Work Order No. 03917.008.028

No. 1 Combination Boiler, No. 2 Lime Kiln, No. 2 and 3 Smelt Dissolving Tank Vent, and No. 3 Recovery Furnace Emission Compliance Test Report

Resolute Forest Products
Catawba, South Carolina
30-31 March and 1 April 2015

Prepared For

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22 April 2015

WESTON SOLUTIONS, INC. (WESTON®)
EMISSION TESTING PRACTICE – AUBURN OPERATIONS
ACCREDITATION STIPULATION

Laboratory:	Weston Solutions, Inc.
Accreditor(s):	Louisiana Environmental Laboratory Accreditation Program (LELAP) – Laboratory and Emission Testing Practice
Accreditation ID:	LELAP – 03024
Scope:	Particulate Matter, Nitrogen Oxides, Carbon Monoxide, and Total Reduced Sulfur Sampling and Analysis
Effective:	LELAP – 21 December 2001
Expires:	LELAP – 30 June 2015

Data Qualifiers

The following are general reporting notes that are applicable to all WESTON reports, unless otherwise noted.

- **NL** denotes data that was not from a LELAP accredited method.
- **LNL** denotes lab results that are not from an accredited LELAP laboratory.
- **NN** denotes data that was not from The NELAC Institute (TNI) accredited method.
- **NNL** denotes lab results that are not from an accredited TNI laboratory.
- **ED** denotes data that is not to be used for compliance purposes and may deviate from approved procedures.
- **Q** denotes data whose QA/QC check did not fall within the specified range. This data is still considered valid.
- **A** denotes data that is anomalously high with no explanation for the outlier.
- **BDL** denotes values that were below the limit of detection of the analyzer and 2% of the span gas was used to calculate an emission rate.
- **DF** denotes a dilution factor.
- **NAP** denotes emission testing performed by personnel from a non-TNI accredited laboratory.
- **S** denotes analysis that has been subcontracted.
- All values are reported on a "dry" basis, unless otherwise designated as "actual" or "wet" basis.

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SECTION 1
INTRODUCTION

Weston Solutions, Inc. (WESTON®) was retained by Resolute Forest Products (Resolute) to conduct various emission testing on the No. 1 Combination Boiler, No. 2 Lime Kiln, No. 2 and 3 Smelt Dissolving Tank Vent, and the No. 3 Recovery Furnace at the mill in Catawba, South Carolina. The purpose of the emission testing was to demonstrate compliance with the South Carolina Department of Health and Environmental Control (DHEC) permit limits.

WESTON performed the emission testing during 30-31 March and 1 April 2015. The project team included the following individuals.

Name	Project Role
Temp Simpkins	Project Manager/Test Team Leader
Paul Green	Test Team Member
Matthew Carroll	Test Team Member
Hunter Goodlett	Test Team Member
Natalie Hornsby	Quality Assurance Manager/Report Coordinator

Mr. Dale Herendeen of Resolute coordinated the testing with mill operations and served as WESTON's technical contact throughout the effort. A representative of DHEC was not present for testing.

The Louisiana Environmental Laboratory Accreditation Program (LELAP) accredits WESTON's emission testing laboratory. The stipulation associated with this accrediting authority precedes the table of contents of this report.

SECTION 2
RESULTS AND DISCUSSION

Table 2-1 presents the mean results of the emission testing with comparison to the permit limits for each source. The results are less than the applicable standard(s) for the sources. Measurement uncertainty is not shown but has been taken into consideration during method development.

TABLE 2-1
SUMMARY OF EMISSION TEST RESULTS

Source/Parameter	Mean Test Results	Permit Limit
No. 1 Combination Boiler		
PM Emission Factor, lb/MMBtu	0.028	**0.6**
No. 2 Lime Kiln		
NO_X Concentration, ppm@10% O_2	37	**152**
No. 2 and 3 Smelt Dissolving Tank Vent		
TRS Emission Factor, lb/ton BLS	0.0007	**0.033**
No. 3 Recovery Furnace		
NO_X Concentration, ppm@8% O_2	55	**78**
CO Emission Rate, lb/hr	95	**235**

Tables 2-2 through 2-5 provide detailed summaries of the emission results, with comparison to the permit limits. Any differences between the calculated results presented in the appendices and the results reported in the summary tables are due to rounding for presentation.

TABLE 2-2
NO. 1 COMBINATION BOILER
SUMMARY OF PM EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	4/1/15	4/1/15	4/1/15	----
Time Began	0949	1400	1540	----
Time Ended	1059	1507	1647	----
Stack Gas Data				
Temperature, °F	457	453	459	457
Velocity, ft/sec	63	61	61	61
Moisture, %	21	21	22	21
CO_2, Concentration, %	12.1	12.8	13.0	12.6
O_2 Concentration, %	7.7	7.0	6.8	7.2
VFR, x 10^5 dscfm	1.32	1.29	1.26	1.29
Particulate Matter				
Isokinetic Sampling Rate, %	106	107	103	106
Concentration, gr/dscf	0.015	0.013	0.013	0.014
Emission Rate, lb/hr	16.7	14.5	13.8	15.0
Emission Factor, lb/MMBtu	0.032	0.027	0.026	0.028
Permit Limit, lb/MMBtu	-----	-----	-----	**0.6**

TABLE 2-3
NO. 2 LIME KILN
SUMMARY OF NO_x EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	3/30/15	3/30/15	3/30/15	----
Time Began	0756	0907	1023	----
Time Ended	0856	1007	1123	----
Stack Gas Data				
O_2 Concentration, %	5.1	5.0	5.3	5.1
Nitrogen Oxides				
Concentration, ppm	52.0	53.0	55.0	53.3
Concentration, ppm @ 10% O_2	35.9	36.3	38.4	36.9
Permit Limit, ppm @ 10% O_2	----	----	----	**152**

TABLE 2-4
NO. 2 AND 3 SMELT DISSOLVING TANK VENT
SUMMARY OF TRS EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	3/31/15	3/31/15	3/31/15	----
Time Began	0846	1040	1240	----
Time Ended	1017	1210	1411	----
Stack Gas Data				
Temperature, °F	171	172	171	171
Velocity, ft/sec	28	27	26	27
Moisture, %	36	46	42	41
CO_2, Concentration, %	0.0	0.0	0.0	0.0
O_2 Concentration, %	20.9	20.9	20.9	20.9
VFR, x 10^4 dscfm	2.41	2.00	2.03	2.15
Process Data				
Production Rate, ton BLS/hr	108.5	107.2	105.8	107.2
Total Reduced Sulfur				
Concentration, ppm	0.06	0.40	1.65	0.70
Emission Rate, lb/hr	0.01	0.04	0.18	0.08
Emission Factor, lb/ton BLS	0.0001	0.0004	0.0017	0.0007
Permit Limit, lb/ton BLS	-----	-----	-----	**0.033**

TABLE 2-5
NO. 3 RECOVERY FURNACE
SUMMARY OF NO_x EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	3/30/15	3/30/15	3/30/15	----
Time Began	1445	1606	1725	----
Time Ended	1548	1709	1828	----
Stack Gas Data				
Temperature, °F	334	332	335	334
Velocity, ft/sec	76	76	76	76
Moisture, %	21	23	24	23
CO_2, Concentration, %	13.3	13.4	13.4	13.4
O_2 Concentration, %	6.0	5.9	5.9	5.9
VFR, $x10^5$, dscm	2.07	2.01	2.00	2.02
Nitrogen Oxides				
Concentration, ppm	64	65	62	64
Concentration, ppm @ 8% O_2	55	56	53	55
Permit Limit, ppm @ 8% O_2	-----	-----	-----	**78**
Carbon Monxoide				
Concentration, ppm	137	108	78	108
Emission Rate, lb/hr	124	95	68	95
Permit Limit, lb/hr	-----	-----	-----	**235**

SECTION 3
SOURCE TESTING METHODOLOGY

The emission testing program was conducted in accordance with the U.S. EPA Reference Methods summarized in Table 3-1. Method descriptions and quality assurance data are provided in the referenced appendices.

TABLE 3-1
SOURCE TESTING METHODOLOGY

Parameter	Method Number	Appendix Reference		Comments
		Method Description	Quality Control Data	
Volumetric Flow Rate	1,2,4	B.1	H	
Gas Composition	3A	B.2	H	
Particulate Matter	5	B.3	H	
Nitrogen Oxides	7E	B.4	H	Instrumental
Carbon Monoxide	10	B.5	H	
Total Reduced Sulfur	16	B.6	H	Gas Chromatography

These results meet all requirements of TNI unless otherwise specified.

The results within this report relate only to the samples listed in the body of this report.

APPENDIX A
SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

Meter Pressure (Pm), in. Hg

$$Pm = Pb + \frac{\Delta H}{13.6\ in.\ H_2O/in.\ Hg}$$

where, Pb = barometric pressure, in. Hg
ΔH = Pressure differential of orifice in. H_2O

Absolute Stack Gas Pressure (Ps), in. Hg

$$Ps = Pb + \frac{Pg}{13.6\ in.\ H_2O/in.\ Hg}$$

where, Pb = barometric pressure, in. Hg
Pg = Static Pressure, in. H_2O

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.64\,°R/in.\ Hg\ \ x\ \ Y\ \ x\ \ Vm\ \ x\ \ Pm}{Tm}$$

where, Y = meter correction factor
Vm = meter volume, cf
Pm = meter pressure, in. Hg
Tm = meter temperature, °R

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04707\ ft^3/mL\ \ x\ \ Vlc$$

where, Vlc = volume of H_2O collected, mL

Moisture Fraction (Measured), (Bws)

$$Bws = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where, Vwstd = standard wet volume, scf
Vmstd = standard meter volume, dscf

Moisture, % (M%)

$$M\% = Bws\ \ x\ \ 100$$

where, Bws = moisture fraction, measured or at saturation, whichever is lowest

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O_2) + (0.28 (100 - \% CO_2 - \% O_2))$$

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md\ (1 - Bws) + 18\,(Bws)$$

where, Md = molecular weight (DRY), lb/lb-mole
Bws = moisture fraction, dimensionless

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \frac{ft}{sec} \sqrt{\frac{(lb/lb - mole)(in.\ Hg)}{(°R)(in.\ H_2O)}} \times Cp \times \sqrt{Delta\ P}\ avg. \times \sqrt{\frac{Ts}{Ps \times Ms}}$$

where, Cp = pitot tube coefficient
Delta P = velocity head of stack gas, in. H_2O
Ts = absolute stack temperature, °R
Ps = absolute stack gas pressure, in. Hg
Ms = molecular weight of stack gas, lb/lb-mole

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60\ sec/min \times Vs \times As$$

where, Vs = stack gas velocity, ft/sec
As = cross-sectional area of stack, ft^2

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.64 \frac{°R}{in.\ Hg} \times Qa \times (1 - Bws) \times \frac{Ps}{Ts}$$

where, Qa = average stack gas flow at stack conditions, ft^3/min
Bws = moisture content (dimensionless)
Ps = absolute stack gas pressure, in. Hg
Ts = absolute stack temperature, °R

Percent Isokinetic Sampling Rate (%I)

$$\% I = \frac{0.0945\,(in.\ Hg)(min)/(°R)(sec) \times Ts \times Vmstd}{Ps \times Vs \times An \times \Theta \times (1 - Bws)}$$

where, Ts = avg. stack temperature, °R
Vmstd = standard meter volume, dscf
Ps = absolute stack gas pressure, in. Hg
Vs = stack gas velocity, ft/sec
An = cross-sectional area of nozzle, ft^2
Θ = total sampling time, min
Bws = moisture content (dimensionless)

Particulate Matter Concentration at Standard Conditions (Cs), gr/dscf

$$Cs = 15.43 \frac{gr}{g} \; x \; \frac{Mn}{Vmstd}$$

where, Mn = particulate matter collected, g
Vmstd = std. meter volume, dscf

Particulate Matter Concentration Corrected for O_2, Cs @ 8% O_2

$$Cs, \frac{gr}{dscf} \; x \; \frac{20.9 - 8\% \, O_2}{20.9 - measured \, \% \, O_2}$$

Note: O_2 corrections are based on source category or specific sources, i.e. 10% for Lime Kilns 8 % for Recovery Boilers

Particulate Matter Emission Rate (PMR), lb/hr

$$PMR = \frac{Cs \;\; x \;\; Qs \;\; x \;\; 60 \frac{min}{hr}}{7000 \frac{gr}{lb}}$$

where, Cs = particulate conc. at std. cond., gr/dscf
Qs = avg. stack gas flow at std. cond., dscf/min

PM Emission Factor (EMF), lb/MMBtu (correcting for O_2)

$$EMF = PM \;\; conc. \frac{gr}{dscf} \;\; x \;\; \frac{lb}{7000 \; gr} \;\; x \;\; F \; factor, \frac{dscf}{MMBtu} \;\; x \;\; \frac{20.9}{20.9 - \% \, O_2}$$

where, PM conc. = Cs
F factor = defined by client or CFR, scf/MMBtu

NO_X Emission Rate (EMR), lb/hr

$$EMR = \frac{conc. \, x \, Mw \, x \, Qs \, x \, 60 \frac{min}{hr} \, x \, 28.32 \frac{L}{dscf}}{24.04 \frac{L}{g - mole} \, x \, 1.0 \, x \, 10^6 \frac{\mu L}{L} \, x \, 454 \frac{s}{lb}}$$

TRS Emission Factor (EMF), lb/ton BLS

$$EMF = \frac{Emission \; Rate, lb/hr}{Production \; Rate, ton \; BLS/hr}$$

APPENDIX B
TEST METHODOLOGY

B.1 VOLUMETRIC FLOW RATE

B.2 GAS COMPOSITION

B.3 PARTICULATE MATTER

B.4 TOTAL REDUCED SULFUR

B.5 NITROGEN OXIDES

B.6 CARBON MONOXIDE

B.1 VOLUMETRIC FLOW RATE

Mass emission rates are calculated by multiplying measured target analyte concentrations by calculated volumetric flow rates. Volumetric flow rates are calculated using measurement data obtained by EPA Reference Methods 1-4.

The ductwork is measured at the sample location to the nearest 0.25 inch using a steel tape measure. Traverse points are selected in accordance with EPA Reference Method 1 on the basis of ductwork dimensions, geometry, and upstream and downstream disturbances. When a sample location does not meet EPA Reference Method 1 criteria, the maximum recommended number of traverse points is used.

Gas Velocity

The velocity of the gas stream is measured in accordance with EPA Reference Method 2 by reading the instantaneous velocity pressure with an inclined manometer at each traverse point using either a standard "P" type or an "S" type pitot tube. The stack pressure is calculated from the measured static pressure of the stack and the ambient barometric pressure. The static pressure is measured by using the static side of the pitot tube, and the barometric pressure is measured using a calibrated aneroid barometer. Magnahelic® gauges with scales of 0 to 5 and 0 to 25 inches of water or an inclined manometer with a scale of 0 to 10 inches of water are used for velocity pressure measurements. Manometer selection is determined by the velocity pressure of the gas stream. A manometer with a 0 to 0.25 inch scale may be used when the velocity pressure of the gas stream is less than 0.02 inches of water. By convention, any measured velocity pressures of less than 0.005 inches of water are recorded and reported as less than 0.005 inches of water. The stack temperature is measured with a calibrated thermocouple and pyrometer.

For low velocity pressure measurements (less than 0.005 inches of water) a hot wire anemometer may be used to measure the velocity of the gas stream. The indicated velocity is used without correction when the gas stream is ambient air with a moisture content of less than 65%. The indicated velocity is corrected in accordance with procedures specified by the manufacturer when the moisture content exceeds 65% or when the dry gas fraction is something other than ambient air.

Gas Composition and Moisture Content

The composition of the gas stream is measured in accordance with EPA Reference Method 3A using an analyzer.

Integrated samples are collected by withdrawing a sample from the source through a moisture condenser into a Tedlar® sample bag. The bag is then analyzed using a calibrated O_2/CO_2 analyzer.

The moisture content of the gas stream is determined using one of the following procedures:

- For sources requiring testing by EPA Reference or Test Methods 5, 8, 12, 13, 17, 23, 26A, 29, 0010, or 0011, moisture is determined by EPA Reference Method 4. At the conclusion of each run the volume of condensed moisture in the impingers of the sampling train is measured and used to calculate the moisture content of the gas stream.

- For sources with temperatures greater than 212 °F, the approximation technique described in EPA Reference Method 4 may be used with midget impingers to condense moisture before dry gas volume measurement.

- For sources with a temperature of less than 212 °F, wet bulb/dry bulb temperature measurements may be made, and the moisture content calculated using vapor pressure tables.

When multiple methods are used for moisture determinations, the lowest moisture value is used for volumetric flow calculations.

The molecular weight of the gas stream is calculated using the measured moisture, oxygen, and carbon dioxide concentrations. The balance of the gas stream is assumed to be nitrogen. The volumetric flow is then calculated at stack and standard conditions using the calculated molecular weight, the measured stack temperature, and measured velocity, stack and barometric pressures. Standard conditions are 68 °F and 29.92 inches of mercury and 0% moisture.

Data Acquisition and Reporting

Data are recorded at the time of collection on preprinted data sheets. Calculations are performed (where possible) with preprogrammed calculators or spreadsheet software.

Quality Control

Quality control procedures for volumetric flow measurements involve leak checks of pitot tubes, pitot tube lines and manometers; periodic analysis of ambient air and duplicate analysis of source gas samples with the Fyrite analyzer; triplicate analysis with the Orsat analyzer; and periodic calibration checks of thermocouples and pyrometers.

Data transfers are minimized. Data sheets are checked for completeness and accuracy. Calculations are verified by a second person.

B.2 GAS COMPOSITION (INSTRUMENTAL)

Oxygen (O_2) and carbon dioxide (CO_2) testing is conducted in accordance with EPA Reference Method 3A.

Sampling Equipment and Procedures

Figure B-1 illustrates the sampling system. The sample is withdrawn continuously from the source through a heated probe, filter, and sample line to a sample conditioner which removes moisture from the gas stream. The sample is then transported to a Paramagnetic O_2 analyzer and an Infrared CO_2 analyzer.

Sample Analysis

The O_2 analyzer uses an electrochemical cell or paramagnetic detector and the CO_2 analyzer uses a non-dispersive infra-red (NDIR) detector to produce an electrical signal which is linearly proportional to the O_2 and CO_2 concentration, respectively.

Data Acquisition and Reduction

Data is acquired electronically using a computer with software designed by WESTON for EPA Reference Method 3A analysis. This system generates a calibration curve, converts electronic signals into concentrations, and provides one-minute averages during the sample run and an average concentration over the duration of the sample run.

Quality Control

At the time of analysis, O_2 and CO_2 in nitrogen calibration gases certified according to EPA Protocol-1, are used to calibrate the analyzer and to determine a bias correction factor for the entire system bias in accordance with EPA Reference Method 3A. The calibration gases are introduced directly to the analyzer to generate the calibration curve. A zero gas and an upscale calibration gas is introduced at the probe and recovered through the sampling and analytical system. A bias correction factor is calculated using the ratio of the concentration measured from the sampling system and concentration measured directly at the analyzer. Sample run averages are corrected for system bias results.

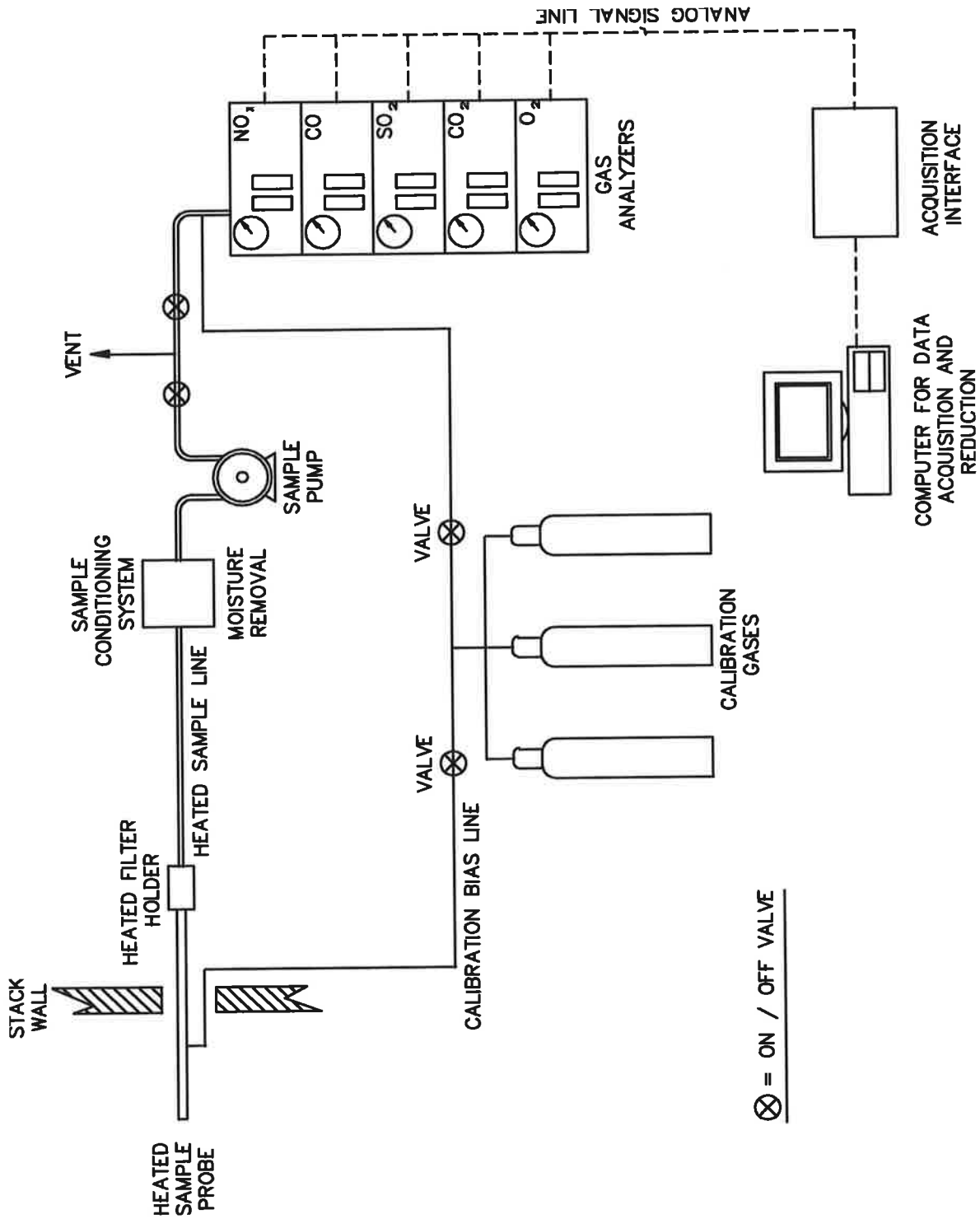

Figure B-1 Continuous Emission Monitoring System

B.3 PARTICULATE MATTER

Particulate matter (PM) emission testing is conducted using EPA Reference Method 5. EPA Reference Methods 1-4 are used, as appropriate, for traverse point selection, determination of stack gas molecular weight, stack gas moisture determination, and volumetric flow rate.

Sampling Equipment and Procedures

The sampling train utilized to perform the PM sampling is an EPA Reference Method 5 train (see Figure B-2). A measured borosilicate, quartz glass, or stainless steel (316) nozzle is attached to a heated (248 ± 25 °F) borosilicate or quartz glass, or stainless steel probe of appropriate length. The probe is connected to a heated (248 ± 25 °F) borosilicate glass filter holder containing a 9-cm glass fiber filter (preweighed to a constant 0.1 mg weight). The first and second impingers each contain 100 mL of distilled water, the third impinger is empty, and the fourth impinger contains 200 to 300 grams of dry preweighed silica gel. The second impinger is a standard Greenburg-Smith type. The first, third, and fourth impingers are of a modified design. All impingers are maintained in a crushed ice bath. A gas measuring control console with a leak-free vacuum pump, a calibrated dry gas meter, a calibrated orifice, and inclined manometers are connected to the final impinger, probe, heated filter holder, and pitot tube via an umbilical cord to complete the train.

Flue gas velocity is measured with a calibrated S-type pitot tube (provided with extensions) fastened alongside the sampling nozzle. Flue gas temperature is monitored with a calibrated direct readout pyrometer equipped with a chromel-alumel (Type K) thermocouple positioned near the sampling nozzle. The probe, filter box, and impinger exit gas temperatures are monitored with a calibrated direct readout pyrometer equipped with Type K thermocouples positioned in the probe, heated filter chamber, and in the sample gas stream after the last impinger. Stack gas stream composition (carbon dioxide and oxygen content) is determined as previously described. The sampling rate is adjusted, based on stack velocity, at each point to ensure the sample is collected isokinetically.

At the conclusion of each test, the sampling train is leak checked. Upon completion of a successful leak check, the sampling train is dismantled, openings are sealed, and the components recovered as described below.

- The glass fiber filter(s) is/are removed from its holder with tweezers and placed in its original container, along with any particulate and filter fragments (Sample Fraction 1).

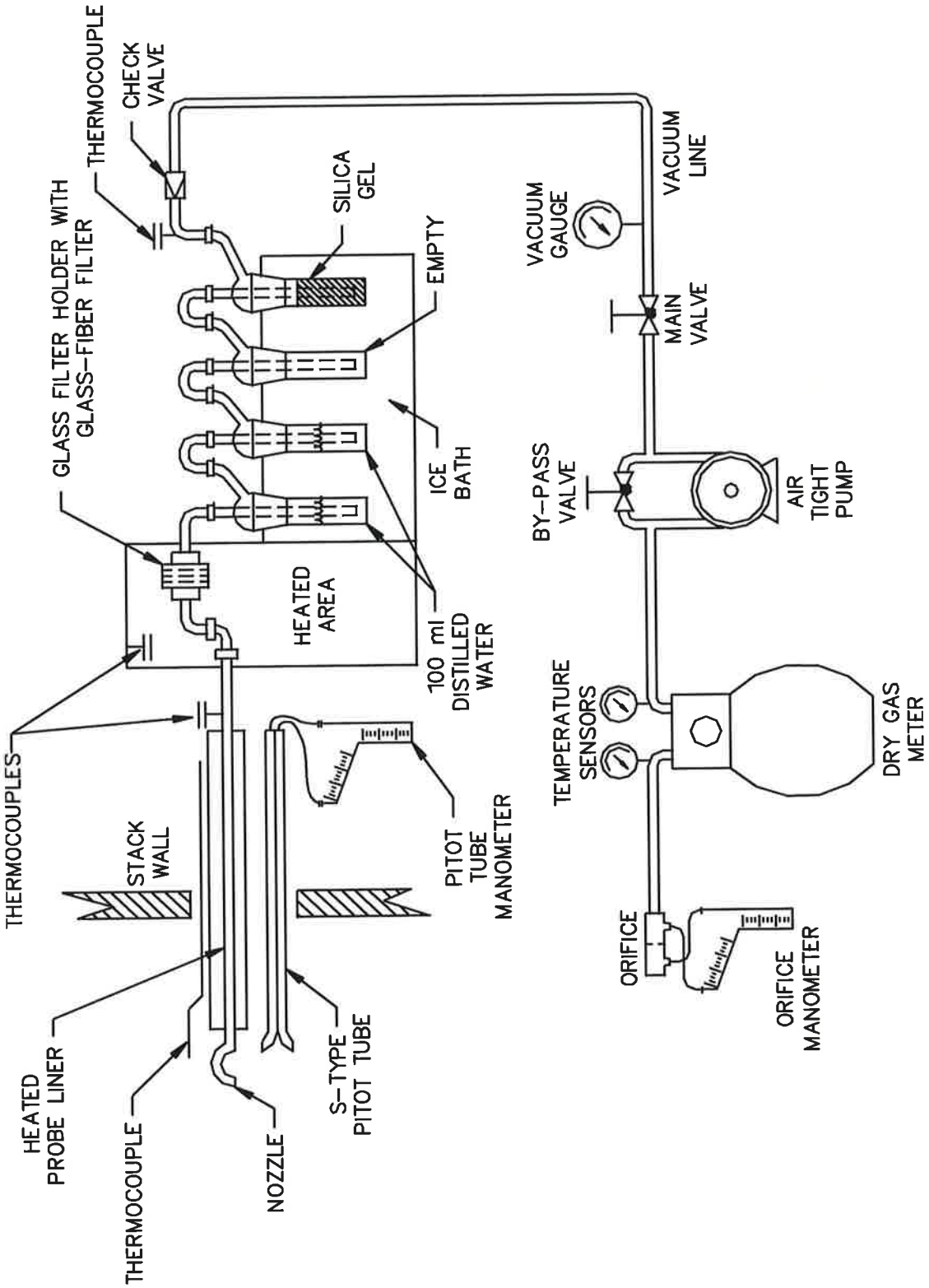

Figure B-2 EPA Reference Method 5 Sampling Train

- The probe and nozzle are separated and the particulate rinsed with distilled water or acetone into a polyethylene container while brushing a minimum of three times. Particulate adhering to the brush is rinsed with the appropriate solvent into the same container. The front half of the filter holder and connecting glassware are also rinsed. These rinses are combined (Sample Fraction 2).

- The total liquid content of impingers one, two, and three are measured volumetrically for stack gas moisture content calculation. This liquid is discarded.

- The silica gel is removed from the last impinger and immediately weighed to the nearest 0.1 g for stack gas moisture content calculation.

- Aliquots of the appropriate solvents and a filter are retained for blank analyses.

Each sample bottle is labeled to clearly identify its contents. The liquid level is marked on each bottle. The samples are then secured for transport to a laboratory for analysis. Sample integrity is assured by maintaining chain-of-custody records.

Sample Analysis

The particulate analysis proceeds as follows:

- The sample filters (Sample Fraction 1) and blank filter are desiccated for 24 hours and weighed to the nearest 0.1 mg to constant (± 0.5 mg) weight.

- The nozzle, probe, and front half of the filter holder wash samples (Sample Fraction 2), along with the solvent blank, are evaporated in tared beakers, then desiccated and weighed to the nearest 0.1 mg to constant (± 0.5 mg) weights.

The total weight of material measured in the front half wash in addition to the weight of material collected on the glass fiber filter represent the total PM catch for each train. Blank corrections are made where appropriate for all sample weights.

Data Acquisition and Reduction

Data are recorded at the time of collection on preprinted data sheets. Calculations are performed with preprogrammed calculators or spreadsheet software. Data transfers are minimized. Field and laboratory data sheets are be checked for completeness and accuracy. Calculations are verified by a second person.

Quality Control

Dry gas meters are calibrated before and after sampling. Thermocouples are calibrated against mercury thermometers, and aneroid barometers are calibrated against a mercury barometer. WESTON participated satisfactorily in the most recent dry gas meter audit supplied by the EPA. Those data are on file at WESTON.

Prior to and following each run, the sampling train is leak checked. An acceptable leak rate does not exceed the lesser of 0.02 actual cubic feet per minute (acfm) or 4% of the actual sampling rate. The isokinetic sampling rate is calculated at the completion of each sample run. If the isokinetic sampling rate is not within 100% ± 10%, the sample run is repeated.

Samples are transported to the laboratory under chain-of-custody. Solvent blanks and filter blanks are analyzed at the same time as the samples. The mass collected on the filters and the mass in the probe wash are corrected by the blank measurements.

WESTON uses Class S weights during each stage of the analysis to verify the accuracy of the balance. The balance is repaired and recalibrated before proceeding if there is a significant difference in the actual mass and measured mass.

B.4 TOTAL REDUCED SULFUR

Total reduced sulfur testing is performed using the procedures described in EPA Reference Method 16. When TRS data must be oxygen corrected, EPA Reference Method 3 using an Orsat analyzer, is performed on an integrated bag sample to measure oxygen concentration.

Sampling Equipment and Procedures

Figure B-3 illustrates the sampling system. A Teflon®-lined, stainless steel probe of sufficient length to monitor the gas stream (without wall effects) is used to extract a gas sample from the emission source. The probe tip is directed away from stack gas flow to minimize particulate and moisture entrainment. The probe is connected directly to the recovery gas line and sample conditioning system.

The sample conditioning system consists of a Teflon® impinger containing 1.5M citrate buffer, adjusted to a pH of 5.4 to 5.8, maintained in an ice bath. Moisture is condensed in the impingers, yielding a dry sample and thus eliminating the need for heated sample lines. Even though the impinger set traps entrained particulate matter, very fine particulate matter is removed by a Balston® AQ Microfiber filter installed at the impinger outlet.

An unheated nylon line is connected from the filter to the sample pump inlet. Sample line length and connections are minimized to reduce surface adsorption of TRS and the possibility of leaks.

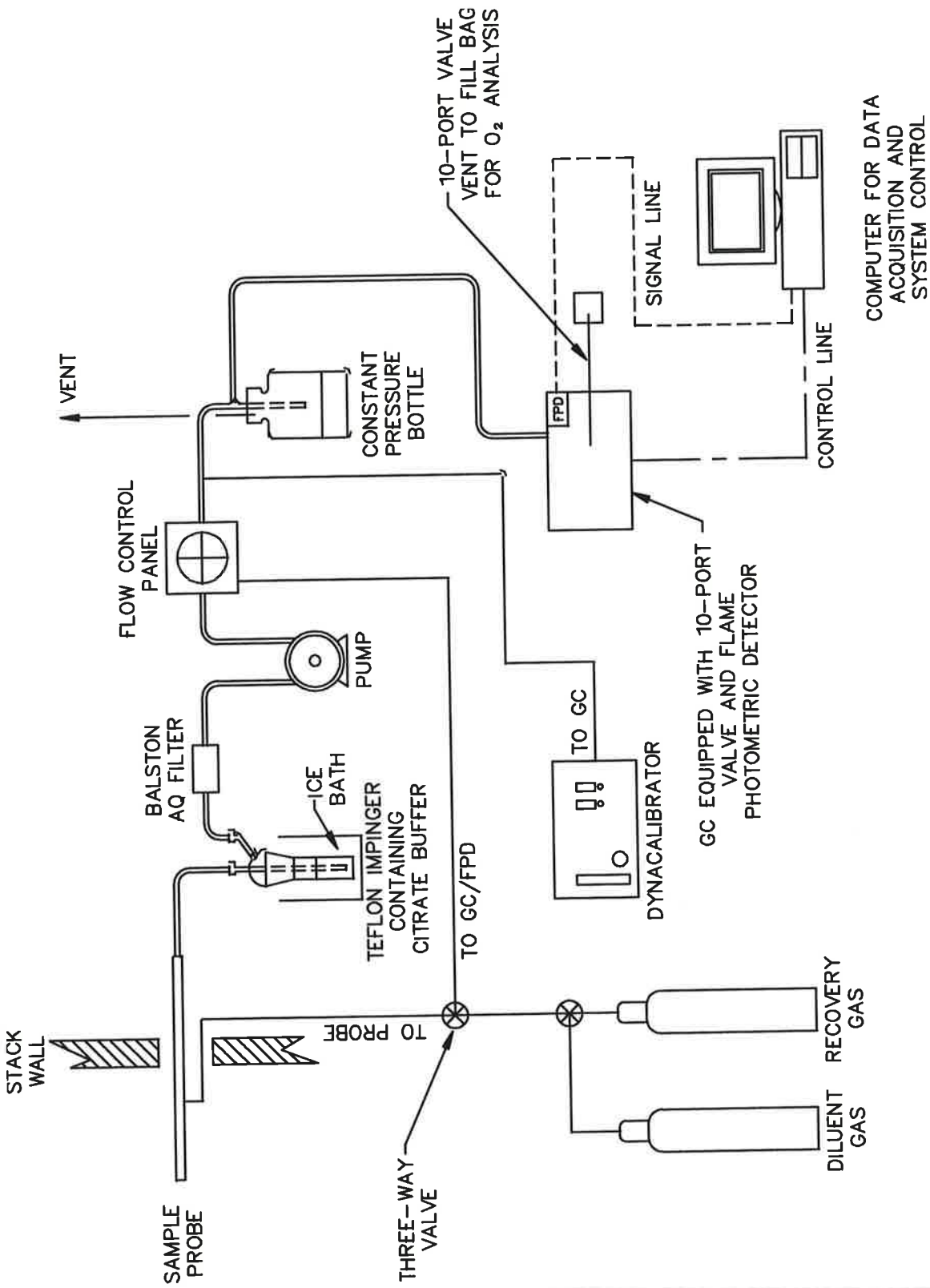

Figure B-3 EPA Reference Method 16 Sampling and Analytical Train

The pump outlet is connected directly to a constant pressure bottle. At this point, a major portion of the sample is vented to the atmosphere, and the remainder is used to charge the gas chromatograph (GC) sample loop. The GC sample loop outlet is connected to a Tedlar® gas collection bag gas sample collection and subsequent analysis using an Orsat apparatus.

Sample Analysis

Separation of hydrogen sulfide (H_2S), methyl mercaptan (MeSH), dimethyl sulfide (DMS), and dimethyl disulfide (DMDS) is accomplished by gas chromatography on a SPB1 Capillary column. After resolution of H_2S, MeSH, and DMS, the Capillary column is backflushed to achieve resolution of DMDS within 2-3 minutes from sample injection. The gas chromatograph is operated on periodic cycle to produce a minimum of ten injections per hour.

Detection of reduced sulfur compounds is accomplished with a flame photometric detector (FPD). The FPD response is calibrated before and after every three hours of testing, using gas phase standards prepared from gravimetrically certified permeation devices.

Data Acquisition and Reduction

The FPD responses are recorded by a computer equipped with software designed by WESTON for reduced sulfur compound analysis. The software controls the timing of the gas-chromatographic cycle, integrates and records peaks, performs calculations, and prints the results. Calibration curves are generated by the software using log-log linear least squares best fit of the data.

Quality Control

Permeation devices certified by the vendor are used to calibrate the FPD response. The temperature of the devices is maintained at a constant value (as certified by vendor) to ensure a constant, accurate permeation rate. The temperature of the permeation chamber is verified at the time of sampling with an National Institute of Standards and Technology (NIST) traceable mercury-in-glass thermometer. The temperature of the permeation chamber is maintained at 50.0 ± 0.1 °C throughout the sampling.

VICI-Metronics, Santa Clara, California, supplied the permeation devices for the testing. The devices are gravimetrically analyzed to measure the emission rate before shipment.

Various concentrations of the permeants are generated by varying the flow of the diluent gas stream over the devices. A calibration curve is constructed of at least three concentrations of each permeant; three successive injections at each concentration yield peak areas that differ from the mean peak area value by less than 5%.

Sampling system integrity is evaluated after every three hours of sampling by injecting a low concentration of H_2S at the probe tip and recovering the sample through the sample conditioning and

sample transport subsystems. The same gas stream is then introduced directly to the GC sample loop. The ratio of concentrations corresponds to the system correction factor. This factor is then used to adjust measured reduced sulfur compound concentrations.

A system audit gas (of appropriate H_2S concentration) is used to evaluate the analytical system integrity each test day. Audit gas results will be within 10% of the certified cylinder concentration.

B.5 NITROGEN OXIDES (INSTRUMENTAL)

Nitrogen oxides (NO_x) testing on some sources may be conducted in accordance with EPA Reference Method 7E.

Sampling Equipment and Procedures

Figure B-1 illustrates the sampling system. The sample is withdrawn from the source through a heated probe, filter, and sample line to a sample conditioner, which removes moisture from the gas stream. The sample is then transported to a Chemiluminescent NO_x Analyzer through a Teflon® line.

Sample Analysis

The analyzer uses an oxidizing converter to produce nitric oxide (NO) molecules. A chemiluminescent reaction of NO and ozone is then used to produce nitrogen dioxide (NO_2), oxygen (O_2), and infrared light. This infrared light is measured using a highly sensitive optical filter/photomultiplier whose output is linearly proportional to the NO concentration.

Data Acquisition and Reduction

Data are acquired electronically using a computer with software designed by WESTON for EPA Reference Method 7E analysis. This system generates a calibration curve, converts electronic signals into concentrations, and provides bias-corrected hourly averages.

Quality Control

At the time of analysis, NO in nitrogen calibration gases, certified according to EPA Protocol-1, are used to calibrate the analyzer and to determine a bias correction factor for the entire system. Calibration and system response is performed in accordance with EPA Reference Method 7E.

Calibration gases are introduced directly to the analyzer to generate the calibration curve. A calibration gas is introduced at the probe and recovered through the sampling and analytical system. A bias correction factor is calculated using the ratio of the measured concentration of the bias gas and concentration certified by the vendor. An interference response study was performed by the manufacturer of the analyzer. The data from this study are on file at WESTON.

B.6 CARBON MONOXIDE

Carbon monoxide testing is conducted in accordance with EPA Reference Method 10.

Sampling Equipment and Procedures

Figure B-1 illustrates the sampling system. Sampling is performed by extraction of an integrated stack gas sample collected in a Tedlar® bag, or by continuous sample extraction and analysis. For both sampling procedures the sample is withdrawn from the stack, through a conditioning system for moisture removal, using a leak-tight sample pump. The dry gas sample is then collected at the outlet of the sample pump using a Tedlar® bag or transported through sample lines to the analyzer for continuous on-line monitoring.

Sample Analysis

The CO Non-Dispersive Infrared (NDIR) analyzer uses gas filter correlation spectroscopy to measure the amount of CO present in the sample. Infrared radiation is chopped and passed through an alternating CO and N_2 correlation filter wheel and the sample stream. Carbon monoxide in the sample absorbs the infrared radiation, leaving the remaining radiation to be measured by a detector producing a linear output signal.

Data Acquisition and Reduction

Data are acquired electronically using a computer with software designed by WESTON for EPA Reference Method 10 analysis.

For data collection using a computer and acquisition interface, the software generates a calibration curve, converts electronic signals into concentrations, and provides bias-corrected run averages. All subsequent calculation procedures required for compliance with EPA Reference Method 10 are performed electronically.

Quality Control

At the time of analysis, EPA Protocol-1 CO in nitrogen calibration gases are used to calibrate the analyzer. Calibration is performed in accordance with EPA Reference Method 10.

A CO_2 interference response study was performed by the manufacturer of the analyzer. The data from this study are on file at WESTON.

APPENDIX C
FIELD DATA –
NO. 1 COMBINATION BOILER

Resolute
Catawba, SC

03917.008.028
No. 1 Combination Boiler

ISOKINETIC CALCULATIONS

		1	2	3	Mean
Run Number		4/1/15	4/1/15	4/1/15	---
Date		949	1400	1540	---
Time Began		1059	1507	1647	---
Time Ended					
INPUT DATA					
Sampling Time, min	(Theta)	60.0	60	60	60
Stack Diameter, in.	(Dia.)	120.00	120.00	120.00	120.00
Barometric Pressure, in. Hg	(Pb)	29.40	29.40	29.40	29.40
Static Pressure, in. H2O	(Pg)	-0.71	-0.71	-0.71	-0.71
Pitot Tube Coefficient	(Cp)	0.84	0.84	0.84	0.84
Meter Correction Factor	(Y)	0.9890	0.9890	0.9890	0.9890
Orifice Calibration Value	(Delta H@)	1.8100	1.8100	1.8100	1.8100
Nozzle Diameter, in.	(Dn)	0.245	0.245	0.245	0.245
Meter Volume, ft^3	(Vm)	36.254	36.660	35.085	36.000
Meter Temperature, °F	(Tm)	76.3	86.1	93.5	85.3
Meter Temperature, °R	(Tm-R)	536.3	546.1	553.5	545.3
Meter Orifice Pressure, in. H2O	(Delta H)	1.177	1.170	1.069	1.139
Ave Sq Rt Orifice Press, (in. H2O)^½	((Delta H)½)avg)	1.080	1.075	1.028	1.061
Volume H2O Collected, mL	(Vlc)	195.4	194.8	190.1	193.4
CO2 Concentration, %	(CO2)	12.1	12.8	13.0	12.6
O2 Concentration, %	(O2)	7.7	7.0	6.8	7.2
Ave Sq Rt Velo Head, (in. H2O)^½	((Delta P)½)avg)	0.820	0.802	0.792	0.805
Stack Temperature, °F	(Ts)	457.3	453.3	458.8	456.5
Stack Temperature, °R	(Ts-R)	917.3	913.3	918.8	916.5
Particulate Collected, g	(Mn)	0.0333	0.0294	0.0269	0.0299
O2 F-Factor, dscf/MMBtu	(Fd)	9600	9600	9600	9600
CALCULATED DATA					
Nozzle Area, ft^2	(An)	3.27E-04	3.27E-04	3.27E-04	3.27E-04
Stack Area, ft^2	(As)	78.54	78.54	78.54	78.54
Stack Pressure, in. Hg	(Ps)	29.35	29.35	29.35	29.35
Meter Pressure, in. Hg	(Pm)	29.49	29.49	29.48	29.48
Standard Meter Volume, ft^3	(Vmstd)	34.775	34.533	32.599	33.969
Standard Water Volume, ft^3	(Vwstd)	9.197	9.169	8.948	9.105
Moisture Fraction (Measured)	(BWS)	0.209	0.210	0.215	0.211
Moisture Fraction (lower sat/meas)	(BWS)	0.209	0.210	0.215	0.211
Mol. Wt. of Dry Gas, lb/lb-mole	(Md)	30.24	30.33	30.35	30.31
Mol. Wt. of Stack Gas, lb/lb-mole	(Ms)	27.68	27.74	27.69	27.71
Average Stack Gas Velocity, ft/sec	(Vs)	62.54	61.00	60.50	61.35
Stack Gas Flow, actual, ft^3/min	(Qa)	294713	287452	285084	289083
Stack Gas Flow, Std , ft^3/min	(Qs)	131537	128752	126035	128775
Isokinetic Sampling Rate, %	(%I)	105.7	107.3	103.4	105.5
Particulate Conc @ Std Cond, gr/ft^3	(Cs)	0.0148	0.0131	0.0127	0.0135
Particulate Emission, lb/hr	(PMR)	16.7	14.5	13.8	15.0
Particulate Emission Factor, lb/MMBtu	(Fd)	0.0321	0.0271	0.0259	0.0284
Calibration check	(Yqa)	0.9909	0.9827	0.9885	0.987
Percent difference from Y					-0.16%

ISOKINETIC FIELD DATA SHEET

Client	Resolute
W.O.#	03917.008.028
Project ID	2015 Compliance
Mode/Source ID	No. 1 Combination Boiler
Samp. Loc. ID	Catawba, SC
Run No.ID	DNF
Test Method ID	5
Filter No.	DA 6931
Source/Location	No. 1 Combination Boiler
Sample Date	04/01/15
Baro. Press (in Hg)	29.74
Operator	MCC

Stack Conditions

	Assumed	Actual
% Moisture	15	
Impinger Vol (ml)		187
Silica gel (g)		8.4
CO2, % by Vol	10	12.1
O2, % by Vol	10	7.7
Temperature (°F)		
Meter Temp (°F)		
Static Press (in H_2O)	-.71	-0.71
Ambient Temp (°F)		

Meter Box ID	A026
Meter Box Y	0.989
Meter Box Del H	1.810
Probe ID / Length	PR-54 / 5'
Probe Material	glass
Pitot / Thermocouple ID	P241
Pitot Coefficient	0.84 0.245
Nozzle ID	~~0.270~~ 0.270
Avg Nozzle Dia (in)	0.270 0.245
Area of Stack (ft^2)	78.54
Sample Time	60
Total Traverse Pts	24

Leak Checks

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.000		0.000
Leak Check @ (in Hg)	A: 0.00 12		7.5
Pitot good	yes / no	yes / no	yes / no
Orsat good	yes / no	yes / no	yes / no

Temp Check

	Pre-Test Set	Post-Test Set
Meter Box Temp	75	
Reference Temp		
Pass/Fail (+/- 2°)	Pass / Fail	Pass / Fail
Temp Change Response ?	yes / no	yes / no

K Factor ~~2.5~~ 1.75

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM INLET TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	Filter	IMPINGER EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)	Impgs Temp	COMMENTS
	0	9:49			896.800									
A 1	2.5		.74	1.3	898.5	461		71	240	258	58	4	230	
2	5		.80	1.4	900.6	462		72	245	270	53	5	240	
3	7.5		.84	1.5	901.7	462		72	245	270	53	5	240	
4	10		.76	1.3	903.5	464		73	248	272	52	5	247	
5	12.5		.70	1.2	904.8	464		72	249	272	50	4	247	
6	15		.55	.96	906.241	452		72	250	272	49	4	249	
B 1	17.5		.74	1.3	907.9	458		73	250	270	50	4	249	
2	20		.85	1.5	909.5	465		74	249	264	49	5	249	
3	22.5		.85	1.5	911.1	463		74	249	264	47	5	249	
4	25		.76	1.3	912.7	454		74	249	256	47	5	249	
5	27.5		.72	1.3	914.4	454		74	249	256	47	5	249	
6	30		.65	1.1	915.980	450		75	250	252	46	5	248	
C 1	32.5		.42	.8	917.1	451		74	250	252	48	5	249	
2	35		.39	.68	918.3	458		74	249	251	47	5	249	
3	37.5		.68	1.2	919.6	459		74	250	252	48	4	249	
4	40		.72	1.3	921.2	458		76	249	252	48	4	249	
5	42.5		.70	1.2	922.7	458		79	250	254	47	5	249	
6	45		.68	1.2	924.340	458		80	249	255	47	5	249	
D 1	47.5		.58	1.0	925.7	455		79	248	252	49	4	249	
2	50		.65	1.1	927.2	456		83	250	252	48	5	250	
3	52.5		.65	1.1	928.7	455		83	250	252	47	5	250	
4	55		.62	1.0	930.1	453		84	249	253	47	5	249	
5	57.5		.62	1.0	931.5	453		84	249	252	47	5	249	
6	60		.58	1.0	933.054	453		85	249	253	48	5	250	
		10:59	Avg Sqrt Delta P .8196	Avg Delta H 1.1767	Total Volume 36.254	Avg Ts 457.3		Avg Tm 76.3	Min/Max 240/250	Min/Max 251/272	Max Temp 58	Max Vac 5	Max Temp 250	
			Avg. Delta P .6771	Avg Sqrt Del H 1.0802	Comments:									

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ISOKINETIC FIELD DATA SHEET

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			Stack Conditions Assumed	Stack Conditions Actual					
Client	Resolute				Meter Box ID	A026			K Factor 1.8
W.O.#	03917.008.028				Meter Box Y	0.989			
Project ID	2015 Compliance	% Moisture	20		Meter Box Del H	1.81	**Leak Checks**	Initial	Mid-Point / Final
Mode/Source ID	No. 1 Combination Boiler	Impinger Vol (ml)		189	Probe ID / Length	PR-5U 5'	Sample Train (ft^3)	0.000	0.000
Samp. Loc. ID	Catawba, SC	Silica gel (g)		5.8	Probe Material	glass	Leak Check @ (in Hg)	11	9
Run No.ID	2	CO2, % by Vol	10	12.8	Pitot / Thermocouple ID	P241	Pitot good	~~yes~~ / no	~~yes~~ / no
Test Method ID	5	O2, % by Vol	10	7.0	Pitot Coefficient	0.84	Orsat good	~~yes~~ / no	~~yes~~ / no
Filter No.	DA6933	Temperature (°F)			Nozzle ID	0.245	**Temp Check**	Pre-Test Set	Post-Test Set
Source/Location	No. 1 Combination Boiler	Meter Temp (°F)			Avg Nozzle Dia (in)	0.245	Meter Box Temp		
Sample Date	04/01/15	Static Press (in H_2O)		-0.71	Area of Stack (ft^2)	78.54	Reference Temp		
Baro. Press (in Hg)	Avg ~~29.74~~ 29.40				Sample Time	60	Pass/Fail (+/- 2°)	Pass / Fail	Pass / Fail
Operator	MCC	Ambient Temp (°F)	79		Total Traverse Pts	24	Temp Change Response ?	yes / no	yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM INLET TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)		IMPINGER EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)	599 Stack	COMMENTS Pitot temp
	0	14:00			942.400									
D 1	2.5		.45	.80	943.7	441	2	81	249		67	3	278	270
2	5		.50	.90	945.0	449		81	249		67	3	269	270
3	7.5		.55	.96	946.4	450		81	250		66	3	269	270
4	10		.54	.94	947.8	450		81	249		65	4	269	270
5	12.5		.54	.94	949.2	451		81	250		62	4	269	269
6	15		.52	.91	950.622	451		81	249		59	4	269	269
C 1	17.5		.42	.76	951.8	449		83	249		58	4	269	268
2	20		.42	.76	953.1	456		83	249		55	4	268	270
3	22.5		.55	1.0	954.5	456		83	249		54	4	267	270
4	25		.62	1.1	955.9	456		84	249		52	4	265 ~~265~~	270
5	27.5		.60	1.1	957.5	457		84	248		51	5	266	270
6	30		.58	1.1	959.018	455		85	249		50	5	267	270
B 1	32.5		.74	1.3	960.6	450		86	250		52	5	267	269
2	35		.79	1.4	962.1	456		87	249		52	5	267	264
3	37.5		.88	1.5	963.8	457		87	249		51	5	268	264
4	40		.82	1.5	965.5	457		88	249		49	5	267	264
5	42.5		.82	1.5	967.3	457		89	249		49	5	267	265
6	45		.80	1.4	969.054	456		90	248		49	6	268	264
A 1	47.5		.76	1.4	970.7	450		90	249		52	6	268	260
2	50		.82	1.5	972.4	455		91	250		51	5	268	260
3	52.5		.83	1.5	974.2	455		92	249		50	6	268	259
4	55		.76	1.4	975.8	455		92	249		50	6	268	259
5	57.5		.65	1.2	977.4	455		93	249		49	6	268	259
6	60	15:07	.65	1.2	979.060	455		93	250		49	6	269	257
			Avg Sqrt Delta P .8015	Avg Delta H 1.7696	Total Volume 36.660	Avg Ts 453.3		Avg Tm 86.1	Min/Max 248/250	Min/Max	Max Temp 67	Max Vac 6	Max Temp 278	264/270 259
			.6507 (MC)	Avg Sqrt Del H 1.0747 (MC)	Comments: (MC)	(MC)		(MC)						

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ISOKINETIC FIELD DATA SHEET

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			Stack Conditions Assumed	Actual						
Client	Resolute				Meter Box ID	A076			K Factor	1.7
W.O.#	03917.008.028				Meter Box Y	0.989				
Project ID	2015 Compliance	% Moisture	20		Meter Box Del H	1.81		**Leak Checks**	Initial	Mid-Point	Final
Mode/Source ID	No. 1 Combination Boiler	Impinger Vol (ml)		109.7	Probe ID / Length	PR 50	5'	Sample Train (ft³)	0.000		0.000
Samp. Loc. ID	Catawba, SC	Silica gel (g)		588.1	Probe Material	glass		Leak Check @ (in Hg)	12		8"
Run No.ID	3	CO2, % by Vol	10	13.0	Pitot / Thermocouple ID	P241		Pitot good	yes / no	yes / no	yes / no
Test Method ID	5	O2, % by Vol	10	6.8	Pitot Coefficient	0.84		Orsat good	yes / no	yes / no	yes / no
Filter No.	DA 6934	Temperature (°F)			Nozzle ID	0.245		**Temp Check**	Pre-Test Set		Post-Test Set
Source/Location	No. 1 Combination Boiler	Meter Temp (°F)			Avg Nozzle Dia (in)	0.245		Meter Box Temp			
Sample Date	04/01/15	Static Press (in H_2O)	-.71	-0.71	Area of Stack (ft²)	78.54		Reference Temp			
Baro. Press (in Hg)	Avg: ~~29.74~~ 29.40				Sample Time	60		Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Operator	MC	Ambient Temp (°F)	81		Total Traverse Pts	24		Temp Change Response	yes / no		yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft³)	STACK TEMP (°F)	DGM INLET TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	Filter	IMPINGER EXIT TEMP (°F)	SAMPLE TRAIN VAC (in Hg)	gas stream temp	COMMENTS
	0	15:40			980.210									
D 1	2.5		.45	.77	981.4	453	92		250	253	67	3	249	
2	5		.50	.85	982.7	459	92		249	252	67	3	250	
3	7.5		.50	.85	984.0	458	92		250	253	64	3	250	
4	10		.55	.94	985.4	458	92		250	252	61	4	249	
5	12.5		.54	.92	986.8	459	93		249	254	59	4	249	
6	15		.53	.90	988.250	457	93		250	252	56	4	249	
C 1	17.5		.42	.71	989.4	456	92		249	253	58	4	251	
2	20		.45	.77	990.7	458	92		250	254	57	3	258	
3	22.5		.55	.94	991.9	458	93		249	249	55	3	262	
4	25		.61	1.0	993.3	458	93		249	255	54	4	268	
5	27.5		.52	.88	994.7	459	93		250	255	52	5	269	
6	30		.49	.83	996.062	458	93		249	255	52	5	268	
B 1	32.5		.76	1.3	997.6	457	93		248	255	55	5	267	
2	35		.82	1.4	999.2	461	93		249	255	54	5	266	
3	37.5		.85	1.4	1000.9	461	94		249	255	51	6	266	
4	40		.84	1.4	1002.6	462	94		250	256	51	6	267	
5	42.5		.71	1.2	1004.2	462	94		250	256	50	6	267	
6	45		.67	1.1	1005.744	461	95		249	256	49	6	267	
A 1	47.5		.71	1.2	1007.2	457	95		249	256	52	5	268	
2	50		.82	1.4	1008.9	457	95		250	256	53	5	269	
3	52.5		.84	1.4	1010.6	461	95		250	255	52	6	269	
4	55		.78	1.3	1012.2	461	95		249	256	51	6	267	
5	57.5		.67	1.1	1013.8	461	96		250	255	50	6	267	
6	60	1647	.67	1.1	1015.295	460	96		249	255	50	6	266	
			Avg Sqrt Delta P	Avg Delta H	Total Volume	Avg Ts	Avg Tm		Min/Max	Min/Max	Max Temp	Max Vac	Max Temp	
			.7923	~~1.0775~~	35.035	458.8	93.5		248/250	246/256	67	6	269	
			.6357	Avg Sqrt Del H ~~1.0326~~ 1.0692	Comments:									
				1.0280										

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SAMPLE RECOVERY FIELD DATA

Client: Resolute
Location/Plant: Catawba, SC
W.O. #: 03917.008.028
Source & Location: No. 1 Combination Boiler

Run No. 1 — Sample Date 04/01/15 — Recovery Date DA6931
Sample I.D. No. 1 Combination Boiler — Analyst MC — Filter Number DA6931

	Impinger									
	1	2	3	4	5	6	7	8	9	Total
Contents	H20	H2O	Empty	SG	X	X	X	X	X	
Final	287	100	0	376.7	X	X	X	X	X	
Initial	100	100	0	368.3	X	X	X	X	X	
Gain	187	0	0	8.4	X	X	X	X	X	195.4

Impinger Color: Clear — Labeled? ✓
Silica Gel Condition: Good — Sealed? ✓

Run No. 2 — Sample Date 04/01/15 — Recovery Date 4/1/15
Sample I.D. No. 1 Combination Boiler — Analyst MC — Filter Number DA6933

	Impinger									
	1	2	3	4	5	6	7	8	9	Total
Contents	H20	H2O	Empty	SG	X	X	X	X	X	
Final	287	102	0	382.6	X	X	X	X	X	
Initial	100	100	0	376.8	X	X	X	X	X	
Gain	187	2	0	5.8	X	X	X	X	X	194.8

Impinger Color: Clear — Labeled? ✓
Silica Gel Condition: Good — Sealed? ✓

Run No. 3 — Sample Date 4/1/15 — Recovery Date 4/1/15
Sample I.D. No. 1 Combination Boiler — Analyst MC — Filter Number DA6934

	Impinger									
	1	2	3	4	5	6	7	8	9	Total
Contents	H20	H2O	Empty	SG	X	X	X	X	X	
Final	280	102	0	359.7	X	X	X	X	X	
Initial	100	100	0	351.6	X	X	X	X	X	
Gain	180	2	0	8.1	X	X	X	X	X	190.1

Impinger Color: Clear — Labeled? ✓
Silica Gel Condition: Good — Sealed? ✓

Check COC for Sample IDs of Media Blanks

WESTON MANAGERS DESIGNERS/CONSULTANTS

RUN DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 1 CB**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **1 Apr 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %
11:46:37	312	7.7	420	12.1
11:46:57	312	7.7	420	12.1
11:47:17	312	7.7	421	12.1
Avgs	**312**	**7.7**	**420**	**12.1**

RUN DATA

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 1 CB**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **1 Apr 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %
15:32:36	286	7.1	446	12.8
15:32:56	285	7.0	446	12.8
15:33:16	285	7.0	446	12.8
Avgs	**285**	**7.0**	**446**	**12.8**

CURRENT READINGS

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 1 CB**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **1 Apr 2015**

Run 3

O_2	CO_2
277 mv	453 mv
6.8 %	13.0 %

CALIBRATION DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 1 CB**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **1 Apr 2015**

Start Time: 11:42

O_2

Method: EPA 3A
Calibration Type: Linear Regression

Calibration Results

%	Cylinder ID	Result, mv
Zero	-	20
12.0	CC156057	472
25.0	CC354619	961

Curve Coefficients

Slope	Intercept	Corr. Coeff.
37.68	20	>0.9999

CO_2

Method: EPA 3A
Calibration Type: Linear Regression

Calibration Results

%	Cylinder ID	Result, mv
Zero	-	-19
12.2	CC156057	426
24.9	CC354619	885

Curve Coefficients

Slope	Intercept	Corr. Coeff.
36.27	-18	>0.9999

✓ MB

CALIBRATION ERROR DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 1 CB**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **1 Apr 2015**

Start Time: 11:42

O_2
Method: EPA 3A
Span Conc. 25.0 %
Slope 37.68 **Intercept** 20.2

Standard %	Response mv	Result %	Difference %	Error %	Status
Zero	20	0.0	0.0	0.0 ✓	Pass
12.0	472	12.0	0.0	0.0 ✓	Pass
25.0	961	25.0	0.0	0.0 ✓	Pass

CO_2
Method: EPA 3A
Span Conc. 24.9 %
Slope 36.27 **Intercept** -18.3

Standard %	Response mv	Result %	Difference %	Error %	Status
Zero	-19	0.0	0.0	0.0 ✓	Pass
12.2	426	12.2	0.0	0.0 ✓	Pass
24.9	885	24.9	0.0	0.0 ✓	Pass

Determination of Stack Gas Velocity - Method 2

Client	Resolute	Operator	MC/PG	Pitot Coeff (Cp)	0.84
Location/Plant	Catawba, SC	Date	01-Apr-15	Stack Area, ft^2 (As)	78.54
Source	#1 Combination Boiler	W.O. Number	03917.008.028	Pitot Tube/Thermo ID	P241

Run Number	Pralin ~~ONE~~ P241		
Time	830		
Barometric Press, in Hg (Pb)	29.40		
Static Press, in H_20 (Pstatic)	-0.70		
Source Moisture, % (BWS)	≈ 18		
O_2, %	≈ 10		
CO_2, %	≈ 10		

Cyclonic Flow Determination		Traverse Location		Leak Check good ? Y / N		Leak Check good ? Y / N		Leak Check good ? Y / N	
Delta P at 0°	Angle yeilding zero Delta P	Port	Point	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)
0	0	A	1		461				
0	0		2		462				
0	0		3		462				
0	0		4		462				
0	0		5		463				
0	0		6		462				
0	0	B	1		460				
.02	2		2		460				
0	0		3		461				
0	0		4		461				
0	0		5		461				
0	0		6		462				
0	0	C	1		460				
0	0		2		460				
0	0		3		460				
0	0		4		460				
0	0		5		460				
0	0		6		460				
0	0	D	1		460				
0	0		2		461				
0	0		3		462				
0	0		4		461				
0	0		5		461				
0	0		6		461				
Avg Angle		Avg Delta P & Temp							
		Avg Sqrt Delta P							
		Average gas stream velocity, ft/sec.							
		Vol. flow rate @ actual conditions, wacf/min							
		Vol. flow rate at standard conditions, dscf/min							

$MWd = (0.32 * O2) + (0.44 * CO2) + (0.28 * (100 - (CO2 + O2)))$

$MWs = (MWd * (1 - (BWS/100))) + (18 * (BWS/100))$

$Tsa = Ts + 460$

$Ps = Pb + (Pstatic/13.6)$

$Vs = 85.49 * Cp * avg\sqrt{DeltaP} * \sqrt{Tsa/(Ps * MWs)}$

$Qs(act) = 60 * Vs * As$

$Qs(std) = 17.64 * (1 - (BWS/100)) * (Ps/Tsa) * Qs(act)$

where:
MWd = Dry molecular weight source gas, lb/lb-mole.
MWs = Wet molecular weight source gas, lb/lb-mole.
Tsa = Source Temperature, absolute(oR)
Ps = Absolute stack static pressure, inches Hg.
Vs = Average gas stream velocity, ft/sec.
Qs(act) = Volumetric flow rate of wet stack gas at actual, wacf/min
Qs(std) = Volumetric flow rate of dry stack gas at standard conditions, dscf/min

Barometric Press, in. Hg (Pb) at Port Elevation

Comments _____

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03917.008.028
#1 CB, #2 LK,
#2-3 SDTV, #3 RF
Compliance

Sample and Velocity Traverse Point Data Sheet - Method 1

Client: Resolutes, Inc.
Loaction/Plant: Catawba, SC
Source: #1 Combination Boiler

Operator: P. Eddy
Date: 4/1/15
W.O. Number: 03917 008 028

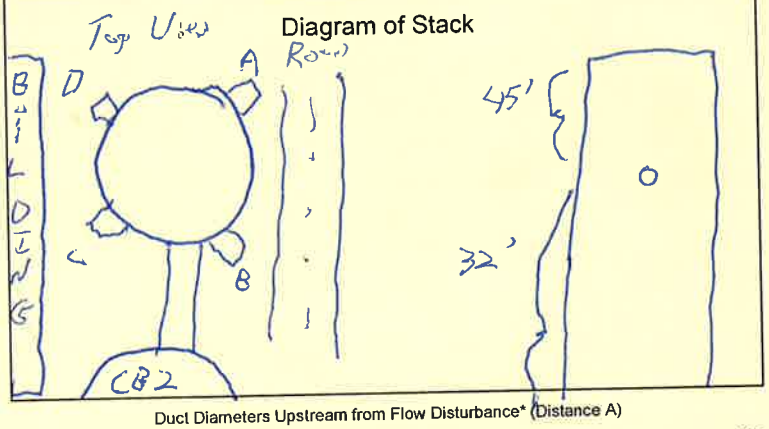
Duct Type	☑ Circular	☐ Rectangular Duct	Indicate appropriate type
Traverse Type	☑ Particulate Traverse	☐ Velocity Traverse	

Distance from far wall to outside of port (in.) = C	127.5
Port Depth (in.) = D	7.5
Depth of Duct, diameter (in.) = C-D	120
Area of Duct (ft^2)	78.54
Total Traverse Points	24
Total Traverse Points per Port	12

Rectangular Ducts Only	
Width of Duct, rectangular duct only (in.)	
Total Ports (rectangular duct only)	

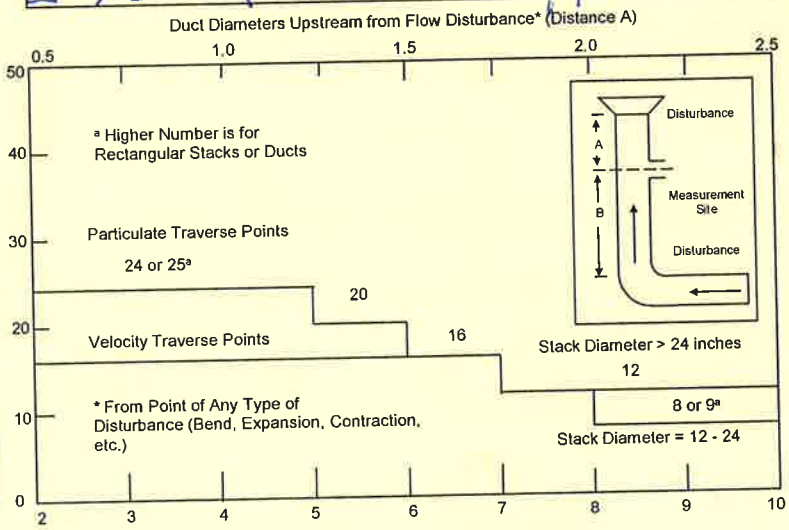
Flow Disturbances	
Upstream - A (ft)	45
Downstream - B (ft)	32
Upstream - A (duct diameters)	4.5
Downstream - B (duct diameters)	3.2

Diagram of Stack



Traverse Point Locations

Traverse Point	% of Duct	Distance from Inside Duct Wall (in)	Distance from Outside of Port (in)
1	2.1	2.5	10.0
2	6.7	8.0	15.5
3	11.8	14.2	~~21.7~~ 21.5
4	17.7	21.2	28.5
5	25.0	30.0	37.5
6	35.6	42.7	50.0
7	64.4	77.3	85.0
8	75.0	90.0	98.0
9	82.3	98.8	106.5
10	88.2	105.8	113.5
11	93.3	112.0	119.5
12	97.9	117.5	125.0



Equivalent Diameter = (2*L*W)/(L+W)

Traverse Point Location Percent of Stack -Circular

Traverse Point Location	1	2	3	4	5	6	7	8	9	10	11	12
1		14.6		6.7		4.4		3.2		2.6		2.1
2		85.4		25		14.6		10.5		8.2		6.7
3				75		29.6		19.4		14.6		11.8
4				93.3		70.4		32.3		22.6		17.7
5						85.4		67.7		34.2		25
6						95.6		80.6		65.8		35.6
7								89.5		77.4		64.4
8								96.8		85.4		75
9										91.8		82.3
10										97.4		88.2
11												93.3
12												97.9

Traverse Point Location Percent of Stack -Rectangular

Traverse Point Location	1	2	3	4	5	6	7	8	9	10	11	12
1		25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2		75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3			83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4				87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5					90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6						91.7	78.6	68.8	61.1	55.0	50.0	45.8
7							92.9	81.3	72.2	65.0	59.1	54.2
8								93.8	83.3	75.0	68.2	62.5
9									94.4	85.0	77.3	70.8
10										95.0	86.4	79.2
11											95.5	87.5
12												95.8

Rectangular Stack Points & Matrix
9 - 3 x 3
12 - 4 x 3
16 - 4 x 4
20 - 5 x 4
25 - 5 x 5
30 - 6 x 5
36 - 6 x 6
42 - 7 x 6
49 - 7 x 7

Port Diam. (in) = A, B = 4.5" C, D = 34.5"
Number of Ports = 4
Method 1.xls

WESTON SOLUTIONS
Integrated Air Services

Tape Measure I.D. # _____

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APPENDIX D
FIELD DATA – NO. 2 LIME KILN

Resolute
Catawba, SC

03917.008.028
No. 2 Lime Kiln

EMISSION CALCULATIONS

	Run 1	Run 2	Run 3	Mean
Date	**3/30/15**	**3/30/15**	**3/30/15**	---
Time Began	**756**	**907**	**1023**	---
Time Ended	**856**	**1007**	**1123**	---
% Oxygen	5.1	5.0	5.3	5.1
Oxygen Reference Concentration, %	10.0	10.0	10.0	10.0
Nitrogen Oxides MW= 46.01				
Concentration, ppm	52.0	53.0	55.0	53.3
Concentration, ppm @10%O2	35.9	36.3	38.4	36.9

AW

RUN SUMMARY

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	NO_x
Method	EPA 3A	EPA 7E
Conc. Units	%	ppm

Time: 07:56 to 08:56

Run Averages

5.1	52

Pre-run Bias at 07:50

Zero Bias	0.1	1
Span Bias	11.9	248
Span Gas	12.0	252

Post-run Bias at 09:01

Zero Bias	0.1	1
Span Bias	11.9	248
Span Gas	12.0	252

Averages corrected for the average of the pre-run and post-run bias

5.1	52

JJB

RUN SUMMARY

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	NO_x
Method	EPA 3A	EPA 7E
Conc. Units	%	ppm

Time: 09:07 to 10:07

Run Averages

5.0	52

Pre-run Bias at 09:01

Zero Bias	0.1	1
Span Bias	11.9	248
Span Gas	12.0	252

Post-run Bias at 10:09

Zero Bias	0.1	1
Span Bias	11.9	246
Span Gas	12.0	252

Averages corrected for the average of the pre-run and post-run bias

5.0	53

✓ 9/13

RUN SUMMARY

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	NO_x
Method	EPA 3A	EPA 7E
Conc. Units	%	ppm

Time: 10:23 to 11:23

Run Averages

5.3	55

Pre-run Bias at 10:09

Zero Bias	0.1	1
Span Bias	11.9	246
Span Gas	12.0	252

Post-run Bias at 11:27

Zero Bias	0.1	1
Span Bias	11.9	249
Span Gas	12.0	252

Averages corrected for the average of the pre-run and post-run bias

5.3	55

VdB

RUN DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
response time 90 sec				
07:57	197	4.8	1267	55
07:58	198	4.9	1245	54
07:59	200	4.9	1237	53
08:00	203	5.0	1230	53
08:01	197	4.8	1228	53
08:02	201	4.9	1226	53
point 2				
08:03	202	5.0	1218	52
08:04	204	5.0	1216	52
08:05	205	5.0	1221	53
08:06	206	5.1	1237	53
08:07	203	5.0	1251	54
08:08	202	5.0	1260	54
point 3				
08:09	207	5.1	1263	55
08:10	207	5.1	1251	54
08:11	211	5.2	1247	54
08:12	209	5.1	1245	54
08:13	206	5.1	1244	54
08:14	205	5.0	1255	54
08:15	205	5.0	1254	54
08:16	206	5.1	1246	54
08:17	206	5.1	1242	54
08:18	210	5.2	1232	53
08:19	212	5.2	1218	52
08:20	213	5.2	1212	52
08:21	209	5.1	1217	52
08:22	211	5.2	1223	53
08:23	212	5.2	1221	53
08:24	213	5.2	1214	52
08:25	214	5.3	1203	52
08:26	215	5.3	1198	51
08:27	213	5.2	1197	51
08:28	210	5.2	1201	52
08:29	209	5.1	1208	52
08:30	207	5.1	1213	52
08:31	210	5.2	1214	52
08:32	210	5.2	1208	52
08:33	211	5.2	1199	51
08:34	213	5.2	1191	51

RUN DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
08:35	210	5.2	1189	51
08:36	208	5.1	1188	51
08:37	209	5.1	1193	51
08:38	211	5.2	1198	51
08:39	214	5.3	1193	51
08:40	213	5.2	1181	51
08:41	214	5.3	1165	50
08:42	212	5.2	1169	50
08:43	208	5.1	1176	50
08:44	209	5.1	1186	51
08:45	208	5.1	1193	51
08:46	212	5.2	1195	51
08:47	209	5.1	1196	51
08:48	210	5.2	1199	51
08:49	210	5.2	1200	51
08:50	209	5.1	1198	51
08:51	210	5.2	1195	51
08:52	212	5.2	1193	51
08:53	214	5.3	1182	51
08:54	214	5.3	1169	50
08:55	215	5.3	1167	50
08:56	209	5.1	1166	50
Avgs	**209**	**5.1**	**1212**	**52**

VdB

WESTON SOLUTIONS

RUN DATA

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
09:08	206	5.1	1256	54
09:09	208	5.1	1232	53
09:10	206	5.1	1215	52
09:11	202	5.0	1198	51
09:12	200	4.9	1195	51
09:13	198	4.9	1195	51
09:14	199	4.9	1199	51
09:15	200	4.9	1207	52
09:16	203	5.0	1215	52
09:17	199	4.9	1212	52
09:18	198	4.9	1216	52
09:19	199	4.9	1221	53
09:20	203	5.0	1216	52
09:21	204	5.0	1196	51
09:22	205	5.0	1186	51
09:23	208	5.1	1186	51
09:24	209	5.1	1193	51
09:25	209	5.1	1193	51
09:26	207	5.1	1186	51
09:27	208	5.1	1191	51
09:28	207	5.1	1193	51
09:29	206	5.1	1200	51
09:30	207	5.1	1211	52
09:31	208	5.1	1217	52
09:32	206	5.1	1221	53
09:33	204	5.0	1227	53
09:34	208	5.1	1234	53
09:35	208	5.1	1237	53
09:36	209	5.1	1235	53
09:37	208	5.1	1233	53
09:38	211	5.2	1229	53
09:39	206	5.1	1226	53
09:40	204	5.0	1221	53
09:41	205	5.0	1223	53
09:42	207	5.1	1220	52
09:43	204	5.0	1218	52
09:44	201	4.9	1219	52
09:45	203	5.0	1219	52
09:46	198	4.9	1218	52
09:47	198	4.9	1218	52
09:48	198	4.9	1222	53

RUN DATA

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
09:49	200	4.9	1218	52
09:50	200	4.9	1217	52
09:51	201	4.9	1210	52
09:52	204	5.0	1204	52
09:53	206	5.1	1212	52
09:54	206	5.1	1215	52
09:55	208	5.1	1214	52
09:56	209	5.1	1218	52
09:57	205	5.0	1227	53
09:58	203	5.0	1240	53
09:59	200	4.9	1243	54
10:00	201	4.9	1236	53
10:01	200	4.9	1234	53
10:02	205	5.0	1221	53
10:03	205	5.0	1211	52
10:04	206	5.1	1217	52
10:05	207	5.1	1228	53
10:06	206	5.1	1233	53
10:07	206	5.1	1234	53
Avgs	**204**	**5.0**	**1216**	**52**

✓ MB

RUN DATA

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
10:24	210	5.2	1302	56
10:25	210	5.2	1280	55
10:26	209	5.1	1273	55
10:27	209	5.1	1268	55
10:28	208	5.1	1271	55
10:29	206	5.1	1276	55
10:30	206	5.1	1280	55
10:31	209	5.1	1289	56
10:32	209	5.1	1289	56
10:33	211	5.2	1275	55
10:34	212	5.2	1262	55
10:35	211	5.2	1260	54
10:36	210	5.2	1248	54
10:37	213	5.2	1243	54
10:38	213	5.2	1251	54
10:39	212	5.2	1259	54
10:40	213	5.2	1257	54
10:41	213	5.2	1255	54
10:42	214	5.3	1249	54
10:43	213	5.2	1251	54
10:44	214	5.3	1261	54
10:45	215	5.3	1269	55
10:46	220	5.4	1267	55
10:47	218	5.4	1253	54
10:48	217	5.4	1238	53
10:49	216	5.3	1227	53
10:50	214	5.3	1227	53
10:51	216	5.3	1236	53
10:52	217	5.4	1248	54
10:53	219	5.4	1250	54
10:54	219	5.4	1248	54
10:55	221	5.5	1248	54
10:56	218	5.4	1241	53
10:57	218	5.4	1247	54
10:58	214	5.3	1253	54
10:59	212	5.2	1259	54
11:00	211	5.2	1267	55
11:01	213	5.2	1268	55
11:02	211	5.2	1266	55
11:03	212	5.2	1269	55
11:04	213	5.2	1277	55

RUN DATA
Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
11:05	211	5.2	1282	55
11:06	218	5.4	1285	56
11:07	218	5.4	1287	56
11:08	220	5.4	1286	56
11:09	220	5.4	1283	56
11:10	219	5.4	1273	55
11:11	217	5.4	1260	54
11:12	219	5.4	1264	55
11:13	219	5.4	1274	55
11:14	214	5.3	1277	55
11:15	217	5.4	1275	55
11:16	217	5.4	1269	55
11:17	217	5.4	1270	55
11:18	215	5.3	1278	55
11:19	217	5.4	1290	56
11:20	219	5.4	1289	56
11:21	222	5.5	1283	56
11:22	220	5.4	1275	55
11:23	221	5.5	1270	55
Avgs	**215**	**5.3**	**1265**	**55**

BIAS
Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 07:50

O_2
Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	19	0.1	0.1	0.4	Pass
Span	12.0	464	11.9	-0.1	-0.4	Pass

NO_x
Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	0	165	1	1	0.2	Pass
Span	252	5199	248	-4	-0.9	Pass

✓ gB

BIAS AND CALIBRATION DRIFT

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 09:01

O_2
Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	19	0.1	0.1	0.4	Pass
Span	12.0	464	11.9	-0.1	-0.4	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	Final %	Difference %	Drift %	Status
Zero	0.1	19	0.1	0.0	0.0	Pass
Span	11.9	464	11.9	0.0	0.0	Pass

*Bias No. 1

NO_x
Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	0	180	1	1	0.2	Pass
Span	252	5198	248	-4	-0.9	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	1	180	1	0	0.0	Pass
Span	248	5198	248	0	0.0	Pass

*Bias No. 1

JGB

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 10:09

O_2
Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	17	0.1	0.1	0.4	Pass
Span	12.0	465	11.9	-0.1	-0.4	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	Final %	Difference %	Drift %	Status
Zero	0.1	17	0.1	0.0	0.0	Pass
Span	11.9	465	11.9	0.0	0.0	Pass

*Bias No. 2

NO_x
Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	0	176	1	1	0.2	Pass
Span	252	5158	246	-6	-1.3	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	1	176	1	0	0.0	Pass
Span	248	5158	246	-2	-0.4	Pass

*Bias No. 2

BIAS AND CALIBRATION DRIFT

Number 4

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 11:27

O_2
Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	16	0.1	0.1	0.4	Pass
Span	12.0	465	11.9	-0.1	-0.4	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	Final %	Difference %	Drift %	Status
Zero	0.1	16	0.1	0.0	0.0	Pass
Span	11.9	465	11.9	0.0	0.0	Pass

*Bias No. 3

NO_x
Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	0	178	1	1	0.2	Pass
Span	252	5215	249	-3	-0.7	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	1	178	1	0	0.0	Pass
Span	246	5215	249	3	0.7	Pass

*Bias No. 3

✓ gB

WESTON SOLUTIONS

CALIBRATION DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 07:42

O_2

Method: EPA 3A
Calibration Type: Linear Regression

Calibration Results

%	Cylinder ID	Result, mv
Zero	-	14
12.0	CC156057	468
25.0	CC354619	963

Curve Coefficients

Slope	Intercept	Corr. Coeff.
38.01	14	>0.9999

NO_x

Method: EPA 7E
Calibration Type: Linear Regression

Calibration Results

ppm	Cylinder ID	Result, mv
Zero	-	150
252	CC9151997BAL	5294
453	CC218480	9378

Curve Coefficients

Slope	Intercept	Corr. Coeff.
20.37	152	>0.9999

CALIBRATION ERROR DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 07:42

O_2
Method: EPA 3A
Span Conc. 25.0 %
Slope 38.01 **Intercept** 13.5

Standard %	Response mv	Result %	Difference %	Error %	Status
Zero	14	0.0	0.0	0.0	Pass
12.0	468	12.0	0.0	0.0	Pass
25.0	963	25.0	0.0	0.0	Pass

NO_x
Method: EPA 7E
Span Conc. 453 ppm
Slope 20.37 **Intercept** 152

Standard ppm	Response mv	Result ppm	Difference ppm	Error %	Status
Zero	150	0	0	0.0	Pass
252	5294	252	0	0.0	Pass
453	9378	453	0	0.0	Pass

METHODS AND ANALYZERS

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

File: C:\Data\Resolute- Catawba\CEM March 2015\No. 2 LK.cem
Program Version: 2.0, built 13 Mar 2014 **File Version:** 2.02
Computer: WINDOWS-PMGFSQ2 **Trailer:** 261
Analog Input Device: Keithley KUSB-3108

Channel 1

Analyte	**O_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 1440 Ser# 4303**
Full-Scale Output, mv	**1000**
Analyzer Range, %	**25.0**
Span Concentration, %	**25.0** ✓

Channel 4

Analyte	**NO_x**
Method	**EPA 7E**, Using Bias
Analyzer Make, Model & Serial No.	**API 200EH Ser# 672**
Full-Scale Output, mv	**10000**
Analyzer Range, ppm	**500**
Span Concentration, ppm	**453** ✓

✓ CB

APPENDIX E
FIELD DATA – NO. 2 AND 3
SMELT DISSOLVING TANK VENT

Resolute
Catawba, SC

03917.008.028
No. 2, 3 SDTV

EMISSION CALCULATIONS

	Run 1	Run 2	Run 3	Mean
Date	**3/31/15**	**3/31/15**	**3/31/15**	---
Time Began	**846**	**1040**	**1240**	---
Time Ended	**1017**	**1210**	**1411**	---
Volumetric Flow Rate, (Qs), DSCFM	2.41E+04	2.00E+04	2.03E+04	2.15E+04
Production Rate, units/hr ton BLS/hr	108.48	107.24	105.75	107.16
Total Reduced Sulfur (TRS MW)= 34.08				
Concentration, ppm	0.06	0.40	1.65	0.70
Emission Rate, lb/hr	0.01	0.04	0.18	0.08
Emission Factor, lb/ton BLS/hr	0.0001	0.0004	0.0017	0.0007

Resolute
Catawba, SC

03917.008.028
No. 2, 3 SDTV

VOLUMETRIC FLOW CALCULATIONS

Run Number	Run 1	Run 2	Run 3	Mean
Date	3/31/15	3/31/15	3/31/15	----
Time	1000	1040	1255	----
Volumetric Flow Data				
Velocity Head, in. H2O				
Point 1	0.14	0.13	0.11	0.13
Point 2	0.19	0.16	0.15	0.17
Point 3	0.21	0.18	0.16	0.18
Point 4	0.19	0.20	0.16	0.18
Point 5	0.18	0.20	0.17	0.18
Point 6	0.16	0.19	0.17	0.17
Point 7	0.15	0.16	0.06	0.12
Point 8	0.11	0.17	0.06	0.11
Point 9	0.15	0.15	0.15	0.15
Point 10	0.21	0.16	0.17	0.18
Point 11	0.22	0.17	0.19	0.19
Point 12	0.20	0.18	0.19	0.19
Point 13	0.18	0.16	0.18	0.17
Point 14	0.21	0.16	0.17	0.18
Point 15	0.18	0.11	0.15	0.15
Point 16	0.16	0.10	0.14	0.13
Square Root of Delta P, (in. H20)^½	0.420	0.400	0.381	0.400
Pitot Tube Coefficient (Cp)	0.84	0.84	0.84	0.84
Barometric Pressure (Pb), in. Hg	29.26	29.26	29.26	29.26
Static Pressure (Pg), in. H2O	-0.14	-0.14	-0.14	-0.14
Stack Pressure (Ps), in. Hg	29.25	29.25	29.25	29.25
Stack Diameter (I.D.), in.	71.0	71.0	71.0	71.0
Stack Cross-sectional Area, ft^2	27.49	27.49	27.49	27.49
Stack Gas				
Temperature (ts), °F	171	172	171	171
Moisture (Bws)	0.363	0.457	0.417	0.412
CO2 Concentration (CO2), %	0.0	0.0	0.0	0.0
O2 Concentration (O2), %	20.9	20.9	20.9	20.9
Molecular Weight (Ms), lb/lb-mole	24.9	23.9	24.3	24.4
Velocity (Vs), ft/sec	28.1	27.3	25.8	27.1
Volumetric Flow Rate,				
At Stack Conditions (Qa), ACFM	46282	45065	42560	44636
At Standard Conditions (Qs), DSCFM	**24107**	**19978**	**20289**	**21458**

✓ CB

Determination of Stack Gas Velocity - Method 2

Client: Resolute
Location/Plant: Catawba, SC
Source: #2+3 SDTV
Operator: MCC
Date: 03/31/15
W.O. Number: 03917.008.028
Pitot Coeff (Cp): 0.84
Stack Area, ft² (As): 27.49
Pitot Tube/Thermo ID: P213

Run Number	1	2	3
Time	10:00	10:40	12:55
Barometric Press, in Hg (Pb)	29.26	29.26	29.26
Static Press, in H_20 (Pstatic)	-0.14	-0.14	-0.14
Source Moisture, % (BWS)	36.3	45.7	41.7
O_2, %	20.9	20.9	20.9
CO_2, %	0	0	0

Cyclonic Flow Determination		Traverse Location		Leak Check good ? Y/ N		Leak Check good ? Y/ N		Leak Check good ? Y/ N	
Delta P at O°	Angle yeilding zero Delta P	Port	Point	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)
0.0		A	1	0.14	172	0.13	172	0.11	170.5
			2	0.19	172	0.16	172	0.15	171
			3	0.21	171	0.18	172	0.16	171
			4	0.19	172	0.20	171	0.16	171
0	0		5	0.18	172	0.20	171	0.17	171
			6	0.16	172	0.19	172	~~0.17~~ 0.17	172
			7	0.15	171	0.16	172	0.06	172
			8	0.11	171	0.17	172	0.06	172
0.05	0	B	1	~~0.98~~ 0.15	170	0.15	173	0.15	171
0	0		2	0.21	171	0.16	172	0.17	171
0	0		3	0.22	171	0.17	171	0.19	171
0	0		4	0.20	171	0.18	171	0.19	172
0	0		5	0.18	172	0.16	171	0.18	172
0	0		6	0.21	172	0.16	172	0.17	171
0	0		7	0.18	171	0.11	173	0.15	171
0	0		8	0.16	171	0.10	174	0.14	170.5

Avg Angle		Avg Delta P & Temp	~~0.166~~ 0.158 / 171.38	0.161 / 171.94	0.149 / 171.25
		Avg SqrtDelta P	~~0.406~~ 0.420	0.400	0.381
		Average gas stream velocity, ft/sec.	28.0	27	26
		Vol. flow rate @ actual conditions, wacf/min	~~46516~~ 46300	45000	43000
		Vol. flow rate at standard conditions, dscf/min	24100	20000	20000

$MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))$

$MWs = (MWd * (1 - (BWS/100))) + (18 * (BWS/100))$

$Tsa = Ts + 460$

$Ps = Pb + (Pstatic/13.6)$

$Vs = 85.49 * Cp * avg\sqrt{DeltaP} * \sqrt{Tsa/(Ps * MWs)}$

$Qs(act) = 60 * Vs * As$

$Qs(std) = 17.64 * (1 - (BWS/100)) * (Ps/Tsa) * Qs(act)$

where:
MWd = Dry molecular weight source gas, lb/lb-mole.
MWs = Wet molecular weight source gas, lb/lb-mole.
Tsa = Source Temperature, absolute(oR)
Ps = Absolute stack static pressure, inches Hg.
Vs = Average gas stream velocity, ft/sec.
Qs(act) = Volumetric flow rate of wet stack gas at actual, wacf/min
Qs(std) = Volumetric flow rate of dry stack gas at standard conditions, dscf/min

Barometric Press, in. Hg (Pb) at Port Elevation

Comments

Method 2.xls

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Determination of Moisture Content in Stack Gases - Method 4
Wet Bulb / Dry Bulb

Client Resolute Source #2+3 SDTV Operator MCC

Location/Plant Catawba, SC W.O. 03917.008.028 Date 03/31/15

Run Number	1	2	3
Time	9:40	11:15	12:55
Barometric Press, in. Hg (Pb)	29.26	29.26	29.26
Static Press, in. H_20 (Pstatic)	-0.14	-0.14	-0.14
Dry Bulb Temperture, °F (Td)	164.5	174.4	170.5
Wet Bulb Temperture, °F (Tw)	164.0	174.4	170.5
Delta T = Td-Tw, (Δ T)	0.50	0	0
Vapor Press H_20 at Tw (Vp), from table	10.61	13.37	12.2
Absolute stack static pressure, inches Hg (Ps)	29.25	29.250	29.250
Partial Press of H_2O (PP)	10.6064	13.3700	12.2000
Moisture, % (BWS)	.363	.457	.417

Vapor Pressure of Water

°F	"Hg	°F	"Hg	°F	"Hg	°F	"Hg	°F	"Hg	°F	"Hg
2	0.0417	47	0.324	80	1.032	113	2.829	146	6.85	179	14.96
4	0.0463	48	0.3364	81	1.066	114	2.911	147	7.024	180	15.29
6	0.0517	49	0.3493	82	1.102	115	2.995	148	7.202	181	15.63
8	0.0571	50	0.3626	83	1.138	116	3.081	149	7.384	182	15.98
10	0.0631	51	0.3764	84	1.175	117	3.169	150	7.569	183	16.34
12	0.0696	52	0.3906	85	1.213	118	3.259	151	7.759	184	16.7
14	0.0768	53	0.4052	86	1.253	119	3.351	152	7.952	185	17.07
16	0.0846	54	0.4203	87	1.293	120	3.446	153	8.15	186	17.44
18	0.0932	55	0.4359	88	1.335	121	3.543	154	8.351	187	17.82
20	0.1205	56	0.452	89	1.378	122	3.642	155	8.557	188	18.21
22	0.1127	57	0.4686	90	1.422	123	3.744	156	8.767	189	18.61
24	0.1248	58	0.4858	91	1.467	124	3.848	157	8.981	190	19.01
26	0.137	59	0.5035	92	1.513	125	3.954	158	9.2	191	19.42
27	0.1429	60	0.5218	93	1.561	126	4.063	159	9.424	192	19.84
28	0.1502	61	0.5407	94	1.61	127	4.174	160	9.652	193	20.27
29	0.1567	62	0.5601	95	1.66	128	4.289	161	9.885	194	20.7
30	0.1647	63	0.5802	96	1.712	129	4.406	162	10.12	195	21.14
31	0.1716	64	0.6009	97	1.765	130	4.525	163	10.36	196	21.59
32	0.1803	65	0.6222	98	1.819	131	4.647	164	10.61	197	22.05
33	0.1878	66	0.6442	99	1.875	132	4.772	165	10.86	198	22.52
34	0.1955	67	0.6669	100	1.932	133	4.9	166	11.12	199	22.99
35	0.2035	68	0.6903	101	1.992	134	5.031	167	11.38	200	23.47
36	0.2188	69	0.7144	102	2.052	135	5.165	168	11.65	201	23.96
37	0.2203	70	0.7392	103	2.114	136	5.302	169	11.92	202	24.46
38	0.2292	71	0.7648	104	2.178	137	5.442	170	12.2	203	24.97
39	0.2383	72	0.7912	105	2.243	138	5.585	171	12.48	204	25.48
40	0.2478	73	0.8183	106	2.31	139	5.732	172	12.77	205	26
41	0.2576	74	0.8462	107	2.379	140	5.881	173	13.07	206	26.53
42	0.2677	75	0.875	108	2.449	141	6.034	174	13.37	207	27.07
43	0.2782	76	0.9046	109	2.521	142	6.19	175	13.67	208	27.62
44	0.2891	77	0.9352	110	2.596	143	6.35	176	13.98	209	28.18
45	0.3004	78	0.9666	111	2.672	144	6.513	177	14.3	210	28.75
46	0.312	79	0.9989	112	2.749	145	6.68	178	14.62	211	29.33
										212	29.92

$Ps = Pb + (Pstatic / 13.6)$

Comments: AM

$$PP = Vp - \frac{(Ps - Vp) * T}{2800 - (1.3 * Tw)}$$

$BWS = (PP / Ps) * 100$

WESTON MANAGERS DESIGNERS/CONSULTANTS

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RUN SUMMARY

Number 1

Client:	**Resolute**	Project Number:	**03917.008.028**
Location:	**Catawba, SC**	Operator:	**Simpkins**
Source:	**No. 2,3 SDTV**	Date:	**31 Mar 2015**
Method:	**16**		

Calibration Number 1

Start Time 08:46 **End Time** 10:17

Average Measured TRS Conc.	0.06	**ppm**
Recovery No. 2	99.6	**%**
TRS Corrected for Recovery	0.06	**ppm**

RUN SUMMARY

Number 2

Client:	**Resolute**	Project Number:	**03917.008.028**
Location:	**Catawba, SC**	Operator:	**Simpkins**
Source:	**No. 2,3 SDTV**	Date:	**31 Mar 2015**
Method:	**16** **Calibration Number** 1		

Start Time 10:40 **End Time** 12:10

Average Measured TRS Conc.	0.39	**ppm**
Recovery No. 3	96.3	**%**
TRS Corrected for Recovery	0.40	**ppm**

RUN SUMMARY

Number 3

Client:	**Resolute**	Project Number:	**03917.008.028**
Location:	**Catawba, SC**	Operator:	**Simpkins**
Source:	**No. 2,3 SDTV**	Date:	**31 Mar 2015**
Method:	**16** **Calibration Number** 1		

Start Time 12:40 **End Time** 14:11

Average Measured TRS Conc.	1.49	**ppm**
Recovery No. 4	90.2	**%**
TRS Corrected for Recovery	1.65	**ppm**

REDUCED SULFUR FIELD DATA

Run 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16** **Calibration Number** 1

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Time	H_2S		MeSH		DMS		DMDS		TRS
	area	ppm	area	ppm	area	ppm	area	ppm	ppm
08:46	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
08:49	2	0.25	<2	<0.27	<2	<0.27	<2	<0.17	0.25
08:52	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
08:55	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
08:58	<2	<0.25	<2	<0.27	<2	<0.27	12	0.47	0.93
09:01	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:04	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:07	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:10	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:13	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:17	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:20	3	0.34	<2	<0.27	<2	<0.27	<2	<0.17	0.34
09:23	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:26	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:29	3	0.33	<2	<0.27	<2	<0.27	<2	<0.17	0.33
09:32	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:35	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:38	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:41	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:44	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:47	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:50	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:53	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:56	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
09:59	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:02	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:05	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:08	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:11	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:14	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
Averages:		**0.03**		-		-		**0.02**	**0.06**

WESTON SOLUTIONS

REDUCED SULFUR FIELD DATA

Run 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16** **Calibration Number** 1

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Time	H_2S		MeSH		DMS		DMDS		TRS
	area	ppm	area	ppm	area	ppm	area	ppm	ppm
10:40	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:43	4	0.36	<2	<0.27	<2	<0.27	<2	<0.17	0.36
10:46	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:49	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:52	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:55	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
10:58	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
11:01	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
11:04	3	0.32	<2	<0.27	<2	<0.27	<2	<0.17	0.32
11:07	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
11:10	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
11:13	4	0.38	<2	<0.27	<2	<0.27	<2	<0.17	0.38
11:16	<2	<0.25	<2	<0.27	<2	<0.27	<2	<0.17	-
11:19	6	0.47	<2	<0.27	<2	<0.27	<2	<0.17	0.47
11:22	5	0.41	4	0.38	<2	<0.27	<2	<0.17	0.78
11:25	5	0.43	<2	<0.27	<2	<0.27	<2	<0.17	0.43
11:28	8	0.56	<2	<0.27	<2	<0.27	<2	<0.17	0.56
11:31	8	0.57	<2	<0.27	<2	<0.27	<2	<0.17	0.57
11:34	9	0.58	<2	<0.27	<2	<0.27	<2	<0.17	0.58
11:37	9	0.60	<2	<0.27	<2	<0.27	<2	<0.17	0.60
11:40	7	0.51	<2	<0.27	<2	<0.27	<2	<0.17	0.51
11:43	6	0.49	<2	<0.27	<2	<0.27	<2	<0.17	0.49
11:46	6	0.46	<2	<0.27	<2	<0.27	<2	<0.17	0.46
11:49	10	0.62	<2	<0.27	<2	<0.27	<2	<0.17	0.62
11:52	5	0.45	<2	<0.27	<2	<0.27	<2	<0.17	0.45
11:55	7	0.51	<2	<0.27	<2	<0.27	<2	<0.17	0.51
11:58	8	0.57	<2	<0.27	<2	<0.27	<2	<0.17	0.57
12:01	20	0.92	<2	<0.27	<2	<0.27	<2	<0.17	0.92
12:04	23	1.02	<2	<0.27	<2	<0.27	<2	<0.17	1.02
12:07	22	0.99	<2	<0.27	<2	<0.27	<2	<0.17	0.99
Averages:		**0.37**		**0.01**		**-**		**-**	**0.39**

REDUCED SULFUR FIELD DATA

Run 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16** **Calibration Number** 1

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Time	H_2S		MeSH		DMS		DMDS		TRS
	area	ppm	area	ppm	area	ppm	area	ppm	ppm
12:40	7	0.50	<2	<0.27	<2	<0.27	<2	<0.17	0.50
12:43	12	0.71	<2	<0.27	<2	<0.27	<2	<0.17	0.71
12:46	11	0.66	<2	<0.27	<2	<0.27	<2	<0.17	0.66
12:49	9	0.61	<2	<0.27	<2	<0.27	<2	<0.17	0.61
12:52	18	0.87	<2	<0.27	<2	<0.27	<2	<0.17	0.87
12:55	22	1.00	<2	<0.27	<2	<0.27	<2	<0.17	1.00
12:58	32	1.21	<2	<0.27	<2	<0.27	<2	<0.17	1.21
13:01	37	1.33	<2	<0.27	<2	<0.27	<2	<0.17	1.33
13:04	34	1.26	<2	<0.27	<2	<0.27	<2	<0.17	1.26
13:07	32	1.23	<2	<0.27	<2	<0.27	<2	<0.17	1.23
13:10	31	1.20	<2	<0.27	<2	<0.27	<2	<0.17	1.20
13:13	41	1.41	<2	<0.27	<2	<0.27	<2	<0.17	1.41
13:16	95	2.27	<2	<0.27	<2	<0.27	<2	<0.17	2.27
13:19	46	1.50	<2	<0.27	<2	<0.27	<2	<0.17	1.50
13:22	49	1.56	<2	<0.27	<2	<0.27	<2	<0.17	1.56
13:25	48	1.54	<2	<0.27	<2	<0.27	<2	<0.17	1.54
13:28	57	1.70	<2	<0.27	<2	<0.27	<2	<0.17	1.70
13:31	58	1.71	4	0.38	8	0.54	<2	<0.17	2.63
13:34	48	1.53	<2	<0.27	<2	<0.27	<2	<0.17	1.53
13:37	52	1.62	<2	<0.27	<2	<0.27	<2	<0.17	1.62
13:40	51	1.59	<2	<0.27	<2	<0.27	10	0.41	2.41
13:43	69	1.88	<2	<0.27	<2	<0.27	<2	<0.17	1.88
13:46	46	1.51	<2	<0.27	<2	<0.27	<2	<0.17	1.51
13:49	52	1.61	<2	<0.27	<2	<0.27	<2	<0.17	1.61
13:52	53	1.63	<2	<0.27	<2	<0.27	<2	<0.17	1.63
13:55	44	1.47	<2	<0.27	<2	<0.27	<2	<0.17	1.47
13:59	54	1.64	<2	<0.27	<2	<0.27	<2	<0.17	1.64
14:02	71	1.92	2	0.28	<2	<0.27	<2	<0.17	2.21
14:05	64	1.80	3	0.35	<2	<0.27	<2	<0.17	2.16
14:08	67	1.86	<2	<0.27	<2	<0.27	<2	<0.17	1.86
Averages:		**1.41**		**0.03**		**0.02**		**0.01**	**1.49**

RECOVERY DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Calibration Number 1 **Before Run** 1
Start Time 08:12 **End Time** 08:33

Recovery was run using H_2S

Recovery Gas to Probe, Time: 08:12

Peak Areas, mv-sec			Average	ppm
500	502	498	500	5.83

Recovery Gas to GC, Time: 08:30

Peak Areas, mv-sec			Average	ppm
506	499	497	501	5.84

Recovery 99.9%

RECOVERY DATA

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Calibration Number 1 **After Run** 1 **Before Run** 2
Start Time 10:17 **End Time** 10:37

Recovery was run using H_2S

Recovery Gas to Probe, Time: 10:17

Peak Areas, mv-sec			Average	ppm
489	492	488	489	5.76

Recovery Gas to GC, Time: 10:31

Peak Areas, mv-sec			Average	ppm
492	492	493	493	5.78

Recovery 99.6%

RECOVERY DATA

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Calibration Number 1 **After Run** 2 **Before Run** 3
Start Time 12:10 **End Time** 12:37

Recovery was run using H_2S

Recovery Gas to Probe, Time: 12:10

Peak Areas, mv-sec			Average	ppm
413	516	519	483	5.72

Recovery Gas to GC, Time: 12:33

Peak Areas, mv-sec			Average	ppm
517	516	515	516	5.94

Recovery 96.3%

RECOVERY DATA

Number 4

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Calibration Number 1 **After Run** 3 **Before Run** 4
Start Time 14:11 **End Time** 14:35

Recovery was run using H_2S

Recovery Gas to Probe, Time: 14:11

Peak Areas, mv-sec			Average	ppm
436	429	413	426	5.32

Recovery Gas to GC, Time: 14:30

Peak Areas, mv-sec			Average	ppm
509	509	514	511	5.90

Recovery 90.2%

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CALIBRATION DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Ambient Temp 72°F **Baro. Press.** 29.48 in. Hg

Compound	**H_2S**	**MeSH**	**DMS**	**DMDS**
Perm. Device ID	T-45601	33-45604	89-45609	89-45611
Perm. Rate, nL/min	531	363	301	210
Ret. Time, sec	25.0	38.5	77.5	137.5
1 Flow 94.1 **mL/min**	**5.64** ppm	**3.86** ppm	**3.20** ppm	**2.23** ppm
Time: 07:45		**Peak Areas, mv-sec**		
	467	269	198	240
	468	269	203	232
	466	268	206	223
Average Area	**467**	**269**	**202**	**232**
2 Flow 26.0 **mL/min**	**20.4** ppm	**14.0** ppm	**11.6** ppm	**8.06** ppm
Time: 07:18		**Peak Areas, mv-sec**		
	4706	2934	2168	2517
	4659	2888	2125	2468
	4616	2876	2119	2420
Average Area	**4660**	**2899**	**2137**	**2468**
3 Flow 14.0 **mL/min**	**37.9** ppm	**25.9** ppm	**21.5** ppm	**15.0** ppm
Time: 06:30		**Peak Areas, mv-sec**		
	13162	9178	6943	8096
	13143	9175	6960	8176
	13162	9189	6970	8187
Average Area	**13156**	**9181**	**6958**	**8153**

CALIBRATION SUMMARY

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

H_2S	1	2	3		
Time	07:45	07:18	06:30		
Conc.	5.64	20.4	37.9		
Response	467	4660	13156		
Calc. Conc.	5.61	20.8	37.5		
% Error	-0.6	+1.7	-1.1		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.7576	1.3529	0.9999	2	0.25

MeSH	1	2	3		
Time	07:45	07:18	06:30		
Conc.	3.86	14.0	25.9		
Response	269	2899	9181		
Calc. Conc.	3.86	13.9	25.9		
% Error	+0.1	-0.2	+0.1		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.8527	1.3430	>0.9999	2	0.27

DMS	1	2	3		
Time	07:45	07:18	06:30		
Conc.	3.20	11.6	21.5		
Response	202	2137	6958		
Calc. Conc.	3.21	11.5	21.7		
% Error	+0.3	-1.1	+0.7		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.8530	1.3675	>0.9999	2	0.27

DMDS	1	2	3		
Time	07:45	07:18	06:30		
Conc.	2.23	8.06	15.0		
Response	232	2468	8153		
Calc. Conc.	2.24	7.95	15.1		
% Error	+0.4	-1.3	+0.9		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.8637	1.7140	0.9999	2	0.17

CALIBRATION DATA

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

Ambient Temp 72°F **Baro. Press.** 29.48 in. Hg

Compound	**H_2S**	**MeSH**	**DMS**	**DMDS**
Perm. Device ID	T-45601	33-45604	89-45609	89-45611
Perm. Rate, nL/min	531	363	301	210
Ret. Time, sec	25.0	38.5	77.5	137.5
1 Flow 78.7 **mL/min**	**6.75** ppm	**4.61** ppm	**3.83** ppm	**2.66** ppm
Time: 17:12		**Peak Areas, mv-sec**		
	660	392	298	339
	660	395	279	318
	663	392	278	323
Average Area	**661**	**393**	**285**	**327**
2 Flow 28.5 **mL/min**	**18.6** ppm	**12.7** ppm	**10.6** ppm	**7.35** ppm
Time: 16:31		**Peak Areas, mv-sec**		
	4369	2793	2025	2442
	4393	2797	2018	2405
	4408	2797	2027	2446
Average Area	**4390**	**2795**	**2023**	**2431**
3 Flow 14.6 **mL/min**	**36.4** ppm	**24.8** ppm	**20.6** ppm	**14.4** ppm
Time: 14:37		**Peak Areas, mv-sec**		
	12457	8752	6522	7614
	12777	9010	6697	8025
	12840	9047	6742	8071
Average Area	**12691**	**8936**	**6654**	**7903**

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WESTON SOLUTIONS

CALIBRATION SUMMARY

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **31 Mar 2015**

H_2S	1	2	3		
Time	17:12	16:31	14:37		
Conc.	6.75	18.6	36.4		
Response	661	4390	12691		
Calc. Conc.	6.64	19.4	35.5		
% Error	-1.6	+4.2	-2.5		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.7629	1.3714	0.9991	2	0.25

MeSH	1	2	3		
Time	17:12	16:31	14:37		
Conc.	4.61	12.7	24.8		
Response	393	2795	8936		
Calc. Conc.	4.56	13.1	24.4		
% Error	-1.1	+2.8	-1.7		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.8612	1.3678	0.9996	2	0.27

DMS	1	2	3		
Time	17:12	16:31	14:37		
Conc.	3.83	10.6	20.6		
Response	285	2023	6654		
Calc. Conc.	3.79	10.8	20.4		
% Error	-0.8	+2.1	-1.3		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.8753	1.3688	0.9998	2	0.27

DMDS	1	2	3		
Time	17:12	16:31	14:37		
Conc.	2.66	7.35	14.4		
Response	327	2431	7903		
Calc. Conc.	2.63	7.57	14.1		
% Error	-1.2	+3.0	-1.8		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.8978	1.7169	0.9995	2	0.18

PERMEATION RATE CALCULATIONS

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

To calculate the permeation rate in volume units:

$$PR_{nl} = PR_{ng} \times (V_{mol} / W_{mol}) \times [(460° + T_a) / T_s] \times (P_s / P_a)$$

Where:

- PR_{nl} = Permeation Rate, nL/min
- PR_{ng} = Permeation Rate, ng/min
- V_{mol} = Molar Volume of any gas @32°F & 29.92 mm Hg = 22.4 L/mole
- W_{mol} = Molecular Weight of compound
- T_a = Ambient Temperature, °F
- T_s = Standard Temperature = 492°R
- P_s = Standard Pressure = 29.92 in Hg
- P_a = Ambient Pressure, in Hg

To calculate concentration:

$$C = PR_{nl} / F_d$$

Where:

- C = Concentration, ppmv
- PR_{nl} = Permeation Rate, nL/min
- F_d = Diluent Flow Rate, mL/min

T_a = 72°F P_a = 29.48

H_2S: Device T-45601 PR_{ng} = 736 ng/min W_{mol} = 34.08
PR_{nl} = 736 x (22.4 / 34.08) x [(460 + 72) / 492] x (29.92 / 29.48)
= **531** nL/min

MeSH: Device 33-45604 PR_{ng} = 710 ng/min W_{mol} = 48.11
PR_{nl} = 710 x (22.4 / 48.11) x [(460 + 72) / 492] x (29.92 / 29.48)
= **363** nL/min

DMS: Device 89-45609 PR_{ng} = 761 ng/min W_{mol} = 62.14
PR_{nl} = 761 x (22.4 / 62.14) x [(460 + 72) / 492] x (29.92 / 29.48)
= **301** nL/min

DMDS: Device 89-45611 PR_{ng} = 803 ng/min W_{mol} = 94.20
PR_{nl} = 803 x (22.4 / 94.20) x [(460 + 72) / 492] x (29.92 / 29.48)
= **210** nL/min

	H_2S	MeSH	DMS	DMDS
Permeation Device ID	T-45601	33-45604	89-45609	89-45611
Permeation Rate, ng/min	736	710	761	803
Permeation Rate, nL/min	531	363	301	210

INSTRUMENT DATA

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2,3 SDTV**
Method: **16**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

File: C:\DATA\Resolute- Catawba\TRS March 2015\SDTVA.trw
Computer: WSAUB61 **Trailer:** 261

Analog Input Device Keithley KPCMCIA 16AI Card

Sampling Rate $^{50}/_{1024}$ sec **Data Interval** 0.5 sec

Gas Chromatograph Shimadzu GC-8a 807

Gases	Pressure psig	Flow mL/min
H_2	30	50
Air	30	60
Carrier	50	30

Temperatures	
Column	130°C
Detector	130°C

Sample Loop	3" lined
Column 1	Carbon Packed
Column 2	none
Detector Range	10

Injection Cycle

Length 180 sec

Valve Timing	Time, sec
Inject	0
Load/Backflush	90

Injection is triggered by **internal** clock

Integration Parameters

Signal threshold 0.67 mv
Peak detection window ±15 sec
Minimum peak area 2 mv-sec **Minimum peak height** 1 mv above baseline

Dynacalibrator

Chamber Temperature 50.0°C
Ambient Temperature 72°F
Barometric Pressure 29.48 in. Hg

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Sample and Velocity Traverse Point Data Sheet - Method 1

Client: Resolute
Loaction/Plant: Catawba, SC
Source: #2+3 SDTV

Operator: MCC
Date: 03/31/15
W.O. Number: 03917.008.028

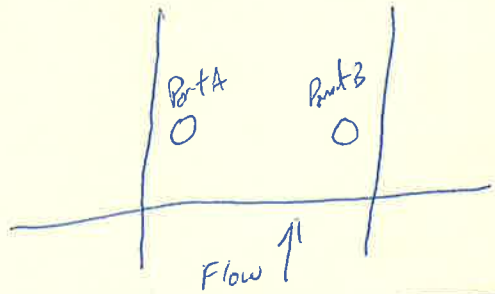
Duct Type	☑ Circular	☐ Rectangular Duct	Indicate appropriate type
Traverse Type	☐ Particulate Traverse	☑ Velocity Traverse	

Distance from far wall to outside of port (in.) = C	72.75
Port Depth (in.) = D	6.75
Depth of Duct, diameter (in.) = C-D	71
Area of Duct (ft^2)	27.49
Total Traverse Points	16
Total Traverse Points per Port	8

Flow Disturbances	
Upstream - A (ft)	10
Downstream - B (ft)	38
Upstream - A (duct diameters)	1.69
Downstream - B (duct diameters)	6.42

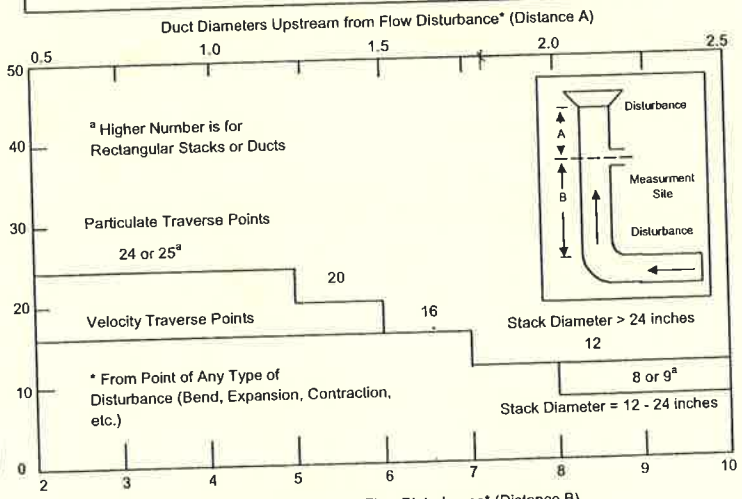
Rectangular Ducts Only	
Width of Duct, rectangular duct only (in.)	
Total Ports (rectangular duct only)	

Diagram of Stack



Traverse Point Locations

Traverse Point	% of Duct	Distance from Inside Duct Wall (in)	Distance from Outside of Port (in)
1	3.2	2.3	9.0
2	10.5	7.5	14.2
3	19.4	13.8	20.5
4	32.3	22.9	29.7
5	67.7	48.1	54.8
6	80.6	57.2	64.0
7	89.5	63.5	70.3
8	96.8	68.5	75.5
9			
10			
11			
12			



Equivalent Diameter = (2*L*W)/(L+W)

Traverse Point Location Percent of Stack -Circular

Traverse Point	Number of Traverse Points: 1	2	3	4	5	6	7	8	9	10	11	12
1		14.6		6.7		4.4		3.2		2.6		2.1
2		85.4		25		14.6		10.5		8.2		6.7
3				75		29.6		19.4		14.6		11.8
4				93.3		70.4		32.3		22.6		17.7
5						85.4		67.7		34.2		25
6						95.6		80.6		65.8		35.6
7								89.5		77.4		64.4
8								96.8		85.4		75
9										91.8		82.3
10										97.4		88.2
11												93.3
12												97.9

Traverse Point Location Percent of Stack -Rectangular

Traverse Point	Number of Traverse Points: 1	2	3	4	5	6	7	8	9	10	11	12
1		25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2		75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3			83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4				87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5					90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6						91.7	78.6	68.8	61.1	55.0	50.0	45.8
7							92.9	81.3	72.2	65.0	59.1	54.2
8								93.8	83.3	75.0	68.2	62.5
9									94.4	85.0	77.3	70.8
10										95.0	86.4	79.2
11											95.5	87.5
12												95.8

Rectangular Stack Points & Matrix
9 - 3 x 3
12 - 4 x 3
16 - 4 x 4
20 - 5 x 4
25 - 5 x 5
30 - 6 x 5
36 - 6 x 6
42 - 7 x 6
49 - 7 x 7

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APPENDIX F
FIELD DATA –
NO. 3 RECOVERY FURNACE

Resolute
Catawba, SC

03917.008.028
No. 3 Recovery

EMISSION CALCULATIONS

	Run 1	Run 2	Run 3	Mean
Date	**3/30/15**	**3/30/15**	**3/30/15**	---
Time Began	**1445**	**1606**	**1725**	---
Time Ended	**1548**	**1709**	**1828**	---
Volumetric Flow Rate, (Qs), DSCFM	2.07E+05	2.01E+05	2.00E+05	2.02E+05
% Oxygen	6.0	5.9	5.9	5.9
Oxygen Reference Concentration, %	8.0	8.0	8.0	8.0
Nitrogen Oxides MW= 46.01				
Concentration, ppm	63.7	65.3	62.0	63.7
Concentration, ppm @8%O2	55.1	56.2	53.3	54.9
Carbon Monoxide MW= 28.00				
Concentration, ppm	137.3	108.3	77.7	107.8
Emission Rate, lb/hr	123.9	94.7	67.7	95.4

AM

Resolute
Catawba, SC

03917.008.028
No. 3 Recovery

VOLUMETRIC FLOW CALCULATIONS

	Run 1	Run 2	Run 3	Mean
Run Number	3/30/15	3/30/15	3/30/15	----
Date	1505	1620	1745	----
Time				
Volumetric Flow Data				
Velocity Head, in. H2O				
Point 1	0.87	0.94	0.98	0.93
Point 2	1.10	0.98	1.00	1.03
Point 3	1.10	1.00	1.10	1.07
Point 4	1.10	1.10	1.10	1.10
Point 5	1.10	1.10	1.10	1.10
Point 6	1.10	1.10	1.10	1.10
Point 7	1.30	1.20	1.20	1.23
Point 8	1.40	1.30	1.30	1.33
Point 9	1.40	1.40	1.30	1.37
Point 10	1.40	1.30	1.30	1.33
Point 11	1.20	1.20	1.20	1.20
Point 12	1.00	1.10	1.00	1.03
Point 13	1.10	1.10	1.10	1.10
Point 14	1.30	1.20	1.20	1.23
Point 15	1.30	1.20	1.30	1.27
Point 16	1.30	1.20	1.20	1.23
Point 17	1.20	1.20	1.30	1.23
Point 18	1.10	1.20	1.10	1.13
Point 19	1.20	1.20	1.20	1.20
Point 20	1.20	1.20	1.20	1.20
Point 21	1.10	1.10	1.10	1.10
Point 22	1.10	1.00	1.00	1.03
Point 23	1.00	1.00	1.00	1.00
Point 24	1.00	1.00	0.99	1.00
Square Root of Delta P, (in. H20)^½	1.078	1.066	1.067	1.070
Pitot Tube Coefficient (Cp)	0.84	0.84	0.84	0.84
Barometric Pressure (Pb), in. Hg	29.48	29.48	29.48	29.48
Static Pressure (Pg), in. H2O	-1.10	-1.10	-1.10	-1.10
Stack Pressure (Ps), in. Hg	29.40	29.40	29.40	29.40
Stack Diameter (I.D.), in.	127.0	127.0	127.0	127.0
Stack Cross-sectional Area, ft^2	87.97	87.97	87.97	87.97
Stack Gas				
Temperature (ts), °F	334	332	335	334
Moisture (Bws)	0.214	0.234	0.237	0.228
CO2 Concentration (CO2), %	13.3	13.4	13.4	13.4
O2 Concentration (O2), %	6.0	5.9	5.9	5.9
Molecular Weight (Ms), lb/lb-mole	27.7	27.5	27.4	27.6
Velocity (Vs), ft/sec	76.4	75.8	76.0	76.1
Volumetric Flow Rate,				
At Stack Conditions (Qa), ACFM	403185	399895	401319	401466
At Standard Conditions (Qs), DSCFM	**206985**	**200578**	**199747**	**202437**

✓ 9/13

Determination of Stack Gas Velocity - Method 2

Client	Resolute	Operator	Green	Pitot Coeff (Cp)	0.84
Location/Plant	Catawba, SC	Date	30-Mar-15	Stack Area, ft² (As)	87.97
Source	No. 3 Recovery	W.O. Number	03917.008.028	Pitot Tube/Thermo ID	~~P 502~~ P213 AB for TS

Run Number	ONE	TWO	THREE
Time	1555	1620	1745
Barometric Press, in Hg (Pb)	29.48	29.48	29.48
Static Press, in H_20 (Pstatic)	-1.1	-1.1	-1.1
Source Moisture, % (BWS)	21.4	23.4	23.7
O_2, %	6.0	5.9	5.9
CO_2, %	13.3	13.4	13.4

Cyclonic Flow Determination		Traverse Location		Leak Check good ? Y / N		Leak Check good ? Y / N		Leak Check good ? Y / N	
Delta P at 0°	Angle yeilding zero Delta P	Port	Point	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)
0	0	A	1	.87	334	.94	332	.98	335
0	0		2	1.1	334	.98	332	1.0	335
0	0		3	1.1	334	1.0	332	1.1	335
0	0		4	1.1	334	1.1	332	1.1	335
0	0		5	1.1	334	1.1	332	1.1	335
0	0		6	1.1	334	1.1	332	1.1	335
0	0		7	1.3	334	1.2	332	1.2	335
0	0		8	1.4	334	1.3	332	1.3	335
0	0		9	1.4	334	1.4	332	1.3	335
0	0		10	1.4	334	1.3	332	1.3	335
0	0		11	1.2	334	1.2	332	1.2	335
0	0		12	1.0	334	1.1	332	1.0	335
0	0	B	1	1.1	334	1.1	332	1.1	335
0	0		2	1.3	334	1.2	332	1.2	335
0	0		3	1.3	334	1.2	332	1.3	335
0	0		4	1.3	332	1.2	332	1.2	335
0	0		5	1.2	334	1.2	332	1.3	335
0	0		6	1.1	334	1.2	332	1.1	335
0	0		7	1.2	334	1.2	332	1.2	335
0	0		8	1.2	334	1.2	332	1.2	335
0	0		9	1.1	334	1.1	332	1.1	335
0	0		10	1.1	334	1.0	332	1.0	335
0	0		11	1.0	334	1.0	332	1.0	335
0	0		12	1.0	334	1.0	332	.99	335
Avg Angle		Avg Delta P & Temp		1.1654	334 ✓	1.1383	332 ✓	1.1404	335 ✓
		Avg $\sqrt{Delta P}$		1.0777 ✓		1.0656 ✓		1.0667 ✓	
Average gas stream velocity, ft/sec.				76.39 ✓		75.76 ✓		76.04 ✓	
Vol. flow rate @ actual conditions, wacf/min				403195		399887		401328	
Vol. flow rate at standard conditions, dscf/min				206990 ✓		200573 ✓		199752 ✓	

$$MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))$$

$$MWs = (MWd * (1 - (BWS/100))) + (18 * (BWS/100))$$

$$Tsa = Ts + 460$$

$$Ps = Pb + (Pstatic/13.6)$$

$$Vs = 85.49 * Cp * avg\sqrt{DeltaP} * \sqrt{Tsa/(Ps * MWs)}$$

$$Qs(act) = 60 * Vs * As$$

$$Qs(std) = 17.64 * (1 - (BWS/100)) * (Ps/Tsa) * Qs(act)$$

where:
MWd = Dry molecular weight source gas, lb/lb-mole.
MWs = Wet molecular weight source gas, lb/lb-mole.
Tsa = Source Temperature, absolute(oR)
Ps = Absolute stack static pressure, inches Hg.
Vs = Average gas stream velocity, ft/sec.
Qs(act) = Volumetric flow rate of wet stack gas at actual, wacf/min
Qs(std) = Volumetric flow rate of dry stack gas at standard conditions, dscf/min

✓ TS

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Comments _____
method2.xls

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Determination of Moisture Content in Stack Gases - Method 4

Client	Resolute				
Location/Plant	Catawba, SC	Operator	Green	Date	3/30/2015
Source	No. 3 Recovery	Meter Box ID	AO 26	Meter Box Y	0.989
W.O. Number	03917.008.028	Temperature °C or °F	F	Sample Volume, ft³ or L	ft3

Run Number		Sample Time (min)	Meter Volume, Vm	Meter Temp (or ambient temp for rotometer)		Meter Press, Delta H (in H_2O)	Impinger Volume, ml	Silica Gel Weight, g	Corrected Volume, Vm(std)	Leak Rate Check
one				Inlet	Outlet				37.864	Initial 0.000@5''
	End Test	1559	816.560	79	79	1.3	412	365.9		Final 0.000@5''
Baro Press., Pb (in Hg)	Start Test	1459	777.300	71	71	1.3	200	358.9	Moisture Volume, Vw(std)	Percent Moisture (%), BWS
29.48	Avg. or Total	60	39.260	75		1.3	212	7.0	10.359	21.4

Run Number		Sample Time (min)	Meter Volume, Vm	Meter Temp (or ambient temp for rotometer)		Meter Press, Delta H (in H_2O)	Impinger Volume, ml	Silica Gel Weight, g	Corrected Volume, Vm(std)	Leak Rate Check
two				Inlet	Outlet				36.999	Initial 0.000@5''
	End Test	1706	855.494	81	81	1.3	432	354.2		Final 0.000@5''
Baro Press., Pb (in Hg)	Start Test	1606	816.700	81	81	1.3	200	346.8	Moisture Volume, Vw(std)	Percent Moisture (%), BWS
29.48	Avg. or Total	60	38.794	81		1.3	232	7.4	11.27	23.4

Run Number		Sample Time (min)	Meter Volume, Vm	Meter Temp (or ambient temp for rotometer)		Meter Press, Delta H (in H_2O)	Impinger Volume, ml	Silica Gel Weight, g	Corrected Volume, Vm(std)	Leak Rate Check
three				Inlet	Outlet				38.593	Initial 0.000@5''
	End Test	1825	896.177	84	84	1.3	446	367.7		Final 0.000@5''
Baro Press., Pb (in Hg)	Start Test	1725	855.600	81	81	1.3	200	359.6	Moisture Volume, Vw(std)	Percent Moisture, %
29.48	Avg. or Total	60	40.577	82.5		1.3	246	8.1	11.96	23.7

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RUN SUMMARY

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 14:45 to 15:06

Run Averages

	6.0	13.1	89	64

Pre-run Bias at 13:17

Zero Bias	0.0	0.0	2	1
Span Bias	11.9	12.0	1267	248
Span Gas	12.0	12.2	1274	252

Post-run Bias at 15:54

Zero Bias	0.0	-0.1	2	-2
Span Bias	11.8	12.1	1265	253
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	6.0	13.3	88	65

RUN SUMMARY

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 15:06 to 15:27

Run Averages

	6.0	13.1	217	61

Pre-run Bias at 13:17

Zero Bias	0.0	0.0	2	1
Span Bias	11.9	12.0	1267	248
Span Gas	12.0	12.2	1274	252

Post-run Bias at 15:54

Zero Bias	0.0	-0.1	2	-2
Span Bias	11.8	12.1	1265	253
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	6.0	13.2	216	62

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WESTON SOLUTIONS

RUN SUMMARY

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 15:27 to 15:48

Run Averages

	5.9	13.1	109	63

Pre-run Bias at 13:17

Zero Bias	0.0	0.0	2	1
Span Bias	11.9	12.0	1267	248
Span Gas	12.0	12.2	1274	252

Post-run Bias at 15:54

Zero Bias	0.0	-0.1	2	-2
Span Bias	11.8	12.1	1265	253
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	6.0	13.3	108	64
Avg 1-3 =	6.0 ✓	13.3 ✓	137.3 ✓	63.7 ✓

AB 4/27 ✓

✓ AB

WESTON SOLUTIONS

RUN SUMMARY

Number 4

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 16:06 to 16:27

Run Averages

	5.8	13.1	159	65

Pre-run Bias at 15:54

Zero Bias	0.0	-0.1	2	-2
Span Bias	11.8	12.1	1265	253
Span Gas	12.0	12.2	1274	252

Post-run Bias at 17:15

Zero Bias	0.1	0.0	0	-1
Span Bias	11.8	11.8	1269	253
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	5.9	13.4	159	66

√ gB

WESTON SOLUTIONS

RUN SUMMARY

Number 5

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 16:27 to 16:48

Run Averages

	5.8	13.1	103	63

Pre-run Bias at 15:54

Zero Bias	0.0	-0.1	2	-2
Span Bias	11.8	12.1	1265	253
Span Gas	12.0	12.2	1274	252

Post-run Bias at 17:15

Zero Bias	0.1	0.0	0	-1
Span Bias	11.8	11.8	1269	253
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	5.9	13.4	103	64

RUN SUMMARY

Number 6

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 16:48 to 17:09

Run Averages

	6.0	13.0	64	65

Pre-run Bias at 15:54

Zero Bias	0.0	-0.1	2	-2
Span Bias	11.8	12.1	1265	253
Span Gas	12.0	12.2	1274	252

Post-run Bias at 17:15

Zero Bias	0.1	0.0	0	-1
Span Bias	11.8	11.8	1269	253
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	6.0	13.3	63	66
Avg 4-6 -	5.9 ✓	13.4 ✓	108.3 ✓	65.3 ✓

AAV 4/22

✓ AB

WESTON SOLUTIONS

RUN SUMMARY

Number 7

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 17:25 to 17:46

Run Averages

	5.8	13.2	74	61

Pre-run Bias at 17:15

Zero Bias	0.1	0.0	0	-1
Span Bias	11.8	11.8	1269	253
Span Gas	12.0	12.2	1274	252

Post-run Bias at 18:34

Zero Bias	0.1	0.0	6	0
Span Bias	11.8	12.1	1271	255
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	5.8	13.4	71	61

RUN SUMMARY

Number 8

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 17:46 to 18:07

Run Averages

	5.7	13.2	98	63

Pre-run Bias at 17:15

Zero Bias	0.1	0.0	0	-1
Span Bias	11.8	11.8	1269	253
Span Gas	12.0	12.2	1274	252

Post-run Bias at 18:34

Zero Bias	0.1	0.0	6	0
Span Bias	11.8	12.1	1271	255
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	5.8	13.5	96	63

✓ 90

RUN SUMMARY

Number 9

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

	O_2	CO_2	CO	NO_x
Method	EPA 3A	EPA 3A	EPA 10	EPA 7E
Conc. Units	%	%	ppm	ppm

Time: 18:07 to 18:28

Run Averages

6.0	13.0	69	62

Pre-run Bias at 17:15

Zero Bias	0.1	0.0	0	-1
Span Bias	11.8	11.8	1269	253
Span Gas	12.0	12.2	1274	252

Post-run Bias at 18:34

Zero Bias	0.1	0.0	6	0
Span Bias	11.8	12.1	1271	255
Span Gas	12.0	12.2	1274	252

Averages corrected for the average of the pre-run and post-run bias

	6.1	13.3	66	62
Avg. 7-9 =	5.9 ✓	13.4 ✓	~~78~~ 77.7	62 ✓

AB 4/22 ✓

✓ DB

WESTON SOLUTIONS

RUN DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %	CO mv	CO ppm	NO_x mv	NO_x ppm
			Point 1					
14:46	239	5.9	459	13.1	377	113	1509	65
14:47	232	5.7	465	13.3	331	99	1508	65
14:48	238	5.9	460	13.2	268	80	1505	65
14:49	239	5.9	459	13.1	321	96	1503	65
14:50	242	6.0	457	13.1	237	71	1508	65
			Point 2					
14:51	240	6.0	459	13.1	156	47	1510	65
14:52	237	5.9	460	13.2	154	46	1508	65
14:53	241	6.0	457	13.1	189	57	1502	65
14:54	248	6.2	450	12.9	220	66	1494	65
14:55	247	6.1	452	12.9	186	56	1477	64
			Point 3					
14:56	236	5.9	461	13.2	151	45	1467	63
14:57	238	5.9	460	13.2	204	61	1467	63
14:58	240	6.0	459	13.1	249	75	1473	64
14:59	235	5.8	463	13.2	364	109	1472	64
15:00	238	5.9	460	13.2	682	204	1466	63
15:01	245	6.1	455	13.0	371	111	1458	63
15:02	239	5.9	461	13.2	434	130	1454	63
15:03	241	6.0	459	13.1	358	107	1449	62
15:04	238	5.9	460	13.2	331	99	1445	62
15:05	242	6.0	455	13.0	370	111	1442	62
15:06	243	6.0	454	13.0	280	84	1441	62
Avgs	**240**	**6.0**	**458**	**13.1**	**297**	**89**	**1479**	**64**

✓ JB

WESTON SOLUTIONS

RUN DATA

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2		CO_2		CO		NO_x	
	mv	%	mv	%	mv	ppm	mv	ppm
15:07	239	5.9	457	13.1	653	196	1448	62
15:08	241	6.0	455	13.0	1013	303	1446	62
15:09	242	6.0	455	13.0	755	226	1448	62
15:10	240	6.0	456	13.0	695	208	1452	63
15:11	238	5.9	458	13.1	347	104	1464	63
15:12	243	6.0	454	13.0	473	142	1458	63
15:13	241	6.0	456	13.0	580	174	1438	62
15:14	240	6.0	456	13.0	683	205	1413	61
15:15	240	6.0	456	13.0	779	233	1401	60
15:16	241	6.0	456	13.0	787	236	1389	59
15:17	244	6.1	453	13.0	1080	323	1388	59
15:18	237	5.9	458	13.1	1218	365	1386	59
15:19	240	6.0	456	13.0	959	287	1378	59
15:20	234	5.8	461	13.2	996	298	1380	59
15:21	239	5.9	459	13.1	679	203	1398	60
15:22	240	6.0	457	13.1	513	154	1420	61
15:23	240	6.0	458	13.1	622	186	1442	62
15:24	238	5.9	459	13.1	584	175	1449	62
15:25	234	5.8	463	13.2	600	180	1450	62
15:26	236	5.9	461	13.2	610	183	1442	62
15:27	242	6.0	456	13.0	556	167	1450	62
Avgs	**239**	**6.0**	**457**	**13.1**	**723**	**217**	**1426**	**61**

✓ 9/13

RUN DATA

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %	CO mv	CO ppm	NO_x mv	NO_x ppm
15:28	235	5.8	463	13.2	745	223	1459	63
15:29	235	5.8	463	13.2	432	129	1452	63
15:30	238	5.9	460	13.2	160	48	1448	62
15:31	237	5.9	460	13.2	225	67	1467	63
15:32	240	6.0	458	13.1	312	93	1473	64
15:33	233	5.8	464	13.3	291	87	1472	64
15:34	239	5.9	459	13.1	243	73	1472	64
15:35	240	6.0	458	13.1	173	52	1474	64
15:36	236	5.9	460	13.2	264	79	1483	64
15:37	242	6.0	454	13.0	534	160	1478	64
15:38	239	5.9	457	13.1	476	143	1461	63
15:39	237	5.9	458	13.1	496	149	1444	62
15:40	235	5.8	460	13.2	493	148	1441	62
15:41	236	5.9	459	13.1	379	114	1442	62
15:42	238	5.9	458	13.1	356	107	1455	63
15:43	238	5.9	458	13.1	296	89	1453	63
15:44	234	5.8	462	13.2	311	93	1443	62
15:45	239	5.9	456	13.0	516	155	1435	62
15:46	239	5.9	456	13.0	307	92	1432	62
15:47	238	5.9	457	13.1	285	85	1438	62
15:48	236	5.9	459	13.1	366	110	1447	62
Avgs	**237**	**5.9**	**459**	**13.1**	**365**	**109**	**1456**	**63**

✓ WB

WESTON SOLUTIONS

RUN DATA

Number 4

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %	CO mv	CO ppm	NO_x mv	NO_x ppm
16:07	234	5.8	460	13.2	491	147	1499	65
16:08	236	5.9	459	13.1	616	184	1487	64
16:09	232	5.7	460	13.2	748	224	1475	64
16:10	237	5.9	457	13.1	639	191	1469	63
16:11	233	5.8	459	13.1	438	131	1472	64
16:12	233	5.8	460	13.2	470	141	1475	64
16:13	232	5.7	462	13.2	751	225	1492	65
16:14	236	5.9	458	13.1	774	232	1484	64
16:15	226	5.6	467	13.3	1149	344	1491	64
16:16	233	5.8	461	13.2	829	248	1491	64
16:17	236	5.9	458	13.1	381	114	1496	65
16:18	236	5.9	459	13.1	306	92	1503	65
16:19	238	5.9	459	13.1	299	90	1495	65
16:20	234	5.8	459	13.1	691	207	1493	65
16:21	233	5.8	462	13.2	614	184	1505	65
16:22	238	5.9	455	13.0	428	128	1518	66
16:23	237	5.9	457	13.1	367	110	1527	66
16:24	239	5.9	456	13.0	236	71	1525	66
16:25	239	5.9	456	13.0	178	53	1526	66
16:26	232	5.7	462	13.2	373	112	1536	67
16:27	235	5.8	461	13.2	375	112	1521	66
Avgs	**235**	**5.8**	**459**	**13.1**	**531**	**159**	**1499**	**65**

✓ JB

WESTON SOLUTIONS

RUN DATA

Number 5

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %	CO mv	CO ppm	NO_x mv	NO_x ppm
16:28	239	5.9	459	13.1	212	64	1500	65
16:29	241	6.0	456	13.0	228	68	1497	65
16:30	239	5.9	458	13.1	182	55	1480	64
16:31	238	5.9	459	13.1	269	81	1462	63
16:32	241	6.0	455	13.0	179	54	1452	63
16:33	240	6.0	456	13.0	589	176	1434	62
16:34	233	5.8	462	13.2	684	205	1427	61
16:35	235	5.8	460	13.2	429	128	1431	61
16:36	238	5.9	456	13.0	300	90	1443	62
16:37	240	6.0	457	13.1	290	87	1449	62
16:38	239	5.9	460	13.2	298	89	1441	62
16:39	238	5.9	459	13.1	153	46	1422	61
16:40	237	5.9	458	13.1	189	57	1425	61
16:41	235	5.8	459	13.1	275	82	1456	63
16:42	233	5.8	460	13.2	291	87	1461	63
16:43	231	5.7	464	13.3	393	118	1453	63
16:44	235	5.8	459	13.1	405	121	1453	63
16:45	233	5.8	460	13.2	403	121	1458	63
16:46	228	5.6	463	13.2	468	140	1460	63
16:47	221	5.5	469	13.4	613	184	1456	63
16:48	231	5.7	460	13.2	365	109	1447	62
Avgs	**235**	**5.8**	**459**	**13.1**	**344**	**103**	**1453**	**63**

✓ qB

WESTON SOLUTIONS

RUN DATA

Number 6

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %	CO mv	CO ppm	NO_x mv	NO_x ppm
16:49	225	5.6	465	13.3	437	131	1448	62
16:50	225	5.6	466	13.3	798	239	1453	63
16:51	231	5.7	463	13.2	738	221	1445	62
16:52	231	5.7	462	13.2	256	77	1465	63
16:53	230	5.7	464	13.3	173	52	1483	64
16:54	231	5.7	462	13.2	238	71	1518	66
16:55	235	5.8	458	13.1	198	59	1536	67
16:56	237	5.9	455	13.0	151	45	1545	67
16:57	236	5.9	458	13.1	105	32	1559	68
16:58	246	6.1	450	12.9	109	33	1552	67
16:59	244	6.1	452	12.9	90	27	1551	67
17:00	244	6.1	454	13.0	92	28	1517	66
17:01	241	6.0	456	13.0	101	30	1511	65
17:02	246	6.1	452	12.9	166	50	1489	64
17:03	248	6.2	450	12.9	142	43	1472	64
17:04	248	6.2	450	12.9	135	40	1475	64
17:05	247	6.1	452	12.9	120	36	1476	64
17:06	250	6.2	449	12.9	123	37	1478	64
17:07	248	6.2	451	12.9	93	28	1457	63
17:08	247	6.1	453	13.0	60	18	1466	63
17:09	244	6.1	454	13.0	140	42	1476	64
Avgs	**240**	**6.0**	**456**	**13.0**	**213**	**64**	**1494**	**65**

✓ 9/13

WESTON SOLUTIONS

RUN DATA

Number 7

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %	CO mv	CO ppm	NO_x mv	NO_x ppm
17:26	238	5.9	456	13.0	171	51	1463	63
17:27	238	5.9	456	13.0	174	52	1463	63
17:28	238	5.9	455	13.0	177	53	1456	63
17:29	240	6.0	452	12.9	156	47	1454	63
17:30	235	5.8	458	13.1	192	58	1440	62
17:31	237	5.9	458	13.1	189	57	1442	62
17:32	237	5.9	457	13.1	279	84	1420	61
17:33	236	5.9	459	13.1	271	81	1405	60
17:34	232	5.7	461	13.2	292	87	1406	60
17:35	230	5.7	463	13.2	415	124	1414	61
17:36	229	5.7	462	13.2	324	97	1410	60
17:37	232	5.7	462	13.2	308	92	1398	60
17:38	233	5.8	462	13.2	231	69	1399	60
17:39	235	5.8	458	13.1	126	38	1394	60
17:40	237	5.9	457	13.1	169	51	1393	60
17:41	232	5.7	463	13.2	315	94	1409	60
17:42	227	5.6	464	13.3	368	110	1399	60
17:43	228	5.6	466	13.3	247	74	1395	60
17:44	231	5.7	463	13.2	252	76	1412	61
17:45	228	5.6	468	13.4	301	90	1444	62
17:46	230	5.7	466	13.3	208	62	1472	64
Avgs	**233**	**5.8**	**460**	**13.2**	**246**	**74**	**1423**	**61**

VJB

RUN DATA

Number 8

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2		CO_2		CO		NO_x	
	mv	%	mv	%	mv	ppm	mv	ppm
17:47	229	5.7	464	13.3	242	73	1485	64
17:48	229	5.7	462	13.2	259	78	1488	64
17:49	227	5.6	467	13.3	326	98	1481	64
17:50	226	5.6	468	13.4	294	88	1477	64
17:51	228	5.6	466	13.3	302	90	1470	63
17:52	227	5.6	467	13.3	315	94	1462	63
17:53	226	5.6	466	13.3	259	78	1461	63
17:54	226	5.6	467	13.3	301	90	1469	63
17:55	229	5.7	464	13.3	388	116	1453	63
17:56	230	5.7	462	13.2	234	70	1419	61
17:57	233	5.8	461	13.2	194	58	1402	60
17:58	231	5.7	462	13.2	230	69	1427	61
17:59	241	6.0	453	13.0	172	52	1454	63
18:00	235	5.8	458	13.1	169	51	1471	63
18:01	233	5.8	460	13.2	246	74	1490	64
18:02	232	5.7	461	13.2	464	139	1501	65
18:03	234	5.8	459	13.1	296	89	1512	65
18:04	233	5.8	461	13.2	387	116	1506	65
18:05	236	5.9	460	13.2	730	219	1494	65
18:06	238	5.9	457	13.1	547	164	1474	64
18:07	235	5.8	461	13.2	512	153	1462	63
Avgs	**231**	**5.7**	**462**	**13.2**	**327**	**98**	**1469**	**63**

V 9B

RUN DATA

Number 9

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2		CO_2		CO		NO_x	
	mv	%	mv	%	mv	ppm	mv	ppm
18:08	238	5.9	459	13.1	472	141	1456	63
18:09	246	6.1	451	12.9	223	67	1468	63
18:10	244	6.1	452	12.9	105	32	1485	64
18:11	240	6.0	452	12.9	163	49	1514	66
18:12	242	6.0	452	12.9	137	41	1499	65
18:13	243	6.0	452	12.9	151	45	1478	64
18:14	241	6.0	455	13.0	232	70	1466	63
18:15	243	6.0	453	13.0	151	45	1456	63
18:16	241	6.0	454	13.0	213	64	1463	63
18:17	243	6.0	454	13.0	161	48	1459	63
18:18	243	6.0	453	13.0	135	40	1457	63
18:19	242	6.0	454	13.0	119	36	1449	62
18:20	247	6.1	449	12.9	113	34	1432	62
18:21	241	6.0	453	13.0	113	34	1434	62
18:22	244	6.1	453	13.0	243	73	1431	61
18:23	243	6.0	451	12.9	279	84	1418	61
18:24	239	5.9	456	13.0	459	137	1400	60
18:25	242	6.0	454	13.0	549	164	1401	60
18:26	240	6.0	455	13.0	223	67	1390	59
18:27	240	6.0	456	13.0	362	108	1378	59
18:28	240	6.0	456	13.0	202	61	1385	59
Avgs	**242**	**6.0**	**454**	**13.0**	**229**	**69**	**1444**	**62**

✓ QB

BIAS
Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 13:17

O_2
Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	15	0.0	0.0	0.0	Pass
Span	12.0	466	11.9	-0.1	-0.4	Pass

CO_2
Method: EPA 3A
Span Conc. 24.9 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	-19	0.0	0.0	0.0	Pass
Span	12.2	418	12.0	-0.2	-0.8	Pass

CO
Method: EPA 10
Span Conc. 2519 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	2	8	2	0	0.0	Pass
Span	1270	4232	1267	-3	-0.1	Pass

✓ NB

WESTON SOLUTIONS

BIAS
Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 13:17

NO_x
Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	-1	204	1	2	0.4	Pass
Span	255	5193	248	-7	-1.5	Pass

JB

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 15:54

O_2

Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	15	0.0	0.0	0.0	Pass
Span	12.0	462	11.8	-0.2	-0.8	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	%	Difference %	Drift %	Status
Zero	0.0	15	0.0	0.0	0.0	Pass
Span	11.9	462	11.8	-0.1	-0.4	Pass

*Bias No. 1

CO_2

Method: EPA 3A
Span Conc. 24.9 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	-22	-0.1	-0.1	-0.4	Pass
Span	12.2	420	12.1	-0.1	-0.4	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	%	Difference %	Drift %	Status
Zero	0.0	-22	-0.1	-0.1	-0.4	Pass
Span	12.0	420	12.1	0.1	0.4	Pass

*Bias No. 1

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WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 2

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 15:54

CO

Method: EPA 10
Span Conc. 2519 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	2	6	2	0	0.0	Pass
Span	1270	4226	1265	-5	-0.2	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	2	6	2	0	0.0	Pass
Span	1267	4226	1265	-2	-0.1	Pass

*Bias No. 1

NO_x

Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	-1	143	-2	-1	-0.2	Pass
Span	255	5303	253	-2	-0.4	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	1	143	-2	-3	-0.7	Pass
Span	248	5303	253	5	1.1	Pass

*Bias No. 1

✓ MB

BIAS AND CALIBRATION DRIFT

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 17:15

O_2
Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	16	0.1	0.1	0.4	Pass
Span	12.0	462	11.8	-0.2	-0.8	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	Final %	Difference %	Drift %	Status
Zero	0.0	16	0.1	0.1	0.4	Pass
Span	11.8	462	11.8	0.0	0.0	Pass

*Bias No. 2

CO_2
Method: EPA 3A
Span Conc. 24.9 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	-19	0.0	0.0	0.0	Pass
Span	12.2	412	11.8	-0.4	-1.6	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	Final %	Difference %	Drift %	Status
Zero	-0.1	-19	0.0	0.1	0.4	Pass
Span	12.1	412	11.8	-0.3	-1.2	Pass

*Bias No. 2

VCB

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 3

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 17:15

CO

Method: EPA 10
Span Conc. 2519 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	2	0	0	-2	-0.1	Pass
Span	1270	4239	1269	-1	-0.0	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	2	0	0	-2	-0.1	Pass
Span	1265	4239	1269	4	0.2	Pass

*Bias No. 2

NO_x

Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	-1	167	-1	0	0.0	Pass
Span	255	5295	253	-2	-0.4	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	-2	167	-1	1	0.2	Pass
Span	253	5295	253	0	0.0	Pass

*Bias No. 2

JPB

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 4

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 18:34

O_2

Method: EPA 3A
Span Conc. 25.0 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	16	0.1	0.1	0.4	Pass
Span	12.0	463	11.8	-0.2	-0.8	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	Final %	Difference %	Drift %	Status
Zero	0.1	16	0.1	0.0	0.0	Pass
Span	11.8	463	11.8	0.0	0.0	Pass

*Bias No. 3

CO_2

Method: EPA 3A
Span Conc. 24.9 %

Bias Results

Standard Gas	Cal. %	Response mv	Bias %	Difference %	Error %	Status
Zero	0.0	-19	0.0	0.0	0.0	Pass
Span	12.2	420	12.1	-0.1	-0.4	Pass

Calibration Drift

Standard Gas	Initial* %	Final mv	Final %	Difference %	Drift %	Status
Zero	0.0	-19	0.0	0.0	0.0	Pass
Span	11.8	420	12.1	0.3	1.2	Pass

*Bias No. 3

VAB

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 4

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 18:34

CO

Method: EPA 10
Span Conc. 2519 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	2	19	6	4	0.2	Pass
Span	1270	4244	1271	1	0.0	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	0	19	6	6	0.2	Pass
Span	1269	4244	1271	2	0.1	Pass

*Bias No. 3

NO_x

Method: EPA 7E
Span Conc. 453 ppm

Bias Results

Standard Gas	Cal. ppm	Response mv	Bias ppm	Difference ppm	Error %	Status
Zero	-1	182	0	1	0.2	Pass
Span	255	5329	255	0	0.0	Pass

Calibration Drift

Standard Gas	Initial* ppm	Final mv	Final ppm	Difference ppm	Drift %	Status
Zero	-1	182	0	1	0.2	Pass
Span	253	5329	255	2	0.4	Pass

*Bias No. 3

✓ab

WESTON SOLUTIONS

CALIBRATION DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 12:39

O_2

Method: EPA 3A
Calibration Type: Linear Regression

Calibration Results

%	Cylinder ID	Result, mv
Zero	-	14
12.0	CC156057	468
25.0	CC354619	963

Curve Coefficients

Slope	Intercept	Corr. Coeff.
38.01	14	>0.9999

CO_2

Method: EPA 3A
Calibration Type: Linear Regression

Calibration Results

%	Cylinder ID	Result, mv
Zero	-	-19
12.2	CC156057	426
24.9	CC354619	888

Curve Coefficients

Slope	Intercept	Corr. Coeff.
36.40	-19	>0.9999

WESTON SOLUTIONS

CALIBRATION DATA
Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 12:39

CO
Method: EPA 10
Calibration Type: Linear Regression

Calibration Results

ppm	Cylinder ID	Result, mv
Zero	-	7
1274	CC177656	4241
2519	CC787	8422

Curve Coefficients

Slope	Intercept	Corr. Coeff.
3.341	-0	>0.9999

NO_x
Method: EPA 7E
Calibration Type: Linear Regression

Calibration Results

ppm	Cylinder ID	Result, mv
Zero	-	166
252	CC9151997BAL	5336
453	CC218480	9298

Curve Coefficients

Slope	Intercept	Corr. Coeff.
20.17	191	0.9999

CALIBRATION ERROR DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 12:39

O_2
Method: EPA 3A
Span Conc. 25.0 %
Slope 38.01 **Intercept** 13.5

Standard %	Response mv	Result %	Difference %	Error %	Status
Zero	14	0.0	0.0	0.0	Pass
12.0	468	12.0	0.0	0.0	Pass
25.0	963	25.0	0.0	0.0	Pass

CO_2
Method: EPA 3A
Span Conc. 24.9 %
Slope 36.40 **Intercept** -18.8

Standard %	Response mv	Result %	Difference %	Error %	Status
Zero	-19	0.0	0.0	0.0	Pass
12.2	426	12.2	0.0	0.0	Pass
24.9	888	24.9	0.0	0.0	Pass

CO
Method: EPA 10
Span Conc. 2519 ppm
Slope 3.341 **Intercept** -0

Standard ppm	Response mv	Result ppm	Difference ppm	Error %	Status
Zero	7	2	2	0.1	Pass
1274	4241	1270	-4	-0.2	Pass
2519	8422	2521	2	0.1	Pass

✓ JB

WESTON SOLUTIONS

CALIBRATION ERROR DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 12:39

NO_x
Method: EPA 7E
Span Conc. 453 ppm
Slope 20.17 **Intercept** 191

Standard ppm	Response mv	Result ppm	Difference ppm	Error %	Status
Zero	166	-1	-1	-0.2	Pass
252	5336	255	3	0.7	Pass
453	9298	452	-1	-0.2	Pass

VOB

WESTON SOLUTIONS

METHODS AND ANALYZERS

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

File: C:\Data\Resolute- Catawba\CEM March 2015\No. 3 Recovery.cem
Program Version: 2.0, built 13 Mar 2014 **File Version:** 2.02
Computer: WINDOWS-PMGFSQ2 **Trailer:** 261
Analog Input Device: Keithley KUSB-3108

Channel 1

Analyte	**O_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 1440 Ser# 4303**
Full-Scale Output, mv	**1000**
Analyzer Range, %	**25.0**
Span Concentration, %	**25.0** ✓

Channel 2

Analyte	**CO_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 1440 Ser# 4303**
Full-Scale Output, mv	**1000**
Analyzer Range, %	**25.0**
Span Concentration, %	**24.9** ✓

Channel 3

Analyte	**CO**
Method	**EPA 10**, Using Bias
Analyzer Make, Model & Serial No.	**Teledyne 300EM Ser# 365**
Full-Scale Output, mv	**10000**
Analyzer Range, ppm	**3000**
Span Concentration, ppm	**2519** ✓

Channel 4

Analyte	**NO_x**
Method	**EPA 7E**, Using Bias
Analyzer Make, Model & Serial No.	**API 200EH Ser# 672**
Full-Scale Output, mv	**10000**
Analyzer Range, ppm	**500**
Span Concentration, ppm	**453** ✓

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Sample and Velocity Traverse Point Data Sheet - Method 1

Client: Resolute
Loaction/Plant: Catawba, SC
Source: BO #3 REC

Operator: P.S.M.
Date: 3/31/15
W.O. Number: 03917-008-028

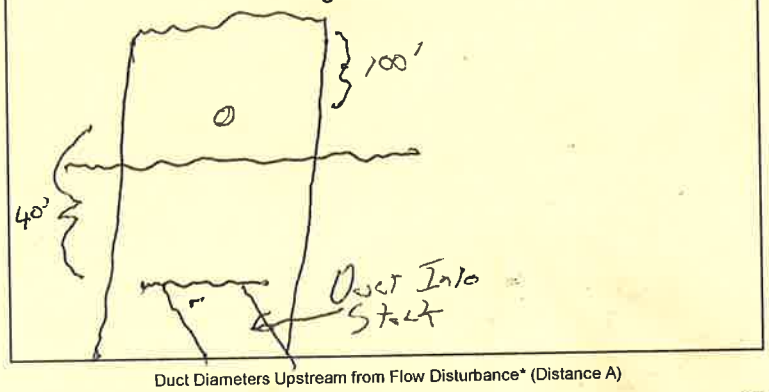
Duct Type	☑ Circular	☐ Rectangular Duct	Indicate appropriate type
Traverse Type	☐ Particulate Traverse	☑ Velocity Traverse	

Distance from far wall to outside of port (in.) = C	139.0
Port Depth (in.) = D	12.0
Depth of Duct, diameter (in.) = C-D	127.0
Area of Duct (ft^2)	87.97
Total Traverse Points	24
Total Traverse Points per Port	12

Rectangular Ducts Only	
Width of Duct, rectangular duct only (in.)	
Total Ports (rectangular duct only)	

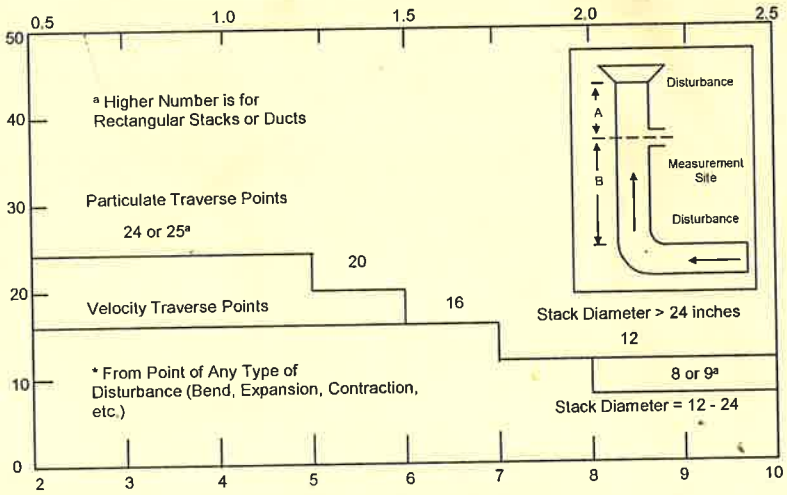
Flow Disturbances	
Upstream - A (ft)	100.0
Downstream - B (ft)	40.0
Upstream - A (duct diameters)	9.45
Downstream - B (duct diameters)	3.78

Diagram of Stack



Traverse Point Locations

Traverse Point	% of Duct	Distance from Inside Duct Wall (in)	Distance from Outside of Port (in)
1	2.1	2.7	14.7
2	6.7	8.5	20.5
3	11.8	15.0	27.0
4	17.7	22.5	34.5
5	25.0	31.8	43.8
6	35.6	45.2	57.2
7	64.4	81.8	93.8
8	75.0	95.3	107.3
9	82.3	104.5	116.5
10	88.2	112.0	124.0
11	93.3	118.5	130.5
12	97.9	124.3	136.3



Equivalent Diameter = (2*L*W)/(L+W)

Traverse Point Location Percent of Stack -Circular

Traverse Location Point	Number of Traverse Points: 1	2	3	4	5	6	7	8	9	10	11	12
1		14.6		6.7		4.4		3.2		2.6		2.1
2		85.4		25		14.6		10.5		8.2		6.7
3				75		29.6		19.4		14.6		11.8
4				93.3		70.4		32.3		22.6		17.7
5						85.4		67.7		34.2		25
6						95.6		80.6		65.8		35.6
7								89.5		77.4		64.4
8								96.8		85.4		75
9										91.8		82.3
10										97.4		88.2
11												93.3
12												97.9

Traverse Point Location Percent of Stack -Rectangular

Traverse Location Point	Number of Traverse Points: 1	2	3	4	5	6	7	8	9	10	11	12
1		25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2		75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3			83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4				87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5					90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6						91.7	78.6	68.8	61.1	55.0	50.0	45.8
7							92.9	81.3	72.2	65.0	59.1	54.2
8								93.8	83.3	75.0	68.2	62.5
9									94.4	85.0	77.3	70.8
10										95.0	86.4	79.2
11											95.5	87.5
12												95.8

Rectangular Stack Points & Matrix
9 - 3 x 3
12 - 4 x 3
16 - 4 x 4
20 - 5 x 4
25 - 5 x 5
30 - 6 x 5
36 - 6 x 6
42 - 7 x 6
49 - 7 x 7

Port Diam. (in) = 6"
Number of Ports = *2
Method 1.xls
* 2 usable for Flow

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Integrated Air Services

Tape Measure I.D. #

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APPENDIX G
LABORATORY DATA

Inter-Office Memorandum

1625 Pumphrey Avenue, Auburn, AL 36832
334.466.5600

TO: Temp Simpkins, Project Manager

cc: File

FROM: Matthew Dallesasse, Laboratory Manager

Date: 4/21/2015

PROJECT: Resolute Catawba

W.O. NO: 03917.008.028

JOB NO.: 2015-083

SUBJECT: Method 5 Analysis Results

ACTION: Analysis of samples received on 6 April 2015

NARRATIVE:

This letter and analytical results constitute our report of the gravimetric determination of the samples submitted to the laboratory for particulate analysis. The samples arrived on 6 April 2015 in accordance with the Chain-of-Custody. The samples were prepared on 6 April 2015 and analyzed on 10 April through 14 April 2015. The analysis followed procedures in USEPA Reference Method 5 for particulate emissions from stationary sources.

Enclosed is a copy of the Chain-of-Custody record, acknowledging receipt of these samples. Please note that any unused portion of the samples will be discarded 90 days after the date of receipt.

These results meet all requirements of TNI, unless otherwise specified.

These results of this report relate only to the samples listed in the body of this report.

This report shall not be reproduced by any organization outside of Weston Solutions, Inc. in part or in full, without the written approval from Weston Solutions, Inc.

QUALITY ASSURANCE AND QUALITY CONTROL:

Quality control procedures conformed to the requirements of the reference method and our laboratory quality assurance program. Duplicate weights differed less than 0.5 mg.

The wash fraction blank residue correction was less than 0.001% of the total mass of the wash solvent used; therefore, the wash fractions were blank corrected per USEPA Method 5.

Filter residue weights were not blank corrected.

Substantiating data is on file and available upon request.

Attachments

Analysis Report

EPA Method 5

Analytical Laboratory
1625 Pumphrey Ave. Auburn, AL 36832
334.466.5600

CLIENT : Resolute Catawba
WESTON W.O. No. : 03917.008.028
Date Received : 4/6/2015
Analyst : AC
Date(s) Analyzed : 4/10/2015 - 4/14/2015
Limit of Quantification, LOQ (g): 0.0005

Lab Job No.: 2015-083

Balance ID: Gertrude
Lab Ambient Temp (F): 70.7
Lab Rel Humidity (%): 45
Barometric Pressure (Hg): 29.23

Source ID	No. 1 CB Run 1	No. 1 CB Run 2	No. 1 CB Run 3	Acetone Blank
Date Collected	**4/1/2015**	**4/1/2015**	**4/1/2015**	**4/1/2015**
Filter ID	DA 6931	DA 6933	DA 6934	DA 7297
PROBE WASH FRACTION (WATER)				
Sample ID	AV 2646	AV 2647	AV 2648	AV 2649
Beaker ID	CB-21-03	CB-22-03	CB-23-03	CB-24-03
Liquid Volume (mL)	42	39	35	220
Constant Initial Weight (g)	**116.1912**	**107.8137**	**106.3339**	**107.4151**
Constant Final Weight (g)	**116.1977**	**107.8205**	**106.3398**	**107.4157**
Final-Initial Beaker Wts. (g)	0.0065	0.0067	0.0059	0.0006
Liquid Blank Correction, ≤ 0.001% (g)	0.0001	0.0001	0.0001	
Mass of PM in Probe Rinse (g)	**0.0064**	**0.0066**	**0.0058**	**0.0006**
FILTER FRACTION				
Filter ID	DA 6931	DA 6933	DA 6934	DA 7297
Constant Initial Weight (g)	**0.4090**	**0.4087**	**0.4078**	**0.4109**
Constant Final Weight (g)	**0.4360**	**0.4315**	**0.4290**	**0.4113**
Final-Initial Filter Wts. (g)	0.0270	0.0228	0.0212	0.0004
Mass of PM on Filter (g)	**0.0270**	**0.0228**	**0.0212**	
SUMMARY				
Mass of PM in Probe Rinse (g)	**0.0064**	**0.0066**	**0.0058**	
Mass of PM on Filter (g)	**0.0270**	**0.0228**	**0.0212**	
Net Mass of PM (g)	**0.0333**	**0.0294**	**0.0269**	

Density of Acetone (g/mL): 0.791

PM - Particulate Matter

Values less than the LOQ are not included in the Net Particulate Weight.

Values are rounded for presentation purposes only, thus values shown may differ from actual calculations.

Sample Recovery Solution **Acetone**

Weight Percent of Blank (SB) Liquid Fraction **0.0004%**

Matthew Dallesasse, Laboratory Manager

LAB JOB NO: 2015-083
SAMPLE TEMP: Ambient

LAB JOB NO:
TEMP:

Custody Transfer Record / Lab Service Request

Client: Resolute - Catawba, SC
Work Order No.: 03917.008.028
Desired TAT: 5 days Results Due By: 4/10/15
Project Manager: Simpkins
Submitted By: Hunter Goodlett Phone #:

ANALYSES REQUESTED: Gravimetric

ANALYTICAL METHOD: 5

Weston Use Only LAB ID	Client ID/ Sample Description	Matrix	Date Collected	Gravimetric
	No. 1 CB Run 1 DA 6931	flt	4/1/15	✓
AV 2646	Run 1 FHR	Acl	↓	✓
	No. 1 CB Run 2 DA6933	flt	↓	✓
AV 2647	Run 2 FHR	Acl	↓	✓
	No. 1 CB Run 3 DA 6934	flt	↓	✓
AV 2648	Run 3 FHR	Acl	↓	✓
	Filter BLANK DA 7297	FLT	↓	
AV 2649	Acetone BLANK	Acl	↓	
	TOTAL LISTED ON THIS COC			

RELINQUISHED BY	RECEIVED BY	DATE/TIME	# / CONDITION	RELINQUISHED BY	RECEIVED BY	DATE/TIME	# / CONDITION
[illegible]	[illegible]	4/6/15/9:21	4/good				
	[illegible]						

WESTON Analytics Use Only

SAMPLES WERE: Shipped or Hand Delivered; Ambient or Chilled

Intact or Damaged*

SECURITY SEALS WERE: Present or Absent

Intact or Broken* or N/A

SAMPLE LOSS: Y or N

COC ACCURATE: Y or N

* NOTE SAMPLE ID ON BACK

WESTON SOLUTIONS
Weston Solutions, Inc.
1625 Pumphrey Avenue
Auburn, Alabama 36832-4303
334-826-6100 • Fax 334-826-8[illegible]
www.westonsolutions.com

03917.008.028
#1 CB, #2 LK, #3 SDTV, RFF
Compliance

APPENDIX H
QUALITY CONTROL DATA

APPENDIX H

EQUIPMENT CALIBRATIONS

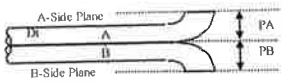
S - Type Pitot Tube Inspection Data Form

Pitot Tube ID NO. P213 Length 12' Probe ID.No. AUB-PR-12I

If all Criteria PASS Cp is equal to 0.84

Inspection Date 3/18/2015 Individual Conducting Inspection KTW/TP

PASS/FAIL

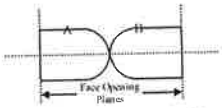


Distance to A Plane (PA) - inches 0.483 PASS

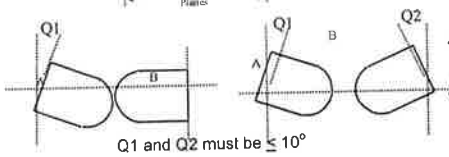
Distance to B Plane (PB) - inches 0.483 PASS

Pitot OD (D_t) - inches 0.375

$1.05\ D_t < P < 1.5\ D_t$ PA must Equal PB



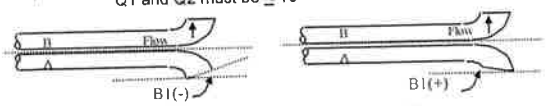
Are Open Faces Aligned Perpendicular to the Tube Axis ◉ YES ○ NO PASS



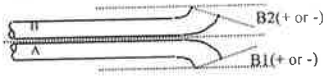
Angle of Q1 from vertical A Tube-degrees (absolute) 1 PASS

Angle of Q2 from vertical B Tube-degrees (absolute) 1 PASS

Q1 and Q2 must be ≤ 10°



Angle of B1 from vertical A Tube-degrees (absolute) 1 PASS



Angle of B1 from vertical B Tube-degrees (absolute) 2 PASS

B1 or B2 must be ≤ 5°

Y = 1 O = 1

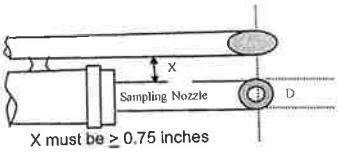
A = 0.966

Z must be ≤ 0.125 inches

W must be ≤ 0.03125 inches

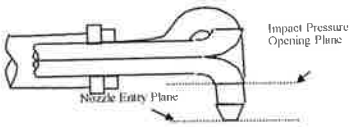
Z = A sin Y = 0.0169 PASS

W = A sin O = 0.0169 PASS

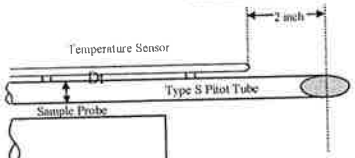


X must be ≥ 0.75 inches

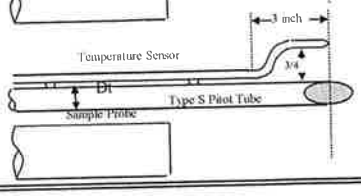
Distance between Sample Nozzle and Pitot (X) - inches 1.25 PASS



Impact Pressure Opening Plane is above the Nozzle Entry Plane ◉ YES ○ NO ○ NA PASS



Thermocouple meets the Distance Criteria in the adjacent figure ○ YES ○ NO ◉ NA PASS



Thermocouple meets the Distance Criteria in the adjacent figure ◉ YES ○ NO ○ NA PASS

POSTTEST CHECK

Client: Resolute Catawba Work Order Number: 03917.008.028

Date: 4/9/2015 Damage Found? ☐ YES ☑ NO

Inspector: KTW Notes:

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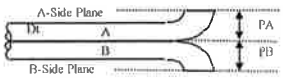
S - Type Pitot Tube Inspection Data Form

Pitot Tube ID NO. P241 Length 5' Probe ID.No. AUB-PR-5U

Inspection Date 3/17/2015 Individual Conducting Inspection KTW/TP

If all Criteria PASS Cp is equal to 0.84

PASS/FAIL

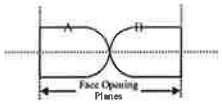


Distance to A Plane (PA) - inches 0.464 PASS

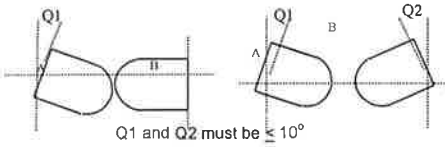
Distance to B Plane (PB) - inches 0.464 PASS

Pitot OD (D_t) - inches 0.375

$1.05\ D_t < P < 1.5\ D_t$ PA must Equal PB



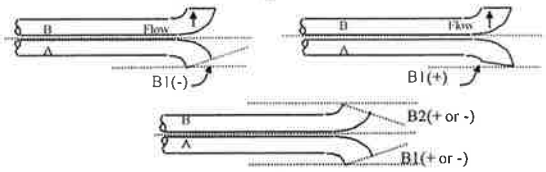
Are Open Faces Aligned Perpendicular to the Tube Axis ◉ YES ○ NO PASS



Angle of Q1 from vertical A Tube-degrees (absolute) 0 PASS

Angle of Q2 from vertical B Tube-degrees (absolute) 1 PASS

Q1 and Q2 must be ≤ 10°



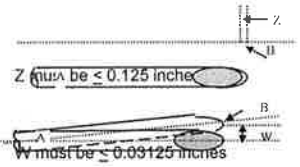
Angle of B1 from vertical A Tube-degrees (absolute) 0 PASS

Angle of B1 from vertical B Tube-degrees (absolute) 1 PASS

B1 or B2 must be ≤ 5°

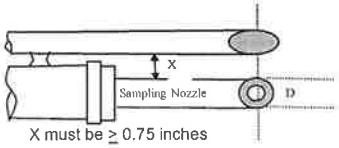
Y = 1 O = 1

A = 0.934

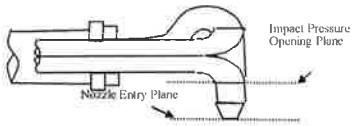


Z = A sin Y = 0.0163 PASS

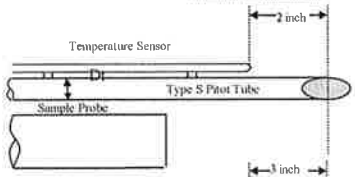
W = A sin O = 0.0163 PASS



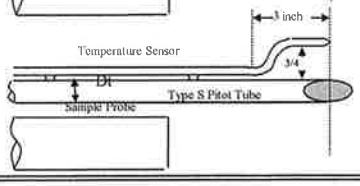
Distance between Sample Nozzle and Pitot (X) - inches 1.25 PASS



Impact Pressure Opening Plane is above the Nozzle Entry Plane ◉ YES ○ NO ○ NA PASS



Thermocouple meets the Distance Criteria in the adjacent figure ○ YES ○ NO ◉ NA PASS



Thermocouple meets the Distance Criteria in the adjacent figure ◉ YES ○ NO ○ NA PASS

POSTTEST CHECK

Client: Resolute Catawba Work Order Number: 03917.008.028

Date: 4/9/2015 Damage Found? ☐ YES ☑ NO

Inspector: KTW Notes:

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Stack Temperature Sensor Calibration Data

Choose Reference Thermometer Below:

☑ Digital Thermometer - Omega Model CL3515R (Serial# 06000183)

☐ Digital Thermometer - Omega Model CL3515R (Serial# 10000046)

Thermocouple Number: AUB-PR-5U Length: 5'
Date: 17-Mar-15
Ambient Temperature,°F: 65
Calibrator: KTW/TP

Reference Point Number	Reference Temperature ° F	Thermocouple Temperature ° F	Temperature Difference %
1 - A	77	78	0.19
B	77	78	0.19
C	77	78	0.19
2 - A	33	33	0.00
B	33	33	0.00
C	33	33	0.00
3 - A	212	211	0.15
B	212	211	0.15
C	212	211	0.15

$$\text{Temp Diff (\%)} = \left| \frac{(\text{Ref Temp, }^{\circ}\text{F} + 460) - (\text{Therm Temp }^{\circ}\text{F} + 460)}{\text{Ref Temp,}^{\circ}\text{ F} + 460} \right| \times 100$$

Are all temperature differences less than +/- 1.5% ? YES

POSTTEST STACK TEMPERATURE SENSOR CALIBRATION DATA

Client: Resolute Catawba
Work Order Number: 03917.008.028
Date: 4/9/2015
Calibrator: KTW

Ambient Temp,° F	Reference Temp,° F	Thermocouple Temp,° F	Temperature Diff, %
80	81	80	0.18

Was a pretest temperature correction used ? ☐ yes ☑ no
Is temperature difference within +/- 1.5% ☑ yes ☐ no
If no, calculations done once with recorded values and once with corrected values _____

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

WESTON SOLUTIONS
Integrated Air Services

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record readings in colored boxes below, other columns are automatically calculated.

DATE: 1/2/15
METER PART #: AO26

METER SERIAL #: 27423
CRITICAL ORIFICE SET SERIAL #: 1515s & 1651

	INITIAL	FINAL	AVG (P_{bar})
BAROMETRIC PRESSURE (in Hg):	29.48	29.45	29.47
Calibrated by:	JAW		

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	AMBIENT F°	DGM F° INITIAL	DGM F° FINAL	Avg DGM F° T_m	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	(4) $\Delta H_@$
8	1	0.2152	25.5	224.671	236.092	11.421	64	66	66	66	40	0.26	11.300	11.083	0.981	1.887
11	2	0.2865	24.5	212.549	224.671	12.122	64	66	66	66	32	0.44	11.998	11.804	0.984	1.803
15	3	0.4168	22.5	176.362	212.549	36.187	63	67	66	67	66	0.92	35.827	35.453	0.990	1.780
21	4	0.5639	20	146.695	176.362	29.667	64	68	68	68	40	1.70	29.345	29.042	0.990	1.803
26	5	0.7072	18	127.283	146.695	19.412	64	68	68	68	21	2.60	19.244	19.122	0.994	1.761
31	6	0.8541	16	67.500	127.283	59.783	63	62	68	65	54	3.90	59.798	59.441	0.994	1.829
														AVG =	0.989	1.810

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

Individual Y's .02 from average?	PASS
Individual $\Delta H_@$ values 0.15 from average?	PASS
Average Y value +/-.02 of 1.000?	PASS

(1) $V_m\,(std) = K_1\, V_m \dfrac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}\,(std) = K' \sqrt{\dfrac{P_{bar}\,\theta}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \dfrac{V_{cr}\,(std)}{V_m\,(std)}$ = DGM calibration factor

Next Calibration Due By:	1/2/2016

(4) $\Delta H_@ = \dfrac{\Delta H\; 0.0319\; T_m\, \theta^2}{P_{bar}\, Y^2\, V_m^2}$

AO26-1-2-15 6 Point Annual.xls

03917.008.028
#1 CR, #2 LK,
#2-3 SDTV, #3 RP
Compliance

CALIBRATION GAS CERTIFICATES

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI76E15A0295	Reference Number:	122-124403035-1
Cylinder Number:	CC156057	Cylinder Volume:	152.5 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22013	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Nov 04, 2013

Expiration Date: Nov 04, 2021

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	12.00 %	12.21 %	G1	+/- 0.6% NIST Traceable	11/04/2013
OXYGEN	12.00 %	11.98 %	G1	+/- 0.4% NIST Traceable	11/04/2013
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061348	CC360808	11.002 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2018
NTRM	09060211	CC262370	9.961 % OXYGEN/NITROGEN	+/- 0.3%	Nov 08, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA510 CO2 42399380022	Nondispersive Infrared (NDIR)	Oct 24, 2013
Horiba MPA510 O2 41499150042	Paramagnetic	Oct 24, 2013

Triad Data Available Upon Request

Signature on file

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI50E15A6731	Reference Number:	122-124324076-1
Cylinder Number:	CC354619	Cylinder Volume:	165.0 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22012	Valve Outlet:	296
Gas Code:	CO2,O2,BALN	Certification Date:	Jul 10, 2012

Expiration Date: Jul 10, 2020

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	25.00 %	24.92 %	G2	+/- 1% NIST Traceable	07/10/2012
OXYGEN	25.00 %	24.97 %	G2	+/- 1% NIST Traceable	07/10/2012
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	080613	CC254469	20.09 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jul 15, 2012
NTRM	090614	CC273522	22.53 % OXYGEN/NITROGEN	+/- 0.4%	Aug 01, 2013

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA510 CO2 42399380022	Nondispersive Infrared (NDIR)	Jun 29, 2012
Horiba MPA510 O2 41499150042	Paramagnetic	Jun 29, 2012

Triad Data Available Upon Request

Signature on file

Approved for Release

Airgas

03917.008.028
#1 CB, #2 LK,
#2/3 SDTV, #3 RF
Compliance

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A1173	Reference Number:	122-124474971-1
Cylinder Number:	CC177656	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22015	Valve Outlet:	350
Gas Code:	CO,BALN	Certification Date:	Jan 27, 2015

Expiration Date: Jan 27, 2023

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	1250 PPM	1274 PPM	G1	+/- 0.6% NIST Traceable	01/27/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12060702	CC356023	2498 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 21, 2017

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA510 CO RS2EGL6K	Nondispersive Infrared (NDIR)	Dec 30, 2014

Triad Data Available Upon Request

Signature on file

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0138	Reference Number:	122-124332946-1
Cylinder Number:	CC787	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22012	Valve Outlet:	350
Gas Code:	CO,BALN	Certification Date:	Aug 29, 2012

Expiration Date: Aug 29, 2020

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	2500 PPM	2519 PPM	G1	+/- 1% NIST Traceable	08/29/2012
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	120607	CC356023	2498 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 21, 2017

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA510 CO RS2EGL6K	Nondispersive Infrared (NDIR)	Aug 02, 2012

Triad Data Available Upon Request

Signature on file

Approved for Release

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A3614	Reference Number:	122-124434399-1
Cylinder Number:	SG9151997BAL	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22014	Valve Outlet:	660
Gas Code:	NO,NOX,BALN	Certification Date:	May 20, 2014

Expiration Date: May 20, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	250.0 PPM	252.3 PPM	G1	+/- 0.9% NIST Traceable	05/13/2014, 05/20/2014
NITRIC OXIDE	250.0 PPM	251.8 PPM	G1	+/- 0.8% NIST Traceable	05/13/2014, 05/20/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061908	CC367439	250.8 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	May 04, 2018
PRM	12328	680179	10.01 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Feb 14, 2012
GMIS	0207201401	CC500492	4.841 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Feb 07, 2017

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801549 NO	FTIR	May 07, 2014
Nicolet 6700 AHR0801549 NO	FTIR	May 07, 2014

Triad Data Available Upon Request

Signature on file

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0167	Reference Number:	122-124436366-3
Cylinder Number:	CC218480	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22014	Valve Outlet:	660
Gas Code:	NO,NOX,BALN	Certification Date:	Jun 03, 2014

Expiration Date: Jun 03, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	450.0 PPM	453.1 PPM	G1	+/- 0.6% NIST Traceable	05/27/2014, 06/03/2014
NITRIC OXIDE	450.0 PPM	450.9 PPM	G1	+/- 0.6% NIST Traceable	05/27/2014, 06/03/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061016	CC359385	500.7 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Feb 16, 2018
PRM	12328	680179	10.01 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Feb 14, 2012
GMIS	0207201401	CC500492	4.841 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Feb 07, 2017

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801549 NO	FTIR	May 07, 2014
Nicolet 6700 AHR0801549 NO	FTIR	May 07, 2014

Triad Data Available Upon Request

Signature on file

Approved for Release

03917.008.028
#1 CB, #2 LK,
#2-3 SDTV, #3 RF
Compliance

Airgas

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02AI99E15A1704	Reference Number:	122-124363397-1
Cylinder Number:	CC365349	Cylinder Volume:	146.2 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22013	Valve Outlet:	660
Gas Code:	NO2,BALA	Certification Date:	Mar 25, 2013

Expiration Date: Mar 25, 2016

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NITROGEN DIOXIDE	50.00 PPM	51.23 PPM	G1	+/- 2.0% NITS Traceable	03/18/2013, 03/25/2013
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	GMIS	CC315295	60.32 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 17, 2015
PRM	PRM	726635	50.0 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Mar 15, 2013

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
ECO PHYSICS NO 822S0864	Chemiluminescence	Mar 11, 2013

Triad Data Available Upon Request

Signature on file

Approved for Release

RESPONSE TIME AND STRATIFICATION CHECK

NO. 3 RECOVERY FURNACE

METHODS AND ANALYZERS

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

File: C:\Data\Resolute- Catawba\CEM March 2015\No. 3 Recovery.cem
Program Version: 2.0, built 13 Mar 2014 **File Version:** 2.02
Computer: WINDOWS-PMGFSQ2 **Trailer:** 261
Analog Input Device: Keithley KUSB-3108

		Response time (sec)
Channel 1		
Analyte	O_2	
Method	**EPA 3A**, Using Bias	60
Analyzer Make, Model & Serial No.	**Servomex 1440 Ser# 4303**	
Full-Scale Output, mv	**1000**	
Analyzer Range, %	**25.0**	
Span Concentration, %	**25.0** ✓	
Channel 2		
Analyte	CO_2	
Method	**EPA 3A**, Using Bias	60
Analyzer Make, Model & Serial No.	**Servomex 1440 Ser# 4303**	
Full-Scale Output, mv	**1000**	
Analyzer Range, %	**25.0**	
Span Concentration, %	**24.9** ✓	
Channel 3		
Analyte	**CO**	
Method	**EPA 10**, Using Bias	60
Analyzer Make, Model & Serial No.	**Teledyne 300EM Ser# 365**	
Full-Scale Output, mv	**10000**	
Analyzer Range, ppm	**3000**	
Span Concentration, ppm	**2519** ✓	
Channel 4		
Analyte	NO_x	
Method	**EPA 7E**, Using Bias	90
Analyzer Make, Model & Serial No.	**API 200EH Ser# 672**	
Full-Scale Output, mv	**10000**	
Analyzer Range, ppm	**500**	
Span Concentration, ppm	**453** ✓	

RUN DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 3 Recovery**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	CO_2 mv	CO_2 %	CO mv	CO ppm	NO_x mv	NO_x ppm
				Point 1				
14:46	239	5.9	459	13.1	377	113	1509	65
14:47	232	5.7	465	13.3	331	99	1508	65
14:48	238	5.9	460	13.2	268	80	1505	65
14:49	239	5.9	459	13.1	321	96	1503	65
14:50	242	6.0	457	13.1	237	71	1508	65
				Point 2				
14:51	240	6.0	459	13.1	156	47	1510	65
14:52	237	5.9	460	13.2	154	46	1508	65
14:53	241	6.0	457	13.1	189	57	1502	65
14:54	248	6.2	450	12.9	220	66	1494	65
14:55	247	6.1	452	12.9	186	56	1477	64
				Point 3				
14:56	236	5.9	461	13.2	151	45	1467	63
14:57	238	5.9	460	13.2	204	61	1467	63
14:58	240	6.0	459	13.1	249	75	1473	64
14:59	235	5.8	463	13.2	364	109	1472	64
15:00	238	5.9	460	13.2	682	204	1466	63
15:01	245	6.1	455	13.0	371	111	1458	63
15:02	239	5.9	461	13.2	434	130	1454	63
15:03	241	6.0	459	13.1	358	107	1449	62
15:04	238	5.9	460	13.2	331	99	1445	62
15:05	242	6.0	455	13.0	370	111	1442	62
15:06	243	6.0	454	13.0	280	84	1441	62
Avgs	**240**	**6.0**	**458**	**13.1**	**297**	**89**	**1479**	**64**

3 pt. strat Re-check
16.7% 50% & 83.3% of duct

WESTON

NO. 2 LIME KILN

RUN DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
response time 90 sec				
07:57	197	4.8	1267	55
07:58	198	4.9	1245	54
07:59	200	4.9	1237	53
08:00	203	5.0	1230	53
08:01	197	4.8	1228	53
08:02	201	4.9	1226	53
point 2				
08:03	202	5.0	1218	52
08:04	204	5.0	1216	52
08:05	205	5.0	1221	53
08:06	206	5.1	1237	53
08:07	203	5.0	1251	54
08:08	202	5.0	1260	54
point 3				
08:09	207	5.1	1263	55
08:10	207	5.1	1251	54
08:11	211	5.2	1247	54
08:12	209	5.1	1245	54
08:13	206	5.1	1244	54
08:14	205	5.0	1255	54
08:15	205	5.0	1254	54
08:16	206	5.1	1246	54
08:17	206	5.1	1242	54
08:18	210	5.2	1232	53
08:19	212	5.2	1218	52
08:20	213	5.2	1212	52
08:21	209	5.1	1217	52
08:22	211	5.2	1223	53
08:23	212	5.2	1221	53
08:24	213	5.2	1214	52
08:25	214	5.3	1203	52
08:26	215	5.3	1198	51
08:27	213	5.2	1197	51
08:28	210	5.2	1201	52
08:29	209	5.1	1208	52
08:30	207	5.1	1213	52
08:31	210	5.2	1214	52
08:32	210	5.2	1208	52
08:33	211	5.2	1199	51
08:34	213	5.2	1191	51
08:35	210	5.2	1189	51

RUN DATA

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln**

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Time	O_2 mv	O_2 %	NO_x mv	NO_x ppm
08:36	208	5.1	1188	51
08:37	209	5.1	1193	51
08:38	211	5.2	1198	51
08:39	214	5.3	1193	51
08:40	213	5.2	1181	51
08:41	214	5.3	1165	50
08:42	212	5.2	1169	50
08:43	208	5.1	1176	50
08:44	209	5.1	1186	51
08:45	208	5.1	1193	51
08:46	212	5.2	1195	51
08:47	209	5.1	1196	51
08:48	210	5.2	1199	51
08:49	210	5.2	1200	51
08:50	209	5.1	1198	51
08:51	210	5.2	1195	51
08:52	212	5.2	1193	51
08:53	214	5.3	1182	51
08:54	214	5.3	1169	50
08:55	215	5.3	1167	50
08:56	209	5.1	1166	50
Avgs	**209**	**5.1**	**1212**	**52**

NO_X CONVERTER EFFICIENCY

NOx CONVERTER EFFICIENCY

Number 1

Client: **Resolute**
Location: **Catawba, SC**
Source: **No. 2 Lime Kiln** / TS No. 3 Recovery

Calibration **1**

Project Number: **03917.008.028**
Operator: **Simpkins**
Date: **30 Mar 2015**

Start Time: 10:20

NO_2 Standard: 51.2 ppm, Cylinder CC365349, Expires 3-25-2016

NO_x
Analyzer: API 200EH Ser# 672

Time	mv	ppm	Status
10:21:20	1099	46.5	Pass
Avg		**46.5**	**Pass**

APPENDIX H

PERMEATION DEVICE CERTIFICATES

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below is certified traceable to N.I.S.T. standards.

Serial Number: T-45601

Certification Date : Jan 5, 2015

Certificate Expires: Jan 5, 2016

Chemical: Hydrogen Sulfide

Part Number: 147-543-0110-C50

Device Type: Dynacal Wafer

Length/Geometry: 40T3

Rate: 736.29 ng/min

Temperature: 50° C

True Accuracy: ± 3.64 %

Max Allowed Accuracy: ± 5.00 %

Certification Method: Gravimetric

Order No.: 116089

Customer: Weston Solutions, Inc.

Notes:

Approved By:

VICI

VICI Metronics, Inc.
26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

03917.008.028
#1 CB, #2 LK,
#2-3 SDTV, #3 RF
Compliance

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below is certified traceable to N.I.S.T. standards.

Serial Number: 33-45604

Certification Date : Jan 5, 2015

Certificate Expires: Jan 5, 2016

Chemical: Methyl Mercaptan

Part Number: 187-040-6000-C50

Device Type: Dynacal Tube

Length/Geometry: 4.00

Rate: 709.77 ng/min

Temperature: 50° C

True Accuracy: ± 1.27 %

Max Allowed Accuracy: ± 2.00 %

Certification Method: Gravimetric

Order No.: 116089

Customer: Weston Solutions, Inc.

Notes:

Approved By:

VICI

VICI Metronics, Inc.
26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

03917.008.028
#1 CB, #2 LK,
#2-3 SDTV, #3 RF
Compliance

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below is certified traceable to N.I.S.T. standards.

Serial Number: 89-45609

Certification Date : Jan 5, 2015

Certificate Expires: Jan 5, 2016

Chemical: Dimethyl Sulfide

Part Number: 107-021-6200-C50

Device Type: Dynacal Tube

Length/Geometry: 2.10

Rate: 760.99 ng/min

Temperature: 50° C

True Accuracy: ± 1.80 %

Max Allowed Accuracy: ± 2.00 %

Certification Method: Gravimetric

Order No.: 116089

Customer: Weston Solutions, Inc.

Notes:

Approved By:

VICI

VICI Metronics, Inc.
26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

03917.008.028
#1 CB, #2 LK,
#2-3 SDTV, #3 RF
Compliance

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below is certified traceable to N.I.S.T. standards.

Serial Number: 89-45611

Certification Date : Jan 5, 2015

Certificate Expires: Jan 5, 2016

Chemical: Dimethyl Disulfide

Part Number: 107-200-6301-C50S

Device Type: Dynacal Tube

Length/Geometry: 20.00

Rate: 802.83 ng/min

Temperature: 50° C

True Accuracy: ± 1.22 %

Max Allowed Accuracy: ± 2.00 %

Certification Method: Gravimetric

Order No.: 116089

Customer: Weston Solutions, Inc.

Notes:

Approved By:

VICI

VICI Metronics, Inc.
26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

03917.008.028
#1 CR, #2 LK,
#2-3 SDTV, #3 RF
Compliance

PROJECT TEAM QUALIFICATIONS

Templeton Simpkins

Qualifications Summary

- More than 15 years of experience sampling stationary source emissions for criteria and hazardous air pollutants using EPA Reference Methods.
- Experience sampling emissions using National Council of the Paper Industry for Air and Stream Improvement (NCASI) methods for the determination of chlorine, chlorine dioxide, chloroform, aldehydes and ketones, and volatile organic compounds.
- Qualified Source Testing Individual (QTSI) Group I , II, III and IV qualified.

Credentials

Qualified Source Testing Individual (QSTI), SES (2009)

Education

B.S., Zoology - Auburn University (1997)

Training, Memberships & Awards

- 8-Hour Hazardous Waste Refresher Course, OSHA 29 CFR 1910.120(e)(8), WESTON (2011)
- 8-Hour Managers and Supervisors Course (SHSC), OSHA 29 CFR 1910.120(e)(4), WESTON (2007)
- 10-Hour Emission Testing Practice (ETP) Initial Modular Training, (1999); Refresher, WESTON (2011)
- Behavior-Based Safety Training – Phase I, WESTON (2007)
- Bloodborne Pathogens Refresher Training, OSHA 29 CFR 1910.1030, WESTON (2011)
- Fall Protection Competent Person Training Course – Refresher, OSHA 29 CFR 1926 Subpart M, Tennessee Valley Training Center (2011)
- Shipping and Transporting Dangerous Goods – Administrative/ Field Personnel – Initial, Weston Solutions, Inc., Manual of Procedures for Shipping and Transporting Dangerous Goods Training Course, 49 CFR 172 Subpart H, WESTON (2008); Refresher, WESTON (2011)
- First Aid Training, (2011)
- CPR Training, (2010)
- 40-Hour Hazardous Material Control and Emergency Response Training, OSHA 29 CFR 1910.120(e)(s), (2000)
- Project Management Training, (2003)

Training, Memberships & Awards

- Qualified Source Testing Individual, Manual Gas Volume Measurements and Isokinetic Particulate Sampling Methods, Source Evaluation Society

Employment History

1998 to Present WESTON [9-98 to Present; Auburn, AL; Unit Manager]

Key Projects

Jet NOx Engineering Study, Houston, TX, Jacobs Engineering, CEM Operator. Test Coordinator and CEM Operator

Tested Emissions from NASA test lab while tiles from Space Shuttle were subjected to earth atmosphere re-entry conditions by argon arc and jet engine

[10-08; WESTON; Proj. No. 02303.024.001]

Emission Testing, Multiple Pulp and Paper, Power Plant Clients, Various Locations, Multiple Clients, Project Manager and Test Team Leader. Performed millwide compliance testing at various locations for particulate, sulfur dioxide, nitrogen oxides, carbon monoxide, sulfuric acid mist, hydrochloric acid, chlorine, chlorine dioxide, volatile organic compounds (VOCs), and total reduced sulfur (TRS).

Performance Specification Testing, Various Locations, Multiple Pulp and Paper Mill Clients, Project Manager and Test Team Leader. Conducted emission testing to determine conformance of continuous emission monitoring systems (CEMSs) with U.S. Environmental Protection Agency (EPA) Performance Specifications 2, 3, and 5.

Relative Accuracy Testing of CEMS, Various Locations, Multiple Pulp and Paper Mill Clients, Project Manager and Test Team Leader. Performed nitrogen oxides, oxygen, sulfur dioxide, carbon monoxide, and TRS emission testing using EPA Reference Methods. Results were compared to emission levels measured by the source CEMS to determine the relative accuracy of the instrument for compliance purposes.

Set Up CEMS, Leaf River, MS, Georgia-Pacific, Test Team Member. Developed a CEMS for TRS on a gas-fired incinerator. [WESTON; Proj. No. 00414]

Lumber Kiln VOC Emission Testing , National Council for Air and Stream Improvement (NCASI), Multiple Locations, Test Team Member. Conducted testing using the National Council for Air and Stream Improvement (NCASI) testing methods.

Key Projects

Emissions Testing, Houston, TX, Jacobs Engineering Group, Test Team Coordinator. Conducted semi-continuous NOX testing on emissions from space shuttle re-entry simulator at the NASA Johnson Space Center, Houston, TX. [WESTON; Proj. No. 02303.024.001]

Paul Edward Green

Qualifications Summary

- Fifteen years of professional experience.
- Experience in sampling stationary source emissions for criteria and hazardous air pollutants using EPA Reference Methods.
- Over 12 years of experience in sampling emissions using EPA Reference Methods 1-5.
- Experience performing Cl_2/ClO_2 testing.
- Experience running acid mist testing.
- Experience performing Ontario Hydro Method for Mercury.
- Boiler MACT testing at various paper mills.
- Ambient air monitoring.
- GPS data recording.

Education

B.S., Wildlife Science - Auburn University (1995)

Training, Memberships & Awards

- Emissions 10-Hour Group Testing Safety Course
- CPR Training, American Red Cross (2001)

Employment History

2009 to Present WESTON [1-09 to Present; Auburn, AL; Project Scientist]

2007 to 2008 E.R. Alley, Inc. [1-07 to 12-08; Decatur, AL; Equipment Stores Manager]

1998 to 2006 WESTON [7-98 to 12-06; City - Not Entered, State - Not Entered; Job Title - Not Entered]

1996 to 1998 Alabama Crown Distributing Co., Inc. [8-96 to 1-98; Huntsville, AL; Assistant Warehouse Manager]

1995 to 1996 Timber Sales and Surveys, Inc. [9-95 to 7-96; Auburn, AL; Rodman]

Key Projects

Bleach Plant Studies, Various Locations, Multiple Clients, Test Team Member. Conducted testing to determine Cl_2 and ClO_2 emissions and scrubber efficiency at various pulp and paper mills throughout the southeastern United States.

Pulp and Paper Mill Emission Testing Projects, Various Locations, Multiple Clients, Test Team Member. Assisted in source sampling for total reduced sulfur (TRS) compounds, sulfur dioxide, and particulate matter at various pulp and paper mills throughout the United States. Responsibilities included setting up and organizing a field laboratory for the collection of samples during source sampling.

Source Sampling, Macon, GA, Riverwood International Corporation, Test Team Member. Assisted in U.S. Environmental Protection Agency (EPA) Method 5 testing. Responsibilities included setting up and organizing a field laboratory for the collection of samples during source sampling.

Method 5 Testing, Pine Bluff, AK, International Paper, Test Team Member. Set up and ran EPA Method 5. [WESTON; Proj. No. 00157.019]

EPA Method 5 Testing, Orange, TX, Inland Paperboard & Packaging. Set up and conducted EPA Method 5 test. Performed volumetric flow rate analysis.

Scrubber Inlet Testing, Demopolis, AL, Gulf States Paper Company, Test Team Member. Conducted EPA Method 5 testing on scrubber inlet. Inlet and outlet were tested simultaneously to demonstrate scrubber efficiency. In-stack filet was used for kilns source.

Mercury Emission Test, Chemical Manufacturer, Test Team Member. Specific responsibilities included preparation, sample collection, and validation of data from several flammable sources. Additional testing was requested after initial effort.

Emission Testing, Brunswick, GA, Georgia-Pacific Corporation, Test Team Member. Conducted acid mist emission testing using EPA Method 5. [WESTON; Proj. No. 00414.019]

CO2/CIO2 Testing, Texarkana, TX, International Paper, Test Team Member. Conducted Cl_2/ClO_2 testing.[WESTON; Proj. No. 00157.026]

Testing Using EPA Methods 1-5, Alabama, Mead, Stevenson, Test Team Leader. Organized testing and performed EPA Reference Methods 1-5.[WESTON; Proj. No. 03415.017]

Sampling for Fuel Oil Contamination, Selma, AL, International Paper, Test Team Member. Conducted groundwater sampling at various wells within mill for fuel oil contamination. Water levels vs. oil levels were also recorded during sampling. [WESTON; Proj. No. 00157.028]

Key Projects

Oil Spill Response, Marshall, MI, EPA Superfund Technical Assessment and Response Team (START). Conducted ambient air monitoring and prepared documentation, and prepared global positioning system (GPS) coordinate documentation.

Matthew C. Carroll

Qualifications Summary

- One year of experience in air quality/emission testing using various EPA/OTM methods.
- Eight years experience leading a ground crew in acquisition of data for GPS mapping using LIDAR and weather stations.
- Licensed Single Engine Land (SEL) Pilot

Education

A.D., Forest and Wildlife Conservation - Penn Foster University (2010)

A.A.S., Horticulture and Greenhouse Science - Snead State Community College (2000)

Training, Memberships & Awards

- RCRA Basics Refresher, WESTON (2015)
- MSHA New Miner Training - Refresher, WESTON (2015)
- IAS Modular Safety Training - Refresher, WESTON (2015)
- Basic Plus Program Refresher, Tennessee Valley Training Center (2015)
- Defensive Driving Classroom Refresher, WESTON (2015)
- TAPPISAFE or Refresher, Tappisafe (2014)
- Shipping and Transporting Dangerous Goods - Field Personnel - Initial, WESTON (2015)
- Radiation Awareness, WESTON (2015)
- MSHA New Miner Training - Initial, WESTON (2014)
- Mishap Management Program, WESTON (2014)
- IAS Modular Safety Training - Initial, WESTON (2014)
- Fall Protection Competent Person, WESTON (2015)
- Defensive Driving Course - St. Paul Insurance (Defensive Driving for Fleet Driver), WESTON (2014)
- Bloodborne Pathogens Training Course, WESTON (2015)
- Behavior Based Safety - Initial, WESTON (2015)
- Global Harmonization System Communication Training 29CFR 1910, WESTON (2014)

Matthew C. Carroll

Employment History

2014 to Present Weston Solutions Inc. [6-14 to Present; Auburn, AL; Associate Project Scientist]

2006 to 2014 Aerotec, LLC [1-06 to 6-14; Bessemer, AL; Ground Crew Supervisor]

2005 Grand Teton Lodge [4-05 to 10-05; Grand Teton Nat'l Park, WY; Wrangler]

Key Projects

Recovery Boiler Scrubber Inlet and Outlet Emission Testing, Fernandina Beach, FL, Rayonier Advanced Materials, Test Team Member. Test Team Member providing emission testing on the Recovery Boiler Scrubber Inlet and Outlet [11-14; WESTON; Proj. No. 05565.008.021]

Kiln 1 and Kiln 2 HWC NESHAP Comprehensive Performance Testing, Logansport, Essroc Cement Corporation, Test Team Member. Test Team Member providing HWC NESHAP Comprehensive Performance Testing on Kiln 1 and Kiln 2 [10-14; WESTON; Proj. No. 13908.002.010]

Lime Kiln - Particulate Matter and Total Reduced Sulfur Compliance Emission Testing, Campti, LA, International Paper, Test Team Member. Test Team Member providing Particulate Matter and Total Reduced Sulfur Compliance Emission Testing on the Lime Kiln at the Red River Plant [8-14; WESTON; Proj. No. 00157.083.011]

Terpenes Emission Testing, Demopolis, AL, Rock-Tenn, Test Team Member. Test Team Member providing Terpenes emission testing [8-14; WESTON; Proj. No. 06282.009.101]

No. 6 Power Boiler Engineering Report, Evadale, TX, Mead Westvaco, Test Team Member. Test Team Member providing particulate matter (PM), nitrogen oxides (NOX), and carbon monoxide (CO) emission testing on the No. 6 Power Boiler [8-14; WESTON; Proj. No. 12908.003.062]

Plant Hammond-Unit 3 ACI, SAMC, and ESP Performance and Optimization Test, Rome, GA, Southern Company, Test Team Member. Test Team Member providing Performance and Optimization Testing for Plant Hammond-Unit 3 ACI, SAMC, and ESP [7-14; WESTON; Proj. No. 12251.012.004; Plant Hammond-Unit 3 ACI, SAMC, and ESP Performance and Optimization Test Report]

Kiln, Alkaline Bypass, and Clinker Cooler Annual Emission Testing, Demopolis, AL, Cemex, Test Team Member. Served as a test team member performing emission testing on the Kiln Stack and the Alkaline Bypass for NOx, SO2, CO, THC, CO2, and O2, with periodic VFR measurements. [6-14; WESTON; Proj. No. 13744.003.001]

Hunter R. Goodlett

Qualifications Summary

- Approximately one year experience with stationary source emission testing, using a variety of US EPA Reference Methods

Education

A.A.S., Business Administration with Psychology Minor - Southern Union State Community (2012)

Training, Memberships & Awards

- 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER), WESTON (2014) (2014)
- Fall Protection Competent Person, WESTON (2014) (2014)
- First Aid/CPR/AED/BBP Heartsaver, WESTON (2014) (2014)
- MSHA New Miner Training - Initial, WESTON (2014)
- Global Harmonization System Hazard Communication Training, WESTON (2014) (2014)
- Mishap Management Program, WESTON (2014)
- TAPPISAFE or refresher, WESTON (2014)
- IAS Modular Safety Training- Initial, WESTON (2014)

Employment History

2013 to 2014 Best Tire and Auto [2-13 to 5-14; Auburn, AL; Automotive Technician, Shop Foreman]

Key Projects

EEI, Joppa, IL, EEI, Team Member. Mercury Compliance Testing [8-14 to Present; WESTON; Proj. No. 10540.002.011.0001]

Rayonier, Jesup, GA, Rayonier - Jesup, Team Member. Compliance Testing on the Power Boiler [10-14 to Present; WESTON; Proj. No. 05565.007.096.0001]

GP Thomson, Thomson, GA, Georgia Pacific Thomson, Team Member. Compliance Testing on the Inlet and Outlet [11-14 to Present; WESTON; Proj. No. 03881.014.002.0001]

Key Projects

Emission Testing, Rome, GA, International Paper Rome, Test Team Member. Compliance Testing on the Lime Kiln [10-14 to Present; WESTON; Proj. No. 00157.087.007.0001]

Natalie N. Hornsby

Qualifications Summary

- Quality Assurance Manager for Auburn IAS
- Thirteen (13) years of experience in emissions testing, including report preparation and data reduction, visible emissions, and on-site particulate matter analysis.
- Gave informative presentation at the 2010 and 2011 annual EUEC Conference on lessons learned from the Boiler MACT/CISWI ICR.
- Gave informative presentation at annual EPRI Conference on EPA's Electronic Reporting Tool (ERT).
- QI Group 3.
- Co-authored Technical Manual on EPA's ERT.
- Five years of experience in wastewater testing laboratory.
- Experience in conducting Phase I Environmental Site Assessments (ESAs).

Credentials

LEED Accredited Professional, U.S. Green Building Council (LEED AP) (2008)

Education

B.S., Environmental Science - Auburn University (1998)

Training, Memberships & Awards

- 40-Hour Hazardous Waste Site Training Course, OSHA 29 CFR 1910.120(e)(3), WESTON (2004)
- 8-Hour Hazardous Waste Refresher Course, OSHA 29 CFR 1910.120(e)(8), WESTON (2015)
- Behavior Based Safety, Phase I Training, WESTON (2015)
- Bloodborne Pathogens Refresher Training, OSHA 29 CFR 1910.1030, WESTON (2015)
- 10-Hour ETP Initial Modular Training, WESTON (2002)
- ETP Modular Safety Refresher, WESTON (2015)
- Fall Protection Competent Person Training Course – Initial, OSHA 29 CFR 1926 Subpart M, Refresher, Tennessee Valley Training Center (2015)
- Shipping and Transporting Dangerous Goods – Administrative/ Field Personnel – Initial, Manual of Procedures for Shipping and Transporting Dangerous Goods Training Course, 49 CFR 172 Subpart H, Refresher, WESTON (2015)

Training, Memberships & Awards

- First Aid Training,, WESTON (2013)
- CPR Training, WESTON (2013)

Employment History

2002 to Present WESTON [3-02 to Present; Auburn, AL; Associate Project Scientist]

1997 to 2002 Environmental Resource Analysts, Inc. [1-97 to 1-02; Auburn, AL; Lab Technician]

Key Projects

Kiln 1, Kiln 2 and Alkaline Bypass CTG Testing, Speed, IN, Essroc Cement Corporation, Quality Assurance Mananger. Mercury, Total Hydrocarbons, Benzene, Dioxins and Furans, Particulate Matter, and multiple metals emissions testing on the Kiln 1, Kiln2, and Alkaline Bypass at Essroc's Speed, Indiana Plant. I was responsible for data and report quality assurance. [6-13; WESTON; Proj. No. 13098.001.019; LUMP SUM]

Auxiliary Boiler Nitrogen Oxides, Carbon Monoxide, and Oxygen Relative Accuracy Test Audit Report, Riesel, TX, Sandy Creek Services, LLC, Quality Assurance Manager. Testing the accuracy of the continuous emissions monitoring system on the Auxiliary Boiler at the Sandy Creek Energy Station. I served as the quality assurance manager. [10-14; WESTON; Proj. No. 15255.001.004; LUMP SUM]

Southern Company Plant Hammond ACI, SAMC, ESP Optimization, Rome, GA, Southern Company, Quality Assurance Manager. [1-15; WESTON; Proj. No. 12251.012.004; LUMP SUM]

Southern Company Plant Hammond ACI, SAMC, ESP Optimization, Rome, GA, Southern Company, Quality Assurance Manager. Emission Testing at Southern Company's Plant Hammond Electric Generating Plant. I was responsible for data and report quality assurance. [1-15; WESTON; Proj. No. 12251.012.004; LUMP SUM]

Electronic Generating Unit (EGU) Information Collection Rule (ICR) Project, Southern Company Services, Project Scientist. Responsible for reporting results using U.S. Environmental Protection Agency (EPA's) Electronic Reporting Tool.

International Paper Boiler Maximum Achievable Control Technology (MACT)/CISWI, ICR Project, Report Coordinator. Responsible for reporting results using EPA's Electronic Reporting Tool.

Key Projects

On-Site Analysis, Demopolis, AL, Rock-Tenn Company, Test Team Member. Performed on-site analysis and data reduction for various source emissions. [1-05 to 2-06; WESTON]

Visible Emission Testing, Auburn, AL, Auburn University, Test Team Member. Performed visible emissions testing on two stacks at Auburn University. [1-05 to 2-06; WESTON]

Visible Emission Testing, Demopolis, AL, Rock-Tenn Company, Test Team Member. Performed visible emissions testing on two stacks at the Rock-Tenn facility. [3-05 to 5-05; WESTON]

On-Site Particulate Analysis, Courtland, AL, International Paper, Test Team Leader. Performed on-site particulate matter analysis and data reduction for various source emissions. Served as client contact during testing. [10-02 to 12-02; WESTON]

APPENDIX I
PROCESS OPERATING/PRODUCTION DATA

		SDTV					RB2			RB3				
		RPIS89.pv	RFIS98.pv	RFIS99.pv	RPIS98.pv	25DI307a.pv	25fi308.pv			51di307a.pv	51fi308.pv			
		Scrubber pump discharge (psig)	Weak wash spray flow (gpm)	Weak wash flow (gpm)	Pressure diff (Inches of WC)	RB2 % BLS	Liq firing rate (gpm)	RB2 LBS/HR BLS		RB3 % BLS	Liq firing rate (gpm)	RB3 LBS/HR BLS	Total Tons/hr BLS	
31-Mar-15 08:45:00	31-Mar-15 09:00:00	48.9	117.1	108.2	5.6	68.3	182.7	80492.3		68.0	315.3	138403.0	109.45	
31-Mar-15 09:00:00	31-Mar-15 09:15:00	48.9	117.0	108.6	5.5	68.4	182.6	80391.6		68.0	316.3	138803.4	109.65	
31-Mar-15 09:15:00	31-Mar-15 09:30:00	48.9	116.9	108.7	5.5	68.4	182.1	80341.5		68.0	312.1	136957.1	108.65	
31-Mar-15 09:30:00	31-Mar-15 09:45:00	48.9	116.9	108.8	5.5	68.4	182.1	80373.2		68.0	307.5	134936.7	107.65	
31-Mar-15 09:45:00	31-Mar-15 10:00:00	48.9	116.9	108.9	5.5	68.4	182.0	80345.7		68.0	307.6	134972.1	107.66	
31-Mar-15 10:00:00	31-Mar-15 10:15:00	48.9	116.7	108.7	5.6	68.4	180.7	79772.0		68.0	309.7	135805.7	107.79	108.48
31-Mar-15 10:15:00	31-Mar-15 10:30:00	48.9	116.9	108.7	5.5	68.4	177.4	78291.9		67.9	310.8	136126.2	107.24	
31-Mar-15 10:30:00	31-Mar-15 10:45:00	48.9	117.0	108.5	5.6	68.4	177.8	78504.9		67.9	310.4	135855.1	107.20	
31-Mar-15 10:45:00	31-Mar-15 11:00:00	49.0	117.0	108.5	5.5	68.4	177.8	78507.1		67.7	312.9	136731.2	107.62	
31-Mar-15 11:00:00	31-Mar-15 11:15:00	48.9	117.0	108.4	5.4	68.4	178.1	78640.1		67.6	313.6	136952.2	107.75	
31-Mar-15 11:15:00	31-Mar-15 11:30:00	48.9	117.2	107.6	5.4	68.5	177.5	78377.0		67.6	312.6	136150.2	107.32	
31-Mar-15 11:30:00	31-Mar-15 11:45:00	48.8	117.1	107.8	5.4	68.5	177.0	78163.1		67.5	312.8	136299.1	107.20	
31-Mar-15 11:45:00	31-Mar-15 12:00:00	48.9	117.0	107.5	5.3	68.5	176.7	78063.1		67.4	313.2	135718.6	107.14	
31-Mar-15 12:00:00	31-Mar-15 12:15:00	48.9	116.9	107.5	5.4	68.5	173.2	76513.1		67.3	313.8	133893.3	106.41	107.24
31-Mar-15 12:15:00	31-Mar-15 12:30:00	48.9	116.9	107.4	5.5	68.5	171.5	75756.3		67.3	313.6	133025.1	105.93	
31-Mar-15 12:30:00	31-Mar-15 12:45:00	48.9	116.9	107.8	5.6	68.5	171.9	75908.3		67.2	314.2	136193.2	106.05	
31-Mar-15 12:45:00	31-Mar-15 13:00:00	48.9	117.0	108.0	5.6	68.4	171.7	75776.3		67.1	314.7	135224.7	106.00	
31-Mar-15 13:00:00	31-Mar-15 13:15:00	48.9	117.2	107.9	5.5	68.4	171.4	75534.9		67.0	313.6	135403.6	105.56	
31-Mar-15 13:15:00	31-Mar-15 13:30:00	48.9	117.1	107.8	5.4	68.4	171.7	75770.4		66.8	315.0	135031.7	105.80	
31-Mar-15 13:30:00	31-Mar-15 13:45:00	48.9	117.2	107.9	5.4	68.4	172.0	75933.4		66.7	315.0	135594.8	105.73	
31-Mar-15 13:45:00	31-Mar-15 14:00:00	48.9	117.3	107.8	5.4	68.3	171.8	75742.5		66.6	316.0	135850.1	105.80	
31-Mar-15 14:00:00	31-Mar-15 14:15:00	49.0	117.7	107.9	5.3	68.3	171.3	75452.0		66.6	316.0	135733.6	105.63	105.75

CB1

		26fc143.pv oil (gpm)	26fc144.pv gas (mft3/h)	26fc100.pv bark (ton/hr)
01-Apr-15 09:45:00	01-Apr-15 10:00:00	0	0	86.5
01-Apr-15 10:00:00	01-Apr-15 10:15:00	0	0	87.9
01-Apr-15 10:15:00	01-Apr-15 10:30:00	0	0	84.5
01-Apr-15 10:30:00	01-Apr-15 10:45:00	0	0	87.6
01-Apr-15 10:45:00	01-Apr-15 11:00:00	0	0	88.1
01-Apr-15 11:00:00	01-Apr-15 11:15:00	0	0	88.1
01-Apr-15 11:15:00	01-Apr-15 11:30:00	0	0	87.1
01-Apr-15 11:30:00	01-Apr-15 11:45:00	0	0	91.7
01-Apr-15 11:45:00	01-Apr-15 12:00:00	0	0	82.4
01-Apr-15 12:00:00	01-Apr-15 12:15:00	0	0	67.0
01-Apr-15 12:15:00	01-Apr-15 12:30:00	0	0	68.4
01-Apr-15 12:30:00	01-Apr-15 12:45:00	0	0	79.2
01-Apr-15 12:45:00	01-Apr-15 13:00:00	0	0	89.0
01-Apr-15 13:00:00	01-Apr-15 13:15:00	0	0	88.1
01-Apr-15 13:15:00	01-Apr-15 13:30:00	0	0	85.0
01-Apr-15 13:30:00	01-Apr-15 13:45:00	0	0	86.5
01-Apr-15 13:45:00	01-Apr-15 14:00:00	0	0	90.0
01-Apr-15 14:00:00	01-Apr-15 14:15:00	0	0	90.0
01-Apr-15 14:15:00	01-Apr-15 14:30:00	0	0	91.9
01-Apr-15 14:30:00	01-Apr-15 14:45:00	0	0	93.7
01-Apr-15 14:45:00	01-Apr-15 15:00:00	0	0	95.8
01-Apr-15 15:00:00	01-Apr-15 15:15:00	0	0	96.2
01-Apr-15 15:15:00	01-Apr-15 15:30:00	0	0	95.7
01-Apr-15 15:30:00	01-Apr-15 15:45:00	0	0	97.7
01-Apr-15 15:45:00	01-Apr-15 16:00:00	0	0	98.0
01-Apr-15 16:00:00	01-Apr-15 16:15:00	0	0	98.0
01-Apr-15 16:15:00	01-Apr-15 16:30:00	0	0	98.0
01-Apr-15 16:30:00	01-Apr-15 16:45:00	0	0	98.0
01-Apr-15 16:45:00	01-Apr-15 17:00:00	0	0	98.1

Kiln

		27fc576.pv gas (kft3/hr)	27fc584.pv oil (gpm)
30-Mar-15 07:50:00	30-Mar-15 08:05:00	84.0	-0.3640468
30-Mar-15 08:05:00	30-Mar-15 08:20:00	84.1	-0.356036
30-Mar-15 08:20:00	30-Mar-15 08:35:00	84.1	-0.3562795
30-Mar-15 08:35:00	30-Mar-15 08:50:00	84.0	-0.3568443
30-Mar-15 08:50:00	30-Mar-15 09:05:00	84.0	-0.357409
30-Mar-15 09:05:00	30-Mar-15 09:20:00	84.0	-0.3579738
30-Mar-15 09:20:00	30-Mar-15 09:35:00	84.0	-0.3585386
30-Mar-15 09:35:00	30-Mar-15 09:50:00	84.1	-0.3591034
30-Mar-15 09:50:00	30-Mar-15 10:05:00	83.2	-0.3596681
30-Mar-15 10:05:00	30-Mar-15 10:20:00	83.1	-0.3602329
30-Mar-15 10:20:00	30-Mar-15 10:35:00	83.1	-0.3607977
30-Mar-15 10:35:00	30-Mar-15 10:50:00	83.0	-0.3613624
30-Mar-15 10:50:00	30-Mar-15 11:05:00	83.0	-0.3619272
30-Mar-15 11:05:00	30-Mar-15 11:20:00	83.0	-0.362492

RB3

		51fy304.pv oil flow	51fi308.pv liquor (gpm)	51cf305.pv gas (Mcf/h)
30-Mar-15 14:45:00	30-Mar-15 15:00:00	0	337.3	18.3
30-Mar-15 15:00:00	30-Mar-15 15:15:00	0	336.1	18.7
30-Mar-15 15:15:00	30-Mar-15 15:30:00	0	336.8	18.9
30-Mar-15 15:30:00	30-Mar-15 15:45:00	0	337.4	18.9
30-Mar-15 15:45:00	30-Mar-15 16:00:00	0	336.8	18.8
30-Mar-15 16:00:00	30-Mar-15 16:15:00	0	336.9	18.9
30-Mar-15 16:15:00	30-Mar-15 16:30:00	0	336.2	19.1
30-Mar-15 16:30:00	30-Mar-15 16:45:00	0	335.3	18.9
30-Mar-15 16:45:00	30-Mar-15 17:00:00	0	336.5	19.2
30-Mar-15 17:00:00	30-Mar-15 17:15:00	0	333.4	19.2
30-Mar-15 17:15:00	30-Mar-15 17:30:00	0	334.6	18.4
30-Mar-15 17:30:00	30-Mar-15 17:45:00	0	337.1	18.0
30-Mar-15 17:45:00	30-Mar-15 18:00:00	0	337.9	17.8
30-Mar-15 18:00:00	30-Mar-15 18:15:00	0	335.2	18.0
30-Mar-15 18:15:00	30-Mar-15 18:30:00	0	330.3	18.4
30-Mar-15 18:30:00	30-Mar-15 18:45:00	0	330.3	18.4
30-Mar-15 18:45:00	30-Mar-15 19:00:00	0	335.6	18.5

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