68	
6/13/11 17:17:45	11.38	10.02	1.9	0.69	
6/13/11 17:18:00	11.38	10.02	2.1	0.67	
6/13/11 17:18:15	11.38	10.02	2.0	0.67	
6/13/11 17:18:30	11.38	10.02	2.0	0.68	
6/13/11 17:18:45	11.38	10.02	2.2	0.66	
6/13/11 17:19:00	11.38	10.02	2.0	0.67	
6/13/11 17:19:15	11.38	10.02	1.9	0.66	
6/13/11 17:19:30	11.38	10.02	1.8	0.66	
6/13/11 17:19:45	11.38	10.02	1.8	0.66	
6/13/11 17:20:00	11.38	10.02	1.9	0.66	
6/13/11 17:20:15	11.38	10.02	1.9	0.65	
6/13/11 17:20:30	11.38	10.02	1.9	0.65	
6/13/11 17:20:45	11.38	10.02	1.9	0.64	
6/13/11 17:21:00	11.38	10.02	2.0	0.64	
6/13/11 17:21:15	11.38	10.02	2.0	0.71	
6/13/11 17:21:30	11.38	10.02	1.9	5.88	
6/13/11 17:21:45	11.01	10.51	2.0	1.65	
6/13/11 17:22:00	7.81	12.50	2.0	0.57	
6/13/11 17:22:15	7.08	9.24	2.1	0.60	
6/13/11 17:22:30	5.64	5.66	2.0	0.63	
6/13/11 17:22:45	4.72	4.36	1.8	0.78	
6/13/11 17:23:00	4.59	4.21	1.9	0.74	
6/13/11 17:23:15	4.58	4.18	1.8	0.67	
6/13/11 17:23:30	4.57	4.17	1.9	0.66	System Bias
6/13/11 17:23:45	4.57	4.16	2.0	0.65	O ₂ Bias 2 Mid = 4.57
6/13/11 17:24:00	4.56	4.15	2.2	0.64	
6/13/11 17:24:15	4.56	4.15	1.8	0.63	
6/13/11 17:24:30	4.56	4.14	1.8	0.60	
6/13/11 17:24:45	4.56	4.14	1.9	0.60	
6/13/11 17:25:00	4.56	4.13	2.0	0.60	
6/13/11 17:25:15	4.56	4.13	1.8	2.72	
6/13/11 17:25:30	4.54	4.36	2.0	2.35	
6/13/11 17:25:45	3.90	6.97	2.3	0.67	
6/13/11 17:26:00	3.25	5.36	2.0	0.64	
6/13/11 17:26:15	1.55	1.75	2.1	0.69	
6/13/11 17:26:30	0.34	0.38	3.2	0.80	
6/13/11 17:26:45	0.13	0.21	11.1	0.81	
6/13/11 17:27:00	0.11	0.18	32.1	0.76	
6/13/11 17:27:15	0.10	0.16	59.7	0.74	
6/13/11 17:27:30	0.10	0.15	85.5	0.72	
6/13/11 17:27:45	0.10	0.14	100.3	0.72	
6/13/11 17:28:00	0.09	0.13	100.8	0.69	
6/13/11 17:28:15	0.09	0.13	100.8	0.72	
6/13/11 17:28:30	0.09	0.12	100.8	0.72	
6/13/11 17:28:45	0.08	0.12	100.8	0.71	
6/13/11 17:29:00	0.08	0.11	100.8	0.69	
6/13/11 17:29:15	0.08	0.11	100.8	0.69	
6/13/11 17:29:30	0.08	0.11	100.8	0.68	
6/13/11 17:29:45	0.07	0.11	100.8	0.66	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 17:30:00	0.07	0.10	100.8	0.67	
6/13/11 17:30:15	0.07	0.10	100.8	3.52	
6/13/11 17:30:30	0.07	0.10	100.8	1.09	
6/13/11 17:30:45	0.09	0.12	100.8	0.79	
6/13/11 17:31:00	0.08	0.11	100.8	0.76	
6/13/11 17:31:15	0.07	0.10	100.8	0.80	
6/13/11 17:31:30	0.06	0.09	100.5	0.84	
6/13/11 17:31:45	0.07	0.09	92.5	0.81	
6/13/11 17:32:00	0.06	0.09	82.8	0.77	
6/13/11 17:32:15	0.06	0.09	75.0	0.73	
6/13/11 17:32:30	0.06	0.09	68.7	0.72	
6/13/11 17:32:45					Computer Tripped
6/13/11 17:33:00					
6/13/11 17:33:15					
6/13/11 17:33:30					
6/13/11 17:33:45					
6/13/11 17:34:00					
6/13/11 17:34:15					
6/13/11 17:34:30					
6/13/11 17:34:45					
6/13/11 17:35:00					
6/13/11 17:35:15					
6/13/11 17:35:30					
6/13/11 17:35:45					
6/13/11 17:36:00					
6/13/11 17:36:15					
6/13/11 17:36:30					
6/13/11 17:36:45					
6/13/11 17:37:00					
6/13/11 17:37:15					
6/13/11 17:37:30					
6/13/11 17:37:45					
6/13/11 17:38:00					
6/13/11 17:38:15					
6/13/11 17:38:30					
6/13/11 17:38:45					
6/13/11 17:39:00					
6/13/11 17:39:15					
6/13/11 17:39:30					
6/13/11 17:39:45					
6/13/11 17:40:00					
6/13/11 17:40:15					
6/13/11 17:40:30					
6/13/11 17:40:45					
6/13/11 17:41:00					
6/13/11 17:41:15					
6/13/11 17:41:30					
6/13/11 17:41:45					
6/13/11 17:42:00					
6/13/11 17:42:15					
6/13/11 17:42:30					
6/13/11 17:42:45					
6/13/11 17:43:00					
6/13/11 17:43:15					
6/13/11 17:43:30					
6/13/11 17:43:45					
6/13/11 17:44:00					
6/13/11 17:44:15					
6/13/11 17:44:30					
6/13/11 17:44:45					
6/13/11 17:45:00	0.28	17.17	2.3	13.83	
6/13/11 17:45:15	0.43	10.53	2.0	1.90	
6/13/11 17:45:30	0.35	4.44	2.3	1.80	
6/13/11 17:45:45	0.14	1.08	3.4	2.04	
6/13/11 17:46:00	0.06	0.34	10.5	2.16	
6/13/11 17:46:15	0.05	0.26	29.8	1.86	
6/13/11 17:46:30	0.05	0.23	58.1	1.68	
6/13/11 17:46:45	0.05	0.20	86.8	1.51	
6/13/11 17:47:00	0.05	0.19	100.8	4.73	
6/13/11 17:47:15	0.05	0.17	100.8	3.45	
6/13/11 17:47:30	0.05	0.16	100.8	1.34	
6/13/11 17:47:45	0.05	0.16	100.8	1.18	
6/13/11 17:48:00	0.05	0.15	100.8	1.15	
6/13/11 17:48:15	0.05	0.14	100.1	1.27	
6/13/11 17:48:30	0.05	0.14	91.1	1.21	
6/13/11 17:48:45	0.05	0.13	81.5	1.11	
6/13/11 17:49:00	0.05	0.13	73.7	1.04	
6/13/11 17:49:15	0.05	0.12	67.7	1.01	
6/13/11 17:49:30	0.05	0.12	62.4	0.99	
6/13/11 17:49:45	0.05	0.12	58.1	0.98	
6/13/11 17:50:00	0.05	0.11	55.3	0.97	
6/13/11 17:50:15	0.05	0.11	52.6	0.95	
6/13/11 17:50:30	0.05	0.11	50.3	0.94	
6/13/11 17:50:45	0.05	0.11	48.8	0.93	
6/13/11 17:51:00	0.05	0.10	47.6	0.92	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/13/11 17:51:15	0.05	0.10	46.9	0.90	
6/13/11 17:51:30	0.05	0.10	45.8	0.88	
6/13/11 17:51:45	0.05	0.10	44.9	0.87	
6/13/11 17:52:00	0.05	0.10	44.6	0.89	
6/13/11 17:52:15	0.05	0.09	44.4	0.88	
6/13/11 17:52:30	0.05	0.09	43.8	0.86	
6/13/11 17:52:45	0.05	0.09	43.6	0.87	System Bias
6/13/11 17:53:00	0.05	0.09	43.9	0.87	O ₂ Bias 2 Zero = 0.05
6/13/11 17:53:15	0.05	0.09	43.6	0.85	CO ₂ Bias 2 Zero = 0.09
6/13/11 17:53:30	0.05	0.09	43.4	0.84	SO ₂ Bias 2 Mid = 43.6
6/13/11 17:53:45	0.05	0.08	43.2	0.83	NO _x Bias 2 Zero = 0.9
6/13/11 17:54:00	0.05	0.08	43.3	0.81	
6/13/11 17:54:15	0.05	0.08	43.0	1.90	
6/13/11 17:54:30	0.05	0.96	43.1	3.21	
6/13/11 17:54:45	0.10	4.17	42.9	22.67	
6/13/11 17:55:00	0.09	2.69	42.4	30.02	
6/13/11 17:55:15	0.06	0.52	41.1	31.13	
6/13/11 17:55:30	0.06	0.14	38.6	31.54	
6/13/11 17:55:45	0.05	0.10	35.3	32.60	
6/13/11 17:56:00	0.05	0.09	32.0	34.18	
6/13/11 17:56:15	0.05	0.09	28.6	35.66	
6/13/11 17:56:30	0.05	0.09	25.2	36.87	
6/13/11 17:56:45	0.05	0.09	22.2	37.83	
6/13/11 17:57:00	0.05	0.08	19.8	38.79	
6/13/11 17:57:15	0.05	0.08	17.3	39.65	
6/13/11 17:57:30	0.05	0.08	15.2	40.43	
6/13/11 17:57:45	0.05	0.08	13.5	41.22	
6/13/11 17:58:00	0.05	0.08	12.2	41.85	
6/13/11 17:58:15	0.05	0.08	11.0	42.39	
6/13/11 17:58:30	0.05	0.08	10.0	42.69	
6/13/11 17:58:45	0.05	0.08	8.8	42.90	
6/13/11 17:59:00	0.05	0.08	8.1	43.08	
6/13/11 17:59:15	0.05	0.08	7.7	43.23	
6/13/11 17:59:30	0.05	0.08	7.1	43.35	
6/13/11 17:59:45	0.05	0.08	6.4	43.41	System Bias
6/13/11 18:00:00	0.05	0.08	6.0	43.47	NO _x Bias 2 Mid = 43.5
6/13/11 18:00:15	0.05	0.08	5.4	43.49	
6/13/11 18:00:30	0.05	0.08	5.1	43.57	
6/13/11 18:00:45	0.05	0.08	4.9	43.63	
6/13/11 18:01:00	0.05	0.08	4.8	43.67	
6/13/11 18:01:15	0.05	0.08	4.4	43.73	
6/13/11 18:01:30	0.05	0.08	4.2	43.78	
6/13/11 18:01:45	0.05	0.08	4.1	43.88	
6/13/11 18:02:00	0.05	0.08	4.1	43.94	
6/13/11 18:02:15	0.05	0.08	4.0	44.00	

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ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 6:26:00	6.66	1.91	1.0	0.9	
6/14/11 6:26:15	1.27	0.37	0.7	0.9	
6/14/11 6:26:30	0.09	0.13	0.6	0.6	
6/14/11 6:26:45	0.01	0.11	0.6	0.5	
6/14/11 6:27:00	0.00	0.10	0.7	0.5	
6/14/11 6:27:15	0.00	0.10	0.7	0.5	
6/14/11 6:27:30	0.00	0.09	0.8	0.5	
6/14/11 6:27:45	0.00	0.09	0.6	0.5	
6/14/11 6:28:00	0.00	0.09	0.6	0.5	
6/14/11 6:28:15	0.00	0.08	0.7	0.5	Calibration Error
6/14/11 6:28:30	-0.01	0.08	0.6	0.4	O ₂ CE Zero = 0.00
6/14/11 6:28:45	0.00	0.08	0.7	0.4	CO ₂ CE Zero = 0.08
6/14/11 6:29:00	0.00	0.08	0.9	0.4	SO ₂ CE Zero = 0.7
6/14/11 6:29:15	-0.01	0.08	0.6	0.4	NO _x CE Zero = 0.4
6/14/11 6:29:30	-0.01	0.08	0.6	0.4	
6/14/11 6:29:45	-0.01	0.08	0.8	1.6	
6/14/11 6:30:00	-0.01	0.07	3.6	4.7	
6/14/11 6:30:15	1.66	1.19	2.1	1.2	
6/14/11 6:30:30	10.47	7.50	0.9	1.4	
6/14/11 6:30:45	17.21	13.29	0.8	1.4	
6/14/11 6:31:00	20.55	17.17	0.6	1.3	
6/14/11 6:31:15	21.89	19.14	0.7	1.3	
6/14/11 6:31:30	22.15	19.57	0.7	1.3	Calibration Error
6/14/11 6:31:45	22.18	19.61	0.7	1.2	
6/14/11 6:32:00	22.19	19.63	0.5	1.2	CO ₂ CE Span = 19.63
6/14/11 6:32:15	22.19	19.64	0.5	1.2	
6/14/11 6:32:30	22.19	19.64	0.5	1.1	
6/14/11 6:32:45	22.20	19.64	0.8	1.1	
6/14/11 6:33:00	22.03	19.21	0.7	1.0	
6/14/11 6:33:15	18.35	15.19	0.8	1.0	
6/14/11 6:33:30	13.74	11.68	0.7	1.1	
6/14/11 6:33:45	11.79	10.29	0.8	1.1	
6/14/11 6:34:00	11.54	10.16	0.8	1.1	Calibration Error
6/14/11 6:34:15	11.52	10.15	0.9	1.0	
6/14/11 6:34:30	11.52	10.15	0.6	1.1	CO ₂ CE Mid = 10.15
6/14/11 6:34:45	11.52	10.15	0.6	1.0	
6/14/11 6:35:00	11.52	10.14	0.5	1.1	
6/14/11 6:35:15	11.52	10.14	1.0	1.5	
6/14/11 6:35:30	11.54	10.10	0.9	0.9	
6/14/11 6:35:45	12.28	9.00	0.6	0.7	
6/14/11 6:36:00	10.82	8.24	0.6	0.9	
6/14/11 6:36:15	9.26	8.17	0.4	1.0	Calibration Error
6/14/11 6:36:30	9.03	8.16	0.3	1.0	O ₂ CE Span = 9.01
6/14/11 6:36:45	9.01	8.15	0.4	1.1	
6/14/11 6:37:00	9.00	8.15	0.5	1.1	
6/14/11 6:37:15	9.00	8.15	0.3	1.1	
6/14/11 6:37:30	9.00	8.15	0.5	0.9	
6/14/11 6:37:45	8.83	7.82	0.8	1.0	
6/14/11 6:38:00	6.62	5.58	0.6	1.1	
6/14/11 6:38:15	4.88	4.34	0.5	1.1	
6/14/11 6:38:30	4.64	4.23	0.6	1.1	Calibration Error
6/14/11 6:38:45	4.63	4.22	0.7	1.1	O ₂ CE Mid = 4.63
6/14/11 6:39:00	4.63	4.22	0.6	1.1	
6/14/11 6:39:15	4.63	4.22	0.6	1.2	
6/14/11 6:39:30	4.63	4.22	0.6	1.2	
6/14/11 6:39:45	4.63	4.21	0.8	1.3	
6/14/11 6:40:00	4.63	4.22	1.7	73.9	
6/14/11 6:40:15	4.72	3.97	1.9	100.9	
6/14/11 6:40:30	3.16	1.84	0.9	91.4	
6/14/11 6:40:45	0.65	0.34	0.6	89.8	
6/14/11 6:41:00	0.07	0.11	0.7	89.3	
6/14/11 6:41:15	0.03	0.09	0.6	89.1	
6/14/11 6:41:30	0.02	0.08	0.8	89.0	
6/14/11 6:41:45	0.02	0.08	0.7	88.8	
6/14/11 6:42:00	0.02	0.08	0.7	88.6	
6/14/11 6:42:15	0.02	0.08	0.7	88.2	
6/14/11 6:42:30	0.02	0.08	0.6	88.0	
6/14/11 6:42:45	0.01	0.08	0.6	87.8	
6/14/11 6:43:00	0.02	0.08	0.7	87.7	
6/14/11 6:43:15	0.01	0.08	0.6	87.5	
6/14/11 6:43:30	0.01	0.08	0.6	87.4	
6/14/11 6:43:45	0.01	0.07	0.7	87.3	
6/14/11 6:44:00	0.01	0.07	0.7	87.2	
6/14/11 6:44:15	0.01	0.07	0.5	87.2	
6/14/11 6:44:30	0.01	0.07	0.5	87.1	
6/14/11 6:44:45	0.01	0.07	0.7	87.1	
6/14/11 6:45:00	0.01	0.07	0.6	87.2	
6/14/11 6:45:15	0.01	0.07	0.5	87.3	
6/14/11 6:45:30	0.00	0.07	0.6	87.6	
6/14/11 6:45:45	0.00	0.07	0.6	87.8	
6/14/11 6:46:00	0.00	0.07	0.5	88.1	
6/14/11 6:46:15	0.00	0.07	0.4	88.2	
6/14/11 6:46:30	0.00	0.07	0.6	88.4	
6/14/11 6:46:45	0.00	0.07	0.5	88.5	
6/14/11 6:47:00	0.00	0.07	0.6	88.7	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 6:47:15	0.00	0.06	0.6	88.9	
6/14/11 6:47:30	0.00	0.06	0.5	88.9	
6/14/11 6:47:45	0.00	0.06	0.5	89.1	
6/14/11 6:48:00	0.00	0.06	0.6	89.2	
6/14/11 6:48:15	0.00	0.06	0.5	89.3	
6/14/11 6:48:30	0.00	0.06	0.7	89.3	Calibration Error
6/14/11 6:48:45	0.00	0.06	0.7	90.2	
6/14/11 6:49:00	0.00	0.06	0.7	90.5	
6/14/11 6:49:15	0.00	0.06	0.8	90.7	
6/14/11 6:49:30	0.00	0.06	0.7	90.8	NO _x CE Span = 90.6
6/14/11 6:49:45	0.00	0.06	0.8	90.8	
6/14/11 6:50:00	0.00	0.06	0.8	84.8	
6/14/11 6:50:15	0.00	0.06	0.6	49.0	
6/14/11 6:50:30	0.00	0.05	0.5	47.2	
6/14/11 6:50:45	-0.01	0.05	0.5	47.1	
6/14/11 6:51:00	-0.01	0.05	0.6	47.0	
6/14/11 6:51:15	-0.01	0.05	0.7	46.9	
6/14/11 6:51:30	-0.01	0.06	0.6	46.8	
6/14/11 6:51:45	-0.01	0.06	0.6	46.7	
6/14/11 6:52:00	-0.01	0.06	0.6	46.7	Calibration Error
6/14/11 6:52:15	-0.01	0.06	0.6	46.7	
6/14/11 6:52:30	-0.01	0.06	0.4	46.7	
6/14/11 6:52:45	-0.01	0.06	0.4	46.7	
6/14/11 6:53:00	-0.01	0.06	0.6	46.7	NO _x CE Mid = 46.7
6/14/11 6:53:15	-0.01	0.06	0.4	41.4	
6/14/11 6:53:30	0.01	0.06	0.5	17.0	
6/14/11 6:53:45	4.92	0.06	1.0	38.0	
6/14/11 6:54:00	15.56	0.06	1.5	40.5	
6/14/11 6:54:15	19.97	0.06	1.3	41.5	
6/14/11 6:54:30	20.58	0.06	1.4	42.2	
6/14/11 6:54:45	20.63	0.06	1.4	42.7	
6/14/11 6:55:00	20.64	0.06	1.4	43.0	
6/14/11 6:55:15	20.64	0.06	1.2	43.3	
6/14/11 6:55:30	20.65	0.06	1.4	43.6	
6/14/11 6:55:45	20.65	0.06	1.3	43.7	
6/14/11 6:56:00	20.65	0.06	1.5	43.9	
6/14/11 6:56:15	20.65	0.06	1.2	44.0	
6/14/11 6:56:30	20.65	0.06	1.3	44.1	
6/14/11 6:56:45	20.66	0.06	1.3	44.4	
6/14/11 6:57:00	20.66	0.06	1.5	44.6	NO ₂ Converter Efficiency Check
6/14/11 6:57:15	20.66	0.06	1.7	44.9	Cyl AAL13927
6/14/11 6:57:30	20.66	0.06	1.6	45.0	Conc. = 49.8
6/14/11 6:57:45	20.66	0.06	1.5	45.1	Response = 44.96
6/14/11 6:58:00	20.66	0.05	1.6	45.0	Eff. = 90.3%
6/14/11 6:58:15	20.67	0.05	1.6	44.8	
6/14/11 6:58:30	20.67	0.05	1.7	44.6	
6/14/11 6:58:45	20.67	0.05	1.7	44.5	
6/14/11 6:59:00	20.67	0.05	1.6	44.3	
6/14/11 6:59:15	20.67	0.05	1.6	44.2	
6/14/11 6:59:30	20.67	0.05	1.8	44.1	
6/14/11 6:59:45	20.67	0.05	1.8	40.3	
6/14/11 7:00:00	20.66	0.05	1.3	13.9	
6/14/11 7:00:15	17.95	0.07	11.1	32.3	
6/14/11 7:00:30	6.67	0.09	90.7	4.6	
6/14/11 7:00:45	2.75	0.16	100.8	13.4	
6/14/11 7:01:00	1.06	0.09	97.2	7.6	
6/14/11 7:01:15	0.16	0.06	89.4	2.7	
6/14/11 7:01:30	0.04	0.05	88.3	2.6	
6/14/11 7:01:45	0.03	0.05	86.7	2.6	
6/14/11 7:02:00	0.02	0.05	85.9	2.5	
6/14/11 7:02:15	0.02	0.05	85.1	2.5	
6/14/11 7:02:30	0.02	0.05	84.2	2.5	
6/14/11 7:02:45	0.02	0.05	83.6	2.4	
6/14/11 7:03:00	0.02	0.05	82.7	2.4	
6/14/11 7:03:15	0.02	0.05	82.0	2.4	
6/14/11 7:03:30	0.01	0.05	81.4	2.3	
6/14/11 7:03:45	0.01	0.05	80.9	2.3	
6/14/11 7:04:00	0.01	0.05	80.9	2.2	
6/14/11 7:04:15	0.01	0.05	80.6	2.2	
6/14/11 7:04:30	0.01	0.05	80.4	2.2	
6/14/11 7:04:45	0.01	0.05	80.4	2.2	
6/14/11 7:05:00	0.01	0.05	80.6	2.2	
6/14/11 7:05:15	0.01	0.05	81.0	2.2	
6/14/11 7:05:30	0.01	0.05	81.5	2.2	
6/14/11 7:05:45	0.01	0.06	82.1	2.1	
6/14/11 7:06:00	0.01	0.06	82.7	2.1	
6/14/11 7:06:15	0.00	0.06	83.6	2.1	
6/14/11 7:06:30	0.00	0.06	84.4	2.1	
6/14/11 7:06:45	0.00	0.06	85.3	2.1	
6/14/11 7:07:00	0.00	0.06	86.0	2.0	
6/14/11 7:07:15	0.00	0.06	86.6	2.1	
6/14/11 7:07:30	0.00	0.06	87.4	2.0	
6/14/11 7:07:45	0.00	0.05	87.9	2.0	
6/14/11 7:08:00	0.00	0.05	88.5	2.0	
6/14/11 7:08:15	0.00	0.05	89.0	2.0	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 7:08:30	-0.01	0.05	89.1	2.0	
6/14/11 7:08:45	-0.01	0.05	89.6	2.0	
6/14/11 7:09:00	0.00	0.05	89.7	1.9	Calibration Error
6/14/11 7:09:15	-0.01	0.05	89.9	1.9	
6/14/11 7:09:30	-0.01	0.05	90.3	2.0	
6/14/11 7:09:45	-0.01	0.05	90.5	1.9	SO ₂ CE Span = 90.3
6/14/11 7:10:00	-0.01	0.05	90.6	2.0	
6/14/11 7:10:15	-0.01	0.05	87.1	1.7	
6/14/11 7:10:30	-0.01	0.05	57.3	1.7	
6/14/11 7:10:45	-0.01	0.05	47.4	1.9	
6/14/11 7:11:00	-0.01	0.05	46.7	1.9	
6/14/11 7:11:15	-0.01	0.05	46.7	1.9	Calibration Error
6/14/11 7:11:30	-0.01	0.05	46.7	1.9	
6/14/11 7:11:45	-0.01	0.05	46.8	1.9	
6/14/11 7:12:00	-0.01	0.05	46.5	1.9	SO ₂ CE Mid = 46.7
6/14/11 7:12:15	-0.01	0.05	46.7	1.9	
6/14/11 7:12:30	-0.01	0.05	46.6	1.9	
6/14/11 7:12:45	-0.01	0.05	46.6	1.9	
6/14/11 7:13:00	-0.01	0.05	46.7	1.9	
6/14/11 7:13:15	-0.01	0.05	44.9	5.8	
6/14/11 7:13:30	0.02	0.41	17.1	15.3	
6/14/11 7:13:45	1.22	5.87	3.6	14.4	
6/14/11 7:14:00	2.66	10.99	2.8	7.1	
6/14/11 7:14:15	3.67	12.10	2.4	3.9	
6/14/11 7:14:30	4.67	6.35	2.4	4.6	
6/14/11 7:14:45	2.09	2.15	2.3	4.9	
6/14/11 7:15:00	0.38	0.44	2.3	4.1	
6/14/11 7:15:15	0.10	0.23	2.2	3.5	
6/14/11 7:15:30	0.08	0.19	2.1	3.5	
6/14/11 7:15:45	0.07	0.17	1.9	3.3	
6/14/11 7:16:00	0.07	0.16	3.0	3.0	
6/14/11 7:16:15	0.06	0.15	7.2	2.9	
6/14/11 7:16:30	0.06	0.14	32.6	2.8	
6/14/11 7:16:45	0.06	0.13	35.6	2.8	
6/14/11 7:17:00	0.06	0.13	45.9	2.6	
6/14/11 7:17:15	0.06	0.12	52.6	2.6	
6/14/11 7:17:30	0.05	0.12	56.0	2.5	
6/14/11 7:17:45	0.06	0.12	56.8	2.4	
6/14/11 7:18:00	0.05	0.11	56.1	2.3	
6/14/11 7:18:15	0.05	0.11	55.6	2.2	
6/14/11 7:18:30	0.05	0.11	54.8	2.2	
6/14/11 7:18:45	0.05	0.11	53.2	2.1	
6/14/11 7:19:00	0.05	0.10	52.3	2.1	
6/14/11 7:19:15	0.05	0.10	51.1	2.0	
6/14/11 7:19:30	0.05	0.10	50.1	2.0	
6/14/11 7:19:45	0.05	0.10	49.0	1.9	
6/14/11 7:20:00	0.05	0.10	47.9	1.9	
6/14/11 7:20:15	0.05	0.10	46.8	1.9	
6/14/11 7:20:30	0.05	0.10	46.3	1.8	
6/14/11 7:20:45	0.05	0.09	45.7	1.8	
6/14/11 7:21:00	0.05	0.09	45.1	1.8	
6/14/11 7:21:15	0.05	0.09	44.8	1.7	
6/14/11 7:21:30	0.05	0.09	44.4	1.7	
6/14/11 7:21:45	0.05	0.09	44.2	1.7	
6/14/11 7:22:00	0.05	0.09	43.9	1.7	
6/14/11 7:22:15	0.05	0.09	43.8	1.7	
6/14/11 7:22:30	0.05	0.09	43.9	1.7	System Bias
6/14/11 7:22:45	0.05	0.09	44.4	1.7	O ₂ Bias 1 Zero = 0.05
6/14/11 7:23:00	0.05	0.09	44.8	1.7	CO ₂ Bias 1 Zero = 0.09
6/14/11 7:23:15	0.05	0.09	44.4	1.7	SO ₂ Bias 1 Mid = 44.5
6/14/11 7:23:30	0.05	0.09	44.6	1.8	NO _x Bias 1 Zero = 1.7
6/14/11 7:23:45	0.05	0.09	44.5	1.6	
6/14/11 7:24:00	0.05	0.09	43.8	1.6	
6/14/11 7:24:15	0.05	0.09	43.4	1.6	
6/14/11 7:24:30	0.05	0.09	43.8	3.0	
6/14/11 7:24:45	0.05	0.27	43.7	4.6	
6/14/11 7:25:00	0.27	3.23	43.6	23.7	
6/14/11 7:25:15	0.34	3.09	43.4	36.7	
6/14/11 7:25:30	0.13	0.76	43.3	38.3	
6/14/11 7:25:45	0.06	0.18	43.1	38.8	
6/14/11 7:26:00	0.05	0.11	42.4	41.8	
6/14/11 7:26:15	0.05	0.10	41.6	44.4	
6/14/11 7:26:30	0.05	0.10	39.9	44.7	
6/14/11 7:26:45	0.05	0.09	38.1	44.7	
6/14/11 7:27:00	0.04	0.09	30.5	44.7	
6/14/11 7:27:15	0.04	0.09	28.5	44.7	
6/14/11 7:27:30	0.04	0.09	26.3	44.7	
6/14/11 7:27:45	0.04	0.09	24.2	44.6	System Bias
6/14/11 7:28:00	0.04	0.09	22.3	44.6	NO _x Bias 1 Mid = 44.5
6/14/11 7:28:15	0.04	0.09	20.5	44.5	
6/14/11 7:28:30	0.04	0.09	18.9	44.4	
6/14/11 7:28:45	0.04	0.09	17.3	44.4	
6/14/11 7:29:00	0.04	0.09	16.1	44.4	
6/14/11 7:29:15	0.04	0.09	14.9	43.6	
6/14/11 7:29:30	0.04	0.09	13.6	28.3	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 7:29:45	0.19	3.44	12.9	26.3	
6/14/11 7:30:00	0.47	5.72	11.7	3.6	
6/14/11 7:30:15	1.93	4.01	10.7	3.4	
6/14/11 7:30:30	3.98	3.87	9.4	3.3	
6/14/11 7:30:45	4.45	3.92	8.2	3.2	
6/14/11 7:31:00	4.51	3.94	7.0	3.2	System Bias
6/14/11 7:31:15	4.52	4.01	6.2	3.1	O ₂ Bias 1 Mid = 4.51
6/14/11 7:31:30	4.51	4.06	5.7	3.0	
6/14/11 7:31:45	4.51	4.08	5.1	2.8	
6/14/11 7:32:00	4.52	4.09	4.5	2.6	
6/14/11 7:32:15	4.52	4.09	4.0	8.2	
6/14/11 7:32:30	4.30	5.52	3.9	3.9	
6/14/11 7:32:45	3.44	8.58	3.6	1.6	
6/14/11 7:33:00	6.05	8.73	3.4	1.7	
6/14/11 7:33:15	10.03	9.59	3.0	1.7	System Bias
6/14/11 7:33:30	11.20	9.93	2.8	1.6	
6/14/11 7:33:45	11.35	9.99	2.6	1.5	CO ₂ Bias 1 Mid = 9.98
6/14/11 7:34:00	11.36	10.00	2.5	1.5	SO ₂ Bias 1 Zero = 2.6
6/14/11 7:34:15	11.37	10.01	2.3	1.5	
6/14/11 7:34:30	11.37	10.01	2.4	1.5	
6/14/11 7:34:45	11.37	10.02	2.2	2.3	
6/14/11 7:35:00	11.38	10.02	2.1	11.1	
6/14/11 7:35:15	10.30	11.21	2.2	12.7	
6/14/11 7:35:30	5.18	14.81	2.0	12.8	
6/14/11 7:35:45	1.92	16.66	1.9	12.8	
6/14/11 7:36:00	1.27	17.00	2.0	13.0	
6/14/11 7:36:15	1.19	17.06	2.0	13.3	
6/14/11 7:36:30	1.16	17.06	2.0	13.3	
6/14/11 7:36:45	1.19	17.04	1.8	13.3	Begin Run 3
6/14/11 7:37:00	1.22	17.03	1.8	13.5	FCCU-29-3
6/14/11 7:37:15	1.23	17.03	1.8	13.6	
6/14/11 7:37:30	1.24	17.03	1.6	13.2	
6/14/11 7:37:45	1.22	17.04	1.8	13.3	FCCU-0061-5
6/14/11 7:38:00	1.18	17.07	1.9	13.3	
6/14/11 7:38:15	1.15	17.10	1.9	13.5	
6/14/11 7:38:30	1.14	17.11	1.8	13.6	
6/14/11 7:38:45	1.16	17.09	1.8	13.7	
6/14/11 7:39:00	1.19	17.07	1.7	13.8	
6/14/11 7:39:15	1.20	17.06	1.5	13.7	
6/14/11 7:39:30	1.22	17.06	1.6	13.9	
6/14/11 7:39:45	1.21	17.07	1.6	14.0	
6/14/11 7:40:00	1.22	17.05	1.6	13.8	
6/14/11 7:40:15	1.23	17.04	1.5	13.6	
6/14/11 7:40:30	1.21	17.06	1.5	13.9	
6/14/11 7:40:45	1.18	17.09	1.3	13.9	
6/14/11 7:41:00	1.19	17.08	1.5	14.1	
6/14/11 7:41:15	1.20	17.07	1.5	14.3	
6/14/11 7:41:30	1.22	17.05	1.3	14.1	
6/14/11 7:41:45	1.22	17.05	1.4	14.0	
6/14/11 7:42:00	1.20	17.07	1.3	13.9	
6/14/11 7:42:15	1.19	17.07	1.4	13.8	
6/14/11 7:42:30	1.19	17.08	1.6	13.7	
6/14/11 7:42:45	1.17	17.10	1.5	13.4	
6/14/11 7:43:00	1.15	17.11	1.4	13.4	
6/14/11 7:43:15	1.12	17.15	1.4	13.8	
6/14/11 7:43:30	1.11	17.17	1.2	14.1	
6/14/11 7:43:45	1.14	17.15	1.3	14.0	
6/14/11 7:44:00	1.18	17.11	1.3	14.4	
6/14/11 7:44:15	1.18	17.10	1.2	14.5	
6/14/11 7:44:30	1.21	17.07	1.4	14.5	
6/14/11 7:44:45	1.24	17.05	1.3	14.3	
6/14/11 7:45:00	1.23	17.06	1.2	14.0	
6/14/11 7:45:15	1.19	17.08	1.2	14.0	
6/14/11 7:45:30	1.14	17.10	1.2	14.0	
6/14/11 7:45:45	1.12	17.13	1.3	14.0	
6/14/11 7:46:00	1.12	17.15	1.3	14.0	
6/14/11 7:46:15	1.10	17.17	1.5	14.1	
6/14/11 7:46:30	1.11	17.18	1.2	14.3	
6/14/11 7:46:45	1.12	17.18	1.2	15.2	
6/14/11 7:47:00	1.11	17.17	1.4	15.0	
6/14/11 7:47:15	1.11	17.16	1.3	15.0	
6/14/11 7:47:30	1.15	17.13	1.2	14.7	
6/14/11 7:47:45	1.18	17.11	1.5	14.5	
6/14/11 7:48:00	1.19	17.11	1.3	14.4	
6/14/11 7:48:15	1.19	17.11	1.3	14.2	
6/14/11 7:48:30	1.18	17.11	1.3	14.6	
6/14/11 7:48:45	1.15	17.13	1.2	15.1	
6/14/11 7:49:00	1.14	17.14	1.1	14.6	
6/14/11 7:49:15	1.16	17.14	1.3	14.1	
6/14/11 7:49:30	1.15	17.15	1.2	14.0	
6/14/11 7:49:45	1.12	17.16	1.1	15.1	
6/14/11 7:50:00	1.11	17.17	1.3	17.2	
6/14/11 7:50:15	1.11	17.17	1.3	16.2	
6/14/11 7:50:30	1.15	17.14	1.2	15.8	
6/14/11 7:50:45	1.15	17.13	1.4	15.4	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 7:51:00	1.16	17.11	1.2	15.0	
6/14/11 7:51:15	1.17	17.11	1.1	14.6	
6/14/11 7:51:30	1.16	17.12	1.2	14.3	
6/14/11 7:51:45	1.14	17.13	1.2	14.2	
6/14/11 7:52:00	1.11	17.16	1.3	14.4	
6/14/11 7:52:15	1.10	17.18	1.2	14.4	Start FCCU-5B-3
6/14/11 7:52:30	1.11	17.17	1.1	14.3	
6/14/11 7:52:45	1.13	17.16	1.1	14.3	
6/14/11 7:53:00	1.12	17.17	1.2	14.3	
6/14/11 7:53:15	1.12	17.17	1.2	15.2	
6/14/11 7:53:30	1.11	17.17	1.0	17.3	
6/14/11 7:53:45	1.12	17.18	1.1	18.7	
6/14/11 7:54:00	1.12	17.18	1.3	17.6	
6/14/11 7:54:15	1.08	17.20	1.1	16.4	
6/14/11 7:54:30	1.07	17.21	1.3	15.3	
6/14/11 7:54:45	1.08	17.21	1.1	14.7	
6/14/11 7:55:00	1.08	17.22	1.0	14.4	
6/14/11 7:55:15	1.08	17.22	1.2	14.5	
6/14/11 7:55:30	1.10	17.21	1.2	14.4	
6/14/11 7:55:45	1.13	17.17	1.2	14.1	
6/14/11 7:56:00	1.15	17.16	1.2	14.0	
6/14/11 7:56:15	1.13	17.17	1.1	13.9	
6/14/11 7:56:30	1.11	17.18	1.3	14.0	
6/14/11 7:56:45	1.11	17.18	1.2	14.1	
6/14/11 7:57:00	1.13	17.17	1.1	14.1	
6/14/11 7:57:15	1.17	17.12	1.1	13.9	
6/14/11 7:57:30	1.18	17.11	1.0	13.7	
6/14/11 7:57:45	1.16	17.14	1.2	13.8	
6/14/11 7:58:00	1.14	17.17	1.2	13.8	
6/14/11 7:58:15	1.15	17.16	1.2	13.8	
6/14/11 7:58:30	1.14	17.15	1.0	13.9	
6/14/11 7:58:45	1.14	17.14	0.9	13.9	
6/14/11 7:59:00	1.15	17.13	1.0	14.0	
6/14/11 7:59:15	1.15	17.13	1.1	14.0	
6/14/11 7:59:30	1.16	17.14	1.1	13.9	
6/14/11 7:59:45	1.15	17.15	1.0	14.0	
6/14/11 8:00:00	1.15	17.16	1.1	14.1	
6/14/11 8:00:15	1.15	17.14	1.2	14.0	
6/14/11 8:00:30	1.18	17.13	1.0	13.9	
6/14/11 8:00:45	1.18	17.13	0.9	13.6	
6/14/11 8:01:00	1.16	17.14	1.1	13.7	
6/14/11 8:01:15	1.12	17.16	1.1	13.8	
6/14/11 8:01:30	1.13	17.16	1.0	13.8	
6/14/11 8:01:45	1.15	17.14	0.9	13.8	
6/14/11 8:02:00	1.16	17.12	1.1	13.7	
6/14/11 8:02:15	1.16	17.13	1.0	13.7	
6/14/11 8:02:30	1.14	17.15	1.0	13.6	
6/14/11 8:02:45	1.13	17.15	1.2	13.6	
6/14/11 8:03:00	1.13	17.16	1.1	13.5	
6/14/11 8:03:15	1.13	17.16	1.0	13.5	
6/14/11 8:03:30	1.12	17.17	0.8	13.5	
6/14/11 8:03:45	1.11	17.18	0.9	13.5	
6/14/11 8:04:00	1.11	17.18	1.1	13.5	
6/14/11 8:04:15	1.10	17.19	1.1	13.4	
6/14/11 8:04:30	1.09	17.19	1.0	13.2	
6/14/11 8:04:45	1.09	17.20	1.1	13.2	
6/14/11 8:05:00	1.07	17.23	1.2	13.4	
6/14/11 8:05:15	1.06	17.24	1.1	13.6	
6/14/11 8:05:30	1.09	17.22	0.9	13.6	
6/14/11 8:05:45	1.12	17.20	0.9	13.6	
6/14/11 8:06:00	1.12	17.19	0.9	13.7	
6/14/11 8:06:15	1.11	17.20	1.0	13.6	
6/14/11 8:06:30	1.12	17.19	0.9	13.4	
6/14/11 8:06:45	1.12	17.18	1.0	13.4	Start FCCU-027-3
6/14/11 8:07:00	1.08	17.19	1.0	13.5	
6/14/11 8:07:15	1.07	17.20	1.1	13.6	
6/14/11 8:07:30	1.08	17.20	1.0	13.5	
6/14/11 8:07:45	1.10	17.19	0.9	13.4	
6/14/11 8:08:00	1.12	17.20	1.0	13.3	
6/14/11 8:08:15	1.11	17.21	1.0	13.5	
6/14/11 8:08:30	1.09	17.21	0.8	13.2	
6/14/11 8:08:45	1.09	17.20	0.8	13.4	
6/14/11 8:09:00	1.08	17.21	0.9	13.6	
6/14/11 8:09:15	1.10	17.20	1.0	13.7	
6/14/11 8:09:30	1.14	17.18	0.9	13.8	
6/14/11 8:09:45	1.16	17.17	0.9	13.8	
6/14/11 8:10:00	1.15	17.16	1.0	13.8	
6/14/11 8:10:15	1.14	17.16	1.0	14.1	
6/14/11 8:10:30	1.13	17.16	0.9	13.9	
6/14/11 8:10:45	1.16	17.14	0.7	13.8	
6/14/11 8:11:00	1.18	17.14	0.8	14.1	
6/14/11 8:11:15	1.18	17.13	0.8	14.3	
6/14/11 8:11:30	1.20	17.10	0.8	14.2	
6/14/11 8:11:45	1.21	17.08	0.9	14.1	
6/14/11 8:12:00	1.21	17.08	1.1	14.1	

**Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack**

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 8:12:15	1.19	17.10	0.9	14.2	
6/14/11 8:12:30	1.18	17.12	0.8	14.1	
6/14/11 8:12:45	1.19	17.13	1.0	14.0	
6/14/11 8:13:00	1.19	17.14	1.1	14.0	
6/14/11 8:13:15	1.18	17.13	1.1	14.0	
6/14/11 8:13:30	1.16	17.15	1.0	14.3	
6/14/11 8:13:45	1.15	17.15	1.0	14.3	
6/14/11 8:14:00	1.19	17.12	1.0	14.3	
6/14/11 8:14:15	1.21	17.11	1.0	14.4	
6/14/11 8:14:30	1.22	17.10	0.9	14.6	
6/14/11 8:14:45	1.24	17.07	1.0	14.3	
6/14/11 8:15:00	1.27	17.04	1.1	13.7	
6/14/11 8:15:15	1.23	17.07	1.0	13.5	
6/14/11 8:15:30	1.16	17.15	0.8	13.6	
6/14/11 8:15:45	1.10	17.19	0.7	13.7	
6/14/11 8:16:00	1.09	17.19	0.7	13.9	
6/14/11 8:16:15	1.10	17.19	0.9	13.8	
6/14/11 8:16:30	1.12	17.18	1.0	13.6	
6/14/11 8:16:45	1.13	17.17	0.7	13.9	
6/14/11 8:17:00	1.12	17.16	0.9	14.1	
6/14/11 8:17:15	1.14	17.14	0.7	13.8	
6/14/11 8:17:30	1.16	17.14	0.6	13.6	
6/14/11 8:17:45	1.15	17.15	0.7	13.7	
6/14/11 8:18:00	1.12	17.17	0.7	13.5	
6/14/11 8:18:15	1.11	17.17	0.7	13.8	
6/14/11 8:18:30	1.09	17.18	0.8	13.7	
6/14/11 8:18:45	1.11	17.17	0.8	13.6	
6/14/11 8:19:00	1.11	17.17	1.0	13.5	
6/14/11 8:19:15	1.10	17.19	0.9	13.5	
6/14/11 8:19:30	1.08	17.21	0.9	13.6	
6/14/11 8:19:45	1.08	17.22	0.7	13.4	Begin Run 1 - M29
6/14/11 8:20:00	1.08	17.21	0.8	13.6	
6/14/11 8:20:15	1.06	17.20	0.7	13.6	
6/14/11 8:20:30	1.07	17.19	1.0	13.3	
6/14/11 8:20:45	1.10	17.18	0.8	13.2	
6/14/11 8:21:00	1.08	17.20	0.7	13.3	
6/14/11 8:21:15	1.05	17.23	0.9	13.4	
6/14/11 8:21:30	1.05	17.24	0.9	13.6	
6/14/11 8:21:45	1.06	17.22	0.9	13.5	
6/14/11 8:22:00	1.08	17.19	0.8	13.5	
6/14/11 8:22:15	1.07	17.19	0.7	13.2	
6/14/11 8:22:30	1.06	17.21	0.7	13.3	
6/14/11 8:22:45	1.04	17.24	0.8	13.5	Start M5B - Ruun 1
6/14/11 8:23:00	1.04	17.24	0.8	13.2	
6/14/11 8:23:15	1.07	17.22	0.8	13.0	
6/14/11 8:23:30	1.05	17.23	1.0	12.9	
6/14/11 8:23:45	1.02	17.25	0.9	12.9	
6/14/11 8:24:00	1.01	17.27	1.1	12.8	
6/14/11 8:24:15	0.99	17.27	0.9	13.0	
6/14/11 8:24:30	0.99	17.27	0.8	12.9	
6/14/11 8:24:45	1.02	17.25	0.6	12.8	
6/14/11 8:25:00	1.02	17.25	0.8	12.9	
6/14/11 8:25:15	1.00	17.27	0.8	13.1	
6/14/11 8:25:30	1.01	17.27	0.9	13.3	
6/14/11 8:25:45	1.03	17.25	0.7	12.9	
6/14/11 8:26:00	1.05	17.23	0.8	12.8	
6/14/11 8:26:15	1.02	17.26	0.8	12.7	
6/14/11 8:26:30	0.98	17.28	0.7	12.6	
6/14/11 8:26:45	0.97	17.30	0.8	12.6	
6/14/11 8:27:00	0.95	17.31	0.7	12.4	
6/14/11 8:27:15	0.95	17.31	0.7	12.4	
6/14/11 8:27:30	0.94	17.32	0.9	12.3	
6/14/11 8:27:45	0.94	17.32	1.0	12.3	
6/14/11 8:28:00	0.93	17.33	0.8	12.0	
6/14/11 8:28:15	0.94	17.32	0.7	12.1	
6/14/11 8:28:30	0.91	17.35	0.8	12.3	
6/14/11 8:28:45	0.89	17.35	1.0	12.4	
6/14/11 8:29:00	0.92	17.33	1.0	12.2	
6/14/11 8:29:15	0.94	17.32	0.9	12.0	
6/14/11 8:29:30	0.94	17.33	0.9	11.9	
6/14/11 8:29:45	0.91	17.35	1.0	11.9	
6/14/11 8:30:00	0.88	17.37	0.8	11.6	
6/14/11 8:30:15	0.87	17.39	0.8	11.4	
6/14/11 8:30:30	0.84	17.43	0.8	11.7	
6/14/11 8:30:45	0.81	17.45	0.9	11.9	
6/14/11 8:31:00	0.83	17.43	0.7	11.9	
6/14/11 8:31:15	0.86	17.40	0.6	11.6	
6/14/11 8:31:30	0.86	17.40	0.6	11.3	
6/14/11 8:31:45	0.83	17.43	0.7	11.6	
6/14/11 8:32:00	0.79	17.47	0.8	11.9	Restart 0061 and EPA 29
6/14/11 8:32:15	0.81	17.45	0.7	11.8	
6/14/11 8:32:30	0.86	17.42	0.8	11.8	
6/14/11 8:32:45	0.86	17.41	0.8	11.8	
6/14/11 8:33:00	0.85	17.41	0.9	12.2	
6/14/11 8:33:15	0.84	17.40	0.8	12.2	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 8:33:30	0.89	17.36	0.7	11.7	
6/14/11 8:33:45	0.92	17.35	0.8	11.3	
6/14/11 8:34:00	0.89	17.37	0.8	11.4	
6/14/11 8:34:15	0.84	17.41	0.8	11.6	
6/14/11 8:34:30	0.84	17.40	0.8	11.6	
6/14/11 8:34:45	0.87	17.38	0.6	11.5	
6/14/11 8:35:00	0.87	17.39	0.8	11.4	
6/14/11 8:35:15	0.86	17.41	0.7	11.5	
6/14/11 8:35:30	0.84	17.42	0.5	11.6	
6/14/11 8:35:45	0.85	17.41	0.8	11.8	
6/14/11 8:36:00	0.87	17.40	0.9	12.1	
6/14/11 8:36:15	0.90	17.38	0.7	12.2	
6/14/11 8:36:30	0.93	17.34	0.7	12.1	
6/14/11 8:36:45	0.95	17.33	0.7	12.2	
6/14/11 8:37:00	0.94	17.33	0.9	12.1	
6/14/11 8:37:15	0.95	17.32	0.8	11.8	
6/14/11 8:37:30	0.93	17.32	0.8	11.9	
6/14/11 8:37:45	0.90	17.37	0.7	12.0	
6/14/11 8:38:00	0.90	17.38	0.7	11.9	
6/14/11 8:38:15	0.89	17.37	0.8	12.0	
6/14/11 8:38:30	0.88	17.38	0.9	12.2	
6/14/11 8:38:45	0.89	17.37	0.9	12.5	
6/14/11 8:39:00	0.91	17.34	0.8	12.4	
6/14/11 8:39:15	0.94	17.31	0.7	12.1	
6/14/11 8:39:30	0.92	17.31	0.7	11.8	
6/14/11 8:39:45	0.85	17.33	0.8	11.6	
6/14/11 8:40:00	0.78	17.37	0.8	11.8	
6/14/11 8:40:15	0.72	17.42	0.8	12.1	
6/14/11 8:40:30	0.72	17.45	0.8	12.6	
6/14/11 8:40:45	0.77	17.43	0.8	12.9	
6/14/11 8:41:00	0.85	17.37	0.7	13.2	
6/14/11 8:41:15	0.92	17.32	0.7	13.3	
6/14/11 8:41:30	0.97	17.30	0.7	12.9	
6/14/11 8:41:45	1.00	17.29	0.8	13.1	
6/14/11 8:42:00	0.98	17.29	0.9	13.0	
6/14/11 8:42:15	0.98	17.26	0.8	13.0	
6/14/11 8:42:30	0.98	17.25	0.9	13.2	
6/14/11 8:42:45	0.99	17.25	1.0	13.3	
6/14/11 8:43:00	1.01	17.25	0.9	13.7	
6/14/11 8:43:15	1.03	17.23	1.0	13.8	
6/14/11 8:43:30	1.07	17.21	0.9	13.6	
6/14/11 8:43:45	1.08	17.20	0.8	13.5	
6/14/11 8:44:00	1.07	17.21	0.7	13.3	
6/14/11 8:44:15	1.05	17.22	0.9	12.7	
6/14/11 8:44:30	1.02	17.24	0.7	12.7	
6/14/11 8:44:45	0.95	17.30	0.8	13.2	
6/14/11 8:45:00	0.91	17.33	1.0	13.9	
6/14/11 8:45:15	0.96	17.30	0.8	14.1	
6/14/11 8:45:30	1.05	17.24	0.7	14.0	
6/14/11 8:45:45	1.11	17.18	0.8	13.8	
6/14/11 8:46:00	1.11	17.17	0.8	14.0	
6/14/11 8:46:15	1.08	17.18	0.7	14.1	
6/14/11 8:46:30	1.07	17.19	0.8	14.3	
6/14/11 8:46:45	1.08	17.19	0.7	14.3	
6/14/11 8:47:00	1.12	17.17	0.9	14.7	Restart 5B
6/14/11 8:47:15	1.15	17.16	0.8	14.9	
6/14/11 8:47:30	1.19	17.11	0.9	14.6	
6/14/11 8:47:45	1.23	17.06	0.8	14.2	
6/14/11 8:48:00	1.21	17.06	0.7	14.2	
6/14/11 8:48:15	1.16	17.09	0.9	14.2	
6/14/11 8:48:30	1.14	17.12	0.8	14.3	
6/14/11 8:48:45	1.14	17.13	0.8	14.7	
6/14/11 8:49:00	1.15	17.13	0.9	14.7	
6/14/11 8:49:15	1.21	17.08	0.9	14.6	
6/14/11 8:49:30	1.24	17.05	0.8	14.6	
6/14/11 8:49:45	1.21	17.05	0.9	14.6	
6/14/11 8:50:00	1.19	17.06	0.6	14.6	
6/14/11 8:50:15	1.19	17.06	0.7	14.9	
6/14/11 8:50:30	1.21	17.07	0.7	15.0	
6/14/11 8:50:45	1.24	17.05	0.8	14.9	
6/14/11 8:51:00	1.26	17.04	0.8	15.3	
6/14/11 8:51:15	1.26	17.04	0.7	15.3	
6/14/11 8:51:30	1.30	16.99	0.7	15.2	
6/14/11 8:51:45	1.34	16.94	0.7	15.1	
6/14/11 8:52:00	1.33	16.93	0.6	14.9	
6/14/11 8:52:15	1.30	16.96	0.9	14.9	
6/14/11 8:52:30	1.25	17.00	0.9	15.0	
6/14/11 8:52:45	1.22	17.02	0.9	15.1	
6/14/11 8:53:00	1.23	17.03	0.9	15.3	
6/14/11 8:53:15	1.25	17.02	0.7	15.1	
6/14/11 8:53:30	1.27	17.02	0.8	15.1	
6/14/11 8:53:45	1.26	17.02	0.7	15.3	
6/14/11 8:54:00	1.26	17.01	0.8	15.1	
6/14/11 8:54:15	1.27	16.99	0.9	15.1	
6/14/11 8:54:30	1.26	17.01	0.8	15.1	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 8:54:45	1.26	17.02	0.6	15.1	
6/14/11 8:55:00	1.29	17.00	0.7	15.1	
6/14/11 8:55:15	1.29	16.98	0.8	15.1	
6/14/11 8:55:30	1.28	16.99	0.7	15.0	
6/14/11 8:55:45	1.25	17.02	0.7	15.0	
6/14/11 8:56:00	1.23	17.04	0.7	14.9	
6/14/11 8:56:15	1.24	17.05	0.8	14.9	
6/14/11 8:56:30	1.25	17.05	1.0	15.0	
6/14/11 8:56:45	1.25	17.03	0.9	15.2	
6/14/11 8:57:00	1.25	17.01	1.1	15.5	
6/14/11 8:57:15	1.27	16.99	0.9	15.4	
6/14/11 8:57:30	1.32	16.95	0.7	15.4	
6/14/11 8:57:45	1.34	16.95	0.7	15.8	
6/14/11 8:58:00	1.34	16.96	0.9	16.1	
6/14/11 8:58:15	1.38	16.92	0.9	16.0	
6/14/11 8:58:30	1.41	16.88	1.0	15.8	
6/14/11 8:58:45	1.42	16.86	1.2	15.7	
6/14/11 8:59:00	1.40	16.88	1.1	15.9	
6/14/11 8:59:15	1.35	16.92	1.0	15.8	
6/14/11 8:59:30	1.34	16.94	0.9	15.6	
6/14/11 8:59:45	1.35	16.92	0.9	15.3	
6/14/11 9:00:00	1.34	16.91	0.8	15.3	
6/14/11 9:00:15	1.32	16.92	0.9	15.0	
6/14/11 9:00:30	1.31	16.94	0.8	15.0	
6/14/11 9:00:45	1.29	16.98	0.9	15.3	
6/14/11 9:01:00	1.27	17.01	1.0	15.5	
6/14/11 9:01:15	1.30	17.00	0.8	15.5	
6/14/11 9:01:30	1.35	16.96	0.9	15.7	
6/14/11 9:01:45	1.38	16.91	1.2	15.4	
6/14/11 9:02:00	1.40	16.87	1.0	15.2	Restart CTM-027
6/14/11 9:02:15	1.37	16.90	1.0	15.1	
6/14/11 9:02:30	1.34	16.92	0.9	15.0	
6/14/11 9:02:45	1.35	16.93	0.9	15.3	
6/14/11 9:03:00	1.34	16.93	0.9	15.5	
6/14/11 9:03:15	1.36	16.91	0.8	15.4	
6/14/11 9:03:30	1.38	16.86	0.9	15.1	
6/14/11 9:03:45	1.38	16.87	0.8	15.2	
6/14/11 9:04:00	1.34	16.91	0.8	15.2	
6/14/11 9:04:15	1.34	16.92	1.2	15.2	
6/14/11 9:04:30	1.38	16.91	1.0	15.7	
6/14/11 9:04:45	1.38	16.89	1.0	15.7	
6/14/11 9:05:00	1.41	16.85	0.7	15.6	
6/14/11 9:05:15	1.41	16.86	0.8	15.5	
6/14/11 9:05:30	1.40	16.88	0.8	15.4	
6/14/11 9:05:45	1.39	16.89	0.9	15.4	
6/14/11 9:06:00	1.40	16.88	0.8	15.3	
6/14/11 9:06:15	1.39	16.88	0.9	15.4	
6/14/11 9:06:30	1.35	16.90	0.8	15.4	
6/14/11 9:06:45	1.35	16.91	0.8	15.5	
6/14/11 9:07:00	1.34	16.91	0.7	15.7	
6/14/11 9:07:15	1.36	16.90	0.9	15.8	
6/14/11 9:07:30	1.39	16.87	0.9	15.5	
6/14/11 9:07:45	1.38	16.87	0.9	15.5	
6/14/11 9:08:00	1.35	16.90	0.9	15.9	
6/14/11 9:08:15	1.35	16.90	0.9	15.7	
6/14/11 9:08:30	1.39	16.87	0.8	15.7	
6/14/11 9:08:45	1.39	16.87	0.9	15.9	
6/14/11 9:09:00	1.38	16.88	1.0	16.0	
6/14/11 9:09:15	1.40	16.88	1.1	15.9	
6/14/11 9:09:30	1.43	16.87	0.9	15.8	
6/14/11 9:09:45	1.44	16.85	0.8	15.5	
6/14/11 9:10:00	1.42	16.86	0.7	15.6	
6/14/11 9:10:15	1.38	16.89	0.7	15.9	
6/14/11 9:10:30	1.39	16.87	1.0	15.8	
6/14/11 9:10:45	1.43	16.84	1.0	15.4	
6/14/11 9:11:00	1.45	16.83	0.9	15.1	
6/14/11 9:11:15	1.39	16.87	0.9	15.1	
6/14/11 9:11:30	1.33	16.92	0.9	15.2	
6/14/11 9:11:45	1.32	16.93	0.8	15.6	
6/14/11 9:12:00	1.35	16.92	1.0	15.7	
6/14/11 9:12:15	1.39	16.87	1.1	15.9	
6/14/11 9:12:30	1.40	16.86	0.9	15.6	
6/14/11 9:12:45	1.39	16.87	0.7	15.6	
6/14/11 9:13:00	1.37	16.90	0.8	15.7	
6/14/11 9:13:15	1.37	16.90	0.9	15.6	
6/14/11 9:13:30	1.40	16.87	0.9	15.5	
6/14/11 9:13:45	1.40	16.86	0.8	15.5	
6/14/11 9:14:00	1.39	16.86	0.8	15.6	
6/14/11 9:14:15	1.39	16.87	0.7	15.9	
6/14/11 9:14:30	1.38	16.88	0.8	16.0	
6/14/11 9:14:45	1.41	16.85	0.8	16.2	
6/14/11 9:15:00	1.44	16.82	0.8	16.4	
6/14/11 9:15:15	1.47	16.80	0.8	16.3	
6/14/11 9:15:30	1.49	16.78	0.8	16.0	
6/14/11 9:15:45	1.47	16.81	0.9	16.1	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 9:16:00	1.42	16.84	0.8	15.9	
6/14/11 9:16:15	1.42	16.83	0.8	15.9	
6/14/11 9:16:30	1.41	16.84	0.9	15.8	
6/14/11 9:16:45	1.40	16.85	0.9	15.7	
6/14/11 9:17:00	1.36	16.88	0.7	15.8	
6/14/11 9:17:15	1.37	16.88	0.6	15.8	
6/14/11 9:17:30	1.39	16.85	0.9	15.9	
6/14/11 9:17:45	1.42	16.83	1.1	15.8	
6/14/11 9:18:00	1.45	16.82	0.8	15.6	
6/14/11 9:18:15	1.43	16.84	0.8	15.6	
6/14/11 9:18:30	1.40	16.85	0.8	15.6	
6/14/11 9:18:45	1.38	16.86	1.1	15.8	
6/14/11 9:19:00	1.35	16.88	1.0	15.9	
6/14/11 9:19:15	1.36	16.89	1.0	16.0	
6/14/11 9:19:30	1.38	16.88	0.9	16.0	
6/14/11 9:19:45	1.42	16.85	0.8	16.1	
6/14/11 9:20:00	1.45	16.83	0.9	16.1	
6/14/11 9:20:15	1.46	16.81	0.9	16.0	
6/14/11 9:20:30	1.44	16.81	1.1	15.9	
6/14/11 9:20:45	1.42	16.83	1.0	16.0	
6/14/11 9:21:00	1.42	16.84	0.8	16.0	
6/14/11 9:21:15	1.44	16.82	0.7	16.2	
6/14/11 9:21:30	1.44	16.81	0.9	16.3	
6/14/11 9:21:45	1.44	16.79	0.9	16.0	
6/14/11 9:22:00	1.44	16.79	0.8	15.9	
6/14/11 9:22:15	1.40	16.84	0.7	15.8	
6/14/11 9:22:30	1.36	16.88	0.9	15.8	
6/14/11 9:22:45	1.35	16.89	0.9	15.9	
6/14/11 9:23:00	1.35	16.88	0.8	15.8	
6/14/11 9:23:15	1.35	16.88	0.8	15.8	
6/14/11 9:23:30	1.36	16.87	0.9	15.5	
6/14/11 9:23:45	1.37	16.87	0.8	15.6	
6/14/11 9:24:00	1.34	16.90	0.8	16.0	
6/14/11 9:24:15	1.34	16.89	0.9	16.0	
6/14/11 9:24:30	1.40	16.85	0.8	15.7	
6/14/11 9:24:45	1.42	16.83	1.0	15.4	
6/14/11 9:25:00	1.39	16.84	0.9	15.5	
6/14/11 9:25:15	1.36	16.87	0.9	15.6	
6/14/11 9:25:30	1.34	16.89	0.8	15.8	
6/14/11 9:25:45	1.35	16.90	0.6	15.8	
6/14/11 9:26:00	1.38	16.88	0.7	15.8	
6/14/11 9:26:15	1.39	16.86	0.9	15.5	
6/14/11 9:26:30	1.41	16.84	0.8	15.6	
6/14/11 9:26:45	1.39	16.85	1.0	15.7	
6/14/11 9:27:00	1.37	16.86	1.0	15.5	
6/14/11 9:27:15	1.39	16.85	0.8	15.6	
6/14/11 9:27:30	1.39	16.85	0.6	15.9	
6/14/11 9:27:45	1.39	16.85	0.7	15.8	
6/14/11 9:28:00	1.41	16.84	0.7	15.6	
6/14/11 9:28:15	1.40	16.83	0.8	15.6	
6/14/11 9:28:30	1.38	16.83	0.8	15.7	
6/14/11 9:28:45	1.37	16.85	0.9	15.8	
6/14/11 9:29:00	1.36	16.87	0.9	16.1	
6/14/11 9:29:15	1.37	16.87	0.9	15.9	
6/14/11 9:29:30	1.41	16.84	1.0	15.7	
6/14/11 9:29:45	1.42	16.83	0.9	15.9	
6/14/11 9:30:00	1.40	16.85	0.8	16.0	
6/14/11 9:30:15	1.42	16.84	0.9	15.9	
6/14/11 9:30:30	1.45	16.82	0.8	15.8	
6/14/11 9:30:45	1.44	16.80	0.9	15.7	
6/14/11 9:31:00	1.43	16.80	0.9	15.9	
6/14/11 9:31:15	1.42	16.81	0.9	15.9	
6/14/11 9:31:30	1.43	16.79	0.8	15.7	
6/14/11 9:31:45	1.43	16.79	0.8	15.6	
6/14/11 9:32:00	1.42	16.81	0.9	15.6	Restart FCCU-29-3
6/14/11 9:32:15	1.40	16.84	0.9	15.5	Restart FCCU-0061-5
6/14/11 9:32:30	1.38	16.86	0.9	15.5	
6/14/11 9:32:45	1.36	16.88	0.9	15.7	
6/14/11 9:33:00	1.35	16.87	0.8	15.8	
6/14/11 9:33:15	1.37	16.85	0.8	15.6	
6/14/11 9:33:30	1.38	16.85	0.8	15.5	
6/14/11 9:33:45	1.35	16.87	0.8	15.7	
6/14/11 9:34:00	1.34	16.87	1.0	15.7	
6/14/11 9:34:15	1.36	16.86	1.1	15.9	
6/14/11 9:34:30	1.37	16.86	1.2	15.9	
6/14/11 9:34:45	1.40	16.85	1.0	15.8	
6/14/11 9:35:00	1.42	16.85	0.8	15.5	
6/14/11 9:35:15	1.40	16.84	1.0	15.6	
6/14/11 9:35:30	1.36	16.85	0.7	15.7	
6/14/11 9:35:45	1.34	16.85	0.7	15.7	
6/14/11 9:36:00	1.34	16.85	0.8	15.7	
6/14/11 9:36:15	1.34	16.88	0.8	15.5	
6/14/11 9:36:30	1.34	16.89	0.9	15.6	
6/14/11 9:36:45	1.32	16.91	0.9	15.7	
6/14/11 9:37:00	1.32	16.90	0.9	15.9	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 9:37:15	1.32	16.90	0.9	15.7	
6/14/11 9:37:30	1.34	16.89	0.9	15.8	
6/14/11 9:37:45	1.34	16.90	0.8	15.8	
6/14/11 9:38:00	1.33	16.89	0.8	15.5	
6/14/11 9:38:15	1.34	16.88	1.0	15.4	
6/14/11 9:38:30	1.33	16.89	1.0	15.6	
6/14/11 9:38:45	1.34	16.89	1.0	15.7	
6/14/11 9:39:00	1.37	16.86	1.0	15.8	
6/14/11 9:39:15	1.39	16.84	1.0	16.0	
6/14/11 9:39:30	1.41	16.81	1.1	15.6	
6/14/11 9:39:45	1.45	16.78	1.1	15.3	
6/14/11 9:40:00	1.42	16.82	1.0	15.2	
6/14/11 9:40:15	1.35	16.86	0.9	15.1	
6/14/11 9:40:30	1.32	16.89	0.8	15.3	
6/14/11 9:40:45	1.30	16.93	0.7	15.4	
6/14/11 9:41:00	1.30	16.92	0.7	15.4	
6/14/11 9:41:15	1.33	16.89	1.0	15.4	
6/14/11 9:41:30	1.34	16.88	0.9	15.4	
6/14/11 9:41:45	1.34	16.89	0.8	15.4	
6/14/11 9:42:00	1.34	16.90	0.9	15.4	
6/14/11 9:42:15	1.35	16.88	0.8	15.5	
6/14/11 9:42:30	1.33	16.88	0.7	15.6	
6/14/11 9:42:45	1.33	16.87	0.7	15.3	
6/14/11 9:43:00	1.33	16.86	0.8	15.3	
6/14/11 9:43:15	1.30	16.88	1.1	15.2	
6/14/11 9:43:30	1.29	16.91	0.9	15.4	
6/14/11 9:43:45	1.30	16.92	0.9	15.8	
6/14/11 9:44:00	1.32	16.90	1.0	16.0	
6/14/11 9:44:15	1.37	16.88	1.0	15.9	
6/14/11 9:44:30	1.39	16.86	1.0	16.0	
6/14/11 9:44:45	1.38	16.86	1.0	15.9	
6/14/11 9:45:00	1.40	16.82	1.1	15.7	
6/14/11 9:45:15	1.38	16.83	1.1	16.0	
6/14/11 9:45:30	1.35	16.83	0.9	15.9	
6/14/11 9:45:45	1.39	16.82	0.9	15.9	
6/14/11 9:46:00	1.39	16.84	0.9	15.7	
6/14/11 9:46:15	1.39	16.83	1.0	15.7	
6/14/11 9:46:30	1.37	16.83	0.9	15.8	
6/14/11 9:46:45	1.34	16.84	0.8	15.6	Restart FCCU-5B-3
6/14/11 9:47:00	1.33	16.86	0.9	15.6	
6/14/11 9:47:15	1.32	16.89	0.9	16.0	
6/14/11 9:47:30	1.34	16.90	0.9	15.9	
6/14/11 9:47:45	1.39	16.85	1.2	15.6	
6/14/11 9:48:00	1.41	16.84	1.4	15.5	
6/14/11 9:48:15	1.37	16.86	1.2	15.4	
6/14/11 9:48:30	1.34	16.87	1.1	15.3	
6/14/11 9:48:45	1.32	16.87	1.0	15.6	
6/14/11 9:49:00	1.30	16.88	1.0	15.7	
6/14/11 9:49:15	1.33	16.87	0.9	15.9	
6/14/11 9:49:30	1.37	16.86	1.0	16.1	
6/14/11 9:49:45	1.40	16.85	0.8	16.2	
6/14/11 9:50:00	1.40	16.84	1.0	16.2	
6/14/11 9:50:15	1.40	16.83	0.9	16.1	
6/14/11 9:50:30	1.39	16.81	0.9	15.9	
6/14/11 9:50:45	1.38	16.80	0.9	16.0	
6/14/11 9:51:00	1.39	16.79	0.9	16.2	
6/14/11 9:51:15	1.41	16.79	1.0	16.4	
6/14/11 9:51:30	1.44	16.77	0.9	16.2	
6/14/11 9:51:45	1.47	16.75	0.7	15.9	
6/14/11 9:52:00	1.48	16.75	0.7	15.9	
6/14/11 9:52:15	1.43	16.77	0.9	15.7	
6/14/11 9:52:30	1.39	16.79	1.0	15.5	
6/14/11 9:52:45	1.36	16.82	0.8	15.6	
6/14/11 9:53:00	1.34	16.85	0.8	15.7	
6/14/11 9:53:15	1.34	16.86	0.8	16.0	
6/14/11 9:53:30	1.37	16.86	0.7	16.0	
6/14/11 9:53:45	1.40	16.83	0.7	15.8	
6/14/11 9:54:00	1.42	16.81	0.6	15.9	
6/14/11 9:54:15	1.42	16.81	0.8	16.0	
6/14/11 9:54:30	1.43	16.80	0.9	16.1	
6/14/11 9:54:45	1.43	16.79	0.8	16.1	
6/14/11 9:55:00	1.45	16.78	0.8	16.1	
6/14/11 9:55:15	1.46	16.77	1.0	16.0	
6/14/11 9:55:30	1.45	16.77	0.8	15.9	
6/14/11 9:55:45	1.42	16.78	0.8	16.1	
6/14/11 9:56:00	1.40	16.80	0.8	15.9	
6/14/11 9:56:15	1.40	16.81	0.8	15.9	
6/14/11 9:56:30	1.40	16.81	0.8	15.6	
6/14/11 9:56:45	1.39	16.82	0.8	15.5	
6/14/11 9:57:00	1.36	16.83	0.8	15.6	
6/14/11 9:57:15	1.35	16.83	0.7	15.6	
6/14/11 9:57:30	1.34	16.84	0.8	15.4	
6/14/11 9:57:45	1.34	16.85	0.9	15.1	
6/14/11 9:58:00	1.34	16.85	0.8	15.1	
6/14/11 9:58:15	1.32	16.88	0.8	15.1	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 9:58:30	1.30	16.89	0.9	15.1	
6/14/11 9:58:45	1.31	16.88	0.8	15.0	
6/14/11 9:59:00	1.32	16.86	1.0	15.1	
6/14/11 9:59:15	1.30	16.86	1.1	15.0	
6/14/11 9:59:30	1.30	16.86	0.9	15.0	
6/14/11 9:59:45	1.33	16.86	0.8	15.0	
6/14/11 10:00:00	1.35	16.87	0.9	15.2	
6/14/11 10:00:15	1.36	16.87	0.7	15.3	
6/14/11 10:00:30	1.38	16.84	0.7	15.3	
6/14/11 10:00:45	1.40	16.83	0.9	15.3	
6/14/11 10:01:00	1.41	16.82	0.8	15.1	
6/14/11 10:01:15	1.39	16.82	0.7	14.8	
6/14/11 10:01:30	1.34	16.84	0.7	14.7	
6/14/11 10:01:45	1.30	16.87	0.7	14.5	
6/14/11 10:02:00	1.29	16.89	0.7	14.4	Restart FCCU-027-3
6/14/11 10:02:15	1.29	16.91	0.9	14.7	
6/14/11 10:02:30	1.26	16.91	0.9	15.0	
6/14/11 10:02:45	1.28	16.89	0.8	15.4	
6/14/11 10:03:00	1.29	16.90	0.8	15.5	
6/14/11 10:03:15	1.33	16.88	0.7	15.4	
6/14/11 10:03:30	1.40	16.83	0.8	15.2	
6/14/11 10:03:45	1.43	16.78	0.6	14.9	
6/14/11 10:04:00	1.42	16.77	0.8	14.5	
6/14/11 10:04:15	1.35	16.81	0.7	14.6	
6/14/11 10:04:30	1.28	16.88	0.9	14.9	
6/14/11 10:04:45	1.27	16.91	0.8	15.1	
6/14/11 10:05:00	1.29	16.91	1.0	15.1	
6/14/11 10:05:15	1.32	16.89	0.9	15.1	
6/14/11 10:05:30	1.34	16.87	0.8	15.2	
6/14/11 10:05:45	1.34	16.86	0.9	15.2	
6/14/11 10:06:00	1.35	16.85	0.9	15.2	
6/14/11 10:06:15	1.36	16.84	0.7	15.1	
6/14/11 10:06:30	1.35	16.83	0.7	15.1	
6/14/11 10:06:45	1.34	16.83	0.8	15.1	
6/14/11 10:07:00	1.33	16.85	0.6	14.9	
6/14/11 10:07:15	1.30	16.89	0.6	14.7	
6/14/11 10:07:30	1.26	16.91	0.9	14.7	
6/14/11 10:07:45	1.23	16.91	1.0	14.9	
6/14/11 10:08:00	1.24	16.92	0.7	14.9	
6/14/11 10:08:15	1.27	16.93	0.6	15.0	
6/14/11 10:08:30	1.28	16.93	0.7	15.2	
6/14/11 10:08:45	1.29	16.91	0.7	15.5	
6/14/11 10:09:00	1.30	16.88	0.6	15.6	
6/14/11 10:09:15	1.33	16.85	0.6	15.3	
6/14/11 10:09:30	1.35	16.82	0.8	15.1	
6/14/11 10:09:45	1.33	16.85	0.8	14.8	
6/14/11 10:10:00	1.31	16.86	0.8	14.9	
6/14/11 10:10:15	1.28	16.90	0.7	15.1	
6/14/11 10:10:30	1.26	16.91	0.9	15.0	
6/14/11 10:10:45	1.29	16.90	0.7	14.9	
6/14/11 10:11:00	1.28	16.91	0.7	14.7	
6/14/11 10:11:15	1.25	16.93	0.6	15.0	
6/14/11 10:11:30	1.25	16.94	0.6	15.1	
6/14/11 10:11:45	1.28	16.91	0.7	15.3	
6/14/11 10:12:00	1.30	16.87	0.6	15.6	
6/14/11 10:12:15	1.32	16.85	0.6	15.3	
6/14/11 10:12:30	1.34	16.86	0.6	15.2	
6/14/11 10:12:45	1.34	16.87	0.7	15.3	
6/14/11 10:13:00	1.33	16.88	0.7	15.3	
6/14/11 10:13:15	1.32	16.87	0.8	15.3	
6/14/11 10:13:30	1.31	16.86	1.0	15.3	
6/14/11 10:13:45	1.31	16.85	0.9	15.0	
6/14/11 10:14:00	1.30	16.87	0.8	15.2	
6/14/11 10:14:15	1.27	16.90	0.7	15.2	
6/14/11 10:14:30	1.28	16.91	0.7	15.2	
6/14/11 10:14:45	1.27	16.90	0.8	15.2	
6/14/11 10:15:00	1.26	16.91	0.8	15.3	
6/14/11 10:15:15	1.26	16.91	0.8	15.2	
6/14/11 10:15:30	1.28	16.90	0.8	15.0	
6/14/11 10:15:45	1.27	16.92	0.5	15.3	
6/14/11 10:16:00	1.23	16.95	0.5	15.2	
6/14/11 10:16:15	1.23	16.93	0.6	14.9	
6/14/11 10:16:30	1.25	16.91	0.7	15.1	
6/14/11 10:16:45	1.23	16.94	0.7	15.1	
6/14/11 10:17:00	1.23	16.94	0.7	15.0	
6/14/11 10:17:15	1.25	16.92	0.7	14.8	
6/14/11 10:17:30	1.26	16.90	0.6	14.8	
6/14/11 10:17:45	1.26	16.91	0.6	14.9	
6/14/11 10:18:00	1.23	16.93	0.6	14.9	
6/14/11 10:18:15	1.23	16.94	0.7	15.0	
6/14/11 10:18:30	1.23	16.95	0.7	15.2	
6/14/11 10:18:45	1.23	16.95	0.6	15.2	
6/14/11 10:19:00	1.25	16.94	0.6	14.9	
6/14/11 10:19:15	1.26	16.93	0.7	15.0	
6/14/11 10:19:30	1.24	16.93	0.7	15.1	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 10:19:45	1.23	16.92	0.6	15.1	
6/14/11 10:20:00	1.23	16.92	0.6	14.9	
6/14/11 10:20:15	1.23	16.93	0.6	14.7	
6/14/11 10:20:30	1.21	16.95	0.4	14.9	
6/14/11 10:20:45	1.20	16.96	0.5	15.0	
6/14/11 10:21:00	1.22	16.95	0.5	15.3	
6/14/11 10:21:15	1.25	16.95	0.8	15.1	
6/14/11 10:21:30	1.27	16.93	0.7	15.3	
6/14/11 10:21:45	1.27	16.91	0.7	15.3	
6/14/11 10:22:00	1.29	16.89	0.7	15.4	
6/14/11 10:22:15	1.29	16.89	0.6	15.3	
6/14/11 10:22:30	1.32	16.85	0.8	15.1	
6/14/11 10:22:45	1.33	16.84	0.9	15.2	
6/14/11 10:23:00	1.28	16.86	0.8	15.1	
6/14/11 10:23:15	1.27	16.87	0.9	15.2	
6/14/11 10:23:30	1.28	16.86	0.7	15.3	
6/14/11 10:23:45	1.30	16.86	0.4	15.1	
6/14/11 10:24:00	1.32	16.86	0.7	15.2	
6/14/11 10:24:15	1.31	16.87	0.6	15.3	
6/14/11 10:24:30	1.28	16.88	0.6	15.3	
6/14/11 10:24:45	1.29	16.87	0.7	15.4	
6/14/11 10:25:00	1.31	16.86	0.7	15.6	
6/14/11 10:25:15	1.34	16.85	0.3	15.7	
6/14/11 10:25:30	1.38	16.82	0.6	15.5	
6/14/11 10:25:45	1.40	16.80	0.4	15.4	
6/14/11 10:26:00	1.35	16.81	0.6	15.2	Restart
6/14/11 10:26:15	1.32	16.81	0.8	15.3	
6/14/11 10:26:30	1.30	16.83	0.5	15.1	
6/14/11 10:26:45	1.29	16.84	0.5	15.3	Restart FCCU-29-3
6/14/11 10:27:00	1.28	16.85	0.6	15.1	Restart FCCU-0061-3
6/14/11 10:27:15	1.29	16.86	0.6	15.0	
6/14/11 10:27:30	1.28	16.88	0.7	15.1	
6/14/11 10:27:45	1.26	16.89	0.6	15.3	
6/14/11 10:28:00	1.28	16.89	0.5	15.5	
6/14/11 10:28:15	1.31	16.86	0.4	15.5	
6/14/11 10:28:30	1.33	16.84	0.5	15.4	
6/14/11 10:28:45	1.32	16.84	0.7	15.7	
6/14/11 10:29:00	1.31	16.85	0.7	15.6	
6/14/11 10:29:15	1.33	16.84	0.7	14.9	
6/14/11 10:29:30	1.32	16.85	0.7	14.6	
6/14/11 10:29:45	1.24	16.89	0.5	14.6	
6/14/11 10:30:00	1.19	16.93	0.5	14.9	
6/14/11 10:30:15	1.20	16.94	0.4	14.9	
6/14/11 10:30:30	1.22	16.93	0.5	15.0	
6/14/11 10:30:45	1.25	16.91	0.5	14.8	
6/14/11 10:31:00	1.26	16.89	0.5	14.6	
6/14/11 10:31:15	1.23	16.91	0.6	14.8	
6/14/11 10:31:30	1.20	16.93	0.6	15.0	
6/14/11 10:31:45	1.22	16.92	0.4	15.1	
6/14/11 10:32:00	1.26	16.90	0.5	15.1	
6/14/11 10:32:15	1.28	16.88	0.7	15.1	
6/14/11 10:32:30	1.29	16.87	0.5	15.2	
6/14/11 10:32:45	1.27	16.87	0.6	15.1	
6/14/11 10:33:00	1.26	16.87	0.5	14.9	
6/14/11 10:33:15	1.26	16.87	0.5	14.9	
6/14/11 10:33:30	1.26	16.88	0.3	15.1	
6/14/11 10:33:45	1.27	16.88	0.3	15.2	
6/14/11 10:34:00	1.31	16.84	0.5	14.9	
6/14/11 10:34:15	1.34	16.81	0.7	14.7	
6/14/11 10:34:30	1.33	16.83	0.5	14.8	
6/14/11 10:34:45	1.29	16.85	0.3	14.7	
6/14/11 10:35:00	1.29	16.85	0.5	14.6	
6/14/11 10:35:15	1.27	16.86	0.7	14.7	
6/14/11 10:35:30	1.27	16.88	0.8	15.0	
6/14/11 10:35:45	1.27	16.88	0.6	15.1	
6/14/11 10:36:00	1.31	16.86	0.3	15.0	
6/14/11 10:36:15	1.34	16.82	0.4	14.9	
6/14/11 10:36:30	1.35	16.81	0.5	14.7	
6/14/11 10:36:45	1.34	16.81	0.6	14.6	
6/14/11 10:37:00	1.33	16.82	0.7	14.3	
6/14/11 10:37:15	1.29	16.85	0.6	14.5	
6/14/11 10:37:30	1.26	16.87	0.5	14.9	
6/14/11 10:37:45	1.27	16.86	0.6	15.2	
6/14/11 10:38:00	1.31	16.85	0.7	15.2	
6/14/11 10:38:15	1.36	16.81	0.5	14.9	
6/14/11 10:38:30	1.40	16.76	0.5	14.8	
6/14/11 10:38:45	1.39	16.76	0.5	14.7	
6/14/11 10:39:00	1.37	16.78	0.6	14.5	
6/14/11 10:39:15	1.32	16.82	0.5	14.3	
6/14/11 10:39:30	1.26	16.86	0.3	14.2	
6/14/11 10:39:45	1.21	16.90	0.3	14.3	
6/14/11 10:40:00	1.19	16.91	0.4	14.1	
6/14/11 10:40:15	1.19	16.91	0.5	14.1	
6/14/11 10:40:30	1.20	16.92	0.6	14.2	
6/14/11 10:40:45	1.19	16.94	0.5	14.2	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 10:41:00	1.18	16.97	0.4	14.4	
6/14/11 10:41:15	1.20	16.96	0.5	14.7	
6/14/11 10:41:30	1.24	16.93	0.4	14.8	
6/14/11 10:41:45	1.28	16.90	0.5	15.0	Restart FCCU-5B-3
6/14/11 10:42:00	1.31	16.86	0.6	15.1	
6/14/11 10:42:15	1.34	16.82	0.5	15.0	
6/14/11 10:42:30	1.35	16.81	0.4	14.9	
6/14/11 10:42:45	1.37	16.79	0.6	14.8	
6/14/11 10:43:00	1.36	16.80	0.5	14.8	
6/14/11 10:43:15	1.35	16.81	0.5	14.9	
6/14/11 10:43:30	1.36	16.80	0.6	15.1	
6/14/11 10:43:45	1.38	16.78	0.7	15.2	
6/14/11 10:44:00	1.40	16.76	0.7	15.2	
6/14/11 10:44:15	1.40	16.77	0.5	15.5	
6/14/11 10:44:30	1.39	16.76	0.5	15.5	
6/14/11 10:44:45	1.44	16.72	0.5	15.4	
6/14/11 10:45:00	1.46	16.71	0.4	15.5	
6/14/11 10:45:15	1.45	16.72	0.7	15.6	
6/14/11 10:45:30	1.46	16.71	0.6	16.0	
6/14/11 10:45:45	1.45	16.70	0.5	16.0	
6/14/11 10:46:00	1.48	16.67	0.5	15.8	
6/14/11 10:46:15	1.50	16.65	0.6	15.8	
6/14/11 10:46:30	1.49	16.65	0.3	15.9	
6/14/11 10:46:45	1.49	16.65	0.5	16.0	
6/14/11 10:47:00	1.46	16.66	0.5	15.9	
6/14/11 10:47:15	1.47	16.66	0.8	16.1	
6/14/11 10:47:30	1.47	16.67	0.5	16.1	
6/14/11 10:47:45	1.47	16.66	0.4	16.0	
6/14/11 10:48:00	1.46	16.66	0.5	15.8	
6/14/11 10:48:15	1.45	16.66	0.7	15.7	
6/14/11 10:48:30	1.45	16.68	0.6	15.9	
6/14/11 10:48:45	1.44	16.69	0.4	16.0	
6/14/11 10:49:00	1.44	16.68	0.5	16.1	
6/14/11 10:49:15	1.47	16.68	0.6	15.9	
6/14/11 10:49:30	1.51	16.66	0.8	16.0	
6/14/11 10:49:45	1.49	16.66	0.7	16.0	
6/14/11 10:50:00	1.46	16.67	0.4	15.7	
6/14/11 10:50:15	1.44	16.68	0.4	15.5	
6/14/11 10:50:30	1.40	16.71	0.5	15.7	
6/14/11 10:50:45	1.36	16.74	0.7	15.7	
6/14/11 10:51:00	1.36	16.77	0.5	15.6	
6/14/11 10:51:15	1.37	16.77	0.5	15.8	
6/14/11 10:51:30	1.35	16.78	0.5	15.7	
6/14/11 10:51:45	1.35	16.77	0.4	15.5	
6/14/11 10:52:00	1.36	16.76	0.4	15.5	
6/14/11 10:52:15	1.38	16.74	0.5	15.3	
6/14/11 10:52:30	1.40	16.74	0.5	15.2	
6/14/11 10:52:45	1.37	16.76	0.5	15.1	
6/14/11 10:53:00	1.33	16.79	0.4	15.0	
6/14/11 10:53:15	1.30	16.80	0.4	15.1	
6/14/11 10:53:30	1.30	16.81	0.6	15.4	
6/14/11 10:53:45	1.30	16.81	0.6	15.3	
6/14/11 10:54:00	1.34	16.79	0.6	15.0	
6/14/11 10:54:15	1.32	16.80	0.5	14.8	
6/14/11 10:54:30	1.28	16.83	0.5	14.8	
6/14/11 10:54:45	1.24	16.86	0.4	14.8	
6/14/11 10:55:00	1.23	16.88	0.5	15.0	
6/14/11 10:55:15	1.23	16.89	0.5	15.4	
6/14/11 10:55:30	1.23	16.89	0.4	15.4	
6/14/11 10:55:45	1.29	16.84	0.3	15.3	
6/14/11 10:56:00	1.32	16.81	0.5	15.2	
6/14/11 10:56:15	1.31	16.81	0.4	15.2	
6/14/11 10:56:30	1.31	16.81	0.5	15.0	
6/14/11 10:56:45	1.31	16.81	0.6	15.0	Restart FCCU-027-3
6/14/11 10:57:00	1.28	16.83	0.6	14.9	
6/14/11 10:57:15	1.28	16.84	0.5	14.9	
6/14/11 10:57:30	1.26	16.86	0.4	14.9	
6/14/11 10:57:45	1.24	16.87	0.3	14.7	
6/14/11 10:58:00	1.22	16.88	0.5	14.5	
6/14/11 10:58:15	1.18	16.91	0.5	14.5	
6/14/11 10:58:30	1.16	16.93	0.5	14.7	
6/14/11 10:58:45	1.17	16.92	0.5	14.7	
6/14/11 10:59:00	1.20	16.91	0.5	14.6	
6/14/11 10:59:15	1.21	16.90	0.5	14.8	
6/14/11 10:59:30	1.21	16.89	0.6	14.8	
6/14/11 10:59:45	1.22	16.90	0.5	14.6	
6/14/11 11:00:00	1.22	16.90	0.6	14.5	
6/14/11 11:00:15	1.21	16.91	0.4	14.4	
6/14/11 11:00:30	1.19	16.93	0.2	14.3	
6/14/11 11:00:45	1.16	16.95	0.4	14.6	
6/14/11 11:01:00	1.15	16.96	0.4	14.7	
6/14/11 11:01:15	1.18	16.93	0.1	14.7	
6/14/11 11:01:30	1.21	16.91	0.3	14.8	
6/14/11 11:01:45	1.22	16.89	0.3	14.8	
6/14/11 11:02:00	1.22	16.89	0.2	14.7	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack
ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 11:02:15	1.23	16.88	0.4	14.6	
6/14/11 11:02:30	1.24	16.88	0.4	14.6	
6/14/11 11:02:45	1.23	16.89	0.2	14.7	
6/14/11 11:03:00	1.23	16.87	0.3	14.5	
6/14/11 11:03:15	1.24	16.86	0.3	14.2	
6/14/11 11:03:30	1.21	16.88	0.4	14.0	
6/14/11 11:03:45	1.16	16.92	0.5	14.0	
6/14/11 11:04:00	1.12	16.95	0.3	13.9	
6/14/11 11:04:15	1.10	16.98	0.4	13.7	
6/14/11 11:04:30	1.09	16.99	0.3	13.7	
6/14/11 11:04:45	1.09	17.00	0.5	14.0	
6/14/11 11:05:00	1.08	17.00	0.7	13.9	
6/14/11 11:05:15	1.11	17.00	0.5	14.0	
6/14/11 11:05:30	1.12	17.00	0.5	14.0	
6/14/11 11:05:45	1.14	16.98	0.4	14.2	
6/14/11 11:06:00	1.16	16.96	0.3	14.3	
6/14/11 11:06:15	1.17	16.94	0.4	13.7	
6/14/11 11:06:30	1.16	16.95	0.4	13.7	
6/14/11 11:06:45	1.11	16.97	0.2	13.6	
6/14/11 11:07:00	1.09	16.99	0.3	13.8	
6/14/11 11:07:15	1.09	17.01	0.3	13.3	
6/14/11 11:07:30	1.09	17.00	0.3	13.5	
6/14/11 11:07:45	1.07	17.01	0.4	13.6	
6/14/11 11:08:00	1.06	17.00	0.4	13.5	
6/14/11 11:08:15	1.08	17.00	0.4	13.5	
6/14/11 11:08:30	1.08	17.03	0.5	13.3	
6/14/11 11:08:45	1.08	17.03	0.6	13.4	
6/14/11 11:09:00	1.07	17.02	0.4	13.3	
6/14/11 11:09:15	1.09	17.00	0.3	13.2	
6/14/11 11:09:30	1.08	17.01	0.4	13.1	
6/14/11 11:09:45	1.08	17.01	0.3	12.9	
6/14/11 11:10:00	1.08	17.02	0.3	13.0	
6/14/11 11:10:15	1.03	17.04	0.2	12.8	
6/14/11 11:10:30	1.02	17.04	0.4	12.9	
6/14/11 11:10:45	1.01	17.06	0.4	12.9	
6/14/11 11:11:00	1.02	17.06	0.4	13.0	
6/14/11 11:11:15	1.04	17.05	0.4	12.7	
6/14/11 11:11:30	1.06	17.03	0.4	12.4	
6/14/11 11:11:45	1.03	17.04	0.1	12.2	Complete Run 3
6/14/11 11:12:00	0.98	17.06	0.0	12.2	
6/14/11 11:12:15	0.95	17.10	0.2	12.3	
6/14/11 11:12:30	0.94	17.13	0.4	12.4	
6/14/11 11:12:45	0.95	17.14	0.3	12.4	
6/14/11 11:13:00	0.97	17.12	0.4	12.5	
6/14/11 11:13:15	0.98	17.10	0.6	8.5	
6/14/11 11:13:30	1.21	16.57	0.6	29.1	
6/14/11 11:13:45	4.44	10.01	0.6	37.9	
6/14/11 11:14:00	3.34	4.17	0.5	38.0	
6/14/11 11:14:15	0.93	1.08	0.5	38.0	
6/14/11 11:14:30	0.15	0.35	0.4	38.0	
6/14/11 11:14:45	0.08	0.27	0.4	38.1	
6/14/11 11:15:00	0.07	0.24	0.5	38.3	
6/14/11 11:15:15	0.06	0.22	0.4	38.1	
6/14/11 11:15:30	0.06	0.20	0.2	37.9	
6/14/11 11:15:45	0.06	0.19	0.3	37.8	
6/14/11 11:16:00	0.06	0.18	0.5	37.7	
6/14/11 11:16:15	0.05	0.17	0.4	37.8	
6/14/11 11:16:30	0.05	0.17	0.3	37.9	
6/14/11 11:16:45	0.05	0.16	0.3	38.1	
6/14/11 11:17:00	0.05	0.16	0.4	38.2	
6/14/11 11:17:15	0.05	0.15	0.5	38.5	
6/14/11 11:17:30	0.05	0.15	0.6	38.8	
6/14/11 11:17:45	0.05	0.14	0.5	39.1	
6/14/11 11:18:00	0.05	0.14	0.4	39.4	
6/14/11 11:18:15	0.05	0.14	0.4	39.7	
6/14/11 11:18:30	0.05	0.13	0.4	40.0	
6/14/11 11:18:45	0.05	0.13	0.3	40.4	
6/14/11 11:19:00	0.05	0.13	0.3	40.8	
6/14/11 11:19:15	0.05	0.13	0.5	41.2	
6/14/11 11:19:30	0.05	0.12	0.4	41.7	
6/14/11 11:19:45	0.05	0.12	0.4	42.2	
6/14/11 11:20:00	0.05	0.12	0.4	42.6	
6/14/11 11:20:15	0.05	0.12	0.4	43.0	
6/14/11 11:20:30	0.04	0.11	0.3	43.4	
6/14/11 11:20:45	0.05	0.11	0.3	43.7	
6/14/11 11:21:00	0.04	0.11	0.4	43.9	
6/14/11 11:21:15	0.05	0.11	0.3	44.2	
6/14/11 11:21:30	0.04	0.11	0.3	44.4	
6/14/11 11:21:45	0.04	0.11	0.4	44.6	
6/14/11 11:22:00	0.04	0.10	0.2	44.8	
6/14/11 11:22:15	0.04	0.10	0.4	45.0	
6/14/11 11:22:30	0.04	0.10	0.3	45.1	
6/14/11 11:22:45	0.04	0.10	0.4	45.2	
6/14/11 11:23:00	0.04	0.10	0.4	45.3	
6/14/11 11:23:15	0.04	0.10	0.3	45.4	

Valero Port Arthur Refinery: Port Arthur, Texas

1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 11:23:30	0.04	0.10	0.3	45.5	
6/14/11 11:23:45	0.04	0.10	0.1	45.5	
6/14/11 11:24:00	0.04	0.10	0.2	45.6	
6/14/11 11:24:15	0.04	0.10	0.3	45.6	
6/14/11 11:24:30	0.04	0.10	0.4	45.7	System Bias
6/14/11 11:24:45	0.04	0.10	0.5	45.8	NO _x Bias 2 Mid = 45.7
6/14/11 11:25:00	0.04	0.10	0.2	45.7	
6/14/11 11:25:15	0.04	0.10	0.1	45.7	
6/14/11 11:25:30	0.04	0.10	0.1	45.8	
6/14/11 11:25:45	0.04	0.10	0.1	45.8	
6/14/11 11:26:00	0.04	0.10	0.1	45.8	
6/14/11 11:26:15	0.04	0.10	0.3	45.8	
6/14/11 11:26:30	0.04	0.10	0.1	36.6	
6/14/11 11:26:45	0.06	1.32	0.5	37.3	
6/14/11 11:27:00	0.20	5.15	0.5	10.6	
6/14/11 11:27:15	0.25	3.57	0.4	5.3	
6/14/11 11:27:30	0.19	0.82	0.5	4.9	
6/14/11 11:27:45	0.07	0.19	0.4	4.9	
6/14/11 11:28:00	0.04	0.13	0.2	4.8	
6/14/11 11:28:15	0.04	0.11	0.9	4.8	
6/14/11 11:28:30	0.04	0.11	6.7	4.3	
6/14/11 11:28:45	0.04	0.11	25.9	3.7	
6/14/11 11:29:00	0.04	0.10	53.7	3.3	
6/14/11 11:29:15	0.04	0.10	80.2	3.0	
6/14/11 11:29:30	0.04	0.10	99.0	13.6	
6/14/11 11:29:45	0.04	0.10	100.8	3.5	
6/14/11 11:30:00	0.04	0.10	100.8	2.4	
6/14/11 11:30:15	0.04	0.10	100.8	2.2	
6/14/11 11:30:30	0.04	0.09	100.8	2.0	
6/14/11 11:30:45	0.04	0.09	98.7	1.9	
6/14/11 11:31:00	0.04	0.09	89.7	1.9	
6/14/11 11:31:15	0.04	0.09	81.4	1.9	
6/14/11 11:31:30	0.04	0.09	74.3	1.8	
6/14/11 11:31:45	0.04	0.09	68.6	1.7	
6/14/11 11:32:00	0.04	0.09	63.7	1.7	
6/14/11 11:32:15	0.04	0.09	59.8	1.6	
6/14/11 11:32:30	0.04	0.09	56.5	1.5	
6/14/11 11:32:45	0.04	0.09	53.7	1.5	
6/14/11 11:33:00	0.04	0.09	51.3	1.5	
6/14/11 11:33:15	0.04	0.08	49.3	1.4	
6/14/11 11:33:30	0.04	0.09	47.7	1.4	
6/14/11 11:33:45	0.04	0.08	46.3	1.4	
6/14/11 11:34:00	0.04	0.08	45.2	1.3	
6/14/11 11:34:15	0.04	0.08	44.2	1.3	
6/14/11 11:34:30	0.04	0.08	43.5	1.3	
6/14/11 11:34:45	0.04	0.08	43.0	1.3	
6/14/11 11:35:00	0.04	0.09	42.6	1.3	
6/14/11 11:35:15	0.04	0.09	42.1	1.3	
6/14/11 11:35:30	0.04	0.08	41.9	1.3	
6/14/11 11:35:45	0.04	0.09	42.0	1.3	
6/14/11 11:36:00	0.04	0.09	41.8	1.3	
6/14/11 11:36:15	0.04	0.09	41.7	1.3	
6/14/11 11:36:30	0.04	0.09	41.4	1.2	
6/14/11 11:36:45	0.04	0.09	41.6	1.2	
6/14/11 11:37:00	0.04	0.09	42.1	1.2	
6/14/11 11:37:15	0.04	0.09	42.4	1.2	System Bias
6/14/11 11:37:30	0.04	0.09	42.3	1.2	O ₂ Bias 2 Zero = 0.04
6/14/11 11:37:45	0.04	0.09	42.7	1.2	CO ₂ Bias 2 Zero = 0.09
6/14/11 11:38:00	0.04	0.09	42.9	1.2	SO ₂ Bias 2 Mid = 42.6
6/14/11 11:38:15	0.04	0.09	42.9	1.2	NO _x Bias 2 Zero = 1.2
6/14/11 11:38:30	0.04	0.09	42.9	1.2	
6/14/11 11:38:45	0.04	0.09	43.0	1.2	
6/14/11 11:39:00	0.04	0.09	43.1	2.0	
6/14/11 11:39:15	0.04	0.28	43.0	7.5	
6/14/11 11:39:30	0.19	6.07	42.9	7.8	
6/14/11 11:39:45	0.42	11.93	42.1	7.6	
6/14/11 11:40:00	0.54	15.55	40.7	7.4	
6/14/11 11:40:15	0.55	17.04	38.6	4.3	
6/14/11 11:40:30	0.50	15.89	35.7	1.6	
6/14/11 11:40:45	0.75	9.52	32.5	0.8	
6/14/11 11:41:00	2.69	5.20	28.5	0.9	
6/14/11 11:41:15	4.24	3.90	23.7	1.0	
6/14/11 11:41:30	4.49	3.72	19.3	1.1	
6/14/11 11:41:45	4.52	3.85	15.5	1.1	
6/14/11 11:42:00	4.53	4.04	12.9	1.0	System Bias
6/14/11 11:42:15	4.53	4.10	10.8	1.0	O ₂ Bias 2 Mid = 4.53
6/14/11 11:42:30	4.53	4.11	9.1	1.0	
6/14/11 11:42:45	4.53	4.11	7.7	1.0	
6/14/11 11:43:00	4.53	4.12	6.8	1.0	
6/14/11 11:43:15	4.53	4.12	5.9	1.0	
6/14/11 11:43:30	4.54	4.12	4.9	3.3	
6/14/11 11:43:45	4.46	4.68	4.4	1.9	
6/14/11 11:44:00	3.66	7.53	4.2	0.8	
6/14/11 11:44:15	5.91	8.39	4.0	0.9	
6/14/11 11:44:30	9.88	9.50	3.5	0.9	

Valero Port Arthur Refinery: Port Arthur, Texas
1241 FCCU WGS Stack

ARI Reference Method Monitoring Data

Date/Time	O ₂ % db by vol.	CO ₂ % db by vol.	SO ₂ ppmv db	NO _x ppmv db	Comments
6/14/11 11:44:45	11.18	9.92	3.2	0.9	
6/14/11 11:45:00	11.35	9.99	2.8	0.9	
6/14/11 11:45:15	11.37	10.00	2.4	1.0	
6/14/11 11:45:30	11.37	10.01	2.2	1.0	
6/14/11 11:45:45	11.38	10.01	2.2	1.0	
6/14/11 11:46:00	11.38	10.02	2.0	1.0	
6/14/11 11:46:15	11.38	10.02	2.0	0.9	System Bias
6/14/11 11:46:30	11.38	10.02	1.5	0.9	
6/14/11 11:46:45	11.39	10.02	1.6	0.9	CO ₂ Bias 2 Mid = 10.02
6/14/11 11:47:00	11.39	10.03	1.7	0.9	SO ₂ Bias 2 Zero = 1.6
6/14/11 11:47:15	11.39	10.03	1.5	0.9	
6/14/11 11:47:30	11.39	10.03	1.4	0.9	
6/14/11 11:47:45	11.39	10.03	1.5	0.9	



Valero Port Arthur Refinery
Source: FCCU-1241 Wet Gas Scrubber Stack
Test Dates: 6/6 - 6/14/11

APPENDIX E

Calibration Data

CEMS CALIBRATION DATA

Plant Name Valero Port Arthur Refinery
 Sampling Location 1241 FCCU WGS Stack
 Date 6/6/2011
 Run Number FCCU-26-1/FCCU-OTM29-1
 Start Time 6/6/11 11:25
 Stop Time 6/6/11 13:35

Plant Rep. Robin Hill
 Team Leader Dan Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)
 CO ppm
 CO₂ 19.60 %
 O₂ 9.00 %
 THC ppm
 NO_x ppm
 SO₂ ppm

System 1 - Stack										Calibration Correction Factors
CALIBRATION ERROR - 8:41 hrs				SYSTEM BIAS CHECK						
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: System Response	9:42 Syst. Bias (% of Span)	Posttest: System Response	13:43 Syst. Bias (% of Span)	hrs Drift (% of Span)		
CO ₂ Zero	0.00	CC64098	0.03	0.2	0.11	0.4	0.12	0.4	0.0	Co=
CO ₂ Low		Diluted From								0.113
CO ₂ Mid	10.00	CC102306	10.04	0.2	9.94	-0.5	9.96	-0.4	0.1	Cm=
CO ₂ High	19.60	19.60 %	19.62	0.1						9.948
O ₂ Zero	0.00	CC64098	0.03	0.3	0.09	0.6	0.09	0.7	0.1	Co=
O ₂ Low		Diluted From								0.090
O ₂ Mid	4.50	CC102306	4.54	0.4	4.52	-0.2	4.54	0.0	0.2	Cm=
O ₂ High	9.00	22.70 %	9.01	0.1						4.531

System 2 - Meter										
CALIBRATION ERROR - 9:01 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 9:30		Posttest: 13:53 hrs				
				System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)		
CO ₂ Zero	0.00	CC64098	0.08	0.4	0.15	0.4	0.08	0.0	-0.4	Co=
CO ₂ Low		Diluted From								0.119
CO ₂ Mid	10.00	CC102306	10.16	0.8	10.19	0.1	10.14	-0.1	-0.3	Cm=
CO ₂ High	19.60	19.60 %	19.66	0.3						10.164

CEMS CALIBRATION DATA

Plant Name Valero Port Arthur Refinery
 Sampling Location 1241 FCCU WGS Stack
 Date 6/6/2011
 Run Number FCCU-26-2/FCCU-OTM29-2
 Start Time 6/6/11 14:01
 Stop Time 6/6/11 16:30

Plant Rep. Robin Hill
 Team Leader Dan Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)

CO		ppm
CO ₂	19.60	%
O ₂	9.00	%
THC		ppm
NO _x		ppm
SO ₂	90.0	ppm

	CALIBRATION ERROR - 8:41 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 13:43		Posttest: 16:48 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.03	0.2	0.12	0.4	0.18	0.7	0.3	Co=
CO ₂ Low		Diluted From								0.147
CO ₂ Mid	10.00	CC102306	10.04	0.2	9.96	-0.4	9.94	-0.5	-0.1	Cm=
CO ₂ High	19.60	19.60 %	19.62	0.1						9.948
O ₂ Zero	0.00	CC64098	0.03	0.3	0.09	0.7	0.08	0.6	-0.1	Co=
O ₂ Low		Diluted From								0.088
O ₂ Mid	4.50	CC102306	4.54	0.4	4.54	0.0	4.50	-0.4	-0.4	Cm=
O ₂ High	9.00	22.70 %	9.01	0.1						4.519

System 2 - Meter

	CALIBRATION ERROR - 9:01 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 13:53		Posttest: 16:31 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.08	0.4	0.08	0.0	0.12	0.2	0.2	Co=
CO ₂ Low		Diluted From								0.103
CO ₂ Mid	10.00	CC102306	10.16	0.8	10.14	-0.1	10.17	0.0	0.1	Cm=
CO ₂ High	19.60	19.60 %	19.66	0.3						10.153

CEMS CALIBRATION DATA

Plant Name **Valero Port Arthur Refinery**
 Sampling Location **1241 FCCU WGS Stack**
 Date **6/7/2011**
 Run Number **FCCU-26-3/FCCU-OTM29-3**
 Start Time **6/7/11 14:35**
 Stop Time **6/7/11 16:46**

Plant Rep. **Robin Hill**
 Team Leader **Dan Fitzgerald**
 CEM Operator **Greg Burch**

Analyzer Span Values (% or ppm)

CO	0.0	ppm
CO ₂	19.60	%
O ₂	9.00	%
THC		ppm
NO _x		ppm
SO ₂	90.0	ppm

6/6/11

	CALIBRATION ERROR - 8:41 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 13:09		Posttest: 17:07 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.03	0.2	0.17	0.7	0.10	0.3	-0.4	Co=
CO ₂ Low		Diluted From								0.134
CO ₂ Mid	10.00	CC102306	10.04	0.2	10.04	0.0	10.04	0.0	0.0	Cm=
CO ₂ High	19.60	19.60 %	19.62	0.1						10.040
O ₂ Zero	0.00	CC64098	0.03	0.3	0.10	0.8	0.10	0.8	0.0	Co=
O ₂ Low		Diluted From								0.102
O ₂ Mid	4.50	CC102306	4.54	0.4	4.59	0.5	4.62	0.9	0.4	Cm=
O ₂ High	9.00	22.70 %	9.01	0.1						4.604

System 2 - Meter

6/6/11

SYSTEM BIAS CHECK										
CALIBRATION ERROR - 9:01 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 14:20		Posttest: 16:24 hrs				
				System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)		
CO ₂ Zero	0.00	CC64098 Diluted From	0.08	0.4	0.14	0.3	0.24	0.8	0.5	Co=
CO ₂ Low										0.187
CO ₂ Mid	10.00	CC102306	10.16	0.8	9.97	-1.0	9.99	-0.9	0.1	Cm=
CO ₂ High	19.60	19.60 %	19.66	0.3						9.981

CEMS CALIBRATION DATA

Plant Name	Valero Port Arthur Refinery
Sampling Location	1241 FCCU WGS Stack
Date	6/8/2011
Run Number	FCCU-0010-1/FCCU-0011-1
Start Time	6/8/11 8:16
Stop Time	6/8/11 12:53

Plant Rep.	Robin Hill
Team Leader	Dan Fitzgerald
CEM Operator	Greg Burch

Analyzer Span Values (% or ppm)		
CO	80.1	ppm
CO ₂	19.60	%
O ₂	9.00	%
THC	90.0	ppm
NO _x		ppm
SO ₂		ppm

	CALIBRATION ERROR - 6:51 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 7:51		Posttest: 13:32 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO Zero	0.0	CC64098	0.1	0.1	3.1	3.8	3.0	3.7	-0.1	Co=
CO Low		Diluted from								3.07
CO Mid	40.0	CC102306	40.8	1.0	43.1	2.8	43.3	3.1	0.3	Cm=
CO High	80.1	202 ppm	80.3	0.2						43.21
CO ₂ Zero	0.00	CC64098	0.05	0.3	0.08	0.1	0.13	0.4	0.3	Co=
CO ₂ Low		Diluted from								0.103
CO ₂ Mid	10.00	CC102306	10.15	0.8	10.01	-0.7	10.03	-0.6	0.1	Cm=
CO ₂ High	19.60	19.60 %	19.60	0.0						10.021
O ₂ Zero	0.00	CC64098	0.02	0.3	0.08	0.6	0.12	1.1	0.4	Co=
O ₂ Low		Diluted from								0.101
O ₂ Mid	4.50	CC102306	4.61	1.2	4.57	-0.4	4.62	0.2	0.6	Cm=
O ₂ High	9.00	22.70 %	9.05	0.6						4.596
THC Zero	0.0	CC64098	0.2	0.2	0.2	0.0	0.0	-0.2	-0.2	Co=
THC Low	30.0	Diluted from	30.6	0.7	30.6	0.0	30.6	0.0	0.0	0.10
THC Mid	50.0	ALM005822	51.2	1.3						Cm=
THC High	90.0	999.8	90.3	0.3						30.61

CEMS CALIBRATION DATA

Plant Name	Valero Port Arthur Refinery
Sampling Location	1241 FCCU WGS Stack
Date	6/8/2011
Run Number	FCCU-0010-2/FCCU-0011-2
Start Time	6/8/11 14:02
Stop Time	6/8/11 18:39

Plant Rep.	Robin Hill
Team Leader	Dan Fitzgerald
CEM Operator	Greg Burch

Analyzer Span Values (% or ppm)		
CO	80.1	ppm
CO ₂	19.60	%
O ₂	9.00	%
THC	90.0	ppm
NO _x		ppm
SO ₂		ppm

	CALIBRATION ERROR - 6:51 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 13:32		Posttest: 19:07 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO Zero	0.0	CC64098	0.1	0.1	3.0	3.7	2.4	2.9	-0.8	Co=
CO Low		Diluted from								2.70
CO Mid	40.0	CC102306	40.8	1.0	43.3	3.1	42.7	2.4	-0.8	Cm=
CO High	80.1	202 ppm	80.3	0.2						43.02
CO ₂ Zero	0.00	CC64098	0.05	0.3	0.13	0.4	0.21	0.8	0.4	Co=
CO ₂ Low		Diluted from								0.171
CO ₂ Mid	10.00	CC102306	10.15	0.8	10.03	-0.6	9.97	-0.9	-0.3	Cm=
CO ₂ High	19.60	19.60 %	19.60	0.0						10.001
O ₂ Zero	0.00	CC64098	0.02	0.3	0.12	1.1	0.06	0.4	-0.6	Co=
O ₂ Low		Diluted from								0.093
O ₂ Mid	4.50	CC102306	4.61	1.2	4.62	0.2	4.58	-0.3	-0.5	Cm=
O ₂ High	9.00	22.70 %	9.05	0.6						4.600
THC Zero	0.0	CC64098	0.2	0.2	0.0	-0.2	0.0	-0.2	0.0	Co=
THC Low	30.0	Diluted from	30.6	0.7	30.6	0.0	29.4	-1.4	-1.3	0.00
THC Mid	50.0	ALM005822	51.2	1.3						Cm=
THC High	90.0	999.8	90.3	0.3						30.00

CEMS CALIBRATION DATA

Plant Name	Valero Port Arthur Refinery
Sampling Location	1241 FCCU WGS Stack
Date	6/9/2011
Run Number	FCCU-0010-3/FCCU-0011-3
Start Time	6/9/11 7:34
Stop Time	6/9/11 12:14

Plant Rep.	Robin Hill
Team Leader	Dan Fitzgerald
CEM Operator	Greg Burch

Analyzer Span Values (% or ppm)		
CO	80.1	ppm
CO ₂	19.60	%
O ₂	9.00	%
THC	90.0	ppm
NO _x		ppm
SO ₂		ppm

	CALIBRATION ERROR - 6:54 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 7:22		Posttest: 12:18 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO Zero	0.0	CC64098	0.1	0.2	0.9	0.9	-0.7	-1.0	-1.9	Co=
CO Low		Diluted from								0.09
CO Mid	40.0	CC102306	39.9	-0.1	39.6	-0.3	39.3	-0.7	-0.4	Cm=
CO High	80.1	202 ppm	79.2	-1.2						39.46
CO ₂ Zero	0.00	CC64098	0.08	0.4	0.14	0.3	0.12	0.2	-0.1	Co=
CO ₂ Low		Diluted from								0.128
CO ₂ Mid	10.00	CC102306	10.13	0.7	9.91	-1.1	9.97	-0.8	0.3	Cm=
CO ₂ High	19.60	19.60 %	19.52	-0.4						9.940
O ₂ Zero	0.00	CC64098	0.03	0.3	0.14	1.2	0.11	0.9	-0.3	Co=
O ₂ Low		Diluted from								0.124
O ₂ Mid	4.50	CC102306	4.52	0.3	4.63	1.1	4.61	0.9	-0.2	Cm=
O ₂ High	9.00	22.70 %	9.05	0.6						4.618
THC Zero	0.0	CC64098	0.0	0.1	0.0	-0.1	0.0	-0.1	0.0	Co=
THC Low	30.0	Diluted from	29.8	-0.3	29.8	0.0	30.6	0.9	0.9	0.000
THC Mid	50.0	ALM005822	49.4	-0.7						Cm=
THC High	90.0	999.8	90.0	0.0						30.180

CEMS CALIBRATION DATA

Plant Name Valero Port Arthur Refinery
 Sampling Location 1241 FCCU WGS Stack
 Date 6/9/2011
 Run Number FCCU-23-1/FCCU-OH-1
 Start Time 6/9/11 14:47
 Stop Time 6/9/11 18:03

Plant Rep. Robin Hill
 Team Leader Dan Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)
 CO ppm
 CO₂ 19.60 %
 O₂ 9.00 %
 THC ppm
 NO_x ppm
 SO₂ ppm

	CALIBRATION ERROR - 6:54 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 12:18		Posttest: 18:44 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.08	0.4	0.12	0.2	0.11	0.1	-0.1	Co=
CO ₂ Low		Diluted from								0.111
CO ₂ Mid	10.00	CC102306	10.13	0.7	9.97	-0.8	9.95	-0.9	-0.1	Cm=
CO ₂ High	19.60	19.6 %	19.52	-0.4						9.958
O ₂ Zero	0.00	CC64098	0.03	0.3	0.11	0.9	0.10	0.8	-0.1	Co=
O ₂ Low		Diluted from								0.105
O ₂ Mid	4.50	CC102306	4.52	0.3	4.61	0.9	4.55	0.3	-0.7	Cm=
O ₂ High	9.00	22.70 %	9.05	0.6						4.579

CEMS CALIBRATION DATA

Plant Name Valero Port Arthur Refinery
 Sampling Location 1241 FCCU WGS Stack
 Date 6/10/2011
 Run Number FCCU-23-2/FCCU-OH-2
 Start Time 6/10/11 7:32
 Stop Time 6/10/11 10:55

Plant Rep. Robin Hill
 Team Leader Dan Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)

CO	80.1	ppm
CO ₂	19.60	%
O ₂	9.00	%
THC	90.0	ppm
NO _x		ppm
SO ₂		ppm

	CALIBRATION ERROR - 7:07 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 7:22		Posttest: 11:06 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.05	0.3	0.19	0.7	0.10	0.3	-0.4	Co=
CO ₂ Low		Diluted from								0.144
CO ₂ Mid	10.00	CC102306	10.14	0.7	10.01	-0.7	9.99	-0.8	-0.1	Cm=
CO ₂ High	19.60	19.60 %	19.59	0.0						10.001
O ₂ Zero	0.00	CC64098	0.05	0.6	0.13	0.9	0.08	0.3	-0.6	Co=
O ₂ Low		Diluted from								0.106
O ₂ Mid	4.50	CC102306	4.58	0.9	4.59	0.1	4.57	-0.1	-0.2	Cm=
O ₂ High	9.00	22.70 %	9.04	0.4						4.580

CEMS CALIBRATION DATA

Plant Name Valero Port Arthur Refinery
 Sampling Location 1241 FCCU WGS Stack
 Date 6/10/2011
 Run Number FCCU-23-3/FCCU-OH-3/FCCU-0061-3
 Start Time 6/10/11 12:28
 Stop Time 6/10/11 16:33

Plant Rep. Robin Hill
 Team Leader Dan Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)

CO		ppm
CO ₂	19.60	%
O ₂	9.00	%
THC		ppm
NO _x		ppm
SO ₂		ppm

	CALIBRATION ERROR - 7:07 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 11:06		Posttest: 16:35 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.05	0.3	0.10	0.3	0.16	0.6	0.3	Co=
CO ₂ Low		Diluted from								0.132
CO ₂ Mid	10.00	CC102306	10.14	0.7	9.99	-0.8	10.00	-0.7	0.0	Cm=
CO ₂ High	19.60	19.60 %	19.59	0.0						9.994
O ₂ Zero	0.00	CC64098	0.05	0.6	0.08	0.3	0.11	0.7	0.4	Co=
O ₂ Low		Diluted from								0.096
O ₂ Mid	4.50	CC102306	4.58	0.9	4.57	-0.1	4.58	0.0	0.0	Cm=
O ₂ High	9.00	22.70 %	9.04	0.4						4.574

CEMS CALIBRATION DATA

Plant Name Valero Port Arthur Refinery
 Sampling Location 1241 FCCU WGS Stack
 Date 6/13/2011
 Run Number FCCU-5B-1, FCCU-29-1, FCCU-027-1
 Start Time 6/13/11 9:29
 Stop Time 6/13/11 12:49

Plant Rep. Robin Hill
 Team Leader Dan Fitzgerald
 CEM Operator Greg Burch

Analyzer Span Values (% or ppm)

CO		ppm
CO ₂	19.60	%
O ₂	9.00	%
THC		ppm
NO _x	90.0	ppm
SO ₂	90.0	ppm

CALIBRATION ERROR - 7:39 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)		Pretest: 8:37 System Response	Syst. Bias (% of Span)	Posttest: 17:09 System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.07	0.3	0.07	0.0	0.09	0.1	0.1	Co=
CO ₂ Low		Diluted from								0.077
CO ₂ Mid	10.00	CC73859	10.14	0.7	9.96	-0.9	10.03	-0.6	0.3	Cm=
CO ₂ High	19.60	19.60 %	19.63	0.1						9.994
O ₂ Zero	0.00	CC64098	0.03	0.3	0.13	1.1	0.05	0.3	-0.8	Co=
O ₂ Low		Diluted from								0.089
O ₂ Mid	4.50	CC73859	4.61	1.2	4.57	-0.5	4.57	-0.5	0.0	Cm=
O ₂ High	9.00	22.70 %	9.01	0.2						4.567
NO _x Zero	0.0	CC64098	0.4	0.4	1.4	1.2	0.9	0.5	-0.6	Co=
NO _x Low		Diluted from								1.13
NO _x Mid	45.0	CC149689	46.8	2.0	43.1	-4.1	43.5	-3.6	0.5	Cm=
NO _x High	90.0	993.9 ppm	90.6	0.7						43.33
SO ₂ Zero	0.0	CC64098	-0.3	-0.4	1.3	1.8	1.9	2.5	0.6	Co=
SO ₂ Low		Diluted from								1.57
SO ₂ Mid	45.0	CC102277	46.2	1.4	42.7	-3.9	43.6	-2.9	1.0	Cm=
SO ₂ High	90.0	1,001 ppm	90.4	0.4						43.16

CEMS CALIBRATION DATA

Plant Name	Valero Port Arthur Refinery	Plant Rep.	Robin Hill
Sampling Location	1241 FCCU WGS Stack	Team Leader	Dan Fitzgerald
Date	6/13/2011	CEM Operator	Greg Burch
Run Number	FCCU-5B-2, FCCU-29-2, FCCU-027-2, FCCU-0061-4		
Start Time	6/13/11 13:18		
Stop Time	6/13/11 17:03		

Analyzer Span Values (% or ppm)		
CO		ppm
CO ₂	19.60	%
O ₂	9.00	%
THC		ppm
NO _x	90.0	ppm
SO ₂	90.0	ppm

	CALIBRATION ERROR - 7:39 hrs				SYSTEM BIAS CHECK					Calibration Correction Factors
	Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)	Pretest: 8:37		Posttest: 17:09 hrs			
					System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.07	0.3	0.07	0.0	0.09	0.1	0.1	Co=
CO ₂ Low		Diluted from								0.077
CO ₂ Mid	10.00	CC73859	10.14	0.7	9.96	-0.9	10.03	-0.6	0.3	Cm=
CO ₂ High	19.60	19.60 %	19.63	0.1						9.994
O ₂ Zero	0.00	CC64098	0.03	0.3	0.13	1.1	0.05	0.3	-0.8	Co=
O ₂ Low		Diluted from								0.089
O ₂ Mid	4.50	CC73859	4.61	1.2	4.57	-0.5	4.57	-0.5	0.0	Cm=
O ₂ High	9.00	22.70 %	9.01	0.2						4.567
NO _x Zero	0.0	CC64098	0.4	0.4	1.4	1.2	0.9	0.5	-0.6	Co=
NO _x Low		Diluted from								1.13
NO _x Mid	45.0	CC149689	46.8	2.0	43.1	-4.1	43.5	-3.6	0.5	Cm=
NO _x High	90.0	993.9 ppm	90.6	0.7						43.33
SO ₂ Zero	0.0	CC64098	-0.3	-0.4	1.3	1.8	1.9	2.5	0.6	Co=
SO ₂ Low		Diluted from								1.57
SO ₂ Mid	45.0	CC102277	46.2	1.4	42.7	-3.9	43.6	-2.9	1.0	Cm=
SO ₂ High	90.0	1,001 ppm	90.4	0.4						43.16

CEMS CALIBRATION DATA

Plant Name	Valero Port Arthur Refinery	Plant Rep.	Robin Hill
Sampling Location	1241 FCCU WGS Stack	Team Leader	Dan Fitzgerald
Date	6/14/2011	CEM Operator	Greg Burch
Run Number	FCCU-5B-3, FCCU-29-3, FCCU-027-3, FCCU-0061-5		
Start Time	6/14/11 7:37		
Stop Time	6/14/11 11:12		

Analyzer Span Values (% or ppm)		
CO		ppm
CO ₂	19.60	%
O ₂	9.00	%
THC		ppm
NO _x	90.0	ppm
SO ₂	90.0	ppm

CALIBRATION ERROR - 6:28 hrs					SYSTEM BIAS CHECK					Calibration Correction Factors
Cylinder Value (% or ppm)	Cylinder Number	Analyzer Calibration Response	Difference (% of Span)		Pretest: 7:22 System Response	Syst. Bias (% of Span)	Posttest: 11:24 System Response	Syst. Bias (% of Span)	Drift (% of Span)	
CO ₂ Zero	0.00	CC64098	0.08	0.4	0.09	0.0	0.09	0.0	0.0	Co=
CO ₂ Low		Diluted from								0.088
CO ₂ Mid	10.00	CC73859	10.15	0.8	9.98	-0.8	10.02	-0.6	0.2	Cm=
CO ₂ High	19.60	19.60 %	19.63	0.2						10.005
O ₂ Zero	0.00	CC64098	0.00	0.0	0.05	0.6	0.04	0.5	-0.1	Co=
O ₂ Low		Diluted from								0.043
O ₂ Mid	4.50	CC73859	4.63	1.4	4.51	-1.3	4.53	-1.1	0.2	Cm=
O ₂ High	9.00	22.70 %	9.01	0.1						4.521
NO _x Zero	0.0		0.4	0.5	1.7	1.4	1.2	0.9	-0.5	Co=
NO _x Low		Diluted from								1.44
NO _x Mid	45.0	CC149689	46.7	1.9	44.5	-2.5	45.7	-1.1	1.4	Cm=
NO _x High	90.0	993.9 ppm	90.6	0.6						45.09
SO ₂ Zero	0.0		0.7	0.8	2.6	2.1	1.6	1.0	-1.1	Co=
SO ₂ Low		Diluted from								2.06
SO ₂ Mid	45.0	CC102277	46.7	1.8	44.5	-2.4	42.6	-4.5	-2.2	Cm=
SO ₂ High	90.0	1,001 ppm	90.3	0.3						43.56

ARI REFERENCE METHOD CEMS DATA

USEPA METHOD 205

DILUTION SYSTEM VERIFICATION

Company: Valero
Location: Port Arthur, Texas
Source: FCCU WGS
Dilution System ID: 3371
Dilution Flow Rate: 5.0 Lpm
Verification date: 6/3/2011

Analyzer Info
Monitor type: O₂
Monitor Span: 22.70
Monitor Serial No.: X1440D1/46

Initial Calibration Data

<u>Calibration Concentration</u>	<u>Calibration results</u>	<u>% Difference</u>
Zero: 0.00	Zero: 0.04	Zero: 0.18
Low:	Low:	Low:
Mid: 11.35	Mid: 11.45	Mid: 0.44
High: 22.70	High: 22.73	High: 0.13

Dilution System Verification

Mid level gas type: <u>EPA Protocol 1</u>	High level dilution gas type: <u>O₂/N₂</u>
Mid level concentration: <u>7.610</u>	High level concentration: <u>22.70</u>
Mid level tank serial #: <u>AAL5614</u>	High level tank serial #: <u>CC102306</u>
	Target concentration No. 1: <u>5.70</u>
	Target concentration No. 2: <u>17.10</u>

Dilution System Results

<u>Target Concentration No. 1</u>			<u>Target Concentration No. 2</u>		
<u>Instrument Response</u>	<u>% difference from average*</u>		<u>Instrument Response</u>	<u>% difference from average*</u>	
Trial No. 1: 5.77	0.40		Trial No. 1: 17.16	0.00	
Trial No. 2: 5.80	0.12		Trial No. 2: 17.16	0.00	
Trial No. 3: 5.81	0.29		Trial No. 3: 17.16	0.00	
Average: 5.793			Average: 17.160		

% Difference from target concentration: 1.64% % Difference from target concentration: 0.35%

Mid Level Calibration Gas Results

<u>Instrument Response</u>	
Trial No. 1: 7.62	Mid Level calibration gas concentration: <u>7.610%</u>
Trial No. 2: 7.62	Average analyzer response: <u>7.620</u>
Trial No. 3: 7.62	Percent difference: <u>0.13</u> *

* Must be less than 2 %

USEPA Method 205 Dilution System Verification
15-second data (Unit #3371)

Date/Time	O ₂ % db by vol.	Comments
6/3/11 16:59:15	21.44	
6/3/11 16:59:30	21.45	
6/3/11 16:59:45	21.44	
6/3/11 17:00:00	21.44	
6/3/11 17:00:15	21.44	
6/3/11 17:00:30	21.42	
6/3/11 17:00:45	21.40	
6/3/11 17:01:00	21.37	
6/3/11 17:01:15	21.31	
6/3/11 17:01:30	21.26	
6/3/11 17:01:45	21.23	
6/3/11 17:02:00	21.21	
6/3/11 17:02:15	17.35	
6/3/11 17:02:30	5.42	
6/3/11 17:02:45	0.47	
6/3/11 17:03:00	-0.01	
6/3/11 17:03:15	-0.05	
6/3/11 17:03:30	-0.06	
6/3/11 17:03:45	-0.06	
6/3/11 17:04:00	-0.07	
6/3/11 17:04:15	-0.07	
6/3/11 17:04:30	-0.07	
6/3/11 17:04:45	-0.08	
6/3/11 17:05:00	-0.08	
6/3/11 17:05:15	0.08	
6/3/11 17:05:30	0.08	
6/3/11 17:05:45	0.07	
6/3/11 17:06:00	0.04	
6/3/11 17:06:15	0.04	
6/3/11 17:06:30	0.04	Calibration Error
6/3/11 17:06:45	0.04	O ₂ CE Zero = 0.04
6/3/11 17:07:00	0.04	
6/3/11 17:07:15	0.04	
6/3/11 17:07:30	0.04	
6/3/11 17:07:45	0.04	
6/3/11 17:08:00	0.07	
6/3/11 17:08:15	6.01	
6/3/11 17:08:30	15.39	
6/3/11 17:08:45	20.42	
6/3/11 17:09:00	22.77	
6/3/11 17:09:15	23.46	
6/3/11 17:09:30	23.54	
6/3/11 17:09:45	23.55	
6/3/11 17:10:00	23.40	
6/3/11 17:10:15	22.78	
6/3/11 17:10:30	22.72	Calibration Error
6/3/11 17:10:45	22.72	O ₂ CE Span = 22.73
6/3/11 17:11:00	22.73	
6/3/11 17:11:15	22.73	
6/3/11 17:11:30	22.73	
6/3/11 17:11:45	22.73	
6/3/11 17:12:00	22.70	
6/3/11 17:12:15	19.78	
6/3/11 17:12:30	14.63	
6/3/11 17:12:45	11.98	
6/3/11 17:13:00	11.51	
6/3/11 17:13:15	11.47	
6/3/11 17:13:30	11.46	
6/3/11 17:13:45	11.46	Calibration Error
6/3/11 17:14:00	11.45	O ₂ CE Mid = 11.45
6/3/11 17:14:15	11.45	
6/3/11 17:14:30	11.45	
6/3/11 17:14:45	11.45	
6/3/11 17:15:00	11.27	
6/3/11 17:15:15	8.62	
6/3/11 17:15:30	6.19	
6/3/11 17:15:45	5.80	
6/3/11 17:16:00	5.78	
6/3/11 17:16:15	5.78	Target Concentration No. 1; Trial No. 1
6/3/11 17:16:30	5.78	Mid Level Trial 1 = 5.77
6/3/11 17:16:45	5.77	
6/3/11 17:17:00	5.77	
6/3/11 17:17:15	5.77	
6/3/11 17:17:30	6.21	
6/3/11 17:17:45	10.82	
6/3/11 17:18:00	15.01	
6/3/11 17:18:15	16.82	
6/3/11 17:18:30	17.13	
6/3/11 17:18:45	17.16	Target Concentration No. 2; Trial No. 1
6/3/11 17:19:00	17.16	High Level Trial 1 = 17.16
6/3/11 17:19:15	17.16	
6/3/11 17:19:30	17.16	
6/3/11 17:19:45	17.16	
6/3/11 17:20:00	17.04	
6/3/11 17:20:15	13.79	

**USEPA Method 205 Dilution System Verification
15-second data (Unit #3371)**

Date/Time	O ₂ % db by vol.	Comments
6/3/11 17:20:30	9.78	
6/3/11 17:20:45	7.96	
6/3/11 17:21:00	7.64	
6/3/11 17:21:15	7.62	Mid-Level Concentration; Trial No. 1
6/3/11 17:21:30	7.62	Mid Std. Trial 1 = 7.62
6/3/11 17:21:45	7.62	
6/3/11 17:22:00	7.62	
6/3/11 17:22:15	7.62	
6/3/11 17:22:30	7.62	
6/3/11 17:22:45	6.34	
6/3/11 17:23:00	4.07	
6/3/11 17:23:15	5.02	
6/3/11 17:23:30	5.68	
6/3/11 17:23:45	5.77	Target Concentration No. 1; Trial No. 2
6/3/11 17:24:00	5.79	Mid Level Trial 2 = 5.80
6/3/11 17:24:15	5.80	
6/3/11 17:24:30	5.80	
6/3/11 17:24:45	5.80	
6/3/11 17:25:00	5.81	
6/3/11 17:25:15	6.13	
6/3/11 17:25:30	10.53	
6/3/11 17:25:45	14.85	
6/3/11 17:26:00	16.78	
6/3/11 17:26:15	17.13	
6/3/11 17:26:30	17.15	
6/3/11 17:26:45	17.16	
6/3/11 17:27:00	17.16	
6/3/11 17:27:15	17.16	Target Concentration No. 2; Trial No. 2
6/3/11 17:27:30	17.16	High Level Trial 2 = 17.16
6/3/11 17:27:45	17.16	
6/3/11 17:28:00	17.16	
6/3/11 17:28:15	17.16	
6/3/11 17:28:30	17.16	
6/3/11 17:28:45	15.74	
6/3/11 17:29:00	11.52	
6/3/11 17:29:15	8.65	
6/3/11 17:29:30	7.72	
6/3/11 17:29:45	7.63	
6/3/11 17:30:00	7.62	
6/3/11 17:30:15	7.62	
6/3/11 17:30:30	7.62	Mid-Level Concentration; Trial No. 2
6/3/11 17:30:45	7.62	Mid Std. Trial 2 = 7.62
6/3/11 17:31:00	7.62	
6/3/11 17:31:15	7.62	
6/3/11 17:31:30	7.62	
6/3/11 17:31:45	7.05	
6/3/11 17:32:00	4.37	
6/3/11 17:32:15	4.72	
6/3/11 17:32:30	5.60	
6/3/11 17:32:45	5.76	
6/3/11 17:33:00	5.78	
6/3/11 17:33:15	5.79	Target Concentration No. 1; Trial No. 3
6/3/11 17:33:30	5.80	Mid Level Trial 3 = 5.81
6/3/11 17:33:45	5.80	
6/3/11 17:34:00	5.81	
6/3/11 17:34:15	5.81	
6/3/11 17:34:30	6.53	
6/3/11 17:34:45	11.43	
6/3/11 17:35:00	15.35	
6/3/11 17:35:15	16.90	
6/3/11 17:35:30	17.14	
6/3/11 17:35:45	17.15	
6/3/11 17:36:00	17.15	Target Concentration No. 2; Trial No. 3
6/3/11 17:36:15	17.16	High Level Trial 3 = 17.16
6/3/11 17:36:30	17.16	
6/3/11 17:36:45	17.16	
6/3/11 17:37:00	17.16	
6/3/11 17:37:15	17.08	
6/3/11 17:37:30	14.26	
6/3/11 17:37:45	10.27	
6/3/11 17:38:00	8.13	
6/3/11 17:38:15	7.66	
6/3/11 17:38:30	7.63	
6/3/11 17:38:45	7.62	
6/3/11 17:39:00	7.62	Mid-Level Concentration; Trial No. 3
6/3/11 17:39:15	7.62	Mid Std. Trial 3 = 7.62
6/3/11 17:39:30	7.62	
6/3/11 17:39:45	7.62	
6/3/11 17:40:00	7.62	
6/3/11 17:40:15	7.63	
6/3/11 17:40:30	10.81	
6/3/11 17:40:45	17.85	
6/3/11 17:41:00	20.49	
6/3/11 17:41:15		
6/3/11 17:41:30		

Instrument: 3371 **MFC:** 1

MAX Flow: 10,000.00 CCM
Cal Date: 02/15/2011 , 16:13:32
Reference Gas: NITROGEN
Description: Factory MFC #1 Calibration Table

Set Flow	True Flow	- Table is selected
500.00	496.86	
1,000.00	1,019.10	
2,000.00	2,047.90	
3,000.00	3,061.90	
4,000.00	4,070.40	
5,000.00	5,070.40	
6,000.00	6,073.20	
7,000.00	7,072.40	
8,000.00	8,082.40	
9,000.00	9,099.80	
10,000.00	10,139.00	

Instrument: 3371 **MFC:** 2

MAX Flow: 10,000.00 CCM
Cal Date: 02/15/2011 , 16:13:40
Reference Gas: NITROGEN
Description: Factory MFC #2 Calibration Table

Set Flow	True Flow	- Table is selected
500.00	464.75	
1,000.00	1,019.50	
2,000.00	2,055.00	
3,000.00	3,075.00	
4,000.00	4,088.80	
5,000.00	5,093.60	
6,000.00	6,099.00	
7,000.00	7,094.10	
8,000.00	8,090.70	
9,000.00	9,084.50	
10,000.00	10,070.00	

Instrument: 3371 **MFC:** 3

MAX Flow: 1,000.00 CCM
Cal Date: 02/15/2011 , 16:13:51
Reference Gas: NITROGEN
Description: Factory MFC #3 Calibration Table

Set Flow	True Flow	- Table is selected
50.00	48.42	
100.00	99.98	

200.00	203.07
300.00	305.63
400.00	408.86
500.00	512.23
600.00	614.79
700.00	718.86
800.00	824.09
900.00	931.08
1,000.00	1,038.80

Instrument: 3371 MFC: 4

MAX Flow: 100.00 CCM
 Cal Date: 02/15/2011 , 16:13:59
 Reference Gas: NITROGEN
 Description: Factory MFC #4 Calibration Table

Set Flow True Flow - Table is selected

5.00	5.55
10.00	11.08
20.00	22.03
30.00	32.76
40.00	43.34
50.00	53.68
60.00	63.90
70.00	74.08
80.00	85.06
90.00	96.60
100.00	108.46

**ARI REFERENCE METHOD CEMS DATA
USEPA METHOD 205
DILUTION SYSTEM VERIFICATION**

Company: Valero
Location: Port Arthur, Texas
Source: FCCU WGS
Dilution System ID: 2431
Dilution Flow Rate: 5.0 Lpm
Verification date: 6/10/2011

Analyzer Info
Monitor type: O₂
Monitor Span: 15.00
Monitor Serial No.: X1440D1/46

Initial Calibration Data

<u>Calibration Concentration</u>	<u>Calibration results</u>	<u>% Difference</u>
Zero: 0.00	Zero: 0.03	Zero: 0.20
Low:	Low:	Low:
Mid: 7.50	Mid: 7.62	Mid: 0.83
High: 15.00	High: 15.04	High: 0.25

Dilution System Verification

Mid level gas type: <u>EPA Protocol 1</u>	High level dilution gas type: <u>O₂/N₂</u>
Mid level concentration: <u>7.609</u>	High level concentration: <u>22.7</u>
Mid level tank serial #: <u>AAL5614</u>	High level tank serial #: <u>CC102306</u>
	Target concentration No. 1: <u>7.50</u>
	Target concentration No. 2: <u>15.00</u>

Dilution System Results

<u>Target Concentration No. 1</u>		<u>Target Concentration No. 2</u>	
<u>Instrument Response</u>	<u>% difference from average*</u>	<u>Instrument Response</u>	<u>% difference from average*</u>
Trial No. 1: 7.61	0.22	Trial No. 1: 14.98	0.00
Trial No. 2: 7.57	0.29	Trial No. 2: 14.98	0.02
Trial No. 3: 7.60	0.07	Trial No. 3: 14.98	0.02
Average: 7.593		Average: 14.982	

% Difference from target concentration: 1.24% % Difference from target concentration: 0.12%

Mid Level Calibration Gas Results

<u>Instrument Response</u>	
Trial No. 1: 7.50	Mid Level calibration gas concentration: <u>7.609%</u>
Trial No. 2: 7.51	Average analyzer response: <u>7.506</u>
Trial No. 3: 7.50	Percent difference: <u>1.35</u> *

* Must be less than 2 %

USEPA Method 205 Dilution System Verification
15-second data

Date/Time	O ₂ % db by vol.	Comments
6/10/11 7:34:00	0.88	
6/10/11 7:34:15	0.09	
6/10/11 7:34:30	-0.02	
6/10/11 7:34:45	-0.04	
6/10/11 7:35:00	-0.05	
6/10/11 7:35:15	-0.05	
6/10/11 7:35:30	-0.05	
6/10/11 7:35:45	-0.05	
6/10/11 7:36:00	-0.06	Calibration Error
6/10/11 7:36:15	-0.01	O ₂ CE Zero = 0.03
6/10/11 7:36:30	0.04	
6/10/11 7:36:45	0.04	
6/10/11 7:37:00	0.04	
6/10/11 7:37:15	0.04	
6/10/11 7:37:30	0.04	
6/10/11 7:37:45	0.04	
6/10/11 7:38:00	0.04	
6/10/11 7:38:15	0.04	
6/10/11 7:38:30	0.03	
6/10/11 7:38:45	0.03	
6/10/11 7:39:00	0.03	
6/10/11 7:39:15	0.03	
6/10/11 7:39:30	0.06	
6/10/11 7:39:45	2.98	
6/10/11 7:40:00	8.04	
6/10/11 7:40:15	11.80	
6/10/11 7:40:30	14.06	
6/10/11 7:40:45	15.03	
6/10/11 7:41:00	15.25	
6/10/11 7:41:15	15.27	
6/10/11 7:41:30	15.28	
6/10/11 7:41:45	15.28	
6/10/11 7:42:00	15.16	
6/10/11 7:42:15	15.12	
6/10/11 7:42:30	15.12	
6/10/11 7:42:45	15.08	
6/10/11 7:43:00	15.05	
6/10/11 7:43:15	15.05	
6/10/11 7:43:30	15.05	
6/10/11 7:43:45	15.05	
6/10/11 7:44:00	15.06	
6/10/11 7:44:15	15.06	
6/10/11 7:44:30	14.60	
6/10/11 7:44:45	11.70	
6/10/11 7:45:00	8.95	
6/10/11 7:45:15	7.83	
6/10/11 7:45:30	7.67	
6/10/11 7:45:45	7.65	
6/10/11 7:46:00	7.65	
6/10/11 7:46:15	7.63	
6/10/11 7:46:30	7.63	
6/10/11 7:46:45	7.91	
6/10/11 7:47:00	10.31	
6/10/11 7:47:15	12.96	
6/10/11 7:47:30	14.49	Calibration Error
6/10/11 7:47:45	14.99	O ₂ CE Span = 15.04
6/10/11 7:48:00	15.07	
6/10/11 7:48:15	15.06	
6/10/11 7:48:30	15.03	
6/10/11 7:48:45	15.02	
6/10/11 7:49:00	15.02	
6/10/11 7:49:15	14.53	
6/10/11 7:49:30	11.59	
6/10/11 7:49:45	8.86	
6/10/11 7:50:00	7.80	
6/10/11 7:50:15	7.65	
6/10/11 7:50:30	7.64	Calibration Error
6/10/11 7:50:45	7.63	O ₂ CE Mid = 7.62
6/10/11 7:51:00	7.62	
6/10/11 7:51:15	7.62	
6/10/11 7:51:30	7.62	
6/10/11 7:51:45	7.36	
6/10/11 7:52:00	5.01	
6/10/11 7:52:15	2.55	
6/10/11 7:52:30	1.68	
6/10/11 7:52:45	1.57	
6/10/11 7:53:00	1.56	
6/10/11 7:53:15	1.66	
6/10/11 7:53:30	4.88	
6/10/11 7:53:45	9.48	
6/10/11 7:54:00	12.67	
6/10/11 7:54:15	14.37	
6/10/11 7:54:30	14.90	Target Concentration No. 2; Trial No. 1
6/10/11 7:54:45	14.98	High Level Trial 1 = 14.98
6/10/11 7:55:00	14.98	

USEPA Method 205 Dilution System Verification
15-second data

Date/Time	O ₂ % db by vol.	Comments
6/10/11 7:55:15	14.98	
6/10/11 7:55:30	14.98	
6/10/11 7:55:45	14.20	
6/10/11 7:56:00	11.00	
6/10/11 7:56:15	8.51	
6/10/11 7:56:30	7.71	Target Concentration No. 1; Trial No. 1
6/10/11 7:56:45	7.62	Mid Level Trial 1 = 7.61
6/10/11 7:57:00	7.61	
6/10/11 7:57:15	7.61	
6/10/11 7:57:30	7.61	
6/10/11 7:57:45	7.61	
6/10/11 7:58:00	7.61	
6/10/11 7:58:15	7.61	
6/10/11 7:58:30	8.00	
6/10/11 7:58:45	8.88	
6/10/11 7:59:00	8.14	
6/10/11 7:59:15	7.59	Mid-Level Concentration; Trial No. 1
6/10/11 7:59:30	7.51	Mid Std. Trial 1 = 7.50
6/10/11 7:59:45	7.50	
6/10/11 8:00:00	7.50	
6/10/11 8:00:15	7.50	
6/10/11 8:00:30	7.50	
6/10/11 8:00:45	7.50	
6/10/11 8:01:00	7.10	
6/10/11 8:01:15	3.91	
6/10/11 8:01:30	0.82	
6/10/11 8:01:45	0.30	
6/10/11 8:02:00	2.58	
6/10/11 8:02:15	5.40	
6/10/11 8:02:30	7.02	Target Concentration No. 1; Trial No. 2
6/10/11 8:02:45	7.51	Mid Level Trial 2 = 7.57
6/10/11 8:03:00	7.58	
6/10/11 8:03:15	7.59	
6/10/11 8:03:30	7.60	
6/10/11 8:03:45	10.49	
6/10/11 8:04:00	13.14	
6/10/11 8:04:15	14.55	
6/10/11 8:04:30	14.93	Target Concentration No. 2; Trial No. 2
6/10/11 8:04:45	14.98	High Level Trial 2 = 14.98
6/10/11 8:05:00	14.98	
6/10/11 8:05:15	14.98	
6/10/11 8:05:30	14.98	
6/10/11 8:05:45	14.98	
6/10/11 8:06:00	14.98	
6/10/11 8:06:15	14.91	
6/10/11 8:06:30	12.96	
6/10/11 8:06:45	10.05	
6/10/11 8:07:00	8.23	
6/10/11 8:07:15	7.60	Mid-Level Concentration; Trial No. 2
6/10/11 8:07:30	7.52	Mid Std. Trial 2 = 7.51
6/10/11 8:07:45	7.51	
6/10/11 8:08:00	7.51	
6/10/11 8:08:15	7.51	
6/10/11 8:08:30	7.51	
6/10/11 8:08:45	8.48	
6/10/11 8:09:00	11.16	
6/10/11 8:09:15	13.30	
6/10/11 8:09:30	14.51	
6/10/11 8:09:45	14.92	Target Concentration No. 2; Trial No. 3
6/10/11 8:10:00	14.99	High Level Trial 3 = 14.98
6/10/11 8:10:15	14.99	
6/10/11 8:10:30	14.98	
6/10/11 8:10:45	14.98	
6/10/11 8:11:00	14.47	
6/10/11 8:11:15	11.38	
6/10/11 8:11:30	8.66	
6/10/11 8:11:45	7.72	Target Concentration No. 1; Trial No. 3
6/10/11 8:12:00	7.61	Mid Level Trial 3 = 7.60
6/10/11 8:12:15	7.60	
6/10/11 8:12:30	7.59	
6/10/11 8:12:45	7.60	
6/10/11 8:13:00	7.60	
6/10/11 8:13:15	7.60	
6/10/11 8:13:30	7.57	Mid-Level Concentration; Trial No. 3
6/10/11 8:13:45	7.51	Mid Std. Trial 3 = 7.50
6/10/11 8:14:00	7.50	
6/10/11 8:14:15	7.50	
6/10/11 8:14:30	7.50	
6/10/11 8:14:45	7.50	
6/10/11 8:15:00	7.50	

Instrument: 2431 MFC: 1

MAX Flow: 5,000.00 CCM
 Cal Date: 01/13/2011 , 11:35:41
 Reference Gas: NITROGEN
 Description: Factory MFC #1 Calibration Table

Set Flow	True Flow	- Table is selected
250.00	247.10	
500.00	505.81	
1,000.00	1,019.40	
1,500.00	1,531.60	
2,000.00	2,042.80	
2,500.00	2,551.50	
3,000.00	3,059.80	
3,500.00	3,568.40	
4,000.00	4,075.20	
4,500.00	4,583.80	
5,000.00	5,082.50	

Instrument: 2431 MFC: 2

MAX Flow: 5,000.00 CCM
 Cal Date: 01/13/2011 , 11:35:01
 Reference Gas: NITROGEN
 Description: Factory MFC #2 Calibration Table

Set Flow	True Flow	- Table is selected
250.00	252.06	
500.00	510.40	
1,000.00	1,024.90	
1,500.00	1,536.80	
2,000.00	2,050.20	
2,500.00	2,561.30	
3,000.00	3,075.20	
3,500.00	3,581.20	
4,000.00	4,092.00	
4,500.00	4,598.20	
5,000.00	5,084.30	

Instrument: 2431 MFC: 3

MAX Flow: 500.00 CCM
 Cal Date: 01/13/2011 , 11:34:20
 Reference Gas: NITROGEN
 Description: Factory MFC #3 Calibration Table

Set Flow	True Flow	- Table is selected
25.00	31.21	
50.00	57.48	

100.00	109.80
150.00	161.72
200.00	213.63
250.00	265.29
300.00	316.81
350.00	368.44
400.00	420.04
450.00	471.69
500.00	523.83

Instrument: 2431

MFC: 4

MAX Flow: 50.00 CCM

Cal Date: 01/13/2011 , 11:33:46

Reference Gas: NITROGEN

Description: Factory MFC #4 Calibration Table

Set Flow	True Flow	- Table is selected
2.50	2.91	
5.00	5.98	
10.00	12.11	
15.00	18.03	
20.00	24.30	
25.00	30.40	
30.00	36.51	
35.00	42.65	
40.00	48.81	
45.00	55.01	
50.00	61.28	

Interference Response

Analyzer Type: Oxygen (O₂)
 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 (CO₂)
 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	%	Zero without Interferent	Zero with Interferent	%	
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: 

**AMETEK****PROCESS & ANALYTICAL INSTRUMENTS
Western Research**

2876 Sunridge Way N.E., Calgary, AB T1Y 7H9 Canada
Telephone: 403-235-8480, Fax: 403-248-3550
E-mail: georges.deon@ametek.com

August 3, 2006

Craig James
ARI Environmental

RE: Interference Check, EPA 40CFR60, Method 6C for the Model 721 or 921 Series
SO2 UV Analyzer.

Dear Craig:

In reference to Table 7E-3 – Interference Check Gas Concentrations. The Model 721 or 921 UV absorption Analyzer measures SO2 at 285nm wavelength with a reference wavelength of 585nm. The following table shows if any species presented interferes with the SO2 measurement.

Potential Interferent	Test % or PPM	Resultant Interference
CO2	5 and 15%	Does not absorb in the UV
H2O	1.0%	Does not absorb in the UV
NO	15ppmv	Does not absorb at 285nm or 585nm
NO2	15ppmv	-0.15ppm interference
N2O	10ppmv	Does not absorb at 285nm or 585nm
CO	50ppmv	Does not absorb in the UV
NH3	10ppmv	Does not absorb at 285nm or 585nm
CH4	50ppmv	Does not absorb in the UV
SO2	20ppmv	Not Applicable – Measured Species
H2	50ppmv	Does not absorb in the UV
HCL	10ppmv	Does not absorb in the UV

Sincerely,

Georges D'Eon
Product Applications Specialist


Interference Response

Analyzer Type: Sulfur Dioxide (SO₂)
 Manufacturer: Bivar Engineered Products (Western Research)
 Detector Type: Pulsed Fluorescence
 Model No.: 721-ATM
 Serial No.: 92-721ATM-7947-1-1
 Calibration Span (%): 100

Test Gas	Test Gas Conc.	High Standard			Zero			Maximum % Interference
		SO ₂ without interferent	SO ₂ with interferent	% Interference	Zero without interferent	Zero with interferent	% Interference	
NH ₃	10 ppm	100.1	100.1	0.0	0.1	0.1	0.0	0.0
CH ₄	50 ppm	102.6	103.1	0.5	0.1	0.3	0.2	0.5
CO	50 ppm	100.5	100.5	0.0	0.3	0.3	0.0	0.0
CO ₂	5%	100.9	101.1	0.2	0.1	0.1	0.0	0.2
CO ₂	12.55%	100.9	101.2	0.3	0.1	0.2	0.1	0.3
NO ₂	15 ppm	101.6	102.2	0.6	0.3	0.5	0.2	0.6
NO _x	15 ppm	101.4	101.4	0.0	0.3	0.3	0.0	0.0
H ₂	1020 ppm	100.6	100.6	0.0	0.4	0.4	0.0	0.0
HCl	10 ppm	100.8	100.6	-0.2	0.1	0.3	0.2	0.2

Sum of the highest absolute value obtained with and without the pollutant present: 1.80 %
 Allowable interference response: 2.5 %

Certification Date: 8/9/2006

Operator: 



Model 600 HCLD NO Interference Data

Interference Response

Date of Test 7/26/2006

Analyzer Type NO

Model No. 600-HCLD

Serial No. S050301

Calibration Span 3000ppm

Test Gas Type		Concentration		Analyzer Response	
		(ppm)		Wet	Dry
H2O		2.5%		0	0
CO2		5%		0	0
CO2		15%		0	0
CO		50		0	0
CH4		50		0	0
SO2		N/A		N/A	N/A
NH3		15		0	0
NO		N/A		N/A	N/A
N2O		9		0	0
NO2		N/A		N/A	N/A


Interference Response

Analyzer Type: Carbon Monoxide (CO)
 Manufacturer: Thermo Electron Corporation
 Detector Type: Non-Dispersive Infrared (NDIR)
 Model No.: 48C
 Serial No.: 506610701
 Calibration Span (ppm): 100

Test Gas	Test Gas Conc.	High Standard		Zero		Maximum % Interference
		CO without interferent	CO with interferent	Zero without Interferent	Zero with interferent	
NH ₃	10 ppm	100.0	100.0	0.0	0.0	0.0
SO ₂	20 ppm	100.0	100.0	0.0	0.3	0.3
CH ₄	50 ppm	100.0	100.0	0.0	0.1	0.1
CO ₂	5%	100.0	99.8	0.0	0.2	0.2
CO ₂	12.55%	100.0	99.6	0.0	-0.1	0.4
NO ₂	15 ppm	100.0	100.0	0.0	0.2	0.2
NO _x	15 ppm	100.0	100.0	0.0	0.2	0.2
H ₂	1020 ppm	100.0	100.0	0.0	0.1	0.1
HCl	10 ppm	100.0	100.0	0.0	0.1	0.1

Sum of the highest absolute value obtained with and without the pollutant present: 1.6 %
 Allowable interference response: 2.5 %

Certification Date: 8/10/2006

Operator: 

ARI Environmental, Inc.
EPA METHOD 5
Initial Meter Box Calibration

Model No: Apex 522
 Serial No. 504019

Operator: ZRM
 Date: 11/12/2010

Pre-Test, Orifice Method
 English Units

Barometric Pressure: 30.16 in.Hg

ΔH	Time		DRY GAS METER VOLUME			METER TEMPERATURE		ORIFICE		VAC.	AMBIENT TEMPERATURE		
						INLET	OUTLET						
	in. H2O	Minutes	Seconds	Initial	Final	Total ¹	Initial	Final	Number		K factor	in. Hg ²	Initial
0.57	10	51	437.100	441.572	4.472	71	71	AJ47	0.3164	18.5	73	73	73.0
1.05	10	5	441.700	447.350	5.650	72	72	AJ55	0.4303	16.5	73	73	73.0
1.75	10	5	447.500	454.698	7.198	72	72	AJ63	0.5482	14.5	73	73	73.0
3.20	11	52	455.100	466.780	11.680	74	74	AJ73	0.7621	11.5	74	74	74.0
4.70	10	5	467.100	479.123	12.023	76	76	AJ81	0.9339	10.0	74	74	74.0

METER FLOW (cubic feet)	ORIFICE FLOW (cubic feet)	METER CALIBRATION FACTOR, Yc ³	DH @ ⁴
4.484	4.485	1.0001	1.886
5.667	5.668	1.0002	1.881
7.218	7.221	1.0004	1.934
11.710	11.803	1.0079	1.840
12.064	12.290	1.0188	1.807

AVG. PRETEST METER CALIBRATION FACTOR: Y⁵ =	1.005	$\Delta H @^6 =$	1.87
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- ¹ Must pull at least 5 cubic feet per orifice
- ² Vacuum must be 15" of Hg or greater
- ³ Individual Ys can not vary from +/-0.02Y of the average
- ⁴ Delta H@ can not be more than +/- 0.15 of average delta H
- ⁵ Ideal Y is 1.000 and can vary no more than +/- 0.05
- ⁶ Ideal Delta H@ is 1.84 and should not vary more than 0.2!

ARI Environmental, Inc.
EPA METHOD 5
Post-test Meter Box Calibration

Model #: Apex 522
 Serial #: 504019
 Pretest Y: 1.005
 Pretest ΔH : 1.87

Operator: RC

Date: 6/22/2011

Post-Test, Orifice Method
 English Units

Barometric Pressure: 30.12 in.Hg

ΔH	Time		DRY GAS METER VOLUME			METER TEMPERATURE			ORIFICE		VAC.	AMBIENT TEMPERATURE			
						INLET		OUTLET							
	Minutes	Seconds	Initial	Final	Total ¹	Initial	Final	Initial	Final	Number	K factor	in. Hg ²	Initial	Final	Avg.
	1.70	15	50	680.600	692.099	11.499	80	81		AJ63	0.5482	12.0	79	79	79.0
1.70	17	18	692.300	704.915	12.615	81	82		AJ63	0.5482	12.0	79	79	79.0	
1.75	10	0	705.300	712.618	7.318	82	83		AJ63	0.5482	13.0	79	79	79.0	

METER FLOW (cubic feet)	ORIFICE FLOW (cubic feet)	METER CALIBRATION FACTOR, Yc ³	DH @ ⁴
11.355	11.261	0.9917	1.876
12.434	12.304	0.9895	1.873
7.201	7.112	0.9877	1.925
AVG. POST-TEST METER CALIBRATION FACTOR =			0.990
PERCENT DIFFERENCE FROM PRETEST Y=			1.53
MAXIMUM ALLOWABLE DIFFERENCE=			5.00

¹ Must pull at least 5 cubic feet per orifice

² Vacuum must be 15" of Hg or greater

³ Individual Ys can not vary from +/-0.02Y of the average

⁴ Delta H@ can not be more than +/- 0.15 of average delta H

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: ZRM
 Date: 11/12/2010

Meterbox No.: 504019
 Calibrator No.: CL-300-21001

Calibrator Setting ° F	Digital Temperature Readout											
	PROBE			STACK			FILTER			EXIT		
	Acutal	Diff.		Acutal	Diff.		Acutal	Diff.		Acutal	Diff.	
0	-2	0.43	0	0	0.00	0	0	0.00	-1	0.22	-1	0.22
200	198	0.30	200	200	0.00	200	200	0.00	200	0.00	201	0.15
400	397	0.35	397	397	0.35	397	397	0.35	397	0.35	397	0.35
600	600	0.00	600	600	0.00	600	600	0.00	600	0.00	600	0.00
800	801	0.08	802	802	0.16	802	802	0.16	802	0.16	803	0.24
1000	1001	0.07	1001	1001	0.07	1001	1001	0.07	1001	0.07	1002	0.14
1200	1198	0.12	1198	1198	0.12	1198	1198	0.12	1198	0.12	1199	0.06
1400	1399	0.05	1400	1400	0.00	1400	1401	0.00	1401	0.05	1401	0.05
1600	1599	0.05	1599	1599	0.05	1598	1600	0.10	1600	0.00	1599	0.05
1800	1800	0.00	1801	1801	0.04	1801	1801	0.04	1801	0.04	1801	0.04

Actual Maximum Difference = 0.43 %
 Allowable Maximum Difference = 1.50 %

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: RC
 Date: 6/22/2011

Meterbox No.: 504019
 Calibrator No.: CL-300-21001

Calibrator Setting ° F	Digital Temperature Readout											
	PROBE		STACK		FILTER		EXIT		AUX			
	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.
0	0	0.00	1	0.22	0	0.00	0	0.00	0	0.00	0	0.00
200	199	0.15	198	0.30	198	0.30	198	0.30	198	0.30	198	0.30
400	397	0.35	397	0.35	397	0.35	397	0.35	397	0.35	397	0.35
600	598	0.19	597	0.28	597	0.28	597	0.28	598	0.19	598	0.19
800	799	0.08	797	0.24	798	0.16	799	0.08	799	0.08	799	0.08
1000	999	0.07	999	0.07	999	0.07	999	0.07	999	0.07	999	0.07
1200	1197	0.18	1198	0.12	1198	0.12	1198	0.12	1199	0.06	1199	0.06
1400	1398	0.11	1397	0.16	1398	0.11	1398	0.11	1399	0.05	1399	0.05
1600	1597	0.15	1599	0.05	1597	0.15	1597	0.15	1598	0.10	1598	0.10
1800	1798	0.09	1799	0.04	1798	0.09	1798	0.09	1799	0.04	1799	0.04

Actual Maximum Difference = 0.35 %
 Allowable Maximum Difference = 1.50 %

ARI Environmental, Inc.
EPA METHOD 5
Initial Meter Box Calibration

Model No: Apex 522
 Serial No. 604180

Operator: ZRM
 Date: 11/19/2010

Pre-Test, Orifice Method
 English Units

Barometric Pressure: 30.36 in.Hg

ΔH	Time		DRY GAS METER VOLUME			METER TEMPERATURE			ORIFICE		VAC.	AMBIENT TEMPERATURE		
						INLET		OUTLET						
	Minutes	Seconds	Initial	Final	Total ¹	Initial	Final	Initial	Number	K factor	in. Hg ²	Initial	Final	Avg.
0.54	10	10	323.300	327.500	4.200	64	66	63	AJ47	0.3164	23.5	66	66	66.0
0.99	10	10	327.500	333.300	5.800	67	71	66	AJ55	0.4303	22.0	66	66	66.0
1.70	10	42	333.400	341.257	7.857	71	71	66	AJ63	0.5482	20.5	66	66	66.0
3.20	13	40	341.800	355.231	13.431	59	70	55	AJ73	0.7621	18.5	59	59	59.0
4.70	13	26	356.200	372.512	16.312	70	81	57	AJ81	0.9339	17.0	59	59	59.0

METER FLOW (cubic feet)	ORIFICE FLOW (cubic feet)	METER CALIBRATION	
4.298	4.258	FACTOR, Yc ³	DH @ ⁴
5.908	5.791	0.9908	1.776
7.998	7.765	0.9802	1.754
13.939	13.880	0.9709	1.857
16.764	16.719	0.9958	1.826
		0.9973	1.775

AVG. PRETEST METER CALIBRATION FACTOR: Y⁵ =	0.987	$\Delta H @^6 =$	1.80
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- ¹ Must pull at least 5 cubic feet per orifice
- ² Vacuum must be 15" of Hg or greater
- ³ Individual Ys can not vary from +/-0.02Y of the average
- ⁴ Delta H@ can not be more than +/- 0.15 of average delta H
- ⁵ Ideal Y is 1.000 and can vary no more than +/- 0.05
- ⁶ Ideal Delta H@ is 1.84 and should not vary more than 0.2!

ARI Environmental, Inc.
EPA METHOD 5
Post-test Meter Box Calibration

Model #: Apex 522
 Serial #: 604180
 Pretest Y: 0.987
 Pretest ΔH @: 1.80

Operator: RC
 Date: 6/22/2011

Post-Test, Orifice Method
 English Units

Barometric Pressure: 30.12 in.Hg

ΔH	Time		DRY GAS METER VOLUME		METER TEMPERATURE			ORIFICE		VAC.	AMBIENT TEMPERATURE		
	Minutes	Seconds	Initial	Final	Total ¹	INLET	OUTLET	Number	K factor	in. Hg ²	Initial	Final	Avg.
1.65	11	10	66.500	74.824	8.324	90	76	AJ63	0.5482	14.0	79	79	79.0
1.65	11	13	75.250	83.627	8.377	90	78	AJ63	0.5482	14.0	79	79	79.0
1.65	12	32	83.900	93.264	9.364	93	80	AJ63	0.5482	14.0	79	79	79.0

METER FLOW (cubic feet)	ORIFICE FLOW (cubic feet)	METER CALIBRATION FACTOR, Yc ³	DH @ ⁴
8.173	7.942	0.9717	1.810
8.199	7.977	0.9730	1.805
9.136	8.914	0.9757	1.799
. POST-TEST METER CALIBRATION FACTOR =			1.80

PERCENT DIFFERENCE FROM PRETEST Y= 1.37
MAXIMUM ALLOWABLE DIFFERENCE= 5.00

- ¹ Must pull at least 5 cubic feet per orifice
² Vacuum must be 15" of Hg or greater

- ³ Individual Ys can not vary from +/-0.02Y of the average
⁴ Delta H@ can not be more than +/- 0.15 of average dealta H

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: ZRM
 Date: 11/19/2010

Meterbox No.: 604180
 Calibrator No.: CL-300-21001

Calibrator Setting ° F	Digital Temperature Readout											
	PROBE			STACK			FILTER			EXIT		
	Acutal	Diff.		Acutal	Diff.		Acutal	Diff.		Acutal	Diff.	
0	-1	0.22	-1	-1	0.22	-2	-2	0.43	-2	-2	0.43	-1
200	199	0.15	199	199	0.15	199	199	0.15	199	199	0.15	199
400	395	0.58	396	396	0.47	395	395	0.58	395	395	0.58	396
600	599	0.09	599	599	0.09	598	598	0.19	598	598	0.19	599
800	800	0.00	800	800	0.00	799	799	0.08	800	800	0.00	800
1000	999	0.07	999	999	0.07	999	999	0.07	999	999	0.07	1000
1200	1197	0.18	1197	1197	0.18	1197	1197	0.18	1197	1197	0.18	1197
1400	1396	0.22	1396	1396	0.22	1395	1395	0.27	1395	1395	0.27	1396
1600	1599	0.05	1599	1599	0.05	1599	1599	0.05	1599	1599	0.05	1600
1800	1797	0.13	1798	1798	0.09	1797	1797	0.13	1798	1798	0.09	1798

Actual Maximum Difference = 0.58 %
 Allowable Maximum Difference = 1.50 %

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: RC
 Date: 6/22/2011

Meterbox No.: 604180
 Calibrator No.: CL-300-21001

Calibrator Setting	Digital Temperature Readout											
	PROBE		STACK		FILTER		EXIT		AUX			
° F	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.	Acutal	Diff.
0	-2	0.43	-2	0.43	-3	0.65	-3	0.65	-3	0.65	-3	0.65
200	196	0.61	196	0.61	195	0.76	195	0.76	195	0.76	195	0.76
400	395	0.58	395	0.58	394	0.70	393	0.81	393	0.81	393	0.81
600	596	0.38	594	0.57	594	0.57	594	0.57	594	0.57	593	0.66
800	794	0.48	795	0.40	795	0.40	795	0.40	795	0.40	794	0.48
1000	994	0.41	996	0.27	995	0.34	995	0.34	995	0.34	993	0.48
1200	1194	0.36	1196	0.24	1195	0.30	1194	0.36	1194	0.36	1193	0.42
1400	1390	0.54	1393	0.38	1392	0.43	1391	0.48	1391	0.48	1390	0.54
1600	1592	0.39	1595	0.24	1594	0.29	1594	0.29	1594	0.29	1594	0.29
1800	1793	0.31	1794	0.27	1793	0.31	1793	0.31	1793	0.31	1793	0.31

Actual Maximum Difference = 0.81 %
 Allowable Maximum Difference = 1.50 %

ARI Environmental, Inc.
EPA METHOD 5
Initial Meter Box Calibration

Model No: 522 Operator: ZRM Pre-Test, Orifice Method
 Serial No. 903012 Date: 11/19/2010 English Units
 Barometric Pressure: 30.36 in.Hg

ΔH	Time		DRY GAS METER VOLUME			METER TEMPERATURE		ORIFICE		VAC.	AMBIENT TEMPERATURE		
in. H ₂ O	Minutes	Seconds	Initial	Final	Total ¹	INLET	OUTLET	Number	K factor	in. Hg ²	Initial	Final	Avg.
0.56	10	41	462.800	467.123	4.323	58	58	AJ47	0.3164	20.0	62	62	62.0
1.00	10	5	467.200	472.811	5.611	59	59						
1.70	11	27	473.100	481.222	8.122	61	61	AJ55	0.4303	18.5	62	62	62.0
3.20	10	21	481.400	491.643	10.243	64	64	AJ63	0.5482	17.5	62	62	62.0
4.80	13	29	494.600	510.998	16.398	69	69				63	63	63.0
						70	70	AJ73	0.7621	15.5	63	63	63.0
						71	71				63	63	63.0
						76	76	AJ81	0.9339	12.5	63	63	63.0

METER FLOW (cubic feet)	ORIFICE FLOW (cubic feet)	METER CALIBRATION FACTOR, Y _c ³	DH @ ⁴
4.473	4.492	1.0042	1.848
5.795	5.766	0.9949	1.783
8.362	8.341	0.9974	1.864
10.444	10.471	1.0026	1.808
16.659	16.717	1.0035	1.807

AVG. PRETEST METER CALIBRATION FACTOR: Y⁵ = 1.001 ΔH@⁶ = 1.82

- ¹ Must pull at least 5 cubic feet per orifice
² Vacuum must be 15" of Hg or greater
³ Individual Y_s can not vary from +/-0.02Y of the average
⁴ Delta H@ can not be more than +/- 0.15 of average delta H
⁵ Ideal Y is 1.000 and can vary no more than +/- 0.05
⁶ Ideal Delta H@ is 1.84 and should not vary more than 0.2%

ARI Environmental, Inc.
EPA METHOD 5
Post-test Meter Box Calibration

Model #: Apex 522 Operator: ZRM Post-Test, Orifice Method
 Serial #: 903012 Date: 6/22/2011 English Units
 Pretest Y: 1.000
 Pretest ΔH @: 1.94 Barometric Pressure: 30.12 in.Hg

ΔH	Time		DRY GAS METER VOLUME			METER TEMPERATURE			ORIFICE		VAC.	AMBIENT TEMPERATURE		
						INLET		OUTLET						
	Minutes	Seconds	Initial	Final	Total ¹	Initial	Final	Initial	Number	K factor	in. Hg ²	Initial	Final	Avg.
1.75	12	14	672.200	681.121	8.921	78	79	78	AJ63	0.5482	20.0	79	79	79.0
1.75	10	0	681.300	688.565	7.265	79	80	79	AJ63	0.5482	20.0	79	79	79.0
1.75	21	16	688.900	704.417	15.517	80	81	80	AJ63	0.5482	20.0	79	79	79.0

METER FLOW (cubic feet)	ORIFICE FLOW (cubic feet)	METER CALIBRATION	
8.843	8.701	FACTOR, Yc ³	DH @ ⁴
7.188	7.112	0.9839	1.939
15.325	15.125	0.9894	1.935
		0.9870	1.932
AVG. POST-TEST METER CALIBRATION FACTOR =		0.987	1.94

ABSOLUTE DIFFERENCE FROM PRETEST Y= 1.32
MAXIMUM ALLOWABLE DIFFERENCE= 5.00

- ¹ Must pull at least 5 cubic feet per orifice ³ Individual Ys can not vary from +/-0.02Y of the average
² Vacuum must be 15" of Hg or greater ⁴ Delta H@ can not be more than +/- 0.15 of average delta H

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: ZRM
 Date: 11/19/2010

Meterbox No.: 903012
 Calibrator No.: CL-300-21001

Calibrator Setting ° F	Digital Temperature Readout											
	PROBE		STACK		FILTER		EXIT		AUX		OVEN	
	Actual	Diff.	Actual	Diff.	Actual	Diff.	Actual	Diff.	Actual	Diff.	Actual	Diff.
0	-1	0.22	-1	0.22	-1	0.22	-1	0.22	-1	0.22	-1	0.22
200	199	0.15	199	0.15	199	0.15	199	0.15	199	0.15	200	0.00
400	396	0.47	396	0.47	396	0.47	395	0.58	396	0.47	396	0.47
600	599	0.09	598	0.19	598	0.19	598	0.19	598	0.19	599	0.09
800	800	0.00	799	0.08	799	0.08	799	0.08	800	0.00	800	0.00
1000	1000	0.00	999	0.07	999	0.07	999	0.07	999	0.07	1000	0.00
1200	1199	0.06	1197	0.18	1197	0.18	1197	0.18	1197	0.18	1198	0.12
1400	1396	0.22	1395	0.27	1395	0.27	1396	0.22	1395	0.27	1399	0.05
1600	1599	0.05	1598	0.10	1598	0.10	1598	0.10	1598	0.10	1599	0.05
1800	1797	0.13	1796	0.18	1796	0.18	1796	0.18	1796	0.18	1798	0.09

Actual Maximum Difference = 0.58 %
 Allowable Maximum Difference = 1.50 %

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: ZRM
 Date: 6/22/2011

Meterbox No.: 903012
 Calibrator No.: CL-300-21001

Calibrator Setting ° F	Digital Temperature Readout											
	AUX			STACK			PROBE			OVEN		
	Actual	Diff.		Actual	Diff.		Actual	Diff.		Actual	Diff.	
0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0
200	201	0.15	201	201	0.15	201	201	0.15	201	201	0.15	201
400	397	0.35	397	397	0.35	398	398	0.23	398	397	0.35	398
600	601	0.09	601	601	0.09	601	601	0.09	601	601	0.09	601
800	802	0.16	802	802	0.16	803	802	0.24	802	802	0.16	802
1000	1002	0.14	1002	1002	0.14	1003	1003	0.21	1003	1002	0.14	1002
1200	1200	0.00	1200	1200	0.00	1201	1201	0.06	1201	1200	0.00	1200
1400	1399	0.05	1398	1398	0.11	1400	1399	0.00	1399	1398	0.11	1398
1600	1603	0.15	1602	1602	0.10	1603	1603	0.15	1603	1602	0.10	1602
1800	1800	0.00	1800	1800	0.00	1802	1801	0.09	1801	1800	0.00	1800

Actual Maximum Difference = 0.35 %
 Allowable Maximum Difference = 1.50 %

APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING WET-TEST METER #11AE6
5-POINT ENGLISH UNITS

Factors/Conversions	
Std Temp	528 °R
Std Press	29.92 in Hg
K ₁	17.647 °R/in Hg

Calibration Conditions	
Date	18-Apr-11 9:45
Barometric Pressure	29.7 in Hg
Calibration Technician	EW
Calibration Meter Gamma	0.9999

Meter Console Information	
Console Model Number	XC-522
Console Serial Number	1104027
DGM Model Number	T-110
DGM Serial Number	26158

Calibration Data									
Metering Console					Calibration Meter				
Run Time	DGM Orifice	Volume	Volume	Sample	Volume	Volume	Volume	Outlet Temp	Outlet Temp
Elapsed	ΔH	Initial	Final	Volume	Initial	Final	Initial	Initial	Final
(t)	(P _{in})	(V _{in})	(V _{out})	(V _s)	(V _{in})	(V _{out})	(V _s)	(t _{in})	(t _{out})
min	in H ₂ O	cubic feet	cubic feet	cubic feet	cubic feet	cubic feet	cubic feet	°F	°F
5.00	5.0	33.777	40.202	6.425	74	75	428.720	433.155	6.435
6.00	3.0	46.216	52.223	6.007	75	77	439.145	445.110	5.965
7.00	2.0	52.223	57.908	5.685	77	78	445.110	450.730	5.620
10.00	1.0	57.908	63.646	5.738	78	78	450.730	456.410	5.680
15.00	0.5	40.202	46.216	6.014	75	75	433.155	439.145	5.990
								70.5	70.5
								70.5	70.5
								70.5	70.5
								70.5	70.5

Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter			Calibration Factor		Flowrate		
(V _{std})	(Q _{std})	(V _{wet})	(Q _{wet})	(Q _{wet})	Value	Variation	Std & Corr	ΔH @	Variation
cubic feet	cfm	cubic feet	cfm	cfm	(Y)	(ΔY)	(Q _{std})	(ΔH@)	(ΔΔH@)
6.378	1.276	6.357	1.271	0.9967	-0.002	-0.002	1.271	1.750	-0.005
5.917	0.986	5.893	0.982	0.9958	-0.003	-0.003	0.982	1.738	-0.018
5.571	0.796	5.552	0.793	0.9966	-0.002	-0.002	0.793	1.763	0.007
5.604	0.560	5.611	0.561	1.0013	0.003	0.003	0.561	1.750	-0.005
5.899	0.393	5.917	0.394	1.0031	0.004	0.004	0.394	1.776	0.021
				0.9987	Y Average			1.755	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.
 Note: For ΔH_g, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is +0.2inches (5.1mm) H₂O.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6, which in turn was calibrated using the American Bell Prover # 157, certified 05/26/2006 using PI Tape S/N 20700139, which is traceable to the National Bureau of Standards (N.I.S.T.).
 Signature *Paul Latta* Date *4/18/11*

ARI Environmental, Inc.
EPA METHOD 5
Post-test Meter Box Calibration

Model #: Apex 522
 Serial #: 1104027
 Pretest Y: 0.999
 Pretest $\Delta H@$: 1.76

Operator: ZRM
 Date: 6/22/2011

Post-Test, Orifice Method
 English Units

Barometric Pressure: 30.12 in.Hg

ΔH	Time		DRY GAS METER VOLUME			METER TEMPERATURE			ORIFICE		VAC. in. Hg ²	AMBIENT TEMPERATURE		
						INLET		OUTLET						
	Minutes	Seconds	Initial	Final	Total ¹	Initial	Final	Initial	Number	K factor		Initial	Final	Avg.
1.65	11	54	297.300	305.851	8.551	81	82	81	AJ63	0.5482	21.0	81	81	81.0
1.65	15	38	306.000	317.263	11.263	82	82	82	AJ63	0.5482	21.0	81	81	81.0
1.65	12	22	317.500	326.421	8.921	83	84	83	AJ63	0.5482	20.0	81	81	81.0

METER FLOW (cubic feet)	ORIFICE FLOW (cubic feet)	METER CALIBRATION FACTOR, Yc ³	DH @ ⁴
8.427	8.448	1.0024	1.824
11.085	11.098	1.0012	1.821
8.760	8.779	1.0022	1.817
POST-TEST METER CALIBRATION FACTOR =			1.82

PERCENT DIFFERENCE FROM PRETEST Y= 0.33
MAXIMUM ALLOWABLE DIFFERENCE= 5.00

¹ Must pull at least 5 cubic feet per orifice

² Vacuum must be 15" of Hg or greater

³ Individual Ys can not vary from +/-0.02Y of the average

⁴ Delta H@ can not be more than +/- 0.15 of average dealta H

Temperature Sensor Calibration Data Sheet

Unit	XC-522	Serial #	1104027
Date	4/18/2011	ThermoCouple No	Model Altek Series 22 Type K
Personnel	EW	Reference	105795
Ambient temp		ASTM Mercury-In-Glass ID	
		NIST Reference TC ID	90728323

Date	Reference Point Number	Source (specify)	Reference Thermometer Temperature F	Thermocouple Display Temperature F	Absolute Temperature Difference %
	1		100	98	0.4
	2		200	200	0.0
	3		300	300	0.0
	4		500	497	0.3
	5		700	700	0.0
	6		900	900	0.0
	7		1100	1100	0.0
	8		1500	1499	0.1
	9		1900	1900	0.0
	10				
	11				
	12				
					0.080
					<1.5

NIST Reference TC ID		90728323
Ice Water	Meter TC	
32° F / 0°	Reading	
32.0	31.0	

Checked By EWT/4/18/11
(Personnel (Sign/Date))

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: ZRM
 Date: 6/22/2011

Meterbox No.: 1104027
 Calibrator No.: CL-300-21001

Calibrator Setting	Digital Temperature Readout											
	PROBE			STACK			FILTER			EXIT		
° F	Acutal	Diff.		Acutal	Diff.		Acutal	Diff.		Acutal	Diff.	
0	0	0.00		0	0.00		0	0.00		0	0.00	
200	200	0.00		200	0.00		200	0.00		200	0.00	
400	400	0.00		400	0.00		400	0.00		400	0.00	
600	599	0.09		598	0.19		598	0.19		598	0.19	
800	800	0.00		800	0.00		799	0.08		799	0.08	
1000	999	0.07		999	0.07		999	0.07		999	0.07	
1200	1200	0.00		1200	0.00		1200	0.00		1200	0.00	
1400	1399	0.05		1399	0.05		1399	0.05		1399	0.05	
1600	1599	0.05		1599	0.05		1598	0.10		1598	0.10	
1800	1798	0.09		1800	0.00		1800	0.00		1800	0.00	

Actual Maximum Difference = 0.19 %
 Allowable Maximum Difference = 1.50 %



APEX INSTRUMENTS METER CONSOLE CALIBRATION

Meter Console Information					
Console Model	MC-623	Console Serial Number	1105002	Encoder Model	HEDS-5701-A02
Gas Meter Model	AP25	Totalizer Scale Factor (Initial)	3.9000	Totalizer Model	Red Lion
Gas Meter Serial#	1900905	Totalizer Scale Factor (Final)	3.9203	Temp Display Model	Watlow SD31

Calibration Conditions					
WTM ID	539784	Calibration Technician	EW		Calibration Date
WTM Cal Factor	1.0024	Barometric Pressure	(Pb)	759	mm Hg
5-May-11					

Calibration Data												Results		
Run Time		Dry Gas Meter			Wet Test Meter		Standardized Volumes				Totalizer		Totalizer	
Elapsed (@)	min	Gas	Pressure	Gas	Totalizer	Gas	Volume	Temp	Initial SF	Totalizer	Wet Test	Gamma	Gamma	Corrected
		(P _m)	(t _m)	(t _w)	Display	(V _w)	liters	°C	(V _{std})	(V _{std})	Meter	Value	Variation	Flowrate
		mm H ₂ O	°C	liters		liters			std liters	std liters	(V _{wet})	(V)	(ΔV)	(Q _m)
									std liters	std liters	std liters			slm
Run 1 - Initial	0.00	100.0	21.0	0.000	901.971	21.0								
Final	5.00	100.0	21.0	18.408	920.752	21.0								
Total/Avg	5.00	100.0	21.0	18.408	18.781	21.0			18.512	18.608	18.751	1.0077	0.008	3.76
Run 2 - Initial	0.00	80.0	21.0	18.408	920.752	21.0								
Final	5.00	80.0	21.0	33.524	935.917	21.0								
Total/Avg	5.00	80.0	21.0	15.116	15.165	21.0			15.172	15.251	15.140	0.9928	-0.007	3.04
Run 3 - Initial	0.00	50.0	21.0	33.524	935.917	21.0								
Final	6.00	50.0	22.0	46.305	948.822	21.0								
Total/Avg	6.00	50.0	21.5	12.781	12.905	21.0			12.770	12.836	12.884	1.0037	0.004	2.15
Run 4 - Initial	0.00	27.0	22.0	46.305	948.822	21.0								
Final	12.00	27.0	22.0	61.148	963.662	21.0								
Total/Avg	12.00	27.0	22.0	14.843	14.840	21.0			14.772	14.849	14.816	0.9978	-0.002	1.24
Run 5 - Initial	0.00	18.0	22.0	61.148	963.662	21.0								
Final	24.00	18.0	22.0	78.484	981.013	22.0								
Total/Avg	24.00	18.0	22.0	17.336	17.351	21.5			17.238	17.328	17.294	0.9980	-0.002	0.72

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 # 1-107, which is traceable to the National Bureau of Standards (N.I.S.I.).

Signature *EW*

Date 5/5/11

POST TEST METER CALIBRATION DATA AND CALCULATION FORM

COMPANY: ARI Environmental

METER NUMBER: 1105002

BAROMETRIC PRESSURE: 30.12

DATE: 6/22/2011

CALIBRATED BY: RC

PRETEST Y FACTOR: 1.000

ROTAMETER SETTING	GILBRATOR FLOWRATE	TIME	PK III INITIAL READING	PK III FINAL READING	PK III VOLUME (V _m)	CALCULATED GILBRATOR VOLUME (V _w)	CALCULATED Y
liters/min	L/min	minutes	liters	liters	liters	liters	
1.0	1.009	10.00	0.0	10.452	10.45	10.09	0.965
1.0	1.022	10.00	0.0	10.589	10.59	10.22	0.965
1.0	1.010	10.00	0.0	10.440	10.44	10.10	0.967
Average =							0.966

PRETEST Y FACTOR = 1.000

POSTTEST Y FACTOR = 0.966

DIFFERENCE, % = -3.5 (Must be < 5%)

Temperature Sensor Calibration Data Sheet

Unit	MC-623	Serial #	1105002
Date	5/4/2011	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	259	0.2
5	371	370	0.2
6	482	482	0.0
7	593	594	-0.1
8	816	816	0.0
9	1038	1038	0.0
10			
11			
12			
			0.025
			<1.5

NIST Reference TC ID		90728323
Ice Water	Meter TC	
32° F / 0° C	Reading	
0.00	0.000	

Checked By

E. White 5/4/11
(Personnel (Sign/Date))

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: RC
Date: 6/22/2011

Meterbox No.: 1105002
Calibrator No.: CL-300-21001

Calibrator Setting ° F	PROBE			Blank			FILTER			Blank			AUX		
	Actual	Diff.		Actual	Diff.		Actual	Diff.		Actual	Diff.		Actual	Diff.	
0	-1	0.22		-1	0.22		-1	0.22		-1	0.22		-1	0.22	
200	199	0.15		199	0.15		199	0.15		199	0.15		199	0.15	
400	398	0.23		398	0.23		398	0.23		398	0.23		398	0.23	
600	599	0.09		599	0.09		599	0.09		599	0.09		599	0.09	
800	799	0.08		799	0.08		799	0.08		799	0.08		799	0.08	
1000	999	0.07		999	0.07		999	0.07		999	0.07		999	0.07	
1200	1199	0.06		1199	0.06		1199	0.06		1199	0.06		1199	0.06	
1400	1399	0.05		1399	0.05		1399	0.05		1399	0.05		1399	0.05	
1600	1599	0.05		1599	0.05		1599	0.05		1599	0.05		1599	0.05	
1800	1799	0.04		1799	0.04		1799	0.04		1799	0.04		1799	0.04	

Actual Maximum Difference =
Allowable Maximum Difference =

0.23
1.50

%
%



APEX INSTRUMENTS METER CONSOLE CALIBRATION

Meter Console Information					
Console Model	MC-623	Console Serial Number	1105003	Encoder Model	HEDS-5701-A02
Gas Meter Model	AP25	Totalizer Scale Factor (Initial)	3.9000	Totalizer Model	Red Lion
Gas Meter Serial#	N/A	Totalizer Scale Factor (Final)	3.8671	Temp Display Model	Watlow SD31

Calibration Conditions					
WTM ID	539784	Calibration Technician	EW		Calibration Date
WTM Cal Factor	1.0024	Barometric Pressure	(Pb)	759	mm Hg
5-May-11					

Calibration Data											
Run Time			Dry Gas Meter			Wet Test Meter			Standardized Volumes		
Elapsed	Gas	Pressure	Gas	Totalizer	Gas	Gas	Volume	Temp	Totalizer	Wet Test	Corrected
(G)	(P _m)	(t _m)	(t _w)	(V _w)	(V _m)	(V _m)	(V _m)	(t _w)	(V _m)	(V _w)	Flowrate
min	mm H ₂ O	°C	°C	liters	liters	liters	liters	°C	std liters	std liters	(Q _m)
											slm
Run 1 - Initial	0.00	100.0	23.0	0.000	205.800	22.0					
Final	5.00	100.0	23.0	18.763	224.408	22.5					
Total/Avg	5.00	100.0	23.0	18.763	18.608	22.3	18.741	18.584	18.499	0.9955	-0.005
Run 2 - Initial	0.00	77.0	23.0	18.763	224.408	22.5					
Final	5.00	77.0	24.0	34.320	239.876	22.5					
Total/Avg	5.00	77.0	23.5	15.557	15.468	22.5	15.479	15.348	15.365	1.0011	0.001
Run 3 - Initial	0.00	48.0	24.0	34.320	239.876	22.5					
Final	6.00	48.0	24.0	47.280	252.737	22.5					
Total/Avg	6.00	48.0	24.0	12.960	12.861	22.5	12.837	12.729	12.775	1.0036	0.004
Run 4 - Initial	0.00	26.0	24.0	47.280	252.737	22.5					
Final	12.00	26.0	24.0	60.961	266.253	23.0					
Total/Avg	12.00	26.0	24.0	13.681	13.516	22.8	13.523	13.409	13.414	1.0004	0.000
Run 5 - Initial	0.00	17.0	24.0	60.961	266.253	23.0					
Final	24.00	17.0	24.0	77.860	282.931	23.0					
Total/Avg	24.00	17.0	24.0	16.899	16.678	23.0	16.689	16.548	16.539	0.9994	-0.001

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 # 1-107, which is traceable to the National Bureau of Standards (N.I.S.I.).

Signature

Date

5/5/11

Temperature Sensor Calibration Data Sheet

Unit MC-623 Serial # 1105003
 Date 5/5/2011 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	593	0.0
8	816	816	0.0
9	1038	1038	0.0
10			
11			
12			
			0.000
			<1.5

NIST Reference TC ID		90728323
Ice Water		Meter TC
32° F / 0° C		Reading
0.00		0.000

Checked By EW 5/5/11
 (Personnel (Sign/Date))

POST TEST METER CALIBRATION DATA AND CALCULATION FORM

COMPANY: ARI Environmental

METER NUMBER: 1105003

BAROMETRIC PRESSURE: 30.12

DATE: 6/22/2011

CALIBRATED BY: RC

PRETEST Y FACTOR: 1.000

ROTAMETER SETTING liters/min	GILBRATOR FLOWRATE L/min	TIME minutes	PK III INITIAL READING liters	PK III FINAL READING liters	PK III VOLUME (Vm) liters	CALCULATED GILBRATOR VOLUME (Vw) liters	CALCULATED Y
1.0	0.998	10.37	0.0	10.774	10.77	10.55	0.979
1.0	1.022	11.37	0.0	11.891	11.89	11.82	0.994
1.0	1.008	11.00	0.0	11.508	11.51	11.09	0.964
Average =							0.979

PRETEST Y FACTOR = 1.000

POSTTEST Y FACTOR = 0.979

DIFFERENCE, % = -2.2 (Must be < 5%)

ARI ENVIRONMENTAL, INC.
EPA METHOD 5
THERMOCOUPLE DIGITAL INDICATOR CALIBRATION DATA SHEET

Operator: RC
Date: 8/22/2011

Meitobox No.: 1105003
Calibrator No.: CL-300-21001

Calibrator Setting ° F	PROBE			Blank			FILTER			Blank			AUX		
	Actual	Diff.		Actual	Diff.		Actual	Diff.		Actual	Diff.		Actual	Diff.	
0	-2	0.43		-2	0.43		-2	0.43		-2	0.43		-2	0.43	
200	198	0.15		199	0.15		199	0.15		199	0.15		199	0.15	
400	398	0.23		398	0.23		398	0.23		398	0.23		398	0.23	
600	598	0.18		598	0.18		598	0.18		598	0.18		598	0.18	
800	799	0.08		799	0.08		799	0.08		798	0.16		788	0.16	
1000	999	0.07		999	0.07		999	0.07		998	0.07		959	0.07	
1200	1199	0.06		1199	0.06		1199	0.06		1199	0.06		1189	0.06	
1400	1399	0.05		1399	0.05		1399	0.05		1399	0.05		1399	0.05	
1600	1599	0.05		1599	0.05		1599	0.05		1599	0.05		1599	0.05	
1800	1800	0.00		1800	0.00		1800	0.00		1800	0.00		1800	0.00	

Actual Maximum Difference = 0.43 %
Allowable Maximum Difference = 1.50 %

Pitot Tube Inspection Data

Client Name: _____

Date: _____

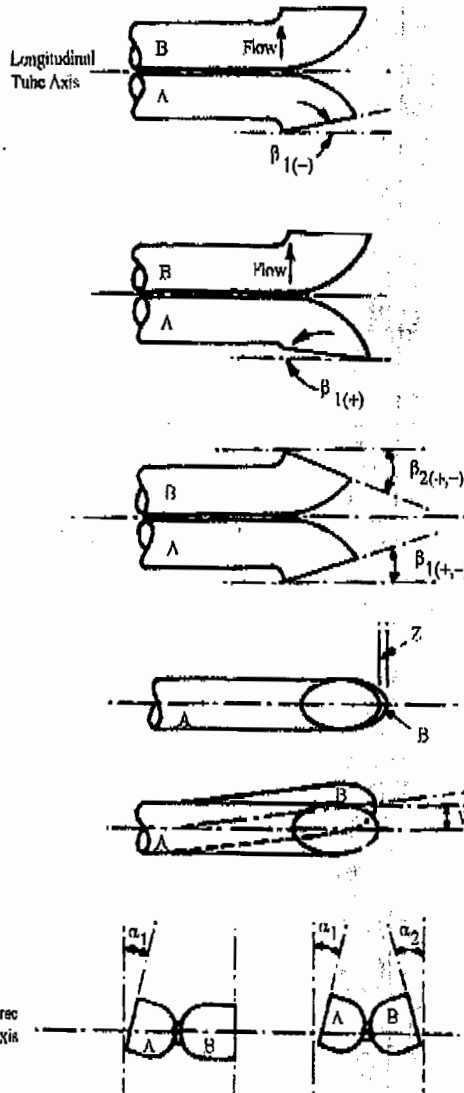
Pre-Sample

2/13/2009

Date: _____

Post-Sample

6/22/2011



y	level?	y
n	obstructions?	n
n	damaged?	n
1	$-10^\circ < \alpha_1 < +10^\circ$	0
0	$-10^\circ < \alpha_2 < +10^\circ$	1
0	$-5^\circ < \beta_1 < +5^\circ$	0
0	$-5^\circ < \beta_2 < +5^\circ$	0
0	γ	2
0	θ	1
0.830	λ	0.95
0.415	$0.3843 < P_A < 0.549$	0.475
0.415	$0.3843 < P_B < 0.549$	0.475
0.366	$0.1875 \leq D_i \leq 0.375$	0.366
0.000	$A \tan \gamma < 0.125''$	0.033
0.00000	$A \tan \theta < 0.03125''$	0.01658
TRUE	$P_A = P_B \pm 0.063$	TRUE
PASS	PASS/FAIL	PASS

Comments:

Pitot tube/probe number **P83** 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:

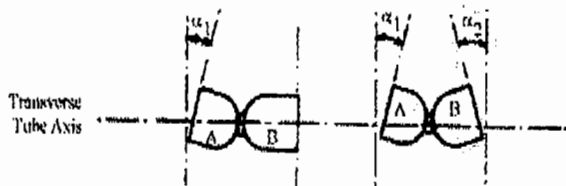
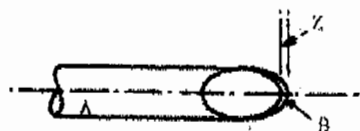
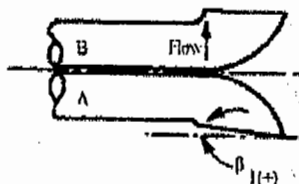
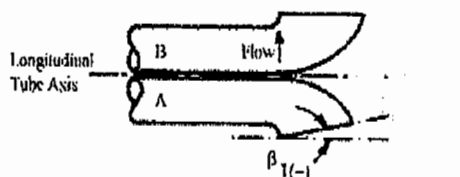
Date:

Pitot Tube Inspection Data

Client Name: _____

Date: Pre-Sample
5/31/2011

Date: Post-Sample
6/22/2011



y	level?	y
n	obstructions?	n
n	damaged?	n
0	$-10^\circ < \alpha_1 < +10^\circ$	1
0	$-10^\circ < \alpha_2 < +10^\circ$	0
0	$-5^\circ < \beta_1 < +5^\circ$	1
0	$-5^\circ < \beta_2 < +5^\circ$	0
0	γ	0
0	θ	0
0.9	A	0.9
0.450	$0.3255 < P_A < 0.465$	0.450
0.450	$0.3255 < P_R < 0.465$	0.450
0.310	$0.1875 \leq D_s \leq 0.375$	0.310
0.000	$A \tan \gamma < 0.125''$	0.000
0.00000	$A \tan \theta < 0.03125''$	0.00000
TRUE	$P_A = P_B \pm 0.063$	TRUE
PASS	PASS/FAIL	PASS

Comments:

Pitot tube/probe number 251 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:

8/2/11

ARI Environmental Inc.
Thermocouple Calibration Data Form



Calibrator: RC
 Thermocouple ID. P83
 Date: pretest 2/13/2009 posttest 6/22/2011
 Barometric: 29.77 29.94
 Reference Thermometer = Mercury in glass

	Reference Point Number	Source	Reference Thermometer Temperature	Meter Readout Temperature	Difference (%)
Pre- Test	T.C	Ice Water	30.0	32.0	-0.41
		Ambient	69.0	65.0	0.76
		Hot Water	139.0	139.0	0.00
Post- Test	T.C	Ice Water	38.0	36.0	0.40
		Ambient	78.0	76.0	0.37
		Hot Water	145.0	143.0	0.33

$$a \text{ (temp. diff.)} = (\text{ref. temp.} + 460) - (\text{Thermo. temp.} + 460) / (\text{ref. temp.} + 460) \times 100$$

Where $-1.5 < a < 1.5$

ARI Environmental Inc.
Thermocouple Calibration Data Form



Calibrator: RC
 Thermocouple ID. P250 (1104250)
 pretest **posttest**
 Date: 5/31/2011 6/22/2011
 Barometric: 30.12 29.97
 Reference Thermometer = Mercury in glass

	Reference Point Number	Source	Reference Thermometer Temperature	Meter Readout Temperature	Difference (%)
Pre- Test	T.C	Ice Water	40.0	39.0	0.20
		Ambient	81.0	81.0	0.00
		Hot Water	162.0	162.0	0.00
Post- Test	T.C	Ice Water	38.0	37.0	0.20
		Ambient	78.0	78.0	0.00
		Hot Water	144.0	145.0	-0.17

$$a \text{ (temp. diff.)} = (\text{ref. temp.} + 460) - (\text{Thermo. temp.} + 460) / (\text{ref. temp.} + 460) \times 100$$

Where $-1.5 < a < 1.5$

ARI Environmental Inc.
Thermocouple Calibration Data Form



Calibrator: RC
 Thermocouple ID. P251 (1104251)
 pretest **posttest**
 Date: 5/31/2011 6/22/2011
 Barometric: 30.12 29.94
 Reference Thermometer = Mercury in glass

	Reference Point Number	Source	Reference Thermometer Temperature	Meter Readout Temperature	Difference (%)
Pre- Test	T.C	Ice Water	41.0	40.0	0.20
		Ambient	83.0	82.0	0.18
		Hot Water	169.0	168.0	0.16
Post- Test	T.C	Ice Water	38.0	36.0	0.40
		Ambient	78.0	76.0	0.37
		Hot Water	144.0	142.0	0.33

$$a \text{ (temp. diff.)} = (\text{ref.temp} + 460) - (\text{Thermo. temp.} + 460) / (\text{ref. temp.} + 460) \times 100$$

Where $-1.5 < a < 1.5$

BAROMETER CALIBRATION

PRE-TEST

CALIBRATOR INITIALS	BAROMETER NUMBER	CALIBRATION DATE	BAROMETER READING (in. Hg)	REFERENCE READING (in Hg.)	DIFFERENCE (+/- 0.1 in Hg)
ZRM	EB833-T7	5/5/2011	30.21	30.21	0

POST-TEST

CALIBRATOR INITIALS	BAROMETER NUMBER	CALIBRATION DATE	BAROMETER READING (in. Hg)	REFERENCE READING (in Hg.)	DIFFERENCE (+/- 0.1 in Hg)
ZRM	EB833-T7	6/22/2011	29.94	29.94	0

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC

Scott™

CERTIFIED MASTER CLASS**Single-Certified Calibration Standard**

11426 FAIRMONT PKWY, LA PORTE, TX 77571

Phone: 800-248-1427 Fax: 281-474-8419

CERTIFICATE OF ACCURACY: Certified Master Class Calibration Standard**Product Information**Document #: 41403901-001
Item No.: M0004060-P-30AL
P.O. No.: 09-024-11Cylinder Number: CC105969
Cylinder Size: 30AL
Certification Date: 25Apr2011
Expiration Date: 24Apr2012
Lot Number: LAP0039741**Customer**ARI ENVIRONMENTAL, INC.
1710 C PRESTON RD
PASADENA, TX 77503
US**CERTIFIED CONCENTRATION****Component Name****Concentration
(Moles)****Accuracy
(+/-%)**CARBON DISULFIDE
CARBONYL SULFIDE
HYDROGEN SULFIDE
NITROGEN524. PPM
510. PPM
495. PPM
BALANCE2
2
2**TRACEABILITY****Traceable To**

Scott Reference Standard

APPROVED BY:


YANG QIN

DATE:

8/25/11

SPECIFICATIONS

Component Name	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)
CARBON DISULFIDE	500.	PPM	524.	PPM	4.8	2.00
CARBONYL SULFIDE	500.	PPM	510.	PPM	2.0	2.00
HYDROGEN SULFIDE	500.	PPM	495.	PPM	1.0	2.00
NITROGEN		BAL		BAL		

TRACEABILITY

Traceable To
Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: 30AL

Pressure: 2000 PSIG
Expiration Date: 24Apr2012

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

PI# 52297 CMC CERTS AND TAGS TO REFLECT ARI52297

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**SCOTT™****RATA CLASS***Dual-Analyzed Calibration Standard*

11426 FAIRMONT PKWY, LA PORTE, TX 77571

Phone: 800-248-1427

Fax: 281-474-8419

CERTIFICATE OF ACCURACY: EPA Protocol GasAssay LaboratoryAIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: 03-127-09

Project No.: 04-77649-003

CustomerARI ENVIRONMENTAL, INC.
03-127-09
1710 C PRESTON RD
PASADENA TX 77503**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: AAL5614

Certification Date:

04Nov2009

Exp. Date: 04Nov2012

Cylinder Pressure***: 1850 PSIG

Batch No: LAP0003619

COMPONENTCERTIFIED CONCENTRATION (Moles)ANALYTICALACCURACY**TRACEABILITY

OXYGEN

7.609 %

+/- 1%

Direct NIST and VSL

NITROGEN

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

<u>TYPE/SRM NO.</u>	<u>EXPIRATION DATE</u>	<u>CYLINDER NUMBER</u>	<u>CONCENTRATION</u>	<u>COMPONENT</u>
NTRM 2350	01Apr2012	A6820	23.51 %	OXYGEN

INSTRUMENTATIONINSTRUMENT/MODEL/SERIAL#DATE LAST CALIBRATEDANALYTICAL PRINCIPLE

BIG SERVOMEX/1101-4605C/4605C

16Oct2009

PARAMAGNETIC

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad AnalysisSecond Triad AnalysisCalibration Curve**OXYGEN**Date: 04Nov2009 Response Unit: %
Z1=0.00000 R1=23.58000 T1=7.64000
R2=23.58000 Z2=0.01000 T2=7.64000
Z3=0.00000 T3=7.64000 R3=23.56000
Avg. Concentration: 7.609 %Concentration = A + Bx + Cx² + Dx³ + Ex⁴
r = 0.9999997
Constants: A = -0.00811775
B = 1.000029704 C =
D = E =

APPROVED BY:

DAVID KELLY

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**Scott™****RATA CLASS***Dual-Analyzed Calibration Standard*

11426 FAIRMONT PKWY, LA PORTE, TX 77571

Phone: 800-248-1427

Fax: 281-474-8419

CERTIFICATE OF ACCURACY: Interference Free Multi-Component EPA Protocol Gas**Assay Laboratory**AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: 03-008-11

Document #: 40555687-001

Customer

ARI ENVIRONMENTAL, INC.

1710 C PRESTON RD
PASADENA TX 77503
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: CC102306
Cylinder Pressure***: 1850 PSIG

Certification Date: 19Feb2011

Exp. Date: 19Feb2014
Batch No: LAP0034896

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
CARBON MONOXIDE	202 PPM	+/- 1%	Direct NIST and VSL
CARBON DIOXIDE	19.6 %	+/- 1%	
OXYGEN	22.7 %	+/- 1%	
NITROGEN	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 2636	02Oct2011	KAL003851	240.8 PPM	CARBON MONOXIDE
NTRM 2300	02Jan2012	K002682	23.01 %	CARBON DIOXIDE
NTRM 2350	01May2013	K026427	23.50 %	OXYGEN

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
SIEMENS CO/ULTRAMAT 6E-HIGH/W0355	02Mar2011	NDIR
FTIR/MG-09-149	11Feb2011	FTIR
SERVOMEX/MODEL 244A/701/718	20Jan2011	PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis**Second Triad Analysis****Calibration Curve****CARBON MONOXIDE**

Date: 17Feb2011 Response Unit: PPM
 Z1=0.00000 R1=240.8000 T1=202.3500
 R2=240.8000 Z2=0.00000 T2=202.3500
 Z3=0.00000 T3=202.5500 R3=240.9000
 Avg. Concentration: 202.4 PPM

Date: 02Mar2011 Response Unit: PPM
 Z1=0.00000 R1=241.1000 T1=202.5500
 R2=241.2000 Z2=0.00000 T2=202.6500
 Z3=0.00000 T3=202.6500 R3=241.2000
 Avg. Concentration: 202.3 PPM

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
 r = 0.9999998
 Constants: A = -0.00358496
 B = 0.999310841 C =
 D = E =

CARBON DIOXIDE

Date: 19Feb2011 Response Unit: %
 Z1=0.00251 R1=22.99574 T1=19.80555
 R2=22.99865 Z2=0.00414 T2=19.62374
 Z3=0.00424 T3=19.64123 R3=23.07062
 Avg. Concentration: 19.61 %

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
 r = 0.99989E-1
 Constants: A = 0.00000E+0
 B = 5.49122E-1 C = 3.87100E-3
 D = 0.00000E+0 E = 0.00000E+0

OXYGEN

Date: 17Feb2011 Response Unit: VOLTS
 Z1=0.00000 R1=0.94000 T1=0.90820
 R2=0.94050 Z2=0.00000 T2=0.90850
 Z3=0.00000 T3=0.90850 R3=0.94060
 Avg. Concentration: 22.68 %

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
 r = 0.9999971
 Constants: A = -0.01046095
 B = 24.96589325 C =
 D = E =

APPROVED BY:

DAVID KELLY



Air Liquide America
Specialty Gases LLC



RATA CLASS

Dual-Analyzed Calibration Standard

11426 FAIRMONT PKWY, LA PORTE, TX 77571

Phone: 800-248-1427

Fax: 281-474-8419

CERTIFICATE OF ACCURACY: Interference Free Multi-Component EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: TBA

Document #: 40354688-001

Customer

ARI ENVIRONMENTAL, INC.

1710 C PRESTON RD
PASADENA TX 77503
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: CC73859
Cylinder Pressure***: 1850 PSIG

Certification Date: 26Jan2011

Exp. Date: 26Jan2014
Batch No: LAP0033126

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
OXYGEN	22.7 %	+/- 1%	Direct NIST and VSL
CARBON DIOXIDE	19.7 %	+/- 1%	
CARBON MONOXIDE	202 PPM	+/- 1%	
NITROGEN	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 2350	01May2013	K026427	23.50 %	OXYGEN
NTRM 1800	01Mar2013	K017950	17.87 %	CARBON DIOXIDE
NTRM 2636	02Oct2011	KAL003851	240.8 PPM	CARBON MONOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
SERVOMEX/MODEL 244A/701/716	20Jan2011	PARAMAGNETIC
FTIR/000929060	15Jan2011	FTIR
SIEMENS CO/ULTRAMAT 6E-HIGH/WO355	24Jan2011	NDIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

OXYGEN

Date: 31Jan2011 Response Unit: VOLTS
Z1=0.00000 R1=0.98350 T1=0.90720
Z2=0.98350 Z2=0.00000 T2=0.90780
Z3=0.00000 T3=0.90800 R3=0.93880
Avg. Concentration: 22.71 %

Second Triad Analysis

Calibration Curve

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.9999971
Constants: A = -0.01046095
B = 24.96589325 C =
D = E =

CARBON DIOXIDE

Date: 26Jan2011 Response Unit: %
Z1=0.00063 R1=17.79329 T1=19.63725
Z2=17.79531 Z2=0.00229 T2=19.64001
Z3=0.00334 T3=19.85110 R3=17.80542
Avg. Concentration: 19.72 %

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 9.99987E-1
Constants: A = 0.00000E+0
B = 9.04431E-1 C = 1.20800E-2
D = 0.00000E+0 E = 0.00000E+0

CARBON MONOXIDE

Date: 24Jan2011 Response Unit: PPM
Z1=0.00000 R1=239.3000 T1=201.2000
Z2=239.3000 Z2=0.00000 T2=201.2000
Z3=0.00000 T3=201.2000 R3=239.3000
Avg. Concentration: 202.5 PPM

Date: 31Jan2011 Response Unit: PPM
Z1=0.00000 R1=240.6000 T1=202.4500
Z2=240.8000 Z2=0.00000 T2=202.4500
Z3=0.00000 T3=202.4500 R3=240.8000
Avg. Concentration: 202.5 PPM

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999
Constants: A = -0.04240763
B = 1.000069172 C =
D = E =

APPROVED BY:

DAVID KELLY

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**SCOTT****RATA CLASS***Dual-Analyzed Calibration Standard*

11426 FAIRMONT PKWY, LA PORTE, TX 77571

Phone: 800-248-1427

Fax: 281-474-8419

CERTIFICATE OF ACCURACY: EPA Protocol Gas**Assay Laboratory**AIR LIQUIDE AMERICA SPECIALTY GASES LLC
11426 FAIRMONT PKWY
LA PORTE, TX 77571

P.O. No.: 03-031-10

Project No.: 04-83032-009

CustomerARI ENVIRONMENTAL, INC.
PO# 03-031-10
1710 C PRESTON RD
PASADENA TX 77503**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: CC102277
Cylinder Pressure***: 1900 PSIG

Certification Date: 09Apr2010

Exp. Date: 08Apr2013

Batch No: LAP0014028

COMPONENTSULFUR DIOXIDE *
NITROGEN**CERTIFIED CONCENTRATION (Moles)**1,001 PPM
BALANCE**ANALYTICAL****ACCURACY****

+/- 1%

TRACEABILITY

Direct NIST and VSL

*** 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 1662	15May2010	KAL003122	975.0 PPM	SULFUR DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
FTIR//000929060	01Apr2010	FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis**Second Triad Analysis****Calibration Curve****SULFUR DIOXIDE ***

Date: 02Apr2010 Response Unit: PPM
Z1=0.04628 R1=973.5997 T1=999.4752
R2=973.7617 Z2=0.07089 T2=999.8500
Z3=0.29218 T3=1000.018 R3=974.0854
Avg. Concentration: 1001. PPM

Date: 09Apr2010 Response Unit: PPM
Z1=-0.31001 R1=975.1909 T1=1001.608
R2=975.6375 Z2=0.10122 T2=1001.619
Z3=0.25661 T3=1002.101 R3=975.7456
Avg. Concentration: 1001. PPM

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
r = 9.99994E-1
Constants: A = 0.00000E+0
B = 9.93708E-1 C = 3.00000E-6
D = 0.00000E+0 E = 0.00000E+0

APPROVED BY:

Ron Stitt

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**SCOTT™****RATA CLASS***Dual-Analyzed Calibration Standard*

11426 FAIRMONT PKWY, LA PORTE, TX 77571

Phone: 800-248-1427

Fax: 281-474-8419

CERTIFICATE OF ACCURACY: EPA Protocol GasAssay Laboratory

P.O. No.: 03-031-10
 AIR LIQUIDE AMERICA SPECIALTY GASES LLC Project No.: 04-83032-006
 11426 FAIRMONT PKWY
 LA PORTE, TX 77571

Customer

ARI ENVIRONMENTAL, INC.
 PO# 03-031-10
 1710 C PRESTON RD
 PASADENA TX 77503

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: CC149689
 Cylinder Pressure***: 1900 PSIG

Certification Date:

09Apr2010

Exp. Date: 08Apr2012

Batch No: LAP0014139

COMPONENTCERTIFIED CONCENTRATION (Moles)ANALYTICALACCURACY**TRACEABILITY

NITRIC OXIDE

993.9

PPM

+/- 1%

Direct NIST and VSL

NITROGEN - OXYGEN FREE

BALANCE

TOTAL OXIDES OF NITROGEN

1,002.

PPM

Reference Value Only

*** 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 1687	02Oct2012	AAL070258	970.3 PPM	NITRIC OXIDE

INSTRUMENTATIONINSTRUMENT/MODEL/SERIAL#

FTIR/000929060

DATE LAST CALIBRATED

11Mar2010

ANALYTICAL PRINCIPLE

FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

NITRIC OXIDE

Date: 02Apr2010 Response Unit: PPM
 Z1=0.00160 R1=966.5002 T1=988.4431
 R2=967.5684 Z2=0.84577 T2=990.2120
 Z3=0.97668 T3=992.0400 R3=967.8732
 Avg. Concentration: 993.3 PPM

Date: 09Apr2010 Response Unit: PPM
 Z1=-0.03177 R1=966.6850 T1=990.9666
 R2=967.2875 Z2=-0.02486 T2=991.2590
 Z3=0.83149 T3=992.2364 R3=968.0659
 Avg. Concentration: 994.5 PPM

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
 r = 9.99999E-1
 Constants: A = 0.00000E+0
 B = 9.08129E-1 C = 1.68000E-4
 D = 0.00000E+0 E = 0.00000E+0

APPROVED BY:

 Ron Stitt

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**Scott™****COMPLIANCE CLASS***Dual-Analyzed Calibration Standard*

500 WEAVER PARK RD, LONGMONT, CO 80501

Phone: 888-253-1635

Fax: 303-772-7673

CERTIFICATE OF ACCURACY: EPA Protocol Gas**Assay Laboratory**AIR LIQUIDE AMERICA SPECIALTY GASES LLC
500 WEAVER PARK RD
LONGMONT, CO 80501

P.O. No.: 03-008-11

Document # : 40557418-001

CustomerARI ENVIRONMENTAL, INC.
ATTN: GREG BURCH
1710 C PRESTON RD
PASADENA TX 77503
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: **AAL13927**Certification Date: **14Feb2011**Exp. Date: **15Aug2011**Cylinder Pressure***: **1900 PSIG****COMPONENT**
NITROGEN DIOXIDE
AIR**CERTIFIED CONCENTRATION (Moles)**
49.8 PPM
BALANCE**ACCURACY****
+/- 2%**TRACEABILITY**
GMIS

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol procedures, September 1997.

REFERENCE STANDARD

<u>TYPE/SRM NO.</u>	<u>EXPIRATION DATE</u>	<u>CYLINDER NUMBER</u>	<u>CONCENTRATION</u>	<u>COMPONENT</u>
NO2/AIR GMIS	16Nov2012	ALM032519	48.30 PPM	NITROGEN DIOXIDE

INSTRUMENTATIONINSTRUMENT/MODEL/SERIAL#
NONOX/CLA-220/41528750062DATE LAST CALIBRATED
17Jan2011ANALYTICAL PRINCIPLE
CHEMILUMINESCENT

APPROVED BY: _____

JON WITZAK



AIR LIQUIDE Air Liquide America
Specialty Gases LLC



Scott

RATA CLASS

Dual-Analyzed Calibration Standard

9810 BAY AREA BLVD, PASADENA, TX 77507

Phone: 281-474-5800

Fax: 281-474-5857

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
9810 BAY AREA BLVD
PASADENA, TX 77507

P.O. No.: 03-048-09

Project No.: 04-73756-002

Customer

ARI ENVIRONMENTAL, INC.
03-048-09
1710 C PRESTON RD
PASADENA TX 77503

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: ALM005822 Certification Date: 02Jun2009 Exp. Date: 02Jun2012
Cylinder Pressure***: 1950 PSIG

COMPONENT

PROPANE

NITROGEN

CERTIFIED CONCENTRATION (Moles)

999.8

PPM

BALANCE

ANALYTICAL

ACCURACY**

+/- 1%

TRACEABILITY

Direct NIST and NMI

*** 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 1200	02Feb2010	K008942	1186. PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#

MTIA/M200/171109

DATE LAST CALIBRATED

02Jun2009

ANALYTICAL PRINCIPLE

GAS CHROMATOGRAPHY

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

PROPANE

Date: 02Jun2009 Response Unit: AREA
Z1=0.00000 R1=1250118. T1=1053279.
R2=1251037. Z2=0.00000 T2=1053122.
Z3=0.00000 T3=1051722. R3=1249358.
Avg. Concentration: 999.8 PPM

Concentration = $A + Bx + Cx^2 + Dx^3 + Ex^4$
 $r = 0.9999979$
Constants: $A = 4.886695186$
 $B = 0.000943706$ $C =$
 $D =$ $E =$

APPROVED BY:

DAVID KELLY



Valero Port Arthur Refinery
Source: FCCU-1241 Wet Gas Scrubber Stack
Test Dates: 6/6 - 6/14/11

APPENDIX F

Process Data

FCCU DAILY DATA - 30 DAYS

FCCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAs

Process Parameters

ARI Environmental, Inc.

Notes:

(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(a)(2) Equation 2

DATE/TIME START	END	FCC Charge Rate BPH	Stack Flow	Coke Burn Off	Scrubber Pressure Drop	Scrubber	Liquid-to-Air Ratio	Scrubber
			FLUE GAS FLOW CORRECTED - EPA SCFM	(1) LBS/HR	INH2O	Total Water Flow GPM		Average Scrubber Liquor pH
6/1/2011 0:00	6/2/2011 0:00	77,343	150,645	54,843.7	12.0	10,073.2	0.0666	7.0
6/2/2011 0:00	6/3/2011 0:00	77,314	150,458	55,015.0	11.9	10,098.4	0.0669	7.0
6/3/2011 0:00	6/4/2011 0:00	77,351	150,074	54,685.6	12.0	10,083.1	0.0670	7.0
6/4/2011 0:00	6/5/2011 0:00	76,169	150,572	54,498.9	12.0	10,148.8	0.0672	7.0
6/5/2011 0:00	6/6/2011 0:00	76,202	150,332	54,799.5	11.9	10,133.1	0.0672	7.0
6/6/2011 0:00	6/7/2011 0:00	76,639	150,066	54,571.3	11.9	10,161.0	0.0674	7.0
6/7/2011 0:00	6/8/2011 0:00	63,049	148,255	50,904.2	11.6	10,152.8	0.0696	7.0
6/8/2011 0:00	6/9/2011 0:00	52,087	143,683	47,824.8	11.0	10,215.9	0.0738	6.8
6/9/2011 0:00	6/10/2011 0:00	51,869	141,436	47,611.3	10.9	10,181.8	0.0743	6.9
6/10/2011 0:00	6/11/2011 0:00	51,665	142,283	47,630.2	11.0	10,244.0	0.0744	6.9
6/11/2011 0:00	6/12/2011 0:00	48,721	130,098	43,403.3	9.8	10,576.8	0.0841	7.0
6/12/2011 0:00	6/13/2011 0:00	34,603	61,334	18,705.7	7.9	10,518.1	0.1757	6.9
6/13/2011 0:00	6/14/2011 0:00	49,437	62,969	23,347.9	9.5	10,018.3	0.1579	7.0
6/14/2011 0:00	6/15/2011 0:00	54,111	80,494	29,767.6	9.5	9,854.3	0.1218	7.0
6/15/2011 0:00	6/16/2011 0:00	56,232	82,568	30,527.9	9.6	9,719.0	0.1178	7.6
6/16/2011 0:00	6/17/2011 0:00	57,862	82,016	30,289.0	9.6	9,956.2	0.1215	7.2
6/17/2011 0:00	6/18/2011 0:00	60,662	80,345	29,927.8	9.6	9,984.8	0.1240	7.2
6/18/2011 0:00	6/19/2011 0:00	60,781	80,862	30,237.3	9.8	9,945.1	0.1225	7.2
6/19/2011 0:00	6/20/2011 0:00	59,470	80,813	30,258.6	9.8	9,982.2	0.1229	7.2
6/20/2011 0:00	6/21/2011 0:00	60,896	81,551	30,130.7	9.7	9,955.1	0.1222	7.2
6/21/2011 0:00	6/22/2011 0:00	63,318	82,040	29,643.4	9.8	9,992.7	0.1230	7.2
6/22/2011 0:00	6/23/2011 0:00	61,079	80,345	29,322.4	9.7	10,006.7	0.1240	7.2
6/23/2011 0:00	6/24/2011 0:00	64,014	80,386	29,334.7	9.7	9,910.9	0.1231	7.2
6/24/2011 0:00	6/25/2011 0:00	65,698	93,097	33,803.5	10.1	9,940.6	0.1071	7.2
6/25/2011 0:00	6/26/2011 0:00	74,016	139,538	50,701.4	11.5	9,926.8	0.0714	7.2
6/26/2011 0:00	6/27/2011 0:00	74,151	137,533	51,368.8	11.4	9,962.8	0.0719	7.2
6/27/2011 0:00	6/28/2011 0:00	74,482	138,731	51,690.7	11.5	9,970.5	0.0715	7.2
6/28/2011 0:00	6/29/2011 0:00	74,952	140,598	51,872.1	11.6	10,009.7	0.0711	7.2
6/29/2011 0:00	6/30/2011 0:00	74,975	143,920	52,696.6	11.7	10,107.3	0.0704	7.2
6/30/2011 0:00	7/1/2011 0:00	74,979	143,682	52,669.7	11.7	10,125.4	0.0706	7.2

FCCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAs
Process Parameters
ARI Environmental, Inc.

Notes:
(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(e)(2) Equation 2

DATE/TIME START	DATE/TIME END	15F11397B PV FCC CHARGE RATE BPH	15A13001A PV REGEN CO MOLE%	15A13002A PV REGEN CO2 MOLE%	15A13003A.P REGEN O2 MOLE%	15T10003.PV FG0014 FLUE GAS CLR OUT DEG F	15P10005. PV FG0014 FLUE GAS CLR OUT F5IG	FLUE GAS TEMP K	A/B BLWR TOTAL AIR MLB/HR	Qa =	15F1245A PV OXYGEN TO SPARGER MLB/HR	15F17448B PV OXYGEN TO SPARGER MLB/HR	15F17448C PV OXYGEN TO SPARGER MLB/HR	O2 Injection	O2 Injection	%Oxy
6/17/2011 0:00	6/2/2011 0:00	77,343	-	19.5	1.2	454.1	0.66	505.3	679.5	151,242.6	0.0	-	0.0	0.0	0.0	2
6/2/2011 0:00	6/3/2011 0:00	77,314	-	19.6	1.1	454.2	0.66	505.4	678.6	151,035.8	0.0	-	0.0	0.0	0.0	2
6/3/2011 0:00	6/4/2011 0:00	77,351	-	19.5	1.3	454.7	0.66	505.6	676.2	150,498.1	0.0	(0.0)	0.0	0.0	0.0	2
6/4/2011 0:00	6/5/2011 0:00	76,169	-	19.4	1.4	454.1	0.66	505.3	678.1	150,916.4	0.0	(0.0)	0.0	0.0	0.0	1
6/5/2011 0:00	6/6/2011 0:00	76,202	-	19.5	1.3	453.5	0.65	505.0	677.2	150,715.7	0.0	(0.0)	0.0	0.0	0.0	2
6/6/2011 0:00	6/7/2011 0:00	76,639	-	19.4	1.2	453.4	0.66	504.9	677.1	150,700.8	-	(0.0)	0.0	0.0	0.0	1
6/7/2011 0:00	6/8/2011 0:00	63,049	-	18.9	3.4	451.8	0.64	504.0	655.4	145,868.5	0.0	(0.0)	0.0	0.0	0.0	1
6/8/2011 0:00	6/9/2011 0:00	52,087	-	18.9	5.0	448.4	0.61	502.2	622.0	138,436.7	0.0	(0.0)	0.0	0.0	0.0	1
6/9/2011 0:00	6/10/2011 0:00	51,869	-	18.9	4.5	448.0	0.60	502.0	615.9	137,085.1	0.0	(0.0)	0.0	0.0	0.0	2
6/10/2011 0:00	6/11/2011 0:00	51,665	-	18.8	4.7	448.4	0.61	502.2	618.8	137,725.2	0.0	-	0.0	0.0	0.0	2
6/11/2011 0:00	6/12/2011 0:00	48,721	-	18.8	4.8	441.1	0.56	498.2	565.0	125,751.5	-	(0.0)	0.0	0.0	0.0	1
6/12/2011 0:00	6/13/2011 0:00	34,603	0.13	16.9	5.9	396.7	0.44	473.7	268.9	59,852.8	0.0	(0.0)	0.0	0.0	0.0	1
6/13/2011 0:00	6/14/2011 0:00	49,437	-	19.7	0.7	426.3	0.51	490.0	285.2	63,465.2	0.4	0.4	0.4	0.4	0.4	243
6/14/2011 0:00	6/15/2011 0:00	54,111	-	19.7	0.9	433.4	0.52	493.9	363.5	80,908.7	2.2	2.1	2.2	2.2	2.2	1304
6/15/2011 0:00	6/16/2011 0:00	56,232	-	19.8	1.2	434.5	0.52	494.5	370.8	82,532.5	5.3	5.2	5.3	5.3	5.3	382
6/16/2011 0:00	6/17/2011 0:00	57,862	0.00	19.8	1.2	433.9	0.52	494.2	368.1	81,944.4	4.8	4.8	4.8	4.8	4.8	2901
6/17/2011 0:00	6/18/2011 0:00	60,662	-	19.9	0.9	434.4	0.53	494.5	361.8	80,517.0	4.3	4.3	4.3	4.3	4.3	2599
6/18/2011 0:00	6/19/2011 0:00	60,781	-	20.0	0.8	436.4	0.54	495.6	364.6	81,155.5	5.3	5.2	5.3	5.3	5.3	3163
6/19/2011 0:00	6/20/2011 0:00	59,470	-	19.9	0.7	436.5	0.54	495.6	365.0	81,234.1	5.3	5.2	5.3	5.3	5.3	3162
6/20/2011 0:00	6/21/2011 0:00	60,896	0.03	19.8	1.2	435.8	0.53	495.2	366.1	81,481.6	5.3	5.2	5.3	5.3	5.3	388
6/21/2011 0:00	6/22/2011 0:00	63,318	0.00	19.6	2.1	434.4	0.53	494.5	365.2	81,273.4	5.3	5.2	5.3	5.3	5.3	3164
6/22/2011 0:00	6/23/2011 0:00	61,079	0.01	19.4	1.2	432.2	0.53	493.3	362.7	80,721.7	5.3	5.2	5.3	5.3	5.3	392
6/23/2011 0:00	6/24/2011 0:00	64,014	0.00	19.5	1.4	434.5	0.54	494.5	361.7	80,502.8	5.3	5.2	5.3	5.3	5.3	393
6/24/2011 0:00	6/25/2011 0:00	65,698	-	19.6	1.7	438.7	0.55	496.8	416.9	92,797.5	4.1	4.1	4.1	4.1	4.1	2470
6/25/2011 0:00	6/26/2011 0:00	74,016	-	19.6	1.6	450.3	0.62	503.2	625.0	139,106.0	0.0	(0.0)	0.0	0.0	0.0	2
6/26/2011 0:00	6/27/2011 0:00	74,151	0.00	19.9	0.5	450.6	0.62	503.4	622.5	138,543.7	0.0	-	0.0	0.0	0.0	2
6/27/2011 0:00	6/28/2011 0:00	74,482	0.00	19.9	0.7	451.4	0.62	503.8	626.6	139,466.2	0.0	(0.0)	0.0	0.0	0.0	2
6/28/2011 0:00	6/29/2011 0:00	74,952	0.00	19.8	1.1	452.4	0.63	504.1	632.7	140,816.2	0.0	(0.0)	0.0	0.0	0.0	2
6/29/2011 0:00	6/30/2011 0:00	74,975	-	19.7	1.4	452.4	0.64	504.4	645.5	143,667.9	0.0	(0.0)	0.0	0.0	0.0	2
6/30/2011 0:00	7/1/2011 0:00	74,979	-	19.8	1.4	452.7	0.64	504.5	644.4	143,416.7	0.0	(0.0)	0.0	0.0	0.0	1

FCU-1241 Wet Gas Scrubber Performance
 Process Parameters
 ARI Environmental, Inc.
 Notes:
 (1) Coke Burn: EPA Method Per MACT UUU 4C

DATE/TIME START	DATE/TIME END	FLUE GAS FLOW CORRECTED - EPA SCFM	Coke Burn Off (1) LBS/HR	Scrubber Pressure Drop 15FD0102.PV AFM Pressure Drop	Scrubber Water Use Calculation						Total Water Flow GPM	Liquid-to-Air Ratio	15AI010 2APV TWR RCIRC pH	15AI010 2BPV TWR RCIRC pH	Average Scrubber Liquid pH
					15FC0100.PV Make-up Flow GPM	15FC0101 NaOH GPM	15FC0102 NaOH GPM	15P0109.P V Discharge Pressure PSIG	15P0115.P V Discharge Pressure PSIG	Pump Curve GPM	15FC0103.P V Scrubber Purge GPM				
6/1/2011 0:00	6/2/2011 0:00	150,645	54,843.7	12.0	269.0	0.65	5.35	91.7	1,930.6	7,677.5	190.1	10,073.2	0.0666	7.0	7.1
6/2/2011 0:00	6/3/2011 0:00	150,458	55,015.0	11.9	268.5	0.65	5.41	91.7	1,929.5	7,670.4	190.0	10,098.4	0.0669	7.0	7.1
6/3/2011 0:00	6/4/2011 0:00	150,074	54,685.6	12.0	269.8	0.64	5.31	91.7	1,933.4	7,684.0	190.0	10,083.1	0.0670	7.0	7.1
6/4/2011 0:00	6/5/2011 0:00	150,572	54,498.9	12.0	269.6	0.64	5.22	91.6	1,935.1	7,748.3	190.0	10,148.8	0.0672	7.0	7.0
6/5/2011 0:00	6/6/2011 0:00	150,332	54,799.5	11.9	268.6	0.65	5.40	91.6	1,934.8	7,733.7	190.0	10,133.1	0.0672	7.0	7.0
6/6/2011 0:00	6/7/2011 0:00	150,066	54,571.3	11.9	268.3	0.70	5.83	91.6	1,937.0	7,739.2	190.0	10,161.0	0.0674	7.0	7.0
6/7/2011 0:00	6/8/2011 0:00	148,255	50,904.2	11.6	266.5	0.75	4.61	91.6	1,937.2	7,753.8	190.0	10,132.8	0.0696	7.1	6.9
6/8/2011 0:00	6/9/2011 0:00	143,683	47,824.8	11.0	262.1	0.87	3.94	91.5	1,941.1	7,818.0	190.0	10,215.9	0.0738	7.0	6.7
6/9/2011 0:00	6/10/2011 0:00	141,436	47,611.3	10.9	260.7	0.77	3.94	91.5	1,941.0	7,845.3	190.0	10,244.0	0.0744	7.0	6.8
6/10/2011 0:00	6/11/2011 0:00	142,283	47,630.2	11.0	261.7	0.76	3.24	91.5	1,943.0	7,854.3	190.0	10,244.0	0.0744	7.0	6.8
6/11/2011 0:00	6/12/2011 0:00	130,098	43,403.3	9.8	255.1	0.68	2.76	85.6	2,294.2	7,894.0	190.0	10,518.1	0.0841	7.1	6.9
6/12/2011 0:00	6/13/2011 0:00	61,334	18,705.7	7.9	175.0	0.23	2.06	84.3	2,375.8	7,811.4	153.6	10,018.3	0.1579	7.0	6.9
6/13/2011 0:00	6/14/2011 0:00	62,969	23,347.9	9.5	192.7	0.47	3.91	92.3	1,895.2	7,603.0	150.0	9,854.3	0.1218	6.6	7.4
6/14/2011 0:00	6/15/2011 0:00	80,494	29,767.6	9.5	196.8	0.42	8.84	92.3	1,892.3	7,468.2	150.0	9,719.0	0.1178	6.9	8.2
6/15/2011 0:00	6/16/2011 0:00	82,568	30,527.9	9.6	197.2	0.19	11.06	92.4	1,891.1	7,700.1	150.0	9,566.2	0.1215	7.0	7.4
6/16/2011 0:00	6/17/2011 0:00	82,016	30,289.0	9.6	202.2	0.53	4.14	92.2	1,894.7	7,731.6	150.0	9,945.1	0.1225	7.0	7.4
6/17/2011 0:00	6/18/2011 0:00	80,345	29,927.8	9.8	203.5	0.56	4.28	92.3	1,894.5	7,689.9	150.0	9,982.2	0.1229	7.0	7.4
6/18/2011 0:00	6/19/2011 0:00	80,862	30,237.3	9.8	203.4	0.60	4.66	92.3	1,894.2	7,725.1	150.0	9,982.2	0.1229	7.0	7.4
6/19/2011 0:00	6/20/2011 0:00	80,813	30,258.6	9.8	205.8	0.62	4.76	92.3	1,894.1	7,700.1	150.0	9,955.1	0.1222	7.0	7.4
6/20/2011 0:00	6/21/2011 0:00	81,551	30,130.7	9.7	205.8	0.58	4.44	92.3	1,893.9	7,734.6	150.0	9,952.7	0.1230	7.0	7.4
6/21/2011 0:00	6/22/2011 0:00	82,040	29,643.4	9.8	209.4	0.55	4.29	92.3	1,893.2	7,746.5	150.0	10,006.7	0.1231	7.0	7.4
6/22/2011 0:00	6/23/2011 0:00	80,345	29,322.4	9.7	210.2	0.63	5.10	92.3	1,890.3	7,655.2	150.0	9,910.9	0.1231	7.0	7.4
6/23/2011 0:00	6/24/2011 0:00	80,386	29,334.7	9.7	208.9	0.67	5.79	92.4	1,888.4	7,678.2	150.0	9,926.8	0.1071	7.0	7.4
6/24/2011 0:00	6/25/2011 0:00	93,097	33,803.5	10.1	217.4	0.71	5.80	92.4	1,888.4	7,650.4	150.0	9,926.8	0.0714	7.0	7.4
6/25/2011 0:00	6/26/2011 0:00	139,538	50,701.4	11.5	233.8	0.82	6.12	92.5	1,881.9	7,690.4	150.0	9,962.8	0.0715	7.0	7.4
6/26/2011 0:00	6/27/2011 0:00	137,533	51,368.8	11.4	234.3	0.87	5.28	92.5	1,881.9	7,690.4	150.0	9,962.8	0.0715	7.0	7.4
6/27/2011 0:00	6/28/2011 0:00	138,731	51,690.7	11.5	239.1	0.85	4.92	92.5	1,882.5	7,690.4	150.0	9,962.8	0.0715	7.0	7.4
6/28/2011 0:00	6/29/2011 0:00	140,598	51,872.1	11.6	239.9	0.84	4.98	92.5	1,883.7	7,690.4	150.0	9,962.8	0.0715	7.0	7.4
6/29/2011 0:00	6/30/2011 0:00	143,920	52,696.6	11.7	244.3	0.84	5.14	92.5	1,882.4	7,690.4	150.0	10,073.2	0.0704	7.0	7.4
6/30/2011 0:00	7/1/2011 0:00	143,682	52,699.7	11.7	244.2	0.81	4.66	92.5	1,882.0	7,690.4	150.0	10,125.4	0.0706	7.0	7.3

FCCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAS

Process Parameters

ARI Environmental, Inc.

Notes:

(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(a)(2) Equation 2

DATE/TIME START	END	FCC Charge Rate BPH	Stack Flow FLUE GAS FLOW CORRECTED - EPA SCFM	Coke Burn Off (1) LBS/HR	Scrubber Pressure Drop IN/H2O	Scrubber Total Water Flow GPM	Liquid-to-Air Ratio	Scrubber Average Liquor pH	
6/6/2011 0:00	6/6/2011 1:00	75,725	151,133	55,061.9	11.9	10,107.4	0.0669	7.1	
6/6/2011 1:00	6/6/2011 2:00	76,384	150,546	54,947.9	11.9	10,106.7	0.0670	7.0	
6/6/2011 2:00	6/6/2011 3:00	76,685	150,510	54,848.5	11.9	10,110.5	0.0669	7.0	
6/6/2011 3:00	6/6/2011 4:00	76,973	150,166	54,668.8	12.0	10,115.1	0.0670	7.0	
6/6/2011 4:00	6/6/2011 5:00	76,965	150,016	54,536.1	12.0	10,100.2	0.0670	7.0	
6/6/2011 5:00	6/6/2011 6:00	76,997	150,201	54,494.5	12.0	10,112.4	0.0670	7.0	
6/6/2011 6:00	6/6/2011 7:00	77,008	149,564	54,093.0	12.0	10,096.6	0.0671	7.0	
6/6/2011 7:00	6/6/2011 8:00	76,995	149,457	53,905.8	11.9	10,100.8	0.0671	7.0	
6/6/2011 8:00	6/6/2011 9:00	76,978	149,386	53,911.8	11.9	10,156.8	0.0674	7.0	FCC Chrg Rate = 76,857
6/6/2011 9:00	6/6/2011 10:00	76,992	150,059	54,449.8	11.9	10,176.3	0.0672	7.0	Coke Burn Off = 55,267
6/6/2011 10:00	6/6/2011 11:00	77,004	150,491	54,833.6	11.8	10,191.2	0.0673	7.0	Scrubber Press. Drop = 11.9
6/6/2011 11:00	6/6/2011 12:00	76,967	150,731	55,236.5	11.8	10,191.8	0.0674	7.0	Scrubber Flow Rate = 10,177
6/6/2011 12:00	6/6/2011 13:00	76,996	150,745	55,743.9	11.8	10,194.9	0.0675	7.0	Liquid-to-Air Ratio = 0.0674
6/6/2011 13:00	6/6/2011 14:00	76,967	151,052	56,101.4	11.9	10,186.8	0.0675	7.0	Scrubber Liquor pH = 7.0
6/6/2011 14:00	6/6/2011 15:00	76,960	150,926	56,085.2	11.9	10,180.1	0.0675	7.0	
6/6/2011 15:00	6/6/2011 16:00	76,944	151,080	56,150.1	11.9	10,191.3	0.0675	7.0	
6/6/2011 16:00	6/6/2011 17:00	75,762	151,397	56,247.3	11.9	10,201.8	0.0675	7.0	
6/6/2011 17:00	6/6/2011 18:00	76,680	151,872	55,649.6	11.9	10,170.1	0.0674	7.0	
6/6/2011 18:00	6/6/2011 19:00	74,937	149,131	53,932.8	12.0	10,196.6	0.0681	7.0	
6/6/2011 19:00	6/6/2011 20:00	75,971	149,019	52,711.9	11.8	10,212.6	0.0682	7.0	
6/6/2011 20:00	6/6/2011 21:00	76,892	148,502	52,783.1	12.1	10,207.9	0.0680	6.9	
6/6/2011 21:00	6/6/2011 22:00	76,937	148,244	52,802.5	12.1	10,196.7	0.0681	6.9	
6/6/2011 22:00	6/6/2011 23:00	76,241	148,435	53,202.3	12.0	10,172.5	0.0679	6.9	
6/6/2011 23:00	6/7/2011 0:00	76,373	149,007	53,448.3	12.0	10,186.4	0.0678	7.0	
6/7/2011 0:00	6/7/2011 1:00	76,828	148,751	53,528.0	11.9	10,178.1	0.0677	7.0	
6/7/2011 1:00	6/7/2011 2:00	77,004	148,334	53,292.4	11.9	10,190.2	0.0679	7.1	
6/7/2011 2:00	6/7/2011 3:00	73,852	147,908	52,939.8	11.9	10,183.3	0.0680	7.1	
6/7/2011 3:00	6/7/2011 4:00	73,533	149,270	52,429.2	11.9	10,194.6	0.0679	7.1	
6/7/2011 4:00	6/7/2011 5:00	76,165	148,589	52,616.9	12.0	10,192.5	0.0680	7.0	
6/7/2011 5:00	6/7/2011 6:00	76,977	148,425	53,084.4	12.1	10,189.2	0.0678	7.0	
6/7/2011 6:00	6/7/2011 7:00	76,987	148,957	53,462.3	12.0	10,189.6	0.0675	6.9	
6/7/2011 7:00	6/7/2011 8:00	73,828	148,382	53,196.4	11.9	10,192.3	0.0679	6.9	
6/7/2011 8:00	6/7/2011 9:00	67,101	149,948	52,313.3	11.8	10,146.4	0.0677	7.1	
6/7/2011 9:00	6/7/2011 10:00	65,039	151,780	52,010.0	11.8	10,077.4	0.0671	7.3	
6/7/2011 10:00	6/7/2011 11:00	61,990	152,658	52,046.1	11.8	10,090.2	0.0672	7.5	
6/7/2011 11:00	6/7/2011 12:00	61,581	151,088	51,343.9	11.7	10,104.7	0.0683	7.1	
6/7/2011 12:00	6/7/2011 13:00	61,627	149,699	51,393.1	11.5	10,119.8	0.0692	6.7	
6/7/2011 13:00	6/7/2011 14:00	60,207	146,842	50,820.6	11.4	10,118.4	0.0705	6.8	
6/7/2011 14:00	6/7/2011 15:00	57,569	145,312	49,969.4	11.2	10,110.4	0.0715	7.0	FCC Chrg Rate = 55,925
6/7/2011 15:00	6/7/2011 16:00	54,281	145,772	49,541.3	11.1	10,130.9	0.0719	7.2	Coke Burn Off = 49,755
6/7/2011 16:00	6/7/2011 17:00	53,010	146,484	48,965.2	11.1	10,132.7	0.0720	6.8	Scrubber Press. Drop = 11.2
6/7/2011 17:00	6/7/2011 18:00	52,220	146,801	48,782.5	11.2	10,157.3	0.0721	6.8	Scrubber Flow Rate = 10,121
6/7/2011 18:00	6/7/2011 19:00	52,216	147,235	48,680.8	11.2	10,159.7	0.0719	6.8	Liquid-to-Air Ratio = 0.0717
6/7/2011 19:00	6/7/2011 20:00	52,237	147,340	48,549.5	11.3	10,160.4	0.0719	6.8	Scrubber Liquor pH = 7.1
6/7/2011 20:00	6/7/2011 21:00	52,226	147,201	48,412.6	11.3	10,166.3	0.0720	6.8	
6/7/2011 21:00	6/7/2011 22:00	52,268	147,318	48,398.8	11.3	10,162.8	0.0719	6.8	
6/7/2011 22:00	6/7/2011 23:00	52,232	146,781	48,073.2	11.3	10,161.4	0.0721	6.8	
6/7/2011 23:00	6/8/2011 0:00	52,205	146,824	47,863.5	11.3	10,159.3	0.0719	6.8	
6/8/2011 0:00	6/8/2011 1:00	52,221	147,059	47,879.5	11.2	10,168.7	0.0718	6.8	
6/8/2011 1:00	6/8/2011 2:00	52,215	146,663	47,688.6	11.3	10,163.8	0.0720	6.8	
6/8/2011 2:00	6/8/2011 3:00	52,208	146,786	47,761.4	11.2	10,163.7	0.0720	6.8	
6/8/2011 3:00	6/8/2011 4:00	52,195	146,724	47,789.2	11.2	10,161.8	0.0720	6.8	
6/8/2011 4:00	6/8/2011 5:00	52,192	146,668	47,728.0	11.2	10,166.2	0.0721	6.8	
6/8/2011 5:00	6/8/2011 6:00	52,198	146,516	47,587.6	11.2	10,166.8	0.0721	6.8	
6/8/2011 6:00	6/8/2011 7:00	52,248	146,602	47,523.5	11.2	10,150.3	0.0719	6.8	
6/8/2011 7:00	6/8/2011 8:00	52,246	146,732	47,533.6	11.3	10,201.6	0.0722	6.9	
6/8/2011 8:00	6/8/2011 9:00	52,230	147,295	47,784.2	11.3	10,239.2	0.0722	6.8	FCC Chrg Rate = 52,083
6/8/2011 9:00	6/8/2011 10:00	52,214	147,510	48,017.8	11.3	10,246.3	0.0723	6.8	Coke Burn Off = 47,896
6/8/2011 10:00	6/8/2011 11:00	52,214	143,436	47,112.7	11.0	10,229.8	0.0742	6.8	Scrubber Press. Drop = 11.0
6/8/2011 11:00	6/8/2011 12:00	52,235	141,796	47,207.5	10.9	10,234.4	0.0750	6.8	Scrubber Flow Rate = 10,233
6/8/2011 12:00	6/8/2011 13:00	51,970	142,743	47,943.7	11.0	10,223.2	0.0747	6.9	Liquid-to-Air Ratio = 0.0743
6/8/2011 13:00	6/8/2011 14:00	51,836	142,461	48,114.9	10.9	10,218.9	0.0749	6.8	Scrubber Liquor pH = 6.8
6/8/2011 14:00	6/8/2011 15:00	52,150	141,756	48,200.7	10.8	10,219.9	0.0751	6.8	
6/8/2011 15:00	6/8/2011 16:00	52,012	141,958	48,313.4	10.8	10,245.1	0.0751	6.9	
6/8/2011 16:00	6/8/2011 17:00	51,888	141,790	48,372.4	10.7	10,243.0	0.0751	6.8	
6/8/2011 17:00	6/8/2011 18:00	51,907	141,880	48,353.9	10.7	10,250.3	0.0751	6.9	
6/8/2011 18:00	6/8/2011 19:00	51,907	142,375	48,429.7	10.7	10,244.1	0.0747	6.9	
6/8/2011 19:00	6/8/2011 20:00	51,946	141,326	48,149.2	10.9	10,250.3	0.0751	6.8	
6/8/2011 20:00	6/8/2011 21:00	51,996	140,075	47,902.8	10.8	10,251.2	0.0755	6.8	
6/8/2011 21:00	6/8/2011 22:00	51,984	139,494	47,601.9	10.8	10,248.2	0.0756	6.9	
6/8/2011 22:00	6/8/2011 23:00	51,959	139,561	47,350.0	10.7	10,243.9	0.0754	6.9	
6/8/2011 23:00	6/9/2011 0:00	51,911	139,360	47,046.6	10.7	10,249.9	0.0755	6.9	
6/9/2011 0:00	6/9/2011 1:00	51,929	139,815	46,787.3	10.7	10,248.2	0.0754	6.9	
6/9/2011 1:00	6/9/2011 2:00	51,917	139,496	46,617.4	10.7	10,244.8	0.0756	6.8	
6/9/2011 2:00	6/9/2011 3:00	51,898	139,740	46,729.2	10.8	10,252.7	0.0754	6.8	
6/9/2011 3:00	6/9/2011 4:00	51,881	139,557	46,757.8	10.9	10,250.9	0.0754	6.8	
6/9/2011 4:00	6/9/2011 5:00	51,854	139,880	46,889.9	10.9	10,250.4	0.0752	6.9	

FCCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAS

Process Parameters
ARI Environmental, Inc.

Notes:

(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(a)(2) Equation 2

DATE/TIME START	END	FCC Charge Rate BPH	Stack Flow FLUE GAS FLOW CORRECTED - EPA SCFM	Coke Burn Off (1) LBS/HR	Scrubber Pressure Drop ARM Pressure Drop IN/H2O	Scrubber Total Water Flow GPM	Liquid-to-Air Ratio	Scrubber Average Liquor pH	Scrubber
6/9/2011 5:00	6/9/2011 6:00	51,855	140,964	47,216.8	11.0	10,249.2	0.0747	6.9	
6/9/2011 6:00	6/9/2011 7:00	51,836	140,841	47,100.6	10.9	10,253.5	0.0749	6.9	
6/9/2011 7:00	6/9/2011 8:00	51,777	140,728	46,949.9	10.9	10,132.4	0.0740	6.9	FCC Chrg Rate = 51,842 Coke Burn Off = 47,969 Scrubber Press. Drop = 10.9 Scrubber Flow Rate = 10,144 Liquid-to-Air Ratio = 0.0739 Scrubber Liquor pH = 6.9
6/9/2011 8:00	6/9/2011 9:00	51,681	140,489	46,893.5	10.9	10,133.3	0.0741	6.9	
6/9/2011 9:00	6/9/2011 10:00	51,725	140,928	47,128.2	10.9	10,149.1	0.0741	6.9	
6/9/2011 10:00	6/9/2011 11:00	51,611	141,766	47,557.3	10.9	10,147.5	0.0738	6.9	
6/9/2011 11:00	6/9/2011 12:00	51,608	141,762	47,816.7	10.9	10,134.2	0.0739	6.9	
6/9/2011 12:00	6/9/2011 13:00	51,854	142,684	48,487.1	10.9	10,152.9	0.0738	6.9	
6/9/2011 13:00	6/9/2011 14:00	51,994	142,664	48,678.6	11.0	10,146.0	0.0738	6.9	
6/9/2011 14:00	6/9/2011 15:00	52,059	142,748	48,735.8	10.9	10,137.6	0.0737	6.9	
6/9/2011 15:00	6/9/2011 16:00	52,087	142,369	48,722.1	10.9	10,150.5	0.0739	6.9	
6/9/2011 16:00	6/9/2011 17:00	52,023	142,599	48,717.9	10.9	10,152.6	0.0738	6.9	
6/9/2011 17:00	6/9/2011 18:00	51,987	142,266	48,402.7	10.9	10,166.5	0.0740	6.9	
6/9/2011 18:00	6/9/2011 19:00	51,977	142,339	48,250.3	10.9	10,160.0	0.0739	6.9	
6/9/2011 19:00	6/9/2011 20:00	51,900	142,528	48,154.1	11.0	10,163.6	0.0737	6.9	
6/9/2011 20:00	6/9/2011 21:00	51,892	142,305	47,863.0	11.0	10,169.7	0.0739	6.9	
6/9/2011 21:00	6/9/2011 22:00	51,865	142,277	47,677.6	11.0	10,175.6	0.0739	6.9	
6/9/2011 22:00	6/9/2011 23:00	51,817	142,156	47,449.8	11.0	10,167.8	0.0738	6.9	
6/9/2011 23:00	6/10/2011 0:00	51,828	141,647	47,169.7	11.0	10,173.9	0.0740	6.9	
6/10/2011 0:00	6/10/2011 1:00	51,776	141,668	47,035.4	11.0	10,180.9	0.0740	6.9	
6/10/2011 1:00	6/10/2011 2:00	51,751	141,326	46,810.1	11.0	10,180.0	0.0742	6.9	
6/10/2011 2:00	6/10/2011 3:00	51,757	141,562	46,858.6	11.0	10,178.0	0.0740	6.9	
6/10/2011 3:00	6/10/2011 4:00	51,752	141,570	46,835.2	11.0	10,176.2	0.0740	6.9	
6/10/2011 4:00	6/10/2011 5:00	51,725	141,613	46,870.7	11.0	10,179.5	0.0740	6.9	
6/10/2011 5:00	6/10/2011 6:00	51,739	141,918	47,032.2	11.0	10,190.5	0.0739	6.9	
6/10/2011 6:00	6/10/2011 7:00	51,738	141,549	46,846.0	11.0	10,177.9	0.0740	6.9	
6/10/2011 7:00	6/10/2011 8:00	51,676	141,084	46,606.9	11.0	10,211.9	0.0745	6.9	FCC Chrg Rate = 51,642 Coke Burn Off = 47,933 Scrubber Press. Drop = 10.9 Scrubber Flow Rate = 10,263 Liquid-to-Air Ratio = 0.0745 Scrubber Liquor pH = 6.9
6/10/2011 8:00	6/10/2011 9:00	51,666	141,236	46,714.9	10.9	10,267.7	0.0748	6.9	
6/10/2011 9:00	6/10/2011 10:00	51,678	141,830	47,105.7	10.9	10,270.5	0.0746	6.9	
6/10/2011 10:00	6/10/2011 11:00	51,671	142,782	47,674.5	10.9	10,270.6	0.0742	6.9	
6/10/2011 11:00	6/10/2011 12:00	51,673	142,559	47,906.3	11.0	10,267.7	0.0745	6.9	
6/10/2011 12:00	6/10/2011 13:00	51,627	143,311	48,450.9	11.0	10,269.7	0.0743	6.9	
6/10/2011 13:00	6/10/2011 14:00	51,637	143,430	48,666.3	11.0	10,252.9	0.0742	6.9	
6/10/2011 14:00	6/10/2011 15:00	51,591	143,233	48,791.8	10.9	10,255.6	0.0744	6.9	
6/10/2011 15:00	6/10/2011 16:00	51,604	143,104	48,759.5	10.9	10,283.2	0.0747	6.9	
6/10/2011 16:00	6/10/2011 17:00	51,597	143,210	48,656.3	10.9	10,276.2	0.0745	6.9	
6/10/2011 17:00	6/10/2011 18:00	51,612	142,738	48,363.2	10.9	10,271.8	0.0747	6.9	
6/10/2011 18:00	6/10/2011 19:00	51,640	142,842	48,244.3	10.9	10,279.2	0.0746	6.9	
6/10/2011 19:00	6/10/2011 20:00	51,619	142,486	48,067.5	11.0	10,282.3	0.0747	6.9	
6/10/2011 20:00	6/10/2011 21:00	51,627	142,558	47,995.9	11.0	10,283.9	0.0747	6.9	
6/10/2011 21:00	6/10/2011 22:00	51,622	142,420	47,761.5	11.0	10,273.6	0.0746	6.9	
6/10/2011 22:00	6/10/2011 23:00	51,604	142,303	47,586.7	11.0	10,287.8	0.0747	6.9	
6/10/2011 23:00	6/11/2011 0:00	51,587	142,519	47,558.7	11.0	10,287.9	0.0745	6.9	
6/11/2011 0:00	6/11/2011 1:00	51,582	142,408	47,543.5	10.9	10,296.8	0.0746	6.9	
6/11/2011 1:00	6/11/2011 2:00	51,563	142,422	47,556.4	10.9	10,301.7	0.0746	6.9	
6/11/2011 2:00	6/11/2011 3:00	51,555	142,508	47,571.3	10.9	10,298.0	0.0746	6.9	
6/11/2011 3:00	6/11/2011 4:00	51,550	142,546	47,609.0	10.9	10,301.6	0.0746	6.9	
6/11/2011 4:00	6/11/2011 5:00	51,573	142,313	47,488.4	10.9	10,291.3	0.0746	6.9	
6/11/2011 5:00	6/11/2011 6:00	51,547	141,870	47,062.9	10.9	10,290.8	0.0747	6.9	
6/11/2011 6:00	6/11/2011 7:00	51,493	141,827	46,924.7	10.8	10,284.0	0.0744	6.9	
6/11/2011 7:00	6/11/2011 8:00	51,515	141,264	46,457.1	10.7	10,291.3	0.0748	6.9	
6/11/2011 8:00	6/11/2011 9:00	51,463	141,096	46,364.9	10.7	10,183.0	0.0741	6.8	
6/11/2011 9:00	6/11/2011 10:00	51,458	141,397	46,650.5	10.7	10,185.5	0.0740	6.9	
6/11/2011 10:00	6/11/2011 11:00	51,392	142,844	47,305.8	10.7	10,183.5	0.0733	6.9	
6/11/2011 11:00	6/11/2011 12:00	51,398	142,389	47,399.5	10.7	10,177.2	0.0737	6.9	
6/11/2011 12:00	6/11/2011 13:00	51,430	142,987	48,020.8	10.8	10,166.6	0.0736	6.9	
6/11/2011 13:00	6/11/2011 14:00	51,472	143,557	48,536.9	10.9	10,158.2	0.0734	6.9	
6/11/2011 14:00	6/11/2011 15:00	51,447	143,402	48,685.7	10.9	10,163.1	0.0737	6.9	
6/11/2011 15:00	6/11/2011 16:00	51,376	143,667	48,770.8	10.8	10,176.7	0.0737	6.9	
6/11/2011 16:00	6/11/2011 17:00	51,362	143,343	48,582.8	10.8	10,192.2	0.0740	6.9	
6/11/2011 17:00	6/11/2011 18:00	51,379	143,705	48,693.9	10.8	10,189.8	0.0737	6.9	
6/11/2011 18:00	6/11/2011 19:00	51,409	143,942	48,869.8	10.8	10,193.2	0.0736	6.9	
6/11/2011 19:00	6/11/2011 20:00	51,396	143,598	48,785.9	10.9	10,190.5	0.0738	6.9	
6/11/2011 20:00	6/11/2011 21:00	51,417	143,868	48,808.7	10.9	10,199.1	0.0736	6.9	
6/11/2011 21:00	6/11/2011 22:00	44,246	115,206	38,978.9	9.1	10,441.9	0.0940	6.7	
6/11/2011 22:00	6/11/2011 23:00	21,347	(3,514)	(1,182.6)	(0.3)	14,352.9	-4.2292	8.2	
6/11/2011 23:00	6/12/2011 0:00	22,936	11,501	3,444.2	(0.1)	14,334.7	1.3100	8.6	
6/12/2011 0:00	6/12/2011 1:00	23,740	24,788	5,827.2	0.5	14,202.6	0.5913	8.4	
6/12/2011 1:00	6/12/2011 2:00	24,271	20,012	4,556.2	0.0	14,161.7	0.7247	8.3	
6/12/2011 2:00	6/12/2011 3:00	23,996	64,823	14,573.5	3.0	13,234.5	0.2084	7.4	
6/12/2011 3:00	6/12/2011 4:00	24,125	70,407	17,236.2	8.9	9,974.4	0.1475	6.8	
6/12/2011 4:00	6/12/2011 5:00	23,929	71,609	17,795.8	8.8	10,041.9	0.1467	6.6	
6/12/2011 5:00	6/12/2011 6:00	23,875	66,621	16,426.4	8.7	10,053.0	0.1575	6.8	
6/12/2011 6:00	6/12/2011 7:00	23,832	64,882	16,202.4	8.7	10,044.3	0.1621	6.5	
6/12/2011 7:00	6/12/2011 8:00	24,251	66,885	17,007.2	8.9	10,061.6	0.1584	6.8	
6/12/2011 8:00	6/12/2011 9:00	24,100	64,971	16,420.8	9.0	10,058.0	0.1628	7.0	
6/12/2011 9:00	6/12/2011 10:00	24,200	66,043	16,808.6	8.9	10,074.3	0.1607	6.8	
6/12/2011 10:00	6/12/2011 11:00	24,154	65,748	16,971.8	8.8	10,067.0	0.1619	6.8	

FCCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAs

Process Parameters

ARI Environmental, Inc.

Notes:

(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(a)(2) Equation 2

DATE/TIME START	END	FCC Charge Rate BPH	Stack Flow FLUE GAS FLOW CORRECTED - EPA SGFM	Coke Burn Off (1) LBS/HR	Scrubber Pressure Drop IN/H2O	Scrubber Total Water Flow GPM	Scrubber Liquid-to-Air Ratio	Scrubber Average Liquor pH
6/12/2011 11:00	6/12/2011 12:00	25,976	65,008	16,918.5	8.7	10,064.3	0.1641	6.8
6/12/2011 12:00	6/12/2011 13:00	30,931	64,687	18,972.9	8.7	10,077.5	0.1688	6.7
6/12/2011 13:00	6/12/2011 14:00	36,494	63,279	22,916.2	8.7	10,078.0	0.1633	6.0
6/12/2011 14:00	6/12/2011 15:00	44,056	63,883	23,461.6	8.8	10,042.4	0.1589	7.0
6/12/2011 15:00	6/12/2011 16:00	47,296	62,076	23,066.2	8.9	10,051.1	0.1616	7.0
6/12/2011 16:00	6/12/2011 17:00	48,215	62,771	23,556.1	8.8	10,047.5	0.1588	6.9
6/12/2011 17:00	6/12/2011 18:00	47,255	62,620	23,447.5	8.9	10,045.6	0.1593	6.9
6/12/2011 18:00	6/12/2011 19:00	47,080	62,686	23,618.0	9.0	10,050.4	0.1592	6.8
6/12/2011 19:00	6/12/2011 20:00	47,364	63,557	23,212.1	9.0	10,029.9	0.1583	6.8
6/12/2011 20:00	6/12/2011 21:00	47,509	63,664	23,319.2	9.1	10,036.1	0.1577	6.8
6/12/2011 21:00	6/12/2011 22:00	47,871	63,478	23,223.5	9.1	10,031.5	0.1580	6.6
6/12/2011 22:00	6/12/2011 23:00	47,947	64,133	23,935.1	9.1	9,969.4	0.1538	6.5
6/12/2011 23:00	6/13/2011 0:00	48,008	63,953	23,734.2	9.2	9,937.9	0.1540	7.6
6/13/2011 0:00	6/13/2011 1:00	47,953	63,580	23,252.8	9.4	9,959.4	0.1562	7.6
6/13/2011 1:00	6/13/2011 2:00	48,445	64,520	23,473.4	9.4	9,967.4	0.1545	7.4
6/13/2011 2:00	6/13/2011 3:00	48,700	64,094	23,467.1	9.4	9,987.2	0.1554	7.1
6/13/2011 3:00	6/13/2011 4:00	48,810	63,933	23,470.9	9.4	10,016.0	0.1558	6.7
6/13/2011 4:00	6/13/2011 5:00	48,625	63,620	23,359.6	9.4	10,029.8	0.1562	6.6
6/13/2011 5:00	6/13/2011 6:00	48,566	63,674	23,350.9	9.4	10,013.0	0.1554	6.6
6/13/2011 6:00	6/13/2011 7:00	48,513	63,383	23,135.5	9.4	10,017.1	0.1562	6.8
6/13/2011 7:00	6/13/2011 8:00	48,496	62,919	22,874.4	9.5	9,970.7	0.1569	6.9
6/13/2011 8:00	6/13/2011 9:00	48,520	62,911	22,898.8	9.4	10,036.4	0.1580	7.0
Run No. FCCU-SB-1								
6/13/2011 9:00	6/13/2011 10:00	48,828	61,586	22,424.5	9.5	10,088.6	0.1626	7.0
6/13/2011 10:00	6/13/2011 11:00	49,572	60,346	22,187.0	9.6	10,074.7	0.1653	6.9
6/13/2011 11:00	6/13/2011 12:00	49,712	60,618	22,507.0	9.5	10,068.1	0.1644	6.8
6/13/2011 12:00	6/13/2011 13:00	50,093	62,090	23,337.8	9.5	10,070.1	0.1607	6.8
6/13/2011 13:00	6/13/2011 14:00	50,064	61,297	22,999.5	9.5	10,046.2	0.1629	6.5
6/13/2011 14:00	6/13/2011 15:00	49,374	61,232	22,970.4	9.4	10,006.3	0.1624	6.7
6/13/2011 15:00	6/13/2011 16:00	50,623	60,070	22,603.3	9.5	9,983.2	0.1648	7.6
6/13/2011 16:00	6/13/2011 17:00	50,706	60,615	22,828.0	9.4	10,009.3	0.1636	7.5
6/13/2011 17:00	6/13/2011 18:00	50,761	62,133	23,377.9	9.3	9,974.7	0.1592	7.4
Run No. FCCU-SB-2								
6/13/2011 18:00	6/13/2011 19:00	50,471	64,087	24,233.1	9.3	10,000.1	0.1541	7.1
6/13/2011 19:00	6/13/2011 20:00	50,009	64,582	24,381.2	9.4	10,032.7	0.1536	6.9
6/13/2011 20:00	6/13/2011 21:00	49,867	64,767	24,451.4	9.5	10,044.3	0.1534	6.7
6/13/2011 21:00	6/13/2011 22:00	49,905	65,603	24,510.1	9.5	10,025.6	0.1521	6.6
6/13/2011 22:00	6/13/2011 23:00	49,920	65,378	24,352.5	9.6	10,013.9	0.1524	6.7
6/13/2011 23:00	6/14/2011 0:00	49,954	64,249	23,875.4	9.5	10,004.7	0.1549	6.9
6/14/2011 0:00	6/14/2011 1:00	49,940	61,324	22,784.4	9.5	10,009.5	0.1622	7.0
6/14/2011 1:00	6/14/2011 2:00	50,178	70,317	26,022.9	9.5	10,011.7	0.1417	7.0
6/14/2011 2:00	6/14/2011 3:00	51,781	80,734	29,647.4	9.4	10,010.8	0.1238	6.9
6/14/2011 3:00	6/14/2011 4:00	52,124	81,100	29,931.9	9.5	10,014.6	0.1228	6.9
6/14/2011 4:00	6/14/2011 5:00	52,168	81,379	29,820.5	9.5	9,987.2	0.1219	6.8
6/14/2011 5:00	6/14/2011 6:00	52,256	81,075	29,601.6	9.5	10,018.1	0.1224	6.8
6/14/2011 6:00	6/14/2011 7:00	52,281	81,249	29,520.6	9.5	10,012.8	0.1220	6.8
Run No. FCCU-SB-3								
6/14/2011 7:00	6/14/2011 8:00	52,275	80,475	29,185.5	9.5	10,014.6	0.1232	6.9
6/14/2011 8:00	6/14/2011 9:00	52,804	80,515	29,410.2	9.6	9,967.4	0.1222	6.9
6/14/2011 9:00	6/14/2011 10:00	53,282	81,156	29,593.1	9.6	9,921.5	0.1210	6.9
6/14/2011 10:00	6/14/2011 11:00	54,137	81,907	29,955.5	9.6	9,916.2	0.1201	6.9
6/14/2011 11:00	6/14/2011 12:00	55,783	81,860	30,249.4	9.5	9,921.1	0.1201	6.8
6/14/2011 12:00	6/14/2011 13:00	56,113	81,843	30,733.8	9.6	9,917.8	0.1198	6.8
6/14/2011 13:00	6/14/2011 14:00	55,496	82,218	30,907.0	9.6	9,893.2	0.1192	6.4
6/14/2011 14:00	6/14/2011 15:00	53,976	82,562	30,801.4	9.5	9,852.2	0.1191	6.4
6/14/2011 15:00	6/14/2011 16:00	54,973	82,638	30,800.9	9.4	9,832.4	0.1188	7.5
6/14/2011 16:00	6/14/2011 17:00	55,824	82,535	30,855.3	9.4	9,808.3	0.1184	7.1
6/14/2011 17:00	6/14/2011 18:00	55,832	82,811	30,738.6	9.4	9,770.4	0.1182	7.2
6/14/2011 18:00	6/14/2011 19:00	55,842	82,921	30,797.9	9.4	9,729.2	0.1175	7.3
6/14/2011 19:00	6/14/2011 20:00	55,857	82,579	30,678.8	9.5	9,682.4	0.1174	7.3
6/14/2011 20:00	6/14/2011 21:00	56,072	82,319	30,577.2	9.6	9,629.5	0.1171	7.4
6/14/2011 21:00	6/14/2011 22:00	57,439	82,111	30,573.1	9.6	9,578.4	0.1165	7.5
6/14/2011 22:00	6/14/2011 23:00	56,137	82,159	30,523.5	9.6	9,513.5	0.1155	7.5
6/14/2011 23:00	6/15/2011 0:00	56,089	82,133	30,428.5	9.5	9,490.7	0.1153	7.6
6/15/2011 0:00	6/15/2011 1:00	56,077	82,170	30,328.9	9.6	9,473.0	0.1152	7.6
6/15/2011 1:00	6/15/2011 2:00	55,896	82,139	30,296.7	9.6	9,459.4	0.1151	7.6
6/15/2011 2:00	6/15/2011 3:00	55,862	82,417	30,303.9	9.6	9,452.4	0.1147	7.6
6/15/2011 3:00	6/15/2011 4:00	55,773	82,273	30,235.7	9.6	9,453.5	0.1149	7.5
6/15/2011 4:00	6/15/2011 5:00	55,684	82,129	30,096.9	9.6	9,435.5	0.1149	7.5
6/15/2011 5:00	6/15/2011 6:00	57,037	81,897	30,154.4	9.6	9,434.7	0.1149	7.5
6/15/2011 6:00	6/15/2011 7:00	57,580	81,850	30,328.9	9.7	9,439.1	0.1147	7.5
6/15/2011 7:00	6/15/2011 8:00	57,834	82,044	30,303.6	9.8	9,449.6	0.1146	7.5
6/15/2011 8:00	6/15/2011 9:00	57,725	82,103	30,292.1	9.8	9,509.3	0.1152	7.4
6/15/2011 9:00	6/15/2011 10:00	57,313	82,490	30,411.0	9.8	9,520.1	0.1147	8.5
6/15/2011 10:00	6/15/2011 11:00	56,590	83,325	30,560.4	9.7	9,570.8	0.1145	9.3
6/15/2011 11:00	6/15/2011 12:00	56,655	83,159	30,610.5	9.7	9,639.3	0.1156	8.7
6/15/2011 12:00	6/15/2011 13:00	57,173	82,669	30,831.1	9.7	9,708.0	0.1169	8.5
6/15/2011 13:00	6/15/2011 14:00	57,267	82,467	30,874.2	9.7	9,799.5	0.1183	8.2
6/15/2011 14:00	6/15/2011 15:00	57,096	82,452	30,853.9	9.5	9,898.9	0.1195	7.7

FCC Chrg Rate = 49,970
Coke Burn Off = 23,302
Scrubber Press. Drop = 9.5
Scrubber Flow Rate = 10,036
Liquid-to-Air Ratio = 0.1629
Scrubber Liquor pH = 7.0

Run No. FCCU-SB-1

Coke Burn Off = 22,372.9

Run No. FCCU-SB-2

Coke Burn Off = 22,857.7

Run No. FCCU-SB-3

FCC Chrg Rate = 53,656
Coke Burn Off = 29,679
Scrubber Press. Drop = 9.6
Scrubber Flow Rate = 9,948
Liquid-to-Air Ratio = 0.1213
Scrubber Liquor pH = 6.9

FCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAs
Process Parameters
ARI Environmental, Inc.
Notes:
(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(a)(2) Equation 2

FCU WET GAS SCRUBBER HOURLY DATA - 8/6/11 @ 00:00 to 8/15/11 @ 15:00

DATE/TIME START	END	FCC Charge Rate BBL	15AI3001AP V	15AI3002A PV	15AI3003AP V	FCU014 FLUE GAS CLR OUT DEG F	15PI0005 FCU014 FLUE GAS CLR OUT PSIG	15FX1090.PV A/B BLWR TOTAL AIR MLB/HR	Qa A/B BLWR AIR =	O2 Injection OXYGEN TO SPARGER MLB/HR	O2 Injection OXYGEN TO SPARGER MLB/HR	O2 Injection OXYGEN TO SPARGER MLB/HR	Calc	Calc	%Oxy	Calc	% O2 in Coke Burn Air - CO Volume
			REGEN CO MOLE%	REGEN CO2 MOLE%	REGEN O2 MOLE%	FLUE GAS CLR OUT DEG F	FCU014 FLUE GAS CLR OUT PSIG	FLUE GAS TEMP K	SCFM	OXYGEN TO SPARGER MLB/HR	OXYGEN TO SPARGER MLB/HR	OXYGEN TO SPARGER MLB/HR					
6/6/2011 0:00	6/6/2011 1:00	75,725	-	19.6	1.4	452.1	0.65	504.6	151,062.5	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 1:00	6/6/2011 2:00	76,384	-	19.6	1.3	453.1	0.65	504.8	150,904.9	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 2:00	6/6/2011 3:00	76,685	-	19.5	1.2	453.6	0.66	505.0	151,057.8	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 3:00	6/6/2011 4:00	76,973	-	19.4	1.2	454.7	0.67	505.6	150,885.0	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 4:00	6/6/2011 5:00	76,965	-	19.4	1.2	455.0	0.67	505.8	150,702.3	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 5:00	6/6/2011 6:00	76,997	-	19.4	1.2	455.0	0.67	505.8	150,949.1	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 6:00	6/6/2011 7:00	77,008	-	19.3	1.2	453.3	0.66	504.9	150,501.3	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 7:00	6/6/2011 8:00	76,995	-	19.2	1.2	453.2	0.66	504.8	150,638.2	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 8:00	6/6/2011 9:00	76,978	-	19.2	1.1	453.4	0.66	504.9	150,729.1	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 9:00	6/6/2011 10:00	76,992	-	19.3	1.1	453.8	0.66	505.1	151,326.4	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 10:00	6/6/2011 11:00	77,004	-	19.4	1.1	454.2	0.66	505.1	151,325.7	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 11:00	6/6/2011 12:00	76,967	-	19.6	1.1	454.2	0.66	505.1	151,268.8	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 12:00	6/6/2011 13:00	76,996	-	19.8	1.0	454.0	0.65	505.3	151,053.3	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 13:00	6/6/2011 14:00	76,967	-	19.8	1.1	454.0	0.66	505.3	150,978.3	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 14:00	6/6/2011 15:00	76,960	-	20.0	1.1	453.2	0.65	504.8	150,773.0	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 15:00	6/6/2011 16:00	76,944	-	20.0	1.1	454.0	0.65	505.3	150,942.3	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 16:00	6/6/2011 17:00	76,962	-	20.0	1.1	453.6	0.65	505.1	151,217.0	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 17:00	6/6/2011 18:00	76,680	-	19.9	1.6	449.9	0.66	502.7	150,958.9	-	-	-	0.0	0.0	1	0.00	1
6/6/2011 18:00	6/6/2011 19:00	74,937	-	19.3	1.4	449.9	0.62	503.0	149,698.7	-	-	-	0.0	0.0	0	0.00	0
6/6/2011 19:00	6/6/2011 20:00	75,971	-	18.9	1.7	452.7	0.60	504.6	149,829.6	-	-	-	0.0	0.0	0	0.00	0
6/6/2011 20:00	6/6/2011 21:00	76,892	-	18.8	1.3	453.2	0.66	504.8	150,086.5	-	-	-	0.0	0.0	0	0.00	0
6/6/2011 21:00	6/6/2011 22:00	76,937	-	18.9	1.3	453.6	0.67	505.1	149,756.9	-	-	-	0.0	0.0	0	0.00	0
6/6/2011 22:00	6/6/2011 23:00	76,241	-	19.0	1.2	452.9	0.66	504.7	149,900.9	-	-	-	0.0	0.0	0	0.00	0
6/6/2011 23:00	6/7/2011 0:00	76,271	-	19.1	1.3	454.0	0.66	505.3	150,273.6	-	-	-	0.0	0.0	0	0.00	0
6/7/2011 0:00	6/7/2011 1:00	76,828	-	19.1	1.1	454.0	0.66	505.3	150,268.7	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 1:00	6/7/2011 2:00	77,004	-	19.0	1.1	454.0	0.66	505.2	150,114.7	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 2:00	6/7/2011 3:00	73,533	-	18.9	1.1	453.8	0.66	505.6	149,686.5	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 3:00	6/7/2011 4:00	73,533	-	18.7	1.2	454.6	0.66	505.9	149,095.8	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 4:00	6/7/2011 5:00	76,165	-	18.8	1.3	455.1	0.66	505.7	149,942.3	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 5:00	6/7/2011 6:00	76,997	-	18.9	1.1	454.9	0.67	505.7	150,256.1	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 6:00	6/7/2011 7:00	73,828	-	19.0	1.1	452.8	0.66	504.6	150,393.3	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 7:00	6/7/2011 8:00	73,828	-	18.8	2.3	452.5	0.66	504.4	150,150.4	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 8:00	6/7/2011 9:00	65,039	-	18.7	3.1	452.7	0.66	504.5	149,855.4	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 9:00	6/7/2011 10:00	61,990	-	18.7	3.5	452.8	0.66	504.6	150,284.9	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 10:00	6/7/2011 11:00	61,581	-	18.8	3.9	452.8	0.65	504.6	147,855.2	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 11:00	6/7/2011 12:00	61,627	-	19.0	3.7	452.0	0.64	504.2	146,318.4	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 12:00	6/7/2011 13:00	60,207	-	19.2	3.6	450.6	0.63	503.4	145,586.9	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 13:00	6/7/2011 14:00	57,569	-	19.2	3.9	449.0	0.62	502.9	143,391.0	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 14:00	6/7/2011 15:00	54,281	-	19.1	4.5	449.7	0.62	502.9	140,952.0	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 15:00	6/7/2011 16:00	53,010	-	19.0	5.1	449.8	0.62	502.9	140,733.0	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 16:00	6/7/2011 17:00	52,220	-	18.9	5.3	449.8	0.62	502.9	140,827.4	-	-	-	0.0	0.0	1	0.00	1
6/7/2011 17:00	6/7/2011 18:00	52,216	-	18.8	5.4	450.2	0.62	503.2	141,214.8	-	-	-	0.0	0.0	0	0.00	0
6/7/2011 18:00	6/7/2011 19:00	52,237	-	18.8	5.4	450.3	0.62	503.2	141,332.1	-	-	-	0.0	0.0	0	0.00	0
6/7/2011 19:00	6/7/2011 20:00	52,226	-	18.8	5.5	450.4	0.62	503.2	141,187.4	-	-	-	0.0	0.0	0	0.00	0
6/7/2011 20:00	6/7/2011 21:00	52,268	-	18.7	5.5	450.2	0.62	502.6	141,360.6	-	-	-	0.0	0.0	0	0.00	0
6/7/2011 21:00	6/7/2011 22:00	52,232	-	18.6	5.5	448.9	0.62	502.4	140,981.8	-	-	-	0.0	0.0	0	0.00	0
6/7/2011 22:00	6/7/2011 23:00	52,205	-	18.5	5.5	449.6	0.62	502.9	141,532.4	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 0:00	6/8/2011 1:00	52,221	-	18.5	5.5	449.6	0.62	503.1	141,164.5	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 1:00	6/8/2011 2:00	52,215	-	18.5	5.5	450.0	0.62	503.1	141,251.8	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 2:00	6/8/2011 3:00	52,208	-	18.5	5.5	450.3	0.62	503.2	141,159.5	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 3:00	6/8/2011 4:00	52,195	-	18.5	5.5	450.1	0.62	503.1	141,072.1	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 4:00	6/8/2011 5:00	52,192	-	18.5	5.5	449.5	0.62	502.8	140,970.0	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 5:00	6/8/2011 6:00	52,198	-	18.4	5.6	448.2	0.62	502.1	141,104.2	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 6:00	6/8/2011 7:00	52,248	-	18.4	5.6	448.2	0.62	502.5	141,284.2	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 7:00	6/8/2011 8:00	52,246	-	18.4	5.5	448.7	0.62	502.9	141,750.9	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 8:00	6/8/2011 9:00	52,230	-	18.4	5.5	448.7	0.62	502.9	141,784.5	-	-	-	0.0	0.0	1	0.00	1
6/8/2011 9:00	6/8/2011 10:00	52,214	-	18.5	5.5	449.8	0.62	502.9	141,784.5	-	-	-	0.0	0.0	1	0.00	1

FCCU-1241 Wet Gas Scrubber Performance Testing / CEMS BATAS

Process Parameters
ARI Environmental, Inc.

Notes:

(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(a)(2) Equation 2

FCCU WET GAS SCRUBBER HOURLY DATA - 6/8/11 @ 00:00 to 6/15/11 @ 15:00

DATE/TIME	END	15F11398.PV	15A13001A.PV	15A13002A.PV	15A13003A.PV	15T10003.PV	15T10004.PV	15T10005.PV	FLUE GAS TEMP °C	FLUE GAS CLR OUT PSIG	A/B BLWR TOTAL AIR MLB/HR	Qa	O2 Injection	O2 Injection	O2 Injection	%Oxy
START		FCC Charge Rate BPH	REGEN CO2 MOLE%	REGEN CO2 MOLE%	REGEN O2 MOLE%	FLUE GAS CLR OUT DEG F	FLUE GAS CLR OUT PSIG	FLUE GAS TEMP °C					O2 SPARGER MLB/HR	O2 SPARGER MLB/HR	O2 SPARGER MLB/HR	%Oxy
6/8/2011 10:00	6/8/2011 11:00	52,214	-	18.7	5.4	448.3	0.60	502.1	619.4	137,863.0	137,863.0	0.0	0.0	0.0	0.0	0.00
6/8/2011 11:00	6/8/2011 12:00	52,235	-	18.9	5.1	448.3	0.60	502.1	619.4	136,402.4	136,402.4	0.0	0.0	0.0	0.0	0.00
6/8/2011 12:00	6/8/2011 13:00	51,970	-	19.1	5.1	448.6	0.60	502.3	614.9	136,846.8	136,846.8	0.0	0.0	0.0	0.0	0.00
6/8/2011 13:00	6/8/2011 14:00	51,836	-	19.3	5.1	448.5	0.59	502.2	613.0	136,424.7	136,424.7	0.0	0.0	0.0	0.0	0.00
6/8/2011 14:00	6/8/2011 15:00	52,150	-	19.3	4.9	447.3	0.60	501.6	611.1	136,008.3	136,008.3	0.0	0.0	0.0	0.0	0.00
6/8/2011 15:00	6/8/2011 16:00	52,012	-	19.3	4.8	447.5	0.60	501.7	611.7	136,355.4	136,355.4	0.0	0.0	0.0	0.0	0.00
6/8/2011 16:00	6/8/2011 17:00	51,888	-	19.3	4.7	447.8	0.60	501.9	613.0	136,431.2	136,431.2	0.0	0.0	0.0	0.0	0.00
6/8/2011 17:00	6/8/2011 18:00	51,907	-	19.3	4.7	447.9	0.60	501.9	613.4	136,524.8	136,524.8	0.0	0.0	0.0	0.0	0.00
6/8/2011 18:00	6/8/2011 19:00	51,907	-	19.3	4.7	447.9	0.60	501.9	613.4	137,072.8	137,072.8	0.0	0.0	0.0	0.0	0.00
6/8/2011 19:00	6/8/2011 20:00	51,946	-	19.2	4.5	447.6	0.60	502.0	613.0	136,432.0	136,432.0	0.0	0.0	0.0	0.0	0.00
6/8/2011 20:00	6/8/2011 21:00	51,996	-	19.2	4.2	447.6	0.60	501.8	610.4	135,846.5	135,846.5	0.0	0.0	0.0	0.0	0.00
6/8/2011 21:00	6/8/2011 22:00	51,984	-	19.1	4.1	446.7	0.59	501.3	609.4	135,631.0	135,631.0	0.0	0.0	0.0	0.0	0.00
6/8/2011 22:00	6/8/2011 23:00	51,959	-	18.9	4.2	445.4	0.59	500.5	610.3	135,823.0	135,823.0	0.0	0.0	0.0	0.0	0.00
6/8/2011 23:00	6/9/2011 00:00	51,911	-	18.8	4.2	445.8	0.59	500.8	609.9	135,734.3	135,734.3	0.0	0.0	0.0	0.0	0.00
6/9/2011 00:00	6/9/2011 01:00	51,929	-	18.7	4.5	446.6	0.60	501.2	610.5	135,885.9	135,885.9	0.0	0.0	0.0	0.0	0.00
6/9/2011 01:00	6/9/2011 02:00	51,917	-	18.7	4.5	446.5	0.60	501.1	609.2	135,576.0	135,576.0	0.0	0.0	0.0	0.0	0.00
6/9/2011 02:00	6/9/2011 03:00	51,898	-	18.7	4.5	447.1	0.60	501.5	610.7	135,916.2	135,916.2	0.0	0.0	0.0	0.0	0.00
6/9/2011 03:00	6/9/2011 04:00	51,881	-	18.7	4.4	448.0	0.60	502.0	610.6	135,902.1	135,902.1	0.0	0.0	0.0	0.0	0.00
6/9/2011 04:00	6/9/2011 05:00	51,854	-	18.7	4.3	448.2	0.61	502.0	612.3	136,276.2	136,276.2	0.0	0.0	0.0	0.0	0.00
6/9/2011 05:00	6/9/2011 06:00	51,855	-	18.7	4.4	448.4	0.61	502.2	616.4	137,198.7	137,198.7	0.0	0.0	0.0	0.0	0.00
6/9/2011 06:00	6/9/2011 07:00	51,836	-	18.7	4.5	447.0	0.61	501.4	615.5	136,980.5	136,980.5	0.0	0.0	0.0	0.0	0.00
6/9/2011 07:00	6/9/2011 08:00	51,777	-	18.6	4.5	447.1	0.61	501.5	615.1	136,698.8	136,698.8	0.0	0.0	0.0	0.0	0.00
6/9/2011 08:00	6/9/2011 09:00	51,681	-	18.7	4.5	447.7	0.61	501.8	614.2	136,699.2	136,699.2	0.0	0.0	0.0	0.0	0.00
6/9/2011 09:00	6/9/2011 10:00	51,725	-	18.7	4.5	448.1	0.61	502.0	615.4	136,973.1	136,973.1	0.0	0.0	0.0	0.0	0.00
6/9/2011 10:00	6/9/2011 11:00	51,611	-	18.8	4.5	448.3	0.60	502.1	618.1	137,559.2	137,559.2	0.0	0.0	0.0	0.0	0.00
6/9/2011 11:00	6/9/2011 12:00	51,608	-	19.0	4.6	448.5	0.60	502.2	616.5	137,704.1	137,704.1	0.0	0.0	0.0	0.0	0.00
6/9/2011 12:00	6/9/2011 13:00	51,854	-	19.2	4.6	449.2	0.60	502.6	618.3	137,621.3	137,621.3	0.0	0.0	0.0	0.0	0.00
6/9/2011 13:00	6/9/2011 14:00	51,994	-	19.3	4.6	449.0	0.60	502.5	617.8	137,491.3	137,491.3	0.0	0.0	0.0	0.0	0.00
6/9/2011 14:00	6/9/2011 15:00	52,059	-	19.3	4.6	447.7	0.60	502.0	618.1	137,575.8	137,575.8	0.0	0.0	0.0	0.0	0.00
6/9/2011 15:00	6/9/2011 16:00	52,087	-	19.3	4.4	448.1	0.60	502.0	617.3	137,596.1	137,596.1	0.0	0.0	0.0	0.0	0.00
6/9/2011 16:00	6/9/2011 17:00	52,023	-	19.3	4.5	448.4	0.60	502.2	618.4	137,625.6	137,625.6	0.0	0.0	0.0	0.0	0.00
6/9/2011 17:00	6/9/2011 18:00	51,967	-	19.2	4.5	448.5	0.61	502.3	617.3	137,593.2	137,593.2	0.0	0.0	0.0	0.0	0.00
6/9/2011 18:00	6/9/2011 19:00	51,977	-	19.1	4.5	448.6	0.60	502.3	618.1	137,576.0	137,576.0	0.0	0.0	0.0	0.0	0.00
6/9/2011 19:00	6/9/2011 20:00	51,900	-	18.9	4.6	448.6	0.61	502.5	619.3	137,825.0	137,825.0	0.0	0.0	0.0	0.0	0.00
6/9/2011 20:00	6/9/2011 21:00	51,892	-	18.9	4.7	449.0	0.61	502.5	618.2	137,597.3	137,597.3	0.0	0.0	0.0	0.0	0.00
6/9/2011 21:00	6/9/2011 22:00	51,865	-	18.9	4.7	447.3	0.61	502.5	618.8	137,724.3	137,724.3	0.0	0.0	0.0	0.0	0.00
6/9/2011 22:00	6/9/2011 23:00	51,817	-	18.8	4.7	447.3	0.61	501.6	618.9	137,743.4	137,743.4	0.0	0.0	0.0	0.0	0.00
6/10/2011 00:00	6/10/2011 01:00	51,828	-	18.7	4.7	447.9	0.61	501.9	617.4	137,405.0	137,405.0	0.0	0.0	0.0	0.0	0.00
6/10/2011 01:00	6/10/2011 02:00	51,776	-	18.6	4.7	448.3	0.61	502.1	618.0	137,539.0	137,539.0	0.0	0.0	0.0	0.0	0.00
6/10/2011 02:00	6/10/2011 03:00	51,751	-	18.5	4.7	448.5	0.61	502.2	618.1	137,287.9	137,287.9	0.0	0.0	0.0	0.0	0.00
6/10/2011 03:00	6/10/2011 04:00	51,752	-	18.5	4.7	448.9	0.61	502.4	618.1	137,564.4	137,564.4	0.0	0.0	0.0	0.0	0.00
6/10/2011 04:00	6/10/2011 05:00	51,739	-	18.6	4.7	449.3	0.61	502.5	619.3	137,560.7	137,560.7	0.0	0.0	0.0	0.0	0.00
6/10/2011 05:00	6/10/2011 06:00	51,738	-	18.5	4.7	447.3	0.61	501.6	617.8	137,844.4	137,844.4	0.0	0.0	0.0	0.0	0.00
6/10/2011 06:00	6/10/2011 07:00	51,676	-	18.5	4.7	447.6	0.61	501.7	616.1	137,121.9	137,121.9	0.0	0.0	0.0	0.0	0.00
6/10/2011 07:00	6/10/2011 08:00	51,666	-	18.5	4.7	447.7	0.61	501.8	616.8	137,282.0	137,282.0	0.0	0.0	0.0	0.0	0.00
6/10/2011 08:00	6/10/2011 09:00	51,678	-	18.6	4.7	447.7	0.61	501.8	618.8	137,726.6	137,726.6	0.0	0.0	0.0	0.0	0.00
6/10/2011 09:00	6/10/2011 10:00	51,671	-	18.8	4.7	448.3	0.60	502.1	621.7	138,369.5	138,369.5	0.0	0.0	0.0	0.0	0.00
6/10/2011 10:00	6/10/2011 11:00	51,673	-	18.9	4.7	449.3	0.60	502.4	619.3	137,826.2	137,826.2	0.0	0.0	0.0	0.0	0.00
6/10/2011 11:00	6/10/2011 12:00	51,627	-	19.1	4.7	449.2	0.60	502.6	621.1	138,237.1	138,237.1	0.0	0.0	0.0	0.0	0.00
6/10/2011 12:00	6/10/2011 13:00	51,637	-	19.2	4.7	449.2	0.60	502.6	620.8	138,163.1	138,163.1	0.0	0.0	0.0	0.0	0.00
6/10/2011 13:00	6/10/2011 14:00	51,591	-	19.3	4.7	447.6	0.60	502.1	619.3	137,826.2	137,826.2	0.0	0.0	0.0	0.0	0.00
6/10/2011 14:00	6/10/2011 15:00	51,604	-	19.3	4.7	448.3	0.60	502.1	618.5	137,661.2	137,661.2	0.0	0.0	0.0	0.0	0.00
6/10/2011 15:00	6/10/2011 16:00	51,597	-	19.2	4.7	448.2	0.60	502.1	619.5	137,874.4	137,874.4	0.0	0.0	0.0	0.0	0.00
6/10/2011 16:00	6/10/2011 17:00	51,612	-	19.2	4.7	448.3	0.60	502.1	618.2	137,591.5	137,591.5	0.0	0.0	0.0	0.0	0.00
6/10/2011 17:00	6/10/2011 18:00	51,640	-	19.1	4.7	448.6	0.61	502.3	619.4	137,866.1	137,866.1	0.0	0.0	0.0	0.0	0.00
6/10/2011 18:00	6/10/2011 19:00	51,619	-	19.0	4.7	448.7	0.60	502.4	618.2	137,585.9	137,585.9	0.0	0.0	0.0	0.0	0.00
6/10/2011 19:00	6/10/2011 20:00	51,627	-	18.9	4.7	448.9	0.61	502.5	618.9	137,739.6	137,739.6	0.0	0.0	0.0	0.0	0.00
6/10/2011 20:00	6/10/2011 21:00	51,622	-	18.9	4.7	448.8	0.61	502.4	619.0	137,769.1	137,769.1	0.0	0.0	0.0	0.0	0.00
6/10/2011 21:00	6/10/2011 22:00	51,604	-	18.8	4.7	447.5	0.61	501.8	619.2	137,804.8	137,804.8	0.0	0.0	0.0	0.0	0.00
6/10/2011 22:00	6/10/2011 23:00	51,604	-	18.8	4.7	447.5	0.61	501.8	619.2	137,804.8	137,804.8	0.0	0.0	0.0	0.0	0.00

FCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAs
Process Parameters
ARI Environmental, Inc.
Notes:
(1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(c)(2) Equation 2

FCU WET GAS SCRUBBER HOURLY DATA - 6/6/11 @ 00:00 to 6/15/11 @ 15:00

DATE/TIME START	DATE/TIME END	FCC Change Rate BPH	15AI3001A.P V	REGEN CO MOLE%	15AI3002A PV	REGEN CO2 MOLE%	15AI3003A.P V	REGEN O2 MOLE%	15T10003.PV PV	FG0014 FLUE GAS CLR OUT DEG F	15P10005 FG0014 FLUE GAS CLR OUT PSIG	FLUE GAS TEMP K	A/B BLWR TOTAL AIR MLB/HR	A/B BLWR AIR			Calc		Calc	% O2 In combined air + O2 to Regen % Volume		
														Qa	O2 Injection	O2 Injection	O2 Injection	Coxy				
															15F1245A.PV	15F1245B.PV	15F1245C.PV	Oxygen to Regen SCFM	Oxygen to Sparger MLB/HR	Oxygen to Sparger MLB/HR	Oxygen to Regen SCFM	% Oxy
6/10/2011 23:00	6/11/2011 0:00	51.587	-	18.8	4.7	448.1	0.61	502.0	620.3	138.062.6	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 0:00	6/11/2011 1:00	51.592	-	18.8	4.7	448.0	0.61	502.0	620.2	138.035.2	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 1:00	6/11/2011 2:00	51.563	-	18.8	4.7	448.2	0.61	502.1	620.2	138.043.6	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 2:00	6/11/2011 3:00	51.555	-	18.8	4.7	448.5	0.61	502.2	620.4	138.083.5	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 3:00	6/11/2011 4:00	51.550	-	18.8	4.7	448.9	0.61	502.5	620.4	138.070.1	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 4:00	6/11/2011 5:00	51.573	-	18.7	4.7	448.7	0.61	502.3	619.9	137.979.0	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 5:00	6/11/2011 6:00	51.547	-	18.6	4.7	447.9	0.61	501.9	619.1	137.792.2	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 6:00	6/11/2011 7:00	51.493	-	18.5	4.6	446.7	0.61	501.2	620.8	136.167.2	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 7:00	6/11/2011 8:00	51.515	-	18.4	4.7	446.8	0.61	501.3	618.0	137.553.0	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 8:00	6/11/2011 9:00	51.463	-	18.3	4.7	446.5	0.61	501.1	617.7	137.485.6	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 9:00	6/11/2011 10:00	51.458	-	18.4	4.6	446.7	0.61	501.2	618.8	137.717.8	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 10:00	6/11/2011 11:00	51.392	-	18.5	4.7	447.5	0.61	501.7	623.9	138.859.0	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 11:00	6/11/2011 12:00	51.398	-	18.7	4.7	448.2	0.60	502.1	620.5	138.096.6	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 12:00	6/11/2011 13:00	51.430	-	18.9	4.7	448.6	0.60	502.3	620.5	138.107.5	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 13:00	6/11/2011 14:00	51.472	-	19.1	4.7	448.6	0.60	502.3	621.5	138.316.3	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 14:00	6/11/2011 15:00	51.447	-	19.3	4.8	447.9	0.60	501.9	619.7	137.915.3	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 15:00	6/11/2011 16:00	51.376	-	19.2	4.8	448.6	0.60	502.3	620.5	138.097.2	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 16:00	6/11/2011 17:00	51.362	-	19.2	4.8	449.0	0.61	502.5	619.2	137.814.0	-	-	-	0.0	1	0.00	1	0.00			0.00	
6/11/2011 17:00	6/11/2011 18:00	51.379	-	19.2	4.8	449.2	0.60	502.6	622.3	138.496.9	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/11/2011 18:00	6/11/2011 19:00	51.409	-	19.2	4.7	449.0	0.60	502.5	622.2	138.095.5	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/11/2011 19:00	6/11/2011 20:00	51.396	-	19.3	4.8	449.2	0.60	502.6	620.5	138.496.9	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/11/2011 20:00	6/11/2011 21:00	51.417	-	19.2	4.7	449.0	0.60	502.5	622.2	138.481.3	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/11/2011 21:00	6/11/2011 22:00	44.246	-	19.1	4.7	443.8	0.52	499.6	498.9	111.044.9	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/11/2011 22:00	6/11/2011 23:00	21.347	-	17.4	7.5	352.7	0.13	451.8	492	(3.393.7)	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 0:00	6/12/2011 1:00	22.936	-	13.4	10.0	367.6	0.15	457.7	107.9	24.018.2	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 1:00	6/12/2011 2:00	23.740	-	12.9	10.0	376.1	0.14	462.4	87.8	19.541.2	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 2:00	6/12/2011 3:00	24.271	-	12.6	10.0	392.1	0.26	471.2	285.3	63.493.3	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 3:00	6/12/2011 4:00	23.996	0.35	13.8	10.0	366.2	0.47	457.0	303.7	67.802.0	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 4:00	6/12/2011 5:00	24.125	0.23	14.2	10.0	364.5	0.47	456.0	307.6	68.458.2	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 5:00	6/12/2011 6:00	23.929	0.24	14.1	10.0	365.0	0.47	455.5	288.8	63.823.0	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 6:00	6/12/2011 7:00	23.832	0.23	14.3	10.0	371.2	0.47	459.7	278.3	61.946.1	-	-	-	0.0	0	0.00	0	0.00			0.00	
6/12/2011 7:00	6/12/2011 8:00	24.251	0.05	14.9	10.0	380.3	0.47	464.7	285.4	63.509.8	-	-	-	0.0	0	0.00	1	0.00			0.00	
6/12/2011 8:00	6/12/2011 9:00	24.100	0.01	14.9	10.0	386.4	0.47	468.1	277.6	61.784.6	-	-	-	0.0	0	0.00	1	0.00			0.00	
6/12/2011 9:00	6/12/2011 10:00	24.200	0.03	15.0	10.0	388.5	0.47	469.2	281.7	62.690.1	-	-	-	0.0	0	0.00	1	0.00			0.00	
6/12/2011 10:00	6/12/2011 11:00	24.154	0.04	15.3	10.0	388.9	0.47	469.5	279.3	62.170.0	-	-	-	0.0	0	0.00	1	0.00			0.00	
6/12/2011 11:00	6/12/2011 12:00	25.976	0.04	15.4	10.0	388.9	0.47	469.5	275.5	61.327.6	-	-	-	0.0	0	0.00	1	0.00			0.00	
6/12/2011 12:00	6/12/2011 13:00	30.931	0.62	17.1	9.4	392.8	0.47	471.6	268.3	59.715.5	-	-	-	0.0	0	0.00	1	0.00			0.00	
6/12/2011 13:00	6/12/2011 14:00	36.494	0.78	19.2	3.0	402.7	0.47	477.0	277.3	61.713.8	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/12/2011 14:00	6/12/2011 15:00	44.056	0.22	19.8	1.9	411.4	0.48	481.8	284.0	63.206.0	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/12/2011 15:00	6/12/2011 16:00	47.296	-	19.9	0.9	416.5	0.48	484.7	279.4	62.180.7	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/12/2011 16:00	6/12/2011 17:00	48.215	-	20.0	0.4	416.8	0.48	484.8	284.2	63.259.9	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/12/2011 17:00	6/12/2011 18:00	47.255	0.02	19.9	0.5	417.3	0.49	485.1	283.4	63.066.2	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/12/2011 18:00	6/12/2011 19:00	47.080	0.13	19.9	0.4	419.6	0.49	486.3	283.6	63.112.1	-	-	-	0.0	0	0.00	3	0.00			0.00	
6/12/2011 19:00	6/12/2011 20:00	47.364	-	19.7	1.5	421.2	0.49	487.2	284.7	63.372.1	-	-	-	0.0	0	0.00	3	0.00			0.00	
6/12/2011 20:00	6/12/2011 21:00	47.509	-	19.7	1.3	421.4	0.49	487.3	285.9	63.659.2	-	-	-	0.0	0	0.00	3	0.00			0.00	
6/12/2011 21:00	6/12/2011 22:00	47.871	-	19.7	1.3	421.4	0.49	487.3	285.3	63.505.4	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/12/2011 22:00	6/12/2011 23:00	47.947	-	19.8	0.4	419.6	0.49	486.2	291.3	64.827.4	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/13/2011 0:00	6/13/2011 1:00	48.008	-	19.7	0.6	419.6	0.49	486.3	289.9	64.514.1	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/13/2011 1:00	6/13/2011 2:00	47.953	-	19.6	1.2	423.0	0.50	488.2	286.5	63.761.9	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/13/2011 2:00	6/13/2011 3:00	48.445	-	19.6	1.4	424.5	0.51	489.0	289.9	64.528.7	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/13/2011 3:00	6/13/2011 4:00	48.700	-	19.6	1.0	424.2	0.50	488.9	288.9	64.282.1	-	-	-	0.0	0	0.00	2	0.00			0.00	
6/13/2011 4:00	6/13/2011 5:00	48.810.8																				

FCU-1241 Wet Gas Scrubber Performance Testing / CEMS RATAS
 Process Parameters
 ARI Environmental, Inc.

FCU-1241 Wet Gas Scrubber Hourly Data - 6/6/11 @ 00:00 to 6/15/11 @ 15:00

Notes:
 (1) Coke Burn: EPA Method Per MACT UUU 40 CFR 63.1573(a)(2) Equation 2

DATE/TIME START	END	FCC Charge Rate BPH	15E11239B.PV	15A13001A.P V	15A13002A PV	15A13003A.P V	REGEN CO MOLE%	REGEN CO2 MOLE%	15A13002A PV	15T10003.PV FO0014 FLUE GAS CLR OUT DEG F	15P10005. PV FO0014 FLUE GAS CLR OUT PSIG	FLUE GAS TEMP K	A/B BLWR TOTAL AIR MLB/HR	Qa =	Calc				Qoxy	%Oxy	Calc
															15F1246A.PV OXYGEN TO SPARGER MLB/HR	15F1248B.PV OXYGEN TO SPARGER MLB/HR	15F1246C.PV OXYGEN TO SPARGER MLB/HR	% O2 in combined air + O2 to regen % Volume			
6/13/2011 12:00	6/13/2011 13:00	50,093	-	20.0	0.3	428.5	0.51	491.2	281.5	62,652.3	360	0.6	0.5	0.7	0.58						
6/13/2011 13:00	6/13/2011 14:00	50,064	-	20.0	0.5	428.9	0.51	491.4	277.2	61,685.4	361	0.6	0.5	0.7	0.58						
6/13/2011 14:00	6/13/2011 15:00	49,374	-	20.0	0.5	426.7	0.51	490.2	276.8	61,610.4	361	0.6	0.6	0.7	0.59						
6/13/2011 15:00	6/13/2011 16:00	50,623	-	20.0	0.3	427.5	0.51	490.7	272.2	60,581.7	384	0.6	0.6	0.7	0.63						
6/13/2011 16:00	6/13/2011 17:00	50,706	-	20.0	0.3	428.1	0.52	491.0	274.8	61,171.3	427	0.7	0.7	0.7	0.70						
6/13/2011 17:00	6/13/2011 18:00	50,761	-	20.0	0.3	428.2	0.52	491.0	281.5	62,558.8	462	0.8	0.7	0.8	0.74						
6/13/2011 18:00	6/13/2011 19:00	50,471	-	20.0	0.0	427.9	0.51	490.9	291.5	64,874.5	495	0.8	0.8	0.8	0.76						
6/13/2011 19:00	6/13/2011 20:00	50,009	-	20.0	0.1	427.6	0.51	490.7	293.4	65,295.8	528	0.9	0.9	0.9	0.81						
6/13/2011 20:00	6/13/2011 21:00	49,867	-	20.0	0.1	428.2	0.51	491.1	294.2	65,483.8	540	0.9	0.9	0.9	0.82						
6/13/2011 21:00	6/13/2011 22:00	49,905	-	20.0	0.7	429.3	0.52	491.7	296.2	65,914.7	556	0.9	0.9	0.9	0.84						
6/13/2011 22:00	6/13/2011 23:00	49,920	-	19.9	0.7	428.2	0.52	491.1	295.3	65,718.4	559	0.9	0.9	0.9	0.85						
6/13/2011 23:00	6/14/2011 00:00	49,934	-	19.8	0.7	428.3	0.52	491.2	290.2	64,589.2	571	1.0	0.9	1.0	0.88						
6/14/2011 00:00	6/14/2011 01:00	49,940	-	19.8	0.7	428.4	0.52	491.2	277.2	61,693.3	572	1.0	0.9	1.0	0.83						
6/14/2011 01:00	6/14/2011 02:00	50,178	-	19.8	0.9	430.7	0.52	492.5	317.4	70,646.8	572	1.0	0.9	1.0	0.72						
6/14/2011 02:00	6/14/2011 03:00	51,781	-	19.7	1.2	433.2	0.52	493.8	363.3	80,849.4	572	1.0	0.9	1.0	0.71						
6/14/2011 03:00	6/14/2011 04:00	52,124	-	19.7	0.9	433.3	0.52	493.9	366.5	81,569.4	572	1.0	0.9	1.0	0.70						
6/14/2011 04:00	6/14/2011 05:00	52,168	-	19.5	0.9	432.9	0.52	493.7	368.2	81,951.5	572	1.0	0.9	1.0	0.70						
6/14/2011 05:00	6/14/2011 06:00	52,256	-	19.4	0.9	432.7	0.52	493.6	367.9	81,880.3	572	1.0	0.9	1.0	0.70						
6/14/2011 06:00	6/14/2011 07:00	52,281	-	19.3	0.9	432.0	0.52	493.2	368.8	82,074.8	567	1.0	0.9	1.0	0.67						
6/14/2011 07:00	6/14/2011 08:00	52,275	-	19.2	1.0	432.6	0.52	493.5	365.4	81,315.1	566	0.9	0.9	1.0	0.66						
6/14/2011 08:00	6/14/2011 09:00	52,804	-	19.3	0.7	433.0	0.52	493.7	366.3	81,534.2	564	0.9	0.9	1.0	0.68						
6/14/2011 09:00	6/14/2011 10:00	53,282	-	19.3	0.9	433.5	0.52	494.0	371.1	82,600.6	559	0.9	0.9	1.0	0.68						
6/14/2011 10:00	6/14/2011 11:00	54,137	-	19.4	0.9	433.5	0.52	494.0	371.2	82,618.2	533	0.9	0.9	1.0	0.58						
6/14/2011 11:00	6/14/2011 12:00	55,783	-	19.6	0.7	434.3	0.52	494.3	371.9	82,761.9	533	0.9	0.9	1.0	0.58						
6/14/2011 12:00	6/14/2011 13:00	56,113	-	19.9	0.2	434.1	0.52	494.3	372.8	82,965.9	485	0.8	0.8	0.8	0.64						
6/14/2011 13:00	6/14/2011 14:00	55,976	-	20.0	0.3	434.6	0.52	494.6	371.8	82,746.6	745	1.3	1.2	1.3	0.90						
6/14/2011 14:00	6/14/2011 15:00	55,976	-	20.0	0.8	433.6	0.52	494.4	371.8	82,741.4	955	1.6	1.5	1.6	1.15						
6/14/2011 15:00	6/14/2011 16:00	54,973	-	20.0	0.9	434.2	0.52	494.4	372.2	82,827.8	2489	4.1	4.1	4.2	2.89						
6/14/2011 16:00	6/14/2011 17:00	55,824	-	20.0	1.1	434.6	0.52	494.5	371.4	82,655.7	2755	4.6	4.5	4.6	3.33						
6/14/2011 17:00	6/14/2011 18:00	55,842	-	20.0	1.1	434.8	0.52	494.7	372.0	82,803.3	2760	4.6	4.6	4.6	3.33						
6/14/2011 18:00	6/14/2011 19:00	55,857	-	20.0	1.1	434.8	0.52	494.7	370.6	82,478.0	2761	4.6	4.6	4.6	3.36						
6/14/2011 19:00	6/14/2011 20:00	56,072	-	20.0	1.1	434.8	0.52	494.8	369.5	82,216.5	2758	4.6	4.5	4.6	3.33						
6/14/2011 20:00	6/14/2011 21:00	56,072	-	20.0	0.9	434.8	0.53	494.8	370.0	82,353.1	2753	4.6	4.5	4.6	3.35						
6/14/2011 21:00	6/14/2011 22:00	56,137	-	19.9	0.9	433.7	0.52	494.1	369.8	82,297.7	2757	4.6	4.6	4.6	3.35						
6/14/2011 22:00	6/14/2011 23:00	56,089	-	19.9	1.0	433.9	0.52	494.2	369.8	82,297.7	2757	4.6	4.5	4.6	3.35						
6/15/2011 00:00	6/15/2011 01:00	56,077	-	19.8	1.1	434.2	0.52	494.4	369.2	82,163.3	2759	4.6	4.6	4.6	3.36						
6/15/2011 01:00	6/15/2011 02:00	55,896	-	19.8	1.2	434.8	0.52	494.8	370.2	82,383.8	2745	4.6	4.5	4.6	3.33						
6/15/2011 02:00	6/15/2011 03:00	55,862	-	19.8	1.3	435.0	0.52	494.6	369.6	82,259.8	2759	4.6	4.5	4.6	3.35						
6/15/2011 03:00	6/15/2011 04:00	55,773	-	19.7	1.3	434.5	0.53	494.7	368.9	82,096.9	2770	4.6	4.6	4.6	3.37						
6/15/2011 04:00	6/15/2011 05:00	55,684	-	19.7	1.1	434.5	0.53	494.5	368.8	82,079.9	3205	5.3	5.3	5.3	3.91						
6/15/2011 05:00	6/15/2011 06:00	57,037	-	19.7	1.1	434.5	0.53	494.5	369.7	82,285.7	3257	5.4	5.4	5.4	3.96						
6/15/2011 06:00	6/15/2011 07:00	57,580	-	19.8	0.8	434.8	0.53	494.1	370.5	82,449.3	3264	5.4	5.4	5.4	3.94						
6/15/2011 07:00	6/15/2011 08:00	57,834	-	19.7	0.9	434.4	0.53	494.5	372.8	82,977.8	3273	5.4	5.4	5.4	3.94						
6/15/2011 08:00	6/15/2011 09:00	57,725	-	19.7	0.9	434.0	0.53	494.4	370.9	83,601.9	3254	5.4	5.4	5.4	3.89						
6/15/2011 09:00	6/15/2011 10:00	57,313	-	19.7	0.9	434.3	0.53	494.4	374.6	83,370.1	3270	5.4	5.4	5.4	3.92						
6/15/2011 10:00	6/15/2011 11:00	56,590	-	19.6	1.1	434.2	0.52	494.7	373.0	83,015.8	3270	5.4	5.4	5.4	3.94						
6/15/2011 11:00	6/15/2011 12:00	56,455	-	19.7	1.1	434.8	0.52	494.8	372.3	82,850.1	3264	5.4	5.4	5.4	3.94						
6/15/2011 12:00	6/15/2011 13:00	57,173	-	19.9	0.7	435.0	0.52	494.8	372.0	82,803.0	3267	5.4	5.4	5.4	3.94						
6/15/2011 13:00	6/15/2011 14:00	57,243	-	20.0	0.6	435.1	0.52	494.8	372.0	82,803.0	3267	5.4	5.4	5.4	3.95						
6/15/2011 14:00	6/15/2011 15:00	57,096	-	20.0	0.7	434.1	0.52	494.3	372.0	82,803.0	3267	5.4	5.4	5.4	3.95						

FCCU-1241 Wet Gas Scrubber Performance
Process Parameters
ARI Environmental, Inc.
Notes:
(1) Coke Burn: EPA Method Per MACT UUU 4C

FCCU WET GAS SCRUBBER HOURLY DATA - 6/6/11 @ 00:00 to 6/15/11 @ 15:00

DATE/TIME	START	END	PLUG GAS FLOW CORRECTED - EPA SCPM	Coke Burn QIF (1) LBS/Hr	Scrubber Pressure Drop AFM Pressure Drop	15F0100.PV Make-up Flow GPM	15F0101.PV NaOH GPM	15F0102.PV NaOH GPM	15P10109.P V Discharge Pressure PSIG	15P10115.P V Discharge Pressure PSIG	Pump Curve GPM	15P10115.P V Discharge Pressure PSIG	Pump Curve GPM	15F0103.P V Scrubber Purge GPM	Total Water Flow GPM	Liquid to Air Ratio	15A010 2A-PV TWR RCIRC PH A PH	15A010 2B-PV TWR RCIRC PH A PH	Average Scrubber Liquid pH
6/6/2011 0:00	6/6/2011 1:00	6/6/2011 2:00	151133	55,061.9	11.9	267.5	0.67	5.64	91.6	1,939.6	46.2	7,704.1	190.9	10,107.4	0.0669	7.0	7.1	7.1	
6/6/2011 2:00	6/6/2011 3:00	6/6/2011 4:00	150346	54,947.9	11.9	268.5	0.67	5.63	91.6	1,937.8	46.2	7,704.2	189.9	10,106.7	0.0670	7.0	7.0	7.0	
6/6/2011 4:00	6/6/2011 5:00	6/6/2011 6:00	150310	54,848.5	11.9	270.6	0.68	5.67	91.6	1,936.3	46.2	7,705.6	190.0	10,105.5	0.0669	7.0	7.0	7.0	
6/6/2011 6:00	6/6/2011 7:00	6/6/2011 8:00	150166	54,668.8	12.0	270.2	0.69	5.75	91.6	1,938.2	46.2	7,705.8	190.0	10,115.1	0.0670	7.0	7.0	7.0	
6/6/2011 8:00	6/6/2011 9:00	6/6/2011 10:00	150016	54,536.1	12.0	270.2	0.69	5.80	91.6	1,936.6	46.2	7,706.9	189.9	10,100.2	0.0670	7.0	7.0	7.0	
6/6/2011 10:00	6/6/2011 11:00	6/6/2011 12:00	150201	54,494.5	12.0	270.0	0.69	5.79	91.6	1,939.7	46.2	7,706.2	189.9	10,112.4	0.0670	7.0	7.0	7.0	
6/6/2011 12:00	6/6/2011 13:00	6/6/2011 14:00	149564	54,093.0	12.0	268.7	0.69	5.78	91.6	1,936.7	46.3	7,694.7	190.0	10,096.6	0.0671	7.0	7.0	7.0	
6/6/2011 14:00	6/6/2011 15:00	6/6/2011 16:00	149457	53,905.8	11.9	267.5	0.70	5.82	91.6	1,940.5	46.3	7,696.2	190.0	10,100.8	0.0671	7.0	7.0	7.0	
6/6/2011 16:00	6/6/2011 17:00	6/6/2011 18:00	149386	53,911.8	11.9	266.5	0.70	5.78	91.6	1,940.0	46.1	7,753.8	190.1	10,156.8	0.0674	7.0	7.0	7.0	
6/6/2011 18:00	6/6/2011 19:00	6/6/2011 20:00	150059	54,449.8	11.9	270.1	0.70	5.73	91.6	1,938.8	46.0	7,753.6	190.0	10,176.3	0.0672	7.0	7.0	7.0	
6/6/2011 20:00	6/6/2011 21:00	6/6/2011 22:00	150491	54,833.6	11.8	268.9	0.70	5.73	91.6	1,937.7	46.0	7,753.6	190.0	10,191.2	0.0674	7.0	7.0	7.0	
6/6/2011 22:00	6/6/2011 23:00	6/6/2011 0:00	150731	55,236.5	11.8	268.9	0.70	5.73	91.6	1,936.2	46.0	7,752.2	190.0	10,191.8	0.0674	7.0	7.0	7.0	
6/6/2011 0:00	6/6/2011 1:00	6/6/2011 2:00	150745	55,743.9	11.8	268.7	0.70	5.77	91.6	1,937.8	46.0	7,750.9	190.0	10,194.9	0.0675	7.0	7.0	7.0	
6/6/2011 2:00	6/6/2011 3:00	6/6/2011 4:00	150545	55,433.6	11.9	268.1	0.70	5.77	91.6	1,937.5	46.0	7,750.9	189.9	10,186.8	0.0675	7.0	7.0	7.0	
6/6/2011 4:00	6/6/2011 5:00	6/6/2011 6:00	151052	56,101.4	11.8	268.1	0.70	5.75	91.6	1,933.3	46.0	7,784.8	189.9	10,186.8	0.0675	7.0	7.0	7.0	
6/6/2011 6:00	6/6/2011 7:00	6/6/2011 8:00	150526	56,085.2	11.9	268.4	0.70	5.81	91.7	1,930.9	45.9	7,785.6	190.0	10,191.3	0.0675	7.0	7.0	7.0	
6/6/2011 8:00	6/6/2011 9:00	6/6/2011 10:00	151080	56,150.1	11.9	268.4	0.70	5.81	91.7	1,932.9	45.9	7,785.6	190.0	10,191.3	0.0675	7.0	7.0	7.0	
6/6/2011 10:00	6/6/2011 11:00	6/6/2011 12:00	151397	56,247.3	11.9	272.5	0.71	5.85	91.7	1,932.9	45.9	7,785.6	190.0	10,170.1	0.0674	7.0	7.0	7.0	
6/6/2011 12:00	6/6/2011 13:00	6/6/2011 14:00	151872	55,649.6	11.9	267.7	0.70	5.83	91.8	1,927.7	46.0	7,795.2	190.0	10,196.6	0.0681	7.0	7.0	7.0	
6/6/2011 14:00	6/6/2011 15:00	6/6/2011 16:00	149131	53,932.8	12.0	266.1	0.70	5.85	91.5	1,937.1	45.9	7,807.9	190.1	10,212.6	0.0682	7.0	7.0	7.0	
6/6/2011 16:00	6/6/2011 17:00	6/6/2011 18:00	149019	52,711.9	11.8	267.8	0.70	5.93	91.6	1,939.2	45.9	7,807.9	190.0	10,207.9	0.0681	7.0	7.0	7.0	
6/6/2011 18:00	6/6/2011 19:00	6/6/2011 20:00	148502	52,802.5	12.1	267.8	0.72	6.11	91.6	1,936.6	46.0	7,793.8	190.0	10,196.7	0.0681	6.9	6.9	6.9	
6/6/2011 20:00	6/6/2011 21:00	6/6/2011 22:00	148435	53,202.3	12.0	269.0	0.75	6.25	91.6	1,936.6	46.0	7,793.8	190.0	10,172.5	0.0679	6.9	6.9	6.9	
6/6/2011 22:00	6/6/2011 23:00	6/6/2011 0:00	149007	53,448.3	12.0	269.0	0.75	6.25	91.6	1,936.6	46.0	7,793.8	190.0	10,186.4	0.0678	7.0	7.0	7.0	
6/6/2011 0:00	6/6/2011 1:00	6/6/2011 2:00	148751	53,528.0	11.9	270.1	0.74	6.27	91.6	1,936.0	46.0	7,795.0	190.0	10,178.1	0.0677	7.0	7.1	7.1	
6/6/2011 2:00	6/6/2011 3:00	6/6/2011 4:00	148334	53,292.4	11.9	269.3	0.72	6.05	91.6	1,935.5	46.0	7,790.3	190.0	10,190.2	0.0679	7.0	7.1	7.1	
6/6/2011 4:00	6/6/2011 5:00	6/6/2011 6:00	149270	52,439.2	11.9	268.7	0.69	5.85	91.6	1,937.4	46.0	7,792.0	190.0	10,183.3	0.0680	7.1	7.1	7.1	
6/6/2011 6:00	6/6/2011 7:00	6/6/2011 8:00	148589	52,616.9	12.0	268.9	0.68	5.78	91.6	1,937.6	46.0	7,792.0	190.0	10,194.6	0.0680	7.1	7.1	7.1	
6/6/2011 8:00	6/6/2011 9:00	6/6/2011 10:00	148425	53,084.4	12.1	267.8	0.70	5.83	91.6	1,940.0	46.0	7,784.8	190.1	10,189.2	0.0680	7.0	7.0	7.0	
6/6/2011 10:00	6/6/2011 11:00	6/6/2011 12:00	148357	53,462.3	12.0	265.5	0.72	5.94	91.6	1,939.2	46.0	7,785.2	190.0	10,192.5	0.0678	7.0	7.0	7.0	
6/6/2011 12:00	6/6/2011 13:00	6/6/2011 14:00	148382	52,313.3	11.8	268.2	0.74	6.09	91.6	1,938.1	46.1	7,785.2	190.0	10,189.6	0.0675	6.9	6.9	6.9	
6/6/2011 14:00	6/6/2011 15:00	6/6/2011 16:00	149348	52,010.0	11.8	270.0	0.63	5.41	91.6	1,938.0	46.1	7,742.0	190.0	10,148.4	0.0677	7.1	7.1	7.1	
6/6/2011 16:00	6/6/2011 17:00	6/6/2011 18:00	151780	52,046.1	11.8	269.0	0.58	4.46	91.6	1,936.0	46.3	7,675.1	190.3	10,090.2	0.0672	7.5	7.4	7.3	
6/6/2011 18:00	6/6/2011 19:00	6/6/2011 20:00	151088	51,343.9	11.7	269.9	0.59	3.79	91.6	1,939.2	46.2	7,701.2	190.0	10,106.7	0.0683	6.8	6.6	6.7	
6/6/2011 20:00	6/6/2011 21:00	6/6/2011 22:00	149599	51,393.1	11.5	267.2	0.72	4.10	91.6	1,937.4	46.2	7,720.4	190.0	10,139.8	0.0692	6.8	6.6	6.8	
6/6/2011 22:00	6/6/2011 23:00	6/6/2011 0:00	146842	50,820.6	11.4	263.1	0.80	4.42	91.6	1,934.7	46.2	7,725.4	190.0	10,118.4	0.0705	6.2	6.2	6.2	
6/6/2011 0:00	6/6/2011 1:00	6/6/2011 2:00	145312	49,969.4	11.2	264.8	0.78	4.13	91.6	1,935.1	46.2	7,717.1	189.9	10,110.4	0.0715	6.2	6.2	6.2	
6/6/2011 2:00	6/6/2011 3:00	6/6/2011 4:00	145772	49,541.3	11.1	264.8	0.74	3.47	91.7	1,933.2	46.1	7,738.8	190.0	10,130.9	0.0719	7.4	7.0	7.2	
6/6/2011 4:00	6/6/2011 5:00	6/6/2011 6:00	146484	48,965.2	11.1	264.2	0.75	3.27	91.7	1,932.7	46.1	7,741.8	190.0	10,132.7	0.0721	7.0	6.7	6.8	
6/6/2011 6:00	6/6/2011 7:00	6/6/2011 8:00	146801	48,782.5	11.2	264.0	0.80	3.23	91.6	1,938.6	46.1	7,760.7	190.0	10,157.3	0.0721	7.0	6.6	6.8	
6/6/2011 8:00	6/6/2011 9:00	6/6/2011 10:00	147235	48,680.8	11.2	265.1	0.82	3.27	91.6	1,937.3	46.0	7,765.1	189.9	10,159.7	0.0719	7.0	6.6	6.8	
6/6/2011 10:00	6/6/2011 11:00	6/6/2011 12:00	147340	48,449.5	11.3	263.9	0.84	3.31	91.6	1,937.0	46.0	7,765.1	189.9	10,166.3	0.0720	7.0	6.6	6.8	
6/6/2011 12:00	6/6/2011 13:00	6/6/2011 14:00	147201	48,412.6	11.3	264.0	0.84	3.34	91.6	1,937.3	46.0	7,765.1	189.9	10,166.3	0.0720	7.0	6.6	6.8	
6/6/2011 14:00	6/6/2011 15:00	6/6/2011 16:00	147318	48,398.8	11.3	263.9	0.87	3.41	91.6	1,936.9	46.0	7,765.1	189.9	10,162.8	0.0721	7.0	6.6	6.8	
6/6/2011 16:00	6/6/2011 17:00	6/6/2011 18:00	147181	48,073.2	11.3	263.4	0.91	3.51	91.6	1,937.6	46.0	7,766.7	190.0	10,161.4	0.0721	7.0	6.6	6.8	
6/6/2011 18:00	6/6/2011 19:00	6/6/2011 20:00	146824	47,879.5	11.2	264.2	0.92	3.52	91.5	1,939.0	46.1	7,766.7	190.0	10,159.3	0.0719	7.0	6.6	6.8	
6/6/2011 20:00	6/6/2011 21:00	6/6/2011 22:00	147059	47,863.5	11.2	264.2	0.93	3.55	91.5	1,942.2	46.0	7,766.9	190.0	10,168.7	0.0718	7.0	6.6	6.8	
6/6/2011 22:00	6/6/2011 23:00	6/6/2011 0:00	146663	47,761.4	11.3	263.4	0.93	3.55	91.5	1,944.2	46.1	7,761.5	190.0	10,165.7	0.0720	7.0	6.6	6.8	
6/6/2011 0:00	6/6/2011 1:00	6/6/2011 2:00	146786	47,789.2	11.2	264.5	0.93	3.58	91.5	1,943.1	46.1	7,761.5	190.0	10,163.8	0.0720	7.0	6.6	6.8	
6/6/2011 2:00	6/6/2011 3:00	6/6/2011 4:00	146724	47,728.0	11.2	264.9	0.93	3.60	91.5	1,943.6	46.1	7,758.9	190.0	10,161.8	0.0721	7.0	6.7	6.8	
6/6/2011 4:00	6/6/2011 5:00	6/6/2011 6:00	146568	47,587.6	11.2	264.7	0.92	3.60	91.4	1,944.7	46.1	7,760.8	190.0	10,166.2	0.0721	7.0	6.7	6.8	
6/6/2011 6:00	6/6/2011 7:00	6/6/2011 8:00	146516	47,523.5	11.2	263.9	0.93	3.62	91.5	1,944.7	46.0	7,763.6	190.0	10,166.8	0.0721	7.0	6.6	6.8	
6/6/2011 8:00	6/6/2011 9:00	6/6/2011 10:00	146602	47,535.6	11.2	263.9	0.93	3.70	91.5	1,941.5	46.1	7,749.8	190.0	10,150.3	0.0719	7.0	6.7	6.8	
6/6/2011 10:00	6/6/2011 11:00	6/6/2011 12:00																	

FCCU-241 Wet Gas Scrubber Performance
Process Parameters
ARI Environmental, Inc.
Notes:
(1) Coke Burn: EPA Method Per MACT UUU 4C

FCCU-241 Wet Gas Scrubber Hourly Data - 6/6/11 @ 00:00 to 6/15/11 @ 15:00

DATE/TIME	Qc	Coke Burn Off	Scrubber Pressure Drop	15F00102 PV	15F00101 PV	15F00100 PV	15F0109 P V	15F0115 P V	Pump Curve	Discharge Pressure	Pump Curve	15F0103 P V	Total Water Flow	Liquid-to-Air Ratio	15A010 PHA	15A010 TWR	2B PV	Average Scrubber Liquid pH
START	END	SCPM	IN/20	NaOH	NaOH	GPM	PSIG	PSIG	GPM	PSIG	GPM	GPM	GPM					
6/9/2011 10:00	6/9/2011 11:00	143.036	47.127	0.93	0.93	261.5	91.6	45.8	1937.3	45.8	7835.4	190.0	10.229.8	0.0742	6.9	6.6	6.8	6.8
6/9/2011 11:00	6/9/2011 12:00	141.796	47.207.5	0.92	0.92	261.3	91.6	45.8	1934.9	45.8	7841.4	190.0	10.234.4	0.0750	7.0	6.7	6.9	6.9
6/9/2011 12:00	6/9/2011 13:00	142.743	47.943.7	0.88	0.88	261.7	91.6	45.8	1934.3	45.8	7832.6	190.0	10.232.2	0.0747	7.0	6.7	6.9	6.9
6/9/2011 13:00	6/9/2011 14:00	142.461	48.114.9	0.87	0.87	262.2	91.7	45.8	1931.2	45.8	7830.7	190.0	10.218.9	0.0749	6.9	6.6	6.8	6.8
6/9/2011 14:00	6/9/2011 15:00	141.756	48.200.7	0.90	0.90	261.0	91.6	45.8	1931.9	45.8	7827.9	190.0	10.219.9	0.0751	6.9	6.6	6.8	6.8
6/9/2011 15:00	6/9/2011 16:00	141.958	48.313.4	0.86	0.86	260.6	91.6	45.8	1937.1	45.8	7852.5	190.0	10.245.1	0.0751	7.0	6.8	6.9	6.9
6/9/2011 16:00	6/9/2011 17:00	141.790	48.372.4	0.83	0.83	262.7	91.6	45.8	1936.1	45.8	7850.3	189.9	10.243.0	0.0751	7.0	6.7	6.8	6.8
6/9/2011 17:00	6/9/2011 18:00	141.880	48.353.9	0.87	0.87	262.7	91.6	45.8	1939.4	45.8	7853.4	190.0	10.250.3	0.0751	7.0	6.7	6.8	6.8
6/9/2011 18:00	6/9/2011 19:00	142.375	48.429.7	0.84	0.84	262.4	91.5	45.8	1940.3	45.8	7846.7	190.0	10.244.1	0.0747	7.0	6.7	6.8	6.8
6/9/2011 19:00	6/9/2011 20:00	141.326	48.449.2	0.80	0.80	261.3	91.5	45.8	1941.6	45.8	7852.4	190.0	10.250.3	0.0751	6.9	6.7	6.8	6.8
6/9/2011 20:00	6/9/2011 21:00	140.075	47.902.8	0.89	0.89	258.9	91.5	45.8	1942.6	45.8	7854.6	190.0	10.251.2	0.0755	6.9	6.7	6.9	6.9
6/9/2011 21:00	6/9/2011 22:00	139.494	47.601.9	0.75	0.75	256.8	91.5	45.8	1944.6	45.8	7851.7	190.0	10.248.2	0.0756	7.0	6.7	6.9	6.9
6/9/2011 22:00	6/9/2011 23:00	139.561	47.350.0	0.72	0.72	257.0	91.4	45.8	1942.5	45.8	7850.7	190.0	10.243.9	0.0754	7.1	6.8	6.9	6.9
6/9/2011 23:00	6/9/2011 00:00	139.360	47.046.6	0.71	0.71	258.0	91.5	45.8	1942.5	45.8	7851.7	190.0	10.244.8	0.0754	7.1	6.8	6.9	6.9
6/9/2011 00:00	6/9/2011 01:00	139.815	46.787.3	0.69	0.69	259.0	91.5	45.8	1940.4	45.8	7851.2	190.0	10.248.2	0.0754	6.9	6.6	6.8	6.8
6/9/2011 01:00	6/9/2011 02:00	139.496	46.617.4	0.71	0.71	258.4	91.5	45.8	1941.7	45.8	7857.5	190.1	10.252.7	0.0754	6.9	6.6	6.8	6.8
6/9/2011 02:00	6/9/2011 03:00	139.740	46.729.2	0.74	0.74	259.5	91.5	45.8	1940.7	45.8	7855.5	190.0	10.250.9	0.0754	6.9	6.6	6.8	6.8
6/9/2011 03:00	6/9/2011 04:00	139.557	46.757.8	0.77	0.77	258.6	91.5	45.8	1941.7	45.8	7855.5	190.0	10.250.9	0.0754	6.9	6.6	6.8	6.8
6/9/2011 04:00	6/9/2011 05:00	139.880	46.889.9	0.75	0.75	259.7	91.5	45.8	1941.6	45.8	7854.0	190.0	10.250.4	0.0752	7.0	6.8	6.9	6.9
6/9/2011 05:00	6/9/2011 06:00	140.964	47.216.8	0.73	0.73	260.9	91.5	45.8	1940.8	45.8	7852.5	190.0	10.249.2	0.0747	7.0	6.8	6.9	6.9
6/9/2011 06:00	6/9/2011 07:00	140.841	47.100.6	0.76	0.76	261.6	91.5	45.8	1941.6	45.8	7855.3	190.0	10.253.5	0.0749	7.0	6.8	6.9	6.9
6/9/2011 07:00	6/9/2011 08:00	140.728	46.949.9	0.78	0.78	259.6	91.5	45.8	1942.2	46.1	7735.7	190.0	10.132.4	0.0740	7.0	6.8	6.9	6.9
6/9/2011 08:00	6/9/2011 09:00	140.489	46.993.5	0.78	0.78	259.5	91.5	45.8	1941.5	46.1	7737.4	190.0	10.133.3	0.0741	7.0	6.8	6.9	6.9
6/9/2011 09:00	6/9/2011 10:00	140.928	47.128.2	0.79	0.79	260.9	91.5	45.8	1942.4	46.1	7737.4	190.0	10.149.1	0.0741	7.0	6.8	6.9	6.9
6/9/2011 10:00	6/9/2011 11:00	141.766	47.517.3	0.77	0.77	260.6	91.5	45.8	1942.2	46.1	7749.9	190.1	10.147.5	0.0738	7.0	6.8	6.9	6.9
6/9/2011 11:00	6/9/2011 12:00	141.762	47.816.7	0.77	0.77	261.8	91.6	45.8	1940.7	46.1	7746.0	190.1	10.134.2	0.0739	7.0	6.8	6.9	6.9
6/9/2011 12:00	6/9/2011 13:00	142.684	48.487.1	0.78	0.78	261.8	91.6	45.8	1937.3	46.1	7755.6	190.0	10.152.9	0.0738	7.0	6.8	6.9	6.9
6/9/2011 13:00	6/9/2011 14:00	142.664	48.678.6	0.81	0.81	261.1	91.6	45.8	1937.3	46.1	7752.9	190.0	10.146.0	0.0738	7.0	6.7	6.9	6.9
6/9/2011 14:00	6/9/2011 15:00	142.748	48.735.8	0.80	0.80	261.4	91.6	45.8	1938.2	46.1	7753.3	190.0	10.137.6	0.0737	7.0	6.7	6.9	6.9
6/9/2011 15:00	6/9/2011 16:00	142.369	48.721.9	0.81	0.81	261.2	91.6	45.8	1937.5	46.1	7757.1	190.0	10.150.5	0.0739	7.0	6.8	6.9	6.9
6/9/2011 16:00	6/9/2011 17:00	142.599	48.717.9	0.85	0.85	262.5	91.6	45.8	1936.0	46.1	7759.4	190.0	10.152.6	0.0738	7.0	6.8	6.9	6.9
6/9/2011 17:00	6/9/2011 18:00	142.765	48.402.7	0.77	0.77	261.1	91.5	45.8	1942.7	46.0	7768.1	190.0	10.166.5	0.0740	7.0	6.8	6.9	6.9
6/9/2011 18:00	6/9/2011 19:00	142.339	48.250.3	0.78	0.78	261.6	91.5	45.8	1939.9	46.0	7765.9	190.0	10.160.0	0.0739	7.0	6.8	6.9	6.9
6/9/2011 19:00	6/9/2011 20:00	142.528	48.154.1	0.78	0.78	261.9	91.5	45.8	1941.1	46.0	7766.1	190.0	10.163.6	0.0737	7.0	6.8	6.9	6.9
6/9/2011 20:00	6/9/2011 21:00	142.305	47.672.6	0.79	0.79	261.7	91.5	45.8	1942.8	46.0	7771.8	190.0	10.169.7	0.0739	7.0	6.8	6.9	6.9
6/9/2011 21:00	6/9/2011 22:00	142.277	47.677.6	0.81	0.81	260.7	91.5	45.8	1942.8	46.0	7769.6	190.0	10.175.6	0.0738	7.0	6.7	6.9	6.9
6/9/2011 22:00	6/9/2011 23:00	142.155	47.499.8	0.80	0.80	260.9	91.4	45.8	1946.4	46.0	7772.3	190.0	10.167.8	0.0740	7.0	6.8	6.9	6.9
6/9/2011 23:00	6/9/2011 00:00	141.649	47.169.7	0.79	0.79	260.7	91.5	45.8	1945.4	46.0	7780.2	190.0	10.173.9	0.0740	7.0	6.8	6.9	6.9
6/9/2011 00:00	6/9/2011 01:00	141.668	47.035.4	0.79	0.79	260.7	91.5	45.8	1945.4	46.0	7780.2	190.0	10.180.0	0.0740	7.0	6.8	6.9	6.9
6/9/2011 01:00	6/9/2011 02:00	141.226	46.810.1	0.79	0.79	260.7	91.5	45.8	1942.7	46.0	7779.0	190.0	10.178.0	0.0740	7.0	6.8	6.9	6.9
6/9/2011 02:00	6/9/2011 03:00	141.570	46.858.6	0.78	0.78	260.9	91.5	45.8	1942.7	46.0	7778.0	190.0	10.176.2	0.0740	7.0	6.8	6.9	6.9
6/9/2011 03:00	6/9/2011 04:00	141.570	46.835.2	0.78	0.78	261.7	91.5	45.8	1943.0	46.0	7778.6	190.0	10.179.5	0.0740	7.0	6.8	6.9	6.9
6/9/2011 04:00	6/9/2011 05:00	141.613	46.870.7	0.77	0.77	261.7	91.5	45.8	1943.9	46.0	7778.6	190.0	10.190.5	0.0739	7.0	6.7	6.9	6.9
6/9/2011 05:00	6/9/2011 06:00	141.918	47.032.2	0.79	0.79	261.0	91.5	45.8	1943.9	46.0	7778.7	189.9	10.177.9	0.0740	7.0	6.7	6.9	6.9
6/9/2011 06:00	6/9/2011 07:00	141.549	46.846.0	0.78	0.78	260.9	91.4	45.8	1943.2	45.7	7811.7	189.9	10.211.9	0.0745	7.0	6.8	6.9	6.9
6/9/2011 07:00	6/9/2011 08:00	141.084	46.606.9	0.77	0.77	260.3	91.4	45.8	1946.6	45.7	7865.5	190.1	10.267.7	0.0748	7.0	6.8	6.9	6.9
6/9/2011 08:00	6/9/2011 09:00	141.236	46.714.9	0.76	0.76	261.5	91.4	45.8	1948.4	45.7	7866.7	190.0	10.270.5	0.0746	7.0	6.8	6.9	6.9
6/9/2011 09:00	6/9/2011 10:00	141.830	47.105.7	0.79	0.79	261.5	91.4	45.8	1948.4	45.7	7867.3	190.0	10.270.6	0.0742	7.0	6.8	6.9	6.9
6/9/2011 10:00	6/9/2011 11:00	142.782	47.674.5	0.76	0.76	259.9	91.5	45.8	1942.4	45.7	7874.3	190.0	10.276.0	0.0746	7.0	6.8	6.9	6.9
6/9/2011 11:00	6/9/2011 12:00	142.559	47.906.3	0.76	0.76	264.9	91.6	45.8	1939.3	45.7	7869.6	190.0	10.267.7	0.0745	7.0	6.8	6.9	6.9
6/9/2011 12:00	6/9/2011 13:00	143.311	48.450.9	0.75	0.75	261.7	91.5	45.8	1940.4	45.7	7873.6	190.0	10.269.7	0.0745	7.0	6.8	6.9	6.9
6/9/2011 13:00	6/9/2011 14:00	143.430	48.666.3	0.75	0.75	262.9	91.6	45.8	1939.9	45.7	7860.2	190.0	10.252.9	0.0742	7.0	6.7	6.9	6.9
6/9/2011 14:00	6/9/2011 15:00	143.233	48.791.8	0.76	0.76	263.4	91.6	45.8	1939.0	45.7	7865.2	190.0	10.255.6	0.0744	7.0	6.8	6.9	6.9
6/9/2011 15:00	6/9/2011 16:00	143.104	48.759.5	0.76	0.76	261.6	91.5	45.8	1941.5	45.7	7866.3	189.9	10.283.2	0.0747	7.0	6.8	6.9	6.9
6/9/2011 16:00	6/9/2011 17:00	143.210	48.656.3	0.75	0.75	262.2	91.5	45.8	1942.1	45.7	7878.1	190.0	10.276.2	0.0745	7.0	6.8	6.9	6.9
6/9/2011 17:00	6/9/2011 18:00	142.738	48.363.2	0.75	0.75	262.3	91.5	45.8	1941.8	45.7	7873.9	190.0	10.271.8	0.0747	7.0	6.7	6.9	6.9
6/9/2011 18:00																		

FCU-1241 Wet Gas Scrubber Performance
 Process Parameters
 ARI Environmental, Inc.
 Notes:
 (1) Coke Burn: EPA Method Per MACT UUU 4C

FCU WET GAS SCRUBBER HOURLY DATA - 8/6/11 @ 00:00 to 8/15/11 @ 15:00

Q ⁺	Coke Burn Off	Scrubber Pressure Drop	FEJG GAS FLOW CORRECTED - EPA SCFM	Scrubber Water Use Calculation										Total Water Flow	Liquid-to-Air Ratio	15A010			Average Scrubber Liquid pH	
				15FC0100.PV	15FC0101.PV	15FC0102.PV	15P0109.PV	15P0115.PV	Pump Curve	Discharge Pressure	15FC0103.PV	Scrubber Purge	15A010 2A.PV			15A010 2B.PV	15A010 2C.PV			
DATE/TIME START	DATE/TIME END	(1) LBS/HR	IN/20	GPM	GPM	GPM	PSIG	GPM	PSIG	GPM	PSIG	GPM	GPM	GPM	GPM	GPM	pH	pH	pH	pH
6/10/2011 23:00	6/11/2011 0:00	142,519	47,558.7	260.9	0.75	2.89	91.5	1,945.6	45.7	7,887.8	190.0	10,287.9	0.0745	7.0	6.8	6.9	6.8	6.9	6.9	6.9
6/11/2011 0:00	6/11/2011 1:00	142,408	47,543.5	262.2	0.75	2.94	91.5	1,945.4	45.6	7,895.5	190.0	10,296.8	0.0746	7.0	6.8	6.9	6.8	6.9	6.9	6.9
6/11/2011 1:00	6/11/2011 2:00	142,422	47,556.4	261.8	0.75	2.81	91.5	1,945.7	45.6	7,900.6	190.2	10,301.7	0.0746	7.0	6.8	6.9	6.8	6.9	6.9	6.9
6/11/2011 2:00	6/11/2011 3:00	142,508	47,571.3	261.9	0.75	2.88	91.5	1,945.9	45.6	7,896.5	190.0	10,298.0	0.0746	7.0	6.8	6.9	6.8	6.9	6.9	6.9
6/11/2011 3:00	6/11/2011 4:00	142,546	47,609.0	263.3	0.74	2.91	91.5	1,943.5	45.6	7,901.1	190.0	10,301.6	0.0746	7.0	6.8	6.9	6.8	6.9	6.9	6.9
6/11/2011 4:00	6/11/2011 5:00	142,313	47,488.4	261.5	0.75	2.77	91.5	1,943.1	45.6	7,893.1	190.0	10,291.3	0.0746	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 5:00	6/11/2011 6:00	141,870	47,062.9	260.7	0.74	3.07	91.5	1,942.9	45.6	7,893.4	190.0	10,290.8	0.0747	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 6:00	6/11/2011 7:00	141,827	46,924.7	261.3	0.75	2.92	91.5	1,944.5	45.7	7,884.6	189.9	10,284.0	0.0748	7.1	6.8	6.9	6.8	6.9	6.8	6.9
6/11/2011 7:00	6/11/2011 8:00	141,264	46,457.1	261.5	0.74	2.90	91.4	1,949.7	45.7	7,886.5	189.9	10,291.3	0.0744	7.0	6.8	6.9	6.7	6.8	6.9	6.9
6/11/2011 8:00	6/11/2011 9:00	141,096	46,364.9	259.8	0.75	3.03	91.5	1,945.9	46.0	7,883.5	190.1	10,183.0	0.0741	7.0	6.7	6.8	6.8	6.9	6.8	6.9
6/11/2011 9:00	6/11/2011 10:00	141,397	46,505.5	260.9	0.74	2.94	91.5	1,945.8	46.0	7,882.8	190.0	10,185.5	0.0740	7.0	6.7	6.8	6.8	6.9	6.8	6.9
6/11/2011 10:00	6/11/2011 11:00	142,889	47,305.8	261.4	0.73	3.02	91.5	1,945.5	46.0	7,882.8	190.0	10,183.5	0.0733	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 11:00	6/11/2011 12:00	142,987	47,399.5	262.1	0.74	3.12	91.5	1,943.3	46.0	7,778.0	190.0	10,177.2	0.0737	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 12:00	6/11/2011 13:00	142,987	48,020.8	262.8	0.73	2.67	91.5	1,944.1	46.0	7,766.2	190.0	10,166.6	0.0736	7.0	6.7	6.9	6.8	6.9	6.7	6.9
6/11/2011 13:00	6/11/2011 14:00	143,557	48,536.9	262.0	0.72	2.95	91.6	1,939.1	46.0	7,763.3	190.1	10,158.2	0.0734	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 14:00	6/11/2011 15:00	143,402	48,536.9	262.7	0.73	2.90	91.5	1,940.3	46.0	7,766.5	190.1	10,163.1	0.0737	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 15:00	6/11/2011 16:00	143,667	48,685.7	263.1	0.72	2.87	91.6	1,938.7	45.9	7,791.4	190.0	10,176.7	0.0737	7.1	6.8	6.9	6.7	6.9	6.7	6.9
6/11/2011 16:00	6/11/2011 17:00	143,343	48,770.8	263.0	0.71	2.88	91.6	1,938.7	45.9	7,791.4	190.0	10,176.7	0.0737	7.1	6.8	6.9	6.7	6.9	6.7	6.9
6/11/2011 17:00	6/11/2011 18:00	143,705	48,782.8	263.0	0.72	2.88	91.6	1,938.7	45.9	7,791.4	190.0	10,176.7	0.0737	7.1	6.8	6.9	6.7	6.9	6.7	6.9
6/11/2011 18:00	6/11/2011 19:00	143,942	48,693.9	263.4	0.71	2.88	91.6	1,938.7	45.9	7,791.4	190.0	10,176.7	0.0737	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 19:00	6/11/2011 20:00	143,598	48,869.8	263.8	0.72	2.71	91.5	1,942.3	46.0	7,794.0	190.1	10,193.2	0.0736	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 20:00	6/11/2011 21:00	143,868	48,808.7	263.8	0.72	2.68	91.5	1,941.0	46.0	7,792.4	190.0	10,193.2	0.0738	7.0	6.7	6.9	6.7	6.9	6.7	6.9
6/11/2011 21:00	6/11/2011 22:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/11/2011 22:00	6/11/2011 23:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 0:00	6/12/2011 1:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 1:00	6/12/2011 2:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 2:00	6/12/2011 3:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 3:00	6/12/2011 4:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 4:00	6/12/2011 5:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 5:00	6/12/2011 6:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 6:00	6/12/2011 7:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 7:00	6/12/2011 8:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 8:00	6/12/2011 9:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 9:00	6/12/2011 10:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 10:00	6/12/2011 11:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 11:00	6/12/2011 12:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 12:00	6/12/2011 13:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 13:00	6/12/2011 14:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 14:00	6/12/2011 15:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 15:00	6/12/2011 16:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 16:00	6/12/2011 17:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 17:00	6/12/2011 18:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 18:00	6/12/2011 19:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 19:00	6/12/2011 20:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.0	10,199.1	0.0736	7.0	6.7	6.9	6.6	6.9	6.6	6.9
6/12/2011 20:00	6/12/2011 21:00	143,598	48,808.7	263.3	0.72	2.82	91.5	1,943.5	45.9	7,800.5	190.									

FCU-1241 Wet Gas Scrubber Hourly Data - 8/6/11 @ 00:00 to 8/15/11 @ 15:00

Process Parameters
ARI Environmental, Inc.
Notes:
(1) Coke Burn: EPA Method Per MACT UUU 4C

DATE/TIME	Q _g GPM GAS FLOW CORRECTED - EPA 5-24-08	Coke Burn Off (1) LBS/HR	Scrubber Pressure Drop 1EED030102RY APM Pressure Drop	Scrubber Water Use Calculation						Total Water Flow GPM	Liquid to Air Ratio	15A1010 2A.PV TWR RCIRC PH A PH	15A1010 2B.PV TWR RCIRC PH B PH	Average Scrubber Liquid pH
				15FC0100.PV Make-up Flow GPM	15FC0101. PV NaOH GPM	15FC0102. PV NaOH GPM	15P10109.P V Discharge Pressure PSIG	Pump Curve GPM	15P10115.P V Discharge Pressure PSIG	Pump Curve GPM				
6/13/2011 12:00	62,090	23,337.8	9.5	195.3	0.50	3.78	92.3	1,893.4	45.8	7,827.2	0.1607	6.9	6.9	6.8
6/13/2011 13:00	61,297	22,995.5	9.5	194.6	0.51	4.69	92.4	1,889.3	45.9	7,807.1	0.1629	6.2	6.2	6.5
6/13/2011 14:00	61,232	22,970.4	9.4	191.0	0.50	7.62	92.4	1,887.7	46.0	7,769.4	0.1624	6.1	7.2	6.7
6/13/2011 15:00	60,070	22,603.3	9.5	192.4	0.46	6.14	92.4	1,887.0	46.1	7,747.2	0.1648	7.7	7.5	7.6
6/13/2011 16:00	60,615	22,828.0	9.4	195.7	0.43	4.74	92.4	1,888.4	46.0	7,770.0	0.1636	7.7	7.4	7.5
6/13/2011 17:00	62,133	23,377.9	9.3	195.6	0.41	3.62	92.4	1,890.5	46.1	7,734.6	0.1592	7.5	7.3	7.4
6/13/2011 18:00	64,087	24,233.1	9.3	196.0	0.41	2.93	92.4	1,891.2	46.1	7,759.5	0.1541	7.3	7.0	7.1
6/13/2011 19:00	64,582	24,381.2	9.4	195.3	0.44	2.80	92.3	1,896.3	46.0	7,787.9	0.1536	7.0	6.8	6.9
6/13/2011 20:00	64,767	24,451.4	9.5	196.0	0.48	3.06	92.3	1,893.8	45.9	7,798.0	0.1534	6.8	6.6	6.7
6/13/2011 21:00	65,603	24,510.1	9.5	195.9	0.52	3.65	92.3	1,893.8	46.0	7,781.7	0.1521	6.6	6.5	6.6
6/13/2011 22:00	65,378	24,352.5	9.6	195.4	0.55	4.45	92.3	1,896.6	46.0	7,767.0	0.1524	6.7	6.6	6.7
6/13/2011 23:00	64,249	23,875.4	9.5	195.2	0.53	4.30	92.3	1,896.1	46.0	7,763.2	0.1524	6.7	6.6	6.7
6/14/2011 00:00	61,324	22,784.4	9.5	196.2	0.53	4.08	92.3	1,897.2	46.1	7,757.7	0.1524	7.0	6.8	6.9
6/14/2011 01:00	70,317	26,022.9	9.5	199.6	0.52	4.08	92.3	1,897.2	46.1	7,757.7	0.1524	7.1	6.9	7.0
6/14/2011 02:00	80,734	29,647.4	9.4	201.5	0.51	3.94	92.3	1,897.2	46.1	7,757.7	0.1524	7.0	6.8	6.9
6/14/2011 03:00	81,100	29,931.9	9.5	200.1	0.53	3.96	92.3	1,897.2	46.1	7,757.7	0.1524	7.0	6.8	6.9
6/14/2011 04:00	81,379	29,920.5	9.5	199.0	0.55	4.07	92.2	1,896.6	46.1	7,757.7	0.1524	6.9	6.7	6.8
6/14/2011 05:00	81,075	29,601.6	9.5	198.1	0.56	4.20	92.2	1,897.2	46.0	7,765.5	0.1524	6.9	6.7	6.8
6/14/2011 06:00	81,249	29,520.6	9.5	201.2	0.56	4.31	92.2	1,904.2	46.1	7,755.5	0.1524	7.0	6.7	6.8
6/14/2011 07:00	80,475	29,185.5	9.5	198.9	0.57	4.36	92.2	1,902.6	46.1	7,758.3	0.1524	7.0	6.8	6.9
6/14/2011 08:00	80,515	29,410.2	9.6	200.1	0.57	4.35	92.2	1,900.2	46.2	7,712.2	0.1524	7.0	6.8	6.9
6/14/2011 09:00	81,156	29,593.1	9.6	199.6	0.56	4.31	92.2	1,899.3	46.3	7,667.8	0.1524	7.0	6.8	6.9
6/14/2011 10:00	81,907	29,555.5	9.6	201.1	0.57	4.38	92.2	1,898.9	46.4	7,666.7	0.1524	7.0	6.7	6.8
6/14/2011 11:00	81,860	30,249.4	9.5	200.7	0.58	4.50	92.3	1,895.7	46.4	7,666.3	0.1524	6.9	6.7	6.8
6/14/2011 12:00	81,843	30,733.8	9.6	200.0	0.58	5.69	92.3	1,895.3	46.4	7,661.6	0.1524	6.0	6.8	6.4
6/14/2011 13:00	82,218	30,907.0	9.5	197.8	0.56	9.46	92.3	1,893.4	46.6	7,601.0	0.1524	5.4	7.3	6.4
6/14/2011 14:00	82,562	30,801.4	9.4	196.7	0.50	9.26	92.4	1,888.8	46.6	7,587.2	0.1524	7.2	7.8	7.5
6/14/2011 15:00	82,638	30,800.9	9.4	197.4	0.43	11.13	92.4	1,888.0	46.7	7,560.3	0.1524	6.1	8.0	7.1
6/14/2011 16:00	82,538	30,855.3	9.4	195.2	0.35	13.00	92.4	1,888.0	46.8	7,522.0	0.1524	6.1	8.2	7.2
6/14/2011 17:00	82,811	30,735.6	9.4	194.3	0.25	14.75	92.4	1,890.8	46.9	7,479.1	0.1524	6.2	8.4	7.3
6/14/2011 18:00	82,921	30,797.3	9.5	192.6	0.16	16.46	92.4	1,891.1	47.1	7,431.2	0.1524	6.3	8.6	7.4
6/14/2011 19:00	82,579	30,678.8	9.6	190.3	0.06	18.00	92.4	1,891.1	47.2	7,379.6	0.1524	6.3	8.7	7.5
6/14/2011 20:00	82,319	30,577.2	9.6	188.8	0.00	19.32	92.4	1,890.5	47.2	7,328.4	0.1524	6.4	8.7	7.5
6/14/2011 21:00	82,111	30,523.5	9.6	189.0	0.00	19.99	92.4	1,889.3	47.2	7,264.5	0.1524	6.3	8.8	7.6
6/14/2011 22:00	82,159	30,523.5	9.6	189.0	0.00	20.00	92.4	1,889.3	47.2	7,243.4	0.1524	6.3	8.8	7.6
6/14/2011 23:00	82,133	30,428.5	9.6	189.3	0.00	19.97	92.4	1,887.7	47.7	7,225.3	0.1524	6.3	8.8	7.6
6/15/2011 00:00	82,170	30,328.9	9.6	189.8	0.00	19.95	92.4	1,886.0	47.8	7,213.6	0.1524	6.3	8.8	7.6
6/15/2011 01:00	82,417	30,303.9	9.6	189.0	0.00	19.94	92.4	1,886.0	47.8	7,206.9	0.1524	6.3	8.8	7.5
6/15/2011 02:00	82,417	30,296.7	9.6	189.8	0.00	19.92	92.4	1,888.1	47.8	7,205.1	0.1524	6.3	8.8	7.5
6/15/2011 03:00	82,273	30,235.7	9.6	189.9	0.00	19.92	92.4	1,888.1	47.8	7,191.0	0.1524	6.3	8.8	7.5
6/15/2011 04:00	82,129	30,066.9	9.6	189.9	0.00	19.91	92.4	1,888.4	47.8	7,191.5	0.1524	6.2	8.7	7.5
6/15/2011 05:00	81,897	30,154.4	9.6	187.9	0.00	19.91	92.4	1,887.8	47.8	7,192.7	0.1524	6.2	8.7	7.5
6/15/2011 06:00	81,850	30,328.9	9.7	188.6	0.00	19.91	92.4	1,887.8	47.8	7,192.7	0.1524	6.2	8.7	7.5
6/15/2011 07:00	82,044	30,303.6	9.8	188.0	0.00	19.91	92.4	1,887.1	47.6	7,262.5	0.1524	6.2	8.7	7.4
6/15/2011 08:00	82,103	30,292.1	9.8	189.3	0.00	19.90	92.4	1,887.6	47.6	7,277.7	0.1524	6.2	8.7	7.4
6/15/2011 09:00	82,490	30,411.0	9.7	189.7	0.01	17.07	92.5	1,885.6	47.6	7,325.0	0.1524	8.6	9.9	8.3
6/15/2011 10:00	83,325	30,560.4	9.8	192.9	0.00	13.43	92.4	1,885.6	47.6	7,325.0	0.1524	8.6	9.9	8.3
6/15/2011 11:00	83,159	30,610.5	9.7	192.9	0.00	9.86	92.4	1,890.0	47.2	7,392.0	0.1524	8.2	8.7	8.5
6/15/2011 12:00	83,669	30,831.1	9.7	202.1	0.00	6.36	92.4	1,891.8	47.0	7,457.7	0.1524	8.2	8.7	8.5
6/15/2011 13:00	82,467	30,874.2	9.7	206.8	0.00	1.72	92.4	1,890.1	46.7	7,550.9	0.1524	7.9	8.4	8.2
6/15/2011 14:00	82,452	30,853.9	9.5	208.7	0.06	(0.00)	92.3	1,897.1	46.4	7,643.2	0.1524	7.4	7.9	7.7



Valero Port Arthur Refinery
Source: FCCU-1241 Wet Gas Scrubber Stack
Test Dates: 6/6 - 6/14/11

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:

Daniel Fitzgerald

Mr. Fitzgerald is the Division Manager of ARI's Source Testing Division with offices located in Wauconda, Illinois and Houston, Texas. With over 32 years experience in process evaluation, emission compliance and control equipment efficiency test programs, Mr. Fitzgerald specializes in the technical planning, coordination and performance of environmental test programs. Mr. Fitzgerald has an extensive background in EPA sampling and analysis applications, incinerator design and optimization, VOC sampling and analysis, RCRA trial burn testing, sampling equipment design and fabrication, implementation of innovative sampling and analysis techniques, methods validation and R&D. Mr. Fitzgerald is presently certified as a QSTI by the Source Evaluation Society (SES) pursuant to the requirements of ASTM D7036-04.

His source sampling experience includes conducting over 1,000 separate test programs involving emissions testing at automotive manufacturing, steel mills, refineries, printing operations, food processing, chemical plants, fume incineration systems, hazardous waste incinerators, bulk gasoline terminals and power plants.

Greg Burch

Mr. Burch is ARI's Source Testing Division South Central Regional Manager and is responsible for planning and managing sampling programs, sample analysis, data reduction, QA/QC reviews, and reporting activity for the regional office. He is certified as a QSTI through the SES. Mr. Burch has been involved with source testing since 1990. He has accumulated extensive experience in flow stream characterization for engineering purposes; emissions sampling for regulatory compliance demonstration and emissions sampling for system audit requirements of CEMS and PEMS.

Jerry Bovee

Mr. Bovee is the Northeast Regional Manager and a Senior Project Manager with ARI. His 20 years of experience includes emission compliance and CEM certification testing for a wide variety of industries including petrochemical, steel mills, electric utilities, cement plants, pulp and paper mills, asphalt plants and general manufacturing plants. Mr. Bovee is presently certified as a QSTI by the SES pursuant to the requirements of ASTM D7036-04.



Test Program Qualifications

Jeff Goldfine

Mr. Goldfine is a Project Manager with ARI. His 7 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. Goldfine is presently certified as a QSTI by the SES pursuant to the requirements of ASTM D7036-04.

Jeff Knapp

Mr. Knapp is a Project Manager with ARI. His 20 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.

Andrew Hornbeck

Mr. Hornbeck is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up.

Chris Hall

Mr. Hall is a source sampling field technician. Mr. Hall is well versed in the operation and maintenance of manual source sampling equipment and has performed these functions on numerous tests for various clients.

Mr. Hall's responsibilities include field sampling, sample analysis, data reduction and interpretation, and maintenance and calibration of continuous and manual source sampling equipment.

Ronnie Mullins

Mr. Mullins is a source sampling field technician. Mr. Mullins is well versed in the operation and maintenance of manual source sampling equipment and has performed these functions on numerous tests for various clients.

Mr. Mullins' responsibilities include field sampling, sample analysis, data reduction and interpretation, and maintenance and calibration of continuous and manual source sampling equipment.

Ron White

Mr. White is the Laboratory Manager with ARI. He is experienced in wet chemistry and chromatography work. He conducts routine analysis of Appendix A reference method samples as well as comprehensive characterization of water samples for a variety of volatile organics. In addition to his analytical responsibilities, Mr. White coordinates the collection, documentation, storage and chain of custody for many of ARI's more comprehensive compliance test programs.

Richard Brank-Campbell

Mr. Brank-Campbell is a source sampling field technician. Mr. Brank-Campbell is well versed in the operation and maintenance of manual source sampling equipment and has performed these functions on numerous tests for various clients.

Mr. Brank-Campbell's responsibilities include field sampling, sample analysis, data reduction and interpretation, and maintenance and calibration of continuous and manual source sampling equipment.

SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT


DANIEL E. FITZGERALD

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

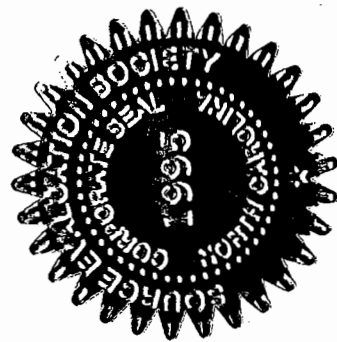
ISSUED THIS 5TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 4TH, 2013


Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board


C. David Bagwell, QSTI/QSTO Review Board


John R. Smith, QSTI/QSTO Review Board



APPLICATION

NO.

2008-218

SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual


LET IT BE KNOWN THAT


DANIEL E. FITZGERALD

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 5TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 4TH, 2013

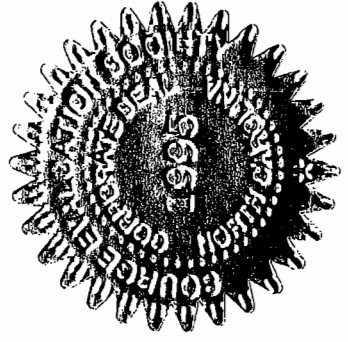

Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board


C. David Bagwell, QSTI/QSTO Review Board


John R. Smith, QSTI/QSTO Review Board

APPLICATION
NO.
2008-218



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT

DANIEL E. FITZGERALD

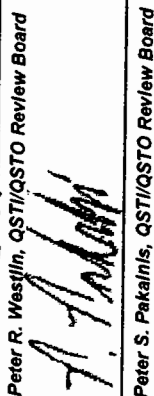
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

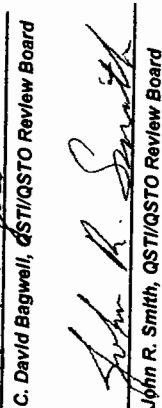
GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS

ISSUED THIS 5TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 4TH, 2013

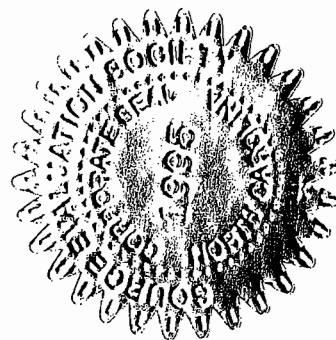

Peter R. Westlin, QSTI/QSTO Review Board


C. David Bagwell, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board


John R. Smith, QSTI/QSTO Review Board

APPLICATION
NO.
2008-218



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

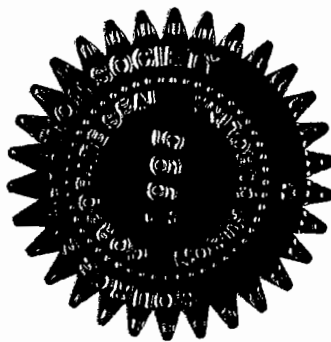
LET IT BE KNOWN THAT

DANIEL E. FITZGERALD

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

HAZARDOUS METALS MEASUREMENT SAMPLING METHODS

ISSUED THIS 15TH OF MARCH 2011 AND EFFECTIVE UNTIL MARCH 14TH, 2016

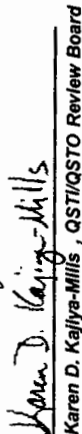


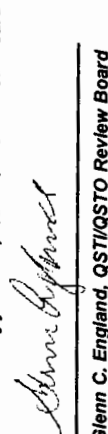

Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board


LeRoy Owens, QSTI/QSTO Review Board


C. David Bagweff, QSTI/QSTO Review Board


Karen D. Kalye-Mills, QSTI/QSTO Review Board


Glenn C. England, QSTI/QSTO Review Board

APPLICATION
NO.
2008-218

SOURCE EVALUATION SOCIETY



Qualified Source Test Individual

LET IT BE KNOWN THAT

GREG D. BURCH

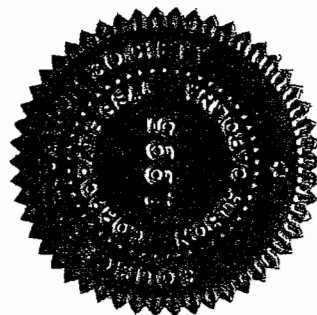
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

BASIC KNOWLEDGE AND MANUAL PARTICULATE SAMPLING METHODS

ISSUED THIS 20TH DAY OF APRIL 2006 AND EFFECTIVE UNTIL APRIL 19TH, 2011

Peter R. Westlin
QSTI Review Board

Leroy F. Owens
QSTI Review Board



Glenn C. England
QSTI Review Board

APPLICATION NO. 2006-027

SOURCE EVALUATION SOCIETY



Qualified Source Test Individual

LET IT BE KNOWN THAT

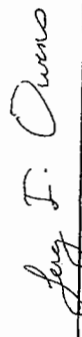
GREG D. BURCH

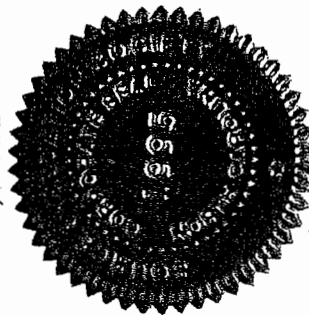
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS SOURCE SAMPLING METHODS

ISSUED THIS 8TH DAY OF JUNE 2006 AND EFFECTIVE UNTIL JUNE 7TH, 2011


Peter R. Westlin
QSTI Review Board


LeRoy F. Owens
QSTI Review Board




Glenn C. Englund
QSTI Review Board

APPLICATION NO. 2006-027

SOURCE EVALUATION SOCIETY



Qualified Source Test Individual

LET IT BE KNOWN THAT

GREG D. BURCH

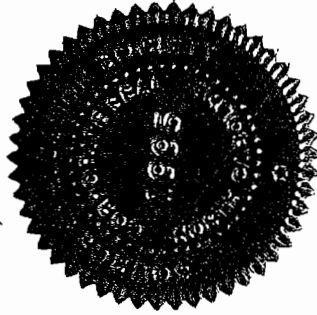
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

INSTRUMENTAL METHODS

ISSUED THIS 8TH DAY OF JUNE 2006 AND EFFECTIVE UNTIL JUNE 7TH, 2011

Peter R. Westlin
QSTI Review Board

LeRoy F. Owens
QSTI Review Board



Glenn C. England
QSTI Review Board

APPLICATION NO. 2006-027

SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT

JERRY A. BOVEE

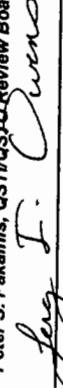
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 19TH DAY OF OCTOBER 2010 AND EFFECTIVE UNTIL OCTOBER 18TH, 2015



Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board

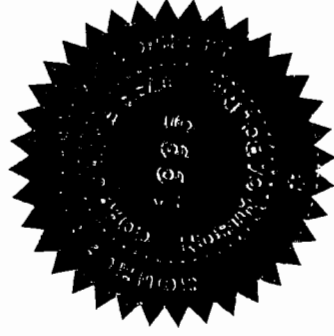

LeRoy Owens, QSTI/QSTO Review Board


C. David Bagwell, QSTI/QSTO Review Board


Karen D. Kallya-Mills, QSTI/QSTO Review Board


Glenn C. England, QSTI/QSTO Review Board

APPLICATION
NO.
2009-354



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

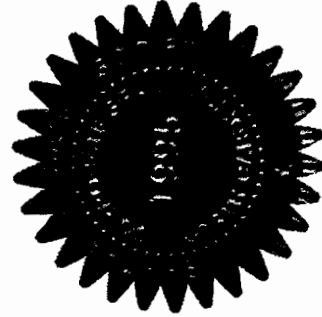
LET IT BE KNOWN THAT

JERRY A. BOVEE


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 8TH DAY OF JULY 2009 AND EFFECTIVE UNTIL JULY 7TH 2014




APPLICATION
NO.
2009-354


C. David Bagwell, QSTI/QSTO Review Board


Karen D. Kajiya-Mills, QSTI/QSTO Review Board


John R. Smith, QSTI/QSTO Review Board


Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakainis, QSTI/QSTO Review Board

SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT

JERRY A. BOVEE

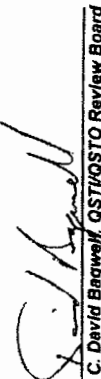
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

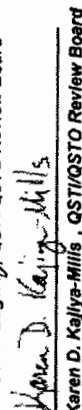
**MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE
SAMPLING METHODS**

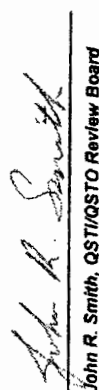
ISSUED THIS 8TH DAY OF JULY 2009 AND EFFECTIVE UNTIL JULY 7TH, 2014


Peter R. Westlin, QSTI/QSTO Review Board

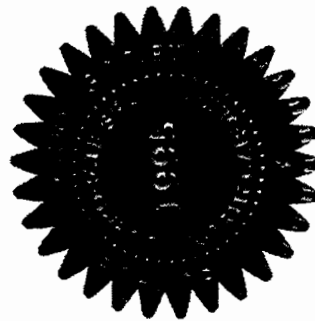

Peter S. Pakalnis, QSTI/QSTO Review Board


C. David Bagweff, QSTI/QSTO Review Board


Karen D. Kajiya-Mills, QSTI/QSTO Review Board


John R. Smith, QSTI/QSTO Review Board

APPLICATION
NO.
2009-354



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT

JERRY A. BOVEE

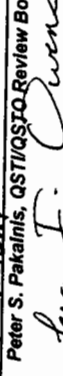
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

HAZARDOUS METALS MEASUREMENT SAMPLING METHODS

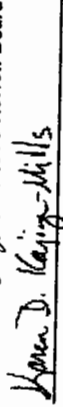
ISSUED THIS 19TH DAY OF OCTOBER 2010 AND EFFECTIVE UNTIL OCTOBER 18TH 2015


Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board


LeRoy Owens, QSTI/QSTO Review Board

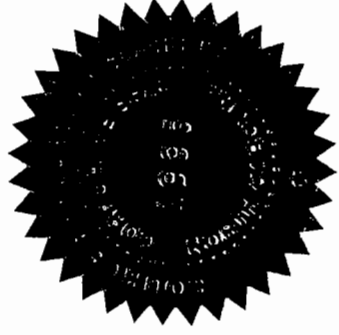

C. David Bagwey, QSTI/QSTO Review Board


Karen D. Kaling-Mills, QSTI/QSTO Review Board


Glenn C. England, QSTI/QSTO Review Board

APPLICATION
NO.

2009-354



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT


JEFF S. GOLDFINE

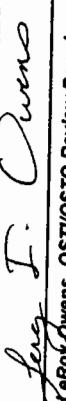
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS


ISSUED THIS 16TH OF NOVEMBER 2010 AND EFFECTIVE UNTIL NOVEMBER 15TH, 2015



Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board

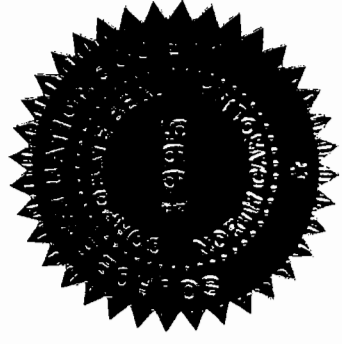

Leroy Owens, QSTI/QSTO Review Board


C. David Bagweff, QSTI/QSTO Review Board


Karen D. Kalliya-Mills, QSTI/QSTO Review Board


Glenn C. England, QSTI/QSTO Review Board

APPLICATION
NO.
2010-489



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT

JEFF S. GOLDFINE

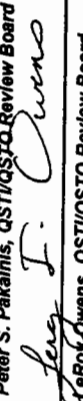
HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

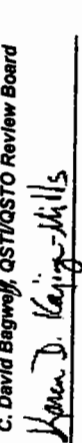
ISSUED THIS 16TH DAY OF NOVEMBER 2010 AND EFFECTIVE UNTIL NOVEMBER 15TH, 2015

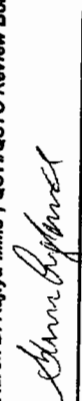

Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board


LeRoy Owens, QSTI/QSTO Review Board


C. David Bagwell, QSTI/QSTO Review Board


Karen D. Kallya-Mills, QSTI/QSTO Review Board


Glenn C. England, QSTI/QSTO Review Board

APPLICATION
NO.
2010-489

