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.

REPORT

of

OFFICIAL AIR POLLUTION TESTS

conducted on the

COKE OVEN "HOT CAR" BAGHOUSE AIR POLLUTION CONTROL SYSTEM

at the

PHILADELPHIA COKE CO., INC.

in

PHILADELPHIA, PA

on

January 8, 9, 12, 13 & 14, 1981

TEST REPORT #9672

Prepared by:

AM
BE
MZ

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Distribution:
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(3 copies)
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(2 copies)

Report Issued: February 4, 1981

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Technical Compilation by:

Write-up & Data Sheets R.K

Date 1/15/81

Calculations M.G.

Date 1/28/81

Conclusions & Recommendations WBR

Date 1/29/81

Approved WMR

Date 1/30/81

I

INTRODUCTION

Philadelphia Coke Co., Inc. requested ROSSNAGEL & ASSOCIATES to conduct an Official Air Pollution Emission Test on the new Buell Bag-house Exhaust System installed for the Coke Oven "Hot Car" at its plant at 4501 Richmond Street, Philadelphia, PA.

ROSSNAGEL & ASSOCIATES issued Proposal #80-296A, dated December 10, 1980. Philadelphia Coke then issued P.O. #H10361, dated December 9, 1980, for this test. The plan for this test had been carefully worked out by Mr. Phil Stout of Philadelphia Coke with the EPA Region III and Philadelphia Air Management personnel.

The Coke Oven Battery was operating within its long established procedure of a "push" approximately every 30 minutes during this test. The operation was from noon to 8:30 P.M. on these test days. It operates 7 days per week.

This test was scheduled for and conducted on January 8, 9, 12 and 13, 1981. Photographs of the testing equipment are shown on Page 5.

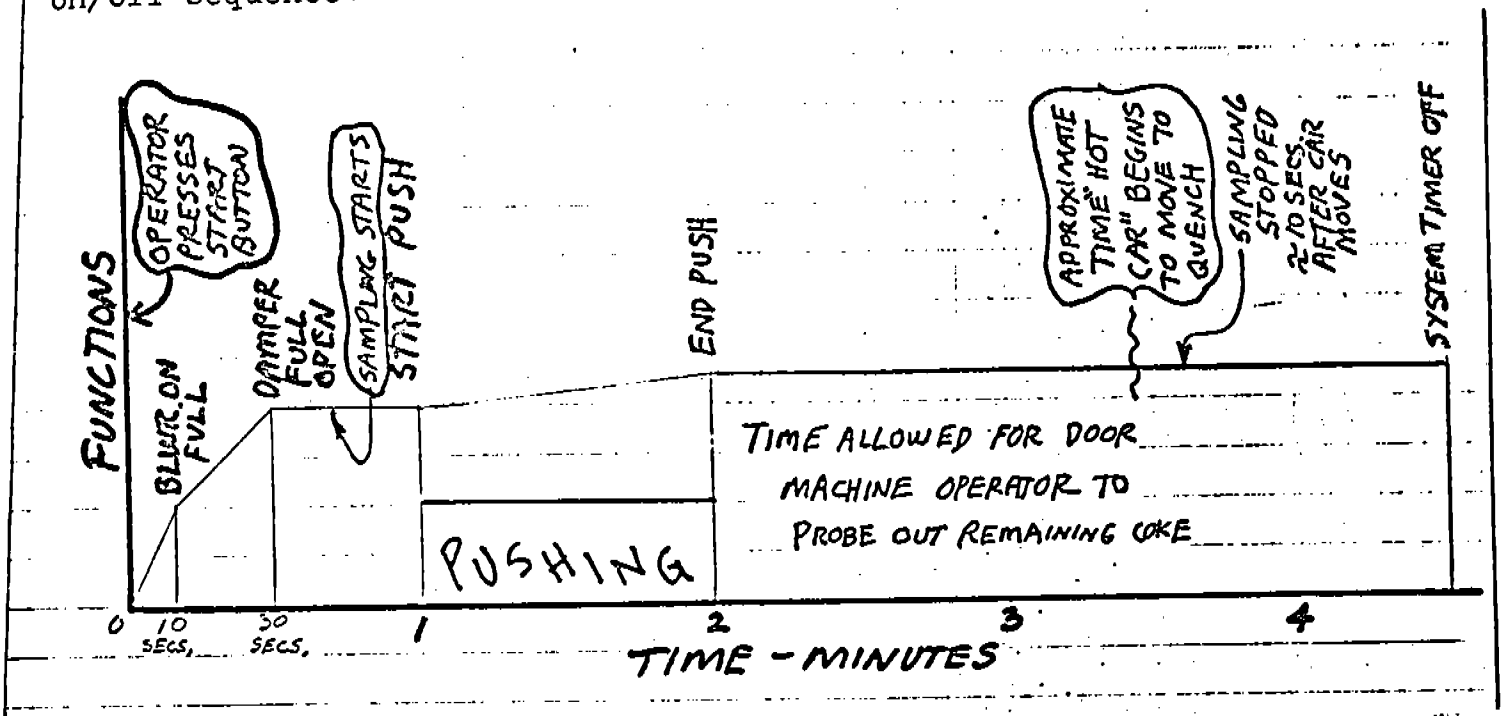
There are 74 individual operating ovens in the Coke Oven Battery. It is a continuous process during which each oven has a charging rate of 17 tons per day. Seventy-eight percent of the coal is made into coke. Seventy percent of the coke is three inches or larger and is called "foundry" coke. The process rate was as follows:

PROCESS RATE

	Date	No. Ovens Pushed during test	Total Coal Input Rate (tons)	Total Coke Produced (tons)
Run #1	1/9/81	18 in 8½ hours	18 x 17 = 306	18 x 13.2 = 237.6
	1/12/81	18 in 8½ hours	18 x 17 = 306	18 x 13.2 = 237.6
Run #2	1/13/81	18 in 8½ hours	18 x 17 = 306	18 x 13.2 = 237.6
	1/14/81	18 in 8½ hours	18 x 17 = 306	18 x 13.2 = 237.6

The emission test was made on the 72 inch I.D. of the vertical outlet stack at 45' feet above ground. Nine sample points were utilized in each of four test ports.

Because of the considerable interest in Coke Oven "Hot Car" Air Pollution Control Systems, ROSSNAGEL & ASSOCIATES has included below a "time phased" diagram of the actual blower on/off and sampling on/off sequence:



The air pollution control system consists of a over three hundred foot long Travel-Vent Exhaust Hood/Duct System manufactured by the Howley Div. of Envirotech. This includes a unique movable 50 ft. long hood over the 40 ft. long "Hot Car". The hood captures the emissions during the "push" and prior to the "Hot Car" run to the Quench Chamber. The approximate 115,000 SCFM exhaust feeds into a Buell Spark-Arrestor/Fallout Compartment and then into a four compartment Buell Type 4HE210 Pulse Jet Air Baghouse. The baghouse has an air-to-cloth ratio of 6.3:1 with 840 bags.△ The prime mover is a Robinson 800 HP Centrifugal Blower, Type FRD, Size 66 x 13 - 3/8. The blower feeds directly into the exhaust stack. There is a critical damper on the blower outlet which is kept closed during the time the blower motor is getting up to speed (10 seconds). Then the electrically operated damper opens in 18-20 seconds allowing the full exhaust flow to be drawn out of the exhaust hood.

A sketch of the system is shown on Pages 6 and 7. Complete details of the actual test, including a schematic diagram, are provided in Section III. A copy of ROSSNAGEL & ASSOCIATES' "Checklist for Isokinetic Stack Testing," utilized by the test team, is also included in Section III for reference.

The test team consisted of, on various days, W. B. Rossnagel, P.E. R. Kipp, Test Supervisor; H. Factor, R. Bessinger, L. Price and S. Harris, Environmentalists.

△ 840 bags x 18.9 sq. ft./bag = 15,876 total sq. ft. of bags

Section II contains the RESULTS, CONCLUSIONS & RECOMMENDATIONS. In Section III is the detailed DESCRIPTION OF TEST. Section IV contains the CALCULATIONS and Section V, the detailed DATA SHEETS, including an Events Log.

ROSSNAGEL & ASSOCIATES wishes to thank Mr. Phil Stout and Mr. Dan Toutant of Philadelphia Coke who willingly assisted whenever requested.

Portions of these tests were witnessed by the following person:

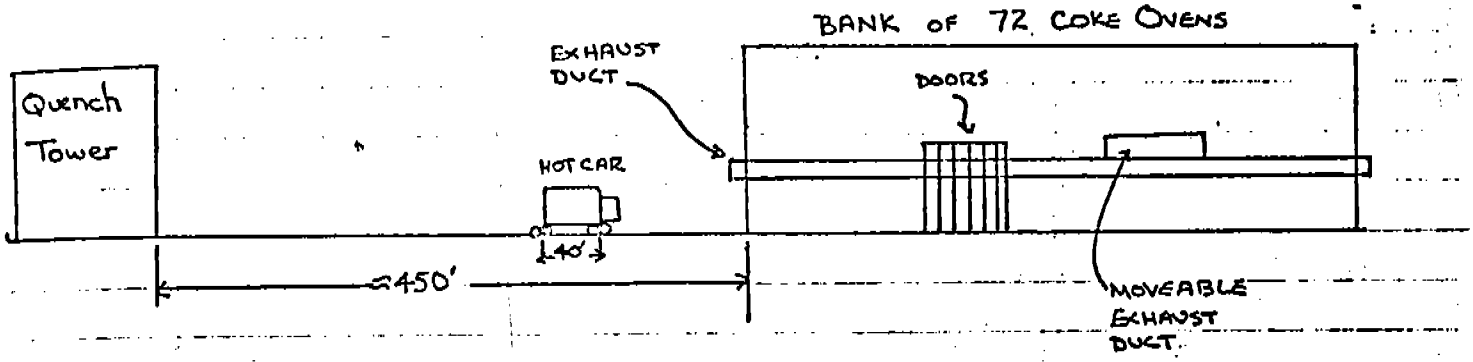
Mr. Bob Scott, Philadelphia Air Management

Note: This report pertains only to the sample or source tested. Information contained herein is not to be reproduced, outside of the Buyer's company, in whole or in part, without the prior written approval of ROSSNAGEL & ASSOCIATES, or the Buyer.

Philadelphia Coke Hot Car Air Pollution Control

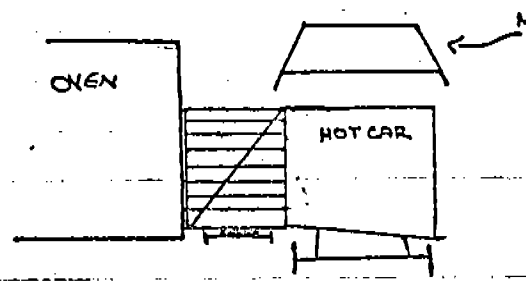
1-13-81

S. Harris



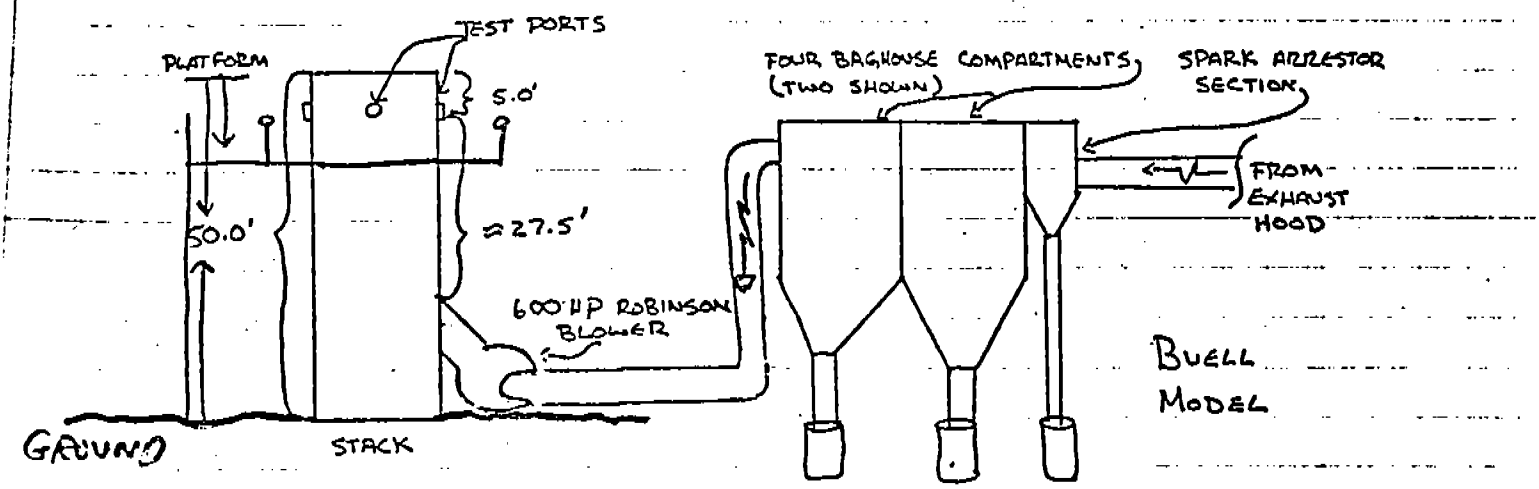
SIDE VIEW APPROXIMATELY TO SCALE

1" = 150'



BURNING COKE PUSHED FROM OVEN INTO HOT CAR

END VIEW NOT TO SCALE



SIDE VIEW OF AIR POLLUTION CONTROL SYSTEM NOT TO SCALE

II

RESULTS, CONCLUSIONS & RECOMMENDATIONS

RESULTS

The basic flow, temperature and moisture performance results are shown in Table I below:

PERFORMANCE DATA

Date	Run	ACFM @ Temp. F.	SCFM (Dry)	%Moisture by Volume (1)	Odor (2)	Visual Emissions (3)
1/9 & 1/12	1	114,021 @ 40 F.	117,690	3.1%	Trace √√√√	< 10%
1/13 & 1/14	2	116,907 @ 76 F.	112,995	2.8%	Trace √√√√	< 10%
--	--	--	--	--	--	--
	Avg.		115,343	3.0%		

TABLE I

Notes: 1) Moisture percent in Table I is corrected to stack conditions. It was obtained by the condensate method and is the average for the entire run.

2) Odor is measured at test ports and is rated as extreme, irritant, excessive, annoying, noticeable, trace or not detectable (N.D.). Odor readings based on the "checked" observations of the test team members. Note this test port odor level - not property line odor.

3) Visual emissions expressed as percent Opacity. The allowable Visual Limit is 20% during "pushing" and 10% during travel of the "Hot Car."

The ACFM and SCFM values in Table IA and the flows used in the emission rate calculation in each run are based on simultaneous velocity readings made at the nozzle during the sampling runs.

The data obtained from the initial traverse was as shown below:

TRAVERSE DATA

Date	ACFM @ Temp. F.	SCFM (Wet)	% Moisture by Volume *
1/8/81	106,707 @ 84 F.	104,586	--
	113,526 @ 84 F.	111, 270	3.1%

TABLE IA

* Moisture in Table IA is at stack conditions and is determined by Wet/Dry bulb thermometer measurements.

The particulate emission rates for each run and the average are provided in Table II below:

EMISSION RATES

Run	ACTUAL						ALLOWABLE ##
	Dry Catch*		Wet Catch**		Total#		lbs/hr (Dry Catch only counts)
	Grains/ scfd	lb/hr	Grains/ scfd	lb/hr	Grains/ scfd	lb/hr	
1	.0053	.42	.0147	1.16	.0200	1.58	3.56 based on 3 pushes/hour or 3.00 based on 2 pushes/hour
2	.0045	.34	.0031	.23	.0076	.57	
3	--	--	--	--	--	--	
Avg.	.0049	.38	.0089	.70	.0138	1.08	

TABLE II

scfd = standard cubic foot dry

* Dry Catch consists of solid particulate and liquid particles (condensibles) with particle sizing generally greater than .3 microns (based on D.O.P. aerosol) or 1.0-1.2 microns (based on particulate). The Dry Catch is obtained from the filter collection, nozzle, probe, filter holder and washes upstream of the filter Filterable PM

** Wet Catch consists of particulates generally smaller than 1.0-1.2 microns (which passed through the filter), dissolved solids and Non-Volatile Residue from the impinger collection and washes downstream of the filter.

\# Total consists of Dry Catch plus Wet Catch.

\#\# Based on Pennsylvania Title 25, Part 2, Subpart C, Article III, Chapter 123.13, Subsection C1(i) and the permit application for the new control system. The Allowable Limit formula is:

$A = .76E^{.42}$ where E = Emission Index (13.2 tons/push)

ROSSNAGEL & ASSOCIATES provides this Glossary of Terms as an aid to having its clients better and more easily understand our test reports. Our firm was the first air pollution testing firm to include all the backup original data and calculations in its comprehensive test reports. We are the only environmental firm in which any computer page also includes a breakdown of all terms and equations (on the same computer sheet) so that an experienced engineer/chemist can manually recheck the computer run-off.

ACFM - Actual Cubic Feet per Minute - corresponds to CFM
SCFM - Standard Cubic Feet per Minute corrected to 70 F. and 760 mm. Hg. EPA uses 68 F. as standard temp.
Dry - moisture has been subtracted
Wet - moisture has been included
Percent Moisture by Volume - means volume of moisture as related to volume of sampled gas
lbs/hr - pounds per hour; same on Dry or Wet basis
LPM - Liters per minute; 28.3 liters = 1 cu. ft.
TLV - Threshold Limit Value - or the maximum concentration of a contaminant that an adult male can be safely exposed to 40 hrs. per week for 50 weeks a year
TWA - Time Weighted Average
T_s - Stack temperature in Rankin (F. + 460)
t_s - Stack temperature in Fahrenheit (F.)
Emission Rate - the actual lb/hr rate of contaminants from a source entering the atmosphere
Concentration - grains/scfd where one grain = 1/7,000 lb, standard cubic foot dry
Concentration corrected to 12% CO_2 - this is done on incinerator tests to correct to a 50% excess air level

1 cu. meter = 35.31 cu. ft. 1 lb = 453.59 grams
1 psi = 2.06 inches Hg 1 gram = 15.3 grains
1 inch Hg = 13.6 inches water
D.I. water - Deionized Distilled Water

Emission Test - consists normally of 1, 2 or 3 test runs
Test Run - a separate complete replicate
Traverse - the prescribed movement of a pitot tube or sampling probe to equal area locations in a duct or stack or doorway or exhaust hood
Sampling - the withdrawing of a quantity of gas to assure a homogeneous volume to test
Isokinetic - the matching of the velocity of the sampled gas entering the nozzle to the actual gas velocity in the duct or stack
ppm. - parts per million (by weight)
ppmV - parts per million (by volume)
N.V.R. - Non-Volatile Residue
Opacity - the percentage of obstruction of light transmittance through an exhaust plume minus any water vapor effects

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Philadelphia Air Management requires a special analysis of the Wet Catch. The results are shown in Table III below:

WET CATCH ANALYSIS*

Run	Sulfate		Soluble		Insoluble		Remarks
	grains/ scfd	lb/hr	grains/ scfd	lb/hr	grains/ scfd	lb/hr	
1	.0028	.22	.0089	.70	.0058	.45	See Conclusions
2	.0007	.05	.0027	.21	.0004	.03	
--	--	--	--	--	--	--	
Avg.	.0018	.14	.0058	.46	.0031	.24	

TABLE III

* The detailed analysis method is shown in Section III.

The results of the Orsat sample are shown in Table IV below:

ORSAT DATA - % - DRY BASIS

Run	Time	Tube No.	CO_2	O_2	CO	N_2*
1	2:33 P.M.	225	.6%	16.8%	0%	82.6%
	4:00 P.M.	1AB	1.0%	20.0%	0%	79.0%
2	1:34 P.M.	218	1.5%	19.5%	0%	79.0%
	12:26 P.M.	233	.4%	20.6%	0%	79.0%

TABLE IV

Note: CO sensitivity is 1/2%.

* determined by difference

The on-site Bacharach CO_2 results are shown in Table V below:

BACHARACH CO_2

Run	Number of Readings	Average CO_2%
1	3	.4%
2	4	.1%
Avg.	3.5	.25%

TABLE V

Other Pertinent Results:

1) The isokinetics for this test are as shown in Table VI below:

PERCENT ISOKINETICS

Run	Percent Isokinetics	Remarks
1	106.8%	All test runs were within the required 100 ± 10%.
2	105.2%	
--	--	

TABLE VI

2) The cyclonic flow check showed the cyclonic effects to be less than 1 degree. The limit established by the EPA is 10 degrees.

CONCLUSIONS

The Table I results show reasonably close correlation in the SCFM flow rates and moisture percentages as expected.

The Table IA results show two traverse results: the first traverse (104,586 SCFM) was done without the test port being plugged with a rag to prevent leakage. The second traverse (111,270 SCFM) resulted when the test team leader had the team repeat the traverse with the test port sealed close with a rag.

The Table II results show the Dry Catch Emission Rate to be well below the .04 grains/scfd guideline (the actual Dry Catch Emission Rate was only 1/8 of the .04 guideline limit) in both runs. The Dry Catch Emission Rate in both Runs #1 and #2 was well below the 3.00 lb/hr limit calculated for a coke production rate of 2 pushes/hr using the formula shown on Page 9. ROSSNAGEL & ASSOCIATES had to correct the normal Form 138.31 Computer Emission Rate Calculation Sheets for the fact that the air pollution control system only operated 4.68 minutes out of every hour. This correction calculation is shown on Page 35.

ROSSNAGEL & ASSOCIATES, after discussions with Philadelphia Coke personnel at the end of Run #1, agreed to conduct a second run with a larger nozzle size after the first run resulted in a sample volume of only 25.39 cubic feet. With the larger nozzle, Run #2 had a sample volume of 66.13 cubic feet. This more than met the Pa. D.E.R. requirement of a 50 cubic foot minimum sample size.

The EPA had requested that a sample of at least 50 mg. of particulate be collected in the emission test. ROSSNAGEL & ASSOCIATES collected:

Run	Dry Catch	Wet Catch	Total Catch
1	9.59 mg.	26.5 mg.	36.09 mg.
2	20.70 mg.	14.4 mg.	35.10 mg.
		Total	71.19 mg.

While over 50 mg. was collected in both runs, it should be remembered that it took 2 days and 18 hours of standing by with the sampling train to conduct each test run shown above. All factors considered, for this very light grain loading, the requirement to collect 50 mg. of sample in one test run was not practical. It would have required almost 4 full days of testing.

ROSSNAGEL & ASSOCIATES has saved the filter and wash collection from each of these runs in the event Philadelphia Coke, the EPA or Philadelphia Air Management wish to inspect them.

The Table III results show the special Wet Catch analysis required by Philadelphia Air Management.

The Table IV Orsat results show an average .87% CO_2 measured in the test ports.

The Table V Bacharach results show an average of .25% CO_2.

The Table VI results show both runs were within the required 100 ± 10% isokinetic requirement.

RECOMMENDATIONS

ROSSNAGEL & ASSOCIATES requests that the Philadelphia Air Management and the EPA accept this report as evidence that the "Hot Car" Baghouse Air Pollution Control System emissions were well within the grains/scfd, the lb/hr and Opacity limits on the day of the test.

III

DESCRIPTION OF TEST

On Thursday, January 8, 1981, H. Factor, R. Kipp, R. Bessinger, L. Price and S. Harris arrived on site at 9:25 A.M. to setup for test. The guard rail interfered with the test equipment and had to be cut out in four locations. The welders completed this at 11:15 A.M., Mr. B. Rossnagel, arrived at 11:30 A.M. Due to this delay and leak check problems encountered due to the extreme cold, the test team and Mr. Phil Stout agreed the test would be started on Friday, January 9, 1981.

On Friday, January 9, 1981, the test team arrived at the Philadelphia Coke plant at 10:10 A.M. and checked the equipment setup. The test team consisted of R. Kipp, H. Factor, R. Bessinger, L. Price and S. Harris. The impinger solutions were found to be frozen even though they were left with 30% IPA in addition to the 100 cc. of D.I. water to prevent freezeup. The impinger case was replaced and a successful leak check was completed.

The runs were conducted at the following times:

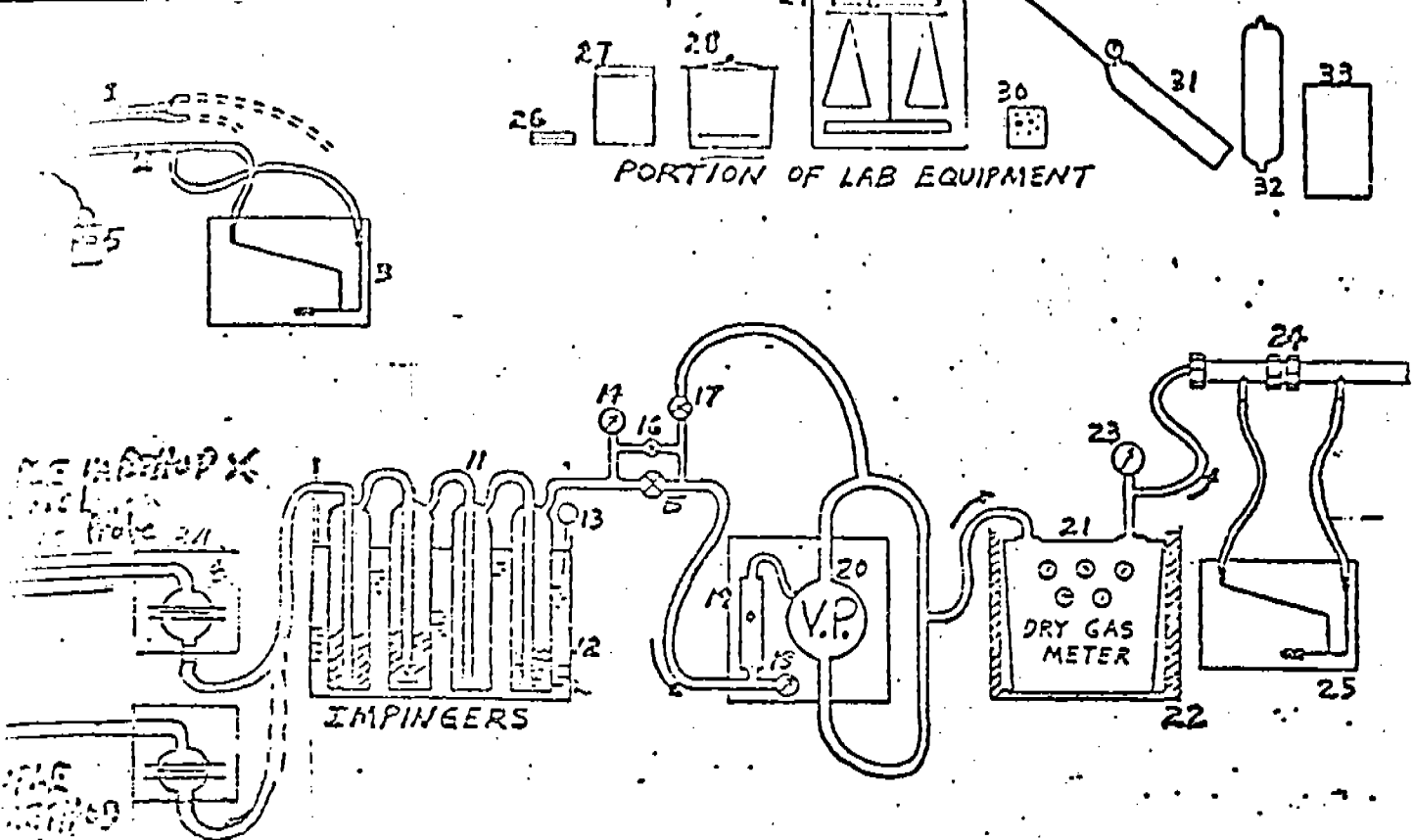
SAMPLING TIMES

Date	Run	Starting Time	Ending Time	Sampling Time Minutes	Remarks
1/9 & 1/12	1	12:20 P.M. 1:00 P.M.	7:34 P.M. 9:18 P.M.	} 73.40	
1/13 & 1/14	2	12:44 P.M. 12:29 P.M.	7:51 P.M. 8:20 P.M.	} 85.96	
--	--	--	--	--	--

The test team worked into darkness on each of the test days because of the agreement to sample 36 points, one point per "push". Since the plant operated until approximately 8:30 P.M., the night tests were a necessity.

Successful leak checks were made on the sampling train before and after each run to verify its integrity.

These emission tests were conducted according to EPA stack testing procedures, specifically EPA Methods #1, 2, 3, 4 and 5 and the requirements of the Philadelphia Air Management. ROSSNAGEL & ASSOCIATES' test equipment and method meet all EPA requirements. This arrangement is shown as Method X on the following page. This arrangement utilizes a glass lined stainless steel probe and 125 mm filter. The filter was maintained at 250 F. in a thermostatically controlled "Hot Box" to keep the sampled gas above the dew point. The sampled gas was then passed through the impinger train which was immersed in an ice bath to condense and collect the moisture and the condensibles.



EXPLANATION OF AIR POLLUTION SAMPLING TEST EQUIPMENT UTILIZED BY ROSSNAGEL & ASSOCIATES

This is the E.P.A. method for testing.

1. Pitot Tube, S Type: Western Precipitation
2. Pitot Tube: Dwyer
3. Inclined 10 in. Manometer: Dwyer
4. Chromel-Alumel Thermocouple: Thermoelectric
5. Bridge Type Temperature Indicator: Thermoelectric

6. Nozzle - various sizes: Gelman
7. Nozzle Holder: Rossnagel & Associates or Western Precipitation
8. Membrane Filter Holder: Gelman
9. Nozzle: Western Precipitation
10. Alundum Thimble Holder: Western Precipitation

11. Impingers, GREENBURG-SMITH Type and other special types: Ace Glass or Gelman
12. Chilled Water Impinger Holder and Travel Case: Rossnagel & Associates
13. Chilled Water Thermometer: Weston
14. Vacuum Gauge: U. S. Gauge
15. Globe Valve - coarse adjustment

16. Needle Valve - fine adjustment: Whitey
17. By-pass Globe Valve
18. Vacuum Gauge: Gelman
19. Approximation Flow Meter: Gelman
20. Vacuum Pump: Gelman

21. Dry Gas Meter: Rockford, Sprague
22. Insulated Dry Gas Meter Holder and Travel Case: Rossnagel & Associates
23. Gas Meter Thermometer: Weston
24. Orifice Disc Meter: Rossnagel & Associates
25. Manometer, 12-C-12 inches or inclined 10 in. type: Dwyer

26. Filter Carriers: Ellisco Inc.
27. Thimble Carriers: Ellisco Inc.
28. Desiccator: Arthur H. Thomas Co.
29. Analytical Balance - to .0001 grams: Fisher Scientific
30. Analytical Balance Weights: Fisher Scientific

31. Sample Bottles - 1 Liter with Vacuum Gauge
32. Integrated Gas Sample Collector:
33. Gas Analysis Test Unit: Bacharach
34. HEATED BOX FOR CYCLONE AND FILTER HOLDER: ROSSNAGEL & ASSOCIATES
35. CYCLONE AND FLASK: ACE GLASS
36. FILTER HOLDER: ACE GLASS
37. HEATING TAPE & VARIACS: A. H. THOMAS

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Impinger #1 was a straight tube bubbler with 100 cc. of distilled deionized water. Impinger #2 contained 100 cc. of distilled deionized water plus a Greenburg-Smith orifice and impact plate. Impinger #3 was a straight tube bubbler initially dry. These impingers collect submicron particles and condensibles. Impinger #4 contained 300 grams of silica gel above the tube in a straight tube, the same as Impinger #1. The silica gel is for the final drying of the gas prior to entering the calibrated dry gas meter.

Complete calibration records of the precision orifice dry gas meter and thermocouple bridge were available on site.

After each Official run the following were changed:

1. The glass fiber MSA .3 micron filter was shipped in its filter holder to the lab for weight determination.

2. The nozzle and probe were double washed with acetone. The washings were placed in containers for inclusion in the "Dry Catch."

3. The contents of Impingers #1 and 2 were measured and placed in a jar for subsequent lab analysis. The collection in Impinger #3 was measured and added to the Wet Catch. All impingers were washed with D.I. water and collected in containers.

4. The silica gel in Impinger #4 was changed and placed in an airtight container for shipment to the lab for weighing to determine the additional moisture collection.

A stainless steel shielded Chromel-Alumel thermocouple was used with a calibrated bridge to obtain accurate temperature readings in the exhaust during the test.

On Page 20 is the "Checklist for Isokinetic Stack Testing" which is utilized by the test team.

ROSSNAGEL & ASSOCIATES

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PROCEDURE #202
January 30, 1981

TOTAL PARTICULATE AND SULFATE LAB ANALYSIS

per

PENNSYLVANIA SOURCE TESTING MANUAL, PA.DER 1978

The analyses for particulate and dissolved residue and sulfate were performed as outlined in the supplied Pennsylvania Source Procedure.

The filters employed for the filtration of the Wet Catch for suspended particulate matter were Millipore GSWP04700, 47 mm diameter, .22 micron pore size.

Procedure: Particulate Analysis

1. Identify and desiccate for 24 hours sufficient filters to filter all liquid collectors and washings.
2. Weigh and record the weights of the filters in addition to the identification number.
3. Before filtering, measure to the nearest ml the volume of liquid in each impinger and record on worksheet. (Vol after test)
4. The impinger solutions are placed in a labeled container and any residue in the impinger is washed into the container using distilled water and a policeman.
5. The washings from the back half of the filter holder and interconnecting glassware is added to 4.
6. The nozzle, probe, front half of the filter holder and the cyclone or cyclone bypass are washed into labeled containers using distilled water. NOTE: any dry material in the cyclone is added to the glass fiber filter.
7. The impingers and the components in Step 5 are washed with acetone into a labeled container.
8. The components in Step 6 are washed with acetone into a labeled container.

   NOTE: Use suction on all filtering.

9. The solutions from (Steps 4 and 5) and (Step 6) are filtered separately using preweighed and identified Millipore filter(s).
10. The two filtrates from Step 9 are measured to the nearest ml and the volume recorded on the worksheet.
11. Air dry, then desiccate for 24 hours all filters used in the above steps. Weigh to the nearest .1 mg and record the weight on the worksheet. (Field personnel should desiccate only)

12. Identify and dry for 2 hours at 105 degrees ± 5 degrees C as many 350 ml evaporating dishes as are needed to evaporate the filtrates. Then desiccate until cool and weigh to the nearest .1 mg. Record the weights with its identification number on the worksheet.

13. Evaporate, using an evaporating dish prepared in 12, 300 ml of the filtrates from 10 and 300 ml of the distilled water (D.I.) separately to constant weight at 105 degrees ± 5 degrees C.-- Desiccate the residue until cool and weigh to the nearest .1 mg and record the weight. Field personnel will secure dishes to prevent loss of material or contamination during transit. THE WASHINGS FROM EACH INDIVIDUAL COLLECTION TRAIN HALF ARE TO BE KEPT SEPARATE.

14. Quantitatively transfer each acetone washing (from Step 8 and Step 7) into a preweighed evaporating dish after measuring and recording the volume of acetone.

15. Place a measured quantity of unused acetone into a preweighed evaporating dish. Normally, 200 ml is sufficient. THIS IS THE BLANK.

16. Evaporate both the blank (15) and the unknowns (14) at < 60 degrees C in vacuum.

17. Desiccate to constant weight and reweigh.

18. A sulfate analysis (turbimetric) is to be performed on the impinger residue from Step 13.

CHECKLIST

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A. PRELIMINARY SURVEY AND PRETEST:

1. Determine if upstream and downstream (simultaneous efficiency tests) or only downstream tests are required. What does Purchase Order and/or state application specify? Get copy of state/city application for installation to confirm test requirements.
2. Contact responsible operating personnel at test location.
3. Make survey of site:
   a. Determine location and size of test ports per RA Dwg. #A-0075C.
   b. Will staging be required? Will ports handle standard 3" NPT probe holder? Is E.P.A. train required? If not, what type train? Is wet catch required?
   c. Measure inside dimensions of breech, duct, stack or flue.
   d. Is adequate shop air available if aspirator is to be used?
   e. Is line voltage at site adequate under required load?
   f. Will temperature be too severe for test personnel at sample port at maximum operating conditions? What is maximum sampling temperature? Are radiation shields or asbestos suits required? Are wind screens required? Are any hazardous chemicals being emitted? If so, are special respirators needed?
   g. Will on-site personnel conduct all process loading and operation? Is sufficient and proper on-site refuse available in an incinerator test?
   h. Is a two way communication system required?
   i. Check effects from charging incinerator (temp., flow, smoke, etc.).
   j. On incinerator tests are firebox and secondary temperature indicating equipment available? When were they last calibrated?
   k. Determine if Sampling Method X, Y, Z or a special method will be used per applicable RA series of Form #20's.
   l. Is it safe to leave equipment overnight i.e. high temperature, wind, rain, vandalism or unusual operations?
   m. Is the roof flat enough for sampling train? If not, what can be done? What ladders, scaffolding, railings, etc. are required?
   n. Find out how the test equip. can best be raised to the testing point from the nearest safe parking place. Is a pulley or block & tackle req'd? Estimate time to raise equipment.
   o. Estimate equipment setup and travel time. Determine whether it is feasible to stay overnight?
   p. Take Polaroid photograph of test site if permitted for future reference.
4. Conduct preliminary velocity and temperature traverse. Fill out RA Form #15. Record time, calibration factor and type of pitot tube used. Take Wet Bulb & Dry Bulb check if exhaust is under 400 F.
5. Make Ringelmann/Opacity check (if applicable). Fill out either proper RA Form #17 or #17-O.
6. Determine exact manufacturing and model number of auxiliary equipment being used, such as:
   a. Auxiliary burners (primary, secondary, afterburners, etc.).
   b. Under fire fans? Over fire fans? In fire air blast?
   c. By-pass dampers? Inlet dampers? Static indicators? Temperature limits? Ozone or oxidizing adders?
   d. Is there a separate gas meter for gas burners on incinerator tests?
   e. Scrubbers, dust collectors, electrostatic precipitators, etc.
7. Make basic scaled sketch (with dimensions) of furnace, combustion chamber, vent, hoods, flue, scrubbers, incinerator, inlet and outlets, sampling downstream & upstream distances.
8. Determine height of stack above ground and distance to nearest property line.
9. Notify by phone call applicable government agency personnel of date and details if an Official Test. Confirm with letter and applicable distribution of copies to customer.
10. Check to see all needed supplies are in the test van; such as spare glass parts, sample jars, evacuated cylinders, Orsat, Bacharach, velometer, tachometer and low velocity electronic micromanometer. Use Van Checklist to assure all equipment is ready-to-use.
11. Would it help to pre-label sample jars and put the measured scrubbing agents in jars?
12. Put in writing any special test needs or potential problems such as state test forms needed, calibration data needed, list of tare weighed filters, minimum sampling volume, etc.
13. Make sure on-site gas meter, orifice, pitot, etc. have been properly calibrated and the attached tags reflect it.

B. LAB PREPARATION:

1. Identify, log and dry thimble/filters in oven (at 215 F. for 3 hours) and desiccate thimbles and filters for at least 24 hours before weighing. Follow special procedures on paper thimbles. Take tare weight of filters (to .0001 grams) on analytical balance. Keep weighed reference in desiccator. Record weights on RA Form #26.
2. Weigh drierite (or equivalent) drying agent for impinger train the day before the test. Store drierite in air tight containers.
3. What other special lab equipment or absorbing solutions are required for the test? During winter months do not leave solutions or liquid samples in test van outdoors overnight.

C. ON DAY OF AN OFFICIAL TEST:

1. Start Events Log Sheet on RA Form #28 upon arrival and then contact operating personnel at test location.
2. Carefully unload and set up equipment unless this is done the day before test. Be sure all ladders and any wind screens are properly secured.
3. Lay out exact probe entry dimension for each sampling point (as related to outer end of test port) per EPA requirements.
4. Mark and/or wire penetration distance on simultaneous reading pitot tube and sample probe. Allow for port, holder, etc. Fasten pitot to probe wherever possible. Mark pitot in relation to probe in order to detect any relative movement between them. When not possible to strap pitot to probe, then take readings at another known reference point in other test port.
5. Make velocity and temperature traverses. Record data on RA Form #15. In turbulent flow check attitude of pitot tube, both rotationally and longitudinally. Also note the type of pitot tube used (i.e. standard or special) on the RA Form #15. Always record time of traverse and process conditions.
6. Record wet and dry bulb readings of stack (up to 400 F.), atmosphere and process inlet air(when req'd). Calculate moisture % by volume per Form #55. Measure Ps, Pm & Tm. Record on Form #16.
7. Calculate flow and then nozzle size to give optimum (near 3/4 cfm.) sampling rate using Fig. 8 and 9 of E.P.A. testing procedure (which is printed on back of ACSSNAGEL & ASSOCIATES' Nomograph Model 81). Measure exact diameter of nozzle with micrometer or vernier caliper and record on Form 16.
8. Verify operating characteristics of equipment and/or process under test: max. or min. temperatures, rate (continuous or batch), input materials, charging cycle of incinerator, chemicals, solvents, etc. Get this information in writing and have it signed by a responsible plant authority.
9. Obtain barometric pressure reading for each run where possible.

10. Install filters from covered containers into filter holders - do not connect filter holder yet. Record filter S/N on RA Form #16.
11. Turn on vacuum pump and allow to warm up at least 15 minutes with bypass valve open.
12. Set up impinger contents as required. ADD ICE FOR CHILLED WATER. Do not connect into sample train yet. Be sure water is added to obtain greater surface area contact on impingers.
13. Connect filter(s) and impingers into train.
14. Make a leak check on sample train up to the nozzle with 15 inches H_g vacuum at V_2 on the pump. The ΔH across the calibrated orifice in RA Form #20 schematic shall be $\leq$.01 inches W.G. On E.P.A. tests leakage to be $\leq$.02 cu. ft. in 60 seconds @15"H_g. On L.A. Air Pollution Control District test system to hold 25 inches H_g (with pump off) for 3 minutes without losing more than 1 inch H_g. Release blockage at inlet and before opening bypass valve or shutting off pump. Remember to read V_m after shutting pump off.
15. Last thing before beginning run verify process is operating and process log is being maintained. Check process during test run.
16. When ready to begin test run, have No. 3 Tester put probe and nozzle in stack at first sample point along with velocity/temperature sensors. At signal from No. 3 Tester that he is in position, start pump and stop watch. Record actual time on log sheet. Adjust for isokinetic conditions. Note stack temperatures, time, pitot readings, orifice adjustment and meter temperature on proper forms.
17. At start of run take complete Ringelmann/Opacity readings on RA Form #17 or 17-0 as required by authorities. Record odors, etc. on RA Form #16. Shutdown pump when changing test ports.
18. The basic test team responsibilities are as follows:
    No.1 Tester (team leader) is responsible for all aspects of test, the team members proficiency and following this checklist. This includes total supervision, proper starting and ending of run plus determination and maintenance of isokinetics and all data. He is to make and record Opacity/Ringelmann observations and leak test. Obtain process information. He is to personally check process.
    No.2 Tester is primarily responsible for proper positioning of probe and adjustment. Communicate probe movements to No. 3 Tester to required isokinetics. He is also responsible for and is to assist No. 3 man as required. He too will maintain a periodic visual emissions check. He will watch instruments for indications of filter clogging or breakage, sticking V_m, leakage, etc. He is responsible for Orsat, Bacharach, evacuated cylinders or other special checks.
    No.3 Tester is stationed at test ports. He will move the probe to the correct sample point per the instructions of the No. 2 Tester. He will communicate loud and clear the time of the point change and the V_p reading immediately upon completion of the change. He will also maintain the stack temperature log and take W.B./D.B. readings, communicating them to the No. 2 Tester. He is responsible for assuring sample point change timing, odor and visual emissions checks.
19. Both the No. 1 & 2 Testers are responsible for communicating test point changes to No. 3 Tester. Insist on a reply when probe is in position.
20. Using ROSSNAGEL & ASSOCIATES' E.P.A. nomograph, correct sampling rate if moisture, temperature or velocity pressure conditions change more than 4%, 100 F. or .02 inches W.G. respectively.
21. Take integrated plus spot CO_2/CO samples in any combustion test as required for Bacharach, Orsat or Gas Chromatography analysis. CO_2 samples must be taken upstream of scrubber.
22. At completion of run, first shut down pump and take probe out of stack stream. Next read V_m and then reconduct the leak test. Be sure to slowly release vacuum in proper direction after leak check. Pour all liquid in hose into Impinger #1. Then flush hose as required (if E.P.A. test, follow E.P.A. procedures) plus inlet nozzle, hose, filter holder and collect residue in separate marked containers. Use bottle brush or rubber policeman to loosen adhering particulates.
23. Measure and record liquid volumes in every impinger on RA Form #54. Condensate collection is critical for a "moisture balance" check on any combustion process. Pour impinger contents into separate marked all glass containers. Keep #1 impinger separate for pH check. Use pHydrion paper if condensate is too small to collect. Do not mix flushes with original impinger collection in EPA Method 5 test.
24. Pour contents of preweighed drying agent from impinger into container to be weighed in lab (if required). Use rubber policeman as necessary. Seal containers with tape.
25. Carefully put filters and thimbles in proper closed protected and identified containers. Handle filter containers carefully to avoid tipping. Place in holders in test van.
26. Calculate isokinetics for first run to determine if sampling was within the required $\pm$ 10%. If not, find error and reset nomograph.
27. Repeat C-5 through C-25 for each run made. Make three one Hour runs or as otherwise specified. Two states allow one run Official Tests.

D. POST TEST LAB WORK (If an E.P.A. Test, follow special E.P.A. procedures):

1. Test team to submit all samples to lab with any special instructions plus responsibility in writing.
2. Transfer liquid samples to beakers for subsequent evaporation. Use a rubber policeman to facilitate the transfer of any adhering particles. For extremely difficult to remove residues use preweighed Gelman Type A glass fiber filters to wipe out the material.
3. Dry all filters and thimbles at 215 F. for three hours. Desiccate, cool and weigh to a constant reading. Follow separate procedure on paper thimbles.
4. Determine micron size of sample or residue when required per seperate procedure.
5. Desiccate all filters and thimbles at least 24 hours. Record final weight on ROSSNAGEL & ASSOCIATES Form #26.
6. Label filters and thimbles for permanent record. Save for one year.
7. Passivate probe, nozzle, thimble holder and clean any other equipment (such as impingers required) after this test. Restock equipment in test van.
8. Weigh silica gel to .1 gms. and report promptly to calculation section. Also do Orsat analysis so that velocity calculations and isokinetics may be calculated.
9. Do Orsat Analysis and silica gel weights within 48 hrs. as they are first data items needed by calculation group.

Written by: W.B. Rossnagel, P.E., President

Form #RA-27I

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AIR - WATER - ENERGY - INDUSTRIAL HYGIENE - NOISE - WASTE

- EXHAUST TESTING
- OF AIR / WATER / NOISE
- ION CONTROL SYSTEMS
- BACTERIA & LIMNOLOGY STUDIES
- SPECIFICATIONS / DRAWINGS
- WATER / WASTE WATER / BIOASSAYS
- CHEMICAL ANALYSES
- GAS CHROMATOGRAPHY, I. R. & A. A.
- ENVIRONMENTAL IMPACT STUDIES

PROCEDURE #130D
8/7/80

CALIBRATION PROCEDURE

ROSSNAGEL & ASSOCIATES uses the following calibration procedures for its field, test van, lab and shop equipment.

As part of its calibration program, ROSSNAGEL & ASSOCIATES built its own pitot tube wind tunnel to A.S.M.E. standards. This is used to calibrate our own pitot tubes plus those brought to us by other firms without such capability. Also, ROSSNAGEL & ASSOCIATES utilizes its own uniquely designed and manufactured precision orifice for field calibration of dry gas meters in its sample trains. This provides for disassembly, cleaning of the orifice and reassembly of the precision stainless steel orifice in less than a minute in the field.

Pitot Tubes: Are cleaned and usually inspected after each test series and redressed after each dusty or high temperature test and at least every 90 days. They are then checked for angles of alignment and condition of the face openings to ensure that they meet the specifications described in the FEDERAL REGISTER (Vol. 42, No. 160 - Thursday, August 18, 1977) for the use of a baseline coefficient value of .84. All pitots are serialized.

Dry Gas Meters: Are calibrated against the ROSSNAGEL & ASSOCIATES' primary standard wet gas meter at least every 90 days or more often if used in acid plant tests. Calibration of field test dry gas meters is recorded on Form #RA-181.

Nozzles: Are measured across three diameters with a vernier caliper before and after every test. When erosion occurs from a high temperature test, they are measured, redressed in our mechanical shop area and remeasured. All nozzles are serialized.

Thermocouple Bridges: Are purchased with the calibration curve and checked against the lab standard thermocouple bridge at least every 60 days.

Thermocouples: Are calibrated against an A.S.T.M. reference thermometer at boiling point, freezing point and across the temperature range of use after each field test series.

Pressure Transducers: Are calibrated at least every 60 days against a micro-manometer, correcting for capillary action effects.

Glass Thermometers: Are calibrated against the A.S.T.M. reference ± 1/4 F. thermometer at least every 60 days. They are checked at body temperature prior to every test.

WBR

W. B. Rossnagel
President

IV

CALCULATIONS

Dry Catch Emission Rate Calculations
Wet Catch Emission Rate Calculations
Percent Isokinetic Calculations
Velocity Calculations
Gas Flow Computation Sheets
Equal Area Sheet

Client	Phila. Coke
Plant Location	Phila., Pa.
Stack Exhaust Code	Hot Car Baghouse Exh.

EMISSION RATE CALCULATIONS Dry Catch

Notes: For basic equations see Steps 15, 16, 17 and 18.

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DATE OF TEST RUN →		1-9/12	COMPUTER PRINTOUT	1-13/14	COMPUTER PRINTOUT		COMPUTER PRINTOUT
FIELD & LAB DATA		RUN 1	1•	RUN 2	1•	RUN	
VOLUME OF GAS SAMPLE THROUGH DRY GAS METER (METER CONDITIONS) V_m (FT³)	1	25.39	25.39	66.13	66.13		
BAROMETRIC PRESS P_{bar} (IN. Hg A)	2	30.10	2• 30.10	30.10	2• 30.10		
GAS METER PRESSURE P_m (IN Hg) = $\frac{\Delta H \text{ Avg.}}{13.6}$	3	.0308	3• 0.03	.1522	3• 0.15		
GAS METER TEMPERATURE t_m (F)	4	27.7	4• 27.70	36.8	4• 36.80		
VOLUME OF GAS SAMPLE STD. CONDITIONS $V_{m\,STD} = \frac{17.71\,V_m(P_{bar}+P_m)}{T_m+460}$ (FT³)	5		5• 27.78		5• 71.32		
TOTAL VOLUME OF LIQUID COLLECTED IN IMPINGERS & SIL GEL V_{lc} (ml)	6	18.8	6• 18.80	43.3	6• 43.30		
VOLUME OF WATER VAPOR IN GAS SAMPLE (STD. COND.) $V_{w\,STD} = .0474\,V_{lc}$ (FT³)	7		7• 0.89		7• 2.05		
TOTAL VOLUME OF GAS SAMPLE @ STD. COND. $V_{TOTAL} = V_{m\,STD} + V_{w\,STD}$ (FT³)	8		8• 28.67		8• 73.37		
PERCENT MOISTURE BY VOLUME $B_{wo} = \frac{V_{w\,STD}}{V_{TOTAL}} \times 100$	9		9• 3.1		9• 2.8		
AMOUNT OF SAMPLE COLLECTED M_N (GMS)	10	.0095	10• 0.0095	.0207	10• 0.0207		
AVERAGE STACK GAS VELOCITY $V_{S\,AVG}$ (FT/SEC)	11	67.15	11• 67.15	68.85	11• 68.85		
CROSS-SECTIONAL AREA OF STACK A (FT²)	12	28.3	12• 28.30	28.3	12• 28.30		
AVERAGE STACK GAS TEMP. $t_{S\,AVG.}$ (F)	13	40.4	13• 40.40	76.1	13• 76.10		
STACK GAS STATIC PRESSURE P_S (IN. Hg A)	14	30.10	14• 30.10	30.10	14• 30.10		
ACTUAL FLOW ACFM $Q'_S = 60\,V_{S\,AVG}\,A$ (FT³/MIN)	15		15• 114020.7		15• 116907.3		
FLOW RT. STD. SCFM CONDITIONS $Q'_S = \frac{17.71\,Q'_S\,P_S}{(t_{S\,AVG}+460)}$ (1-Bwo DRY)	16		16• 117689.9		16• 112995.0		
EMISSION RATE OF PARTICULATES $W_S = \frac{.1323\,M_N\,Q'_S}{V_{M\,STD}}$ (LB/HR) DRY	17		17• 5.3751		17• 4.3389		
CONCENTRATION IN GRAINS/SCFD (DRY BASIS) $C'_S = \frac{15.43\,M_N}{V_{M\,STD}}$ (DRY)	18		18• 0.0053		18• 0.0045		

FORM "RA 138-31 EPA REVISED 2/11/77

CALC. BY: MG DATE: 1-16-81 CHECKED BY: WAL DATE: 1/28 PAGE: 23

Client	Phila Co Ko.
Plant Location	Phila Pa.
Stack Exhaust Code	Hot Cap Baghouse exhaust

EMISSION RATE CALCULATIONS

WET

Notes: For basic equations see Steps 15, 16, 17 and 18. CATCH.

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DATE OF TEST RUN →		1-9/12 RUN 1	COMPUTER PRINTOUT	1-13/16 RUN 2	COMPUTER PRINTOUT	RUN	COMPUTER PRINTOUT
FIELD & LAB DATA							
VOLUME OF GAS SAMPLE THROUGH DRY GAS METER (METER CONDITIONS) V_M (FT³)	1	25.39	1• 25•39	66.13	1• 66•13		
BAROMETRIC PRESS P_{bar} (IN. Hg A)	2	30.10	2• 30•10	30.10	2• 30•10		
GAS METER PRESSURE P_M (IN Hg) = $\frac{\Delta H \text{ Avg.}}{13.6}$	3	.0308	3• 0•03	.1522	3• 0•15		
GAS METER TEMPERATURE t_m (F)	4	27.7	4• 27•70	36.8	4• 36•80		
VOLUME OF GAS SAMPLE STD. CONDITIONS $V_{M\,STD} = \frac{17.71 V_M (P_{bar} + P_M)}{T_M + 460}$ (FT³)	5		-5• 27•78		-5• 71•32		
TOTAL VOLUME OF LIQUID COLLECTED IN IMPINGERS & SIL GEL V_{lc} (ml)	6	18.8	6• 18•80	43.3	6• 43•30		
VOLUME OF WATER VAPOR IN GAS SAMPLE (STD. COND.) $V_{W\,STD} = .0474 V_{lc}$ (FT³)	7		-7• 0•89		-7• 2•05		
TOTAL VOLUME OF GAS SAMPLE @ STD. COND. $V_{TOTAL} = V_{M\,STD} + V_{W\,STD}$ (FT³)	8		-8• 28•67		-8• 73•37		
PERCENT MOISTURE BY VOLUME $B_{WO} = \frac{V_{W\,STD}}{V_{TOTAL}} \times 100$	9		-9• 3•1		-9• 2•8		
AMOUNT OF SAMPLE COLLECTED M_N (GMS)	10	.0265	10• 0•0265	.0144	10• 0•0144		
AVERAGE STACK GAS VELOCITY $V_{S\,AVG}$ (FT/SEC)	11	67.15	11• 67•15	68.81	11• 68•85		
CROSS-SECTIONAL AREA OF STACK A (FT²)	12	28.3	12• 28•30	28.3	12• 28•30		
AVERAGE STACK GAS TEMP. $t_{S\,AVG.}$ (F)	13	40.4	13• 40•40	76.1	13• 76•10		
STACK GAS STATIC PRESSURE P_S (IN. Hg A)	14	30.10	14• 30•10	30.10	14• 30•10		
ACTUAL FLOW ACFM $Q'_S = 60 V_{S\,AVG.} A$ (FT³/MIN.)	15		-15• 114,020•7		-15• 116,907•3		
FLOW RT STD. SCFM $Q'_S = \frac{17.71 Q'_S P_S}{(t_{S\,AVG} + 460)}$ (FT³/MIN DRY)	16		-16• 117,689•9		-16• 114995•0		
EMISSION RATE OF PARTICULATES $W_S = \frac{.1323 M_N Q'_S}{V_{M\,STD}}$ (LBS/HR DRY)	17		-17• 14•8529		-17• 3•0184		
CONCENTRATION IN GRAINS/SCFD (DRY BASIS) $C'_S = \frac{15.43 M_N}{V_{M\,STD}}$ (DRY)	18		-18• 0•0147		-18• 0•0031		

FORM EPA 138.31.EPA

CALC. BY: MG DATE: 1-16-81 CHECKED BY: DWR DATE: 1/28 PAGE: 24

CLIENT	Ohilg Coke
PLANT LOCATION	Ohilg Ca
STACK/EXHAUST	Hot Gas Bypass Exhaust
ODE/CHAPTER	

% ISOKINETIC SAMPLING CALCULATIONS

NOTES:

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DATE OF TEST RUN →		RUN 1	COMPUTER PRINTOUT	1-13-71 RUN 2	COMPUTER PRINTOUT	RUN	COMPUTER PRINTOUT
FIELD & LAB DATA							
AVERAGE STACK GAS TEMPERATURE $t_{s_{AVG}}$ (F)	1	40.4	1• 40•40	66.13	1• 66•13		
TOTAL VOLUME OF LIQUID COLLECTED (IMP & SIL GEL) V_{lc} (ml)	2	18.8	2• 18•80	43.3	2• 43•30		
GAS METER TEMPERATURE t_m (F)	3	27.7	3• 27•70	36.8	3• 36•80		
VOL. OF GAS SAMPLED THRU DRY GAS METER @ METER CONDITIONS V_m (FT^3)	4	25.39	4• 25•39	66.13	4• 66•13		
BAROMETRIC PRESSURE P_{bar} (IN.Hg A)	5	30.10	5• 30•10	30.10	5• 30•10		
GAS METER PRESSURE $P_m = \frac{\Delta H}{13.6}$ (IN. Hg)	6	.0308	6• 0•03	.1522	6• 0•15		
AVERAGE STACK GAS VELOCITY $(V_s)_{AVG}$ (FT/sec)	7	67.15	7• 67•15	68.85	7• 68•85		
ABSOLUTE STACK GAS STATIC PRESS. P_s (IN. Hg A)	8	30.10	8• 30•10	30.10	8• 30•10		
SAMPLING NOZZLE DIAMETER d_n (INCHES)	9	.125	9• 0•12	.1875	9• 0•18		
SAMPLING TIME θ (MIN.)	10	73.4	10• 73•400	86.9	10• 86•900		
% ISOKINETIC SAMPLING I (%)	11		106•8		105•2		

$$I = \frac{305.6\,(t_{s\,AVG}+460)\,[.00267\,V_{lc}\,(t_m+460)+V_m(P_{bar}+P_m)]}{\theta\,(t_m+460)\,(V_s)_{AVG}\,P_s\,(d_n)^2}$$

FORM 139.10 EPA
REVISED 2/8/78

CALC. BY: [illegible] DATE: 1-16-71 CHECKED BY: ASR DATE: 1/22 PAGE: 25

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Run # 1 Job # 9672

Client Phila Coke Ohila Pa

$M_d = .44(\%CO_2) + .32(\%O_2) + .28(\%N_2 + \%CO)$

1) $.44 \times (\%CO_2) = .44 \times (\quad) =$

2) $.32 \times (\%O_2) = .32 \times (\quad) =$

3) $.28 \times (\%N_2 + \%CO) = .28 \times (\quad + \quad) =$ _____

4) $\therefore M_d =$ _____ lb/lb-mole(dry)

5) $B_{wo} =$ _____ %

See page 3

$M_s = M_d(1 - B_{wo}/100) + .18\, B_{wo}$ lb/lb-mole (wet)

6) $M_s =$ _____ lb/lb-mole(wet)

			Computer Printout
7)	Avg $\sqrt{\Delta P}$		Page 1 of 3 CONTINUED
8)	F_s	1.	
9)	t_s Avg.	2.	
10)	P_s	3.	
11)	M_s	4.	
12)	V_s Avg Ft/Sec		

$(V_s)_{Avg.} = 85.48 F_s (\sqrt{\Delta P})_{Avg.} \sqrt{\dfrac{t_{s\,Avg} + 460}{P_s M_s}}$ Ft/sec.

Where: $F_s = .99$ For Std. Pitot

$F_s = .84$ For Special Pitot (Type "S")

NOTES: 1) M_d = Mol. Wt. Dry

2) M_d = 28.84 lb/lb-mole for Std. Dry Air

3) M_s = Mol. Wt. Corrected for Moisture

CALC. BY: MG DATE: 1-16-81

CHECKED BY: MBR DATE: 1/22/81

(Vs) CALCULATION

1.	1.8000
0.	2.5000
	3.3541
2.	1.6000
0.	2.0000
	2.5298
3.	1.7000
0.	2.0000
	2.6076
4.	1.8000
0.	2.0000
	2.6832
5.	2.0000
0.	1.8300
	2.5580
6.	2.2000
0.	1.9200
	2.8476
7.	1.2000
0.	1.5800
	1.7306
8.	2.0000
0.	2.5000
	3.5355
9.	1.5000
0.	2.3300
	2.9472
10.	1.6000
0.	1.5300
	1.9353
11.	1.7000
0.	2.2500
	2.9336
12.	1.6000
0.	2.7500
	[illegible]

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Run # 1 Job # 9672

Client Phila Coke. Ohio Pa

$M_d = .44(\%CO_2) + .32(\%O_2) + .28(\%N_2 + \%CO)$

1) $.44 \times (\%CO_2) = .44 \times (\quad) =$

2) $.32 \times (\%O_2) = .32 \times (\quad) =$

3) $.28 \times (\%N_2 + \%CO) = .28 \times (\quad + \quad) =$ _____

4) $\therefore M_d =$ _____ lb/lb-mole(dry)

5) $B_{wo} =$ _____ %

$M_s = M_d(1 - B_{wo}/100) + .18\,B_{wo}$ lb/lb-mole (wet)

6) $\therefore M_s =$ _____ lb/lb-mole(wet)

		Computer Printout
7)	$Avg \sqrt{\Delta P}$	
8)	F_s	1.
9)	t_s Avg.	2.
10)	P_s	3.
11)	M_s	4.
12)	V_s Avg Ft/Sec	

Page 1 of 3 CONTINUED

$(V_s)_{Avg.} = 85.48 F_s (\sqrt{\Delta P})_{Avg.} \sqrt{\frac{t_{s\,Avg} + 460}{P_s M_s}}$ Ft/sec.

Where: $F_s = .99$ For Std. Pitot

$F_s = .84$ For Special Pitot (Type "S")

NOTES: 1) M_d = Mol. Wt. Dry

2) M_d = 28.84 lb/lb-mole for Std. Dry Air

3) M_s = Mol. Wt. Corrected for Moisture

CALC. BY: MG DATE: 1-16-81

CHECKED BY: MBR DATE: 1/22/81

Form #RA-141.210 Pg. 26

			1.	1.8060
1	1.5 (Min.)		2.	2.5000
	2.5 x Time		3.	3.3541
			1.	1.6000
2	2		2.	2.0000
	2 x Time		3.	2.5298
			1.	1.7000
3	2		2.	2.0000
	2 x Time		3.	2.6076
			1.	1.8000
4	2		2.	2.0000
	2 x Time		3.	2.6932
			1.	2.0000
5	1.83		2.	1.8300
	$\sqrt{\Delta P}$ x Time		3.	2.5000
			1.	2.2000
6	1.92		2.	1.9200
	$\sqrt{\Delta P}$ x Time		3.	2.8476
			1.	1.2000
7	1.58		2.	1.5800
	$\sqrt{\Delta P}$ x Time		3.	1.7308
			1.	2.0000
8	2.15		2.	2.0000
	$\sqrt{\Delta P}$ x Time		3.	3.0355
			1.	1.6000
9	2.33		2.	1.8300
	$\sqrt{\Delta P}$ x Time		3.	2.9472
			1.	1.6000
10	1.53		2.	1.5300
	$\sqrt{\Delta P}$ x Time		3.	1.9393
			1.	1.7000
11	2.24		2.	2.2500
	$\sqrt{\Delta P}$ x Time		3.	2.9336
			1.	1.6000
12	2.72		2.	2.7500
	$\sqrt{\Delta P}$ x Time		3.	3.6785

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Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055

Run # 1 Job # 9672

Client Phila. Coke Phila Pa.

$M_d = .44(\%CO_2) + .32(\%O_2) + .28(\%N_2 + \%CO)$

1) $.44 \times (\%CO_2) = .44 \times (\quad) =$

2) $.32 \times (\%O_2) = .32 \times (\quad) =$

3) $.28 \times (\%N_2 + \%CO) = .28 \times (\quad + \quad) =$ _____

4) $\therefore M_d =$ _____ lb/lb-mole(dry)

See Page 3

5) $B_{wo} =$ _____ %

$M_s = M_d(1 - B_{wo}/100) + .18 B_{wo}$ lb/lb-mole (wet)

6) $\therefore M_s =$ _____ lb/lb-mole(wet)

		Computer Printout
7)	Avg $\sqrt{\Delta P}$	Page 2 of 3 CONTINUED
8)	F_s	1.
9)	t_s Avg.	2.
10)	P_s	3.
11)	M_s	4.
12)	V_s Avg Ft/Sec	

$$(V_s)_{Avg.} \text{ Ft/sec.} = 85.48 F_s (\sqrt{\Delta P})_{Avg.} \sqrt{\frac{t_{s\,Avg} + 460}{P_s M_s}}$$

Where: $F_s = .99$ For Std. Pitot

$F_s = .84$ For Special Pitot (Type "S")

NOTES: 1) M_d = Mol. Wt. Dry

2) M_d = 28.84 lb/lb-mole for Std. Dry Air

3) M_s = Mol. Wt. Corrected for Moisture

CALC. BY: MR DATE: 1-16-81

CHECKED BY: WBR DATE: 1/22/81

Velocity (V_s) Calculation

Pt.	Time (Min.)		Computer Printout
			13•
1			1•6000
	1.50		0•
	x Time		1•5800
			2•1197
			14•
2			1•6000
	1.58		0•
	x Time		1•5800
			2•1197
			15•
3			1•9000
	1.58		0•
	x Time		1•5800
			2•1778
			15•
4			1•6000
	1.67		0•
	x Time		1•6700
			2•1124
			17•
5			1•5000
	1.43		0•
	x Time		1•6300
			2•2412
			18•
6			1•4000
	2.24		0•
	x Time		2•2500
			2•6622
			19•
7			1•4000
	3.03		0•
	x Time		3•0300
			3•5351
			20•
8			1•3000
	2.20		0•
	x Time		2•2000
			2•5033
			21•
9			1•2000
	3.13		0•
	x Time		3•1300
			3•4287
			22•
10			1•1000
	2.50		0•
	x Time		2•5500
			2•6744
			23•
11			1•1000
	1.0		0•
	x Time		1•0300
			1•0488
			24•
12			1•4000
	2.13		0•
			2•1300

Velocity (V_s) Calculation

Time (min.)		Computer Printout
		25.
	1	1.1000
1.		0.
2.47		2.4700
Δp x Time		2.5908
		26.
	2	1.0000
2.1.85		0.
Δp x Time		1.8300
		1.8300
		27.
1.	3	1.1000
1.92		0.
Δp x Time		1.9200
		2.0137
		28.
3	4	1.3000
2.3		0.
Δp x Time		2.3000
		2.6224
		29.
1.4	5	1.4000
1.75		0.
Δp x Time		1.7500
		2.0706
		30.
1.3	6	1.3000
1.67		0.
Δp x Time		1.6700
		1.9640
		31.
1.5	7	1.5000
2.35		0.
Δp x Time		2.3500
		2.6781
		32.
1.5	8	1.5000
1.65		0.
Δp x Time		1.6500
		2.2412
		33.
1.7	9	1.7000
2.67		0.
Δp x Time		2.6700
		3.4312
		34.
1.6	10	1.0000
1.67		0.
Δp x Time		1.6700
		2.1124
		35.
1.6	11	1.0000
1.65		0.
Δp x Time		1.6500
		2.0871
		36.
1.2	12	1.2000
1.52		0.
Δp x Time		1.5200
		1.8656

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Run # 1 Job # 9672

Client Phila. Coke, Phila Pa.

$M_d = .44(\%CO_2) + .32(\%O_2) + .28(\%N_2 + \%CO)$

1) $.44 \times (\%CO_2) = .44 \times (.8) =$ (WE 2 readings)

2) $.32 \times (\%O_2) = .32 \times (18.4) =$

3) $.28 \times (\%N_2 + \%CO) = .28 \times (80.8) =$

4) $\therefore M_d =$ 25.8 lb/lb-mole(dry)

5) $B_{wo} =$ 3.1 %

$M_s = M_d(1 - B_{wo}/100) + .18\,B_{wo}$ lb/lb-mole (wet)

6) $\therefore M_s =$ 28.53 lb/lb-mole(wet)

				Computer Printout
7)	Avg $\sqrt{\Delta P}$			1.2251
8)	F_s	.84	1.	-1. 0.8400
9)	t_s Avg.	40.4	2.	-2. 40.4000
10)	P_s	30.1	3.	-3. 30.1000
11)	M_s	28.53	4.	-4. 28.5400
12)	V_s Avg. Ft/Sec.			67.1422

$$(V_s)_{Avg.} \text{ Ft/sec.} = 85.48 F_s (\sqrt{\Delta P})_{Avg.} \sqrt{\frac{t_{s\,Avg.} + 460}{P_s M_s}}$$

Where: $F_s = .99$ For Std. Pitot

$F_s = .84$ For Special Pitot (Type "S")

NOTES: 1) M_d = Mol. Wt. Dry

2) M_d = 28.84 lb/lb-mole for Std. Dry Air

3) M_s = Mol. Wt. Corrected for Moisture

CALC. BY: MG DATE: 1.16.81

CHECKED BY: WBK DATE: 1/22/81

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Run # 2 Job # 9672.
Client Phila. Co. Phila. Pa.

$M_d = .44(\%CO_2)+.32(\%O_2)+.28(\%N_2+\%CO)$

1) $.44 \times (\%CO_2) = .44 \times (\quad) =$

2) $.32 \times (\%O_2) = .32 \times (\quad) =$

3) $.28 \times (\%N_2+\%CO) = .28 \times (\quad + \quad) =$ _____

4) $\therefore M_d =$ _____ lb/lb-mole(dry)

5) $B_{wo} =$ _____ %

See Page 3.

$M_s = M_d(1-B_{wo}/100)+.18B_{wo}$ lb/lb-mole (wet)

6) $\therefore M_s =$ _____ lb/lb-mole(wet)

			Computer Printout
7)	Avg $\sqrt{\Delta P}$		Page 1 of 3 CONTINUED
8)	F_s	1.	
9)	t_s Avg.	2.	
10)	P_s	3.	
11)	M_s	4.	
12)	V_s Avg Ft/Sec		

$$(V_s)_{Avg.} \text{ Ft/sec.} = 85.48 F_s (\sqrt{\Delta P})_{Avg.} \sqrt{\frac{t_{s\,Avg} + 460}{P_s M_s}}$$

Where: $F_s = .99$ For Std. Pitot
$F_s = .84$ For Special Pitot (Type "S")

NOTES: 1) M_d = Mol. Wt. Dry
2) M_d = 28.84 lb/lb-mole for Std. Dry Air
3) M_s = Mol. Wt. Corrected for Moisture

CALC. BY: MF DATE: 1-16-81
CHECKED BY: MJR DATE: 1/22/81

Velocity (V_s) Calculation

Computer Printout

1	1.	1.9000	
	2.	3.2000	
		4.4108	
2	1.	1.9000	
	2.	2.1000	
		2.8946	
3	1.	1.6000	3.67 Time
	2.	3.0700	
		4.5238	
4	1.	1.6000	3.07 Time
	2.	3.0700	
		3.8632	
5	1.	1.7000	3.40 Time
	2.	3.5000	
		5.0849	
6	1.	1.6000	3.60 Time
	2.	3.6000	
		4.5536	
7	1.	2.1000	2.00 Sr x Time
	2.	2.8000	
		2.8982	
8	1.	2.0000	2.42 Sr x Time
	2.	2.4200	
		3.4223	
9	1.	1.7000	1.88 Sr x Time
	2.	1.9800	
		2.4512	
10	1.	1.7000	1.82 Sr x Time
	2.	1.8300	
		2.5860	
11	1.	1.6000	2.43 Sr x Time
	2.	2.8300	
		3.5796	
12	1.	1.8000	1.67 Sr x Time
	2.	1.9700	

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Run # 2 Job # 9672

Client Phila. Coke Phila Pa.

Velocity (Vs) Calculation

Time (Min.)		Computer Printout
		15.
		1.0000
1		0.
2.18		2.1200
Σ Time		2.9247
		14.
		1.9000
2		0.
2.03		2.0300
Σ Time		2.7991
		15.
		1.7000
3		0.
2.04		2.0400
Σ Time		2.8598
		16.
		1.6000
4		0.
1.25		1.2500
Σ Δp x Time		1.5811
		17.
		1.5000
5		0.
2.33		2.3300
Σ Δp x Time		2.6536
		18.
		1.2000
6		0.
2.32		2.3200
Σ Δp x Time		2.5414
		19.
		1.1000
7		0.
1.13		1.1300
Σ Δp x Time		1.1351
		20.
		1.1000
8		0.
1.13		1.1300
Σ Δp x Time		1.1351
		21.
		1.0000
9		0.
2.75		2.7500
Σ Δp x Time		2.7500
		22.
		0.9500
10		0.
2.42		2.4200
Σ Δp x Time		2.3587
		23.
		1.1000
11		0.
2.00		2.2000
Σ Δp x Time		2.3373
		24.
		1.9000
12		0.
2.65		2.6300

$M_d = .44(\%CO_2) + .32(\%O_2) + .28(\%N_2 + \%CO)$

1) $.44 \times (\%CO_2) = .44 \times (\quad) =$

2) $.32 \times (\%O_2) = .32 \times (\quad) =$

3) $.28 \times (\%N_2 + \%CO) = .28 \times (\quad + \quad) =$ _____

4) $\therefore M_d =$ _____ lb/lb-mole(dry)

See page 3

5) $B_{wo} =$ _____ %

$M_s = M_d(1 - B_{wo}/100) + .18 B_{wo}$ lb/lb-mole (wet)

6) $\therefore M_s =$ _____ lb/lb-mole(wet)

			Computer Printout
7)	Avg. $\sqrt{\Delta P}$		Page 2 & 3 Continued →
8)	F_s	1.	
9)	t_s Avg.	2.	
10)	P_s	3.	
11)	M_s	4.	
12)	V_s Avg Ft/Sec		

$$(V_s)_{Avg.} \text{ Ft/sec.} = 85.48 F_s (\sqrt{\Delta P})_{Avg.} \sqrt{\frac{t_{s\,Avg} + 460}{P_s M_s}}$$

Where: $F_s = .99$ For Std. Pitot

$F_s = .84$ For Special Pitot (Type "S")

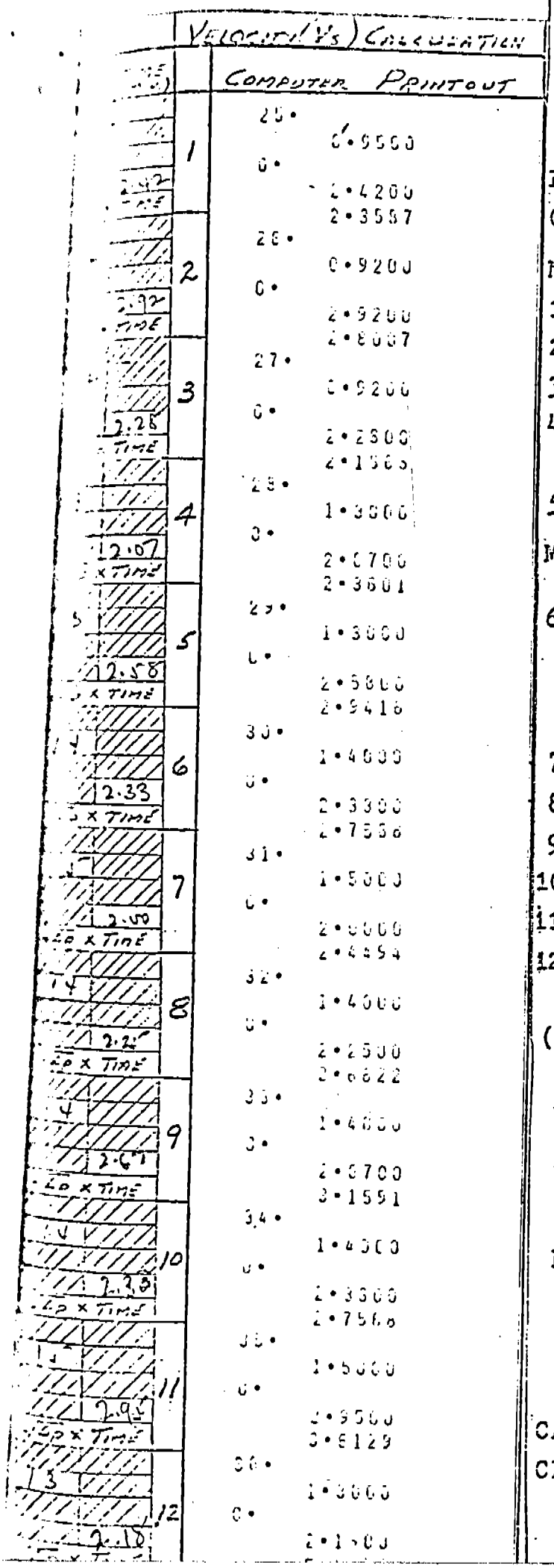
NOTES: 1) M_d = Mol. Wt. Dry

2) M_d = 28.84 lb/lb-mole for Std. Dry Air

3) M_s = Mol. Wt. Corrected for Moisture

CALC. BY: MC DATE: 1-16-81

CHECKED BY: WSK DATE: 1/24/81



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Run # 2 Job # 9672

Client Phila Gas Co. Phila Pa.

$M_d = .44(\%CO_2) + .32(\%O_2) + .28(\%N_2 + \%CO)$

1) $.44 \times (\%CO_2) = .44 \times (\quad) =$ (avg. of 2 readings)

2) $.32 \times (\%O_2) = .32 \times (\quad) =$

3) $.28 \times (\%N_2 + \%CO) = .28 \times (\quad) =$

4) $\therefore M_d =$ 28.95 lb/lb-mole(dry)

5) $B_{wo} =$ 2.8 %

$M_s = M_d(1 - B_{wo}/100) + .18\,B_{wo}$ lb/lb-mole (wet)

6) $\therefore M_s =$ 28.15 lb/lb-mole(wet)

				Computer Printout
7)	Avg $\sqrt{\Delta P}$			1.2161 1.4773
8)	F_s	.84	1.	-1. 0.8400
9)	t_s Avg.	76.1	2.	-2. 76.1000
10)	P_s	30.10	3.	-3. 30.1000
11)	M_s	28.15	4.	-4.
12)	V_s Avg Ft/Sec			28.5400 85.9851

$$(V_s)_{Avg.} \text{ Ft/sec.} = 85.48 F_s (\sqrt{\Delta P})_{Avg.} \sqrt{\frac{t_{s\,Avg.} + 460}{P_s M_s}}$$

Where: $F_s = .99$ For Std. Pitot

$F_s = .84$ For Special Pitot (Type "S")

NOTES: 1) M_d = Mol. Wt. Dry

2) M_d = 28.84 lb/lb-mole for Std. Dry Air

3) M_s = Mol. Wt. Corrected for Moisture

CALC. BY: mc DATE: 1/21/81

CHECKED BY: CMR DATE: 1/22/81

Customer Phila. Coke
Location Phila, Pa
Unit Buell Boghouse Stack
Sketch (if applicable)

GAS FLOW COMPUTATION SHEET

Test No. 04 Test Team RB-SH
Date 1-8-80
Barometer 30.10 in. Hg.

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Mid-Atlantic Division
1217 Central Avenue
Charlotte, N. C. 28204

Southeastern Division
250 Arizona Avenue N.E.
Atlanta, Georgia 30307

Dry Bulb 84 F. Time 1:40 AM/PM Pitot Type Spec.
Wet Bulb 80 F. SP + 0 in WG / in Hg Fs for Pitot .84

INLET ☐ OUTLET ☑

	SAMPLING POINT	V_p in. W.G.	$\sqrt{V_p}$	Temp. t_s F.	Velocity fpm
1.	5	.2	1.095		
2.	2	.6	1.265		
3.	3	.6	1.265	84	
4.	4	.5	1.225		
5.	5	.2	1.095		
6.	6	.1	1.048	84	
7.	7	.1	1.048		
8.	8	.96	.979	84	
9.	9	.97	.985		
10.					
11.					
12.					
			10.005		Total
			1.111		Avg.

Formulae & Calculations:

1. t_s (Avg.) = 84 + 460 = 544 T_s (Rankin)
2. Duct Area = A = $\frac{\pi 72 \times 72}{4 \times 144}$ = 28.26 sq.ft.
3. P_s = Barometer ± SP = 30.10 / 1.006 in. Hg.
4.* G. D. = $\rho_s \left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = .0735 lbs./cu.ft
5.* K = Constant = $\frac{1096.5}{\sqrt{G.D.}}$ = $\frac{1096.5}{.271}$ = 4,046
6.* V = Velocity = $K F_s \sqrt{V_{P\,AVG.}}$ = 4,046 × .94 × 1.111 = 3,775.9 ft/min.
7.* VOLUME average = A×V = 28.26 × 3,775.9 = 106,707 ACFM
8. SCFM = Volume $\left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = 106,707 × .97 = 104,586 SCFM

* Continuous calculation, do not clear calculator

Based on one test port only

Page 32

Dry Bulb ___ F. Time ___ AM/PM Pitot Type ___
Wet Bulb ___ F. SP + ___ in WG / in Hg Fs for Pitot ___

INLET ☐ OUTLET ☐

SAMPLING POINT	V_p in. W.G.	$\sqrt{V_p}$	Temp. t_s F.	Velocity fpm
				Total
				Avg.

1. t_s (Avg.) = ___ + 460 = ___ T_s (Rankin)
2. Duct Area = A = ___ = ___ sq. ft.
3. P_s = Barometer ± SP = ___ in. Hg.
4.* G. D. = $\rho_s \left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = ___ lbs/cu. ft.
5.* K = Constant = $\frac{1096.5}{\sqrt{G.D.}}$ = ___ / ☐ = ___
6.* V = Velocity = $K F_s \sqrt{V_{P\,AVG.}}$ ___ = ___ ft/min.
7.* VOLUME average = A×V = ___ ACFM
8. SCFM = Volume $\left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = ___ SCFM

ρ_s = Spec. Wt. of Air = .075 lbs/ft³

Calculated by ___ Approved by ___ Date 1/10/80

Customer Phila. Coke
Location Phila, PA
Unit Byell Baghouse Stack
Sketch (if applicable)

GAS FLOW COMPUTATION SHEET

Test No. 07 Test Team RB-SH
Date 1-8-81
Barometer 30.10 in. Hg.

Engineering & Testing Consultants
Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055

Mid-Atlantic Division
1217 Central Avenue
Charlotte, N. C. 28204

Southeastern Division
250 Arizona Avenue N.E.
Atlanta, Georgia 30307

Calculated by [illegible] Approved by [illegible]
Date 1/11/81 Date 1-26-81

Dry Bulb 84 F. Time 1:00 AM PM Pitot Type Spec.
Wet Bulb ___ F. SP + 0 in WG in Hg F_B for Pitot .84

	INLET SAMPLING POINT	INLET V_p in. W.G.	INLET $\sqrt{V_p}$	OUTLET ✓ Temp. t_s F.	OUTLET ✓ Velocity fpm
1.	S 1	1.5	1.225	84	
2.	2	1.5	1.225		
3.	3	1.5	1.225		
4.	4	1.8	1.342	84	
5.	5	1.4	1.183		
6.	6	1.3	1.140		
7.	7	1.2	1.140	84	
8.	8	.45	.475		
9.	9	—			
10.					
11.					
12.			9.455		Total
			1.182		Avg.

Dry Bulb ___ F. Time ___ AM PM Pitot Type Spec.
Wet Bulb ___ F. SP + ___ in WG in Hg F_B for Pitot .84

INLET SAMPLING POINT	INLET V_p in. W.G.	INLET $\sqrt{V_p}$	OUTLET Temp. t_s F.	OUTLET Velocity fpm
				Total
				Avg.

Formulae & Calculations:

1. t_s (Avg.) = 84 + 460 = 544 T_s (Rankin)
2. Duct Area = A = $\frac{\pi \times 72 \times 72}{4 \times 144}$ = 28.26 sq.ft.
3. P_s = Barometer ± SP = 30.10 in. Hg.
4.* G. D. = $\rho_s \left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = .0735 lbs./cu.ft
5.* K = Constant = $\frac{1096.5}{\sqrt{G.D.}}$ .271 = 4,046
6.* V = Velocity = $K F_s \sqrt{V_{P_{AVG.}}}$ 4,017.2 ft/min.
7.* VOLUME average = A×V = 113,525 ACFM
8. SCFM = Volume $\left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = 111,270 SCFM

* Continuous calculation, do not clear calculator

Based on one test port only

1. t_s (Avg.) = ___ + 460 = ___ T_s (Rankin)
2. Duct Area = A = ___ = ___ sq. ft.
3. P_s = Barometer ± SP = ___ in. Hg.
4.* G. D. = $\rho_s \left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = ___ lbs/cu. ft.
5.* K = Constant = $\frac{1096.5}{\sqrt{G.D.}}$ ___ = ___
6.* V = Velocity = $K F_s \sqrt{V_{P_{AVG.}}}$ ___ ft/min.
7.* VOLUME average = A×V = ___ ACFM
8. SCFM = Volume $\left(\frac{530}{T_s}\right)\left(\frac{P_s}{29.92}\right)$ = ___ SCFM

ρ_s = Spec. Wt. of Air = .075 lbs/ft³

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JOB Phila. Coke Co
LOCATION Phila Pa.
DATE 1/13 1/14 1981
Hot Car Hand Baghouse Exh. Stack

% MOISTURE CALCULATION

Engineering & Testing Consultants
Air - Water - Noise

	CONDENSATE METHOD #									WET & DRY BULB METHOD					
	V_m (ft^3)	t_m (F.)	P_b ("Hg)	$P_b - P_m$ ("Hg)	V.P. of Water @ t_m ("Hg)	Vw. Condensate (ml)	Vv $= .00267 \frac{V_w \times T_m}{P_b - P_m}$ ($T_m = 460 + F$)	Corr. factor Mm $= \frac{V.P. \times V_m}{P_b - P_m}$ △	Q % Moisture $= \frac{V_v + M_m}{V_v + V_m} \times 100$	t_{Dry} (F.)	t_{Wet} (F.)	V.P. of Water @ t_{Dry} ("Hg)	% Rel. Humidity (Do not use decimal) ##	% Moisture $\frac{V.P. \times \% R.H.}{P_s}$	Remark 30.15
1							Run # 2	1/13		65	62	.6222	75	1.6%	
2								1/13		64	62	.6009	77	1.5%	avg
3								1/14		88	84	1.335	82	3.6%	2.3%
4								1/14		94	90	1.610	84	4.5%	
5								1/8		84	80	1.175	80	3.1%	
6															
7															
8															
9															

Pb = Barometric Pressure ("Hg) ABS. V.P. = Vapor Pressure $V1_c$ = Vw
Pm = Pressure (△H) @ meter, with EPA train use Pb + △H/13.6
# = From WP-50 ## = From Psychometric Chart Q = % Moisture by Volume
R.H.= % Vapor Pressure
△ Do not use Mm when water is used in impingers and silica gel is used.
Ps = Pressure in Stack sampling ports ("Hg)
Percent moisture means the percent of water vapor volume as compared to total air volume.
When $t_{Dry} = t_{Wet}$ the air is 100% saturated = 100% R.H.

Data by RK
Date 1/14
Calc's. by MG
Date 1/15/81
App'd. by [illegible]
Date 1/21/81

Form #RA-56G

0672 ROSSNAGEL & ASSOCIATES
Engineering & Testing Consultants
Air · Water · Noise
234 Rt. 70 • Medford, N.J. 08055
(609) 654-1441

Date 1-16-71
Made By WJBR
Checked By WJBR

Phila.
Co., Phila. Pa.

CONVERSION OF LB/HR COMPUTER CALCULATIONS TO ACTUAL LB/HR BASED ON 2 PUSHES/HR

Total Coke Oven Operating Time 34 hrs.

Total Sampling Train Operating Time 159.36 minutes

∴ ACTUAL OPERATING MINUTES/HOUR IS:

$$\frac{159.36}{34} = 4.687 \text{ MINUTES/HOUR}$$

∴ THE LB/HR COMPUTER RESULTS ON PAGES 24 & 24 (WHICH ARE BASED ON THE NORMAL 60 MINUTES OPERATION/HOUR) MUST BE CORRECTED AS SHOWN BELOW BEFORE BEING INSERTED IN TABLE II ON PAGE 9.

RUN	DRY CATCH	WET CATCH
1	$5.4 \times \frac{4.68}{60} = .42$ *	$14.9 \times \frac{4.68}{60} = 1.16$ *
2	$4.3 \times \frac{4.68}{60} = .34$ *	$3.0 \times \frac{4.68}{60} = .23$ *

* lb/hr. based on 2 pushes/hour

1672

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Engineering & Testing Consultants
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(609) 654-1441

Date 1-16-71

Made By MG

Checked By [illegible]

Phila Coke Co
Phila Pa.

Description Vic Calculation from Moisture (2.82 - F55)

$$V_{lc} = \frac{21.097 \times B_{wo} \times V_{m(std)}}{1 - B_{wo}}$$

RUN		V_{lc}
1	$\frac{21.097 \times 3.1 \times 27.78}{96.9}$	= 18.8
2.	$\frac{21.097 \times 2.8 \times 71.32}{97.2}$	= 43.3

#72

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Air - Water - Noise
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(609) 654-1441

Date 1-26-81

Made By MG

Checked By

Phila Coke Co.
Phila Pa

Description Table III. Calculations - using 1GRAM as a reference.

Using Mn (line 10 F13F) of 1GRAM for reference -

RUN 1 - Lb/Hr = 560.4886 | Grs/scf. = .5554

RUN 2 Lb/Hr = 209.6079 | Grs/scf = .2163

Then by proportion

TABLE 3

RUN 1 Col. 1. $.00501 \times 560.4886 = 2.81$ $2.81 \times \frac{4.68}{60} = .219$ Lb/Hr
$.00501 \times .5554 = .0028$ ——— $= .0028$ Grs/scf.

Run 2 Col 1. $.00334 \times 209.6079 = .70$ $.70 \times \frac{4.68}{60} = .054$ Lb/Hr.
$.00334 \times .2163$ ——— $= .0007$ Grs/scf.

Run 1. Col 2. $.0161 \times 560.4886 = 9.02$ $9.02 \times \frac{4.68}{60} = .703$ Lb/Hr
$.0161 \times .5554 =$ ——— $.0089$ Grs/scf

Run 2 Col 2. $.0127 \times 209.6079 = 2.66$ $2.66 \times \frac{4.68}{60} = .207$ Lb/Hr.
$.0127 \times .2163 =$ ——— $.0027$ Grs/scf

Run 1. Col 3. $.0104 \times 560.4886 = 5.83$ $5.83 \times \frac{4.68}{60} = .454$ Lb/Hr
$.0104 \times .5554 =$ ——— $.0058$ Grs/scf.

Run 2. Col 3. $.0017 \times 209.6079 = .36$ $.36 \times \frac{4.68}{60} = .028$ Lb/Hr.
$.0017 \times .2163 =$ ——— $.0004$ Grs/scf

Date 1-29-81

Engineering & Testing Consultants
Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055
(609) 654-1441

Made By MG

Checked By [illegible]

Name Phila. Coke Co
Phila Pa

Description Allowable Limit Calculations

ALLOWABLE LIMIT CALCULATED

from

EQUATION $A = .76E^{.42}$

where

A = allowable Limit in lbs/hr.
E = Emission Index in tons/hr.

2 Pushes/hr. $A = .76 \times (\overbrace{13.2 \times 2}^{3.95})^{.42} = 3.0$ lbs/hr.

3 Pushes/hr $A = .76 \times (\overbrace{13.2 \times 3}^{4.69})^{.42} = 3.56$ lbs/hr.

where 13.2 tons is amount of finished coke/push

9072

ROSSNAGEL & ASSOCIATES

Engineering & Testing Consultants
Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055
(609) 654-1441

Date 1-16-81
Made By MG
Checked By CMRC

Name Phila Coke Co. Phila Pa.

Description Sampling time calculations. Decimal minutes vs Minutes + seconds.

RUN 1

1/9/81

Min & Sec. →	Min.
2:30	2.50
2:00	2.00
2:00	2.00
2:00	2.00
1:50	1.83
1:55	1.92
1:35	1.58
2:30	2.50
2:20	2.33
1:32	1.53
2:15	2.25
2:45	2.75
1:35	1.58
1:35	1.58
1:34	1.58
1:40	1.67
1:50	1.83
2:15	2.25

1/12/81

3:02	3.03
2:10	2.20
3:08	3.13
2:33	2:55
1:00	1.00
2:08	2.13
2:28	2.49
1:50	1.83
1:55	1.92
2:18	2.3
1:45	1:75
1:40	1.67
2:21	2.35
1:50	1.83
2:40	2:67
1:40	1.67
1:39	1.65
1:31	1:52
TOT=	73.40

RUN 2

1/13/81 Min & Sec.	1/14/81 Min.
3:12	3.20
2:06	2:10
3:40	3.67
2:04	3:07
1:54	1.90
1:36	1.60
2:00	2.00
2:25	2.42
1:53	1.88
1:50	1.83
2:05	2:08
1:52	1.87
2:11	2.18
2:02	2.03
2:03	2.04
1:15	1.25
2:20	2.33
2.19	2.32
1:08	1.13
2:45	2.75
2:25	2.42
2:12	2.20
2:38	2.63
2:25	2.42
1:55	1.92
2.17	2.28
2:04	2.07
2:35	2.58
2:20	2.33
2:00	2.00
2:25	2.25
1:40	1.67
3:20	3.33
1:57	1.95
2:05	2:08
2:11	2.18
TOT=	85.96

V

DATA SHEETS

Events Logs
Sampling Data Sheets
Impinger Data Sheets
Lab Reports

LaCorte Co. JOB

Erie, PA LOCATION

DAY Thursday

DATE 1-8-81

RECORDED BY RK

EVENTS LOG

TIME	EVENT
9:25am	TEST TEAM ARRIVED AT SITE HF, RK, RB, LP, S.H.
9:31	AT STACK - BEGAN SET-UP
9.40	RAILING - IN WAY OF TEST EQUIPMENT will HAVE TO BE CUT OUT
10:15	WELDERS ARRIVED TO MODIFY RAILING
10:30	HAD TO GO GET MORE OXYGEN
11:15	WELDERS DONE.
11:25	WBR ARRIVED AT SITE
1:00pm	Did TRAVERSE on South port.
1:20	PROBLEMS WITH LEAK CHECK DUE TO THE COLD.
1:50	MEETING WITH WBR.
2:00	WBR. AND HF. LEFT SITE.
2:20	CHANGED IMPINGER CASES.
2:30	PASSED LEAK CHECK THROUGH IMPINGER CASE
2:35	PASSED LEAK CHECK TO NOZZLE. 005 AT ISOKINETIC
3:10	ALL EQUIPMENT HAS BEEN PACKED OR SECURED FOR THE NIGHT LEFT SITE RK, RB, LP, SH HEADED FOR LUNCH AND MEDFORD

VISITORS LOG

DON TOUTANT

PHIL STOUT

ROSSNAGEL & ASSOCIATES

Engineering & Testing Consultants
Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055

PHILADELPHIA COKE JOB

Phila. Pa. LOCATION

DAY FRIDAY

DATE 1-9-81

RECORDED BY RK

EVENTS LOG

TIME	EVENT
10:10 AM	TEST TEAM ARRIVED AT SITE HF, RK, RB, LP, SH
10.20	DISCOVERED SOLUTIONS IN IMPINGERS FROZEN. Coal also frozen. SET UP NEW IMPINGER CART WITH 150ml OF 50% IPA.
11:00	LEAK CHECK THROUGH IMPINGER CART Good
11:15	PRETEST LEAK CHECK Good. - WAITING FOR 1ST PUSH
12:20pm	Point 9- 2:30 Sec -
12:52	Point 8 2:00
1:15	Point 7 2:00
1:38	Point 6 2:00 —— DRY BULB 70
2:10	Point 5 1:50
2:30	Point 4 1:55 - BACHARACH 1.0 2:10PM
2:53	Point 3 : 1:35 BACHARACH .05 2:53PM
3:07	Point 2 2:30 BACHARACH .00 3:32PM
3:15	H.FACTOR LEFT SITE
3:28	Point 1 - 2:20 —— DRY BULB 70F
3:32	MOVE TO EAST PORT
3:56	Point E9. 1:32 AVG 2:04
4:00	-PLANT STOPS FOR LUNCH
5:05	Point E8 2:15 —— DRY BULB 70°F
5:35	Point E7 2:45
6:04	Point E 6 1:35
6:23	Point 5 1:35
6:38	Point 4 1:35
6.55	Point 3 1:40
7:16	Point 2 1.50 ← AVG 1:53
7:34	Point 1 2:15
8:15	ALL EQUIPMENT HAS BEEN LOADED ON SECURITY LEFT FOR MEDFORD

VISITORS LOG

Bob Scott

AIR MANAGEMENT SERVICES

ROSSNAGEL & ASSOCIATES

Engineering & Testing Consultants

Air - Water - Noise

234 Rt. 70 • Medford, N.J. 08055

Philadelphia Coke JOB

Philadelphia Pa LOCATION

DAY Monday

DATE 1-12-80

RECORDED BY RK

EVENTS LOG

TIME	EVENT
10:35am	TEST TEAM ARRIVED AT SITE RK, S.H.
10:50am	H.F.R.B ARRIVED
11:10	PASSED LEAK CHECK through Impingers
11:20	PASSED PRE-TEST LEAK CHECK WAITING FOR 1ST PUSH
12:30pm	PUSH #1 UNABLE TO SAMPLE this push the Hot Car Hood
12:55	WAS NOT USED.
1:06pm	H.F LEFT SITE BEGAN TEST
6:10pm	- DELAY BECAUSE OF FROZEN COAL
6:21pm	change TEST PORTS-
8:40pm	DELAY- LOST STEAM PRESSURE
9:25pm	PASSED POST TEST LEAK CHECK
10:00pm	EQUIPMENT SECURED LEFT SITE FOR IMEQUED RK, RB, SH.

VISITORS LOG

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Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055

Philadelphia Coke JOB

Phila., Pa. LOCATION

DAY Tuesday

DATE 1-13-81

RECORDED BY RK

EVENTS LOG

TIME	EVENT
10:25am	TEST TEAM ARRIVED AT SITE RB, SH, LP
10:35AM	HF RF ARRIVED · BEGAN CLEAN-UP & SET-UP PROCEDURES
11:25	PASSED LEAK CHECK THROUGH FITTINGS
11:30	PASSED PRE-TEST LEAK CHECK. · WAITING FOR FIRST PUSH -
12:22 PM	MADE A PUSH did NOT TURN BLOWER ON - COULD NOT SAMPLE
12:44	BEGAN RUN 2 Bacharach .00 .5
1:15	HF, SH LEFT SITE
5:05	MOVED TO FAST TEST PORT
7:53	END ½ RUN ·
8:20	ALL EQUIPMENT SECURED OR PACKED LEFT SITE FOR MED FORD.

VISITORS LOG

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234 Rt. 70 • Medford, N.J. 08055

Philadelphia COKE JOB

Phila., Pa. LOCATION

DAY WEDNESDAY

DATE 1-14-81

RECORDED BY RK.

EVENTS LOG

TIME	EVENT
10:35 AM	TEST TEAM ARRIVED AT SITE RK, RB, & SH.
11:15	PASSED PRE-TEST LEAK CHECK
12.29 pm	RESUME RUN. BACHARACH .0 .0
5:25	Changed TO WEST PORT
9:51	End Run. SUCCESSFULLY PASSED POST-TEST LEAK CHECK
9:40	ALL EQUIPMENT LOADED LEFT FOR MEDFORD. RK, RB, SH.

VISITORS LOG

ROSSNAGEL & ASSOCIATES

Engineering & Testing Consultants
Air - Water - Noise
234 Rt. 70 • Medford, N.J. 08055

(09) 654-1441

Data by: RK

Engineering & Testing Consultants

Medford, NJ - Atlanta, GA - Charlotte, NC

PHILADELPHIA COKE DATE: 1-9-81 TEST NO. 04

SAMPLED HOT CAR HOOD BAGHOUSE EXHAUST STACK

ESS. OPERATING CONDITIONS SEE SEPARATE LOG

1

Sampling Point	Line V_1 in Hg	t_m Dry Gas Meter t_1	t_m Dry Gas Meter t_2	t_s Stack Temp	V_p Pitot Rdg.	ΔH_{Pm} Orifice Rdg.	V_m Dry Gas Meter Rdg.	Remarks
S9	4	27	21	28	1.8	.50	927.54	START RUN
S8	3	31	24	28	1.6	.45		
S7	3	31	25	29	1.7	.47		
S6	4	31	26	28	1.8	.5		
S5	4	31	27	27	2.0	.54		
S4	4	33	27	27	2.2	.6		
S3	3	32	27	26	1.2	3.3		
S2	4	34	28	28	2.0	.54		
S1	3	36	29	27	1.6	.44		
				1 SET LOC			934.41	CHANGE PORTS
E9	4	35	29	24	1.6	.44		
E8	3	37	26	23	1.7	.47		
E7	3	36	26	23	1.6	.44		
E6	4	31	27	24	1.8	.5		
E5	4	29	28	23	1.8	.5		
E4	4	33	28	24	1.9	.52		
E3	3	33	28	24	1.6	.44		
E2	3	32	28	23	1.5	.41		
E1	3	32	28	23	1.4	.37		END 1/2
		[illegible]	[illegible]				940.41	RUN

Barometric Pressure: 30.10 in. Hg.A
Static Pressure: _____ in. Hg.
Static Pressure: _____ in. W.G.

Dry Gas Meter S/N G.I.I.
Orifice S/N G.I.I
Vacuum Pump S/N G.I.I
Filter, Thimble S/N: 2552

Sample Train Used

☒ EPA Method 5 ☐ ASTM
☐ EPA Method 6/8 ☐ Other

Pre-Test Leak Check

<.005 ft.^{3} @ 15 "Hg. for 60 secs.

Post-Test Leak Check

< — ft.^{3} @ — "Hg. for — secs.

Opacity/Ringlemann: Max. —
Avg. —

Odor: —

Orsat # 225 @ 2:31 Pm

Evac. Cyl. # — @ —

Isokinetic Parameters

Calib. Factor 1.89
t_m = 60 F
% H_2O = 5%
P_s/P_m = 1.0
C = 1.01

Nozzle Dia.	1/8	1/4	3/16
t_s =	85	85	—
∴ Theo. Pitot =	7.2	.45	—

Notes: Max ΔH .49 N.O. ΔH=1" W.G.
Time shown is start of each minute sampling cycle

CONTINUED NEXT PAGE

...icates change in isokinetics
Avg. t_1 and t_2 to determine Avg. t_m

Avg. t_m = —— = ____ F
Avg. P_m (ΔH) = —— = ____ W.G. ÷ 13.6 = ____ "Hg.

#RA-16N

Page 46

$V_{m\,corr.}$ = V_m x ____ . ____ = ____ . ____ cu.ft. corrected

arters Office
) 654-1441

ROSSNAGEL & ASSOCIATES

Engineering & Testing Consultants

Medford, NJ - Atlanta, GA - Charlotte, NC

SAMPLING DATA SHEET

Data by: RK

Philadelphia Coke DATE: 1-12-80 TEST NO. 04

SAMPLED Hot Car Hood Baghouse Exhaust Stack

ESS OPERATING CONDITIONS 5

1

Sampling Point	Line V_l in. Hg	t_m Dry Gas Meter t_1	t_m Dry Gas Meter t_2	t_s Stack Temp.	V_p Pitot Rdg.	$\Delta H_{@}$ Orifice Rdg.	V_m Dry Gas Meter Rdg.	Remarks
19	3	28	35	26	1.4	.39	940.67	RESUME RUN 1
18	3	34	29	50	1.3	.36	"	
17	3	39	34	54	1.2	.34	"	
16	3	38	35	51	1.1	.30	"	
15	3	33	32	45	1.1	.31	"	
14	3	30	26	57	1.4	.39	"	
13	2	27	23	48	1.1	.31	"	
12	2	27	22	45	1.0	.28	"	
11	2	25	20	35	1.1	.31	"	
							946.77	
10	3	24	20	43	1.3	.36	"	
8	3	22	20	64	1.4	.39	"	
7	3	25	21	76	1.3	.36	"	
6	3	27	21	79	1.5	.42	"	
5	3	28	22	81	1.5	.42	"	
4	3	28	22	74	1.7	.47	"	
3	3	27	22	59	1.6	.44	"	
2	3	27	22	67	1.6	.44	"	
1	2	28	21	41	1.2	.33	952.93	END RUN
ΣΔ		477	445			Δ =	25.39	

Barometric Pressure: ___ in. Hg.A
Static Pressure: ___ in. Hg.
Static Pressure: ___ in. W.G.
Dry Gas Meter S/N SEE PAGE 1
Orifice S/N ___
Vacuum Pump S/N ___
Filter, Thimble S/N: ___

Sample Train Used

☒ EPA Method 5 ☐ ASTM
☐ EPA Method 6/8 ☐ Other ___

Pre-Test Leak Check
<.005 ft.³ @ 15 "Hg. for 60 secs.

Post-Test Leak Check
<.005 ft.³ @ 5 "Hg. for 60 secs.

Opacity/Ringlemann: Max. —
Avg. —

Odor: —

Orsat # 1AR @ 4:03 PM

Evac. Cyl. # — @ —

Isokinetic Parameters

Calib. Factor ___
t_m = ___ F
% H_2O = ___
P_s/P_m = ___
SEE PAGE 1
C = ___

Nozzle Dia. ___
t_s = ___
∴ Theo. Pitot = ___

Notes: HOT > 225 F

$T_s = \frac{1454}{36} = 40.4$

dicates change in isokinetics

: Avg. t_1 and t_2 to determine Avg. t_m

Avg. $t_m = \frac{1916}{72} = 27.7$ F

Avg. $P_m(\Delta H) = \frac{15.07}{36} = .4189$ W.G. ÷ 13.6 = .0308 "Hg.

V_m = V_m x 1.0 = 25.39 cu.ft.

#RA-16N

(609) 654-1441

Data by: RK

Engineering & Testing Consultants

Medford, NJ - Atlanta, GA - Charlotte, NC

Philadelphia Coke DATE: 1-13-80 TEST NO. 04

SAMPLED Hot Gas Hood Baghouse Exhaust Stack

CESS OPERATING CONDITIONS SEE SEPARATE LOG

2

	Sampling Point	Line V_1 in. Hg	t_m Dry Gas Meter t_1	t_m Dry Gas Meter t_2	t_s Stack Temp.	V_p Pitot Rdg.	ΔH P_m Orifice Rdg.	V_m Dry Gas Meter Rdg.	Remarks
	S9	13	36	32	78	1.9	2.6	953.38	BEGIN 4 RUN
	S8	14	42	38	76	1.9	2.6		2.4
	S7	14	42	40	86	1.8	2.5		2.4
	S6	13	41	39	65	1.6	2.3		-
	S5	14	39	37	64	1.7	2.4		-
	S4	13	38	36	63	1.6	2.3		-
	S3	14	37	35	70	2.1	2.9		2.5
	S2	14	36	34	67	2.0	2.8		2.4
	S1	14	33	31	58	1.7	2.4		
									Change Points
	F9	14	32	30	71	1.7	2.4		-
	8	14	32	30	88	1.6	2.3		-
	7	14	32	30	72	1.8	2.5		2.4
	6	14	31	29	61	1.8	2.5		-
	5	14	33	30	65	1.9	2.6		2.3
	4	14	33	31	71	1.7	2.4		-
	3	14	31	29	67	1.6	2.3		-
	2	13	31	28	70	1.5	2.1		-
	1	9	31	28	56	1.2	1.7		End 5 RUN
							21	988.30	

Barometric Pressure: ___ in. Hg.A
Static Pressure: ___ in. Hg.
Static Pressure: ___ in. W.G.

Dry Gas Meter S/N GII
Orifice S/N GII
Vacuum Pump S/N GII
Filter, ~~Thimble~~ S/N: 2553

Sample Train Used

☒ EPA Method 5 ☐ ASTM
☐ EPA Method 6/8 ☐ Other

Pre-Test Leak Check

<005 ft.^{3} @ 15 "Hg. for 60 secs.

Post-Test Leak Check

< ___ ft.^{3} @ ___ "Hg. for ___ secs.

Opacity/Ringlemann: Max. —
Avg. —

Odor: —

Orsat # 218 @ 2:34 pm

Evac. Cyl. # — @ —

Isokinetic Parameters

Calib. Factor 1.89
t_m = 60 F
% H_2O = 5 %
P_s/P_m = 1.0
C = 1.01
Nozzle Dia. 3/16
t_s = 60 F
∴ Theo. Pitot = 1.3

Notes: DRY 65 WET 62
64 ↔ 62

dicates change in isokinetics
: Avg. t_1 and t_2 to determine Avg. t_m

Avg. t_m = —— = ___ F
Avg. P_m (ΔH) = —— = ___ W.G. ÷ 13.6 = ___ "Hg.
$V_{m\,corr.}$ = V_m x ___ = ___ cu.ft. corrected

#RA-16N

a) 654-1441

Data by: RK

Engineering & Testing Consultants

Medford, NJ - Atlanta, GA - Charlotte, NC

Philadelphia Coke DATE: 1-14-81 TEST NO. 04

SAMPLED Hot Car Hood Baghouse Exhaust Stack

ESS OPERATING CONDITIONS SEE SEPARATE LOG

2

	Sampling Point	Line V_1 in Hg	t_m Dry Gas Meter t_1	t_m Dry Gas Meter t_2	t_s Stack Temp.	V_p Pitot Rdg.	ΔH Pm Orifice Rdg.	V_m Dry Gas Meter Rdg.	Remarks
	N9	9	29	27	73	1.1	1.6	98.77	RESUME RUN
	N8	9	34	29	88	1.1	1.6	Y	
	N7	9	40	37	78	1.0	1.4		
	N6	8	47	42	88	.95	1.3		
	N5	8	48	45	94	1.1	1.6		
	N4	9	48	43	93	1.2	1.7		
	N3	8	46	43	75	.95	1.2		
48	N2	8	46	42	77	.92	1.3		
7	N1	7	41	38	64	.92	1.3	4	CHANGE PORTS
								00281	
43	W9	11	41	38	89	1.3	1.9	Y	
59	W8	11	40	38	88	1.3	1.9		
17	W7	11	41	39	90	1.4	2.0		
39	W6	12	41	39	88	1.5	2.1		
12	W5	12	40	38	76	1.4	2.0		
28	W4	12	39	38	81	1.4	2.0		
46	W3	12	41	38	82	1.4	2.0		
04	W2	12	41	39	88	1.5	2.1	Y	
20	W1	11	40	39	79	1.3	1.9	019.51	END RUN
=	85.96		1373	1279			Δ=	66.13	

Barometric Pressure: ___ in. Hg.A
Static Pressure: - in. Hg.
Static Pressure: - in. W.G.
Dry Gas Meter S/N GII.
Orifice S/N GII
Vacuum Pump S/N GII
Filter, ~~Thimble~~ S/N: ___

Sample Train Used

☒ EPA Method 5 ☐ ASTM
☐ EPA Method 6/8 ☐ Other ___

Pre-Test Leak Check

<.005 ft.^{3} @ 15 "Hg. for 60 secs.

Post-Test Leak Check

<.005 ft.^{3} @ 16 "Hg. for 60 secs.

Opacity/Ringlemann: Max. -
Avg. -

Odor: ___

Orsat # 223 @ 12:29 pm

Evac. Cyl. # — @ —

Isokinetic Parameters

Calib. Factor ___
t_m = ___ F
% H_2O = ___
P_s/P_m = ___
C = SEE PAGE 1
Nozzle Dia. ___
t_s = ___
∴ Theo. Pitot = ___ $T_s = \frac{2739}{36} = 76.1$

Notes: WET/DRY - 84/88
Hot Box 225F 90/94

indicates change in isokinetics

te: Avg. t_1 and t_2 to determine Avg. t_m

Avg. $t_m = \frac{2652}{72} = 36.8$ F

Avg. P_m (ΔH) $= \frac{74.5}{36} = 2.0694$ W.G. ÷ 13.6 = .1522 "Hg.

$V_{m\,corr.} = V_m \times 1.00 = 66.13$ cu.ft. corrected

rm #RA-16N

Phila. Coke

ION Phila., Pa.

Hot Car Hood Baghouse Exhaust Stack

IMPINGER DATA SHEET

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RUN #		DATE	VOL-ONE	CONTENTS OF IMPINGERS 1	2	3	4 (cc)	TOTAL CONDENSATE V_{lc} EPA = (OR V_w) WF-50	LOCATION & REMARKS
1	START	1-9-81	–	150ml	150ml	–	300g		Imp #1+2 were filled w/ 100ml DI, +50ml of IPA to prevent freezing.
X	END	1-12-81	–	132ml	135ml	–	310g		
X	Δ		–	-18ml	-15ml	–	+10g	-23 ml	
2	START	1-13-81	–	150ml	150ml	–	300g		Same as Run #1.
X	END	1-14-81	–	119ml	122ml	–	323g		
X	Δ			-31ml	-28ml	–	+23g	-36 ml	
	START								
X	END								
X	Δ							ml	
	START								
X	END								
X	Δ							ml	
	START								
X	END								
X	Δ							ml	

Data by RB

Approved by RK

50

9672

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Date 1·12·81

Made By S. Harris

Checked By WJR

Name Phila Coke

House Stack

Description Sampling Times for North and West Ports

Philadelphia Coke
1·12·81 S. Harris

Actual Time	Point	Sample Time (Minutes)	
12:57 PM	N9	3:02	
1:26	N8	2:10	
2:00	N7	3:08	
2:44	N6	2:33	
3:20	N5	1:00	
4:00	N4	2:09	
4:39	N3	2:29	
5:19	N2	1:50	
6:18	N1	1:55	TOTAL 20:14
6:39	W9	2:19	
6:57	W8	1:45	
7:14	W7	1:40	
7:32	W6	2:21	
7:50	W5	1:50	
8:14	W4	2:10	
8:39	W3	1:40	
8:58	W2	1:39	
9:14	W1	1:31	16.9 MIN

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#9672

#

Name Phila Coke
Phila Pa.

Date 1/13/81

Made By S. Harris

Checked By WSR

Description Sampling Train - S & E Ports

Phila. Coke 1-13-81 Pushing Schedule S. Harris

	Stated Time	Actual Time	Port	Sampling Time
1.	12:05 PM	PM	S	Minutes
2.	20	12:42	S 9	3:12 min
3.	40	1:11	S 8	2:06
4.	1:05	1:32	S 7	340
5.	35	212	S 6	204
6.	2:05	245	S 5	154
7.	30	303	S 4	136
8.	50	326	S 3	200
9.	3:25	358	S 2	225
10.	55	459	S 1	153
	Lunch	519	E 9	150
11.	4:25	538	E 8	205
12.	55	558	E 7	152
13.	5:20	622	E 6	211
14.	50	641	E 5	202
15.	6:15	658	E 4	203
16.	45	715	E 3	115
17.	7:15	734	E 2	220
18.	45	749	E 1	219
19.	8:15			

2:09 ave minutes

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Date 1/14/81
Made By S Harris
Checked By [illegible]

Name Phila Coke
Phila Pa.

Description Sampling times New Ports.

PHILA COKE PUSHING SCHEDULE 1.14.81
S Harris

STATED TIME	ACTUAL TIME	PORT	SAMPLE TIME
12:05 PM	12:26 PM	N9	1:08 MINUTES; SECONDS
30	12:58	N8	2:45
55	1:27	N7	2:25
1:20	1:53	N6	2:12
45	2:22	N5	2:38
2:10	2:43	N4	2:25
35	3:20	N3	1:55
3:00	3:45	N2	2:17
25	MISSED	[illegible]	—
50	5:16	N1	2:04
LUNCH			
4:20	5:40	W9	2:35
45	5:56	W8	2:20
5:15	6:14	W7	2:00
45	6:35	W6	2:15
6:15	7:09	W5	1:40
45	7:25	W4	3:20
7:15	7:43	W3	1:57
45	8:02	W2	2:05
8:15	8:17	W1	2:11

AVG. 2:14 minutes

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ORSAT-GAS ANALYSIS REPORT (DRY BASIS)

Laboratory Report No. _____ Test Date 1-9-81

Test Report No. 9672 Job Name Philadelphia Coke
Analyzed by SH Date 1-17-81
Checked by RK Date 1-17-81

LAB RECORD	RESULTS			REMARKS
	Reading	Difference	Percent	
CYL. — TIME* 9:00				
Volume of sample	100ml	—	—	Ambient
Total volume measured	100ml	—	—	Air
Carbon dioxide	1	1	1	
Oxygen	21	20	20	
Carbon monoxide (by absorption)	21	0	0	
Nitrogen (by difference)	100	79	79	
CYL. 225 TIME* 2:23pm				
Volume of sample	250	—	—	Sample
Total Volume measured	100	—	—	Taken
Carbon dioxide	.6	.6	.6	1-9-81
Oxygen	17.4	16.8	16.8	Run #1
Carbon monoxide (by absorption)	17.4	0	0	
Nitrogen (by difference)	100	82.6	82.6	
CYL. 1AB TIME* 4:00Ph				
Volume of sample	250ml	—	—	Sample Taken
Total volume measured	100ml	—	—	1-12-81
Carbon dioxide	1	1	1	
Oxygen	21	20	20	Run #1
Carbon monoxide (by absorption)	21	0	0	
Nitrogen (by difference)	100	79	79	

* Time sample taken in field

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ORSAT-GAS ANALYSIS REPORT (DRY BASIS)

Laboratory Report No. _____ Test Date 1-13-81

Test Report No. 9672 Job Name PHILADELPHIA
Analyzed by SW Date 1.17.81
Checked by _____ Date _____

LAB RECORD	RESULTS			REMARKS
	Reading	Difference	Percent	
CYL. 214 TIME* 1:34PM				RUN 2
Volume of sample	250	-	-	1-13-81
Total volume measured	100	-	-	
Carbon dioxide	1.5	1.5	1.5	
Oxygen	21	19.5	19.5	
Carbon monoxide (by absorption)	21	0	0	
Nitrogen (by difference)	100	79	79	
CYL. 233 TIME* 2:16PM				
Volume of sample	250	-	-	RUN 2
Total Volume measured	100	-	-	TAKEN 1.14.81
Carbon dioxide	.4	.4	.4	
Oxygen	21	20.6	20.6	
Carbon monoxide (by absorption)	21	0	0	
Nitrogen (by difference)	100	79	79	
CYL. _____ TIME* _____				
Volume of sample				
Total volume measured				
Carbon dioxide				
Oxygen				
Carbon monoxide (by absorption)				
Nitrogen (by difference)				

* Time sample taken in field

Midwestern Division
Denio Enviro. Consultants
4022 Stonehaven Rd.
South Euclid, Ohio

Mid-Atlantic Division
1217 Central Avenue
Charlotte, N. C. 28204

Southeastern Division
250 Arizona Avenue N.E.
Atlanta, Georgia 30307

Form #RA-67J

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Customer Phila. Coke

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Job # 9672
Lab Report # 8457
Sheet ___ of ___

Date Submitted: _____
Date Completed: 1-21-81

Results to be:
Phoned in _____
Written report ✓

Type and Number of Samples Submitted for Analysis:

Filters, Impinger Solutions, Wash Solutions X 2 Runs

Specific Analysis Information (ie G.C. or THC Analysis):

Soluble + Insoluble Particulate and Turbidimetric Sulfate

Results: All weights in mg

	Dry Catch (Table 3 Col. 2)			Wet Catch (Table 3 Col. 3)			Wet Catch Sulfate (Table 3 Col. 1)
	Filter	Wash	Total	Soluble Dissolved	Insoluble Suspend	Total	
Run 1	1.11	8.48	9.59	16.1	10.4	26.5	5.01
Run 2	6.35	14.35	20.70	12.7	1.7	14.4	3.34

Total Dry & Wet Catch Sample Collected = 71.19 mg. in two runs

Notebook No. and Page: 361; 171-73

SEE PROCEDURE # Attachment #4 Comm. of Pa. Source Testing Manual

Analyst: D. Martelli

Approved: _____

The liability of ROSSNAGEL & ASSOCIATES and its divisions, with respect to the services charged for herein, shall in no event exceed the amount of the invoice.

Job # 9672
Lab # 8457
Job Name Phila. Coke

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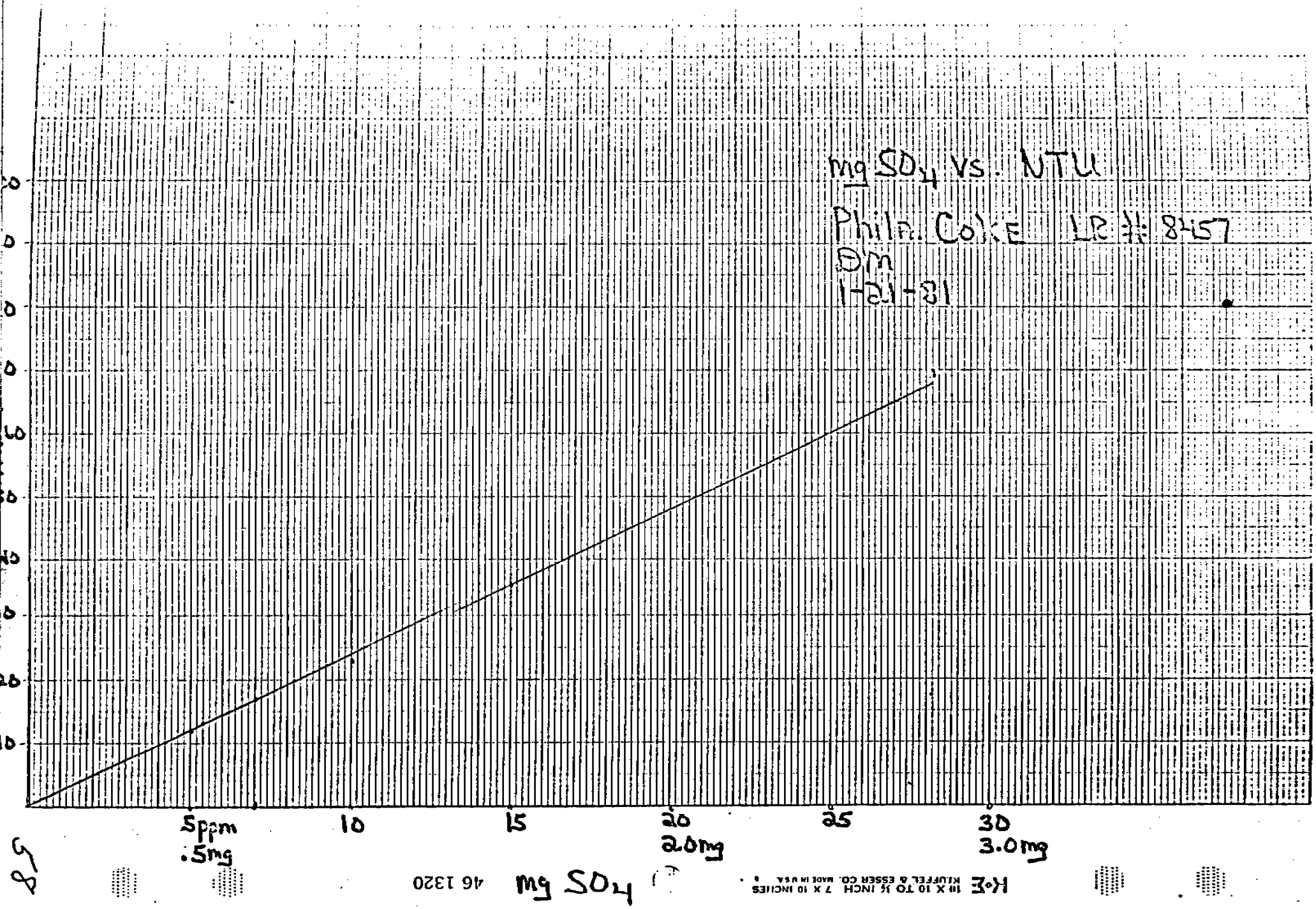
Date 1-21-81
Made By D. Martelli
Checked By MW

Description Lab Data - Sulfate Analysis

ml used Na_2SO_4/H_2O	Sample	Turbidity - NTU Initial	Final Reading
5 / 95	Standard	——	12
10 / 90	Standard	——	23
15 / 85	Standard	——	36
100	Control (7ppm)	1	17
100	Run 1 Dmp Ita Wet Catch	3	16
100	Run 2 Dmp Ita	2	20
100	Blank	1	2

Note: The actual samples were rehydrated by adding 150 ml DI H_2O.


mg SO4 vs. NTU
Phila. Coke LR #: 8457
DM
1-21-81
5ppm
.5mg
10
15
20
2.0mg
25
30
3.0mg
mg SO4
46 1320
K+E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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Job # 9672
Lab # 8457
Job Name Phila. Coke

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Date 1-21-81
Made By D. Martelli
Checked By [illegible]

Description Wet Catch Sulfate Analysis

$$\text{Total mg } H_2SO_4 = (\text{mg } SO_4)_{graph}\left(\frac{Tv}{Av}\right)\left(\frac{Iv}{Ev}\right)\left(\frac{98}{96}\right), \text{ where}$$

$(\text{mg } SO_4)_{graph}$ = mg as Sulfate from graph
Tv = Rehydration Total Volume, ml (150)
Av = Aliquot Volume Analyzed, ml
Iv = Initial Vol. Filtrate, ml
Ev = Volume Evaporated, ml
$\left(\frac{98}{96}\right)$ = Gravimetric Factor, $\frac{H_2SO_4}{SO_4}$

Run 1, Impinger 1+2

$$\text{mg } H_2SO_4 = (.64-.02)\left(\frac{150}{100}\right)\left(\frac{1055}{200}\right)\left(\frac{98}{96}\right)$$
$$= 5.01$$

Run 2, Impinger 1+2

$$\text{mg } H_2SO_4 = (.70-.02)\left(\frac{150}{100}\right)\left(\frac{1442}{200}\right)\left(\frac{98}{96}\right)$$
$$= 3.34$$

AP-42 Section 12.2
Reference
Report Sect. 4
Reference 148

SOTDAT/STEEL LIBRARY SYSTEM

Report Title: —

Plant and Location: Philadelphia Coke, Philadelphia, PA

SCC: 30300303

Testing Date(s): 1/81

By Whom: ~~Rosmo~~ Rossnagel

Stack Test Review Attached: no

Reviewed by:

Problems Seen by Reviewer:

Confidentiality Status:

If status is confidential, list confidential pages or sections:

Source of Determination of the Confidentiality Status:

Report Encoded by:

Date Encoded:

Form Numbers:

Comments: