MEASUREMENT OF PM_{10} & $PM_{2.5}$ EMISSION FACTORS AT A STONE CRUSHING PLANT

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Notation

English Symbol	Description
A	Area of stack or duct at sampling location
A_n	Cross sectional area of sampling nozzle
b_f	Average blockage factor
B_{ws}	Moisture content of gas stream
C	Cunningham correction factor
C_1	Re-estimated Cunningham correction factor for particle diameter equivalent to the actual cut size diameter and calculated using the actual stack gas temperature
C_p	Pitot coefficient for the combined cyclone pitot
C_p'	Coefficient for the pitot used in the preliminary traverse
C_{total}	Concentration of total filterable and condensable particulate
$C_{PM_{10}}$	Concentration of PM_{10} filterable and condensable particulate
$C_{PM_{2.5}}$	Concentration of $PM_{2.5}$ filterable and condensable particulate
D_{50}	Particle cut diameter
D_{50_1}	Re-calculated particle cut diameters based on re-estimated C_1, (micrometers)
$D_{50_{LL}}$	Cut diameter for cyclone I corresponding to the 2.25 micrometer cut diameter for cyclone IV
D_{50}	Cyclone I cut diameter corresponding to the middle of the overlap zone between the cyclone I, 11.0 micrometer performance curve and the cyclone IV 2.25 micrometer performance curve.
I	Percent isokinetic sampling
K_p	85.49, ft/s (pounds/mole -°R)
M_1	Solids recovered from sample jar 1, PM>10
M_2	Solids recovered from sample jar 2, ≤10 and >2.5 PM
M_3	Solids recovered from sample jar 3, ≤2.5 PM
M_4	Milligrams of solids on the filter, ≤2.5 PM
M_{202}	Condensed material recovered from Method 202, ≤2.5 PM
Md	Molecular weight of dry gas
Mw	Molecular weight of wet gas
N	Number of total traverse points
N_{re}	Reynolds number
Qs	Sampling rate (ACFM) for cyclone I to achieve specified D_{50}
Q_{sST}	Total dry gas flow rate(DSCFM) through the sampling assembly
Q_I	Sampling rate (ACFM) for cyclone I to achieve specified D_{50}
Q_{IV}	Sampling rate (ACFM) for cyclone IV to achieve specified D_{50}
P_{bars}	Barometric pressure
P_s	Absolute stack pressure
R_{min}	Stack/nozzle ratio, minimum velocity parameter
R_{max}	Stack/nozzle ratio, maximum velocity parameter
t_r	Total projected run time
t_n	Sampling time at point n

Notation (Continued)

English Symbol	Description
t_1	Sampling time at point 1
T_m	Meter box temperature
T_s	Absolute stack temperature
v	Velocity of stack gas
v_n	Sample gas velocity in the nozzle
v_{min}	Minimum stack velocity
v_{max}	Minimum stack velocity
V_{ms}	Gas volume sampled, corrected to standard conditions (SCF)
V_m	Dry gas volume sampled (dry gas meter data), ACF
V_c	Quantity of water captured in impingers and silica gel
Z	Ratio between estimated cyclone IV D_{50} values

Greek Symbol	Description
ΔH	Meter box orifice pressure drop,
$\Delta H@$	Pressure drop across orifice at flow rate of 0.75 SCFM at standard conditions, [Note: specific to each orifice and meter box]
Δp_n	Velocity pressure measured at point n during the test run
Δp_1	Velocity pressure measured at point 1 during the test run
Δp_{min}	Minimum velocity pressure within the isokinetic criteria
Δp_{max}	Maximum velocity pressure within the isokinetic criteria
Δp_s	Velocity pressure adjusted for combined cyclone pitot tube
Δp_m	Observed velocity pressure using S-type pitot tube in Method 2 traverse, preliminary traverse
Δp_{s_1}	Velocity pressure calculated in Equation 24
Δp_{s_2}	Velocity pressure corrected for blockage
γ	Dry gas meter gamma value
θ	Total run time
μ	Gas viscosity

Other Symbol	Description
$\%CO_2$	Carbon Dioxide content of gas stream
$\%O_2$	Oxygen content of gas stream

Acronyms

ACFM	Actual cubic feet per minute
CSR	Constant sampling rate
DSCFM	Dry standard cubic feet per minute
DSCF	Dry standard cubic feet
EPA	U.S. Environmental Protection Agency
ICP	Ion coupled plasma spectroscopy
PM	Particulate matter
PM_{10}	Particulate matter with an aerodynamic diameter equal to or less than 10 micrometers
$PM_{2.5}$	Particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers
SCF	Standard cubic feet
SCFM	Standard cubic feet per minute
SRI	Southern Research Institute

MEASUREMENT OF PM_{10} & $PM_{2.5}$ EMISSION FACTORS AT A STONE CRUSHING PLANT

1. SUMMARY

The purpose of this test program was to accurately measure PM_{10} and $PM_{2.5}$ particulate emissions from a set of tertiary crushers, a fines crusher, a conveyor transfer point, and a vibrating sizing screen at a stone crushing plant. These tests were part of the National Stone Association (NSA) program initiated in 1991 to determine emission factors for the crushed stone industry. The Vulcan Materials Company Plant in Pineville, North Carolina served as the test location for the 1996 tests. This plant was selected because (1) a variety of stone processing equipment was available, (2) there was safe access to all the test locations, (3) the travel costs to the plant were low, and (4) it was conveniently accessible to representatives of the U.S. EPA and the State of North Carolina who were invited to view the tests.

These tests were sponsored by NSA and were conducted by Air Control Techniques, P.C. (ACTPC) in accordance with the test protocols developed for previous tests conducted by ACTPC for NSA on similar emission sources.

At the present time, there is not a U.S. EPA promulgated reference method for the measurement of particulate in the $PM_{2.5}$ size range. ACTPC used a testing technique that is a combination of Method 201A for PM_{10} and the cascade cyclone particle sizing technique developed by EPA. This sampling system consists of the PM_{10} cyclone from Method 201A followed by the $PM_{2.5}$ cyclone from a five stage cascade cyclone train. A 47mm filter is mounted after the $PM_{2.5}$ cyclone. The sampling train is identical to Method 201A except that the $PM_{2.5}$ cyclone is inserted between the PM_{10} cyclone and the filter. For this reason, the term "modified Method 201A" used in this report is appropriate for describing the overall test method. This method was chosen since it is consistent with Reference Method 201A[1] for PM_{10} and with an EPA test development report concerning $PM_{2.5}$ particulate[2].

A conventional quasi-stack system was used to conduct emission tests on the inlets and outlets of a 7 foot shorthead tertiary crusher and a 1560 omni-cone tertiary crusher. This method has been used in previous studies to develop AP-42 emission factors. Two enclosures were built at the inlets to the tertiary crushers, and one enclosure was built around the outlet of both tertiary crushers. The enclosures were ducted together to a common sampling point where the modified Method 201A sampling train was used to measure particulate concentrations. Using this testing approach, all of the PM_{10} emissions from the crushers inlets and outlets were captured efficiently. Adjacent ambient sources of PM_{10} emissions did not affect the results. This is the most accurate method available for the capture and testing of fugitive particulate emissions from tertiary crushers.

A quasi-stack enclosure was used for capturing fugitive particulate emissions from the conveyor transfer point and the fines crusher. This method has been used in previous studies to develop AP-42 emission factors. In both sources, separate inlet and outlet enclosures were combined into a duct leading to the sampling location. The Modified Method 201A sampling train was used to measure the PM_{10} and $PM_{2.5}$ emission rates in both sets of tests.

The vibrating sizing screen emission tests were conducted using a track-mounted hood system. This fugitive emission testing procedure is an adaptation of EPA Reference Method 5D. This method has been used in previous studies to develop AP-42 emission factors. The traversing hood had dimensions of 2 feet by 2 feet and was mounted approximately 12 inches above the upper screen deck of the vibrating sizing screen. The small hood size and the mounting position ensured that the normal PM_{10} particulate emissions were not significantly influenced by the fugitive emission capture system. The hood capture velocity was selected based on smoke tube qualitative observations of the fugitive dust capture characteristics. The track-mounted hood was ducted to a sampling location where the modified Method 201A sampling train was used to measure the PM_{10} and $PM_{2.5}$ particulate concentrations.

The PM_{10} and $PM_{2.5}$ emission factors are presented in Table 1. The PM_{10} emission factors are based on the modified Method 201A filter catches combined with the less than PM_{10} acetone rinses. The ambient particulate concentrations were measured using an MIE nephelometer and the concentrations have been factored out of the emission factors presented in Table 1. The ambient concentrations were less than 2% of the total observed particulate concentrations.

Table 1. PM_{10} and $PM_{2.5}$ Emission Factors

Equipment Tested	Emission Factor Size Range	Pounds of Emission per Ton of Stone Throughput
Tertiary Crusher	≤ 2.5 Microns	0.00009
Tertiary Crusher	≤ 10 Microns	0.00036
Fines Crusher	≤ 2.5 Microns	0.00007
Fines Crusher	≤ 10 Microns	0.00032
Conveyor Transfer Point	≤ 2.5 Microns	0.000013
Conveyor Transfer Point	≤ 10 Microns	0.000042
Vibrating Screen	≤ 2.5 Microns	0.00005
Vibrating Screen	≤ 10 Microns	0.00028

The PM_{10} results are very similar to those already published in AP-42. The results of the 1996 tests are compared with the present AP-42 data in Table 2. With the exception of the fines crusher, these results are similar to the AP-42 data. The differences that do exist are due primarily to normal plant-to-plant variability.

Table 2. Comparison of PM_{10} Results with AP-42

Source	Pineville 1996	AP-42	Ratio, (Present Data)/(AP-42)
Tertiary Crushers	0.00036	0.00059	0.61
Fines Crusher	0.00032	0.00200[1]	0.16
Conveyor Transfer Point	0.000042	0.000048	0.88
Vibrating Screen	0.00028	0.00084	0.33

[1] Not a true fines crusher. This crusher was the seventh crusher in the crushing circuit but not a true fines crushing application.

2. SAMPLING LOCATIONS AND TESTING PROCEDURES

2.1 Objectives

The objective of these tests was to accurately measure PM_{10} and $PM_{2.5}$ emissions from a set of tertiary crushers, a fines crusher, a conveyor transfer point, and a vibrating sizing screen at a stone crushing plant. All of these sources were controlled with conventional wet suppression techniques. The specific objectives included the following.

- Efficiently capture the PM_{10} and $PM_{2.5}$ emissions entrained by the equipment being tested without significantly affecting the emission rate from the equipment.

- Determine the PM_{10} and $PM_{2.5}$ emissions concentrations using modified Method 201A.

- Determine the ambient PM_{10} and $PM_{2.5}$ concentrations during the three to six hour time period of the emission test.

- Calculate the equipment specific PM_{10} and $PM_{2.5}$ emission factors based on measured stone throughput rates.

- Measure the moisture content, size distribution, silt content and throughput rates of the stone being handled by the specific pieces of equipment to document the representativeness of the test conditions.

- Measure the ambient temperatures, barometric pressures, and relative humidity to document the representativeness of the test conditions.

- Measure the ambient wind speed and direction during the vibrating sizing screen tests to confirm that the sampling criteria were satisfied throughout the test periods.

2.2 Process Description and Operation

The Vulcan Materials Company Plant in Pineville, North Carolina produces 1.5 million tons of crushed granite per year. It uses crushing, screening, and conveying equipment that is representative of the crushed stone industry in general. A flowchart of the plant process equipment is shown in Figure 1.

Tertiary Crushers

The 7 foot shorthead and 1560 omni-cone tertiary crushers are located side-by-side and were tested simultaneously. The feed stream to both tertiary crushers is the oversized stone discharged from the two parallel 8 foot by 20 foot vibrating sizing screens. The crushers discharge the crushed stone onto conveyor C-4 shown in Figure 1. The stone is transferred from conveyor C-4 to conveyor C-3 and is then sent back to the vibrating sizing screens. The stone flow through this part of the Pineville plant is termed "closed circuit" because oversized material recirculates through the vibrating sizing screens and crushers until the stone is crushed small enough to fall through the vibrating sizing screen.

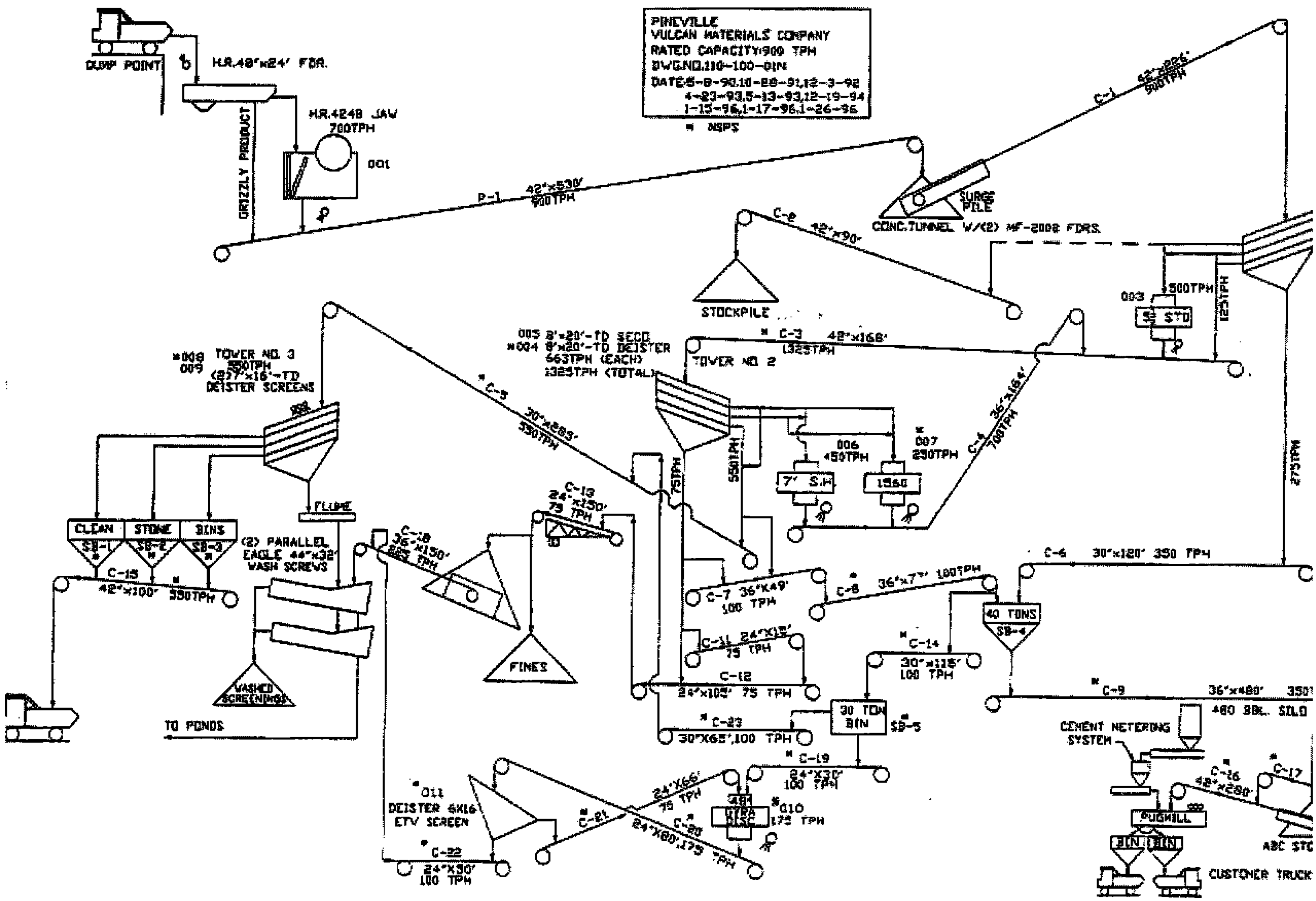

Figure 1. Pineville, Vulcan Materials Company, Process Flowchart

Fines Crusher

The 48 inch grya-disc fines crusher receives material from two conveyors shown as C-19 and C-21 in Figure 1. Conveyor C-19 handles small stone that has passed through the second deck of the dual 8 foot by 20 foot triple deck vibrating sizing screens and fine material that has passed through the third deck of the 6 foot by 16 foot triple deck vibrating sizing screen. The gyra-disc also receives the oversized stone from the 6 foot x 16 foot fines vibrating sizing screen. This oversized stone is conveyed to the fines crusher on conveyor C-21. The fines crusher discharges the crushed stone onto conveyor C-20 in Figure 1.

Conveyor Transfer Point

The transfer point from conveyor C-4 to conveyor C-3 was also tested for emissions. This conveyor handles the material that has been sent to the tertiary crushers for size reduction.

Vibrating Sizing Screens

There are two parallel 8 foot by 20 foot vibrating sizing screens. The screen serves the 7 foot shorthead tertiary crusher. A splitter is used to proportion the stone between the parallel vibrating sizing screens. The splitter directs 60% of the total stone flow to the vibrating sizing screen tested and the downstream shorthead crusher. The stone is fed to the vibrating sizing screens and tertiary crushers by conveyor C-3 shown in Figure 1.

Wet Suppression Fugitive Dust Control

Wet suppression is used for fugitive dust control of the 7 foot shorthead tertiary crusher, the 1560 omni-cone tertiary crushers, the vibrating sizing screens, the conveyor transfer points, and the fines crusher. Water spray nozzles are located on (1) the outlet of both the 7 foot shorthead and 1560 omni-cone tertiary crushers, (2) the outlet of the 5 ½ foot standard secondary crusher, (3) the 6 foot by 16 foot vibrating sizing screen upstream of the secondary crusher, and (4) on the outlet of the 48 inch gyra-disc.

Not all water spray nozzles in the overall plant system are required to control fugitive dust emissions. The amount of wet suppression required to control fugitive dust emissions is dependent on the ambient temperature, relative humidity, and the composition of the material being handled. Over-wetting of the stone does not have any environmental benefits, and it can cause blinding of the lower screens or blockage of the fines discharge chute underneath the vibrating sizing screens.

2.3 Fugitive Emission Capture Procedures

NSA and EPA have sponsored a number of studies concerning PM_{10} emissions from stone crushing plants.[3-10] Since 1992, NSA has tested 4 tertiary crushers, 4 vibrating sizing screens, 3 transfer points, 1 fines crusher and 1 fines vibrating sizing screen for PM_{10} emissions (AP-42 Section 11.19.2 Crushed Stone Processing). There have also been tests conducted on three quarry haul roads and a storage pile. The PM_{10} emissions tests performed at the Vulcan Materials Company, Pineville Plant supplement all these data. Prior to the 1996 tests at Pineville, no $PM_{2.5}$ data have been available in AP-42 or the general technical literature. The $PM_{2.5}$ emission factor data are of interest due to the November 1996 proposed changes in the particulate National Ambient Air Quality Standards.

The objective of these tests was to accurately measure PM_{10} and $PM_{2.5}$ emissions from a set of tertiary crushers, a fines crusher, a conveyor transfer point, and a vibrating sizing screen. Since there are no air pollution control devices on these units, fugitive emission capture procedures were needed. The emission capture procedures that are generally applied to fugitive dust emission sources include (1) enclosures and quasi-stack sampling, (2) roof monitor sampling, and (3) upwind-downwind profiling. ACTPC considered the criteria listed in Table 3 in selecting the emission capture procedures and designing the specific systems for the test program. Due to the physical configuration of the stone processing equipment tested at Pineville, ACTPC used the same emission capture procedures that have been used to develop the existing AP-42 database for crushed stone processing.

Table 3. Fugitive Emission Capture Procedure Selection and System Design Criteria
• The capture system should not create higher-than-actual PM_{10} and $PM_{2.5}$ emission rates due to high gas velocity conditions near the point of PM_{10} and $PM_{2.5}$ particle entrainment.
• The capture system should not create a sink for PM_{10} and $PM_{2.5}$ emissions.
• The capture system should isolate the process equipment unit being tested from other adjacent sources of PM_{10} and $PM_{2.5}$ emissions.
• The capture system should not create safety hazards for the emission test crew or for plant personnel. It should not create risks to the plant process equipment.
• The capture system should not obstruct routine access to the process equipment by plant personnel.
• The capture system and overall test procedures should be economical, practical, and readily adaptable to other plants so that these tests can be repeated by organizations wishing to confirm or challenge the emission factor data developed in this project.

The conventional quasi-stack sampling procedure satisfied these criteria for tests of a set of tertiary crushers, fines crusher, and conveyor transfer point. The roof monitoring procedure conducted using a traversing hood satisfied these criteria for the vibrating sizing screen.

Quasi-Stack Enclosures for the 7 Foot Shorthead and the 1560 Omni-Cone Tertiary Crushers

The inlet to the two tertiary crushers was defined as the discharge chute of the vibrating screens into the crusher vessel. The inlet area of the 7 foot shorthead crusher had a height of approximately 1½ feet and a diameter of approximately 7 feet. The inlet area of the 1560 omni-cone crusher had a height of approximately 1 foot and a diameter of approximately 5 feet. The inlets of both crushers were enclosed with sealed metal sheeting to allow capture of the PM_{10} and $PM_{2.5}$ emissions caused by the stone-to-stone attrition. The discharge points of both crushers is conveyor C-4 shown on Figure 1. The discharge areas of both crushers were enclosed together. The combined outlet enclosure extended 5 feet upstream and downstream of both crushers. The combined outlet enclosure measured approximately 4 feet high by 30 feet long by 5 feet wide and was constructed of sealed foam board supported on a wood frame.

The tertiary crusher inlet enclosures each had 8 inch takeoff ducts. These two 8 inch ducts were wyed together into a 12 inch duct. Photograph 1 (Appendix A) shows both inlet enclosures, the takeoff ducts, and the wye. The combined crusher outlets enclosure had a 16 inch diameter takeoff duct. The combined 12 inch diameter inlet duct was teed together with the 16 inch crusher outlet duct leading to an 18 inch diameter duct. Photograph 2 shows the combined outlet enclosure takeoff and tee. Photograph 3 shows the 7 foot shorthead side of the combined outlet enclosure. The 18 inch diameter duct was connected to a forward curved type centrifugal blower having a capacity of approximately 2,500 ACFM. With all of the enclosures ducted into the 18 inch diameter duct, only one test location was required. The PM_{10} and $PM_{2.5}$ emissions measurements for the tertiary crusher were conducted in the 18 inch diameter duct shown in Photograph 4. Air flow measurements were made in each leg of the system. Dampers were used to balance air flow. Table 4 shows the measured air flows.

Table 4. Tertiary Crusher Enclosure Specifications

Enclosure	Volume of Enclosure, Cubic Feet	Air Flow in Enclosure Duct, ACFM	Air Changes, Number per Minute	Diameter of Enclosure Duct, Inches	Gas Velocity in Duct, Feet per Minute
Inlet of 7 Foot Shorthead	58	425	7.3	8	1,200
Inlet of 1560 Omni-cone	20	300	15.0	8	840
Combined Outlet Enclosures	1200 actual (~60% solid) 480	1775	3.7	16	1,260
Total System, Test Location Specifications	558	2500	4.5	18	1,440

Particulate readings were made using an MIE nephelometer to correct the observed PM_{10} and $PM_{2.5}$ concentrations measured in the outlet duct. The ambient concentrations were subtracted from the measured test location concentrations. The ambient concentrations were consistently less than 2% of the total observed PM_{10} and $PM_{2.5}$ concentrations.

The combined gas flow from the inlet and outlet enclosures was controlled by a Dayton Model 7C507, 18 ¼ inch diameter, ¾ horsepower blower. The average air flow rate of 2,500 ACFM was sufficient to maintain a negative pressure in all parts of the enclosures. Negative pressures were necessary to ensure that there was no loss of PM_{10} and $PM_{2.5}$ emissions from the enclosures. High negative static pressures were undesirable because there could be high velocity ambient air streams entering the enclosure that would bias the test results to higher-than-actual emissions.

"Roof" Monitoring Traversing Hood Test Procedures for Vibrating Sizing Screens
The track-mounted hood system used for sampling the vibrating screen consisted of a 2 foot by 2 foot galvanized steel hood suspended 12 inches above the upper deck of the vibrating sizing screen. The position of the hood above the stone is shown in Photographs 5 and 6. This hood position was sufficiently close to the upper screen deck to ensure good emission capture but not so close that the entering air stream caused significantly greater-than-actual PM_{10} and $PM_{2.5}$ emissions. ACTPC believes that there was only a slight bias to higher-than-actual particulate concentrations due to the close placement of the hood above the moving stone on the upper screen.

A Dayton Model 7C553, 9 inch diameter, ¼ horsepower radial blade blower was used to maintain the capture velocity of the air entering the hood. This face velocity was set at 200 feet per minute based on the hood capture characteristics observed during qualitative smoke tube tests. This velocity is substantially higher than the 50 feet per minute minimum capture velocity specified for vibrating screens in the report by JACA Corporation, entitled "Control of Air Emissions from Process Operations in the Rock Crushing Industry." The traversing hood capture velocity is also substantially higher than many other types of industrial hoods.

The top area of the vibrating screen was divided into a 3 by 8 array of sampling points, each of which was 2 feet by 2 feet. The only area not sampled was the 4 foot strip across the upper inlet side of the vibrating screen where the stone feed dumps onto the top of the screen. Positioning the hood in this location was not necessary or prudent due to the constant stream of falling stone from the discharge chute (Photograph 6). Air moving downward with the stream of stone from the chute travels along the screen and was captured in the 3 by 8 sampling array.

ACTPC sized the ductwork from the hood to the sampling location for an average gas flow velocity of approximately 1,000 feet per minute. The purpose of this velocity was to ensure that there were no impaction losses of PM_{10} particles in the duct. This velocity is also sufficiently low to prevent scouring of PM_{10} particles from the surfaces of large particles inadvertently captured by the closely positioned hood. Some settling of particles substantially larger than 10 microns was anticipated due to this design velocity. However, observations after each test indicated that these losses were relatively small. The capture and measurement of particles larger than 10 microns was not intended in this test program. The emission capture system was designed specifically for PM_{10} and $PM_{2.5}$ particles, which have negligible settling rates as indicated by their very low terminal settling velocities.

The gas stream from the hood entered a short section of 12 inch diameter flexible duct that allowed the hood to traverse the 3 by 8 array over the vibrating screen. The flex duct was connected to a rigid 12 inch duct that led to the sample location and a blower that was on the ground approximately 35 feet below. Photograph 7 shows the flexible and the rigid ductwork.

Wind speed and direction were monitored to ensure that emissions from the adjacent downwind screen (not being tested) did not bias the tests. The wind speed and direction criteria were (1) sustained wind speeds $\leq$ 10 mph, (2) gusts $\leq$ 15 mph, and (3) wind direction predominantly from the west and south. It was not necessary to interrupt the tests at any time to satisfy these criteria. Photograph 8 shows the placement of the wind speed and direction indicator. This location was chosen because there were no airflow disturbances, and the sensors were at the same elevation as the vibrating screen.

Quasi-Stack Enclosure Testing Procedures for the Conveyor Transfer Point

Enclosures were built around the transfer point of conveyor C-4 to C-3 in Figure 1. The inlet to the transfer point conveyor C-4 had an area of 4 feet by 5 feet. This area was covered, to the maximum extent possible, with sealed foam board to allow the natural air flow induced by the stone flow to carry the PM_{10} and $PM_{2.5}$ emissions to the outlet of the transfer point. The middle of the transfer point was also covered to maintain the induced air draft caused by the stone on the conveyor. The discharge point of the of the transfer point is conveyor C-3, which leads to the 8 foot by 20 foot vibrating screens. The transfer point allows oversized material to be recycled in a closed loop until it is crushed to at least the size of the top screen.

The outlet of the transfer point, having an area of approximately 1 foot by 4.5 feet, was enclosed, and a hood was built to capture PM_{10} and $PM_{2.5}$ emissions. Photograph 9 shows the transfer point hood enclosure outlet. The hood had a 12 inch diameter, eighteen foot long outlet duct that lead to the ground. Photograph 10 shows the transfer point outlet duct. This outlet duct was used as a combined sampling point for both the inlet and the outlet of the transfer point. When the outlet duct reached the ground, it turned 90° and proceeded to the blower. A Dayton Model 7C553, 9 inch diameter, ¼ horsepower radial blade blower was used to maintain the capture velocity of the air entering the hood. The face velocity was set at 200 feet per minute based on the hood capture characteristics observed during qualitative smoke tube tests. The average air flow rate of 900 ACFM was sufficient to maintain a negative pressure in all parts of the enclosures. Negative pressures were required to ensure that there was no loss of PM_{10} and $PM_{2.5}$ emissions from the enclosures. High negative static pressures were undesirable because there could be high velocity ambient air streams entering the enclosure, which could increase emissions.

ACTPC sized the ductwork from the hood to the sampling location for an average gas flow velocity of approximately 1,000 feet per minute. This velocity was selected to minimize impaction losses of particulate matter and to avoid scouring-related generation of large particles inadvertently captured in the enclosure hoods.

Quasi-Stack Testing Procedures for the 48 Inch Gyra Disc Fines Crusher

The inlet to the fines crusher was defined as the discharge chute of conveyors C-19 and C-21 into the crusher vessel (Figure 1). The inlet area of the 48 inch gyra-disc had a height of approximately 1 foot and a diameter of approximately 4 feet. The inlet of the fines crusher was enclosed with sealed metal sheeting to allow capture of the PM_{10} and $PM_{2.5}$ emissions caused by the stone to stone attrition. The discharge point of the fines crusher is conveyor C-20 in Figure 1. The discharge of the fines crusher was enclosed. The outlet enclosure measured approximately 4 feet high by 12 feet long by 4 feet wide and was constructed of sealed foam board supported on a wood frame.

The fines crusher inlet enclosure had a 12 inch diameter takeoff duct. Photograph 11 shows the fines crusher inlet enclosure and takeoff duct. The fines crusher outlet enclosure had a 16 inch diameter takeoff duct shown in Photograph 12. The 12 inch diameter inlet duct was teed together with the 16 inch diameter fines crusher outlet duct to lead to an 18 inch duct. Photograph 13 shows the combined outlet enclosure takeoff and tee. The 18 inch diameter duct was connected to a forward curved centrifugal blower having a capacity of 2,350 ACFM. With both of the enclosures ducted into the 18 inch diameter duct, only one test location was required. The PM_{10} and $PM_{2.5}$ emissions measurements for the fines crusher were conducted in the 18 inch diameter duct shown in Photograph 14. Air flow measurements were conducted in each leg of the system. Table 5 shows the measured airflow of each leg of the system.

Ambient air particulate readings were conducted using an MIE nephelometer to correct the PM_{10} and $PM_{2.5}$ concentrations in the duct. The ambient concentrations were subtracted from the measured test location concentrations. The ambient concentrations were consistently less than 2% of the total particulate concentrations.

Table 5. Fines Crusher Enclosure Specifications					
Enclosure	Volume of Enclosure, Cubic Feet	Airflow in Enclosure Duct, ACFM	Air Changes, Number per Minute	Diameter of Enclosure Duct, Inches	Gas Velocity in Duct, Feet per Minute
Inlet Enclosure	12.6	660	52.4	12	840
Outlet Enclosure	192 actual (30% solid) 134.4	1,690	12.6	16	1,200
Total System, Test Location Specifications	147	2,350	16.0	18	1,320

The combined gas flow from the inlet and outlet enclosures was controlled by a Dayton Model 7C507, 18 ¼ inch diameter, ¾ horsepower blower. The average air flow rate of 2,350 ACFM was enough to maintain negative pressures in all parts of the enclosures. Negative pressures were required to ensure that there was no loss of PM_{10} and $PM_{2.5}$ emissions from the enclosures. High negative static pressures were undesirable since there could be high velocity ambient air streams entering the enclosure, which could increase emissions.

2.4 PM_{10} and $PM_{2.5}$ Sampling Methods and Equipment

At the present time, there is not a U.S. EPA promulgated reference method for the collection and analysis of particulate in the $PM_{2.5}$ size range. Accordingly, there is not an off-the-shelf procedure. ACTPC evaluated possible alternative testing techniques and recommended that the NSA tests be conducted using a method that is a combination of Method 201A for PM_{10} and the cascade cyclone particle sizing technique previously developed by EPA. This sampling system consists of the PM_{10} cyclone from Method 201A followed by the $PM_{2.5}$ cyclone from a five stage cascade cyclone train. A 47mm filter is mounted after the $PM_{2.5}$ cyclone. The sampling train is identical to Method 201A except that the $PM_{2.5}$ cyclone is inserted between the PM_{10} cyclone and the filter. For this reason, the term "modified Method 201A" is used in this report and is appropriate for describing the overall test method. The modified Method 201A sampling equipment and procedures are discussed in detail in a 1989 report prepared by Southern Research Institute for EPA's Emission Measurement Laboratory.[2] This report is presently the only EPA published material available concerning measurement of $PM_{2.5}$ emissions. This method satisfied all Method 201A requirements and is most consistent with EPA reference method procedures in general.

Both cyclones and the filter are coupled closely together so that the entire sampling head shown in Figure 2 can be operated in-situ. This is important to avoid the biases in the test method caused by particle losses or particle size distribution changes in the nozzle and probes used in extractive (non in-situ) tests. The PM_{10} cyclone in the sampling head is termed cyclone I because it is the first cyclone in the original cascade cyclone sampling train. For the same reason, the $PM_{2.5}$ cyclone is termed cyclone IV because it is the fourth cyclone in series in the complete cascade cyclone train. The sampling train is operated in a manner that is consistent with U.S. EPA Reference Method 201A and other EPA particulate matter measurement methods.. The complete sampling procedures are described in reference 2 and in a set of equations shown in Appendix B. It should be noted, however, that ACTPC has modified some of the nomenclature in the equations to forms consistent with Method 201A and other EPA particulate emission testing reference methods.

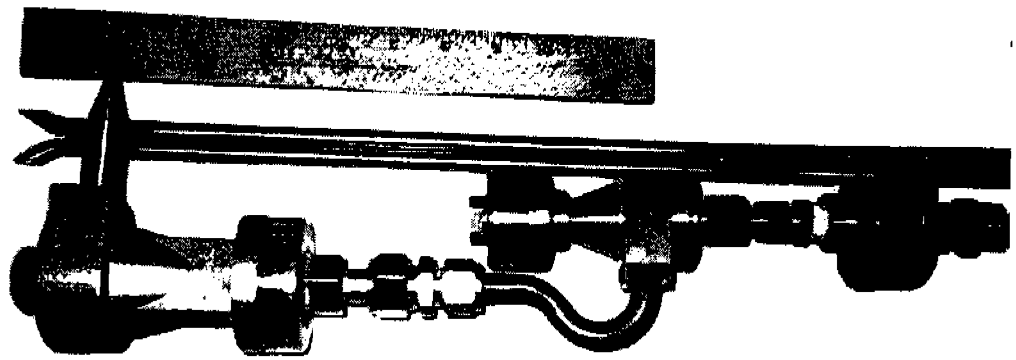

Figure 2. Modified Method 201A Sampling Head

As with Method 201A, the modified method 201A is a constant sampling rate (CSR) technique. It is critical to maintain the actual sample gas flow rate in each of the cyclones at a rate that provides the desirable particle collection efficiencies. Cyclone I must collect particles that have a D_{50} (particle size collected with 50% efficiency) between 9 and 11.0 microns in order to be consistent with Method 201A. Cyclone IV (the second cyclone in Figure 2) should optimally have a cut diameter between 2.25 and 2.75 microns. Using the cyclone performance curves provided in reference 2 and summarized in Appendix B, ACTPC has calculated the sampling rates necessary to simultaneously satisfy the cyclone I and cyclone IV D_{50} ranges. The area between the two solid lines in Figure 3 demonstrates that this range is reasonably large for sources operating at elevated gas temperatures. However, the acceptable operating range becomes extremely narrow at ambient temperatures such as the fugitive sources tested as part of this project. Even slight changes in air temperature can result in deviations from the desired D_{50} range. Furthermore, it is important to maintain the sampling velocities in the nozzle at a rate that is between 80% and 120% of the isokinetic velocity.

Sample times were relatively long to ensure that catch weights of both the PM_{10} and $PM_{2.5}$ cyclones could be analyzed gravimetrically. All sample times were based on 6 hours with the exception of run 1 on the fines crusher, which was limited to 3 hours due to approaching weather conditions. These sampling times were considerably longer than the one-hour runs typically used in EPA Methods 5 and 17 for the measurement of total filterable particulate. These long sampling times were needed due to the relatively low particulate matter concentrations in the $PM_{2.5}$ size range.

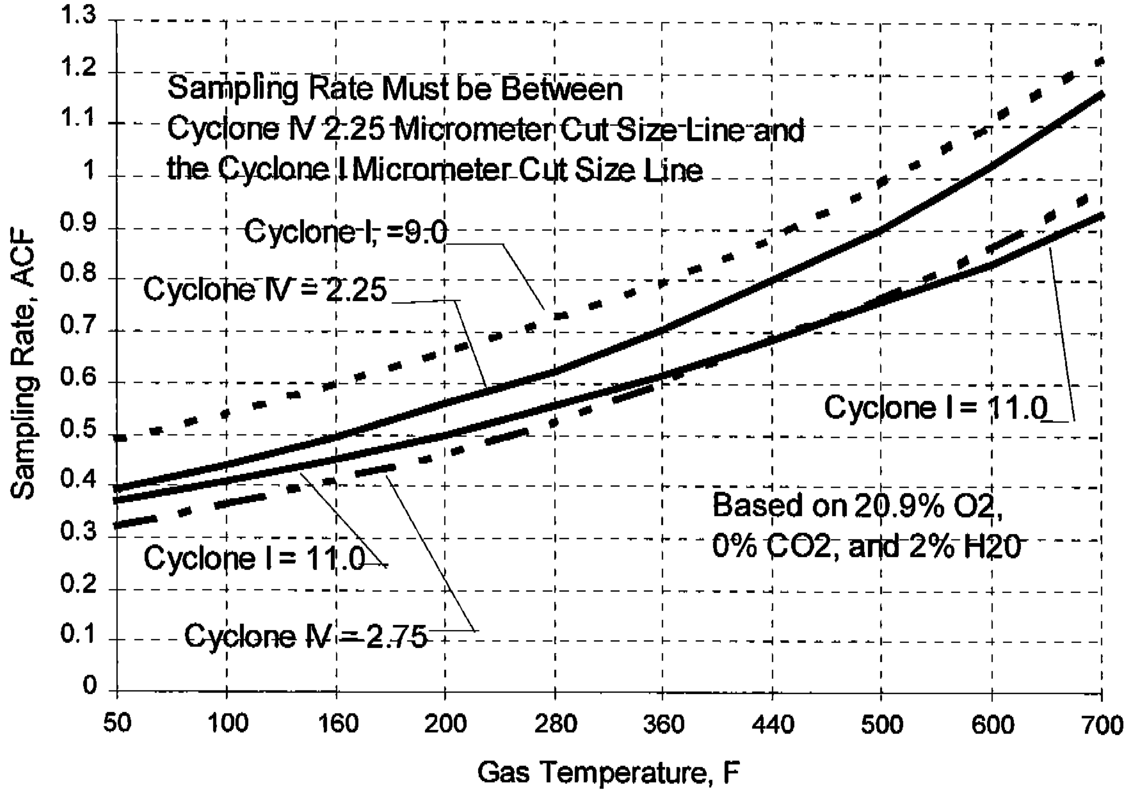

Figure 3. Sampling Rate Requirements of Modified Method 201A

2.5 Monitoring Process Operating Conditions

There are a number of process variables and weather conditions that could conceivably influence PM_{10} and $PM_{2.5}$ emission rates from the equipment tested.

- Stone moisture level
- Stone size distribution
- Stone silt content
- Stone throughput rates
- Stone type
- Stone 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 because granite is the only type of stone processed at this plant.

It was also necessary to monitor the ambient particulate concentrations in the two size ranges so that the emission rates could be corrected for ambient particulate entering the enclosures and vibrating screen hoods.

Stone Moisture Levels

Stone samples were taken during each of the emission tests. In all cases, these samples consisted of 2 linear feet long samples of stone from the conveyor serving the unit being tested. Table 6 outlines the conveyors that were used for each particular unit tested. The conveyors were stopped by plant personnel for approximately 5 minutes to permit the ACTPC test crew to remove the stone sample. The sample was placed in a sealed plastic bucket. The samples were weighed and multiplied by the conveyor speed in order to calculate a stone throughput rate in tons per hour.

Table 6. Stone Sample Conveyor Locations (Figure 1)

Date	Corresponding Run Numbers	Sample Conveyor Number
November 11, 1996	TP - 1 TC - 1	Conveyor C-4
November 12, 1996	TP - 2 TC - 2	Conveyor C-4
November 13, 1996	TP - 3 TC - 3	Conveyor C-4
November 18, 1996	VS - 1	Conveyor C-3
November 19, 1996	VS - 2	Conveyor C-3
November 20, 1996	VS - 3	Conveyor C-3
November 18, 1996	FC - 1	Conveyor C-20
November 19, 1996	FC - 2	Conveyor C-20
November 20, 1996	FC - 3	Conveyor C-20

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 8 pounds. Following the procedures outlined in Appendices C.1 and C.2 of the Fifth Edition of AP-42, the sample was weighed, dried and reweighed. The weight loss during the drying cycle was used to calculate the moisture content.

Ambient PM_{10} and $PM_{2.5}$ Particulate Levels

An MIE, Inc. nephelometer was used to monitor and provide real time data on the ambient levels of PM_{10} and $PM_{2.5}$ particulate during the tests. This instrument provided a time weighted average (TWA) of ambient particulate matter concentrations in micrograms per cubic meter on a real-time basis. Measurements were taken during the all of the emission factor tests. The ambient concentrations were subtracted from the in-stack concentrations of the emission factor tests. The nephelometer readings were taken approximately 200 feet from any operating equipment to ensure that the data was representative of background ambient air concentrations.

Stone Size Distribution and Silt Content

Samples of the stone obtained during the test (Section 2.5.1) were used to determine the size distribution and silt content. The silt content has been defined as the less than 200 mesh material. The initial sample quadrants used for moisture analysis were also used for analysis by ASTM sizing screens. The sample of approximately 8 pounds (following moisture analysis) was allowed to cool and then loaded into the ASTM sizing screens.

The following specific sizing screens were used.

- 0.375 inches (9.5 millimeters)
- 4 mesh (4.75 millimeters)
- 40 mesh (425 microns)
- 100 mesh (150 microns)
- 200 mesh (75 microns)
- 400 mesh (38 microns)

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.

Stone Throughput Rates

The stone processing rate for the crushers has been defined as the total volume of stone exiting the crushers and discharging on the conveyor belt. The stone processing rates for the transfer point and vibrating screens have been defined as the total volume of stone entering the transfer point and vibrating screen. The throughput rate for the vibrating screen was factored down to 60% of the total amount going to the two vibrating screens in parallel. The 60% multiplier is based on the plant setting for the splitter that controls the stone flow to the two crushers. The throughput capacity of the 7 foot shorthead crusher is greater than the throughput capacity of the 1560 Omni-cone crusher.

The stone samples (2 linear feet) taken from the conveyor were weighed. The values were multiplied by the conveyor speed in feet per minute and then divided by 2 (length of conveyor sample) to produce a pounds per minute stone throughput. This number was then multiplied by 60 minutes and divided by 2,000 pounds per ton to yield a stone throughput rate in tons per hour.

3.0 TEST RESULTS

3.1 Stone Moisture Levels

The stone moisture levels for the PM_{10} and $PM_{2.5}$ emission factor tests are presented in Table 7. The moisture levels for this test were lower than previous NSA sponsored tests. Only one test was conducted when the moisture level of the stone being processed was higher than 1%.

Table 7. Stone Moisture Levels

Date	Corresponding Run Numbers	Sample Conveyor Number	Stone Moisture Level
November 11, 1996	TP - 1 TC - 1	Conveyor C-4	0.78%
November 12, 1996	TP - 2 TC - 2	Conveyor C-4	1.4%
November 13, 1996	TP - 3 TC - 3	Conveyor C-4	0.89%
November 18, 1996	VS - 1	Conveyor C-3	0.59%
November 19, 1996	VS - 2	Conveyor C-3	0.40%
November 20, 1996	VS - 3	Conveyor C-3	0.47%
November 18, 1996	FC - 1	Conveyor C-20	0.62%
November 19, 1996	FC - 2	Conveyor C-20	0.80%
November 20, 1996	FC - 3	Conveyor C-20	0.76%

3.2 Ambient PM_{10} and $PM_{2.5}$ Concentrations

The ambient PM_{10} and $PM_{2.5}$ concentrations were monitored by an MIE Dataram nephelometer. The MIE Dataram provides a real-time and time weighted average measurement of airborne particulate concentrations. The Dataram measures mass concentrations of airborne dust, smoke, mists, and fumes and provides continuous real-time readouts. The Dataram has a wide measurement range from 0.0001 milligrams per cubic meter to 400 milligrams per cubic meter. The major advantage of the Dataram is that the results are instantaneous and can be produced immediately without laboratory gravimetric analyses of filters.

The nephelometer was used to measure time weighted averages of PM_{10} and $PM_{2.5}$ concentrations during the emission factor tests. The ambient concentrations of PM_{10} and $PM_{2.5}$ are presented in Table 8.

Table 8. Time Weighted Average (TWA) Ambient Particulate Concentrations					
Date	Sample Start Time	Sample Stop Time	Corresponding Run Numbers	$PM_{2.5}$ Particulate Concentration, micrograms/ cubic meter	PM_{10} Particulate Concentration, micrograms/ cubic meter
November 11, 1996	10:38	11:38	TP - 1, TC - 1	N/A	54.5
November 11, 1996	11:39	12:45	TP - 1, TC - 1	22.2	N/A
November 12, 1996	10:15	11:21	TP - 2, TC - 2	N/A	21.1
November 12, 1996	11:27	13:10	TP - 2, TC - 2	13.6	N/A
November 13, 1996	08:07	10:10	TP - 3, TC - 3	N/A	34.2
November 13, 1996	10:13	12:35	TP - 3, TC - 3	28.5	N/A
November 18, 1996	09:23	10:14	VS - 1, FC - 1	N/A	197.3 [1]
November 18, 1996	07:55	09:20	VS - 1, FC - 1	92.9 [1]	N/A
November 19, 1996	09:00	10:20	VS - 2, FC - 2	N/A	35.2
November 19, 1996	10:23	11:41	VS - 2, FC - 2	22.9	N/A
November 20, 1996	08:30	09:36	VS - 3, FC - 3	N/A	58.3
November 20, 1996	09:38	11:27	VS - 3, FC - 3	42.7	N/A

[1] Note, Hazy day.

3.3 Stone Throughput Rates

The stone throughput rates were calculated for each processing unit using the formula discussed in Section 2.5.4 of this report. The total stone throughput rate of the vibrating screens was multiplied by 60% based on the plant-set feed rates to each screen and the capacity of the 7 foot shorthead and 1560 omni-cone crushers. The calculated stone throughput rates for the vibrating screen and the 7 foot shorthead tertiary crusher are presented in Table 9.

Table 9. Stone Throughput Rates			
Date	Corresponding Run Numbers	Sample Conveyor Number	Stone Throughput Level, Tons/Hour
November 11, 1996	TP - 1 TC - 1	Conveyor C-4	952.1
November 12, 1996	TP - 2 TC - 2	Conveyor C-4	889.0
November 13, 1996	TP - 3 TC - 3	Conveyor C-4	1,034.9
November 18, 1996	VS - 1	Conveyor C-3	907.3
November 19, 1996	VS - 2	Conveyor C-3	906.3
November 20, 1996	VS - 3	Conveyor C-3	1,123.3
November 18, 1996	FC - 1	Conveyor C-20	249.5
November 19, 1996	FC - 2	Conveyor C-20	254.5
November 20, 1996	FC - 3	Conveyor C-20	252.4

3.4 PM_{10} AND $PM_{2.5}$ Emission Factors

The PM_{10} and $PM_{2.5}$ emission factors were calculated in accordance with the procedures illustrated in the example calculation in Appendix C. The particulate captured on the filter and in the $PM_{2.5}$ cyclone outlet tube was weighed and added to yield a total $PM_{2.5}$ capture weight. The $PM_{2.5}$ capture weight was added to the particulate captured in the PM_{10} cyclone outlet tube and the $PM_{2.5}$ cyclone catch cup to supply the PM_{10} capture weight. These two separate capture weights were divided by the dry standard cubic feet of gas sampled to determine the concentration of PM_{10} and $PM_{2.5}$ particulate matter in the gas sampled.

The PM_{10} and $PM_{2.5}$ emissions from the vibrating screen were determined by multiplying the PM_{10} and $PM_{2.5}$ particulate concentrations measured in the hood-blower system by 24 separate sampling points.

The data are expressed in pounds of PM_{10} and $PM_{2.5}$ per ton of stone throughput. The measured PM_{10} and $PM_{2.5}$ emission factors are presented in Table 10. The low emission factors are consistent with general observations and photographs taken during the test. There were no visible fugitive dust emissions during the tests.

Table 10. PM_{10} and $PM_{2.5}$ Emission Factors

Equipment	Tertiary Crusher		Fines Crusher		Conveyor Transfer Point		Vibrating Screen	
Emission Factor Size Range	PM_{10} lb/ton	$PM_{2.5}$ lb/ton	PM_{10} lb/ton	$PM_{2.5}$ lb/ton	PM_{10} lb/ton	$PM_{2.5}$ lb/ton	PM_{10} lb/ton	$PM_{2.5}$ lb/ton
Run # 1	0.00044	0.00009	0.00041	0.00009	0.000052	0.000015	0.00020	0.00004
Run # 2	0.00036	0.00011	0.00033	0.00008	0.000043	0.000013	0.00043	0.00008
Run # 3	0.00028	0.00009	0.00020	0.00005	0.000032	0.000009	0.00020	0.00004
3 Run Average	0.00036	0.00009	0.00032	0.00007	0.000042	0.000013	0.00028	0.00005

The PM_{10} emission factors are very close to those measured in previous tests with the exception of the fines crusher data. ACTPC believes that the differences in the data for the fines crushers are due to extremely small particle sizes at the previously tested fines crusher.

The PM_{10} and $PM_{2.5}$ emissions should be relatively low since very high energy levels are needed to cause stone attrition to the less than 10 micron range. Therefore, it is unlikely that the stone processing equipment is creating substantial quantities of PM_{10} and $PM_{2.5}$ particulate. This is also indicated in the size distribution and silt analysis conducted by ACTPC using dried stone. These size distribution and silt content data are presented in Table 11. The stone analyses show near negligible levels of dust in the less than 200 mesh (75 micron) or silt size range.

Table 11. Particle Size Distributions,
Percentages Greater than Sieve Size

Sieve Size	TP - 1 TC - 1	TP - 2 TC - 2	TP - 3 TC - 3	FC-1	FC-2	FC-3	VS-1	VS-2	VS-3
9.5 Millimeters	65.6%	59.97%	63.11%	48.83%	46.64%	39.50%	81.19%	89.88%	82.67%
4.75 Millimeters (4 Mesh)	12.6%	14.24%	14.72%	23.02%	23.09%	27.91%	7.99%	4.65%	7.32%
425 Microns (40 Mesh)	14.9%	17.94%	13.84%	20.93%	22.66%	24.71%	6.71%	2.93%	5.78%
150 Microns (100 Mesh)	2.7%	3.04%	3.12%	2.53%	2.70%	2.81%	1.25%	0.79%	1.49%
75 Microns (200 Mesh)	1.8%	2.25%	2.61%	1.98%	2.27%	2.19%	1.19%	0.75%	1.31%
38 Microns (400 Mesh)	1.1%	1.44%	1.45%	1.42%	1.47%	1.63%	1.09%	0.53%	0.85%
< 38 Microns	1.1%	1.11%	1.14%	1.29%	1.16%	1.23%	0.58%	0.47%	0.58%
% Silt, (Less than 200 Mesh)	2.2%	2.55%	2.59%	2.71%	2.63%	2.86%	1.67%	1.00%	1.43%

4. QUALITY ASSURANCE/QUALITY CONTROL

4.1 Temperature, Moistures, Barometric Pressure, Wind Speed, and Wind Direction

Ambient moisture was determined using the wet bulb-dry bulb technique. A sling psychrometer was used for determining the ambient temperature and relative humidity. The sling psychrometer uses two mercury in glass thermometers. The barometric pressure was monitored using a barometer that was checked daily with the Charlotte, NC Airport. The wind speed and direction were monitored using a MAXIMUM™ wind speed and direction instrument.

4.2 Dry Gas Meter Calibration

All dry gas meters were fully calibrated to determine the volume correction factor prior to field use. Post-test calibration checks were performed as soon as possible after the equipment was returned to the shop. Pre- and post-test calibrations agreed within $\pm$ 5 percent. The calibration procedure is documented in Section 3.3.2 of EPA Publication No. 600/4-77-237b.

4.3 Particulate Sampling QC Procedures

Sampling QC procedures included the following.

- Properly prepared glassware was used for recovering samples.
- All sampling nozzles were manufactured and calibrated according to EPA standards.
- Filters were weighed, handled, and stored in a manner to prevent contamination.
- Recovery procedures were completed in a clean environment.

4.4 Sample Volume, D_{50} Values, and Percent Isokinetics

All sample runs met the results acceptability criteria as defined by Section 6.3.5 of Method 201A. The isokinetic rates were within $\pm$20 percent. A summary of the sampling rates and percent isokinetics for the modified Method 201A tests is presented in Table 12.

Table 12. Average Isokinetic, D_{50}s, and ΔH Values

Run Number	Isokinetics, (%)	Cyclone I D_{50}, Microns	Cyclone IV D_{50}, Microns	ΔH (Avg), In. W.C.
TC-1	95.2	10.83	2.28	0.49
TC-2	90.5	10.87	2.29	0.48
TC-3	93.4	10.84	2.29	0.48
FC-1	97.6	10.56	2.21	0.48
FC-2	97.3	10.60	2.23	0.48
FC-3	103.3	10.63	2.24	0.47
TP-1	92.8	10.21	2.08	0.56
TP-2	86.8	10.47	2.15	0.55
TP-3	89.8	10.44	2.14	0.55
VS-1	98.5	10.61	2.22	0.51
VS-2	98.6	10.53	2.21	0.50
VS-3	103.9	10.66	2.25	0.50

All of the isokinetic results are consistent with Method 201A criteria of 80% to 120%. The PM_{10} (cyclone I) D_{50} values are also consistent with the Method 201A requirement of D_{50} values equal to or greater than 9.0 microns and equal to or less than 11.0 microns. Because all of the D_{50} values in this test program are greater than 10 microns, some particles with aerodynamic diameters greater than 10 microns were included in the PM_{10} catch. This means that there is a slight bias to larger-than-actual PM_{10} emissions.

Some of the $PM_{2.5}$ (cyclone IV) D_{50} values were slightly below the desirable range of 2.25 to 2.75 microns. This occurred due to the very narrow acceptable sampling rate range for ambient sources shown in Figure 3. Adjustment of the sampling rate by even 0.01 ACFM to allow higher cyclone IV D_{50} values might have caused out-of-specification cyclone I D_{50} values. The sampling rates used in the tests were considered the best operating range for both cyclones together. The slightly low cyclone IV D_{50} values indicates that the $PM_{2.5}$ emission rates are biased slightly lower-than-actual.

4.5 Temperature Measuring Device Calibration and Type S Pitot Tube Calibration

Reference mercury in glass stem thermometers were used to verify all temperature readings. They were calibrated using the procedure described in Section 3.4.2 of EPA Document 600/4-77-027b.

EPA has specific guidelines concerning the construction and geometry of an acceptable S-type pitot tube. If the specified guidelines are met, a pitot tube coefficient of 0.84 is used. Information pertaining to S-type pitot tubes is presented in detail in Section 3.1.1 of EPA Publication No. 600/4-77-027b. Only S-type pitot tubes meeting the required EPA specifications were used in this project.

4.6 Data Validation

All data and/or calculations for flow rates and emission rates were made using computer software and were validated by an independent check. All calculations were spot checked for accuracy and completeness. In general, all measurement data were validated based on the following criteria.

- Process conditions were representative during sampling or testing.
- Acceptable sample collection procedures were confirmed by determination of actual D_{50} values for both cyclones and acceptable isokinetic levels as required by Method 201A .
- Testing adhered to prescribed QC procedures.

5.0 REFERENCES

1. U.S. EPA. Method 201A. 40 CFR, Part 60, Appendix A.

2. Dawes, S.S., and W.E. Farthing. "Application Guide for Measurement of PM2.5 at Stationary Sources." Southern Research Institute draft report numbered SRI-ENV-88-198. Prepared in accordance with EPA Contract 68-020-4442 and submitted to Mr. Thomas E. Ward, U.S. EPA Monitoring Systems Laboratory. Undated.

3. Richards, J., T. Brozell, and W. Kirk, PM-10 Emissions from a Tertiary Crusher. U.S. EPA Contract 68-D1-0055. January 1992.

4. Kirk, W., T. Brozell, and J. Richards, PM-10 Emissions from a Tertiary Crusher and a Tertiary Screen. U.S. EPA Contract 68-D1-0055. October 1992.

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7. Brozell, T., and J. Richards, PM-10 Emissions from a Tertiary Crusher and a Tertiary Screen. U.S. Environmental Protection Agency. May 1993.

8. Brozell, T., and J. Richards, PM-10 Emissions from a Tertiary Crusher and a Tertiary Screen U.S. Environmental Protection Agency. May 1993.

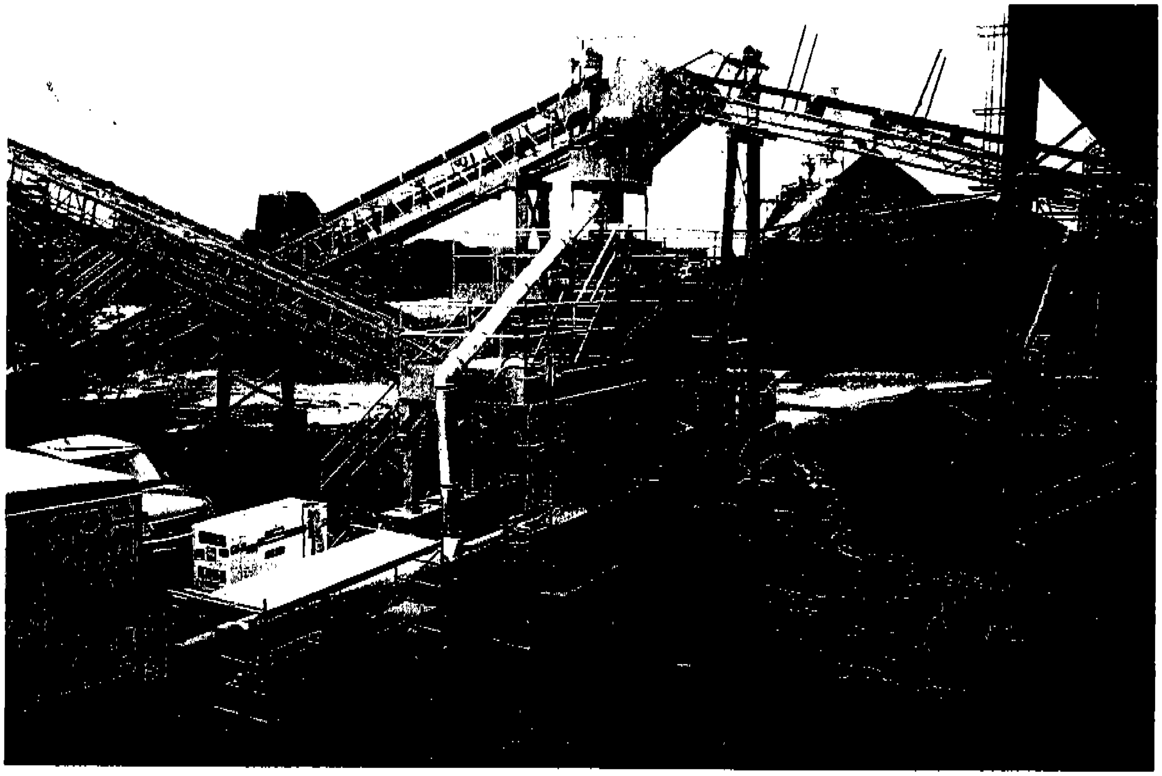
9. Richards, J.R. and T. Brozell, PM10 Emission Factors for Sloped, Vibrating Screens and Tertiary Crushers at Five Stone Crushing Plants. Paper presented at the National Stone Association Annual Meeting Concerning Health, Safety, and Environment, Atlanta, Georgia. November 1993.

10. Brozell, T., PM-10 Emissions from Two Transfer Points at a Granite Stone Crushing Plant. U.S. EPA Contract 68-D1-0055. January 1994.

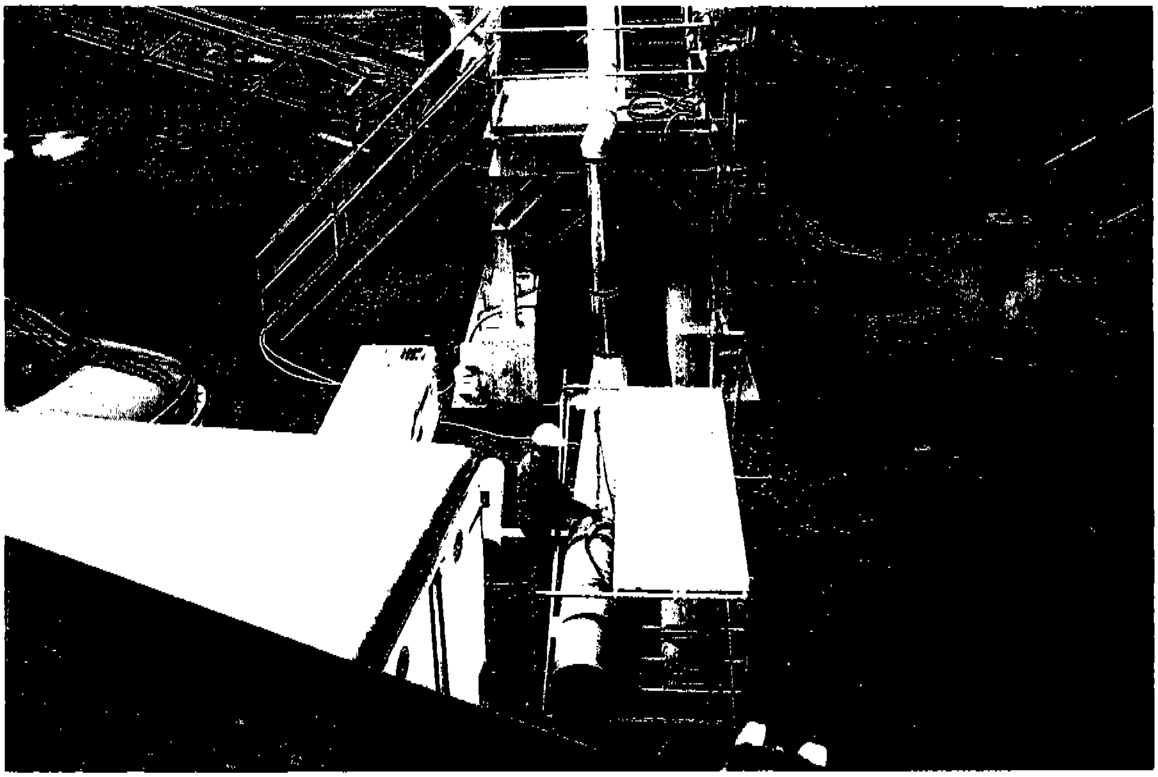
11. Frankel, R., A Review of Methods for Measuring PM-10 Emission Rates from Stationary Sources. Report submitted to the EPA Emissions Measurement Laboratory. Undated.

APPENDIX A.

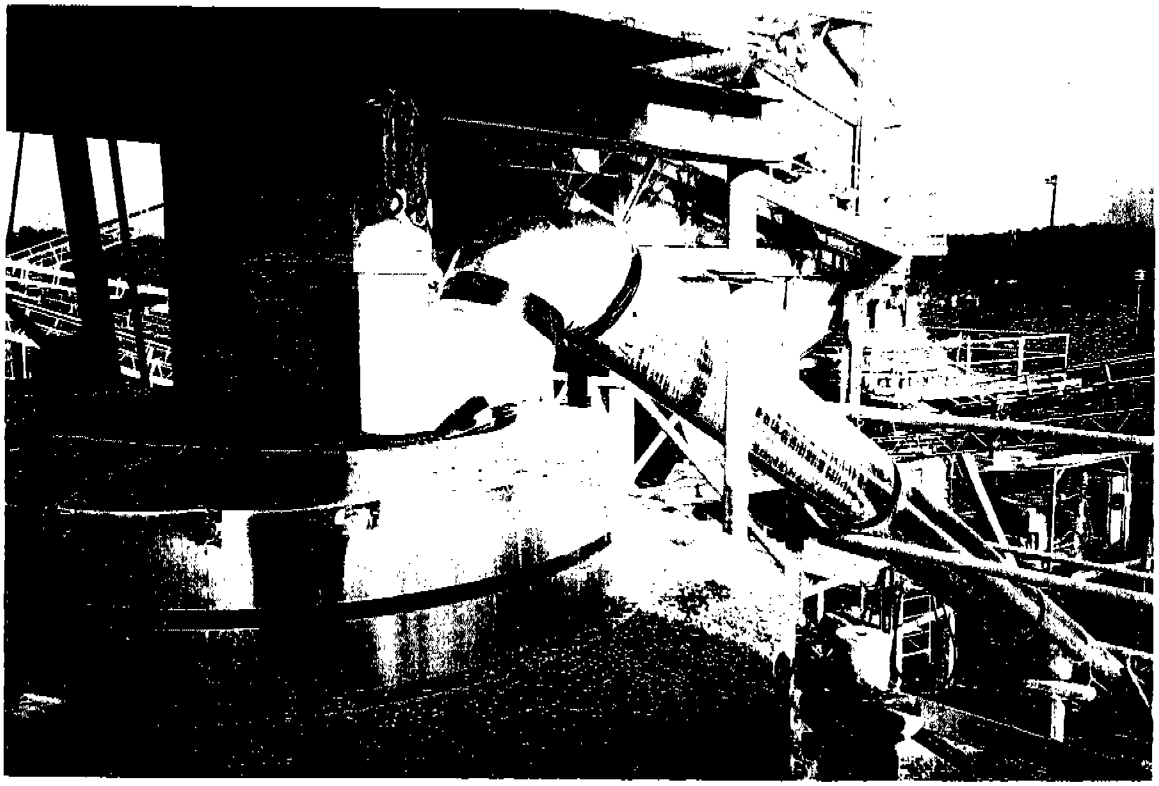
PHOTOGRAPHS OF TEST LOCATIONS



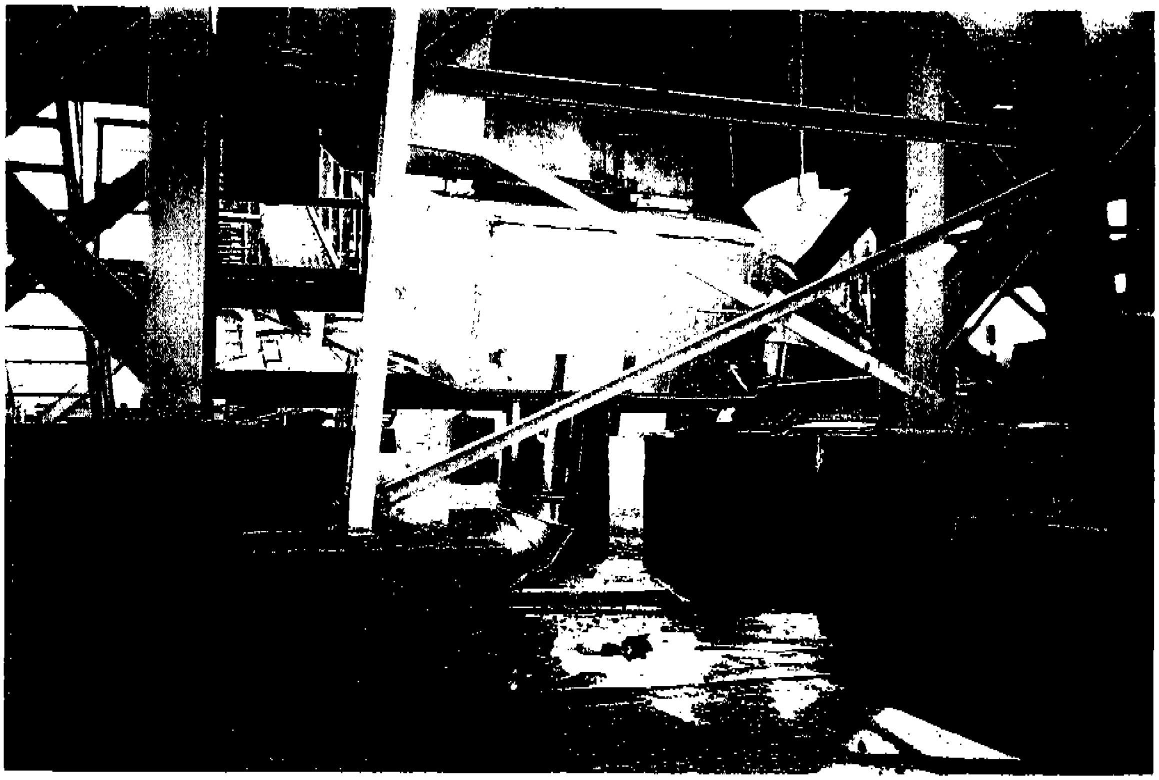
Photograph 13. Fines Crusher 12 Inch Inlet Duct Coming Down to Tee (upper part of photograph)
Blower and Test Location (lower part of photograph)



Photograph 14. Fines Crusher 16 Inch Outlet Takeoff Duct (under platform)
Teed to 12 Inch Inlet Duct, Increased to 18 Inch Sample Duct



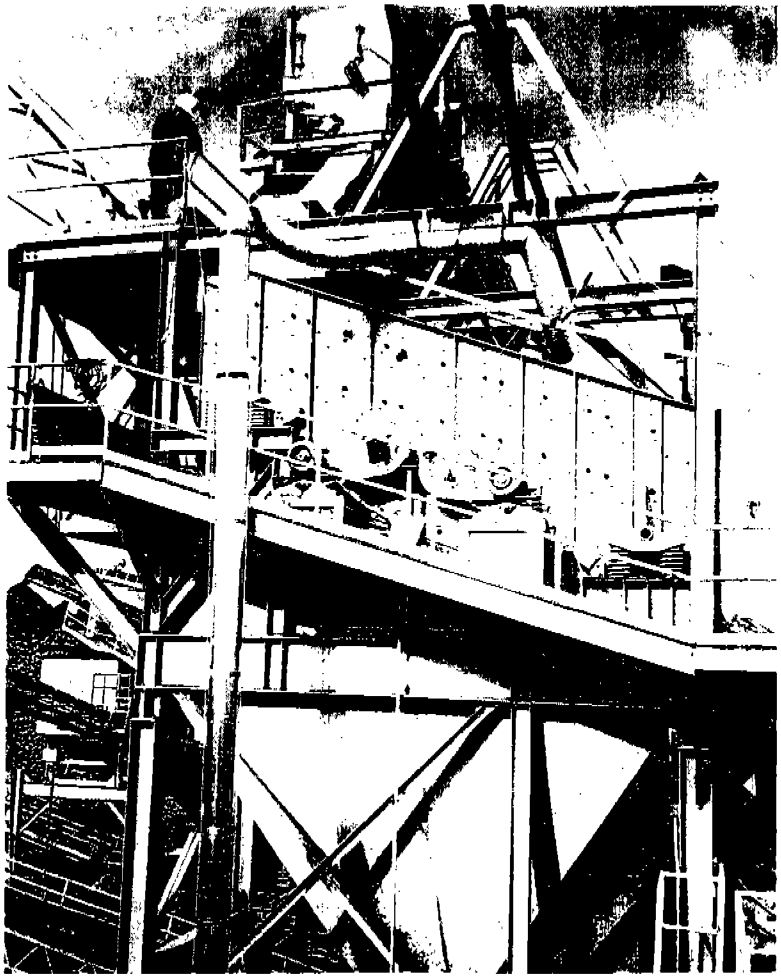
Photograph 11. Fines Crusher Inlet Enclosure with 12 Inch Takeoff Duct Coming Down



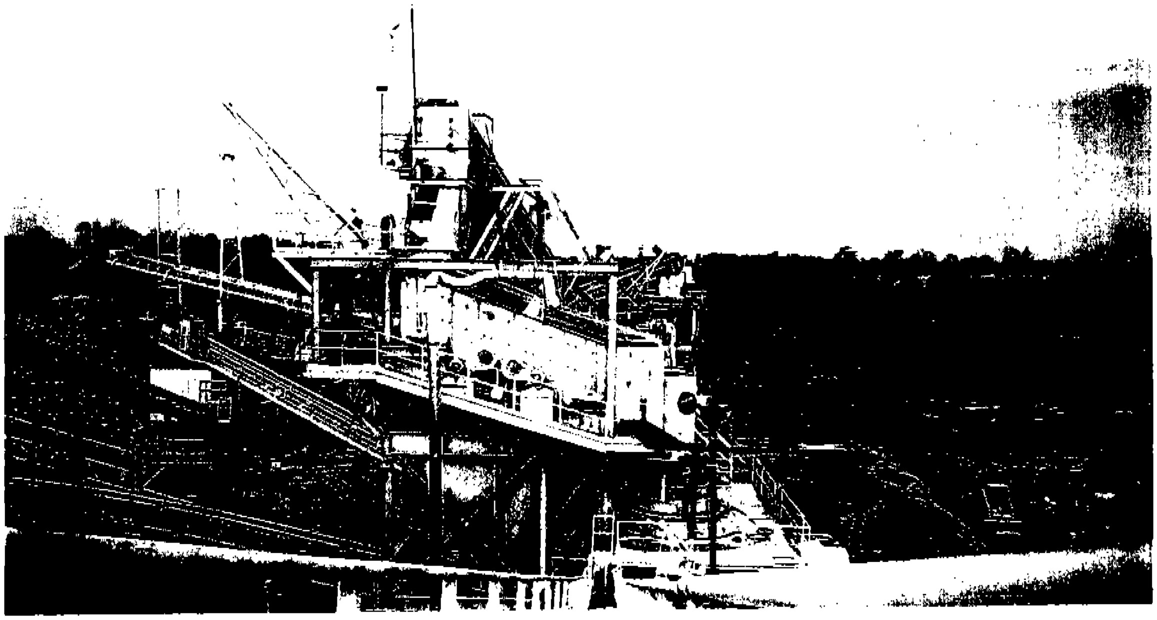
Photograph 12. Fines Crusher 16 Inch Outlet Takeoff Duct and Enclosure

Photograph 9. Transfer Point Combined Inlet and Outlet Enclosure Hood with 12 Inch Takeoff Duct

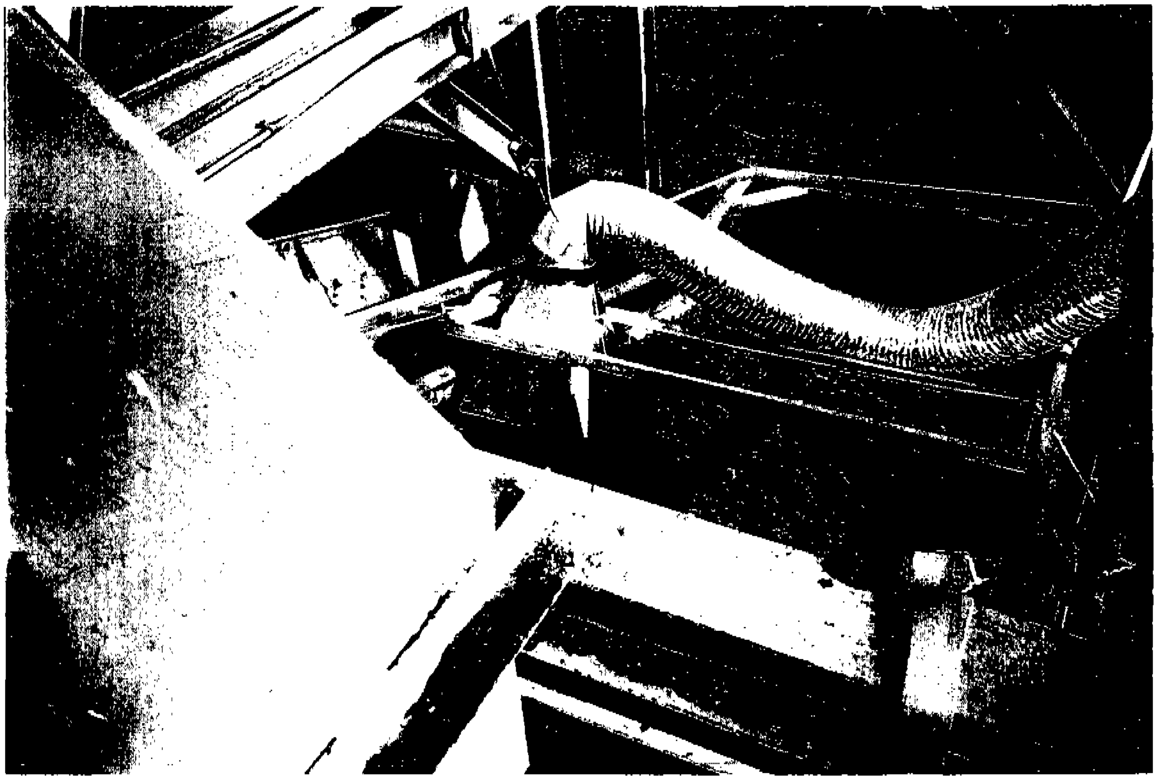
Photograph 10. Transfer Point 12 Inch Outlet Duct Proceeding to Sample Location and Blower Below



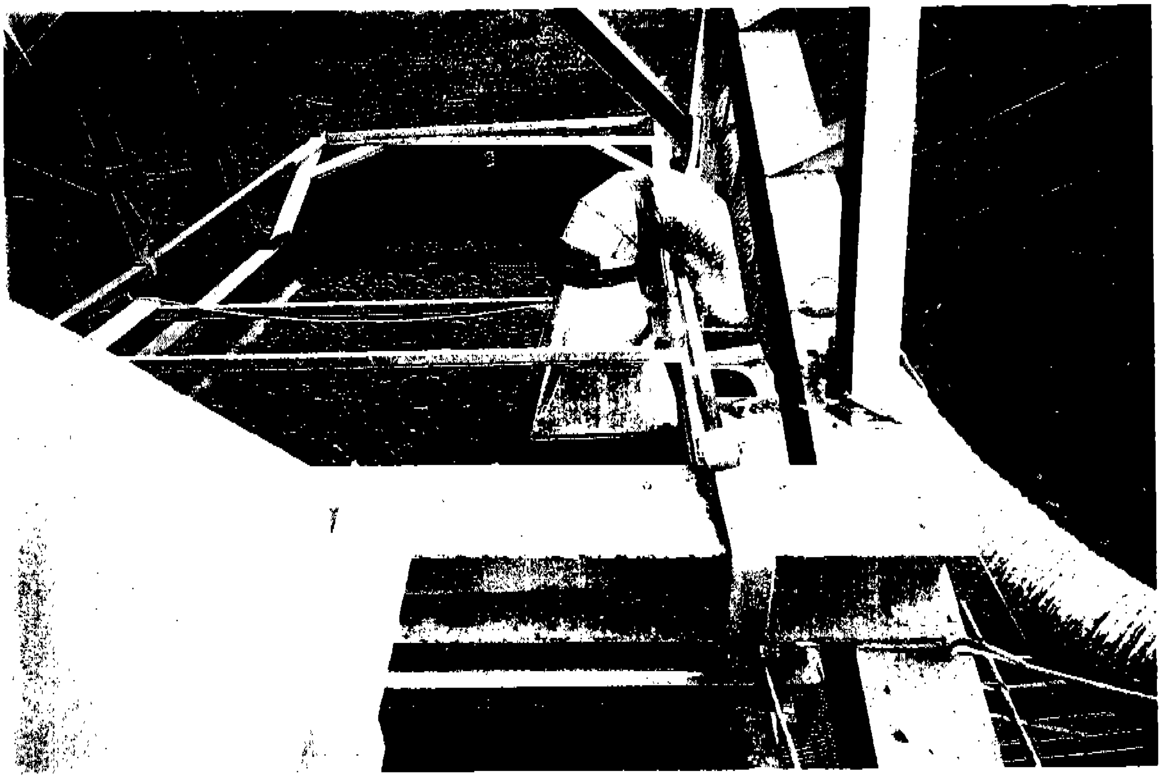
Photograph 7. Vibrating Screen, Flexible Takeoff Duct Connected to Rigid Outlet Duct Proceeding to Sample Location and Blower Below



Photograph 8. Vibrating Screen, Wind Speed and Direction Indicator in Foreground, Traversing Track-Mounted Hood System in Background

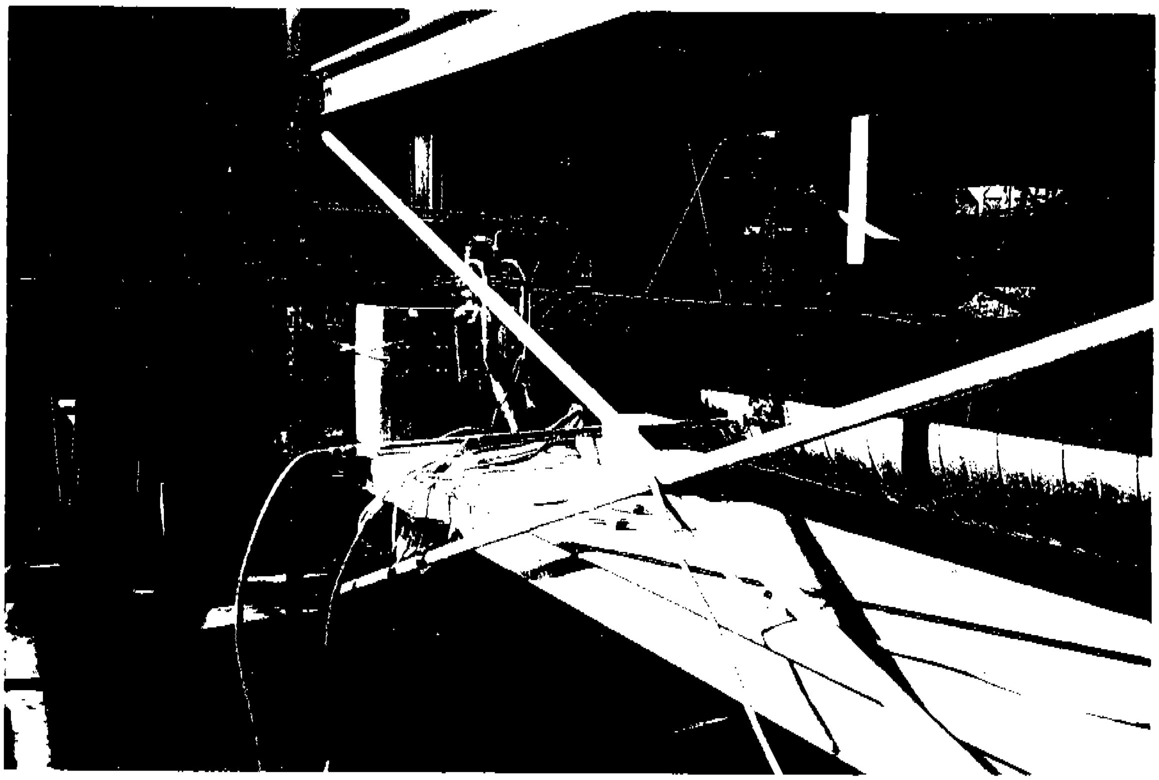


Photograph 5. Vibrating Screen, Track-Mounted Hood System with Flexible Duct Takeoff to Allow Traversing of the Hood System

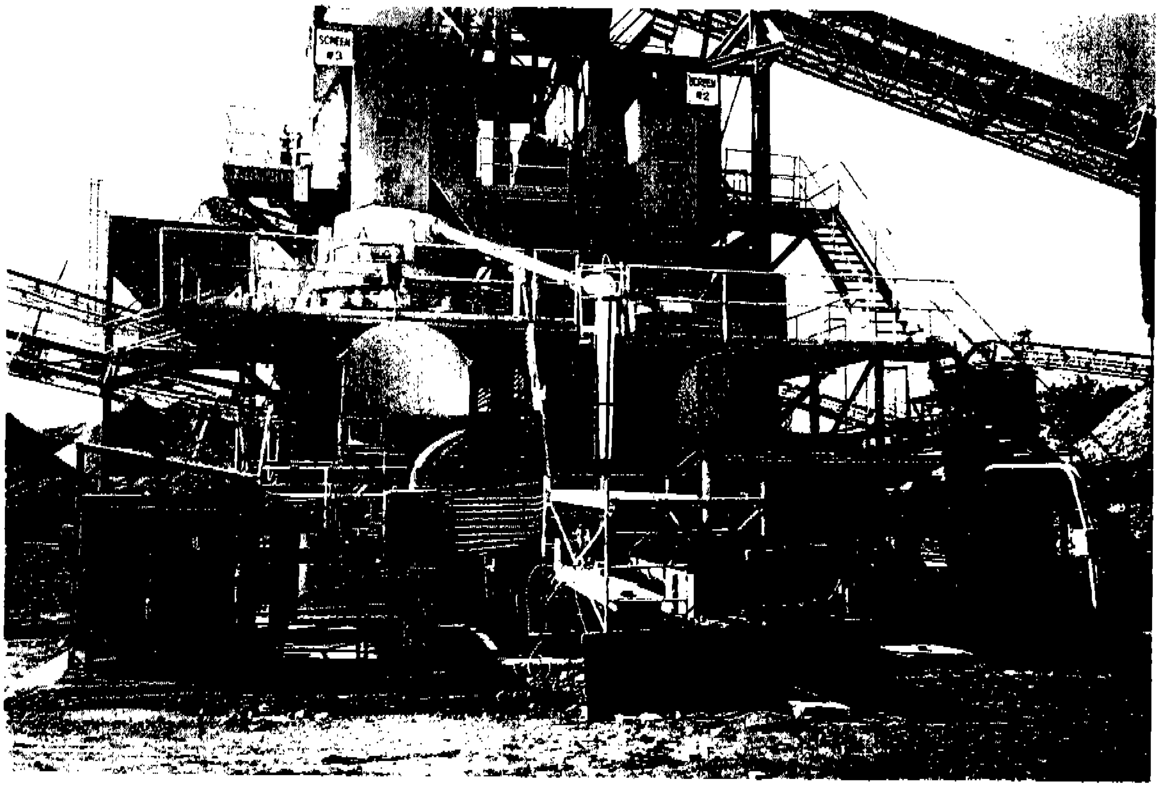


Photograph 6. Vibrating Screen, Track-Mounted Hood System, Structural Steel I Beam and Stone Flow Prevent Sampling in Upper 4 Feet of Vibrating Screen

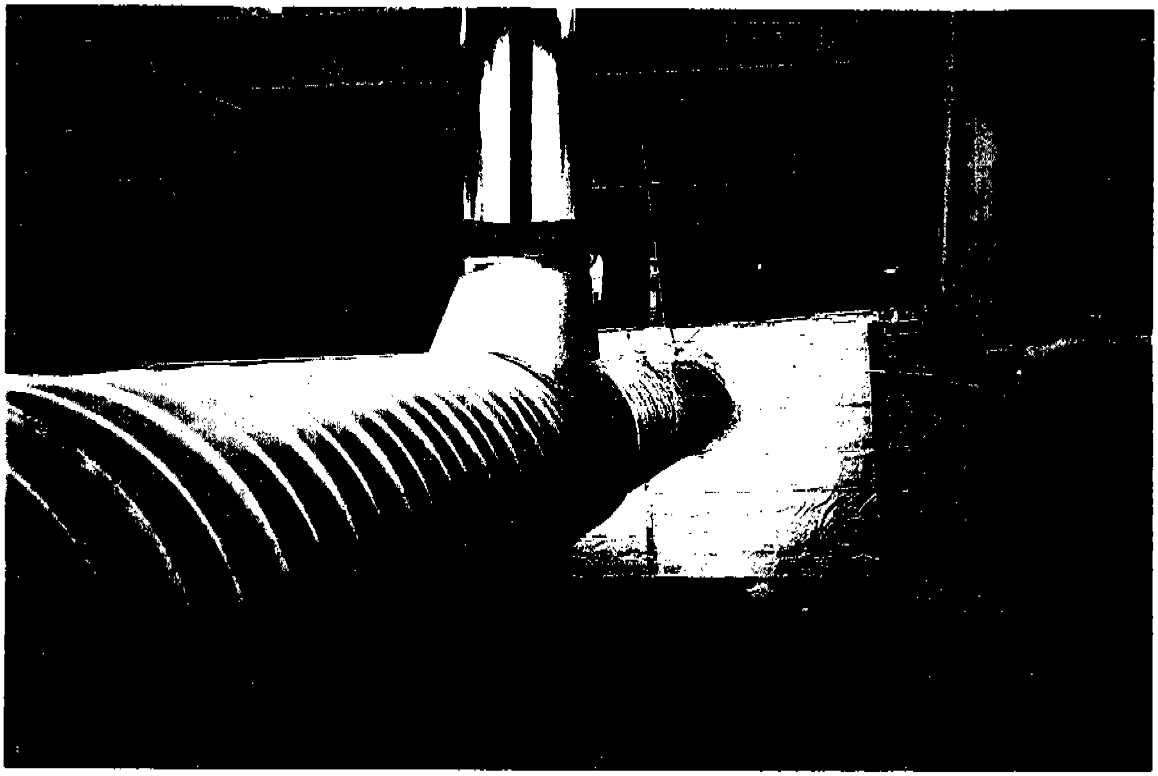
Photograph 3. Tertiary Crusher, South Side of Outlet Enclosure



Photograph 4. Tertiary Crusher 18 Inch Sample Duct
Tee and Outlet Enclosure can be seen in the Background.



Photograph 1. Tertiary Crusher Inlets Wyed Together with Common 12 Inch Duct Coming Down to Tee (upper part of photograph) Blower and Test Location (lower part of photograph)



Photograph 2. Tertiary Crusher 16 Inch Outlet Takeoff Duct Teed to 12 Inch Common Inlet Duct, Increased to 18 Inch Sample Duct

APPENDIX B.

PM_{10} AND $PM_{2.5}$ TEST CALCULATIONS

Step 1. Select sampling location and port sizes.

Step 2. Preliminary Measurements

$$\mu = C_1 + C_2 T_s + C_3 T_s^2 + C_4(\%O_2) - C_5 B_{ws} \qquad \text{Equation 1}$$

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(100 - \%O_2 - \%CO_2) \qquad \text{Equation 2}$$

$$M_w = M_d(1 - B_{ws}) + 18(B_{ws}) \qquad \text{Equation 3}$$

Calculations are based on data obtained during the preliminary measurements.

Step 3. Determine the sample gas flow rate.

$$C = 1 + 0.0057193\left[\frac{\mu}{P_s D_{50}}\right]\left[\frac{T_s}{M_w}\right]^{0.5} \qquad \text{Equation 7}$$

$$D_{50_{LL}} = 9.507 C^{0.3007}\left[\frac{M_w P_s}{T_s}\right]^{0.1993} \qquad \text{Equation 9 } (N_{re} < 3162)$$

$$D_{50} = \left(\frac{11 + D_{50_{LL}}}{2}\right) \qquad \text{Equation 10}$$

All calculations in this step use data obtained during the preliminary traverse.

Step 3. Determine the sample gas flow rate (continued).

$$Q_S = Q_I = 0.07296(\mu)\left[\frac{T_s}{M_w P_s}\right]^{0.2949}\left[\frac{1}{D_{50}}\right]^{1.4102} \qquad \text{Equation 4}$$

$$N_{re} = 8.64\text{x}10^5\left[\frac{P_s M_w}{T_s}\right]\left[\frac{Q_s}{\mu}\right] \qquad \text{Equation 8}$$

If Nre > 3162, then recalculate the $D_{50_{LL}}$ using Equation 11. Calculate the D_{50} target value.
If Nre <3162 go directly to Point A.

$$D_{50_{LL}} = 10.0959C^{0.4400}\left[\frac{M_w P_s}{T_s}\right]^{0.0600} \qquad \text{Equation 11 } (N_{re} \geq 3162)$$

$$D_{50} = \left(\frac{11 + D_{50LL}}{2}\right) \qquad \text{Equation 10}$$

Use value of $D_{50_{LL}}$ determined in Equation 11., recalculate the sample flow rate in cyclone I using the D_{50} from Equation 10.

$$Q_S = Q_I = 0.07296(\mu)\left[\frac{T_s}{M_w P_s}\right]^{0.2949}\left[\frac{1}{D_{50}}\right]^{1.4102} \qquad \text{Equation 4}$$

Recheck the Reynolds Number using Equation 8 to confirm that it is equal to or greater than 3162.

Step 3. Determine the sample gas flow rate (continued).

POINT A

$$\Delta H = \left[\frac{Q_s(1 - B_{ws})P_s}{T_s}\right]^2\left[\frac{1.083 T_m M_d \Delta H@}{P_{bar}}\right] \qquad \text{Equation 12}$$

Determine the orifice pressure drop using the sample gas flow rate, Q_s, from the preliminary traverse and measured (or estimated) stack data obtained during the preliminary traverse.

Calculate orifice pressure drops(ΔH) at ± 50°F of the observed stack temperature during the preliminary traverse. These data are used if there is a significant change in the gas temperature during the test.

Step 3. Select Nozzle(s)

POINT B

$$v_n = \frac{3.056Q_s}{D^2} \quad \text{Equation 13}$$

Qs is obtained from Equation 4. The diameter, D, of the nozzle believed to be most appropriate is used in Equation 13. The next set of steps are a trial-and-error process for selecting the nozzle that will allow isokinetic sampling.

$$R_{min} = \left[0.2457 + \left(0.3072 - \frac{0.2603(\mu)(Q_s)^{0.5}}{v_n^{1.5}}\right)^{0.5}\right] \quad \text{Equation 14}$$

$$R_{max} = \left[0.4457 + \left(0.5690 + \frac{0.2603(\mu)(Q_s)^{0.5}}{v_n^{1.5}}\right)^{0.5}\right] \quad \text{Equation 15}$$

If R_{min} is an imaginary number (value under square root function is negative) or if R_{min} is less than 0.5, then the minimum velocity is calculated as shown in Equation 16. If R_{min} is a real value greater than 0.5, then the minimum velocity is calculated using Equation 17.

$$v_{min} = v_n(0.5) \quad \text{Equation 16}$$

$$v_{min} = v_n R_{min} \quad \text{Equation 17}$$

Equation 18 should be used to calculate the maximum stack velocity if the R_{max} value is greater than 1.5. If R_{max} is equal to or less than 1.5, Equation 19 should be used to calculate the maximum stack velocity.

$$v_{max} = v_n(1.5) \quad \text{Equation 18}$$

$$v_{max} = v_n R_{max} \quad \text{Equation 19}$$

$$\Delta p_{min} = 1.3686x10^{-4}\left[\frac{P_s M_w}{T_s}\right]\left[\frac{v_{min}}{C_p}\right]^2 \quad \text{Equation 20}$$

$$\Delta p_{max} = 1.3686x10^{-4}\left[\frac{P_s M_w}{T_s}\right]\left[\frac{v_{max}}{C_p}\right]^2 \quad \text{Equation 21}$$

Compare the velocity pressure minimum and maximums calculated in Equations 16 and 17. If these completely bracket the velocity pressure drop measurements during the preliminary traverse, go to Point C. If some of the velocity pressure drops are outside the calculated minimum and maximum values, return to Point B and select another nozzle diameter. Repeat this trial-and-error process as many times as necessary

POINT C

Step 4. Assemble the combined cyclone sampling head and leak check the entire train.

This is the only time that the combined cyclone sampling head is leak checked.

Step 5. Conduct the test.

$$t_1 = \left[\frac{\sqrt{\Delta p_1}}{\left(\sqrt{\Delta p}\right)_{avg}}\right]\left[\frac{t_r}{N}\right]$$ Equation 22

$$t_n = t_1 \frac{\sqrt{\Delta p_n}}{\sqrt{\Delta p_1}}$$ Equation 23

$$\Delta p_s = \Delta p_m \left[\frac{C_p}{C_p'}\right]^2$$ Equation 24

The velocity pressure correction shown in this equation is used only if the pitot tube used with the combined cyclone sampling head has a different coefficient that the pitot tube used during the preliminary traverse.

$$b_f = (12.0 / A)$$ Equation 25

$$\Delta p_{s_2} = \Delta p_{s_1} \left[\frac{1}{(1 - b_f)}\right]^2$$ Equation 26

The velocity pressure correction provided by Equation 26 is needed only when the duct or stack being tested has a diameter less than 24 inches. This correction term should not be used on stacks less than 18 inches diameter being tested by extractive sampling techniques.

Do <u>not</u> leak check the combined cyclone sampling head and train during port changes.

Step 6. Document the process and air pollution control device operating conditions.

Step 7 - Remove the combined cyclone head after the test and leak check the remainder of the sampling system.

Remove the combined cyclone sampling head before leaking checking the remainder of the sampling train.

Step 8 - Recover the particulate in the > 10 micrometers, ≤10 and > 2.5 micrometers, and ≤ 2.5 micrometers size ranges.

Disiccate and weigh the samples in each size category. Determine the solids catch weights in the following size ranges

- >10 micrometer size range (M1, sample jar #1)
- ≥ 10 micrometers and >2.5 micrometers size range (M2, sample jar #2)
- ≤ 2.5 micrometer size range (M3 and M4, sample jars #3 and #4)

Step 9. Calculate the actual test conditions.

$$V_{ms} = \left[\frac{528}{29.92}\right]\left[\gamma V_m\right]\left[\frac{\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{T_m}\right] \qquad \text{Equation 27}$$

$$Q_{s_{ST}} = \frac{V_{ms}}{\theta} \qquad \text{Equation 28}$$

$$V_{ws} = 0.04707 V_c \qquad \text{Equation 29}$$

$$B_{ws} = \left[\frac{V_{ws}}{V_{ms} + V_{ws}}\right] \qquad \text{Equation 30}$$

The data used in all of these equations is obtained during the test run.

$$Q_s = \frac{29.92}{528} Q_{s_{ST}} \left[\frac{1}{\left(1 - B_{ws}\right)}\right]\left[\frac{T_s}{P_s}\right] \qquad \text{Equation 31}$$

$$\mu = C_1 + C_2 T_s + C_3 T_s^2 + C_4\left(\%O_2\right) - C_5 B_{ws} \qquad \text{Equation 1}$$

$$M_d = 0.44\left(\%CO_2\right) + 0.32\left(\%O_2\right) + 0.28(100 - \%O_2 - \%CO_2) \qquad \text{Equation 2}$$

$$M_w = M_d(1 - B_{ws}) + 18(B_{ws}) \qquad \text{Equation 3}$$

$$N_{re} = 8.64\text{x}10^5\left[\frac{P_s M_w}{T_s}\right]\left[\frac{Q_s}{\mu}\right] \qquad \text{Equation 8}$$

Step 9. Calculate the actual test conditions.
Determine the cut diameter of cyclone I based on actual conditions.

$$D_{50} = 0.15625\left[\frac{T_s}{M_w P_s}\right]^{0.2091}\left[\frac{\mu}{Q_s}\right]^{0.7091}$$ Equation 32

Step 9. Calculate the actual test conditions. Determine the cut diameter of cyclone IV at actual conditions.

Note: this is a trial-and-error iterative solution. This is needed since the Cunningham correction factor is a function of the particle diameter, and the cut diameter is a function of the Cunningham correction factor.

$$C = 1 + 0.0057193\left[\frac{\mu}{P_s D_{50}}\right]\left[\frac{T_s}{M_w}\right]^{0.5}$$ Equation 7

$$D_{50} = 0.0024302\left[\frac{\mu}{Q_s}\right]^{1.1791}\left[\frac{1}{C}\right]^{0.5}\left[\frac{T_s}{P_s M_w}\right]^{0.6790}$$ Equation 33 ($N_{re}<3162$)

$$D_{50} = 0.019723\left[\frac{\mu}{Q_s}\right]^{0.8058}\left[\frac{1}{C}\right]^{0.5}\left[\frac{T_s}{P_s M_w}\right]^{0.3058}$$ Equation 34 ($N_{re}\geq 3162$)

POINT D

$$C_1 = 1 + 0.0057193\left[\frac{\mu}{P_s D_{50}}\right]\left[\frac{T_s}{M_w}\right]^{0.5}$$ Equation 35

$$D_{50_1} = 0.0024302\left[\frac{\mu}{Q_s}\right]^{1.1791}\left[\frac{1}{C_1}\right]^{0.5}\left[\frac{T_s}{P_s M_w}\right]^{0.6790}$$

Equation 36 ($N_{re}<3162$)

$$D_{50_1} = 0.019723\left[\frac{\mu}{Q_s}\right]^{0.8058}\left[\frac{1}{C_1}\right]^{0.5}\left[\frac{T_s}{P_s M_w}\right]^{0.3058}$$ Equation 37 ($N_{re}\geq 3162$)

$$Z = \frac{D_{50_1}}{D_{50}}$$ Equation 38

If Z is equal to or greater than 0.99 and less than or equal to 1.01, then continue on to point E.
If Z is outside this range, go back to point D and modify C1 slightly. Continue this iterative process until the Z value is between 0.99 and 1.01.

Step 9. Calculate the actual test conditions.
Determine the average stack velocity.

POINT E

$$v = K_p C_p \left(\sqrt{(\Delta p)}\right)_{avg} \left[\sqrt{\frac{T_s}{P_s M_w}}\right] \qquad \text{Equation 40}$$

The isokinetic ratio is calculated using equation 35. This ratio must be between 80% and 120%.

$$I = \left(\frac{100 T_s V_{ms} 29.92}{60 v \theta A_n P_s (1 - B_{ws}) 528}\right) \qquad \text{Equation 41}$$

$$C_{total} = \left(\frac{7000}{453{,}592}\right)\left[\frac{M_1 + M_2 + M_3 + M_4}{V_{ms}}\right] \qquad \text{Equation 42}$$

$$C_{PM_{10}} = \left(\frac{7000}{453{,}592}\right)\left[\frac{M_2 + M_3 + M_4}{V_{ms}}\right] \qquad \text{Equation 43}$$

$$C_{PM_{2.5}} = \left(\frac{7000}{453{,}592}\right)\left[\frac{M_3 + M_4}{V_{ms}}\right] \qquad \text{Equation 44}$$

APPENDIX C.

EXAMPLE EMISSION FACTOR CALCULATIONS

EXAMPLE CALCULATIONS

Run Number: VS - 1

Stack Gas Temperature, °R

$$T_s = 460 + ts$$

$$T_s = 460 + 51.6 = 511.6$$

Volume of Dry Gas Sampled at Standard Conditions, Dry Standard Cubic Feet

$$V_{mstd} = [17.64][\gamma V_m]\left[\frac{\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{T_m}\right]$$

$$V_{mstd} = [17.64][1.004][138.954]\left[\frac{\left(29.50 + \frac{0.51}{13.6}\right)}{70.6}\right]$$

$$V_{mstd} = 136.997$$

Sample Gas Flow Rate, DSCFM

$$Q_{sST} = \frac{V_{mstd}}{\theta}$$

$$Q_{sST} = \frac{136.997}{356.0}$$

$$Q_{sST} = 0.396$$

Volume of Water Sampled, SCF

$$V_{wstd} = 0.04707[Vlc]$$

$$V_{wstd} = 0.04707[38.34]$$

$$V_{wstd} = 1.805$$

Fraction of Water Vapor in Sample Gas Stream

$$\%H_2 0 = \left[\frac{V_{wstd}}{V_{mstd} + V_{wstd}} \right]$$

$$\%H_2 0 = \left[\frac{1.805}{136.997 + 1.805} \right]$$

$$\%H_2 0 = 1.3$$

Sample Gas Flow Rate, ACFM

$$Q_s = \frac{29.92}{528} \left[Q_{sST} \right] \left[\frac{1}{\left(1 - B_{ws}\right)} \right] \left[\frac{T_s}{P_s} \right]$$

$$Q_s = \frac{29.92}{528} [0.396] \left[\frac{1}{(1 - 0.013)} \right] \left[\frac{511.6}{29.47} \right]$$

$$Q_s = 0.395$$

Stack Gas Viscosity at Actual Sampling Conditions

$$\mu = C_1 + C_2 T_s + C_3 T_s^{\ 2} + C_4 \left(\%O_2\right) - C_5 B_{ws}$$

Where:	C1	=	51.05
	C2	=	0.207
	C3	=	0.0000324
	C4	=	53.147
	C5	=	74. 143
	Ts	=	460 + ts

$$\mu = 51.05 + 0.207[511.6] + 0.0000324[511.6]^2 + 53.147 \left[\frac{20.9}{100} \right] - 74.143 \left[\frac{1.3}{100} \right]$$

$$\mu = 175.58 \ \text{ micropoise}$$

Molecular Weight of Sample Gas, Dry

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

$$M_d = 0.44(0\%) + 0.32(20.9) + 0.28(100 - 20.9 - 0\%)$$

$$M_d = 28.84 \quad \text{pounds / pound mole}$$

Molecular Weight of Sample Gas, Actual Conditions

$$M_w = M_d(1 - B_{ws}) + 18(B_{ws})$$

$$M_w = 28.83(1 - \frac{1.3}{100}) + 18(\frac{1.3}{100})$$

$$M_w = 28.70$$

Diameter of Particles in PM_{10} Cyclone, Microns

$$D_{50} = 0.15625\left[\frac{T_s}{M_w P_s}\right]^{0.2091}\left[\frac{\mu}{Q_s}\right]^{0.7091}$$

$$D_{50} = 0.15625\left[\frac{511.6}{(28.70)(29.47)}\right]^{0.2091}\left[\frac{175.58}{0.395}\right]^{0.7091}$$

$$D_{50} = 10.61$$

Reynolds Number of Gas Flowing through the Sample Head, Demensionless

$$N_{re} = 8.64\text{x}10^5\left[\frac{P_s M_w}{T_s}\right]\left[\frac{Q_s}{\mu}\right]$$

$$N_{re} = 8.64\text{x}10^5\left[\frac{(29.47)(28.70)}{511.6}\right]\left[\frac{0.395}{175.58}\right]$$

$$N_{re} = 3{,}213.4$$

Cunningham Correction Factor, Dimensionless

$$C = 1 + 0.0057193\left[\frac{\mu}{P_s D_{50}}\right]\left[\frac{T_s}{M_w}\right]^{0.5}$$

$$C = 1 + 0.0057193\left[\frac{\mu}{P_s D_{50}}\right]\left[\frac{T_s}{M_w}\right]^{0.5}$$

$$C = 1.065$$

Diameter of Particles in $PM_{2.5}$ Cyclone, Microns

$$D_{50} = 0.019723\left[\frac{\mu}{Q_s}\right]^{0.8058}\left[\frac{1}{C_1}\right]^{0.5}\left[\frac{T_s}{P_s M_w}\right]^{0.3058}$$

$$D_{50} = 0.019723\left[\frac{175.58}{0.395}\right]^{0.8058}\left[\frac{1}{1.065}\right]^{0.5}\left[\frac{511.6}{(29.47)(29.70)}\right]^{0.3058}$$

$$D_{50} = 2.22$$

Average Stack Gas Velocity, Feet/second

$$vs = K_p C_p\left(\sqrt{(\Delta p)}\right)_{avg}\left[\sqrt{\frac{T_s}{P_s M_w}}\right]$$

$$vs = (85.49)(0.84)\left(\sqrt{(0.0973)}\right)\left[\sqrt{\frac{511.6}{(29.47)(29.70)}}\right]$$

$$vs = 17.43$$

Wet Volumetric Flue Gas Flow Rate at Stack Conditions, Cubic Feet per Minute

$$Qaw = \left[\frac{60}{144}\right] * vs * A$$

$$Qaw = \left[\frac{60}{144}\right] * 17.43 * 0.785$$

$$Qaw = 821$$

Dry Volumetric Flue Gas Flow Rate at Standard Conditions, Cubic Feet per Minute

$$Qsd = \left[\frac{60}{144}\right] * Mfd * vs * A * \left[\frac{528}{ts + 460}\right]\left[\frac{Ps}{29.92}\right]$$

$$Qsd = \left[\frac{60}{144}\right] * 0.987 * 17.43 * 0.785\left[\frac{528}{511.6}\right]\left[\frac{29.47}{29.92}\right]$$

$$Qsd = 824$$

Isokinetic Sampling Rate, Percent

$$I = \left(\frac{100T_sV_{ms}29.92}{60v\theta A_nP_s(1 - B_{ws})528}\right)$$

$$I = \left(\frac{100(511.6)(136.997)(29.92)}{60(17.43)(346.0)(0.000383)(29.47)(1 - 0.013)528}\right)$$

$$I = 98.5$$

Particulate Concentration ≤ 10 Microns, Grains per Dry Standard Cubic Foot

$$C_{PM10} = \left(\frac{7000}{453{,}592}\right)\left[\frac{\text{CatchWeight}}{V_{ms}}\right]$$

$$C_{PM10} = \left(\frac{7000}{453{,}592}\right)\left[\frac{0.00105}{136.997}\right]$$

$$C_{PM10} = 0.00118$$

Particulate Concentration ≤ 2.5 Microns, Grains per Dry Standard Cubic Foot

$$C_{PM2.5} = \left(\frac{7000}{453{,}592}\right)\left[\frac{\text{CatchWeight}}{V_{ms}}\right]$$

$$C_{PM10} = \left(\frac{7000}{453{,}592}\right)\left[\frac{0.0021}{136.997}\right]$$

$$C_{PM2.5} = 0.000237$$

Particulate ≤10 Microns Emission Rate, Pounds per hour

$$E_{PM10} = \left(\frac{C_{PM10}}{7000}\right) * Qsd * 60$$

$$E_{PM10} = \left(\frac{0.00118}{7000}\right) 824 * 60$$

$$E_{PM10} = 0.0077$$

Particulate Concentration ≤ 10 Microns, Grains per Dry Standard Cubic Foot

$$C_{PM10} = \left(\frac{7000}{453{,}592}\right)\left[\frac{\text{Catch Weight}}{V_{ms}}\right]$$

$$C_{PM10} = \left(\frac{7000}{453{,}592}\right)\left[\frac{0.00105}{136.997}\right]$$

$$C_{PM10} = 0.00118$$

Particulate Concentration ≤ 2.5 Microns, Grains per Dry Standard Cubic Foot

$$C_{PM2.5} = \left(\frac{7000}{453{,}592}\right)\left[\frac{\text{Catch Weight}}{V_{ms}}\right]$$

$$C_{PM10} = \left(\frac{7000}{453{,}592}\right)\left[\frac{0.0021}{136.997}\right]$$

$$C_{PM2.5} = 0.000237$$

Particulate ≤10 Microns Emission Rate, Pounds per hour

$$E_{PM10} = \left(\frac{C_{PM10}}{7000}\right) * Qsd * 60$$

$$E_{PM10} = \left(\frac{0.00118}{7000}\right)824 * 60$$

$E_{PM10} = 0.0077$ (1 point) (24 points = 0.0077 x 24 = 0.1848 lbs/hr)

Particulate ≤ 2.5 Microns Emission Rate, Pounds per hour

$$E_{PM2.5} = \left(\frac{C_{PM2.5}}{7000}\right) * Qsd * 60$$

$$E_{PM2.5} = \left(\frac{0.000237}{7000}\right) 824 * 60$$

$$E_{PM2.5} = 0.0014$$ (1 point) (24 points = 0.0014 x 24 = 0.0332 lbs/hr)

PM 10 and PM 2.5 Emission Factors, Pounds per Ton

$$EF_{Pm10} = \frac{E_{Pm10}}{Tons / hour}$$

$$EF_{Pm10} = \frac{0.1859}{907.3}$$

$$EF_{Pm10} = 0.00020$$

$$EF_{Pm2.5} = \frac{E_{Pm2.5}}{Tons / hour}$$

$$EF_{Pm2.5} = \frac{0.0332}{907.3}$$

$$EF_{Pm2.5} = 0.00004$$

APPENDIX D.

CALCULATIONS SHEETS

Tertiary Crusher

Client: National Stone Association
Facility: Vulcan Materials Company, Pineville, North Carolina
Sampling Location: Tertiary Crusher

		TC-1	**TC-2**	**TC-3**
	Test Date	11/11/96	11/12/96	11/13/96
	Run Start Time	0914	1008	0730
	Run Finish Time	1615	1625	1345
	Net Sampling Points	12	12	12
Theta	Net Run Time, Minutes	358.58	358.58	359.59
Dia	Nozzle Diameter, Inches	0.234	0.234	0.234
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	0.9780	0.9780	0.9780
Pbar	Barometric Pressure, Inches Hg	29.50	29.85	29.85
ΔH	Avg. Pressure Differential of Meter, Inches H_20	0.49	0.48	0.48
Vm	Volume of Metered Gas Sample, Cubic Feet	144.527	145.322	145.974
tm	Dry Gas Meter Temperature, ° F	73	82	78
Vmstd	Volume of Metered Gas Sample, DSCF	138.143	138.212	139.969
Vlc	Total Volume of Liquid Collected, ml	37.0	42.0	26.0
	Volume used if over saturation, ml		38.7	
Vwstd	Volume of Water Vapor, SCF	1.742	1.820	1.224
%H2O	Moisture Content, Percent by Volume	1.2	1.3	0.9
$\%H2O_{SAT}$	Moisture, Saturated @ Flue Gas Conditions, %	1.3	1.3	1.4
Mfd	Dry Mole Fraction	0.988	0.987	0.991
$\%O_2$	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.71	28.70	28.75
Pg	Flue Gas Static Pressure, Inches H_2O	-0.52	-0.57	-0.39
Ps	Absolute Flue Gas Pressure, Inches Hg	29.46	29.81	29.82
ts	Flue Gas Temperature, ° F	52.0	52.4	53.9
ΔP	Average Velocity Head, Inches H_2O	0.1624	0.1781	0.1697
vs	Flue Gas Velocity, Feet/Second	22.52	23.45	22.91
A	Stack/Duct Area, Square Inches	254.9	254.9	254.9
Qsd	Volumetric Air Flow Rate, Dry SCFM	2,398	2,524	2,470
Qaw	Volumetric Air Flow Rate, Wet ACFM	2,392	2,490	2,433
%I	Isokinetic Sampling Rate, Percent	95.2	90.5	93.4
	PM10 & PM2.5 Results Calculations			
μstack	Stack Gas Viscosity, micropoises	175.71	175.77	176.45
Qs	Flow, at Cyclone Conditions, ACFM (Actual)	0.384	0.381	0.384
Cut size	Dia. of Particles in PM10 Cyclone, Microns	10.83	10.87	10.84
Cut size	Dia. of Particles in PM2.5 Cyclone, Microns	2.28	2.29	2.29
	Particulate Catch Weights, Milligrams			
≤PM10	Less than or equal to 10 Microns	180.6	132.6	124.5
≤PM2.5	Less than of equal to 2.5 Microns	35.8	41.3	37.9

	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF	2.02E-02	1.48E-02	1.37E-02
µg/m^3	Concentration, micrograms/DSCM	46170.2	33882.1	31413.0
	Particulate ≤ 2.5 Microns			
gr/DSCF	Concentration, grains/DSCF	4.00E-03	4.61E-03	4.18E-03
µg/m^3	Concentration, micrograms/DSCM	9152.2	10553.0	9562.7
	Ambient Particulate Concentrations			
µg/m^3	PM10 Concentration, micrograms/DSCM	54.50	21.10	34.20
µg/m^3	PM2.5 Concentration, micrograms/DSCM	22.20	13.60	28.50
	Particulate Corrected for Ambient Concentrations			
µg/m^3	PM10 Concentration, micrograms/DSCM	46115.65	33860.99	31378.84
µg/m^3	PM2.5 Concentration, micrograms/DSCM	9130.02	10539.42	9534.18
	Particulate Emission Rates, Pounds/Hour			
lb/hr	PM10 Emission Rate, lb/hr	0.4142	0.3201	0.2903
lb/hr	PM2.5 Emission Rate, lb/hr	0.0820	0.0996	0.0882
	Equipment Throughput Rate TPH			
Tons/Hr	Stone Troughput Rate during Test, Tons/Hour	952	889	1035
	Emission Factors			
lbs/Ton	Pounds of PM10 per Ton of Stone	0.00044	0.00036	0.00028
lbs/Ton	Pounds of PM2.5 per Ton of Stone	0.00009	0.00011	0.00009

Client: National Stone Association
Facility: Vulcan Materials Company, Pineville, North Carolina
Sampling Location: Transfer Point

		TP-1	TP-2	TP-3
	Test Date	11/11/96	11/12/96	11/13/96
	Run Start Time	1015	1003	0731
	Run Finish Time	1558	1600	1325
	Net Sampling Points	1	1	1
Theta	Net Run Time, Minutes	342.38	373.71	350.20
Dia	Nozzle Diameter, Inches	0.265	0.265	0.265
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	1.0040	1.0040	1.0040
Pbar	Barometric Pressure, Inches Hg	29.50	29.85	29.85
ΔH	Avg. Pressure Differential of Meter, Inches H_20	0.56	0.55	0.55
Vm	Volume of Metered Gas Sample, Cubic Feet	144.425	153.937	144.135
tm	Dry Gas Meter Temperature, °F	69	76	70
Vmstd	Volume of Metered Gas Sample, DSCF	142.920	152.148	143.857
Vlc	Total Volume of Liquid Collected, ml	44.0	43.0	27.0
	Volume used if over saturation, ml			
Vwstd	Volume of Water Vapor, SCF	2.071	2.024	1.271
%H2O	Moisture Content, Percent by Volume	1.4	1.3	0.9
$\%H2O_{SAT}$	Moisture, Saturated @ Flue Gas Conditions, %	1.4	1.3	1.0
Mfd	Dry Mole Fraction	0.986	0.987	0.991
$\%O_2$	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.69	28.70	28.74
Pg	Flue Gas Static Pressure, Inches H_2O	-0.24	-0.32	-0.25
Ps	Absolute Flue Gas Pressure, Inches Hg	29.48	29.83	29.83
ts	Flue Gas Temperature, °F	52.8	51.6	46.1
ΔP	Average Velocity Head, Inches H_2O	0.1225	0.1310	0.1225
vs	Flue Gas Velocity, Feet/Second	19.57	20.10	19.31
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM	922	962	938
Qaw	Volumetric Air Flow Rate, Wet ACFM	922	947	910
%I	Isokinetic Sampling Rate, Percent	92.8	86.8	89.8
	PM10 & PM2.5 Results Calculations			
μstack	Stack Gas Viscosity, micropoises	175.79	175.58	174.55
Qs	Flow, at Cyclone Conditions, ACFM (Actual)	0.418	0.401	0.399
Cut size	Dia. of Particles in PM10 Cyclone, Microns	10.21	10.47	10.44
Cut size	Dia. of Particles in PM2.5 Cyclone, Microns	2.08	2.15	2.14
	Particulate Catch Weights, Milligrams			
≤PM10	Less than or equal to 10 Microns	58.3	45.5	38.5
≤PM2.5	Less than of equal to 2.5 Microns	16.7	14.4	11.3

	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF	6.30E-03	4.62E-03	4.13E-03
µg/m³	Concentration, micrograms/DSCM	14406.2	10561.3	9451.5
	Particulate ≤ 2.5 Microns			
gr/DSCF	Concentration, grains/DSCF	1.80E-03	1.46E-03	1.21E-03
µg/m³	Concentration, micrograms/DSCM	4126.6	3342.5	2774.1
	Ambient Particulate Concentrations			
µg/m³	PM10 Concentration, micrograms/DSCM	54.50	21.10	34.20
µg/m³	PM2.5 Concentration, micrograms/DSCM	22.20	13.60	28.50
	Particulate Corrected for Ambient Concentrations			
µg/m³	PM10 Concentration, micrograms/DSCM	14351.65	10540.21	9417.33
µg/m³	PM2.5 Concentration, micrograms/DSCM	4104.43	3328.88	2745.59
	Particulate Emission Rates, Pounds/Hour			
lb/hr	PM10 Emission Rate, lb/hr	0.0496	0.0380	0.0331
lb/hr	PM2.5 Emission Rate, lb/hr	0.0142	0.0120	0.0096
	Equipment Throughput Rate TPH			
Tons/Hr	Stone Troughput Rate during Test, Tons/Hour	952.1	889.0	1034.9
	Emission Factors			
lbs/Ton	Pounds of PM10 per Ton of Stone	0.000052	0.000043	0.000032
lbs/Ton	Pounds of PM2.5 per Ton of Stone	0.000015	0.000013	0.000009

Client: National Stone Association
Facility: Vulcan Materials Company, Pineville, North Carolina
Sampling Location: Vibrating Screen

		VS-1	VS-2	VS-3
	Test Date	11/18/96	11/19/96	11/20/96
	Run Start Time	0749	0741	0734
	Run Finish Time	1525	1400	1327
	Net Sampling Points	1	1	1
Theta	Net Run Time, Minutes	346.00	347.90	344.89
Dia	Nozzle Diameter, Inches	0.265	0.265	0.265
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	1.0040	1.0040	1.0040
Pbar	Barometric Pressure, Inches Hg	29.50	29.20	29.15
Δ H	Avg. Pressure Differential of Meter, Inches H_2O	0.51	0.5	0.5
Vm	Volume of Metered Gas Sample, Cubic Feet	138.954	140.842	137.882
tm	Dry Gas Meter Temperature, ° F	70.6	70.5	68.1
Vmstd	Volume of Metered Gas Sample, DSCF	136.997	137.470	134.961
Vlc	Total Volume of Liquid Collected, ml	67.0	51.0	33.0
	Volume used if over saturation, ml	38.34		
Vwstd	Volume of Water Vapor, SCF	1.805	2.401	1.553
%H2O	Moisture Content, Percent by Volume	1.3	1.7	1.1
$\%H2O_{SAT}$	Moisture, Saturated @ Flue Gas Conditions, %	1.3	1.7	1.6
Mfd	Dry Mole Fraction	0.987	0.983	0.989
$\%O_2$	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.70	28.66	28.72
Pg	Flue Gas Static Pressure, Inches H_2O	-0.46	-0.42	-0.46
Ps	Absolute Flue Gas Pressure, Inches Hg	29.47	29.17	29.12
ts	Flue Gas Temperature, ° F	51.6	58.0	56.4
Δ P	Average Velocity Head, Inches H_2O	0.0973	0.0999	0.0870
vs	Flue Gas Velocity, Feet/Second	17.43	17.86	16.65
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM	824	822	772
Qaw	Volumetric Air Flow Rate, Wet ACFM	821	842	785
%I	Isokinetic Sampling Rate, Percent	98.5	98.6	103.9
	PM10 & PM2.5 Results Calculations			
µstack	Stack Gas Viscosity, micropoises	175.58	176.82	176.88
Qs	Flow, at Cyclone Conditions, ACFM (Actual)	0.395	0.405	0.398
Cut size	Dia. of Particles in PM10 Cyclone, Microns	10.61	10.53	10.66
Cut size	Dia. of Particles in PM2.5 Cyclone, Microns	2.22	2.21	2.25
	Particulate Catch Weights, Milligrams			
≤PM10	Less than or equal to 10 Microns	10.5	20.5	12.3
≤PM2.5	Less than of equal to 2.5 Microns	2.1	3.9	2.9

	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF	1.18E-03	2.30E-03	1.41E-03
µg/m³	Concentration, micrograms/DSCM	2706.8	5266.5	3218.6
	Particulate ≤ 2.5 Microns			
gr/DSCF	Concentration, grains/DSCF	2.37E-04	4.38E-04	3.32E-04
µg/m³	Concentration, micrograms/DSCM	541.4	1001.9	758.9
	Ambient Particulate Concentrations			
µg/m³	PM10 Concentration, micrograms/DSCM	197.30	35.20	58.30
µg/m³	PM2.5 Concentration, micrograms/DSCM	92.90	22.90	42.70
	Particulate Corrected for Ambient Concentrations			
µg/m³	PM10 Concentration, micrograms/DSCM	2509.47	5231.26	3160.32
µg/m³	PM2.5 Concentration, micrograms/DSCM	448.45	979.01	716.16
	Point Particulate Emission Rates, Pounds/Hour			
lb/hr	PM10 Emission Rate, lb/hr	0.0077	0.0161	0.0091
lb/hr	PM2.5 Emission Rate, lb/hr	0.0014	0.0030	0.0021
	Total Particulate Emission Rates, Pounds/Hour			
24 Points	PM10 Emission Rate, lb/hr	0.1859	0.3865	0.2193
24 Points	PM2.5 Emission Rate, lb/hr	0.0332	0.0723	0.0497
	Equipment Throughput Rate TPH			
Tons/Hr	Stone Troughput Rate during Test, Tons/Hour	907.3	906.3	1123.3
	Emission Factors			
lbs/Ton	Pounds of PM10 per Ton of Stone	0.00020	0.00043	0.00020
lbs/Ton	Pounds of PM2.5 per Ton of Stone	0.00004	0.00008	0.00004

Client: National Stone Association
Facility: Vulcan Materials Company, Pineville, North Carolina
Sampling Location: Fines Crusher

		FC-1	FC-2	FC-3
	Test Date	11/18/96	11/19/96	11/20/96
	Run Start Time	0838	0748	0736
	Run Finish Time	1330	1415	1352
	Net Sampling Points	12	12	12
Theta	Net Run Time, Minutes	180.00	358.50	359.83
Dia	Nozzle Diameter, Inches	0.234	0.234	0.234
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	1.0080	1.0080	1.0080
Pbar	Barometric Pressure, Inches Hg	29.50	29.20	29.15
ΔH	Avg. Pressure Differential of Meter, Inches H_20	0.48	0.48	0.47
Vm	Volume of Metered Gas Sample, Cubic Feet	72.412	145.334	144.449
tm	Dry Gas Meter Temperature, ° F	70	75	72
Vmstd	Volume of Metered Gas Sample, DSCF	71.752	141.215	140.928
Vlc	Total Volume of Liquid Collected, ml	95.0	43.0	39.0
	Volume used if over saturation, ml	20.1		
Vwstd	Volume of Water Vapor, SCF	0.945	2.024	1.836
%H2O	Moisture Content, Percent by Volume	1.3	1.4	1.3
$\%H2O_{SAT}$	Moisture, Saturated @ Flue Gas Conditions, %	1.5	1.8	1.7
Mfd	Dry Mole Fraction	0.987	0.986	0.987
$\%O_2$	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.70	28.69	28.70
Pg	Flue Gas Static Pressure, Inches H_2O	-0.41	-0.4	-0.39
Ps	Absolute Flue Gas Pressure, Inches Hg	29.47	29.17	29.12
ts	Flue Gas Temperature, ° F	54.6	59.6	57.7
ΔP	Average Velocity Head, Inches H_2O	0.1665	0.1673	0.1459
vs	Flue Gas Velocity, Feet/Second	22.85	23.14	21.59
A	Stack/Duct Area, Square Inches	254.9	254.9	254.9
Qsd	Volumetric Air Flow Rate, Dry SCFM	2,421	2,400	2,247
Qaw	Volumetric Air Flow Rate, Wet ACFM	2,427	2,457	2,293
%I	Isokinetic Sampling Rate, Percent	97.6	97.3	103.3
	PM10 & PM2.5 Results Calculations			
µstack	Stack Gas Viscosity, micropoises	176.30	177.42	177.05
Qs	Flow, at Cyclone Conditions, ACFM (Actual)	0.400	0.403	0.400
Cut size	Dia. of Particles in PM10 Cyclone, Microns	10.56	10.60	10.63
Cut size	Dia. of Particles in PM2.5 Cyclone, Microns	2.21	2.23	2.24
	Particulate Catch Weights, Milligrams			
≤PM10	Less than or equal to 10 Microns	23.4	37.7	24.6
≤PM2.5	Less than of equal to 2.5 Microns	5.1	9.5	6.0

	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF	5.03E-03	4.12E-03	2.69E-03
μg/m³	Concentration, micrograms/DSCM	11517.4	9428.3	6164.7
	Particulate ≤ 2.5 Microns			
gr/DSCF	Concentration, grains/DSCF	1.10E-03	1.04E-03	6.57E-04
μg/m³	Concentration, micrograms/DSCM	2510.2	2375.8	1503.6
	Ambient Particulate Concentrations			
μg/m³	PM10 Concentration, micrograms/DSCM	197.30	35.20	58.30
μg/m³	PM2.5 Concentration, micrograms/DSCM	92.90	22.90	42.70
	Particulate Corrected for Ambient Concentrations			
μg/m³	PM10 Concentration, micrograms/DSCM	11320.10	9393.09	6106.38
μg/m³	PM2.5 Concentration, micrograms/DSCM	2417.30	2352.93	1460.88
	Particulate Emission Rates, Pounds/Hour			
lb/hr	PM10 Emission Rate, lb/hr	0.1027	0.0844	0.0514
lb/hr	PM2.5 Emission Rate, lb/hr	0.0219	0.0212	0.0123
	Equipment Throughput Rate TPH			
Tons/Hr	Stone Troughput Rate during Test, Tons/Hour	249.5	254.5	252.4
	Emission Factors			
lbs/Ton	Pounds of PM10 per Ton of Stone	0.00041	0.00033	0.00020
lbs/Ton	Pounds of PM2.5 per Ton of Stone	0.00009	0.00008	0.00005

APPENDIX E.

FIELD DATA SHEETS

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: Crusher

Plant	Vulcan Materials	Pitot Type		Bar Press (in HG)	29.30
City		Pitot No.		Post Leak Check	
Operatoor	B Palm	Pitot Cp	0.84	Stack Diameter (in)	18"
Date	11-10-96	Thermocouple	—	CO2/O2 Analysis By	—

MEASUREMENT DEVICE

- Micromanometer ☐
- 10" Mannometer ☑
- Magnehelic ☐
- Other ☐ Explain:

TRAVERSE SCHEMATIC

Run No.		TERTIARY		TRANSFER			
Time		1203					
Ts(DB) deg F							
Ts(WB) deg F							
Pg(in H2O)		-.52		-0.26			
Ps(in HG)							
CO2 %							
O2 %							
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	.26	49	0.08	45		
	2	.16	46	0.08	45		
	3	0.14	46	0.10	47		
	4	0.18	45	0.12	47		
	5	0.18	44	0.12	47		
	6	0.17	44	0.03	46		
B	1	~~0.34~~ 0.11	47				
	2	~~0.30~~ 0.15	46				
	3	0.16	46				
	4	0.18	46				
	5	0.20	46				
	6	0.17	45				
Average		sqrt 0.412		sqrt 0.291		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)		22.97		16.22			
Qa (acfm)		2435		764.61			
Qs (dscfm)		2461		773.01			

$Ps = Pbar + Pg/13.6$

$Moist(\%) = 100(Bws)$

$Md = 0.44(\%CO2) + 0.32(\%O2) + 0.28(\%N2 + \%CO)$

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

$Vs = 85.49Cp(sqrt[(Delta\ P)avg]) \times sqrt[(Ts+460)/MsPs)]$

$Qa = 60VsAs$

$Qs = Qa[528/(Ts+460)](Ps/29.92) \times (1 - Bws)$

00000001

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: Tertiary Crusher

Plant	Vulcan	Pitot Type	
City	Charlotte	Pitot No.	
Operator	B Palm	Pitot Cp	0.84
Date	11-11-96	Thermocouple	

Bar Press (in HG)	29.55
Post Leak Check	
Stack Diameter (in)	18"
CO2/O2 Analysis By	—

MEASUREMENT DEVICE

- Micromanometer ☐
- 10" Manometer ☐
- Magnehelic ☐
- Other ☑

Explain: Air Data Multi-Meter

TRAVERSE SCHEMATIC

Run No.		Pre-1		20A			
Time				1623			
Ts(DB) deg F							
Ts(WB) deg F							
Pg(in H2O)		-0.52		-0.5351			
Ps(in HG)							
CO2 %		0.0		0.0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	.2171	34	0.1700			
	2	.1294	34	0.1043			
	3	~~.298~~ .1302	34	0.1342			
	4	~~.248~~ .2013		0.1833			
	5	~~.443~~ .1987		0.1858			
	6	.1876	34	0.1839			
B	1	.1717	34	0.1495			
	2	.1542	34	0.1298			
	3	.1324	34	0.1354			
	4	.1877	34	0.1814			
	5	.1707	34	0.1598			
	6	.1698	34	0.1573			
Average		sqrt 0.412		sqrt		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

Ps = Pbar + Pg/13.6

Moist(%) = 100(Bws)

Md = 0.44(%CO2) + 0.32(%O2) + 0.28(%N2 + %CO)

Ms = Md(1-Bws) + 18Bws

Vs = 85.49Cp(sqrt[(Delta P)avg]) x sqrt[(Ts+460)/MsPs)]

Qa = 60VsAs

Qs = Qa[528/(Ts+460)](Ps/29.92) x (1 - Bws)

00000002

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN-PINEVILLE NC	11/11/95	TERT. CRUSHER	201A (2.5 & 10)	#1

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BHK	29.50	-.52	49°F	004	18	0.84	4' TEFLON	—	0.234

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
<1%	M5-7	1.893	0.978			—	0.008 @8"	0.000 @10"	20.9	0	—

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	9:14	446.853	0.217	0.49	49	—	—	55	53	6
~~2~~ —	10		450.85	"		49			56	55	6
~~3~~ —	20		454.83	"		49			58	57	6
A-~~4~~2	33:45		460.30	0.129~~4~~		49			59	60	6
~~5~~ —	40		462.81	"		49			59	60	6
~~6~~ —	50		466.75	"		49			60	65	6
A-3	59:55		470.80	0.130		49			63	64	6
—	70		474.81	"		49			62	72	7
—	80		478.83	"		49			62	72	7
A-4	86:00		481.23	0.201		52			63	74	7
	100		486.92	"		52			66	75	7
	110		491.14	"		52			65	76	7
A-5	~~120~~ 118:30			0.199		52			60	76	7

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE TEMP	AVE. TEMP.
		0.414	0.49	~~52.9~~ 51.972	73.086

00000003

EMISSION TESTING

PLANT AND CITY				DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
VULCAN - PINEVILLE NC				11/11/96	TERT. CRUSHER			201A (2.5&10)		#1			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)		P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU. (in. Hg)
A-5	130		498.97		0.199	0.49	52	—	—	59	77	—	7
	140		503.32		"	0.49	52			58	77		7
A-6	150:55		507.613		0.188	0.49	52			57	77		7
	160		511.62		"	0.49	52			54	76		7
	170		515.80		"		52			54	75		7
B-1	182:30	0:00	520.50		0.172		52			55	76		7
	190/10		524.37		"		50			56	76		7
	200/20		528.46		"		50			56	77		7
B-2	30:10		532.61		0.154		53			55	78		7
	40		536.65		"		53			56	78		7
	50		541.05		"		54			57	77		7
B-3	58:30		545.04		0.132		54			57	78		7-8
	70		549.11		"		54			57	78		7
	80		553.21		"		54			57	77		7
B-4	84:55		555.12		0.187		54			57	78		7.5
	100		560.96		"		54			57	77		7.5
	110		565.38		"		55			57	77		7.5
B-5	116:20		567.59		0.171		55			56	78		7.5
	130				"		54			56	78		7.5
	140		576.57		"		54						
Page Totals	TOTAL TIME		DGM VOLUME		AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

Sheet Checked By: ______ Date ______

00000004

EMISSION TESTING ... TA

PLANT AND CITY				DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
VULCAN - PINEVILLE NC				11/11/96	TERT. CRUSHER			201A 10 & 2.5		#1			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)		VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX TEMP (F)	SAMPLE TRAIN VACUU (in. Hg)
B-6	146:20		579.63 ~~578.83~~		0.170	0.49	54	—	—	56	78	—	7.5
	160				〃	0.49	54	—	—	56	78	—	7.5
	170				〃	0.49	54	—	—	56	78	—	7.5
END	176:15		591.380		—	—	—	—	—			—	

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ______ Date ______

00000005

DEECO

VELOCITY TRAVERSE DATA

SAMPLING LOCATION

~~Transfer Point~~ Tertiary Crusher

Plant	Vulcan	Pitot Type	S	Bar Press (in HG)	29.85
City	Charlotte	Pitot No.	~~0.84~~	Post Leak Check	
Operator	B Palm	Pitot Cp	0.84	Stack Diameter (in)	~~18"~~ 18"
Date	11-12-96	Thermocouple	-	CO2/O2 Analysis By	-

MEASUREMENT DEVICE

Micromanometer ☐

10" Manometer ☐

Magnehelic ☐

Other ☑

Explain: Air Data Multi Meter

TRAVERSE SCHEMATIC

Run No.		Pre / 2		Post / 2			
Time		0711					
Ts(DB) deg F		32					
Ts(WB) deg F		30					
Pg(in H2O)		~~.5036~~ -0.5661		-0.6559			
Ps(in HG)							
CO2 %		0.0		0.0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	~~0.0650~~	0.1769	~~0.1422~~	0.1629		
	2	0.1330		~~0.1461~~	0.1485		
	3	0.1926		0.1439			
	4	0.1962		0.1732			
	5	0.2000		0.1628			
	6	0.1805		0.1578			
B	1	0.2112		0.1965			
	2	0.2849		0.1681			
	3	0.1468		0.1411			
	4	0.2016		0.1447			
	5	0.1945		0.1575			
	6	0.1994		0.1717			
Average		sqrt 0.438		sqrt 0.406		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

Ps = Pbar + Pg/13.6

Moist(%) = 100(Bws)

Md = 0.44(%CO2) + 0.32(%O2) + 0.28(%N2 + %CO)

Ms = Md(1-Bws) + 18Bws

Vs = 85.49Cp(sqrt[(Delta P)avg]) x sqrt[(Ts+460)/MsPs)]

Qa = 60VsAs

Qs = Qa[528/(Ts+460)](Ps/29.92) x (1 - Bws)

~~* Single point location~~

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE, NC	11/12/96	TERT. CRUSHER	M201A 2.5&10	#2

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BHR	29.85	-0.566	45	0012	18"	0.84	4' TEFLON	—	0.234

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK ~~INITIAL~~ FINAL	LEAK CHECK ~~FINAL~~ INITIAL	O2 CONTENT %	CO2 CONTENT %	K FACTOR
0.6%	M5-7	1.893	0.978			—		0.008 @10"	20.9	0	—

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	10:08	608.384	0.177	0.48	55	—	—	54	70	6
"	10		612.50	"		55			55	72	6
"	20		616.51	"		55			56	73	6.5
A-2	28:45		620.03	0.133		55			56	75	7
"	40		624.10	"		56			56	77	7
"	50		628.16	"		56			54	80	7
A-3	53:40		630.12			53			52	82	7
"	70		636.75			52			50	83	7
"	80		640.70			51			50	84	7
A-4	83:40		642.20			50			50	84	7
"	100		648.78			49			50	84	7
"	110		652.82			49			49	83	7
A-5	113:50					49			49	83	7
	TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE TEMP				AVE TEMP	

PLANT AND CITY				DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
VULCAN - PINEVILLE, NC				11/12/96	TERT. CRUSHER			M201A 2.5 & 10		#2			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)		P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
A-5	130		660.89			0.48	50	—	—	51	84	—	7
"	140		664.91			0.48	50			50	84		7.5
A-6	144:20		666.63			0.48	50			50	84		7.5
"	160		672.98			0.48	50			51	85		7.5
"	170		676.99			0.48	51			51	84		7.5
B-1	173:20/0:00	1:30PM	678.50			0.48	52			52	82		7.5
"	10		682.51			0.48	52			52	82		7.5
"	20		687.21			0.48	52			52	82		7.5
B-2	31:20		691.64			0.48	52			53	82		7.5
"	40		695.13			0.48	52			52	83		7.5
"	50		699.18			0.48	52			53	84		7.5
B-3	67:50		706.38			0.48	53			54	84		7.5
"	70		706.92			0.48	53			54	84		7.5
"	80		710.94			0.48	53			55	83		8
B-4	94:00		~~716.62~~ 716.72			0.48	53			55	84		8
"	100		719.11			0.48	53			54	83		8
"	110		723.15			0.48	52			54	84		8
B-5	124:40					0.48	53			55	84		8
"	130		731.32			0.48	53			55	85		8
"	140		735.43			0.48	53			55	84		8

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

14.0
25:20
44
01:50
0
10
24
30
40
54:40
60
70

Sheet Checked By: ______ Date ______

EMISSION TESTING D DATA

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE	11/12/96	TERT. CRUSHER	M201A	#2

	TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
84:45	B-6	154:45		741.32		0.48	54	—	—	54	84	—	8
90	"	160		743.40		0.48	54			54	84		8
100	"	170		74		0.48	54			54	85		8
115:15	END	~~185:15~~ 358:40		753.706		—	—			—	—		—

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ____________ Date ______

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: TC

Plant	Vulcan	Pitot Type		Bar Press (in HG)	29.90
City	Charlotte	Pitot No.		Post Leak Check	
Operator	Blalm	Pitot Cp	0.84	Stack Diameter (in)	18"
Date	11-13-96	Thermocouple	–	CO2/O2 Analysis By	–

MEASUREMENT DEVICE

- Micromanometer ☐
- 10" Manometer ☐
- Magnehelic ☐
- Other ☑

Explain: Air Data Meter

TRAVERSE SCHEMATIC

Run No.		Pre/3		Post/3			
Time		0705		1354			
Ts(DB) deg F		32					
Ts(WB) deg F		30					
Pg(in H2O)		-0.6958		-0.6754			
Ps(in HG)							
CO2 %		0.0		0.0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	0.2349		0.1745			
	2	0.1691		0.1687			
	3	0.1698		0.1163			
	4	0.1986		0.1757			
	5	0.2024		0.1738			
	6	0.1776		0.1638			
B	1	0.1863		0.1600			
	2	0.1771		0.1358			
	3	0.1608		0.1378			
	4	0.1841		0.1644			
	5	0.1827		0.1361			
	6	0.1863		0.1412			
Average		sqrt 0.431		sqrt		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

Ps = Pbar + Pg/13.6

Moist(%) = 100(Bws)

Md = 0.44(%CO2) + 0.32(%O2) + 0.28(%N2 + %CO)

Ms = Md(1-Bws) + 18Bws

Vs = 85.49Cp(sqrt[(Delta P)avg]) x sqrt[(Ts+460)/MsPs)]

Qa = 60VsAs

Qs = Qa[528/(Ts+460)](Ps/29.92) x (1 - Bws)

00000010

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE NC	11/13/96	TERT, CRUSHER	M201A 2.5 & 10	#3

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BHR	29.85	-0.64	32 to 52		18"	0.84	4' TEFLON	—	0.234

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
0.8%	M5-7	1.893	0.978			—	0.018 @11"	0.015 @11"	20.9	0	—

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	7:30AM	754.078		0.48	46	—	—	38	50	6
"	10					"			39	54	6
"	20		762.21			"			40	57	6
A-2	33:45		767.51			"			45	60	6
"	40					48			47	65	6
"	50		774.10			"			46	65	6
A-3	62:20					50			48	70	6.5
"	70					53			49	70	6.5
"	80		786.25			53			51	72	6.5
A-4	91:00		790.70			55			52	75	6.5
"	100		794.35			55			53	76	6.5
"	110					55			53	76	6.5
A-5	122:05		803.21			55			52	78	7
	TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE TEMP.				AVE. TEMP.	

PLANT AND CITY				DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
VULCAN - PINEVILLE, NC				11/13/96	TERT. CRUSHER			201A	2.5 & 10	#3			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)		P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL.GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
A-5	130		806.44			0.48	50	—	—	53	79	—	7
"	140		810.50				53			54	80		7
A-6	153:20		813.91				55			55	81		7
"	160		818.55				56			55	82		7
"	170		822.62				60			57	83		7
B-1	182:40/0	10:41 AM	827.745				60			62	81		7
"	10		831.86				56			62	83		7
"	20		835.93				59			61	83		7
B-2	30:00		840.06				55			60	84		7
"	40		844.13				54			60	83		7
"	50		848.18				55			61	85		7.5
B-3	59:20		852.02				53			60	85		7.5
"	70		856.42				55			59	85		7.5
"	80		860.59				54			60	85		7.5
B-4	87:15						55			60	85		8
"	100						57			61	84		8
"	110		872.72				57			60	85		8
B-5	117:05		875.70				58			62	85		8
"	130						57			62	85		8
"	140		884.94				58			63	86		8
Page Totals	TOTAL TIME		DGM VOLUME		AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

Sheet Checked By: ______ Date ______

00000012

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE, NC	11/13/96	TERT. CRUSHER	201A 2.5&10	#3

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (In. H2O)	H ORIFICE (In. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (In. Hg)
B-6	146:50				0.48	56	—	—	63	86	—	8
"	160		893.15			56			64	87		8
"	170		897.30			56			53	86		8
END	176:55		900.052			—			—	—		—
	359.59											
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

Sheet Checked By: ____________ Date ______

00000013

PARTICULATE/SAMPLE RECOVERY DATA SHEET

DEECO

Client/Location: Vulcan / Tertiary Crusher Sampling Date(s): 11-11 /

RUN No.: 1 Recovery Date: 11-11-96 Recovered By: TB

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	94	103	3				217
Initial Wt.	100	100	0				180
Net Weight	-6	3	3				37

Total Moisture = 37.0 grams

Description of Impinger Contents: Clear

Silica Gel Color: Pink Percent Spent: 80 %

Filter I.D. No.: Filter Container I.D.:

Description of Particulate on Filter: Sealed: Y N

Probe Rinse Container I.D.: NA Liquid Level Marked/Sealed: Y N

Impinger Contents Container: NA Liquid Level Marked/Sealed: Y N

RUN No.: 2 Recovery Date: 11/ Recovered By: BP/TB

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	98	109	0				235
Initial Wt.	100	100	0				200
Net Weight	-2	9					35

Total Moisture = 42 grams

Description of Impinger Contents:

Silica Gel Color: Percent Spent: 65 %

Filter I.D. No.: Filter Container I.D.:

Description of Particulate on Filter: Sealed: Y N

Probe Rinse Container I.D.: Liquid Level Marked/Sealed: Y N

Impinger Contents Container: Liquid Level Marked/Sealed: Y N

RUN No.: 3 Recovery Date: 11/13 Recovered By: BR

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	720	631	526				875
Initial Wt.	721	631	525				849
Net Weight	-1	0	1				26

Total Moisture = 26 grams

Description of Impinger Contents:

Silica Gel Color: Percent Spent: 70 %

Filter I.D. No.: Filter Container I.D.:

Description of Particulate on Filter: Sealed: Y N

Probe Rinse Container I.D.: Liquid Level Marked/Sealed: Y N

Impinger Contents Container: Liquid Level Marked/Sealed: Y N

BLANKS: Probe rinse: Impinger: Filter:

00000014

DEECO

VELOCITY TRAVERSE DATA

SAMPLING LOCATION

Transfer Point

Plant	Vulcan	Pitot Type	S-type	Bar Press (in HG)	✓
City		Pitot No.		Post Leak Check	
Operator		Pitot Cp	.84	Stack Diameter (in)	12"
Date	11-11-96	Thermocouple		CO2/O2 Analysis By	20.9/0

MEASUREMENT DEVICE

Micromanometer ☑

~~10" Manometer~~ ☑

Magnehelic ☐

Other: ☐
Explain:

TRAVERSE SCHEMATIC

A

B

Run No.		MD-TP-1		TP-1 Post			
Time		0700/0704		1608			
Ts(DB) deg F		34					
Ts(WB) deg F		32					
Pg(in H2O)							
Ps(in HG)		-0.24		-0.3087			
CO2 %		0.0		0.0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	0.1124	30	0.131			
	* 2	0.1111	30	0.127			
	3	0.1027	30	0.1173			
	4	0.1126	30	0.1197			
	5	0.1392	30	0.1238			
	6	0.1398	30	0.1249			
B	1	0.1046	30	0.0912			
	2	0.1250	30	0.1138			
	3	0.1439	30	0.1311			
	4	0.1247	30	0.1384			
	5	0.1336	30	0.1235			
	6	0.1358	30	0.1209			
Average		sqrt 0.351		sqrt		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

Ps = Pbar + Pg/13.6

Moist(%) = 100(Bws)

Md = 0.44(%CO2) + 0.32(%O2) + 0.28(%N2 + %CO)

Ms = Md(1-Bws) + 18Bws

Vs = 85.49Cp(sqrt[(Delta P)avg]) x sqrt[(Ts+460)/MsPs)]

Qa = 60VsAs

Qs = Qa[528/(Ts+460)](Ps/29.92) x (1 - Bws)

00000015

METHOD 5 TESTING FIELD DATA SHEET

DECCO

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan Charlotte	11-11-96	Transfer Point	201	1

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
B Palm	29.50	-0.24	49	~~005~~ 006	12"	—	4' Teflon		0.265

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
<18	MS-4	1.841	1.004	—	—	—	~~0.010 @ 6"~~ 0.005 @ 15"	0.005 @ 15"			—

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24 HR)	DGM READING Vm (cu. ft)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC. (in. Hg)
1	0	~~0950~~ 1015	810.881	0.11	.56	49	NA	NA	41	54	11
	10		815.16			50			44	56	12
	20		819.15			51			46	58	12
	30		823.21			52			46	62	12
	40		827.50			55			47	63	12
	50		832.01			56			48	64	12
	60	1115	835.97			62			48	67	12
	70		840.19			50			48	69	12
	80		844.41			51			48	72	12
	90		848.58			51			47	71	13
	100		852.86			52			48	71	13
	110		857.06			51			48	70	13
	120	1215	861.31			50			49	71	13
	TOTAL TIME		DGM VOLUME 144.425	AVE SQRT delta P	AVE delta H 0.56	AVE. TEMP. 52.8				AVE. TEMP. 68.7	

EMISSION TESTING A

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan Materials / Charlotte	11-11	Transfer Point	201	1

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
	130	130	865.56		0.56 ~~0.67~~	50	NA	NA	48	72	NA	13
	140		869.81	—		52			49	71		13
	150		873.42			50			49	72		13
	160		878.36			56			49	72		13
	170		882.62			50			50	72		13
	180	1315	886.47			53			50	73		13
	190		891.12			54			50	73		13
	200		895.39			54			51	73		13
	210		899.67			50			50	73		13
	220		904.02			55			50	73		13
	230		908.12			56			50	73		13
	240	1415	912.31			56			51	73		13
	250		916.12			55			51	71		13.5
	260		920.68			55			50	71		13.5
	270		924.89			54			50	69		13.5
	280		929.07			54			50	69		13.5
	290		933.27			55			51	69		13.5
	300	1515	937.48			56			51	69		14
	310		941.67			55			52	69		14
	320		945.88			56			52	67		14
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

Sheet Checked By: ______ Date ______

00000017

EMISSION TESTIN(

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan / Charlotte	11-11-96	Transfer Point	201	1

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
	330		950.06		0.56	53	NA	NA	53	67	NA	14
	340		954.25	—		56			54	66		14
	342:23	1558	955.306									

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By:

Date

VELOCITY TRAVERSE DATA

SAMPLING LOCATION

Transfer Point

Plant: Vulcan
City: Charlotte
Operator: BPhn
Date: 11-12-96

Pitot Type:
Pitot No.:
Pitot Cp: 0.84
Thermocouple:

Bar Press (in HG): 29.85
Post Leak Check:
Stack Diameter (in): 12"
CO2/O2 Analysis By: —

MEASUREMENT DEVICE

Micromanometer ☐

10" Manometer ☒

Magnehelic ☐

Other ☑ Explain: Air Data Multi Meter

TRAVERSE SCHEMATIC

Run No.		Rue/2		Rest/2			
Time		0708		1626			
Ts(DB) deg F		32					
Ts(WB) deg F		30					
Pg(in H2O)		-.3244		-.3015			
Ps(in HG)							
CO2 %		0.0					
O2 %		20.9					
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	0.1115		0.1353			
	2	0.1128		0.1287			
	3	0.1196		0.1062			
*	4	0.1444		0.1349			
	5	0.1452		0.1347			
	6	0.1420		0.1331			
B	1	0.1191		0.1349			
	2	0.1146		0.1331			
	3	0.1369		0.1478			
	4	0.1377		0.1310			
	5	0.1416		0.1299			
	6	0.1433		0.1319			
Average		sqrt 0.361		sqrt 0.363		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

Ps = Pbar + Pg/13.6

Moist(%) = 100(Bws)

Md = 0.44(%CO2) + 0.32(%O2) + 0.28(%N2 + %CO)

Ms = Md(1-Bws) + 18Bws

Vs = 85.49Cp(sqrt[(Delta P)avg]) x sqrt[(Ts+460)/MsPs)]

Qa = 60VsAs

Qs = Qa[528/(Ts+460)](Ps/29.92) x (1 - Bws)

00000019

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan / Charlotte	11-12-96	Transfer Point	201	2

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BPalm	29.85	-.32	45°	–	12"	0.84	4' Teflon		0.265

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
.6	MS-4	1.841	1.004	–	–	–	0.005 C@ 11"	0.005 C@ 11"	20.9	0.0	–

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
4	0	1003	975.031	0.14	0.55	39	NA	NA	38	59	7
	10		979.19			40			38	61	7
	20		~~483.31~~ 983.31			48			42	64	7
	30		987.39			50			44	67	7
	40		991.54			52			44	69	7
	50		995.64			56			45	71	7
	60		999.77			56			45	72	7
	70		1003.99			54			45	74	7
	80		1007.75			55			45	74	7
	90		1011.59			55			44	75	7
	100		1015.75			56			44	75	7
	110		1019.95			56			44	76	7
	120		1024.14			57			44	76	7
	TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.				AVE. TEMP.	
			153.937			51.6				75.6	

Page 1 of 2

EMISSION TESTIN(

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan / Charlotte	11-12-96	Transfer Point	201	2

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	ΔP VELOCITY HEAD (in. H2O)	ΔH ORIFICE (in. H2O)	STACK TEMP (°F)	PROBE TEMP (°F)	FILTER OVEN TEMP (°F)	SIL GEL IMPINGER TEMP (°F)	DGM IN/OUT TEMP (°F)	AUX. TEMP. (°F)	SAMPLE TRAIN VACUUM (in. Hg)
4	130		1028.32	0.14	0.55	56	NA	NA	45	45 77/80	NA	7
	140		1032.49			57			45	78		7
	150		1036.67			58			46	78		7
	160		1040.83			60			46	78		7
	170		1045.00			54			46	79		7
	180		1049.13			50			46	79		7
	190		1053.29			47			46	79		7
	200		1057.41			47			46	78		7
	210		1061.56			47			47	78		7
	220		1065.65			47			47	78		7
	230		1069.79			48			47	77		7
	240		1073.92			54			48	77		7
	250		1078.04			49			48	77		7
	260		1082.16			47			48	77		7
	270		1086.02			46			47	77		7.5
	280		1090.39			46			47	77		7.5
	290		1094.49			46			48	79		7.5
	300		1098.58			50			48	79		7.5
	310		1102.69			52			49	80		7.5
	320		1106.82			55						
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT ΔP	AVG ΔH	AVG STK °F				AVG DGM °F		

Sheet Checked By: ______ Date ______

00000021

EMISSION TESTING

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan / Charlotte	11-12-94	Transfer Point	201	2

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (°F)	PROBE TEMP (°F)	FILTER OVEN TEMP (°F)	SIL GEL IMPINGER TEMP (°F)	DGM IN/OUT TEMP (°F)	AUX. TEMP. (°F)	SAMPLE TRAIN VACUUM (in. Hg)
4	330		1110.94	0.14	0.55	56	NA	NA	50	~~50~~ 80	NA	7.5
	340		1115.06			54			52	80		7.5
	350		1119.18			54			52	80		7.5
	360		1123.31			53			52	80		7.5
	370		1127.42			54			52	81		7.5
	373.7		1128.968						~~52~~	~~81~~		

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ____________ Date ______

00000022

DESCO

VELOCITY TRAVERSE DATA

SAMPLING LOCATION

Transfer Point

Plant :	Vulcan	Pitot Type		Bar Press (in HG)	29.90
City	Charlotte	Pitot No.		Post Leak Check	
Operator	B [illegible]	Pitot Cp	0.84	Stack Diameter (in)	12"
Date =	11-13-96	Thermocouple	-	CO2/O2 Analysis By	-

MEASUREMENT DEVICE

Micromanometer ☐

10" M Manometer ☐

Magnehelic ☐

Other ☑

Explain: Air Data Multi Meter

TRAVERSE SCHEMATIC

Run No.		Pre/3		Post/3			
Time		0720		1345			
Ts(DB) deg F		32					
Ts(WB) deg F		30					
Pg(in H2O)		-0.2491		-0.3112			
Ps(in HG)							
CO2 %		0.0		0.0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	0.1163		0.1112			
	2	0.1186		0.1342			
*	3	0.1287		0.1331			
	4	0.1267		0.1461			
	5	0.1468		0.1321			
	6	0.1293		0.1247			
B	1	0.1533		0.1247			
	2	0.1577		0.1304			
	3	0.1402		0.1268			
	4	0.1337		0.1310			
	5	0.1440		0.1371			
	6	0.1338		0.1363			
Average		sqrt 0.368		sqrt 0.332		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

Ps = Pbar + Pg/13.6

Moist(%) = 100(Bws)

Md = 0.44(%CO2) + 0.32(%O2) + 0.28(%N2 + %CO)

Ms = Md(1-Bws) + 18Bws

Vs = 85.49Cp(sqrt[(Delta P)avg]) x sqrt[(Ts+460)/MsPs)]

Qa = 60VsAs

Qs = Qa[528/(Ts+460)](Ps/29.92) x (1 - Bws)

00000023

METHOD 5 TESTING FIELD DATA SHEET

DEECO

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan Charlotte	11-13-96	Transfer Point	201	3

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
B Palm	~~29.90~~ 29.85	~~30~~ -0.249	32°		12"	0.84	4' Teflon		0.265

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
.8	MS-4	1.841	1.064	-	-	-	0.005 @ 11"	0.005 @ 11"	20.9	0.0	-

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
3	0	0731	129.613	0.128	0.55	40	NA	NA	34	49	7
	10		133.46			37			34	49	7
	20		137.41			39			35	52	7
	30		141.51			39			36	54	7
	40		145.55			40			36	56	7
	50		149.56			40			36	59	7
	60	0831	153.64			41			37	61	7
	70		157.79			42			38	63	7
	80		161.93			42			40	64	7
	90		166.05			42			41	65	7
	100		170.18			42			41	68	7
	110		174.31			43			40	69	7
	120	0931	178.44			42			40	71	7

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.	AVE. TEMP.
	144.137			46.1	70.4

00000024

EMISSION TESTING

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan / Charlotte	11-13-96	Transfer Point	201	3

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (°F)	PROBE TEMP (°F)	FILTER OVEN TEMP (°F)	SIL GEL IMPINGER TEMP (°F)	DGM IN/OUT TEMP (°F)	AUX. TEMP. (°F)	SAMPLE TRAIN VACUUM (in. Hg)
3	130	~~130~~	182.56	0.128	0.55	42	NA	NA	39	71	NA	7
	140		186.73			44			40	72		7
	150		190.90			44			40	72		7
	160		195.05			45			41	73		7
	170		199.21			46			42	74		7
	180	1631	203.37			45			45	74		7
	190		207.52			46			46	75		7
	200		211.73			47			44	75		7
	210		215.87			48			44	76		7
	220		220.21			49			46	77		7
	230		224.14			51			47	77		7
	240	1131	228.28			51			47	78		7
	250		232.37			51			47	78		7.5
	260		236.45			51			48	78		7.5
	270		240.55			51			48	78		7.5
	280		244.69			50			49	78		7.5
	290		248.79			52			48	78		7.5
	300	1231	~~625~~ 8 252.90			53			49	78		7.5
	310		257.00			55			50	79		7.5
	320		261.12			56			50	80		
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT P	AVG H	AVG STK °F				AVG DGM °F		

Sheet Checked By: ______ Date ______

0000002

EMISSION TESTING

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan/Charlotte	11-13-96	Transfer Point	201	3

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
3	330		~~256~~ 265.28	0.128	0.55	53	NA	NA	51	81	NA	8
	340		269.31	—		53			49	83		8
	350.2	1325	273.750									

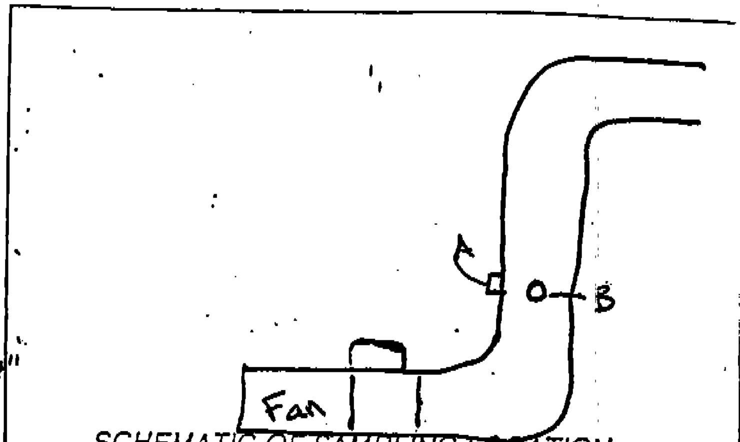
Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ____________ Date ______

00000026

EPA METHOD 1
TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Volcan
CITY Charlotte STATE NC
SAMPLING LOCATION Transfer Point
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 12"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) –
NEAREST UPSTREAM DISTURBANCE >2 34"
DISTURBANCE Bend
NEAREST DOWNSTREAM DISTURBANCE >8 17¼"
DISTURBANCE Bend
SAMPLER B Palm DATE 11-10-96



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8-INCH)	DISTANCE B	TRAVERSE DISTANCE FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	4.4	12	½"	–	½"
2	14.6		1¾"		1¾"
3	29.6		3½"		3½"
4	70.4		8½"		8½"
5	85.4		10¼"		10¼"
6	95.6		11½"		11½"

PARTICULATE/SAMPLE RECOVERY DATA SHEET

Client/Location: Vulcan/Transfer Point   Sampling Date(s): 11-11/

RUN No.: 1   Recovery Date: 11-10-96   Recovered By: TEH

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	100	95	0				216
Initial Wt.	100	100	0				167
Net Weight	0	-5	0				49

Total Moisture = 44.0 grams

Description of Impinger Contents: Clear
Silica Gel Color: Pink/   Percent Spent: 95 %
Filter I.D. No.:   Filter Container I.D.:
Description of Particulate on Filter: Sealed: Y N
Probe Rinse Container I.D.: NA   Liquid Level Marked/Sealed: Y N
Impinger Contents Container: NA   Liquid Level Marked/Sealed: Y N

RUN No.: 2   Recovery Date: 11/12   Recovered By: BR/TB

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	104	101	0				235
Initial Wt.	100	100	0				197
Net Weight							

Total Moisture = 43 grams

Description of Impinger Contents:
Silica Gel Color: Percent Spent: 75 %
Filter I.D. No.:   Filter Container I.D.:
Description of Particulate on Filter: Sealed: Y N
Probe Rinse Container I.D.:   Liquid Level Marked/Sealed: Y N
Impinger Contents Container: Liquid Level Marked/Sealed: Y N

RUN No.: 3   Recovery Date: 11/13   Recovered By: BR

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	740	694	579				919
Initial Wt.	745	694	578				888
Net Weight	-5	0	1				31

Total Moisture = 27 grams

Description of Impinger Contents:
Silica Gel Color: Percent Spent: 70 %
Filter I.D. No.:   Filter Container I.D.:
Description of Particulate on Filter: Sealed: Y N
Probe Rinse Container I.D.:   Liquid Level Marked/Sealed: Y N
Impinger Contents Container: Liquid Level Marked/Sealed: Y N

BLANKS: Probe rinse: Impinger: Filter:

0000028

DEECO

VELOCITY TRAVERSE DATA

SAMPLING LOCATION

Vibrating Screen

Plant	Vulcan	Pitot Type	S	Bar Press (in HG)	29.70
City	Charlotte	Pitot No.		Post Leak Check	✓
Operator	BPalm	Pitot Cp	0.84	Stack Diameter (in)	12"
Date	11/18/96	Thermocouple	—	CO2/O2 Analysis By	

MEASUREMENT DEVICE

- Micromanometer ☐
- 10" Manometer ☐
- Magnehelic ☐
- Other ☑
- Explain:

TRAVERSE SCHEMATIC

		11-17-96		11-18-96			
Run No.		Fan Check		Pre/1		Post/1	
Time		1645		0730		1704	
Ts(DB) deg F				54			
Ts(WB) deg F				49			
Pg(in H2O)							
Ps(in HG)		-.43		-.4618		-.4129	
CO2 %		0.0		0.0		0.0	
O2 %		20.9		20.9		20.9	
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	.06	55	.0944	50	.0764	48
	2	.07		.0833		.0825	
	3	.075		.0951		.1110	
	4	.10		.1130		.1121	48
	5	.11	55	.1082	51	.1211	
	6	.085		.0994		.1202	
B	1	.065		.0756		.0927	
	2	.07	55	.0825		.0737	48
	3	.09		.0832		.0718	
	4	.11		.1189	52	.1200	
	5	.095	55	.1240		.0996	48
	6	.08		.0990		.0879	
				Av. ΔP 0.097			
Average		sqrt 0.289		sqrt 0.312		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

$Ps = Pbar + Pg/13.6$

$Moist(\%) = 100(Bws)$

$Md = 0.44(\%CO2) + 0.32(\%O2) + 0.28(\%N2 + \%CO)$

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

$Vs = 85.49Cp(\text{sqrt}[(\text{Delta P})avg]) \times \text{sqrt}[(Ts+460)/MsPs)]$

$Qa = 60VsAs$

$Qs = Qa[528/(Ts+460)](Ps/29.92) \times (1 - Bws)$

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan Charlotte	11-18-96	Vibrating Screen	201	1

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
Bldm	29.60	-.4618	48	016	12	.84	3' Teflon		0.265

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
1	M5-4	1.841	1.004	-	-	-	0.005 @9"	0.005 @9"			—

	TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
1-A	6	0	0749	273.920	.0994	0.51	49	NA	NA	45	52	6.5
		10		277.85			49			45	56	6.5
1-B		20		281.85			49			46	59	6.5
		30		285.71			50			47	61	6.5
1-C		40		289.63			50			47	63	6.5
		50		293.94			50			47	65	6.9
2-C		60	0849	298.22			51			48	66	6.5
2-B		70		302.02			51			48	67	6.5
		80		306.06			51			49	68	7
2-A		90		310.13			52			50	69	7
3-A		100		314.15			52			50	69	7
		110		318.17			53			51	70	7
3-B		120	0949	322.23			53			51	71	7

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP. (stack)	AVE. TEMP. (DGM)
	138.452			51.6	70.6

00000030

EMISSION TESTING - A

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan Charlotte	11-18-96	Vibrating Screen	201	1

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	ΔP VELOCITY HEAD (in. H2O)	ΔH ORIFICE (in. H2O)	STACK TEMP (°F)	PROBE TEMP (°F)	FILTER OVEN TEMP (°F)	SILICA GEL IMPINGER TEMP (°F)	DGM IN/OUT TEMP (°F)	AUX. TEMP. (°F)	SAMPLE TRAIN VACUUM (in. Hg)
6	130		326.21	0.044 ~~0.99~~	0.51	53	NA	NA	51	72	NA	7.5
	140		330.23			51			49	72		7.5
	150		334.28			51			51	73		7.5
	160		338.33			51			51	73		7.5
	170	1230	342.37			53			49	63		7.5
	180	~~1538~~ ~~1644~~	346.36			53			48	68		7.5
	190		350.40			53			50	70		7.5
	200		354.30			53			52	71		7.5
	210		358.95			53			52	73		7.5
	220		362.25			52			53	74		7.5
	230		366.30			53			52	74		7.5
	240		370.23			53			52	75		7.5
	250		374.21			52			51	76		7.5
	260		378.21			52			51	77		7.5
	270		382.22			52			51	77		7.5
	280		386.25			53			51	78		7.5
	290		390.31			52			51	78		7.5
	300		394.47			51			51	78		7.5
	310		398.35			52			50	78		7.5
	320		402.38			52			50	78		7.5
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT ΔP	AVG ΔH	AVG STK °F				AVG DGM °F		

* Stop run (165) min., Due to rain Vm 340.381

Sheet Checked By: ______ Date ______

0000031

EMISSION TESTIN(- A

PLANT AND CITY		DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan	Charlotte	11-18		201	1

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
6	330		406.42	0.099	0.51	51	NA	NA	50	78	NA	7.5
	340	~~1525~~	410.44	0.099		51	NA	NA	50	78	NA	7.5
	~~*350~~	346.0	412.874									
	~~362.5~~											

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

8C
8B
8A

Sheet Checked By: Date

00000032

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: Vibrating Screen

Plant: Vulcan
City: Charlotte
Operator: Blalm
Date: 11-19-96

Pitot Type:
Pitot No.:
Pitot Cp: 0.84
Thermocouple:

Bar Press (in HG): 29.20
Post Leak Check:
Stack Diameter (in): 12"
CO2/O2 Analysis By: -

MEASUREMENT DEVICE

Micromanometer ☐
10" Manometer ☐
Magnehelic ☐
Other ☑
Explain: Air Data Meter

TRAVERSE SCHEMATIC

Run No.		Pre/1		Post/1			
Time		0715		1410			
Ts(DB) deg F							
Ts(WB) deg F							
Pg(in H2O)		-0.4231		-0.4798			
Ps(in HG)							
CO2 %		0.0		0.0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	0.1488		0.0773			
	2	0.0717		0.0761			
	3	0.0744		0.1018			
	4	0.1159		0.0831			
*	5	0.0990		0.0705			
	6	0.0932		0.0791			
B	1	0.1433		0.1496			
	2	0.0877		0.1031			
	3	0.0972		.0995			
	4	0.1413		0.1101			
*	5	0.1091		0.0926			
	6	0.1100		0.0960			
Avg ΔP²		.106					
AVG ΔP		0.1076					
Average		sqrt 0.326		sqrt 0.306		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

$Ps = Pbar + Pg/13.6$

$Moist(\%) = 100(Bws)$

$Md = 0.44(\%CO2) + 0.32(\%O2) + 0.28(\%N2 + \%CO)$

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

$Vs = 85.49Cp(\mathrm{sqrt}[(\mathrm{Delta\ P})avg]) \times \mathrm{sqrt}[(Ts+460)/MsPs)]$

$Qa = 60VsAs$

$Qs = Qa[528/(Ts+460)](Ps/29.92) \times (1 - Bws)$

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan / Charlotte	11-19	Vibrating Screen	201A	2

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BPalm	29.2	~~29.20~~ BP -.4231	51°	009	12	0.84	3' Teflon		0.265

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
1.4	M5-4	1.841	1.004	–	–	–	0.006 @ 9"	0.005 @ 12"	20.9	0.0	–

1-A 1-B 1-C 2-C 2-B 2-A 3-A 3-B

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
5	0	0741	413.184	0.099	0.51	52	NA	NA	49	55	8
	10		417.18			53			46	59	8
	20		421.17			53			47	63	8
	* 30		425.25			52			49	63	8
	40		429.24			53			49	65	8
	50		433.12			54			49	67	8
	60	0843	437.17			55			50	68	8
	70		441.23			55			50	68	8
	80		445.30			56			51	69	8
	90		449.32			55			52	69	8
	100		453.36			56			53	69	8
	110		457.38			57			53	70	8
	120	0943	461.42			57			53	71	8

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.	AVE. TEMP.
	140.842			61.1	64.6

* Stop run 8:09

* [illegible] 8:17 [illegible]

00000034

EMISSION TESTING - TA

PLANT AND CITY			DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
Vulcan Charlotte			11-1996	Vibrating Screen			201A		2			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
5	130		465.47	0.099	0.51	57	NA	NA	54	71	NA	8
	140		469.43			57			55	71		8
	150		473.57			58			56	72		8
*	160		477.70			59			55	69		8.5
	170		481.75			59			55	70		8.5
	180	1056	485.78			61			54	71		8.5
	190		489.87			60			54	71		8.5
	200		493.94			60			55	72		8.5
	210		498.00			61			56	72		8.5
	220		502.07			59			56	73		8.5
	230		506.11			59			56	73		8.5
	240		510.18			60			56	74		8.5
	250		514.24			61			56	75		8.5
	260		518.34			60			57	75		8.5
	270		522.42			60			57	75		8.5
	280	1236	526.50			62			57	76		8.5
	290		530.41			61			57	76		8.5
**	300		534.67			61			55	75		8.5
	310	1322	538.79			61			55	74		8.5
	320		542.97			61			55	75		9
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

3-C 4-C 4-B 4-A 5-A 5-B 5-C 6-C 6-B 6-A

Sheet Checked By: ____________ Date ______

(1015) *Stop [illegible] (151.7) [illegible] / [illegible] ** [illegible] production on screen (303.7)

EMISSION TESTING

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan / Charlotte	11-19-96	Vibrating Screen	201A	2

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN VACUUM (in. Hg)
5	330	1342	546.80	0.099	0.51	61	NA	NA	56	75	NA	9
	340	1352	550.83			63			56	76		9
	347.9	1400	554.026									

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ____________ Date ______

00000036

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: Vibrating Screen

Plant: Vulcan
City: Charlotte
Operator: B Palm
Date: 11-20-96

Pitot Type: S
Pitot No.: -
Pitot Cp: 0.84
Thermocouple: -

Bar Press (in HG): 29.15
Post Leak Check: ✓
Stack Diameter (in): 12
CO2/O2 Analysis By: —

MEASUREMENT DEVICE

- Micromanometer ☐
- 10" Manometer ☐
- Magnehelic ☐
- Other ☑

Explain: Air Data Multi Meter

TRAVERSE SCHEMATIC

Run No.		Pre/3		Post/5			
Time		0715		1332			
Ts(DB) deg F							
Ts(WB) deg F							
Pg(in H2O)		-0.4596		-0.3972			
Ps(in HG)							
CO2 %		0.0		0.0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	0.1013	52	0.0733			
	2	0.0807		0.0757			
	3	0.0815		0.0767			
	4	0.1007		0.0994			
	5	0.0940		0.0926			
	6	0.0827		0.0769			
B	1	0.0971		0.0746			
	2	0.0921		0.0701			
	3	0.0812		0.0729			
	4	0.0955		0.1153			
	5	0.0855		0.1014			
	6	0.0787		0.0903			
Avg	ΔP	0.089					
Average		sqrt	0.298	sqrt		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

$Ps = Pbar + Pg/13.6$

$Moist(\%) = 100(Bws)$

$Md = 0.44(\%CO2) + 0.32(\%O2) + 0.28(\%N2 + \%CO)$

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

$Vs = 85.49Cp(sqrt[(Delta\ P)avg]) \times sqrt[(Ts+460)/MsPs)]$

$Qa = 60VsAs$

$Qs = Qa[528/(Ts+460)](Ps/29.92) \times (1 - Bws)$

METHOD 5 TESTING FIELD DATA SHEET

DEECO

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan Charlotte	11-20-96	Vibrating Screen	201 A	3

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BPalm	29.15	-0.4596	60°	011	12	0.84	3' Teflon		0.265

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
	MS-4	1.841	1.004	—	—	—	0.00 @ 11	0.00 @ 11"	20.9	0.0	—

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
3	0	0734	554.165	0.0815	0.5	50	NA	NA	45	56	7
	10		558.15			51			45	57	7
	20		562.20			52			45	58	7
	30		566.16			52			45	59	7
	40		570.14			52			45	60	7
	50		574.18			52			45	61	7
	60		578.18			51			46	63	7
	70		582.16			51			46	64	7
	80		586.11			52			47	64	7
	90		590.13			52			47	65	
	100		594.04			53			48	66	7
	110		598.09			53			48	66	7
	120		602.10			54			49	67	7
	TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP				AVE. TEMP.	

1-A, A, 1-B, 1-C, 2-C, 2-B, 2-A, 3A, 3-B

00000038

EMISSION TESTIN(- A

PLANT AND CITY		DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan	Charlotte	11-20-96	Vibrating Screen	201A	3

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	VELOCITY HEAD (in. H2O)	ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP (F)	SAMPLE TRAIN ACUU (in. Hg)
3 3-C	130	0944	606.11	0.0815	0.	53	NA	NA	49	67	NA	7
	140		610.10			54			50	67		7
4-C *	150		614.10			56			50	67		7
4-B	160		618.07			56			50	68		7
	170		622.05			58			52	68		7
4-A	180		626.11			59			52	69		7
5-A	190		630.00			59			53	70		7
	200		634.01			58			54	70		7
5-B	210		638.11			59			54	71		7
5-C	220		641.98			59			54	72		7
	230		645.97			60			55	73		7
6-C	240		649.97			60			55	72		7
6-B *	250		654.02			60			56	73		7
	260		658.01			60			56	73		7
6-A	270		662.03			60			56	73		7
7-A	280		666.17			61			58	74		7
	290		670.20			60			58	74		7
7-B	300		674.12			60			54	74		7
7-C	310		678.08			60			53	74		7
	320		682.14			61			53	75		7
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

Sheet Checked By: ____________ Date ________

00000039

EMISSION TESTING - 4

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Vulcan Charlotte	11-2096	Vibrating Screen	201 A	3

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
3	330	1312	686.12	0.0815	0.50	64	NA	NA	55	75	NA	7
	340		690.11			61			54	76		7
	344.89	1327	692.047									

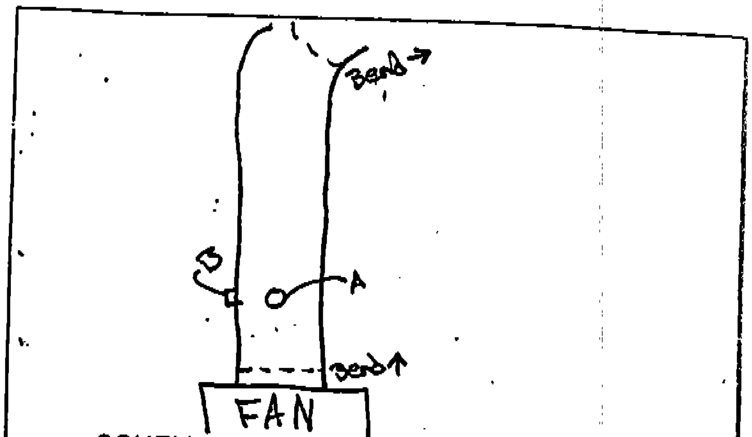
Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ____________ Date ______

0000004C

EPA METHOD 1
TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Vulcan
CITY Charlotte STATE NC
SAMPLING LOCATION Vibrating Screen
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 12"
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) –
NEAREST UPSTREAM DISTURBANCE 32"
DISTURBANCE Bend
NEAREST DOWNSTREAM DISTURBANCE 386"
DISTURBANCE Bend
SAMPLER BPalm DATE 11-18-96



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8-INCH)	DISTANCE B	TRAVERSE DISTANCE FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	4.4	12"	1/2"	–	1/2"
2	14.6		1 3/4"		1 3/4"
3	29.6		3 1/2"		3 1/2"
4	70.4		8 1/2"		8 1/2"
5	85.4		10 1/4"		10 1/4"
6	95.6		11 1/2"		11 1/2"

PARTICULATE/SAMPLE RECOVERY DATA SHEET

DEECO

Client/Location: Screen Sampling Date(s): 11-18

RUN No.: 1 Recovery Date: 11-18-96 Recovered By: Blalm

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	671	645	611				875
Initial Wt.	659	639	602				835
Net Weight	12	6	9				40

Total Moisture = 67 grams

Description of Impinger Contents: ______
Silica Gel Color: ______ Percent Spent: ______ %
Filter I.D. No.: ______ Filter Container I.D.: ______
Description of Particulate on Filter: ______ Sealed: Y N
Probe Rinse Container I.D.: ______ Liquid Level Marked/Sealed: Y N
Impinger Contents Container: ______ Liquid Level Marked/Sealed: Y N

RUN No.: 2 Recovery Date: 11-19-96 Recovered By: ______

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	677	645	614				875
Initial Wt.	671	645	611				833
Net Weight	6	0	3				42

Total Moisture = 51 grams

Description of Impinger Contents: ______
Silica Gel Color: ______ Percent Spent: ______ %
Filter I.D. No.: ______ Filter Container I.D.: ______
Description of Particulate on Filter: ______ Sealed: Y N
Probe Rinse Container I.D.: ______ Liquid Level Marked/Sealed: Y N
Impinger Contents Container: ______ Liquid Level Marked/Sealed: Y N

RUN No.: 3 Recovery Date: 11-20 Recovered By: ______

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	674	646	615				915
Initial Wt.	677	645	614				881
Net Weight							

Total Moisture = ______ grams

Description of Impinger Contents: ______
Silica Gel Color: ______ Percent Spent: ______ %
Filter I.D. No.: ______ Filter Container I.D.: ______
Description of Particulate on Filter: ______ Sealed: Y N
Probe Rinse Container I.D.: ______ Liquid Level Marked/Sealed: Y N
Impinger Contents Container: ______ Liquid Level Marked/Sealed: Y N

BLANKS: Probe rinse: ______ Impinger: ______ Filter: ______

00000042

DESCO

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: Fines Crusher

Plant	Vulcan	Pitot Type	S	Bar Press (in HG)	29.70
City	Charlotte	Pitot No.		Post Leak Check	✓
Operator	BJm	Pitot Cp	0.84	Stack Diameter (in)	18"
Date	11-17-96 & 11/18	Thermocouple	—	CO2/O2 Analysis By	20.9

11-18-96

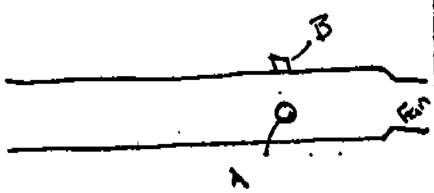
MEASUREMENT DEVICE

- Micromanometer ☐
- 10" Manometer ☑
- Magnehelic ☐
- Other ☐ Explain:

Run No.			Pre / 1		Post		
Time	1705		0731		1450		
Ts(DB) deg F							
Ts(WB) deg F							
Pg(in H2O)	-.41		-.41				
Ps(in HG)							
CO2 %	0.0		0.0				
O2 %	20.9		20.9				

port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts	
A	1	.14	57	.135	50	.1180	51	.1180
	2	.15	58	.14	51	.1353		.1353
	3	.17	61	.16	51	.1871		.1871
	4	.175	59	.19	51	.2122		.2122
	5	.18	57	.195	51	.1733		.1733
	6	.17	57	.18	51	.2202		.2202
B	1	.10	56	.115	52	.1118		.1118
	2	.12	56	.12	52	.1304		.1304
	3	.135	56	.13	52	.1370		.1370
	4	.14	56	.21	52	.1921		.1921
	6	.165	56	.22	52	.2027		.2027
	6	.215	55	.21	52	.2127		.2127
AVG ΔP →				0.165			0.167	
Average √ΔP		port 0.392		port 0.406		port	0.409	
Moist (%)								
Moist (Bws)								
Md(lb/lbmole)								
Ms(lb/lbmole)								
Vs (ft/s)		21.94						
Qa (acfm)		2326.2						
Qs (dscfm)		2327.9						

TRAVERSE SCHEMATIC



$Ps = Pbar + Pg/13.6$

$Moist(\%) = 100(Bws)$

$Md = 0.44(\%CO2) + 0.32(\%O2) + 0.28(\%N2 + \%CO)$

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

$Vs = 85.49Cp(sqrt[(Delta P)avg]) \times sqrt[(Ts+460)/MsPs)]$

$Qa = 60VsAs$

$Qs = Qa[528/(Ts+460)](Ps/29.92) \times (1 - Bws)$

00000043

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE NC	11/18/96	FINES CRUSHER	201A 2.5&10	#1

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BHR	29.50	-.41	52	0015	18"	0.84	4' TEFLON		0.234

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
1%	M5-6	1.816	1.008			—	0.015@ 10"	0.000 @8"	20.9	0	—

REVISED 1.5%

TRAV POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	8:38AM	377.238	~~0.0~~	0.48	53	—	—	48	60	6
"	10		~~381.8~~ 381.50	0.14	0.48	53			47	62	6.5
A-2	13:40		382.87	0.14		54			47	64	6.5
"	20		385.36	"		54			48	65	7
A-3	27:20		388.25	0.16		54			49	66	7
"	30		389.92	"		54			49	67	7
A-4	42:10		394.13	0.19		55			50	68	7
"	50			"		55			50	69	7
A-5	58:15		400.57	0.20		55			49	70	7
"	70			"		55			49	72	7
A-6	74:35		407.10	0.18		56			49	72	7
"	80			"		55			51	74	7
	90:15		412.251			55			52	74	7
	TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE TEMP				AVE TEMP	
	180.0		72.412		0.48	48.2				70.0	

PLANT AND CITY				DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
VULCAN - PINEVILLE NC				11/18/96	FINES CRUSHER			201A 25&10		#1			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)		P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
B-1	0	10:14	413.251			0.48	53	—	—	50	74	—	7
"	10		417.22				53			52	75		7
STOPPED DUE TO RAIN → B-2	12:30	10:27/ 12:29 PM	418.25				54			53	66		7
"	20	12:50	421.29				55			51	68		7
B-3	25:20		423.47				55			51	70		7
"	30	-13:20	425.34				55			51	70		7
B-4	38:40		428.83				55			52	72		7
"	50 OR	16:50	433.46				55			53	73		6.5
B-5	55:30		435.61				55			54	74		7
"	60 OR	17:20	437.43				56			55	75		7
B-6	72:50		442.61				56			54	75		7
"	80		445.57				56			54	76		7
~~77.25~~ END	89:45		449.650			—	—	—	—	—	—	—	—

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ______ Date ______

00000045

DEECO

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: Fines Crusher

Plant	Vulcan	Pitot Type		Bar Press (in HG)	
City	Charlotte	Pitot No.		Post Leak Check	
Operator	BLdM	Pitot Cp	0.84	Stack Diameter (in)	-
Date	11-19-96	Thermocouple		CO2/O2 Analysis By	

MEASUREMENT DEVICE

- Micromanometer ☐
- 10" Manometer ☐
- Magnehelic ☐
- Other: ☑ Explain: Air Data Meter

TRAVERSE SCHEMATIC

Run No.		Pre/2		Post/2			
Time		0938		1439			
Ts(DB) deg F							
Ts(WB) deg F							
Pg(in H2O)				-0.3403			
Ps(in HG)		-0.3974					
CO2 %		0.0					
O2 %		20.9					
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A-1		.1488	5	0.1511			
2		.1436		0.1268			
3		.1675		0.1728			
4		.2079		0.1824			
5		.2379		0.1817			
6		.1611		0.1772			
B1		.1266		0.1118			
2		.1286		0.1411			
3		.1603		0.1687			
4		.1972		0.1826			
5		.1980		0.2094			
6		.1663		0.1982			
Average		sqrt		sqrt 0.407		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)							
Qs (dscfm)							

$Ps = Pbar + Pg/13.6$

$Moist(\%) = 100(Bws)$

$Md = 0.44(\%CO2) + 0.32(\%O2) + 0.28(\%N2 + \%CO)$

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

$Vs = 85.49Cp(\mathrm{sqrt}[(\Delta P)avg]) \times \mathrm{sqrt}[(Ts+460)/MsPs)]$

$Qa = 60VsAs$

$Qs = Qa[528/(Ts+460)](Ps/29.92) \times (1 - Bws)$

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN-PINEVILLE, NC	11/19/96	FINES CRUSHER	201A 2.5&10μm	#2

OPERATOR	AMBIENT PRESS (in. Hg)	STATIC PRESS (in. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (in.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BHR	29.20	-0.40	58	0017	18"	0.84	4' TEFLON	—	0.234

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
1.4%	M5-6	1.816	1.008			—	0.005 @ 11"	0.004 @ 14"	20.9	0	—

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (in. H2O)	delta H ORIFICE (in. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP. (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	7:48AM	449.628		0.48	55	—	—	50	64	6
"	10		453.70			55			50	65	6
"	20		457.75			55			51	67	6
A-2	28:00		460.99			56			52	69	6
"	40		465.84			56			52	69	6
"	50		469.89			56			53	70	6
A-3	55:35		472.21			56			53	70	6
"	70		477.93			56			53	71	6
"	80		482.01			56			54	72	6
A-4	85:20		484.15			56			54	73	6
"	100		490.06			56			54	73	6
"	110		494.13			57			55	74	6
A-5	118:30		497.58			57			56	74	6
	TOTAL TIME 358.50		DGM VOLUME 145.334	AVE SQRT delta P	AVE delta H 0.48	AVE. TEMP. 60				AVE. TEMP. 75	

59.7

00000047

EMISSION TESTINC D DATA

PLANT AND CITY				DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
VULCAN - PINEVILLE, NC				11/19/96	FINES CRUSHER			201A 2.5 & 10 µm		#2			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (In. H2O)	H ORIFICE (In. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (In. Hg)
A-5	130		502.26		0.48	59	—	—	55	75	—	6
"	140		506.32			59			56	74		6.5
A-6	153:55	10:16	509.56 511.88			60			56 60	74 72		6.5
"	160		514.30			60			57	75		6.5
"	170		518.33			60			56	76		6.5
B-1	183:10/0	11:12AM	523.651			63			56	76		6.5
	10		527.66			65			57	76		6.5
	20		531.70			65			57	77		6.5
B-2	25:50		533.95			62			57	77		6.5
	40		539.79			62			57	78		6.5
	50		543.81			62			57	78		6.5
B-3	51:55		544.61			62			58	79		6.5
	70		552.22			62			58	79		6.5
	80		556.26			62			57	79		6.5
B-4	81:00		556.65			62			57	79		6.5
	100		564.34			62			57	79		6.5
	110		566.40 568.33			62			56	77		6.5
B-5	113:20		569.76			62			55	79		6.5
	130		576.55			62			55	79		6.5
	140		580.60			62			56	79		6.5
Page Totals	TOTAL TIME		DGM VOLUME	AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

10:16AM STOPPED 148:00 PRODUCT. DOWN START 10:29AM

104:00 1:00PM STOPPED PRODUCT DOWN START BACK 1:[illegible]PM

Sheet Checked By: ______ Date ______

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE, NC	11/19/96	FC	201A 2.5&10 μm	#2

TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
B-6	145:40		582.97		0.48	62	—	—	56	81	—	6.5
"	160		588.75			62			57	82		6.5
"	170		592.81			62			55	82		6.5
END	175:20		594.962			—			—	—		—
TOTAL:	358:30											

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ____________ Date ______

00000049

DEECO

VELOCITY TRAVERSE DATA

SAMPLING LOCATION: Fines Crusher

Plant: Vulcan
City: Charlotte
Operator: BPelm
Date: 11-20-96

Pitot Type:
Pitot No.:
Pitot Cp: 0.84
Thermocouple: -

Bar Press (in HG): 29.15
Post Leak Check:
Stack Diameter (in): 18
CO2/O2 Analysis By: -

MEASUREMENT DEVICE

Micromanometer ☒
10" Manometer ☐
Magnehelic ☐
Other ☐
Explain:

TRAVERSE SCHEMATIC

Run No.		FC-3 PRE		Post 3			
Time		0723		1420			
Ts(DB) deg F							
Ts(WB) deg F							
Pg(in H2O)							
Ps(in HG)		-0.3931		-0.3567			
CO2 %		0		0			
O2 %		20.9		20.9			
port	point	Delta P	Ts	Delta P	Ts	Delta P	Ts
A	1	0.1080	53	0.1320			
	2	0.1445		0.1433			
	3	0.1541		0.1280			
	4	0.1768		0.1457			
	5	0.1858		0.1419			
	6	0.1420		0.1345			
B	1	0.1006	~~0.1051~~	0.1051			
	2	0.1248	~~0.124~~	0.1249			
	3	0.1463		0.1312			
	4	0.1552		0.1859			
	5	0.2022		0.1988			
	6	0.1504		0.1636			
$\sqrt{\ }^2 \rightarrow$		0.148					
Average		sqrt 0.385		sqrt		sqrt	
Moist (%)							
Moist (Bws)							
Md(lb/lbmole)							
Ms(lb/lbmole)							
Vs (ft/s)							
Qa (acfm)		2293.4					
Qs (dscfm)		2269.9					

Ps = Pbar + Pg/13.6

Moist(%) = 100(Bws)

Md = 0.44(%CO2) + 0.32(%O2) + 0.28(%N2 + %CO)

Ms = Md(1-Bws) + 18Bws

Vs = 85.49Cp(sqrt[(Delta P)avg]) x sqrt[(Ts+460)/MsPs)]

Qa = 60VsAs

Qs = Qa[528/(Ts+460)](Ps/29.92) x (1 - Bws)

0000050

DEECO

METHOD 5 TESTING FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE, NC	11/20/96	FINES CRUSHER	201A 2.5&10	#3

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESS (In. Hg)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
BHK	29.15	-0.39	50		18	0.84	4' TEFLON	—	0.234

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL. FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
1	M5-6	1.816	1.008			—	0.005@ 8"		20.9	0	—

TRAV. POINT NO.	ELAPSED TEST TIME (MIN)	CLOCK TIME (24-HR)	DGM READING Vm (cu. ft.)	delta P VELOCITY HEAD (In. H2O)	delta H ORIFICE (In. H2O)	STACK TEMP (deg. F)	PROBE TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL IMPINGER TEMP (deg. F)	DGM IN/OUT TEMP (deg. F)	SAMPLE TRAIN VAC (In. Hg)
A-1	0	7:36AM	595.175		0.47	50	—	—	50	53	6
"	10		599.02			50			50	60	6
"	20		602.89			51			50	64	6
A-2	25:40		605.16			51			50	64	6
"	40		610.67			51			51	64	6
"	50		614.68			52			51	65	6
A-3	55:15		616.73			52			52	66	6
"	70		622.67			54			52	68	6
"	80		626.68			54			53	68	6
A-4	85:50		629.05			55			54	68	6
"	100		634.51			55			54	69	6
"	110		638.58			55			55	70	6
A-5	118:40		641.96			56			55	71	6
	TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.				AVE. TEMP. 71.9	

PLANT AND CITY				DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER			
VULCAN-PINEVILLE, NC				11/20/96	FINES CRUSHER			201A 2.5&10		#3			
TRAV. POINT NO.	ELAPSED TEST TIME (min)	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)		P VELOCITY HEAD (in. H2O)	H ORIFICE (in. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SILGEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (in. Hg)
A-5	130		646.60			0.47	56	—	—	55	72	—	6
"	140		650.59				57			56	73		6
A-6	152:15						59			56	72		6
"	160		658.57				58			56	73		6
"	170		662.55				59			58	74		6.5
B-1	181:40		667.17				59			59	73		6.5
"	10		671.24				59			59	73		6.5
"	20		675.33				59			60	74		7
B-2	24:45		677.32				60			60	75		7
"	40		683.53				60			60	76		7
"	50						61			61	76		7
B-3	52:15		688.68				62			61	76		7
"	70		695.88				61			61	75		7
"	80		699.87				61			61	76		7
B-4	82:05		700.69				62			61	76		7
"	100						62			60	76		7
"	110		711.99				62			59	77		7
B-5	112:30						62			61	78		7
"	130		720.06				62			62	78		7
"	140						63			63	78		7
Page Totals	TOTAL TIME		DGM VOLUME		AVG SQRT P	AVG H	AVG STK F				AVG DGM F		

STOPPED 10:05AM DUE TO PRODUCT DOWN BACK 10:10AM

Sheet Checked By: ____________ Date ______

00000052

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
VULCAN - PINEVILLE, NC	11/20/96	FINES CRUSHER	201A 2.5&10	#3

TRAV. POINT NO.	~~ELAPSED TEST TIME (min)~~	CLOCK TIME (24-hr)	GAS METER READING Vm (ft3)	P VELOCITY HEAD (In. H2O)	H ORIFICE (In. H2O)	STACK TEMP (F)	PROBE TEMP (F)	FILTER OVEN TEMP (F)	SIL GEL IMPINGER TEMP (F)	DGM IN/OUT TEMP (F)	AUX. TEMP. (F)	SAMPLE TRAIN ACUU (In. Hg)
B-6		147:55	727.38		0.47	62	—	—		79	—	7
〃		160	732.26		↓	62	↓	↓		79	↓	7
〃		170				62				79		7
END	1:52PM	178:10	739.624									
TOTAL	→	359.83										

Page Totals	TOTAL TIME	DGM VOLUME	AVG SQRT P	AVG H	AVG STK F	AVG DGM F

Sheet Checked By: ______ Date ______

00000053

DEECO

EPA METHOD 1
TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

*SAME DUCT FOR TERT. & FINES CRUSHER BR 11/20/96

PLANT Vulcan Materials

CITY ______ STATE NC

SAMPLING LOCATION CRUSHER

INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE A) 18"

INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE, (DISTANCE B) —

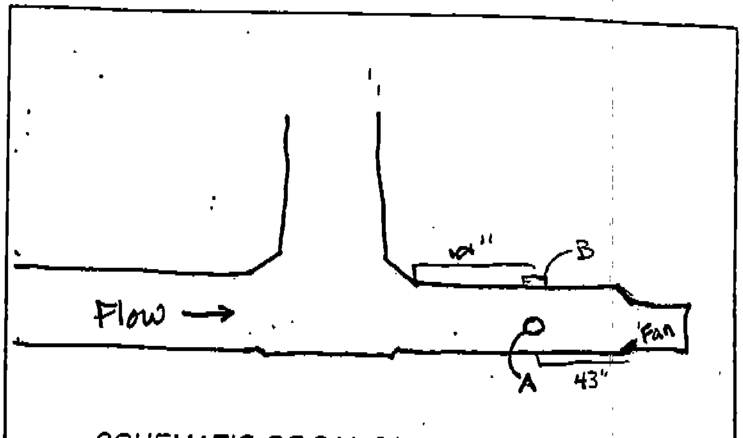
NEAREST UPSTREAM DISTURBANCE 101"

DISTURBANCE T

NEAREST DOWNSTREAM DISTURBANCE 43"

DISTURBANCE Flange

SAMPLER Bldm DATE 11-10-96



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8-INCH)	DISTANCE B	TRAVERSE DISTANCE FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	4.4	18"	3/4"	—	3/4"
2	14.6	↓	2 5/8		2 5/8"
3	29.6		5 3/8		5 3/8"
4	70.4		12 5/8		12 5/8"
5	85.4		15 5/8		15 5/8"
6	95.6		17 1/4		17 1/4"

epa1circ.wk1

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DEECO

PARTICULATE/SAMPLE RECOVERY DATA SHEET

Client/Location: Fines Crusher Sampling Date(s): 11-18/11-20

RUN No.: 1 Recovery Date: 11-18-96 Recovered By: BP

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	754	714	578	/	/	/	854
Initial Wt.	682	712	~~758~~ 573 (8)	/	/	/	838
Net Weight	72	2	5				16

* SATURATION % USED INSTEAD

Total Moisture = 95 grams

Description of Impinger Contents: ______

Silica Gel Color: ______ Percent Spent: 80 %

Filter I.D. No.: ______ Filter Container I.D.: ______

Description of Particulate on Filter: ______ Sealed: Y N

Probe Rinse Container I.D.: ______ Liquid Level Marked/Sealed: Y N

Impinger Contents Container: ______ Liquid Level Marked/Sealed: Y N

RUN No.: 2 Recovery Date: 11-19-96 Recovered By: BP/lm

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	766	717	581				884
Initial Wt.	754	714	578				854
Net Weight	8	3	3				30

Total Moisture = 43 grams

Description of Impinger Contents: ______

Silica Gel Color: ______ Percent Spent: 70 %

Filter I.D. No.: ______ Filter Container I.D.: ______

Description of Particulate on Filter: ______ Sealed: Y N

Probe Rinse Container I.D.: ______ Liquid Level Marked/Sealed: Y N

Impinger Contents Container: ______ Liquid Level Marked/Sealed: Y N

RUN No.: 3 Recovery Date: ______ Recovered By: ______

Impingers:	1	2	3	4	5	6	Silica Gel
Final Wt.	(8) ~~766~~ 774	646	651				876
Initial Wt.	766	717	581				844
Net Weight	8	-71	70				32

Total Moisture = 39 grams

Description of Impinger Contents: ______

Silica Gel Color: ______ Percent Spent: 70 %

Filter I.D. No.: ______ Filter Container I.D.: ______

Description of Particulate on Filter: ______ Sealed: Y N

Probe Rinse Container I.D.: ______ Liquid Level Marked/Sealed: Y N

Impinger Contents Container: ______ Liquid Level Marked/Sealed: Y N

00000055

BLANKS: Probe rinse: ______ Impinger: ______ Filter: ______

APPENDIX F.

LABORATORY SAMPLE ANALYSIS SHEETS

performed by
DEECO INC.
3404 Lake Woodard Drive
Raleigh, North Carolina 27604
919-250-0285

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number TC-1

Sample Location

Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	LPM 2.5 Filter	Yes

Back-half Filter

Filter container number 004

Date and time of wt	11/19/96 1501 BAD	Gross wt	0.1026 g
Date and time of wt	11/20/96 1508 BAD	Gross wt	0.1023 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	0.1025 g
		Tare wt of filter	0.0673 g
		Weight of particulate on filter	0.0352 g

Total weight of particulate 0.0352 + 0.0728 + 0.0006 = 0.1086 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks

Signature of analyst Bradman Dewees

Signature of reviewer Dianne Tarkix

SAMPLE ANALYTICAL DATA FORM

Plant: Aircontrol Tech/Vulcan Charlotte, NC Run Number: TC-1
Sample Location: ______
Relative Humidity: ______

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse (PM_{10}>x>$PM_{2.5}$)	<10PM 10>PM 2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5}$>x)	<PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number: 5837 80 mL

Date and time of wt	DT 11-21-96 1116	Gross wt	3.9374 g
Date and time of wt	BAD 11-22-96 2125	Gross wt	3.9315 g
Date and time of wt	BAD 11-23-96 1704	Gross wt	3.9306 g
Date and time of wt	BAD 11-26-96 2002	Gross wt	3.9305 g
		Average Gross wt	3.9306 g
		Tare wt	3.8578 g
		Wt of acetone blank	0 g
		Weight of particulate in acetone	0.0728 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number: 5842
Acetone rinse volume ($V_a w$): 40 mL mL
Acetone blank residue concentration (C): ______ mL
$W_a = C_a V_a w$ = ( ) ( ) ( ) = ______ g

Date and time of wt	DT 11-21-96 1117	Gross wt	3.6652 g
Date and time of wt	BAD 11-22-96 2121	Gross wt	3.6626 g
Date and time of wt	BAD 11-23-96 1707	Gross wt	3.6610 g
Date and time of wt		Gross wt	3.6607 g
		Average Gross wt	3.6609 g
		Tare wt of beaker	3.6603 g
		Wt of acetone blank	~~0.0006~~ BAD g
		Weight of particulate in acetone rinse (m_a)	0.0006 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks: This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst: [illegible]
Signature of reviewer: [illegible]

00000002

Signature of reviewer ____________________

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number TC-2
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	2 PM 2.5 Filter	yes

Back-half Filter

Filter container number 012

Date and time of wt 11/19/96 1458 BAD Gross wt 0.1063 g
Date and time of wt 11/20/96 1510 BAD Gross wt 0.1060 g
Date and time of wt ____ Gross wt ____ g
Date and time of wt ____ Gross wt ____ g
Average Gross wt 0.1062 g

Tare wt of filter 0.0673 g
Weight of particulate on filter 0.0389 g

Total weight of particulate 0.0389 + 0.0915 + 0.0024 = 0.1328 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks

Signature of analyst Barbara DeWees
Signature of reviewer Denise Tarbox

00000003

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number TC-2

Sample Location

Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10} > x > PM_{2.5}$)	<10PM10 > PM2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5} > x$)	< PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5827 80mL

Date and time of wt	DT 11-21-96 1117	Gross wt	3.6874 g
Date and time of wt	BAD 11-22-96 2126	Gross wt	3.6835 g
Date and time of wt	BAD 11-23-96 1459	Gross wt	3.6839 g
Date and time of wt	BAD 11-26-96 2006	Gross wt	3.6842 g
		Average Gross wt	3.6841 g
		Tare wt	3.5926 g
		Wt of acetone blank	0 g
		Weight of particulate in acetone	0.0915 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse a[redacted]container number 5840

Acetone rinse volume ($V_a w$) 35 mL mL

Acetone blank residue concentration (C) mL

$W_a = C_a V_a w =$ ( ) ( ) ( ) = g

Date and time of wt	DT 11-21-96 1115	Gross wt	3.4362 g
Date and time of wt	BAD 11-22-96 2109	Gross wt	3.4343 g
Date and time of wt	BAD 11-23-96 1634	Gross wt	3.4342 g
Date and time of wt		Gross wt	g
		Average Gross wt	3.4343 g
		Tare wt of beaker	3.4319 g
		Wt of acetone blank	g
		Weight of particulate in acetone rinse (m_a)	0.0024 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewees

Signature of reviewer Donna Tarkiy

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number TC-3

Sample Location

Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter		

Back-half Filter

Filter container number 018

Date and time of wt	11/19/96 1457 BAD	Gross wt	0.1003 g
Date and time of wt	11/20/96 1508 BAD	Gross wt	0.1000 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	0.1002 g
		Tare wt of filter	0.0655 g
		Weight of particulate on filter	0.0347 g

Total weight of particulate 0.0347 + 0.0866 + 0.0032 = 0.1245 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks

Signature of analyst Barbara DeWees

Signature of reviewer Donna Tarbey

00000005

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number TC-3
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10}>x>PM_{2.5}$)	< 10PM10 > PM 2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5}>x$)	< PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5838 100 mL

Date and time of wt	DT 11-21-96 1116	Gross wt	3.7697 g
Date and time of wt	BAD 11-22-96 2117	Gross wt	3.7662 g
Date and time of wt	BAD 11-23-96 1652	Gross wt	3.7663 g
Date and time of wt		Gross wt	g
		Average Gross wt	3.7663 g
		Tare wt	3.6797 g
		Wt of acetone blank	g
		Weight of particulate in acetone	0.0866 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number 5841
Acetone rinse volume ($V_a w$) 25 mL mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w =$ ( ) ( ) ( ) = g

Date and time of wt	DT 11-21-96 1114	Gross wt	3.7302 g
Date and time of wt	BAD 11-22-96 2113	Gross wt	3.7271 g
Date and time of wt	BAD 11-23-96 1619	Gross wt	3.7268 g
Date and time of wt		Gross wt	g
		Average Gross wt	3.7270 g
		Tare wt of beaker	3.7238 g
		Wt of acetone blank	g
		Weight of particulate in acetone rinse (m_a)	0.0032 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewey
Signature of reviewer Denise Tarkey

00000006

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number TP-1
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	<PM 2.5 Filter	yes

Back-half Filter

Filter container number 006

Date and time of wt 11/19/96 1455 BAD — Gross wt 0.0829 g
Date and time of wt 11/20/96 1507 BAD — Gross wt 0.0825 g
Date and time of wt — Gross wt g
Date and time of wt — Gross wt g

Average Gross wt 0.0827 g

Tare wt of filter 0.0692 g
Weight of particulate on filter 0.0135 g
BAD

Total weight of particulate 0.0135 + 0.0416 + 0.0032 = ~~0.05~~ 0.0583 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks

Signature of analyst Barbara Dewees
Signature of reviewer Dianne Tasker

00000007

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number TP-1
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10} > x > PM_{2.5}$)	<PM 10 > PM 2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5} > x$)	< PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5835 75 mL

Date and time of wt DT 1111 11-21-96	Gross wt 3.9359	g
Date and time of wt BAD 2119 11-22-96	Gross wt 3.9330	g
Date and time of wt BAD 1654 11-23-96	Gross wt 3.9326	g
Date and time of wt	Gross wt	g
	Average Gross wt 3.9328	g
	Tare wt 3.8912	g
	Wt of acetone blank ~~.416~~	g BAD
	Weight of particulate in acetone 0.0416	g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number 5836
Acetone rinse volume ($V_a w$) 40 mL mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w =$ ( ) ( ) ( ) = g

Date and time of wt DT 11-21-96 1119	Gross wt 3.4493	g
Date and time of wt BAD 11-22-96 2116	Gross wt 3.4458	g
Date and time of wt BAD 11-23-96 ~~11~~1622	Gross wt 3.4452	g
Date and time of wt BAD 11-26-96 2048	Gross wt 3.4442	g
BAD 11-27-96 1325 3.4446	Average Gross wt 3.4444	g
	Tare wt of beaker 3.4412	g
	Wt of acetone blank	g
	Weight of particulate in acetone rinse (m_a) 0.0032	g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewez
Signature of reviewer Donna Tarbox

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number TP-2
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	LPM 2.5 filter	yes

Back-half Filter

Filter container number 008

Date and time of wt	11/19/96 1452 BAD	Gross wt	0.0837 g
Date and time of wt	11/20/96 1512 BAD	Gross wt	0.0834 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	0.0836 g

Tare wt of filter 0.0693 g
Weight of particulate on filter ~~0.0146~~ g 0.0143 BAD

Total weight of particulate 0.0143 + 0.0311 + 0.0001 = 0.0455 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks

Signature of analyst Barbara DeWeese
Signature of reviewer Donna Lashley

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number TP-2
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10}>x>PM_{2.5}$)	<PM10 > PM2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5}>x$)	<PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5831 55mL

Date and time of wt DT 11-21-96 1120	Gross wt 3.5069	g
Date and time of wt BAD 11-22-96 2123	Gross wt 3.5059	g
Date and time of wt BAD 11-23-96 1705	Gross wt 3.5052	g
Date and time of wt BAD 11-26-96 2313	Gross wt 3.5050	g
	Average Gross wt 3.5051	g
	Tare wt 3.4740	g
	Wt of acetone blank	g
	Weight of particulate in acetone 0.0311	g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse a[redacted]container number 5829
Acetone rinse volume (V_aw) 20mL mL
Acetone blank residue concentration (C) mL
$W_a = C_aV_aw$ = ( ) ( ) ( ) = g

Date and time of wt DT 1112 11-21-96	Gross wt 3.8137	g
Date and time of wt BAD 2111 11-22-96	Gross wt 3.8417	g
Date and time of wt BAD 1625 11-23-96	Gross wt 3.8411	g
Date and time of wt BAD 2008 11-26-96	Gross wt 3.8410	g
	Average Gross wt 3.8411	g
	Tare wt of beaker 3.8410	g
	Wt of acetone blank 0.0001	g
	Weight of particulate in acetone rinse (m_a)	g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewees
Signature of reviewer Dennis Tarkey

00000010

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number *TP-3*
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	*LPM 2.5 Filter*	*yes*

Back-half Filter

Filter container number *TP-3*

Date and time of wt *11/19/96 1450 BAW* Gross wt *0.0809* g
Date and time of wt *11/20/96 1511 BAW* Gross wt *0.0804* g
Date and time of wt Gross wt g
Date and time of wt Gross wt g
Average Gross wt *0.0807* g

Tare wt of filter *0.0697* g
Weight of particulate on filter *0.0110* g

Total weight of particulate *0.0110 + 0.272 + 0.0003 = 0.0385* g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks

Signature of analyst *Barbara Dewee*
Signature of reviewer *Donna Ashley*

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number TP-3
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10} > x > PM_{2.5}$)	<10PM10 > PM2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5} > x$)	<PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5851 60 mL

Date and time of wt	11/22/96 2127 BAD	Gross wt	3.7459 g
Date and time of wt	11/23/96 1620 BAD	Gross wt	3.7456 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	3.7458 g
		Tare wt	3.7186 g
		Wt of acetone blank	g
		Weight of particulate in acetone	0.0272 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number 5834
Acetone rinse volume ($V_a w$) mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w$ = ( ) ( ) ( ) = g

Date and time of wt	11/22/96 2114 BAD	Gross wt	3.5837 g
Date and time of wt	11/23/96 1617 BAD	Gross wt	3.5838 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	3.5838 g
		Tare wt of beaker	3.5835 g
		Wt of acetone blank	g
		Weight of particulate in acetone rinse (m_a)	0.0003 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewees
Signature of reviewer Donna Tashiff

00000012

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number VS-1

Sample Location

Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	< PM 2.5 filter	yes

Back-half Filter

Filter container number 016

Date and time of wt	11/23/96 2124 BAD	Gross wt	0.0667 g
Date and time of wt	11/24/96 2303 BAD	Gross wt	0.0667 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	0.0667 g
		Tare wt of filter	0.0655 g
		Weight of particulate on filter	0.0012 g

Total weight of particulate 0.0012 + 0.0084 + 0.0009 = 0.0105 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks

Signature of analyst Barbara Dewees

Signature of reviewer Barry Hayfield

SAMPLE ANALYTICAL DATA FORM

Plant ______ Aircontrol Tech/Vulcan Charlotte, NC ______ Run Number VS-1

Sample Location ______

Relative Humidity ______

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10}>x>PM_{2.5}$)	<10PM 10 >PM2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5}>x$)	<PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5862 90 mL

Date and time of wt	11/26/96 2329 BAD	Gross wt	3.9127 g
Date and time of wt	11/27/96 1305 BAD	Gross wt	3.9128 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	3.9128 g
		Tare wt	3.9044 g
		Wt of acetone blank	g
		Weight of particulate in acetone	0.0084 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number 5855

Acetone rinse volume ($V_a w$) 25 mL ______ mL

Acetone blank residue concentration (C) ______ mL

$W_a = C_a V_a w =$ ( ) ( ) ( ) = ______ g

Date and time of wt	11/26/96 2321 BAD	Gross wt	3.5877 g
Date and time of wt	11/27/96 1310 BAD	Gross wt	3.5877 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	3.5877 g
		Tare wt of beaker	3.5868 g
		Wt of acetone blank	g
		Weight of particulate in acetone rinse (m_a)	0.0009 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewees

Signature of reviewer Donna Tarley

00000014

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number VS-2
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	LPM2.5 Filter	yes

Back-half Filter

Filter container number 009

Date and time of wt	11/23/96 2125 BAD	Gross wt	0.0701 g
Date and time of wt	11/24/96 2305 BAD	Gross wt	0.0701 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	0.0701 g
		Tare wt of filter	0.0673 g
		Weight of particulate on filter	0.0028 g

Total weight of particulate 0.0028 + 0.0166 + 0.0011 = 0.0205 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks

Signature of analyst Barbara DeWeese
Signature of reviewer Barry Rayfield

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number VS-2
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10} > x > PM_{2.5}$)	<10PM10 > PM2.5 filter	teflon tape
Acetone [redacted] ($PM_{2.5} > x$)	<PM 2.5 rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5857 95 mL

Date and time of wt	11/26/96 2335 BAD	Gross wt	3.4764 g
Date and time of wt	11/26/96 1252 BAD	Gross wt	3.4763 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	3.4764 g
		Tare wt	3.4598 g
		Wt of acetone blank	g
		Weight of particulate in acetone	0.0166 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse a[redacted] container number 5853
Acetone rinse volume ($V_a w$) 25 mL mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w =$ ( ) ( ) ( ) = g

Date and time of wt	11/26/96 2318 BAD	Gross wt	3.9640 g
Date and time of wt	11/27/96 1314 BAD	Gross wt	3.9637 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	3.9639 g
		Tare wt of beaker	3.9628 g
		Wt of acetone blank	g
		Weight of particulate in acetone rinse (m_a)	0.0011 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewees
Signature of reviewer Dinne Tarhoff

SAMPLE ANALYTICAL DATA FORM

Plant Air Control Tech/Vulcan Charlotte, NC Run Number VS-3

Sample Location

Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	LPM 2.5 Filter	yes

Back-half Filter

Filter container number 011

Date and time of wt 11/23/96 2128 BAD Gross wt 0.0692 g
Date and time of wt 11/24/96 2307 BAD Gross wt 0.0692 g
Date and time of wt Gross wt g
Date and time of wt Gross wt g
Average Gross wt 0.0692 g

Tare wt of filter 0.0678 g
Weight of particulate on filter 0.0014 g

Total weight of particulate 0.0014 + 0.0094 + 0.0015 = 0.0123 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks

Signature of analyst Barbara Dewer

Signature of reviewer Barry Rayfield

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number VS - 3
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10}>x>PM_{2.5}$)	<10PM 10 >PM2.5 filter	teflon tape
Acetone [redacted] ($PM_{2.5}>x$)	<PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5844 70mL

Date and time of wt 11/26/96 2052 BAD	Gross wt	3.72~~0~~42 g
Date and time of wt 11/27/96 1322 BAD	Gross wt	3.7245 g
Date and time of wt	Gross wt	g
Date and time of wt	Gross wt	g
	Average Gross wt	3.7244 g
	Tare wt	3.7150 g
	Wt of acetone blank	g
	Weight of particulate in acetone	0.0094 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number 5854
Acetone rinse volume (V_aw) 25 mL mL
Acetone blank residue concentration (C) mL
$W_a = C_aV_aw =$ ( ) ( ) ( ) = g

Date and time of wt 11/26/96 2333 BAD	Gross wt	3.5846 g
Date and time of wt 11/27/96 1329 BAD	Gross wt	3.5850 g
Date and time of wt	Gross wt	g
Date and time of wt	Gross wt	g
	Average Gross wt	3.5848 g
	Tare wt of beaker	~~3.7150~~ BAD 3.5833 g
	Wt of acetone blank	g
	Weight of particulate in acetone rinse (m_a)	0.0015 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dew[illegible]
Signature of reviewer [illegible] Tarley

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SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number FC-1
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	< PM2.5 Filter	yes

Back-half Filter

Filter container number 015

Date and time of wt 11/23/96 2119 BAD Gross wt 0.0704 g
Date and time of wt 11/24/96 2259 BAD Gross wt 0.0705 g
Date and time of wt Gross wt g
Date and time of wt Gross wt g
Average Gross wt 0.0705 g

Tare wt of filter 0.0664 g
Weight of particulate on filter 0.0041 g

Total weight of particulate 0.0041 + 0.0183 + 0.0010 = 0.0234 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks

Signature of analyst Barbara Dewees
Signature of reviewer Barry Rayfield

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number FC-1
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10} > x > PM_{2.5}$)	<10PM 10 > PM2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5} > x$)	< PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5860 125 mL
Date and time of wt 11/26/96 2057 BAD — Gross wt 3.5512 g
Date and time of wt 11/26/96 1317 BAD — Gross wt 3.5507 g
Date and time of wt — Gross wt g
Date and time of wt — Gross wt g
Average Gross wt 3.5510 g
Tare wt 3.5327 g
Wt of acetone blank g
Weight of particulate in acetone 0.0183 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number 5858
Acetone rinse volume ($V_a w$) 25 mL mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w = (\quad) (\quad) (\quad) =$ g
Date and time of wt 11/26/96 2323 BAD — Gross wt 3.7193 g
Date and time of wt 11/27/96 1326 BAD — Gross wt 3.7193 g
Date and time of wt — Gross wt g
Date and time of wt — Gross wt g
Average Gross wt 3.7193 g
Tare wt of beaker ~~3.7813~~ g
3.7183 BAD
Wt of acetone blank g
Weight of particulate in acetone rinse (m_a) 0.0010 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewyer
Signature of reviewer Donna Tarley

SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number FC-2
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	<PM 2.5 Filter	yes

Back-half Filter

Filter container number 017

Date and time of wt 11/23/96 2120 BAD Gross wt 0.0733 g
Date and time of wt 11/24/96 2301 BAD Gross wt 0.0734 g
Date and time of wt ______ Gross wt ______ g
Date and time of wt ______ Gross wt ______ g
Average Gross wt 0.0734 g

Tare wt of filter 0.0654 g
Weight of particulate on filter 0.0080 g

Total weight of particulate 0.0080 + 0.0282 + 0.0015 = 0.0377 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks

Signature of analyst Barbara Dewese
Signature of reviewer Barry Rayfield

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number FC-2
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10} > x > PM_{2.5}$)	<10PM 10 >PM 2.5 Rinse	teflon tape
Acetone[redacted] ($PM_{2.5} > x$)	<PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5859 95 mL

Date and time of wt	11/26/96 2331 BAD	Gross wt	BAD 4.0092	g
Date and time of wt	11/27/96 1254 BAD	Gross wt	4.0093	g
Date and time of wt		Gross wt		g
Date and time of wt		Gross wt		g
		Average Gross wt	4.0093	g
		Tare wt	3.9811	g
		Wt of acetone blank		g
		Weight of particulate in acetone	0.0282	g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse a[redacted]container number 5856
Acetone rinse volume ($V_a w$) 25 mL mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w$ = ( ) ( ) ( ) = g

Date and time of wt	11/26/96 2320 BAD	Gross wt	3.3339	g
Date and time of wt	11/27/96 1313 BAD	Gross wt	3.3337	g
Date and time of wt		Gross wt		g
Date and time of wt		Gross wt		g
		Average Gross wt	3.3338	g
		Tare wt of beaker	3.3323	g
		Wt of acetone blank		g
		Weight of particulate in acetone rinse (m_a)	0.0015	g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara Dewar
Signature of reviewer Donna Tarlox

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SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number FC-3

Sample Location

Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter		

Back-half Filter

Filter container number 010

Date and time of wt	11/23/96 2122 BAD	Gross wt	0.0740 g
Date and time of wt	11/24/96 2302 BAD	Gross wt	0.0740 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	0.0740 g
		Tare wt of filter	0.0683 g
		Weight of particulate on filter	~~0.0057~~ g BAD

Total weight of particulate 0.0057 + 0.0186 + 0.0003 = ~~0.00~~ 0.0246 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks

Signature of analyst Barbara Dewese

Signature of reviewer Barry Rayfield

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number FC-3
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10}>x>PM_{2.5}$)	<10PM 10 > PM2.5 Rinse	teflon tape
Acetone [redacted] ($PM_{2.5}>x$)	<PM 2.5 Rinse	teflon tape

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5861 75 mL
Date and time of wt 11/26/96 2337 BAD Gross wt 3.8742 g
Date and time of wt 11/26/96 1250 BAD Gross wt 3.8744 g
Date and time of wt Gross wt g
Date and time of wt Gross wt g
Average Gross wt 3.8743 g
Tare wt 3.8557 g
Wt of acetone blank g
Weight of particulate in acetone 0.0186 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse [redacted] container number 5866
Acetone rinse volume ($V_a w$) 20 mL mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w = (\quad)(\quad)(\quad) =$ g
Date and time of wt 11/26/96 2327 BAD Gross wt 3.3310 g
Date and time of wt 11/27/96 1309 BAD Gross wt 3.3307 g
Date and time of wt Gross wt g
Date and time of wt Gross wt g
Average Gross wt g
Tare wt of beaker 3.3307 g

Wt of acetone blank g
Weight of particulate in acetone rinse (m_a) 0.0003 g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara DeWees
Signature of reviewer Donna Lasher

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SAMPLE ANALYTICAL DATA FORM

Plant *Air Control Tech/Vulcan Charlotte, NC* Run Number Blk

Sample Location

Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Back-half Filter	LPM 2.5 filter	yes

Back-half Filter

Filter container number 002

Date and time of wt 11/19/96 1454 BAD	Gross wt 0.0674	g
Date and time of wt 11/20/96 1515 BAD	Gross wt 0.0672	g
Date and time of wt	Gross wt	g
Date and time of wt	Gross wt	g
	Average Gross wt 0.0673	g
	Tare wt of filter 0.0681	g
	Weight of particulate on filter (−0.0008)	g

Total weight of particulate ______ g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks

Signature of analyst Barbara Dewees

Signature of reviewer Donna Tackey

SAMPLE ANALYTICAL DATA FORM

Plant Aircontrol Tech/Vulcan Charlotte, NC Run Number B/K
Sample Location
Relative Humidity

Sample Type	Sample label name	Liquid level marked and/or container sealed
Acetone Rinse ($PM_{10}>x>PM_{2.5}$) Acetone & Filter ($PM_{2.5}>x$)	BlK	

Front-half Acetone
(less than 10 micron and greater than 2.5 micron)

Front-half acetone container number 5846 100 mL

Date and time of wt	11/26/96 2324 BAD	Gross wt	3.5850 g
Date and time of wt	11/26/96 1319 BAD	Gross wt	3.5851 g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	3.5851 g
		Tare wt	3.5850 g
		Wt of acetone blank	· g
		Weight of particulate in acetone	0.0001 g

Acetone Rinse
(less than 2.5 micron)

Back-half acetone rinse and filter container number
Acetone rinse volume ($V_a w$) mL
Acetone blank residue concentration (C) mL
$W_a = C_a V_a w =$ ( ) ( ) ( ) = g

Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
Date and time of wt		Gross wt	g
		Average Gross wt	g
		Tare wt of beaker	g
		Wt of acetone blank	g
		Weight of particulate in acetone rinse (m_a)	g

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.
Remarks This set of samples also included a greater than 10 micron acetone rinse fraction. It has not been analyzed, but has been archived.

Signature of analyst Barbara DeWees
Signature of reviewer Donna Tarhix

APPENDIX G.

CHAIN OF SAMPLE CUSTODY SHEETS

DEECO, Inc
3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

Date:	11\ \96
Lab:	DEECO
Train:	M5/201A

Plant Name: VULCAN MATERIALS   **Plant Location:**   **Project Name:** 96-1402

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Todd M. [illegible]	11/11/96	Barbara Dewees	10:00 11/15/96	

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
TC-1	11/11	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
TC-1		Composite	PARTICULATE MATTER	M5/201A	<10PM10->PM2.5 RI <10PM10->PM2.5 RI		DEECO
TC-1		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 RINSE <PM2.5 RINSE		DEECO
TC-1		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER	Light gray Loading good	DEECO
TC-2	11/12	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
TC-2		Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI		DEECO
TC-2		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
TC-2		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER	ok	DEECO

00000001

DEECO, Inc
3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

Date:	11\ \96
Lab:	DEECO
Train:	M5/201A

Plant Name: VULCAN MATERIALS

Plant Location:

Project Name: 96-1402

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
[signature]		[signature]	10:20 11/15/96	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
TC-3	11/13	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
TC-3	↓	Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI		DEECO
TC-3	↓	Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
TC-3	↓	Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER	OK	DEECO
TP-1	11/11	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
TP-1	↓	Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI		DEECO
TP-1	↓	Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
TP-1	↓	Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER	Light speckled spotty catch (Frit)	DEECO

DEECO, Inc

3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

Date:	11\ \96
Lab:	DEECO
Train:	M5/201A

Plant Name: VULCAN MATERIALS **Plant Location:** **Project Name:** 96-1402

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
[illegible]		[illegible]	10:00 11/15/96	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
TP-2	11/12	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
TP-2		Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI		DEECO
TP-2		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
TP-2		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER	OK	DEECO
TP-3	11/13	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
TP-3		Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI		DEECO
TP-3		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
TP-3		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER	OK	DEECO

DEECO, Inc
3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

Date:	11\ \96
Lab:	DEECO
Train:	M5/201A

Plant Name: VULCAN MATERIALS   Plant Location: Project Name: 96-1402

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Todd T. Blozell	0950 11/19	[illegible]	10:00 11/21/96	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
VS-1	11/18	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
VS-1		Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI	light	DEECO
VS-1		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
VS-1		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER	light 2.5→10 Rinse	DEECO
VS-2	11/19	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
VS-2		Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI		DEECO
VS-2		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
VS-2		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER		DEECO

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DEECO, Inc

3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

Date:	11\ \96
Lab:	DEECO
Train:	M5/201A

Plant Name: VULCAN MATERIALS   Plant Location: Project Name: 96-1402

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Todd T. Buzzell	11/18 0915	Barbara DeWeese	10:00 11/21/96	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
VS-3	11/20	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
VS-3		Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI	light Rinse	DEECO
VS-3		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
VS-3		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER		DEECO
FC-1	11/18	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
FC-1		Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI	light Rinse	DEECO
FC-1		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
FC-1		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER		DEECO

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DEECO, Inc
3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

Date:	11\ \96
Lab:	DEECO
Train:	M5/201A

Plant Name: VULCAN MATERIALS   Plant Location: Project Name: 96-1402

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Todd T. Bizzell	11/19 1510	Barbara Dewees	10:20 11/21/96	

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
FC-2	11/19	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
FC-2	↓	Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI		DEECO
FC-2		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
FC-2	↓	Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER		DEECO
FC-3	11/20	Composite	PARTICULATE MATTER	M5/201A	ARCHIVE ARCHIVE		DEECO
FC-3	↓	Composite	PARTICULATE MATTER	M5/201A	<PM1010->PM2.5 RI <10PM10->PM2.5 RI	light Rinse	DEECO
FC		Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 RINSE		DEECO
FC	↓	Composite	PARTICULATE MATTER	M5/201A	<PM2.5 FILTER <PM2.5 FILTER		DEECO

APPENDIX H.

STONE THROUGHPUT, PARTICLE SIZE DISTRIBUTION AND MOISTURE DATA SHEETS & CALCULATIONS

Production, silt and moisture Log

Plant Name: **Vulcan Materials Corporation**. Client: **National Stone Association**

Job Number **322** City State: **Pineville, North Carolina** Test Location: Conveyor C-4

Date: 11/11/96 Run Number TP9TC-1 Sample Time 14:10.

Belt Length in feet 273 Seconds for 1 Revolution 35.92 Belt Speed feet/min 456

Pounds of stone/2foot sample 139.2 pounds Production Rate Tons/Hour 952.1

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375 inch 9.5 millimeters	537.9	2770.1	2232.2	65.6
2) 4 mesh 4.75 millimeters	499.8	929.8	430.0	12.6
3) 40 mesh 425 microns	387.9	~~505.8~~ 893.7	505.8	14.9
4) 100 mesh 150 microns	326.6	419.7	93.1	2.7
5) 200 mesh 75 microns	351.9	414.8	62.9	1.8
6) 400 mesh 38 microns	457.3	495.3	38	1.1
7)				1
Pan # 1	367.7	406.1	38.4	1.1
Pan #2				
Totals	N/A	N/A	3400.4	99.8

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight **Wet - Pan Weight** = 3429.6.

B.) Sample Weight **Dry - Pan Weight** = 3402.7.

C.) % Moisture = [(A - B) / (A)] * 100 = 0.78%.

00000001

Production, silt and moisture Log

Plant Name: Vulcan Materials Corporation. Client: National Stone Association

Job Number 322 City State: Pineville, North Carolina Test Location: Conveyor C-4

Date: 11/12/96 Run Number TP4TC-2 Sample Time 11:25.

Belt Length in feet 273 Seconds for 1 Revolution 35:92 Belt Speed feet/min 456

Pounds of stone/2foot sample 108.3 pounds Production Rate Tons/Hour 740.8/889 (20%↑)

lighten up on feed so belt would not need to be shoveled

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375" 9.5millimeters	525.8	1710.3	1184.5	~~40.03~~ 59.97
2) 4mesh	500.0	781.2	281.2	14.24
3) 40mesh	387.2	741.6	354.4	17.94
4) 100mesh	328.5	388.6	60.1	3.04
5) 200mesh	352.3	396.7	44.4	2.25
6) 400mesh	457.6	486.2	28.6	1.44
7)				
Pan # 1	367.7	389.7	22	1.11
Pan #2				
Totals	N/A	N/A	1975.2	99.99

20% UNDER Refer to beltscale 20% good beltscale 850-900

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight Wet - Pan Weight = 1992.8.

B.) Sample Weight Dry - Pan Weight = 1964.9.

C.) % Moisture = [(A - B) / (A)] * 100 = 1.4%.

Production, silt and moisture Log

Plant Name: **Vulcan Materials Corporation** . Client: **National Stone Association**

Job Number **322** City State: **Pineville, North Carolina** Test Location: Conveyor C4.

Date: 11/13/96 Run Number TPQTC-3 Sample Time 10:20 .

Belt Length in feet 273 Seconds for 1 Revolution 35:92 Belt Speed feet/min 456

Pounds of stone/2foot sample 151.3 pounds Production Rate Tons/Hour 1034.9

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375"	537.1	2719.9	2182.8	63.11
2) 4 mesh	516.2	1025.2	509.0	14.72
3) 40 mesh	387.9	866.5	478.6	13.84
4) 100 mesh	326.5	434.6	108.1	3.12
5) 200 mesh	352.0	442.2	90.2	2.61
6) 400 mesh	457.3	507.6	50.3	1.45
7)				
Pan # 1	367.7	407.3	39.6	1.14
Pan #2				
Totals	**N/A**	**N/A**	3458.6	99.99

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight **Wet - Pan Weight** = 3492.1.

B.) Sample Weight **Dry - Pan Weight** = 3460.7.

C.) % Moisture = [(A - B) / (A)] * 100 = 0.899 .

Production, silt and moisture Log

Plant Name: Vulcan Materials Corporation . Client: National Stone Association

Job Number 322 City State: Pineville, North Carolina Test Location: Conveyor 20

Date: 11/18/96 Run Number FC-1 Sample Time 0940.

Belt Length in feet 166 Seconds for 1 Revolution 41:98 Belt Speed feet/min 238

Pounds of stone/2foot sample 69.9 pounds Production Rate Tons/Hour 249.5

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375	537.1	1942.5	1405.4	48.83
2) No. 4	516.3	1179.0	662.7	23.02
3) No. 40	388.1	990.5	602.4	~~15.53~~ 20.93
4) No. 100	326.5	399.4	72.9	2.53
5) No. 200	351.9	408.8	56.9	1.98
6) No. 400	457.3	498.1	40.8	1.42
7)				
Pan # 1	367.7	404.8	37.1	1.29
Pan #2				
Totals	N/A	N/A	2878.2	100.0

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight **Wet - Pan Weight** = 2897.1.

B.) Sample Weight **Dry - Pan Weight** = 2879.1.

C.) % Moisture = [(A - B) / (A)] * 100 = 0.62.

Production, silt and moisture Log

Plant Name: Vulcan Materials Corporation. Client: National Stone Association

Job Number 322 City State: Pineville, North Carolina Test Location: Conveyor 3

Date: 11/18/96 Run Number VS-1 Sample Time 15:40.

Belt Length in feet ______ Seconds for 1 Revolution ______ Belt Speed feet/min 553

Pounds of stone/2foot sample 182.3 pounds Production Rate Tons/Hour 1512.2 (60% TO SCREEN)

large material from SECONDARY

907.3

#3

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375	537.1	4159.1	3622.00	81.19
2) #4	516.3	873.1	356.8	7.99
3) #40	388.1	687.4	299.3	6.71
4) #100	326.5	382.1	55.6	1.25
5) #200	351.9	405.2	53.3	1.19
6) #400	457.3	505.8	48.5	1.09
7)				
Pan # 1	367.7	393.5	~~393.5~~ 25.8	0.58
Pan #2				
Totals	N/A	N/A	4461.3	100.00

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight Wet - Pan Weight = 4487.9.

B.) Sample Weight Dry - Pan Weight = 4461.3.

C.) % Moisture = [(A - B) / (A)] * 100 = 0.59%.

Production, silt and moisture Log

Plant Name: Vulcan Materials Corporation. Client: National Stone Association

Job Number 322 City State: Pineville, North Carolina Test Location: Conveyor 20.

Date: 11/19/96 Run Number FC-2 Sample Time 910.

Belt Length in feet 166 Seconds for 1 Revolution 41.98 Belt Speed feet/min 238

Pounds of stone/2foot sample 71.3 pounds Production Rate Tons/Hour 254.5

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375	537.1	2224.7	1687.6	46.64
2) #4	516.3	1351.9	835.6	23.09
3) #40	388.1	1208.1	820.0	22.66
4) #100	326.5	424.1	97.6	2.70
5) #200	351.9	433.9	82.0	2.27
6) #400	457.3	510.4	53.1	1.47
7)				
Pan # 1	367.7	409.9	42.2	1.16
Pan #2				
Totals	N/A	N/A	3618.10	99.99

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight Wet - Pan Weight = 3648.8.

B.) Sample Weight Dry - Pan Weight = 3619.7.

C.) % Moisture = [(A - B) / (A)] * 100 = 0.80.

Production, silt and moisture Log

Plant Name: Vulcan Materials Corporation. Client: National Stone Association

Job Number 322 City State: Pineville, North Carolina Test Location: Conveyor 3.

Date: 11/19/96 Run Number VS-2 Sample Time 14:15.

Belt Length in feet ______ Seconds for 1 Revolution ______ Belt Speed feet/min 553

Pounds of stone/2foot sample 182.1 pounds Production Rate Tons/Hour 1510.5 (60%) to SCREE 906.3 #3

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375	537.1	5851.6	5314.5	89.88
2) #4	516.3	791.3	275	4.65
3) #40	388.1	561.9	173.8	2.93
4) # 100	326.5	373.5	47	0.79
5) #200	351.9	396.1	44.2	0.75
6) #400	457.3	488.5	31.2	0.53
7)				
Pan # 1	367.7	395.2	27.5	0.47
Pan #2				
Totals	N/A	N/A	5913.2	100.0

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight **Wet - Pan Weight** = 5938.8.

B.) Sample Weight **Dry - Pan Weight** = 5914.9.

C.) % Moisture = [(A - B) / (A)] * 100 = 0.4%.

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Production, silt and moisture Log

Plant Name: Vulcan Materials Corporation . Client: National Stone Association

Job Number 322 City State: Pineville, North Carolina Test Location: C-20 .

Date: 11/20/96 Run Number FC-3 Sample Time 0845 .

Belt Length in feet 166 Seconds for 1 Revolution 41.98 Belt Speed feet/min 238

Pounds of stone/2foot sample 70.7 pounds Production Rate Tons/Hour 252.4

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375	537.1	1914.3	1377.2	39.50
2) #4	516.3	1489.5	973.2	27.91
3) #40	388.1	1249.5	861.4	24.71
4) #100	326.5	424.5	98.0	2.81
5) #200	351.9	428.4	76.5	2.19
6) #400	457.3	514.3	57.0	1.63
7)				
Pan # 1	367.7	410.7	43	1.23
Pan #2				
Totals	N/A	N/A	3486.3	99.98

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight Wet - Pan Weight = 3512.9 .

B.) Sample Weight Dry - Pan Weight = 3486.2 .

C.) % Moisture = [(A - B) / (A)] * 100 = 0.76% .

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Production, silt and moisture Log

Plant Name: Vulcan Materials Corporation . Client: National Stone Association

Job Number 322 City State: Pineville, North Carolina Test Location: C-3.

Date: 11/20/96 Run Number VS-3 Sample Time 10:40.

Belt Length in feet ______ Seconds for 1 Revolution ______ Belt Speed feet/min 553

Pounds of stone/2foot sample 225.7 pounds Production Rate Tons/Hour 1872.2 (60%) to screen #3 1123.3TPH

Pan Size	Tare Weight	Sample + Tare	Sample Alone	% of Total
1) 0.375	537.1	5169.7	4632.6	82.67
2) #4	516.3	926.3	410.0	7.32
3) #40	388.1	711.8	323.7	5.78
4) #100	326.5	410.3	83.8	1.49
5) #200	351.9	425.1	73.2	1.31
6) #400	457.3	505.2	47.9	0.85
7)				
Pan # 1	367.7	400.2	32.5	0.58
Pan #2				
Totals	N/A	N/A	5603.7	100.00

Circle Pan Used for Moisture Determination 1 2

A.) Sample Weight **Wet - Pan Weight** = 5632.5

B.) Sample Weight **Dry - Pan Weight** = 5605.8

C.) % Moisture = [(A - B) / (A)] * 100 = 0.47%

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APPENDIX I.

AMBIENT PM_{10} AND $PM_{2.5}$ DATA SHEETS

Ambient Conditions

Plant Name: **Vulcan Materials Corporation** Client: **National Stone Association** Job Number **322** City State: **Pineville, North Carolina**

45 50 30.0 1045

Wet Bulb 32 °F Dry Bulb 34 °F P_{BAR} 30.0 0700

68 0.9

Relative Humidity 81 % Moisture 0.6.

Date: 11/11/96 Run Number TP+TC-1 Observer TB.

Clock Time	Date	Location	PM10 TWA µg/m³	PM2.5 TWA µg/m³	Ambient √	Stack √
10:38/11:38	11/11/96	150' upwind of primary	54.5		✓	
11:39/1245	11/11/96	"		22.2	✓	
125 4/1257	11/11/96	TP STACK		1.47 mg/m³		✓
1318/1321	11/11/96	TP STACK	3.38 mg/m³	~~3.~~		✓
1303/1306	11/11/96	TC Stack		3.67 mg/m³		✓
1312/1315	11/11/96	TC STACK	8.21 mg/m³	~~8.21 mg/m³~~		✓

Ambient Conditions

Plant Name: **Vulcan Materials Corporation** Client: **National Stone Association** Job Number **322** City State: **Pineville, North Carolina**

Wet Bulb 30 (36) ^{0}F Dry Bulb 32 (43) ^{0}F P_{BAR} 29.85 07:10 (10:36)

Relative Humidity 81 (50) % Moisture 0.5 (0.5).

Date: 11/12/96 Run Number TP9TC-2 Observer TJB.

Clock Time	Date	Location	PM10 TWA µg/m³	PM2.5 TWA µg/m³	Ambient √	Stack √
		200 feet from				
0856/10:15	11/12/96	SECONDARY C.	21.9		✓	
10:15/1121	11/12/96	"	21.1		✓	
1127/1310	11/12/96	"		13.6	✓	
1345/1347	11/12/96	TP		1.66 mg/m³		✓
1402/1405	11/12/96	TC	~~3.13~~	3.13 mg/m³		✓
1410/1413	11/12/96	TC	5.40 mg/m³			✓
1415/1418	11/12/96	TP	3.15 mg/m³			✓

Plant Down

Ambient Conditions

Plant Name: **Vulcan Materials Corporation** Client: **National Stone Association** Job Number **322** City State: **Pineville, North Carolina**

Wet Bulb 30 °F Dry Bulb 32 °F PBAR 29.6

Relative Humidity 80 % Moisture 0.5.

Date: 11/13/96 Run Number TP4TC-3 Observer TTB.

Clock Time	Date	Location	PM10 TWA µg/m3	PM2.5 TWA µg/m3	Ambient √	Stack √
0807 - 1010	11/13/96	200' from SECONDARY CRUSHER	34.2		✓	
1013 - 1235	11/13/96	"		28.5	✓	
	11/13/96	TP		1.08 mg/m3		✓
	11/13/96	TC		2.55 mg/m3		✓
	11/13/96	~~TC~~ TC	8.24 mg/m3			✓
	11/13/96	TP	5.40 mg/m3			✓

Ambient Conditions

Plant Name: **Vulcan Materials Corporation** Client: **National Stone Association** Job Number **322** City State: **Pineville, North Carolina**

Wet Bulb 49 °F Dry Bulb 54 °F PBAR 29.5

Relative Humidity 70 % Moisture 1%.

Hazy, Rain Possible

Date: 11/18/96 Run Number VS+FC-1 Observer TTB.

952 Rain Drizzle lite
10:33 Shut Down wait for rain drizzle clear out

Clock Time	Date	Location	PM10 TWA µg/m³	PM2.5 TWA µg/m³	Ambient √	Stack √
0755/920	11/18/96	200' from SECONDARY		92.9	✓	
0923/1014	11/18/96	"	197.3		✓	
12:30-1232	11/18/96	Fines Crusher	1.83mg/m³			✓
1235-1237	11/18/96	Vibrating SCREEN	383			✓
1246-1248	11/18/96	FC		1.14mg/m³		✓
12/43/1245	11/18/96	VS		232		✓

Ambient Conditions

Plant Name: **Vulcan Materials Corporation** Client: **National Stone Association** Job Number **322** City State: **Pineville, North Carolina**

Wet Bulb 54 ^{0}F Dry Bulb 57 ^{0}F P_{BAR} 29.2

Relative Humidity 81 % Moisture 1.4.

Date: 11/19/96 Run Number VS-FC-2 Observer TTB.

Clock Time	Date	Location	PM10 TWA µg/m^3	PM2.5 TWA µg/m^3	Ambient √	Stack √
0836/0838	11/19/96	FC		789		✓
840/0842	11/19/96	VS	~~3~~	323		✓
0847/0849	11/19/96	VS	848			✓
0850/0852	11/19/96	FC	1.75mg/m^3			✓
0900/1020	11/19/96	200' from	35.2		✓	
1023/1141	11/19/96	secondary		22.9	✓	

Ambient Conditions

Page 1 of 1.

Plant Name: **Vulcan Materials Corporation** Client: **National Stone Association** Job Number **322** City State: **Pineville, North Carolina**

Wet Bulb 51 ^0F Dry Bulb 53 ^0F P_{BAR} 29.15

Relative Humidity 86 % Moisture 1.1.

Date: 11/20/96 Run Number VC-FS-3 Observer TTB.

Partly Cloudy

Clock Time	Date	Location	PM10 TWA μg/m³	PM2.5 TWA μg/m³	Ambient √	Stack √
0811/0813	11/20/96	FC		755.7		✓
0815/0817	11/20/96	VS		837.2		✓
0820/0822	11/20/96	VS	1.20 mg/m³			✓
0823/0825	11/20/96	FC	1.32 mg/m³			✓
0830/0936	11/20/96	200' from	58.3		✓	
0938/1127	11/20/96	SECONDARY		42.7	✓	

APPENDIX J.

VIBRATING SCREEN WIND SPEED AND DIRECTION DATA SHEETS

Vibrating Screen Wind Speed and Direction Data

Plant Name: **Vulcan Materials Corporation** Client: **National Stone Association** Job Number **322**

City State: **Pineville, North Carolina**

Date: 11/18/96 Run Number VS-1 Observer JB/BP.

Stop Due to Rain

Time	Wind Speed mph	Wind Direction
0800	1	SW
0815	1	SW
0830	1	SW
0845	1	SW
0900	0	SW
0915	0	SW
0930	7	SW
0945	1	SW
1000	1	SW
1015	1	SW
* 1230	2	SW
1245	1	SW
1300	[illegible]	SW
1315	6	SW
1330	4	SW
1345	6	SW
1400	6	SW
1415	3	W
1430	3	SW
1445	4	SW
1500	8	SW

Vibrating Screen Wind Speed and Direction Data

Plant Name: Vulcan Materials Corporation Client: National Stone Association Job Number 322

City State: Pineville, North Carolina

Date: 11-19-96 Run Number VS-2 Observer BPdm.

Time	Wind Speed	Wind Direction
0745	1	NE
0800	1	NE
0815	1	N
0830	1	N
0845	1	WNW
0900	1	NW
0915	1	NW
0930	0	W
0945	0	W
~~0~~1000	1	N
~~0~~ 1015	1	N
1030	2	N
1045	2	N
1100	2	SW
1115	5	SW
1130	0	N
1145	1	N
1200	3	N
1215	2	N
1230	3	NW
1245	5	NW
1300	2	NE
1315	3	NE
1330	0	E
1345	4	NW

Vibrating Screen Wind Speed and Direction Data

Plant Name: Vulcan Materials Corporation Client: National Stone Association Job Number 322

City State: Pineville, North Carolina

Date: 11/20/96 Run Number VS-3 Observer TTB/BLP.

Time	Wind Speed	Wind Direction
0745	0	E
0800	0	E
0815	0	N
0830	0	N
0845	3	NE
0900	3	NE
0915	5	NE
0930	1	E
0945	4	E
1000	2	NE
1015	1	NE
1030	2	NE
1045	2	NE
1100	3	NE
1115	2	N
1130	0	N
1145	2	N
1200	3	N
1215	5	NE
1230	3	NE
1245	4	N
1300	2	NW
1315	0	N

APPENDIX K.

US EPA OAQPS/NCDEHNR CORRESPONDENCE

nsa **National Stone Association**

1415 Elliot Place, N.W., Washington, D.C. 20007-2599 202/342-1100

TO : Ron Myers	
FAX # : 919/541-0684	
COMPANY : US EPA OAQPS Emission Factors Development MD-14	
FROM : Bill Ford	
DATE : November 7, 1996	
TOTAL PAGES :	(including cover sheet)
We transmit from 202-342-0702. If you do not receive the pages clearly, call me at 800-342-1415 or locally at 202-342-1100.	

Just a reminder that $PM_{2.5}$ particulate emissions testing is scheduled to get underway Monday, November 11, 1996 at Vulcan Material Co.'s Pineville Quarry. The quarry is located south of Charlotte, North Carolina off I-77 at Nations Ford Road. The contact person for Vulcan Materials Co. is Mike Poplin in Winston-Salem. He can be reached at 910/767-4600.

The schedule is as follows:

November 8 - 10	Tertiary crusher / transfer point set up
November 11 - 13	Tertiary crusher / transfer point testing
November 15 - 17	Vibrating screen set up
November 18 - 20	Vibrating screen testing

We also plan to gather preliminary test data on a fines crusher November 18 - 20 that will be used for planning future fines testing.

Test protocols using a cascade cyclone method will be the same as those approved for the earlier crusher, screen and transfer point tests, except that a nephelometer will be used to measure ambient PM_{10} and $PM_{2.5}$, eliminating the need for Hi-vols for the screen tests and HEPA filters for the crusher and transfer point make-up air. Three six-hour tests will be done on each source. These will be done under controlled conditions (wet suppression in use). We will not test under uncontrolled (dry) conditions. One filter from each source will be analyzed by Polarized Light Microscopy (PLM) to confirm that only particles less than 2.5 micrometers are present and to determine the organic and inorganic components of the $PM_{2.5}$.

A copy of a memo from Fred Allen, North Carolina Aggregates Association, to Laura Butler inviting the North Carolina Air Program Staff to observe is attached for your information.

Please call either me, John Hayden, Dr. John Richards or Todd Brozell, Horace Willson, Steve Whitt or Mike Poplin should you have questions or need more information. Hope you can visit the site.

NORTH CAROLINA
AGGREGATES ASSOCIATION

November 5, 1996

TO: Laura Butler

FROM: Fred Allen *Fred*

SUBJECT: Field Testing of Quarry Emissions

This will confirm our invitation for you, your staff or others from the Department or local programs to visit the site of sampling and testing for quarry dust emissions.

Beginning November 11, Dr. John Richards and Todd Brozell of Air Control Techniques, PC, will be sampling and testing tertiary crusher, screen and transfer point emissions at Vulcan Materials Co. Pineville (NC) Quarry, South of Charlotte off I-77 at Nations Ford Road.

This field testing is being sponsored by the National Stone Association in cooperation with EPA to help determine both PM_{10} and $PM_{2.5}$ emissions.

On behalf of Vulcan Materials Co. and the referenced associations, we welcome you to view the field testing.

For convenience of the operator, we ask that you visit on either Tuesday afternoon, November 12 or Tuesday anytime, November 19. Please call Mr. Mike Poplin of Vulcan Materials Co. to coordinate your visit. He may be reached in Winston-Salem at 910/767-4600. Of course, the testing schedule may vary due to weather, equipment, or other uncertainties, so please check with Mike before visiting.

The aggregate industry is serious about our efforts to know as much as possible about our emissions and to be able to effectively control particulate emissions. We welcome your participation and comments about this project.

cc: Mike Poplin
Horace Willson
Bill Ford
Dr. John Richards /

Butler/emissions field test

SUITE 210 — CASWELL BUILDING — THE KOGER CENTER
P.O. BOX 30603 RALEIGH, NORTH CAROLINA 27622 PHONE (919) 782-7055