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 16, 1988

MEMORANDUM

TO: Don Patterson

FROM: Edward Choromanski

SUBJECT: Hudson Materials, Inc.
West Milford, New Jersey
APC ID No. 30510
NJ Stack No. 001

Emission tests were conducted at the above referenced facility on September 24, 1987. The purpose of the tests is to determine the compliance of the source with Permit/Certificate No. 78268 and with New Source Performance Standards (NSPS) Subpart I - Standards of Performance for Asphalt Concrete Plants.

Len Sobolewski reviewed the final emission test report. His review indicates that the particulate emission rates from the PLT #2-1 (CMI Drum Mix Asphalt Plant) were within the standards stated on Permit No. 78268, during all test runs. The particulate test results were also within the standards prescribed by N.S.P.S. Subpart I.

The total hydrocarbon test results indicated that the hydrocarbon concentration (as equivalent methane) was below the 40 ppm detection limit during all test runs. The carbon monoxide test results indicated that Run No. 1 and 3 were below the 10 ppm detection limit while Run No. 2 the CO emissions were within the permit standard.

Process parameters for the CMI Drum Mix Asphalt Plant were as follows.

RUN NO.	1	2	3
Avg. Burner Setting (%)	90	40	50
Avg. Aggregate Processed (TPH)	265	244	255
Avg. Liquid Asphalt (TPH)	14.0	10.9	11.5
Avg. Mix Temp. (^{o}F)	300	295	303
Avg. Baghouse ΔP ("H_2O)	4	3.5	4.0

Permit No. 78268 indicates the amount of material processed as 395 tons per hours The source was operating at a 67% process level during the tests.

Based on the fact that the total hydrocarbon concentration was less than 40 ppm the adjusted THC concentration (at the maximum 40 ppm detection level) is 56 ppm at 7% oxygen.

For CO Runs No. 1 and 3 and based on a 10 ppm detection limit the adjusted CO concentration is 14 ppm at 7% oxygen. For Run No. 2 where the CO concentration was found to be 35.7 ppm the adjusted CO concentration is 49.98 ppm.

Based on the results indicated in the emission test report, I recommend that a five year operating certificate be issued to the source for the following reasons.

1) Particulates emissions were within the standards stated on Permit 78268 and NSPS Subpart I.

2) Carbon monoxide and total hydrocarbon emissions are within the policy standards of the Division.

c Bill O'Sullivan
Milt Polakovic
Harold Christiff
Rich Craig
Mike Papp
Leonard Sobolewski

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

March 11, 1988

MEMORANDUM

TO: Ed Choromanski

FROM: Len Sobolewski

SUBJECT: Hudson Materials Inc.
Stack Test Report
NJDEP ID No. 030510

Emission tests were conducted at the Hudson Materials Inc., located in Ringwood, New Jersey on September 24 and 25, 1987.

The C.M.I. Drum Mix Asphalt Plant (N.J. Stack No. 001) was tested for particulate, total hydrocarbons and carbon monoxide to determine compliance with the standards stated on Permit/Certificate Number 078268.

The results of these tests using the data submitted by Ramcon Environmental Corporation is as follows.

PARTICULATES

RUN	DATE	EMISSION RATES		
		ALLOWABLE (LBS/HR) SUB 8*	ALLOWABLE (LBS/HR) SUB 6**	ACTUAL (LBS/HR)
1	09-24-87	10.009	5.334	1.278
2	09-25-87	10.009	5.256	1.300
3	09-25-87	10.009	5.397	0.734

* The above subchapter 8 particulate allowable lbs/hr emission rate is based upon the standards stated on Permit/Certificate Number 078268.

** The above subchapter 6 allowable lbs/hr emission is based upon the standards prescribed by N.J.A.C. 7:27-6 (0.02 grains per wet standard cubic feet).

PARTICULATES

RUN	DATE	ALLOWABLE* gr/dscf	ACTUAL gr/dscf
1	09-24-87	0.04	0.0064
2	09-25-87	0.04	0.0066
3	09-25-87	0.04	0.0036

* The above particulate allowable gr/dscf emission rate is based upon the standards prescribed by the Code of Federal Regulations Parts 53 to 60 Subpart I - "Standards of Performances for Hot Mix Asphalt Facilities.

TOTAL HYDROCARBONS

RUN	DATE	ALLOWABLE* LB/HR	ACTUAL LB/HR	CALCULATED LB/HR
1	09-24-87	3.0	BDL**	2.33***
2	09-25-87	3.0	BDL**	2.30***
3	09-25-87	3.0	BDL**	2.38***

* The above total hydrocarbon allowable lb/hr emission rate is based upon the standards stated on Permit/Certificate Number 078268 burning #2 fuel oil.

** Denotes below detection limits which indicates less than 40 ppm total volatile organics using a gas chromatograph.

*** The calculated total hydrocarbon lb/hr emission rate is based on the lowest detected limit of the total hydrocarbons (40 ppm), to demonstrate compliance with the allowable emission rate stated on the Permit/Certificate.

CARBON MONOXIDE

RUN	DATE	ALLOWABLE LB/HR	ACTUAL LB/HR	CALCULATED LB/HR
1	09-24-87	13.87	BDL**	1.02***
2	09-25-87	13.87	35.7	3.57***
3	09-25-87	13.87	BDL**	1.04***

* The above carbon monoxide allowable lb/hr emission rate is based upon the standards stated on Permit/Certificate Number 078268 burning #2 fuel oil.

** Denotes below detection limits which indicates less than 10 ppm carbon monoxide using a gas chromatograph.

*** The calculated carbon monoxide lb/hr emission rate is based on the lowest detected limit of the carbon monoxide (10 ppm) to demonstrate compliance with the allowable emission rate stated on the Permit/Certificate.

RAMCON
ENVIRONMENTAL CORPORATION

SOURCE SAMPLING
for
PARTICULATE EMISSIONS
HUDSON MATERIALS, INC.
RINGWOOD, NEW JERSEY
September 24 & 25, 1987

Ken Ryan
Hudson Materials, Inc.

G. Sumner Buck, III
President

Sam Turner
Field Supervisor

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112
TELEPHONE 800/458-4567 IN TENNESSEE 901/458-7000

RAMCON
ENVIRONMENTAL CORPORATION

October 16, 1987

Mr. Ken Ryan
Hudson Materials, Inc.
590 Bellville Turnpike
Kearny, NJ 07032

Re: Particulate Emissions Test - Ringwood, New Jersey

Dear Mr. Ryan:

Enclosed you will find four copies of our report on the particulate emissions test we conducted your plant. Based on our test results, the average grain loading of the three test runs does pass both EPA New Source Performance Standards and those set by the State of New Jersey. Therefore, the plant is operating in compliance with Federal and State Standards.

You will want to sign the report covers and send two copies to:

Mr. Frank Papp
New Jersey D.E.P.
Div. of Environmental Quality
380 Scotch Road
West Trenton, NJ 08628

You will need to keep one copy of the report at the plant. We certainly have enjoyed working with you and look forward to serving you again in the future.

Sincerely,

G. Sumner Buck, III
President

GSBIII:kr

Enclosures

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112
TELEPHONE 800/458-4567 IN TENNESSEE 901/458-7000

TABLE OF CONTENTS

I. INTRODUCTION

On September 24 & 25, 1987, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate, CO and VOC emissions compliance at Hudson Materials' Caterpillar drum mix asphalt plant located in Ringwood, New Jersey. RAMCON personnel conducting the test were Sam Tuner, Field Supervisor and Allen Turner. Kim Rea was responsible for the final particulate laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Environmental Testing & Consulting, Inc. conducted the hydrocarbon and carbon monoxide analyses. Custody of the particulate samples was limited to Mr. Turner and Ms. Rea.

The purpose of the test was to determine if the rate of particulate, CO and VOC emissions from the plant's baghouse and the total contaminants by weight (grain loading) are below the N.S.P.S. limits set by EPA and the State of New Jersey.

II. TEST RESULTS

Table I summarizes the test results. The grain loading limitation for particulates for EPA is .04 gr/DSCF and is specified in 39 FR 9314, March 8, 1974, 60.92 Standards for Particulate Matter (1), as amended. The allowable emissions for the State of New Jersey for particulates is .02 gr/SCF.

Mr. Frank Papp of New Jersey's Department of Environmental Protection observed the testing conducted by RAMCON. Allen Turner conducted the opacity test (Reference Method 9) which ranged from 0% to 5% on all three runs and therefore, meets N.S.P.S. requirements.

TABLE I

SUMMARY OF TEST RESULTS
September 24 & 25, 1987

Test Run	Grain Loading (EPA)	Grain Loading (New Jersey)	VOC Emissions	CO Emissions
1	0.0065 gr/DSCF	0.0050 gr/SCF	*BDL	*BDL
2	0.0067 gr/DSCF	0.0053 gr/SCF	*BDL	35.5 PPM
3	0.0036 gr/DSCF	0.0029 gr/SCF	*BDL	*BDL
Avg.	0.0056 gr/DSCF	0.0044 gr/SCF		

*BDL = Below Detection Limits (which means less than 10 ppm for CO and less than 40 ppm for VOC using a gas chromatograph).

On the basis of these test results, the average grain loading on the three test runs is below the .04 gr/dscf emissions standard set by EPA and the .02 gr/SCF emissions standard set by the State of New Jersey. Therefore, the plant is operating in compliance with EPA and New Jersey N.S.P.S. standards.

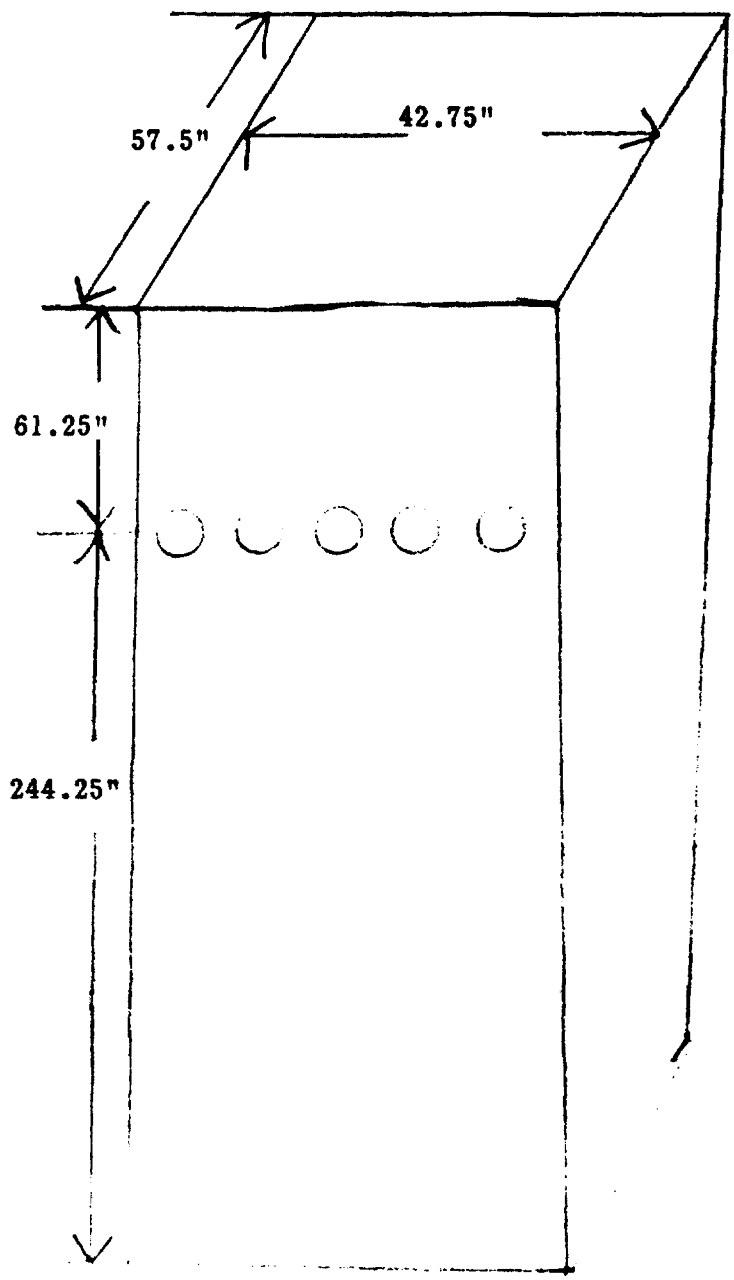
III. TEST PROCEDURES

A. Method Used: The source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

B. Problems Encountered: No problems were encountered that affected testing.

C. Sampling Site: The emissions test was conducted after a baghouse on a rectangular stack measuring 57.5" x 42.75" with an equivalent diameter of 49.0". Five sampling ports were placed 61.25" down (1.25 diameters upstream) from the top of the stack and 244.25" up (5.0 diameters downstream) from the last flow disturbance. Thirty points were sampled, six through each port for two minutes each.

Points on a Diameter	Probe Mark
1	4.8"
2	14.4"
3	24.0"
4	33.6"
5	43.2"
6	52.8"



IV. THE SOURCE

IV. THE SOURCE

Hudson Materials, Inc. employs a CMI drum mix asphalt plant which is used to manufacture hot mix asphalt for road pavement. The process consists of blending prescribed portions of cold feed materials (sand, gravel, screenings, chips, etc.) uniformly and adding sufficient hot asphalt oil to bind the mixture together. After the hot asphalt mix is manufactured at the plant, it is transported to the location where it is to be applied. The hot asphalt mix is spread evenly over the surface with a paver and then compacted with a heavy roller to produce the final product.

The following is a general description of the plant's manufacturing process: The cold feed materials (aggregate) are dumped into four separate bins which in turn feed a common continuous conveyor. The aggregate is dispensed from the bins in accordance with the desired formulation onto the cold feed system conveyor to an inclined weigh conveyor then to a rotating drum for continuous mixing and drying at approximately 300°F. The required amount of hot asphalt oil is then injected onto and mixed into the dried aggregate. The now newly formed hot asphalt mix is pulled to the top of a storage silo by conveyor. The hot asphalt mix is then discharged from the storage silo through a slide gate into waiting dump trucks, which transport the material to a final destination for spreading. The rated capacity of the plant will vary with each aggregate mix and moisture content with a 5% surface moisture removal.

The drum mixer uses a burner fired with fuel oil to heat air to dry the aggregate, and the motion of the rotating drum to blend the aggregate and hot asphalt oil thoroughly. The air is drawn into the system via an exhaust fan. After passing through the burner and the mixing drum, the exhaust gasses pass through a baghouse. The baghouse is manufactured by CMI. The exhaust gasses are drawn through the baghouse and discharged to the atmosphere through a stack. The design pressure drop across the tube-sheet is 1 - 6 inches of water. The particulate matter, which is removed by the baghouse, is reinjected into the drum mixer.

1. Aggregate bins: Virgin aggregate is fed individually into each of four bins by type. It is metered onto a conveyor belt running under the bins to a shaker screen. The proporation of each aggregate type is determined by the job mix formula and pre-set to be metered out to meet these specifications.

2. Preliminary oversize screen: The aggregate is fed through a shaker screen where oversize rocks and foreign material is screened out of the mix.

3. Weigh conveyor belt: The aggregate is conveyed to the rotary drum dryer on a conveyor belt which weighs the material. The production rate is determined by this weight reading.

4. Rotary drum dryer/mixer: The aggregate is fed into the rotary drum dryer where it is tumbled by flighting into a veil in front of a flame which drives off the moisture. Further mixing is also accomplished in this drum. Hot liquid asphalt is injected approximately one-third of the way down the inclined drum where it is mixed with the aggregate.

5. Burner: The fuel fired burner is used to provide the flame which drys the aggregate.

6. Knock off baffleing: A baffeling plate is inserted in the "dirty" side plenum as a knock out for heavy particles in the air stream. These particles fall to the bottom of the baghouse.

7. Baghouse: The hot gases are pulled through the bags into the clean air plenum. The solid particulate matter is trapped on the dust coat buildup on the bags. A bag cleaning cycle consisting of jet burst of air from the inside (or clean air side) of the bags sends a large bubble of air down the inside of the bags shaking loose buildup on the bag surface. This particulate matter is collected at the bottom of the baghouse and reinjected into the drum mixer where it is used as part of the finished project.

8. Liquid asphalt storage: The liquid asphalt is stored in this heated tank until it is needed in the mixer. The amount of asphalt content and its temperature are pre-set for each different type job.

9. Conveyor to surge/storage bin: The finished product of aggregate mixed with liquid asphalt is conveyed to a surge bin.

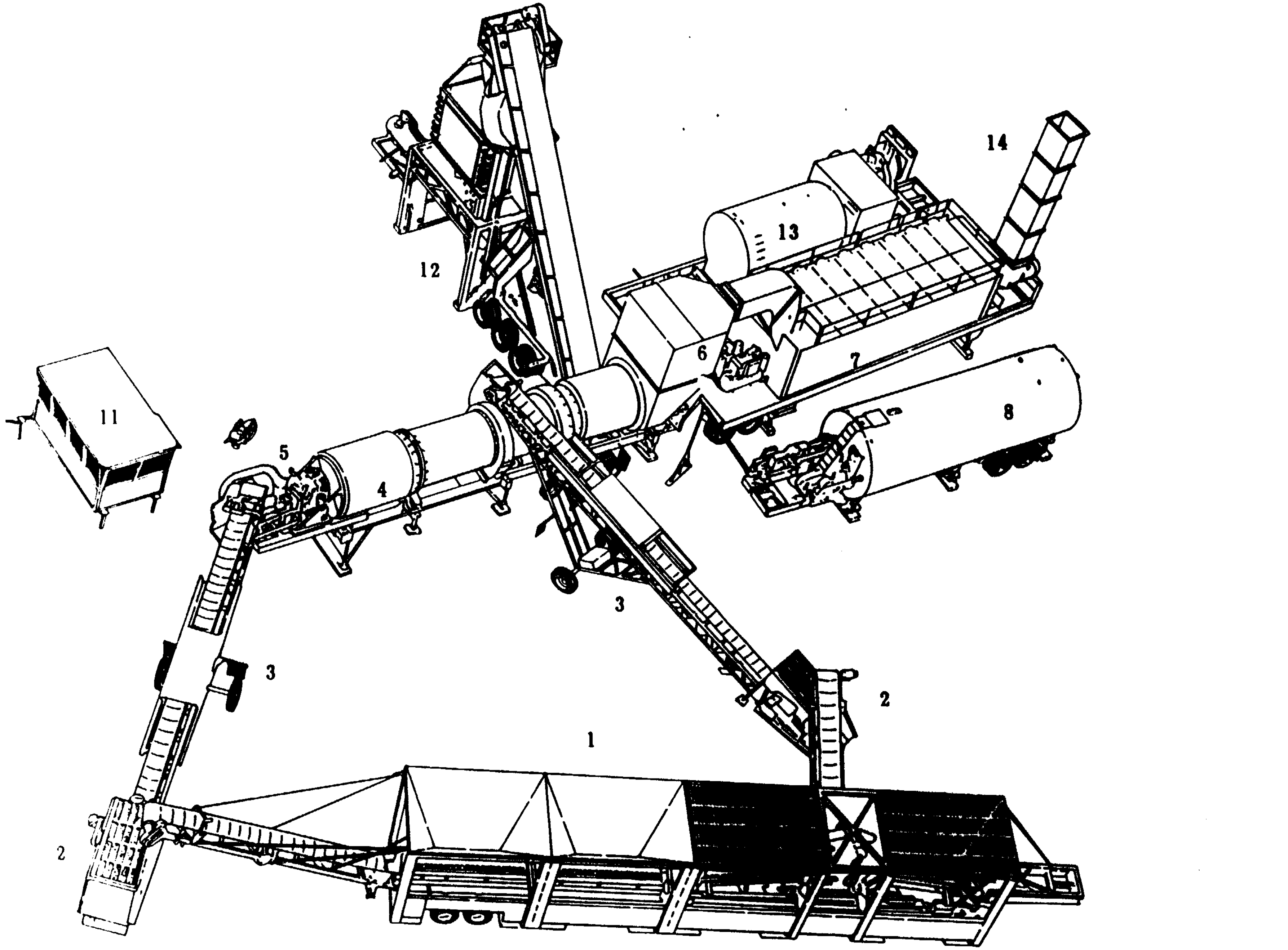
10. Surge/Storage bin: The asphaltic cement is dumped into this surge bin and metered out to dump trucks which pull underneath a slide gate at the bottom of the bin.

11. Control/operators house: The entire plant operation is controlled from this operator's house.

12. Truck loading scale: As the trucks receive the asphalt from the storage/surge bin they are weighed on the loading scale which tells the plant operator the amount of asphalt that is being trucked on each individual load.

13. Fuel Storage

14. Stack



CMI drum mixer plant (baghouse)

DATA SUMMARY

Plant

1. Manufacturer of plant CMI/Caterpiller.
2. Designed maximum operating capacity 500 TPH @ 5 % moisture.
3. Actual operation rate 265 TPH @ 3 % moisture.
4. Startup date 6/8/87.
5. Type of fuel used in dryer #2 Diesel.
6. Quanity of fuel consumption 6 GPM.

Aggregate

7. Name/type of mix Base.
8. Percent asphalt in mix 4.2 %.
9. Temperature of asphalt 300.
10. Sieve/Screening analysis: % Passing;

1"		3/8"		#	
3/4"		#		#	
1/2"		#		#200	

Baghouse

11. Manufacturer CMI Caterpiller.
12. No. of bags 820. Type of bags NoMax.
13. Air to cloth ratio 7/1. Designed ACFM 84,483.
14. Square feet of bags 12085.
15. Type of cleaning; pulse jet ~~✓~~, reverse air ____, plenum pulse ✓, other ____.
16. Cleaning cycle time ~~10 sec~~ 15 sec.
17. Interval between cleaning cycle 15 Sec.
18. Pressure drop across baghouse 3.7 - 4.0 psi.
19. Pulse pressure on cleaning cycle 100 psi.

COMPANY NAME ____________ DATE ____________

COMPANY REPRESENTATIVE ____________

Form #REC-03

PLANT DATA[8]

COMPANY NAME Hudson Materials

COMPANY REP. James Montesano DATE 9/24 - 9/25/87 PHONE # 928-9022

DATA SOURCE ______

PLANT LOCATION Ringwood N.J.

PLANT MFG. Caterpillar PLANT MODEL # PVM-2000 C.M.I. PLANT TYPE Drum Mix

MIX SPECIFICATION # ______ OIL SPECIFICATION # ______

Time 24 Hour	#2 Fuel Oil ✓ / Nat. Gas __ / Propane __ / Coal __	Burner Setting	Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	__ Venturi / __ Baghouse Pressure Drop Inches Water
8:45		80%	250		14.60	285	3.25
9:00		80%	250		15.15	280	3.20
9:15		82%	250		14.60	280	3.20
9:30		81	250		14.57		
9:45		Shut	Down				
10:00		80%	250		11.25	285	3.25
10:15							
10:30							
10:45							
11:00							
11:15	—	60%	250		13.57	290	3.[illegible]
11:30		65%	250		13.25	300	3.25
11:45		65%	255		13.[illegible]	[illegible]	[illegible]
12:00		63%	250		13.50	280	3.20
12:15							
12:30		60%	250		13.05	275	3.70
12:45		65%	260		[illegible]	285	3.70
1:00		60%	265		[illegible]	[illegible]	
1:15							
1:30		95%	260		13.99	[illegible]	[illegible]
[illegible]		90%	259		14.01	3[illegible]	[illegible]
[illegible]		95%	[illegible]		14.05	300	4
[illegible]		90%	2[illegible]		14.[illegible]0	3[illegible]	[illegible]
[illegible]		95%	269		14.03	3[illegible]	4

(1)

PLANT DATA(9)

COMPANY NAME SAME

COMPANY REP. ______ DATE ______ PHONE # ______

DATA SOURCE ______

PLANT LOCATION ______

PLANT MFG. ______ PLANT MODEL # ______ PLANT TYPE ______

MIX SPECIFICATION # ______ OIL SPECIFICATION # ______

Time 24 Hour	✓ Fuel Oil 2# / Nat. Gas __ / Propane __ / Coal __	Burner Setting	Aggregate TPH	Recycle TPH	Liquid Asphalt TPH	Mix Temp. °F	__ Venturi / __ Baghouse Pressure Drop Inches Water
7:45		40%	235	—	11.50	290	3.5
8:00		40%	[illegible]		11.85	285	[illegible]
8:15		35%	[illegible]		[illegible]	[illegible]	3.25
8:30		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
8:45		45%	[illegible]		[illegible]	[illegible]	[illegible]
9:00		45%	250		12.15	300	3.25
9:15		45%	250		10.40	315	3.25
9:30		45%	250		10.70	295	4.
9:45		65%	270		11.39	290	4.
10:00		55%	260		10.25	290	4.
10:15		50%	240		10.35	295	4.
10:30		50%	260		10.09	295	4.
10:45		45%	260		[illegible]	295	4.
11:00		55%	[illegible]		[illegible]	[illegible]	4
11:15		55%	250		[illegible]	310	4
11:30		50%	250		10.40	310	4
11:45		45%	265		10.25	300	4

(2) (3)

REC #04

V. EQUIPMENT USED

V. EQUIPMENT USED

Equipment used on conducting the particulate emissions test was:

A. The Lear Siegler PM-100 stack sampler with appropriate auxillary equipment and glassware. The train was set up according to the schematic on the nex page.

B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer was used to check the barometric pressure.

C. Weston dial thermometers are used to check meter temperatures. An Analogic Model 2572 Digital Thermocouple is used for stack temperatures.

D. A Hays 621 Analyzer was used to measure the oxygen, carbon dioxide and carbon monoxide content of the stack gases. For non-combustion sources, A Bacharach Instrument Company Fyrite is used for the gas analysis.

E. Filters are mady by Schleicher and Schuell and are type 1-HV with a porosity of .03 microns.

F. The acetone is reagent grade or ACS grade with a residue of $\leq$ .001.

VI. LABORATORY PROCEDURES & RESULTS

LABORATORY PROCEDURES FOR PARTICULATE SAMPLING

I. Field Preparation

A. FILTERS: Fiberglass 4" sampling filters are prepared as follows:

Filters are removed from their box and numbered on the back side with a felt pen. The numbering system is continuous from job to job. The filters are placed in a dessicator to dry for at least 24 hours. Clean plastic petri dishes, also numbered, top and bottom, are placed in the dessicator with the filters. After dessication, the filters are removed one at a time and weighed on the Sartorius analytical balance, then placed in the correspondingly numbered petri dish. Weights are then recorded in the lab record book. Three filters are used for each complete particulate source emissions test and there should be several extra filters included as spares.

B. SILICA GEL: Silica Gel used for the test is prepared as follows:

Approximately 200 g of silica gel is placed in a wide mouth "Mason" type jar and dried in an oven (175°C for two hours). The open jars are removed and placed in a dessicator until cool (2 hours) and then tightly sealed. The jars are then numbered and weighed on the triple beam balance to the closest tenth of a gram, and this weight is recorded for each sealed jar. The number of silica gel jars used is the same as the number of filters. Silica gel should be indicating type, 6-16 mesh.

II. Post-Testing Lab Analysis

A. FILTERS: The filters are returned to the lab in their sealed glass filter holder which was used in field sampling. In the lab these holders are opened. The filter is placed in its petri dish with the lid off and returned to the dessicator for at least 24 hours. The top half of the filter holder is washed into the corresponding probe wash bottle and the bottom half of the filter holder is washed into the corresponding impinger catch bottle. (See II, C and D). After dessication, the filters are reweighed. The final weight is recorded in the lab record book. The filter pick up weight is calculated and recorded also. This procedure is repeated for all filters used in the field.

Alternately, the test team may opt to oven dry the filters at 220°F for two to three hours, weigh the sample, and use this weight as a final weight.

B. SILICA GEL: The sealed silica gel jars should be reweighed on the triple-beam balance and their weights recorded as shown on previous page.

C. PROBE RINSINGS: In all tests, a probe wash-out analysis will be necessary. These samples are returned in sealed Mason jars and consist of A.R. Acetone with an unknown solid content. Clean 250 ml beakers are used to make this analysis. These should be immaculately washed and rinsed with deionized water, then oven dried at 105°C for about one hour. The beakers should be moved to the dessicator to cool for ninety (90) minutes, then labeled with a pencil and weighed on the Sartorius analytical balance. Any variance from this procedure should be duplicated exactly when reweighing, as this procedure has been found to be quite sensitive. After preparing the necessary number of beakers (one for each probe wash and one blank) the Mason jars should be opened, poured into the beaker, and any material remaining on the jar walls rinsed with an acetone wash bottle into the beaker. The amount of liquid in the beaker should be noted on the analysis form. The acetone rinsings are evaporated on a warming plate. The liquid is kept swirled with an air sweep to prevent "bumping". When the acetone is evaporated the beakers are weighed as in Section II A.

D. IMPINGER CATCH: In some testing cases, the liquid collected in the impingers must be analyzed for solids content. This involves a similar procedure to the probe wash solids determination, except that the liquid is deionized water.

E. ACETONE: Conduct a blank analysis of acetone in the 1 gallon glass container. This acetone will be used in the field for rinsing the probe, nozzle, and top half of the filter holder. Performing such a blank analysis prior to testing will insure that the quality of the acetone to be used will not exceed the .001% residual purity standard.

SPECIAL NOTE

When sampling sources high in moisture content, (such as asphalt plants) the filter paper sometimes sticks to the filter holder. When removing the filter it may tear. In order to maintain control of any small pieces of filter paper which may be easily lost, they are washed with acetone into the probe washing. This makes the filter weight light (sometimes negative) and the probe wash correspondingly heavier. The net weight is the same and no particulate is lost. This laboratory procedure is taught by EPA in the Quality Assurance for Source Emissions Workshop at Research Triangle Park and is approved by EPA.

WEIGHING PROCEDURE - SARTORIUS ANALYTICAL BALANCE

The Sartorius balance is accurate to 0.1 mg and has a maximum capacity of 200 grams. The balance precision (standard deviation) is 0.05 mg. Before weighing an item, the balance should first be zeroed. This step should be taken before every series of weighings. To do this, the balance should have all weight adjustments at "zero" position. The beam arrest lever (on the lower left hand side toward the rear of the balance) is then slowly pressed downward to full release position. The lighted vernier scale on the front of the cabinet should align the "zero" with the mark on the cabinet. If it is not so aligned, the adjustment knob on the right hand side (near the rear of the cabinet) should be turned carefully until the marks align. Now return the beam arrest to horizontal arrest position. The balance is now "zeroed".

To weigh an item, it is first placed on the pan. And the sliding doors are closed to avoid air current disturbance. The weight adjustment knob on the right hand side must be at "zero". The beam arrest is then slowly turned upward. The lighted scale at the front of the cabinet will now indicate the weight of the item in grams. If the scale goes past the divided area, the item then exceeds 100 g weight (about 3-1/2 ounces) and it is necessary to arrest the balance (beam arrest lever) and move the lever for 100 g weight away from you. It is located on the left hand side of the cabinet near the front, and is the knob closest to the side of the cabinet. The balance will not weigh items greater than 200 grams in mass, and trying to do this might harm the balance. Remember -- this is a delicate precision instrument.

After the beam is arrested, in either weight range, the procedure is the same. When the weight of the item in grams is found, "dial in" that amount with the two knobs on the left hand side (near the 100 g lever) color coded yellow and green. As you dial the weight, the digits will appear on the front of the cabinet. When the proper amount is dialed, carefully move the arrest lever down with a slow, steady turn of the wrist. The lighted dial will appear, and the right hand side knob (front of cabinet) is turned to align the mark with the lower of the two lighted scale divisions which the mark appears between. When these marks are aligned, the two lighted digits along with the two indicated on the right hand window on the cabinet front are the fractional weight in grams (the decimal would appear before the lighted digits) and the whole number of grams weight is the amount "dialed in" on the left.

In general, be sure that the beam is in "arrest" position before placing weight on or taking weight off of the pan. Don't "dial in" weight unless the beam is arrested. The balance is sensitive to even a hand on the table near the balance, so be careful and painstaking in every movement while weighing.

Form REC#8

SAMPLE ANALYTICAL DATA FORM

Plant Location Hudson Materials — Relative humidity in lab 49 %

Sample Location hot mix asphalt plant — Density of Acetone (pa) .7853 mg/ml

Blank volume (V_a) 200 ml

Date/Time wt. blank 10/1/87 — Gross wt. 97.2469 mg

Date/Time wt. blank 10/2/87 — Gross wt. 97.2468 mg

Ave. Gross wt. 97.2469 mg

Tare wt. 97.2465 mg

Weight of blank (m_{ab}) .0004 mg

Acetone blank residue concentration (C_a) $(C_a) = (M_{ab}) / (V_a) (p_a)$ = (.0000025 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} p_a$ = (.0000025)(200)(.7853) = (.0004)

		Run # 1	Run # 2	Run # 3
Acetone rinse volume (V_{aw})	ml	200	200	200
Date/Time of wt 10/1/87 9:45 Gross wt	g	133.1379	129.1889	164.4330
Date/Time of wt 10/2/87 8:30 Gross wt	g	133.1375	129.1887	164.4329
Average Gross wt	g	133.1377	129.1888	164.4330
Tare wt	g	133.1206	129.1804	164.4268
Less acetone blank wt (W_a)	g	.0004	.0004	.0004
Wt of particulate in acetone rinse (m_a)	g	.0167	.0080	.0058

Filter Numbers	#	KR-2342	KR-2343	KR-2340
Date/Time of wt 10/1/87 9:45 Gross wt	g	.5148	.5253	.5213
Date/Time of wt 10/2/87 8:30 Gross wt	g	.5146	.5250	.5211
Average Gross wt	g	.5147	.5252	.5212
Tare wt	g	.5129	.5152	.5170

Weight of particulate on filters(s) (m_f)	g	.0018	.0100	.0042
Weight of particulate in acetone rinse	g	.0167	.0080	.0058
Total weight of particulate (m_n)	g	.0185	.0180	.0100

Note: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weight) be subtracted from the sample weight.

Remarks

Signature of analyst Kim Rea   Signature of reviewer [signature]

PROCEDURE FOR ANALYSIS OF VOS

(Using a Gas Chromatograph*)

G.C.: Varion 3700

Detector: Flame Ionization Detector (FID)

Sampling Valve

C Sample Loop: Valco 8-Port

Column: 3% SP-1500/Carbopack B

Temp. 35°C - Hold 3 min. increase to 220°C at 8°C/min.

Flow (Carrier gas): 30 ml/min Nitrogen

The resulting peaks from each sample were recorded & integrated on a Hewlett Packard 3390A Integrator. The individual VOA's were calculated as Methane. The PPM value was determined from a linear regression curve of the total height from each sample using 0, 10 and 50 ppm as the initial values in the GC integrator.

*New Jersey A.P.C. 7:27B-3.9

PROCEDURE FOR ANALYSIS OF CARBON MONOXIDE IN STACK GAS

The samples of gas was taken from the stack by an integrated sampler and placed into a Tedlar bag. Analysis for carbon monoxide was by a Hewlett-Packard 4700A Gas Chromatograph with a thermal conductivity detector, and a molecular sieve 5A column packing. 500 microliter samples were taken from each of the three stack gas samples and injected directly into the G.C. A 500 microliter calibration standard of carbon monoxide was injected into the GC before and after the running of the samples. The two calibration runs were averaged and the coefficient of variation was calculated. The peak height of each sample was measured to determine the parts per million of CO for each sample run.

ENVIRONMENTAL TESTING & CONSULTING INC.
2924 WALNUT GROVE RD. • MEMPHIS, TENN. 38111 • PHONE (901) 327-2750

October 9,1987

Mr. Sumner Buck
Ramcon
223 Scott Street
Memphis, TN 38122

REF: Analytical Testing
Hudson No. 1, 2, 3 - Total Hydrocarbons as Methane and Carbon Monoxide

Dear Mr. Buck:

The above referenced samples have been analyzed per your instructions. The tests were performed in our laboratory (#00210) using the following procedures:

Total Hydrocarbons as Methane

GC : Varian 3700 equipped with Flame Ionization Detector
Column : Empty glass
Temperature : 45C Isothermal
Injection : 6 Port Valco Valve with 10cc sample loop

Carbon Monoxide

GC : Hewlett Packard 5700A equipped with Thermal Conductivity Detector Column :
Molecular Sieve 5A
Temperature : 70C Isothermal
Injection : 5cc gas tight syringe

The results of these tests are found on the attached pages along with copies of all pertinent information accumulated during the procedure. If you have any questions, please feel free to contact me.

Very truly yours,

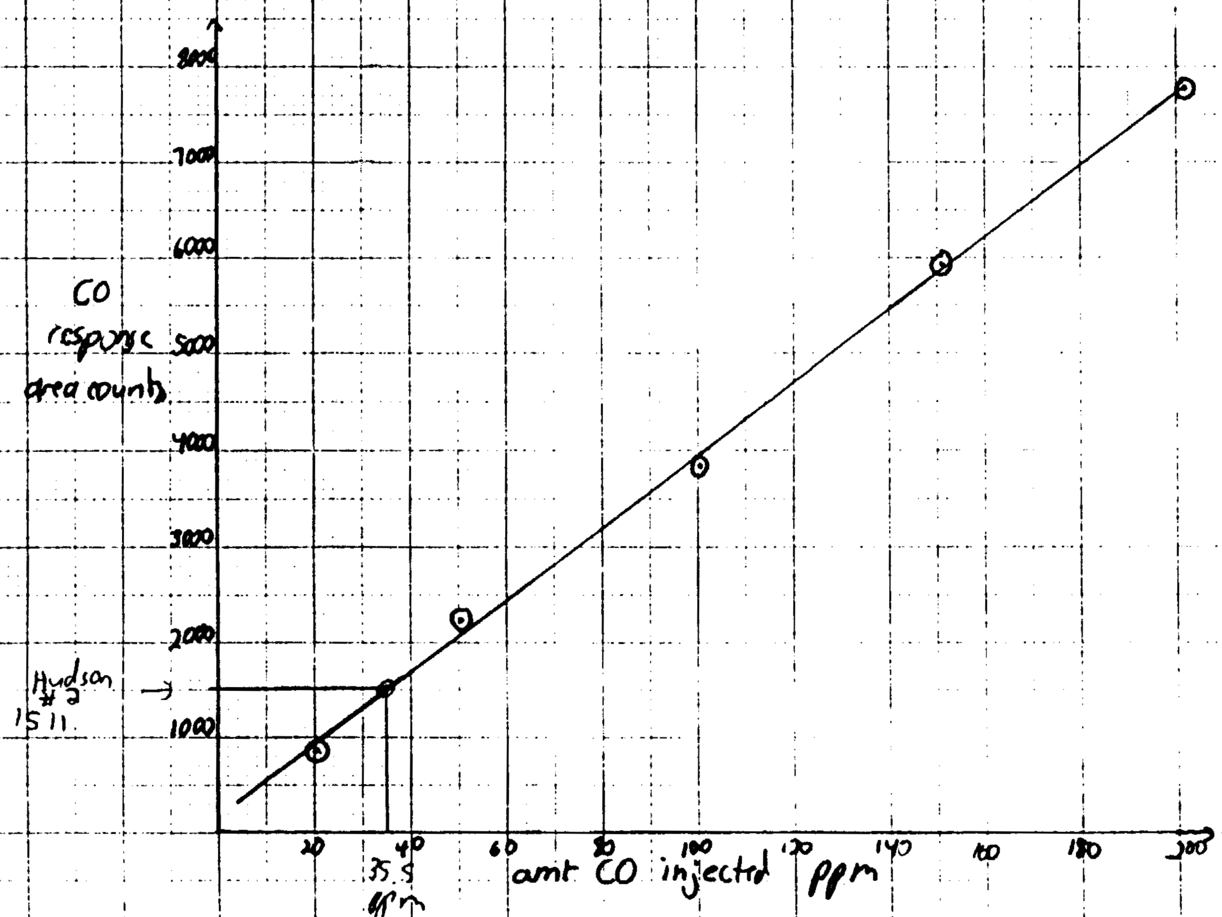
Nathan A. Pera
Laboratory Manager

Attachment

Sample	Carbon Monoxide	Total Hydrocarbons as Methane
Hudson #1	BDL*	BDL**
Hudson #2	35.5 ppm	BDL**
Hudson #3	BDL*	BDL**

*BDL - below detection limit 10ppm.
**BDL - below detection limit 40ppm. Chromatogram resembled that of background; there was no discernible methane peak.

CO Standard Curve



CO standard curve

ppm CO	response
20.16	876
50.40	2224
100.8	3827
151.2	5924
201.6	7786

correlation = 0.9992
slope : 37.74
y-intercept = 171.4

Hudson #1 2cc inj. no peak → BDL

Hudson #2 1cc inj. area : 1511

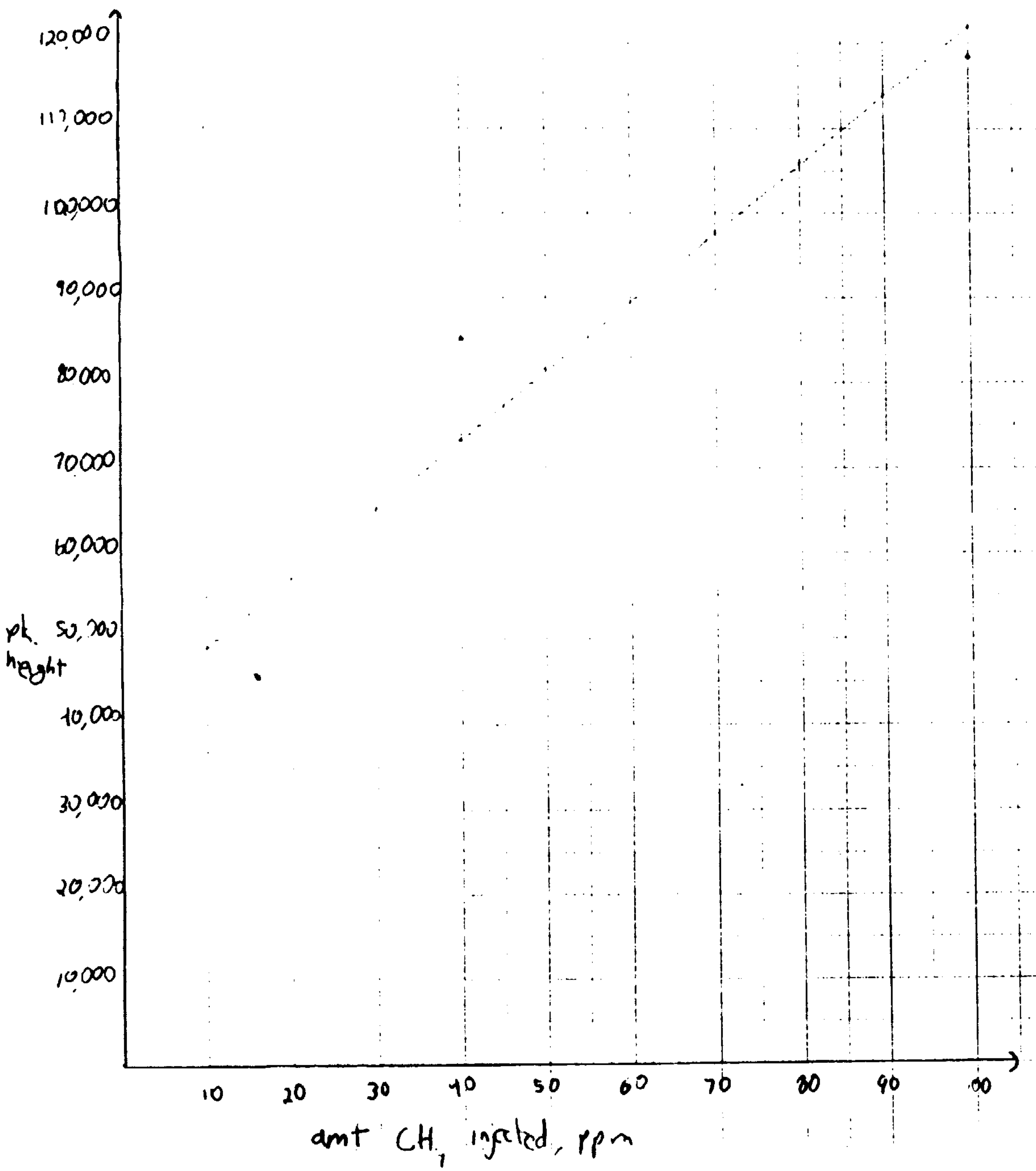
$$\frac{1511 - 171.4}{37.74} = 35.5 \text{ ppm}$$

Hudson #3 2cc inj. no peak → BDL

Calculation: $\frac{(\text{Area Sample Component}) - (\text{y-intercept})}{\text{slope}}$

= ppm Carbon Monoxide

Methane Standard Curve



standard curve

ppm CH_4	height
16	45,494
40	85,206
100	118,652

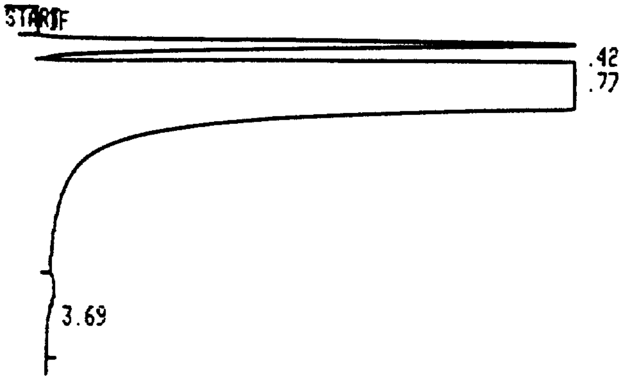
Correlation: 0.9577
Slope = 810.64
y-intercept = 40964

Hudson-1	62159	Background
Hudson-2	72158	Background
Hudson-3	52125	Background

LIST: LIST
PEAK CAPACITY: 1159

ZERO = 0, 196.1
ATT 2↑ = 0
CHT SP = 1.0
PK WD = 0.16
THRSH = -1
AR REJ = 0

0.5CC 100PPM CO
eq. to 50.4ppm CO 1cc



STOP

RUN # 11

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.42	58800	BH	0.117	0.250
0.77	2.3508E+07	ISHH	0.231	99.741
3.69	2224	TBP	0.394	0.009

TOTAL AREA= 2.3569E+07
MUL FACTOR= 1.0000E+00

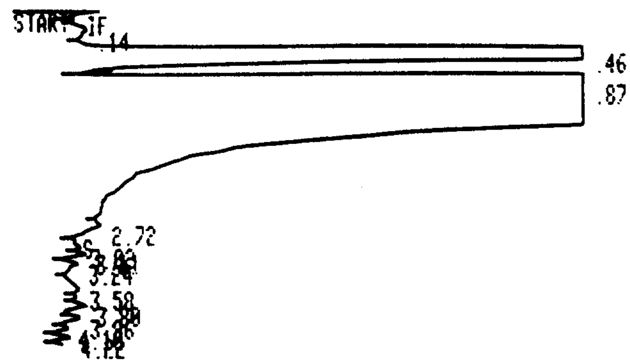
(20)

ZERO 1 0 @
LIST: ZERO = 10, 196.3

LIST: LIST
PEAK CAPACITY: 1159

ZERO = 10, 196.3
ATT 2↑ = -2
CHT SP = 1.0
PK WD = 0.16
THRSH = -3
AR REJ = 0

100.8 ppm
0.2 cc
eq. to 1cc 20.16ppm



STOP

RUN # 21

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.14	369	PP	0.121	0.004
0.46	101680	D PB	0.104	0.993
0.87	1.0132E+07	SPB	0.182	98.960
2.72	478	DTBB	0.145	0.005
3.02	292	BV	0.094	0.003
3.11	374	D VP	0.076	0.004
3.24	473	D PV	0.119	0.005
3.58	876	VV	0.176	0.009
3.80	738	D VV	0.109	0.007
3.96	660	D VV	0.112	0.007
4.10	270	D VP	0.078	0.003
4.22	228	D PP	0.057	0.002

avg. 790

TOTAL AREA= 1.0239E+07
MUL FACTOR= 1.0000E+00

1.5 cc
100.8 ppm CO
eq to
1 cc 151.2 ppm

LIST: LIST
PEAK CAPACITY: 1159

ZERO = 0, 196.1
ATT 2↑ = 0
CHT SP = 1.0
PK WD = 0.16
THRSH = -1
AR REJ = 0

STOP

RUN # 15

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.41	32514	PH	0.081	0.051
0.60	6.3985E+07	SHB	0.304	99.940
3.61	5924	TBB	0.405	0.009

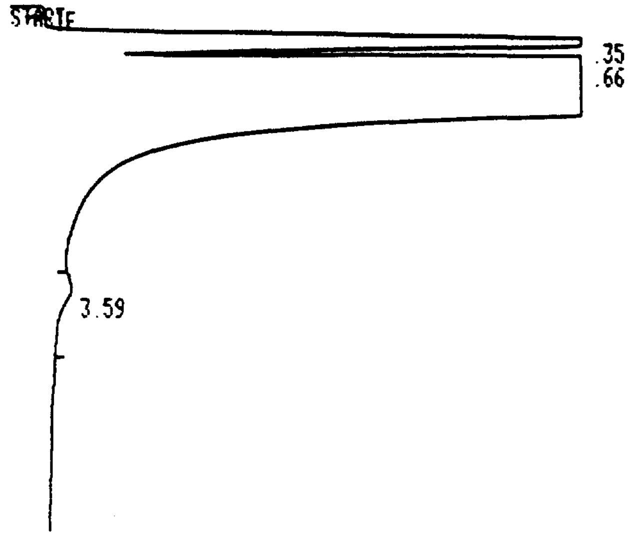
TOTAL AREA= 6.4024E+07
MUL FACTOR= 1.0000E+00

(21)

1 cc
100.8 ppm CO

LIST: LIST
PEAK CAPACITY: 1159

ZERO = 0, 196.1
ATT 2↑ = 0
CHT SP = 1.0
PK WD = 0.16
THRSH = -1
AR REJ = 0



STOP

RUN # 12

AREA%

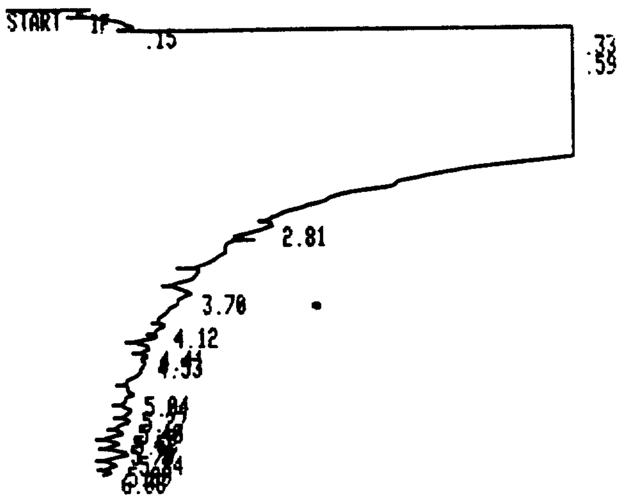
RT	AREA	TYPE	AR/HT	AREA%
0.35	115060	BH	0.182	0.262
0.66	4.3805E+07	ISHH	0.300	99.729
3.59	3827	TBB	0.446	0.009

TOTAL AREA= 4.3924E+07
MUL FACTOR= 1.0000E+00

LIST: LIST
PEAK CAPACITY: 1159

Hudson #1
2 cc

ZERO = 10, 196.2
ATT 2↑ = -2
CHT SP = 1.0
PK WD = 0.16
THRSH = -3
AR REJ = 0



RUN # 22

AREA%

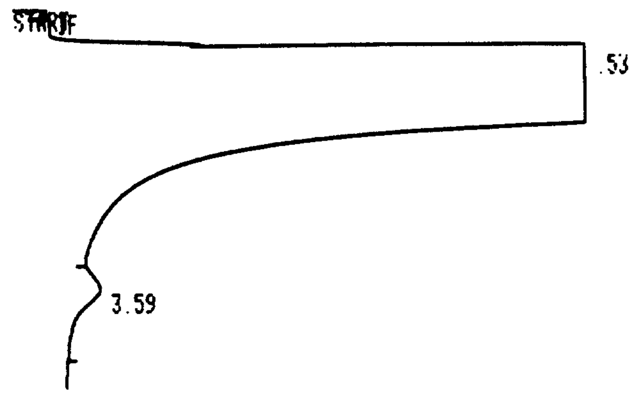
RT	AREA	TYPE	AR/HT	AREA%
0.15	1518	BH	0.130	0.002
0.33	1.7550E+07	SHH	0.125	21.423
0.59	6.4363E+07	SHB	0.310	78.567
2.81	318	DTBB	0.118	3.8818E-04
3.70	1518	PV	0.275	0.002
4.12	567	D VV	0.133	6.9212E-04
4.41	362	PV	0.093	4.4189E-04
4.53	1222	D VV	0.309	0.002
5.04	594	D VV	0.171	7.2508E-04
5.27	544	VV	0.135	6.6405E-04
5.40	474	D VV	0.108	5.7860E-04
5.56	298	D VP	0.083	3.6376E-04
5.70	217	D PV	0.068	2.6489E-04
5.84	498	D VV	0.095	6.0790E-04
5.99	192	D VV	0.068	2.3437E-04
6.08	61	I VP	0.041	7.4461E-05

TOTAL AREA= 8.1922E+07
MUL FACTOR= 1.0000E+00

LIST: LIST
PEAK CAPACITY: 1159

2cc 100.8 µl n CO
eq. to 1cc 201.6 µl n CO

ZERO = 0, 196.1
ATT 2↑ = 0
CHT SP = 1.0
PK WD = 0.16
THRSH = -1
AR REJ = 0



RUN # 13

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.53	8.3411E+07	ISBH	0.331	99.991
3.59	7786	TBP	0.427	0.009

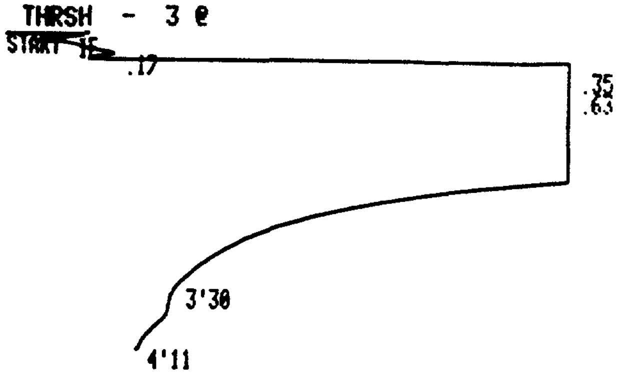
TOTAL AREA= 8.3419E+07
MUL FACTOR= 1.0000E+00

LIST: LIST
PEAK CAPACITY: 1159

ZERO = 10, 196.2
ATT 2↑ = 0
CHT SP = 1.0
PK WD = 0.16
THRSH = -2
AR REJ = 0

Hudson #3
2cc

ATT 2↑ - 2 @
THRSH - @
THRSH - 3 @



STOP

RUN # 25

AREA%

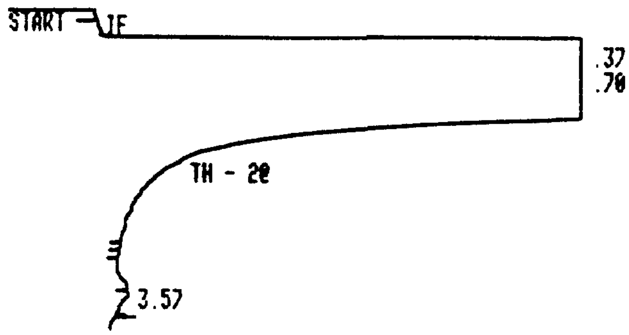
RT	AREA	TYPE	AR/HT	AREA%
0.17	2054	BH	0.143	0.003
0.35	1.5060E+07	SHH	0.122	21.134
0.63	5.6198E+07	ISHH	0.295	78.863

TOTAL AREA= 7.1260E+07
MUL FACTOR= 1.0000E+00

ATT 2↑ 0 @
THRSH - 1 @
LIST: LIST
PEAK CAPACITY: 1159

Hudson #2
1 cc

ZERO = 10, 196.2
ATT 2↑ = 0
CHT SP = 1.0
PK WD = 0.16
THRSH = -1
AR REJ = 0



STOP

RUN # 24

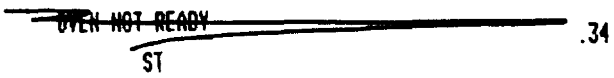
AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.37	7732000	SBH	0.131	18.170
0.70	3.4819E+07	SHB	0.265	81.826
3.57	1511	TPY	0.157	0.004

TOTAL AREA= 4.2553E+07
MUL FACTOR= 1.0000E+00

CH_3 40ppm

ID 2 . 0 - 4 0 0



RUN # 286 OCT/09/87 08:52:56
ID 2.0-40

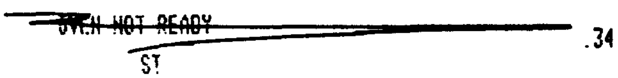
HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.34	90909	PB	0.158	100.000

TOTAL HGHT= 90909
MUL FACTOR= 1.0000E+00

CH_3 40 ppm

LIST: ID 2.0-40



RUN # 287 OCT/09/87 08:54:52
ID 2.0-40

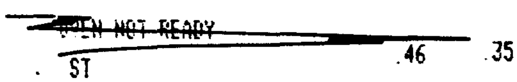
HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.34	79503	PB	0.179	100.000

TOTAL HGHT= 79503
MUL FACTOR= 1.0000E+00

Hudson #3

LIST: ID 2.0-3



RUN # 289 OCT/09/87 09:02:12
ID 2.0-3

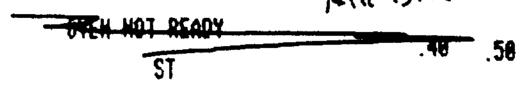
HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.35	52125	PV	0.125	55.751
0.46	41371	I VP	0.219	44.249

TOTAL HGHT= 93496
MUL FACTOR= 1.0000E+00

(24) LIST: ID 2.0-00

Air Blk



RUN # 283 OCT/09/87 08:47:28
ID 2.0-00

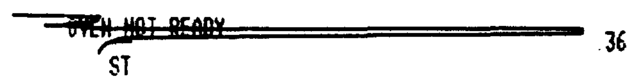
HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.40	41628	BV	0.107	45.595
0.50	49671	I VH	0.267	54.405

TOTAL HGHT= 91299
MUL FACTOR= 1.0000E+00

CH_4 100ppm

ID 2 . 0 - 1 0 0 0



RUN # 284 OCT/09/87 08:49:41
ID 2.0-100

HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.36	118257	PB	0.144	100.000

TOTAL HGHT= 118260
MUL FACTOR= 1.0000E+00

CH_4 100ppm

LIST: ID 2.0-100

RUN # 285 OCT/09/87 08:51:19
ID 2.0-100

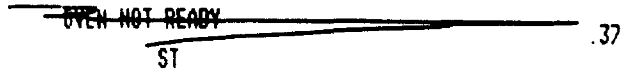
HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.35	119047	BB	0.117	100.000

TOTAL HGHT= 119050
MUL FACTOR= 1.0000E+00

Hudson #2

ID 2 . 0 - 2 @



RUN # 290 OCT/09/87 09:05:27
ID 2.0-2

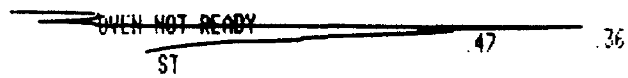
HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.37	72158	I BH	0.296	100.000

TOTAL HGHT= 72158
MUL FACTOR= 1.0000E+00

Hudson #1

ID 2 . 0 - 1 @



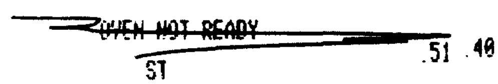
RUN # 291 OCT/09/87 09:12:02
ID 2.0-1

HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.36	69159	PV	0.128	59.539
0.47	46998	I VH	0.260	40.461

TOTAL HGHT= 116160
MUL FACTOR= 1.0000E+00

ID 2 . 0 - 1 6 @ CH_4 16ppm



RUN # 292 OCT/09/87 09:13:41
ID 2.0-16

HEIGHT%

RT	HEIGHT	TYPE	AR/HT	HEIGHT%
0.40	45494	PV	0.154	53.027
0.51	40300	I VH	0.244	46.973

TOTAL HGHT= 85794
MUL FACTOR= 1.0000E+00

VII. CALCULATIONS

57.5 X 42.75

NAME: HUDSON MATERIALS

LOCATION: RING WOOD, NEW JERSEY

		date	9/24/87	9/25/87	9/25/8
	SUMMARY OF TEST DATA		RUN # 1	RUN # 2	RUN #
	SAMPLING TRAIN DATA	start	14:16	07:33	10:13
		finish	16:00	08:52	11:32
1	Sampling time, minutes	θ	60	60	60
2	Sampling nozzle diameter, in.	Dn	.300	.300	.300
3	Sampling nozzle cross-sectional area, ft^2.	An	.000491	.000491	.000491
4	Isokinetic variation	I	110	104	108
5	Sample gas volume - meter conditions, cf.	Vm	45.43	41.81	42.48
6	Average meter temperature, °R	Tm	541	530	530
7	Average oriface pressure drop, in.H_2O	ΔH	2.21	1.80	1.76
8	Total particulate collected mg.	Mn	18.5	18.0	10.0
	VELOCITY TRAVERSE DATA				
9	Stack area, ft^2.	A	17.1	17.1	17.1
10	Absolute stack gas pressure, in. Hg.	Ps	30.00	30.20	30.20
11	Barometric pressure, in. Hg.	Pbar	30.00	30.20	30.20
12	Average absolute stack temperature, °R	Ts	729	719	729
13	Average $\sqrt{\text{velocity head}}$, (Cp= .80)	$\sqrt{\Delta P}$	.64	.63	.62
14	Average stack gas velocity ft. / sec.	Vs	42	40	40
	STACK MOISTURE CONTENT				
15	Total water collected by train, ml.	Vic	311.0	291.0	289.0
16	Moisture in stack gas, %	Bws	24.9	24.8	24.3
	EMISSIONS DATA:				
17	Stack gas flow rate, dscf/hr. (000's)	Qsd	1,394	1,388	1,364
18	Total particulate concentration, gr/dscf	Cs	.0065	.0067	.0036
19	Total particulate concentration, lbs/hr	E	1.3	1.3	.7
20	Total particulate concentration, lbs/mbtu	E'	.0000	.0000	.0000
	ORSAT DATA				
21	Percent CO2 by volume	CO2	10.0	10.0	10.0
22	Percent O2 by volume	O2	11.0	11.0	11.0
23	Percent CO by volume	CO	.0	.0	.0
24	Percent N2 by volume	N2	79.0	79.0	79.0

Buzzycalc

Dry Gas Volume :

$$V_{m(std)} = V_m \left[\frac{T_{(std)}}{T_m} \right] \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{(std)}} \right] = 17.64 \; \frac{°R}{in.Hg.} \; Y \; V_m \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m} \right]$$

Where:

$V_{m(std)}$ = Dry Gas Volume through meter at standard conditions, cu.ft.

V_m = Dry Gas Volume measured by meter, cu.ft.

P_{bar} = Barometric pressure at oriface meter, in. Hg.

P_{std} = Standard absolute pressure,(29.92 in. Hg.)

T_m = Absolute temperature at meter °R

T_{std} = Standard absolute temperature (528°R)

ΔH = Average pressure drop across oriface meter, in. H_2O

Y = Dry gas meter calibration factor

13.6 = Inches water per inches Hg.

Run # 1 $V_{m(std)} = 17.64 \; (.99)(45.43) \left[\frac{(30.00) + \frac{2.21}{13.6}}{541} \right] = 44.05$ dsc

Run # 2 $V_{m(std)} = 17.64 \; (.99)(41.81) \left[\frac{(30.20) + \frac{1.80}{13.6}}{530} \right] = 41.62$ dsc

Run # 3 $V_{m(std)} = 17.64 \; (.99)(42.48) \left[\frac{(30.20) + \frac{1.76}{13.6}}{530} \right] = 42.28$ dsc

Total contaminants by weight: 'GRAIN LOADING'

Particulate concentration C_s' gr./dscf.

$$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{M_n}{V_{m(std)}} \right]$$

Where:

C_s' = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions,gr./dscf.

M_n = Total amount of particulate matter collected, mg.

$V_{m(std)}$ = Dry gas volume through meter at standard conditions, cu.ft.

Run # 1: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{18.5}{44.05} \right] = .0065 \text{ gr./dscf.}$$

Run # 2: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{18.0}{41.62} \right] = .0067 \text{ gr./dscf.}$$

Run # 3: $$C_s' = \left[0.0154 \frac{gr}{mg} \right] \left[\frac{10.0}{42.28} \right] = .0036 \text{ gr./dscf.}$$

Dry molecular weight:

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%CO + \%N_2).$$

Where:

M_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).
0.264	= Ratio of O_2 to N_2 in air, v/v.
0.28	= Molecular weight of N_2 or CO, divided by 100.
0.32	= Molecular weight of O_2 divided by 100.
0.44	= Molecular weight of CO_2 divided by 100.

Run # 1: $M_d = 0.44(10.0\%) + 0.32(11.0\%) + 0.28(.0\% + 79.0\%) =$ 30.0 lb./lb.-mol

Run # 2: $M_d = 0.44(10.0\%) + 0.32(11.0\%) + 0.28(.0\% + 79.0\%) =$ 30.0 lb./lb.-mol

Run # 3: $M_d = 0.44(10.0\%) + 0.32(11.0\%) + 0.28(.0\% + 79.0\%) =$ 30.0 lb./lb.-mol

Water vapor condensed :

$$V_{wc_{std}} = \left[V_f - V_i \right] \left[\frac{P_w}{M_w} \frac{R \; T_{(std)}}{P_{(std)}} \right] = 0.04707 \left[V_f - V_i \right]$$

$$V_{wsg_{std}} = \left[W_f - W_i \right] \left[\frac{R}{M_w} \frac{T_{(std)}}{P_{(std)}} \right] = 0.04715 \left[W_f - W_i \right]$$

Where:

0.04707 = Conversion factor ft^3/ml.

0.04715 = Conversion factor ft^3/g.

$V_{wc_{std}}$ = Volume of water vapor condensed (standard conditions) scf.

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel (standard conditions

V_f = Final volume of impinger contents, ml.

V_i = Initial volume of impinger contents

p = Density of water, (0.002201 lb/ml).

R = Ideal gas constant, 21.85 (in.Hg.)(cu.ft./lb.-mole)($^\circ$R)

M_w = Molecular weight of water vapor (18.0 lb/lb-mole).

T_{std} = Absolute temperature at standard conditions, 528°R.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

Run # 1: $V_{wc(std)}$ = (0.04707) (300.0) = 14.1 cu.ft
$V_{wsg(std)}$ = (0.04715) (11.0) = .5 cu.ft

Run # 2: $V_{wc(std)}$ = (0.04707) (282.0) = 13.3 cu.ft
$V_{wsg(std)}$ = (0.04715) (9.0) = .4 cu.ft

Run # 3: $V_{wc(std)}$ = (0.04707) (275.0) = 12.9 cu.ft
$V_{wsg(std)}$ = (0.04715) (14.0) = .7 cu.ft

Moisture content of stack gases: $$B_{ws} = \frac{V_{wc_{std}} + V_{wsg_{std}}}{V_{wc_{std}} + V_{wsg_{std}} + V_{m_{std}}} \times 100$$

Where:

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

V_m = Dry gas volume measured by dry gas meter, (dcf).

$V_{wc_{std}}$ = Volume of water vapor condensed corrected to standard conditions (scf).

$V_{wsg_{std}}$ = Volume of water vapor collected in silica gel corrected to standard conditions (scf).

Run # 1: $$B_{ws} = \frac{14.1 + .5}{14.1 + .5 + 44.05} \times 100 = 24.9\ \%$$

Run # 2: $$B_{ws} = \frac{13.3 + .4}{13.3 + .4 + 41.62} \times 100 = 24.8\ \%$$

Run # 3: $$B_{ws} = \frac{12.9 + .7}{12.9 + .7 + 42.28} \times 100 = 24.3\ \%$$

Molecular weight of stack gases: $M_s = M_d\ (1-B_{ws}) + 18\ (B_{ws})$.

Where:

M_s = Molecular weight of stack gas, wet basis, (lb./lb.-mole).

M_d = Molecular weight of stack gas, dry basis, (lb./lb.-mole).

Run # 1: M_s = 30.0 (1- .249) + 18 (.249) = 27.0 (lb./lb.-mole).

Run # 2: M_s = 30.0 (1- .248) + 18 (.248) = 27.0 (lb./lb.-mole).

Run # 3: M_s = 30.0 (1- .243) + 18 (.243) = 27.1 (lb./lb.-mole).

Stack gas velocity:

$$V_s = K_p\ C_p \left[\sqrt{\Delta P}\right] \text{avg.} \sqrt{\frac{T_{s(avg.)}}{P_s\ M_s}}$$

Where:

V_s = Average velocity of gas stream in stack, ft./sec.

K_p = 85.49 ft/sec $\left[(g/g\text{-mole})\text{-}(mm\ Hg) / (^\circ K)(mm\ H_2O)\right]^{1/2}$

C_p = Pitot tube coefficient,(dimensionless).

ΔP = Velocity head of stack gas, in. H_2O.

P_{bar} = Barometric pressure at measurement site, (in.Hg).

P_g = Stack static pressure (in.Hg).

P_s = Absolute stack gas pressure, (in.Hg) = $P_{bar} + P_g$

P_{std} = Standard absolute pressure, (29.92 in.Hg).

t_s = Stack temperature, ($^\circ$f).

T_s = Absolute stack temperature, ($^\circ$R). = 460 + t_s.

M_s = Molecular weight of stack gas, wet basis, (lb/lb-mole).

Run # 1: $V = (85.49)(.80)(.64)\sqrt{\frac{729}{(30.00)(27.01)}} = 41.52$ ft/s

Run # 2: $V = (85.49)(.80)(.63)\sqrt{\frac{719}{(30.20)(27.02)}} = 40.44$ ft/s

Run # 3: $V = (85.49)(.80)(.62)\sqrt{\frac{729}{(30.20)(27.08)}} = 40.03$ ft/s

Stack gas flow rate:

$$Q_{sd} = 3600 \left[1-B_{wc}\right] V_s\, A \left[\frac{T_{std}}{T_{stk}}\right] \left[\frac{P_s}{P_{std}}\right]$$

Where:

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, (dscf/hr).

A = Cross sectional area of stack $(ft.)^2$.

3600 = Conversion factor, sec./hr.

t_s = Stack temperature (°f).

T_s = Absolute stack temperature, (°R).

T_{std} = Standard absolute temperature, (528°R).

P_{bar} = Barometric pressure at measurement site, (in.Hg.).

P_g = Stack static pressure, (in.Hg.).

P_s = Absolute stack gas pressure, (in.Hg.); = $P_{bar} + P_g$

P_{std} = Standard absolute pressure, (29.92 in.Hg.)

Run # 1:

$$Q_{sd} = 3600\ (1-.249)\ (41.52)\ (17.1) \left[\frac{528}{729}\right] \left[\frac{30.00}{29.92}\right] = 1393997 \text{ dscf.}$$

Run # 2:

$$Q_{sd} = 3600\ (1-.248)\ (40.44)\ (17.1) \left[\frac{528}{719}\right] \left[\frac{30.20}{29.92}\right] = 1387644 \text{ dscf.}$$

Run # 3:

$$Q_{sd} = 3600\ (1-.243)\ (40.03)\ (17.1) \left[\frac{528}{729}\right] \left[\frac{30.20}{29.92}\right] = 1363741 \text{ dscf.}$$

Emissions rate from stack:

$$E = \frac{(C_s)(Q_{sd})}{7000 \text{ gr./lb.}} = \text{lb. / hr.}$$

Where:

E = Emissions rate, lb./hr.

C = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions (gr/dscf).

Q = Dry volumetric stack gas flow rate corrected to standard conditions, (dscf/hr).

Run # 1: $$E = \frac{(.0065)(1393997)}{7000} = 1.3 \text{ lb. / hr.}$$

Run # 2: $$E = \frac{(.0067)(1387644)}{7000} = 1.3 \text{ lb. / hr.}$$

Run # 3: $$E = \frac{(.0036)(1363741)}{7000} = .7 \text{ lb. / hr.}$$

$$\text{Isokinetic variation : } I = 100\,T_s \left[\frac{0.002669\,V_{ic} + (V_m/T_m)(P_{bar} + \Delta H/13.6)}{60 \quad O \quad V_s \quad P_s \quad A_n} \right]$$

Where:

I	=	Percent isokinetic sampling.
100	=	Conversion to percent.
T_s	=	Absolute average stack gas temperature, °R.
0.002669	=	Conversion factor, Hg – ft^3/ml – °R.
V_{ic}	=	Total volume of liquid collected in impingers and silica gel, m
T_m	=	Absolute average dry gas meter temperature, °R.
P_{bar}	=	Barometric pressure at sampling site, (in.Hg).
ΔH	=	Average pressure differential across the oriface meter, (in.H_2(
13.6	=	Specific gravity of mercury.
60	=	Conversion seconds to minutes
O	=	Total sampling time, minutes.
V_s	=	Stack gas velocity, ft./sec.
P_s	=	Absolute stack gas pressure, in.Hg.
A_n	=	Cross sectional area of nozzle, ft^2.

Run # 1:

$$I = 100 \times 729 \left[\frac{(0.002669)(311.0) + \frac{45.4}{541}\left[30.00 + \frac{2.21}{13.6}\right]}{60\,(\ 60\ )\,(\ 41.52\ )\,(30.00\ )\,(\ .000491\ )} \right] = 110\ \%$$

Run # 2:

$$I = 100 \times 719 \left[\frac{(0.002669)(291.0) + \frac{41.8}{530}\left[30.20 + \frac{1.80}{13.6}\right]}{60\,(\ 60\ )\,(\ 40.44\ )\,(30.20\ )\,(\ .000491\ )} \right] = 104\ \%$$

Run # 3:

$$I = 100 \times 729 \left[\frac{(0.002669)(289.0) + \frac{42.5}{530}\left[30.20 + \frac{1.76}{13.6}\right]}{60\,(\ 60\ )\,(\ 40.03\ )\,(30.20\ )\,(\ .000491\ )} \right] = 108\ \%$$

Stack Gas Emissions - New Jersey Standard:

$$E = Wt(gms) \times \frac{1}{Vt\ (cu.ft.)} \times 15.43\ \frac{(grs)}{(gm)}$$

Where; Wt(gms) = Total particulate weight in grams

Vt (cu.ft.) = Total cubic feet of gas sampled at flue conditions.

Run #1: $$\frac{.0185}{45.43 \times 1.249} \times 15.43 = 0.0050 \text{ gr/SCF}$$

Run #2: $$\frac{.0180}{41.81 \times 1.248} \times 15.43 = 0.0053 \text{ gr/SCF}$$

Run #3: $$\frac{.0100}{42.48 \times 1.243} \times 15.43 = 0.0029 \text{ gr/SCF}$$

VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Hudson Materials

4.5

Location Hewitt N.J.
Operator Sam Turner
Date 9-24-87
Run No. 1
Sample Box No. 2
Meter Box No. 646882
Meter H @ 1.89
C Factor .956
Pitot Tube Coefficient Cp .80

Ambient Temperature 72
Barometric Pressure 30.00
Assumed Moisture, % 18
Probe Length, m(ft) 5
Nozzle Identification No. .0004909
Avg. Calibrated Nozzle Dia., (in.) .30/.30/.30
Probe Heater Setting
Leak Rate, m^3/min. (cfm) .02 at 7.5" Vac
Probe Liner Material Pyrex
Static Pressure, mm Hg (in. Hg) .1/13.6
Filter No. KR-2342

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	500	411
INITIAL	200	400
DIFFERENCE	300	11

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A-1	14:16 / 14:18	0	250	.06	.30	873.575 / 874.40	72 71	70	220	60
2	14:49:30 / 14:51:30	0	250	.06	.30	875.40	80 75	70	220	60
3	14:53:30	0	260	.06	.30	876.00	92 76	70	220	60
4	14:55:30	0	260	.05	.23	876.40	86 77.5	69	220	60
5	14:57:30	0	265	.05	.23	877.00	86 77.5	69	215	60
6	14:59:30	0	262	.15	.68	877.80	88 78	69	215	60
B-1	15:01 / 15:03	0	257	.25	1.1	879.10	85 79	70	220	60
2	15:05	2.5	270	.50	2.25	880.68	88 78	69	220	60
3	15:07	2.0	266	.40	1.80	881.80	92 80	69	210	40
4	15:09	2.0	266	~~.30~~ .25	1.1	883.10	93 81	69	210	40
5	15:11	1.0	266	.20	.90	884.20	93 81.5	70	210	40
6	15:13	1.0	260	.17	.77	885.20	94 82	70	210	40
C-1	15:18 / 15:20	2.5	268	.50	2.3	886.80	80 76	72	225	40

Form 4055-85

Form #REC-03

RAMCON emissions test log sheet, cont. DATE 9-24-88 LOCATION ____________ TEST NO. 1

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft.^{3})	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	15:22	2.5	279	.50	2.3	888.60	88 80	72	225	50
3	15:24	2.5	279	.48	2.2	890.10	93 82.0	72	225	50
4	15:26	2.5	279	.40	1.8	891.80	95 83.0	72	215	50
5	15:28	2.0	280	.35	1.6	893.20	96 84	72	215	50
6	15:30	2.0	278	.28	1.3	894.28	96 84	72	215	50
D-1	15:32 / 15:34	6.0	275	1.1	4.95	896.90	88 81	74	225	55
2	15:36	6.0	275	1.1	4.95	899.30	94 83	73	225	55
3	15:38	6.0	275	1.0	4.5	901.50	97 85	73	210	50
4	15:40	4.5	278	.75	3.4	903.50	98 86	74	210	50
5	15:42	4.0	278	.55	2.5	905.10	100 87	74	215	50
6	15:44	3.0	275	.35	1.6	906.60	100 87	74	220	50
E-1	15:48 / 15:50	6.5	272	1.2	5.4	909.10	84 79	74	215	60
2	15:52	6.5	271	1.2	5.4	911.90	94 84	74	215	60
3	15:54	6.0	272	.90	4.0	913.50	95 84.5	74	215	60
4	15:56	6.0	272	.90	4.0	916.00	96 85	74	215	60
5	15:58	5.0	270	.70	3.2	917.70	98 86	74	200	60
6	16:00	2.5	250	.20	.90	919.005	98 86	74	200	60

RAMCON ENVIRONMENTAL CORPORATION

Plant: Hudson Materials — 3.9

Location: Hewitt N.J.
Operator: Sam Turner
Date: 9-25-89
Run No.: 2
Sample Box No.: 2
Meter Box No.: 646 882
Meter H @: 1.89
C Factor: .986
Pitot Tube Coefficient Cp: .86

Ambient Temperature: 50
Barometric Pressure: 30.20
Assumed Moisture, %: 25
Probe Length, m(ft): 5'
Nozzle Identification No.: .0004808
Avg. Calibrated Nozzle Dia., (in.): .30/.30/.32
Probe Heater Setting: 5
Leak Rate, m^3/min. (cfm): .007 at 3" vac
Probe Liner Material: Pyrex
Static Pressure, mm Hg (in. Hg): .1/.136
Filter No.: KR 2343

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	482	409
INITIAL	200	400
DIFFERENCE	282	9

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_s) °F	VELOCITY HEAD (P_s) in H2O	PRESSURE DIFF. ORF. MTR in H2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A 1	7:33:30 / 7:35:30	0	256	.30	1.2	920.015 / 921.40	58 58	58	225	40
2	7:37:30	2	256	.80	3.1	923.50	69 64	59	225	40
3	7:39:30	1	261	.55	2.1	924.80	76 68	60	225	40
4	7:41:30	2	261	.80	3.1	926.60	78 69	60	225	40
5	7:43:30	3	259	1.1	4.3	928.60	82 71	60	225	40
6	7:45:30	3	258	1.1	4.3	930.85	84 73	62	225	50
B - 1	7:47:30 / 7:49:30	0	243	.30	1.2	932.30	76 69	62	225	50
2	7:51:30	0	252	.40	1.6	933.40	80 71	62	225	50
3	7:53:30	2	258	.60	2.3	935.00	82 72	62	220	60
4	7:55:30	2.5	259	.80	3.1	937.40	83 72.5	62	220	60
5	7:57:30	3.0	261	1.0	3.9	939.80	85 76	63	225	65
6	7:59:30	3.0	261	.90	3.5	941.20	86 74.0	63	225	65
C - 1	8:05 / 8:07	0	255	.30	1.2	942.40	70 67	64	220	65

Form #REC-05

RAMCON emissions test log sheet, cont. DATE 9-25-87 LOCATION Hewitt NJ TEST NO. 2

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	809	1	265	.40	1.6	943.60	78	71 64	220	50
3	8:11	2	269	.50	2.0	945.30	82	73 64	220	50
4	8:13	2	268	.60	2.3	946.80	83	73.5 64	220	55
5	8:15	2.5	267	.80	3.1	948.80	84	74 64	220	50
6	8:17	2.5	267	.75	2.9	951.00	86	75 64	220	55
D-1	8:23 / 8:25	0	257	.20	.78	952.16	74	69 64	225	55
2	8:27	0	261	.20	.78	953.10	78	71 64	225	55
3	8:29	0	263	.15	.59	953.90	80	72 64	215	50
4	8:31	0	265	.19	.74	955.00	80	72 64	215	50
5	8:33	0	264	.28	1.1	956.50	82	73 64	215	50
6	8:35	1	265	.35	1.4	957.70	82	73 64	200	50
E-1	8:40:30 / 8:42:30	0	234	.08	.30	958.30	68	65 62	200	50
2	8:44:30	0	246	.08	.38	959.00	72	67 62	225	50
3	8:46:30	0	256	.04	.16	959.70	78	70 62	200	50
4	8:48:30	0	261	.03	.12	960.20	78	70 62	225	50
5	8:50:30	0	264	.07	.23	960.90	78	70 62	215	45
6	8:52:30	0	264	.16	.62	961.825	79	70.5 62	215	45

RAMCON ENVIRONMENTAL CORPORATION

Plant: Hudson Materials
Location: Hewitt N.J.
Operator: Sam Turner
Date: 9-25-87
Run No.: 8
Sample Box No.: 2
Meter Box No.: 646882
Meter H @: 1.89
C Factor: .986
Pitot Tube Coefficient Cp: .80

Ambient Temperature: 60
Barometric Pressure: 30.20
Assumed Moisture, %: 2.5
Probe Length, m(ft): 5'
Nozzle Identification No.: .0004808
Avg. Calibrated Nozzle Dia., (in.): .30/.30/.30
Probe Heater Setting: 5
Leak Rate, m^3/min. (cfm): .013 at 5.5" Vac
Probe Liner Material: Pyrex
Static Pressure, mm Hg (in. Hg): .1/13.6
Filter No.: KR-2340

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	525	414
INITIAL	200	400
DIFFERENCE	325	14

Schematic of Stack Cross Section

TRAV. PT NO.	SAMPLING TIME (θ) min.	VACUUM in. Hg	STACK TEMP (T_S) °F	VELOCITY HEAD (P_S) in H20	PRESSURE DIFF. ORF. MTR in H_2O	GAS SAMPLE VOLUME ft^3	GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet	GAS SAMPLE TEMP. AT DRY GAS METER °F Outlet	FILTER HOLDER TEMP °F	GAS TEMP LVG CONDENSER OR LAST IMPINGER °F
A-1	10:13 / 10:15	1	225	.05	.195	962.4 / 963.40	64 61	58	225	40
2	10:17	0	269	.05	.195	964.10	72 65	58	225	40
3	10:19	0	273	.08	.30	964.90	74 66	58	~~225~~ 215	45
4	10:21	0	274	.08	.30	965.60	74 66	58	215	45
5	10:23	0	272	.08	.30	966.40	76 67.5	59	210	45
6	10:25	0	271	.15	.60	967.40	77 68.5	60	210	45
B-1	10:26:30 / 10:28:30	0	273	.15	.60	968.30	72 66	60	210	45
2	10:30:30	0	278	.18	.70	968.50	76 68	60	205	42
3	10:32:30	0	283	.18	.70	970.40	80 70	60	205	42
4	10:34:30	0	284	.20	.78	971.40	80 71	62	210	40
5	10:36:30	0	279	.35	1.4	972.60	80 71	62	210	40
6	10:38:30	0	274	.35	1.4	974.05	82 72	62	210	45
C-1	10:47 / 10:49	0	269	.30	1.2	975.20	68 65	62	200	45

Form #REC-06

RAMCON emissions test log sheet, cont. DATE 9-25-87 LOCATION Hewitt NJ TEST NO. 3

TRAVERSE POINT	SAMPLING TIME θ (min)	VACUUM mm Hg (in. Hg)	STACK TEMP T_s (°F)	VELOCITY HEAD ΔP_s (in. H_2O)	ORFICE DIFF. PRESSURE ΔH (in. H_2O)	GAS VOLUME V_m (ft^3)	GAS SAMPLE TEMP. (°F) in	GAS SAMPLE TEMP. (°F) out	SAMPLE BOX TEMP. (°F)	IMPINGER TEMP (°F)
2	10:51	1	268	,40	1.6	976.60	76 69	62	210	45
3	10:53	1	276	,40	1.6	978.00	80 71.5	63	220	45
4	10:55	2	277	,50	2.0	980.50	82 72.5	63	220	45
5	10:57	1	270	,40	1.6	981.80	83 73	63	220	45
6	10:59	4	268	,70	2.7	983.00	84 73.5	63	210	50
D-1	~~11:04~~ 11:06	4.5	268	,96	3.50	985.86	72 68	64	210	50
2	11:08	5.0	268	1.1	4.3	987.20	76 70	64	200	55
3	11:10	3.5	267	,80	3.1	989.20	80 72	64	200	55
4	11:12	2.5	266	.60	2.3	991.10	82 73	64	200	55
5	11:14	2	268	,45	1.8	992.50	84 74	64	225	45
6	11:16	2	266	,30	1.2	993.80	84 74	64	225	45
E-1	~~11:20~~ 11:22	0	252	,26	,78	994.99	72 68	64	220	~~45~~ 55
2	11:24	2	268	,50	2.0	996.50	80 72.5	65	220	55
3	11:26	3	267	,80	3.1	998.30	86 72.5	65	225	55
4	11:28	3.5	268	1,0	3.9	001.20	86 73	66	225	55
5	11:30	4.0	267	1,0	3.9	2.40	86 73.5	67	220	~~60~~ 60
6	11:32	4.0	265	1.2	4.7	4.88	86 73.5	67	220	60

IX. CALIBRATIONS

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 10-1-89 Meter box number 646 882

Barometric pressure, P_b = 30.52 in. Hg Calibrated by Sam Turner

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: Avg[a] (t_d), °F	Time (Θ), min	Y_i	$ΔH@_i$ in. H_2O
0.5	5								
1.0	5	169.60 / 174.727	76	84 / 83	81 / 81	82.25	8.88	.984	1.74
1.5	10								
2.0	10	159.20 / 169.374	76	85 / 86	80 / 80	82.75	13.02	.991	1.86
3.0	10	148.60 / 158.715	76	84 / 89	79 / 80	83	10.67	.994	1.88
4.0	10								
							Avg	.99	1.83

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		
1.0	0.0737		
1.5	0.110		
2.0	0.147		
3.0	0.221		
4.0	0.294		

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

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 9-18-87 Meter box number 646882

Barometric pressure, P_b = 30.40 in. Hg Calibrated by Sam Turner

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: Avg[a] (t_d), °F	Time (Θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5								
1.0	5	672.00 / 677.13	76	77 / 78	77 / 78	77.5	9.32	.974	1.94
1.5	10								
2.0	10	677.50 / 687.613	76	76 / 83	76 / 74	77.25	12.95	.986	1.87
3.0	10	688.10 / 698.13	76	83 / 88	74 / 74	79.75	10.6	.997	1.87
4.0	10								
							Avg	.986	1.89

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \dfrac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \dfrac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\dfrac{(t_w + 460)\, \Theta}{V_w}\right]^2$
0.5	0.0368		
1.0	0.0737		
1.5	0.110		
2.0	0.147		
3.0	0.221		
4.0	0.294		

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

Quality Assurance Handbook M4-2.3A (front side)

Form #REC-02

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 6-19-86 Thermocouple number Hot box

Ambient temperature 24 °C Barometric pressure 29.95 in. Hg

Calibrator Sam Thuney Reference: mercury-in-glass ✓

other ______

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	boiling water	100 °C	100 °C	0
B	Ambient	24°C	23.9	<.1 %
C	ambient 9-24-87	72°F	72°F	0%

[a]Type of calibration system used.

[b]$\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 6-17-86 Thermocouple number inlet / outlet

Ambient temperature 24 °C Barometric pressure 29.9 in. Hg

Calibrator S Turner Reference: mercury-in-glass ✓

other ____

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] %
A	inlet ambient	24 °C	24 °C	0
B	outlet ambient	24 °C	24 °C	0
	ambient 9-24-87	72 °F	72 °F	0

[a]Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 1/09/87 Thermocouple number 51

Ambient temperature 55°F °C Barometric pressure 29.86 in. Hg

Calibrator Shawn Greenwood Reference: mercury-in-glass ✓

other ______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
A	Ice Water	32°F	32°F	0%
B	Boiling Water	212°F	211°F	.005%
C	Oil	380°F	382°F	.005%
D	Ambient	55°F	56°F	.02%
	9-24-97	72°F	72°F	0%

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c]$\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

RAMCON

Lear Siegler Stack Sampler

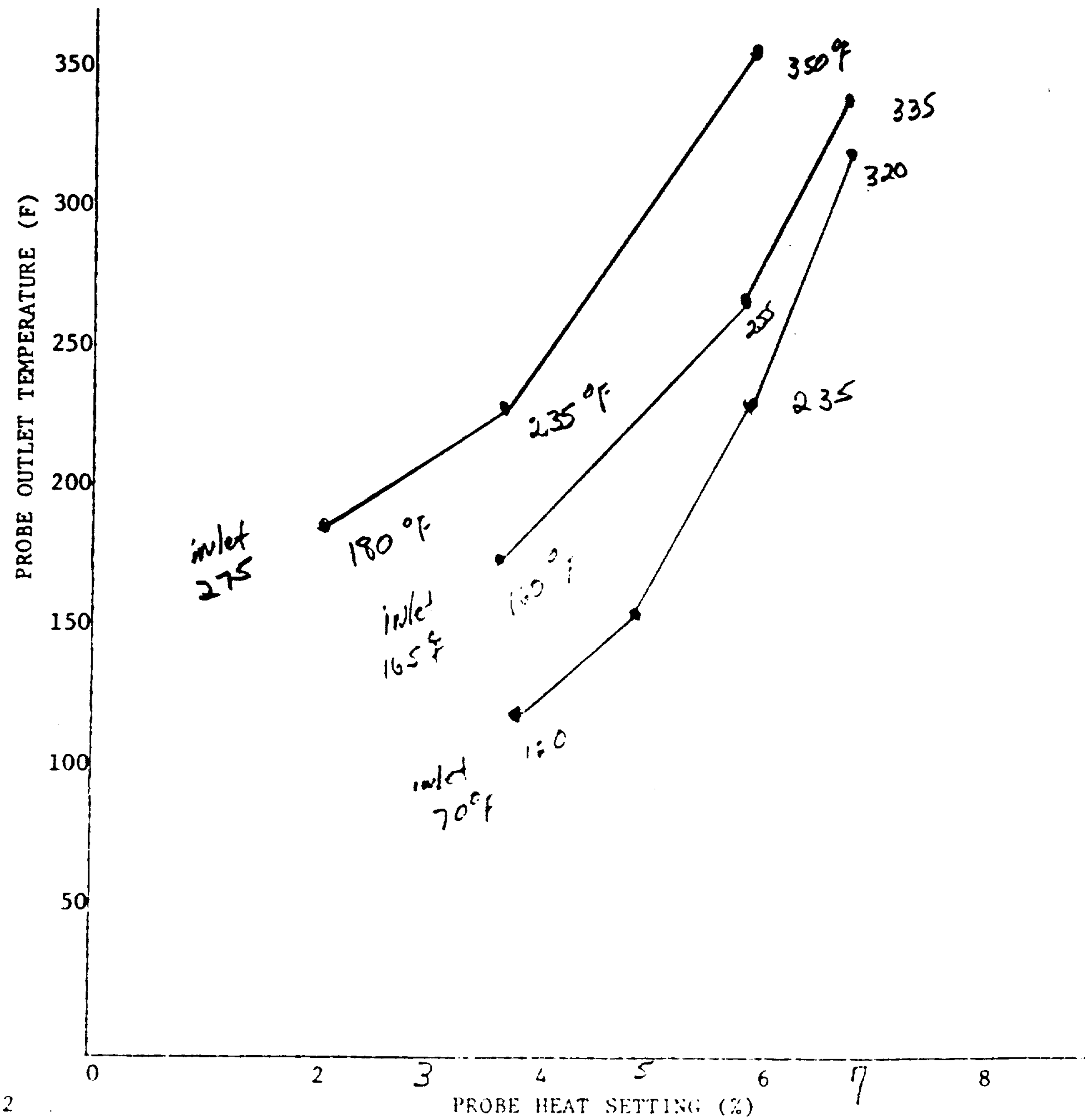
Heating Probe Calibration

Probe No. 51 Probe Length 5'

Date of Calibration 4-3-86 Signature Sam T. Turner

Name of Company to be tested ____________

Note: 3 ft. probe - 5 min. warmup
6 ft. probe - 15 min. warmup
10 ft. probe - 30 min. warmup
Calibration flow rate = .75 CFM



Form No. EED-17-2

RAMCON ENVIRONMENTAL CORPORATION

Lear Siegler Stack Sampler

Nozzle Diameter Calibration

Date ____________ Signature ____________

Nozzle No.	Average Diameter	Nozzle No.	Average Diameter
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

Pitot Tube Calibration (S Type)

Pitot Tube Identification No. 51 Date 8-21-87

Calibrated by: C. Mitchell

"A" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp (s) cm H_2O (in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(A)$
1	1.01	1.57	0.802	0
2	0.65	1.01	0.802	0
3	0.38	0.59	0.802	0
		$\bar{C}_p$ (SIDE A)	0.802	

"B" SIDE CALIBRATION

Run No.	Δp std cm H_2O (in. H_2O)	Δp(s) cm H_2O in. H_2O)	$C_p(s)$	DEVIATION $C_p(s)-\bar{C}_p(B)$
1	1.01	1.58	0.800	+0.001
2	0.65	1.01	0.802	+0.003
3	0.38	0.60	0.796	-0.003
		$\bar{C}_p$ (SIDE B)	0.799	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} |C_p(s) - \bar{C}_p(\text{A OR B})|}{3} \leftarrow \text{MUST BE} \le 0.01$$

$$|\bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B})| \leftarrow \text{MUST BE} \le 0.01$$

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p\ std}{\Delta p_s}}$$

Form No. EED-17-1

X. RAMCON PERSONNEL

RAMCON Environmental Stack Test Team

Sumner Buck - President

Sumner Buck is the President of RAMCON Environmental. He is a graduate of the EPA 450 "Source Sampling for Particulate Pollutants" course and the 474 "Continuous Emissions Monitoring" course all given at RTP. Mr. Buck is a qualified V.E. reader with current certification. Mr. Buck has personally sampled over 400 stacks including over 300 asphalt plants. He is 42 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

Sam Turner - Field Supervisor

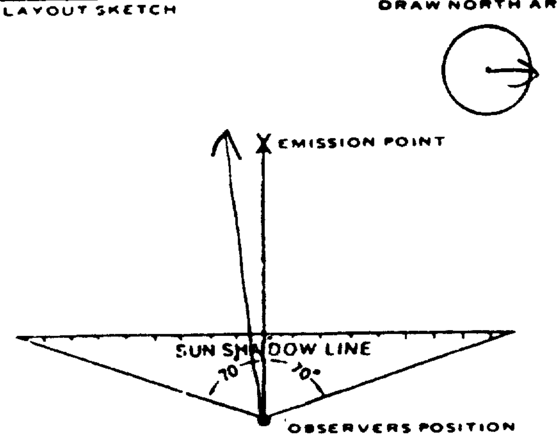
Sam Turner has five years experience in the Air Division and is our field supervisor. He has sampled over 30 large boiler stacks and approximately 200 asphalt plants. He is a graduate of State Technical Institute of Memphis, and holds an Associate Degree in Environmental Engineering. He also has current certification as a V.E. reader.

XI. VISIBLE EMISSIONS

SOURCE NAME	Hudson materials
ADDRESS	
CITY	Hewitt
STATE	N.J.
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	drum mix
OPERATING MODE	—
CONTROL EQUIPMENT	baghouse
OPERATING MODE	—
DESCRIBE EMISSION POINT	
HEIGHT ABOVE GROUND LEVEL	30 ft.
HEIGHT RELATIVE TO OBSERVER	
DISTANCE FROM OBSERVER	100 yds
DIRECTION FROM OBSERVER	North
DESCRIBE EMISSIONS	
EMISSION COLOR	light brown
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	continuous
WATER DROPLETS PRESENT NO ☐ YES ☐	No
IS WATER DROPLET PLUME ATTACHED ☐ DETACHED ☐	
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	when steam dissipates
DESCRIBE BACKGROUND	
BACKGROUND COLOR	Blue
SKY CONDITIONS	Partly Cloudy
WIND SPEED	0-5
WIND DIRECTION	0
AMBIENT TEMPERATURE	50
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



COMMENTS: run # 1

OBSERVATION DATE	START TIME	STOP TIME
9-24-97	2:40	3:40

M \ SEC	0	15	30	45	M \ SEC	0	15	30	45
1	0	0	0	0	31	0	5		
2	0	0	0	0	32	5	0	//	5
3	0	0	0	0	33	6	5	0	0
4	0	0	0	0	34	0	5	0	5
5	0	0	0	0	35	0	5	0	0
6	5	0	0	0	36	0	0	5	0
7	0	0	5	0	37	0	0	0	5
8	0	5	0	0	38	0	0	5	0
9	5	0	6	5	39	0	5	5	0
10	0	0	5	0	40	0	0	0	5
11	0	5	0	5	41	0	0	5	0
12	0	5	0	0	42	6	5	0	0
13	5	0	0	5	43	0	0	5	0
14	5	0	0	5	44	5	0	5	0
15	5	0	0	0	45	0	0	5	0
16	0	5	5	0	46	0	5	0	0
17	0	0	5	0	47	0	5	0	0
18	5	0	5	0	48	5	0	5	0
19	0	5	0	5	49	6	5	0	0
20	0	5	0	0	50	5	0	5	0
21	5	0	0	5	51	0	5	0	0
22	5	0	5	0	52	5	0	0	5
23	0	0	0	0	53	0	5	0	0
24	0	5	0	0	54	5	0	5	0
25	0	0	5	0	55	5	5	0	0
26	0	5	0	5	56	0	0	5	0
27	0	0	5	0	57	0	5	0	0
28	0	5	0	5	58	0	0	0	5
29	0	0	5	0	59	0	5	0	0
30	5	0	0	5	60	0	5	0	5

AVERAGE OPACITY FOR HIGHEST PERIOD	
NUMBER OF READINGS ABOVE ___ % WERE	
RANGE OF OPACITY READINGS — MINIMUM	
MAXIMUM	
OBSERVER'S NAME (PRINT)	ALLEN TURNER
OBSERVER'S SIGNATURE	Allen Turner
DATE	
ORGANIZATION	
CERTIFIED BY	
DATE	
VERIFIED BY	
DATE	

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SIGNATURE

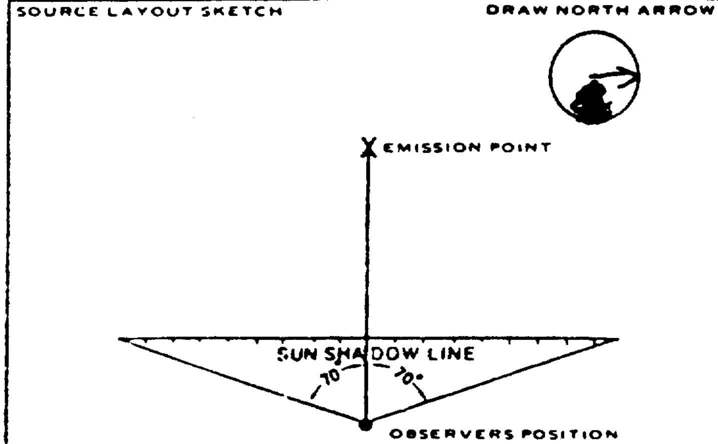
TITLE

DATE

REC# 14

Field	Entry
SOURCE NAME	Hudson materials
ADDRESS	980 Burnt meadow Rd.
CITY	Hewitt
STATE	N.J.
ZIP	07456
PHONE	201 728-9022
SOURCE ID NUMBER	
PROCESS EQUIPMENT	drum mix asphalt
OPERATING MODE	
CONTROL EQUIPMENT	Baghouse
OPERATING MODE	
DESCRIBE EMISSION POINT	
HEIGHT ABOVE GROUND LEVEL	30 ft
HEIGHT RELATIVE TO OBSERVER	
DISTANCE FROM OBSERVER	50 yds
DIRECTION FROM OBSERVER	west
DESCRIBE EMISSIONS	light Brown when steam disappears
EMISSION COLOR	light Brown
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	Continuous (checked)
WATER DROPLETS PRESENT NO ☐ YES ☐	No (checked)
IS WATER DROPLET PLUME ATTACHED ☐ DETACHED ☐	
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	end of steam plume
DESCRIBE BACKGROUND	[redacted] Blue sky
BACKGROUND COLOR	[redacted] blue
SKY CONDITIONS	Clear
WIND SPEED	0-5 MPH
WIND DIRECTION	
AMBIENT TEMPERATURE	50
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE: 9-25-87 — START TIME: 8:35 — STOP TIME: 9:35

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	5	0	0
2	0	5	0	0	32	0	0	5	0
3	5	0	0	5	33	5	0	5	0
4	0	0	5	0	34	0	0	0	0
5	0	5	0	0	35	5	0	0	5
6	5	0	0	5	36	0	5	0	0
7	0	0	0	5	37	0	0	5	0
8	5	5	0	5	38	5	0	0	0
9	0	0	0	5	39	0	0	5	0
10	0	0	0	0	40	0	0	5	0
11	0	5	0	0	41	5	0	0	5
12	0	5	0	5	42	0	0	0	0
13	0	0	5	0	43	0	0	0	5
14	0	5	0	0	44	0	0	5	0
15	5	0	0	5	45	5	0	0	5
16	0	5	0	0	46	0	0	5	0
17	5	0	0	0	47	0	5	0	0
18	0	5	0	0	48	0	0	0	0
19	5	0	5	0	49	5	0	5	0
20	0	0	5	0	50	0	5	0	0
21	5	0	5	0	51	0	0	5	0
22	0	5	0	0	52	5	0	0	0
23	0	0	0	5	53	0	5	0	5
24	5	0	0	5	54	5	0	0	5
25	0	5	0	0	55	0	5	0	5
26	5	0	5	0	56	0	0	0	5
27	5	0	5	0	57	5	0	0	5
28	0	0	5	0	58	0	0	5	0
29	0	5	0	5	59	0	5	0	0
30	0	0	5	0	60	5	0	0	0

Field	Entry
AVERAGE OPACITY FOR HIGHEST PERIOD	
NUMBER OF READINGS ABOVE __ % WERE	
RANGE OF OPACITY READINGS — MINIMUM / MAXIMUM	
OBSERVER'S NAME (PRINT)	Allen Turner
OBSERVER'S SIGNATURE	Allen Turner
DATE	9-25-87
ORGANIZATION	Pawson Environmental Corp
CERTIFIED BY	Carl Koontz
DATE	
VERIFIED BY	State of Jersey
DATE	

COMMENTS: Run #2

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TITLE — DATE

SOURCE NAME	OBSERVATION DATE	START TIME	STOP TIME
Fordson	9-25-87	10:20	11:20

ADDRESS: 980 Burnt Meadow

CITY: Fernwill **STATE:** NJ **ZIP:** 07456

PHONE: 201-728-9022 **SOURCE ID NUMBER:**

PROCESS EQUIPMENT: CMI Baghouse **OPERATING MODE:** —

CONTROL EQUIPMENT: Baghouse **OPERATING MODE:** —

DESCRIBE EMISSION POINT:

HEIGHT ABOVE GROUND LEVEL: 30 ft **HEIGHT RELATIVE TO OBSERVER:**

DISTANCE FROM OBSERVER: 50 yds **DIRECTION FROM OBSERVER:** west

DESCRIBE EMISSIONS: [redacted]

EMISSION COLOR: light brown **PLUME TYPE:** CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐ **IS WATER DROPLET PLUME:** ATTACHED ☐ DETACHED ☐

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: at end of plume

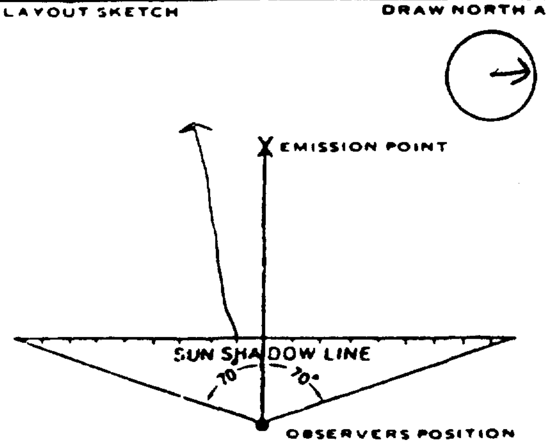
DESCRIBE BACKGROUND: Blue sky

BACKGROUND COLOR: blue **SKY CONDITIONS:** Clear

WIND SPEED: 0-5 MPH **WIND DIRECTION:** swirling

AMBIENT TEMPERATURE: 50 **RELATIVE HUMIDITY:**

SOURCE LAYOUT SKETCH **DRAW NORTH ARROW**



M \ SEC	0	15	30	45	M \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD:

NUMBER OF READINGS ABOVE % WERE:

COMMENTS: Run #3

RANGE OF OPACITY READINGS: MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): ALLEN TURNER

OBSERVER'S SIGNATURE: Allen Turner **DATE:**

ORGANIZATION: Ramcor Environmental Corp.

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SIGNATURE:

TITLE: **DATE:**

CERTIFIED BY: Carl Koontz **DATE:**

VERIFIED BY: State of Tenn **DATE:**

REC#14

(54)

TENNESSEE AIR POLLUTION CONTROL SMOKE SCHOOL ~~TRAINING FORM~~ SUNGLASSES

NAME Allan Turner RUN# ______ SUNGLASSES ✓

COMPANY Parson COURSE LOCATION ST IM

DATE 6-3-87 SKY clear WIND 10,5 DISTANCE & DIRECTION TO STACK 20'

QUALIFIED

Graded by ______

READING #																						ERROR
1	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	1
2	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	2
3	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	3
4	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	4
5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	5
6	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	6
7	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	7
8	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	8
9	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	9
10	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	10
11	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	11
12	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	12
13	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	13
14	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	14
15	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	15
16	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	16
17	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	17
18	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	18
19	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	19
20	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	20
21	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	21
22	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	22
23	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	23
24	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	24
25	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	25

DEVIATION 4.2

26	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	26
27	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	27
28	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	28
29	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	29
30	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	30
31	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	31
32	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	32
33	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	33
34	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	34
35	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	35
36	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	36
37	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	37
38	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	38
39	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	39
40	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	40
41	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	41
42	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	42
43	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	43
44	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	44
45	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	45
46	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	46
47	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	47
48	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	48
49	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	49
50	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	50

I hereby certify that [illegible] DEVIATION ______

[illegible]