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PM10 EMISSION FACTORS FOR A STONE CRUSHING PLANT DEISTER VIBRATING SCREEN AND CRUSHER

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1.0 SUMMARY

1.1 TEST PROCEDURES AND RESULTS

The National Stone Association (NSA) sponsored this PM10 emission test program in order to determine PM10 emission factors applicable to various process units at stone crushing plants. The test site was the Vulcan Materials, Inc. facility in Skippers, Virginia. The specific sources tested were a 7 foot heavy duty shorthead Simmons cone crusher (7′ crusher) and an 8 by 20 foot Deister vibrating screen. Entropy Environmentalists, Inc. (Entropy) developed the emission testing program and conducted the PM10 emission tests.

A Quasi-stack system was used to conduct emission tests on the inlet and outlet of the 7′ crusher. Small enclosures were installed at both locations. Clean make-up air from HEPA filters was blown into each enclosure at a rate approximately equal to the exhaust gas stream flow rate being drawn to the emission sampling location. Using this testing approach, all of the PM10 emissions from the crusher inlet and outlet were efficiently captured and adjacent sources of PM10 emissions did not affect the results.

The Deister vibrating screen emission tests were conducted using a track-mounted hood system. The hood has dimensions of 2 feet by 2 feet and was mounted 12 inches above the upper screen deck of the Deister Screen. The small scale and the mounting position of the hood ensured that the normal PM10 emissions were not significantly influenced by the presence of the hood. The capture velocity in the hood was set by adjusting the variable speed DC motor of the tubeaxial fan installed on the hood outlet duct. The hood capture velocity was selected based on observations of the fugitive dust capture characteristics of the hood. This testing approach is an adaptation of the conventional "roof monitoring" technique for fugitive emission testing.

The PM10 emissions were tested using EPA Method 201A. The tests were divided into two sets: stone moisture levels greater than 1.5%, and stone moisture levels less than 1.5%. The results of the PM10 emission tests are presented in Table 1. The emission rates determined during both series of tests on the 7′ crusher and the Deister screen were low. These wet stone emission factor results are entirely consistent with the zero visible emissions operating conditions observed during all of these tests. Stone samples obtained during each of the tests were also analyzed and found to have very low levels of material below approximately less than 10 microns.

TABLE 1. CRUSHER PM10 EMISSIONS

PM10 Source	Stone Moisture (% Weight)	PM10 Emissions (Pounds/Ton)
Crusher	(< 1.5%)	0.00397
	(> 1.5%)	0.00026
Deister Screen	(< 1.5%)	0.02701
	(> 1.5%)	0.00103

1.2 KEY PERSONNEL

The National Stone Association Project Manager was Mr. Bill Ford. He was assisted by Mr. Ronnie Walker of Vulcan Materials, Inc. The Entropy project manager was Mr. Todd Brozell. Technical assistance was provided by Mr. Bill Kirk and Dr. John Richards of Entropy. The tests were observed by Mr. Solomon Ricks of the U.S. EPA, OAQPS Emission Measurement Branch, Mr. Dennis Shipman of the U.S. EPA, OAQPS Emission Inventory Branch, Mr. Horace Wilson of Martin Marietta, and Mr. Steve Witt of Martin Marietta. A summary of the key personnel and their phone number are provided in Table 2.

TABLE 2. KEY PERSONNEL

	Telephone Numbers
National Stone Association	
Mr. Bill Ford	(202) 342-1100
Vulcan Materials, Inc.	
Mr. Ronnie Walker	(804) 634-4158
Martin Marietta	
Mr. Horace Wilson	(919) 781-4550
Mr. Steve Witt	(919) 781-4550
U.S. EPA, Emission Inventory Branch	
Mr. Dennis Shipman	(919) 541-5477
U.S. EPA, Emission Measurement Branch	
Mr. Soloman Ricks	(919) 541-5242
Entropy Environmentalists, Inc.	
Mr. Todd Brozell	(919) 781-3550
Mr. Bill Kirk	(919) 781-3550
Dr. John Richards	(919) 781-3550

2.0 PLANT AND SAMPLING LOCATION DESCRIPTION

2.1 PROCESS DESCRIPTION AND OPERATION

The Skippers, Virginia plant produces crushed granite used for road paving and construction. Figure 1 provides a simplified flowchart of the portion of the plant relevant to this emission testing program. The primary surge pile shown in the upper right of Figure 1 is rock which has been conveyed from the large surge pile of rock in the quarry. The stone is then conveyed via Stream 1 to the 7′ X 20′ vibrating screens and the coarse product is conveyed via Stream 2 to the coarse surge pile. The coarse product is transported via Streams 3 and 4 to the 7′ heavy duty shorthead Simmons Cone Crusher (hereafter referred to as the 7′ crusher). Entropy monitored the stone feed rate leaving the 7′ crusher by weighing a two foot section of Stream 5 and multiplying this weight by the speed of the belt.

The 7′ crusher reduces the size distribution of the material received from the coarse surge pile. Stone leaving the 7′ crusher ranges in size from 3 inches to relatively small particles. The material from the 7′ crusher discharges onto a conveyor (Stream 5) leading to the outlets of two Model 1560 omni cone crushers. Following the omni cone crushers discharge, the main feed conveyor (Stream 6) contains all of the plant production with the exception of oversized product. The main feed conveyor (Stream 6) delivers the stone to the top of the structure housing the Deister vibrating screens. The plant operates a scale on this conveyor to calculate total daily tonnage from all three crushers to the 8′ X 20′ screens. Entropy also used this scale as a basis for calculations of the Deister screen.

The stone flow to the Deister screens and the omni cone crushers is termed "closed circuit" since oversized material containing some fines adhering to the surface can recirculate through the Deister and omni cone crushers until the stone is crushed small enough to fall through the Deister screen. The 7′ crusher that Entropy tested however had no recirculated stone flowing through it.

The Deister decks are 8 feet wide by 20 feet long and are inclined on a 20 degree slope. There are three vertically stacked decks. The upper deck has a mesh opening of 1.125 square inches, for the first 12 feet of travel and an opening of 1 square inch for the last 8 feet of travel. The middle deck has mesh opening of 0.58 square inches and the lower deck has slot openings of 0.118 inches by 1 inch. Stone collecting on the middle and lower decks are combined as one product stream. Fine particles passing through all three decks collect as a separate process stream. The oversized material remaining on the top screen goes to the inlet of the Omni Cone crushers. The total quantity of oversized material entering the Omni Cone crushers is estimated to be 500 to 600 tons per hour. The stone feed rates to the two Deister screens were approximately equal during the tests.

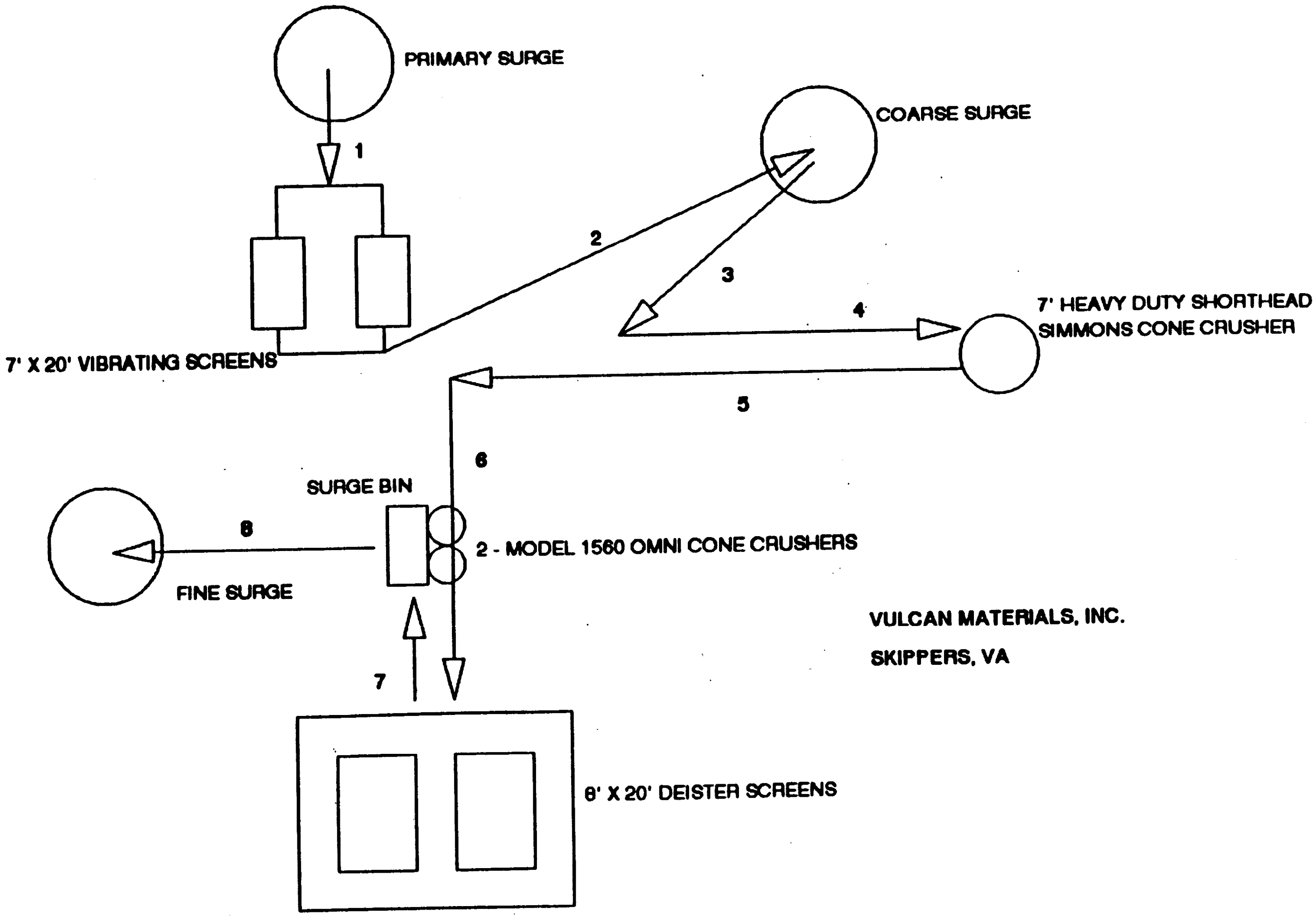

Figure 1. Simplified Process Flowchart

2.2 FUGITIVE DUST CONTROL

Wet suppression is used for fugitive dust control of the 7′ Simmons crusher, two Model 1560 omni cone crushers, and the Deister vibrating screens. There are water spray nozzles located on the vibrating feeder to the 7′ crusher, on the conveyor underneath the crusher, and on the discharge chute near the top of the Deister screens. Not all of these spray nozzles are necessary to maintain wet conditions. The nozzles on the inlet chute to the Deister screen were off during the tests. Over-wetting of the rock can cause blinding of the lower screen or blockage of the fines discharge chute underneath the Deister. During these emission tests, the plant experienced no significant screen blinding conditions.

2.3 SAMPLING AND EMISSION TESTING PROCEDURES

2.3.1 Fugitive Emission Test Approach

Since there are no air pollution control devices on the Deister screens or the 7′ crusher, fugitive emission testing procedures were needed to capture and measure the PM10 emissions. Entropy considered the criteria listed in Table 3 in designing the test program. Entropy evaluated alternative testing procedures during several site visits by Entropy personnel. The emission testing techniques which are generally applied to fugitive dust emission sources include,

- Upwind-downwind profiling,
- Roof monitor sampling, and
- Enclosures and Quasi-stack sampling.

Deister Screen Testing Alternatives

The roof monitoring approach of fugitive emission testing appeared to be the most applicable technique for the Deister screen at the Skippers plant. This involved the sampling at a horizontal array of sampling points above the surface of the emission source. However, an adaption of the general procedure was necessary due to the lack of a partial enclosure to serve as the roof monitor and due to the swirling gas flows created by wind leakage around the screen enclosure. Accordingly, Entropy designed and installed a track-mounted hood system for fugitive emission capture. By using this track-mounted hood version of roof monitor sampling, it was possible to accurately capture and measure the PM10 emissions without influencing the PM10 emission rates from the screen surface.

Upwind-downwind profiling techniques involve measurement of the increase in PM10 concentrations as a gas stream passes over or around the source being evaluated. This is usually performed using ambient PM10 monitors in upwind and downwind locations. Entropy concluded that this approach was not applicable to the Deister screen at the Skippers, Virginia plant because of the building constructed around the Deister screen. Also, there were a number of possible sources immediately upwind and downwind of the 7′ crusher. These sources included crushers, conveyors and conveyor transfer points, and Interstate 95 traffic. It would be impossible to isolate the 7′ crusher from these nearby sources using an upwind-downwind testing procedure.

Table 2. FUGITIVE EMISSION CAPTURE SYSTEM DESIGN CRITERIA
• The capture system should not create higher-than-actual PM10 emission rates due to high gas velocity conditions near the point of PM10 particle entrainment. • The capture system should not create a sink for PM10 emissions. • The capture system should isolate the process unit being tested from other adjacent sources of PM10 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 systems should not obstruct routine access to the process equipment by plant personnel. • The capture system and overall test procedures must 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 quasi-stack method involves the construction of a temporary enclosure around the Deister screen and the installation of a duct and fan system for gas handling. Entropy rejected this approach primarily because of the extremely high gas flow rates necessary. To simulate the identical emission conditions for typical wind speeds at the plant would require gas flow rates between 13,200 and 52,800 actual cubic feet per minute (ACFM). Ductwork with a diameter between 4 and 6 feet would be necessary to carry this large gas flow at velocities where PM10 losses would be minimized. Since the Deister vibrating screen is on a relatively small platform 80 feet above the ground, this ductwork would have to be quite long and carefully supported. This approach would be prohibitively expensive. Other disadvantages include:

- It would be extremely difficult to simulate actual wind speeds and wind approach angles using make-up air.
- An enclosure restricts plant operations personnel's access to the vibrating screen
- Construction safety risks are possible due to the lack of access and due to the rotating equipment in restricted areas.

7′ Crusher Inlet and Outlet Testing Alternatives

The quasi-stack method appeared to be the most accurate and practical approach for capturing the fugitive emissions from the inlet and outlet areas of the 7′ crusher. This approach allowed isolation of the 7′ crusher from the other fugitive dust sources in the immediate vicinity.

The quasi-stack method required the construction of temporary enclosures around the inlet and outlet of the 7′ crusher and the installation of a duct and fan system for gas handling. Since the PM10 emissions are generated primarily by stone-to-stone attrition in the crusher and during falling, the use of an enclosure does not influence the rate of PM10 emissions.

The roof monitoring approach of fugitive emission capture involves the sampling at a horizontal array of sampling points above the surface of the emission source. This approach was rejected because there was no logical means to sample in the area immediately above the crusher inlet or outlet. The emission profiling technique was also rejected for the crusher emission points since there were a number of other possible PM10 sources in the immediate vicinity of the crusher.

2.3.2 PM10 Emission Testing Procedure

Deister Screen Testing Equipment

The track-mounted hood system used for sampling the Deister Screen consisted of a 2 foot by 2 foot aluminum hood suspended 12 inches above the upper deck of the Deister vibrating screen. The position of the hood above the stone is shown in Figures 2 and 3. This hood position was close enough to the upper screen deck to ensure good emission capture but not so close that the entering air stream caused greater-than-actual PM10 emissions. A variable speed DC-driven tubeaxial fan controlled the capture velocity of the air entering the hood. This velocity was set at 150 feet per minute based on the hood capture characteristics observed using smoke and lightweight strips of fabric. This velocity is higher than the 50 feet per minute minimum capture velocity specified in reference 9 for vibrating screens.

The top area of the Deister screen was divided into a 3 by 9 array of sampling locations, each of which was 2 feet by 2 feet in size. The only area not sampled was the 4-foot strip across the upper inlet side of the Deister screen where the stone feed dumps onto the top of the screen. Positioning the hood in this location would have artificially increased PM10 emissions and caused rapid abrasion of the hood. PM10 from the inlet chute area of the screen are captured as the hood traverses the uppermost portions of the screen.

Entropy sized the ductwork from the hood to the sampling location for an average gas flow velocity less than 1000 feet per minute. This transport velocity is well below the 3500 to 4500 feet per minute velocity used to size commercial ductwork in stone crushing plants and other facilities handling large diameter dusts[2,8]. The purpose of the high velocities in commercial ducts is to ensure that large diameter dust particles do not settle and accumulate in the ductwork over long time periods. PM10 sized dust particles have negligible gravity settling rates in the gas stream residence times in the ducts.

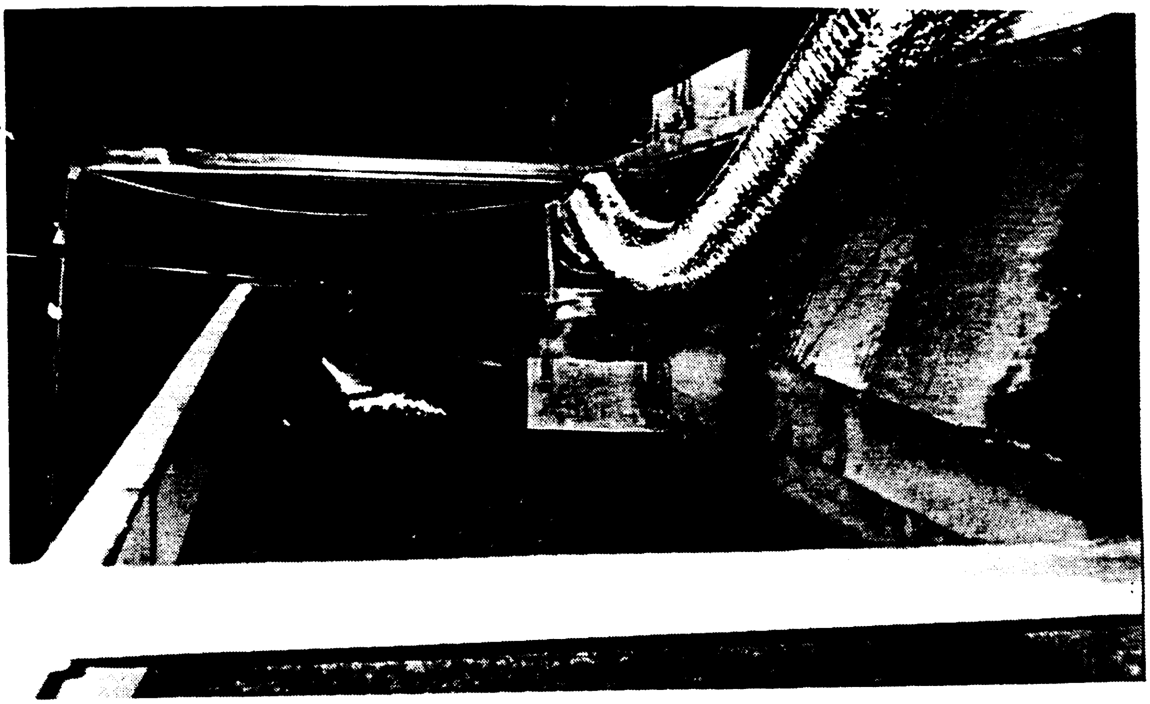

Figure 2. Side View of Traversing Hood in Deister Screen

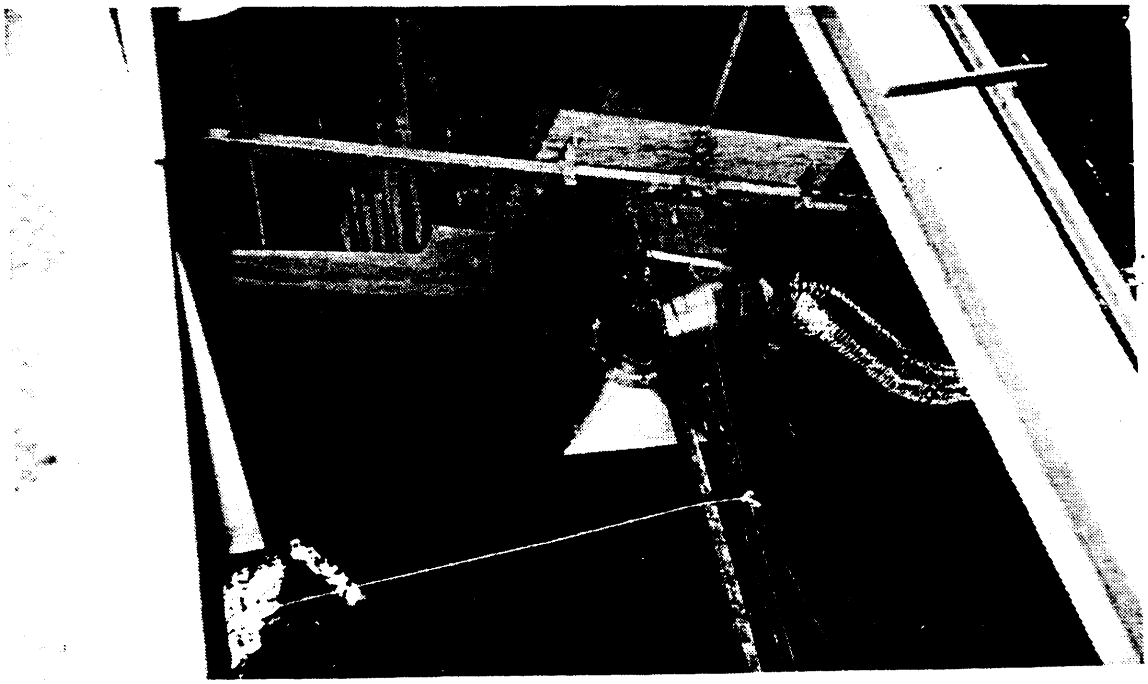

Figure 3. Top View of Traversing Hood in Deister Screen

Dust accumulation in the ductwork was not a problem during this study since the hood operating times were relatively short and the flexible duct was cleaned regularly. The 1000 feet per minute duct velocity limit is advantageous since this limits the impaction of particles less than 10 microns on the side walls of the hood elbow and the side walls of the flexible duct. Also, the low gas transport velocity limits any formation of PM10 emissions due to the movement of the gas stream over the surfaces of large diameter particles entrained in the gas stream or settling on the bottom of the duct.

7' Crusher Testing Equipment

The inlet to the 7' crusher was defined as the discharge of the vibrating feeder into the crusher vessel. This area, having a height of approximately 5 feet, was enclosed with neoprene to allow capture of the PM10 emissions caused by the stone-to-stone attrition during movement of the stone. The discharge point of the 7' crusher is a conveyor leading to the outlets of the secondary crushers to the Diester screens (Streams 5,6). The discharge point was enclosed approximately 3 feet upstream and downstream of the 7' crusher discharge point. There are several water spray nozzles on the downstream side of this conveyor. Figure 4 shows a side view of the 7' crusher.

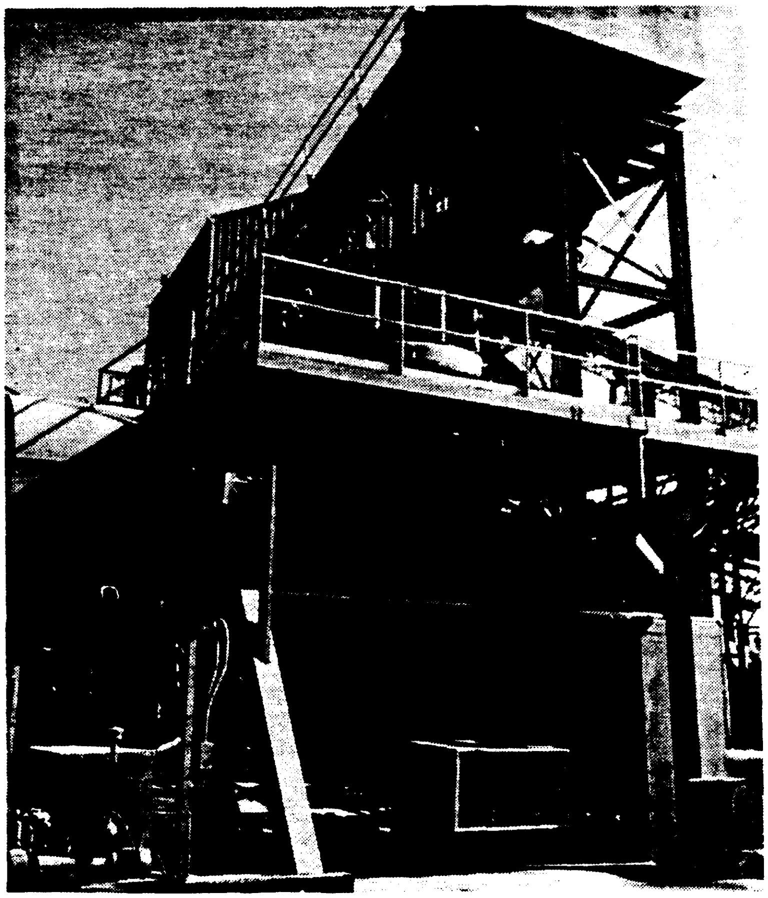

Figure 4. Side View of 7' Crusher

Enclosures were built around the inlet and outlet of the crusher. The inlet enclosure measured approximately 40" high with a 78" diameter, the outlet measured 6'H X 12'D X 5'W. The enclosure outlet ducts were combined into a single 1 foot diameter outlet duct. The single one foot diameter duct was used as a combined sample point for both the inlet and outlet of the crusher. The one foot diameter duct was then increased to a two foot diameter duct, to allow use of a two foot diameter SCR driven tubeaxial fan. Filtered air was supplied to each of the enclosures by means of HEPA (high efficiency particulate absolute) filters and centrifugal fans. Use of HEPA make-up air ensured that PM10 emissions measured in the outlet duct were generated by the unit being tested rather than from adjacent sources. The air flows from each enclosure were set by adjusting the variable speed DC motor of the tubeaxial fan installed on the combined outlet duct. The mounting positions of the inlet and outlet ducts on the enclosures ensured that the normal PM10 emissions were not significantly influenced by air flow patterns.

Close-up views of the crusher inlet before and after installation of the enclosure are provided in Figures 5 and 6. In Figure 6, the flexible duct in the center right delivers the HEPA filtered make-up air to the enclosure and the duct in the background takes PM10-laden air to the emission testing location. The crusher outlet enclosure is shown in Figures 7 and 8. In Figure 8, the long horizontal duct in the center of the photographs contains the PM10 emissions from the outlet enclosure and the vertical duct on the right contains the PM10 emissions descending from the inlet enclosures. The gas streams are joined at the duct TEE shown in the lower right of Figure 8.

The combined gas flow from the inlet and outlet enclosures was controlled by a Dayton Model 3C411 24 inch, 2 HP direct current (DC) driven tubeaxial fan. This variable speed fan was set at the gas flow rate necessary to maintain a slightly negative static pressure within the enclosure. Negative pressures were required to ensure that there was no loss of PM10 emissions from the enclosure. Highly negative static pressures were undesirable since there could be high velocity ambient air streams entering the enclosure which could increase the PM10 emissions.

PM10 Sampling Equipment

EPA Reference Method 201A was used to monitor the PM10 emissions from the 7' crusher. This complete sampling system consists of: (1) a sampling nozzle, (2) a PM10 sampler, (3) a probe and umbilical cord, (4) an impinger train, and (5) flow control system. Due to the relatively small ducts and the constant sample gas flow rates set using the DC-driven tubeaxial fans, the "S"-type pitot tube was not mounted on the PM10 sampler probe. Gas velocities were determined prior to the emission tests.

Particulate matter larger than 10 microns in diameter is collected in the cyclone located immediately downstream of the sampling nozzle. Particulate smaller than 10 microns is collected on the outlet tube of the cyclone and on the downstream glass-fiber filter.

The cyclone and filter system used in this study met the design and sizing requirements of Section 5.2 of Method 201A. The gas flow rate through the cyclone was set based on the orifice pressure head equation provided in Figure 4 of Method 201A. The gas flow rate was kept constant throughout the emission test program.

Figure 5. Crusher Inlet Before Installation of Enclosure

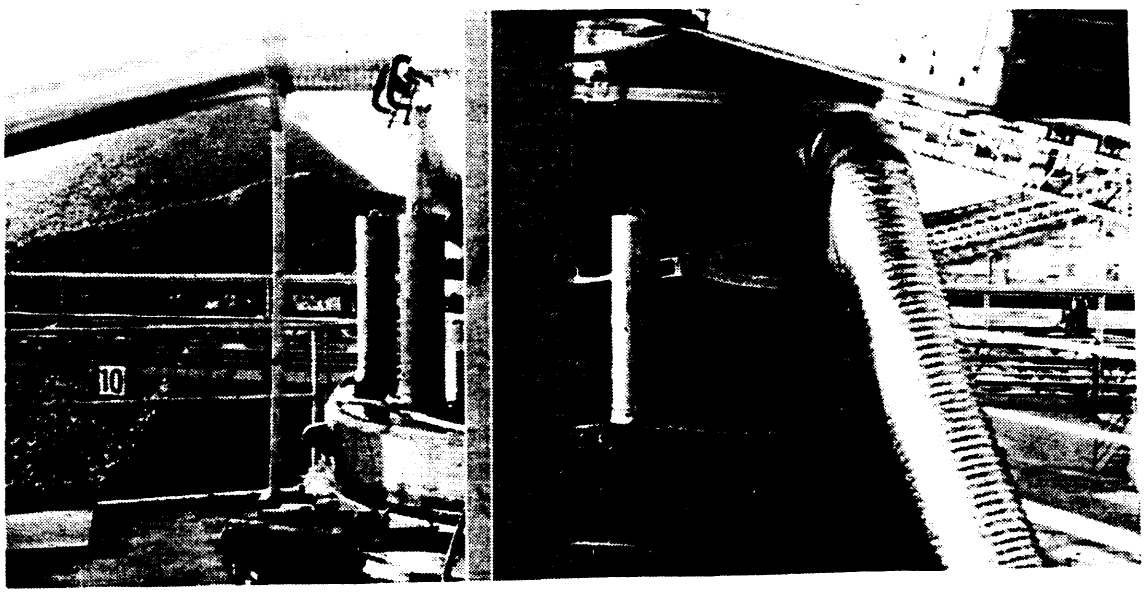

Figure 6. Crusher Inlet with Enclosure

Figure 7. Crusher Outlet Enclosure

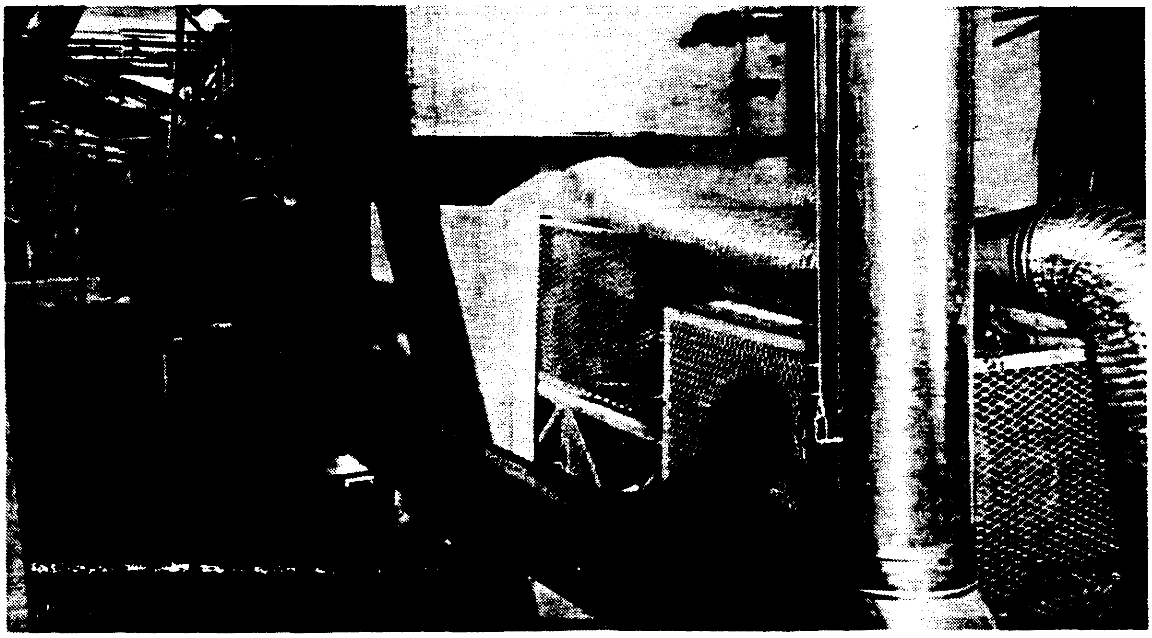

Figure 8. Crusher Outlet Enclosure

PM10 sampling was performed in a 1-foot (inlet / outlet location) diameter smooth wall duct mounted directly off the enclosures of the crusher. The 4-inch diameter sampling port was located 8 duct diameters downstream of the flexible duct connection and 2 duct diameters upstream of the fan. Sampling in the vertical direction across the ducts was not possible since dust collected in the cyclone could be resuspended and pass through to the filter. The sampling nozzles were selected to provide 80 to 120% isokinetic conditions. The cyclone and nozzle assembly were mounted within the duct during sampling.

The particulate samples were recovered using the procedures specified in Method 201A. The sample recovery scheme is illustrated in Figure 9. The material from the filter, cyclone outlet tube, and filter inlet housing were combined to determine the total PM10 catch weight.

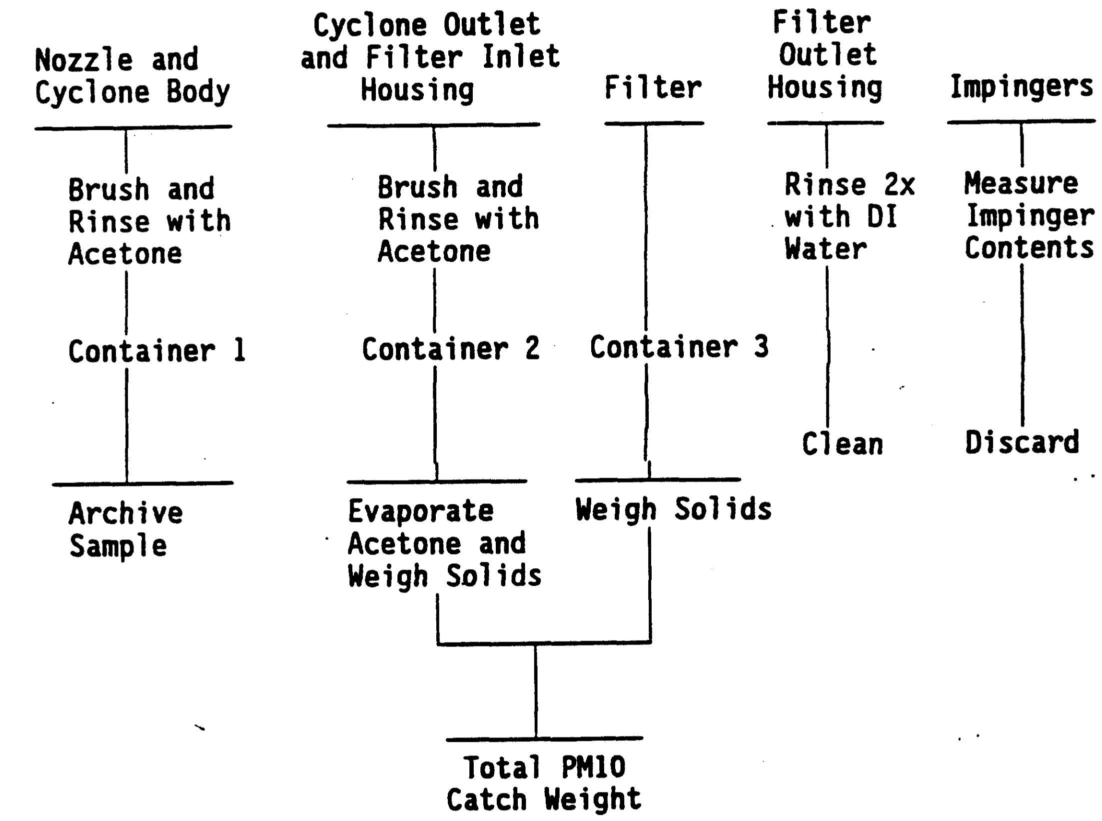

Figure 9. Sample Recovery

2.4 MONITORING OF PROCESS OPERATING CONDITIONS

There are a number of process variables and weather conditions which could conceivably influence PM10 emission rates from the Deister screen:

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

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

2.4.1 Stone Moisture Level

A stone sample was removed during each of the emission tests. In all cases, this sample consisted of a 2 linear foot sample of stone from the main conveyor leaving the 7' crusher (Stream 5 of Figure 1). The conveyor was stopped by plant personnel for approximately 5 minutes to permit the Entropy test crew to remove the stone sample. The sample was placed in a sealed plastic bucket.

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

2.4.2 Ambient PM10 Levels

One ambient PM10 monitor was operated inside the Deister screen enclosure. It was operated only during the time periods that PM10 emission sampling was in progress. The ambient air flow rates through the samplers were calibrated using an Airdata micromanometer. The filters were weighed and PM10 levels during the test were calculated. This data however was not used in the emissions calculations because it became apparent that the ambient PM10 monitor was being strongly influenced by emissions from the Deister screen and was not providing data representative of PM10 levels in the ambient air entering the Deister screen building.

2.4.3 Stone Size Distribution and Silt Content

Samples of the stone obtained during the test (see Section 2.4.1) were used to determine the size distribution and silt content. The initial sample quadrants used for moisture analysis was used for analysis by ASTM sizing screens. The sample of approximately 2 pounds was heated to 350 Fahrenheit for

30 minutes to drive off the moisture, then allowed to cool, then loaded into the top pan. The screen size mesh openings included:

- 37.5 Millimeters
- 19.0 Millimeters
- 4.75 Millimeters
- 2.00 Millimeters
- 150 Microns
- 75 Microns
- 38 Microns
- Bottom pan

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

2.4.4 Stone Processing and Production Rates

The stone processing rate of the 7' crusher has been defined by Entropy as the total volume of stone leaving the 7' crusher (Stream 5). The volume of stone in tons for a particular test was calculated by removing and weighing a 2 foot section of the stone from the conveyor leaving the 7' crusher. This amount in pounds/feet was then multiplied by the speed of the conveyor in feet/minute to produce a rate in pounds/minute. Then to obtain the total amount of stone per test this number was multiplied by the length of the test (minutes). This calculation is shown below:

(Pounds Stone per 2 FT) X (380 FT per Minute)
= Pounds Stone per Minute

(Pounds Stone per Minute) X (Test Minutes) X (Ton/2000 Pounds)
= Tons of Stone/Test

3.0 TEST RESULTS

3.1 OBJECTIVES AND TEST MATRIX

The objective of this test program was to determine the PM10 emission factors for a Simmons 7' crusher and a Deister vibrating screen at a stone crushing plant. The test program concerned both wet and dry stone conditions. The specific objectives included the following:

- Capture the PM10 emissions from the inlet and outlet of a 7' crusher without significantly affecting the emission rate.
- Capture the PM10 emissions from the Deister vibrating screen without significantly affecting the emission rate.
- Determine the PM10 emission concentrations by means of EPA Reference Method 201A.
- Calculate the total PM10 emission rates using the known outlet duct gas flow rates and the Method 201A emission concentrations.
- Measure the stone moisture content, stone feed rate, stone size distribution, and stone silt content.

The stone processing rate of the Deister screen has been defined by Entropy as the total quantity of stone produced by the plant minus the fines removed prior to the secondary crusher. The actual quantities of stone passing through the Deister are considerably higher than this value since all of the oversized material remaining on the top deck of the Deister is sent to the 2 Omni Cone crushers and then returned to the Deister screen. The quantities of stone in stream 6 shown Figure 1 are approximately 50% higher than the quantity in stream 3 due to this recycle loop. This recycle estimate is based on measurements of the stone feed rates via the Plant weigh belt scale, on the conveyor discharging stone to the two Deister screens.

The secondary feed weigh belt scale has been chosen as the basis for the production rate definition since these data are most readily available at other stone crushing plants. The disadvantage of this definition is that it creates emission factor values in pounds per ton of stone, which are higher than would be calculated if the production rate were based on the total feed rate.

The stone processing rate calculation at the Skippers plant tested during this study is further complicated by the presence of two Deister screens operated in parallel. Because of the configuration of the equipment there is no quantitative means to determine the separate stone flow rates to each. Entropy has based on emission factor calculations of a 50%-50% split based on observations during the emission tests.

3.2 STONE MOISTURE LEVELS

The stone moisture levels for the 7' crusher PM10 emission factor tests are presented in Table 4. The moisture criteria proposed in the Test Plan were: dry condition - less than 1.5%, and wet conditions - equal to or greater than 1.5%. The actual values during the testes were generally consistent with these criteria. Only the last dry test had a value outside of this range. The high moisture level of 2.5% in this run was due to the inadvertent washing of the conveyor by the plant cleanup crew five minutes before the end of the test and immediately prior to stone sampling. This 2.5% value is not representative of the actual stone moisture levels during the test.

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

TABLE 4. STONE MOISTURE LEVELS

Date	Conditions	Test	Moisture Content (% weight)
11-16-92	Dry	1	0.69
11-16-92	Dry	2	0.70
11-16-92	Dry[1]	3	2.50[1]
		Average	0.695
11-17-92	Wet	1	2.04
11-18-92	Wet	2	1.13
11-19-92	Wet	3	2.17
		Average	1.78

Note: [1] - Plant began to wash down the area before the test was completed and immediately prior to stone sampling. The 2.5% value is not representative of conditions during the test.

3.3 AMBIENT PM10 CONCENTRATIONS

The ambient PM10 concentrations were monitored by means of a Anderson PM10 Hi-Vol sampler. This instrument has a cyclonic pre-collector for particles greater than 10 microns followed by a back-up filter. The analyzer was located on the southwest corner of the Deister platform. In this location, it indicated the PM10 levels in the enclosure of the Deister.

This analyzer was turned on immediately prior to the emission test and turned off at the conclusion of the test. The PM10 concentrations were calculated by dividing the filter catch weights by the total standard cubic feet sampled during the on-line time. The ambient PM10 levels presented in Table 5 are relatively high.

TABLE 5.
AMBIENT PARTICULATE CONCENTRATION
STANDARD GAS CONDITIONS

	Time Start	Time Stop	Grams Catch	HiVol#1 mg/ft^3 Dry
11-16-92	11:15	12:15	5.1933	4.02
11-16-92	13:30	15:02	7.0881	3.58
11-16-92	15:27	16:27	6.6748	5.17
11-17-92	10:20	16:30	1.3747	0.174
11-18-92	10:20	16:22	1.1435	0.151
11-19-92	10:52	17:17	1.0324	0.126

3.4 STONE PRODUCTION RATES

The 7′ crusher stone processing rates were calculated following the formula given in Section 2.4.4 of this report. The Deister (west unit) stone processing rates were calculated based primarily on the data provided by the plant's weigh belt scale (Stream 6, Figure 1). The total stone production rate through the Deister screens-crusher circuit was divided in half based on the assumption that both Deister screens received equal stone loadings. The total processing rate during the test was calculated by multiplying the average stone production rate times the duration of the emission data. The calculated stone production rates for the West Deister screen during the tests are presented in Table 6.

TABLE 6. STONE PRODUCTION DATA

Date	Test	Condition	West Deister	Crusher
			Processing Rate, Tons	
11-16-92	1	Dry	552	578
11-16-92	2	Dry	552	498
11-16-92	3	Dry	552	484
11-17-92	1	Wet	589	388
11-18-92	2	Wet	617	521
11-19-92	3	Wet	531	490

3.5 PM10 EMISSION FACTORS

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

The total PM10 emissions from the Deister screen were determined by multiplying the constant gas flow rate (standard conditions) of the hood-fan system times the 27 separate sampling locations. The total gas flow rate from the Deister screen was multiplied by the measured PM10 concentration to yield the total PM10 emission rate.

The data are expressed in pounds of PM10 per ton of stone processed through the West Deister screen. The production rate was estimated using the weigh belt scale and averaging the data for the period of the emission test. It was assumed that both of the Deister screens receive an equal stone loading.

The measured PM10 emission factors for both the 7′ crusher and the Deister screen are presented in Table 7. The average values for the wet tests are more than a factor of 15 below the average value for the dry tests. This is consistent with general observations during the emission tests. During the dry tests, there were heavy visible emissions from the Deister screen as indicated in Figures 11 and 12. No visible emissions were apparent during the wet tests. The extremely low emissions occurring during the wet tests are indicated the photographs shown in Figures 2 and 3.

TABLE 7. DEISTER SCREEN AND 7′ CRUSHER PM10 EMISSIONS

		PM10 Emissions; Pounds/Ton	
Dry Stone (< 1.5%)		7′ Crusher	Screen
	Run 1	.00205	.02363
	Run 2	.00367	.02986
	Run 3	.00619	.02754
	Average	.00397	.02701
Wet Stone (> 1.5%)			
	Run 1	.00027	.00103
	Run 2	.00037	.00107
	Run 3	.00015	.00100
	Average	.00026	.00103

The emission factors measured during the emission test program are well below previously reported emission factors for total particulate matter[9]. The emission factors applicable to total particulate emissions cannot be compared

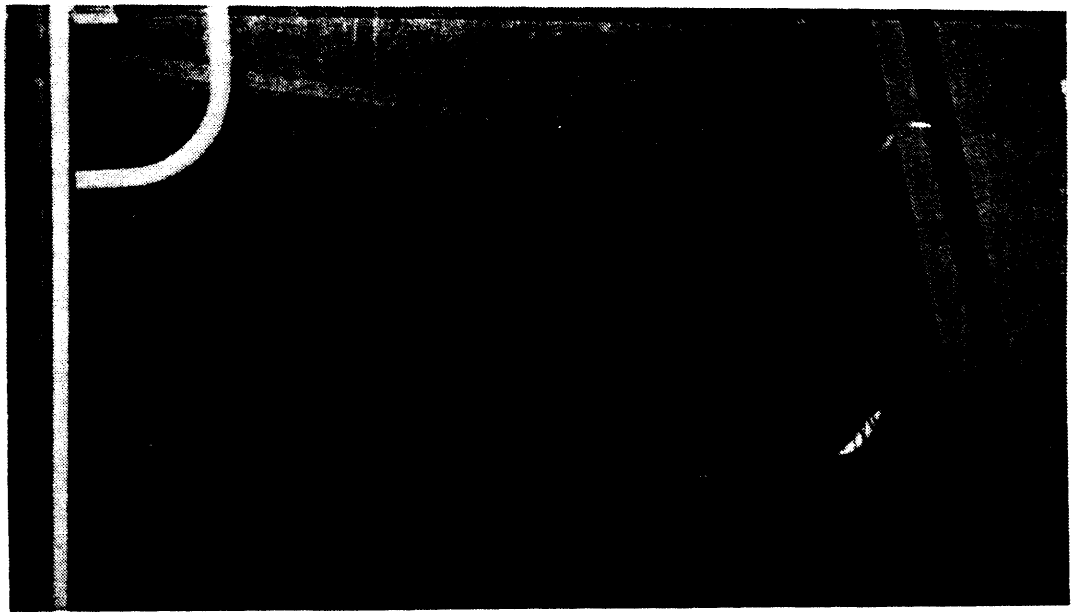

Figure 11. Emissions from Deister Screen During Dry Test

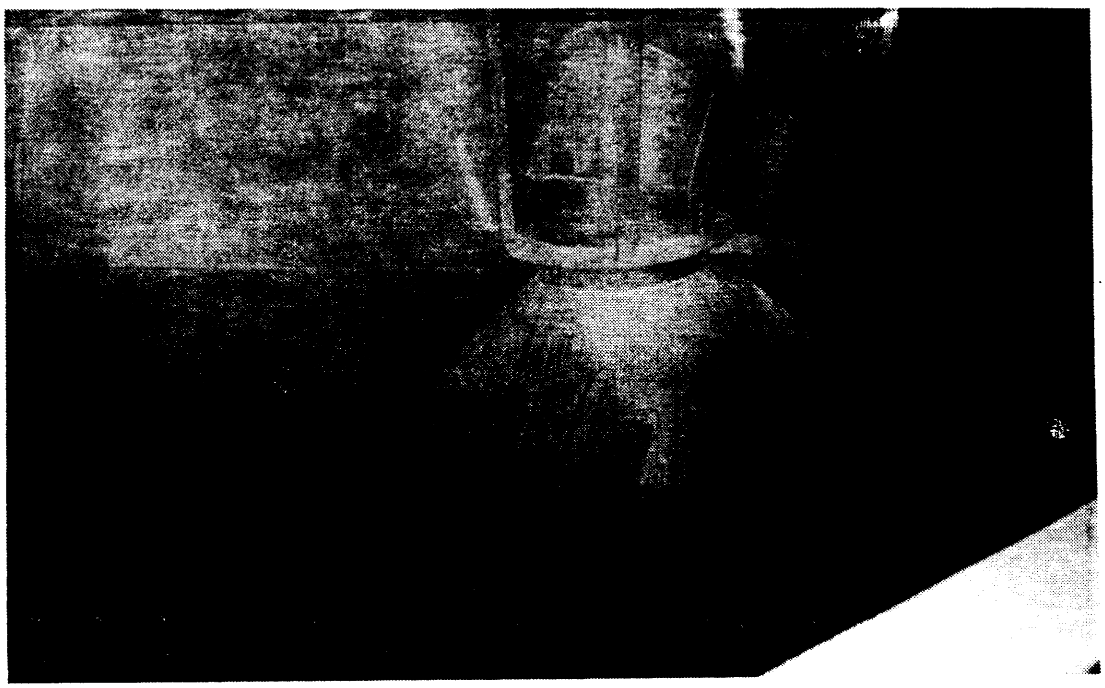

Figure 12. Emissions from Deister Screen During Dry Test

with PM10 emission factors. The PM10 fraction of the total particulate emissions should be relatively low since very high energy levels are needed to cause stone attrition to the 10 micron range. It is unlikely that the 7' crusher and Deister screens aree creating substantial quantities of PM10 particulate. This is indicated by particle size distribution tests conducted by Entropy using "as sampled" and dried stone. The size distribution data is provided in Table 8-1 and Table 8-2. As indicated in Table 8-1, the wet stone had near negligible levels of dust in the less than 75 micron size range.

TABLE 8-1. PARTICLE SIZE DISTRIBUTIONS FOR DRY RUNS

Size Range	Fraction of Sample in Specified Range: Test 1, Dry	Test 2, Dry	Test 3, Dry
> 37.5 Millimeters	0	0	0
> 19.0 Millimeters	0.464	0.208	0.385
> 4.75 Millimeters	0.394	0.441	0.424
> 2.00 Millimeters	0.055	0.114	0.071
> 150 Microns	0.062	0.179	0.088
> 75 Microns	0.011	0.025	0.015
> 38 Microns	0.007	0.017	0.010
Bottom Pan	0.008	0.019	0.009

TABLE 8-2. PARTICLE SIZE DISTRIBUTIONS FOR WET RUNS

Size Range	Fraction of Sample in Specified Range: Test 1, Wet	Test 2, Wet	Test 3, Wet
> 37.5 Millimeters	0.116	0	0
> 19.0 Millimeters	0.284	0.624	0.497
> 4.75 Millimeters	0.399	0.282	0.290
> 2.00 Millimeters	0.054	0.034	0.086
> 150 Microns	0.094	0.034	0.095
> 75 Microns	0.016	0.008	0.013
> 38 Microns	0.011	0.006	0.010
Bottom Pan	0.012	0.012	0.011

4.0 QA/QC ACTIVITIES

4.1 QC PROCEDURES

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

4.2 VELOCITY/VOLUMETRIC FLOW RATE DETERMINATION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4.3 QA AUDITS

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

4.4 PARTICULATE/CONDENSIBLES SAMPLING QC PROCEDURES

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

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

4.5 SAMPLE VOLUME AND PERCENT ISOKINETICS

All sampling runs met the results acceptability criteria as defined by Section 6.3.5 of Method 201-A. The isokinetic rates are within ±20 percent. A summary of the sample volume and percent isokinetics is presented in Table 9.

TABLE 9.
AVERAGE DELTA H AND ISOKINETIC RESULTS

Run #	Percent Iso (%)	Delta H (Avg)
D-C-M201A-1	84.9	.600
D-C-M201A-2	84.3	.620
D-C-M201A-3	84.7	.620
W-C-M201A-1	100.9	.640
W-C-M201A-2	104.9	.640
W-C-M201A-3	107.7	.640

Run #	Percent Is (%)	Delta H (Avg)
D-S-M201A-1	94.6	.589
D-S-M201A-2	94.6	.589
D-S-M210A-3	95.4	.589
W-S-M201A-1	95.9	.610
W-S-M210A-2	93.5	.610
W-S-M201A-3	94.8	.610

4.6 MANUAL SAMPLING EQUIPMENT CALIBRATION PROCEDURES

4.6.1 Type-S Pitot Tube Calibration

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

4.6.2 Sampling Nozzle Calibration

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

4.6.3 Temperature Measuring Device Calibration

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

4.6.4 Dry Gas Meter Calibration

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

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

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

Table 10. Meter Box Calibration Audit

Meter Box Number	Pre-Audit Value	Allowable Error	Calculated Gamma	Acceptable
N-25	0.9908	0.9512<Y<1.0304	0.9892	Yes
N-24	0.9895	0.9499<Y<1.0290	1.0103	Yes

4.7 DATA VALIDATION

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

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

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

5.0 REFERENCES

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5. B. Weaver, "Stretching water resources," Pit & Quarry, March 1991, p. 22-24.

6. R.E. Kenson and P.T. Bartlett, Technical Manual for the Measurement of Fugitive Emissions: Roof Monitor Sampling Method for Industrial Fugitive Emissions, EPA-600/2-76-089b, U.S. Environmental Protection Agency, Research Triangle Park, 1976.

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

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

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

6.0 GLOSSARY

1. ASTM: American Society for Testing & Materials

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

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

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

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

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

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

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

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

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

11. Scalping Screen: removes oversize material.

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

APPENDIX A

FIELD DATA AND RESULTS TABULATION

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Crusher

		D-C-M201A-1	D-C-M201A-2	D-C-M201A-3
	Test Date	11/16/92	11/16/92	11/16/92
	Run Start Time	1006	1215	1355
	Run Finish Time	1150	1337	1528
	Net Traversing Points	1	1	1
Theta	Net Run Time, Minutes	60	60	60
Dia	Nozzle Diameter, Inches	0.187	0.187	0.187
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	0.9895	0.9895	0.9895
Pbar	Barometric Pressure, Inches Hg	30.7	30.7	30.7
Delta H	Avg. Pressure Differential of Orifice Meter, Inches H2O	0.60	0.62	0.62
Vm	Volume of Metered Gas Sample, Dry ACF	26.083	26.561	26.597
tm	Dry Gas Meter Temperature, Degrees F	70	86	84
Vmstd	Volume of Metered Gas Sample, Dry SCF*	26.409	26.107	26.238
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, mL	1.3	1.8	1.1
Vwstd	Volume of Water Vapor, SCF*	0.061	0.085	0.052
%H2O	Moisture Content, Percent by Volume	0.2 **	0.3 **	0.2
%H2OSAT	Moisture Sat. @ Flue Gas Conditions, %	1	1.1	1.1
Mfd	Dry Mole Fraction	0.998	0.997	0.998
%CO2	Carbon Dioxide, Percent by Volume, Dry	0	0	0
%O2	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
%CO+N2	CO + N2, Percent by Volume, Dry	79.1	79.1	79.1
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.82	28.81	28.82
Pg	Flue Gas Static Pressure, Inches H2O	-1.3	-1.3	-1.3
Ps	Absolute Flue Gas Pressure, Inches Hg	30.60	30.60	30.60
ts	Flue Gas Temperature, Degrees F	45	49	49
Delta-p	Average Velocity Head, Inches H2O	0.61	0.61	0.61
vs	Flue Gas Velocity, Feet per Second	42.44	42.62	42.61
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	2,134	2,124	2,126
Qmsd	Volumetric Air Flow Rate, Dry SCMM*	60	60	60
Qaw	Volumetric Air Flow Rate, Wet ACFM	2,000	2,008	2,008
%I	Isokinetic Sampling Rate, Percent	84.9	84.3	84.7

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

** Moisture used in calculations.

(Continued Next Page)

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Crusher

		D-C-M201A-1	D-C-M201A-2	D-C-M201A-3
	PM10 Calculations			
ucyc	Stack Gas Viscosity	174.8	175.7	175.8
Qs	PM10 Flow, at Cyclone Conditions, ACFM	0.413	0.412	0.413
D50	Dia. of Particles in Cyclone, Microns	10.13	10.20	10.19
	Particulate Catch,			
mg<D50	≤ 10 Microns, Milligrams	111.2	170.0	279.6
mg>D50	> 10 Microns, Milligrams	2195.1	4030.7	3659.5
mg	Total Milligrams	2306.3	4200.7	3939.1
	Percent of Total Particulate,			
%<D50	≤ 10 Microns	4.82	4.05	7.10
%>D50	> 10 Microns	95.2	96.0	92.9
	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF*	0.0650	0.100	0.164
lb/hr	Emission Rate, lb/hr	1.19	1.83	3.00

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

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Screen

		D-S-M201A-1	D-S-M201A-2	D-S-M201A-3
	Test Date	11/16/92	11/16/92	11/16/92
	Run Start Time	1115	1330	1527
	Run Finish Time	1215	1502	1627
	Net Traversing Points	1	1	1
Theta	Net Run Time, Minutes	60	60	60
Dia	Nozzle Diameter, Inches	0.283	0.283	0.283
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	0.9908	0.9908	0.9908
Pbar	Barometric Pressure, Inches Hg	30.7	30.7	30.7
Delta H	Avg. Pressure Differential of Orifice Meter, Inches H2O	0.589	0.589	0.589
Vm	Volume of Metered Gas Sample, Dry ACF	26.743	26.921	27.154
tm	Dry Gas Meter Temperature, Degrees F	57	62	63
Vmstd	Volume of Metered Gas Sample, Dry SCF*	27.794	27.711	27.898
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, mL	1.1	0.9	3.3
Vwstd	Volume of Water Vapor, SCF*	0.052	0.042	0.155
%H2O	Moisture Content, Percent by Volume	0.2 **	0.2 **	0.6
%H2OSAT	Moisture Sat. @ Flue Gas Conditions, %	1.1	1.2	1.1
Mfd	Dry Mole Fraction	0.998	0.998	0.994
%CO2	Carbon Dioxide, Percent by Volume, Dry	0	0	0
%O2	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
%CO+N2	CO + N2, Percent by Volume, Dry	79.1	79.1	79.1
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.82	28.82	28.77
Pg	Flue Gas Static Pressure, Inches H2O	-0.25	-0.25	-0.25
Ps	Absolute Flue Gas Pressure, Inches Hg	30.68	30.68	30.68
ts	Flue Gas Temperature, Degrees F	47	50	49
Delta-p	Average Velocity Head, Inches H2O	0.1040	0.1040	0.1040
vs	Flue Gas Velocity, Feet per Second	17.54	17.59	17.59
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	881	878	876
Qmsd	Volumetric Air Flow Rate, Dry SCMM*	25	25	25
Qaw	Volumetric Air Flow Rate, Wet ACFM	827	829	829
%I	Isokinetic Sampling Rate, Percent	94.6	94.6	95.4

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

** Moisture used in calculations.

(Continued Next Page)

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Screen

		D-S-M201A-1	D-S-M201A-2	D-S-M201A-3
	<u>PM10 Calculations</u>			
ucyc	Stack Gas Viscosity	175.3	176.0	175.5
Qs	PM10 Flow, at Cyclone Conditions, ACFM	0.435	0.436	0.440
D50	Dia. of Particles in Cyclone, Microns	9.79	9.81	9.73
	Particulate Catch,			
mg<D50	≤ 10 Microns, Milligrams	115.2	145.5	135.6
mg>D50	> 10 Microns, Milligrams	510.3	1227.9	486.9
mg	Total Milligrams	625.5	1373.4	622.5
	Percent of Total Particulate,			
%<D50	≤ 10 Microns	18.4	10.6	21.8
%>D50	> 10 Microns	81.6	89.4	78.2
	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF*	0.0640	0.0810	0.0750
lb/hr	Emission Rate, lb/hr	0.483	0.610	0.563

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

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Crusher

		W-C-M201A-1	W-C-M201A-2	W-C-M201A-3
	Test Date	11/17/92	11/18/92	11/19/92
	Run Start Time	1020	1020	1129
	Run Finish Time	1634	1622	1630
	Net Traversing Points	1	1	1
Theta	Net Run Time, Minutes	345	341	270
Dia	Nozzle Diameter, Inches	0.167	0.167	0.167
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	0.9895	0.9895	0.9895
Pbar	Barometric Pressure, Inches Hg	30.4	30.4	30.6
Delta H	Avg. Pressure Differential of Orifice Meter, Inches H2O	0.64	0.64	0.64
Vm	Volume of Metered Gas Sample, Dry ACF	152.92	155.706	123.184
tm	Dry Gas Meter Temperature, Degrees F	85	85	74
Vmstd	Volume of Metered Gas Sample, Dry SCF*	149.117	151.834	123.400
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, mL	24.4	38.8	33.4
Vwstd	Volume of Water Vapor, SCF*	1.149	1.826	1.572
%H2O	Moisture Content, Percent by Volume	0.8 **	1.2 **	1.3
%H2OSAT	Moisture Sat. @ Flue Gas Conditions, %	1.4	1.8	1.5
Mfd	Dry Mole Fraction	0.992	0.988	0.987
%CO2	Carbon Dioxide, Percent by Volume, Dry	0	0	0
%O2	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
%CO+N2	CO + N2, Percent by Volume, Dry	79.1	79.1	79.1
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.75	28.71	28.70
Pg	Flue Gas Static Pressure, Inches H2O	-0.8	-0.8	-0.81
Ps	Absolute Flue Gas Pressure, Inches Hg	30.34	30.34	30.54
ts	Flue Gas Temperature, Degrees F	55	61	56
Delta-p	Average Velocity Head, Inches H2O	0.68	0.68	0.67
vs	Flue Gas Velocity, Feet per Second	45.5	45.8	45.1
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	2,211	2,191	2,191
Qmsd	Volumetric Air Flow Rate, Dry SCMM*	63	62	62
Qaw	Volumetric Air Flow Rate, Wet ACFM	2,144	2,158	2,125
%I	Isokinetic Sampling Rate, Percent	100.9	104.9	107.7

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

** Moisture used in calculations.

(Continued Next Page)

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Crusher

		W-C-M201A-1	W-C-M201A-2	W-C-M201A-3
	<u>PM10 Calculations</u>			
ucyc	Stack Gas Viscosity	176.8	177.9	176.6
Qs	PM10 Flow, at Cyclone Conditions, ACFM	0.419	0.439	0.443
D50	Dia. of Particles in Cyclone, Microns	10.18	9.91	9.77
	Particulate Catch,			
mg<D50	≤ 10 Microns, Milligrams	52.4	101.4	31.0
mg>D50	> 10 Microns, Milligrams	42.7	128.9	261.0
mg	Total Milligrams	95.1	230.3	292.0
	Percent of Total Particulate,			
%<D50	≤ 10 Microns	55.1	44.0	10.6
%>D50	> 10 Microns	44.9	56.0	89.4
	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF*	0.00542	0.0103	0.00388
lb/hr	Emission Rate, lb/hr	0.103	0.194	0.0728

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

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Screen

		W-S-M201A-1	W-S-M201A-2	W-S-M201A-3
	Test Date	11/17/92	11/18/92	11/19/92
	Run Start Time	1020	1020	1052
	Run Finish Time	1630	1622	1717
	Net Traversing Points	1	1	1
Theta	Net Run Time, Minutes	360	360	360
Dia	Nozzle Diameter, Inches	0.283	0.283	0.283
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
Y	Dry Gas Meter Calibration Factor	0.9908	0.9908	0.9908
Pbar	Barometric Pressure, Inches Hg	30.4	30.4	30.6
Delta H	Avg. Pressure Differential of Orifice Meter, Inches H2O	0.61	0.61	0.61
Vm	Volume of Metered Gas Sample, Dry ACF	166.689	162.488	166.143
tm	Dry Gas Meter Temperature, Degrees F	73	82	79
Vmstd	Volume of Metered Gas Sample, Dry SCF*	166.410	159.522	165.096
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, mL	21.4	40.2	42.5
Vwstd	Volume of Water Vapor, SCF*	1.007	1.892	2.000
%H2O	Moisture Content, Percent by Volume	0.6 **	1.2 **	1.2
%H2OSAT	Moisture Sat. @ Flue Gas Conditions, %	1.4	1.9	1.4
Mfd	Dry Mole Fraction	0.994	0.988	0.988
%CO2	Carbon Dioxide, Percent by Volume, Dry	0	0	0
%O2	Oxygen, Percent by Volume, Dry	20.9	20.9	20.9
%CO+N2	CO + N2, Percent by Volume, Dry	79.1	79.1	79.1
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	28.84	28.84	28.84
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.77	28.71	28.71
Pg	Flue Gas Static Pressure, Inches H2O	-0.25	-0.25	-0.25
Ps	Absolute Flue Gas Pressure, Inches Hg	30.38	30.38	30.58
ts	Flue Gas Temperature, Degrees F	55	63	55
Delta-p	Average Velocity Head, Inches H2O	0.104	0.103	0.105
vs	Flue Gas Velocity, Feet per Second	17.78	17.85	17.82
A	Stack/Duct Area, Square Inches	113.1	113.1	113.1
Qsd	Volumetric Air Flow Rate, Dry SCFM*	867	852	869
Qmsd	Volumetric Air Flow Rate, Dry SCMM*	25	24	25
Qaw	Volumetric Air Flow Rate, Wet ACFM	838	841	840
%I	Isokinetic Sampling Rate, Percent	95.9	93.5	94.8

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

** Moisture used in calculations.

(Continued Next Page)

FIELD DATA AND RESULTS TABULATION

PLANT: Vulcan Materials, Skippers, Va.

SAMPLING LOCATION: Screen

		W-S-M201A-1	W-S-M201A-2	W-S-M201A-3
	PM10 Calculations			
ucyc	Stack Gas Viscosity	176.9	178.4	176.5
Qs	PM10 Flow, at Cyclone Conditions, ACFM	0.447	0.438	0.443
D50	Dia. of Particles in Cyclone, Microns	9.72	9.96	9.76
	Particulate Catch,			
mg<D50	≤ 10 Microns, Milligrams	32.9	34.8	27.4
mg>D50	> 10 Microns, Milligrams	68.9	57.4	21.9
mg	Total Milligrams	101.8	92.2	49.3
	Percent of Total Particulate,			
%<D50	≤ 10 Microns	32.3	37.7	55.6
%>D50	> 10 Microns	67.7	62.3	44.4
	Particulate ≤ 10 Microns			
gr/DSCF	Concentration, grains/DSCF*	0.00305	0.00337	0.00256
lb/hr	Emission Rate, lb/hr	0.0227	0.0246	0.0191

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

EMISSION FACTOR CALCULATIONS - DEISTER SCREEN

Run D-S-M201A-1 $\dfrac{0.483 \text{ Lbs./Hr} \times 27}{552 \text{ Tons/Hr.}}$ = 0.02363 Lbs./Ton

Run D-S-M201A-2 $\dfrac{0.610 \text{ Lbs./Hr.} \times 27}{552 \text{ Tons/Hr.}}$ = 0.02986 Lbs./Ton

Run D-S-M201A-3 $\dfrac{0.563 \text{ Lbs./Hr.} \times 27}{552 \text{ Tons/Hr.}}$ = 0.02754 Lbs./Ton

Average = 0.02701 Lbs./Ton

Run W-S-M201A-1 $\dfrac{0.0227 \text{ Lbs./Hr} \times 27}{588 \text{ Tons/Hr.}}$ = 0.00103 Lbs./Ton

Run W-S-M201A-2 $\dfrac{0.0246 \text{ Lbs./Hr.} \times 27}{617 \text{ Tons/Hr.}}$ = 0.00107 Lbs./Ton

Run W-S-M201A-3 $\dfrac{0.0191 \text{ Lbs./Hr.} \times 27}{513 \text{ Tons/Hr.}}$ = 0.00100 Lbs./Ton

Average = 0.00103 Lbs./Ton

Note: Production Data from Table 7.

EMISSION FACTOR CALCULATIONS - CRUSHER

Run D-C-M201A-1 $\dfrac{1.19\ \text{Lbs./hr.}}{578\ \text{Tons/Hr.}}$ = 0.00205 lbs./Ton

Run D-C-M201A-2 $\dfrac{1.83\ \text{Lbs./Hr.}}{498\ \text{Tons/Hr.}}$ = 0.00367 lbs./Ton

Run D-C-M201A-3 $\dfrac{3.00\ \text{Lbs./hr.}}{484\ \text{Tons/Hr.}}$ = 0.00619 lbs./Ton

Average = 0.00397 lbs./Ton

Note: Production Rate Data From Table 7

Run W-C-M201A-1 $\dfrac{0.103\ \text{Lbs./hr.}}{387\ \text{Tons/Hr.}}$ = 0.000266 lbs./Ton

Run W-C-M201A-2 $\dfrac{0.194\ \text{Lbs./Hr.}}{521\ \text{Tons/Hr.}}$ = 0.000372 lbs./Ton

Run W-C-M201A-3 $\dfrac{0.0728\ \text{Lbs./Hr.}}{490\ \text{Tons/Hr.}}$ = 0.000149 lbs./Ton

Average = 0.00026 lbs./Ton

APPENDIX B

RAW FIELD DATA SHEETS

Sampling and Velocity Traverse Point Determination
EPA Method 1

PLANT NAME Vulcan

CITY, STATE Skippers

SAMPLING LOCATION crusher

NO. OF PORTS AVAILABLE 1

NO. OF PORTS USED 1

PORT INSIDE DIAMETER 4

DISTANCE FROM FAR WALL TO OUTSIDE OF PORT 12

NIPPLE LENGTH AND/OR WALL THICKNESS 0

DEPTH OF STACK OR DUCT 12

STACK OR DUCT WIDTH (IF RECTANGULAR) ____

EQUIVALENT DIAMETER:

$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(\quad)(\quad)}{(\quad + \quad)} = \_\_\_\_$$

DISTANCE FROM PORTS TO FLOW DISTURBANCES	UPSTREAM	DOWNSTREAM
	112	42
DIAMETERS	9.25	3.5

STACK/DUCT AREA = ________ = 113.1 IN²

LOCATION OF POINTS IN CIRCULAR STACKS OR DUCTS

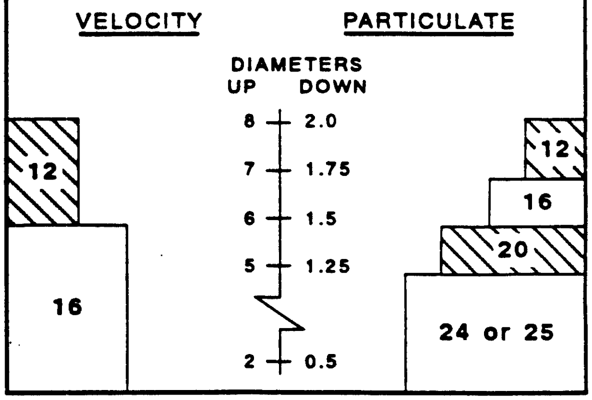
	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8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

LOCATION OF POINTS IN RECTANGULAR STACKS OR DUCTS

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

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



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

POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	2.1	.25	1/4
2	6.7	.80	3/4
3	11.8	1.42	1 3/8
4	17.7	2.12	2 1/8
5	25.0	3.00	3
6	35.6	4.27	4 1/4
7	64.4	7.73	7 3/4
8	75.0	9.00	9
9	82.3	9.88	9 7/8
10	88.2	10.58	10 5/8
11	93.3	11.20	11 1/4
12	97.9	11.75	11 3/4
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

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SEE REVERSE FOR FIELD USE CHECKLIST

ENTROPY

METHOD 201A (PM-10) FIELD DATA

ENTROPY

Plant Name	Vulcan materials	Run Number	D-C-M201A-1
City/State	Skippers VA	Time Start	1006
Sampling Location	Crusher	Time Stop	1150
Date 11/16/92 Team Leader CGM Techs N/A		Job Number	11216
*Train Leak Check Vacuum, In. Hg	15 3	Barometric Pressure, In. Hg	30.7
Train Leak Rate, Cubic Ft./Min.	.008 .006	Static Pressure, In. H_2O	-1.3

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 38 Pre
- ✓ Thermocouple @ 72 Post

IDENTIFICATION NUMBERS

Meterbox	N24	Meterbox Gamma	.9895	Reagent Box	C51
T/C Readout	F48	T/C Probe	R266	Umbilical	N/A
Sampling Box	N/A	Orsat Pump	N/A	Tedlar Bag	N/A
Nozzle(s) Actually Used:				Pitot	N/A
No.	1012	Diameter	.187	No.	
Diameter					

FILTER NO.	TARE
PM 126	.2263

Est % H_2O 2

Delta $H_@$	1.838
Delta H_t	.586
Delta H_{t+50}	.484
Delta H_{t-50}	.724
Delta P_{avg}	.5193
Meter Temp.	60
Stack Temp.	40

NOZZLE SELECTION CRITERIA

Desired Dia. .180

	Nozzle 1	Nozzle 2
Diameter	.187	
Nozzle Number	1012	
Delta P_{min}	.194	
Delta P_{max}	.727	

FYRITE

C_p N/A

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F	
1	A 4	5.0	0:00	654.897	.61	.60	64	2	N/A	42	42	42	
2	4	5:0	5.00	657.04	.61	.60	66	2		42	42	42	
3	4	5:00	10.00	659.18	.61	.60	67	2		40	43	43	
4	4	5:00	15:00	661.33	.61	.60	69	2		40	43	43	
5	4	5:00	20:00	663.45	.61	.60	71	2		40	44	44	23:16
6	4	5:00	25:00	665.65	.61	.60	64	2		46	46	46	
7	4	5:00	30:00	667.83	.61	.60	66	2		40	46	46	
8	4	5:00	35:00	670.03	.61	.60	67	2		40	47	47	
9	4	5:00	40:00	672.22	.61	.60	71	2		42	47	47	
10	4	5:000	45:00	674.41	.61	.60	74	2		42	47	47	45 51
11	4	5:00	50:00	676.61	.61	.60	78	2		42	48	48	
12	4	5:00	55:00	678.80	.61	.60	82	2		42	48	48	
			60:00	680.980									
			minutes	Vm	$(\sqrt{\Delta P})^2$	ΔH	tm					ts	

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name: Vulcan Material
City/State: Skippers VA
Sampling Location: Crus
Date: 11-16-92 Team Leader: GGM Techs: -
*Train Leak Check Vacuum, In. Hg: 15 | 5 | ___ | ___
Train Leak Rate, Cubic Ft./Min.: .001 | .004 | ___ | ___

Run Number: D-C-M201A-2
Time Start: 1215
Time Stop: 1337
Job Number: 11236
Barometric Pressure, In. Hg: 30.17
Static Pressure, In. H_2O: -1.3

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- ~~N/A~~ ✓ Thermocouple @ 72 Pre
- ✓ Thermocouple @ 80 Post

IDENTIFICATION NUMBERS

Meterbox: N24 Meterbox Gamma: .9695 Reagent Box: C551
T/C Readout: F48 T/C Probe: R266 Umbilical: N/A
Sampling Box: N/A Orsat Pump: N/A Tedlar Bag: N/A
Nozzle(s) Actually Used: Pitot: N/A
No. 1012 Diameter .187 No. ___ Diameter ___

FILTER NO.	TARE
PM171	0.2674

Est % H_2O: 1

Delta $H_@$: 1.838
Delta H_t: .586
Delta H_{t+50}: .484
Delta H_{t-50}: .724
Delta P_{avg}: .5193
Meter Temp.: 60
Stack Temp.: 40

NOZZLE SELECTION CRITERIA

Desired Dia. .180

	Nozzle 1	Nozzle 2
Diameter	.187	
Nozzle Number	1012	
Delta P_{min}	.194	
Delta P_{max}	.197	

FYRITE

C_p: N/A

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps: Filter Box, °F	Gas Temps: Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-4	5:00	0	681.630	.61	.62	78	2	N/A	46	51	51
2	4	5:00	5	683.85	.61	.62	78	2		46	49	49
3	4	5:00	10	686.09	.61	.62	81	2		44	49	49
4	4	5:00	15	688.26	.61	.62	83	2		44	49	49
5	4	5:00	20	690.48	.61	.62	84	2		44	48	48
6	4	5:00	25	692.71	.61	.62	86	2		46	50	50
7	4	5:00	30	694.93	.61	.82	88	2		48	50	50
8	4	5:00	35	697.15	.61	.62	90	2		48	50	50
9	4	5:00	40	699.37	.61	.62	92	2		50	49	49
10	4	5:00	45	701.58	.61	.62	92	2		50	49	49
11	4	5:00	50	703.80	.61	.62	92	2		50	50	50
12	4	5:00	55	706.01	.61	.62	89	2		50	49	49
			60	708.191								
			minutes	Vm	$(\sqrt{\Delta P})^2$	ΔH	tm					ts

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

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METHOD 201A (PM-10) FIELD DATA

Plant Name: Vulcan Materials
City/State: Skippers VA.
Sampling Location: crusher
Date: 11-16-92 Team Leader: CGM Techs:
*Train Leak Check Vacuum, In. Hg: 10 | 4 | |
Train Leak Rate, Cubic Ft./Min.: .008 | .004 | |

Run Number: P-C-M201A-3
Time Start: 13:55
Time Stop: 1528
Job Number: 11236
Barometric Pressure, In. Hg: 30.1
Static Pressure, In. H_2O: -1.3

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 80 Pre
- Thermocouple @ ____ Post

IDENTIFICATION NUMBERS

Meterbox: MB4 Meterbox Gamma: .9895 Reagent Box: 0551
T/C Readout: E48 T/C Probe: R266 Umbilical: N/A
Sampling Box: N/A Orsat Pump: N/A Tedlar Bag: N/A
Nozzle(s) Actually Used: Pitot: N/A
No. 1012 Diameter .187 No. ____ Diameter ____

FILTER NO.	TARE
PM181	0.2733

Est % H_2O: ____

Delta $H_@$: 1.838
Delta H_t: .566
Delta H_{t+50}: .484
Delta H_{t-50}: .727
Delta P_{avg}: .5153
Meter Temp.: 60
Stack Temp.: 40

NOZZLE SELECTION CRITERIA

Desired Dia.: .180

	Nozzle 1	Nozzle 2
Diameter	.187	
Nozzle Number	1012	
Delta P_{min}	.194	
Delta P_{max}	.727	

FYRITE

C_p ____

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A 4	5:00	0.00	708.279	.61	.62	84	2	N/A	54	51	51
2	4	5	5	710.61	.61	.62	84	2		50	49	49
3	4	5	10	712.85	.61	.62	86	2		48	50	50
4	4	5	15	715.08	.61	.62	88	2		48	49	49
5	4	5	20	717.30	.61	.62	89	2		48	49	49
6	4	5	25	719.51	.61	.62	90	2		44	49	49
7	4	5	30	721.72	.61	.62	91	2		44	49	49
8	4	5	35	723.94	.61	.62	75	2		44	49	49
9	4	5	40	726.14	.61	.62	77	2		44	49	49
10	4	5	45	728.37	.61	.62	78	2		40	48	48
11	4	5	50	730.57	.61	.62	80	2		40	49	49
12	4	5	55	732.77	.61	.62	82	3		40	48	48
			60	734.976								
			minutes	Vm	$(\sqrt{\Delta P})^2$	ΔH	tm					ts

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

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ENTROPY

METHOD 201A (PM-10) FIELD DATA

page 1

Plant Name: Vulcan Material
City/State: Skippers VA.
Sampling Location: Crusher
Date: 11-17-92
Team Leader: LGM
Techs: —
*Train Leak Check Vacuum, In. Hg: 15 | 3
Train Leak Rate, Cubic Ft./Min.: .002 | .000
Run Number: W-L-M201-1
Time Start: 1020
Time Stop: 1834
Job Number: 11236
Barometric Pressure, In. Hg: 30.4
Static Pressure, In. H_2O: -.8

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 42 Pre
- Thermocouple @ ___ Post

IDENTIFICATION NUMBERS

Meterbox: N24
Meterbox Gamma: .9895
Reagent Box: 561
T/C Readout: F48
T/C Probe: R266
Umbilical: N/A
Sampling Box: N/A
Orsat Pump: N/A
Tedlar Bag: N/A
Nozzle(s) Actually Used:
Pitot: N/A
No. 1001 Diameter .167 No. ___ Diameter ___

FILTER NO.	TARE
PM151	0.2670

Est % H_2O: .5

Delta $H_@$: 1.838
Delta H_t: .671
Delta H_{t+50}: .529
Delta H_{t-50}: .793
Delta P_{avg}: .703
Meter Temp.: 75
Stack Temp.: 34

NOZZLE SELECTION CRITERIA

Desired Dia. .167

	Nozzle 1	Nozzle 2
Diameter	.167	
Nozzle Number	1001	
Delta P_{min}	.3494	
Delta P_{max}	1.1111	

FYRITE

C_p N/A

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Impinger Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A 4	15 T 0	0:00	809.220	.68	.64	68	2	N/A	47	47	47
2	4		15	816.08	.68	.64	74	2		44	49	49
3	4		30	822.96	.68	.64	72	2		44	50	50
4	4		45	829.81	.68	.64	77	2		46	50	50
5	4		60:00	836.66	.68	.64	76	2		46	52	52
6	4		15	843.50	.68	.64	76	2		48	53	53
7	4		30	850.32	.68	.64	76	2		48	53	53
8	4		45	857.14	.68	.64	82	2		48	54	54
9	4		120/0	863.95	.68	.64	86	2		48	55	55
10	4		15	870.77	.68	.64	85	2		44	55	55
11	4		30	877.64	.68	.64	87	2		44	56	56
12	4		45	884.61	.68	.64	87	2		44	56	56
			180/0									

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

page 2

Plant Name: Vulcan Material
City/State: Skippers VA
Sampling Location: crushers
Date: 11-17-92 Team Leader: LLM Techs: ______
Run Number: W-C-M201A-1
Time Start: ______
Time Stop: ______
Job Number: 11236
*Train Leak Check Vacuum, In. Hg ______ ______ ______ ______
Train Leak Rate, Cubic Ft./Min. ______ ______ ______ ______
Barometric Pressure, In. Hg ______
Static Pressure, In. H_2O ______

EQUIPMENT CHECKS

- ______ Pitot, Pretest
- ______ Pitot, Posttest
- ______ M3 Sampling Sys/Ted Bag
- ______ Thermocouple @ ______ Pre
- ______ Thermocouple @ ______ Post

IDENTIFICATION NUMBERS

Meterbox ______ Meterbox Gamma ______ Reagent Box ______
T/C Readout ______ T/C Probe ______ Umbilical ______
Sampling Box ______ Orsat Pump ______ Tedlar Bag ______
Nozzle(s) Actually Used: Pitot ______
No. ______ Diameter ______ No. ______ Diameter ______

FILTER NO.	TARE

Est % H_2O ______

Delta $H_@$ ______
Delta H_t ______
Delta H_{t+50} ______
Delta H_{t-50} ______
Delta P_{avg} ______
Meter Temp. ______
Stack Temp. ______

NOZZLE SELECTION CRITERIA

Desired Dia. ______

	Nozzle 1	Nozzle 2
Diameter		
Nozzle Number		
Delta P_{min}		
Delta P_{max}		

FYRITE

______
______
______
______

C_p ______

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps: Filter Box, °F	Gas Temps: Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-4	15:00	~~15~~ 180/0	891.52	.68	.64	88	2	N/A	40	57	57
2	4		~~30~~ 15	898.44	.65	.64	90	2		40	57	57
3	4		~~45~~ 30	805.33	.68	.64	90	2		40	58	58
4	4		~~240/0~~ 45	812.25	.68	.64	90	2		40	58	58
5	4		~~15~~ 240/0	819.15	.68	.64	92	2		41	58	58
6	4		~~30~~ 15	926.06	.68	.64	93	2		42	58	58
7	4		~~45~~ 30	932.97	.68	.64	94	2		42	57	57
8	4		~~300/0~~ 45	939.85	.68	.64	94	2		42	57	57
9	4		~~15~~ 300/0	946.79	.68	.64	92	2		42	56	56
10	4		~~30~~ 15	953.75	.68	.64	90	2		42	55	55
11	4		~~45~~ 30	960.66	.68	.64	90	2		42	55	55
12	4		45	962.140	.68	.64					1	
			360									

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

Plant Name: Vulcan Material
City/State: Skippers Va.
Sampling Location: Crusher
Date: 11-19-92 Team Leader: CGM Techs: ____

Run Number: W-C-M201A-3
Time Start: 1129
Time Stop: ____
Job Number: 11236

*Train Leak Check Vacuum, In. Hg: 10 ____ ____ ____
Train Leak Rate, Cubic Ft./Min.: .001 ____ ____ ____
Barometric Pressure, In. Hg: 30.6
Static Pressure, In. H_2O: -.81

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- 50✓ Thermocouple @ 50 Pre
- ____ Thermocouple @ ____ Post

IDENTIFICATION NUMBERS

Meterbox: N24 Meterbox Gamma: .9895 Reagent Box: ____
T/C Readout: F48 T/C Probe: R366 Umbilical: N/A
Sampling Box: N/A Orsat Pump: N/A Tedlar Bag: N/A
Nozzle(s) Actually Used: Pitot: N/A
No. 1001 Diameter .167 No. ____ Diameter ____

FILTER NO.	TARE
PM34	6.0897

Est % H_2O: ____

Delta $H_@$: 1.838
Delta H_t: .672
Delta H_{t+50}: .532
Delta H_{t-50}: .791
Delta P_{avg}: .684
Meter Temp.: 75
Stack Temp.: 50

NOZZLE SELECTION CRITERIA

Desired Dia. .169

	Nozzle 1	Nozzle 2
Diameter	.167	
Nozzle Number	1001	
Delta P_{min}	.358	
Delta P_{max}	1.137	

FYRITE

____
____
____
____

C_p: N/A

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps: Filter Box, °F	Gas Temps: Impinger Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A 4	15:00	0.00	161.096	.67	.64	58	2	N/A	40	50	50
2	4		15	167.187	.67	.64	64	2		40	54	54
3	4		30	174.65	.67	.64	72	2		40	54	54
4	4		45	181.46	.67	.64	75	2		40	55	55
5	4		60/0	188.30	.67	.64	78	2		40	56	56
6	4		15	195.17	.67	.64	75	2		42	57	57
7	4		30	202.03	.67	.64	78	2		42	57	57
8	4		45	208.86	.67	.64	78	2		44	58	58
9	4		120/0	215.76	.67	.64	77	2		44	58	58
10	4		15	222.53	.67	.64	76	2		44	58	58
11	4		30	229.35	.67	.64	76	2		46	58	58
12	4		45	236.19	.67	.64	76	2		46	58	58

* REMOVE HEAD BEFORE
POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA page 2

Plant Name vulcan materials
City/State Skippers Va
Sampling Location Crusher
Date 11-19-92 Team Leader CGM Techs
*Train Leak Check Vacuum, In. Hg
Train Leak Rate, Cubic Ft./Min.

Run Number W-C-M201A-3
Time Start
Time Stop
Job Number 1236
Barometric Pressure, In. Hg
Static Pressure, In. H_2O

EQUIPMENT CHECKS

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

IDENTIFICATION NUMBERS

Meterbox ___ Meterbox Gamma ___ Reagent Box ___
T/C Readout ___ T/C Probe ___ Umbilical ___
Sampling Box ___ Orsat Pump ___ Tedlar Bag ___
Nozzle(s) Actually Used: Pitot ___
No. ___ Diameter ___ No. ___ Diameter ___

FILTER NO. **TARE**

Est % H_2O

Delta $H_@$
Delta H_t
Delta H_{t+50}
Delta H_{t-50}
Delta P_{avg}
Meter Temp.
Stack Temp.

NOZZLE SELECTION CRITERIA

Desired Dia.

	Nozzle 1	Nozzle 2
Diameter		
Nozzle Number		
Delta P_{min}		
Delta P_{max}		

FYRITE

C_p

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps: Filter Box, °F	Gas Temps: Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	4	15:00	1810/0	243.03	.67	.64	76	2	N/A	46	58	58
2	4		15	249.71	.67	.64	76	2		46	58	58
3	4		30	256.52	.67	.64	74	2		48	57	57
4	4		45	263.50	.67	.64	72	2		48	56	56
5	4		2410/0	270.46	.67	.64	71	2		46	57	57
6	4		15	277.40	.67	.64	69	2		44	56	56
7	4			284.28								
8	4											
9	4											
10	4											
11	4											
12	4											

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

page 1

Plant Name: Vulcan Material	Run Number: W-C-M201A-2
City/State: Skippers Va.	Time Start: 1020
Sampling Location: Crusher	Time Stop: 1622
Date: 11-18-92 Team Leader: CGM Techs:	Job Number: 11236
*Train Leak Check Vacuum, In. Hg: 15	Barometric Pressure, In. Hg: 30.4
Train Leak Rate, Cubic Ft./Min.: .002	Static Pressure, In. H_2O: -.8

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- 50 Thermocouple @ ✓ Pre
- ____ Thermocouple @ ____ Post

IDENTIFICATION NUMBERS

Meterbox	N24	Meterbox Gamma	.9895	Reagent Box	
T/C Readout	F48	T/C Probe	R266	Umbilical	N/A
Sampling Box	N/A	Orsat Pump	N/A	Tedlar Bag	N/A
Nozzle(s) Actually Used:				Pitot	N/A
No.	1001	Diameter	.167	No. / Diameter	

FILTER NO.	TARE
BM 174	0.2737

Est % H_2O ____

Delta $H_@$	1.838
Delta H_t	.642
Delta H_{t+50}	.532
Delta H_{t-50}	.751
Delta P_{avg}	.693
Meter Temp.	75
Stack Temp.	45

NOZZLE SELECTION CRITERIA

Desired Dia. .168

	Nozzle 1	Nozzle 2
Diameter	.167	
Nozzle Number	1001	
Delta P_{min}	.3587	
Delta P_{max}	1.1370	

FYRITE

C_p N/A

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	4	15:00	0:00	66.097	.68	.64	54	2	N/A	46	55	55
2	4		15	72.98	.68	.64	60	2		46	55	55
3	4		30	79.79	.68	.64	68	2		46	58	58
4	4		45	86.59	.68	.64	73	2		46	58	58
5	4		60/0	93.44	.68	.64	78	2		44	59	59
6	4		15	100.32	.68	.64	80	2		44	58	59
7	4		30	107.23	.68	.64	84	2		44	60	60
8	4		45	114.04	.68	.64	88	2		44	60	60
9	4		120/0	120.89	.68	.64	88	2		44	61	61
10	4		15	127.64	.68	.64	90	2		46	62	62
11	4		30	134.46	.68	.64	90	2		46	63	63
12	4		45	141.28	.68	.64	91	2		46	63	63

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

page 2

Plant Name Vulcan Materials

City/State Skippers Va.

Sampling Location Crusher

Date 11-18-92 Team Leader ______ Techs ______

Run Number W-C-M201 2

Time Start ______

Time Stop ______

Job Number 11236

*Train Leak Check Vacuum, In. Hg ______ ______ ______ ______

Train Leak Rate, Cubic Ft./Min. ______ ______ ______ ______

Barometric Pressure, In. Hg ______

Static Pressure, In. H_2O ______

EQUIPMENT CHECKS

- ______ Pitot, Pretest
- ______ Pitot, Posttest
- ______ M3 Sampling Sys/Ted Bag
- ______ Thermocouple @ ______ Pre
- ______ Thermocouple @ ______ Post

IDENTIFICATION NUMBERS

Meterbox ______ Meterbox Gamma ______ Reagent Box ______

T/C Readout ______ T/C Probe ______ Umbilical ______

Sampling Box ______ Orsat Pump ______ Tedlar Bag ______

Nozzle(s) Actually Used: Pitot ______

No. ______ Diameter ______ No. ______ Diameter ______

FILTER NO.	TARE

Est % H_2O ______

Delta $H_@$ ______

Delta H_t ______

Delta H_{t+50} ______

Delta H_{t-50} ______

Delta P_{avg} ______

Meter Temp. ______

Stack Temp. ______

NOZZLE SELECTION CRITERIA

Desired Dia. ______

	Nozzle 1	Nozzle 2
Diameter		
Nozzle Number		
Delta P_{min}		
Delta P_{max}		

FYRITE

______

______

______

______

C_p ______

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps: Filter Box, °F	Gas Temps: Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-4	15:00	180/0	148.07	.68	.64	93	2	N/A	44	62	62
2	4		15	154.89	.68	.64	93	2		44	63	63
3	4		30	161.68	.68	.64	92	2		42	64	64
4	4		45	168.54	.68	.64	92	2		42	64	64
5	4		240/0	175.37	.68	.64	94	2		42	64	64
6	4		15	182.21	.68	.64	94	2		42	64	64
7	4		30	189.07	.68	.64	94	2		42	64	64
8	4		45	195.92	.68	.64	93	2		42	64	64
9	4		300/0	202.81	.68	.64	90	3		42	63	63
10	4		15	209.78	.68	.64	90	3		42	63	63
11	4		30	216.63								
12	4		~~~~341	221.803								
			~~									

* REMOVE HEAD BEFORE
POSTTEST LEAK CHECK ______ ______ ______ ______ ______ ______

Severe]and. for EQPT.

METHOD 201A (PM-10) FIELD DATA

Plant Name	VULCAN MATERIALS	Run Number	D-S-M201A-1
City/State	SKIPPERS, VA	Time Start	1115
Sampling Location	SCREEN	Time Stop	1215
Date	11-16-92 Team Leader STA Techs WKK	Job Number	112360
*Train Leak Check Vacuum, In. Hg	15 5	Barometric Pressure, In. Hg	30.7
Train Leak Rate, Cubic Ft./Min.	0 .002	Static Pressure, In. H_2O	-.25

EQUIPMENT CHECKS

- ✓ Pitot, Pretest
- ✓ Pitot, Posttest
- NA M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 43 Pre
- ✓ Thermocouple @ 56 Post

IDENTIFICATION NUMBERS

Meterbox	N25	Meterbox Gamma	.9908	Reagent Box	609
T/C Readout	F-77	T/C Probe	R154	Umbilical	U99
Sampling Box	25	Orsat Pump	NA	Tedlar Bag	NA
Nozzle(s) Actually Used:				Pitot	NA
No.	1005	Diameter	.283	No.	Diameter

FILTER NO.	TARE
PM-201	.2703

Est % H_2O 1

Delta $H_@$	1.724
Delta H_t	.588
Delta H_{t+50}	.486
Delta H_{t-50}	.727
Delta P_{avg}	.104
Meter Temp.	60
Stack Temp.	38

NOZZLE SELECTION CRITERIA

Desired Dia. .274

	Nozzle 1	Nozzle 2
Diameter	.283	.249
Nozzle Number	1005	
Delta P_{min}	.0215	.0359
Delta P_{max}	.1833	.2752

FYRITE

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C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-7	5	0	287.364	.1040	.589	44	1	NA	42	46	46
2	"	5	5	288.59	.1040	.589	44			42	46	46
3	"	5	10	291.78	.1040	.589	48			42	46	46
4	"	5	15	294.02	.1040	.589	50			44	47	47
5	"	5	20	296.32	.1040	.589	54			46	47	47
6	"	5	25	298.56	.1040	.589	57			46	47	47
7	"	5	30	300.69	.1040	.589	59			46	47	47
8		5	35	302.89	.1040	.589	63			46	46	46
9		5	40	305.11	.1040	.589	63			46	48	48
10		5	45	307.29	.1040	.589	66			46	47	47
11		5	50	309.42	.1040	.589	68			46	50	50
12		5	55	311.77	.1040	.589	69			46	50	50
			60	314.107								

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name: VULCAN MATERIALS
City/State: SKIPPERS, VA
Sampling Location: SCREEN
Date: 11-16-92 Team Leader: SRA Techs: WKK
*Train Leak Check Vacuum, In. Hg: 15
Train Leak Rate, Cubic Ft./Min.: .002

Run Number: D-S-M201A-2
Time Start: 1330
Time Stop: 1502
Job Number: 11236
Barometric Pressure, In. Hg: 30.7
Static Pressure, In. H_2O: -.25

EQUIPMENT CHECKS

- ✓ Pitot, Pretest
- ✓ Pitot, Posttest
- NA M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 52 Pre
- ✓ Thermocouple @ 52 Post

IDENTIFICATION NUMBERS

Meterbox: N25 Meterbox Gamma: .9908 Reagent Box: 609
T/C Readout: F-77 T/C Probe: R154 Umbilical: U99
Sampling Box: 25 Orsat Pump: NA Tedlar Bag: NA
Nozzle(s) Actually Used: Pitot: NA
No. 1005 Diameter .283 No. Diameter

FILTER NO.	TARE
PM-111	.2166

Est % H_2O: 1

Delta $H_@$: 1.724
Delta H_t: .588
Delta H_{t+50}: .486
Delta H_{t-50}: .727
Delta P_{avg}: .104
Meter Temp.: 60
Stack Temp.: 38

NOZZLE SELECTION CRITERIA

Desired Dia. .274

	Nozzle 1	Nozzle 2
Diameter	.283	.249
Nozzle Number	1005	
Delta P_{min}	.0215	.0359
Delta P_{max}	.1833	.2752

FYRITE

–

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Impinger Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-7	5	0	314.412	.1040	.589	50	1	NA	50	48	48
2		5	5	316.70	.1040	.589	51			50	49	49
3		5	10	318.97	.1040	.589	54			50	49	49
4		5	15	321.16	.1040	.589	58			52	50	50
5		5	20	323.38	.1040	.589	60			50	50	50
6		5	25	325.62	.1040	.589	60			52	50	50
7		5	30	327.86	.1040	.589	64			50	49	49
8		5	35	330.09	.1040	.589	66			50	50	50
9		5	40	332.34	.1040	.589	68			56	50	50
10		5	45	334.56	.1040	.589	70			56	51	51
11		5	50	336.80	.1040	.589	70			56	50	50
12		5	55	339.07	.1040	.589	72			56	50	50
			60	341.333								

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

Plant Name: VULCAN MATERIALS
City/State: SKIPPERS, VA
Sampling Location: SCREEN
Date: 11·16·92 Team Leader: STA Techs: ______
*Train Leak Check Vacuum, In. Hg: 15 | 5 | ___ | ___
Train Leak Rate, Cubic Ft./Min.: .004 | .002 | ___ | ___

Run Number: D-S-M201A 3
Time Start: 1527
Time Stop: 1627
Job Number: 11236
Barometric Pressure, In. Hg: 30.7
Static Pressure, In. H_2O: -.25

EQUIPMENT CHECKS

- ✓ Pitot, Pretest
- ✓ Pitot, Posttest
- NA M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 48 Pre
- ✓ Thermocouple @ 48 Post

IDENTIFICATION NUMBERS

Meterbox: N-25 Meterbox Gamma: .9908 Reagent Box: 609
T/C Readout: F-77 T/C Probe: R15A Umbilical: U99
Sampling Box: 25 Orsat Pump: NA Tedlar Bag: NA
Nozzle(s) Actually Used: Pitot: NA
No. 1005 Diameter .283 No. ______ Diameter ______

FILTER NO.	TARE
PM-206	.2740

Est % H_2O: 1

Delta $H_@$: 1.724
Delta H_t: .588
Delta H_{t+50}: .486
Delta H_{t-50}: .727
Delta P_{avg}: .104
Meter Temp.: 60
Stack Temp.: 38

NOZZLE SELECTION CRITERIA

Desired Dia. .274

	Nozzle 1	Nozzle 2
Diameter	.283	.249
Nozzle Number	1005	
Delta P_{min}	.0215	.0359
Delta P_{max}	.1833	.2752

FYRITE

—

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-7	5	0	341.342	.1040	.589	54	1	NA	45	51	51
2	↓	5	5	343.57	.1040	.589	54	1	↓	46	50	50
3		5	10	345.95	.1040	.589	56	1		46	50	50
4		5	15	348.23	.1040	.589	58	1		46	50	50
5		5	20	350.47	.1040	.589	59	1		48	49	49
6		5	25	352.73	.1040	.589	~~60~~ 62	1		48	49	49
7		5	30	354.96	.1040	.589	64	1		48	49	49
8		5	35	357.19	.1040	.589	66	1		49	48	47
9		5	40	359.47	.1040	.589	68	1		44	49	49
10		5	45	361.73	.1040	.589	70	1		44	49	49
11		5	50	364.02	.1040	.589	70	1		44	49	48
12	↓	5	55	366.25	.1040	.589	72	1	↓	44	48	48
			60	368.496								

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

1/2

METHOD 201A (PM-10) FIELD DATA

Plant Name VULCAN MATERIALS
City/State SKIPPERS, VA
Sampling Location SCREEN
Date 11-17-92 Team Leader STA Techs TTB WKK
*Train Leak Check Vacuum, In. Hg 15 5
Train Leak Rate, Cubic Ft./Min. .004 .002

Run Number W-S-M201A-1
Time Start 1020
Time Stop 1630
Job Number 11236
Barometric Pressure, In. Hg 30.4
Static Pressure, In. H_2O -.25

EQUIPMENT CHECKS

- NA Pitot, Pretest
- NA Pitot, Posttest
- NA M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 46 Pre
- ✓ Thermocouple @ 57 Post

IDENTIFICATION NUMBERS

Meterbox N-25 Meterbox Gamma .9908 Reagent Box 616
T/C Readout 77 T/C Probe R154 Umbilical U-99
Sampling Box 25 Orsat Pump N/A Tedlar Bag N/A
Nozzle(s) Actually Used: Pitot DP-8
No. 1005 Diameter .283 No. Diameter

FILTER NO.	TARE
PM-125	.2650

Est % H_2O 1

Delta $H_@$ 1.724
Delta H_t .605
Delta H_{t+50} .500
Delta H_{t-50} .748
Delta P_{avg} .104
Meter Temp. 75
Stack Temp. 38

NOZZLE SELECTION CRITERIA

Desired Dia. .270

	Nozzle 1	Nozzle 2
Diameter	.283	
Nozzle Number	1005	
Delta P_{min}	.0215	
Delta P_{max}	.1833	

FYRITE

—

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Impinger Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-4	15	0	425.418	.104	.61	52	1	NA	40	46	46
2			15	432.28	.104	.61	57	1		40	48	48
3			30	439.06	.104	.61	65	1		40	50	50
4			45	445.89		.61	71	1		40	50	50
5			60/0 1	452.75			75	1		40	51	51
6			15	459.63			77	1		40	52	52
7			30	466.52			80	1		40	54	54
8			45	473.48			74	1		44	54	54
9			60/0 2	480.45			72	1		44	55	55
10			15	487.43			72	1		44	55	55
11			30	494.39			70	1		46	56	56
12			45	501.34			72	1		46	57	57
				5								

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

Plant Name Vulcan Materials
City/State Skippers, Va
Sampling Location Screen
Date 11/17/92 Team Leader STA Techs TTB, WKK
*Train Leak Check Vacuum, In. Hg 15 5
Train Leak Rate, Cubic Ft./Min. .004 .002

Run Number W-S-M201A-1
Time Start 1020
Time Stop ~~1136~~ 1630
Job Number 11236
Barometric Pressure, In. Hg 30.4
Static Pressure, In. H_2O -.25

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 46 Pre
- ✓ Thermocouple @ 57 Post

IDENTIFICATION NUMBERS

Meterbox N-25 Meterbox Gamma .9908 Reagent Box 616
T/C Readout 77 T/C Probe R154 Umbilical U-99
Sampling Box 25 Orsat Pump N/A Tedlar Bag N/A
Nozzle(s) Actually Used: Pitot DP-8
No. 1005 Diameter .283 No. Diameter

FILTER NO.	TARE
PM125	.2650

Est % H_2O 1

Delta $H_@$ 1.724
Delta H_t .605
Delta H_{t+50} .520
Delta H_{t-50} .748
Delta P_{avg} .104
Meter Temp. 75
Stack Temp. 58

NOZZLE SELECTION CRITERIA

Desired Dia. .270

	Nozzle 1	Nozzle 2
Diameter	.283	
Nozzle Number	1005	
Delta P_{min}	.0215	
Delta P_{max}	.1833	

FYRITE

-

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-4	15	60/0 3	508.31	0.104	0.61	74	1	NA	46	57	57
2			15	515.253	0.104	0.61	75	1	NA	48	57	57
3			30	522.255	0.104	0.61	75	1	NA	48	58	58
4			45	529.23	.104	.61	76	1		48	59	59
5			60/0 4	536.20	.104	.61	76	1		48	59	59
6			15	543.21	.104	.61	76	1		48	59	59
7			30	550.17	.104	.61	76	1		48	59	59
8			45	557.13	.104	.61	77	1		48	60	60
9			60/0 5	564.09	.104	.61	78	1		48	59	59
10			15	571.12	.104	.61	76	1		48	59	59
11			30	578.01	.104	.61	76	1		48	58	58
12			45	585.05	.104	.61	75	1		48	57	57
			60/off 6	592.107								

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

Plant Name VULCAN MATERIALS
City/State SKIPPERS, VA
Sampling Location SCREEN
Date 11-18-92 Team Leader STA Techs
*Train Leak Check Vacuum, In. Hg 15
Train Leak Rate, Cubic Ft./Min. .004

Run Number W-S-M201A-2
Time Start 1020
Time Stop 1622
Job Number 11236
Barometric Pressure, In. Hg 30.4
Static Pressure, In. H_2O -.25

EQUIPMENT CHECKS

NA Pitot, Pretest
NA Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
✓ Thermocouple @ 54 Pre
Thermocouple @ Post

IDENTIFICATION NUMBERS

Meterbox N-25 Meterbox Gamma .9908 Reagent Box
T/C Readout F-77 T/C Probe R154 Umbilical U99
Sampling Box Orsat Pump NA Tedlar Bag NA
Nozzle(s) Actually Used: Pitot NA
No. 1005 Diameter .283 No. Diameter

FILTER NO.	TARE
PM-127	.2669

Est % H_2O 1

Delta $H_@$ 1.724
Delta H_t .610
Delta H_{t+50} .507
Delta H_{t-50} .748
Delta P_{avg} .103
Meter Temp. 75
Stack Temp. 54

NOZZLE SELECTION CRITERIA

Desired Dia. .272

	Nozzle 1	Nozzle 2
Diameter	.283	
Nozzle Number	1005	
Delta P_{min}	.0221	
Delta P_{max}	.1882	

FYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Impinger Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-A	15	0	598.362	.103	.61	50	1	NA	52	54	54
2			15	605.18			58	1		52	55	55
3			30	611.94			68	1		56	57	57
4			45	618.84			72	1		58	58	58
5			60/0 1	625.76			74	1		59	59	59
6			15	632.69			76	1		61	61	61
7			30	639.91			79	1		62	62	62
8			45	646.56			78	1		62	62	62
9			60/0 2	652.49			81	1		60	63	63
10			15	660.30			84	1		60	64	64
11			30	667.45			65	1		60	65	65
12			45	674.42			87	1		60	65	65

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

ENTROPY

METHOD 201A (PM-10) FIELD DATA

Plant Name Vulcan Materials
City/State Skippers VA.
Sampling Location Screen
Date 11-18-92 Team Leader STA Techs
*Train Leak Check Vacuum, In. Hg
Train Leak Rate, Cubic Ft./Min.

Run Number W-S-M201A-2
Time Start
Time Stop
Job Number 11236
Barometric Pressure, In. Hg 30.4
Static Pressure, In. H_2O -.25

EQUIPMENT CHECKS

- N/A Pitot, Pretest
- N/A Pitot, Posttest
- N/A M3 Sampling Sys/Ted Bag
- ✓ Thermocouple @ 54 Pre
- Thermocouple @ ___ Post

IDENTIFICATION NUMBERS

Meterbox N-25 Meterbox Gamma .9908 Reagent Box
T/C Readout F-77 T/C Probe R154 Umbilical U99
Sampling Box Orsat Pump N/A Tedlar Bag N/A
Nozzle(s) Actually Used: Pitot N/A
No. 1005 Diameter .283 No. Diameter

FILTER NO.	TARE
PM-127	0.2669

Est % H_2O 1

Delta $H_@$ 1.724
Delta H_t 0.610
Delta H_{t+50} 0.507
Delta H_{t-50} 0.748
Delta P_{avg} 0.103
Meter Temp. 75
Stack Temp. 54

NOZZLE SELECTION CRITERIA

Desired Dia. .272

	Nozzle 1	Nozzle 2
Diameter	.283	
Nozzle Number	1005	
Delta P_{min}	0.0221	
Delta P_{max}	0.1882	

FYRITE

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-4	15	3	681.395	.103	0.61	87	1	N/A	68	64	64
2			15	688.370			88			70	66	66
3			30	695.367			88			60	67	67
4			45	702.368			88			60	66	66
5			4	709.364			88			60	67	67
6			15	716.355			90			60	68	68
7			30	723.348			90			60	68	68
8			45	730.345			90			60	67	67
9			5	737.325			90			60	67	67
10			15	744.368			90			60	66	66
11			30	751.405			90			60	66	66
12			45	758.437			88			61	65	65
			50	760.850								

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

Plant Name: VULCAN MATERIALS
City/State: SKIPPERS, VA
Sampling Location: SCREEN
Date: 11.19.92 Team Leader: STA Techs:
*Train Leak Check Vacuum, In. Hg: 15
Train Leak Rate, Cubic Ft./Min.: .002

Run Number: W-S-M201A-3
Time Start: 1052
Time Stop: 1717
Job Number: 11236
Barometric Pressure, In. Hg: 30.6
Static Pressure, In. H_2O: -.25

EQUIPMENT CHECKS

NA Pitot, Pretest
NA Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
✓ Thermocouple @ 50 Pre
✓ Thermocouple @ 50 Post

IDENTIFICATION NUMBERS

Meterbox: N-25 Meterbox Gamma: .9908 Reagent Box: 609
T/C Readout: F-77 T/C Probe: R154 Umbilical: U99
Sampling Box: 25 Orsat Pump: NA Tedlar Bag: NA
Nozzle(s) Actually Used: Pitot: NA
No. 1005 Diameter .283 No. Diameter

FILTER NO.	TARE
PM-200	.2708

Est % H_2O: 1

Delta $H_@$	1.724
Delta H_t	.589
Delta H_{t+50}	.489
Delta H_{t-50}	.724
Delta P_{avg}	.104
Meter Temp.	75
Stack Temp.	50

NOZZLE SELECTION CRITERIA

Desired Dia. .271

	Nozzle 1	Nozzle 2
Diameter	.283	
Nozzle Number	1005	
Delta P_{min}	.0220	
Delta P_{max}	.1877	

FYRITE

–

C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps Filter Box, °F	Gas Temps Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-9	15	60/0 3	845.183	.105	.61	83	1	NA	38	57	57
2	↓	↓	15	852.142	↓	↓	84	1	↓	38	58	58
3			30	859.110			84	1		39	58	58
4			45	866.073			83	1		38	58	58
5			60/0 4	873.065			83	1		38	57	57
6			15	880.060			83	1		38	57	57
7			30	887.065			83	1		38	56	56
8			45	894.02			83	1		38	55	55
9			60/0 5	899.94			82	1		40	53	53
10			15	907.78			80	1		40	52	52
11			30	914.61			80	1		40	50	50
12			45	921.53			80	1		40	50	50
			60 6	928.449								

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

METHOD 201A (PM-10) FIELD DATA

Plant Name: VULCAN MATERIALS
City/State: SKIPPERS, VA
Sampling Location: SCREEN
Date: 11.19.92 Team Leader: STA Techs: ____
Run Number: W-S-M201A-3
Time Start: 1052
Time Stop: 1717
Job Number: 11236
*Train Leak Check Vacuum, In. Hg: 15 ____ ____ ____
Train Leak Rate, Cubic Ft./Min.: .002 ____ ____ ____
Barometric Pressure, In. Hg: 30.6
Static Pressure, In. H_2O: -.25

EQUIPMENT CHECKS

NA Pitot, Pretest
NA Pitot, Posttest
NA M3 Sampling Sys/Ted Bag
✓ Thermocouple @ 50 Pre
____ Thermocouple @ 50 Post

IDENTIFICATION NUMBERS

Meterbox: N-25 Meterbox Gamma: .9908 Reagent Box: 609
T/C Readout: F-77 T/C Probe: R154 Umbilical: U99
Sampling Box: 25 Orsat Pump: NA Tedlar Bag: NA
Nozzle(s) Actually Used: Pitot: NA
No. 1005 Diameter .283 No. ____ Diameter ____

FILTER NO.	TARE
PM-200	.2708

Est % H_2O: 1

Delta $H_@$: 1.724
Delta H_t: .589
Delta H_{t+50}: .489
Delta H_{t-50}: .724
Delta P_{avg}: .104
Meter Temp.: 75
Stack Temp.: 50

NOZZLE SELECTION CRITERIA

Desired Dia.: .271

	Nozzle 1	Nozzle 2
Diameter	.283	
Nozzle Number	1005	
Delta P_{min}	.0220	
Delta P_{max}	.1877	

FYRITE

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C_p .84

	Sample Point	Dwell Time, Minutes	Elapsed Time, Minutes	Dry Gas Meter Readings Cubic Feet	Pitot Reading, In. H_2O (ΔP)	Orifice Setting, In. H_2O (ΔH)	Gas Meter Temp, °F	Vacuum Gauge, In. Hg	Gas Temps: Filter Box, °F	Gas Temps: Imping Exit, °F	Cyclone Temp, °F	Stack Temp, °F
1	A-9	15	0	762.306	.105	.61	58	1	NA	40	50	50
2			15	769.15			62	1		40	52	52
3			30	775.91			70	1		40	53	53
4			45	782.79			76	1		40	55	55
5			60/0 1	789.74			80	1		40	55	55
6			15	796.71			80	1		40	56	56
7			30	803.66			74	1		40	57	57
8			45	810.61			80	1		40	58	58
9			60/0 2	817.55			79	1		40	58	58
10			15	824.41			80	1		40	58	58
11			30	831.31			82	1		40	58	58
12			45	838.24			83			40	58	58

* REMOVE HEAD BEFORE POSTTEST LEAK CHECK

ENTROPY

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name Vulcan Materials Job No. 11236

Sampling Location crusher

Start	Stop	Comments/Problems
1020	1041	clean duct
1057	1240	plant down
1305	1634	

Run No. W-C-M201A-1
Date 11-17-92

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

Posttest Leak Rate ______ Sample Appearance ______

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

Start	Stop	Comments/Problems
1020	1050	unit stop
1054	1117	change flex duct
1120	1138	unit stop
1146	1503	stop to take process sample
1308	1622	End run crusher stoped

Run No. W-C-M201A-2
Date 11-18-92

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

Posttest Leak Rate ______ Sample Appearance ______

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

Start	Stop	Comments/Problems
1029	1141	crusher stops
1143	11:46	Crusher Went Down
1215	1630	

Run No. W-C-M201A-3
Date 11-18-92

Sampling Team Initials ~~STA~~ CGM (Team Leader) WKR (Others)

Posttest Leak Rate ______ Sample Appearance ______

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

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ENTROPY

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name Vulcan Materials Job No. 11236

Sampling Location Screen

Start	Stop	Comments/Problems
1115	1215	

Run No. D-S-MZ01A-1

Date 11-16-92

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

Posttest Leak Rate ______ Sample Appearance ______

Good Run (check)? ___YES ___NO (if NO, explain in "Comments/Problems")

Start	Stop	Comments/Problems
1330	1428	
1500	1502	

Run No. D-S

Date ______

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

Posttest Leak Rate ______ Sample Appearance ______

Good Run (check)? ___YES ___NO (if NO, explain in "Comments/Problems")

Start	Stop	Comments/Problems
1527	1627	

Run No. ______

Date ______

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

Posttest Leak Rate ______ Sample Appearance ______

Good Run (check)? ___YES ___NO (if NO, explain in "Comments/Problems")

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name ____________ Job No. ______

Sampling Location ____________

Start	Stop	Comments/Problems
1020	1240	PROCESS DOWN
1250	1630	END TEST.

Run No. W-S-MZ01A-1

Date 11-16-92

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

Posttest Leak Rate .002 Sample Appearance ______

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

Start	Stop	Comments/Problems
1020	1118	
1120	1139	
1146	1622	

Run No. ______

Date ______

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

Posttest Leak Rate ______ Sample Appearance ______

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

Start	Stop	Comments/Problems

Run No. ______

Date ______

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

Posttest Leak Rate ______ Sample Appearance ______

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

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ENTROPY

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name Vulcan Material Job No. 11236

Sampling Location crusher

Run No. D-C-M201A-1

Date 11/16/92

Start	Stop	Comments/Problems
1006	1029	unit stopped
1106	1130	unit stopped
1137	1150	End run

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

Posttest Leak Rate .006 Sample Appearance ________

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

Run No. D-C-M201A-2

Date 11-16-92

Start	Stop	Comments/Problems
1215	1222	unit stopped
1223	1300	stopped unit to take sample
1305	1310	unit stopped
1327	1337	End Run

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

Posttest Leak Rate .004 Sample Appearance ________

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

Run No. D-C-M201A-3

Date 11-16-92

Start	Stop	Comments/Problems
1355	1427	unit down
1500	1528	End run

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

Posttest Leak Rate .004 Sample Appearance ________

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

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name Vulcan Materials Job No. 11236

Sampling Location crusher

Run No. W-C-M201A-1

Date 11-17-92

Start	Stop	Comments/Problems
1020	1041	clean duct
1057	1240	plant down
1305	1634	

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

Posttest Leak Rate ______ Sample Appearance ______

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

Run No. W-C-M201A#2

Date 11-18-92

Start	Stop	Comments/Problems
1020	1050	unit stop
1054	1117	change flue duct
1120	1138	unit stop
1146	1503	stop to take process sample
1308	1622	End run crusher stoped

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

Posttest Leak Rate ______ Sample Appearance ______

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

Run No. W-C-M201A-3

Date 11-18-92

Start	Stop	Comments/Problems
1029	1141	crusher stops
1143	1146	Crusher Went Down
1215	1630	

Sampling Team Initials ~~STA~~ CGM (Team Leader) WKR (Others)

Posttest Leak Rate .000 Sample Appearance ______

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

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EASTERN

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name Vulcan Materials Job No. 11736

Sampling Location Screen

Run No. D-S-MZ01A-1

Date 11-16-92

Start	Stop	Comments/Problems
1115	1215	

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

Posttest Leak Rate ______ Sample Appearance ______

Good Run (check)? ___YES ___NO (if NO, explain in "Comments/Problems")

Run No. D-S

Date ______

Start	Stop	Comments/Problems
1330	1428	
1500	1502	

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

Posttest Leak Rate ______ Sample Appearance ______

Good Run (check)? ___YES ___NO (if NO, explain in "Comments/Problems")

Run No. ______

Date ______

Start	Stop	Comments/Problems
1527	1627	

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

Posttest Leak Rate ______ Sample Appearance ______

Good Run (check)? ___YES ___NO (if NO, explain in "Comments/Problems")

FIELD TEST LOG (USE REVERSE SIDE ALSO)

Plant Name ______ Job No. ______

Sampling Location ______

Run No. W-S-M201A-1

Date 11-16-92

Start	Stop	Comments/Problems
1020	1240	PROCESS DOWN
1250	1630	END TEST.

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

Posttest Leak Rate .002 Sample Appearance ______

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

Run No. ______

Date ______

Start	Stop	Comments/Problems
1020	1118	
1120	1139	
1146	1622	

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

Posttest Leak Rate ______ Sample Appearance ______

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

Run No. ______

Date ______

Start	Stop	Comments/Problems

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

Posttest Leak Rate ______ Sample Appearance ______

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

AIR FLOW RATE DETERMINATIONS

Plant Name VULCAN MATERIALS Run No. C-MZ-1

City/State SKIPPERS, VA Date 11.14.92

Test Location CRUSHER Personnel STA, CGM

Barometric Pres. (Pbar) 30.4 In. Hg Static Pres. (Pg) ______ In. H_2O

Pitot/Orifice ID HH-60-5 Pitot Coef. (Cp) .84 Pres. Gauge Set ID ADM 860

Thermocouple ID RZ10 Duct Length/Diameter ______ Width ______

--Specify inches (") or feet (')--

VELOCITY TRAVERSES
Start-Finish Times: ______ - ______

Point No.	ΔP In. H_2O	Temp. °F
A-1	.46	50
2	.47	
3	.51	
4	.51	
5	.49	
6	.59	
7	.58	
8	.54	
9	.53	
10	.53	
11	.51	
12	.52	
Avg.*		

ORSAT DATA

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

Bag No. ______ Pump ______

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

F-1023 rev. 7-92

ENTROPY

AIR FLOW RATE DETERMINATIONS

Plant Name ______________________ Run No. WC-N2 1

City/State ______________________ Date 11-19-92

Test Location ______________________ Personnel ______________________

Barometric Pres. (Pbar) ________ In. Hg   Static Pres. (Pg) -.817 In. H_2O

Pitot/Orifice ID ________ Pitot Coef. (Cp) ____ Pres. Gauge Set ID ________

Thermocouple ID ________ Duct Length/Diameter ________ Width ________

--Specify inches (") or feet (')--

VELOCITY TRAVERSES
Start-Finish Times: 802 - 812

Point No.	ΔP In. H_2O	Temp. °F
A-1	.6891	34
2	.699	
3	.651	
4	.685	
5	.761	
6	.743	
7	.748	
8	.755	
9	.732	
10	.720	
11	.642	
12	.619	
Avg.*		

ORSAT DATA

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

Bag No. ________ Pump ________

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root.   See page 2 for field flow rate calculations.

F-1023 rev. 7-92

ENTROPY

AIR FLOW RATE DETERMINATIONS

Plant Name Vulcan Material Run No. V-C-M2-2

City/State Skippers Va Date 11-18-92

Test Location Crusher Personnel

Barometric Pres. (Pbar) 30.4 In. Hg Static Pres. (Pg) -.81 In. H_2O

Pitot/Orifice ID Pitot Coef. (Cp) .84 Pres. Gauge Set ID MM

Thermocouple ID R224 Duct Length/Diameter 12 Width
--Specify inches (") or feet (')--

VELOCITY TRAVERSES
Start-Finish Times: -

Point No.	ΔP In. H_2O	Temp. °F
A 1	.66	45
2	.70	
3	.67	
4	.68	
5	.74	
6	.73	
7	.73	
8	.76	
9	.74	
10	.70	
11	.61	
12	.61	
Avg.*		

ORSAT DATA

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

Bag No. ________ Pump ________

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

F-1023 rev. 12-91

ENTROPY

AIR FLOW RATE DETERMINATIONS

Plant Name Vulcan Materials   Run No. W-C-M2-3

City/State Skippers Va.   Date 11-19-92

Test Location Crusher   Personnel ______

Barometric Pres. (Pbar) 30.4 In. Hg   Static Pres. (Pg) ______ In. H_2O

Pitot/Orifice ID ______   Pitot Coef. (Cp) ____   Pres. Gauge Set ID ______

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

VELOCITY TRAVERSES
Start-Finish Times: 855 - 905

Point No.	ΔP In. H_2O	Temp. °F
A 1	.67	50
2	.71	50
3	.65	50
4	.67	↓
5	.72	
6	.75	
7	.75	
8	.72	
9	.71	
10	.73	
11	.60	
12	.60	
Avg.*		

ORSAT DATA

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

Bag No. ______   Pump ______

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root.   See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name: Vulcan Materials Run No.: S-MZ-1
City/State: Skippers, VA Date: 11-14-92
Test Location: Screen Personnel: STA, CGM
Barometric Pres. (Pbar): 30.4 In. Hg Static Pres. (Pg): -.25 In. H_2O
Pitot/Orifice ID: HH-60-8 Pitot Coef. (Cp): .84 Pres. Gauge Set ID: ADM 860
Thermocouple ID: R303 Duct Length/Diameter: ____ Width: ____
--Specify inches (") or feet (')--

VELOCITY TRAVERSES
Start-Finish Times: ____ - ____

Point No.	ΔP In. H_2O	Temp. °F
A-1	.079	38 AMB
2	.085	
3	.088	
4	.076	
5	.091	
6	.102	
7	.104	
8	.110	
9	.108	
10	.109	
11	.112	
12	.116	
Avg.*		

ORSAT DATA

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

Bag No. ____ Pump ____

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

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ENTROPY

AIR FLOW RATE DETERMINATIONS

Plant Name VULCAN MATERIALS Run No. W-S-MZ-1
City/State SKIPPERS, VA Date 11-~~17~~-92
Test Location SCREEN Personnel STA, CGM
Barometric Pres. (Pbar) 30.4 In. Hg Static Pres. (Pg) -.239 In. H_2O
Pitot/Orifice ID DP-8 Pitot Coef. (Cp) .84 Pres. Gauge Set ID ADM-860
Thermocouple ID R154 Duct Length/Diameter ______ Width ______
--Specify inches (") or feet (')--

VELOCITY TRAVERSES
Start-Finish Times: 818 - 825

Point No.	ΔP In. H_2O	Temp. °F
A-1	.098	36
2	.102	
3	.097	
4	.104	
5	.093	
6	.105	
7	.107	
8	.111	
9	.112	
10	.108	
11	.111	
12	.109	
Avg.*		

ORSAT DATA

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

Bag No. ______ Pump ______

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name VULCAN MATERIALS Run No. W-S-M2-2

City/State SKIPPERS VA Date 11-18-92

Test Location SCREEN Personnel STA, CGM

Barometric Pres. (Pbar) 30.4 In. Hg Static Pres. (Pg) -.25 In. H_2O

Pitot/Orifice ID HH-60-5 Pitot Coef. (Cp) .84 Pres. Gauge Set ID ADM 860

Thermocouple ID R210 Duct Length/Diameter ______ Width ______

--Specify inches (") or feet (')--

VELOCITY TRAVERSES
Start-Finish Times: 910 - 920

Point No.	ΔP In. H_2O	Temp. °F
A-1	.101	454
2	.110	
3	.102	
4	.103	
5	.095	
6	.097	
7	.102	
8	.105	
9	.105	
10	.111	
11	.104	
12	.105	
Avg.*		

ORSAT DATA

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

Bag No. ________ Pump ________

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

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ENTROPY

AIR FLOW RATE DETERMINATIONS

Plant Name VULCAN MATERIALS Run No. W-S-MZ-3

City/State SKIPPERS, VA Date 11-19 92

Test Location SCREEN Personnel CGM, STA

Barometric Pres. (Pbar) 30.6 In. Hg Static Pres. (Pg) -.25 In. H_2O

Pitot/Orifice ID HH-60-5 Pitot Coef. (Cp) .84 Pres. Gauge Set ID ADM860

Thermocouple ID R210 Duct Length/Diameter ______ Width ______

--Specify inches (") or feet (')--

VELOCITY TRAVERSES
Start-Finish Times: 840 - 850

Point No.	ΔP In. H_2O	Temp. °F
A-1	.104	50
2	.098	
3	.099	
4	.101	
5	.096	
6	.107	
7	.101	
8	.115	
9	.105	
10	.113	
11	.107	
12	.105	
Avg.*		

ORSAT DATA

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

Bag No. ______ Pump ______

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

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ENTROPY

AIR FLOW RATE DETERMINATIONS

Plant Name Vulcan Materials Run No. IN-C-M2-1

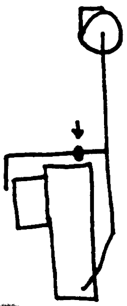
City/State Skippers, Va Date 11/18/92

Test Location Inlet to crusher 3' from Tee Personnel TTB/WKK

Barometric Pres. (Pbar) 30.4 In. Hg Static Pres. (Pg) -.5934 In. H_2O

Pitot/Orifice ID STANDARD/S Type Pitot Coef. (Cp) .99/.84 Pres. Gauge Set ID ADM-860

Thermocouple ID ADM-860/62°F Duct Length/Diameter 12" Dia Width ______
--Specify inches (") or feet (')--



VELOCITY TRAVERSES
Start-Finish Times: 10:00 - 11:00

Point No.	ΔP In. H_2O	~~Temp. °F~~ STANDARD Pitot ft/min
A-1	.1242	1322
2	.1582	1327
3	.1534	1362
4	.1551	1343
5	.1914	1339
6	.1955	1371
B-1	.1856	1191
2	.2085	1321
3	.1726	1327
4	.1787	1393
5	.1648	1413
6	.1811	1405
Avg.*	.1717	1343

ORSAT DATA

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

Bag No. ______ Pump ______

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

Dry at Standard Conditions, Qsd = SCFM

Wet at Stack Conditions, Qaw = ACFM

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

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22.38 ft/sec

AIR FLOW RATE DETERMINATIONS

Plant Name Vulcan Materials   Run No. OUT-C-M2-1

City/State Skippers, Va   Date 11/18/92

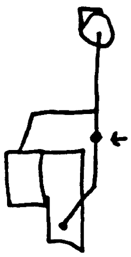
Test Location Outlet of crusher 3' from tee   Personnel JTB/WKK

Barometric Pres. (Pbar) 30.4 In. Hg   Static Pres. (Pg) -.6505 In. H_2O

Pitot/Orifice ID STANDARD/STYPE Pitot Coef. (Cp) .99/.84 Pres. Gauge Set ID ADM-860

Thermocouple ID ADM860 - 62° F   Duct Length/Diameter 12" DIA   Width ______

--Specify inches (") or feet (')--



VELOCITY TRAVERSES
Start-Finish Times: 1000 - 11:00

Point No.	ΔP In. H_2O	Temp. °F
A-1	.1721	1280
2	.1722	1374
3	.1304	1364
4	.1864	1280
5	.1669	1385
6	.1589	1319
B-1	.2239	1233
2	.2035	1334
3	.1899	1433
4	.2120	1435
5	.1601	1297
6	.1614	1230
Avg.*	.1773	1330

ORSAT DATA

Sampling Time	Analysis Time	CO_2 (A) Reading	O_2 (B) Reading	$\%O_2$ (B-A)	$\%CO+N_2$ (100-B)
STANDARD	Pitot	ft/MIN			
	Average				

Bag No. ______ Pump ______

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

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

MOISTURE DATA (STOICHIOMETRIC)

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

VOLUMETRIC AIR FLOW RATES

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

ADDITIONAL DATA

* ΔP average is square of average square root.   See page 2 for field flow rate calculations.

22.17 ft/sec

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APPENDIX C

CALIBRATION DATA SHEETS

ISOKINETIC METERBOX FULLTEST CALIBRATION

Meterbox No. N24

Calibrated By FGM

Date 8-19-92

Barometric Pressure (P_b) 29.65 (In. Hg)

Standard Meter No. 1017057

Standard Meter Coeff. (Y_{ds}) .9868

STANDARD METER			METERBOX METERING SYSTEM				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (θ) Min.	Orifice Setting (ΔH) In. H_2O	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H@$ In. H_2O
5.195	74	13	0.5	5.345	87	.9812	1.802
5.231		13	0.5	5.384	87	.9809	1.777
5.453		7	2.0	5.641	99	.9936	1.815
5.371		7	2.0	5.577	100	.9928	1.863
5.915		5	4.8	6.090	101	.9951	1.882
5.901		5	4.8	6.102	102.5	.9934	1.886
					Average	.9895	1.838

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

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

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

ISOKINETIC METERBOX FULLTEST CALIBRATION

Meterbox No. N25

Calibrated By PJ

Date 7-1-92

Barometric Pressure (P_b) 29.47 (In. Hg)

Standard Meter No. 683323

Standard Meter Coefficient .9980

STANDARD METER			METERBOX METERING SYSTEM				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (Θ) Min.	Orifice Setting (ΔH) In. H2O	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	ΔH@ In. H_2O
5.277	77	13	0.5	5.491	91.5	.9838	1.723
5.255	↓	13	0.5	5.470	92	.9843	1.736
5.717		7	2.0	5.940	94.5	.9869	1.693
5.707		7	2.0	5.938	97	.9900	1.692
8.661		7	4.8	8.926	100	.9979	1.753
6.182		5	4.8	6.376	102.5	1.0016	1.748
					Average	.9908	1.724

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

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

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

R-0030 rev. 10-91

ENTROPY

ISOKINETIC METERBOX POSTTEST CALIBRATION

METERBOX NO. N24

Date 11-23-92 Calibrated By PJ Job Number 11236

Barometric Pressure (P_b) 29.36 (In. Hg) Meterbox Vacuum 2 (In. Hg)

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

STANDARD METER			METERBOX METERING SYSTEM				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (θ) Min.	Orifice Setting (ΔH) In. H_2O	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H@$ In. H_2O
5.666	73	13	0.6	5.899	84.5	.9759	1.803
5.473	↓	↓	↓	5.881	95.5	.9647	1.894
5.472	↓	↓	↓	5.899	97.5	.9650	1.888
					Average	.9685	1.862

Fulltest Y_d .9895 Date 8-19-92 % Dev. 2.1 Allowed Dev.: ± 5%

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

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

ISOKINETIC METERBOX POSTTEST CALIBRATION

METERBOX NO. N25

Date 11-20-92 Calibrated By PJ Job Number 11236

Barometric Pressure (P_b) 30.6 (In. Hg) Meterbox Vacuum 1.0 (In. Hg)

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

STANDARD METER			**METERBOX METERING SYSTEM**				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (θ) Min.	Orifice Setting (ΔH) In. H_2O	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H@$ In. H_2O
5.830	69	13	0.6	6.086	90	.9925	1.588
5.832	↓	↓	↓	6.093	91	.9875	1.584
5.836	↓	↓	↓	6.102	92	.9886	1.579
					Average	.9895	1.584

Fulltest Y_d .9908 Date 7-1-92 % Dev. 0.1 Allowed Dev.: ± 5%

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

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

STANDARD DRY GAS METER CALIBRATION

Meter Number 1017057

Date 2-11-92 Auditor(s) MBC/PJ Barometric Press. (P_{bar}) 30.1

Spirometer Gas Volume Cubic Feet (V_s)	Spirometer Temp. °F (t_s)	Dry Gas Meter Gas Volume Cubic Feet (V_{ds})	Dry Gas Meter Temp. °F (t_{ds})	Pressure In. H_2O (ΔP)	Time Min. (Θ)	Test Flow Rate cfm	Calc'd Flow Rate cfm (Q)	Meter Coeff. Gamma (Y_{ds})
2.641	73.4	2.655	70	-.29	10	0.23	.2629	.9891
2.587	73.4	2.593	70	-.29		0.23	.2575	.9920
2.668	75.2	2.644	71	-.30		0.23	.2647	1.0019
3.934	75.2	3.978	72	-.53		0.55	.3903	.9843
3.907	75.2	3.935	72	-.53		0.55	.3876	.9882
3.944	75.2	3.971	72	-.54		0.55	.3913	.9886
4.663	75.2	4.749	73	-.69		0.80	.4626	.9795
4.690	75.2	4.738	73	-.70		0.80	.4653	.9875
4.699	75.2	4.731	73	-.71		0.80	.4662	.9909
7.614	75.2	7.764	73	-1.60		2.10	.7554	.9805
7.687	75.2	7.858	73	-1.61		2.10	.7626	.9781
7.769	75.2	7.883	73	-1.62		2.10	.7708	.9854
9.954	73.4	10.193	73	-2.60		3.45	.9909	.9821
10.000	73.4	10.220	73	-2.62		3.45	.9954	.9840
10.046	73.4	10.260	73	-2.61		3.45	1.000	.9847
11.876	73.4	12.082	73	-3.60		4.70	1.182	.9909
11.894	73.4	12.069	72	-3.60		4.70	1.184	.9916
11.858	73.4	12.098	72	-3.60		4.70	1.180	.9863
13.115	73.4	13.377	72	-4.32		5.80	1.306	.9883
13.097	75.2	13.368	72	-4.36		5.80	1.299	.9844
13.097	75.2	13.370	72	-4.40		5.80	1.299	.9843
							Average	.9868

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

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

R-0047 rev. 9-91

ENTROPY

STANDARD DRY GAS METER CALIBRATION

Meter Number 1054682

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

Spirometer Gas Volume Cubic Feet (V_s)	Spirometer Temp. °F (t_s)	Dry Gas Meter Gas Volume Cubic Feet (V_{ds})	Dry Gas Meter Temp. °F (t_{ds})	Pressure In. H_2O (ΔP)	Time Min. (Θ)	Test Flow Rate cfm	Calc'd Flow Rate cfm (Q)	Meter Coeff. Gamma (Y_{ds})
2.760	75.2	2.764	79.5	-.27	10	0.23	.2698	1.0071
2.732	75.2	2.724	79	-.28		0.23	.2671	.9926
2.714	76.1	2.730	78.5	-.27		0.23	.2649	.9993
4.126	77	4.167	78	-.47		0.55	.3654	.9931
4.162	77	4.155	78	-.49		0.55	.4055	1.0048
4.135	77	4.135	77.5	-.50		0.55	.4029	1.0021
4.891	77	4.932	77	-.61		0.80	.4765	.9931
4.909	77	4.912	77	-.63		0.80	.4783	1.0009
4.891	77	4.932	77	-.61		0.80	.4675	.9950
7.796	77	7.850	77	-1.30		2.10	.7596	.9982
7.796	77	7.865	77.5	-1.30		2.10	.7596	.9954
7.805	77	7.842	78	-1.30		2.10	.7605	1.0004
9.945	78.8	10.042	78.5	-2.00		3.45	.9657	.9948
9.927	78.8	10.013	78	-2.00		3.45	.9640	.9904
9.945	78.8	10.042	78	-2.00		3.45	.9657	.9938
11.603	78.8	11.724	79	-2.60		4.70	1.1267	.9965
11.576	78.8	11.726	79	-2.60		4.70	1.1241	.9939
11.521	78.8	11.694	79	-2.60		4.70	1.1187	.9891
12.732	78.8	12.910	79	-3.10		5.80	1.2364	.9942
12.778	78.8	12.983	79	-3.20		5.80	1.2408	.9924
12.714	78.8	12.928	79	-3.15		5.80	1.2346	.9916
							Average	.9961

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

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

STANDARD DRY GAS METER CALIBRATION

Meter Number 6838323

Date 2-12-92 Auditor(s) MBC/PJ Barometric Press. (P_{bar}) 30.11

Spirometer Gas Volume Cubic Feet (V_s)	Spirometer Temp. °F (t_s)	Dry Gas Meter Gas Volume Cubic Feet (V_{ds})	Dry Gas Meter Temp. °F (t_{ds})	Pressure In. H_2O (ΔP)	Time Min. (Θ)	Test Flow Rate cfm	Calc'd Flow Rate cfm (Q)	Meter Coeff. Gamma (Y_{ds})
2.723	73.4	2.736	72	-.30	10	0.23	.2711	.9925
2.732	73.4	2.705	72	-.30		0.23	.2720	1.0081
2.796	73.4	2.759	72	-.31		0.23	.2784	1.0115
4.199	73.4	4.186	73	-.57		0.55	.4181	1.0010
4.190	73.4	4.201	73	-.58		0.55	.4175	.9980
4.217	74.3	4.172	73	-.58		0.55	.4199	1.0115
4.982	75.2	5.008	73	-.75		0.80	.4944	.9925
5.018	75.2	5.001	73	-.76		0.80	.4980	1.0011
4.973	75.2	5.006	74	-.76		0.80	.4935	.9930
7.814	75.2	7.838	74	-1.60		2.10	.7755	.9987
7.823	75.2	7.818	74	-1.62		2.10	.7764	1.0024
7.787	75.2	7.864	74	-1.62		2.10	.7728	.9919
10.064	75.2	10.134	74	-2.56		3.45	.9988	.9970
10.073	75.2	10.073	74	-2.60		3.45	.9997	.9962
10.055	75.2	10.114	74	-2.61		3.45	.9979	.9983
11.831	75.2	11.929	74	-3.50		4.70	1.174	.9981
11.767	76.1	11.914	74	-3.50		4.70	1.166	.9923
11.790	77.0	11.905	74	-3.50		4.70	1.166	.9933
13.179	77.0	13.311	74	-4.32		5.80	1.304	.9950
13.133	77.0	13.282	74	-4.32		5.80	1.299	.9938
13.069	77.0	13.259	74	-4.32		5.80	1.293	.9907
							Average	.9980

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

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

R-0047 rev. 9-91

ENTROPY

CALIBRATION DATA CHECKLIST

ISOKINETIC METERBOXES

Meterbox Number	Full Test	Field Audit	Post Test	Meterbox Number	Full Test	Field Audit	Post Test
9895 ~~N24~~							
9908 ~~N25~~							

STANDARD METERS (For Above)

Yds ______ Yds ______ Yds ______ Yds ______

NONISOKINETIC METERBOXES

Meterbox Number	Pre Test	Post Test	Meterbox Number	Pre Test	Post Test

NOZZLES (Initial Calibration)

Nozzle Number	Dia.	Nozzle Number	Dia.	Nozzle Number	Dia.	Nozzle Number	Dia.
1012	.187						
1005	.283						
1001	.167						

PITOTS (Initial Calibration)

Pitot No.	Pitot No.	Pitot No.	Pitot No.	Pitot No.	Pitot No.

THERMOCOUPLES (Initial Calibration)

Number	Number	Number	Number	Number	Number	Number
R266						
R154						

EQUIPMENT CHECKLIST COMPLETE? ______ GAS CYLINDER CERT. SHEETS REQUESTED? ______

OTHER DEVICES ______

ENTROPY

ISOKINETIC METERBOX FULLTEST CALIBRATION

Meterbox No. N24 Calibrated By FGM

Date 8-19-92 Barometric Pressure (P_b) 29.65 (In. Hg)

Standard Meter No. 1017057 Standard Meter Coeff. (Y_{ds}) .9868

STANDARD METER			METERBOX METERING SYSTEM				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (Θ) Min.	Orifice Setting (ΔH) In. H_2O	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	ΔH@ In. H_2O
5.195	74	13	0.5	5.345	87	.9812	1.802
5.231	↓	13	0.5	5.384	87	.9809	1.777
5.453		7	2.0	5.641	99	.9936	1.815
5.371		7	2.0	5.577	100	.9928	1.863
5.915		5	4.8	6.090	101	.9951	1.882
5.901		5	4.8	6.102	102.5	.9934	1.886
					Average	.9895	1.838

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

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

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

R-0030 rev. 7-92

ENTROPY

ISOKINETIC METERBOX FULLTEST CALIBRATION

Meterbox No. N25

Date 7-1-92

Standard Meter No. 683323

Calibrated By PJ

Barometric Pressure (P_b) 29.47 (In. Hg)

Standard Meter Coefficient .9980

STANDARD METER			METERBOX METERING SYSTEM				
Gas Volume (V_{ds}) cf	Temp. (t_{ds}) °F	Time (Θ) Min.	Orifice Setting (ΔH) In. H20	Gas Volume (V_d) cf	Temp. (t_d) °F	Coeff. (Y_d)	ΔH@ In. H_2O
5.277	77	13	0.5	5.491	91.5	.9838	1.723
5.255		13	0.5	5.470	92	.9843	1.736
5.717		7	2.0	5.940	94.5	.9869	1.693
5.707		7	2.0	5.938	97	.9900	1.692
8.661		7	4.8	8.926	100	.9979	1.753
6.182		5	4.8	6.376	102.5	1.0016	1.748
					Average	.9908	1.724

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

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

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

R-0030 rev. 10-91

ENTROPY

NOZZLE NUMBER: 1001

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
10-26-88	SRD	.167	.168	.168	.167	.168	.168
3-6-92	JPW	.166	.168	.166	.166	.168	.167

NOTE: All diameters measured in inches.

ENTROPY ENVIRONMENTALISTS, INC.

NOZZLE CALIBRATION

NOZZLE NUMBER 1012

Date	Calib. By	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
8-10-91	WLS	.183	.184	.183	.183	.183	.183
3-6-92	JPW	.182	.182	.182	.183	.183	.182
9-3-92	JPW	.188	.188	.187	.186	.187	.187

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

R-0033a rev. 3-91

ENTROPY

NOZZLE NUMBER: 1005

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
10-26-88	SRD	.279	.277	.278	.278	.278	.278
11/15/88	BKG	.290	.292	.291	.292	.292	.292
3/10/89	BKG	.294	.293	.295	.296	.296	.295
3-6-92	JPW	.283	.283	.282	.283	.282	.283

NOTE: All diameters measured in inches.

ENTROPY ENVIRONMENTALISTS, INC.

APPENDIX D

SAMPLING LOG AND CHAIN-OF-CUSTODY RECORDS

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 0551 Assembly Date 11-10 Assembled By J.W-M.M

Plant Name/address ~~National Stone Gtt-~~ SK Vulcan SKippers Job No. 11236

Sampling Loc. Stone crusher Method M201A

Individual Tare Of Reagent 200 (Ml)(gm) Of DI H2O

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

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

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

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
D-6-M201A-1	11/16	PM126	0.2663	✓	CGM	11/16	5	✓	TJB
D-6-M201A-2	11/16	PM171	0.2674	✓	CGM	11/16	5	✓	TJB
D-6-M201A-3	11/16	PM181	0.2733	✓	TJB	11/16	5	✓	CGM

Run 1 — Filter Appearance*: Gray loaded
Reagents Appearance*: clear

Run 2 — Filter Appearance*: ______
Reagents Appearance*: ______

Run 3 — Filter Appearance*: ______
Reagents Appearance*: ______

Run 4 — Filter Appearance*: ______
Reagents Appearance*: ______

* Use "REMARKS" section if needed.

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

REMARKS ______

Custodian ______ Date ______ Time ______

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. N/A Assembly Date 11/ Assembled By

Plant Name/address Vulcan Materials Skippers Va Job No. 11236

Sampling Loc. Screen Ambeignt Method AMB PM10

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

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

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

Individual Tare Of Sil. Gel ______ Gm ______ other (specify)

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
W-S-PM10-1	11/17/92	N/A	2.9405	N/A	TIB	11/17/92	N/A	N/A	TIB
10:20 - 16:30									
W-S-PM10-2	11/18/92	N/A	3.0069	N/A	TIB	11/18/92	N/A	N/A	TIB
10:20 - 16:23									
W-S-PM10-3	11/19/92	N/A	2.9510	N/A	TIB	11/19/92	N/A	N/A	TIB
10:52 - 17:15									

Run W-S-PM10-1:
Filter Appearance* Gray
Reagents Appearance* N/A

Run W-S-PM10-2:
Filter Appearance* Gray
Reagents Appearance*

Run W-S-PM10-3:
Filter Appearance* Grey
Reagents Appearance*

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

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

REMARKS All filters kept in TIB custody locked at all times.

Custodian ______ Date ______ Time ______

Q-1002 rev. 10-91

ENTROPY

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. N/A Assembly Date N/A Assembled By N/A

Plant Name/address Vulcan Materials / Skippers Va Job No. 11236

Sampling Loc. Screen Ambeint Method AMB PM10

Individual Tare Of Reagent ________ (Ml)(gm) of ________

Individual Tare Of Reagent ________ (Ml)(gm) of ________

Individual Tare Of Reagent ________ (Ml)(gm) of ________

Individual Tare Of Sil. Gel ________ Gm ________ other (specify)

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
D-S-PM10-1	11/16/92	N/A	2.9615	N/A	TTB	11/16	N/A	N/A	TTB
11:15 - 12:15				Filter Appearance* Heavy Gray					
				Reagents Appearance*					
D-S-PM10-2	11/16/92	N/A	2.9385	N/A	TTB	11/16	N/A	N/A	TTB
N/A				Filter Appearance* Same					
				Reagents Appearance*					
D-S-PM10-3	11/16/92	N/A	2.945	N/A	TTB	11/16	N/A	N/A	TTB
15:27 - 16:27				Filter Appearance* Same					
				Reagents Appearance*					
				Filter Appearance*					
				Reagents Appearance*					

* Use "REMARKS" section if needed.

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

REMARKS All filters kept locked in TTB possession.

Custodian ________________ Date ________ Time ________

Q-1002 rev. 10-91

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. 0551

Container Type (check) ✓ Reagent Box ___Cooler ___Other ______

Plant Name/Address Vulcan / SK [illegible]

Job No. 11236   Sampling Method M201A (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
027	11-10	10:30	S	Jean Williams	
	11-14	10:43	B	Chad McKay	change trains
123	11-14	11:10	S	Chad McKay	
	11-16	10:15	B	Todd 7. Brozell	charge trains
1393	11-17	10:20	S	Todd 7. Brozell	
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

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

Received by Sample Custodian   **Seal Intact?

[signature] Signature   11-23-92 Date   9:00 Time   ✓ Yes ___No

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

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

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

REMARKS ______

L-0023 rev. 10-91

ENTROPY

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 0561 Assembly Date 11-10-92 Assembled By [illegible]

Plant Name/address Vulcan Materials / Skippers, Va Job No. 11236

Sampling Loc. Crusher (Wet) Method 201A

Individual Tare Of Reagent 200 (Ml)(gm) Of DI H20

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

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

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

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
W-C-M201A-1	11-17-92	151	.2670	✓	KGM	11-17-92	10	✓	CCM
W-C-M201A-2	11-18-92	PMF4	.2737	✓	KGM	11/18/92	30	✓	CGM
W-C-M201A-3	11/19/92			✓	TB	11/19/92	30	✓	TB

Run W-C-M201A-1:

Filter Appearance* Light Gray

Reagents Appearance* Clear

Run W-C-M201A-2:

Filter Appearance* Light Gray

Reagents Appearance* Clear

Run W-C-M201A-3:

Filter Appearance* Light gray

Reagents Appearance* Clear

Filter Appearance* ______

Reagents Appearance* ______

* Use "REMARKS" section if needed.

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

REMARKS ______

Custodian ______ Date ______ Time ______

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. 0561

Container Type (check) ✓ Reagent Box ___Cooler ___Other ______

Plant Name/Address Vulcan Materials

Job No. 11236   Sampling Method M201A   (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
1534	11-10	10:30	S	Jean Williams	
	11-16	240	B	Todd Bozell	Chg. Trains
0344	11-19	17:30	S	Todd T. Bozell	
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

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

Received by Sample Custodian   **Seal Intact?

[signature] Signature   11-23-92 Date   9:00 Time   ✓ Yes ___No

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

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

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

REMARKS ______

L-0023 rev. 10-91

ENTROPY

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 609 Assembly Date 11-10 Assembled By J70/MM

Plant Name/address Vulcan Materials Job No. 11236

Sampling Loc. Screen Method M201A

Individual Tare Of Reagent 200 (Ml)(gm) Of DI H20

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

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

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

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
D-S-201A-1	11/16	~~PM126~~	~~.2663~~	✓	TTB	11/16	5	✓	TTB
		PM 201	.2703						
D-S-201A-2	11/16	~~PM171~~	~~.2674~~	✓	TTB	11/16	3	✓	TTB
		PM111	.2665						
D-S-201A-3	11/16	~~PM181~~	~~.2733~~	✓	TTB	11/16	3	✓	TTB
		PM206	.2740						

Run D-S-201A-1:
Filter Appearance* Gray loaded
Reagents Appearance* Clear

Run D-S-201A-2:
Filter Appearance* Gray Loaded
Reagents Appearance* Clear

Run D-S-201A-3:
Filter Appearance* Gray loaded
Reagents Appearance* Clear

Filter Appearance* ______

Reagents Appearance* ______

* Use "REMARKS" section if needed.

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

REMARKS ______

Custodian ______ Date ______ Time ______

G-1002 rev. 10-91

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. 609

Container Type (check) ✓ Reagent Box ___ Cooler ___ Other ___

Plant Name/Address Vulcan Materials Skippers, Va

Job No. 11236 Sampling Method M201 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
518	11-10	11:45	S	[illegible] Williams	
	11-14	10:45	B	[illegible]	CHARGE TRAINS
1606	11-14	11:10	S	[illegible]	
	11-16	10:10	B	Todd T. Brozell	Chg Train
0077	11-17	10:20	S	Todd T. Brozell	Check paper work
	11-18	10:20	B	Todd T. Brozell	
0995	11-18	10:25	S	Todd T. Brozell	
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

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

Received by Sample Custodian

[illegible] Signature 11-23-92 Date 9:00 Time

**Seal Intact? ✓ Yes ___ No

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

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

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

REMARKS ___

L-0023 rev. 10-91

ENTROPY

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 616 Assembly Date 11-10 Assembled By J20 . MM

Plant Name/address Yuban Materials/Skippers Va Job No. 11236

Sampling Loc. Screen Wet Method 201A

Individual Tare Of Reagent 200 (Ml)(gm) Of DI H_2O

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

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

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

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
WS-M201-1	11-17-92	PM 125	0.2650	✓	CGM	11-17-92	10	✓	CGM

Filter Appearance* Light Gray

Reagents Appearance* Clear

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
W-S-M201A-2	11/18/92	PM127	.2669	✓	CGM	11/18/92	15	✓	CGM

Filter Appearance* Light gray

Reagents Appearance* Clear

Run Number	Run Date	Filter or XAD Number	Filter or XAD Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
W-S-M201A-3	11/19/92	PM200	.2708	✓	TB	11/19/92	25	✓	TB

Filter Appearance* Light gray

Reagents Appearance* Clear

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

Filter Appearance* ______

Reagents Appearance* ______

* Use "REMARKS" section if needed.

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

REMARKS ______

Custodian ______ Date ______ Time ______

E-1002 rev. 10-91

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. 616

Container Type (check) ✓ Reagent Box ___Cooler ___Other ___

Plant Name/Address Vulcan Materials / Skippers, Va

Job No. 1236 Sampling Method M201A (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
223	11/10	10:45	S	Jean Williams	
	17:30	17:30	B	Todd T. Bazzell	Chg Trains
388 n/m	17:30	17:30	S	Todd T. Bazzell	
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

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

Received by Sample Custodian **Seal Intact?

___ Signature ___ Date ___ Time ___Yes ___No

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

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

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

REMARKS ___

L-0023 rev. 10-91

ENTROPY

APPENDIX E

MOISTURE ANALYTICAL DATA

MOISTURE ANALYTICAL RESULTS

Plant Name Vulcan Materials Job No. 11236

City/State Skippers, Va Sampling Loc. Crusher

Run Number	D-C-M201A-1	D-C-M201A-2	D-C-M201A-3
Sampling Date	11/16/92	11/16/92	11/16/92
Analysis Date	11/16/92	11-16-92	11/16/92
Analyst	TTB	TTB	SGM
Reagent 1 (200g H_2O)			
Final Weight, g	569.1	~~568.6~~ 570.4	572.1
Tared Weight, g	572.6	574.2	575.2
Water Catch, g	-3.5	~~5.6~~ -3.8	-3.1
Reagent 2 (____)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 (____)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	212.1	215.3	204.7
Tared Weight, g	207.3	209.7	200.5
ADSORBED WATER, g	4.8	5.6	4.2
TOTAL WATER COLLECTED, g	1.3g	~~0g~~ 1.8	1.1

Balance No. #41 Type (✓) Triple Beam X Electronic ___ Reagent Box No. 551

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

Comments

L-0036 rev. 7-92

ENTROPY

MOISTURE ANALYTICAL RESULTS

Plant Name Valcan Materials Job No. 11236

City/State Skippers, Va Sampling Loc. Crusher (Wet)

Run Number	W-C-M201A-1	W-C-M201A-2	W-C-M201A-3
Sampling Date	11-17-92	11/18/92	11/19/92
Analysis Date	11-17-92	11/18/92	11/19/92
Analyst	TTB	TTB	TTB

Reagent 1 (DI H_2O)			
Final Weight, g	580.0	590.9	590.6
Tared Weight, g	580.9	578.1	579.6
Water Catch, g	-.9	12.8	11.0
Reagent 2 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	234.9	230.0	241.0
Tared Weight, g	209.6	204.0	218.6
ADSORBED WATER, g	25.3	26.0	22.4
TOTAL WATER COLLECTED, g	24.4	38.8	33.4

Balance No. #41 Type (✓) Triple Beam ✓ Electronic ___ Reagent Box No. 561

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

Comments

L-0036 rev. 7-92

ENTROPY

MOISTURE ANALYTICAL RESULTS

Plant Name Vulcan Materials Job No. 1236

City/State Skippers, Va Sampling Loc. Screen (DRY)

Run Number	D-5-M201A-1	D-5-M201A-2	D-5-M201A-3
Sampling Date	11/16/92	11/16/92	11/16/92
Analysis Date	11/16/92	11/16/92	11/16/92
Analyst			

Reagent 1 (200 mls H_2O)			
Final Weight, g	571.3	575.9	548.1
Tared Weight, g	574.8	579.6	550.2
Water Catch, g	-3.5	-3.7	-2.1
Reagent 2 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 (______)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	206.8	217.6	206.8
Tared Weight, g	202.2	213.0	201.4
ADSORBED WATER, g	4.6	4.6	5.4
TOTAL WATER COLLECTED, g	1.1	.9	3.3

Balance No. #41 Type (✓) Triple Beam X Electronic ___ Reagent Box No. 609

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

Comments ____

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ENTROPY

MOISTURE ANALYTICAL RESULTS

Plant Name Vulcan Materials Job No. 11236

City/State Skippers, Va Sampling Loc. Screen

Run Number	W-S-M201A-1	W-S-M201A-2	W-S-M201A-3
Sampling Date	11/17/92	11/18/92	11/19/92
Analysis Date	11/17/92	11/18/92	11/19/92
Analyst	TTB	TTB	TTB
Reagent 1 (200mls H_2O)			
Final Weight, g	528.3	585.5	594.9
Tared Weight, g	535.7	572.3	580.3
Water Catch, g	-7.4	13.2	14.6
Reagent 2 (________)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 (________)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	236.9	239.3	236.3
Tared Weight, g	208.1	212.3	208.4
ADSORBED WATER, g	28.8	27.0	27.9
TOTAL WATER COLLECTED, g	21.4	40.2	42.5

Balance No. 41 Type (✓) Triple Beam X Electronic ___ Reagent Box No. 616

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

Comments ______________________________

L-0036 rev. 7-92

ENTROPY

APPENDIX F

AUDIT DATA SHEETS

SAMPLING EQUIPMENT AUDIT

Plant Name VULCAN MATERIALS Job No. 11236

City/State SKIPPERS, VA Auditor(s) STA

Test Loc. CRUSHER Date 11.14.92

BAROMETER
Entropy In-House Ref. Barometer ________ "Hg vs Field Barometer ________ "Hg

Date Compared ____________ Dev. ______ "Hg (Max. Allowable Dev.: ± 0.1 "Hg)

Field Barometric Pressure Corrected for Test Location Elevation? (√) _____
(Note: deduct 0.1" Hg from local NWS *STATION* pressure for each 100' of test location elevation; example: 29.6 - (300'/100 * 0.1) = 29.3" Hg.)

Ref. Therm. Initial Ambient Temp., °F ____	Allowable Deviation From Ambient	Ambient Temperature, °F				Audit OK (√)
THERMOMETERS *						
Dry Gas Meter	± 5.4 °F	____	(Meterbox No. ______)			____
Impinger Exit	± 2.0 °F	____	____	____	____	____
Filter Box	± 5.4 °F	____	____	____	____	____

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

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

TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK
/		/		/		/		/	

* ± 8.0 °F = ± 1.5% of ambient absolute temperature.
** (± 2.0 °F if used in saturated or water droplet-laden gas stream.)

ISOKINETIC METERBOX I.D. N2A Gamma (Y) .9895 ΔH@ 1.838

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

Barometric Pressure (P_{bar}) 30.4 Auditor STA Date 11.14.92

Dry Gas Meter Reading (Cubic Ft.)	Meter Temperature (°F)	Lower and Upper Limits for Audit Gamma
Final 640.163	Final 70	0.96 * Y = .94992
Initial 632.800	Initial 65	1.04 * Y = 1.02908

Dry Gas Volume Metered (Cubic Ft.)	Average Meter Temp. (°F)	Run Time (Base = 10) (Minutes)	Run Time (Base = 10) (Seconds)
Vm = 7.364	Tm = 67.5	10	0

0.75 = Ideal Sampling Rate

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

$$Y_c = \frac{[10 + (0 / 60)]}{7.364} * \left[\frac{0.0319\ (67.5 + 460)}{30.4}\right]^{.5} = 1.0103$$

Audit Gamma

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

F-1113 rev. 7-92

ENTROPY

SAMPLING EQUIPMENT AUDIT

Plant Name Vulcan Materials Job No. 11236
City/State Skippers, Va Auditor(s) STA
Test Loc. Screen Date 11/14/92

BAROMETER
Entropy In-House Ref. Barometer ________ "Hg vs Field Barometer ________ "Hg
Date Compared ____________ Dev. ______ "Hg (Max. Allowable Dev.: ± 0.1 "Hg)
Field Barometric Pressure Corrected for Test Location Elevation? (√) ____
(Note: deduct 0.1" Hg from local NWS *STATION* pressure for each 100' of test location elevation; example: 29.6 - (300'/100 * 0.1) = 29.3" Hg.)

Ref. Therm. Initial Ambient Temp., °F ____	Allowable Deviation From Ambient	Ambient Temperature, °F				Audit OK (√)
THERMOMETERS *						
Dry Gas Meter	± 5.4 °F	____	(Meterbox No. ______)			____
Impinger Exit	± 2.0 °F	____	____	____	____	____
Filter Box	± 5.4 °F	____	____	____	____	____

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

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

TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK	TC No. / °F	√ OK
/		/		/		/		/	

* ± 8.0 °F = ± 1.5% of ambient absolute temperature.
** (± 2.0 °F if used in saturated or water droplet-laden gas stream.)

ISOKINETIC METERBOX I.D. N25 Gamma (Y) .9908 ΔH@ 1.724
As Applicable (check): Zero Magnehelics? √ Zero/Level Manometer? ____
Barometric Pressure (P_{bar}) 30.4 Auditor STA Date 11.14.92

Dry Gas Meter Reading (Cubic Ft.)	Meter Temperature (°F)	Lower and Upper Limits for Audit Gamma
Final 230.446	Final 60	0.96 * Y = .9512
Initial 223.000	Initial 54	1.04 * Y = 1.0304

Dry Gas Volume Metered (Cubic Ft.)	Average Meter Temp. (°F)	Run Time (Base = 10) (Minutes)	(Seconds)
Vm = 7.446	Tm = 57	10	0

0.75 = Ideal Sampling Rate

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

$$Y_c = \frac{[10 + (0 / 60)]}{7.446} * \left[\frac{0.0319\ (57 + 460)}{30.4}\right]^{.5} = .9892$$

Audit Gamma

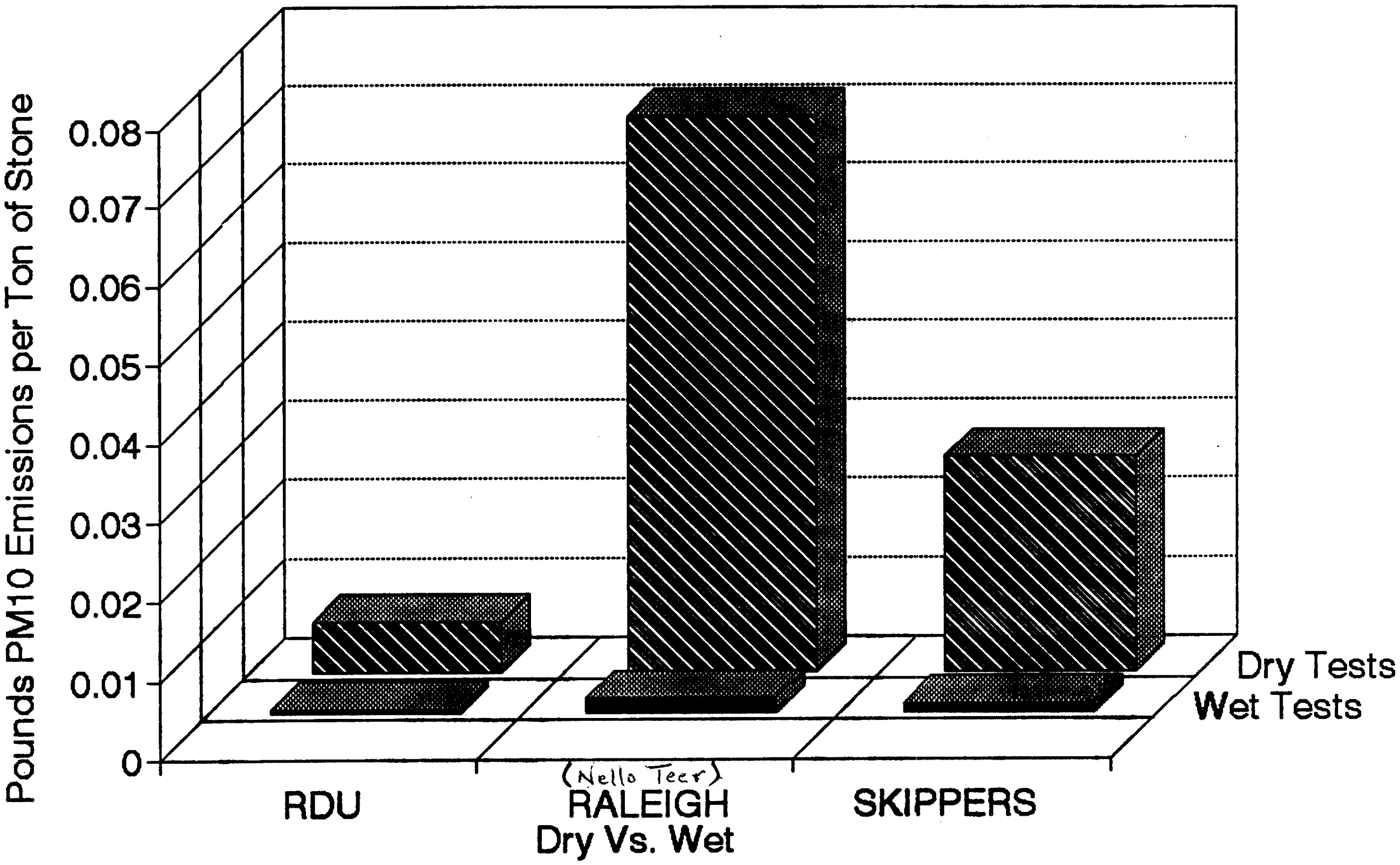
Audit Gamma Acceptable (between lower & upper limits)? (√) ✓ Yes ____ No

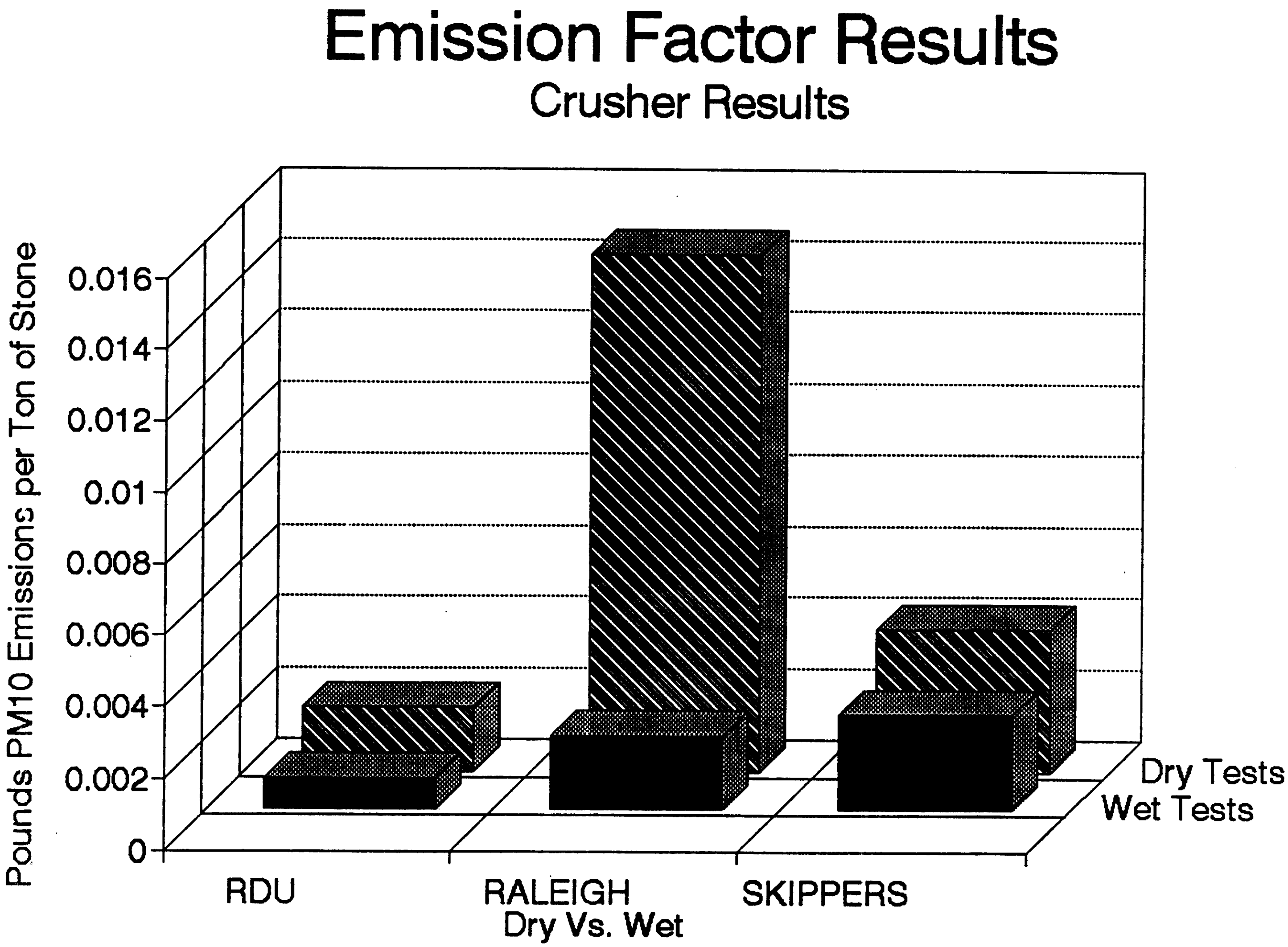
F-1113 rev. 7-92

ENTROPY

Emission Factor Results

Deister Screen Results




Emission Factor Results
Crusher Results
Pounds PM10 Emissions per Ton of Stone
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
RDU
RALEIGH
SKIPPERS
Dry Vs. Wet
Dry Tests
Wet Tests

Screen

	Dry	Wet
RDU	0.00618	0.00054
RALEIGH	0.07041	0.00184
SKIPPERS	0.02701	0.00103

Crusher

	Dry	Wet
RDU	0.001758	0.000832
RALEIGH	0.01446	0.00203
SKIPPERS	0.00397	0.0026