RAMCON

ENVIRONMENTAL CORPORATION

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

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

# SOURCE SAMPLING
for
PARTICULATE EMISSIONS
**CITY WIDE ASPHALT CO., INC.**
St. Joseph, Missouri
October 18, 1988

Harold Moody
City Wide Asphalt Co., Inc.

G. Sumner Buck, III
President

Dave Armstrong
Team Leader

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112
TELEPHONE 800/458-4567 IN TENNESSEE 901/458-7000 FAX 901-458-3868

RAMCON
ENVIRONMENTAL CORPORATION

October 31, 1988

Mr. Harold Moody
City Wide Asphalt Co., Inc.
1701 N. 291 Highway
Sugar Creek, MO 64056

Re: Particulate Emissions Test - St. Joseph, Missouri

Dear Mr. Moody:

Enclosed you will find four copies of our report on the particulate emissions tests we conducted at City Wide Asphalt's plant located in St. Joseph, Missouri. Based on our test results, your plant does pass both EPA New Source Performance Standards and those set by the State of Missouri. The average grain loading of the three test runs was below the allowable emissions standard set by EPA and the State of Missouri. Therefore, this plant is operating in compliance with State and Federal Standards.

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

Mr. Tom Scheppers
Missouri DNR
P. O. Box 176
Jefferson City, Missouri 65102

You will need to keep one copy of the report at the plant.

We certainly have enjoyed working with you and we look forward to serving you again in the future.

Sincerely,

G. Sumner Buck, III
President

GSBIII:mew

Enclosures

RAMCON BUILDING, 223 SCOTT STREET, MEMPHIS, TENNESSEE 38112
TELEPHONE 800/458-4567 IN TENNESSEE 901/458-7000 FAX 901-458-3868

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## I. INTRODUCTION

On October 18, 1988, personnel from RAMCON Environmental Corporation (REC) conducted a source emissions test for particulate emissions compliance at City Wide Asphalt Company's H&B drum mix asphalt plant located in St. Joseph, Missouri. RAMCON personnel conducting the test were Dave Armstrong, Team Leader, and Frank Kuhn. Kim Rea was responsible for the particulate laboratory analysis including taring the beakers and filters and recording final data in the laboratory record books. Custody of the samples was limited to Mr. Armstrong and Ms. Rea. Environmental Testing & Consulting, Inc. was responsible for the SO2 analysis, and the coal analysis was completed by Commercial Testing & Engineering.

The purpose of the test was to determine if the rate of particulate emissions from the plant's baghouse and the total contaminants by weight (grain loading) is below the allowable limits set by the State of Missouri.

## II. TEST RESULTS

Table I summarizes the test results. The grain loading limitation for EPA is specified in 39 FR 9314, March 8, 1974, 60.92 Standards for Particulate Matter (1), as amended. The allowable N.S.P.S. particulate emissions for EPA and the State of Missouri is .04 gr/dscf.

Mr. Tom Scheppers of the Missouri Department of Natural Resources, observed the testing conducted by RAMCON. Frank Kuhn conducted visible emissions (Reference Method 9); opacity on all three runs ranged from 0-15%, therefore meeting N.S.P.S. requirements.

TABLE I

SUMMARY OF TEST RESULTS
October 18, 1988

| Test Run | Time | Grain Loading | $SO_2$ Emissions | Actual Emissions |
|---|---|---|---|---|
| 1 | 12:15 to 13:21 | 0.0137 gr/DSCF | 3.64 lbs/hr | 2.24 lbs/hr |
| 2 | 14:16 to 15:21 | 0.0156 gr/DSCF | 3.67 lbs/hr | 2.54 lbs/hr |
| 3 | 16:25 to 17:32 | 0.0374 gr/DSCF | 4.09 lbs/hr | 6.25 lbs/hr |
| | Average: | 0.0222 gr/DSCF | 3.80 lbs/hr | 3.68 lbs/hr |

On the basis of these test results, the average grain loading of the three test runs was below the .04 gr/DSCF emissions limitation set by US EPA and the State of Missouri. Therefore, the plant is operating in compliance with State and Federal Standards.

## III. TEST PROCEDURES

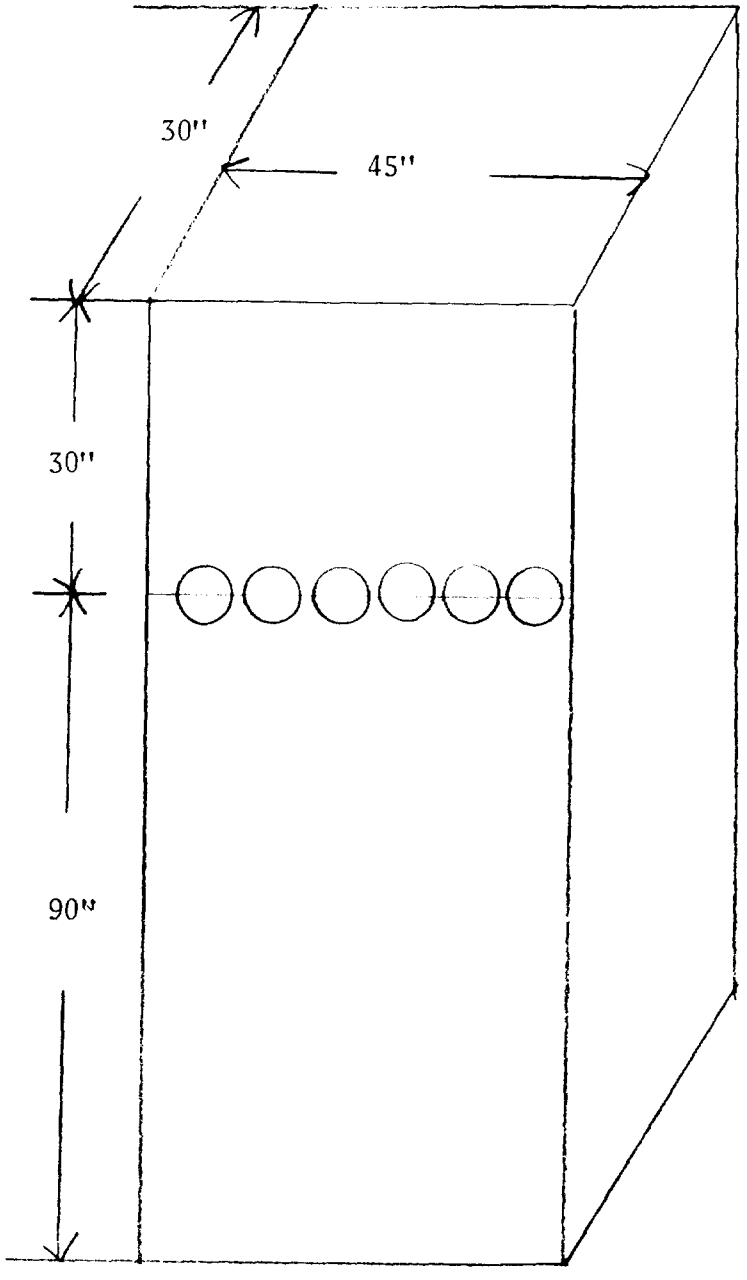
A. Method Used: The source sampling was conducted in accordance with requirements of the U.S. Environmental Protection Agency as set forth in 39 FR 9314, March 8, 1974, 60.93, as amended.

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 30" x 45" with an equivalent diameter of 36". Six sampling ports were placed 30" down (0.8 diameters upstream) from the top of the stack and 90" up (2.5 diameters downstream) from the last flow disturbance. Thirty points were sampled, five through each port for two minutes each, for a total sampling time of 60 minutes per test run.

| Points on a Diameter | Probe Mark |
|---|---|
| 1 | *12.0" |
| 2 | 18.0" |
| 3 | 24.0" |
| 4 | 30.0" |
| 5 | 36.0" |

*Measurements include a 6" standoff.



# IV. THE SOURCE

## IV. THE SOURCE

City Wide Asphalt Co. employs an H&B 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 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% moisture removal.

The drum dryer uses a burner a burner fired with coal 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 air passes through a baghouse. The baghouse was manufactured by H&B. The exhaust gas is drawn through the baghouse and discharged to the atmosphere through the 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.

# PLANT DATA

COMPANY NAME City Wide Asphalt Co., Inc.
COMPANY REP. _____ DATE 10-18-88 PHONE # 816 279-2886
DATA SOURCE CRT Screens
PLANT LOCATION 4101 S. 50th Terrace, St. Joseph, Mo. 64507
PLANT MFG. H&B PLANT MODEL # 87-962 PLANT TYPE Drum Mix
MIX SPECIFICATION # APWA Type 3 OIL SPECIFICATION # COAL

| Time 24 Hour | ___ Fuel Oil ___ Nat. Gas ___ Propane ___ Coal ___ | Burner Setting | Aggregate TPH | Recycle TPH | Liquid Asphalt TPH | Mix Temp. °F | ___ Venturi ☒ Baghouse Pressure Drop Inches Water |
|---|---|---|---|---|---|---|---|
| 12:15 PM | Coal | 6.8 | 294 | N/A | 13.8 | 290 | 3.60 |
| 12:30 | Coal | 7.4 | 302 | | 14.2 | 290 | 3.60 |
| 12:45 | Coal | 7.0 | 300 | | 14.5 | 283 | 3.60 |
| 1:00 | Coal | 7.25 | 298 | | 13.8 | 280 | 3.60 |
| 1:15 | Coal | 7.25 | 292 | | 14.1 | 285 | 3.60 |
| | | | | | | | |
| 2:20 | Coal | 6.55 | 291 | | 14.7 | 287 | 4.10 |
| 2:36 | Coal | 6.75 | 293 | | 14.2 | 282 | 4.00 |
| 2:50 | Coal | 7.00 | 287 | | 13.9 | 279 | 4.00 |
| 3:05 | Coal | 6.90 | 297 | | 14.2 | 282 | 3.75 |
| 3:20 | Coal | 6.20 | 297 | | 14.5 | 283 | 3.95 |
| | | | | | | | |
| 4:25 | Coal | 7.20 | 290 | | 13.9 | 275 | 3.90 |
| 4:40 | Coal | 7.25 | 290 | | 13.9 | 285 | 4.00 |
| 4:55 | Coal | 7.25 | 290 | | 13.7 | 281 | 4.10 |
| 5:10 | Coal | 7.50 | 297 | | 14.3 | 285 | 4.20 |
| 5:25 | Coal | 7.40 | 287 | | 13.6 | 282 | 4.10 |

## DATA SUMMARY

### Plant

1. Manufacturer of plant H & B.
2. Designed maximum operating capacity 350 TPH @ 5 % moisture.
3. Actual operation rate 310 TPH @ 4 % moisture.
4. Startup date July 22, 1988.
5. Type of fuel used in dryer #2 Diesel & Coal.
6. Quanity of fuel consumption #2 Diesel 1½ gal Ton Asph.
   Coal 1 Ton / 100 Ton Asph.

### Aggregate

7. Name/type of mix APWA Type 3 Surface.
8. Percent asphalt in mix 4.6 %.
9. Temperature of asphalt 300.
10. Sieve/Screening analysis: % Passing;

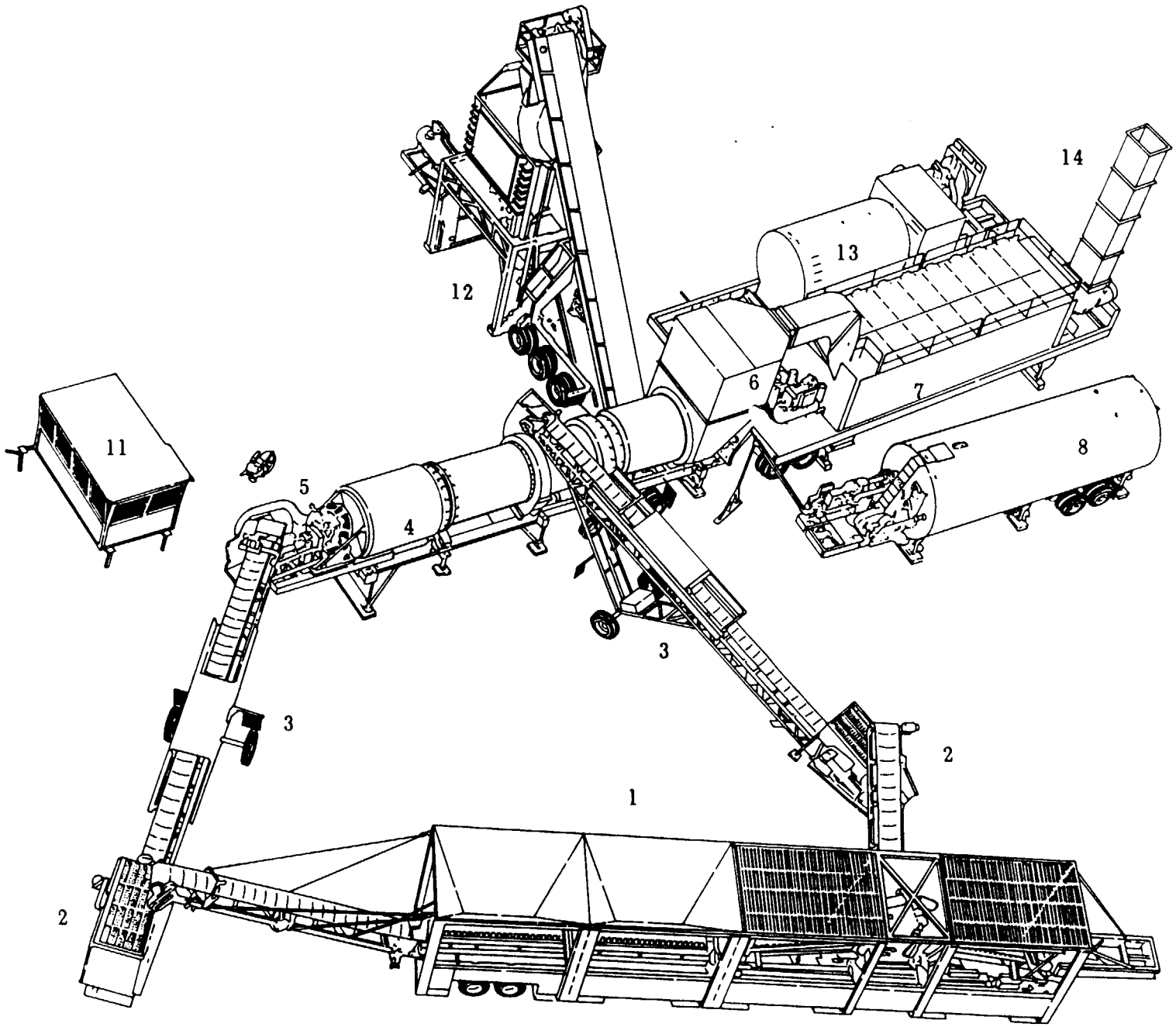
| | | | | | |
|---|---|---|---|---|---|
| 1" | | 3/8" | | # | |
| 3/4" | | # | | # | |
| 1/2" | | # | | #200 | |

### Baghouse

11. Manufacturer H & B.
12. No. of bags 672. Type of bags 16 oz NONEX.
13. Air to cloth ratio 4.5:1. Designed ACFM 46,000.
14. Square feet of bags 8,647.
15. Type of cleaning; pulse jet X, reverse air ____,
    plenum pulse ____, other ____.
16. Cleaning cycle time 2 min 40 Seconds.
17. Interval between cleaning cycle 14 Seconds.
18. Pressure drop across baghouse 3.5 inches $H_2O$.
19. Pulse pressure on cleaning cycle 120 psi.

COMPANY NAME City Wide Asphalt Co Inc. DATE 10/18/88

COMPANY REPRESENTATIVE George E Lang




CMI drum mixer plant (baghouse)

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

# 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.

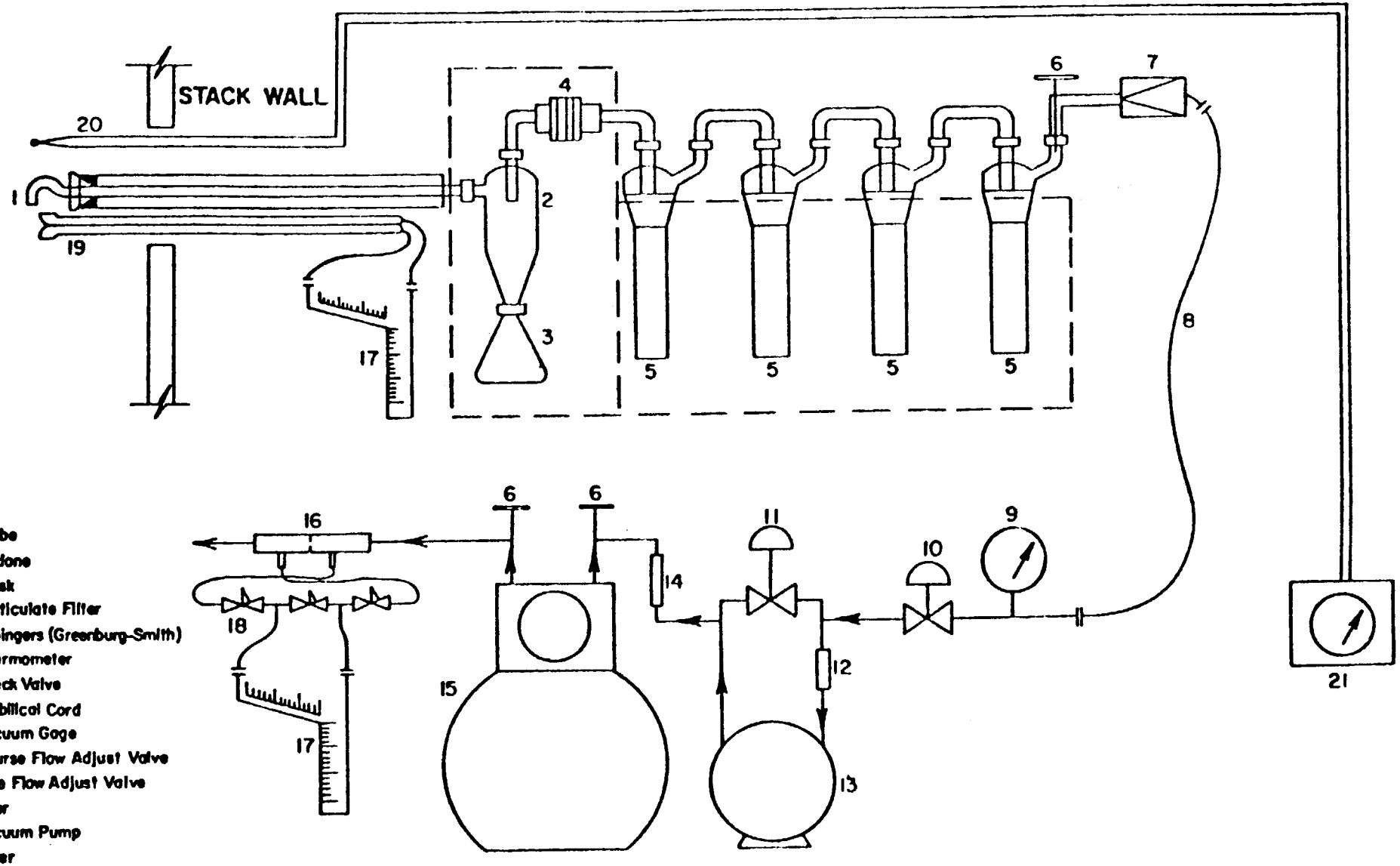
B. An Airguide Instruments Model 211-B (uncorrected) aneroid barometer was used to check the barometric pressure.

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.




1) Probe
2) Cyclone
3) Flask
4) Particulate Filter
5) Impingers (Greenburg-Smith)
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gage
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
19) Pitot
20) Thermocouple
21) Pyrometer

# SAMPLING TRAIN
## USED FOR ISOKINETIC SAMPLING

# 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 petri dishes. In the lab, the dishes are opened and placed into a dessicator for at least 24 hours. Then, the filters are weighed continuously every 6 hours until a constant weight is achieved. All data is recorded on the laboratory forms that will be bound in the test report.

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 silica gel used in the stack test is returned to the appropriate mason jar and sealed for transport to the laboratory where it is reweighed to a constant weight on a triple-beam balance to the nearest tenth of a gram.

C. PROBE RINSINGS: In all tests, where a probe washout analysis is necessary, this is accomplished in accordance with procedures specified in "EPA Reference Method 5". These samples are returned in sealed mason jars to the laboratory for analysis. The front half of the filter holder is washed in accordance with the same procedures and included with the probe wash. Reagent or ACS grade acetone is used as the solvent. The backhalf of the filter holder is washed with deionized water into the impinger catch for appropriate analysis.

D. IMPINGER CATCH: In some testing cases, the liquid collected in the impingers must be analyzed for solid 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 from the one 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 City wide Asphalt — Relative humidity in lab 45 %

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

Blank volume ($V_a$) 200 ml

Date/Time wt. blank 10-20-88 — Gross wt. 127.3642 mg

Date/Time wt. blank 10-21-88 — Gross wt. 127.3638 mg

Ave. Gross wt. 127.3640 mg

Tare wt. 127.3640 mg

Weight of blank ($m_{ab}$) 0 mg

Acetone blank residue concentration ($C_a$) $(C_a) = (M_{ab}) / (V_a)(P_a) = ($ 0 mg/g)

Weight of residue in acetone wash: $W_a = C_a V_{aw} P_a = ($ 0 $)($ 200 $)($ .7853 $) = ($ 0 $)$

| | | | Run # 1 | Run # 2 | Run # 3 |
|---|---|---|---|---|---|
| Acetone rinse volume ($V_{aw}$) | | ml | 200 | 200 | 200 |
| Date/Time of wt 10-20-88 | Gross wt | g | 140.8884 | 159.7036 | 135.1286 |
| Date/Time of wt 10-21-88 | Gross wt | g | 140.8883 | 159.7032 | 135.1279 |
| | Average Gross wt | g | 140.8884 | 159.7034 | 135.1283 |
| | Tare wt | g | 140.8682 | 159.6975 | 135.030 |
| Less acetone blank wt ($W_a$) | | g | 0.0 | 0.0 | 0.0 |
| Wt of particulate in acetone rinse ($m_a$) | | g | 0.0202 | 0.0059 | 0.0983 |

| | | | | | |
|---|---|---|---|---|---|
| Filter Numbers | | # | FK-3117 | FK-3118 | FK-3119 |
| Date/Time of wt 10-20-88 | Gross wt | g | 0.5428 | 0.5639 | 0.5380 |
| Date/Time of wt 10-21-88 | Gross wt | g | 0.5424 | 0.5638 | 0.5380 |
| | Average Gross wt | g | 0.5426 | 0.5639 | 0.5380 |
| | Tare wt | g | 0.5201 | 0.5200 | 0.5198 |

| | | | | |
|---|---|---|---|---|
| Weight of particulate on filters(s) ($m_f$) | g | 0.0225 | 0.0439 | 0.0182 |
| Weight of particulate in acetone rinse | g | 0.0202 | 0.0059 | 0.0983 |
| Total weight of particulate ($m_n$) | g | 0.0427 | 0.0498 | 0.1165 |

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 [illegible] Signature of reviewer [illegible]

# $SO_2$ ANALYSIS

(Method 8)

Plant City Wide Date 10-31-88

Audit Samples

| Audit Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| $V_{soln}$ (ml) | | | | | | | | |
| $V_a$ (ml) | | | | | | | | |
| N (N) | | | | | | | | |
| $V_t$ (ml) | | | | | | | | |
| | | | | | | | | |
| $V_{m(std)}$ (dscm) | | | | | | | | |
| $C_{SO_2}$ (mg/dscm) | | | | | | | | |
| | | | | | | | | |

$K_2$ = 32.03 mg/meq

$SO_2$ Analysis for Impinger 2 & 3 Combined.

| Run Number | 1 | | 2 | | 3 | | Blank | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| $V_{soln}$ (ml) | 325 | | 325 | | 325 | | | |
| $V_a$ (ml) | 20 | | | | | | | |
| N (N) | 0.0089 | | | | | | | |
| $V_t$ (ml) | 15.6 | 15.6 | 16.2 | 16.2 | 17.0 | 17.2 | 0.10 | |
| | | | | | | | | |
| $V_{m(std)}$ (dscf) | | | | | | | | |
| $C_{SO_2}$ (lb/dscf) | | | | | | | | |
| | | | | | | | | |

$K_3$ = $7.061 \times 10^{-5}$ lb/meq

Standardized vs. .01 N

Analysis performed by: [illegible] Approved by: [illegible]

RAMCON ENVIRONMENTAL CORPORATION

UM 1/20
SAMPLE(S) DATE 10/18

PLANT City Wide RUN # 1, 2, 3

SAMPLE SITE _____ IMPINGER # 3 & 4 each (combine)

SOLUTION OF hydrogen peroxide TOTAL # OF SAMPLES FOR ANALYSES 3

ANALYZE FOR:

- ____ CHLORIDES
- ____ CHLORINE
- ____ FLUORIDES
- ____ $NO_X$ AS $NO_2$
- ✓ $SO_2$
- ____ $SO_3$ & $H_2SO_4$ MIST
- ____ ANTIMONY
- ____ ARSENIC
- ____ BERYLLIUM
- ____ CADMIUM
- ____ HEXAVALENT CHROMIUM
- ____ CHROMIUM
- ____ LEAD
- ____ MANGANESE
- ____ MERCURY
- ____ NICKEL
- ____ THALLIUM
- ____ ACRYLIC ACID
- ____ METHANOL
- ____ METHYL METHACRYLATE
- ____ STYRENE
- ____ OTHER _____

| RUN # | VOLUME (ml) |
|---|---|
| 1 | 325 |
| 2 | 325 |
| 3 | 325 |

ANALYZE BY THE FOLLOWING METHOD:

- ____ TEXAS METHOD
- ____ MECURIC NITRATE
- ✓ METHOD 6
- ____ METHOD 7
- ____ METHOD 7c
- ____ METHOD 12
- ____ METHOD 13B (SPECIFIC ION ELECTRODE)
- ____ METHOD 25
- ____ GAS CHROMATOGRAPHY/ NIOSH METHOD ____
- ____ ATOMIC ABSORPTION

## $SO_2$ ANALYSIS

(Method 8)

Audit Samples

| Audit Number | A03120 | | A01289 | | A01271 | | BLANK | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| $V_{soln}$ (ml) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| $V_a$ (ml) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| N (N) | 0.0102 | 0.0102 | 0.0102 | 0.0102 | 0.0102 | 0.0102 | 0.0102 | 0.0102 |
| $V_t$ (ml) | 20.3 | 20.0 | 32.6 | 33.35 | 9.5 | 9.5 | 0.10 | 0.10 |
| A01289-C | | | (3RD) | 33.8 | | | | |
| $V_{m(std)}$ (dscm) | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 |
| $C_{SO_2}$ (mg/dscm) | 1571.4 | 1548.0 | 2528.1 | 2586.4 | 731.2 | 731.2 | | |
| A01289-C | | | (3RD) | 2605.3 | | | | |

$K_2$ = 32.03 mg/meq

# VII. CALCULATIONS

## SUMMARY OF TEST DATA

| | | 10-18-88 RUN #1 | 10-18-88 RUN #2 | 10-18-8 RUN #3 |
|---|---|---|---|---|
| **SAMPLING TRAIN DATA** | | | | |
| | start | 12:15 | 14:16 | 16:25 |
| | finish | 13:21 | 15:21 | 17:32 |
| 1. Sampling time, minutes | $\theta$ | 60.0 | 60.0 | 60.0 |
| 2. Sampling nozzle diameter, in. | $D_n$ | .2700 | .2700 | .2700 |
| 3. Sampling nozzle cross-sect. area, $ft^2$ | $A_n$ | .000398 | .000398 | .000398 |
| 4. Isokinetic variation | I | 99.2 | 102.0 | 96.9 |
| 5. Sample gas volume - meter cond., cf. | $V_m$ | 49.517 | 51.280 | 50.190 |
| 6. Average meter temperature, $^oR$ | $T_m$ | 535 | 541 | 544 |
| 7. Avg. oriface pressure drop, in. $H_2O$ | dH | 1.53 | 1.48 | 1.60 |
| 8. Total particulate collected, mg. | $M_n$ | 42.70 | 49.80 | 116.50 |
| **VELOCITY TRAVERSE DATA** | | | | |
| 9. Stack area, $ft^2$ | A | 9.40 | 9.40 | 9.40 |
| 10. Absolute stack gas pressure, in. Hg. | $P_s$ | 29.75 | 29.75 | 29.75 |
| 11. Barometric pressure, in. Hg. | $P_{bar}$ | 29.75 | 29.75 | 29.75 |
| 12. Avg. absolute stack temperature, $R^o$ | $T_s$ | 728 | 739 | 725 |
| 13. Average $-\sqrt{\text{vel. head}}$, ( $C_p$= .79) | $-\sqrt{dP}$ | 0.98 | 0.96 | 0.99 |
| 14. Average stack gas velocity, ft./sec. | $V_s$ | 63.51 | 62.33 | 63.90 |
| **STACK MOISTURE CONTENT** | | | | |
| 15. Total water collected by train, ml. | $V_{ic}$ | 360.00 | 328.00 | 345.00 |
| 16. Moisture in stack gas, % | $B_{ws}$ | 26.10 | 23.93 | 25.24 |
| **EMISSIONS DATA** | | | | |
| 17. Stack gas flow rate, dscf/hr.(000's) | $Q_{sd}$ | 1145 | 1139 | 1170 |
| 18. Stack gas flow rate, cfm | acfm | 35820 | 35154 | 36040 |
| 19. Particulate concentration, gr/dscf | $C_s$ | 0.0137 | 0.0156 | 0.0374 |
| 20. Particulate concentration, lb/hr | E | 2.24 | 2.54 | 6.25 |
| 21. Total $SO_2$ concentration, lb/dscf | C' | .000003175 | .000003220 | .00000349 |
| 22. Total $SO_2$ emissions, lbs/hr | $ESO_2$ | 3.64 | 3.67 | 4.09 |
| **ORSAT DATA** | | | | |
| 23. Percent $CO_2$ by volume | $CO_2$ | 6.80 | 7.30 | 6.80 |
| 24. Percent $O_2$ by volume | $O_2$ | 13.10 | 12.60 | 13.10 |
| 25. Percent CO by volume | CO | .00 | .00 | .00 |
| 26. Percent $N_2$ by volume | $N_2$ | 80.10 | 80.10 | 80.10 |

Format: sumry4r

**Dry Gas Volume**

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

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 $^oR$.

$T_{std}$ = Standard absolute temperature ( $528^oR$).

dH = Average pressure drop across oriface meter, in. $H_2O$.

Y = Dry gas meter calibration factor.

13.6 = Inches water per inches Hg.

RUN 1:

$$V_{m(std)} = (17.64)(.987)(49.517)\left[\frac{(29.75) + \frac{1.53}{13.6}}{535}\right] = 48.122 \text{ dscf}$$

RUN 2:

$$V_{m(std)} = (17.64)(.987)(51.280)\left[\frac{(29.75) + \frac{1.48}{13.6}}{541}\right] = 49.276 \text{ dscf}$$

RUN 3:

$$V_{m(std)} = (17.64)(.987)(50.190)\left[\frac{(29.75) + \frac{1.60}{13.6}}{544}\right] = 47.977 \text{ dscf}$$

**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:

$$C_s' = \left[ 0.0154 \frac{gr}{mg} \right] \left[ \frac{42.70}{48.122} \right] = 0.0137 \text{ gr./dscf.}$$

Run 2:

$$C_s' = \left[ 0.0154 \frac{gr}{mg} \right] \left[ \frac{49.80}{49.276} \right] = 0.0156 \text{ gr./dscf.}$$

Run 3:

$$C_s' = \left[ 0.0154 \frac{gr}{mg} \right] \left[ \frac{116.50}{47.977} \right] = 0.0374 \text{ gr./dscf.}$$

**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:

$$M_d = 0.44(\ 6.80\%) + 0.32(13.10\%) + 0.28(\ .00\% + 80.10\%) = 29.61 \ \frac{lb}{lb\text{-}mole}$$

Run 2:

$$M_d = 0.44(\ 7.30\%) + 0.32(12.60\%) + 0.28(\ .00\% + 80.10\%) = 29.67 \ \frac{lb}{lb\text{-}mole}$$

Run 3:

$$M_d = 0.44(\ 6.80\%) + 0.32(13.10\%) + 0.28(\ .00\% + 80.10\%) = 29.61 \ \frac{lb}{lb\text{-}mole}$$

**Water Vapor Condensed**

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

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

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), ml.

$V_f - V_i$ = Final volume of impinger contents less initial volume, ml.

$W_f - W_i$ = Final weight of silica gel less initial weight, g.

$p_w$ = Density of water, 0.002201 lb/ml.

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

$M_w$ = Molecular weight of water vapor, 18.0 lb/lb-mole.

$T_{std}$ = Absolute temperature at standard conditions, 528$^oR$.

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

Run 1:

$V_{wc(std)}$ = (0.04707) ( 350.0) = 16.5 cu.ft
$V_{wsg(std)}$ = (0.04715) ( 10.0) = 0.5 cu.ft

Run 2:

$V_{wc(std)}$ = (0.04707) ( 318.0) = 15.0 cu.ft
$V_{wsg(std)}$ = (0.04715) ( 10.0) = 0.5 cu.ft

Run 3:

$V_{wc(std)}$ = (0.04707) ( 325.0) = 15.3 cu.ft
$V_{wsg(std)}$ = (0.04715) ( 20.0) = 0.9 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:

$$B_{ws} = \frac{16.5 + 0.5}{16.5 + 0.5 + 48.122} \times 100 = 26.10\ \%$$

Run 2:

$$B_{ws} = \frac{15.0 + 0.5}{15.0 + 0.5 + 49.276} \times 100 = 23.93\ \%$$

Run 3:

$$B_{ws} = \frac{15.3 + 0.9}{15.3 + 0.9 + 47.977} \times 100 = 25.24\ \%$$

**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:

$M_s$ = 29.61 ( 1 - 26.10 ) + 18 ( 26.10 ) = 26.58 (lb./lb.-mole)

Run 2:

$M_s$ = 29.67 ( 1 - 23.93 ) + 18 ( 23.93 ) = 26.88 (lb./lb.-mole)

Run 3:

$M_s$ = 29.61 ( 1 - 25.24 ) + 18 ( 25.24 ) = 26.68 (lb./lb.-mole)

$$V_s = K_p \, C_p \left[ \sqrt{dP} \right]_{avg.} \sqrt{\frac{T_{s(avg.)}}{P_s \; M_s}}$$

Where:

| | | |
|---|---|---|
| $V_s$ | = | Average velocity of gas stream in stack, ft./sec. |
| $K_p$ | = | 85.49 ft/sec $\left[ (g/g\text{-mole})\text{-}(mm\ Hg) \ / \ (^oK)(\ mm\ H_2O \right]^{1/2}$ |
| $C_p$ | = | Pitot tube coefficient, (dimensionless). |
| dP | = | 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, ($^of$). |
| $T_s$ | = | Absolute stack temperature, ($^oR$). = 460 + $t_s$. |
| $M_s$ | = | Molecular weight of stack gas, wet basis, (lb/lb-mole). |

Run 1:

$$V = (85.49)\ (\ .79)\ (\ 0.98) \sqrt{\frac{728}{(29.75)(26.58)}} = 63.51 \text{ ft/sec.}$$

Run 2:

$$V = (85.49)\ (\ .79)\ (\ 0.96) \sqrt{\frac{739}{(29.75)(26.88)}} = 62.33 \text{ ft/sec.}$$

Run 3:

$$V = (85.49)\ (\ .79)\ (\ 0.99) \sqrt{\frac{725}{(29.75)(26.68)}} = 63.90 \text{ ft/sec.}$$

**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, ($^o$f). |
| $T_s$ | = | Absolute stack temperature, ($^o$R). |
| $T_{std}$ | = | Standard absolute temperature, (528$^o$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:

$$Q_{sd}=3600(1-\ .2610\ )(\ 63.51)(\ 9.40)\left[\frac{528}{728}\right]\left[\frac{29.75}{29.92}\right] = 1145367.4\ \frac{dscf}{hr}$$

Run 2:

$$Q_{sd}=3600(1-\ .2393\ )(\ 62.33)(\ 9.40)\left[\frac{528}{739}\right]\left[\frac{29.75}{29.92}\right] = 1139871.2\ \frac{dscf}{hr}$$

Run 3:

$$Q_{sd}=3600(1-\ .2524\ )(\ 63.90)(\ 9.40)\left[\frac{528}{725}\right]\left[\frac{29.75}{29.92}\right] = 1170635.8\ \frac{dscf}{hr}$$

**Emissions Rate from Stack**

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

Where:

$E$ = Emissions rate, lb/hr.

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

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

Run 1:

$$E = \frac{(0.0137)\ (1145367.4)}{7000} = 2.24\ lb. / hr.$$

Run 2:

$$E = \frac{(0.0156)\ (1139871.2)}{7000} = 2.54\ lb. / hr.$$

Run 3:

$$E = \frac{(0.0374)\ (1170635.8)}{7000} = 6.25\ lb. / hr.$$

$$I = 100 \; T_s \left[ \frac{0.002669 \; V_{ic} + (V_m / T_m) \; (P_{bar} + dH / 13.6)}{60 \quad \theta \quad V_s \quad P_s \quad A_n} \right]$$

Where:

| | | |
|---|---|---|
| $I$ | = | Percent isokinetic sampling. |
| 100 | = | Conversion to percent. |
| $T_s$ | = | Absolute average stack gas temperature, $^oR$. |
| 0.002669 | = | Conversion factor, Hg - $ft^3$/ml - $^oR$. |
| $V_{ic}$ | = | Ttl vol of liquid collected in impingers and silica gel, ml. |
| $T_m$ | = | Absolute average dry gas meter temperature, $^oR$. |
| $P_{bar}$ | = | Barometric pressure at sampling site, (in. Hg). |
| dH | = | Av pressure differential across the oriface meter, (in.$H_2O$). |
| 13.6 | = | Specific gravity of mercury. |
| 60 | = | Conversion seconds to minutes. |
| $\theta$ | = | 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:

$$I = (100)(\ 728\ ) \left[ \frac{(0.002669)(360.00) + \frac{49.517}{535} \left[ 29.75 + \frac{1.53}{13.6} \right]}{60\ (\ 60.0\ )\ (\ 63.51\ )\ (\ 29.75\ )\ (\ .000398\ )} \right] = 99.2\%$$

Run 2:

$$I = (100)(\ 739\ ) \left[ \frac{(0.002669)(328.00) + \frac{51.280}{541} \left[ 29.75 + \frac{1.48}{13.6} \right]}{60\ (\ 60.0\ )\ (\ 62.33\ )\ (\ 29.75\ )\ (\ .000398\ )} \right] = 102.0\%$$

Run 3:

$$I = (100)(\ 725\ ) \left[ \frac{(0.002669)(345.00) + \frac{50.190}{544} \left[ 29.75 + \frac{1.60}{13.6} \right]}{60\ (\ 60.0\ )\ (\ 63.90\ )\ (\ 29.75\ )\ (\ .000398\ )} \right] = 96.9\%$$

$$E = CSO_2 \times Q_{sd}$$

Where:

$E$ = Emissions of sulfur dioxide, lbs/hr.

$Q_{sd}$ = Stack gas flow rate, dscf/hr.

$CSO_2$ = Sulfur dioxide concentration, lbs/dscf.

Run # 1:

E = ( .000003175 lbs/dscf)( 1145367.4 dscf/hr) = 3.64 lbs/hr

Run # 2:

E = ( .000003220 lbs/dscf)( 1139871.2 dscf/hr) = 3.67 lbs/hr

Run # 3:

E = ( .000003492 lbs/dscf)( 1170635.8 dscf/hr) = 4.09 lbs/hr

**Emissions of $SO_2$ PPM (Parts Per Million)**

$$E = CSO_2 \left| \frac{453.593g}{1\ lb} \right| \frac{MOL\ SO_2}{64g\ SO_2} \left| \frac{22.4\ l}{MOL} \right| \frac{293^oK}{273^oK} \left| \frac{ft^3}{28.317\ l} \right| 1{,}000{,}000$$

Where; $CSO_2$ = Concentration of $SO_2$ in lbs/dscf.

453.593 = Conversion to grams.

64/MOL $SO_2$ = Molar conversion of $SO_2$.

22.4 l/MOL = Volumetric molar conversion $273^oK$.

$293^oK/273^oK$ = Temperature correction to std. conditions.

28.317 l = Conversion of liters to cubic feet.

1,000,000 = Conversion to parts per million.

Run # 1:

$$E = .000003175 \frac{lbs}{dscf} \left| \frac{453.593g}{1\ lb} \right| \frac{MOL\ SO_2}{64g\ SO_2} \left| \frac{22.4\ l}{MOL} \right| \frac{293^oK}{273^oK} \left| \frac{ft^3}{28.317\ l} \right| 1{,}000{,}000 = 19.10ppm$$

Run # 2:

$$E = .000003220 \frac{lbs}{dscf} \left| \frac{453.593g}{1\ lb} \right| \frac{MOL\ SO_2}{64g\ SO_2} \left| \frac{22.4\ l}{MOL} \right| \frac{293^oK}{273^oK} \left| \frac{ft^3}{28.317\ l} \right| 1{,}000{,}000 = 19.38ppm$$

Run # 3:

$$E = .000003492 \frac{lbs}{dscf} \left| \frac{453.593g}{1\ lb} \right| \frac{MOL\ SO_2}{64g\ SO_2} \left| \frac{22.4\ l}{MOL} \right| \frac{293^oK}{273^oK} \left| \frac{ft^3}{28.317\ l} \right| 1{,}000{,}000 = 21.01ppm$$

**Concentration of Sulfur Dioxide**

$$CSO_2 = \frac{K_3 N \ (V_t - V_{tb}) \ (V_{soln}/V_a)}{V_{m(std)}}$$

Where:

$CSO_2$ = Sulfur dioxide concentration, lbs/dscf.

$K_3$ = $7.061 \times 10^{-5}$, lbs/meq.

N = Normality of barium perchlorate titrant, g. equivalent/liter.

$V_t$ = Volume of barium perchlorate titrant used for the sample, ml.

$V_{tb}$ = Volume of barium perchlorate titrant used for the blank, ml.

$V_{soln}$ = Total volume of solution in which the sulfur dioxide sample is contained, ml.

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to std. conditions, dscf.

$V_a$ = Volume of sample aliquot titrated, ml.

Run # 1:

$$CSO_2 = 7.061 \times 10^{-5} \frac{[\ .00859(\ 15.60 - .10\ )(325.0/20.00)\ ]}{(\ 48.122\ )} = .000003175 \text{ lbs/dscf}$$

Run # 2:

$$CSO_2 = 7.061 \times 10^{-5} \frac{[\ .00859(\ 16.20 - .10\ )(325.0/20.00)\ ]}{(\ 49.276\ )} = .000003220 \text{ lbs/dscf}$$

Run # 3:

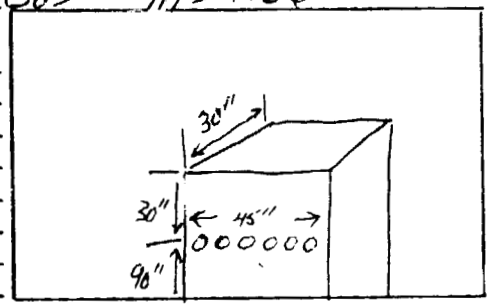
$$CSO_2 = 7.061 \times 10^{-5} \frac{[\ .00859(\ 17.10 - .10\ )(325.0/20.00)\ ]}{(\ 47.977\ )} = .000003492 \text{ lbs/dscf}$$

# VIII. FIELD DATA

RAMCON ENVIRONMENTAL CORPORATION

Plant Citywide Asphalt (HAB) coal (50²) M = 1.56

Location St. Joseph, Mo.
Operator Dave Armstrong
Date 10-18-88
Run No. 1
Sample Box No. 1
Meter Box No. C-282 / 7002205
Meter H @ 1.05
C Factor .987
Pitot Tube Coefficient Cp .795




Schematic of Stack Cross Section

| | IMPINGER VOLUME, ml | SILICA GEL WEIGHT, g |
|---|---|---|
| FINAL | 650 | 314 |
| INITIAL | 300 | 304 |
| DIFFERENCE | 350 | 10 |

Ambient Temperature 56°F
Barometric Pressure 29.75
Assumed Moisture, % 17%
Probe Length, m(ft) 3 ft.
Nozzle Identification No. 10003976
Avg. Calibrated Nozzle Dia., (in.) .270/.270/.270
Probe Heater Setting 5
Leak Rate, m³/min. (cfm) +.006 @ 5"
Probe Liner Material Stainless Steel
Static Pressure, mm Hg (in. Hg) +.05
Filter No. FK 3117 / 15801

| 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 H20 | GAS SAMPLE VOLUME ft³ | GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet | Outlet | FILTER HOLDER TEMP °F | GAS TEMP LVG CONDENSER OR LAST IMPINGER °F |
|---|---|---|---|---|---|---|---|---|---|---|
| A 1 | 1215 / 1217 | 4 | 228 | 1.1 | 1.7 | 395.724 / 397.43 | 62 | 60 | 265 | 40 |
| 2 | 1219 | 4 | 258 | 1.1 | 1.7 | 399.13 | 66 | 60 | 275 | 40 |
| 3 | 1221 | 4 | 274 | 1.0 | 1.6 | 400.79 | 70 | 60 | 245 | 40 |
| 4 | 1223 | 4 | 272 | 1.0 | 1.6 | 402.45 | 72 | 62 | 255 | 40 |
| 5 | 1225 | 4 | 270 | 1.0 | 1.6 | 404.11 | 76 | 62 | 260 | 40 |
| B 1 | 1226 / 1228 | 4 | 262 | 1.0 | 1.6 | 405.82 | 76 | 62 | 275 | 40 |
| 2 | 1230 | 5 | 270 | 1.3 | 2.0 | 407.74 | 80 | 62 | 265 | 40 |
| 3 | 1232 | 5 | 274 | 1.3 | 2.0 | 409.97 | 80 | 62 | 240 | 40 |
| 4 | 1234 | 4 | 274 | 1.1 | 1.7 | 411.68 | 82 | 64 | 250 | 40 |
| 5 | 1236 | 4 | 272 | 1.1 | 1.7 | 413.48 | 84 | 64 | 265 | 40 |
| C 1 | 1237 / 1239 | 4 | 258 | 1.0 | 1.6 | 415.24 | 84 | 64 | 270 | 40 |
| 2 | 1241 | 5 | 266 | 1.2 | 1.9 | 416.99 | 84 | 66 | 260 | 40 |
| 3 | 1243 | 5 | 272 | 1.3 | 2.0 | 418.83 | 86 | 66 | 255 | 40 |

Form #REC-06

**RAMCON** emissions test log sheet, cont. DATE 10-18-88 LOCATION St. Joseph, MO. TEST NO. 1

| TRAVERSE POINT | SAMPLING TIME θ (min) | VACUUM mm Hg (in. Hg) | STACK TEMP $T_s$ (°F) | VELOCITY HEAD $\Delta P_s$ (in. $H_2O$) | ORFICE DIFF. PRESSURE ΔH (in. $H_2O$) | GAS VOLUME Vm ($ft^3$) | GAS SAMPLE TEMP. (°F) in | GAS SAMPLE TEMP. (°F) out | SAMPLE BOX TEMP. (°F) | IMPINGER TEMP (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1245 | 4 | 272 | 1.0 | 1.6 | 420.43 | 86 | 66 | 245 | 40 |
| 5 | 1247 | 4 | 270 | .97 | 1.5 | 422.22 | 86 | 66 | 255 | 40 |
| D 1 | 1248 / 1252 | 4 | 264 | .86 | 1.3 | 423.83 | 84 | 68 | 270 | 40 |
| 2 | 1252 | 4 | 244 | 1.0 | 1.6 | 425.74 | 84 | 68 | 240 | 40 |
| 3 | 1254 | 4 | 268 | 1.0 | 1.6 | 426.98 | 86 | 68 | 245 | 40 |
| 4 | 1256 | 4 | 268 | .97 | 1.5 | 428.66 | 86 | 68 | 250 | 40 |
| 5 | 1258 | 4 | 266 | .82 | 1.3 | 430.22 | 86 | 66 | 270 | 40 |
| E 1 | 1300 / 1302 | 3.5 | 254 | .74 | 1.2 | 431.34 | 86 | 68 | 275 | 40 |
| 2 | 1304 | 4 | 262 | .92 | 1.4 | 433.30 | 86 | 68 | 245 | 40 |
| 3 | 1306 | 4 | 268 | 1.0 | 1.6 | 434.81 | 88 | 70 | 240 | 40 |
| 4 | 1308 | 4 | 268 | 1.0 | 1.6 | 436.45 | 90 | 70 | 245 | 40 |
| 5 | 1310 | 4 | 268 | .82 | 1.3 | 437.06 | 90 | 70 | 255 | 40 |
| F 1 | 1311 / 1313 | 3.5 | 268 | .65 | 1.0 | 439.40 | 86 | 70 | 265 | 40 |
| 2 | 1315 | 3.5 | 270 | .74 | 1.2 | 440.83 | 88 | 70 | 275 | 40 |
| 3 | 1317 | 4 | 280 | .82 | 1.3 | 442.38 | 90 | 72 | 270 | 40 |
| 4 | 1319 | 4 | 285 | .78 | 1.2 | 443.83 | 90 | 72 | 255 | 40 |
| 5 | 1321 | 3.5 | 280 | .65 | 1.0 | 445.241 | 90 | 72 | 240 | 40 |

RAMCON ENVIRONMENTAL CORPORATION

Plant CITY WIDE ASPHALT

Location ST. JOSEPH, MO.
Operator DALE ARMSTRONG
Date 10-18-88
Run No. 2
Sample Box No. 1
Meter Box No. C-282/700205
Meter H @ 1.05
C Factor .987
Pitot Tube Coefficient Cp .745

M=1.56

Schematic of Stack Cross Section

Ambient Temperature 60°F
Barometric Pressure 29.75
Assumed Moisture, % 17
Probe Length, m(ft) 3 FT.
Nozzle Identification No. .0003976
Avg. Calibrated Nozzle Dia., (in.) .270/.270/.270
Probe Heater Setting 5
Leak Rate, m³/min. (cfm) .003 @ 5"
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in.Hg) .05
Filter No. FK 3118 / .5200

| | IMPINGER VOLUME, ml | SILICA GEL WEIGHT, g |
|---|---|---|
| FINAL | 618 | 314 |
| INITIAL | 300 | 304 |
| DIFFERENCE | 318 | 10 |

| TRAV. PT NO. | SAMPLING TIME (θ) min. | VACUUM in. Hg | STACK TEMP (Ts) °F | VELOCITY HEAD (Ps) in H20 | PRESSURE DIFF. ORF. MTR in H20 | GAS SAMPLE VOLUME ft³ | GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet | Outlet | FILTER HOLDER TEMP °F | GAS TEMP LVG CONDENSER OR LAST IMPINGER °F |
|---|---|---|---|---|---|---|---|---|---|---|
| A 1 | 1416 / 1418 | 2 | 262 | .42 | .66 | 445.461 / 446.57 | 76 | 70 | 245 | 40 |
| 2 | 1420 | 2.5 | 270 | .64 | 1.0 | 447.38 | 78 | 70 | 255 | 40 |
| 3 | 1422 | 2 | 272 | .36 | .56 | 447.86 | 78 | 70 | 275 | 40 |
| 4 | 1424 | 3 | 270 | .57 | .89 | 449.13 | 80 | 70 | 265 | 40 |
| 5 | 1426 | 2 | 268 | .42 | .66 | 450.65 | 82 | 70 | 265 | 40 |
| B 1 | 1427 / 1429 | 3.5 | 264 | .62 | .97 | 451.38 | 82 | 70 | 250 | 40 |
| 2 | 1431 | 4 | 268 | 1.0 | 1.6 | 453.22 | 84 | 70 | 265 | 40 |
| 3 | 1433 | 4 | 270 | 1.0 | 1.6 | 454.83 | 84 | 70 | 245 | 40 |
| 4 | 1435 | 4 | 272 | .75 | 1.2 | 456.79 | 86 | 70 | 250 | 40 |
| 5 | 1437 | 3 | 270 | .45 | .70 | 458.72 | 88 | 70 | 260 | 40 |
| C 1 | 1438 / 1440 | 4 | 262 | .92 | 1.4 | 460.53 | 88 | 70 | 265 | 40 |
| 2 | 1442 | 5 | 266 | 1.4 | 2.2 | 462.51 | 90 | 72 | 275 | 40 |
| 3 | 1444 | 4.5 | 270 | 1.2 | 1.9 | 464.53 | 90 | 72 | 260 | 40 |

Form #REC-06

**RAMCON** emissions test log sheet, cont. DATE 10-18-88 LOCATION St. Joseph, Mo TEST NO. 2

| TRAVERSE POINT | SAMPLING TIME θ (min) | VACUUM mm Hg (in. Hg) | STACK TEMP $T_s$ (°F) | VELOCITY HEAD $\Delta P_s$ (in. $H_2O$) | ORFICE DIFF. PRESSURE ΔH (in. $H_2O$) | GAS VOLUME Vm ($ft.^3$) | GAS SAMPLE TEMP. (°F) in | GAS SAMPLE TEMP. (°F) out | SAMPLE BOX TEMP. (°F) | IMPINGER TEMP (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1446 | 4 | 270 | .78 | 1.2 | 466.72 | 92 | 72 | 245 | 40 |
| 5 | 1448 | 4 | 268 | .68 | 1.1 | 468.37 | 92 | 72 | 250 | 40 |
| D 1 | 1449/1451 | 5 | 262 | 1.3 | 2.0 | 470.21 | 92 | 72 | 265 | 40 |
| 2 | 1453 | 5 | 264 | 1.3 | 2.0 | 472.05 | 92 | 72 | 275 | 40 |
| 3 | 1455 | 5 | 270 | 1.3 | 2.0 | 474.14 | 94 | 74 | 260 | 40 |
| 4 | 1457 | 4.5 | 272 | 1.1 | 1.7 | 475.76 | 94 | 74 | 240 | 40 |
| 5 | 1459 | 4 | 270 | 1.0 | 1.6 | 477.59 | 94 | 74 | 245 | 40 |
| E 1 | 1500/1502 | 4 | 262 | 1.0 | 1.6 | 479.32 | 94 | 74 | 260 | 40 |
| 2 | 1504 | 5 | 280 | 1.3 | 2.0 | 481.24 | 94 | 74 | 270 | 40 |
| 3 | 1506 | 5 | 278 | 1.4 | 2.2 | 483.36 | 94 | 74 | 270 | 40 |
| 4 | 1508 | 4 | 270 | 1.0 | 1.6 | 485.34 | 94 | 74 | 255 | 40 |
| 5 | 1510 | 4 | 274 | 1.0 | 1.6 | 487.42 | 96 | 74 | 250 | 40 |
| F 1 | 1511/1513 | 4.5 | 246 | 1.1 | 1.7 | 489.34 | 92 | 74 | 240 | 40 |
| 2 | 1515 | 4 | 268 | 1.0 | 1.6 | 491.22 | 94 | 74 | 240 | 40 |
| 3 | 1517 | 4 | 276 | 1.0 | 1.6 | 493.07 | 96 | 74 | 245 | 40 |
| 4 | 1519 | 4.5 | 274 | 1.2 | 1.9 | 494.90 | 96 | 74 | 255 | 40 |
| 5 | 1521 | 4.5 | 272 | 1.1 | 1.7 | 496.741 | 96 | 74 | 270 | 40 |

RAMCON ENVIRONMENTAL CORPORATION

Plant CITY WIDE ASPHALT

Location ST. JOSEPH, MO.
Operator DOUG ARMSTRONG
Date 10-14-88
Run No. 2
Sample Box No. 1
Meter Box No. C-282 / 700205
Meter H @ 1.05
C Factor .987
Pitot Tube Coefficient Cp .795

m = 1.6

Ambient Temperature 62°F
Barometric Pressure 29.75
Assumed Moisture, % 24
Probe Length, m(ft) 3ft.
Nozzle Identification No. .00039 74
Avg. Calibrated Nozzle Dia., (in.) .270/.270/.270
Probe Heater Setting 5
Leak Rate, $m^3$/min. (cfm)
Probe Liner Material STAINLESS STEEL
Static Pressure, mm Hg (in. Hg) +.05
Filter No. FK 3119 / 15148

| | IMPINGER VOLUME, ml | SILICA GEL WEIGHT, g |
|---|---|---|
| FINAL | 625 | 531 |
| INITIAL | 300 | 511 |
| DIFFERENCE | 325 | 20 |

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 $H_2O$ | PRESSURE DIFF. ORF. MTR in $H_2O$ | GAS SAMPLE VOLUME $ft^3$ | GAS SAMPLE TEMP. AT DRY GAS METER °F Inlet | Outlet | FILTER HOLDER TEMP °F | GAS TEMP LVG CONDENSER OR LAST IMPINGER °F |
|---|---|---|---|---|---|---|---|---|---|---|
| A 1 | 1625 / 1627 | 4.5 | 256 | 1.1 | 1.8 | 496.968 / 498.85 | 80 | 76 | 275 | 40 |
| 2 | 1629 | 4.5 | 262 | 1.1 | 1.8 | 500.64 | 82 | 76 | 260 | 40 |
| 3 | 1631 | 4 | 266 | 1.0 | 1.6 | 502.46 | 84 | 76 | 240 | 40 |
| 4 | 1633 | 4 | 264 | .96 | 1.5 | 504.06 | 84 | 76 | 245 | 40 |
| 5 | 1635 | 4 | 270 | 1.0 | 1.6 | 505.48 | 86 | 76 | 250 | 40 |
| B 1 | 1636 / 1638 | 4.5 | 260 | 1.1 | 1.8 | 507.17 | 84 | 76 | 270 | 40 |
| 2 | 1640 | 4.5 | 264 | 1.2 | 1.9 | 508.93 | 86 | 76 | 275 | 40 |
| 3 | 1642 | 4.5 | 268 | 1.2 | 1.9 | 510.65 | 86 | 76 | 260 | 40 |
| 4 | 1644 | 4.5 | 270 | 1.2 | 1.9 | 512.36 | 86 | 76 | 245 | 40 |
| 5 | 1646 | 4 | 276 | 1.0 | 1.6 | 514.14 | 90 | 76 | 245 | 40 |
| C 1 | 1649 / 1651 | 4 | 258 | 1.0 | 1.6 | 515.96 | 92 | 76 | 255 | 40 |
| 2 | 1653 | 5 | 266 | 1.3 | 2.1 | 517.66 | 92 | 76 | 270 | 40 |
| 3 | 1655 | 5 | 270 | 1.4 | 2.2 | 519.58 | 94 | 76 | 275 | 40 |

Form #REC-06

**RAMCON** emissions test log sheet, cont. DATE 10-18-88 LOCATION St. Joseph, Mo. TEST NO. 3

| TRAVERSE POINT | SAMPLING TIME θ (min) | VACUUM mm Hg (in. Hg) | STACK TEMP $T_s$ (°F) | VELOCITY HEAD $\Delta P_s$ (in. $H_2O$) | ORFICE DIFF. PRESSURE ΔH (in. $H_2O$) | GAS VOLUME Vm ($ft.^3$) | GAS SAMPLE TEMP. (°F) in | GAS SAMPLE TEMP. (°F) out | SAMPLE BOX TEMP. (°F) | IMPINGER TEMP (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1657 | 5 | 264 | 1.3 | 2.1 | 521.56 | 94 | 76 | 265 | 40 |
| 5 | 1659 | 5 | 264 | 1.3 | 2.1 | 523.48 | 96 | 76 | 250 | 40 |
| D 1 | 1700 / 1702 | 4 | 260 | .92 | 1.5 | 525.24 | 94 | 76 | 250 | 40 |
| 2 | 1704 | 4 | 264 | 1.0 | 1.6 | 527.17 | 96 | 76 | 255 | 40 |
| 3 | 1706 | 4.5 | 268 | 1.3 | 2.1 | 529.04 | 96 | 76 | 245 | 40 |
| 4 | 1708 | 4.5 | 270 | 1.1 | 1.7 | 530.81 | 94 | 76 | 240 | 40 |
| 5 | 1710 | 4 | 264 | .88 | 1.4 | 532.53 | 96 | 76 | 245 | 40 |
| E 1 | 1711 / 1713 | 4 | 260 | .65 | 1.0 | 533.17 | 96 | 76 | 250 | 40 |
| 2 | 1715 | 4 | 264 | .98 | 1.6 | 535.72 | 96 | 76 | 255 | 40 |
| 3 | 1717 | 4 | 268 | 1.0 | 1.6 | 537.18 | 96 | 76 | 265 | 40 |
| 4 | 1719 | 4 | 272 | 1.0 | 1.6 | 538.96 | 96 | 76 | 275 | 40 |
| 5 | 1721 | 4 | 274 | .73 | 1.2 | 540.31 | 96 | 76 | 270 | 40 |
| F 1 | 1722 / 1724 | 3.5 | 256 | .46 | .74 | 541.67 | 94 | 76 | 260 | 40 |
| 2 | 1726 | 3.5 | 256 | .52 | .83 | 543.04 | 96 | 76 | 250 | 40 |
| 3 | 1728 | 4 | 260 | .67 | 1.1 | 544.53 | 96 | 76 | 250 | 40 |
| 4 | 1730 | 4 | 264 | .62 | 1.0 | 545.70 | 96 | 76 | 240 | 40 |
| 5 | 1732 | 4 | 264 | .92 | 1.5 | 547.158 | 96 | 76 | 245 | 40 |

CITY WIDE ASPHALT ST. JOSEPH, MO. 10-18-88 -37- TYPE CMPO SAMPLE

| Run # 1 | 1 | | 2 | | 3 | | |
|---|---|---|---|---|---|---|---|
| Collection Method Continuous/Grab GAS | Actual Reading | Net | Actual Reading | Net | Actual Reading | Net | Average Net Volume |
| $CO_2$ | | 7 | | 7 | | 6.5 | 6.8 |
| $O_2$ (Net is actual $O_2$ reading minus actual $CO_2$ reading) | | | | | | | 13.1 |
| CO (Net is actual CO reading minus actual $O_2$ reading) | | | | | | | 0 |
| $N_2$ (Net is 100 minus actual CO reading) | | | | | | | 80.1 |

| Run # 2 | 1 | | 2 | | 3 | | |
|---|---|---|---|---|---|---|---|
| Collection Method Continuous/Grab GAS | Actual Reading | Net | Actual Reading | Net | Actual Reading | Net | Average Net Volume |
| $CO_2$ | | 8 | | 7 | | 7 | 7.3 |
| $O_2$ (Net is actual $O_2$ reading minus actual $CO_2$ reading) | | | | | | | 12.6 |
| CO (Net is actual CO reading minus actual $O_2$ reading) | | | | | | | 0 |
| $N_2$ (Net is 100 minus actual CO reading) | | | | | | | 80.1 |

| Run # 3 | 1 | | 2 | | 3 | | |
|---|---|---|---|---|---|---|---|
| Collection Method Continuous/Grab GAS | Actual Reading | Net | Actual Reading | Net | Actual Reading | Net | Average Net Volume |
| $CO_2$ | | 6 | | 7 | | 7.5 | 6.8 |
| $O_2$ (Net is actual $O_2$ reading minus actual $CO_2$ reading) | | | | | | | 13.1 |
| CO (Net is actual CO reading minus actual $O_2$ reading) | | | | | | | 0 |
| $N_2$ (Net is 100 minus actual CO reading) | | | | | | | 80.1 |

Form REC#18

# IX. CALIBRATIONS

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number _____ Date 10-21-88 Meter box number C-282 Plant _____

Barometric pressure, $P_b$ = 29.74 in. Hg Dry gas meter number 700205 Pretest Y .987

| Orifice manometer setting, ($\Delta H$), in. $H_2O$ | Gas volume: Wet test meter ($V_w$), $ft^3$ | Gas volume: Dry gas meter ($V_d$), $ft^3$ | Temperature: Wet test meter ($t_w$), °F | Temperature: Dry gas meter: Inlet ($t_{d_i}$), °F | Temperature: Dry gas meter: Outlet ($t_{d_o}$), °F | Temperature: Dry gas meter: Average[a] ($t_d$), °F | Time ($\theta$), min | Vacuum setting, in. Hg | $Y_i$ | $Y_i \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 10.25 | 78 | 95 | 82 | 88.5 | 13.88 | 5 | .992 | 1.08 |
| 1 | 10 | 10.28 | 78 | 96 | 82 | 89 | 13.95 | 5 | .990 | 1.09 |
| 1 | 10 | 10.20 | 78 | 96 | 82 | 89 | 13.75 | 5 | .998 | 1.06 |
| | | | | | | | | | Y = | .993 |

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

where

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

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

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

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

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

$t_d$ = Average temperature of the gas in the dry gas meter, obtained by the average of $t_{d_i}$ and $t_{d_o}$, °F.

$\Delta H$ = Pressure differential across orifice, in. $H_2O$.

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

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

$P_b$ = Barometric pressure, in. Hg.

$\theta$ = Time of calibration run, min.

# METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 10-3-88 Meter box number C-282/700205

Barometric pressure, $P_b$ = 29.56 in. Hg Calibrated by D. Armstrong

| 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 | | 78 | | | | | | |
| 1.0 | 5 | ~~464.861~~ / ~~472.211~~ | 78 | ~~100~~ / 100 | ~~83~~ / 82 | 91 | 9.48 | .973 | 1.10 |
| 1.5 | 10 | ~~949.984~~ / ~~959.40~~ | 78 | ~~100~~ / 100 | ~~83~~ / 82 | 91 | 10.51 | 1.00 | 1.00 |
| 2.0 | 10 | | | | | | | | |
| 3.0 | 10 | | | | | | | | |
| 4.0 | 10 | | | | | | | | |
| | | | | | | | Avg | .987 | 1.05 |

| ΔH, in. $H_2O$ | $\frac{\Delta H}{13.6}$ | $Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t + 460)}$ | $\Delta H@_i = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\ \Theta}{V_w}\right]^2$ |
|---|---|---|---|
| 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 $t_d$.



Form #REC-02

Date 9-5-87 Thermocouple number Inlet

Ambient temperature 83 ~~°C~~ °F Barometric pressure 30.52 in. Hg

Calibrator C. Mitchell Reference: mercury-in-glass ✓

other

| Reference point number[a] | Source[b] (specify) | Reference Thermometer Temperature, ~~°C~~ °F | Thermocouple Potentiometer Temperature, ~~°C~~ °F | Temperature Difference,[c] % |
|---|---|---|---|---|
| A | Ice bath | 33 | 33 | 0 |
| B | oven | 150 | 150 | 0 |
| C | oven | 175 | 175 | 0 |
| D | Ambient | 83 | 83 | 0 |
| | 10-18-88 | 56°F | 56°F | 0 |

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

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

Date 9-5-87 Thermocouple number Hotbox #2

Ambient temperature 84 °F Barometric pressure 30.52 in. Hg

Calibrator C. Mitchell Reference: mercury-in-glass ✓

other _____

| Reference point number[a] | Source[b] (specify) | Reference Thermometer Temperature, °F | Thermocouple Potentiometer Temperature, °F | Temperature Difference,[c] % |
|---|---|---|---|---|
| A | Ice bath | 33 | 33 | 0 |
| B | Oven | 150 | 150 | 0 |
| C | Oven | 175 | 175 | 0 |
| D | Ambient | 84 | 84 | 0 |
| | 10-14-86 | 56 | 56 | 0 |

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

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

Date 3/18/88 Thermocouple number 33

Ambient temperature 68 °C Barometric pressure 30.28 in. Hg

Calibrator [illegible] 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 Bath | 33° | 33° | 0% |
| B | Ambient | 68° | 68° | 0% |
| C | Oven | 180° | 180° | 0% |
| D | Heated Oil | 330° | 330° | 0% |
| | 10-18-88 | 56° | 56° | 0% |

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

[b]Type of calibration system used.

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

Figure 2.5 stack temperature sensor calibration data form.

RAMCON

Lear Siegler Stack Sampler

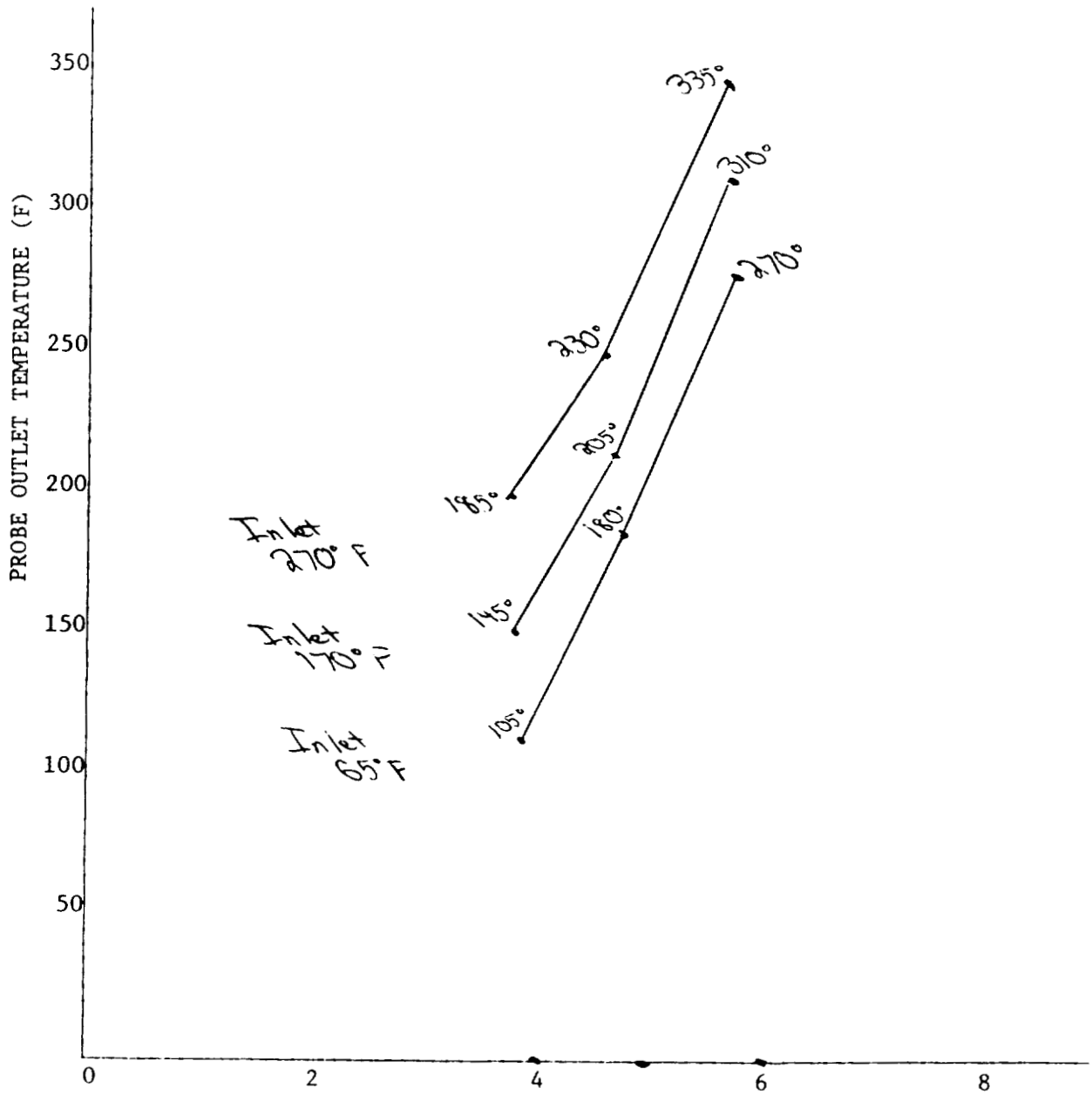
Heating Probe Calibration

Probe No. 33 Probe Length 3 ft.

Date of Calibration 2/21/88 Signature Shawn Greenwood

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



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. 3 Date [illegible]

Calibrated by: [illegible]

"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 | 1.2 | 1.10 | .795 | <.01 |
| 2 | 0.[illegible] | 1.25 | .80 | <.01 |
| 3 | 0.55 | .88 | .791 | <.01 |
| | | $\bar{C}_p$ (SIDE A) | .795 | |

"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 | 1.2 | 1.85 | .805 | <.01 |
| 2 | 0.80 | 1.25 | .80 | <.01 |
| 3 | 0.55 | .87 | .795 | <.01 |
| | | $\bar{C}_p$ (SIDE B) | .80 | |

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

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

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

# 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 44 years old and a graduate of the University of Mississippi with graduate studies at Memphis State University and State Technical Institute of Memphis.

**Dave Armstrong** - Team Leader

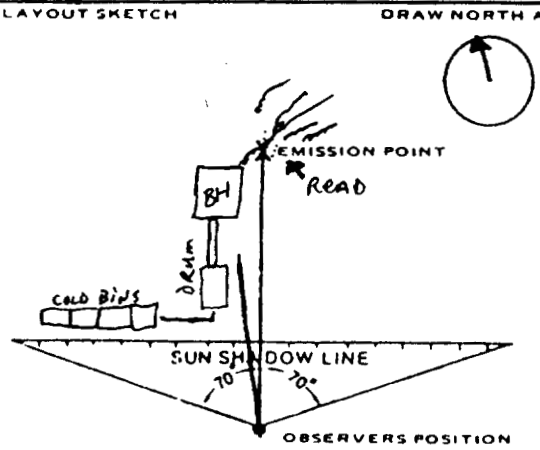
Dave Armstrong has been employed by RAMCON for three years. He has undergone extensive training in Methods 1 through 9. He is qualified as a team leader and has personally sampled over 150 stacks including over 100 asphalt plants. He is currently certified as a V.E. reader.

# XI. VISIBLE EMISSIONS

①

| | |
|---|---|
| SOURCE NAME | CITY Wide ASPHALT |
| ADDRESS | |
| CITY | ST. JOSEPH |
| STATE | MO. |
| ZIP | |
| PHONE | |
| SOURCE ID NUMBER | |
| PROCESS EQUIPMENT | ASPHALT PLANT |
| OPERATING MODE | 300 TPH |
| CONTROL EQUIPMENT | BAGHOUSE |
| OPERATING MODE | |
| DESCRIBE EMISSION POINT | AT STACK EXIT |
| HEIGHT ABOVE GROUND LEVEL | 30' |
| HEIGHT RELATIVE TO OBSERVER | 30' |
| DISTANCE FROM OBSERVER | 75' |
| DIRECTION FROM OBSERVER | N - NW |
| DESCRIBE EMISSIONS | |
| EMISSION COLOR | GRAY/WHITE |
| PLUME TYPE: | CONTINUOUS X FUGITIVE ☐ INTERMITTENT ☐ |
| WATER DROPLETS PRESENT | NO X YES ☐ |
| IS WATER DROPLET PLUME | ATTACHED ☐ DETACHED X |
| AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED | 8-10' ABOVE STACK EXIT |
| DESCRIBE BACKGROUND | [redacted] TK SKY/BROKEN CLOUDS |
| BACKGROUND COLOR | GRAY/WHITE/BLUE |
| SKY CONDITIONS | CLEAR |
| WIND SPEED | 3-5 MPH |
| WIND DIRECTION | EAST |
| AMBIENT TEMPERATURE | 56°F |
| RELATIVE HUMIDITY | |

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW




| OBSERVATION DATE | START TIME | STOP TIME |
|---|---|---|
| 10-18-88 | 12:15 | 13:15 |

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

| | |
|---|---|
| AVERAGE OPACITY FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE 15 % WERE 0 |
| RANGE OF OPACITY READINGS | 0% MINIMUM 15% MAXIMUM |
| OBSERVER'S NAME (PRINT) | FRANK C. KUHN |
| OBSERVER'S SIGNATURE | Frank C. Kuhn |
| DATE | 10-18-88 |
| ORGANIZATION | RAMCON ENVIRONMENTAL CORP. |
| CERTIFIED BY | CARL KOONTZ |
| DATE | 8-6-88 |
| VERIFIED BY | STATE OF TENN. |
| DATE | 8-6-88 |

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

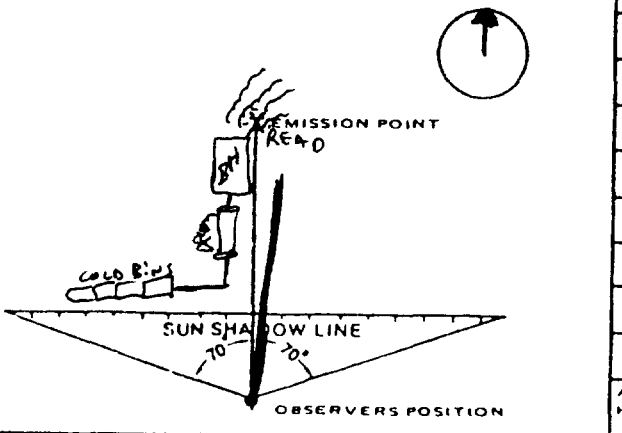
DATE

REC#14

②

| | |
|---|---|
| SOURCE NAME | City Wide Asphalt |
| ADDRESS | |
| CITY | St. Joseph |
| STATE | Mo. |
| ZIP | |
| PHONE | |
| SOURCE ID NUMBER | |
| PROCESS EQUIPMENT | Asphalt Plant |
| OPERATING MODE | 300 TAH |
| CONTROL EQUIPMENT | Baghouse |
| OPERATING MODE | |
| DESCRIBE EMISSION POINT | At stack exit |
| HEIGHT ABOVE GROUND LEVEL | 30' |
| HEIGHT RELATIVE TO OBSERVER | 30' |
| DISTANCE FROM OBSERVER | 50' |
| DIRECTION FROM OBSERVER | N |
| DESCRIBE EMISSIONS | |
| EMISSION COLOR | White/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 | 8-10' above stack exit |
| DESCRIBE BACKGROUND | Sky |
| BACKGROUND COLOR | Blue |
| SKY CONDITIONS | Clear |
| WIND SPEED | 5-10 MPH |
| WIND DIRECTION | East/Northeast |
| AMBIENT TEMPERATURE | 60° F |
| RELATIVE HUMIDITY | |

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW




| OBSERVATION DATE | START TIME | STOP TIME |
|---|---|---|
| 10-18-88 | 1415 | 1515 |

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

| | |
|---|---|
| AVERAGE OPACITY FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE 15 % WERE 0 |
| RANGE OF OPACITY READINGS | 0% MINIMUM 15% MAXIMUM |
| OBSERVER'S NAME (PRINT) | FRANK C. KUHN |
| OBSERVER'S SIGNATURE | Frank C. Kuhn |
| DATE | 10-18-88 |
| ORGANIZATION | Ramcon Environmental Corp. |
| CERTIFIED BY | Carl Koontz |
| DATE | 8-6-88 |
| VERIFIED BY | State of Tenn. |
| DATE | 8-6-88 |

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

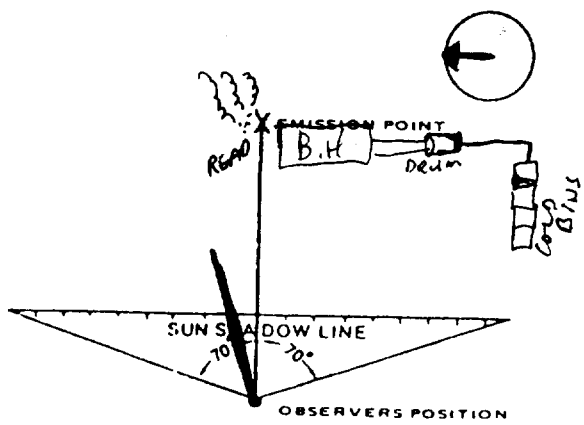
DATE

REC#14

(3)

| | |
|---|---|
| SOURCE NAME | City Wide Asphalt |
| ADDRESS | |
| CITY | St. Joseph |
| STATE | Mo. |
| ZIP | |
| PHONE | |
| SOURCE ID NUMBER | |
| PROCESS EQUIPMENT | Asphalt Plant |
| OPERATING MODE | 300 TPH |
| CONTROL EQUIPMENT | Baghouse |
| OPERATING MODE | |
| DESCRIBE EMISSION POINT | At Stack Exit |
| HEIGHT ABOVE GROUND LEVEL | 30' |
| HEIGHT RELATIVE TO OBSERVER | 30' |
| DISTANCE FROM OBSERVER | 150' |
| DIRECTION FROM OBSERVER | EAST |
| DESCRIBE EMISSIONS | |
| EMISSION COLOR | White/Gray |
| PLUME TYPE: | CONTINUOUS [X] FUGITIVE [ ] INTERMITTENT [ ] |
| WATER DROPLETS PRESENT | NO [X] YES [ ] |
| IS WATER DROPLET PLUME | ATTACHED [ ] DETACHED [X] |
| AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED | 8-10' Above Stack Exit |
| DESCRIBE BACKGROUND | Sky |
| BACKGROUND COLOR | Blue |
| SKY CONDITIONS | Clear |
| WIND SPEED | 5 MPH |
| WIND DIRECTION | N-NE |
| AMBIENT TEMPERATURE | 72° F |
| RELATIVE HUMIDITY | |

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW




| OBSERVATION DATE | START TIME | STOP TIME |
|---|---|---|
| 10-18-88 | 1630 | 1730 |

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

| | |
|---|---|
| AVERAGE OPACITY FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE 15 % WERE 0 |
| RANGE OF OPACITY READINGS | 0% MINIMUM 15% MAXIMUM |
| OBSERVER'S NAME (PRINT) | FRANK C. KUHN |
| OBSERVER'S SIGNATURE | Frank C. Kuhn |
| DATE | 10-18-88 |
| ORGANIZATION | RAMCON ENVIRONMENTAL CORP. |
| CERTIFIED BY | CARL KOONTZ |
| DATE | 8-6-88 |
| VERIFIED BY | STATE OF TENN. |
| DATE | 8-6-88 |

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

DATE

REC#14

# SMOKE SCHOOL TRAINING FORM

NAME FRANK C. KUHN RUN # 1 SUNGLASSES NO

COMPANY [illegible] COURSE LOCATION

DATE [illegible] SKY WIND [illegible] DISTANCE & DIRECTION TO STACK

WHITE

| | | | | | | | | | | | | | | | | | | | | | 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 4.8

BLACK

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 the above readings

DEVIATION 4.0

METHOD 5 - PARTICULATE EMISSIONS

PLANT NAME: City Wide Asphalt ST JOSEPH MO
UNIT TESTED: H&B drum mix asphalt plant
RUN NUMBER: 3
DATE TESTED: 10-13-89

| | | | |
|---|---|---|---|
| NO. OF POINTS | 30 | PERCENT OXYGEN | 13.1 |
| TIME PER POINT | 2.00 | PERCENT CARBON DIOXIDE | 6.2 |
| LEAK RATE | 0.0000 | PERCENT CARBON MONOXIDE | 0.0 |
| Y (METER CORR FACT) | 0.987 | Cp (PITOT COEFF) | 0.795 |
| As (STACK AREA) | 9.38 | Dn (NOZZLE DIAM) | 0.270 |
| Pbar (BAR PRESS) | 29.75 | Vm(std) | 476.968 |
| Mn (WT PARTICULATE) | 116.5000 | Vwstd | 547.158 |
| Vc | 325.0 | | |
| Wsg | 20.0 | | |

| POINT NUMBER | STATIC PRESSURE (Ps) | STACK TEMP (Ts) | VELOCITY PRESSURE (delta Ps) | ORIFICE PRESS DIFF (delta H) | DRY GAS METER TEMP INLET (Tmi) | OUTLET (Tmo) |
|---|---|---|---|---|---|---|
| 1 | 0.05 | 256.0 | 1.10 | 1.80 | 80.0 | 76.0 |
| 2 | 0.05 | 262.0 | 1.10 | 1.80 | 82.0 | 76.0 |
| 3 | 0.05 | 266.0 | 1.00 | 1.60 | 84.0 | 76.0 |
| 4 | 0.05 | 264.0 | 0.96 | 1.50 | 84.0 | 76.0 |
| 5 | 0.05 | 270.0 | 1.00 | 1.60 | 86.0 | 76.0 |
| 6 | 0.05 | 260.0 | 1.10 | 1.80 | 84.0 | 76.0 |
| 7 | 0.05 | 264.0 | 1.20 | 1.90 | 86.0 | 76.0 |
| 8 | 0.05 | 268.0 | 1.20 | 1.90 | 86.0 | 76.0 |
| 9 | 0.05 | 270.0 | 1.20 | 1.90 | 86.0 | 76.0 |
| 10 | 0.05 | 276.0 | 1.00 | 1.60 | 90.0 | 76.0 |
| 11 | 0.05 | 258.0 | 1.00 | 1.60 | 92.0 | 76.0 |
| 12 | 0.05 | 266.0 | 1.30 | 2.10 | 92.0 | 76.0 |
| 13 | 0.05 | 270.0 | 1.40 | 2.20 | 94.0 | 76.0 |
| 14 | 0.05 | 264.0 | 1.30 | 2.10 | 94.0 | 76.0 |
| 15 | 0.05 | 264.0 | 1.30 | 2.10 | 96.0 | 76.0 |
| 16 | 0.05 | 260.0 | 0.92 | 1.50 | 94.0 | 76.0 |
| 17 | 0.05 | 264.0 | 1.00 | 1.60 | 96.0 | 76.0 |
| 18 | 0.05 | 268.0 | 1.30 | 2.10 | 96.0 | 76.0 |
| 19 | 0.05 | 270.0 | 1.10 | 1.70 | 96.0 | 76.0 |
| 20 | 0.05 | 264.0 | 0.88 | 1.40 | 96.0 | 76.0 |
| 21 | 0.05 | 260.0 | 0.65 | 1.00 | 96.0 | 76.0 |
| 22 | 0.05 | 266.0 | 0.98 | 1.60 | 96.0 | 76.0 |
| 23 | 0.05 | 268.0 | 1.00 | 1.60 | 96.0 | 76.0 |
| 24 | 0.05 | 272.0 | 1.00 | 1.60 | 96.0 | 76.0 |
| 25 | 0.05 | 274.0 | 0.73 | 1.20 | 96.0 | 76.0 |
| 26 | 0.05 | 256.0 | 0.46 | 0.74 | 96.0 | 76.0 |
| 27 | 0.05 | 256.0 | 0.52 | 0.83 | 96.0 | 76.0 |
| 28 | 0.05 | 260.0 | 0.67 | 1.10 | 96.0 | 76.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 0.05 | 258.0 | 1.00 | 1.60 | 92.0 | 76.0 |
| 12 | 0.05 | 266.0 | 1.30 | 2.10 | 92.0 | 76.0 |
| 13 | 0.05 | 270.0 | 1.40 | 2.20 | 94.0 | 76.0 |
| 14 | 0.05 | 264.0 | 1.30 | 2.10 | 94.0 | 76.0 |
| 15 | 0.05 | 264.0 | 1.30 | 2.10 | 96.0 | 76.0 |
| 16 | 0.05 | 260.0 | 0.92 | 1.50 | 94.0 | 76.0 |
| 17 | 0.05 | 264.0 | 1.00 | 1.60 | 96.0 | 76.0 |
| 18 | 0.05 | 268.0 | 1.30 | 2.10 | 96.0 | 76.0 |
| 19 | 0.05 | 270.0 | 1.10 | 1.70 | 96.0 | 76.0 |
| 20 | 0.05 | 264.0 | 0.88 | 1.40 | 96.0 | 76.0 |
| 21 | 0.05 | 260.0 | 0.65 | 1.00 | 96.0 | 76.0 |
| 22 | 0.05 | 266.0 | 0.98 | 1.60 | 96.0 | 76.0 |
| 23 | 0.05 | 268.0 | 1.00 | 1.60 | 96.0 | 76.0 |
| 24 | 0.05 | 272.0 | 1.00 | 1.60 | 96.0 | 76.0 |
| 25 | 0.05 | 274.0 | 0.73 | 1.20 | 96.0 | 76.0 |
| 26 | 0.05 | 256.0 | 0.46 | 0.74 | 96.0 | 76.0 |
| 27 | 0.05 | 256.0 | 0.52 | 0.83 | 96.0 | 76.0 |
| 28 | 0.05 | 260.0 | 0.67 | 1.10 | 96.0 | 76.0 |
| 29 | 0.05 | 268.0 | 0.62 | 1.00 | 96.0 | 76.0 |
| 30 | 0.05 | 264.0 | 0.92 | 1.50 | 96.0 | 76.0 |
| AVG | 0.05 | 264.9 | 0.99 | 1.60 | 91.8 | 76.0 |

| | |
|---|---|
| STACK VELOCITY | 64.31 (ft/sec) |
| STANDARD VOLUME SAMPLED | 47.99 (SCF) |
| AVERAGE DRY GAS METER TEMP | 83.9 (°F) |
| PERCENT MOISTURE | 25.29 (%) |
| STANDARD STACK FLOW RATE | 19987.38 (DSCFM) |

| | |
|---|---|
| ISOKINETIC SAMPLING RATE IS | 96.28 (%) |
| PARTICULATE EMISSION RATE IS | 6.290 (lb/hr) |
| PARTICULATE EMISSION RATE IS | 0.0375 (gr/dscf) |

PLANT NAME: City Wide Asphalt ST JOSEPH MO
UNIT TESTED: H&B drum mix asphalt plant
RUN NUMBER: 2
DATE TESTED: 10-18-88

| | | | |
|---|---|---|---|
| NO. OF POINTS | 30 | PERCENT OXYGEN | 12.6 |
| TIME PER POINT | 2.00 | PERCENT CARBON DIOXIDE | 7.3 |
| LEAK RATE | 0.0030 | PERCENT CARBON MONOXIDE | 0.0 |
| Y (METER CORR FACT) | 0.987 | Cp (PITOT COEFF) | 0.795 |
| As (STACK AREA) | 9.38 | Dn (NOZZLE DIAM) | 0.270 |
| Pbar (BAR PRESS) | 29.75 | Vinitial | 445.461 |
| Mn (WT PARTICULATE) | 49.8000 | Vfinal | 496.741 |
| Vc | 318.0 | | |
| Wsg | 10.0 | | |

| POINT NUMBER | STATIC PRESSURE (Ps) | STACK TEMP (Ts) | VELOCITY PRESSURE (delta Ps) | ORIFICE PRESS DIFF (delta H) | DRY GAS METER TEMP INLET (Tmi) | DRY GAS METER TEMP OUTLET (Tmo) |
|---|---|---|---|---|---|---|
| 1 | 0.05 | 262.0 | 0.42 | 0.66 | 76.0 | 70.0 |
| 2 | 0.05 | 270.0 | 0.64 | 1.00 | 78.0 | 70.0 |
| 3 | 0.05 | 272.0 | 0.36 | 0.56 | 78.0 | 70.0 |
| 4 | 0.05 | 270.0 | 0.57 | 0.89 | 80.0 | 70.0 |
| 5 | 0.05 | 268.0 | 0.42 | 0.66 | 82.0 | 70.0 |
| 6 | 0.05 | 264.0 | 0.62 | 0.97 | 82.0 | 70.0 |
| 7 | 0.05 | 268.0 | 1.00 | 1.60 | 84.0 | 70.0 |
| 8 | 0.05 | 270.0 | 1.00 | 1.60 | 84.0 | 70.0 |
| 9 | 0.05 | 272.0 | 0.75 | 1.20 | 86.0 | 70.0 |
| 10 | 0.05 | 270.0 | 0.45 | 0.70 | 88.0 | 70.0 |
| 11 | 0.05 | 262.0 | 0.92 | 1.40 | 88.0 | 70.0 |
| 12 | 0.05 | 266.0 | 1.40 | 2.20 | 90.0 | 72.0 |
| 13 | 0.05 | 270.0 | 1.20 | 1.90 | 90.0 | 72.0 |
| 14 | 0.05 | 270.0 | 0.78 | 1.20 | 92.0 | 72.0 |
| 15 | 0.05 | 268.0 | 0.68 | 1.10 | 92.0 | 72.0 |
| 16 | 0.05 | 262.0 | 1.30 | 2.00 | 92.0 | 72.0 |
| 17 | 0.05 | 264.0 | 1.30 | 2.00 | 92.0 | 72.0 |
| 18 | 0.05 | 270.0 | 1.30 | 2.00 | 94.0 | 74.0 |
| 19 | 0.05 | 272.0 | 1.10 | 1.70 | 94.0 | 74.0 |
| 20 | 0.05 | 270.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 21 | 0.05 | 262.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 22 | 0.05 | 280.0 | 1.30 | 2.00 | 94.0 | 74.0 |
| 23 | 0.05 | 278.0 | 1.40 | 2.20 | 94.0 | 74.0 |
| 24 | 0.05 | 270.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 25 | 0.05 | 274.0 | 1.00 | 1.60 | 96.0 | 74.0 |
| 26 | 0.05 | 246.0 | 1.10 | 1.70 | 92.0 | 74.0 |
| 27 | 0.05 | 268.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 28 | 0.05 | 276.0 | 1.00 | 1.60 | 96.0 | 74.0 |
| 29 | 0.05 | 274.0 | 1.20 | 1.90 | 94.0 | 74.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 0.05 | 282.0 | 0.92 | 1.40 | 88.0 | 72.0 |
| 12 | 0.05 | 266.0 | 1.40 | 2.20 | 90.0 | 72.0 |
| 13 | 0.05 | 270.0 | 1.20 | 1.90 | 90.0 | 72.0 |
| 14 | 0.05 | 270.0 | 0.78 | 1.20 | 92.0 | 72.0 |
| 15 | 0.05 | 268.0 | 0.68 | 1.10 | 92.0 | 72.0 |
| 16 | 0.05 | 262.0 | 1.30 | 2.00 | 92.0 | 72.0 |
| 17 | 0.05 | 264.0 | 1.30 | 2.00 | 92.0 | 72.0 |
| 18 | 0.05 | 270.0 | 1.30 | 2.00 | 94.0 | 74.0 |
| 19 | 0.05 | 272.0 | 1.10 | 1.70 | 94.0 | 74.0 |
| 20 | 0.05 | 270.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 21 | 0.05 | 262.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 22 | 0.05 | 280.0 | 1.30 | 2.00 | 94.0 | 74.0 |
| 23 | 0.05 | 278.0 | 1.40 | 2.20 | 94.0 | 74.0 |
| 24 | 0.05 | 270.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 25 | 0.05 | 274.0 | 1.00 | 1.60 | 96.0 | 74.0 |
| 26 | 0.05 | 246.0 | 1.10 | 1.70 | 92.0 | 74.0 |
| 27 | 0.05 | 268.0 | 1.00 | 1.60 | 94.0 | 74.0 |
| 28 | 0.05 | 276.0 | 1.00 | 1.60 | 96.0 | 74.0 |
| 29 | 0.05 | 274.0 | 1.20 | 1.90 | 96.0 | 74.0 |
| 30 | 0.05 | 272.0 | 1.10 | 1.70 | 96.0 | 74.0 |
| AVG | 0.05 | 268.7 | 0.96 | 1.48 | 89.4 | 72.1 |

| | |
|---|---|
| STACK VELOCITY | 62.07 (ft/sec) |
| STANDARD VOLUME SAMPLED | 49.30 (SCF) |
| AVERAGE DRY GAS METER TEMP | 80.8 (°F) |
| PERCENT MOISTURE | 21.35 (%) |
| STANDARD STACK FLOW RATE | 19167.62 (DSCFM) |

| | |
|---|---|
| ISOKINETIC SAMPLING RATE IS | 101.08 (%) |
| PARTICULATE EMISSION RATE IS | 2.561 (lb/hr) |
| PARTICULATE EMISSION RATE IS | 0.0156 (gr/dscf) |

# METHOD 5 - PARTICULATE EMISSIONS

PLANT NAME: City Wide Asphalt ST JOSEPH MO
UNIT TESTED: H&B drum mix asphalt plant
RUN NUMBER: 1
DATE TESTED: 10-18-88

| | | | |
|---|---|---|---|
| NO. OF POINTS | 30 | PERCENT OXYGEN | 13.1 |
| TIME PER POINT | 2.00 | PERCENT CARBON DIOXIDE | 6.8 |
| LEAK RATE | 0.0060 | PERCENT CARBON MONOXIDE | 0.0 |
| Y (METER CORR FACT) | 0.987 | Cp (PITOT COEFF) | 0.795 |
| As (STACK AREA) | 9.38 | Dn (NOZZLE DIAM) | 0.270 |
| Pbar (BAR PRESS) | 29.75 | Vinitial | 395.727 |
| Mn (WT PARTICULATE) | 42.7000 | Vfinal | 445.241 |
| Vc | 350.0 | | |
| Wsg | 10.0 | | |

| POINT NUMBER | STATIC PRESSURE (Ps) | STACK TEMP (Ts) | VELOCITY PRESSURE (delta Ps) | ORIFICE PRESS DIFF (delta H) | DRY GAS METER TEMP INLET (Tmi) | OUTLET (Tmo) |
|---|---|---|---|---|---|---|
| 1 | 0.05 | 228.0 | 1.10 | 1.70 | 62.0 | 60.0 |
| 2 | 0.05 | 258.0 | 1.10 | 1.70 | 66.0 | 60.0 |
| 3 | 0.05 | 274.0 | 1.00 | 1.60 | 70.0 | 60.0 |
| 4 | 0.05 | 272.0 | 1.00 | 1.60 | 72.0 | 62.0 |
| 5 | 0.05 | 270.0 | 1.00 | 1.60 | 76.0 | 62.0 |
| 6 | 0.05 | 262.0 | 1.00 | 1.60 | 76.0 | 62.0 |
| 7 | 0.05 | 270.0 | 1.30 | 2.00 | 80.0 | 62.0 |
| 8 | 0.05 | 274.0 | 1.30 | 2.00 | 80.0 | 62.0 |
| 9 | 0.05 | 274.0 | 1.10 | 1.70 | 82.0 | 64.0 |
| 10 | 0.05 | 272.0 | 1.10 | 1.70 | 84.0 | 64.0 |
| 11 | 0.05 | 258.0 | 1.00 | 1.60 | 84.0 | 64.0 |
| 12 | 0.05 | 266.0 | 1.20 | 1.90 | 84.0 | 66.0 |
| 13 | 0.05 | 272.0 | 1.30 | 2.00 | 86.0 | 66.0 |
| 14 | 0.05 | 272.0 | 1.00 | 1.60 | 86.0 | 66.0 |
| 15 | 0.05 | 270.0 | 0.97 | 1.50 | 86.0 | 66.0 |
| 16 | 0.05 | 264.0 | 0.96 | 1.30 | 84.0 | 68.0 |
| 17 | 0.05 | 264.0 | 1.00 | 1.60 | 84.0 | 68.0 |
| 18 | 0.05 | 268.0 | 1.00 | 1.60 | 86.0 | 68.0 |
| 19 | 0.05 | 268.0 | 0.97 | 1.50 | 86.0 | 68.0 |
| 20 | 0.05 | 266.0 | 0.82 | 1.30 | 86.0 | 68.0 |
| 21 | 0.05 | 254.0 | 0.74 | 1.20 | 86.0 | 68.0 |
| 22 | 0.05 | 262.0 | 0.92 | 1.40 | 86.0 | 68.0 |
| 23 | 0.05 | 268.0 | 1.00 | 1.60 | 89.0 | 70.0 |
| 24 | 0.05 | 268.0 | 1.00 | 1.60 | 90.0 | 70.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 | 0.05 | 270.0 | 1.30 | 2.00 | 80.0 | 62.0 |
| 8 | 0.05 | 274.0 | 1.30 | 2.00 | 80.0 | 62.0 |
| 9 | 0.05 | 274.0 | 1.10 | 1.70 | 82.0 | 64.0 |
| 10 | 0.05 | 272.0 | 1.10 | 1.70 | 84.0 | 64.0 |
| 11 | 0.05 | 258.0 | 1.00 | 1.60 | 84.0 | 64.0 |
| 12 | 0.05 | 266.0 | 1.20 | 1.90 | 84.0 | 66.0 |
| 13 | 0.05 | 272.0 | 1.30 | 2.00 | 86.0 | 66.0 |
| 14 | 0.05 | 272.0 | 1.00 | 1.60 | 86.0 | 66.0 |
| 15 | 0.05 | 270.0 | 0.97 | 1.50 | 86.0 | 66.0 |
| 16 | 0.05 | 264.0 | 0.86 | 1.30 | 84.0 | 68.0 |
| 17 | 0.05 | 264.0 | 1.00 | 1.60 | 84.0 | 68.0 |
| 18 | 0.05 | 268.0 | 1.00 | 1.60 | 86.0 | 68.0 |
| 19 | 0.05 | 268.0 | 0.97 | 1.50 | 86.0 | 68.0 |
| 20 | 0.05 | 266.0 | 0.82 | 1.30 | 86.0 | 68.0 |
| 21 | 0.05 | 254.0 | 0.74 | 1.20 | 86.0 | 68.0 |
| 22 | 0.05 | 262.0 | 0.92 | 1.40 | 86.0 | 68.0 |
| 23 | 0.05 | 268.0 | 1.00 | 1.60 | 88.0 | 70.0 |
| 24 | 0.05 | 268.0 | 1.00 | 1.60 | 90.0 | 70.0 |
| 25 | 0.05 | 268.0 | 0.82 | 1.30 | 90.0 | 70.0 |
| 26 | 0.05 | 268.0 | 0.65 | 1.00 | 86.0 | 70.0 |
| 27 | 0.05 | 270.0 | 0.74 | 1.20 | 88.0 | 70.0 |
| 28 | 0.05 | 280.0 | 0.82 | 1.30 | 90.0 | 72.0 |
| 29 | 0.05 | 285.0 | 0.78 | 1.20 | 90.0 | 72.0 |
| 30 | 0.05 | 280.0 | 0.65 | 1.00 | 90.0 | 72.0 |
| AVG | 0.05 | 267.5 | 0.98 | 1.53 | 82.8 | 66.3 |

| | |
|---|---|
| STACK VELOCITY | 64.09 (ft/sec) |
| STANDARD VOLUME SAMPLED | 48.16 (SCF) |
| AVERAGE DRY GAS METER TEMP | 74.5 (°F) |
| PERCENT MOISTURE | 26.03 (%) |
| STANDARD STACK FLOW RATE | 19256.53 (DSCFM) |

| | |
|---|---|
| ISOKINETIC SAMPLING RATE IS | 98.29 (%) |
| PARTICULATE EMISSION RATE IS | 2.258 (lb/hr) |
| PARTICULATE EMISSION RATE IS | 0.0137 (gr/dscf) |