Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP42 Section:	11.19.1
Reference:	11
Title:	Source Emissions Compliance Test Report, Number Two Sand Dryer, Jesse S. Morie & Son, Inc., Mauricetown, New Jersey, Roy F. Weston, Inc., West Chester, PA, August 1987.

SAND & GRAVEL
REF. 11 (BR) and AP-42

Let's protect our earth

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
CN 027, TRENTON, N.J. 08625

JORGE H. BERKOWITZ, Ph.D.
DIRECTOR

(609) 292-5383

March 17, 1988

MEMORANDUM

"Morie CO"

TO: Don Patterson

FROM: Edward Choromanski

SUBJECT: The Morie Company, Inc.
Commercial Township, New Jersey
APC ID No. 75027
NJ Stack No. 002

Emission tests were conducted at the above referenced facility on July 29, 1987. The purpose of the tests was to determine thee particulate and NO_x emissions from the No. 2 Sand Dryer (NJ Stack No. 002) and determine if the source was within the standards stated on Permit No. 75378.

Frank Papp reviewed the final emission tests report. His review indicates that the particulate emission rates were within the standards stated on Permit No. 75378, during all test runs. However, the nitrogen oxides tests were inconclusive. The consultant employed a test procedure with a detectable limit above the actual NO_x concentration found in the stack. Thus, no results for the NO_x were determined. Since no one individual knew before hand what the actual NO_x concentration was, the standard EPA Method 7 was conducted.

From the results of the stack tests, the company filed for an amendment to Permit No. 75378 for increase NO_x emissions in the order of 25 lbs/hr. They figured this number based on the detection limit of the test procedure listed.

Based on the results of the emission tests, the following action is recommended.

1) Keep Certificate No. 75378 temporary since the company has failed to demonstrate actual NO_x emissions required by the permit.

2) Require the company to conduct additional NO_x tests using EPA Method 7D or 7E which have a detection limit of 1 ppm.

3) Deny the new permit application submitted by the company for higher NO_x emissions.

c Milt Polakovic
Harold Christiff
Rich Craig
Julius Trivald
Frank Papp

Let's protect our earth

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
CN 027
TRENTON, N.J. 08625

MARCH 15, 1988

MEMORANDUM

TO: EDWARD CHOROMANSKI

FROM FRANK PAPP

SUBJECT: THE MORIE COMPANY, INC.
COMMERCIAL TWP., N.J.
NJDEP ID No. 75027

On July 29, 1987 stack tests for particulate and NOx were conducted on the #2 Sand Dryer/Cooler Stack (P&Ct No. 75378) at the Morie Company Inc. of Commercial Township, N.J. by Roy F. Weston, Inc. of West Chester, Pa.. The results reported are as follows:

	RUN 1	RUN 2	RUN 3	ALLOWABLE
PARTICULATE				
-GRAINS/DSCF	.0035	.0034	.0008	
-LBS/HR	1.51	1.42	.36	11.0
NOx				
-PPMV	<69	<71	<70	
-LB/HR	<25	<25	<25	2.72
PRODUCTION				
-TONS/HR	93.1	92.7	90.2	100

Technical Services calculations using the raw data supplied produced substantially the same results.

These tests indicate that emissions from the #2 Sand Dryer/Cooler Stack (P&Ct. No. 75378) were within the standards for particulate on all three sample runs. The NOx tests were essentially meaningless, since the lower detectable limit of the analytical method employed was above the permit allowable.

SOURCE EMISSIONS COMPLIANCE TEST REPORT
NUMBER TWO SAND DRYER
JESSE S. MORIE & SON, INC.
MAURICETOWN, NEW JERSEY

W.O.# 2373-01-02

AUGUST 1987

Jeffrey D. O'Neill
Section Manager

Barry L. Jackson
Project Manager
Air Quality Testing Services

Prepared by:
ROY F. WESTON, INC.
Weston Way
West Chester, PA 19380
(215) 692-3030

DRAFT COPY

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SUMMARY

Jesse S. Morie and Son, Inc. (MORIE) contracted Roy F. Weston, Inc. (WESTON) to conduct a source emissions compliance testing and analysis program on the Number Two Sand Dryer Baghouse Stack located at its Mauricetown, New Jersey Plant.

The primary objective of the survey was to determine particulate and oxides of nitrogen (NO_x) concentrations and mass rates exiting the baghouse in order to establish the compliance status of the source with applicable New Jersey Department of Environmental Protection (DEP) air pollution regulations. A series of three baghouse outlet (stack) particulate and NO_x tests was conducted during this program.

Particulate and NO_x emission compliance test results are summarized in Table 1.

All testing procedures conformed to the U.S. Environmental Protection Agency (EPA) and NJDEP protocols.

JESSE S. MORIE & SON, INC.

MAURICETOWN, NEW JERSEY

TABLE 1

SUMMARY OF COMPLIANCE TEST RESULTS FOR NO. 2 SAND DRYER

Source	Test Run No.	Test Date	Measured Particulate Emissions		NJ Allowable Particulate Emissions	Measured NO_x Emissions		NJ Allowable NO_x Emissions
			Concentration gr/dscf[1]	Mass Rate lbs/hr	Mass Rate lbs/hr[2]	Concentration ppm/v[3]	Mass Rate lbs/hr	Mass Rate lbs/hr
Baghouse Outlet	One	7/29/87	0.0035	1.51	6.99	<69.	<25.	
Baghouse Outlet	Two	7/29/87	0.0034	1.42	6.99	<71.	<25.	
Baghouse Outlet	Three	7/29/87	0.0008	0.36	6.99	<70.	<25.	
Average	-	-	0.0026	1.10	-	<70.	<25.	-

1 gr/dscf = grains per dry standard cubic foot. Standard conditions = 70°F (21.1°C) and 29.92 inches (760 mm) mercury dry basis.

2 Permit limit of 6.99 lb/hr includes the allowable emission rate for the three sources (Dryer 1, Dryer 2, and cooler exhausts) controlled by the baghouse (2.33 lbs/hr per source).

INTRODUCTION

MORIE retained WESTON to conduct a source compliance testing and analysis program on the Number Two Sand Dryer Baghouse Stack located at its Mauricetown, Jew Jersey Plant.

The primary objective of the program was to determine the particulate and NO_x emissions compliance status of the source relevant to NJDEP regulations.

Three particulate and three NO_x tests utilizing NJDEP Air Test Method 1[1] and EPA Method 7A[2] procedures, respectively, were performed on the baghouse outlet on July 29, 1987 by WESTON Air Quality Testing Services personnel.

Detailed test data and test results summaries are presented on Table 2.

Descriptions of the sand dryer process, test location, test equipment, test procedures, sample recovery techniques and analytical methods used during the survey are also included herein. Process operations record, raw test data, laboratory reports, sample calculations, equipment calibration records and a list of WESTON project participants are provided in Appendices A through F, respectively.

1 NJAC 7:27B-1, Air Test Method 1, "Sampling and Analytical Procedures for Determining Emissions of Particles from Manufacturing Processes and from Combustion of Fuels".

2 40CFR60, Appendix A - Reference Methods.

DESCRIPTION OF PROCESS

The No. 2 Sand Dryer is a natural gas fired 2-stage Carrier vibrating fluid dryer with cooler, designed to produce a maximum of 100 tons per hour (tph) (200,000 lbs/hr) of industrial and foundry sand on a continuous basis.

During normal operating conditions, the production rate ranges between 80 and 100 tons/hr dried. When moisture content of the sand exceeds 5 percent, the production rate is reduced toward the lower end of the range.

Particulate emissions from the dryers and cooler are controlled by an Aero Pulse design baghouse. A process flow diagram is shown in Figure 1.

JESSE MORIE AND SONS, INC.

Number 2 Sand Dryer
Process Flow Diagram

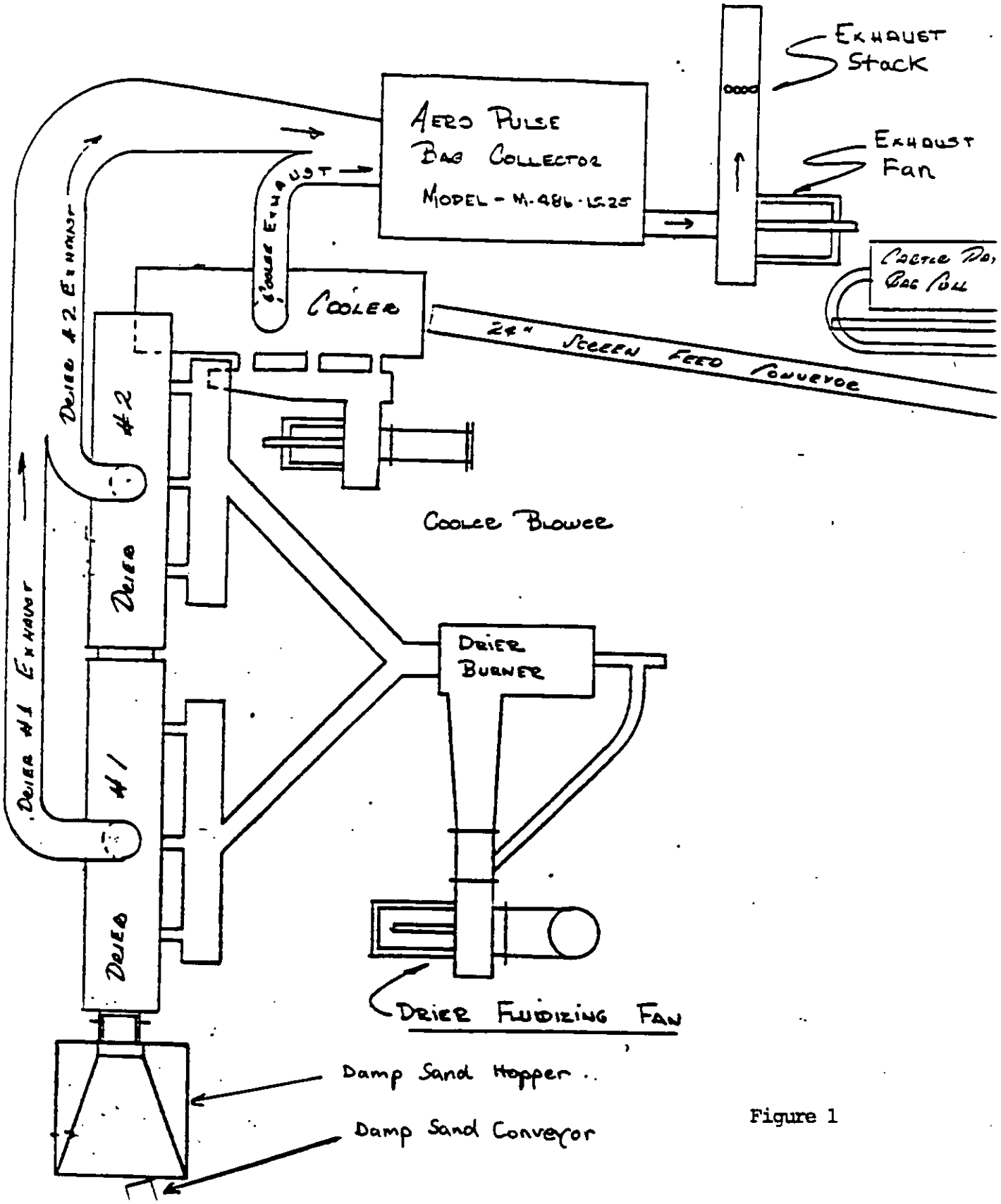


Figure 1

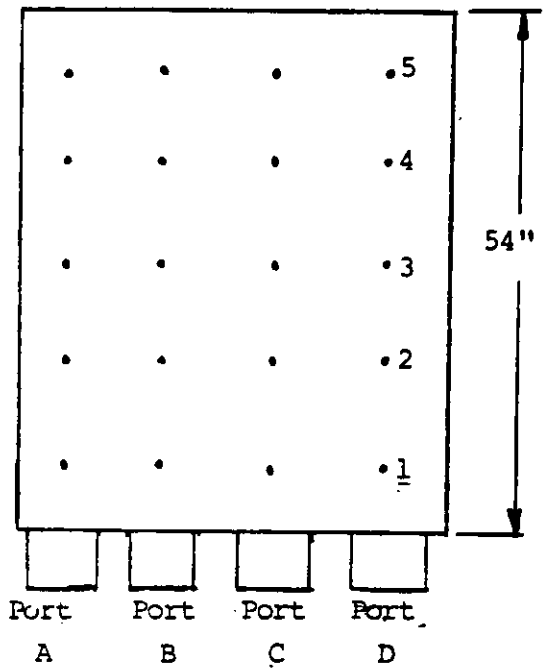
DESCRIPTION OF TEST LOCATIONS

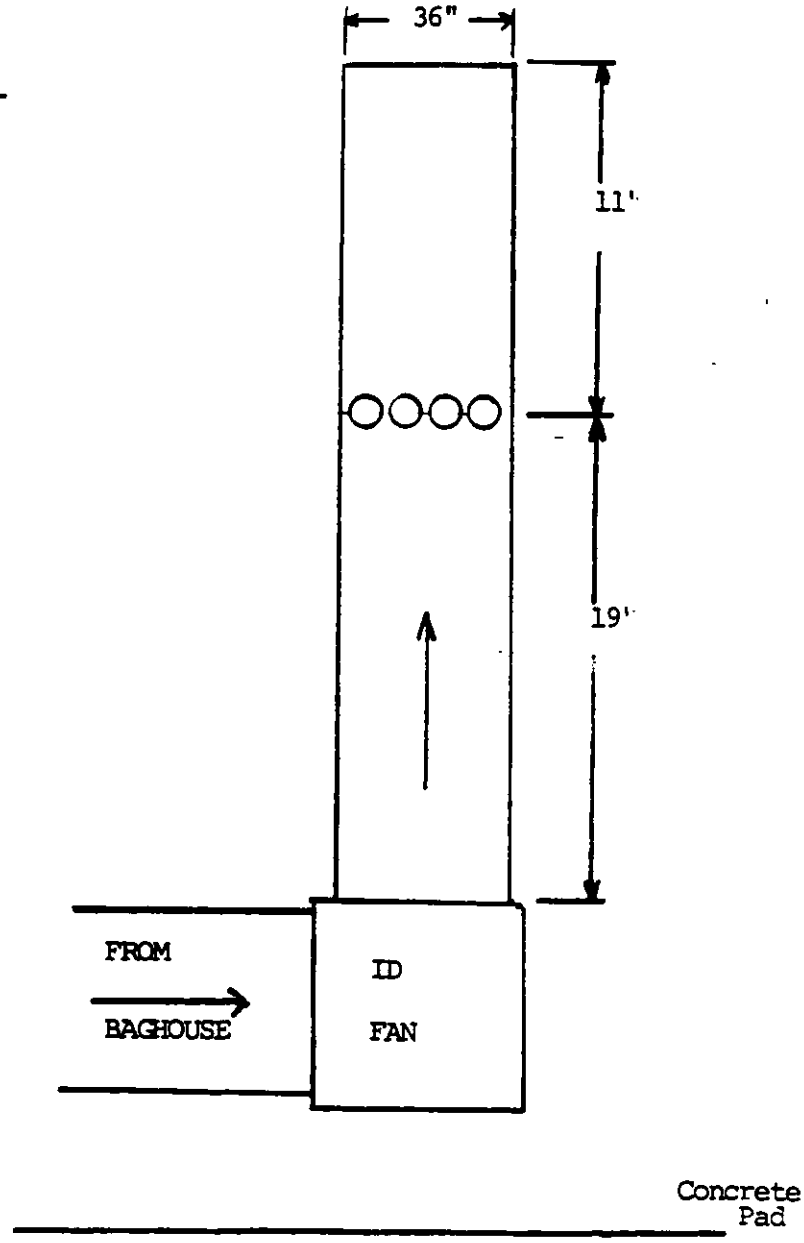
#2 Sand Dryer Baghouse Outlet

A series of four equally-spaced 4" ID test ports were placed in a horizontal axis on a vertical section of the rectangular 36"wide x 54" deep stack downstream from the system ID fan.

The test ports were located in the stack wall at a site which was 5 equivalent stack diameters from the nearest downstream flow disturbance (ID fan outlet) and 3 stack diameters upstream from the stack discharge point. Criteria for traverse point location as dictated by New Jersey Air Test Method 1 required a minimum of twenty traverse points, five per port axis, for this stack configuration. Figure 2 illustrates the test port and a sampling port locations.

JESSE MORIE AND SONS, INC.
MAURIETOWN, NEW JERSEY





Traverse Point Number		Distance From Inside Near Wall Inches
ABCD	1	5 3/8
	2	16 1/4
	3	27
	4	37 3/4
	5	48 5/8

Figure 2: Number 2 Sand Dryer
Baghouse Stack
Port and Sampling Point Locations

DESCRIPTION OF SAMPLING TRAIN

Particulate

The sampling train utilized to perform the particulate sampling at the baghouse outlet was a New Jersey Air Test Method 1 train (see Figure 3).

A calibrated stainless steel nozzle was attached to a heated ($\leq 225^{\circ}F$) 6 ft. borosilicate probe. Flue gas temperature was monitored with a calibrated direct readout pyrometer equipped with a chromel alumel thermocouple positioned near the sampling nozzle. Probe exit and filter exit gas temperatures were monitored with a calibrated direct readout pyrometer equipped with chromel-alumel thermocouple positioned in the sample gas stream after the probe but before the filter and after the filter, respectively.

Stack gas stream composition (carbon dioxide, oxygen, and carbon monoxide content) was determined utilizing a bag sampler and an Orsat apparatus to analyze integrated samples of the flue gases for each test. The integrated samples of the flue gases were collected at a constant rate of 0.8 liter per minute at each sample point. Triplicate Orsat analyses were performed on each sample.

NO_x

An EPA Method 7A sampling train was used to measure nitrogen oxide emissions.

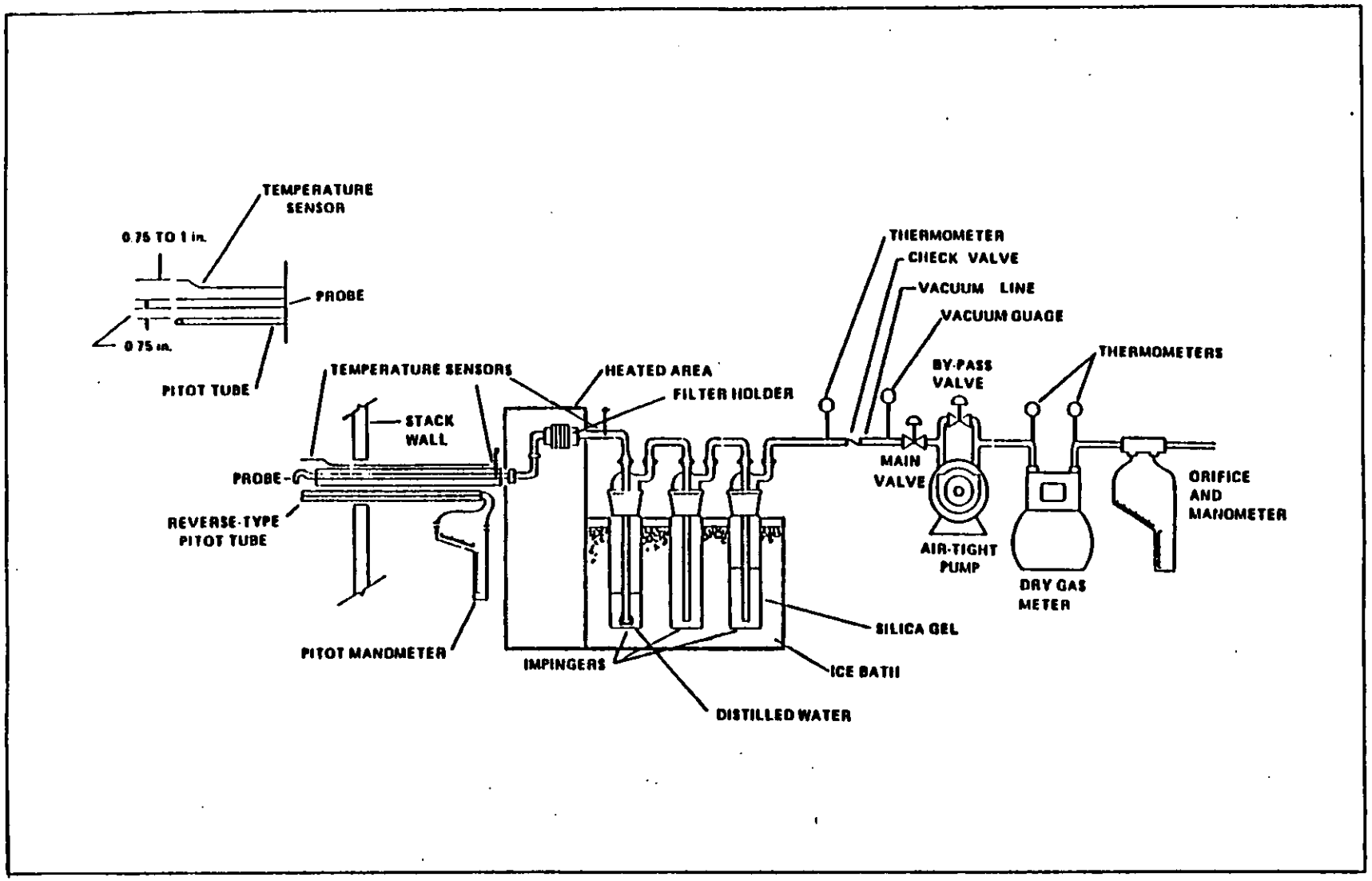


FIGURE 3 PARTICULATE SAMPLING TRAIN

N.J. Air Test Method 1

A heated borosilicate glass sampling probe containing a glass wool filter to remove particulate was connected to a two-liter borosilicate round-bottom boiling flask in a foam encasement. The flask was charged with 25 mL of sulfuric acid/hydrogen peroxide adsorbing solution, and fitted with a glass three-way valve. A mercury U-tube manometer was connected to the sample flask and to a vacuum pump by means of vacuum tubing. Another three-way valve was placed between the manometer and pump. A squeeze bulb was used to purge the sampling probe of extraneous gases prior to sample collection.

A schematic of the sampling train is presented in Figure 4.

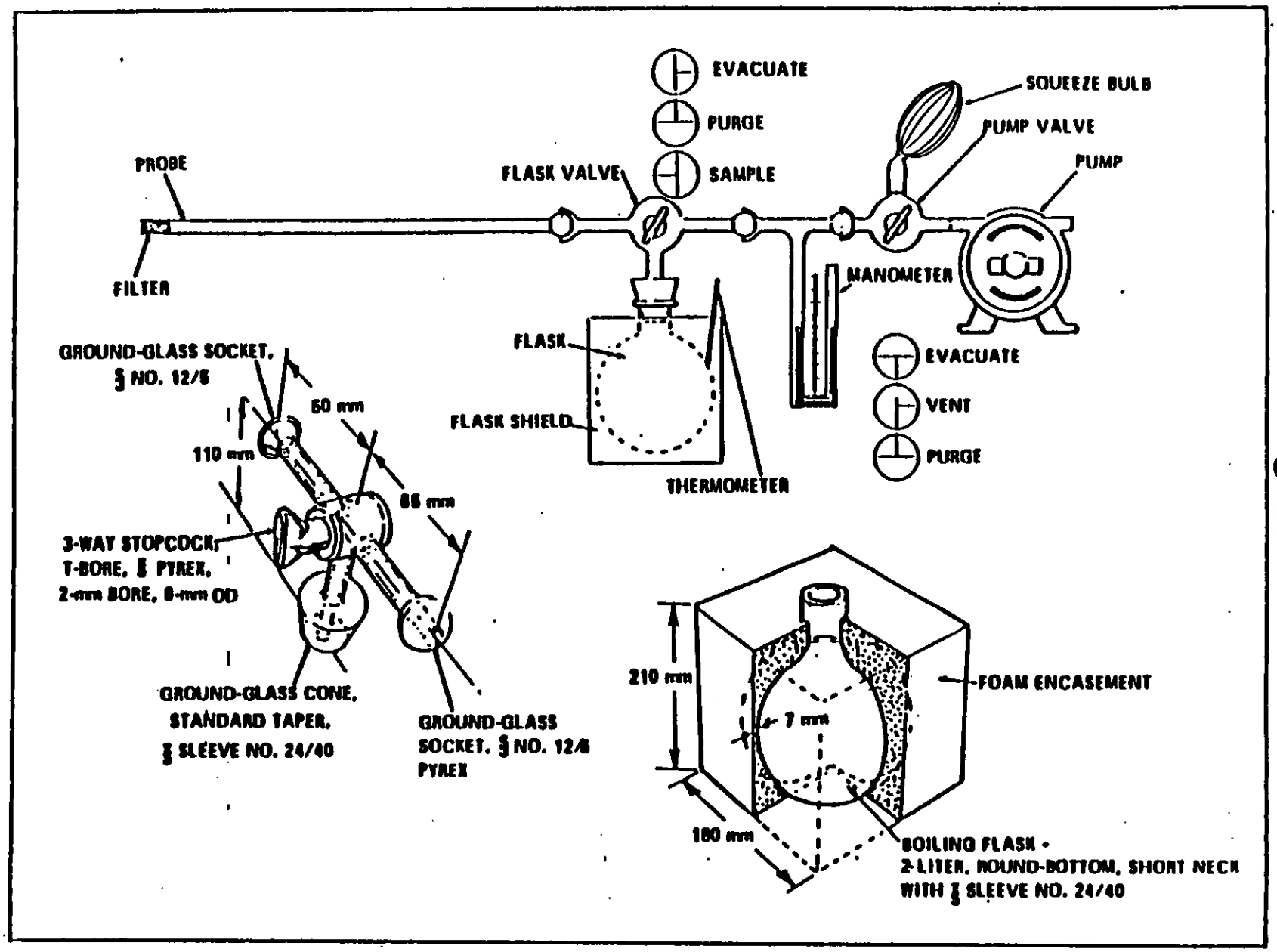


FIGURE 4 NO. SAMPLING TRAIN
EPA METHOD 7 A

TEST PROCEDURES

Preliminary Tests

Preliminary test data was obtained at the baghouse outlet test location. Stack geometry measurements were recorded, and traverse point distances calculated. A preliminary velocity traverse was performed at the test location to determine velocity profiles using a calibrated S-type pitot tube and a Dwyer inclined manometer. Flue gas temperatures were observed with a calibrated direct readout pyrometer equipped with a chromel-alumel thermocouple. An EPA Method 4 moisture test was conducted to determine the stack gas water vapor content. A check for the presence or absence of cyclonic flow was conducted prior to formal testing. The cyclonic flow check at the test site, proved to be negative ($\bar{\alpha} < 20^{\circ}$), verifying the suitability of the test site for obtaining representative samples.

Calibration of probe nozzles, pitot tubes, metering systems, and temperature gauges was performed according to EPA Method 5[2] and NJDEP procedures. See Appendix E for calibration records.

Formal Tests

A series of three particulate and NO_x test runs was conducted on the Number Two Sand Dryer baghouse outlet location.

Test period length for each particulate test run was 80 minutes. A total of twenty traverse points (5 per port) were sampled for four minutes each.

Particulate

During particulate sampling, gas stream velocities were measured by inserting a calibrated "S" type pitot tube into the gas stream adjacent to the sampling nozzle. The velocity pressure differential was observed immediately after positioning the nozzle at each point, and the sampling rate was adjusted to maintain isokineticity.Stack gas temperature was monitored at each point with a pyrometer and thermocouple. Temperature readings of the probe exit, filter exit, final impinger and dry test meter gas stream were also recorded. Leak checks were performed on the test apparatus according to NJ Air Test Method One instructions, prior to and following each run.

A constant rate integrated sampling technique was employed to collect flue gas samples at each particulate traverse point for the molecular weight determination using an Orsat analyzer. The sampling train was operated for 5 minutes with the tedlar bag disconnected to purge extraneous gases prior to each test.

NO_x

A total of 4 NO_x grab samples were collected in conjunction with each particulate test.

NO_x flasks were evacuated to at least 3 inches mercury absolute pressure. Following evacuation and successful leak check, each flask was attached to the heated ($\sim 250^{o}F$) probe which was positioned at a single point in the stack gas stream. Stack gas was purged through the probe and three way sample valve by means of a squeeze bulb. Following sample purge the 3-way valve was switched to the sample position for at least 15 seconds while drawing sample gas.

After sampling, the valve was closed and each flask was shaken for 5 minutes before transport to the field laboratory.

Particulate Sample Recovery

At the conclusion of each test run, the sampling train was dismantled, the openings sealed and the components transported to the field laboratory. A complete chain-of-custody record for the samples was maintained from this point forward.

A consistent procedure was employed for sample recovery:

1. The preweighed glass fiber filter was removed from its holder with tweezers and placed in its original container (petri dish) along with any loose particulates and filter fragments (sample type 1).

2. The particulate adhering to the internal surfaces of the nozzle, probe and front-half of the filter holder was rinsed with acetone into a borosilicate container while brushing a minimum of three times until no visible particulate remained. Particulate adhering to the brush was rinsed with acetone into the same container. The container was sealed with a Teflon-lined closure (sample type 2).

3. The total volume of liquid in impingers 1 and 2 was measured to the nearest milliliter, the value recorded and the impinger contents were discarded.

4. The silica gel was removed from the last impinger and immediately weighed to the nearest tenth gram. The weight gain was recorded.

5. An acetone blank sample was placed into a borosilicate/Teflon container for gravimetric analysis.

Each container was labeled to clearly identify its contents. The height of the fluid level was marked on the container of each sample to determine if leakage had occurred during transport. All samples were placed in a locked shipping crate, then transported to the WESTON laboratories for analysis.

<u>NO_x Sample Recovery</u>

At the conclusion of each NO_x grab sample acquisition period the flask was sealed then transported to the field laboratory.

A consistent procedure was employed for sample recovery for each test flask:

1. Following a minimum of 16 hours absorption period after sampling the flask was shaken for 2 minutes.

2. The flask was connected to a mercury manometer, the flask pressure or vacuum, temperature and pressure measured and the values recorded.

3. The 25 ml absorption solution along with two 5 ml distilled water rinses of the flask were transferred to a polyethylene sample bottle which was sealed with a plastic cap.

4. The flask blank of the NO_x absorbing solution and associated distilled water rinses was placed in a polyethylene sample bottle for analysis.

Each sample container was clearly labeled to identify its contents. The height of the fluid level was marked on the container to indicate whether leakage occurred during transport. All samples were placed into a locked shipping crate, then transported to the WESTON laboratory under strict chain-of-custody for analysis.

Particulate Analysis

Gravimetric analysis of the particulate samples was performed as follows:

1. The filters (sample type 1) and any loose fragments were heated to 220-230°F for 2 to 3 hours, cooled in a dessicator to room temperature and weighed to a constant weight (±0.5mg) to the nearest 0.1 mg.

2. The front-half acetone wash samples (sample type 2) and an acetone blank were transferred to tared 250-mL beakers, and evaporated to dryness at ambient temperature and pressure. The samples were then heated to 220-230°F, dessicated for 24 hours and weighed to a constant 0.1 mg weight. Final front-half wash residue weights were determined by correcting for the acetone blank factor.

The weight of the material collected on the glass fiber filter plus the residue weight of the acetone wash sample yields the total front half weight which was used to calculate the particulate emission results. See Summary of Particulate Test Results table for catch breakdowns.

NO_x Sample Analysis

Analysis of the NO_x grab samples was conducted according to the EPA Method 7A ion chromotography procedures.

A method blank, lab blanks, DEP supplied, audit samples and nitrate standards were analyzed with the field samples to establish lab data validity.

TEST RESULTS AND DISCUSSION

A summary of the compliance test results is presented in Table 1, page 2 of this report. Detailed test data and test results summaries are provided on Table 2 of this section.

All test data and test results herein are believed to be representative of process emissions encountered during the survey periods. No sampling or analytical problems were noted during the test program. Representatives of NJDEP were present during all sampling periods to witness the tests.

During all test periods, the measured particulate emissions mass rate was below the DEP allowable of 6.99 lbs/hr. The measured NO_x mass emissions rate was below the DEP allowable of __ pounds per hour during all three test periods. It should be noted that all NO_x analytical results were below the detection limit of the Method 7A analysis procedures.

During the test program two (2) NO_x audit samples were given to the WESTON sampling team by representatives of the DEP. Results of the audit sample analyses are presented in Table II of the laboratory reports section (Appendix C).

JESSE MORIE & SON
MAURICETOWN, NJ

TABLE 2

TEST DATA:			
Test run number	1	2	3
Test location	#2 SAND DRYER STACK		
Test date	7-29-87	7-29-87	7-29-87
Test time period	1010-1142	1344-1516	1654-1820
SAMPLING DATA:			
Sampling duration, min.	80.0	80.0	80.0
Nozzle diameter, in.	0.181	0.181	0.181
Cross sectional nozzle area, sq.ft.	0.000179	0.000179	0.000179
Barometric pressure, in. Hg	30.09	30.10	30.10
Avg. orifice press. diff., in H2O	1.50	1.46	1.49
Avg. dry gas meter temp., deg F	92	99	93
Avg. abs. dry gas meter temp., deg. R	552	559	553
Total liquid collected by train, ml	67.7	71.0	77.8
Std. vol. of H2O vapor coll., cu.ft.	3.2	3.4	3.7
Dry gas meter calibration factor	0.998	0.998	0.998
Sample vol. at meter cond., dcf	54.015	54.369	54.577
Sample vol. at std. cond., dscf (1)	52.236	51.924	52.678
Percent of isokinetic sampling	99.2	100.1	100.6
GAS STREAM COMPOSITION DATA:			
CO2, % by volume, dry basis	0.0	0.0	0.0
O2, % by volume, dry basis	20.3	20.4	20.4
CO, % by volume, dry basis	0.0	0.0	0.0
N2, % by volume, dry basis	79.7	79.6	79.6
Molecular wt. of dry gas, lb/lb mole	28.8	28.8	28.8
H2O vapor in gas stream, prop. by vol.	0.058	0.061	0.065
Mole fraction of dry gas	0.942	0.939	0.935
Molecular wt. of wet gas, lb/lb mole	28.2	28.2	28.1
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H2O	-0.88	-0.86	-0.87
Static pressure, in. Hg	-0.065	-0.063	-0.064
Absolute pressure, in. Hg	30.03	30.04	30.04
Avg. temperature, deg. F	130	129	128
Avg. absolute temperature, deg.R	590	589	588
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	20	20	20
Avg. gas stream velocity, ft./sec.	72.4	71.2	72.2
Stack/duct cross sectional area, sq.ft.	13.50	13.50	13.50
Avg. gas stream volumetric flow, wacf/min.	58600	57700	58500
Avg. gas stream volumetric flow, dscf/min.	49700	49000	49400
NOx EMISSIONS:			
Average concentration, lb/dscf	8.28E-06 LT	8.43E-06 LT	8.38E-06 LT
Average concentration, ppm/v	69.306 LT	70.563 LT	70.169 LT
Average concentration, mg/cu.m	132.567 LT	134.971 LT	134.217 LT
Mass emission rate, lbs/hr	24.708 LT	24.774 LT	24.868 LT
PARTICULATE EMISSIONS:			
Concentration, gr/dscf	0.0037	0.0034	0.0008
Mass rate, lbs/hr	1.58	1.42	0.36
SOURCE OPERATIONS DATA (2)			
Sand throughput (tons/hour)			
Wet feed	93.1	92.7	90.2
Dry product	90.7	90.3	87.6

LT = Less than detection limit of analytical method

(1) Standard conditions = 70 deg. F. (21.2 deg. C.) and 29.92 inches Hg (760 mm Hg)

(2) Monitored by Morie plant personnel

APPENDIX A

PROCESS OPERATIONS RECORD

Recorded by Morie Plant Personnel

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The Moric Company Inc

7/29/87

by James Zalaczny

Run	Feed sand moisture content	Dryer Temp°	cooler Temp°	Air Temp. baghouse	Final product ton
Time					
#1					
10:11	2.9 %	124°	132°	145°	37.2 tons (Read.
10:40	2.4 %	120	153	145	
11:10	2.6 %	123	142	145	
11:30	2.2 %	124	157	145	171.8 ~~155.3~~ tons Readin
Ave 89 mins Run	2.525	122.75	148.5	145	134.6 tons dry

Hourly Rate Dry tons $\frac{134.6 \text{ tons}}{89 \text{ mins}} \times \frac{60 \text{ mins}}{\text{Hr}} = 90.7$ tons Hour outlet

Hourly Rate wet tons $\frac{90.74 \text{ dry tons}}{1.0 - .02525 \text{ moisture}} = 93.1$ tons wet feed rate

#2					
1:39	2.4 %	122	154	145	345.8 start
2:09	2.9 %	119	141	145	
2:41	2.6 %	121	144	145	
3:14	2.4 %	122	141	145	488.8 ~~488.8~~ finish
Ave 95 mins	2.575	121	145	145	143.0 tons

Hourly Rate dry tons $\frac{143.0 \text{ tons}}{95 \text{ mins}} \times 60 \text{ mins/Hr} = 90.3$ tons dry /Hr outlet

Hourly Rate wet tons $\frac{90.3 \text{ tons}}{1.0 - .02575 \text{ moisture}} = 92.7$ tons /Hr feed rate

Run		Feed sand moisture content	Dryer Temp°	Cooler temp°	Air temp baghouse	Final Product (Tons)
#3						
	4:53	2.9 %	122	125	145	632.7 start
	5:23	2.7 %	121	114	145	
	5:53	3.0 %	120	116	145	
	6:21	3.1 %	121	128	145	961.2 Finish
Ave	88 mins	2.925	121	120.75	145	128.5 tons

Hourly Rate
Dry tons $\frac{128.5 \text{ tons}}{88 \text{ mins}} \times 60 \text{ mins/Hr} = 87.6$ tons/Hr outlet

Hourly Rate wet tons $\frac{87.6 \text{ tons}}{1.0 - .02925} = 90.2$ tons/Hr inlet rate

APPENDIX B

RAW TEST DATA

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CLIENT: Merck

FACILITY: Manchester

TEST LOCATION: #2 Dryer

TEST RUN NO.: 1-2-3

TEST DATE: 7-29-87

ROY F. WESTON, INC.

EMISSION TEST DATA/REPORT
QA/QC CHECK LIST

	Initial Data Averages	Data Check 1	Data Check 2 (if req'd)	Data Completeness Check
Raw Test Data	JDC	RR		
	Initial Lab Calculator	Check 1	Check 2 (if req'd)	Data Completeness Check
Laboratory Data				
	Initial Calculator	Check 1	Check 2 (if req'd)	Reasonable-ness Check
Test Result Calculations	RR	JDC		
	Author	Check 1	Check 2 (if req'd)	Completeness Reasonable-ness Check
Test Data Tables	RR	JDC		
	Author	Check 1	Check 2 (if req'd)	Table of Contents, Figure, page number Check
Report Body	JDC	BLD		
	Originator	Check 1	Check 2 (if req'd)	
Appendices Completeness	JDC	JDC		

Compilation Check: Page alignment and completeness

Draft Report 9-9-87
(if required)
Final Report

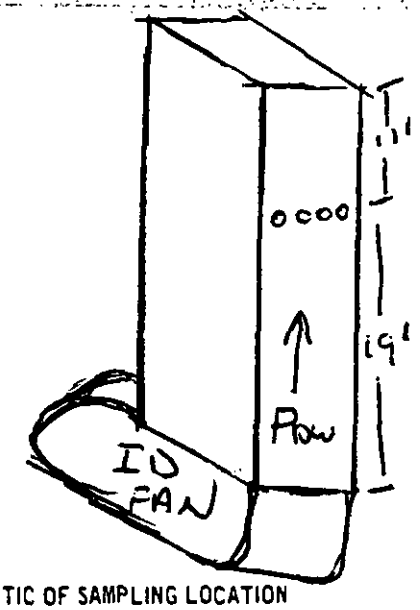
Date provided to Client: 9-9-87

Final Report Review: PD
PM
SM/DM

etdr10.24

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Jessie Marie + Sons
DATE 7/28/87
SAMPLING LOCATION Dryer #2 Stack
INSIDE OF FAR WALL TO
OUTSIDE OF PORT (DISTANCE A) 59 1/4
INSIDE OF NEAR WALL TO
OUTSIDE OF PORT (DISTANCE B) 5 1/4
STACK I.D. (DISTANCE A - DISTANCE B) 54" x 36"
NEAREST UPSTREAM DISTURBANCE 11'
NEAREST DOWNSTREAM DISTURBANCE 19'
CALCULATOR Mills / Barker



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF PORT (SUM OF COLUMNS 4 & 5)
ABCD		54 x 36"			
1	5.4		5 1/2	5 1/4	10 5/8
2	16.2		16 1/4		21 1/2
3	27		27		32 1/4
4	37.8		37 3/4		43 1/8
5	48.6		48 5/8		53 7/8

GAS VELOCITY AND VOLUME DATA FORM

Plant Jessie Marie Tank Location Drier #2 STACK
Date 7/28/87 Run no. Prelim 24-hr. clock time 13:16 - 13:43
Operators MILLS/BAKER Stack diameter or dimensions, in. 36" x 54"
Barometric pressure, in. Hg 29.94 Cross sectional area, ft.^{2} 36 x 54
Pitot tube identification no. P15 Cp .84

	Traverse Point Number	Velocity head (Δp), in. H_2O	Stack Temperature (T_s), °F.	Static pressure (P_{static}) in. H_2O	Cyclonic flow determination: Δp at 0° reference	Cyclonic flow determination: Angle (α) which yields a null Δp
3:16	D					
	1	1.80	126		0.05	<5
	2	1.20	127			
	3	0.87	127	-0.75	0	
	4	0.82	128			
	5	0.56	127			
	C					
	1	1.80	129			
	2	1.70	128	-.85	0	
	3	1.40	128			
	4	1.20	128	-.92	0	
	5	0.91	128			
	B					
	1	2.1	128			
	2	1.64	128	-.73	0	
	3	1.4	129			
	4	1.1	128			
	5	0.81	127	-.75	0.02	<5
	A					
	1	2.0	128			
	2	1.4	127	-.88	0	
	3	0.88	127		0	
	4	0.78	127			
13:43	5	0.65	126	-.55	0	
		Avl ΔP 1.25				
		Avg. √Δp 1.098678	Avg. Ts 127.55	Avg. P static -.77		Avg. α[a]

[a] Must be <10 degrees to be acceptable.

MOISTURE DETERMINATION FORM

Plant Jessie Mine + Sons Date 7/28/87

Sample location Dryer 2 STACK Run no. Preline

Operator Mills Barker Barometric pressure (P_b), in. Hg. 29.94

Comments:

	24-hr. clock time	Gas meter reading, $ft.^3$	Orifice meter pressure differential (ΔH), in. H_2O	Dry gas meter temperature (T_m) Inlet °F.	Dry gas meter temperature (T_m) Outlet °F.
F.L.C. .002 cfm at 15 in Hg Stop	13:43	188.216	1.5	94	97
Start	13:13	167.532	1.5	91	93
F.L.C. .002 cfm at 15 in Hg		Total V_m	Ave. ΔH	Avg. T_m	

Impinger volume

Final, ml 119

Initial, ml 100

Net, ml 19

Silica gel weight

Final, g 260.5

Initial, g 250

Net, g 10.5

Calculations

(1) P_b = 29.94

(2) Total V_m = 20.684

(3) Avg. ΔH = 1.5

(4) Avg. T_m = 93.75

(5) Net ml = 19

(6) Net g = 10.5

(7) $$V_{m(std)} = \frac{17.64 \times V_m (P_b + \frac{\Delta H}{13.6})}{(T_m + 460)} = \frac{17.64 \times 20.684 (29.94 + \frac{1.5}{13.6})}{(93.75 + 460)} = 19.800$$

(8) $$V_{w(std)} = (.04707 \times \text{Net ml}) + (.04715 \times \text{Net g}) = (.04707 \times 19) + (.04715 \times 10.5) = 1.389$$

(9) $$\%M = \frac{100 \times V_{w(std)}}{V_{w(std)} + V_{m(std)}} = \frac{100 \times 1.389}{1.389 + 19.800} = 6.56\%$$

NOMOGRAPH DATA

PLANT Jessie Mine + Sons

DATE 7/28/87

SAMPLING LOCATION Drier #2 Stack

CONTROL BOX NO. Nutech 6

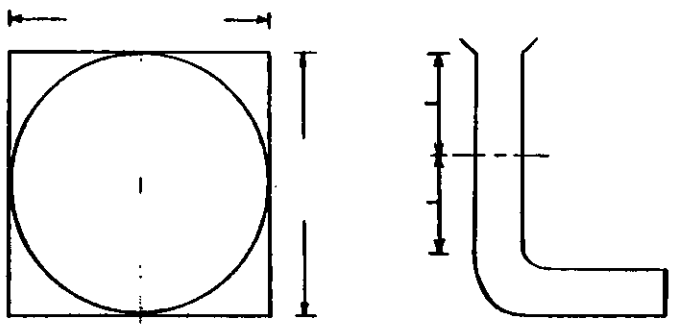
CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.82
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	105
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.95
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	29.77
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s / P_m	.998
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	127.5
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	1.25
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	2.1
C FACTOR	1.05	
CALCULATED NOZZLE DIAMETER, in.	.195	
ACTUAL NOZZLE DIAMETER, in.	.181	
REFERENCE Δp, in. H_2O	1.25	

PARTICULATE F .D DATA FORM

Ts = 13.5

Sheet 1 of 2

Plant Jessie Morie + Sons
City Millville N.J.
Location Drier #2 Stack
Operator Mills/Barker/Rakowicz
Run No. Run 1 Date 2/19/87
Ambient temp., °F 75°
Baro. press. (P_b), in. Hg. 30.09
Sample box no. 1
Meter box no. Nutech #6
Meter box ΔH@ 1.826
Meter box cal. (Y) .9978
Probe length, ft. 6 ft
Probe liner material borosilicate
Probe heater setting 70



Test point schematic

Pitot tube identification no. P15
Pitot tube cal. factor (C_p) .84
Nozzle identification no. 11T
Avg. nozzle diameter (D_n), in. .181
Pyrometer identification no. Nutech 6
Thermocouple identification no. T23
Assumed moisture, % 6
Assumed temperature, °F. 128
Static pressure (P_{static}), in. H_2O -.88
C factor ____ Reference Δp ____
Initial leak rate .005 cfm @ 15 in. Hg
Final leak rate .015 cfm @ 9 in. Hg
Filter no. 9278
Comments: Pitot tube LC. good
Orsat leak ok good

K FACTOR = 1.00

Traverse point number	Sampling time, min.	24-hr. clock time	Velocity head (ΔP), in. H_2O	Orifice meter pressure differential (ΔH), in. H_2O	Gas meter reading, $ft.^3$	Dry gas meter temperature (T_m) Inlet °F.	Dry gas meter temperature (T_m) Outlet °F.	Source temperature (T_s), °F	Probe Exit Temp	Pump vacuum, in.Hg. gauge	Impinger exit gas temp., °F.	Filter box temp., °F.	Filter Exit Temp
A	0	1010			189.420								
1	4	1014	2.40	2.40	192.900	85	87	127	194	6"	75	225	142
2	8	1018	2.40	2.40	196.500	86	89	129	197	6.2"	75	212	145
3	12	1022	1.20	1.20	198.750	87	91	128	199	3.9"	75	195	149
4	16	1026	.78	.78	200.605	87	92	129	202	3.0	70	198	153
5	20	1030	.70	.70	202.627	87	92	129	206	2.5	67	200	159
B	0												
1	4	10:35	2.20	2.2	206.000	88	92	130	201	5.5	59	202	153
2	8	1039	1.90	1.9	209.000	89	93	130	205	5.0	61	203	162
3	12	1043	1.50	1.5	211.650	89	95	130	203	4.2	60	209	164
4	16	1047	1.20	1.2	214.000	89	95	129	204	3.9	62	210	165
5	20	1051	.94	.94	216.414	90	94	131	203	3.0	63	205	164
		1055											
	Total θ		Avg. $\sqrt{\Delta P}$	Avg. ΔH	Total V_m	Avg. T_m		Avg. T_s		Max. vac.	Max. temp.	Min. Max.	

Comments: Static -.88

Run 1

Sheet 2 of 2

Traverse point number	Sampling time, min.	24-hr. clock time	Velocity head (ΔP), in. H_2O	Orifice meter pressure differential (ΔH), in. H_2O	Gas meter reading, $ft.^3$	Dry gas meter temperature (T_m) Inlet °F.	Dry gas meter temperature (T_m) Outlet °F.	Source temperature (T_s), °F	Probe exit temp	Pump vacuum, in. Hg. gauge	Impinger exit gas temp., °F.	Filter box temp., °F.	Filter exit temp
C	0				216.414								
1	4	1057	1.9	1.9	219.22	90	93	132	198	5.0	63	215	156
2	8	1101	1.7	1.7	222.700	90	95	131	208	5.0	58	215	168
3	12	1105	1.8	1.8	225.310	91	96	130	208	5.0	58	210	171
4	16	1109	1.6	1.6	228.40	92	97	130	202	4.6	61	208	173
5	20	1113	1.2	1.2	230.557	92	97	129	198	3.5	60	203	173
		1117	leak check		.01 @	10" Hg							
D	0				230.625								
1	4	1122	1.7	1.7	233.800	92	94	133	195	4.2	63	210	151
2	8	1126	1.5	1.5	236.500	92	96	134	219	4.2	60	210	167
3	12	1130	1.4	1.4	238.800	93	97	134	220	4.0	62	209	169
4	16	1134	1.2	1.2	241.100	93	97	133	220	4.0	64	220	170
5	20	1138	.85	.85	243.503	93	97	130	223	3.0	65	219	175
		1142											
	Total θ		Avg. √ΔP	Avg. ΔH	Total V_m	Avg. T_m		Avg. T_s		Max. vac.	Max. temp.	Min. Max.	
	80		~~1.208924~~ 1.206598	1.5035 ~~1.5035~~	54.015	91.85		130.4		6.2			

Monie
A2 Dryer Outlet
Run One
7-29-87

```
√ΔP      1.5035
ΔH       1.5035
TS       130.4
TM       91.85
VMA      54.015
PBAR     30.06
VLC      46.7
MSG      21.7
MUD      28.813
AS       13.5
TT       80.8
STAT     -0.88
DN       0.1811
Y        0.9978
CP       0.84
TH2O     67.7
VMS      52.236042448
VWS      3.2089863
%M       5.787679123
MD       .94212320888
MWS      .28.18717826
PS       30.02529412
VACT     72.50996057
QACT     58.72239.02369
VSTA     61.5268280 5
QSTA     498.36.7307 22
%I       98.967235 99
FHWT     0.
T WT     0.
FHGR     0.
FHLB     0.
T GR     0.
T LB     0.
```

Comments:

NITROGEN OXIDE FIELD DATA FORM

Plant Jessie Marie City Millville N.J.

Sample location Drier #2 Stack Date 7/29/87

Operator Mills/Rakowicz Barometric pressure (P_{bar}) 30.05 in. Hg

Sample number	Drier #2 Sample point location	Sample time 24-hr	Probe temperature, °F	Flask and valve number	Volume of flask and valve (V_F), ml	Initial pressure in. Hg			Initial temperature	
						Leg A_i	Leg B_i	P_i [a]	°F (t_i)	°R (T_i) [b]
1-1	C	10:31		N	2077	15.4	13.0	1.65	78	538
1-2	C	10:35		SH	2080	15.3	12.9	1.85	78	538
1-3	C	10:58		FU	2085	15.2	12.9	1.95	90	550
1-4	A	11:04		14	2075	15.0	12.7	2.35	90	550
1-5	A	11:20		3	2111	15.0	12.5	2.55	85	545
1-6	A	11:39		D	2097	15.0	11.7	3.35	90	550
2-1	D	13:56		7	2103	14.8	11.4	3.85	95	555
2-2	D	14:20		E	2088	14.7	11.3	4.05	95	555
2-3	A	14:56		5	2093	15.4	11.8	2.85	95	555
2-4	A	15:15		4	2095	15.7	12.0	2.35	98	558
3-1	D	17:08		M	2080	15.8	12.2	2.05	95	555
3-2	D	17:30		W	2062	15.8	12.1	2.15	93	553

[a] $P_i = P_{bar} - (A_i + B_i)$. [b] $T_i = t_i + 460°F$.

NITROGEN OXIDE FIELD DATA FORM

Plant Jessie Marie + Sons City Millville N.J.
Sample location Drier #2 Stack Date 7/29/87
Operator Mills Barometric pressure (P_{bar}) 30.08 in. Hg

Sample number	Sample point location	Sample time 24-hr	Probe temperature, °F	Flask and valve number	Volume of flask and valve (V_F), ml	Initial pressure in. Hg			Initial temperature	
						Leg A_i	Leg B_i	P_i [a]	°F (t_i)	°R (T_i) [b]
3-3	D	17:45		2	2095	15.9	12.3	1.85	87	547
3-4	A	17:58		11	2090	16.0	12.3	1.75	87	547
3-5	A	18:15		A-1	2059	16.0	12.3	1.75	85	545
3-6	A	18:22		HQ1	2093	15.8	12.1	2.15	85	545

[a] $P_i = P_{bar} - (A_i + B_i)$. [b] $T_i = t_i + 460°F$.

NO_x SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant JESSE MARIE MILLVILLE NJ Date 7/30/87

Sample recovery personnel BARKER/MILLS Barometric pressure, (P_{bar}) 29.45 in. Hg

Person with direct responsibility for recovered samples M. BARKER

FLASK AND VALVE	VOLUME	Sample number	Final pressure, in. Hg: Leg A_f	Leg B_f	P_f [a]	Final temperature, °F (t_f)	°R (T_f)[b]	Sample recovery time, 24-h	pH adjusted 9 to 12	Liquid level marked	Samples stored in locked container	P_f [a]
N	2077	1-1	+.5	+.5	+1.0	87	547	1530	—	✓	✓	28.45
SH	2080	1-2	+.7	+.7	+1.4	88	548	1540	—	✓	✓	28.05
FU	2085	1-3	+.2	+.2	+.4	89	549	1550	—	✓	✓	29.05
14	2075	1-4	+.6	+.6	+1.2	89	549	1600	—	✓	✓	28.25
3	2111.	1-5	+.8	+.8	+1.6	89	549	1610	—	✓	✓	27.85
D	2097	1-6	+.4	+.4	+.8	88	548	1620	—	✓	✓	28.65
7	2103	2-1	-.6	-.6	-1.2	81	541	1100	—	✓	✓	30.65
E	2088	2-2	-.4	-.4	-.8	88	548	1630	—	✓	✓	30.25
5	2093	2-3	+.5	+.5	+1.0	87	547	1640	—	✓	✓	28.45
4.	2095	2-4	+.2	+.2	+0.4	87	547	1650	—	✓	✓	29.05
M	2080	3-1	+.6	+.6	+1.2	87	547	1700	—	✓	✓	28.25
W	2062	3-2	+.5	+.5	+1.0	87	547	1710	—	✓	✓	28.45

$P_f = P_{bar} - (A_f + B_f)$. $T_f = t_f + 460°F$.

Lab person with direct responsibility for recovered samples TB/MT

Date recovered samples received 7/30/87 Analyst E.C.

All samples identifiable? ✓ Yes All liquids at marked level? ✓ Yes

Remarks

Signature of lab sample trustee

NO_x SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant JESSE MARIE MILLVILLE N.J. Date 7/30/87

Sample recovery personnel BARKER/MILLS Barometric pressure, (P_{bar}) 29.45 in. Hg

Person with direct responsibility for recovered samples M. BARKER

FLASK AND VALVE	VOLUME	Sample number	Final pressure, in. Hg: Leg A_f	Leg B_f	P_f [a]	Final temperature, °F (t_f)	°R (T_f)[b]	Sample recovery time, 24-h	pH adjusted 9 to 12	Liquid level marked	Samples stored in locked container	P_f [a]
R	2095	3-3	+.1	+.1	+.2	88	548	1720	—	✓	/	29.25
π	2090	3-4	+.4	+.4	+.8	87	547	1725	—	✓	/	28.65
A-1	2059	3-5	+.4	+.4	+.8	88	548	1730	—	✓	/	28.65
HQ1	2093	3-6	0	0	0	87	547	1735	—	✓	/	29.45

$P_f = P_{bar} - (A_f + B_f)$. $T_f = t_f + 460°F$.

Lab person with direct responsibility for recovered samples TB/MT

Date recovered samples received 7/30/87 Analyst E.C.

All samples identifiable? Yes All liquids at marked level? ✓ Yes

Remarks

Signature of lab sample trustee

APPENDIX C

LABORATORY REPORTS

morie.810

Inter-Office Memorandum

WESTON
DESIGNERS CONSULTANTS

TO: Jeff O'Neill
cc: Lee Carfioli

FROM: Mike Taylor

DATE: 8 August 1987

PROJECT: Jesse Morie

W.O. NO.: 2373-01-02

SUBJECT: Results for Compliance Air Analysis Performed
For Jessie Morie R.F.W. Batch 8707-951

ACTION:

Attached are the results for the source emission tests that were received by Weston Analytics on July 30, 1987. The samples were analyzed for particulates according to the EPA Reference Method 5 and for nitrous oxides according to EPA Reference Method 7A.

Raw data sheets, results of EPA performance samples, and custody transfer records are attached for your information.

Should you have any questions regarding the data or this report, please do not hesitate to call.

Approved by
James Michael Taylor
Department Manager
Mobile Field Operations Dept.

JMT: lmv

WESTON

Date of Report: 8/8/87
Client: Jesse Morie

TABLE I

EPA Method 5: Particulates

RFW Number	Client I.D.	Date Collected	Date Analyzed	Net Weight In Grams*
8707-951-0010	Acetone Blank 001	7-29-87	7-31-87 thru 8-8-87	0.0002
8707-951-0020	Filter Blank #9248 002	7-29-87		0.0006
8707-951-0030	Run #1 Front Half Acetone 003	7-29-87	7-31-87 thru 8-8-87	0.0123
8707-951-0040	Run #1 Filter #9278 004	7-29-87		0.0006
8707-951-0050	Run #2 Front Half Acetone 005	7-29-87	7-31-87 thru 8-8-87	0.0117
8707-951-0060	Run #2 Filter 9274 006	7-29-87		-0.0001
8707-951-0070	Run #3 Front Half Acetone 007	7-29-87	7-31-87 thru 8-8-87	0.0032
8707-951-0080	Run #3 Filter 9276 008	7-29-87		-0.0004

*Note that filter weights and acetone washes have not been been blank corrected.

SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant JESSE MORIE Sample date 7/29/87

Sample location #2 DRYER STACK Run number 1

Sample recovery person RAKIEWICZ Recovery date 7/29/87

Filter(s) number 9278

MOISTURE

Impingers			Silica gel		
Final volume (wt)	146 ml (g)		Final wt	271.7 g	g
Initial volume (wt)	100 ml (g)		Initial wt	250.0 g	g
Net volume (wt)	46 ml (g)		Net wt	21.7 g	g
Total moisture	67.7 g				

Color of silica gel blush pink

Description of impinger water clear

RECOVERED SAMPLE

Blank filter container number ~~004~~ 002 Sealed ✓

Filter container number 004 Sealed ✓

Description of particulate on filter light brown

Acetone rinse container number 003 Liquid level marked? ✓

Acetone blank container number 001 Liquid level marked? ✓

Samples stored and locked ✓

Remarks

Date of laboratory custody 7/30/87

Laboratory personnel taking custody M. Taylor

Remarks

GAS ANALYSIS DATA FORM

Plant JESSIE MORIE Sample location DRIER #2 STACK

Date 7/29/87 Run no. ONE Operator BARKER / MILLS

Sample type: single-point or (multipoint) grab or (integrated)

Analytical method ORSAT Comments AMBIENT O_2 20.4

LEAK CHECK 0.0

Sample point	24-hour clock time	% CO_2 Reading 1	% O_2 Reading 2	% O_2 Net[a]	% CO Reading 3	% CO Net[b]
	1240	0.0	20.4	20.4	20.4	0.0
	1245	0.0	20.2	20.2	20.2	0.0
	1248	0.0	20.4	20.4	20.4	0.0
Averages		0.0	----	20.33	----	0.0

N_2 79.67

$\% N_2 = 100 - (\% CO_2 + \% O_2 + \% CO)$ 6.5056 22.3076

$MW_d = 0.440 (\% CO_2) + 0.320 (\% O_2) + 0.280 (\% N_2 + \% CO) =$ 28.813

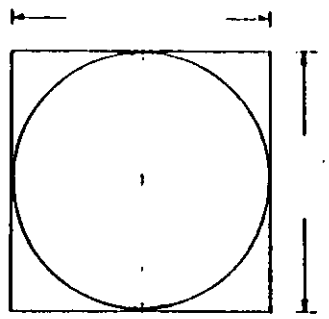
[a] Net % O_2 = Reading 2 - Reading 1

[b] Net % CO = Reading 3 - Reading 2

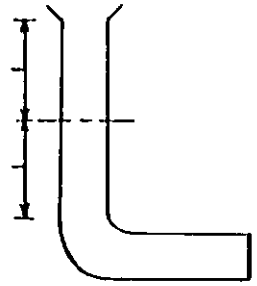
PARTICULAT 'IELD DATA FORM

Sh 1 of 2

Plant Jesse Morie + Sons
City Millville NJ
Location Dryer #2 Stack
Operator Mills Barker Rakiewicz
Run No. 2 Date 7/29/87
Ambient temp., °F 84
Baro. press. (P_b), in. Hg. 30.10
Sample box no. NUTECH 6
Meter box no. ~~[illegible]~~
Meter box ΔH@ 1.826
Meter box cal. (Y) .9978
Probe length, ft. 6
Probe liner material borosilicate
Probe heater setting 70



Cross section



Plan or elevation

Test point schematic

Pitot tube identification no. P15
Pitot tube cal. factor (C_p) .84
Nozzle identification no. 111
Avg. nozzle diameter (D_n), in. .181
Pyrometer identification no. NUTECH 6
Thermocouple identification no. T23
Assumed moisture, % 7
Assumed temperature, °F. 128
Static pressure (Pstatic), in. H_2O -.86
C factor ____ Reference Δp ____
Initial leak rate .015 cfm @ 15 in. Hg
Final leak rate .005 cfm @ 7 in. Hg
Filter no. 9274
Comments: Pitot tube L.C. good
Orsat L.C. good
K. Factor = 1

Traverse point number	Sampling time, min.	24-hr. clock time	Velocity head (ΔP), in. H_2O	Orifice meter pressure differential (ΔH), in. H_2O	Gas meter reading, $ft.^3$	Dry gas meter temperature (T_m) Inlet °F.	Dry gas meter temperature (T_m) Outlet °F.	Source temperature (T_s), °F	Probe exit °F	Pump vacuum, in.Hg. gauge	Impinger exit gas temp., °F.	Filter box temp., °F.	Bx exit °F
A	0	1344			244.850								
1	4	1348	2.10	2.10	248.300	94	95	130	213	6.0	68	219	139
2	8	1352	1.75	1.75	251.100	94	97	129	214	5.2	62	214	141
3	12	1356	1.00	1.00	253.500	95	99	130	213	3.8	58	220	153
4	16	1400	.85	.85	255.710	95	99	131	216	3.4	58	208	152
5	20	1404	.75	.75	257.159	96	99	130	218	3.0	58	216	153
B	0	1411		start	257.560								
1	4	1415	2.10	2.10	261.250	96	100	127	203	6.0	59	206	129
2	8	1419	1.90	1.90	264.650	97	100	128	211	5.8	56	212	151
3	12	1423	1.55	1.55	267.200	97	101	127	210	5.0	58	220	157
4	16	1427	1.30	1.30	270.000	97	101	127	207	4.2	59	203	154
5	20	1431	.96	.96	272.070	99	103	127	206	3.8	59	210	149
	Total θ		Avg. $\sqrt{\Delta P}$	Avg. ΔH	Total V_m	Avg. T_m		Avg. T_s		Max. vac.	Max. temp.	Min. Max.	

Comments:

Traverse point number	Sampling time, min.	24-hr. clock time	Velocity head (ΔP), in. H_2O	Orifice meter pressure differential (ΔH), in. H_2O	Gas meter reading, $ft.^3$ 272.070	Dry gas meter temperature (T_m) Inlet °F.	Dry gas meter temperature (T_m) Outlet °F.	Source temperature (T_s), °F probe	Source temperature (T_s), °F exit of	Pump vacuum, in.Hg. gauge	Impinger exit gas temp., °F.	Filter box temp., °F.	Filter box temp., °F. Box exit of
C	0												
1	4	1434	2.20	2.20	275.750	98	100	127	193	6.2	60	205	139
2	8	1438	1.90	1.90	278.630	98	102	127	206	6.0	61	192	150
3	12	1442	1.60	1.60	281.200	98	102	128	205	5.0	62	203	150
4	16	1446	1.50	1.50	284.100	98	102	129	202	5.0	62	215	156
5	20	1450	1.05	1.05	286.424	98	103	130	216	4.0	62	216	161
	0	1456											
D 1	4	1500	2.10	2.10	290.10	98	101	130	205	6.0	65	213	158
2	8	1504	1.70	1.70	292.550	99	103	129	216	5.9	59	221	162
3	12	1508	1.05	1.05	295.300	99	103	127	217	4.0	59	202	159
4	16	1512	.96	.96	297.300	98	102	128	214	3.5	59	213	157
5	20	1516	.81	.81	299.320	99	102	127	215	3.0	61	209	156

```
F<L     1.189298
<H      1.4565
TS      128.5
TM      98.925
VMA     54.47
PBAR    30.1
VMC     54.369
USG     17.
MWD     28.817
AS      13.5
TT      80.
STAT    -0.86
DN      0.181
Y       0.9978
CP      0.84
TH2O    71.
WMS     -52.020541172
WMS     3.6654
WMS     6.0762711154
%M      .93923722885
MD      .28.15972975
MWS     30.0367647-1
PS      71.238682449
VACT    57703.57581
QACT    60.480904949
VSTD    48889.53267
QSTD    100.29336381
%I      0.
FHWT    0.
T WT    0.
FHGR    0.
FHLB    0.
T GR    0.
T LB    0.
```

Movie #2 Data Run 2 7-27-87

Total θ	Avg. $\sqrt{\Delta P}$	Avg. ΔH	Total V_m	Avg. T_m	Avg. T_s	Max. vac.	Max. temp.	Min. Max.
80	1.189298	1.4565	54.470	98.925	128.50	6.2	62	

Comments: Static ~~[illegible]~~ Static — .86" H_2O 54.369

SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant JESSE MORIE + SON Sample date 7/29/87

Sample location #2 DRYER STACK Run number 2

Sample recovery person RAKIEWICZ Recovery date

Filter(s) number 9274

MOISTURE

Impingers			Silica gel		
	134 20				
	154				
Final volume (wt)	[redacted]	ml (g)	Final wt	267 g	g
Initial volume (wt)	100	ml (g)	Initial wt	250 g	g
Net volume (wt)	54 [redacted]	ml (g)	Net wt	17 g	g
Total moisture	[redacted] 71	g			

Color of silica gel blush pink

Description of impinger water clear

RECOVERED SAMPLE

Blank filter container number Sealed

Filter container number 006 Sealed ✓

Description of particulate on filter extremely light

Acetone rinse container number 005 Liquid level marked? ✓

Acetone blank container number Liquid level marked?

Samples stored and locked ✓

Remarks

Date of laboratory custody 7/30/87

Laboratory personnel taking custody M. Taylor

Remarks

GAS ANALYSIS DATA FORM

Plant JESSIE MORIE Sample location DRIER #2 STACK

Date 7/29/87 Run no. TWO Operator BARKER / MILLS

Sample type: single-point or multipoint grab or integrated

Analytical method ORSAT Comments AMBIENT O_2 20.4
LEAK CHECK 0.0

	Sample point	24-hour clock time	% CO_2 Reading 1	% O_2 Reading 2	% O_2 Net[a]	% CO Reading 3	% CO Net[b]	
GRAB	B	14:29	0.0	20.5	20.5	20.5	0.0	
	INT		0.0	20.5	20.5	20.5	0.0	
	INT		0.0	20.4	20.4	20.4	0.0	
	INT		0.0	20.4	20.4	20.4	0.0	
GRAB	Between TEST 2 + ~~TEST~~ 3		1.2	20.8	19.6	20.8	0.0	
GRAB	From STACK PLATFORM		1.0	20.7	19.7	20.7	0.0	
								N_2
	Averages - of integrated		0.0	----	20.43	----	0.0	79.57

$\% N_2 = 100 - (\% CO_2 + \% O_2 + \% CO) =$ 0.0 ~~6.5389~~ 22.2796

$MW_d = 0.440 (\% CO_2) + 0.320 (\% O_2) + 0.280 (\% N_2 + \% CO) =$ ~~28.818~~ 28.817 =
6.5376

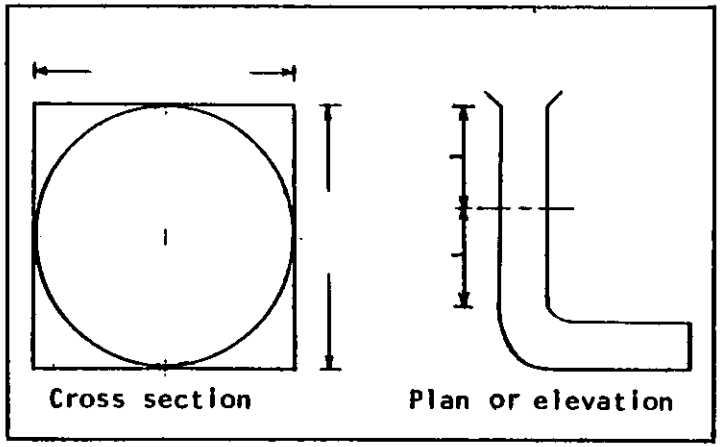
[a] Net % O_2 = Reading 2 - Reading 1

[b] Net % CO = Reading 3 - Reading 2

PARTICULATE . _D DATA FORM

Sheet _ of 2

Plant JESSE MORIE + SONS
City MILLVILLE NJ
Location DRYER #2 STACK
Operator RWKIEWICZ MILLS BARKER
Run No. 3 Date 7/29/87
Ambient temp., °F 87°F
Baro. press. (P_b), in. Hg. 30.10
Sample box no.
Meter box no. NUTECH 6
Meter box ΔH@ 1.826
Meter box cal. (Y) .9978
Probe length, ft. 6
Probe liner material borosilicate
Probe heater setting 30



Test point schematic

Pitot tube identification no. P15
Pitot tube cal. factor (C_p) .84
Nozzle identification no. 11T
Avg. nozzle diameter (D_n), in. .181
Pyrometer identification no. NUTECH 6
Thermocouple identification no. T23
Assumed moisture, % 7
Assumed temperature, °F. 129
Static pressure (P_{static}), in. H_2O -.87
C factor ___ Reference Δp
Initial leak rate .008 cfm @ 15 in. Hg
Final leak rate .007 cfm @ 9 in. Hg
Filter no. 9276
Comments: orsat leak check good
pitot tube leak check good

Traverse point number	Sampling time, min.	24-hr. clock time	Velocity head (ΔP), in. H_2O	Orifice meter pressure differential (ΔH), in. H_2O	Gas meter reading, $ft.^3$	Dry gas meter temperature (T_m) Inlet °F.	Dry gas meter temperature (T_m) Outlet °F.	Source temperature (T_s) °F	Source temperature (T_s) probe outlet °F	Pump vacuum, in.Hg. gauge	Impinger exit gas temp., °F.	Filter box temp., °F.	Filter box temp., °F. probe outlet
	0	1654			299.480								
A 1	0 4		2.40	2.40	303.300	91	91	129	200	8	68	215	121
2	4 8	1658	1.70	1.70	306.100	90	92	128	219	6.2	67	205	134
3	8 12	1702	1.00	1.00	308.50	90	93	129	233	4.1	68	202	134
4	12 16	1706	.85	.85	310.30	91	93	130	224	3.7	66	204	136
5	16 20	1710	.72	.72	312.302	91	94	131	221	3.0	68	200	138
	20												
B	0	1716											
1	4	1720	2.10	2.10	316.30	91	94	130	207	7.0	66	206	136
2	8	1724	2.0	2.0	318.50	91	95	128	205	7.0	61	203	147
3	12	1728	1.6	1.6	322.10	92	96	126	198	6.0	64	209	147
4	16	1732	1.2	1.2	324.30	92	96	127	197	5.0	68	205	147
5	20	1736	1.2	1.2	326.690	92	96	128	199	4.8	68	208	143
	Total θ		Avg. $\sqrt{\Delta P}$	Avg. ΔH	Total V_m	Avg. T_m		Avg. T_s		Max. vac.	Max. temp.	Min. Max.	

Comments: Static pressure -.88

Sheet _____ of _____

Traverse point number	Sampling time, min.	24-hr. clock time	Velocity head (ΔP), in. H_2O	Orifice meter pressure differential (ΔH), in. H_2O	Gas meter reading, $ft.^3$	Dry gas meter temperature (T_m) Inlet °F.	Dry gas meter temperature (T_m) Outlet °F.	Source temperature (T_s), °F probe	Source temperature (T_s), °F probe	Pump vacuum, in.Hg. gauge	Impinger exit gas temp., °F.	Filter box temp. °F.	Filter box temp. °F. Bottom outlet
C					326.690								
C	0	1738											
1	4	1742	1.9	1.9	329.62	92	94	129	188	6.8	68	209	137
2	8	1746	1.8	1.8	332.90	92	96	128	202	6.2	60	215	147
3	12	1750	1.7	1.7	335.45	92	97	127	201	6.0	58	211	148
4	16	1754	1.5	1.5	338.22	92	97	126	198	5.5	60	209	145
5	20	1758	1.1	1.1	340.885	92	96	126	196	4.5	60	217	142
D	0	1800											
1	4	1804	1.9	1.9	343.85	92	94	126	190	6.5	59	213	135
2	8	1808	1.7	1.7	346.60	92	95	127	225	6.0	56	225	139
3	12	1812	1.5	1.5	349.90	92	96	127	203	5.5	57	222	143
4	16	1816	1.1	1.1	352.00	91	95	127	209	5.0	60	222	144
5	20	1820	.80	.80	354.057	91	94	126	205	4.2	62	226	140
	Total θ 80		Avg. √ΔP 1.204517	Avg. ΔH 1.4885	Total V_m 54.577	Avg. T_m 93.075		Avg. T_s 127.75		Max. vac 8	Max. temp. 68	Min. Max.	

Moore #2 Dryer

Run 3

7-29-87

```
Γ ΔP      \\\\\\\\\\\\\\\\
ΔH        1.204517
TS        1.4885
TM        127.7575
VMA       93.0775
PBAR      54.5777
VWC       30.1
WSG       55.8
MWD       22.8
RS        28.816
TT        13.5
STAT      80.
DN        -0.87
Y         0.1181
CP        0.9978
TH2O      0.84
VMS       77.8
VWS       52.678146
%M        3.687272
MD        6.542470111
MWS       .933457529
PS        28.10836643
VACT      30.03602941
QACT      72.17134386
VSTD      58458.78853
QSTD      61.04463397
%I        49946.15815
FHWT      100.593207
T WT      0.
FHGR      0.
FHLB      0.
```

Comments:

SAMPLE RECOVERY AND INTEGRITY DATA FORM

Plant Jesse Morse & Son Sample date 7/29/87

Sample location #2 Sand Dryer Run number 3

Sample recovery person Rakiewicz Recovery date 7/29/87

Filter(s) number 9276

MOISTURE

Impingers			Silica gel		
	25 130				
Final volume (wt)	155	ml (g)	Final wt	272.8 g	g
Initial volume (wt)	100	ml (g)	Initial wt	250 g	g
Net volume (wt)	55	ml (g)	Net wt	22.8 g	g
Total moisture	77.8	g			

Color of silica gel 90% pink

Description of impinger water clear

RECOVERED SAMPLE

Blank filter container number _____ Sealed _____

Filter container number 008 Sealed ✓

Description of particulate on filter _____

Acetone rinse container number 007 Liquid level marked? ✓

Acetone blank container number _____ Liquid level marked? _____

Samples stored and locked ✓

Remarks _____

Date of laboratory custody 7/30/87

Laboratory personnel taking custody M. Taylor

Remarks _____

GAS ANALYSIS DATA FORM

Plant JESSIE MARIE Sample location DRIER #2 STACK

Date 7/29/87 Run no. THREE Operator BARKER / MILLS

Sample type: single-point or multipoint; grab or integrated

Analytical method ORSAT Comments AMBIENT O_2 20.4
LEAKCHECK CO

Sample point	24-hour clock time	% CO_2 Reading 1	% O_2 Reading 2	% O_2 Net[a]	% CO Reading 3	% CO Net[b]
GRAB		0.0	20.2	20.2	20.2	0.0
GRAB		0.0	20.2	20.2	20.2	0.0
INT		0.0	20.5	20.5	20.5	0.0
INT		0.0	20.3	20.3	20.3	0.0
INT		0.0	20.4	20.4	20.4	0.0
Averages of Integrated		0.0	----	20.40	----	0.0

N_2

$\% N_2 = 100 - (\% CO_2 + \% O_2 + \% CO) = 79.60$

$MW_d = 0.440 (\% CO_2) + 0.320 (\% O_2) + 0.280 (\% N_2 + \% CO) = 28.816$

$0.0 + 6.528 + 22.288$

[a] Net % O_2 = Reading 2 - Reading 1

[b] Net % CO = Reading 3 - Reading 2

WESTON

Date of Report: 8-8-87
Client: Jesse Morie

TABLE II

EPA Method 7A: NO_x

RFW Number	Client I.D.	Date Collected	Date Analyzed	NO_x Concentration In Total µg
8707-951-0090	NO_x Blank 009	7-29-87	7-31-87	<25
0100	NO_x N 2077ml 011	7-29-87	7-31-87	<25
0110	NO_x SH 2080ml 012	7-29-87	7-31-87	<25
0120	NO_x FU 2085ml 013	7-29-87	7-31-87	<25
0130	NO_x 14 2075ml 014	7-29-87	7-31-87	<25
0140	NO_x 3 2111ml 015	7-29-87	7-31-87	<25
0150	NO_x D 2097ml 016	7-29-87	7-31-87	<25
0160	NO_x 7 2103ml 021	7-29-87	7-31-87	<25
0170	NO_x E 2088ml 022	7-29-87	7-31-87	<25
0180	NO_x 5 2093ml 023	7-29-87	7-31-87	<25
0190	NO_x 4 2095ml 024	7-29-87	7-31-87	<25
0200	NO_x M 2080ml 031	7-29-87	7-31-87	<25
0210	NO_x W 2062ml 032	7-29-87	7-31-87	<25
0220	NO_x Z 2095ml 033	7-29-87	7-31-87	<25
0230	NO_x ¶ 2090ml 034	7-29-87	7-31-87	<25
0240	NO_x A1 2059ml 035	7-29-87	7-31-87	<25
0250	NO_x HQ1 2093ml 036	7-29-87	7-31-87	<25

RFW Number	Client I.D.	NO_x Concentration in mg/DSCM
8707-951-0260	B02732	892.9
0270	B01409	893.4

WESTON

Custody Transfer Record/Lab Work Request

Received By [illegible] Client [illegible] RFW Contact [illegible]
Date 7/[illegible]/87 Client Contact [illegible] Date Due 8/7/87
Assigned to _____ Phone _____ Project Number [illegible]-01-02

8/07-87

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	[illegible]	[illegible]						
0010	[illegible]	[illegible]		7/[illegible]/87	[illegible]								
20	[illegible]	[illegible]			[illegible]								
30	[illegible]	[illegible]			[illegible]								
40	004	[illegible] 9278			[illegible]								
50	005	[illegible]			[illegible]								
60	006	[illegible] 9274			[illegible]								
70	007	[illegible]			[illegible]								
80	008	[illegible] 9276			[illegible]								
90	009	[illegible]			[illegible]								
100	0011	[illegible]						Possibility [illegible]					
110	0012	NOx SH 2098 ml						Stop to take pa[illegible]					
120	0013	NOx EU 2095 ml											
130	014	NOx 14 2075 ml											
140	0015	NOx 3 2111 ml											
150	0016	NOx D 2097 ml											
160	0021	NOx 7 2103 ml						Possibility [illegible]					
170	0022	NOx F 2088 ml						Stop [illegible]					
180	0023	NOx 5 2095 ml											
190	0024	NOx 4 2045 ml											

Matrix:
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

Special Instructions: [illegible]

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
Analysis	[illegible]	[illegible]	7/[illegible]/87	1815					

RFW 21-21-001/A-3/86

Initial Lab Dicki

WESTON

Custody Transfer Record/Lab Work Request

Received By [illegible] Client [illegible]
Date 7/30/87 Client Contact [illegible]
Assigned to _____ Phone _____

RFW Contact [illegible]
Date Due [illegible]
Project Number [illegible]-01-02

8/04-1/87

SAMPLE IDENTIFICATION / **ANALYSES REQUESTED**

Sample No.	Client ID No.	Description	Matrix	Date Collected	Container/Preservative	[illegible]							
0200	0031	Vox M 2080		7/31	[illegible]								
210	0032	Vox W 2062		↓	↓								
220	0033	Vox Z 2075											
230	0034	Vox [illegible] 2070											
240	0035	Vox N-1 2051											
250	0036	Vox [illegible] 2013		↓	↓								
		Performance Sample				✓							
		Performance Sample				✓							

Matrix:
S- Soil DS- Drum Solids
W- Water DL- Drum Liquids
O- Oil X- Other

Special Instructions:

Items/Reason	Relinquished By	Received By	Date	Time	Items/Reason	Relinquished By	Received By	Date	Time
[illegible]	[illegible]	[illegible]	7/31/87	1515					

RFW 21-21-001/A-3/86

NOx Book No. 31 July 1987

Page No.

NO_3 peak ht @ ret. time

blank –
25µg 195 @ 4.50
50 428 @ 4.19
100 845 @ 4.09 $S = \frac{1}{8.814} = 0.1135$
150 1270 @ 4.59
250 2190 @ 4.75
blk –
...own/xxx Lot 0485 464 @ 4.17 (t.v. = 298.6) 263.3 mg/105cm 88.2%
...m G xxx Lot 0485 520 @ 4.62 (t.v. = 338.4) 295.1 87.2
blk –
707-951-0260 (B02732) 1438 @ 4.12 816.1
-0270 (B01409) 1452 @ 4.19 824.0
blk –
951-0090 149 @ 4.19 <25µg
-0100 –
-0110 –
-0120 –
-0130 –
-0140 –
-0150 –
-0160 –
-0170 –
-0180 –
-0190 –
-0200 –
-0210 –
-0220 –
-0230 –
-0240 –
-0250 –
-0250 rep –
blk –
25µg 173 @ 4.79
50 394 @ 4.34
100 784 @ 4.35 $S = \frac{1}{7.863} = 0.1272$
150 1193 @ 4.82
250 1947 @ 4.19

To Page No.

Witnessed & Understood by me.	Date	Invented by	Date
		Recorded by Nicki J. Perrone	7/31/87

Project No.

NOx — Book No. — 31 July 1987 — 19

e No. — NO_3 peak ht @ ret time

blk	–		
known 1XXX (298.6)	450 @ 4.62	286.2 mg/DSCM	95.8%
" 6XXX (338.4)	516 @ 4.54	328.2	97.2
blk	–	<.25 ~~mg~~	
7-951-[redacted] (002732)	1392 @ 4.30	[redacted]	
[redacted] (001429)	1384 @ 4.59	[redacted]	
blk	–	<.25 mg	
951-0090	–		
-0100	–		
-0110	–		
-0120	–		
-0130	–		
-0140	–		
-0150	–		
-0160	–		
-0170	–		
-0180	–		
-0190	–		
-0200	–		
-0210	–		
-0220	–		
-0230	–		
-0240	–		
-0250	–		
-0250	–		
blk	–		
25 ug	172 @ 4.42		
50	395 @ 4.60		
100	786 @ 4.42	$S = \frac{1}{7.973} = 0.1254$	
150	1192 @ 4.39		
250	1973 @ 4.47		
blk	–		
known 1XXX (298.6)	464 @ 4.64	290.9 mg/DSCM	97.4%
known 6XXX (338.4)	504 @ 4.34	316.0	93.4
blk	–		
951-[redacted] (002732)	1436 @ 4.34	[redacted]	
[redacted] (001429)	1446 @ 4.20	[redacted]	

To Page No.

ed & Understood by me.	Date	Invented by	Date 7/31/87
		Recorded by Vicki J. Kerson	

	volume, mL	
8707-951-0090	83	
-0100	39	Run 1
-0110	34	
-0120	35	
-0130	34	
-0140	34	
-0150	34	
-0160	35	Run 2
-0170	35	
-0180	35	
-0190	35	
-0200	36	Run 3
-0210	35	
-0220	29	
-0230	33	
-0240	32	
-0250	37	

EPA NO_x reference.

Lot 0485

(1xxx) tv = 298.6 mg/DSCM

(4xxx) tv = 338.4

APPENDIX D

SAMPLE CALCULATIONS

morie.810

PARTICULATE SAMPLE CALCULATIONS

Client Jesse Morie Inc. Plant Mauricetown N.J.

Test Run No. One Test Date 7-29-87

Test Location #2 Sand Dryer Baghouse Outlet Test Period 1010 - 1142

1. Volume of dry gas sampled at standard conditions 70 °F, 29.92 in. Hg), dscf.

$$V_{m(std)} = \frac{17.71 \times Y \times V_m \times (P_b + \frac{\overline{\Delta H}}{13.6})}{(\overline{T_m} + 460)}$$

$$V_{m(std)} \quad \frac{17.71 \times 0.998 \times 54.015 \times (30.09 + \frac{1.50}{13.6})}{(92 + 460)} = 52.24$$

Where:

$V_{m(std)}$	=	Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscf.
V_m	=	Volume of gas sample measured by the dry gas meter at meter conditions, dcf.
P_b	=	Barometric pressure, in. Hg.
$\overline{\Delta H}$	=	Average pressure drop across the orifice meter, in. H_2O.
$\overline{T_m}$	=	Average dry gas meter temperature, °F.
Y	=	Dry gas meter calibration factor.
17.64	=	Factor that includes ratio of standard temperature (530 °R) to standard pressure (29.92 in. Hg), °R/in. Hg.
13.6	=	Specific gravity of mercury.

2. Volume of water vapor in the gas sample corrected to standard conditions, scf.

$$V_{w(std)} = (0.04733) \times V_{wc}) + (0.0474) \times W_{wsg})$$

$$V_w(std) = (0.04733) \times 46.) + (0.04740) \times 21.7) = 3.2$$

Where:

$V_{w(std)}$	=	Volume of water vapor in the gas sample corrected to standard conditions, scf.
V_{wc}	=	Volume of liquid condensed in impingers, ml.
W_{wsg}	=	Weight of water vapor collected in silica gel, g.
0.04707	=	Factor which includes the density of water (0.002201 lb/ml), the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) $(ft^3)/(lb\text{-}mole)(^oR)$; absolute temperature at standard conditions (528^oR), absolute pressure at standard conditions (29.92 in. Hg), ft^3/ml.
0.04715	=	Factor which includes the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg)$(ft^3)/(lb\text{-}mole)(^oR)$, absolute temperature at standard conditions (528^oR), absolute pressure at standard conditions (29.92 in. Hg), and 453.6 g/lb, ft^3/g.

3. Moisture content.

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$B_{ws} = \frac{3.2}{3.2 + 52.24} = 0.058$$

Where:

B_{ws}	=	Proportion of water vapor, by volume, in the gas stream, dimensionless.

4. Mole fraction of dry gas.

$$M_d = 1 - B_{ws}$$

$$M_d = 1 - .058 = 0.942$$

Where:

M_d	=	Mole fraction of dry gas, dimensionless

5. Dry molecular weight of gas stream, lb/lb-mole.

$$MW_d = 0.440(\%\ CO_2) + 0.320(\%\ O_2) + 0.280(\%N_2 + \%\ CO)$$

$$MW_d = (0.440 \times 0.0) + (0.320 \times 20.3) + (0.280\ (79.7 + 0.0)$$

$$= 28.8$$

Where:

MW_d	=	Dry molecular weight, lb/lb-mole.
$\%CO_2$	=	Percent carbon dioxide by volume, dry basis.
$\%O_2$	=	Percent oxygen by volume, dry basis.
$\%N_2$	=	Percent nitrogen by volume, dry basis.
%CO	=	Percent carbon monoxide by volume, dry basis.
0.440	=	Molecular weight of carbon dioxide, divided by 100.
0.320	=	Molecular weight of oxygen, divided by 100.
0.280	=	Molecular weight of nitrogen or carbon monoxide, divided by 100.

6. Actual molecular weight of gas stream (wet basis), lb/lb-mole.

$$MW_s = (MW_d \times M_d) + 18\ (1 - M_d)$$

$$MW_s = (28.8 \times 0.942) + 18\ (1 - .942)$$

$$= 28.2$$

Where:

MW_s	=	Molecular weight of wet gas, lb/lb-mole.
18	=	Molecular weight of water, lb/lb-mole.

7. Average velocity of gas stream at actual conditions, ft/sec.

$$v_s = 85.49 \times C_p \times (\sqrt{\Delta p})\ \text{avg.} \times \left[\frac{T_s\ (\text{avg})}{P_s \times MW_s}\right]^{\frac{1}{2}}$$

v_s = 85.49 x 0.840 x 1.2066 x $\left[\frac{590.}{30.03 \times 28.19}\right]^{\frac{1}{2}}$

= 72.3

Where:

v_s = Average gas stream velocity, ft/sec.

85.49 = Pitot tube constant, ft/sec x $\left[\frac{(lb/lb\text{-}mole)(in.Hg)}{(^oR)\ (in.\ H_2O)}\right]^{\frac{1}{2}}$

C_p = Pitot tube coefficient, dimensionless.

T_s = Absolute gas stream temperature, ^oR. = $T_s, ^oF + 460$

P_s = Absolute gas stack pressure, in. Hg. = $P_b + \frac{P_{static}}{13.6}$

Δp = Velocity head of stack gas, in. H_2O

8. Average gas stream volumetric flow rate at actual conditions, wacf/hr.

$Q_{s(act)}$ = 3,600 x v_s x A_s

= 3,600 x 72.3 x 13.5 = 3,516,000. ÷ 60

= 58600. wacf/min

Where:

$Q_{s(act)}$ = Volumetric flow rate of wet stack gas at actual conditions, wacf/hr.

A_s = Cross-sectional area of stack, ft.^{2}

9. Average gas stream dry volumetric flow rate at standard conditions, dscf/hr.

$Q_{s(std)}$ = $17.71 \times M_d \times \frac{P_s}{T_s} \times Q_{s(act)}$

= $17.71 \times .942 \times \frac{30.03}{590} \times 2,985,000. \div 60 =$

49800. scf/min

Where:

$Q_{s(std)}$ = Volumetric flow rate of dry stack gas at standard conditions, dscf/hr.

10. Isokinetic variation calculated from intermediate values, percent.

$$I = \frac{17.251 \times T_s \times V_{m(std)}}{v_s \times \theta \times P_s \times M_d \times (D_n)^2}$$

$$I = \frac{17.251 \times 590. \times 52.24}{72.3 \times 80. \times 30.0 \times .942 \times (.181)^2} = 99.$$

Where:

I	=	Percent of isokinetic sampling.
θ	=	Total sampling time, minutes.
D_n	=	Diameter of nozzle, inches.
17.327	=	Factor which includes standard temperature (530°R) standard pressure (29.92 in.Hg), the formula for calculating area of circle $\frac{D^2}{4}$, conversion of square feet to square inches (144), conversion of seconds to minutes (60), and conversion to percent (100), $\frac{(in.\ Hg)\ (in^2)\ (min)}{(^oR)\ (ft^2)\ (sec)}$

11. Particulate concentration, gr/dscf.

$$C_1 = 15.432 \times \frac{M_t}{V_{m(std)}}$$

$$C_1 = 15.432 \times \frac{.0126}{52.24} = 0.0037$$

Where:

C_1	=	Particulate concentration, gr/dscf.
M_t	=	Total weight of particulate caught by train, g.
15.432	=	Conversion factor of gr/g.

12. Particulate concentration, gr/wacf.

$$C_2 = C_1 \times \frac{Q_{s(std)}}{Q_{s(act)}} = .0037 \times \frac{49800.}{58600.} = 0.0031$$

Where:

C_2	=	Particulate concentration, gr/wacf.

13. Particulate mass emission rate, lb/hr.

$PMR_t = 0.000142857 \times C_1 \times Q_{s(std)}$

$= 0.000142857 \times .0037 \times 2,985,000. = 1.58$

Where:

PMR_t	=	Particulate mass emission rate, lb/hr.
0.000142857	=	Conversion factor relating grains to pounds (7,000), lb/gr.

14. Conversion Factors:

From	To	Multiply by
in.	mm.	25.40
ft.	m.	0.3048
$ft.^2$	$m.^2$	0.092903
$ft.^3$	$m.^3$	0.028317
$gr/ft.^3$	$g/m.^3$	2.28833
lbs/hr.	g/hr.	453.59

Temperature

$^oC = 5/9\ (F-32)$

$^oR = {}^oF + 460$

$^oK = {}^oC + 273$

EPA METHOD 7A

NO_x SAMPLE CALCULATIONS

Client: Jesse Morie Inc.

PLANT: Maurice town N.J.

Test Run No. One

Test Date: 7-29-87

Grab Sample No. One

Sample Time: 1031

Flask No. N

Test Location: #2 Dryer Outlet

NOTE: CALCULATIONS PRESENTED BELOW ARE FOR A SINGLE GRAB SAMPLE. NOx EMISSIONS DATA ON TABLES 3 AND 4 ARE BASED ON THE AVERAGE OF THREE GRAB SAMPLES TAKEN DURING THE ASSOCIATED METHOD 5/8 RUN.

1. Volume of dry gas sampled at standard conditions (68°F, 29.92 in. Hg), ml.

$$V_{sc} = 17.64\ (V_f - Va)\ \left(\frac{P_f}{T_f} - \frac{P_i}{T_i}\right)$$

$$= 17.64\ (2077 - 25)\ \left(\frac{30.45}{547} - \frac{1.65}{538}\right) = 1904$$

WRONG

RUN 1-1 1779 ml

Where:

V_{sc} = Sample volume at standard conditions of 68°F and 29.92 in. Hg (dry basis), ml.

V_f = Volume of flask and valve, ml.

V_a = Volume of absorbing solution, 25 ml.

P_f = Final absolute pressure of flask, in Hg

P_i = Initial absolute pressure of flask, in. Hg

T_f = Final absolute temperature of flask, °F.

T_i = Initial absolute temperature of flask, °R.

17.64 = Factor that includes ratio of standard temperature (528°R) to standard pressure (29.92 in. Hg), °R/in. Hg

2. Sample concentration, mg/dscm as NO_2

$$C = \frac{HSF \times 10{,}000}{Vsc}$$

$$= \frac{<25. \times 10{,}000}{1904} = <131.$$

Where:

HSF = Total ug per sample

10^4 = 1:10 dilution times conversion factor of 1000 ug/mg

3. Sample concentration, ppm/v as NO_2

$$ppm\ NO_2 = 0.5228 \times C$$

$$= 0.5228 \times 131 = < 69.$$

Where: 0.5228 = conversion factor from ug/dscm to ppm/v

4. Sample concentration, lbs/dscf as NO_2

$$C = ppm \times \frac{M}{385.1 \times 10^6}$$

$$= 69 \times \frac{46}{385.35 \times 10^6} = < 8.237 \times 10^{-6}$$

Where:

M = Molecular Weight of NO_2

5. NO_x emission rate, poundsper hour, as NO_2:

$$PMR_{nox} = C \times Q_{s(std)} = < 8.237 \times 10^{-6} \times 49{,}800 \times 60 = < 25.$$

Where:

PMR_{nox} = Mass emission rate of NO_x as NO_2, lb/hr.

$Q_{s(std)}$ = Volumetric flow rate of dry stack gas at standard conditions, dscf/hr.

6. Conversion factors:

From	To	Multiply by
in.	mm	25.40
lbs/ft.^{3}	mg/m^3	16.018×10^6
lbs/hr.	g/hr.	453.59

Temperature

$^oC = 5/9\ (F-32)$

$^oR = {}^oF + 460$

$^oK = {}^oC + 273$

APPENDIX E

EQUIPMENT CALIBRATION RECORDS

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w Calib

METER BOX CALIBRATION DATA AND CALCULATION FORM

te 15 May 1987

Meter Box Number NuTech #6

rometric pressure, P_b = 30.01 in. Hg

Calibrated by [illegible]

ifice nometer tting (ΔH), . H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperatures: Wet test meter (t_w), °F	Temperatures: Dry gas meter: Inlet (t_{d_i}), °F	Temperatures: Dry gas meter: Outlet (t_{d_o}), °F	Temperatures: Dry gas meter: Avg[a] (t_d) °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
5	5	129.708 134.725	75.2	80 80 81	81 82 83	81.2	12.17	1.006	1.697
.0	5	124.191 129.210	75.2	79 80 80	80 58 83	80.7	8.7	1.004	1.694
5	10	135.223 145.344	75.2	81 82 82	82 85 86	84.5	14.77	1.002	1.818
)	10	146.095 156.277	75.2	82 83 83	83 85 87	83.8	13.4	.9930	1.998
..0	10	157.036 167.284	75.2	82 83 83	83 85 87	83.8	10.93	.9842	1.922
.0	10								
							Avg	Y .9978	$\Delta H@$ 1.826

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$		$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\theta}{V_w}\right]^2$		
0.5	0.0368	541.2 - 30.01 - 5 535.2 - 30.05 - 5.017	1.006	.01585 .000001 541.2 - 30.01	5352 - 12.17 ÷5 ✓	1.697
1.0	0.0735	540.7 - 30.01 - 5 535.2 - 30.08 - 5.019	1.004	.0317 .000002 540.7 - 30.01	5352 - 8.7 ÷5 ✓	1.694
1.5	0.110	544.5 - 30.01 - 10 535.2 - 30.12 - 10.131	1.002	.047355 .0000049 544.5 - 30.01	5352 - 14.77 ÷10	1.818
2.0	0.147	543.8 - 30.01 - 10 535.2 - 30.16 - 10.172	.9930	.06344 .0000039 543.8 - 30.01	535.2 - 13.4 ÷10 ✓	1.998
3.0	0.221	543.8 - 30.01 - 10 535.2 - 30.23 - 10.248	.9842	.0951 .000000 543.8 - 30.01	535.2 - 10.93 ÷10 ✓	1.922
4.0	0.294					

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

New Calibration

METER BOX CALIBRATION DATA AND CALCULATION FORM

Date 2 August 1987 Meter Box Number Nutech #6

Barometric pressure, P_b = 29.82 in. Hg Calibrated by Bruce Wood

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperatures: Wet test meter (t_w), °F	Temperatures: Dry gas meter: Inlet (t_{d_i}), °F	Temperatures: Dry gas meter: Outlet (t_{d_o}), °F	Temperatures: Dry gas meter: Avg[a] (t_d) °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5	392.840 397.868	77	83 83 83	84 84 85	83.7	12.22	1.006	[illegible]
1.0	5	403.437 408.463	76	83 83 83	83 83 84	83.2	8.7	1.005	[illegible]
1.5	10	409.715 419.836	76	82 82 83	83 83 85	83.8	14.97	.9981	[illegible]
2.0	10	420.334 430.496	76	82 82 83	83 84 86	83.3	13.08	.9926	[illegible]
3.0	10	431.764 442.006	76	82 83 83	83 85 87	84.2	10.72	.9806	[illegible]
4.0	10								
							Avg	Y .9964	$\Delta H@$ 1.511

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\theta}{V_w}\right]^2$
0.5	0.0368	543.7 · 29.82 · 5 537 · 29.86 · 5.028 1.006	.01585 .0000647 543.7 · 29.82 [illegible]
1.0	0.0735	543.7 · 29.82 · 5 537 · 29.84 · 5.063 1.0005	.03177 .0000127 543.7 · 29.82 [illegible]
1.5	0.110	542.8 · 29.82 · 10 536 · 29.87 · 10.121 .9981	.04755 .0000229 542.8 [illegible]
2.0	0.147	543.3 · 29.82 · 10 535 · 29.91 · 10.162 .9926	.0634 .0000351 543.3 · 29.81 [illegible]
3.0	0.221	544 · 29.82 · 10 536 · 30.04 · 10.248 .9840	.0945 [illegible] 544.2 · 29.82 [illegible]
4.0	0.294		

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

Tibrator: Bruce Wood

POSTTEST DRY GAS METER CALIBRATION DATA FORM

Test numbers _____ Date 3 Aug 1987 Meter box number NUTECH #6 Plant Jessie-Marie & Sons

Barometric pressure, P_b = 29.83 in.Hg Dry gas meter number _____ Pretest Y .9955

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg.	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$
1.5"	10	360.340 370.423	78	80 80 81	81 82 84	81.3	14.9	5.5"	.9942	
1.5"	10	370.423 380.477	77	81 82 83	82 84 86	83	14.73	5.5"	1.002	
1.5"	10	380.477 390.58	77	82 83 83	83 85 86	83.7	14.76	5.5"	.9978	
									Y = .9980	

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, $\frac{t_{d_i} + t_{d_o}}{2}$, °F.

ΔH = Pressure differential across orifice, in H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ± 0.05Y

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$

$$\Delta H@_i = \frac{0.0317\,\Delta H}{P_b\,(t_d + 460)} \left[\frac{(t_w + 460)\,\theta}{V_w}\right]$$

WESTON

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 6/29/87 Thermocouple number NUTECH #6

Ambient temperature 80 °F Barometric pressure 29.55 in. Hg

Calibrator T Barber Reference: mercury-in-glass YES

other

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
32°F	ICE BATH	32°F	32°F	0
80°F	AMBIENT	80°F	79°F	-.185
300°F	HOT OIL	300°F	301°F	+.132

[a]Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °F} + 459.67) - (\text{test thermom temp, °F} + 459.67)}{\text{ref temp, °F} + 459.67}\right] 100 \leq 1.5\%.$

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot Tube 15

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? ____ yes (explain below) ✓ no

α_1 = 1 ° (<10°), α_2 = 1 ° (<10°), β_1 = 1 ° (<5°),
β_2 = 1 ° (<5°)

γ = 2 °, θ = 0 °, A = 1.020 cm (in.)

z = A sin γ = .036 cm (in.); <0.32 cm (<1/8 in.),
w = A sin θ = 0 cm (in.); <.08 cm (<1/32 in.)

P_A .510 cm (in.) P_b .510 cm (in.)

D_t = .375 cm (in.)

Comments: Inspected 7/10/87 B. Straub

Calibration required? ____ yes ✓ no

NOZZLE CALIBRATION DATA FORM

Date 7/28/87 Calibrated by Jack Mills

Nozzle identification number	Nozzle diameter, inches[a]			ΔD,[b]	D_{avg}[c]
	D_1	D_2	D_3		
11 T	.182	.182	.180	.002	.181

Where:

[a] $D_{1,2,3}$ = three different nozzle diamters, inches; each diameter must be measured to nearest 0.001 in.

[b] ΔD = maximum difference between any two diameters, inches. ΔD must be $\leq$ 0.004 in.

[c] D_{avg} = nozzle diameter = average of D_1, D_2 and D_3.

APPENDIX F

WESTON PROJECT PARTICIPANTS

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PROJECT PARTICIPANTS

The following WESTON employees participated in this project:

Richard B. Ruch Project Director	econENVIRONomics	Division
Barry L. Jackson Project Manager	econENVIRONomics	Division
Jeffrey O'Neill Section Manager	econENVIRONomics	Division
Roy Rakiewicz Project Scientist	econENVIRONomics	Division
Jack Mills Laboratory Technician	econENVIRONomics	Division
Ted Barker Project Technician	econENVIRONomics	Division
Mike Taylor Laboratory Supervisor	WESTON	Analytics
Emily Carfioli Laboratory	WESTON	Analytics Supervisor