PM10 EMISSION FACTORS FOR A STONE CRUSHING PLANT TRANSFER POINT

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2.0 PLANT AND SAMPLING LOCATION DESCRIPTION

2.1 PROCESS DESCRIPTION AND OPERATION

The Raleigh-Durham plant produces crushed granite used for construction and road paving. Figure 2-1 is a flowchart of the portion of the Raleigh-Durham plant which is relevant in this project. This has been prepared based on a drawing labelled "Plant 613 Flow Diagram" provided by Martin Marietta. The transfer point tested is circled and joins Streams 10 and 11.

Rock blasted from various locations in the quarry is trucked to a primary crusher located in the quarry pit. A large surge pile in the quarry pit is used to provide a steady flow of stone to the plant processing equipment located adjacent to the quarry. A conveyor is used to deliver the stone to the vibrating screen above the secondary crushers. Martin Marietta monitors the stone feed rate from the quarry by means of a load cell type weigh belt scale near the discharge end of this conveyor. This instrument is used as the indicator of plant production rates. Normal production rates range from 400 to 600 tons per hour.

The vibrating screen serving the secondary crushers removes fine material produced during blasting or during primary crushing. These fines are conveyed to a separate storage pile and are sold as product. Typical fines levels are estimated at 80 tons per hour by Martin Marietta personnel.

Two cone-type secondary crushers reduce the size distribution of the material received from the surge pile. Stone leaving the secondary crushers ranges in size from 6 inches to relatively small particles. The material from both secondary crushers discharges onto a conveyor leading to the transfer point tested and then to the tertiary crusher inlet. The tertiary crusher discharge stream also discharges onto this conveyor (now labelled stream 10). Following the tertiary crusher discharge, the main feed conveyor (stream 10) contains all of the plant production with the exception of the fines discharge stream discussed earlier. The quantity of this stream exceeds the total plant throughput rates monitored using the weigh belt feeder on the conveyor leading to the secondary crusher due to the recycle of oversized material separated by the Deister screens.

The main feed conveyor stream passes through the tested transfer point and delivers the stone to the top of the structure housing the Deister vibration screens and the Omnicone tertiary crusher. The stone flow to the Deister screens and tertiary crusher is termed "closed circuit" since oversized material and incompletely screened fines can recirculate through the Deister and tertiary crusher[3]. The plant operates approximately 200 days per year. Total production quantities per year are approximately 1,000,000 tons.

2.2 FUGITIVE DUST CONTROL

Wet suppression is used for fugitive dust control of the transfer point. There are water spray nozzles located on the exit conveyor underneath the transfer point. There are also spray nozzles located at the exit of the

1.0 SUMMARY

1.1 TEST PROCEDURES AND RESULTS

Martin Marietta Aggregates sponsored this emission test program in order to determine PM10 and total particulate emission factors applicable to transfer points at stone crushing plants. The test site was the Martin Marietta Aggregates Raleigh-Durham North Carolina facility. The specific source tested was a transfer point. Entropy Environmentalists, Inc. (Entropy) developed the emission testing program and conducted the PM10 and total particulate emission tests.

A Quasi-stack system was used to conduct emission tests on the transfer point. Small enclosures were installed at both the inlet and outlet of the transfer point. Using this testing approach, all of the PM10 emissions from the transfer point were efficiently captured and adjacent sources of PM10 emissions did not significantly affect the results.

The PM10 emissions were tested using EPA Method 201A, and the total particulate emissions were tested using EPA Method 5. The tests were divided into two sets: stone moisture levels greater than 1.5%, and stone moisture levels less than 1.5%. The results of the PM10 emission tests are presented in Table 1-1., and the total particulate results are presented in Table 1-2. The emission rates determined during both series of tests were low. The very low wet stone emission factor results are entirely consistent with the zero visible emissions observed during all of the tests. Stone samples obtained during the tests were also analyzed and found to have very low levels of material below less than 10 microns.

TABLE 1-1. TRANSFER POINT PM10 EMISSIONS

Stone Moisture (% Weight)	PM10 Emissions (Pounds of Emissions/ Ton of Stone)
(≤ 1.5%)	0.00289
(> 1.5%)	0.000015

TABLE 1-2. TRANSFER POINT TOTAL PARTICULATE EMISSIONS

Stone Moisture (% Weight)	Total Emissions (Pounds of Emissions/ Ton of Stone)
(≤ 1.5%)	0.05504
(> 1.5%)	0.000080

tertiary crusher (beginning of stream 10), at the top of the stream conveyor above the Deister screens, and on the discharge chute near the top of the Deister screens. Not all of these spray nozzles are necessary to maintain wet conditions. Over wetting of the rock can cause blinding of the lower screen or blockage of the fines discharge chute underneath the Deister[4,5]. During these emission tests, the plant experienced no significant screen blinding conditions.

2.3 SAMPLING AND EMISSION TESTING PROCEDURES

2.3.1 Fugitive Emission Test Approach

Since there is no air pollution control devices on the transfer point, fugitive emission testing procedures were needed to capture and measure the PM10 and total particulate emissions. The quasi-stack method appeared to be the most accurate and practical approach for capturing the fugitive emissions from the inlet and outlet areas of the transfer point. This approach allowed isolation of the transfer point from the other fugitive dust sources in the immediate vicinity. The quasi-stack method required the construction of temporary enclosures around the inlet and outlet of the transfer point and the installation of a duct and fan system for gas handling. Since the PM10 emissions are generated primarily by stone-to-stone attrition in the transfer point and during falling, the use of an enclosure does not significantly influence the rate of PM10 emissions.

2.3.2 Emission Testing Procedure

The inlet to the transfer point has an area of approximately 1 foot high, by 3.5 feet wide by 8 feet long it was enclosed with foam insulation to allow capture of the emissions caused by the stone-to-stone attrition during movement of the stone. The discharge point of the transfer point is the lower conveyor leading to the Deister screens. The actual transfer point was completely enclosed in a steel chute. The discharge point was enclosed approximately 8 feet downstream of the transfer point. There are several water spray nozzles on the downstream side of the transfer point. Figure 2-2. shows a view of the transfer point.

The enclosure had a one foot diameter outlet duct which ran approximately 35 feet to the ground, it was used as a combined sample point for both the inlet and outlet of the transfer point. The one foot diameter duct upon reaching the ground turned 90° via an elbow and was then increased to a two foot diameter duct, to allow use of a two foot diameter SCR driven tubeaxial fan. The air flows from the combined enclosure were set by adjusting the variable speed DC motor of the tubeaxial fan installed on the outlet duct. Figures 2-2. and 2-3. show views of the inlet and outlet of the transfer point prior to the construction of enclosures. Figure 2-4. shows a view of the transfer point inlet and outlet after the installation of the enclosure. The combined gas flow from the inlet and outlet enclosures was controlled by a Dayton Model 3C411 24 inch, 2 HP direct current (DC) driven tubeaxial fan. This variable speed fan was set at the gas flow rate necessary to maintain a slightly negative static pressure within the enclosure.

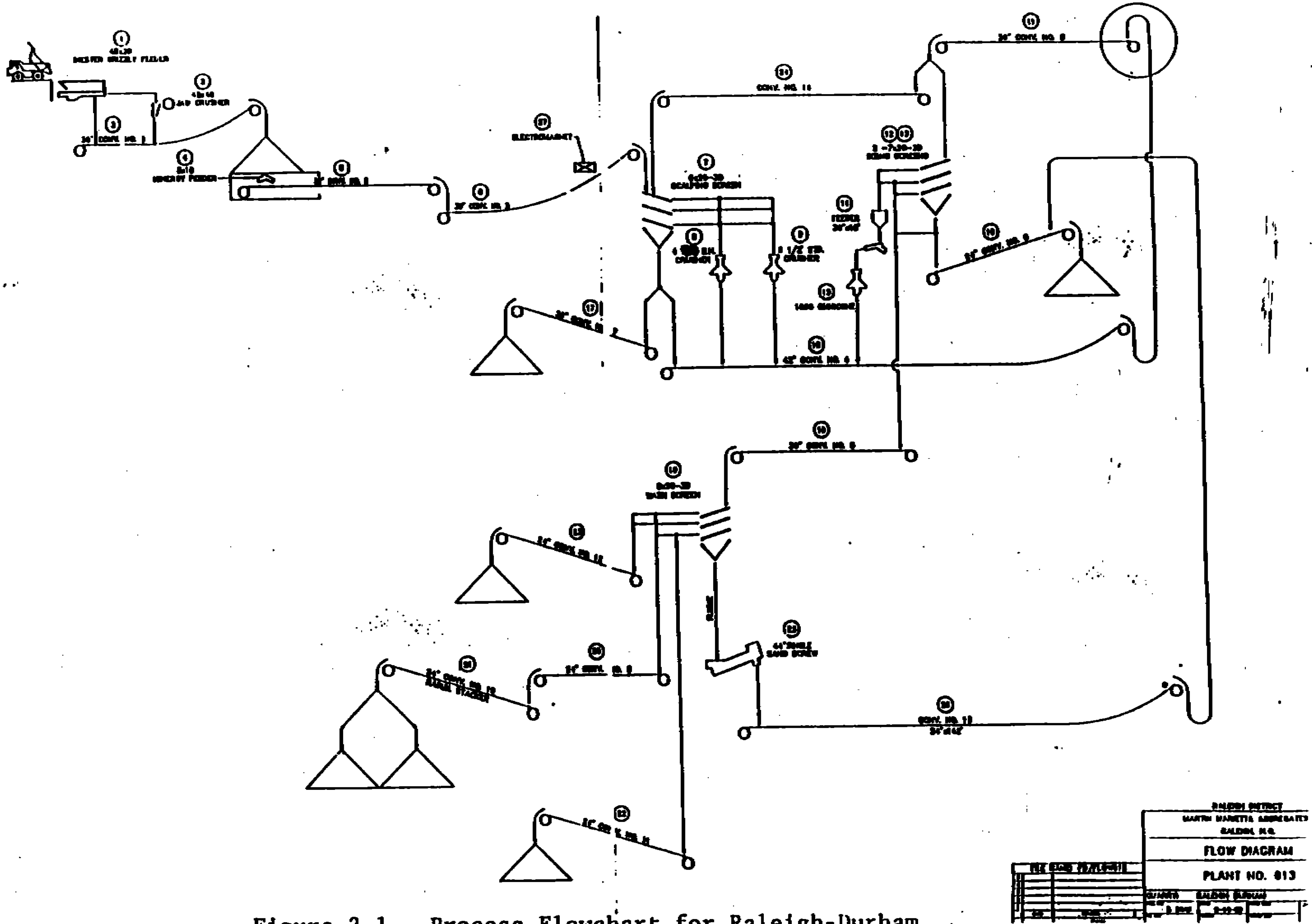

Figure 2-1. Process Flowchart for Raleigh-Durham, North Carolina Plant

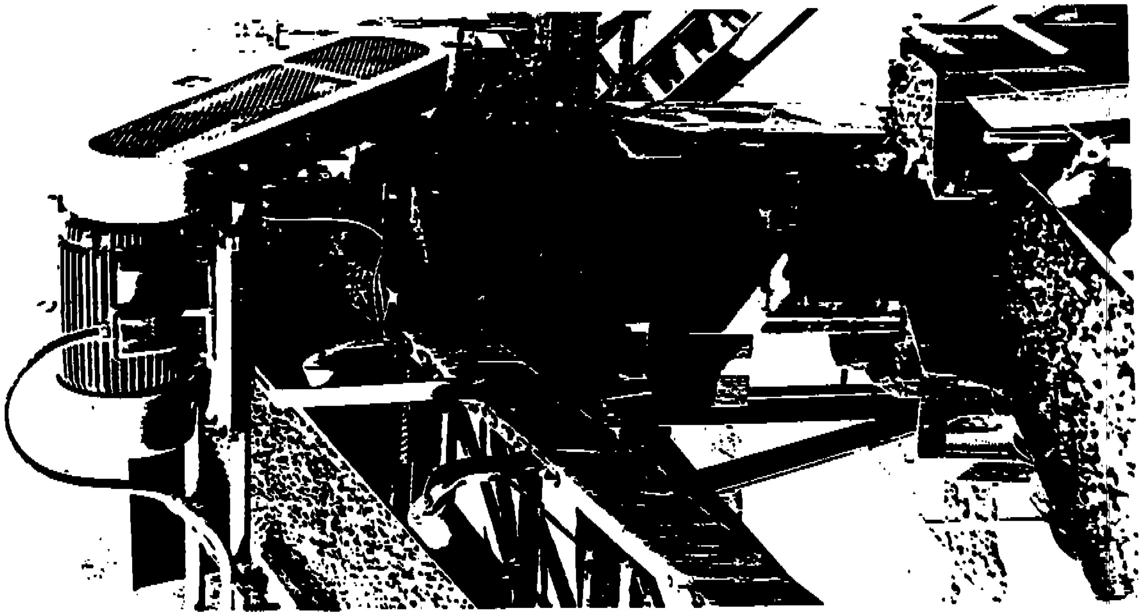

Figure 2-2. Inlet and Outlet of Transfer Point

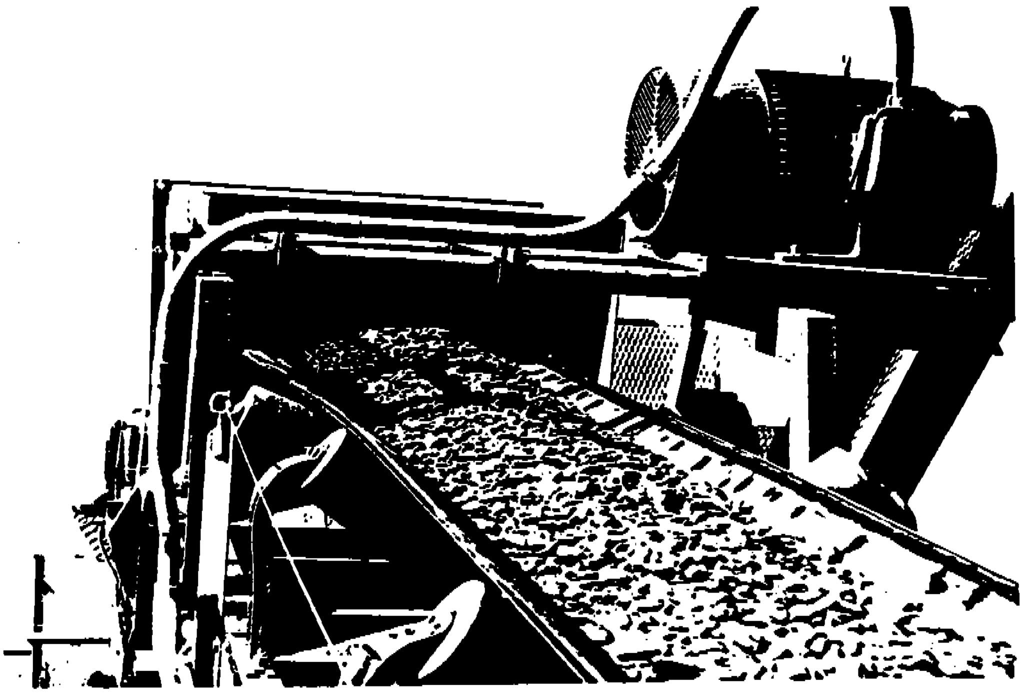

Figure 2-3. Inlet of Transfer Point

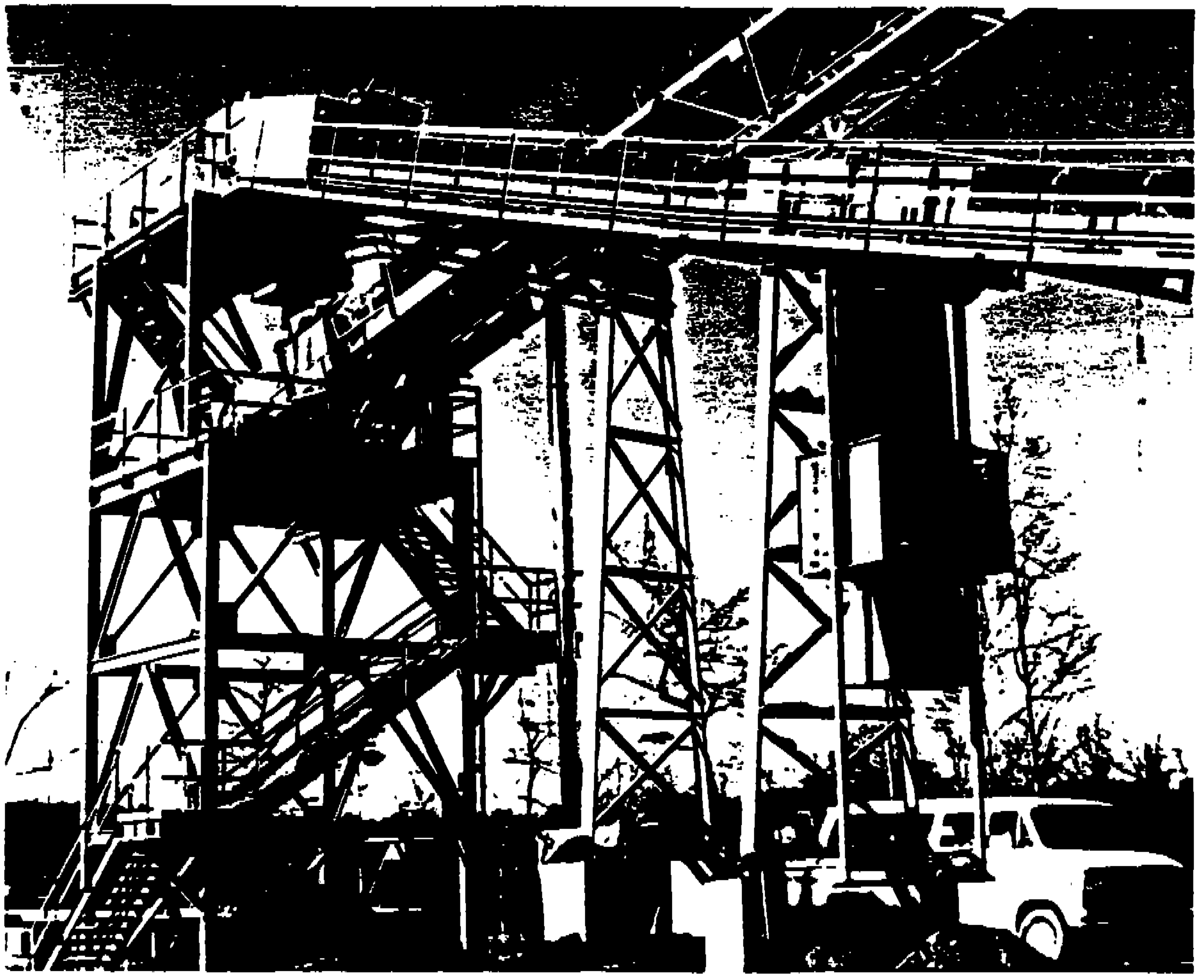

Figure 2-4. Inlet and Outlet Transfer Point Enclosures

Negative pressures were required to ensure that there was no loss of PM10 emissions from the enclosure. Highly negative static pressures were undesirable since there could be high velocity ambient air streams entering the enclosure which could increase the PM10 emissions.

2.3.3 Sampling Equipment

EPA Reference Method 201A and Method 5 were used to monitor the PM10 and total particulate emissions respectively, from the transfer point. The Method 201A complete sampling system consists of: (1) a sampling nozzle, (2) a PM10 sampler, (3) a probe and umbilical cord, (4) an impinger train, and (5) flow control system. Due to the relatively small ducts and the constant sample gas flow rates set using the DC-driven tubeaxial fans, the "S"-type pitot tube was not mounted on the PM10 sample probe. Gas velocities were determined prior to the emission tests. The Method 5 complete sampling system consists of: (1) a sampling nozzle, (2) a probe and umbilical cord, (3) a Method 5 filter, (4) an impinger train, and (5) flow control system.

In the Method 201A sampling train particulate matter larger than 10 microns in diameter is collected in the cyclone located immediately downstream of the sampling nozzle. Particulate smaller than 10 microns is collected on the outlet tube of the cyclone and on the downstream glass-fiber filter, see Figure 2-5. The cyclone and filter system used in this study met the design and sizing requirements of Section 5.2 of Method 201A. The gas flow rate through the cyclone was set based on the orifice pressure head equation provided in Figure 4 of Method 201A. The gas flow rate was kept constant throughout the emission test program.

Sampling was performed in the 1-foot (inlet / outlet location) diameter smooth wall duct mounted off the enclosures of the transfer point. The 4-inch diameter sampling port was located more than 8 duct diameters downstream of the enclosures and more than 2 duct diameters upstream of the elbow leading to the 2 foot diameter fan. The sampling nozzles were selected to provide 80 to 120% for Method 201A and 90% to 110% for Method 5 isokinetic conditions. The particulate samples were recovered using the procedures specified in Method 201A, and Method 5.

2.4 MONITORING OF PROCESS OPERATING CONDITIONS

There are a number of process variables and weather conditions which could conceivably influence emission rates from the transfer point:

- Stone moisture level
- Stone size distribution
- Stone silt content
- Stone feed rates
- Stone friability
- Stone hardness and density

All of these variables with the exception of stone type were monitored using a combination of plant instruments, special monitoring equipment, and stone sample analyses. Stone type was not monitored since granite is the only type of stone processed at this plant.

Figure 2-5. Method 201A Sample Probe

2.4.1 Stone Moisture Level

Two stone samples were removed during the emission tests. These samples consisted of a 2 linear foot sample of stone from the main conveyor entering the transfer point. The conveyor was stopped by plant personnel for approximately 5 minutes to permit the Entropy test crew to remove the stone sample. The sample was placed in a sealed plastic bucket.

A sample was selected for analysis by placing the stone in a pile and dividing it into four quadrants. The quadrant randomly selected for analysis was further subdivided in quadrants until the sample quantity was less than approximately 2 pounds. This sample was then weighed and heated in an oven at a gas temperature of approximately 350 degrees Fahrenheit. The weight loss during heating was calculated and reported as the stone moisture level.

2.4.2 Ambient PM10 Levels

One ambient PM10 monitor was operated in the sample area of the transfer point. It was operated only during the time periods that emission sampling was in progress. The ambient air flow rates through the samplers were calibrated using an Airdata micromanometer. The filters were weighed and PM10 levels during the test were calculated.

2.4.3 Stone Size Distribution and Silt Content

Samples of the stone obtained during the test (see Section 2.4.1) were used to determine the size distribution. The initial sample quadrants used for moisture analysis were used for analysis by ASTM sizing screens. The sample of approximately 2 pounds was heated to 350 Fahrenheit for 30 minutes to drive off the moisture, then allowed to cool, then loaded into the top pan. The screen size mesh openings included:

- 1.5 Inches
- 0.75 Inches
- 0.375 Inches
- 0.0787 Inches
- 150 Microns
- 75 Microns
- 38 Microns
- Bottom pan

The loaded ASTM screens were placed in a RO-TAP shaker and processed for 10 minutes. The weights of stone remaining on each of the screens were then determined by subtracting the screen tare weights from the loaded weights.

2.4.4 Stone Processing and Production Rates

The total plant production rate as monitored by the weigh belt scale to the secondary crusher has been used as the stone throughput rate at the transfer point. This is necessary since plants using the emission factor data will not have independent measurements of the actual stone throughputs at each conveyor transfer point. The main weigh belt scale is the only readily available stone throughput monitor. The actual stone throughputs are approximately 100 Tons/Hour higher than indicated by the plant monitoring data due primarily to the recycling of oversized material back to the tertiary crusher. The emission factors expressed in terms of pounds of emissions per ton of stone throughput have been calculated using the plant process monitor Tons/Hour plus the estimated 100 Tons/Hour recycled oversized material.

The total volume of stone in tons for a particular test was calculated by dividing the total daily production tonnage by the total daily operating hours plus the 100 Tons/Hour oversize recycle (tons of stone/hour of operation)+(100 tons of oversize recycled stone/Hour). The measured emission factor (lbs of emissions/hour of operation) is then divided by the total daily production tonnage to yield (lbs of emission/ton of stone).

3.0 TEST RESULTS

3.1 OBJECTIVES AND TEST MATRIX

The objective of this test program was to determine the PM10 and total particulate emission factors for a transfer point at a stone crushing plant. The test program concerned both wet and dry stone conditions. The specific objectives included the following:

- Capture the emissions from the inlet and outlet of a transfer point without significantly affecting the emission rate.
- Determine the PM10 emission concentrations by means of EPA Reference Method 201A.
- Determine the total emission concentrations by means of EPA Reference Method 5.
- Calculate the emission rates using the known outlet duct gas flow rates and the Method 201A and Method 5 emission concentrations.
- Measure the stone moisture content, stone size distribution, and stone silt content.

The stone processing rate of the Deister screen has been defined by Entropy as the total quantity of stone produced by the plant minus the fines removed prior to the secondary crusher.

The secondary feed weigh belt scale has been chosen as the basis for the production rate definition since these data are most readily available at other stone crushing plants. The disadvantage of this definition is that it creates emission factor values in pounds per ton of stone, which are higher than would be calculated if the production rate were based on the actual feed rate, for this reason the estimated 100 Tons/Hour oversize recycle has been included in all calculations to yield a more representative production rate.

3.2 STONE MOISTURE LEVELS

The stone moisture levels for the transfer point emission factor tests are presented in Table 3-1. The moisture criteria proposed in the Test Plan were: dry condition - less than 1.5%, and wet conditions - equal to or greater than 1.5%. The actual values during the tests were consistent with these criteria.

During the emission tests, the stone color was used to qualitatively evaluate moisture levels. Short term changes in stone moisture were indicated by shifts between grey and white. These variations occurred in all of the wet condition tests, but they could not be quantified because of the time needed to obtain a representative stone sample. Stone moisture levels were controlled by the plant personnel operating certain water spray headers in the process.

TABLE 3-1. STONE MOISTURE LEVELS

Date	Conditions	Test	Moisture Content (% weight)
1-14-92	Wet	1	2.62
1-18-93	Dry	1	0.29

3.3 AMBIENT PM10 CONCENTRATIONS

The ambient PM10 concentrations were monitored by means of a Anderson PM10 Hi-Vol sampler. This instrument has a cyclonic pre-collector for particles greater than 10 microns followed by a back-up filter. The ambient air flow rates through the samplers were calibrated using an Airdata micromanometer. The analyzer was located on the ground near the sampling point, in this location, it indicated the PM10 levels in the sampling area.

This analyzer was turned on immediately prior to the emission test and turned off at the conclusion of the test. The PM10 concentrations were calculated by dividing the filter catch weights by the total standard cubic feet sampled during the on-line time. The PM10 ambient concentration data was subtracted from the total PM10 concentration data measured using the Method 201A sampling train. The data on the ambient PM10 levels have been presented in Table 3-2.

TABLE 3-2.
AMBIENT PARTICULATE CONCENTRATION
STANDARD GAS CONDITIONS

	Time Start	Time Stop	Grams Catch	PM10 Concentration mg/ft^3
1-7-93	09:45	14:06	0.0381	0.00682[1]
1-11-93	08:50	14:40	0.2204	0.02909
1-14-93	08:30	14:50	0.2608	0.03170
1-18-93	09:50	16:30	0.9775	0.11537

[1]Rain delays, very high moisture

3.4 STONE PRODUCTION RATES

The transfer point stone processing rates were calculated following the formula outlined in Section 2.4.4 of this report. The transfer points stone throughput rates were calculated based primarily on the data provided by the plant's weigh belt scale. The total processing rate during the test was calculated by adding the estimated 100 Tons/Hour oversize recycle to the average stone production rate. The calculated stone production rates for the transfer point during the tests are presented in Table 3-3.

TABLE 3-3. STONE PRODUCTION DATA

Date	Test	Method	Condition	Oversize Recycle Tons/Hour	Total Processing Rate, Tons/Hour
1-6-93	1	M5	Wet	100	596
1-7-93	1	M201A	Wet	100	584
1-11-93	2	M201A, M5	Wet	100	604
1-14-93	3	M201A, M5	Wet	100	542
1-18-93	1,2,3	M201A, M5	Dry	100	608

3.5 PM10 EMISSION FACTORS

The PM10 emission factors were calculated in accordance with standard procedures. The particulate captured on the filter, in the cyclone outlet tube, and in the filter inlet housing was weighed and added to yield a total capture weight. This value is divided by the standard cubic feet of gas sampled to determine the concentration of PM10 particulate matter in the gas sampled.

The data are expressed in pounds of PM10 per ton of stone put through the transfer point. The total production rate was estimated by summing the oversize recycled material and the weigh belt scale data for the period of the emission test. The measured PM10 emission factors for the transfer point are presented in Table 3-4.. The measured total particulate emission factors for the transfer point are presented in Table 3-5.

The average values for the wet tests are well below the average value for the dry tests. This is consistent with general observations during the emission tests. During the dry tests, there were visible emissions from the outlet dust. No visible emissions were apparent during the wet tests.

TABLE 3-4. TRANSFER POINT CRUSHER PM10 EMISSIONS

		PM10 Emissions; Pounds/Ton
Dry Stone (< 1.5%)		
	Run 1	0.00293
	Run 2	0.00249
	Run 3	0.00325
	Average	0.00289
Wet Stone (> 1.5%)		
	Run 1	0.000012
	Run 2	0.000019
	Run 3	0.000014
	Average	0.000015

TABLE 3-5. TRANSFER POINT TOTAL PARTICULATE EMISSIONS

		Total Emissions; Pounds/Ton
Dry Stone (< 1.5%)		
	Run 1	0.02862
	Run 2	0.06726
	Run 3	0.06924
	Average	0.05504
Wet Stone (> 1.5%)		
	Run 1	0.000057
	Run 2	0.000023
	Run 3	0.000161
	Average	0.000080

The emission factors measured during the Method 201A emission test program are well below the measured emission factors for total particulate matter. Table 3-6. shows the comparison of the Method 201A (PM10) and Method 5 (Total Particulate) results. The PM10 fraction of the total particulate emissions are relatively low since very high energy levels are needed to cause stone attrition to the 10 micron range. It is unlikely that the transfer point is creating substantial quantities of PM10 particulate. This is indicated by particle size distribution tests conducted by Entropy using dried stone. The size distribution data is provided in Table 3-7. As indicated in Table 3-7., the stone had near negligible levels of dust in the less than 38 micron size range.

TABLE 3-6. TOTAL PARTICULATE PM10 COMPARISON

Test Condition	Method 5 Total Particulate Lbs emission/ Ton of Stone	Method 201A PM10 Lbs emission/ Ton of Stone	Ratio of Method 5 / Method 201A
Dry	0.05504	0.00289	19.05
Wet	0.000080	0.000015	5.33
Ratio of Dry/Wet	688.00	192.66	

TABLE 3-7. PARTICLE SIZE DISTRIBUTIONS

Size Range	Fraction of Sample in Specified Range	
	Test 1, Wet	Test 2, Dry
> 1.5 Inches	0.0770	0.1039
> 0.75 Inches	0.3896	0.4975
> 0.375 Inches	0.1578	0.2466
> 0.0787 Inches	0.2344	0.1007
> 150 Microns	0.0894	0.0327
> 75 Microns	0.0208	0.0063
> 38 Microns	0.0144	0.0056
Bottom Pan	0.0167	0.0064

4.0 QA/QC ACTIVITIES

4.1 QC PROCEDURES

The specific internal quality assurance and quality control procedures used during this test program are described in this section. Velocity and volumetric flow rate data collection are discussed in Section 4.2. Section 4.3 discusses QA audits. QC procedures for particulate and percent isokinetics are presented in Sections 4.4 and 4.5, respectively. Manual equipment calibration is described in Section 4.6. Data validation is discussed in Section 4.7.

4.2 VELOCITY/VOLUMETRIC FLOW RATE DETERMINATION

The QC procedures for velocity / volumetric flow rate determinations follow guidelines set forth by EPA Method 2.

Flue gas moisture was determined according to EPA Method 4 sampling trains. Flue gas moisture content (B_{ws}) was determined by dividing the volume (mass) of moisture collected by the impingers by the standardized volume of gas sampled. The following QC procedures were followed in determining the volume of moisture collected:

- Preliminary reagent tare weights were measured to the nearest 0.1 g.
- The balance zero was checked and re-zeroed as necessary before each weighing.
- The balance was leveled and placed in a clean, motionless environment for weighing.
- The indicating silica gel was fresh for each run.
- The silica gel impinger gas temperature was maintained below 68°F.

The QC procedures below were followed regarding accurate sample gas volume determination:

- The dry gas meter is fully calibrated every 6 months using an EPA approved intermediate standard.
- The gas meter was read to a thousandth of a cubic foot for the initial and final readings.
- The meter thermocouples were compared with ambient prior to the test run as a check on operation.
- Readings of the dry gas meter, meter orifice pressure (ΔH), and meter temperatures were taken at every sampling point.

- Accurate barometric pressures were recorded at least once per day.

- Post-test dry gas meter checks were completed to verify the accuracy of the meter full calibration constant (Y).

- The S-type pitot tube was visually inspected before sampling.

- Both legs of the pitot tube were leak checked before and after sampling.

- Proper orientation of the S-type pitot tube was maintained while making measurements. The roll and pitch axis of the S-type pitot tube were maintained at 90° to the flow.

- The pitot tube/manometer umbilical lines were inspected before and after sampling for moisture condensate.

- Cyclonic or turbulent flow checks were performed prior to testing the source.

- Average velocity pressure reading were recorded at each point instead of recording extreme high or low values.

- Pitot tube coefficients were determined based on physical measurement techniques as delineated in Method 2.

- The stack gas temperature measuring system was checked by observing ambient temperatures prior to placement in the stack.

4.3 QA AUDITS

Meterbox calibration audits were performed according to Method 5, section 4.4. All of the equipment pre-test and post-test results are presented in Table 9.

4.4 PARTICULATE/CONDENSIBLES SAMPLING QC PROCEDURES

Quality control procedures for particulate sampling ensure high quality flue gas concentrations and emissions data. Flue gas concentrations are determined by dividing the mass of analyte (particulate) collected by the standardized volume of gas sampled. Sampling QC procedures which ensure that a representative amount of the analytes are collected by the sampling system include:

- The sampling rate is within 20 percent of isokinetic for Method 201A (100 percent) and is within 10 percent of isokinetic for Method 5.
- Only properly prepared glassware is used.
- All sampling nozzles were manufactured and calibrated according to EPA standards.
- Filters are weighed, handled, and stored in a manner to prevent any contamination.
- Recovery procedures are completed in a clean environment.
- Field reagent blanks are collected.

4.5 SAMPLE VOLUME AND PERCENT ISOKINETICS

All sampling runs met the results acceptability criteria as defined by Section 6.3.5 of Method 201-A. The isokinetic rates are within ±20 percent. Furthermore the Method 5 sampling runs met the results acceptability criteria as defined in Method 5, the isokinetic rates are within ±10 percent. A summary of the sample rates and percent isokinetics is presented in Table 4-1.

TABLE 4-1.
AVERAGE DELTA H AND ISOKINETIC RESULTS

Run #	Percent Iso (%)	Delta H (Avg)
Wet-TP-M201A-1	111.6	.652
Wet-TP-M201A-2	114.2	.652
Wet-TP-M201A-3	112.1	.649
Dry-TP-M201A-1	90.2	.650
Dry-TP-M201A-2	108.6	.650
Dry-TP-M201A-3	107.2	.650

Run #	Percent Is (%)	Delta H (Avg)
Wet-TP-M5-1	100.1	2.02
Wet-TP-M5-2	100.4	2.22
Wet-TP-M5-3	99.1	2.25
Dry-Tp-M5-1	100.4	1.82
Dry-TP-M5-2	98.8	1.88
Dry-TP-M5-3	98.4	1.75

4.6 MANUAL SAMPLING EQUIPMENT CALIBRATION PROCEDURES

4.6.1 Type-S Pitot Tube Calibration

The EPA has specified guidelines concerning the construction and geometry of an acceptable Type-S pitot tube. If the specified design and construction guidelines are met, a pitot tube coefficient of 0.84 is used. Information pertaining to the design and construction of the Type-S pitot tube is presented in detail in Section 3.1.1 of EPA Document 600/4-77-027b. Only Type-S pitot tubes meeting the required EPA specifications are used. Pitot tubes are inspected and documented as meeting EPA specifications prior to field sampling.

4.6.2 Sampling Nozzle Calibration

Calculation of the isokinetic sampling rate requires that the cross sectional area of the sampling nozzle be accurately determined. All nozzles are thoroughly cleaned, visually inspected, and calibrated according to the procedure outlined in Section 3.4.2 of EPA Document 600/4-77-027b.

4.6.3 Temperature Measuring Device Calibration

Accurate temperature measurements are required during source sampling. Bimetallic stem thermometers and thermocouple temperature sensors are calibrated using the procedure described in Section 3.4.2 of EPA Document 600/4-77-027b. Each temperature sensor is calibrated at a minimum of three points over the anticipated range of use against a NIST-traceable mercury-in-glass thermometer. All sensors are calibrated prior to field sampling.

4.6.4 Dry Gas Meter Calibration

Dry gas meters (DGM's) are used in the sample trains to monitor the sampling rate and measure the sample volume. All DGM's are fully calibrated to determine the volume correction factor prior to their use in the field. Post-test calibration checks are performed as soon as possible after the equipment has been returned as a QA check on the calibration coefficients. Pre- and post-test calibrations should agree within 5 percent. The calibration procedure is documented in Section 3.3.2 of EPA Document 600/4-77-237b.

Prior to calibration, a positive pressure leak check of the system is performed using the procedure outlined in Section 3.3.2 of EPA Document 600/4-77-237b. The system is placed under approximately 10 inches of water pressure and a gauge oil manometer is used to determine if a pressure decrease can be detected over a one-minute period. If leaks are detected, they are eliminated before actual calibrations are performed.

After the sampling console is assembled and leak checked, the pump is allowed to run for 15 minutes to allow the pump and DGM to warm-up. The valve is then adjusted to obtain the desired flow rate. For the pre-test calibrations, data are collected at orifice manometer settings (ΔH) of 0.5, 1.0, 1.5, 2.0, 3.0 and 4.0 inches H_2O. Gas volumes of 5 ft^3 are used for the two lower orifice settings, and volumes of 10 ft^3 are used for the higher settings. The individual gas meter correction factors (Y_i) are calculated for each orifice setting and averaged. The method requires that each of the individual correction factors fall within ± 2 percent of the average correction factor or the meter is cleaned, adjusted, and recalibrated. For the post-test calibration, the meter is calibrated three times at the average orifice setting and vacuum used during the actual test. The meter box calibration data is presented in Table 4-2.

Table 4-2. Meter Box Calibration Audit

Meter Box Number	Pre-Audit Value	Allowable Error	Calculated Gamma	Acceptable
N-33	1.0032	0.9631<Y<1.0433	0.9829	Yes

4.7 DATA VALIDATION

All data and/or calculations for flow rates, moisture content, and isokinetic rates made using a computer software program are validated by an independent check. All calculations are spot checked for accuracy and completeness.

In general, all measurement data are validated based on the following criteria:

- Process conditions during sampling or testing.
- Acceptable sample collection procedures.
- Consistency with expected other results.
- Adherence to prescribed QC procedures.

5.0 REFERENCES

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8. Industrial Ventilation, A Manual of Recommended Practice, Edwards Brothers, 1980.

9. JACA Corporation, Control of Air Emissions from Process Operations in the Rock Crushing Industry," EPA Contract No. 68-01-4135, U.S. Environmental Protection Agency, Washington, D.C., February 1978.

10. IT Environmental Programs, Inc., Regulatory and Inspection Manual for Nonmetallic Mineral Processing Plant, EPA-240/1/90-010, U.S. Environmental Protection Agency, Washington, D.C., 1991.

6.0 GLOSSARY

1. ASTM: American Society for Testing & Materials

2. Aggregate: in the case of materials of construction, essentially inert materials which, when bound together into a conglomerated mass by a matrix, form concrete, mastic, mortar or plaster; crushed rock or gravel screened to size for use in road surfaces, concrete or bituminous mixes; any of several hard materials such as sand, gravel, stone, slag, cinders or other inert materials used for mixing with a cementing material to form concrete. Aggregate, in a surface course in the building of roads is often called a "road metal".

3. Conveyor belt: a rubberized belt, usually 18" to 60" wide, used to carry aggregates.

4. Crusher (cone): a crusher that is specially designed to produce fines.

5. Crusher (primary): usually a jaw or gyratory type crusher which reduces very large rocks to a size that can be processed by a secondary crusher.

6. Crusher (secondary): any second or third stage crusher that further reduces the size of stone.

7. Fines: the smaller particles of aggregates; usually less than .25" in size.

8. Head Pulley: the driving pulley, usually at the discharge end of conveyor belt.

9. Ro-Tap screen: trade name for a type of testing screen.

10. Scalping: a screening operation, removing stone too large for the crusher.

11. Scalping Screen: removes oversize material.

12. Screen (or sieve): a metallic plate or sheet, woven wire cloth or similar device, with regularly spaced apertures of uniform size mounted in a suitable frame or holder for use in separating material according to size.

Appendix A. Field Data and Results Tabulation

PLANT: Martin Marietta

SAMPLING LOCATION: Transfer Point

		WET-TP-201A-1	WET-TP-201A-2	WET-TP-201A-3
	Test Date	1/7/93	1/11/93	1/14/93
	Run Start Time	945	1010	1020
	Run Finish Time	1406	1440	1450
	Net Traversing Points	1	1	1
Theta	Net Run Time, Minutes	255	270	270
Dia	Nozzle Diameter, Inches	0.248	0.248	0.248
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	1.0032	1.0032	1.0032
Pbar	Barometric Pressure, Inches Hg	30.1	30.1	30.1
Delta H	Avg. Pressure Differential of Orifice Meter, Inches H2O	0.652	0.652	0.649
Vm	Volume of Metered Gas Sample, Dry ACF	116.76	120.865	120.458
tm	Dry Gas Meter Temperature, Degrees F	86	59	67
Vmstd	Volume of Metered Gas Sample, Dry SCF*	114.089	124.244	121.945
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, mL	29.0	22.6	23.4
Vwstd	Volume of Water Vapor, SCF*	1.365	1.064	1.101
%H2O	Moisture Content, Percent by Volume	1.2	0.8	0.9
%H2OSAT	Moisture Sat. @ Flue Gas Conditions, %	0.9 **	0.8	0.8 **
Mfd	Dry Mole Fraction	0.991	0.992	0.992
%CO2	Carbon Dioxide, Percent by Volume, Dry	0	0	0
%O2	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
%CO+N2	CO + N2, Percent by Volume, Dry	79.1	79.1	79.1
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.74	28.75	28.75
Pg	Flue Gas Static Pressure, Inches H2O	-0.32	-0.32	-0.32
Ps	Absolute Flue Gas Pressure, Inches Hg	30.08	30.08	30.08
ts	Flue Gas Temperature, Degrees F	42	38	38
Delta-p	Average Velocity Head, Inches H2O	0.1207	0.1207	0.1207
vs	Flue Gas Velocity, Feet per Second	19.0	18.93	18.93
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	939	943	943
Qssd	Volumetric Air Flow Rate, Dry SCMM*	26.6	26.7	26.7
Qaw	Volumetric Air Flow Rate, Wet ACFM	896	892	892
%I	Isokinetic Sampling Rate, Percent	111.6	114.2	112.1

* 68° F (20° C) — 29.92 Inches of Mercury (Hg).

** Moisture used in calculations.

(Continued Next Page)

FIELD DATA AND RESULTS TABULATION

PLANT: Martin Marietta

SAMPLING LOCATION: Transfer Point

		WET-TP-201A-1	WET-TP-201A-2	WET-TP-201A-3
	PM10 Calculations			
ucyc	Stack Gas Viscosity	173.3	172.7	172.6
Qs	PM10 Flow, at Cyclone Conditions, ACFM	0.428	0.436	0.428
D50	Dia. of Particles in Cyclone, Microns	9.85	9.68	9.80
	Particulate Catch,			
mg<D50	≤ 10 Microns, Milligrams	10.1	15.2	11.0
mg>D50	> 10 Microns, Milligrams	4.00	7.3	15.5
mg	Total Milligrams	14.1	22.5	26.5
	Percent of Total Particulate,			
%<D50	≤ 10 Microns	71.63	67.6	41.5
%>D50	> 10 Microns	28.4	32.4	58.5
	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF*	0.00137	0.00189	0.00139
lb/hr	Emission Rate, lb/hr	0.0110	0.0153	0.0113

* 68° F (20° C) — 29.92 Inches of Mercury (Hg).

PLANT: Martin Marietta

SAMPLING LOCATION: Transfer Point

		DRY-TP-201A-1	DRY-TP-201A-2	DRY-TP-201A-3
	Test Date	1/18/93	1/18/93	1/18/93
	Run Start Time	1135	1349	1550
	Run Finish Time	1235	1432	1630
	Net Traversing Points	1	1	1
Theta	Net Run Time, Minutes	60	40	40
Dia	Nozzle Diameter, Inches	0.248	0.248	0.248
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	1.0032	1.0032	1.0032
Pbar	Barometric Pressure, Inches Hg	29.9	29.9	29.9
Delta H	Avg. Pressure Differential of Orifice Meter, Inches H2O	0.6503	0.6500	0.65
Vm	Volume of Metered Gas Sample, Dry ACF	22.644	18.357	17.924
tm	Dry Gas Meter Temperature, Degrees F	96	99.3	93
Vmstd	Volume of Metered Gas Sample, Dry SCF*	21.584	17.394	17.178
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, mL	6.9	0.1	4.7
Vwstd	Volume of Water Vapor, SCF*	0.325	0.00471	0.221
%H2O	Moisture Content, Percent by Volume	1.5	0.0 **	1.3
%H2OSAT	Moisture Sat. @ Flue Gas Conditions, %	0.9 **	1	0.8 **
Mfd	Dry Mole Fraction	0.991	1.00	0.992
%CO2	Carbon Dioxide, Percent by Volume, Dry	0.0	0.0	0.0
%O2	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
%CO+N2	CO + N2, Percent by Volume, Dry	79.1	79.1	79.1
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.74	28.84	28.75
Pg	Flue Gas Static Pressure, Inches H2O	-0.19	-0.19	-0.19
Ps	Absolute Flue Gas Pressure, Inches Hg	29.89	29.89	29.89
ts	Flue Gas Temperature, Degrees F	42	45	38
Delta-p	Average Velocity Head, Inches H2O	0.12	0.12	0.12
vs	Flue Gas Velocity, Feet per Second	19.0	19.04	18.94
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	933	937	938
Qmsd	Volumetric Air Flow Rate, Dry SCMM*	26.4	26.5	26.6
Qaw	Volumetric Air Flow Rate, Wet ACFM	896	897	893
%I	Isokinetic Sampling Rate, Percent	90.2	108.6	107.2

* 68° F (20° C) -- 29.92 Inches of Mercury (Hg).

** Moisture used in calculations.

(Continued Next Page)

FIELD DATA AND RESULTS TABULATION

PLANT: Martin Marietta

SAMPLING LOCATION: Transfer Point

		DRY-TP-201A-1	DRY-TP-201A-2	DRY-TP-201A-3
	PM10 Calculations			
ucyc	Stack Gas Viscosity	173.1	175.0	172.3
Qs	PM10 Flow, at Cyclone Conditions, ACFM	0.348	0.417	0.411
D50	Dia. of Particles in Cyclone, Microns	11.41	10.12	10.09
	Particulate Catch,			
mg<D50	≤ 10 Microns, Milligrams	316.7	215.0	275.3
mg>D50	> 10 Microns, Milligrams	6,688.8	5,693.3	5,726.5
mg	Total Milligrams	7,005.5	5,908.3	6,001.8
	Percent of Total Particulate,			
%<D50	≤ 10 Microns	4.52	3.64	4.59
%>D50	> 10 Microns	95.5	96.4	95.4
	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF*	0.226	0.191	0.247
lb/hr	Emission Rate, lb/hr	1.81	1.53	1.99

* 68° F (20° C) -- 29.92 Inches of Mercury (Hg).

FIELD DATA AND RESULTS TABULATION

PLANT: Martin Marietta, Raleigh, NC

LOCATION: Transfer Point, Wet

RUN #	DATE	OPERATOR
WET-TP-M5-1	1/06/93	Darrell W. Soyars
WET-TP-M5-2	1/11/93	Darrell W. Soyars
WET-TP-M5-3	1/14/93	Darrell W. Soyars

		WET-TP-M5-1	WET-TP-M5-2	WET-TP-M5-3
	Run Start Time	0824	0850	0830
	Run Finish Time	0929	0957	0945
	Net Traversing Points	12	12	12
Theta	Net Run Time, Minutes	60.00	60.00	60.00
Dia	Nozzle Diameter, Inches	0.335	0.335	0.335
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	1.0032	1.0032	1.0032
Pbar	Barometric Pressure, Inches Hg	30.10	30.10	29.75
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	2.02	2.22	2.25
Vm	Volume Of Metered Gas Sample, Dry ACF	46.752	48.538	48.771
tm	Dry Gas Meter Temperature, Degrees F	75	56	58
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	46.840	50.414	49.848
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	13.9	7.6	8.0
Vwstd	Volume of Water Vapor, SCF*	0.654	0.358	0.377
$\%H_2O$	Moisture Content, Percent by Volume From Measured Water Catch	1.4	.7	.7
	Saturation at Flue Gas Temperature	.9**	.6**	.7**
Mfd	Dry Mole Fraction	0.991	0.994	0.993
Md	Gas Molecular Weight, lb/lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.74	28.77	28.76
Pg	Flue Gas Static Pressure, Inches H_2O	-0.32	-0.24	-0.31
Ps	Absolute Flue Gas Pressure, Inches Hg	30.08	30.08	29.73
ts	Flue Gas Temperature, Degrees F	42	34	37
Delta-p	Average Velocity Head, Inches H_2O	0.1371	0.1545	0.1583
vs	Flue Gas Velocity, Feet/Second	20.26	21.32	21.78
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	1,001	1,073	1,076
Qaw	Volumetric Air Flow Rate, Wet ACFM	955	1,005	1,026
%I	Isokinetic Sampling Rate, Percent	100.1	100.4	99.1

* 68° F (20° C) -- 29.92 Inches of Mercury (Hg)

** ACTUAL $\%H_2O$ USED IN CALCULATIONS

(Continued next page)

FIELD DATA AND RESULTS TABULATION
(Continued)

PLANT: Martin Marietta, Raleigh, NC

		WET-TP-M5-1	WET-TP-M5-2	WET-TP-M5-3
	Filterable Particulate			
mg	Catch Weight, Milligrams	12	4.9	30.6
gr/DSCF	Concentration, grains/DSCF *	0.00395	0.00150	0.00947
lb/hr	Emission Rate, lb/hr	0.0339	0.0138	0.0874

* 68° F (20° C) -- 29.92 Inches of Mercury (Hg)

EXAMPLE TEST CALCULATIONS RUN WET-TP-M5-1

Transfer Point, Wet

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$Vmstd = Y * Vm * \frac{Pbar + (Delta\ H/13.6)}{(460 + tm)} * \frac{460 + tstd}{Pstd}$$

$$Vmstd = 1.0032 * 46.752 * \frac{30.10 + (2.020/13.6)}{(460 + 75)} * \frac{460 + 68}{29.92} = 46.840\ DSCF$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$$Vwstd = 0.04707 * Vlc * (460 + tstd)/528$$

$$Vwstd = 0.04707 * 13.9 * (460 + 68)/528 = 0.654\ SCF$$

PERCENT MOISTURE, BY VOLUME, AS MEASURED IN FLUE GAS

$$\%H_2O = 100 * Vwstd / (Vwstd + Vmstd)$$

$$\%H_2O = \frac{0.654}{0.654 + 46.840} * 100 = 1.4\ \%$$

ABSOLUTE FLUE GAS PRESSURE

$$Ps = Pbar + (Pg / 13.6)$$

$$Ps = 30.10 + (-0.32/13.6) = 30.08\ \text{inches Hg}$$

SATURATED PERCENT MOISTURE AT FLUE GAS TEMPERATURE

$$\%H_2O = \frac{10^{[6.6911 - (3144/(ts + 390.86))]}}{Ps} * 100$$

$$\%H_2O = \frac{10^{[6.6911 - (3144/(42 + 390.86))]}}{30.08} * 100 = 0.9$$

DRY MOLE FRACTION OF FLUE GAS

$$Mfd = 1 - \%H_2O / 100$$

$$Mfd = 1 - 0.9/100 = 0.991$$

DRY MOLECULAR WEIGHT OF FLUE GAS

$$Md = (\%CO_2/100 * 44) + (\%O_2/100 * 32) + ((100 - \%CO_2 - \%O_2)/100 * 28)$$

$$Md = (0.0/100 * 44) + (20.9/100 * 32) + ((100 - 0.0 - 20.9)/100 * 28)$$

$$Md = 28.84 \text{ lb/lb-Mole}$$

WET MOLECULAR WEIGHT OF FLUE GAS

$$Ms = (Md * Mfd) + (0.18 * \%H_2O)$$

$$Ms = (28.84 * 0.991) + (0.18 * 1.4) = 28.74 \text{ lb/lb-Mole}$$

AVERAGE FLUE GAS VELOCITY [Note: (Delta p)avg is square of average square root]

$$vs = 85.49 * Cp * \left[\frac{(\text{Delta P})avg * (460 + ts)}{Ps * Ms} \right]^{1/2}$$

$$vs = 85.49 * 0.840 * \left[\frac{0.1371 * (460 + 42)}{30.08 * 28.74} \right]^{1/2} = 20.26 \text{ ft/sec}$$

DRY VOLUMETRIC FLUE GAS FLOW RATE AT STANDARD CONDITIONS

$$Qsd = \frac{60}{144} * Mfd * vs * A * \frac{460 + tstd}{460 + ts} * \frac{Ps}{Pstd}$$

$$Qsd = \frac{60}{144} * 0.991 * 20.26 * 113.1 * \frac{460 + 68}{460 + 42} * \frac{30.08}{29.92}$$

$$Qsd = 1{,}001 \text{ DSCFM}$$

WET VOLUMETRIC FLUE GAS FLOW RATE AT ACTUAL CONDITIONS

$$Qaw = 60 / 144 * vs * A$$

$$Qaw = 60 / 144 * 20.26 * 113.1 = 955 \text{ ACFM}$$

PERCENT ISOKINETIC OF SAMPLING RATE

$$\%I = \frac{Pstd}{460 + tstd} * \frac{100}{60} * \frac{(ts + 460) * Vmstd}{Ps * vs * Mfd * Theta * (\pi * (NozzleDia/2)^2/144)}$$

$$\%I = \frac{29.92}{460 + 68} * \frac{100}{60} * \frac{(42 + 460) * 46.840}{30.08 * 20.26 * 0.991 * 60.00 * (\pi * (0.335/2)^2/144)}$$

$$\%I = 100.1 \ \%$$

CONCENTRATION, GRAINS PER DRY STANDARD CUBIC FOOT, FILTERABLE PARTICULATE

$$gr/DSCF = \frac{7{,}000}{453.592} * \frac{(mg / 10^3)}{Vmstd}$$

$$gr/DSCF = \frac{7{,}000}{453.592} * \frac{(12.0/10^3)}{46.840} = 0.00395 \quad gr/DSCF$$

EMISSION RATE, POUNDS PER HOUR, FILTERABLE PARTICULATE

$$lb/hr = \frac{60}{453.592} * \frac{(mg / 10^3)}{Vmstd} * Qsd$$

$$lb/hr = \frac{60}{453.592} * \frac{(12.0/10^3)}{46.840} * 1{,}001 = 0.0339 \quad lb/hr$$

FIELD DATA AND RESULTS TABULATION

PLANT: Martin Marietta, Raleigh, NC

LOCATION: Transfer Point, Dry

RUN #	DATE	OPERATOR
DRY-TP-M5-1	1/18/93	Scott T. Ajax
DRY-TP-M5-2	1/18/93	Scott T. Ajax
DRY-TP-M5-3	1/18/93	Scott T. Ajax

		DRY-TP-M5-1	DRY-TP-M5-2	DRY-TP-M5-3
	Run Start Time	0950	1243	1444
	Run Finish Time	1125	1345	1547
	Net Traversing Points	12	12	12
Theta	Net Run Time, Minutes	60.00	60.00	60.00
Dia	Nozzle Diameter, Inches	0.335	0.335	0.335
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	1.0032	1.0032	1.0032
Pbar	Barometric Pressure, Inches Hg	29.90	29.90	29.90
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.82	1.88	1.75
Vm	Volume Of Metered Gas Sample, Dry ACF	45.496	45.776	44.022
tm	Dry Gas Meter Temperature, Degrees F	89	97	95
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	44.029	43.684	42.173
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	6.9	7.6	[illegible]
Vwstd	Volume of Water Vapor, SCF*	0.325	0.358	0.428
%H_2O	Moisture Content, Percent by Volume From Measured Water Catch	.7**	.8**	1.0
	Saturation at Flue Gas Temperature	.8	1.0	.9*
Mfd	Dry Mole Fraction	0.993	0.992	0.991
Md	Gas Molecular Weight, lb/lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.76	28.75	28.73
Pg	Flue Gas Static Pressure, Inches H_2O	-0.19	-0.19	-0.19
Ps	Absolute Flue Gas Pressure, Inches Hg	29.89	29.89	29.89
ts	Flue Gas Temperature, Degrees F	38	45	44
Delta-p	Average Velocity Head, Inches H_2O	0.1197	0.1236	0.1162
vs	Flue Gas Velocity, Feet/Second	18.90	19.35	18.74
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	937	945	916
Qaw	Volumetric Air Flow Rate, Wet ACFM	891	912	883
%I	Isokinetic Sampling Rate, Percent	100.4	98.8	98.4

* 68° F (20° C) -- 29.92 Inches of Mercury (Hg)

** ACTUAL %H_2O USED IN CALCULATIONS

(Continued next page)

FIELD DATA AND RESULTS TABULATION
(Continued)

PLANT: Martin Marietta, Raleigh, NC

		DRY-TP-M5-1	DRY-TP-M5-2	DRY-TP-M5-3
	Filterable Particulate			
mg	Catch Weight, Milligrams	6165	14293.8	14629.9
gr/DSCF	Concentration, grains/DSCF *	2.16	5.05	5.35
lb/hr	Emission Rate, lb/hr	17.4	40.9	42.1

* 68° F (20° C) -- 29.92 Inches of Mercury (Hg)

Appendix B. Raw Field Data Sheets

PRELIMINARY VELOCITY AND STATIC ...

Plant Name MARTIN MARIETTA Job No. 11462

City/State RALEIGH, NC Date 1-6-92

Test Location TRANSFER POINT Personnel STA, WKK

Barometric Pres. (Pbar) 30.1 In. Hg Static Pres. (Pg) ______ In. H_2O

Pitot ID ______ Pitot Coeff. (Cp) ______ Pressure Gauge Set ID ______

Thermocouple ID ______ Duct Length/Diameter ______ Width ______
--Specify inches (") or feet (')--

TRAVERSES Start-Finish Times:			
Pt. No.	Yaw ∠°	ΔP "H_2O	Temp °F
A-1	0	.0563	50°
2		.0761	
3		.1562	
4		.1890	
5		.1581	
6		.1207	
B-1		.0865	
2		.0979	
3		.1486	
4		.1794	
5		.1773	
6		.1041	
Avg*			

ORSAT DATA

Sampling Time	Analysis Time	CO_2 (A) Reading	O_2 (B) Reading	%O_2 (B-A)	%CO+N_2 (100-B)
	Average				

Bag No. ______ Pump ______

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H_2O

MOISTURE DATA (STOICHIOMETRIC)

Free Water in Fuel, %		
Water from Fuel Combustion, %		
Ambient Water, %		
Relative Humidity, %		
Ambient Temperature, °F		
Total %		

VOLUMETRIC AIR FLOW RATES

Dry at Standard Conditions, Qsd =	SCFM
Wet at Stack Conditions, Qaw =	ACFM

HORIZONTAL DUCT FLYASH/DUST BUILDUP >1" DEPTH?

Yes___ No___ If yes, see page 2 for instructions

* 1. ∠ average is summation of absolute values divided by number of measurements and must be ≤ 20°.
2. ΔP average is square of average square root.

F-1107 rev. 9-91

See page 2 for cyclonic flow check criteria.

ENTROPY

Sampling and Velocity Traverse Point Determination
EPA Method 1

PLANT NAME Martin Marietta

CITY, STATE Raleigh, NC

SAMPLING LOCATION Transfer Point

NO. OF PORTS AVAILABLE 2

NO. OF PORTS USED 1

PORT INSIDE DIAMETER 3"

DISTANCE FROM FAR WALL TO OUTSIDE OF PORT 12"

NIPPLE LENGTH AND/OR WALL THICKNESS 0"

DEPTH OF STACK OR DUCT 12"

STACK OR DUCT WIDTH (IF RECTANGULAR) —

EQUIVALENT DIAMETER:

$D_E = \frac{2 \times DEPTH \times WIDTH}{DEPTH + WIDTH} = \frac{2(\quad)(\quad)}{(\quad + \quad)} =$ N/A

DISTANCE FROM PORTS TO FLOW DISTURBANCES	UPSTREAM	DOWNSTREAM
	25'	4'
DIAMETERS	~~[illegible]~~ 25	4

STACK/DUCT AREA = $\pi(6)^2$ = 113.1 IN²

LOCATION OF POINTS IN CIRCULAR STACKS OR DUCTS

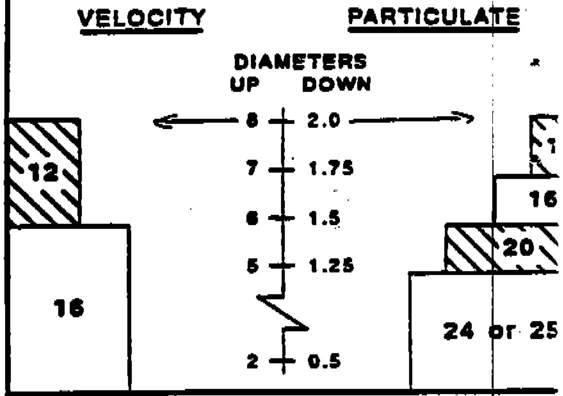
	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF POINTS IN RECTANGULAR STACKS OR DUCTS

	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

DRAW HORIZONTAL LINE THROUGH DIAMETER

If more than 8 and 2 diameters and [illegible] dia. is less than 24", use 8 or 9 p[illegible]



PITOT USED (✓) TYPE "S" ____ STANDARD ____

POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	4.4	.528	½
2	14.6	1.752	1¾
3	29.6	3.552	3½
4	70.4	8.448	8½
5	85.4	10.248	1[illegible]
6	95.6	11.472	11½
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

METHOD 201A (PM-10) FIELD DATA (continued)

Plant Name MARTIN MARIETTA
City/State RALEIGH, N.C.
Sampling Location TRANSFER POINT

Run Number WET-TP-201A-1
Time Start 0945
Time Stop 1406

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F
13	A-6	15.0	180	924.46	0.1207	87	43	0.652	1.0	NA	38	43
14			195	931.32		87	43		1.0		39	43
15			210	938.18		87	42		1.0		40	42
16			225	945.03		87	44		1.0		40	44
17			240	951.89		87	43		1.0		39	43
18			255	958.76		87	42		1.0		40	42
19			270									
20			285									
21			300									
22			315									
23			330									
24			345									
25			360									
26												
27												
28												
23												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												

256.20

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

~~360~~	116.760	0.1207	86	42	0.652
minutes	Vm	$(\sqrt{\Delta P})^2$	tm	ts	ΔH

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name MARTIN MARIETTA
City/State RALEIGH, N.C.
Sampling Location TRANSFER POINT
Date 1/7/95 Team Leader DWS/STA Techs
*Train Leak Check Vacuum, In. Hg 10
Train Leak Rate, Cubic Ft./Min. .001

Run Number WET-TP-201A-1
Time Start 0945
Time Stop 1406
Job Number 11432
Barometric Pressure, In. Hg 30.10
Static Pressure, In. H_2O -.32

EQUIPMENT CHECKS

✓ Pitot, Pretest
✓ Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
✓ Thermocouple @ 43°F Pre
✓ Thermocouple @ 45 Post

IDENTIFICATION NUMBERS

Meterbox N33 Meterbox Gamma 1.0032 Reagent Box 0580
T/C Readout FUJI T/C Probe R318 Umbilical U117
Sampling Box 33 Orsat Pump NA Tedlar Bag NA
Nozzle(s) Actually Used: Pitot 5-1
No. 3004 Diameter .248 No. Diameter

FILTER NO.	TARE
~~NA~~	~~NA~~
PM 277	0.2711

Est % H_2O 0.5

Delta $H_@$ 1.818
Delta H_t 0.652
Delta H_{t+50} 0.541
Delta H_{t-50} 0.801
Delta P_{avg} .1267
Meter Temp. 90
Stack Temp. 50

NOZZLE SELECTION CRITERIA

Desired Dia. .258

	Nozzle 1	Nozzle 2
Diameter	.248	
Nozzle Number	3004	
Delta P_{min}	.0371	
Delta P_{max}	.2030	

FYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F
1	A-6	15	0	842.00	0.1207	84	42	0.652	1.0	NA	40	42
2			15	848.82		82	42	0.652	1.0		40	42
3			30	855.62		83	41		1.0		40	41
4			45	862.38		84	42		1.0		57	42
5			60	869.22		84	41		1.0		40	41
6			75	876.14		85	41		1.0		40	41
7			90	883.05		85	41		1.0		38	41
8			105	889.99		86	40		1.0		37	40
9			120	896.92		85	43		1.0		38	43
10			135	903.83		85	43		1.0		38	43
11			150	910.71		87	44		1.0		37	44
			165	917.58		87	44		1.0			44

* REMOVE HEAD BEFORE

ENTROPY

METHOD 201A (PM-10) FIELD DATA (continued)

Plant Name MARTIN MARIETTA
City/State RALEIGH N.C
Sampling Location TRANSFER POINT

Run Number WET-TP-201A-2
Time Start 1010
Time Stop 1440

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps: Filter Box, °F	Gas Temps: Imping Exit, °F	Cyclone Temp, °F
13	A-6	15	180	1109.73	.1207	60	40	.652	1.0	NA	40	40
14			195	1116.41		61	41		1.0		40	41
15			210	1123.07		61	39		1.0		40	39
16			225	1129.72		61	41		1.0		40	41
17			240	1136.39		61	40		1.0		40	40
18			255	1143.02		61	40		1.0		40	40
19			270	1149.665		61	41		1.0		40	41
20												
21												
22												
23												
24												
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28												
23												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

[illegible] minutes | 120.965 Vm | .1207 $(\sqrt{\Delta P})^2$ | 59 tm | 38 ts | 0.652 ΔH

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name: MARTIN MARIETTA
City/State: RALEIGH N.C
Sampling Location: TRANSFER POINT
Date: 1/11/93 Team Leader: DWS/STA Techs:
*Train Leak Check Vacuum, In. Hg: 5
Train Leak Rate, Cubic Ft./Min.: .001

Run Number: WET-TP-201A-2
Time Start: 1010
Time Stop: 1440
Job Number: 11032
Barometric Pressure, In. Hg: 30.10
Static Pressure, In. H_2O: -.24

EQUIPMENT CHECKS

- ✓ Pitot, Pretest
- ✓ Pitot, Posttest
- NA M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 35 Pre
- Thermocouple @ ___ Post

IDENTIFICATION NUMBERS

Meterbox: N33 Meterbox Gamma: 1.0032 Reagent Box: 0580
T/C Readout: FUST T/C Probe: R318 Umbilical: U117
Sampling Box: 33 Orsat Pump: NA Tedlar Bag: NA
Nozzle(s) Actually Used: Pitot: 5-1
No. 3004 Diameter .248 No. ___ Diameter ___

FILTER NO.	TARE
PM237	.268

Est % H_2O: 0.5

Delta $H_@$: 1.818
Delta H_t: .652
Delta H_{t+50}: .541
Delta H_{t-50}: .801
Delta P_{avg}: .1247
Meter Temp.: 90
Stack Temp.: 50

NOZZLE SELECTION CRITERIA

Desired Dia. .258

	Nozzle 1	Nozzle 2
Diameter	.248	
Nozzle Number	3004	
Delta P_{min}	.0371	
Delta P_{max}	.2850	

PYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Impinger Exit, °F	Cyclone Temp, °F
1	A-6	15	0	1028.800	.1207	58	36	.652	1.0	~~250~~	42	36
2			15	1035.56		57	38		1.0	NA	40	38
3			30	1042.52		57	36		1.0		40	36
4			45	1049.34		57	34		1.0		40	34
5			60	1056.06		56	37		1.0		40	37
6			75	1062.78		56	38		1.0		40	38
7			90	1069.50		57	36		1.0		40	36
8			105	1076.22		58	34		1.0		40	34
9			120	1082.95		58	36		1.0		40	36
10			135	1089.67		57	36		1.0		40	36
11			150	1094.34		60	40		1.0		40	40
			165	1103.05		60	39		1.0		[illegible]	39

* REMOVE HEAD BEFORE

ENTROPY

METHOD 201A (PM-10) FIELD DATA (continued)

Plant Name MARTIN MARIETTA
City/State RALEIGH, N.C
Sampling Location

Run Number WET-TP-201A-3
Time Start 1020
Time Stop 1450

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F
13	A-6	15.0	180	295.98	.1207	71	40	.649	1.0	NA	45	40
14			195	302.62		71	40		1.0		44	40
15			210	309.25		72	37		1.0		42	37
16			225	315.93		74	39		1.0		41	39
17			240	~~322.65~~ 322.65		74	40		1.0		42	40
18			255	329.35		75	39		1.0		42	39
19			270	336.06		76	36		1.0		40	36
20												
21												
22												
23												
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25												
26												
27												
28												
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29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

minutes	Vm	$(\sqrt{\Delta P})^2$	tm	ts	ΔH
[illegible]	120.458	0.01207	67	38	0.649

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name MARTIN MARIETTA
City/State RALEIGH N.C
Sampling Location TRANSFER POINT
Date 1/14/93 Team Leader JWS Techs
*Train Leak Check Vacuum, In. Hg 5
Train Leak Rate, Cubic Ft./Min. .001

Run Number WET-TP-201A-3
Time Start 1020
Time Stop 1450
Job Number 11452
Barometric Pressure, In. Hg 29.75
Static Pressure, In. H_2O -.31

EQUIPMENT CHECKS

✓ Pitot, Pretest
✓ Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
✓ Thermocouple @ 39 Pre
Thermocouple @ ___ Post

IDENTIFICATION NUMBERS

Meterbox N35 Meterbox Gamma 1.0032 Reagent Box 0580
T/C Readout FUS1 T/C Probe R201 Umbilical U117
Sampling Box 33 Orsat Pump NA Tedlar Bag NA
Nozzle(s) Actually Used: Pitot 5-1
No. 3004 Diameter .248 No. ___ Diameter ___

FILTER NO.	TARE

Est % H_2O 0.5

Delta $H_@$ 1.818
Delta H_t .649
Delta H_{t+50} .538
Delta H_{t-50} .797
Delta P_{avg} .1267
Meter Temp. 90
Stack Temp. 50

NOZZLE SELECTION CRITERIA

Desired Dia. .258

	Nozzle 1	Nozzle 2
Diameter	.248	
Nozzle Number	3004	
Delta P_{min}	.087	
Delta P_{max}	.281	

FYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F
1	A-6	15.0	0	215.602	.1207	57	39	.649	1.0	NA	40	39
2			15	222.33		57	38		1.0		42	38
3			30	226.82		59	39		1.0		44	39
4			45	235.83		60	40		1.0		42	40
5			60	242.53		61	40		1.0		44	40
6			75	249.19		62	40		1.0		45	40
7			90	255.82		64	39		1.0		44	39
8			105	262.56		67	40		1.0		44	40
9			120	269.29		67	41		1.0		45	41
10			135	276.03		69	40		1.0		45	40
			150	280.47		70	41		1.0		44	41
			165	289.35		71	41		1.0		44	41

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name MARTIN MARIETTA
City/State RALEIGH, NC
Sampling Location TRANSFER POINT
Date 1-18-93 Team Leader STA Techs
*Train Leak Check Vacuum, In. Hg 10 5
Train Leak Rate, Cubic Ft./Min. .01 .004

Run Number DRY-TP-M201A-1
Time Start 1135
Time Stop 1235
Job Number 11437
Barometric Pressure, In. Hg 29.9
Static Pressure, In. H_2O -.19

EQUIPMENT CHECKS
NA Pitot, Pretest
NA Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
— Thermocouple @ 40 Pre
— Thermocouple @ 44 Post

IDENTIFICATION NUMBERS
Meterbox N33 Meterbox Gamma 1.0032 Reagent Box 623
T/C Readout FUJI T/C Probe Umbilical U117
Sampling Box Orsat Pump NA Tedlar Bag NA
Pitot NA
Nozzle(s) Actually Used:
No. 3004 Diameter .248 No. — Diameter —

FILTER NO.	TARE
PM281	.2715

Est % H_2O 0.57

Delta $H_@$ 1.818
Delta H_t .650
Delta H_{t+50} .539
Delta H_{t-50} .799
Delta P_{avg} .1200
Meter Temp. 90
Stack Temp. 50

NOZZLE SELECTION CRITERIA
Desired Dia. .261

	Nozzle 1	Nozzle 2
Diameter	.248	
Nozzle Number		
Delta P_{min}	.0370	
Delta P_{max}	.2821	

PYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F
1	B-6	10	0	388.746	.12	92	42	.6503	1	NA	48	42
2	B-6	10	10	393.33	.12	94	39	.6503	1		48	39
3	B-6	10	20	397.81	.12	95	42	.6503	1		48	42
4	B-6	10	30	402.33	.12	98	43	.6503	1		48	43
5	B-6	10	40	406.89	.12	98	43	.6503	1		48	43
6	B-6	10	50	411.39	.12	98	45	.6503	1		48	45
7			60									
8												
9												
10												
11												
12												

* REMOVE HEAD BEFORE

ENTROPY

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name: MARTIN MARIETTA (CONT.) Job No. 11432

Sampling Location: TRANSFER POINT

Run No. WET-TP-201A-2

Date 1/11/93

Start	Stop	Comments/Problems
1010	1440	RUN COMPLETED

Sampling Team Initials DWS (Team Leader) ______ (Others)

Posttest Leak Rate .002 Sample Appearance CLEAN

Good Run (check)? ✓ YES ___ NO (if NO, explain in "Comments/Problems")

Run No. WET-TP-M5-

Date 1/14/93

Start	Stop	Comments/Problems
0830	0900	PORT CHANGE
0907	0927	POWER LOSS
0935	0945	RUN COMPLETED

Sampling Team Initials DWS (Team Leader) ______ (Others)

Posttest Leak Rate .002 Sample Appearance CLEAN / WHITE DUST

Good Run (check)? ✓ YES ___ NO (if NO, explain in "Comments/Problems")

Run No. WET-~~BG~~ TP-201A

Date 1/14/93

Start	Stop	Comments/Problems
1020	1450	RUN COMPLETED

Sampling Team Initials ______ (Team Leader) ______ (Others)

Posttest Leak Rate ______ Sample Appearance ______

Good Run (check)? ___ YES ___ NO (if NO, explain in "Comments/Problems")

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name MARTIN MARIETTA
City/State RALEIGH, NC
Sampling Location TRANSFER POINT
Date 1.18.93 Team Leader STA Techs
*Train Leak Check Vacuum, In. Hg 10 10
Train Leak Rate, Cubic Ft./Min. .008 .002

Run Number DRY-TP-M201A 3
Time Start 1550
Time Stop 1630
Job Number 11432
Barometric Pressure, In. Hg 29.9
Static Pressure, In. H_2O -.19

EQUIPMENT CHECKS

NA Pitot, Pretest
NA Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
✓ Thermocouple @ 42 Pre
✓ Thermocouple @ 44 Post

IDENTIFICATION NUMBERS

Meterbox N33
T/C Readout FUJI
Sampling Box 33
Meterbox Gamma 1.0032
T/C Probe R210
Orsat Pump NA
Reagent Box 623
Umbilical U117
Tedlar Bag NA
Pitot NA
Nozzle(s) Actually Used:
No. 3004 Diameter .248 No. Diameter

FILTER NO.	TARE
PM282	.2718

Est % H_2O 0.5%

Delta $H_@$ 1.818
Delta H_t .650
Delta H_{t+50} .539
Delta H_{t-50} .799
Delta P_{avg} .1200
Meter Temp. 90
Stack Temp. 50

NOZZLE SELECTION CRITERIA

Desired Dia. .261

	Nozzle 1	Nozzle 2
Diameter	.248	
Nozzle Number		
Delta P_{min}	.0370	
Delta P_{max}	.2821	

PYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F
1	B-6	10	0	524.541	.12	94	47	.65	1	NA	50	47
2	B-6	10	10	529.11	.12	92	45	.65	1	↓	50	45
3	B-6	10	20	533.61	.12	91	45	.65	1	↓	50	45
4	B-6	10	30	538.04	.12	93	44	.65	1	↓	50	44
5			40	542.465								
6												
7												
8												
9												
10												
11												
12												

* REMOVE HEAD BEFORE

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name MARTIN MARIETTA
City/State RALEIGH, NC
Sampling Location TRANSFER POINT
Date 1.18.93 Team Leader STA Techs
*Train Leak Check Vacuum, In. Hg 10 5
Train Leak Rate, Cubic Ft./Min. .012 .004

Run Number DRY-TP-M201A-2
Time Start 1349
Time Stop 1432
Job Number 11432
Barometric Pressure, In. Hg 29.9
Static Pressure, In. H_2O -.19

EQUIPMENT CHECKS

NA Pitot, Pretest
NA Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
✓ Thermocouple @ 45 Pre
✓ Thermocouple @ ___ Post

IDENTIFICATION NUMBERS

Meterbox N33 Meterbox Gamma 1.0032 Reagent Box 623
T/C Readout FUJI T/C Probe R207 Umbilical U117
Sampling Box 6B Orsat Pump NA Tedlar Bag NA
Nozzle(s) Actually Used: Pitot NA
No. 3004 Diameter .248 No. ___ Diameter ___

FILTER NO.	TARE
PM230	.2687

Est % H_2O 0.5

Delta $H_@$ 1.818
Delta H_t .650
Delta H_{t+50} .539
Delta H_{t-50} ~~.2~~.799
Delta P_{avg} .1200
Meter Temp. 90
Stack Temp. 50

NOZZLE SELECTION CRITERIA

Desired Dia. .261

	Nozzle 1	Nozzle 2
Diameter	.248	
Nozzle Number		
Delta P_{min}	.0370	
Delta P_{max}	.2821	

PYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Gas Meter Temp, °F	Stack Temp, °F	Orifice Setting, In. H_2O (ΔH)	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Impinger Exit, °F	Cyclone Temp, °F
1	B-6	16	0	461.884	.12	98	45	.65	1	NA	50	~~46~~ 45
2	B-6	10	10	466.51	.12	99	44	.65	1		50	44
3	B-6	10	20	471.08	.12	100	45	.65	1		50	45
4	B-6	10	30	475.74	.12	100	44	.65	1		45	44
5	B-6	10	40	480.~~48~~241	~~.12~~			~~.65~~				
6	~~B-6~~	~~10~~	~~50~~		~~.12~~			~~.65~~				
7			~~60~~									
8												
9												
10												
11												

* REMOVE HEAD BEFORE

ENTROPY

PLANT MACTIA MARIETTA JOB NO. 11432 DATE 1/11/93

CITY/STATE RALEIGH, NC TIME START 0850

SAMPLING LOC. TRANSFER POINT TIME FINISH 0957

BAROMETRIC PRESSURE, IN. HG 30.10 STATIC PRESSURE, IN. H2O -.24 OPERATOR DWS

LEAK CHECK, VACUUM IN. HG 15 ASST(S) STA

LEAK RATE, CUBIC FEET/MIN. .001

EQUIPMENT CHECKS*

✓ PITOT, PRETEST

✓ PITOT, POSTTEST

✓ NOZZLE, PRE/POST

✓ TC 36 °F PRE

✓ TC 37 °F POST

NA ORSAT SYSTEM

FILTER/XAD	TARE WT.
E3086	.5048

EQUIPMENT I.D. NUMBERS

REAGENT BOX 0716 METER BOX N3 Y 1.0032

PITOT ~~504~~-13 Cp .84 NOZ'L 110 DIA. .335

TC READOUT FUJI TC PROBE R31B UMBILICAL U117

SAMPL'G BOX 47 ORSAT PUMP NA TEDLAR BAG NA

NOMOGRAPH DATA

DELTA HG	~~1.848~~	1.818
METER TEMP	~~76~~	70
EST. %H2O	~~4.0~~	.5
C FACTOR	~~1.031~~	1.040
STACK TEMP	~~400~~	40
REF DELTA P	~~.144~~	.128
K FACTOR	~~12.790~~	14.424

LEAK CHECKS

B

E

B

E

B

E

B

E

B

E

B

E

FYRITES

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H2O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H2O ACTUAL	ORIFICE SETTING IN. H2O IDEAL	GAUGE VACUUM IN. HG	GAS TEMPERATURES °F FILTER *	IMPING. EXIT	PROBE OR COND EXIT**	✓
1	A-1	0	980.4	0.12	50	33	1.67	1.67	1.0	248	45	N/A	
2	2	5	984.02	0.14	50	32	1.97	1.97	1.0	250	42		
3	3	10	987.88	0.17	52	33	2.39	2.39	1.0	250	41		
4	4	15	992.08	0.19	54	34	2.68	2.68	1.0	248	40		
5	5	20	996.51	0.18	56	35	2.55	2.55	1.0	248	38		
6	6	25	1000.82	0.17	57	33	2.41	2.41	1.0	248	38		
7	B-1	30	1004.952	0.14	56	32	1.99	1.99	1.0	250	37		
8	2	35	1008.82	0.07	58	34	0.994	0.994	1.0	248	37		
9	3	40	1011.64	0.16	57	35	2.27	2.27	1.0	250	36		
10	4	45	1015.63	0.19	59	35	2.70	2.70	1.0	252	37		
11	5	50	1020.41	0.18	60	34	2.56	2.56	1.0	252	36		
12	6	55	1024.45	0.17	61	36	2.42	2.42	1.0	250	36		
13	END	60	1028.568										
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													

* FILTER EXIT for NJ Method 1. FILTER BOX for all other

** PROBE EXIT & ✓ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has a condense

60	48.538	0.1545	55.83	33.67	2.22
Min. (θ)	Vm	$(\sqrt{\Delta P})^2$	tm	ts	ΔH

ENTROPY

PLANT Martin Marietta　　JOB NO. 11432　　DATE 1/6/92

CITY/STATE Raleigh N.C　　TIME START 0824

SAMPLING LOC. Transfer Point　　TIME FINISH 0929

BAROMETRIC PRESSURE, IN. HG 30.10　　STATIC PRESSURE, IN. H2O -.32　　OPERATOR DWS

LEAK CHECK, VACUUM IN. HG 15　5　　ASST(S) STA

LEAK RATE, CUBIC FEET/MIN. .001　.001

EQUIPMENT CHECKS*

- ✓ PITOT, PRETEST
- PITOT, POSTTEST
- ✓ NOZZLE, PRE/POST
- ✓ TC 43 °F PRE
- ✓ TC 42 °F POST
- NA ORSAT SYSTEM

FILTER/XAD	TARE WT.
23083	.4998

EQUIPMENT I.D. NUMBERS

REAGENT BOX 0216　METER BOX N33　Y 1.0032
PITOT 4-13　C_p .84　NOZ'L 110　DIA. .385
TC READOUT FUSI　TC PROBE R318　UMBILICAL U117
SAMPL'G BOX 47　ORSAT PUMP NA　TEDLAR BAG NA

NOMOGRAPH DATA

DELTA H@	1.818
METER TEMP	70
EST. %H2O	1.0
C FACTOR	1.032
STACK TEMP	150
REF DELTA P	0.184
K FACTOR	12.781

LEAK CHECKS

B 815.738
E 815.752

PYRITES

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

	LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H2O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H2O ACTUAL	ORIFICE SETTING IN. H2O IDEAL	GAUGE VACUUM IN. HG	GAS TEMPERATURES °F FILTER *	IMPING. EXIT	PROBE OR COND EXIT**	√
	1	A-1	0	795.027	.0650	60	42	.907	.907	1	250	64	N/A	
	2	2	5	797.68	.0710	62	41	.997	.997	1	250	60		
	3	3	10	800.49	.0980	64	43	1.376	1.376	1	248	56		
	4	4	15	803.77	0.150	68	43	2.120	2.120	1	250	52		
	5	5	20	807.79	0.155	71	42	2.20	2.20	1	250	48		
0854	6	6	25	811.72	0.138	74	42	1.97	1.97	1	248	42		
0859	7	B-1	30	815.738	0.152	76	43	2.18	2.18	1	248	43		
	8	2	35	819.76	0.161	80	40	2.34	2.34	1	250	43		
	9	3	40	823.98	0.190	82	42	2.76	2.76	1	252	42		
	10	4	45	828.54	0.195	84	42	2.83	2.83	1	250	44		
	11	5	50	833.28	0.183	86	42	2.67	2.67	1	248	47		
	12	6	55	837.92	0.129	87	42	1.89	1.89	1	248	50		
0929	13	END	60	841.793										
	14													
	15													
	16													
	17													
	18													
	19													
	20													
	21													
	22													
	23													
	24													
	25													

* FILTER EXIT for NJ Method 1. FILTER BOX for all oth

** PROBE EXIT & √ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has a [illegible]

Min. (θ)	Vm	$(\sqrt{\Delta p})^2$	tm	ts	ΔH
60	46.952	.1371	74.5	42	2.02

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ENTROPY

PLANT MARTIN MARIETTA RUN NO.
CITY/STATE RALEIGH, NC JOB NO. 11432 DATE 1.18.93
SAMPLING LOC. TRANSFER POINT TIME START 9:50
BAROMETRIC PRESSURE, IN. HG 29.9 STATIC PRESSURE, IN. H2O ~~29.9~~ -.19 TIME FINISH 11:25
LEAK CHECK, VACUUM IN. HG 10 10 OPERATOR STA
LEAK RATE, CUBIC FEET/MIN. .01 .01 ASST(S)

EQUIPMENT CHECKS*	
✓	PITOT, PRETEST
✓	PITOT, POSTTEST
✓	NOZZLE, PRE/POST
✓	TC 40 °F PRE
✓	TC 39 °F POST
NA	ORSAT SYSTEM

FILTER/XAD	TARE WT.
E3082	.4967

E3082

0.4967

EQUIPMENT I.D. NUMBERS

REAGENT BOX 0219 METER BOX N33 Y 1.0032
PITOT A-13 Cp .84 NOZ'L 110 DIA. .335
TC READOUT FUJI TC PROBE A0 UMBILICAL U117
SAMPL'G BOX 47 ORSAT PUMP NA TEDLAR BAG NA

NOMOGRAPH DATA

DELTA HG	1.818
METER TEMP	90
EST. %H2O	0.5
C FACTOR	1.079
STACK TEMP	45
REF DELTA P	.124
K FACTOR	14.817

LEAK CHECKS

B
E
B
E
B
E

PYRITES

ECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H2O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H2O ACTUAL	ORIFICE SETTING IN. H2O IDEAL	GAUGE VACUUM IN. HG	GAS TEMPERATURES °F FILTER *	IMPING. EXIT	PROBE OR COND EXIT**
1	A-1	0	343.075	.08	83	40	1.18	1.18	1	250	40	NA
2	2	5	346.11	.08	83	38	1.18	1.18	1	250	40	
3	3	10	349.12	.12	85	37	1.79	1.79	1	250	40	
4	4	15	352.88	.13	86	36	1.94	1.94	1	240	40	
5	5	20	356.78	.15	89	37	2.2	2.2	1	240	40	
6	6	25	360.96	.13	88	37	1.87	1.87	1	240	44	
7	B-1	30	364.80	.15	90	37	2.5	2.5	2	240	44	
8	2	35	369.24	.12	93	37	1.81	1.81	2	250	44	
9	3	40	373.12	.10	94	37	1.51	1.51	1	250	46	
10	4	45	376.65	.14	95	38	2.12	2.12	2	250	46	
11	5	50	380.77	.13	96	38	1.97	1.97	2	250	46	
12	6	55	384.79	.12	91	39	1.80	1.80	2	250	48	
13	END	60	388.571									
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												

* FILTER EXIT for NJ Method 1. FILTER BOX for all ot

** PROBE EXIT & √ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has a conde

Min. (θ)	Vm	$(\sqrt{\Delta p})^2$	tm	ts	ΔH
60	45.496	.1197	89.42	37.5	1.82

ENTROPY

PLANT MARTIN MARIETTA

CITY/STATE RALEIGH N.C JOB NO. 11452 DATE 1/18/93

SAMPLING LOC. TRANSFER POINT TIME START 0830

BAROMETRIC PRESSURE, IN. HG 29.75 STATIC PRESSURE, IN. H2O -.51 TIME FINISH 0945

OPERATOR DWS

LEAK CHECK, VACUUM IN. HG 15 5

ASST(S)

LEAK RATE, CUBIC FEET/MIN. .001 .001

EQUIPMENT CHECKS*

✓ PITOT, PRETEST
✓ PITOT, POSTTEST
✓ NOZZLE, PRE/POST
✓ TC 35 °F PRE
✓ TC 38 °F POST
NA ORSAT SYSTEM

FILTER/XAD	TARE WT.
E3085	.5051

EQUIPMENT I.D. NUMBERS

REAGENT BOX 0216 METER BOX N33 Y 1.0032
PITOT 4-15 C_p .84 NOZ'L 110 DIA. .335
TC READOUT FUJS TC PROBE R318 UMBILICAL U117
SAMPL'G BOX 47 ORSAT PUMP NA TEDLAR BAG NA

NOMOGRAPH DATA

DELTA H@	~~1.818~~	1.818
METER TEMP	~~70~~	80
EST. %H2O	~~0.5~~	0.5
C FACTOR	~~1.090~~	1.059
STACK TEMP	~~45~~	50
REF DELTA P	~~0.129~~	.128
K FACTOR	~~14.281~~	14.406

LEAK CHECKS

B 190.786
E 190.904

PYRITES

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H2O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H2O ACTUAL	ORIFICE SETTING IN. H2O IDEAL	GAUGE VACUUM IN. HG	GAS TEMPERATURES °F FILTER *	IMPING. EXIT	PROBE OR COND EXIT**	✓
1	A-1	0	166.600	0.12	45	35	1.66	1.66	1.0	250	40	NA	
2	2	5	170.18	0.13	52	35	1.82	1.82	1.0	248	42		
3	3	10	173.89	0.15	54	35	2.11	2.11	1.0	250	44		
4	4	15	177.92	0.21	58	36	2.97	2.97	1.0	248	45		
5	5	20	182.67	0.19	60	37	2.67	2.67	1.0	246	41		
6	6	25	186.91	0.14	62	37	1.99	1.99	1.0	248	40		
7	B-1	30	190.788	0.16	59	37	2.26	2.26	1.0	250	41		
8	2	35	194.99	0.17	60	36	2.41	2.41	1.0	248	42		
9	3	40	199.13	0.15	62	37	2.13	2.13	1.0	250	44		
10	4	45	203.03	0.18	63	37	2.56	2.56	1.0	250	45		
11	5	50	207.51	0.16	61	38	2.26	2.26	1.0	248	45		
12	6	55	211.55	0.15	62	39	2.12	2.12	1.0	248	46		
13	END	60	215.487	-	-	-	-	-	-	-	-		
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													

* FILTER EXIT for NJ Method 1. FILTER BOX for all other:

** PROBE EXIT & ✓ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has a c[illegible]se

Min. (θ)	Vm	$(\sqrt{\Delta p})^2$	tm	ts	ΔH
60	101.771	.1583	63.17	36.58	2.22

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ENTROPY

PLANT Martin Marietta RUN NO. [illegible]

CITY/STATE Raleigh, NC JOB NO. 11432 DATE 1-18-93

SAMPLING LOC. Transfer Point TIME START ~~9~~ 144

BAROMETRIC PRESSURE, IN. HG 29.9 STATIC PRESSURE, IN. H_2O -.19 TIME FINISH 1547

LEAK CHECK, VACUUM IN. HG 10 10 OPERATOR STA

LEAK RATE, CUBIC FEET/MIN. .002 .004 ASST(S)

EQUIPMENT CHECKS*

- ✓ PITOT, PRETEST
- ✓ PITOT, POSTTEST
- ✓ NOZZLE, PRE/POST
- ✓ TC 42 °F PRE
- ✓ TC 46 °F POST
- NA ORSAT SYSTEM

FILTER/XAD	TARE WT.
E3089	.5019

E3084

0.5019

EQUIPMENT I.D. NUMBERS

REAGENT BOX 0219 METER BOX N33 Y 1.0032

PITOT 4-13 C_p .84 NOZ'L 110 DIA. .3375

TC READOUT Fuji TC PROBE 40 UMBILICAL U117

SAMPL'G BOX 47 ORSAT PUMP NA TEDLAR BAG NA

NOMOGRAPH DATA

DELTA HG	1.818
METER TEMP	90
EST. %H2O	0.5
C FACTOR	1.074
STACK TEMP	45
REF DELTA P	.124
K FACTOR	14.817

LEAK CHECKS

B 8AM	B
E	E
B	B
E	E
B	B
E	E

FYRITES

ECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H2O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H2O ACTUAL	ORIFICE SETTING IN. H2O IDEAL	GAUGE VACUUM IN. HG	GAS TEMPERATURES °F FILTER *	IMPING. EXIT	PROBE OR COND EXIT**
1	A-1	0	480.241	.07	90	43	1.04	1.04	1	230	40	NA
2	2	5	483.14	.09	90	42	1.34	1.34	1	230	40	
3	3	10	486.39	.09	90	43	1.34	1.34	1	240	50	
4	4	15	489.64	.12	90	45	1.77	1.77	1	240	50	
5	5	20	493.28	.10	91	44	1.48	1.48	1	240	50	
6	6	25	496.67	.14	92	43	2.1	2.1	1	240	50	
7	B-1	30	500.69	.15	96	43	2.2	2.2	1	245	55	
8	2	35	504.77	.13	98	44	1.95	1.95	2	245	55	
9	3	40	508.71	.13	100	43	1.96	1.96	2	245	55	
10	4	45	512.62	.14	100	44	2.1	2.1	2	245	55	
11	5	50	516.71	.13	100	43	1.96	1.96	2	240	55	
12	6	55	520.67	.12	102	45	1.81	1.81	2	240	55	
13	END	60	524.263									
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												

* FILTER EXIT for NJ Method 1. FILTER BOX for all o

** PROBE EXIT & ✓ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has a cond

Min. (θ)	Vm	$(\sqrt{\Delta p})^2$	tm	ts	ΔH
60	44.022	.1162	94.42	43.5	1.75

ENTROPY

PLANT Martin Marietta RUN NO. [illegible]

CITY/STATE Raleigh, NC JOB NO. 11432 DATE 1.18.93

SAMPLING LOC. Transfer Point TIME START 1243

BAROMETRIC PRESSURE, IN. HG 29.9 STATIC PRESSURE, IN. H2O -.19 TIME FINISH 1345

LEAK CHECK, VACUUM IN. HG 10 10 OPERATOR STA

LEAK RATE, CUBIC FEET/MIN. .006 .004 ASST(S)

EQUIPMENT CHECKS*

- ✓ PITOT, PRETEST
- ✓ PITOT, POSTTEST
- ✓ NOZZLE, PRE/POST
- ✓ TC 47 °F PRE
- ✓ TC 47 °F POST
- NA ORSAT SYSTEM

FILTER/XAD	TARE WT.
E3081	.4982

E3081

0.4982

EQUIPMENT I.D. NUMBERS

REAGENT BOX 0219 METER BOX N33 Y 1.0037

PITOT 4-3 C_p .84 NOZ'L 110 DIA. .335

TC READOUT FUJI TC PROBE R154 UMBILICAL U117

SAMPL'G BOX 35 ORSAT PUMP NA TEDLAR BAG NA

NOMOGRAPH DATA

DELTA HG	1.818
METER TEMP	95
EST. %H2O	.5
C FACTOR	1.079
STACK TEMP	45
REF DELTA P	.124
K FACTOR	14.817

LEAK CHECKS

B
E
B
E
B
E

B
E
B
E
B
E

PYRITES

*[PITOT: ...]ECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H2O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H2O ACTUAL	ORIFICE SETTING IN. H2O IDEAL	GAUGE VACUUM IN. HG	GAS TEMPERATURES °F FILTER *	IMPING. EXIT	PROBE OR COND EXIT**
1	A-1	0	415.485	.07	92	42	1.05	1.05	1	255	46	NA
2	2	5	418.92	.08	93	47	1.18	1.18	1	255	48	
3	3	10	421.98	.12	94	45	1.79	1.79	1	255	48	
4	4	15	425.67	.14	94	44	2.1	2.1	2	250	48	
5	5	20	429.75	.15	96	44	2.2	2.2	3	250	50	
6	6	25	433.93	.15	98	42	2.3	2.3	3	245	50	
7	B-1	30	438.08	.15	100	44	2.3	2.3	3	240	50	
8	2	35	442.27	.13	100	43	1.96	1.96	3	240	50	
9	3	40	446.23	.13	100	46	1.95	1.95	3	240	50	
10	4	45	450.15	.12	100	46	1.80	1.80	3	240	55	
11	5	50	455.92	.14	100	46	2.1	2.1	3	245	55	
12	6	55	458.06	.12	100	46	1.80	1.80	3	245	55	
13		60	461.761									
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												

* FILTER EXIT for NJ Method 1. FILTER BOX fo[r] [...] o[...]

** PROBE EXIT & ✓ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has [...]nd[...]

60	45.776	.1236	97.25	44.58	1.88
Min. (Θ)	Vm	$(\sqrt{\Delta p})^2$	tm	ts	ΔH

ENTROPY

Appendix C. Calibration Data Sheets

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name MARTIN MARIETTA Job No. 11432

Sampling Location TRANSFER POINT

Start	Stop	Comments/Problems
1349	1428	BELT STOPPED.
1431	1432	

Run No. DRY TP M201A-3

Date 1.18.93

Sampling Team Initials STA (Team Leader) ________ (Others)

Posttest Leak Rate .004 Sample Appearance ________

Good Run (check)? ✓ YES ___ NO (if NO, explain in "Comments/Problems")

Start	Stop	Comments/Problems
1444	1514	PORT CHANGE
1517	1547	

Run No. DRY·TP·M5-3

Date 1.18.93

Sampling Team Initials STA (Team Leader) ________ (Others)

Posttest Leak Rate .004 Sample Appearance ________

Good Run (check)? ✓ YES ___ NO (if NO, explain in "Comments/Problems")

Start	Stop	Comments/Problems
1556	1630	END TEST.

Run No. DRY-TP-M201A-3

Date 1.18.93

Sampling Team Initials STA (Team Leader) ________ (Others)

Posttest Leak Rate .002 Sample Appearance ________

Good Run (check)? ✓ YES ___ NO (if NO, explain in "Comments/Problems")

F-0006 rev. 10-91

ENTROPY

ISOKINETIC METERBOX POSTTEST CALIBRATION

METERBOX NO. N33

Date 1-20-93 Calibrated By PJ Job Number 11432

Barometric Pressure (P_b) 30.08 (In. Hg) Meterbox Vacuum 15 (In. Hg)

Standard Meter No. 3586003 Standard Meter Coeff. (Y_{ds}) .9901

STANDARD METER			METERBOX METERING SYSTEM				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (Θ) Min.	Orifice Setting (ΔH) In. H_2O	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	ΔH@ In. H_2O
5.830	72	8	1.5	6.121	93.5	.9776	1.561
5.098	↓	7	↓	5.379	96.5	.9780	1.555
5.103	↓	7	↓	5.382	98	.9811	1.548
					Average	.9789	1.555

Fulltest Y_d 1.0033 Date 12-1-92 % Dev. 2.4 Allowed Dev.: ± 5%

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + (\Delta H / 13.6))}$$

$$\Delta H@ = \frac{0.0319 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \Theta}{Y_{ds} * V_{ds}} \right]^2$$

R-0031 rev. 7-92

ISOKINETIC METERBOX [illegible]

Meterbox No. N-33 Date 12-1-92 Calibrated By P. Judd

Barometric Pressure (P_b) 29.49 (In. Hg) Meterbox Vacuum 0 (In. Hg)

Standard Meter No. 1054682 Standard Meter Coeff. (Y_{ds}) .9961

STANDARD METER			METERBOX METERING SYSTEM				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (Θ) Min.	Orifice Setting (ΔH) In. H_2O	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	ΔH@ In. H_2O
5.051	70	13	0.5	5.241	90.5	.9959	1.841
5.035		13	0.5	5.227	92.5	.9990	1.846
5.461		7	2.0	5.669	96	1.0016	1.809
5.448		7	2.0	5.645	98.5	1.0080	1.809
6.025		5	4.8	6.242	101.5	1.0066	1.802
6.015		5	4.8	6.256	104.5	1.0080	1.798
					Average	1.0032	1.818

1. Coefficient range: 0.97-1.03.
2. Coefficient tolerance: for individual runs, ± 0.02 from average.
3. ΔH@ range: 1.6-2.0.
4. ΔH@ tolerance: ≤ 0.15 In. H_2O over ΔH range of 0.4 In.-4.0 In.

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + (\Delta H / 13.6))}$$

$$\Delta H@ = \frac{0.0319 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \Theta}{Y_{ds} * V_{ds}}\right]^2$$

STANDARD ...

Meter Number 3586003

Date 9-3-92 Auditor(s) MB c/PJ Barometric Press. (P_{bar}) 29.88

Spirometer Gas Volume Cubic Feet (V_s)	Spirometer Temp. °F (t_s)	Dry Gas Meter Gas Volume Cubic Feet (V_{ds})	Dry Gas Meter Temp. °F (t_{ds})	Pressure In. H_2O (ΔP)	Time Min. (Θ)	Test Flow Rate cfm	Calc'd Flow Rate cfm (Q)	Meter Coeff. Gamma (Y_{ds})
2.696	77	2.733	79	-.43	10	0.23	.2646	.9911
2.723	77	2.720	79	-.44		0.23	.2673	1.0060
2.796	78.8	2.789	79	-.44		0.23	.2735	1.0040
4.117	78.8	4.184	79	-.69		0.55	.3661	.9859
4.144	79.7	4.158	79	-.70		0.55	.4047	.9970
4.162	80.6	4.153	79	-.71		0.55	.4058	1.0010
4.991	80.6	5.018	80	-.89		0.80	.4866	.9957
5.009	80.6	5.005	80	-.89		0.80	.4884	1.0019
4.945	81.5	5.011	80	-.89		0.80	.4814	.9863
7.978	82.4	8.034	80.5	-1.80		2.10	.7753	.9940
7.869	83.3	8.020	81	-1.75		2.10	.7634	.9812
7.951	84.4	8.062	81	-1.75		2.10	.7701	.9847
10.155	84.2	10.311	81	-2.80		3.45	.9835	.9859
10.118	84.2	10.292	81.5	-2.80		3.45	.9800	.9850
10.109	84.2	10.280	82	-2.80		3.45	.9791	.9862
11.940	84.2	12.174	82	-3.80		4.70	1.1564	.9860
11.867	84.2	12.118	82	-3.80		4.70	1.1494	.9845
11.885	84.2	12.131	82	-3.80		4.70	1.1511	.9758
13.078	84.2	13.311	82	-4.50		5.80	1.2667	.9895
13.024	84.2	13.309	82	-4.50		5.80	1.2614	.9855
13.097	84.2	13.387	82	-4.50		5.80	1.2685	.9853
							Average	.9901

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_{bar})}{(V_{ds})\ (t_s + 460)\ [P_{bar} + (\Delta P / 13.6)]}$$

$$Q = (17.64)\ \left[\frac{(P_b)\ (V_s)}{(t_s + 460)\ (\Theta)}\right]$$

R-0047 rev. 9-91

ENTROPY

STANDARD DRY GAS METER CALIBRATION

Meter Number 105468 2

Date 7-28-92 Auditor(s) MBC/PJ Barometric Press. (P_{bar}) 29.66

Spirometer Gas Volume Cubic Feet (V_s)	Spirometer Temp. °F (t_s)	Dry Gas Meter Gas Volume Cubic Feet (V_{ds})	Dry Gas Meter Temp. °F (t_{ds})	Pressure In. H_2O (ΔP)	Time Min. (θ)	Test Flow Rate cfm	Calc'd Flow Rate cfm (Q)	Meter Coeff. Gamma (Y_{ds})
2.760	75.2	2.764	79.5	-.27	10	0.23	.2698	1.0071
2.732	75.2	2.774	79	-.28		0.23	.2671	.9926
2.714	76.1	2.730	78.5	-.27		0.23	.2649	.9993
4.126	77	4.167	78	-.47		0.55	.3654	.9931
4.162	77	4.155	78	-.49		0.55	.4055	1.0048
4.135	77	4.135	77.5	-.50		0.55	.4029	1.0021
4.891	77	4.932	77	-.61		0.80	.4765	.9931
4.909	77	4.912	77	-.63		0.80	.4783	1.0009
4.891	77	4.932	77	-.61		0.80	.4675	.9950
7.796	77	7.850	77	-1.30		2.10	.7596	.9982
7.796	77	7.865	77.5	-1.30		2.10	.7596	.9954
7.805	77	7.842	78	-1.30		2.10	.7605	1.00[illegible]
9.945	78.8	10.042	78.5	-2.00		3.45	.9657	.9948
9.927	78.8	10.013	78	-2.00		3.45	.9640	.9904
9.945	78.8	10.042	78	-2.00		3.45	.9657	.9938
11.603	78.8	11.724	79	-2.60		4.70	1.1267	.9965
11.576	78.8	11.726	79	-2.60		4.70	1.1241	.9939
11.521	78.8	11.694	79	-2.60		4.70	1.1187	.9891
12.733	78.8	12.910	79	-3.10		5.80	1.2364	.9942
12.778	78.8	12.983	79	-3.20		5.80	1.2408	.9924
12.714	78.8	12.928	79	-3.15		5.80	1.2346	.9916
							Average	.9961

$$Y_{ds} = \frac{(V_s)\,(t_{ds} + 460)\,(P_{bar})}{(V_{ds})\,(t_s + 460)\,[P_{bar} + (\Delta P / 13.6)]}$$

$$Q = (17.64)\left[\frac{(P_b)\,(V_s)}{(t_s + 460)\,(\theta)}\right]$$

R-0047 rev. 9-91

ENTROPY

NOZZLE NUMBER: 207

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
11-30-82	TWA	.309	.310	.310	.310	.309	0.310"
11-18-83	FLO	.314	.314	.312	.315	.314	0.314"
3-8-84	JNC	.312	.312	.311	.312	.312	0.312"
7 3 84	GMC	.305	.306	.304	[illegible]	.304	0.304"
1/3/85	ATM	.313	.310	.310	.311	.311	0.311"
3 25 85	MRH	.307	.305	.305	.307	.306	0.307"
7-19-85	RWB	.305	.306	.307	.305	.303	0.305"
2.26.86	BB	•310	• 311	• 308	• 309	• 307	0.309
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.308	[illegible]
11-5-86	KB	.312	.310	.311	.310	.312	0.311
12-23-86	BOR	.313	.316	.314	.313	.315	.314
1/13/87	JE	.313	.311	.312	.310	.310	0.311
3/10/87	ST	.312	.313	.315	.312	.314	[illegible]
3/13/87	SSH	.305	.306	308	.305	.307	.306
3-20-87	SH	.310	.311	.311	.310	.309	.310
5-14-87	J.E.	.310	.306	.308	.310	—	.309
9/1/87	CJ.E	.316	.315	.317	.314	.317	.317
4/13/88	J.E.	.317	.315	.315	.314	.317	0.317
9/1/88	BKG	.317	.316	.314	.315	.315	.315
4/10/89	BKG	.320	.317	.319	.318	.320	.319
7/18/89	BKG	.320	.321	.319	.321	.322	.321
8-22-89	JRW	.312	.309	.312	.310	.312	.311
3.27.90	MLH	.311	.313	.314	.313	.313	.313
3-8-91	TKR	~~.321~~	~~.322~~	-MISSING -			
3-20-91	WLS	.314	.317	.315	.314	.315	.315

ENTROPY ENVIRONMENTALISTS, INC.

NOZZLE NUMBER: 201

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Avera[ge]
11-30-82	TWA	.177	.176	.176	.175	.176	0.176"
11-18-83	PLO	.178	.177	.177	.176	.177	0.177"
3-8-84	JNC	.175	.177	.174	.176	.174	0.175"
7-5-84	GML	.174	.173	.174	.173	.174	0.174"
2-1-85	SSH	.174	.173	.173	.174	.175	0.174"
~~7-19-85~~	~~RWB~~						
2-26-86	BB	.174	.175	.176	.177	.174	0.175
7-1-86	RB	.170	.171	.172	.170	.170	.171
11-5-86	RB	.171	.173	.170	.171	.172	0.171
1/13/87	JE	.174	.176	.174	.175	.176	0.175"
3/11/87	ST	.176	.178	.178	.178	.174	.177
3/13/87	SSH	.169	.171	.171	.167	.171	0.170
3-20-87	SH	.169	.172	.171	.172	.173	.171
5-14-87	J.E	.169	.171	.170	.173	—	0.171
9/1/87	J.E	.167	.169	.171	.171	.171	0.170
4/12/88	JE	.169	.169	.172	.173	.169	0.170
9/1/88	BKG	.182	.182	[illegible]	.183	.184	.18[illegible]
3/27/89	BKG	.184	.186	.185	.187	.186	.186
4/10/89	BKG	.186	.188	.186	.188	.187	.187
7/18/89	BKG	.189	.188	.188	.189	.189	.189
8-22-89	JRW	.177	.178	.178	.179	.176	.178
10-20-89	JRW	.177	.180	.179	.180	.177	.179
3-22-90	MLH	.178	.174	.178	.176	.177	.177
3-8-91	TRR	.182	.180	.182	.181	.181	.181

ENTROPY ENVIRONMENTALISTS, INC.

NOZZLE NUMBER: 110

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
11-30-82	TWA	.370	.372	.372	.370	.371	0.371"
8-31-83	ST	.371	.371	.370	.369	.370	0.370"
11-15-83	PLO	.374	.374	.372	.373	.375	0.374"
3/8/84	JNC	.370	.370	.372	.372	.371	0.371"
7 5 84	TTM	.374	.376	.374	.373	.374	0.374"
3 28 85	JDE	.372	.371	.369	.368	.371	[illegible]
10.23.85	GMC.	.374	.375	.375	.377	.374	0.375
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-13-86	JDE	.373	.375	.376	.374	.376	0.375
7-10-86	BB	.368	.371	.371	.369	.370	.370
9-18-86	BB	.370	.371	.371	.372	.369	0.371
1/19/87	JE	.371	.374	.375	.375	.372	0.373
3/10/87	ST	.373	.372	.372	.372	.373	0.372
3/13/87	SSH	.366	.365	.365	.365	.366	0.365
6/4/87	JE	.370	.372	.372	.370	.371	.371
8/26/88	BKG	Replaced					
1/27/89	BKG	Taken out of service			8/26/88		
8-22-89	JRW	Taken out of service			8-26-88		
	"						
1-5-90	JRW	.339	.340	.339	.340	.339	.339
8-28-90	WLS	.335	.337	.337	.335	.336	.336
3-6-91	TRR	.336	.335	.334	.336	.335	.335

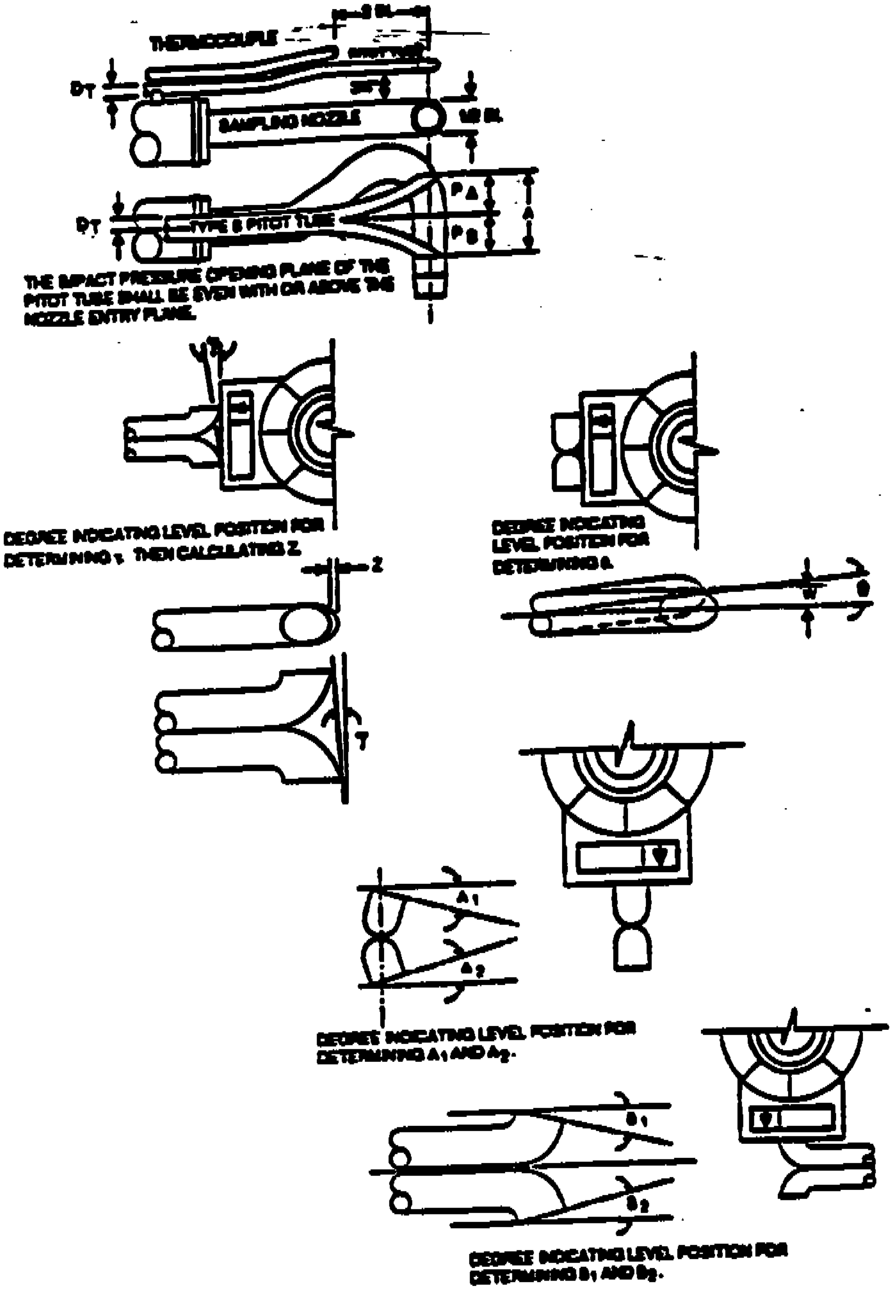
Nozzle replaced 1-5-89.

ENTROPY ENVIRONMENTALISTS, INC.

NOZZLE NUMBER: 210

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
11-30-82	TWA	.368	.370	.368	.368	.368	0.368"
11-18-83	PLO	.368	.370	.367	.367	.369	0.368"
3-8-84	JNC	.366	.366	.369	.369	.367	0.367"
7 5 84	GML	.367	.366	.367	.36[illegible]	.365	0.366
1-3-85	ATM	.368	.370	.370	.369	.370	0.369"
3-25-85	MRW	.364	.364	.367	.366	.368	0.364"
2-26-86	BB	.367	.369	.366	.366	.368	0.367
7-1-86	BB	.369	.368	.367	.366	.367	0.367
11-5-86	BB	.365	.367	.365	.366	.365	0.366
1/13/87	JE	.369	.369	.371	.368	.370	0.369
3/10/87	ST	.371	.370	.370	.369	.369	0.370
3/13/87	SSH	.364	.363	.363	.362	.362	0.363
3-20-87	SH	.368	.368	.369	.368	.368	.368
5-12-87	J.E.	.368	.369	.369	.369	—	.369
9/1/87	J.E.	.368	.365	.369	.368	.367	.367
4/13/88	J.E.	.365	367	.365	.363	.364	.365
9/1/88	BKG	.374	.373	.374	.374	.375	.37[illegible]
4/10/89	BKG	.375	.377	.376	.379	.377	.377
7/18/89	BKG	.377	.376	.378	.376	.376	.377
8-22-89	JRW	.368	.371	.369	.371	.369	.370
3-27-90	MLH	.370	.367	.368	.370	.369	.369
3-8-91	TRR	.371	.370	.373	.372	.370	.371

ENTROPY ENVIRONMENTALISTS, INC.



level?	yes
obstructions?	NONE
damaged?	NONE
$-10° < \alpha_1 < +10°$	1°
$-10° < \alpha_2 < +10°$	0
$-5° < B1 < +5°$	0
$-5° < B2 < +5°$	1°
γ	1°
θ	0
A	.916
$1.05\ D_t < P_a < 1.5\ D_t$	.462
$1.05\ D_t < P_b < 1.5\ D_t$	.454
$3/16" < D_t < 3/8"$	.375
$A \tan \gamma < 0.125"$	.014
$A \tan \theta < 0.03125"$	0
$P_a = P_b \pm 0.063"$	yes .012

See 40 CFR 60, Vol. 42 No. 160 EPA Method 2. Verify the minimum 2-inch setback of the thermocouple and the minimum 3/4-inch separation between the pitot tube and the nozzle as shown at the top of this page.

Comments: ______________________________

I certify that pitot tube/probe number 4-13 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube calibration factor of 0.84.

Signature W. L. Shull

Date 12-30-91

R-0028 rev. 3/90

ENTROPY

NOZZLE NUMBER 3004

Date	Calib. By	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
3-6-92	JPW	.250	.247	.248	.248	.249	.248

Note: 1. All diameters measured in inches.
2. Maximum 0.004 inches from lowest to highest diameter.

R-0033a rev. 3-91

ENTROPY

THERMOCOUPLE CALIBRATION

Thermocouple No.: R318

Date: 1/10/91 Calibrated By: RDS

Barometric Pressure, Inches Hg: 29.30 Ambient Temperature, °F: 74.0

Mercury-In-Glass Thermometer I.D. No.: 7121K

Calibration System Used	Potentiometer I.D. Number	Reference Thermometer Temperature T_o °F	Reference Thermometer Temperature T_c °F	Mean Temperature of Hg Column T_m °F	Thermocouple Thermometer Temperature T_t °F	Temperature Diff., % (Allowable: ≤ 1.5 %)
Ice Bath	F69	32.0	31.96	73.0	34.8	-.58
		32.0	31.96	73.0	35.2	-.66
		32.0	31.96	73.0	33.4	-.29
Boiling Water	F69	217.0	218.65	124.0	213.0	.83
		217.0	218.54	130.0	212.6	.88
		217.0	218.51	132.0	212.4	.90
Boiling Oil	F69	388.0	394.89	180.0	384.4	1.23
		388.0	394.76	184.0	384.2	1.24
		388.0	394.49	192.0	384.6	1.16

Corrected Temperature $= T_c = T_o + [(.00009) * (T_o - 20) * (T_o - T_m)]$

Temperature Difference $= \dfrac{[(T_c + 460) - (T_t + 460)]}{(T_c + 460)} * 100$

R-0023 Rev. 8-90

THERMOCOUPLE CALIBRATION

Thermocouple No.: R154

Date: 3/06/91

Calibrated By: RDS

Barometric Pressure, Inches Hg: 29.33

Ambient Temperature, °F: 70.0

Mercury-In-Glass Thermometer I.D. No.: 7121K

Calibration System Used	Potentiometer I.D. Number	Reference Thermometer Temperature T_o °F	T_c °F	Mean Temperature of Hg Column T_m °F	Thermocouple Thermometer Temperature T_t °F	Temperature Diff., % (Allowable: ≤ 1.5 %)
Ice Bath	F43	32.0	31.96	66.0	33.2	-.25
		32.0	31.96	66.0	33.4	-.29
		32.0	31.96	66.0	32.6	-.13
Boiling Water	F43	215.0	217.02	100.0	210.2	1.01
		215.0	216.98	102.0	210.0	1.03
		215.0	216.98	102.0	211.2	.8[illegible]
Boiling Oil	F43	380.0	386.45	181.0	381.2	.62
		386.0	392.75	181.0	381.0	1.38
		380.0	386.45	181.0	381.2	.62

Corrected Temperature $= T_c = T_o + [(.00009) * (T_o - 20) * (T_o - T_m)]$

Temperature Difference $= \dfrac{[(T_c + 460) - (T_t + 460)]}{(T_c + 460)} * 100$

R-0023 Rev. 8-90

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. ________

Container Type (Check) R✓ Reagent Box ___Cooler ___Other ________

Plant Name/Address Martin Marietta, Raleigh, NC

Job No. 11432 Sampling Method 201A (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
1910	1/4/93	11:09	S	Mary Mullins	
	/ /		B		
319 B	1/18/93	7:20	S	William K Kirk JR	Prepare 3 dry runs
	1-27-93	1125	B	Cathy L. Thompson	
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Received by Sample Custodian **Seal Intact?

[signature] 1-27-93 1458 ✓Yes ___No

Signature Date Time

As Applicable:
All liquid levels at mark (check)? ___ YES ___ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by ________________ Date ________ Time ________

CONDENSATE SAMPLES put in refrige. by ________________ Date ________ Time ________

REMARKS ________________________________

L-0023 rev. 10-91

ENTROPY

Appendix D. Sampling Log and Chain-of-Custody Records

RECORD OF CUSTODY, CONTAINER NO. ____________

Container Type ~~(check)~~ R✓ Reagent Box ___Cooler ___Other ____________

Plant Name/Address Martin Marietta

Job No. 11432 Sampling Method M201-A (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
383	1/4/93	10:40	S	Mary Mullins	
	1-6-93	8:05	B	[illegible]	Charge Traus
756	1-27-93	1115	S	Cathy L. Thompson	
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Received by Sample Custodian

[illegible] 1-27-93 1456

Signature Date Time

**Seal Intact? ✓ Yes ___No

As Applicable:
All liquid levels at mark (check)? ___ YES ___ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by ____________ Date ________ Time ________

CONDENSATE SAMPLES put in refrige. by ____________ Date ________ Time ________

REMARKS ____________

L-0023 rev. 10-91

ENTROPY

Box No. 623 Assembly Date 1/4/93 Assembled By mm

Plant Name/address Martin Marietta - Raleigh RTP Job No. 11432

Sampling Loc. Transfer Point Method M201A

Individual Tare Of Reagent 200 (Ml)(gm) Of DI

Individual Tare Of Reagent - (Ml)(gm) Of

Individual Tare Of Reagent ____ (Ml)(gm) Of

Individual Tare Of Sil. Gel ~200 Gm ____ other (specify)

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
Dry-TP-M201A-1	1-18-93	PM281	0.2715	✓	CLT	1-18-93	5	✓	WKK
				Filter Appearance*					
				Reagents Appearance*					
Dry-TP-M201A-2	1-18-93	PM230	0.2687	✓	CLT	1-18-93	∅	✓	WKK
				Filter Appearance*					
				Reagents Appearance*					
Dry-TP-M201A-3	1-18-93	PM282	0.2718	✓	CLT	1-18-93	10	✓	WKK
				Filter Appearance*					
				Reagents Appearance*					
				Filter Appearance*					
				Reagents Appearance*					

* Use "REMARKS" section if needed.

@ All liquid levels at mark? (check) YES ___ NO ___ (estimate loss if not at mark; use "REMARKS" section).

REMARKS ____

Custodian ____ Date ____ Time ____

Q-1002 rev. 10-91

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. ____________

Container Type ~~(check)~~ R✓ Reagent Box ___Cooler ___Other____________

Plant Name/Address Martin Marietta

Job No. 11432 Sampling Method M5 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
1691	1/4/93	10:42	S	Mary T Mullins	
	1/6/93	8:44	B	Todd Brozell	Chg Trains
1958	1-27-93	1120	S	Cathy L. Thompson	
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Received by Sample Custodian **Seal Intact?

[signature] 1-27-93 1455 ✓Yes ___No

Signature Date Time

As Applicable:
All liquid levels at mark (check)? ___ YES ___ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by ____________________ Date ________ Time ________

CONDENSATE SAMPLES put in refrige. by ____________________ Date ________ Time ________

REMARKS ____

L-0023 rev. 10-91

ENTROPY

Box No. C580 Assembly Date 1/4/93 Assembled By mm

Plant Name/address Martin Marietta Job No. 11432

Sampling Loc. ~~Martin Marietta~~ Transfer Pt. Method M201A

Individual Tare Of Reagent 200 (Ml)(gm) Of DI

Individual Tare Of Reagent - (Ml)(gm) Of

Individual Tare Of Reagent ____ (Ml)(gm) Of

Individual Tare Of Sil. Gel ~200 Gm ____ other (specify)

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
WET-TP-M201A-1	~~1/6/93~~ CLT 1-7-93	PM277	.2341	✓	CLT	1-7-93	10	✓	CLT
WET-TP-M201A-2	1-11-93	PM237	.2681	✓	CLT	1-11-93	10	✓	CLT
WET-TP-M201A-3	1-14-93	PM280	0.2724	✓	CLT	1-14-93	10	✓	CLT

Run 1 — Filter Appearance*: Light, grey particulate

Reagents Appearance*: Clear

Run 2 — Filter Appearance*: same

Reagents Appearance*: same

Run 3 — Filter Appearance*: Same

Reagents Appearance*: same

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

@ All liquid levels at mark? (check) YES ___ NO ___ (estimate loss if not at mark; use "REMARKS" section).

REMARKS ____

Custodian ____ Date ____ Time ____

Q-1002 rev. 10-91

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. ________

Container Type ~~(check)~~ R✓ Reagent Box ___ Cooler ___ Other ________

Plant Name/Address Martin Marietta

Job No. 11432   Sampling Method M5   (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
396	1/4/93	10:41	S	Mary Mullins	
			B		
~~396~~	1/18/93	7:00	B	William K Kirk Jr	OPEN TO charge trains
			S		for 3 dry runs
907	1-27-93	1130	S	Cathy L. Thompson	
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By   ** Use "REMARKS" Section if more space needed.

Received by Sample Custodian   **Seal Intact?

[signature]   1-27-93   1453   ✓ Yes ___ No

Signature   Date   Time

As Applicable:
All liquid levels at mark (check)? ___ YES ___ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by ________ Date ________ Time ________

CONDENSATE SAMPLES put in refrige. by ________ Date ________ Time ________

REMARKS ________

L-0023 rev. 10-91

ENTROPY

Box No. C219 Assembly Date 1/4/93 Assembled By MM

Plant Name/address Martin Marietta Job No. 11432

Sampling Loc. Transfer Pt. Method M5

Individual Tare Of Reagent 200 (Ml)(gm) Of DI

Individual Tare Of Reagent - (Ml)(gm) Of

Individual Tare Of Reagent (Ml)(gm) Of

Individual Tare Of Sil. Gel ~200 Gm other (specify)

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
Dry-TP-M5-1	1-18-93	E3082	0.4967	✓	WKK	1-18-93	10		

Filter Appearance*

Dark gray, heavy partic.

Reagents Appearance*

Clear

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
Dry-TP-M5-2	1-18-93	E3081	0.4982	✓	WKK	1-18-93	10		

Filter Appearance*

Same

Reagents Appearance*

Same

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
Dry-TP-M5-3	1-18-93	E3084	0.5019	✓	WKK	1-18-93	10		

Filter Appearance*

Same

Reagents Appearance*

Same

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

@ All liquid levels at mark? (check) YES ___ NO ___ (estimate loss if not at mark; use "REMARKS" section).

REMARKS

Custodian Date Time

Q-1002 rev. 10-91

ENTROPY

Please include this form with the final (typed) results, and whenever the final results are faxed to Entropy.

The samples referenced in Entropy Environmentalists Inc. RFA or purchase order No. E3351-11254 were shipped by Entropy on 3/29/93 (date) via hand (mode) to EEI (laboratory) by J. Bruce Nemet (signature)

The samples were received for analysis on 03/29/93 (date) at EET (laboratory) by D. Kinchelo (signature)

As applicable, note any broken seals, leakage, spillage, or damage to samples. If discrepancy, specify seal No., jar No., sample No., etc.

SAMPLE TRANSFER RECORD OF CUSTODY

Please include this form with the final (typed) results, and whenever the final results are faxed to Entropy.

The samples referenced in Entropy Environmentalists Inc. RFA or purchase order No. 3169-1432-13 were shipped by Entropy on 1-27-93 (date) via pers. custody (mode) to GEI (laboratory) by John [signature] (signature)

The samples were received for analysis on 02/03/93 (date) at EEI (laboratory) by D. Kincheloe (signature)

As applicable, note any broken seals, leakage, spillage, or damage to samples. If discrepancy, specify seal No., jar No., sample No., etc.

L-0012 rev. 8-92

ENTROPY

MOISTURE ANALYTICAL RESULTS

Plant Name Martin-Marietta Job No. 11432

City/State Raleigh, NC Sampling Loc. Transfer Pt.

Run Number	Wet-TP-MZ01A-1	Wet-TP-MZ01A-2	Wet-TP-MZ01A-3
Sampling Date	1-7-93	1-11-93	1-14-93
Analysis Date	1-7-93	1-11-93	1-14-93
Analyst	CLT	CLT	CLT

Reagent 1 (200 mL DI H_2O)			
Final Weight, g	595.2	584.5	585.1
Tared Weight, g	585.5	584.4	579.8
Water Catch, g	9.7	0.1	5.3
Reagent 2 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g	9.7	0.1	5.3
Silica Gel			
Final Weight, g	239.4	233.0	237.5
Tared Weight, g	220.1	210.5	219.4
ADSORBED WATER, g	19.3	22.5	18.1
TOTAL WATER COLLECTED, g	29.0	22.6	23.4

Balance No. ______ Type (✓) Triple Beam ✓ Electronic ___ Reagent Box No. 0580

Balance located in stable, draft-free area (✓)? Yes ✓ No ___ (If "No", explain below.)

Comments ______

L-0036 rev. 7-92

ENTROPY

Appendix E. Moisture Analytical Data

MOISTURE ANALYTICAL RESULTS

Plant Name Martin-Marietta Job No. 11432

City/State Raleigh, NC Sampling Loc. Transfer Pt.

Run Number	Wet-TP-M5-1	Wet-TP-M5-2	Wet-TP-M5-3
Sampling Date	1-6-93	1-11-93	1-14-93
Analysis Date	1-6-93	1-11-93	1-14-93
Analyst	CLT	CLT	CLT

Reagent 1 (200 mL DI H_2O)			
Final Weight, g	582.0	550.7	579.9
Tared Weight, g	578.6	551.9	579.2
Water Catch, g	3.4	-1.2 *	0.7
Reagent 2 (____)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 (____)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g	3.4	-1.2	0.7
Silica Gel			
Final Weight, g	228.7	231.0	220.7
Tared Weight, g	218.2	222.2	213.4
ADSORBED WATER, g	10.5	8.8	7.3
TOTAL WATER COLLECTED, g	13.9	7.6	8.0

Balance No. ________ Type (✓) Triple Beam ✓ Electronic ___ Reagent Box No. 0216

Balance located in stable, draft-free area (✓)? Yes ✓ No ___ (If "No", explain below.)

Comments * Moisture loss visible

L-0036 rev. 7-92

ENTROPY

MOISTURE ANALYTICAL RESULTS

Plant Name ~~Martin Marietta~~ Job No. 11432

City/State Raleigh, NC Sampling Loc. Transfer Pt.

Run Number	Dry-TP-MS-1	Dry-TP-MS-2	Dry-TP-MS-3
Sampling Date	1-18-93	1-18-93	1-18-93
Analysis Date	1-18-93	1-18-93	1-18-93
Analyst	WKK	WKK	WKK
Reagent 1 (200 mL DI H_2O)			
Final Weight, g	584.3	577.3	555.8
Tared Weight, g	584.1	582.4 *	554.1
Water Catch, g	0.2	-5.1	1.7
Reagent 2 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g	0.2	-5.1	1.7
Silica Gel			
Final Weight, g	220.0	237.8	229.2
Tared Weight, g	212.6	225.8	221.8
ADSORBED WATER, g	7.4	12.0	7.4
TOTAL WATER COLLECTED, g	7.6	6.9	9.1

Balance No. ______ Type (✓) Triple Beam ✓ Electronic ___ Reagent Box No. 0219

Balance located in stable, draft-free area (✓)? Yes ✓ No ___ (If "No", explain below.)

Comments Suspect initial tare - visible, same level, tare & final

L-0036 rev. 7-92

ENTROPY

RFA No. 3170-11432

Plant Name Martin Marietta

Analyst D. Kincheloe   Date Rec'd in Lab 02/03/93

Lead Analyst D. Kincheloe   Analysis Date 02/08/93

Analysis Method & Analytes Method 201 A

Sample Matrix & Components Filters, Filter rinses, Nozzle/Cyclone rinses.

Summary of Sample Prep (added rinse in lab, final volumed, pH adjusted, etc.)

Transfer filters/particulate individually to tared, teflon baggies, desiccate 24 hrs., weigh until final.

Transfer acetone rinses individually to tared, teflon baggies, evaporate in the evaporator tank, desiccate 24 hrs, weigh until final.

Summary of Instrumentation Mettler AT 100 Analytical Balance

Minimum Detectable Limit 0.1mg ± 0.3 mg.

Summary of QA/QC Sample Analysis N/A

Spikes (describe spikes and % recovery) N/A

Specific Comments Regarding Sample Analysis (Note unusual catch weights, interferences, odd sample behavior, and steps taken to confirm unusual results. Also note any deviations from standard analytical procedures, together with justification and possible affect on results. Specify run number(s) when applicable.)

The runs DRY-TP-M201A -1, -2, & -3 are all visibly very heavy in particulate.

Runs WET-TP-M201A -1, -2, & -3 are all visibly light in weight and appear approximately equal in total amount of particulate.

Confirmation of Data Review

Lead Analyst Signature D. Kincheloe   Date 02/08/93

Lab QA Officer Signature J. F. Jones, Jr   Date 2/8/93

USE PAGE 2 IF ADDITIONAL SPACE NEEDED FOR ANY ITEM

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ENTROPY

SAMPLE TRANSFER RECORD OF CUSTODY

Please include this form with the final (typed) results, and whenever the final results are faxed to Entropy.

The samples referenced in Entropy Environmentalists Inc. RFA or purchase order No. 3170-11432-13 were shipped by Entropy on 1-27-93 (date) via pers. custody (mode) to EET (laboratory) by [signature] (signature)

The samples were received for analysis on 02/03/93 (date) at EEI (laboratory) by D. Kuchelor (signature)

As applicable, note any broken seals, leakage, spillage, or damage to samples. If discrepancy, specify seal No., jar No., sample No., etc.

L-0012 rev. 8-92

ENTROPY

PARTICULATE SAMPLING LABORATORY RESULTS (Version 04.28.92)

Plant Name:	MARTIN MARIETTA	EEI Ref#	11432
		File:	M201A
Sampling Location:	Transfer Point (TPT)		Page of
Date Received:	02/03/93	File Pathway:	H:\JOBS\11432\LAB\M201A.WQ1

Run Number: DRY-TP-M201A-1

Sample I.D. / Container #	init.	date		in stack filter / 764 <= 10 ug
	DK	02/05	@	4.3243
	DK	02/04		4.3246
Baggie Tare Wt., g.				3.8082
Filter Tare Wt., g.				0.2715
FILTER SAMPLE WT., g.				0.2446

Sample I.D. / Container #	init.	date		in stack filter rinse / 765 <= 10 ug	date		nozzle & cyclone rinse / 766 >10ug
	DK	02/08	@	3.7075	02/08	@	10.3002
	DK	02/05A		3.7076	02/05A		10.3006
Tare Wt., g.		(55	ml)	3.6353	(145	ml)	3.6112
RINSE SAMPLE WT., g.				0.0722			6.6890

Filter Catch, mg.	244.6	NA
Rinse Catch, mg.	72.2	6689.0
Blank Residue, mg.	0.1	0.2
Net Rinse Catch, mg.	72.1	6688.8
FILTERABLE PARTICULATE, mg.	316.7	6688.8

Blank Beaker #	B / 782
Final wt., mg.	3.6980
Tare wt., mg.	3.6977
Residue, mg.	0.3
Volume, ml.	200
Density, mg/ml	785.0
Conc., mg/mg	1.911E-06 <-
Upper Limit, mg/mg	1.000E-05

—Legend—
@ = Final Weight
F = Filter R = Rinse

1 = Light
2 = Medium
3 = Heavy or Dark

Sample Description

Run #	Color	Loading
-1	1 2 3	1 2 3

Predominate color of samples is: LIGHT GRAY.
Date of full balance span: 02/01/93
Notes and comments:

Printing Date: 08-Feb-93 Printing Time: 04:26 PM

Plant Name:	MARTIN MARIETTA		**EEI Ref#**	11432
			File:	M201A
Sampling Location:	NA			
Date Received:	02/03/93		**File Pathway:**	H:\JOBS\11432\LAB\M201A.WQ1

Run Number				Ace. Blank
Sample ID/Container #				B / 782
	init.	date		
	DK	02/08	@	3.6980
	DK	02/05A		3.6982
Tare Wt., g.		(200	ml)	3.6977
SAMPLE WT., g.				0.0003

Date of full balance span: 02/01/93

Notes and comments:

PARTICULATE SAMPLING LABORATORY RESULTS (Version 04.28.92)

Plant Name:	MARTIN MARIETTA	EEI Ref#	11432
		File:	M201A
Sampling Location:	Transfer Point (TPT)	Page	
		of	
Date Received:	02/03/93	File Pathway:	H:\JOBS\11432\LAB\M201A.WQ1

Run Number: DRY-TP-M201A-3

Sample I.D. / Container #	init.	date		in stack filter / 770 <= 10 ug
	DK	02/05	@	4.2791
	DK	02/04		4.2792
Baggie Tare Wt., g.				3.7515
Filter Tare Wt., g.				0.2718
FILTER SAMPLE WT., g.				0.2558

Sample I.D. / Container #	init.	date		in stack filter rinse / 771 <= 10 ug	date		nozzle & cyclone rinse / 772 > 10ug
	DK	02/08		3.6242	02/08	@	9.4298
	DK	02/05A	@	3.6241	02/05A		9.4301
Tare Wt., g.		(35	ml)	3.6045	(130	ml)	3.7031
RINSE SAMPLE WT., g.				0.0196			5.7267

Filter Catch, mg.	255.8	NA
Rinse Catch, mg.	19.6	5726.7
Blank Residue, mg.	0.1	0.2
Net Rinse Catch, mg.	19.5	5726.5
FILTERABLE PARTICULATE, mg.	275.3	5726.5

Blank Beaker #	B / 782		---Legend---
Final wt., mg.	3.6980		@ = Final Weight
Tare wt., mg.	3.6977		F = Filter R = Rinse
Residue, mg.	0.3		
Volume, ml.	200		1 = Light
Density, mg/ml	785.0		2 = Medium
Conc., mg/mg	1.911E-06	<-	3 = Heavy or Dark
Upper Limit, mg/mg	1.000E-05		

Sample Description

Run #	Color	Loading
-3	1 2 3	1 2 3

Predominate color of samples is: LIGHT GRAY.
Date of full balance span: 02/01/93
Notes and comments:

PARTICULATE SAMPLING LABORATORY RESULTS (Version 04.28.92)

Plant Name:	MARTIN MARIETTA	EEI Ref#	11432
		File:	M201A
Sampling Location:	Transfer Point (TPT)		
Date Received:	02/03/93	File Pathway:	H:\JOBS\11432\LAB\M201A.WQ1

Run Number				DRY-TP-M201A-2
Sample I.D. / Container #				in stack filter / 767 < = 10 ug
	init.	date		
	DK	02/05	@	4.2303
	DK	02/04		4.2306
Baggie Tare Wt., g.				3.7627
Filter Tare Wt., g.				0.2687
FILTER SAMPLE WT., g.				0.1989

Sample I.D. / Container #				in stack filter rinse / 768 < = 10 ug				nozzle & cyclone rinse / 769 >10ug
	init.	date			date			
	DK	02/08		3.7367	02/08		@	9.4530
	DK	02/05A	@	3.7366	02/05A			9.4531
Tare Wt., g.		(50	ml)	3.7204	(125	ml)		3.7595
RINSE SAMPLE WT., g.				0.0162				5.6935

Filter Catch, mg.	198.9	NA
Rinse Catch, mg.	16.2	5693.5
Blank Residue, mg.	0.1	0.2
Net Rinse Catch, mg.	16.1	5693.3
FILTERABLE PARTICULATE, mg.	215.0	5693.3

Blank Beaker #	B / 782	
Final wt., mg.	3.6980	
Tare wt., mg.	3.6977	
Residue, mg.	0.3	
Volume, ml.	200	
Density, mg/ml	785.0	
Conc., mg/mg	1.911E-06	<--
Upper Limit, mg/mg	1.000E-05	

—Legend—
@ = Final Weight
F = Filter R = Rinse

1 = Light
2 = Medium
3 = Heavy or Dark

Sample Description

Run #	Color	Loading
-2	1 2 3	1 2 3

Predominate color of samples is: LIGHT GRAY.
Date of full balance span: 02/01/93
Notes and comments:

Printing Date: 08-Feb-93 Printing Time: 04:25 PM

PARTICULATE SAMPLING LABORATORY RESULTS (Version 04.28.92)

Plant Name:	MARTIN MARIETTA	EEI Ref#	11432
		File:	M201A
Sampling Location:	Transfer Point (TPT)	Page	of
Date Received:	02/03/93	File Pathway:	H:\JOBS\11432\LAB\M201A.WQ1

Run Number: WET-TP-M201A-2

Sample I.D. / Container #	init.	date		in stack filter / 776 <= 10 ug
	DK	02/05	@	3.9256
	DK	02/04		3.9260
Baggie Tare Wt., g.				3.6435
Filter Tare Wt., g.				0.2681
FILTER SAMPLE WT., g.				0.0140

Sample I.D. / Container #	init.	date		in stack filter rinse / 777 <= 10 ug	date		nozzle & cyclone rinse / 778 > 10ug
	DK	02/08	@	3.5197	02/08		3.6392
	DK	02/05A		3.5198	02/05A	@	3.6388
Tare Wt., g.		(30	ml)	3.5185	(50	ml)	3.6314
RINSE SAMPLE WT., g.				0.0012			0.0074

Filter Catch, mg.	14.0	NA
Rinse Catch, mg.	1.2	7.4
Blank Residue, mg.		0.1
Net Rinse Catch, mg.	1.2	7.3
FILTERABLE PARTICULATE, mg.	15.2	7.3

Blank Beaker #	B / 782
Final wt., mg.	3.6980
Tare wt., mg.	3.6977
Residue, mg.	0.3
Volume, ml.	200
Density, mg/ml	785.0
Conc., mg/mg	1.911E-06 <-
Upper Limit, mg/mg	1.000E-05

—Legend—
@ = Final Weight
F = Filter R = Rinse

1 = Light
2 = Medium
3 = Heavy or Dark

Sample Description

Run #	Color	Loading
-2	1 2 3	1 2 3

Predominate color of samples is: LIGHT GRAY.
Date of full balance span: 02/01/93
Notes and comments:

Printing Date: 08-Feb-93 Printing Time: 04:25 PM

PARTICULATE SAMPLING LABORATORY RESULTS (Version 04.28.92)

Plant Name: MARTIN MARIETTA | **EEI Ref#** 11432 | **File:** M201A

Sampling Location: Transfer Point (TPT)

Date Received: 02/03/93 | **File Pathway:** H:\JOBS\11432\LAB\M201A.WQ1

Run Number WET-TP-M201A-1

Sample I.D. / Container #	init.	date		in stack filter / 773 <= 10 ug
	DK	02/05	@	4.1614
	DK	02/04		4.1616
Baggie Tare Wt., g.				3.8832
Filter Tare Wt., g.				0.2711
FILTER SAMPLE WT., g.				0.0071

Sample I.D. / Container #	init.	date		in stack filter rinse / 774 <= 10 ug	date		nozzle & cyclone rinse / 775 >10ug
	DK	02/08		3.8172	02/08	@	3.6371
	DK	02/05A	@	3.8170	02/05A		3.6372
Tare Wt., g.		(30	ml)	3.8140	(45	ml)	3.6330
RINSE SAMPLE WT., g.				0.0030			0.0041

Filter Catch, mg.	7.1	NA
Rinse Catch, mg.	3.0	4.1
Blank Residue, mg.		0.1
Net Rinse Catch, mg.	3.0	4.0
FILTERABLE PARTICULATE, mg.	10.1	4.0

Blank Beaker #	B / 782	
Final wt., mg.	3.6980	
Tare wt., mg.	3.6977	
Residue, mg.	0.3	
Volume, ml.	200	
Density, mg/ml	785.0	
Conc., mg/mg	1.911E-06	<--
Upper Limit, mg/mg	1.000E-05	

—Legend—
@ = Final Weight
F = Filter R = Rinse

1 = Light
2 = Medium
3 = Heavy or Dark

Sample Description

Run #	Color	Loading
-1	1 2 3	1 2 3

Predominate color of samples is: LIGHT GRAY.
Date of full balance span: 02/01/93
Notes and comments:

ENTROPY
Environmentalists, Inc.

P.O. Box 12291
Research Triangle Park
North Carolina 27709-2291
919-781-3550 FAX 919-787-8442

REQUEST FOR ANALYSIS

PO#: 3169-11432-13

Customer Name: Martin Marietta
Raleigh, NC

Laboratory: EEI

Date Transmitted: 1/27/93

Results Due By: 2/10/93

Sample Matrix: Method 5

PM: WKK

Analysis: Analyze for particulate.

Sample #	Sample ID	Components/Comments
1	Dry-TP-M5-1	filter, acetone rinse (1 & 2 of 2)
2	Dry-TP-M5-2	filter, acetone rinse
3	Dry-TP-M5-3	filter, acetone rinse
4	Wet-TP-M5-1	filter, acetone rinse
5	Wet-TP-M5-2	filter, acetone rinse
6	Wet-TP-M5-3	filter, acetone rinse
7	Blank	acetone

Received: 02/03/93 @ 1:4

Final 02/08/93

Submitted By:

PARTICULATE SAMPLING LABORATORY RESULTS (Version 04.28.92)

Plant Name: MARTIN MARIETTA

EEI Ref# 11432
File: M201A

Sampling Location:

Date Received: 02/03/93

File Pathway: H:\JOBS\11432\LAB\M201A.WQ1

Run Number WET-TP-M201A-3

	init.	date		in stack filter / 779 <= 10 ug
Sample I.D. / Container #				
	DK	02/05	@	3.8597
	DK	02/04		3.8599
Baggie Tare Wt., g.				3.5776
Filter Tare Wt., g.				0.2724
FILTER SAMPLE WT., g.				0.0097

	init.	date			in stack filter rinse / 780 <= 10 ug	date			nozzle & cyclone rinse / 781 >10ug
Sample I.D. / Container #									
	DK	02/08		@	3.7034	02/08			3.6243
	DK	02/05A			3.7038	02/05A		@	3.6242
Tare Wt., g.		(	35	ml)	3.7020	(	35	ml)	3.6086
RINSE SAMPLE WT., g.					0.0014				0.0156

Filter Catch, mg.	9.7	NA
Rinse Catch, mg.	1.4	15.6
Blank Residue, mg.	0.1	0.1
Net Rinse Catch, mg.	1.3	15.5
FILTERABLE PARTICULATE, mg.	11.0	15.5

Blank Beaker #	B / 782
Final wt., mg.	3.6980
Tare wt., mg.	3.6977
Residue, mg.	0.3
Volume, ml.	200
Density, mg/ml	785.0
Conc., mg/mg	1.911E-06 <-
Upper Limit, mg/mg	1.000E-05

—Legend—
@ = Final Weight
F = Filter R = Rinse

1 = Light
2 = Medium
3 = Heavy or Dark

Sample Description

Run #	Color	Loading
-3	1 2 3	1 2 3

Predominate color of samples is: LIGHT GRAY.
Date of full balance span: 02/01/93
Notes and comments:

Printing Date: 08-Feb-93 Printing Time: 04:25 PM

Plant Name:	MARTIN MARIETTA		EEI Ref#	11432
			Filename:	M5
Sampling Location:	N/A			
Date Received:	02/03/93	File Pathway:	H:\JOBS\11432\LAB\M5.WQ1	

Run Number ACETONE BLANK

	init.	date		B / 763
Sample ID/Container #				
	DK	02/08		3.5499
	DK	02/05A	@	3.5498
Tare Wt., g.		(200	ml)	3.5498
SAMPLE WT., g.				0.0000

Date of full balance span 02/01/93

Notes and comments:

RFA No. 3169-11432

Plant Name Martin Marietta

Analyst D. Kincheloe Date Rec'd in Lab 02/03/93

Lead Analyst D. Kincheloe Analysis Date 02/08/93

Analysis Method & Analytes Method 5

Sample Matrix & Components - Filters, - Acetone

Summary of Sample Prep (added rinse in lab, final volumed, pH adjusted, etc.)

Transfer filters/particulate individually to tared, teflon baggies, desiccate, 24 hrs., weigh until final.

Transfer acetone rinses individually to tared, teflon baggies, evaporate in the evaporator tank, desiccate 24 hrs, weigh until final.

Summary of Instrumentation Mettler AT 100 Analytical Balance

Minimum Detectable Limit 0.1 mg

Summary of QA/QC Sample Analysis N/A

Spikes (describe spikes and % recovery) N/A

Specific Comments Regarding Sample Analysis (Note unusual catch weights, interferences, odd sample behavior, and steps taken to confirm unusual results. Also note any deviations from standard analytical procedures, together with justification and possible affect on results. Specify run number(s) when applicable.)

Run DRY-TP-M5-1 is visibly almost half in weight compared to runs DRY-TP-M5-2, -3.

Run WET-TP-M5-3 is visibly double the weight of runs WET-TP-M5-1, -2.

Confirmation of Data Review

Lead Analyst Signature D. Kincheloe Date 02/08/93

Lab QA Officer Signature [signature] Date 02/08/93

USE PAGE 2 IF ADDITIONAL SPACE NEEDED FOR ANY ITEM

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ENTROPY

Plant Name: MARTIN MARIETTA

EEI Ref# 11432
Filename: M5

Sampling Location: Transfer Point (TPT)

Page of

Date Received: 02/03/93   File Pathway: H:\JOBS\11432\LAB\M5.WQ1

Run Number	init.	date		WET-TP-M5-1	date		WET-TP-M5-2	date		WET-TP-M5-3
Sample ID/Container #				F / 757			F / 759			F / 761
	DK	02/05	@	3.8633	02/05	@	4.2131	02/05	@	4.2398
		02/04		3.8635	02/04		4.2133	02/04		4.2400
Baggie Tare Wt., g.				3.3596			3.7081			3.7208
Filter Tare Wt., g.				0.4998			0.5048			0.5051
FILTER SAMPLE WT., g.				0.0039			0.0002			0.0139
Sample ID/Container #				R / 758			R / 760			R / 762
	DK	02/08	@	3.7835	02/08	@	3.8888	02/08	@	3.8391
	DK	02/05A		3.7836	02/05A	@	3.8888	02/05A	@	3.8391
Tare Wt., g.		(125	ml)	3.7754	(85	ml)	3.8841	(105	ml)	3.8224
RINSE SAMPLE WT., g.				0.0081			0.0047			0.0167
Filter Catch, mg.				3.9			0.2			13.9
Rinse Catch, mg.				8.1			4.7			16.7
Rinse Blank Residue, mg.				0.0			0.0			0.0
Net Rinse Catch, mg.				8.1			4.7			16.7
FILTERABLE PARTICULATE, mg.				12.0			4.9			30.6

Blank Beaker #	B / 763
Final wt., mg.	3.5498
Tare wt., mg.	3.5498
Residue, mg.	0.0
Volume, ml.	200
Density, mg/ml	785.0
Conc., mg/mg	0.0 <--
Upper Limit, mg/mg	1.000E-05

—Legend—
@ = Final Weight
F = Filter   R = Rinse

1 = Light
2 = Medium
3 = Heavy or Dark

Sample Description

Run #	Color	Loading
-1	1 2 3	1 2 3
-2	1 2 3	1 2 3
-3	1 2 3	1 2 3

Predominate color of samples is: LIGHT GRAY.
Date of full balance span 02/01/93
Notes and comments:
The filters are all clear; the rinses are light gray in color.

Printing Date: 08-Feb-93   Printing Time: 04:41 PM

Plant Name:	MARTIN MARIETTA	EEI Ref# 11432
		Filename: M5
Sampling Location:	Transfer Point (TPT)	Page
Date Received:	02/03/93	of

File Pathway: H:\JOBS\11432\LAB\M5.WQ1

Run Number	init.	date	DRY-TP-M5-1	date	DRY-TP-M5-2	date	DRY-T[illegible]3
Sample ID/Container #			F / 751		F / 753		F / 755
	DK	02/05	@ 7.3193	02/05	@ 18.3368	02/05	@ 18.4814
	DK	02/04	7.3195	02/04	18.3378	02/04	18.4819
Baggie Tare Wt., g.			3.6847		3.7201		3.6556
Filter Tare Wt., g.			0.4967		0.4982		0.5019
FILTER SAMPLE WT., g.			3.1379		14.1185		14.3239
Sample ID/Container #			R / 752		R / 754		R / 756
	DK	02/08	6.7240	02/08	@ 4.4571	02/08	[illegible]
	DK	02/05A	@ 6.7237	02/05A	@ 4.4571	02/05A	@ [illegible]
Tare Wt., g.		(150 ml)	3.6966	(175 ml)	3.6518	(60 ml)	3.5927
RINSE SAMPLE WT., g.			3.0271		0.8053		0.3060
Filter Catch, mg.			3137.9		14118.5		14323.9
Rinse Catch, mg.			3027.1		805.3		306.0
Rinse Blank Residue, mg.			0.0		0.0		0.0
Net Rinse Catch, mg.			3027.1		805.3		306.0
FILTERABLE PARTICULATE, mg.			6165.0		14923.8		14629.9

Blank Beaker #	B / 763
Final wt., mg.	3.5498
Tare wt., mg.	3.5498
Residue, mg.	0.0
Volume, ml.	200
Density, mg/ml	785.0
Conc., mg/mg	0.0 <-
Upper Limit, mg/mg	1.000E-05

—Legend—
@ = Final Weight
F = Filter R = Rinse

1 = Light
2 = Medium
3 = Heavy or Dark

Sample Description

Run #	Color	Loading
-1	1 2 3	1 2 3
-2	1 2 3	1 2 3
-3	1 2 3	1 2 3

Predominate color of samples is: MEDIUM-LIGHT GRAY.
Date of full balance span 02/01/93
Notes and comments:
The filterable particulate is very heavy and is medium gray in color; the rinses are all light gray in color.

Printing Date: 08-Feb-93 Printing Time: 04:41 PM

RFA No. 3168-11432

Plant Name Martin Marietta

Analyst D. Kincheloe

Date Rec'd in Lab 02/04/93

Lead Analyst D. Kincheloe

Analysis Date 02/09/93

Analysis Method & Analytes Method PM-10 "Hi-Vol"

Sample Matrix & Components - Filters - (8" x 10")

Summary of Sample Prep (added rinse in lab, final volumed, pH adjusted, etc.)

Desiccate filters at least 24 hrs, weigh every 24 hrs. until final weight is obtained.

Summary of Instrumentation Mettler AT 100 Analytical Balance.

Minimum Detectable Limit 0.1 mg ± 0.3 mg

Summary of QA/QC Sample Analysis N/A

Spikes (describe spikes and % recovery) N/A

Specific Comments Regarding Sample Analysis (Note unusual catch weights, interferences, odd sample behavior, and steps taken to confirm unusual results. Also note any deviations from standard analytical procedures, together with justification and possible affect on results. Specify run number(s) when applicable.)

No problems

Confirmation of Data Review

Lead Analyst Signature D. Kincheloe

Date 02/09/93

Lab QA Officer Signature [signature]

Date 02/09/93

USE PAGE 2 IF ADDITIONAL SPACE NEEDED FOR ANY ITEM

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ENTROPY

ENTROPY
Environmentalists, Inc.

P.O. Box 12291
Research Triangle Park
North Carolina 27709-2291
919-781-3550 FAX 919-787-8442

REQUEST FOR ANALYSIS

PO#: 3168-11432-13

Customer Name: Martin Marietta
Raleigh, NC

Laboratory: EEI

Date Transmitted: 1/27/93

Results Due By: 2/10/93

Sample Matrix: Hi-vol filters

PM: WKK

Analysis: Analyze for PM-10 particulate.

Sample #	Sample ID	Components/Comments
1	Dry-TP-HV-1	hi-vol filter
2	Wet-TP-HV-1	hi-vol filter
3	Wet-TP-HV-2	hi-vol filter
4	Wet-TP-HV-3	hi-vol filter

Processed: 02/04/93 @ 11

Final! 02/09/93

Submitted By: ____________

Appendix F. Audit Data Sheets

HI-VOL PARTICULATE LABORATORY RESULTS (Version 09.30.92)

Plant Name:	Martin Marietta		**EEI Ref#:** 11432		**Filename:** HIVOLS
Date Received:	02/01/93	**File Pathway:**	H:\JOBS\11432\LAB\HIVOLS.WQ1		Page

	Run Number:	DRY-TP-HV-1		
Sample Location Transfer Point				
		5.3243		
		5.3248		
	Filter Tare Wt., g.	4.3468		
FILTER SAMPLE WT., g.		0.9775	0.0000	0.0000

	Run Number:	WET-TP-HV-1	WET-TP-HV-2	WET-TP-HV-3
Sample Location Transfer Point				
		4.5072	3.1729	4.6189
		4.5088	3.1752	4.6194
	Filter Tare Wt., g.	4.4691	2.9525	4.3581
FILTER SAMPLE WT., g.		0.0381	0.2204	0.2608

	Run Number:			
Sample Location				
	Filter Tare Wt., g.			
FILTER SAMPLE WT., g.		0.0000	0.0000	0.0000

SAMPLE DESCRIPTION

	Run #	Color	Loading	Run #	Color	Loading
LEGEND	1	1 2 3	1 2 3	1	1 2 3	1 2 3
1 = Light				2	1 2 3	1 2 3
2 = Medium				3	1 2 3	1 2 3
3 = Heavy or Dark						

Predominate color of samples is: MEDIUM GRAY.
Date of full balance span: 02/01/93
Notes and comments:

Printing Date: 09-Feb-93 Printing Time: 03:00 PM

Plant Name MARTIN MARIETTA Job No. 11432

City/State RALEIGH, N.C. Auditor(s) DWS

Test Loc. TRANSFER POINT Date 1/6/93

BAROMETER

Entropy In-House Ref. Barometer 29.75 "Hg vs Field Barometer 29.75 "Hg

Date Compared 1/6/93 Dev. ___ "Hg (Max. Allowable Dev.: ± 0.1 "Hg)

Field Barometric Pressure Corrected for Test Location Elevation? (√) ___

(Note: deduct 0.1" Hg from local NWS STATION pressure for each 100' of test location elevation; example: 29.6 - (300'/100 * 0.1) = 29.3" Hg.)

Ref. Therm. Initial Ambient Temp., °F 38

THERMOMETERS *	Allowable Deviation From Ambient	Ambient Temperature, °F				Audit OK (√)
Dry Gas Meter	± 5.4 °F	38	(Meterbox No. N33)			✓
Impinger Exit	± 2.0 °F	38				✓
Filter Box	± 5.4 °F	38				✓

* Adjust thermometer until acceptable. If it cannot be adjusted, use as back-up. If no backup, record ambient temperature indicated by unadjusted thermometer and label with correction factor (indicate):

THERMOCOUPLES Allowable Deviation from Ambient: ± 8.0°F* (± 2.0°F)**

TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK
R318 / 57	✓	R201 / 38	✓	/		/		/	

* ± 8.0 °F = ± 1.5% of ambient absolute temperature.

** (± 2.0 °F if used in saturated or water droplet-laden gas stream.)

ISOKINETIC METERBOX I.D. N33 Gamma (Y) 1.0032 ΔH@ 1.818

As Applicable (check): Zero Magnehelics? ✓ Zero/Level Manometer? ___

Barometric Pressure (P_{bar}) 29.75 Auditor DWS Date 1/6/93

Dry Gas Meter Reading (Cubic Ft.)	Meter Temperature (°F)	Lower and Upper Limits for Audit Gamma
Final 166.598	Final 52	0.96 * Y = .96307
Initial 158.750	Initial 38	1.04 * Y = 1.04333

Dry Gas Volume Metered (Cubic Ft.)	Average Meter Temp. (°F)	Run Time (Base = 10) (Minutes)	(Seconds)
Vm = 7.848	Tm = 45	10	29

0.75 = Ideal Sampling Rate

$$Y_c = \frac{[Min. + (Sec. / 60)]}{Vm} * \left[\frac{\{[(29.92) / (460 + 68) * (0.75)^2] * (Tm + 460)\}}{P_{bar}}\right]^{.5}$$

$$Y_c = \frac{[10 + (29 / 60)]}{7.848} * \left[\frac{0.0319\ (45 + 460)}{29.75}\right]^{.5} = .982965$$

Audit Gamma

Audit Gamma Acceptable (between lower & upper limits)? (√) ✓ Yes ___ No

1.335796 .735864

F-1113 rev. 7-92

ENTROPY