Let's protect our earth

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
Bureau of New Source Review
CN 027
Trenton, N.J. 08625-0027
1-800-441-0065

Anthony J. McMahon
Acting Director

William O'Sullivan, P.E., Assistant Director
Air Quality Engineering and Technology

January 18, 1990

MEMORANDUM

TO: Michael Pratt

FROM: Len Sobolewski

SUBJECT: The Morie Company Inc.
Mauricetown Plant
Mauricetown, New Jersey
N.J.D.E.P. ID No. 75027

Stack emission tests were conducted for Nitrogen Oxide at the subject facility on November 22, 1989, by Air Nova Inc.

The purpose of the test was to determine whether the Nitrogen Oxide emissions from the Number 2 Sand Dryer/Cooler Stack (N.J. Stack No. 002) were within the standards stated on Permit/Certificate Number 088859 as filed under the New Jersey Administrative Code 7:27-8 "Permits".

The results of the emission tests conducted by Air Nova Inc., as reported to the Bureau of Technical Services is as follows.

RUN	DATE	ALLOWABLE NO_X	ACTUAL NO_X
1	11-22-89	7.10	2.60
2	11-22-89	7.10	2.80
3	11-22-89	7.10	2.90

PRODUCTION RATES

RUN	DATE	TIME	NUMBER 2 FUEL OIL	SAND PRODUCTION FEED RATE
1	11-22-89	13:32-14:32	131 GAL/HR	180,000 LBS
2	11-22-89	15:07-16:07	137 GAL/HR	178,000 LBS
3	11-22-89	16:14-17:14	145 GAL/HR	176,000 LBS

For all test runs the Number 2 Sand Dryer/Cooler (NJ Stack No. 002) was venting the production of industrial silica sand. The Permit/Certificate Number 088859 lists a maximum productions rate of 200,000 lbs/hr of silica sand.

In conclusion, the Bureau of Technical Services calculations using the submitted field test data produced essentially the same results as those reported by Air Nova Inc., during all test runs.

Let's protect our earth

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
Bureau of New Source Review
CN 027
Trenton, N.J. 08625-0027
1-800-441-0065

Anthony J. McMahon
Acting Director

William O'Sullivan, P.E., Assistant Director
Air Quality Engineering and Technology

January 31, 1990

MEMORANDUM

TO: Joe DePierro

THROUGH: Edward Choromanski

FROM: Michael Pratt MP

SUBJECT: The Morie Company, Inc.
APC Plant ID No. 75027
NJ Stack No. 002
Permit/Certificate to Operate (P/CT) No. 88859

Emission tests were conducted on No. 2 sand dryer/cooler.

The purpose of these test was to determine NO_x emission rates and then to compare them with P/CT No. 88859 allowables.

NOTES:

1) On July 29, 1987 subject equipment was tested for particulate and NO_x emission rates. Particulate emission rates were within P/CT No. 75378 (it was superseded by present P/CT No 88859) allowables.

   However, NO_x emission rates were inconclusive. Therefore, November 22,1989 stack test was confined only to NO_x emission rates.

2) According to Air-Nova, Inc. submitted report, stack testing for NO_x was done during burning of No. 2 fuel oil (i.e. maximum conditions for NO_x emissions. Subject plant has the capability to burn natural gas as well).

Leonard Sobolewski reviewed the submitted test report. His review indicated the following:

1) Production rate during subject stack test was in the range of 88 to 90% of P/CT NO. 88859 200,000 lb/hr.

2) NO_x emission rates were well within P/CT No. 88859 allowables.

CONCLUSION:

Compliance.

RECOMMENDATION:

Temporary certificate can be changed to permanent status pending approval by SRO.

cc: Milton Polakovic
Lou Mikolajczyk
Harry Hornikel
Leonard Sobolewski

Project No. 1301

The Morie Company, Inc.
Mauricetown Plant

Emission Compliance
Test Program

Prepared for:

Mr. James Zadorozny
The Morie Company
1201 N. High Street
Millville, New Jersey 08332

November 1989

Table of Contents

		Page
1.0	Introduction	1
2.0	Site Description	2
3.0	Test Results	4
4.0	Discussion of Results	6
5.0	Description of Project	7

Appendix A - Field Data Sheets

Appendix B - Chart Recorder Print-out

Appendix C - Calibration Data Sheets

Appendix D - Calculation Printouts

Appendix E - Gas Standard Certification

Appendix F - NO_x Converter Efficiency Data

Appendix G - Emission Test Production Data Form

1.0 Introduction

AirNova, Inc. conducted an emission compliance test program at The Morie Company, Inc. Mauricetown Plant (APC ID No 75027-002) for the purpose of demonstrating compliance with applicable New Jersey Department of Environmental Protection (NJDEP) Regulations. The emission sampling was conducted to determine the emission rate of Nitrogen Oxides from the No. 2 Sand Dryer/Cooler Stack. The testing was conducted on November 22, 1989 by the following AirNova personnel:

- Mark D. Daly	President
- John J. Deemer	Project Manager
- Joseph May	Testing Technician

This report contains a description of the testing program, the results of the testing, as well as field data, calibration data, and calculation print-outs.

2.0 Site Description

The source which was tested was the No. 2 Sand Dryer/Cooler. The source consisted of the following components:

- Two (2) vibrating fluid bed dryers
- A vibrating fluid bed cooler
- Aeropulse dust collector

Silica sand is dried by direct heat exchange as it passes through two (2) Carrier Vibrating Fluid Bed Dryers which are connected in series. The primary fuel for the heat exchange is natural gas. The secondary fuel is No. 2 Fuel Oil. Because the combustion No. 2 Fuel Oil would have a greater potential for NO_x emissions, it was selected as the fuel for the testing program. The method of firing for the No. 2 Fuel Oil is air atomization. The dried sand then passes through a Carrier Vibrating Fluid Bed Cooler. The sand dryer/cooler system is designed to process a maximum of 200,000 pounds per hour. The actual production data is presented in Table 2-1. An Aeropulse Baghouse is utilized to capture the potential particulate emissions which are exhausted from each of the two (2) dryers and the cooler. The baghouse is designed for a flowrate of approximately 71,000 ACFM. The actual data is presented in Table 3-1. The emissions from the baghouse are exhausted to the atmosphere.

The Morie Company Inc.
No. 2 Sand Dryer/Cooler Production Data
11/22/89

Run No.	Time	No. 2 Fuel Burn Rate (gal/hr)	Product Feed Rate (lbs/hr)
1	13:32-14:32	131	180000
2	15:07-16:07	137	178000
3	16:14-17:14	145	176000
average		137.7	178000.0

Table 2-1

3.0 Test Results

3.1 Air Flows, Temperature, Moisture Levels

Run No.	Location	ACFM	Temperature °F	Moisture level %	DSCFM
1	Outlet	52025	115	2.8	47153
2	Outlet	51870	115	4.0	46397
3	Outlet	52617	118	3.3	47167
Average		52171	116	3.4	46906

3.2 Orsat Data

Run No.	Location	% O_2	% CO_2
1	Outlet	20.3	0.8
2	Outlet	20.2	0.6
3	Outlet	20.3	1.0
Average		20.3	0.8

3.3 Oxides of Nitrogen Concentrations and Emission Rates

Run	Location	Concentration ppmd	Emission Rates lbs/hr
1	Outlet	7.6	2.6
2	Outlet	8.3	2.8
3	Outlet	8.6	2.9
Average		8.2	2.8

3.4 Cyclonic Flow Data

Port	Traverse Point	Recorded Yaw Angle
A	1	-1
	2	-2
	3	0
	4	1
	5	0
	6	0
B	1	+2
	2	0
	3	1
	4	0
	5	0
	6	0
C	1	-3
	2	-1
	3	0
	4	1
	5	0
	6	0
D	1	1
	2	1
	3	0
	4	0
	5	0
	6	0

4.0 Discussion of Results

The stack gas concentrations of Nitrogen Oxides (NO_x) ranged from 7.6 ppm to 8.6 ppm with an average concentration of 8.2 ppm. The NO_x emission rate ranged from 2.6 lbs/hr to 2.9 lbs/hr with an average of 2.8 lbs/hr. The allowable NO_x emission rate, based upon the No. 2 Sand Dryer/Cooler "Permit Application" is 7.14 lbs/hr.

5.0 Description of Project

The following stationary source emission testing methodologies were utilized at the outlet No. 2 Sand Dryer/Cooler sampling location:

- EPA Method 1 - Sample and Velocity Traverses for Stationary Sources
- EPA Method 2 - Determination of Stack Gas Velocity and Volumetric Flow Rate
- EPA Method 3 - Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight
- EPA Method 4 - Determination of Moisture Content in Stack Gases
- EPA Method 7E - Determination of Nitrogen Oxides Emission from Stationary Sources (Instrumental Analyzer Procedure

The absence of cyclonic flow was demonstrated at the outlet location according to section 2.4 of EPA Reference Method 1. A type S-Pitot tube was connected to a manometer. The Pitot tube was placed at each of the traverse point locations. The pitot tube was placed in a position perpendicular to the stack gas flow. An angle finder was placed on the pitot tube which was rotated until a reading of zero (0) was obtained. The "yaw" angle was then recorded.

EPA Reference Method 2

The flow rate was determined according to EPA Reference Method 2. The stack gas differential pressures (velocity heads) were determined with a type S-pitot tube simultaneously with the stack gas temperature. The stack gas temperature was determined with a thermocouple. These determinations were conducted before and after each sampling run.

EPA Reference Method 3

One (1) single point integrated gas sample was extracted from the stack and collected in Tedlar bags during each of the three (3) sample runs. The sample runs were conducted simultaneously with the moisture and Nitrogen Oxide determinations. The samples were collected by extracting stack gases through a pump and a rotometer followed by direct fill into a flexible Tedlar bag. The samples were collected at a rate of one (1) liter per minute over a 60 minute sampling period.

EPA Reference Method 4

The EPA Method 4 sampling train was utilized to determine the moisture content of the stack gases. The EPA Method 4 sampling train consisted of the following apparatus connected in series to the sampling module:

- Heated Stainless Steel sampling probe
- Cyclone bypass and filter bypass assembly contained within a heated compartment with the gas stream temperatures maintained at approximately 225°F
- A modified Greenburg-Smith impinger containing 100 ml of water
- A Greenburg-Smith impinger containing 100 ml of water
- A modified Greenburg-Smith impinger, empty
- A modified Greenburg-Smith impinger containing approximately 220 g of silica gel desiccant

Prior to the start of sampling runs, leak checks were conducted to insure that all connections were leak free. The leak check was conducted in the following manner. The sample train was completely assembled. The end of the sampling probe was capped. A vacuum of at least fifteen (15) inches Mercury (HG) was drawn on the sampling train to demonstrate that the sampling train had a leak rate which was less than 0.02 cubic feet per minute (cfm). Following the leak check, the sample line heating system was turned on. The moisture samples were collected at an approximately rate rate of 0.75 cfm for a 60 minute sampling period. Three (3) sample runs were conducted.

EPA Reference Method 7E

The EPA Reference Method 7E sample train was utilized to determine the Nitrogen Oxide concentration of the stack gases by chemiluminescent analysis. The NO_x emission testing was conducted while the fluid bed dryers were utilizing No. 2 Fuel Oil. The NO_x emission potential is greater during fuel oil combustion. The sampling train consisted of the following apparatus connected in series:

- Stainless steel sampling Probe
- Heated teflon sampling line
- Condensation trap (for moisture removal)
- Sample pump
- Thermo Electron Model 10A NO/NO_x Analyzer

The following start-up and calibration procedures were utilized:

- The front-panel range switch was set at 25 ppm
- The front panel mode switch was set to "NO" mode
- The power was switched on and the analyzer was allowed to "warm-up" for approximately 12 hours.
- The Bypass needle valve will be adjusted for a flow rate of 2 liters per minute (lpm).
- The following Upscale Calibration gases were utilized: 9.2 ppm and 18.4 ppm. The span control adjustments were made accordingly.

These standards were prepared on site from a certified standard gas of 46 ppm Nitric Oxide (NO) in Nitrogen (N_2). The standards were prepared with a Standard Technology, Inc. Model S6D Non-Bleeding Gas Divider. Dilution gas (Nitrogen) and a span gas (46 ppm NO in N_2) were introduced to a gas divider with a 5 position selection cock. The following positions were utilized:

Selection Cock Position	Standard Gas/Dilution Gas Ratio	Corresponding NO Concentration ppm
0	0/5	0
1	1/5	9.2
2	2/5	18.4

The mode switch was then switched to NO_x for stack gas measurement.

Appendix A

Field Data Sheets

Project Number _____ Test Number 1

Plant Marie

Date 11-22-89 Time _____

Sampling Location OUTLET

Sample Type MOISTURE

Run Number 1

Operators JIM

Ambient Temperature 43

Barometer 30.28

Orsat Analysis

Sample Type (Bag, Integrated, Continuous) _____

GAS \ RUN	1		2		3		AVERA. MET VOLUM
	ACTUAL READING	MET	ACTUAL READING	MET	ACTUAL READING	MET	
CO_2	0.6	0.6	0.8	0.8	0.8	0.8	0.1
O_2 MET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING	21.1	20.3	21.1	20.3	—		20.
CO MET IS ACTUAL CO READING MINUS ACTUAL O_2 READING	21.1	0.0	—	—	—		0.0
N_2 MET IS 100 MINUS ACTUAL GB READING	79.3						

Fyrite Analysis

CO_2 O_2

Field Data - Moisture

Time 1324 - 1434

Final Meter Vol. 611.713

Initial Mtr. Vol. 577.031

Total Meter Vol. 34.682

Meter Temp. In 42/52

Out 42/49

Rotameter Setting 1.3 H_2O

Final H_2O Vol. _____

Init. H_2O Vol. 200 ml

Net Volume _____

LEAK < 0.02

Comments: 0.5 "Hg

TRAVERSE POINT LOCATION & VELOCITY DATA BY

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=Act I.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1			A 1	.65	111
2			2	.92	111
3	P_c = 0.35		3	1.3	113
4			4	1.4	113
5			5	1.5	114
6			6	2.0	115
7					
8			B 1	.67	110
9			2	.91	113
10			3	1.4	115
11			4	1.4	115
12			5	1.4	115
13			6	1.4	116
14					
15			C 1	.69	113
16			2	.83	115
17			3	1.2	116
18			4	1.2	118
19			5	1.4	117
20	[illegible]		6	1.6	117
21	D 1	.58 IN			
22	2	.72 IN	D 1	.57	111
23	3	1.3 118	2	.74	113
24	4	1.7 117	3	1.3	116
25	5	1.8 117	4	1.75	117
26	6	2.0 119	5	1.8	118
27			6	2.0	118
28	C 1	.78	119		
29	2	.98	119		
30	3	1.1	119		
31	4	1.3	119		
32	5	1.4	118		
33	6	1.6	118		
34					
35	B 1	.63	114		
36	2	.82	116		
37	3	1.05	117		
38	4	1.3	118		
39	5	1.45	118		
40	6	1.75	119		
41					
42	A 1	.65	112		
43	2	.77	116		
44	3	.83	118		
45	4	1.2	120		
46	5	1.4	120		
47	6	2.0	120		
48					

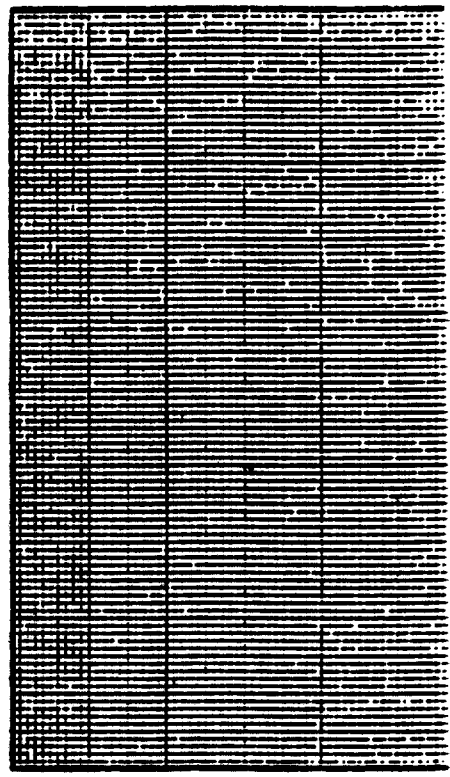

DIAGRAM OF STACK, PORTS, & TRAVERS POINTS (indicate direction of flow

INSIDE DIMENSIONS OF SAMPLE PLANE _____

STACK GAUGE PRESSURE in. H_2O _____

NEAREST UPSTREAM DISTURBANCE _____

NEAREST DOWNSTREAM DISTURBANCE _____

PROCESS & CONTROL EQUIPMENT DESCRIPTION _____

Project Number _____ Test Number 3

Plant Nixon

Date 11/22/89 Time —

Sampling Location _____

Sample Type M+H2 2/4

Run Number 3

Operators MAD/JTM

Ambient Temperature 28

Barometer 30.28

Orsat Analysis

Sample Type (Bag, Integrated, Continuous) _____

GAS	RUN 1 ACTUAL READING	1 WET	2 ACTUAL READING	2 WET	3 ACTUAL READING	3 WET	AVERAGE WET VOLUME
CO_2	1.0	1.0	1.0	1.0	1.0	1.0	1.
O_2; WET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING	21.9	20.3	21.3	20.3	—	—	20.
CO; WET IS ACTUAL CO READING MINUS ACTUAL O_2 READING	20.3	0.0	—	—	—	—	0.0
N_2; WET IS 100 MINUS ACTUAL CO READING	77.7						

Fyrite Analysis

CO_2 O_2

Field Data - Moisture

Time 1616 - 1716

Final Meter Vol. 690.365

Initial Mtr. Vol 657.212

Total Meter Vol. _____

Meter Temp. In 49 / 53

Out 48 / 52

Rotameter Setting 1.2 "H2O

Final H_2O Vol. _____

Init. H_2O Vol. _____

Net Volume _____

Comments:

TRAVERSE POINT LOCATION & VELOCITY DATA BY

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=A x I.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp), in. H_2O	STACK TEMPERATURE (T_s), °F
1	A 1	.67	113		
2	2	.91	113		
3	3	1.3	113		
4	4	1.35	114		
5	5	1.5	114		
6	6	2.1	114		
7	B 1	.68	113		
8	2	.93	115		
9	3	1.3	116		
10	4	1.4	116		
11	5	1.4	116		
12	6	1.4	118		
13	C 1	.69	115	$\bar{\Delta p}$ =	.35
14	2	.86	115		
15	3	1.2	117		
16	4	1.3	118		
17	5	1.4	119		
18	6	1.5	119		
19	D 1	.56	122		
20	2	.75	122		
21	3	1.25	125		
22	4	1.7	127		
23	5	1.8	127		
24	6	2.0	125		
25	A 1	.65	121		
26	2	.85	122		
27	3	1.3	123		
28	4	1.4	123		
29	5	1.65	123		
30	6	1.8	123		
31	B 1	.65	119		
32	2	.78	124		
33	3	1.05	124	$\bar{\Delta p}$ =	.35
34	4	1.3	125		
35	5	1.45	125		
36	6	1.55	127		
37	C 1	.89	122		
38	2	1.1	123		
39	3	1.2	125		
40	4	1.3	125		
41	5	1.3	125		
42	6	1.6	125		
43	D 1	.56	122		
44	2	.79	123		
45	3	1.2	124		
46	4	1.55	124		
47	5	1.8	125		
48	6	2.0	125		

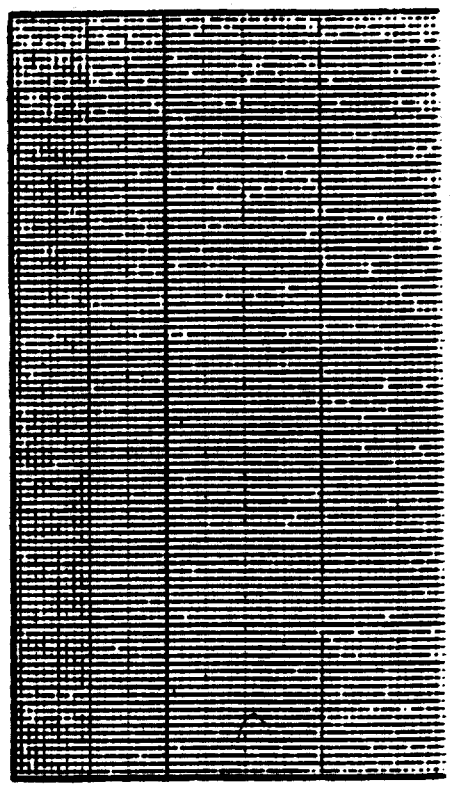

DIAGRAM OF STACK, PORTS, & TRAVERSE POINTS (indicate direction of flow)

INSIDE DIMENSIONS OF SAMPLE PLANE _____

STACK GAUGE PRESSURE in. H_2O _____

NEAREST UPSTREAM DISTURBANCE _____

NEAREST DOWNSTREAM DISTURBANCE _____

PROCESS & CONTROL EQUIPMENT DESCRIPTION _____

A-2

Project Number _____ Test Number 2

Plant Moss Lake

Date 11/22/89 Time _____

Sampling Location _____

Sample Type CTHD 2/4

Run Number 2

Operators MAC / JM

Ambient Temperature _____

Barometer 30.28

Orsat Analysis

Sample Type (Bag, Integrated, Continuous) _____

GAS \ RUN	1		2		3		AVG
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET	
CO_2	0.6	0.6	0.6	0.6	0.6	0.6	0.
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	20.8	20.2	20.8	20.2	—	—	20.
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	20.8	0.0	—	—	—	—	0.
N_2 (NET IS 100 MINUS ACTUAL CO READING)							

Fyrite Analysis

CO_2 O_2

Field Data - Moisture

Time 1455 - 1607

Final Meter Vol. 657.176

Initial Mtr. Vol. 614.434

Total Meter Vol. _____

Meter Temp. In 50 / 54

Out 48 / 50

Rotameter Setting 1.1 "H

Final H_2O Vol. _____

Init. H_2O Vol. _____

Net Volume _____

LICK CO.001

Comments: @ 6 "Hg

TRAVERSE POINT LOCATION & VELOCITY DATA BY _____

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=A×I.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (Δp), in. H_2O	STACK TEMPERATURE (T_s), °F
1	A 1	.56	111		
2	2	.78	111		
3	3	1.3	112		
4	4	1.5	114		
5	5	1.7	114		
6	6	1.8	114		
7	B 1	.62	113	Δp = .33	
8	2	.73	115		
9	3	.98	116		
10	4	1.25	117		
11	5	1.50	119		
12	6	1.85	118		
13	C 1	.78	117		
14	2	.89	118		
15	3	1.15	119		
16	4	1.3	115		
17	5	1.5	118		
18	6	1.65	117		
19	D 1	.45	111		
20	2	.63	112		
21	3	1.4	116		
22	4	1.75	116		
23	5	2.1	118		
24	6	2.3	119		
25	A 1	.68	120		
26	2	.83	122		
27	3	1.2	122		
28	4	1.43	123	Δp = .36	
29	5	1.65	123		
30	6	1.85	123		
31	B 1	.65	122		
32	2	.76	122		
33	3	1.0	122		
34	4	1.3	124		
35	5	1.45	125		
36	6	1.8	125		
37	C 1	.87	125		
38	2	1.0	125		
39	3	1.3	125		
40	4	1.3	125		
41	5	1.3	125		
42	6	1.6	126		
43	D 1	.52	117		
44	2	.72	117		
45	3	.92	118		
46	4	1.75	118		
47	5	1.8	122		
48	6	2.1	125		

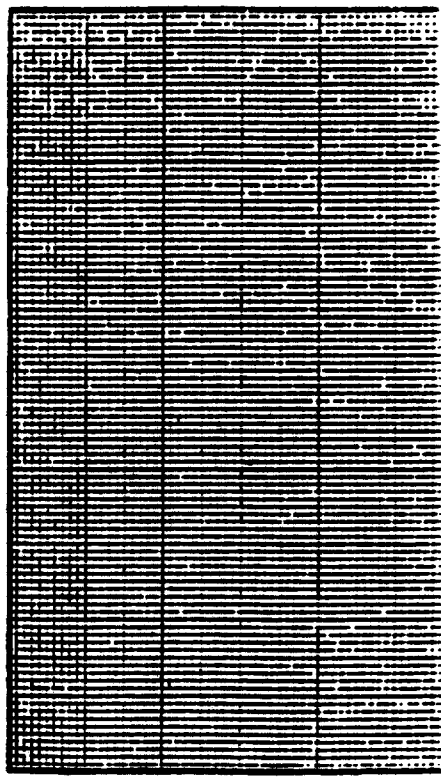

DIAGRAM OF STACK, PORTS, & TRAVERS POINTS (indicate direction of flow

INSIDE DIMENSIONS OF SAMPLE PLANE _____

STACK GAUGE PRESSURE in. H_2O _____

NEAREST UPSTREAM DISTURBANCE _____

NEAREST DOWNSTREAM DISTURBANCE _____

PROCESS & CONTROL EQUIPMENT DESCRIPTION _____

Appendix B

Chart Recorder Printout

Appendix C

Calibration Data

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
GAS METER SHOP

PROOF TEST RECORD

METER SIZE: CL175 | DATE RECEIVED: 10/04/89 | INSPECTOR: C. RIZZA

DATE TESTED: 10/05/89 | MANUFACTURER: ROCKWELL

PROVER NO. 1264 | TEMPERATURE: | OIL : 73° F.

METER NUMBER: 6837018 | PROVER AIR: 73° F.

175 C.F.H.

TEST # 1	2.0 CU. FT.	PERCENT PROOF	100.0
TEST # 2	2.0 CU. FT.		100.0
TEST # 3	2.0 CU. FT.		100.0

35 C.F.H

TEST # 1	2.0 CU. FT.	PERCENT PROOF	100.I
TEST # 2	2.0 CU. FT.		100.0
TEST # 3	2.0 CU. FT.		100.0

A calibration and accuracy test was performed on test meter number 6837018 for:

AirNova Inc
931 Haddon Avenue
Collingswood,N.J.
08108

METER REPAIR SUPERVISOR

CARMEN RIZZA

Carmen Rizza

C-1

AirNova Inc., Quality Assurance Program
Results of EPA Method 5 Meter Box Audit

INTER-LABORATORY STUDY RESULTS DATE: 11/08/88

(JUNE 1988)

POLLUTANT - DGM

C34011
MR. ROBERT MCKINNEY
AIRNOVA, INC.
931 HADDON AVE. / P.O. BOX 97
COLLINGSWOOD, NJ 08108

UNITS - CUBIC METERS

ORIFICE NUMBER	REPORTED VALUE	EPA VALUE	PERCENT DIFFERENCE
442	.2650	.2638	.46
442	.2641	.2634	.25
442	.2650	.2641	.34

C-2

STACK SAMPLER CALIBRATION SHEET

Calibrated by Joe MAY

Date 5-9-89 Box No. 5

Pump ✓ Pump Oil ✓

Clean Quick Connects ✓ Valves ✓

Manometers ✓ Dry Test Meter ✓

Thermometers

Lights Buzzer

Electrical Check - Amphenol

Variac Vacuum Gauge

Leak Check at 27" Hg. - Leakage 0.00 CFM

Remarks

CALIBRATION - ORIFICE AND METER

Man Orifice	CF_w	CF_d	T_W	IT_d	OT_d	T_d avg.	Pb	$Time_t$
0.5	2.031	2.040	525	~~530~~	~~530~~	530	30.10	5
1.0	2.856	2.864	524			532	30.10	5
2.0	7.933	7.969	530			538	30.10	10
3.0	9.650	9.618	531			539	30.16	10
4.0	11.161	11.091	532			542	30.10	10
5.0	12.416	12.359	532			544	30.16	10

Tolerances

Y = 0.99 - 1.00 - 1.01

ΔH = 1.6 - 1.84 - 2.1

IBR[illegible]N C[illegible]JLA[illegible]S M[illegible]t Box Calibrated by JRK Date 5-3-89 Box No. 4

0.0317 (Man. orifice) $\left(\frac{(T_w + 460)t}{P_b\ (T_d \text{ avg.} + 460)}\right)^2 \frac{}{CF_w}$	Man.	$\Delta H_@$	$\frac{CF_w\ P_b\ (T_d \text{ avg.} + 460)}{CF_d\ (P_b + \frac{\text{Man. orifice}}{13.6})\ (T_w + 460)}$	Man.	Y
0.01585 $\left(\frac{(65+460)\ 5}{29.68\ (65+460)}\right)^2 \frac{}{1.189}$	.5	1.76	1.982 x 29.61 (65 + 460) / 1.982 (29.68 + 0.0368) (65 + 460)	.5	1.009
0.0317 $\left(\frac{(65+460)\ 5}{29.66\ (67+460)}\right)^2 \frac{}{2.746}$	1.0	1.85	2.746 x 29.66 (67 + 460) / 2.749 (29.68 + 0.0735) (67 + 460)	1.0	1.004
0.0634 $\left(\frac{(65+460)\ 10}{29.66\ (75+460)}\right)^2 \frac{}{7.671}$	2.0	1.88	7.671 x 29.66 (75 + 460) / 7.660 (29.66 + 0.147) (65 + 460)	2.0	1.001
0.0951 $\left(\frac{(65+460)\ 10}{29.68\ (65+460)}\right)^2 \frac{}{9.[illegible]}$	3.0	1.85	9.[illegible] x 29.68 (75 + 460) / 9.485 (29.68 + 0.221) (65 + 460)	3.0	1.01
0.1268 $\left(\frac{(65+460)\ 10}{29.68\ (75+460)}\right)^2 \frac{}{10.809}$	4.0	1.88	10.809 x 29.68 (75 + 460) / 10.839 (29.68 + 0.294) (65 + 460)	4.0	1.006
0.1585 $\left(\frac{(65+460)\ 10}{29.68\ (78+460)}\right)^2 \frac{}{12.043}$	5.0	1.89	12.043 x 29.68 (78 + 460) / 12.646 (29.68 + 0.368) (65 + 460)	5.0	1.01

C-1

Appendix D

Calculation Print-outs

Air Nova Inc.

EPA Methods 2,3,4,7E Calculations

Plant	Morie Company
	**********
Operation	No. 2 Sand Dryer Exhaust
	**********
Run	1
	**********
Location	Mauricetown, New Jersey
	**********
Date	11/22/89
	**********

Outlet Test Data

Vwc =	12	cc	Vol. of H2O collected (impingers)
Vwsg =	9.3	g	Wt of water collected in silica gel
Vm =	34.682	cf	Dry gas meter reading
Pb =	30.28	in. Hg	Barometric pressure
Ps =	30.25	in. Hg	Stack pressure
dP^.5 =	1.091	in. H2O	Average square of delta p
dH =	1.500	in. H2O	Average draft gauge reading
Tm =	506.25	R	Average meter temperature
Ts =	574.58	R	Average stack temperature
Y =	0.99		Meter calibration factor
t =	60	min.	Duration of sampling time
A =	13.5000	sq.ft.	Cross sectional area of stack
Cp =	0.85		Pitot tube correction factor
Kp =	85.49		Pitot tube constant

1) Volume of gas sampled at standard conditions, Vmstd.

Vmstd = Vm * Y * (Pm*Tstd)/(Pstd*Tm)

Vmstd = 36.38 dscf

2) Volume of water vapor collected at standard conditions, Vwstd.

Vwstd = K1 * Vwc Vwsgstd = K2 * Vwsg

Vwstd = 0.56 scf Vwsgstd = 0.44

3) Decimal fraction of moisture by volume in stack gas , Bws

Bws = Vwstd+Vwsgstd/(Vwstd + Vwsgstd + Vmstd)

Bws = 0.028

D-1

4) Molecular weight of the stack gas, Ms.

Md = (44*%CO2)+(28*%CO)+(32*%O2)+(28*%N2)

Ms = 28.94

Orsat analysis

% CO2	0.8
% CO	0
% O2	20.3
% N2	78.9

5) Stack gas velocity, Us in fps.

vs = Kp * Cp * (dp^.5) * (Ts/(Ps*Ms))^.5

vs = 64.23 fps

6) Actual Stack gas volumetric flow rate ,Qa

Qa = A * vs * 60 sec/min

Qa = 52024.6 cfm

7) Standardized volumetric flow rate ,Qstd.

Qstd = Qa * (1-Bws) * (Tstd/Ts) * (Ps/Pstd)

Qstd = 47153.1 dscfm

8) Oxides of Nitrogen Emission Rate (as nitrogen dioxide)

lbs NOx/hr = (Cgas * DSCFH * MW)/387*10^6

MW =	46.01	g/g-mole	Molecular weight of NO2
C =	8.100	ppm (dry)	Concentration indicated by analyzer
CO =	0.8	ppm	Avg. initial , final zero bias check
Cm =	18.4	ppm	Avg.initial,final upscale bias check
Cma =	18.4	ppm	Actual conc. of upscale gas

Cgas = (C - CO) * (Cma/(Cm - CO))

Cgas = 7.6318181 ppm

lbs NOx/hr = 2.57

Air Nova Inc.

EPA Methods 2,3,4,7E Calculations

Plant	Morie Company
Operation	No. 2 Sand Dryer Exhaust
Run	2
Location	Mauricetown, New Jersey
Date	11/22/89

Outlet Test Data

Vwc =	26	cc	Vol. of H2O collected (impingers)
Vwsg =	11.6	g	Wt of water collected in silica gel
Vm =	42.742	cf	Dry gas meter reading
Pb =	30.28	in. Hg	Barometric pressure
Ps =	30.26	in. Hg	Stack pressure
dP^.5 =	1.086	in. H2O	Average square of delta p
dH =	1.500	in. H2O	Average draft gauge reading
Tm =	510.50	R	Average meter temperature
Ts =	575.42	R	Average stack temperature
Y =	0.99		Meter calibration factor
t =	60	min.	Duration of sampling time
A =	13.5000	sq.ft.	Cross sectional area of stack
Cp =	0.85		Pitot tube correction factor
Kp =	85.49		Pitot tube constant

1) Volume of gas sampled at standard conditions, Vmstd.

Vmstd = Vm * Y * (Pm*Tstd)/(Pstd*Tm)

Vmstd = 44.46 dscf

2) Volume of water vapor collected at standard conditions, Vwstd.

Vwstd = K1 * Vwc Vwsgstd = K2 * Vwsg

Vwstd = 1.22 scf Vwsgstd = 0.55

3) Decimal fraction of moisture by volume in stack gas , Bws

Bws = Vwstd+Vwsgstd/(Vwstd + Vwsgstd + Vmstd)

Bws = 0.040

4) Molecular weight of the stack gas, Ms.

Md = (44*%CO2)+(28*%CO)+(32*%O2)+(28*%N2)

Ms = 28.90

Orsat analysis

% CO2	0.6
% CO	0
% O2	20.2
% N2	79.2

5) Stack gas velocity, Us in fps.

vs = Kp * Cp * (dp^.5) * (Ts/(Ps*Ms))^.5

vs = 64.04 fps

6) Actual Stack gas volumetric flow rate ,Qa

Qa = A * vs * 60 sec/min

Qa = 51870.4 cfm

7) Standardized volumetric flow rate ,Qstd.

Qstd = Qa * (1-Bws) * (Tstd/Ts) * (Ps/Pstd)

Qstd = 46397.1 dscfm

8) Oxides of Nitrogen Emission Rate (as nitrogen dioxide)

lbs NOx/hr = (Cgas * DSCFH * MW)/387*10^6

MW =	46.01	g/g-mole	Molecular weight of NO2
C =	8.800	ppm (dry)	Concentration indicated by analyzer
CO =	1	ppm	Avg. initial , final zero bias check
Cm =	18.3	ppm	Avg.initial,final upscale bias check
Cma =	18.4	ppm	Actual conc. of upscale gas

Cgas = (C - CO) * (Cma/(Cm - CO))

Cgas = 8.2959537 ppm

lbs NOx/hr = 2.75

Air Nova Inc.

EPA Methods 2,3,4,7E Calculations

Plant	Morie Company
Operation	No. 2 Sand Dryer Exhaust
Run	3
Location	Mauricetown, New Jersey
Date	11/22/89

Outlet Test Data

Vwc =	22	cc	Vol. of H2O collected (impingers)
Vwsg =	9.3	g	Wt of water collected in silica gel
Vm =	42.742	cf	Dry gas meter reading
Pb =	30.28	in. Hg	Barometric pressure
Ps =	30.25	in. Hg	Stack pressure
dP^.5 =	1.101	in. H2O	Average square of delta p
dH =	1.500	in. H2O	Average draft gauge reading
Tm =	510.50	R	Average meter temperature
Ts =	577.83	R	Average stack temperature
Y =	0.99		Meter calibration factor
t =	60	min.	Duration of sampling time
A =	13.5000	sq.ft.	Cross sectional area of stack
Cp =	0.85		Pitot tube correction factor
Kp =	85.49		Pitot tube constant

1) Volume of gas sampled at standard conditions, Vmstd.

Vmstd = Vm * Y * (Pm*Tstd)/(Pstd*Tm)

Vmstd = 44.46 dscf

2) Volume of water vapor collected at standard conditions, Vwstd.

Vwstd = K1 * Vwc

Vwstd = 1.04 scf

Vwsgstd = K2 * Vwsg

Vwsgstd = 0.44

3) Decimal fraction of moisture by volume in stack gas , Bws

Bws = Vwstd+Vwsgstd/(Vwstd + Vwsgstd + Vmstd)

Bws = 0.033

4) Molecular weight of the stack gas, Ms.

Md = (44*%CO2)+(28*%CO)+(32*%O2)+(28*%N2)

Ms = 28.97

Orsat analysis

% CO2	1
% CO	0
% O2	20.3
% N2	78.7

5) Stack gas velocity, Us in fps.

vs = Kp * Cp * (dp^.5) * (Ts/(Ps*Ms))^.5

vs = 64.96 fps

6) Actual Stack gas volumetric flow rate ,Qa

Qa = A * vs * 60 sec/min

Qa = 52617.3 cfm

7) Standardized volumetric flow rate ,Qstd.

Qstd = Qa * (1-Bws) * (Tstd/Ts) * (Ps/Pstd)

Qstd = 47167.2 dscfm

8) Oxides of Nitrogen Emission Rate (as nitrogen dioxide)

lbs NOx/hr = (Cgas * DSCFH * MW)/387*10^6

MW =	46.01	g/g-mole	Molecular weight of NO2
C =	8.300	ppm (dry)	Concentration indicated by analyzer
CO =	-0.5	ppm	Avg. initial , final zero bias check
Cm =	18.3	ppm	Avg.initial,final upscale bias check
Cma =	18.4	ppm	Actual conc. of upscale gas

Cgas = (C - CO) * (Cma/(Cm - CO))

Cgas = 8.6127659 ppm

lbs NOx/hr = 2.90

Appendix E

Gas Standard Certification

Matheson®
Gas Products
World Leader in Specialty Gases & Equipment

POST OFFICE BOX 85
EAST RUTHERFORD, NEW JERSEY 07073
TELEPHONE: (201) 933-2400

RECEIVED NOV 0 3 1989

Air Nova
931 Haddon Avenue
Collingswood, NJ 08108

Date November 2, 1989

Our Invoice # _____

Your P.O. # AN481

Lot No. 102489-2S

Gentlemen:

Below are the results of the analysis you requested, as reported by our laboratory. Results are in volume percent, unless otherwise indicated.

LABORATORY REPORT ON GAS ANALYSIS

CYL. # SX12862 MIXTURE REQ. 45PPM NO/N2	ANALYSIS
46 PPM Nitric Oxide	
Balance Nitrogen	

CYL. # SX13373 MIXTURE REQ. 90PPM NO/N2	ANALYSIS
94 PPM Nitric Oxide	
Balance Nitrogen	

CYL. # MIXTURE REQ.	ANALYSIS

CYL. # MIXTURE REQ.	ANALYSIS

Analyst Jeff Marshall

E-1

Appendix F

NO_x Converter Efficiency Data

NOx CONVERTER EFFICIENCY

Date: 6/15/89 NOx Analyzer: TECO 10AR

S/N: 10A/R21611-200

Span Gas conc. 90 ppm NO

3 ppm NO2

Mode	Chart Deflection	Reference
NO Span Response.	90.0	
NO mode with 10% dilution by Air	79.3	a
NO mode. Ozone on.	17.5	b
NOx Mode.	78.5	c
NOx mode. Ozone off.	79.7	d
NOX mode. Air off.	90.7	
	1.01	(1.05=OK
NOx Eff=[1+(c-d)/(a-b)]*100	98.1	%

Technician _____

EMISSION TEST PRODUCTION
REPORT FORM

I. Company Name The Morie Company Inc. APC Plant ID# 75027-002
Plant Location Mauricetown, NJ
Certificate Number
Designation of Equipment No 2 Sand Dryer/Cooler

II. Emission Test Date(s) 11/22/89
Tests Conducted By:
Name of Firm Air Nova, Inc
Business Address 5845-A Clayton Avenue, Pennsauken, NJ 08109
Phone Number (609) 486-1500
Test Team Representatives Mark D. Daly
John J. Deemer
Joseph May

Length of Test 13:32 - 17:14 (3 hours 42 min)

	Run #1	Run #2	Run #3
Test Time (Start/Finish)	13:32 / 14:32	15:07 / 16:07	16:14 / 17:14

III. Certificate Operating Conditions

A. List Conditions	Achieved (Yes or No)
NO_x emission rate of	Yes
7.14 lbs/hr during No. 2	
Fuel Combustion	

B. Log of Certificate Conditions During Stack Test
(Record at least every 15 minutes)

Condition	Run #	Readout	Time of Recording
NO_x stack conc.	1	8.1 (avg)	13:32 - 14:32
NO_x stack conc.	2	8.8 (avg)	15:07 - 16:07
NO_x stack conc	3	8.3 (avg)	16:14 - 17:14

G-1

Type of Waste Constituents N/A

Auxiliary Fuel N/A

Burning Rate N/A

D. Other:

Description of Operation and Process Rate

Silica Sand is dried by direct heat exchange in 2 Vibrating Fluid Bed Dryer. Dried Sand then passes through a Fluid Bed Cooler.

V. Control Equipment Parameters

CEMs Required (Yes/No) No

Contaminant?

STACK TEST CEM READING

Parameter Cont/Read	Parameter Cont/Read	Parameter Cont/Read	Time	Test Run #
N/A	N/A	N/A	N/A	N/A

A. Control Equipment performance Parameter

Parameter	Reading	Time	Run #
N/A	N/A	N/A	N/A

IV. Equipment Operation/Process Parameters

Number of Sources Connected _____

Number of Sources Operating _____

Production Rate: Normal ✓

Maximum _____

A. Raw Materials:

	Test Run #1	Test Run #2	Test Run #3
Usage Rate (lbs/hr)	180,000	178,000	176,000
Breakdown (% by weight)			
	100%	100%	100%
	Industrial	Industrial	Industrial
	Sand (silica)	silica Sand	Silica Sand

B. Surface Coating:

Material Being Coated N/A

Type of Coating N/A

Coating Rate (Gals/Hr) N/A

Is Coating Altered (Yes or No) N/A

With N/A

Distance From Coating Head to Exhaust Duct N/A

C. Fuel Burning - ~~Incineration~~: (For Direct Heat Exchange

Type of Fuel No. 2 Fuel Oil

Fuel Burning Rate See below (lbs/hr), (gals/hr), (ft/hr)

Fuel Additives _____, % _____

Meter Reading (if available)	Time
131 gals/hr	13:32 - 14:32
137 gals/hr	15:07 - 16:07
145 gals/hr	16:19 - 17:19

B. Additional Observations

Fugitive Emissions (Yes/No) No

Equipment Location

Visible Emissions From Stack (Yes/No) No

Odors Noticeable No

Vicinity of Equipment (Yes/No)
Near Exhaust Stack (Yes/No)
Off Property (Yes/No)

VI. Samples

Type of Sample Orsat (EPA Method 3)
Time of Sampling during Runs 1, 2, 3
Sampled By Mark Daly
Sample Taken From Stack Outlet

To Be Analyzed For Carbon Dioxide, Oxygen
Analyzed By Mark Daly

Form Information Supplied by: Name/Title (Please Print)
John J. Deemer / Project Manager

Signature(s)/Date John J Deemer 11/30/89

DEP Usage Only
Rec'd By Sample Rec'd Date/Time Rev'd By