Koppers Industries, Inc.

Pittsburgh, Pennsylvania

Susquehanna Wood Treating Facilities Vacuum Pump Emissions Study

April 1994

CHESTER ENVIRONMENTAL

KOPPERS INDUSTRIES, INC.
Pittsburgh, Pennsylvania

Susquehanna Wood Treating Facilities
Vacuum Pump Emissions Study

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CHESTER
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VACUUM PUMP EMISSIONS STUDY
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SUSQUEHANNA WOOD TREATING FACILITIES
VACUUM PUMP EMISSIONS STUDY
SECTION 1.0
INTRODUCTION

During period of May 24 through May 25, 1990, a testing program was conducted at the Koppers Industries, Inc. Susquehanna wood treating plant. An EPA Modified Method 5 program for the determination of emissions from stationary sources, utilizing an XAD adsorbent cannister connected into sample train, was conducted by Keystone Environmental Resources, Inc., at that time a subsidiary of Chester Environmental. The testing program involved the sampling of gases exhausted from a treating cylinder during each step of the wood treating cycle. The compounds of interest, Polynuclear Aromatic Hydrocarbons (PAHs), were collected in the sample train, which included an XAD adsorbent. EPA Method 4 was used for moisture determinations and Methods 1 & 2 were used to determine stack flow characteristics. The results of the testing are listed in Section 3.0 and Tables 1 through 4 of this report, with a summary in Table 5.

Testing was performed by the Air Quality Division of Keystone Environmental Resources, Inc. The test crew was comprised of Mark Grunebach and Pat Stockton. The purpose of the test program was to document the emissions of creosote components from this process source.

This document is a revision of a report which was originally published in August 1990 to support the development of emissions values to be used in calculating releases under SARA Title III. This report has been requested to address a broader spectrum of PAH compounds than was originally reported, as well as to correct some errors in calculations which were noted in the original report.

The objective of this revised document is to develop the collected data into a series of emission factors applicable to treating of wood with creosote. The results were compared to the recently proposed emission factors for wood preserving in AP-42 - Compilation of Air Pollution Emissions Factors, Section 10.8 - Wood Preserving.

SUSQUEHANNA WOOD TREATING FACILITIES
VACUUM PUMP EMISSIONS STUDY
SECTION 2.0
DISCUSSION

2.1 PROCESS DESCRIPTION

The following is a description of the wood treatment steps and pollution control measures at the Koppers Industries, Inc., Susquehanna, Pennsylvania plant, as shown in the attached Flow Diagram (Figure 1).

The wood treatment facility typically operates 24 hours per day, 5 days per week, 215 days per year. The facility treats green ties, flanges, and lumber and dry ties, flanges and bridges and lumber. A total of 1,668,770 cubic feet of wood was treated in 1991. Steam for heating in the treating process is supplied by a wood waste boiler. The fuel used for the boiler is creosote-treated cross ties. The plant has three creosote treating cylinders (8 ft. dia. x 140 ft. long).

60/40 creosote-coal tar solution is delivered to the plant by heated rail car or truck tankers and stored in three storage/work tanks. Two tanks are 48,100 gallon capacity and one tank is 63,200 gallon capacity.

The Boulton process, the first step in wood treating, is used to "condition", i.e., remove moisture from green wood prior to treatment with creosote. In this process, the cylinder is filled with creosote and a 25-inch Hg vacuum is pulled on the cylinder. Vapors from the cylinder are condensed in a shell and tube condenser, and the condensate is transferred to the wastewater treatment system. Boultonizing lasts from 8 to 18 hours depending on the amount of moisture in the wood and the species of the wood to be treated. After Boultonizing, the creosote is transferred from the cylinder and returned to the work tank.

After conditioning by Boultonizing, the wood is treated with creosote using the Rueping process. The cylinder is initially pressurized with air to 50-55 psi for $^1/_2$ hour. Creosote is then added to the cylinder to displace the air and heated. The cylinder is then further pressurized to 145 psi, and the pressure is maintained for 1-$^1/_2$ to 4 hours, until the desired product retention is reached. After pressurization, the creosote is transferred from the cylinder and returned to the work tank.

Following the treating step, a final vacuum step is performed, during which a 22-inch Hg final vacuum is pulled on the cylinder for a period of 2 hours. The final vacuum is maintained by a vacuum pump. Vapors from the cylinder are condensed in the condenser and the condensate is processed through the wastewater treatment system.

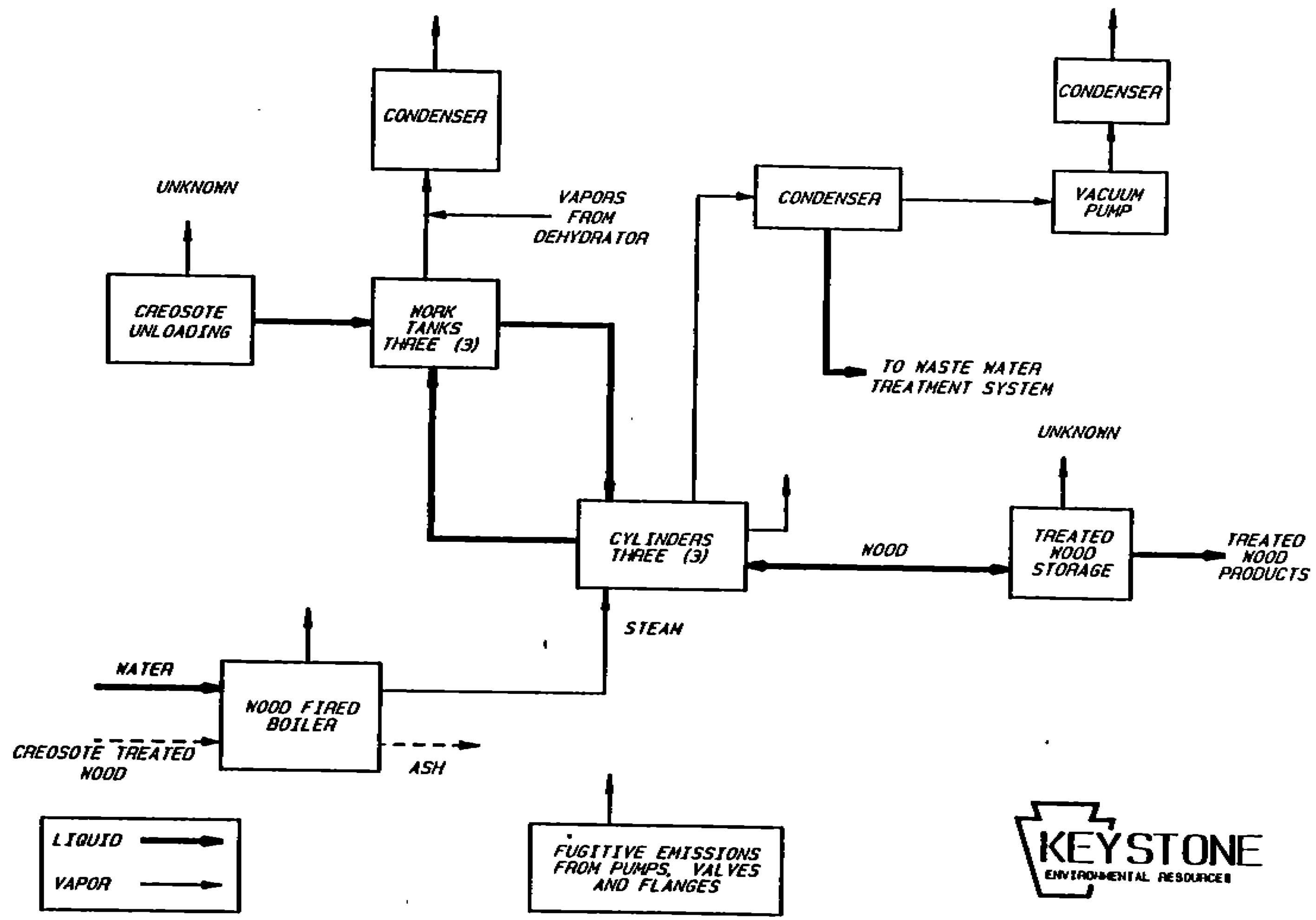

FIGURE 1
CREOSOTE TREATMENT
PROCESS FLOW DIAGRAM
KOPPERS INDUSTRIES, INC.
SUSQUEHANNA PLANT
MONTGOMERY, PA

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During the testing program on May 24 and 25, 1990, wood treating was accomplished in two cylinders. The specific process schedule and the associated testing sequence are shown in Figure 2.

2.2 TEST METHODOLOGIES

The execution of the test program required the use of several promulgated procedures. This section outlines the sampling and analytical procedures utilized. Methodologies are summarized in the following table.

Parameter	Sampling and Analytical Procedure
Location of Traverse Points	EPA Method 1
Gas Velocity & Volumetric Flow Rate	EPA Method 2
Gas Moisture Content	EPA Method 4
Polynuclear Aromatic Hydrocarbons	EPA Method 5 - Modified

Determination of the volumetric flow rate was performed in accordance with EPA Reference Methods during each test run. Due to the small size of the pipeline, the volumetric flow rate measurement was performed through a single sampling point.

The velocity head pressures were measured with a Type S Pitot tube. Temperature measurements were performed concurrently with the velocity measurements using a type K thermocouple.

Since the "gas" which is removed from the wood in the Boultonizing process is air, the molecular weight was assumed to be 28.8 (20% oxygen and 80% nitrogen).

2.3 SAMPLING PROCEDURE

2.3.1 Volumetric Flow Rate and Moisture Content

Gas velocities, volumetric flow rates, and moisture content of the exhaust gas were determined in accordance with EPA Stationary Source Sampling Methods 1, 2, and 4 respectively. The volumetric flow rate of each source was calculated using a stack velocity determination, dry gas molecular weight, and moisture content in accordance

FIGURE 2
SUMMARY OF TEST PROGRAM
KOPPERS INDUSTRIES, INC.
SUSQUEHANNA, PA

TIME	CYLINDER #1 BATCH K-289 2380 CF	CYLINDER #2 BATCH K-290 3470 CF	SAMPLES COLLECTED
09:00 AM	BOULTON START		
09:30 AM			
10:00 AM			
10:30 AM			
11:00 AM			
11:30 AM			
12:00 PM			
12:30 PM			
01:00 PM		BOULTON START	
01:30 PM			
02:00 PM			
02:30 PM			✓ IFC-1, OFC-1
03:00 PM			IFC-1, OFC-1
03:30 PM	BOULTON END		IFC-1, OFC-1
04:00 PM	ITIAL AIR, PRESSURE @50 psi		
04:30 PM	AIR RELEASE		
05:00 PM	CREOSOTE IN		
05:30 PM	PRESSURE @ 200 psi		✓ IFC-2, OFC-2
06:00 PM			IFC-2, OFC-2
06:30 PM		BOULTON END	IFC-2, OFC-2
07:00 PM		INITIAL AIR, PRESSURE @50 psi	
07:30 PM		AIR RELEASE	✓ IFC-3, OFC-3
08:00 PM	CREOSOTE BACK	CREOSOTE IN	
08:30 PM	FINAL VACUUM	PRESSURE @ 200 psi	
09:00 PM			IFC-4, OFC-4
09:30 PM			IFC-4, OFC-4
10:00 PM			IFC-4, OFC-4
10:30 PM	RECOVER DRIPPINGS		
11:00 PM			
11:30 PM			
12:00 AM			
12:30 AM		CREOSOTE BACK	
01:00 AM		FINAL VACUUM	
01:30 AM			
02:00 AM			
02:30 AM			
03:00 AM		RECOVER DRIPPINGS	

one 1-hr run on each cylinder

<u>SUMMARY OF SAMPLES COLLECTED</u>

IFC-1, OFC-1 - BOTH CYLINDER #1 AND CYLINDER #2 BOULTONIZING
IFC-2, OFC-2 - BOULTONIZING IN CYLINDER #2 ONLY
IFC-3, OFC-3 - AIR PRESSURE RELEASE IN CYLINDER #2 ONLY
IFC-4, OFC-4 - FINAL VACUUM IN CYLINDER #1 ONLY

TEST_SCH.XLS

with EPA Method 2 and reported in terms of actual cubic feet per minute (ACFM), standard cubic feet per minute (SCFM), and dry standard cubic feet per minute (DSCFM). Moisture determination was accomplished by gravimetric analysis of the moisture sampling train. The impingers were weighed prior to and following each test to the nearest 0.1 gram. Calculation of the moisture content, in percent by volume, was performed in accordance with EPA Method 4.

2.3.2 PAHs

EPA Modified Method 5 involved the determination of PAH compounds using an XAD collection medium in the Method 5 sample train. A sampling probe was inserted into the sampling port of the stack and a known volume of gas passed through the XAD canister where the PAH compounds were collected. The XAD was then sealed to prevent any contamination or PAH loss. Water portions of the sample train were extracted and combined with the XAD extract. The resultant sample was analyzed in accordance with EPA Method 610. The following is a list of PAHs for which analyses were performed.

- Carbazole
- Naphthalene
- Acenaphthalene
- Acenaphthene
- Fluorene
- Phenanthrene
- Anthracene
- Fluoranthene
- Pyrene
- Benzo(a)Anthracene
- Chrysene
- Benzo(b)Fluoranthene
- Benzo(k)Fluoranthene
- Benzo(a)Pyrene
- Dibenzo(a,h)Anthracene
- Benzo(g,h,i)Perylene
- Indeno(1,2,3-cd)Pyrene
- Dibenzofuran

The analytical results are contained in Appendix B.

2.3.3 Quality Control

All Pitot tubes, thermocouples, differential pressure gauges and scales used in the test program are calibrated on a routine basis and inspected prior to their use. Pitot tubes, connecting tubing and differential pressure gauges were leak checked on-site before and after each velocity measurement. Upon completion of the program, a calibration check of the equipment actually used in the testing was performed.

SUSQUEHANNA WOOD TREATING FACILITIES
VACUUM PUMP EMISSIONS STUDY
SECTION 3.0
RESULTS AND CONCLUSIONS

The test program presented above addressed emissions from each step of the wood treating cycle during which emissions from the vacuum system can occur, including the wood conditioning step at the beginning of the treating cycle; the air release step following pressurization; and the final vacuum step prior to removing the treated wood from the treating cylinder. Among the purposes of the test program in 1990 was that of determining the control efficiency of the condenser downstream of the vacuum pumps. Based upon a review of the test results, that specific objective was not accomplished. Among the reasons for that conclusion were the following:

1) Some concentrations at the exit of the condenser were higher than inlet concentrations;
2) flow measurements were inconsistent, which may have been caused by the use of different measurement methods for flow rate on the inlet (Pitot tube) and outlet (hot wire anemometer); and
3) emissions from the condenser showed wide variations compared to emissions from the vacuum pump, which were fairly consistent.

On the basis of these results, no further evaluation of the emissions out of the vacuum pump condenser was performed. However, the results that apply to the emissions from the vacuum pump during the wood conditioning step, the air release step and the final vacuum step are valid.

3.1 RESULTS

3.1.1 Testing Results

Appendix A consists of the Stack Sampling Data Sheets which were completed during the testing on May 24 & 25, 1990 in accordance with the procedures outlined in Section 2. The data were reduced using appropriate equations in EPA Method 2 to determine the average stack gas velocity and average gas flow rate during the wood conditioning step and the final vacuum step. Sample calculations are shown in Appendix D. In the case of the air release step, the volumetric discharge over the entire air release step was determined by calculations (See Figure 3).

Appendix B contains the results of the PAH analysis of the samples collected in the Modified Method 5 sampling train. The analyses were performed by High

FIGURE 3

FLOW DURING AIR RELEASE

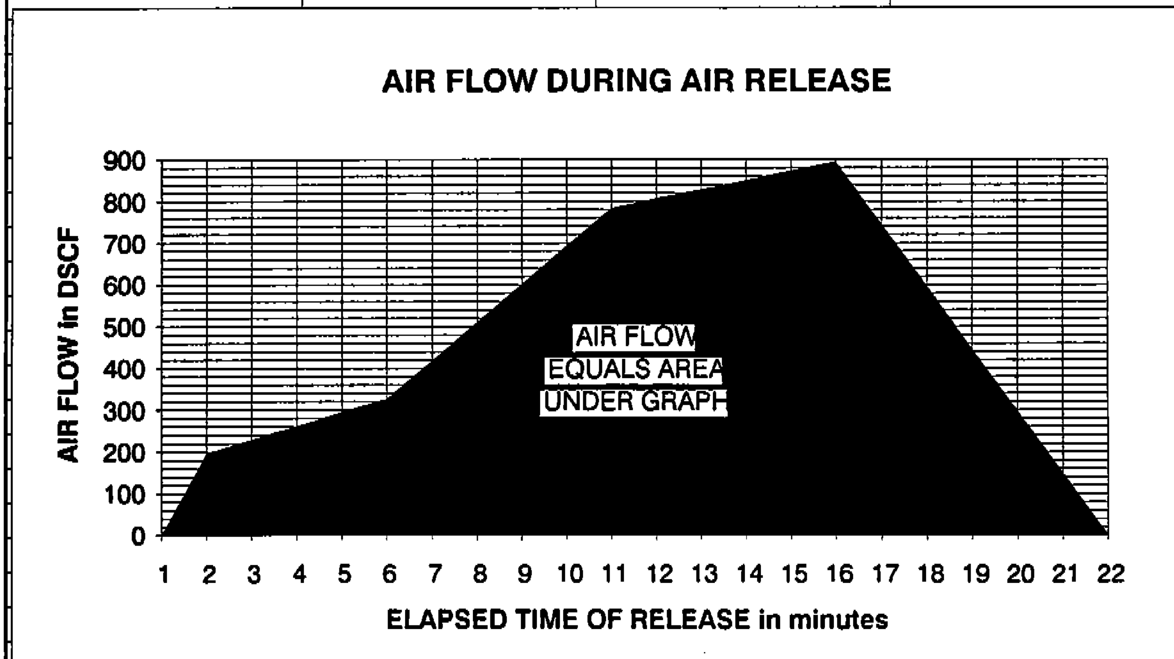
VACUUM PUMP EMISSIONS

KOPPERS INDUSTRIES, INC.

PAH EMISSIONS FROM WOOD TREATING

SUSQUEHANNA PLANT

ELAPSED TIME min	FLOW TO CONDENSER DSCFM	MEASURED OR INTERPOLATED	FLOW TO CONDENSER DSCF
0	0		98
1	195	measured	212
2	228	interpolated	245
3	261	interpolated	278
4	294	interpolated	311
5	327	measured	373
6	418	interpolated	464
7	510	interpolated	556
8	601	interpolated	647
9	693	interpolated	738
10	784	measured	795
11	806	interpolated	817
12	828	interpolated	839
13	850	interpolated	861
14	872	interpolated	883
15	894	measured	820
16	745	interpolated	671
17	596	interpolated	522
18	447	interpolated	373
19	298	interpolated	224
20	149	measured	75
21	0	measured	0
TOTAL FLOW DURING AIR RELEASE in DSCF			10796



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Performance Liquid Chromatography (HPLC). The results were reported as mg of PAH compound/total sample. That information, when divided by the sample size (see "Meter Reading" column of Stack Sampling Data Sheet) to provide the sample concentration.

Appendix C contains the Koppers' data sheets for the wood treating batches during the period of testing. By comparing the data in Appendix C with the "Time" column of Stack Sampling Data Sheet, the specific operations occurring during the sampling program can be determined. Furthermore, by combining the hours of treatment and amount of wood treated in Appendix C with the sample concentration and air flow, an emission factor can be calculated.

3.1.2 Data Quality Assessment

An assessment of the quality of the data was made based on the criteria contained in Section 3. - GENERAL DATA REVIEW AND ANALYSIS - of *EMISSION FACTOR DOCUMENTATION FOR AP-42 SECTION 10.8.* Each of the criteria used to screen data were evaluated.

Literature Search and Screening

1. Emission testing must be from a primary source - All data developed during this study was original.
2. Study must contain results based upon more than one test run - A total of four runs were performed. While these runs may have been for different steps in the wood treating cycle, the consistency of procedures and results indicate the validity of the test conclusions.
3. The report must contain data to evaluate test procedures and operating conditions - Original data on both the testing and operating procedures are included to document the conclusions.

Emission Data Quality Rating System

Based upon the five criteria for data exclusion presented, none of the data would be excluded. (Note that two of the criteria apply to control devices which are not applicable because this study addressed uncontrolled emissions.

The data produced by this study have a data rating of "A" because multiple tests using accepted methodologies were performed and, because of the following evaluation:

1. Source operation - well documented as being within typical parameters

2. Sampling procedures - generally accepted methodologies were utilized
3. Sampling and process data - variations within the data set (consistent with the natural variation of creosote) are reasonable
4. Laboratory analysis and calculations - original chromatograms are available upon request.

Emission Factor Quality Rating System

The quality of the emission factors developed from this study were rated as D--Below Average. Although the data itself is A-rated, only one facility was tested, even though this facility is considered to be typical of the fourteen facilities operated by Koppers Industries, Inc.

(It should also be noted that the ratings in the Emission Factor Documentation show a data rating of "C" and an Emission Factor rating of "E--Poor" for the emission factors which have been proposed.

3.2 CONCLUSIONS

3.2.1 Wood Conditioning

Tables 1 & 2 summarize the results of the emission testing during the wood conditioning step. Table 1, "Boultonizing on Two Cylinders", shows an emission factor for all creosote components of 2.58×10^{-4} lb creosote / cubic foot of wood treated. Table 2, "Boultonizing on One Cylinder", shows an emission factor of 3.2×10^{-5} lb creosote / cubic foot of wood treated. Individual creosote components are shown on the respective tables.

Among the possible reasons for the difference in the results from the two tests are the following:

- Each test was conducted at a different elapsed time in the wood conditioning step;
- Condensation of PAHs on the uninsulated pipeline surfaces may have been greater while Boultonizing on one cylinder than on two cylinders;
- Subtle differences in the composition of the creosote, the characteristics of the wood, or weather conditions may have contributed to the difference in emission factors.

In any event, in light of the small amount of emissions from the wood conditioning process, these different values may not be significantly different.

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3.2.2 Air Release

Table 3 summarizes the results of the emission testing during the air release step. It shows an emission factor for all creosote components of 7.60×10^{-5} lb creosote / cubic foot of wood treated.

3.2.3 Final Vacuum

Table 4 summarizes the results of the emission testing during the final vacuum step. It shows an emission factor for all creosote components of 4.66×10^{-6} lb creosote / cubic foot of wood treated.

3.2.4 Summary of Conclusions

It is Chester's recommendation that the values found in Table 5 be used for emission factors for the wood conditioning step, the air release step and the final vacuum step in the wood treating process.

TABLE 1				
BOULTONIZING IN TWO CYLINDERS				
VACUUM PUMP EMISSIONS				
KOPPERS INDUSTRIES, INC.				
PAH EMISSIONS FROM WOOD TREATING				
SUSQUEHANNA PLANT				
SAMPLE SIZE in ~~cu ft~~ DSCF	17.8			
AIR FLOW in DSCFM	227			
WOOD TREATED in cu ft	5852			
HOURS OF OPERATION in hrs	17.9			
SAMPLE NO:	SUS-FC1-I			
	ANALYTICAL	SAMPLE	PROCESS	CALCULATED
PAH	RESULTS	CONCEN.	MASS	EMISSION
			EMISSION	FACTOR
		(1)	(2)	(3)
	mg/TS	~~lb/cf~~	lb/hr	lb/cf
	mg/total sample	lb/DSCF		lb/ft³ of wood treated
CARBAZOLE				
NAPHTHALENE	24.7	3.06E-06	4.16E-02	1.27E-04
ACENAPHTHYLENE	9.22	1.14E-06	1.55E-02	4.75E-05
ACENAPHTHENE	2.93	3.63E-07	4.94E-03	1.51E-05
FLUORENE	0.827	1.02E-07	1.39E-03	4.26E-06
PHENANTHRENE	0.217	2.69E-08	3.66E-04	1.12E-06
ANTHRACENE	0.036	4.45E-09	6.07E-05	1.86E-07
FLUORANTHENE				
PYRENE				
BENZO(a)ANTHRACENE				
CHRYSENE	0.0126	1.56E-09	2.12E-05	6.50E-08
BENZO(b)FLUORANTHENE				
BENZO(k)FLUORANTHENE				
BENZO(a)PYRENE				
DIBENZO(a,h)ANTHRACENE				
BENZO(g,h,i)PERYLENE				
INDENO(1,2,3-cd)PYRENE				
DIBENZOFURAN	12.1	1.50E-06	2.04E-02	6.24E-05
	TOTAL	6.19E-06	8.43E-02	2.58E-04
(1) - Sample concentration = Analytical Results / Sample Size				
(2) - Process Mass Emission = Sample Concentration * Air Flow				
(3) Calculated Emission Factor = Process Mass Emissions / Wood Treated				

TABLE 2				
BOULTONIZING IN ONE CYLINDER				
VACUUM PUMP EMISSIONS				
KOPPERS INDUSTRIES, INC.				
PAH EMISSIONS FROM WOOD TREATING				
SUSQUEHANNA PLANT				
SAMPLE SIZE in cu ft	37.76			
AIR FLOW in DSCFM	228.9			
WOOD TREATED in cu ft	3412			
HOURS OF OPERATION in hrs	17.9			
SAMPLE NO:	SUS-FC2-I			
	ANALYTICAL	SAMPLE	PROCESS	CALCULATED
PAH	RESULTS	CONCEN.	MASS	EMISSION
			EMISSION	FACTOR
		(1)	(2)	(3)
	mg/TS	lb/cf	lb/hr	lb/cf
CARBAZOLE	0.223	1.30E-08	1.79E-04	9.37E-07
NAPHTHALENE	5.07	2.96E-07	4.06E-03	2.13E-05
ACENAPHTHALENE				
ACENAPHTHENE				
FLUORENE	0.807	4.71E-08	6.47E-04	3.39E-06
PHENANTHRENE	0.507	2.96E-08	4.06E-04	2.13E-06
ANTHRACENE	0.007	4.08E-10	5.61E-06	2.94E-08
FLUORANTHENE				
PYRENE				
BENZO(a)ANTHRACENE				
CHRYSENE	0.0126	7.35E-10	1.01E-05	5.30E-08
BENZO(b)FLUORANTHENE				
BENZO(k)FLUORANTHENE				
BENZO(a)PYRENE				
DIBENZO(a,h)ANTHRACENE				
BENZO(g,h,i)PERYLENE				
INDENO(1,2,3-cd)PYRENE				
DIBENZOFURAN	0.984	5.74E-08	7.88E-04	4.14E-06
	TOTAL	4.44E-07	6.10E-03	3.20E-05
(1) - Sample concentration = Analytical Results / Sample Size				
(2) - Process Mass Emission = Sample Concentration * Air Flow				
(3) Calculated Emission Factor = Process Mass Emissions / Wood Treated				

TABLE 3

AIR RELEASE

VACUUM PUMP EMISSIONS

KOPPERS INDUSTRIES, INC.

PAH EMISSIONS FROM WOOD TREATING

SUSQUEHANNA PLANT

SAMPLE SIZE in ~~cu ft~~ DSCF	11.54
AIR FLOW in DSCF	10796
WOOD TREATED in cu ft	3472
SAMPLE NO:	SUS-FV1-I

PAH	ANALYTICAL RESULTS	SAMPLE CONCEN. (1)	PROCESS MASS EMISSION (2)	CALCULATED EMISSION FACTOR (3)
	mg/TS	lb/cf	lb/hr	lb/cf
CARBAZOLE		✓	✓	
NAPHTHALENE	1.04	1.99E-07	1.29E-01	3.70E-05
ACENAPHTHALENE				
ACENAPHTHENE	0.213	4.07E-08	2.63E-02	7.58E-06
FLUORENE	0.0083	1.58E-09	1.03E-03	2.96E-07
PHENANTHRENE	0.0799	1.53E-08	9.88E-03	2.85E-06
ANTHRACENE	0.0183	3.49E-09	2.26E-03	6.52E-07
FLUORANTHENE	0.0342	6.53E-09	4.23E-03	1.22E-06
PYRENE	0.0282	5.38E-09	3.49E-03	1.00E-06
BENZO(a)ANTHRACENE	0.0065	1.24E-09	8.04E-04	2.31E-07
CHRYSENE	0.0069	1.32E-09	8.53E-04	2.46E-07
BENZO(b)FLUORANTHENE	0.0063	1.20E-09	7.79E-04	2.24E-07
BENZO(k)FLUORANTHENE	0.0024	4.58E-10	2.97E-04	8.55E-08
BENZO(a)PYRENE	0.0032	6.11E-10	3.96E-04	1.14E-07
DIBENZO(a,h)ANTHRACENE				
BENZO(g,h,i)PERYLENE				
INDENO(1,2,3-cd)PYRENE				
DIBENZOFURAN	0.686	1.31E-07	8.48E-02	2.44E-05
	TOTAL	4.07E-07	2.64E-01	7.60E-05

(1) - Sample concentration = Analytical Results / Sample Size

(2) - Process Mass Emission = Sample Concentration * Air Flow

(3) Calculated Emission Factor = Process Mass Emissions / Wood Treated

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EMISSION RATES AND FACTORS ARE INCORRECT. THEY ARE BASED ON A GAS FLOW RATE OF 10796 DSCFM. ACTUALLY 10796 IS THE TOTAL VOLUME OF GAS FLOW OVER THE 22-MIN AIR RELEASE CYCLE.

TABLE 4				
FINAL VACUUM				
VACUUM PUMP EMISSIONS				
KOPPERS INDUSTRIES, INC.				
PAH EMISSIONS FROM WOOD TREATING				
SUSQUEHANNA PLANT				
SAMPLE SIZE in cu ft	28.63			
AIR FLOW in DSCFM	162			
WOOD TREATED in cu ft	2380			
HOURS OF OPERATION in hr	2			
SAMPLE NO:	SUS-FV1-I			
	ANALYTICAL	SAMPLE	PROCESS	CALCULATED
PAH	RESULTS	CONCEN.	MASS	EMISSION
			EMISSION	FACTOR
		(1)	(2)	(3)
	mg/TS	lb/cf	lb/hr	lb/cf
CARBAZOLE				
NAPHTHALENE	4.72	3.63E-07	3.53E-03	2.97E-06
ACENAPHTHALENE				
ACENAPHTHENE	0.7	5.39E-08	5.23E-04	4.40E-07
FLUORENE	0.0359	2.76E-09	2.68E-05	2.26E-08
PHENANTHRENE	0.333	2.56E-08	2.49E-04	2.09E-07
ANTHRACENE	0.0062	4.77E-10	4.64E-06	3.90E-09
FLUORANTHENE				
PYRENE				
BENZO(a)ANTHRACENE				
CHRYSENE	0.0055	4.23E-10	4.11E-06	3.46E-09
BENZO(b)FLUORANTHENE				
BENZO(k)FLUORANTHENE				
BENZO(a)PYRENE				
DIBENZO(a,h)ANTHRACENE				
BENZO(g,h,i)PERYLENE				
INDENO(1,2,3-cd)PYRENE				
DIBENZOFURAN	1.62	1.25E-07	1.21E-03	1.02E-06
	TOTAL	5.71E-07	5.55E-03	4.66E-06
(1) - Sample concentration = Analytical Results / Sample Size				
(2) - Process Mass Emission = Sample Concentration * Air Flow				
(3) Calculated Emission Factor = Process Mass Emissions / Wood Treated				

TABLE 5			
SUMMARY OF EMISSION FACTORS			
VACUUM PUMP EMISSIONS			
KOPPERS INDUSTRIES, INC.			
PAH EMISSIONS FROM WOOD TREATING			
SUSQUEHANNA PLANT			
PAH	WOOD CONDITIONING EMISSION FACTOR	AIR RELEASE EMISSION FACTOR	FINAL VACUUM EMISSION FACTOR
	lb/cf	lb/cf	lb/cf
CARBAZOLE	4.69E-07		
NAPHTHALENE	7.43E-05	3.70E-05	2.97E-06
ACENAPHTHALENE	2.38E-05		
ACENAPHTHENE	7.55E-06	7.58E-06	4.40E-07
FLUORENE	3.83E-06	2.96E-07	2.26E-08
PHENANTHRENE	1.62E-06	2.85E-06	2.09E-07
ANTHRACENE	1.08E-07	6.52E-07	3.90E-09
FLUORANTHENE		1.22E-06	
PYRENE		1.00E-06	
BENZO(a)ANTHRACENE		2.31E-07	
CHRYSENE	5.90E-08	2.46E-07	3.46E-09
BENZO(b)FLUORANTHENE		2.24E-07	
BENZO(k)FLUORANTHENE		8.55E-08	
BENZO(a)PYRENE		1.14E-07	
DIBENZO(a,h)ANTHRACENE			
BENZO(g,h,i)PERYLENE			
INDENO(1,2,3-cd)PYRENE			
DIBENZOFURAN	3.33E-05	2.44E-05	1.02E-06
	1.45E-04	7.60E-05	4.66E-06

APPENDIX A

RAW FIELD DATA SHEETS

CHESTER ENVIRONMENTAL

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Susquehanna - Koppers Industries
LOCATION: Inlet to Final Condensor
ACTIVITY NO.: Boltanizing Process
CONTROL BOX OPERTOR: MG
PROBE HANDLER:
CLEAN UP:

DATE: 5/24/90
TEST NO.: SUS-~~Inlet~~ EFS-1
NOZZLE: 3/8 SS Tubing
STATIC PRESSURE Ps: 0.6
PORT DIRECTION: Horizontal
BAROMETRIC PRESSURE: 29.60

ΔH@: 1.634 12/28/89
METER CORRECTION: .9778
PITOT CORRECTION: .84
CONTROL BOX NO.: 3
NOMOGRAPH SET POINT:
LENGTHS OF UMBILICAL ___ x 25' X x 50'

HOT BOX NO.: Bucket
COLD BOX NO.: Bucket
PROBE NO.: Teflon + Stainless St
FILTER NO.: —
STACK DIA.: 8.0"

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ Temp. XAD Exit °F	~~Hot Box~~ Bucket °F Iced Down	Comments
6" IN	1440	748.913	.05	.60	.60	83	75	5.0	106	no heat	42	68	60 min/point
			.05	.60	.60	91	77	5.0	105		41		
			.05	.60	.60	92	79	5.0	105		42		
	9.9%		.05	.60	.60	95	79	5.0	105		40		
			.045	.60	.60	95	80	5.0	105		43		
	H_2O		.045	.60	.60	98	81	5.0	104		44		
	%		.045	.60	.60	99	83	5.0	104		42		
			.05	.60	.60	99	83	5.0	105		44		
			.05	.60	.60	98	83	5.0	105		42	10.17% H_2O	
			.05	.60	.60	98	82	5.0	106		41		
	~~1540~~		.045	.60	.60	98	82	5.0	105		41		
	1540	776.713	.045	.60	.60	98	82	5.0	~~1..~~ 106		41		

90

LEAK CHECK

	in. Hg.	Rate
Before	6.0	<.02 CFM
After	7.0	<.02 CFM

ORSAT

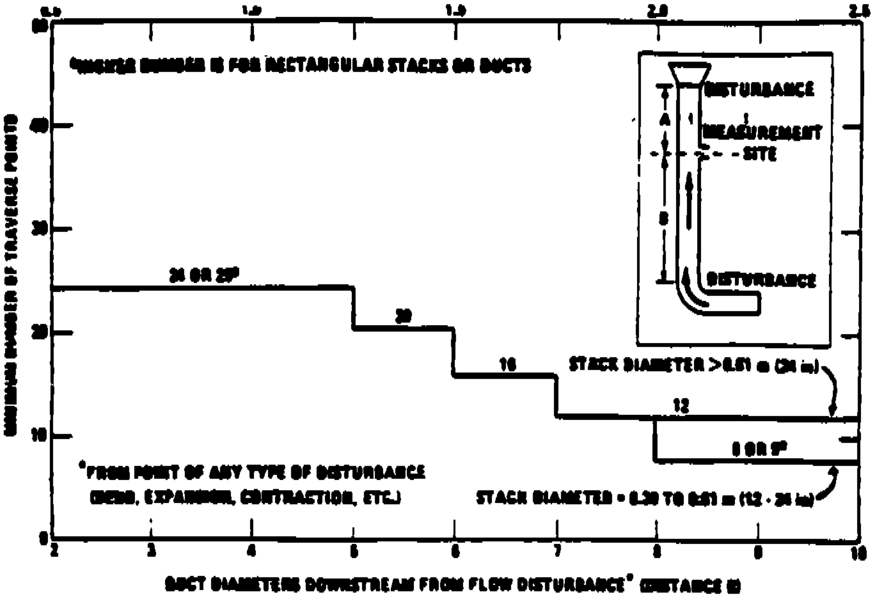
	1	2
CO_2		
O_2		
CO		
N		

PITOT LEAK CHECK

POS.	NEG.
OK 15 sec	OK 15 sec

Impinger No.	Final	Initial	Difference
1 Dry	479.70	438.8	40.9
2 100 ml	580.1	566.3	13.8
3 Cond	974.3	966.5	7.8
4 Dry	378.6	378.4	.2

XAD 1148.9-114
Sil Gel 685.7-67



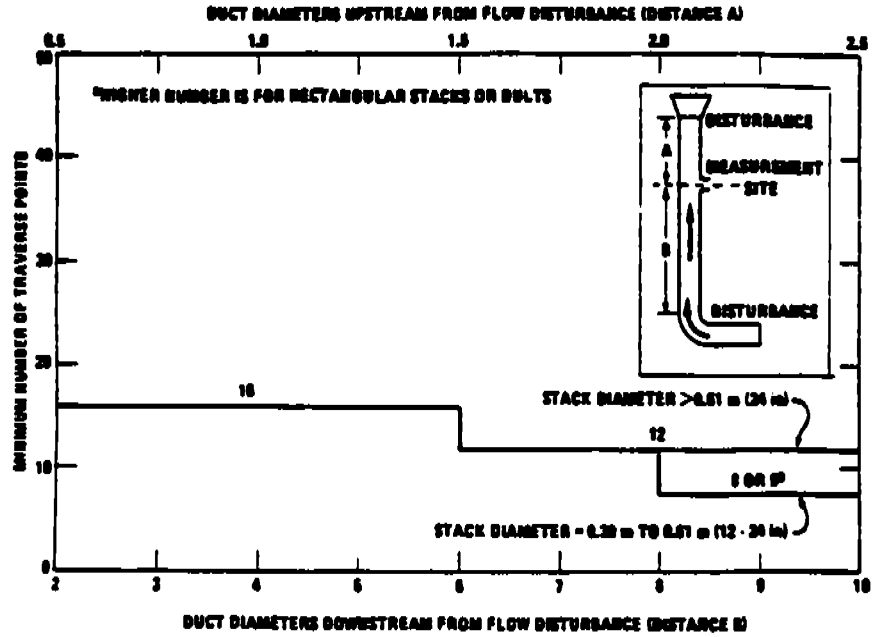


Table 1-2. Location of Traverse Points in Circular Stacks

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Table 1-1. Cross-Section Layout for Rectangular Stacks

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

1/2

STACK SAMPLING DATA SHEET

PLANT: Susquehanna-Koppers Indust. DATE: 5/24/90 ΔH@: 1.777 12/27/89 HOT BOX NO.: 5

LOCATION: Outlet to Final Condensor TEST NO.: SUS-OFC-1 METER CORRECTION: 1.0350 COLD BOX NO.: 5

ACTIVITY NO.: Boltanizing Process NOZZLE: PITOT CORRECTION: — PROBE NO.: Teflon Line 1/4"

CONTROL BOX OPERTOR: [initials] STATIC PRESSURE Ps: .05 in. H_2O CONTROL BOX NO.: 1 FILTER NO.: —

PROBE HANDLER: PORT DIRECTION: Horizontal NOMOGRAPH SET POINT: STACK DIA.: 4.0"

CLEAN UP: BAROMETRIC PRESSURE: 29.60 LENGTHS OF UMBILICAL ___ x 25' X x 50' High Pressure Line

Point	Time	Meter Reading (dry) CF	Velocity ~~HD in. H_2O~~ FPM	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ XAD Exit Temp. °F	Hot Box Iced Down °F	Comments
	14:40	1040.655	275 FPM	0.6	0.6	76	74	5.0	78		43		
	14:45			0.6	0.6	81	75	5.0	78		43		
	14:50			0.6	0.6	84	77	5.0	78		43		
	14:55			0.6	0.6	85	78	5.5	79		45		
	15:00		250 FPM	0.6	0.6	86	79	5.5	78		39		
	15:05			0.6	0.6	88	80	5.5	78		40		
	15:10			0.6	0.6	89	81	5.5	78		40		
	15:15			0.6	0.6	90	82	5.5	78		41		
	15:20			0.6	0.6	90	83	5.5	78		40		
	15:25			0.6	0.6	90	83	5.5	78		38		
	15:30			0.6	0.6	91	84	6.0	78		38		
	15:35		260 FPM	0.6	0.6	91	84	6.0	78		39		
	15:40	1066.648											

LEAK CHECK

	in. Hg.	Rate
Before	5.0	<.02 CFM
After	7.0	<.02 CFM

ORSAT

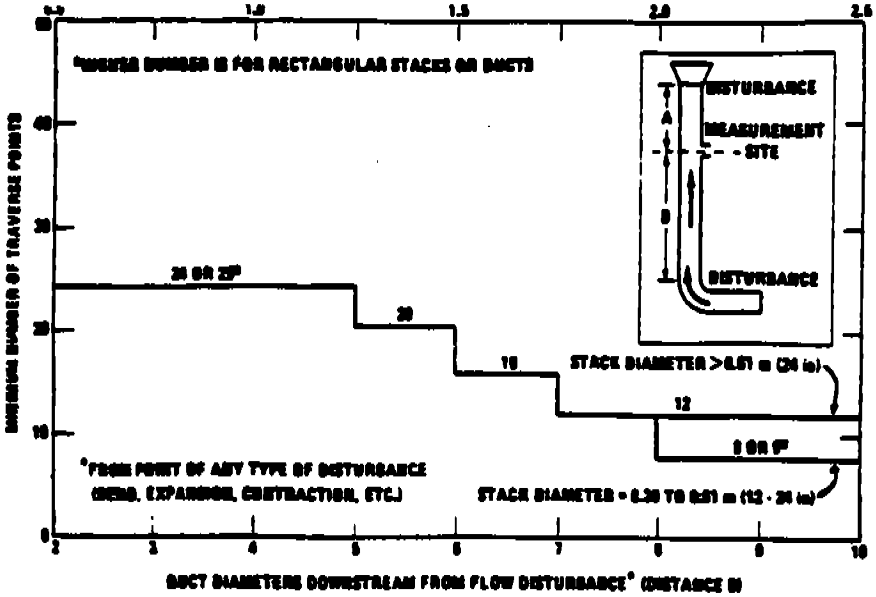
	1	2
CO_2		
O_2		
CO		
N		

PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1 XAD COND.	1186.1	1158.0	28.1
2 DRY	446.3	446	.3
3 Sil. Gel	662.5	653.6	8.9
4			

6.38 % H_2O



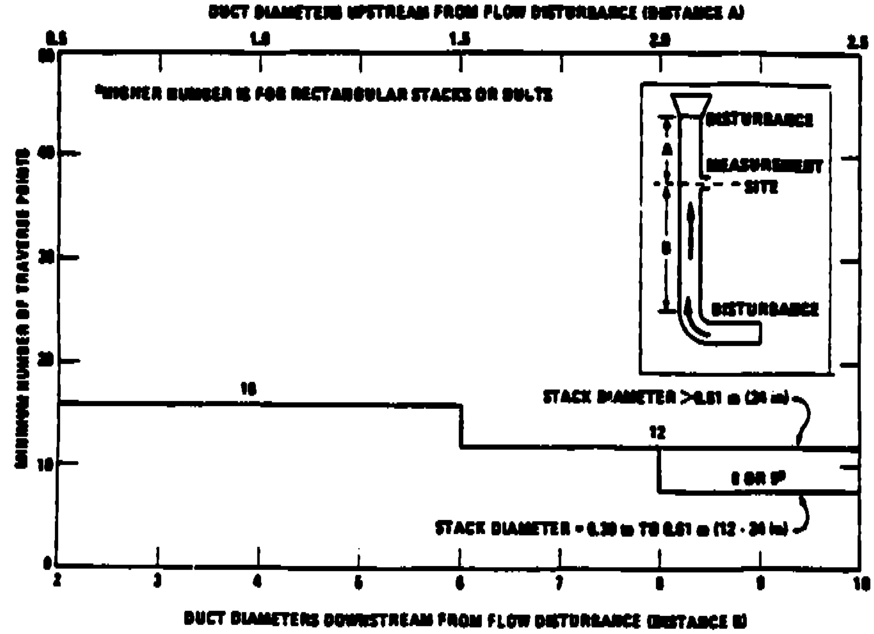


Table 1-2. Location of Traverse Points in Circular Stacks

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter— 2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Table 1-1. Cross-Section Layout for Rectangular Stacks

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

1/2

PLANT: Susquehanna Koppers Ind. DATE: 5/24/90 ΔH@: 1.634 12/28/89 HOT BOX NO.: Bucket 1

LOCATION: Inlet to Final Condenser TEST NO.: SUS-IFC-2 METER CORRECTION: .9778 COLD BOX NO.: " 1

ACTIVITY NO.: Boltanizing Process NOZZLE: 3/8" SS Tubing PITOT CORRECTION: .84 PROBE NO.: Teflon & SS. Tubing

CONTROL BOX OPERTOR: STATIC PRESSURE Ps: +.60 CONTROL BOX NO.: 3 FILTER NO.: None

PROBE HANDLER: PORT DIRECTION: (Horz) NOMOGRAPH SET POINT: STACK DIA.: 8.0

CLEAN UP: BAROMETRIC PRESSURE: 29.60 LENGTHS OF UMBILICAL ___ x 25' ___ x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. XAD °C/°F	Hot Box °F	Comments
6" IN	1720	776.951	.05	.60	.60	83	77	5.0	109	No Heat	41	None	Going one
			.05	.60	.60	89	76	5.0	110		41		point
			.05	.60	.60	92	77	5.0	110		39		Note traverse was the
			.05	.60	.60	93	77	5.0	110		40		same vel at
			.05	.60	.60	94	78	5.0	110		41		all points
			.05	.60	.60	94	78	5.0	110		41		
			.05	.60	.60	94	78	5.0	110		42		
			.055	.60	.60	94	79	5.0	111		41		
			.055	.60	.60	94	79	5.0	111		42		
			.05	.60	.60	95	79	5.0	111		42		12.73%
			.05	.60	.60	95	79	5.0	111		43		
	1820	804.708	.055	.60	.60	95	80	5.0	111		42		

Ave.

LEAK CHECK

	in. Hg.	Rate
Before	6.0	L.02 CFM
After	6.5	L.02 CFM

ORSAT

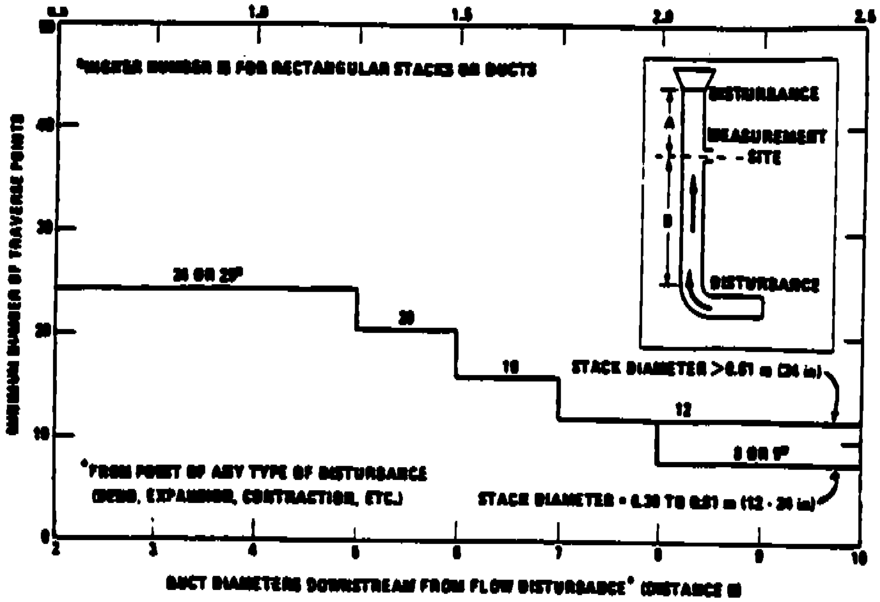
	1	2
CO_2		
O_2		
CO		
N		

PITOT LEAK CHECK

POS.	NEG.
15 scc O.K.	15 scc O.K.

Impinger No.	Final	Initial	Difference
1 GS 100 ml H_2O	661.3	595.6	65.7
2 XAD	1151.7	1141.0	10.7
3 Silica Gel	689.3	685.6	3.7
4			

% H_2O 12.67



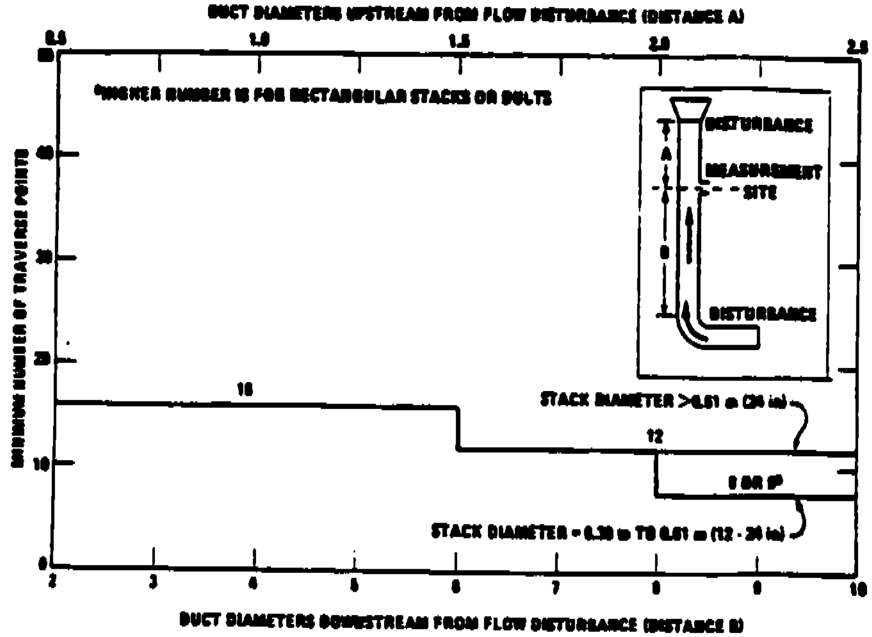


TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

1/2

PLANT: Susquehanna-Koppers Ind. DATE: 5/24/90
LOCATION: Outlet to Final Condensor TEST NO.: SUS-OFC-2
ACTIVITY NO.: Bottanizing Process NOZZLE: ______
CONTROL BOX OPERTOR: PJF STATIC PRESSURE Ps: .05
PROBE HANDLER: ______ PORT DIRECTION: Horizontal
CLEAN UP: ______ BAROMETRIC PRESSURE: 29.60

ΔH@: 1.777 12/27/89
METER CORRECTION: 1.0350
PITOT CORRECTION: —
CONTROL BOX NO.: 1
NOMOGRAPH SET POINT: ______
LENGTHS OF UMBILICAL ____ x 25' X x 50' High Pressure Line

HOT BOX NO.: 5
COLD BOX NO.: 5
PROBE NO.: Teflon Line 1/4"
FILTER NO.: —
STACK DIA.: 4.0"

Point	Time	Meter Reading (dry) CF	Velocity ~~HD in. H2O~~ FPM	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ Temp. XAD Exit °F	Hot Box °F Iced Down	Comments
	1720	1066.776	250 FPM	0.6	0.6	74	72	5.0	79		47		
	1725			0.6	0.6	79	73	5.0	80		47		
	1730			0.6	0.6	82	75	5.0	80		45		
	1735			0.6	0.6	84	77	5.5	80		40		
	1740			0.6	0.6	86	78	5.5	81		40		
	1745			0.6	0.6	87	79	5.5	80		42		
	1750		290 FPM	0.6	0.6	87	80	5.5	79		41		
	1755			0.6	0.6	88	81	5.5	78		41		
	1800			0.6	0.6	89	82	5.5	79		41		
	1805			0.6	0.6	89	82	5.5	79		42		
	1810			0.6	0.6	89	83	5.5	78		43		
	1815		265 FPM	0.6	0.6	90	83	5.5	78		41		

1820 1094.130

LEAK CHECK

	in. Hg.	Rate
Before	5.0	L.02 CFM
After	6.0	L.02 CFM

ORSAT

	1	2
CO_2		
O_2		
CO		
N		

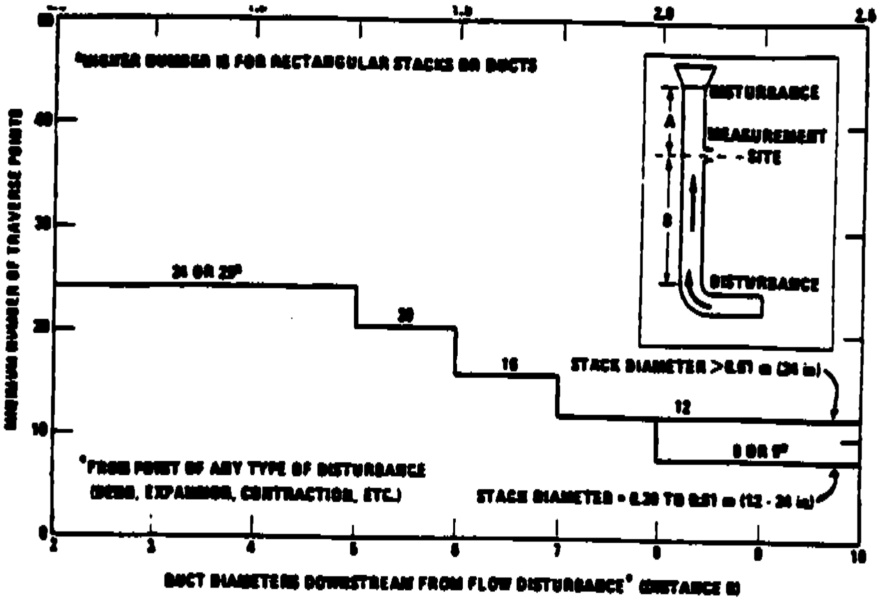
PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1 Dry	461.3	447.2	14.1
2 XAD Coil Cond.	1174.2	1160.2	14
3 Sil. Gel	671.6	662.5	9.1
4			

37.2 g

6.02 % H_2O



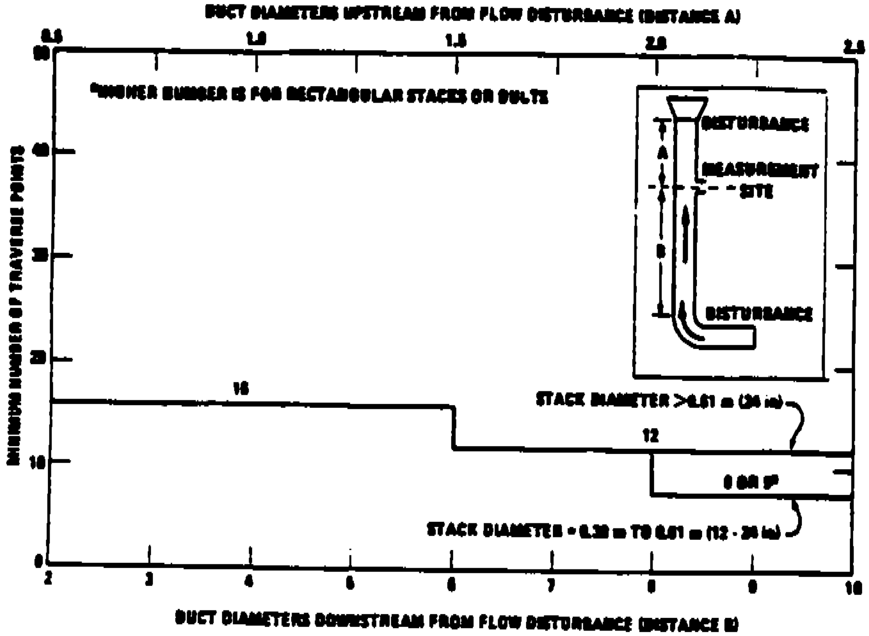


TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	79.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

Sus-IFC-3 SUS-ARI-3

STACK SAMPLING DATA SHEET

PLANT: Susquehanna-Koppers Indust. DATE: 5/25/90 ΔH@: 1.634 12/28/89 HOT BOX NO.: 1

LOCATION: Inlet to Final Cond. TEST NO.: Sus-IFC-3 METER CORRECTION: .9778 COLD BOX NO.: 1

ACTIVITY NO.: Air Release NOZZLE: 3/8 SS Tubing PITOT CORRECTION: .84 PROBE NO.: Teflon

CONTROL BOX OPERTOR: MG STATIC PRESSURE Ps: .60 CONTROL BOX NO.: 3 FILTER NO.: —

PROBE HANDLER: PORT DIRECTION: HORZ NOMOGRAPH SET POINT: STACK DIA.: 8.0"

CLEAN UP: BAROMETRIC PRESSURE: 29.75 LENGTHS OF UMBILICAL ___ x 25' ___ x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. XAD °F	Hot Box °F	Comments
6" IN	715	804.836	.03	.80	.80	58	52	5.0	54	No Heat	.41		
			.08	.80	.80	65	52	5.0	65				ONE point
			.48	.80	.80	72	55	5.0	86				
			.62	.80	.80	74	56	5.0	96		40		Air
	736	816.376	.01	.80	.80	75	56	5.0	96				Stopped
		816.376											19 mins
													RAN 21 mins

LEAK CHECK

	in. Hg.	Rate
Before	6.0	L.02 CFM
After	6.5	L.02 CFM

ORSAT

	1	2
CO_2		
O_2	20.5	
CO		
N	79.5	

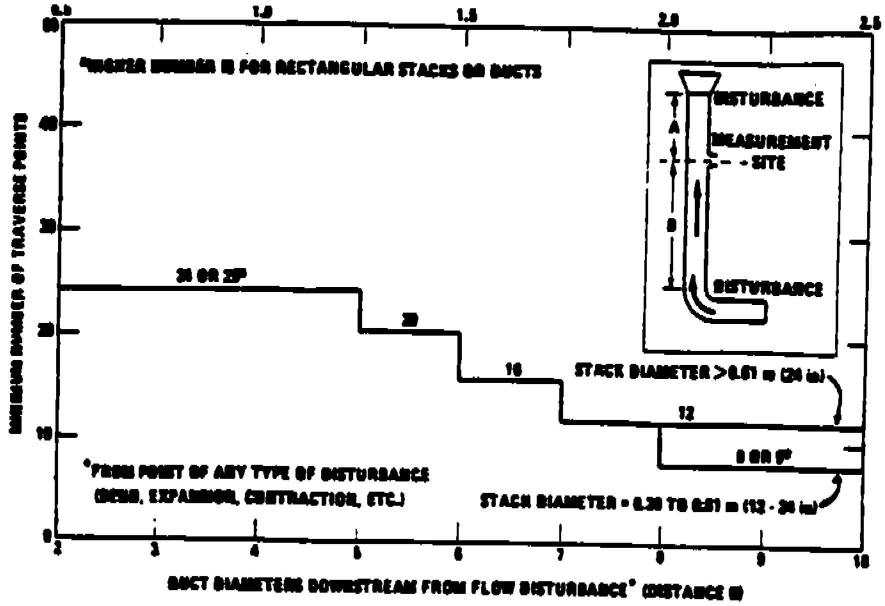
PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1 100 ml G.S. H_2O	598.4	595.4	3
2 XAD	1140.2	1139.8	.4
3 Sil. Gel	690.8	689.3	1.5
4			

4.9

2.02% H_2O



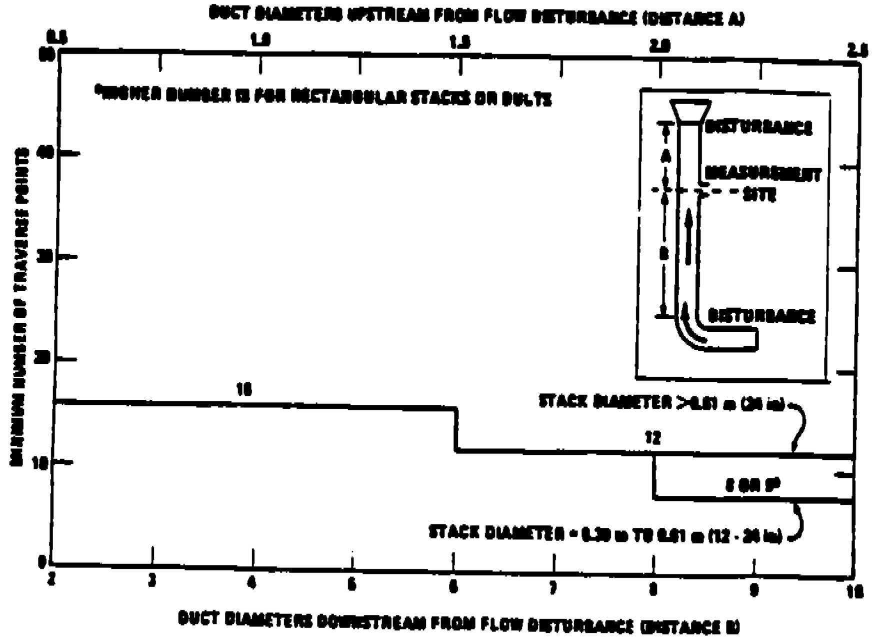


Table 1-2. Location of Traverse Points in Circular Stacks

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Table 1-1. Cross-Section Layout for Rectangular Stacks

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

SUS-OFC-3

STACK SAMPLING DATA SHEET

SUS-ARO-3

PLANT: Susquehanna-Koppers Inc. DATE: 5/25/90 ΔH@: 1.777 12/27/89 HOT BOX NO.: 5

LOCATION: Air Release-Outlet TEST NO.: SUS-OFC-3 ~~SUS-Air Release-Outlet~~ ~~SUS-ARO-3~~ METER CORRECTION: 1.0350 COLD BOX NO.: 5

ACTIVITY NO.: NOZZLE: PITOT CORRECTION: PROBE NO.: Teflon Line 1/4"

CONTROL BOX OPERTOR: PJD STATIC PRESSURE Ps: CONTROL BOX NO.: 1 FILTER NO.: —

PROBE HANDLER: PORT DIRECTION: Horizontal NOMOGRAPH SET POINT: STACK DIA.: 4.0"

CLEAN UP: BAROMETRIC PRESSURE: 29.75 LENGTHS OF UMBILICAL ____ x 25' X x 50' High Pressure Line

Point	Time	Meter Reading (dry) CF	Velocity ~~HD in. H2O~~ FPM	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ Temp. XAD Exit °F	Hot Box °F Iced Down	Comments
2" IN	7:15	94.212	210 FPM	0.8	0.8	57	53	6.0	53		44		
	7:20			0.8	0.8	60	54	6.0	54		43		
	7:25			0.8	0.8	62	55	6.0	71		43		
	7:30			0.8	0.8	65	58	6.0	70		42		
	7:35		410 FPM	0.8	0.8	67	59	6.0	69		41		
	7:40	1048.300		0.8	0.8	68	60	6.0	67		42		
	~~7:45~~												

LEAK CHECK

	in. Hg.	Rate
Before	5.0	L.02 CFM
After	7.0	L.02 CFM

ORSAT

	1	2
CO_2		
O_2		
CO		
N		

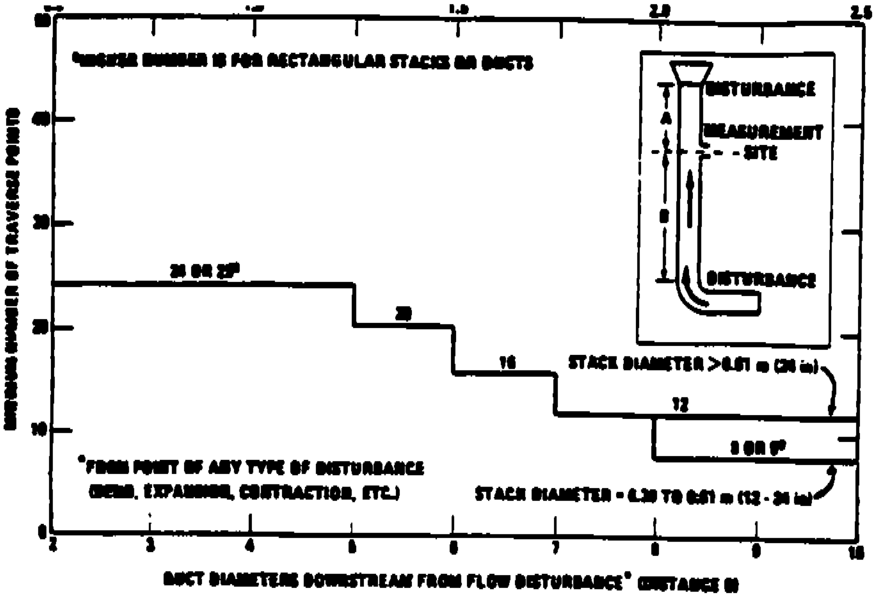
PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1 100ml H_2O	545.9	544.1	1.8
2 XAD Cond	1157.7	1157.3	0.4
3 Silica gel	674.1	671.6	2.5
4			

Total: 4.7

H_2O .10 .02



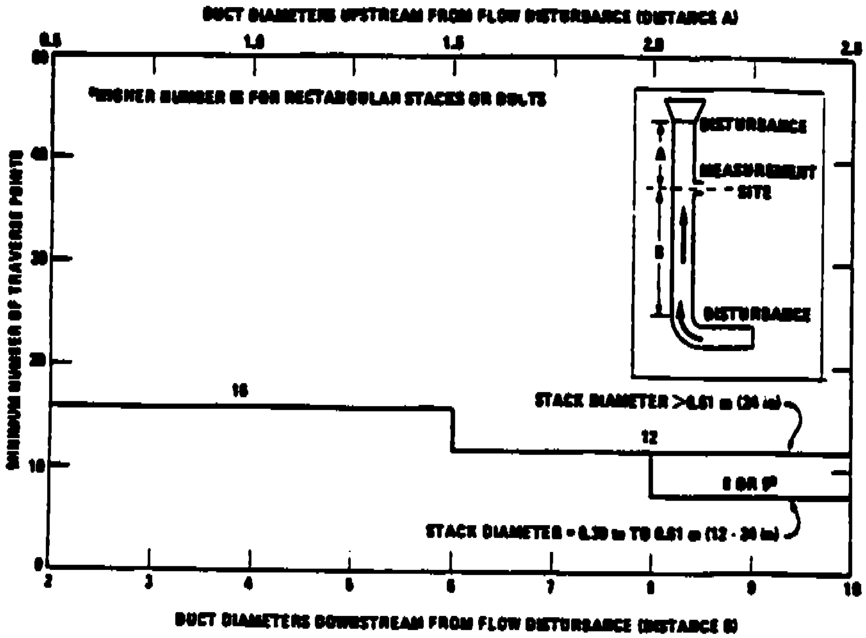


Table 1-2. Location of Traverse Points in Circular Stacks

(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Table 1-1. Cross-Section Layout for Rectangular Stacks

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

SUS-IFC-4 SUS-FVI-4

STACK SAMPLING DATA SHEET

PLANT: Susquehanna-Koppers Ind. DATE: 5/25/90 ΔH@: 1.634 12/28/89 HOT BOX NO.: 1
LOCATION: Final/Vacuum TEST NO.: SUS-FVI-4 METER CORRECTION: .9778 COLD BOX NO.: 1
ACTIVITY NO.: NOZZLE: 3/8" SS Tubing PITOT CORRECTION: .84 PROBE NO.: Teflon tubing
CONTROL BOX OPERTOR: MG STATIC PRESSURE Ps: +.55 CONTROL BOX NO.: 3 FILTER NO.: —
PROBE HANDLER: PORT DIRECTION: Horizontal NOMOGRAPH SET POINT: STACK DIA.: 8.0"
CLEAN UP: BAROMETRIC PRESSURE: 29.75 LENGTHS OF UMBILICAL ___ x 25' X x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ Temp. XAD Exit °F	Hot Box Iced Down °F	Comments
6" IN	0845	816.480	.05	.60	.60	67	59	4.0	69	No Heat	42		One point for 60 mins
			.035	.60	.60	71	59	4.0	70		40		
			.02	.60	.60	76	60	4.0	74		40		
			.02	.60	.60	78	61	4.0	74		40		
			.02	.60	.60	79	62	4.0	74		41		
			.015	.60	.60	81	63	4.0	76		40		
			.015	.60	.60	82	64	4.0	78		42		
			.015	.60	.60	82	65	4.0	79		42		
			.015	.60	.60	84	66	4.0	80		43		3.47%
			.015	.60	.60	86	68	4.0	81		42		
			.015	.60	.60	86	68	4.0	82		42		
	0945	845.112	.015	.60	.60	87	69	4.0	82		43		

LEAK CHECK

	in. Hg.	Rate
Before	6.0	<.02 CFM
After	6.5	<.02 CFM

ORSAT

	1	2
CO_2	—	
O_2	20.5	
CO	—	
N	79.5	

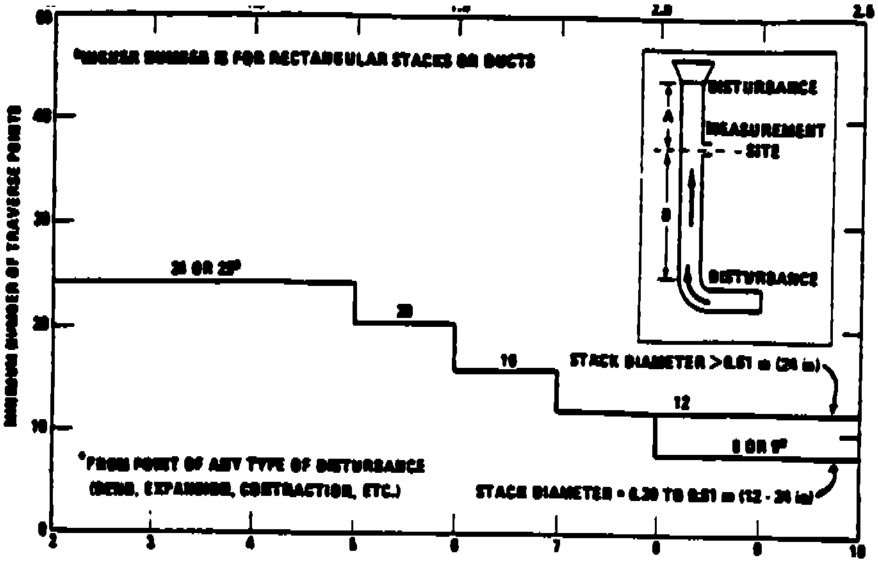
PITOT LEAK CHECK

POS.	NEG.
15 sec	15 sec

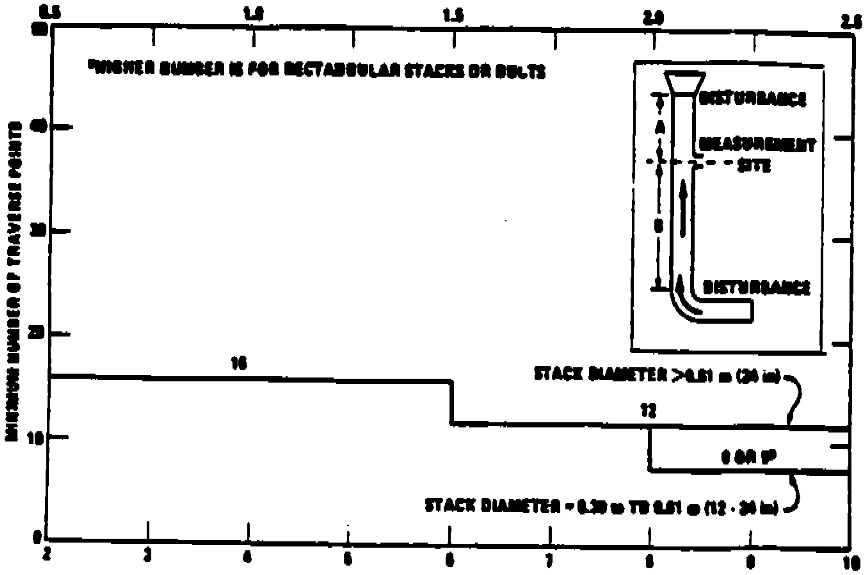
Impinger No.	Final	Initial	Difference
1 100mL	611.0	598.4	12.6
2 XAD	1157.7	1152.5	5.2
3 S. Gel	677.4	674.1	3.3
4			

Total: 21.1

3.52%



DUCT DIAMETERS UPSTREAM FROM FLOW DISTURBANCE (DISTANCE A)



DUCT DIAMETERS DOWNSTREAM FROM FLOW DISTURBANCE (DISTANCE B)

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

[redacted] SUS-FVO-4

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Susquehanna Koppers IND DATE: 5/25/90 ΔH@: 1.777 12-27-90 HOT BOX NO.: 5
LOCATION: Final Vacuum Outlet TEST NO.: SUS-~~FVO~~ OFC-4 METER CORRECTION: 1.0350 COLD BOX NO.: 5
ACTIVITY NO.: NOZZLE: 1/4 Teflon Tubing PITOT CORRECTION: — PROBE NO.: 1/4" Teflon
CONTROL BOX OPERTOR: PJ STATIC PRESSURE Ps: CONTROL BOX NO.: 1 FILTER NO.: None
PROBE HANDLER: / PORT DIRECTION: Horizontal NOMOGRAPH SET POINT: STACK DIA.: 4"
CLEAN UP: BAROMETRIC PRESSURE: 29.75 LENGTHS OF UMBILICAL ___ x 25' X x 50' High Pressure Line

Point	Time	Meter Reading (dry) CF	Velocity ~~HD in. H_2O~~ FPM	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ XAD Exit Temp. °F	Hot Box °F Iced Down	Comments
2" IN	8:45	105.125	150 FPM	0.6	0.6	64	61	3.5	72		42		
	8:50			0.6	0.6	69	62	3.5	72		42		
	8:55			0.6	0.6	71	64	3.5	69		41		
	9:00			0.6	0.6	73	66	3.5	71		41		
	9:05			0.6	0.6	75	67	3.5	70		42		
	9:10			0.6	0.6	76	68	4.0	70		41		
	9:15		140 FPM	0.6	0.6	78	70	4.0	71		41		
	9:20			0.6	0.6	80	71	4.0	72		42		
	9:25			0.6	0.6	81	73	4.0	75		41		
	9:30			0.6	0.6	83	75	4.0	76		41		
	9:35			0.6	0.6	85	77	4.0	78		42		
	9:40		100 FPM	0.6	0.6	87	79	4.0	79		41		
	9:45	130.850							81				

LEAK CHECK

in. Hg.	Rate
10.0	<.02 cfm
	<.02 cfm

ORSAT

	1	2
CO_2		
O_2		
CO		
N		

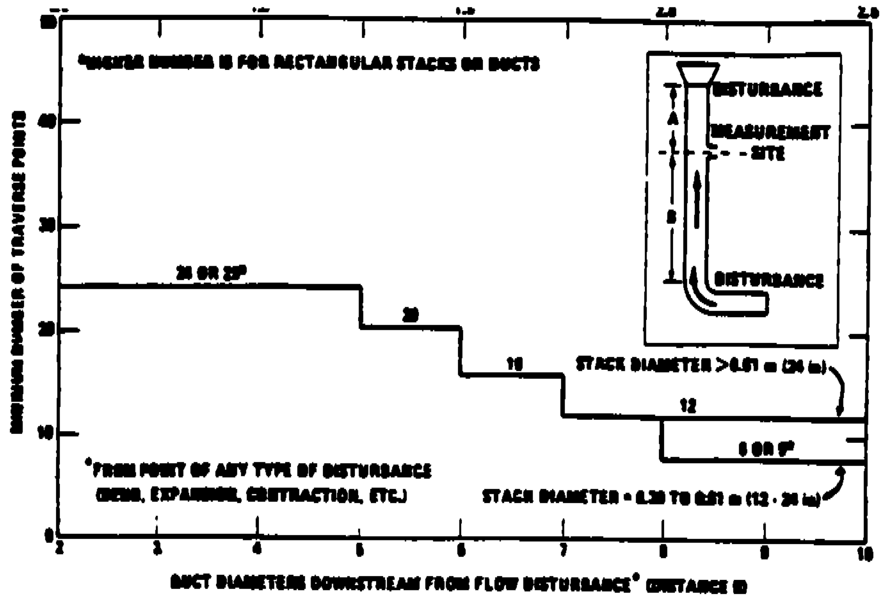
PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1 100ml H_2O	557.6	544.6	13
2 XAD COND.	1149.8	1142.9	6.9
3 Silicel	634.3	628.6	5.7
4	634.3		

} 25.6

4.91%



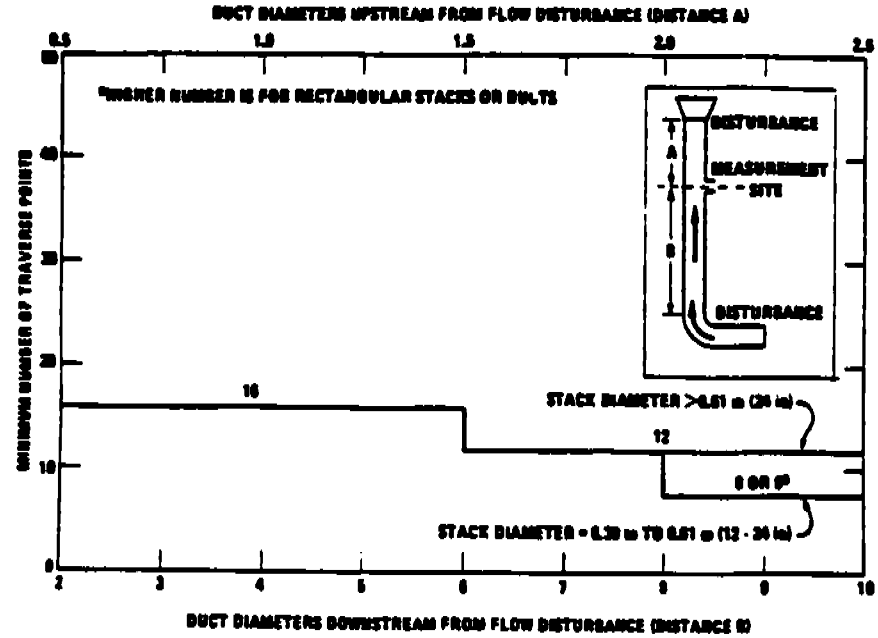


TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter— 2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Roanoke-Koppers Indust. DATE: 5/23/90 ΔH@: 1.777 12/27/89 HOT BOX NO.: Bucket #1
LOCATION: Final Vacuum-Cylinder #2 TEST NO.: Roanoke-FV-Cyc. #2 METER CORRECTION: 1.0350 COLD BOX NO.: Bucket #1
ACTIVITY NO.: NOZZLE: 3/8" stainless tubing PITOT CORRECTION: .84 PROBE NO.: Teflon + Stainless St
CONTROL BOX OPERTOR: STATIC PRESSURE Ps: CONTROL BOX NO.: 1 FILTER NO.: —
PROBE HANDLER: PORT DIRECTION: Horizontal NOMOGRAPH SET POINT: STACK DIA.: 4"
CLEAN UP: BAROMETRIC PRESSURE: 29.10 LENGTHS OF UMBILICAL ___ x 25' X x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ Temp. XAD Exit °F	Bucket ~~Hot Box~~ Iced Down °F	Comments
	8:37	1015.400	USE SAME VELOCITY AS NEXT TEST	0.0	0.0	66	64	16.0	262		43°F		
	8:42			0.0	0.0	68	65	16.0	226		43		
	8:47			0.0	0.0	69	66	16.0	257		43		
	8:52			0.0	0.0	71	67	16.0	274		45		
	8:57			0.0	0.0	71	68	16.0	275		44		98% H_2O
	9:02			0.0	0.0	71	69	16.0	268		50		
	9:07			0.0	0.0	72	70	16.0	272		50		
	9:12			0.0	0.0	73	72	16.0	278		52		
	9:17			0.0	0.0	73	72	16.0	284		51		Difference
	9:22			0.0	0.0	74	73	16.0	280		51	(5)	300.4
	9:27			0.0	0.0	75	75	16.0	281		53	(6)	39
	9:32			0.0	0.0	76	76	16.0	210		54	(7)	3.8
	9:37	1017.785											

TOTAL gm 347

LEAK CHECK

	in. Hg.	Rate
Before	10.0	L.02 CFM
After	16.0	L.02 CFM

ORSAT

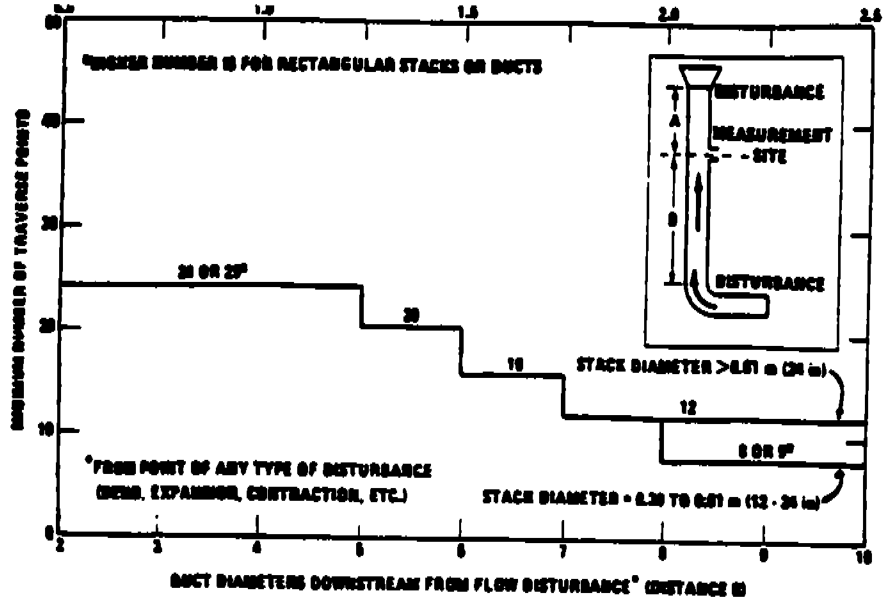
	1	2
CO_2		
O_2		
CO		
N		

PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1 Dry	831.2	438.8	392.4
2 100ml H_2O	954.9	564.6	390.3
3 Dry	902.9	448.5	454.4
4 Coil Cond.	1903.4	960.4	934.0

(5) G.S. Dry 498.2 - 497.8
(6) XAD Cond. 1173.0 - 1169.
(7) Sil. Gel 670.3 - 666.5



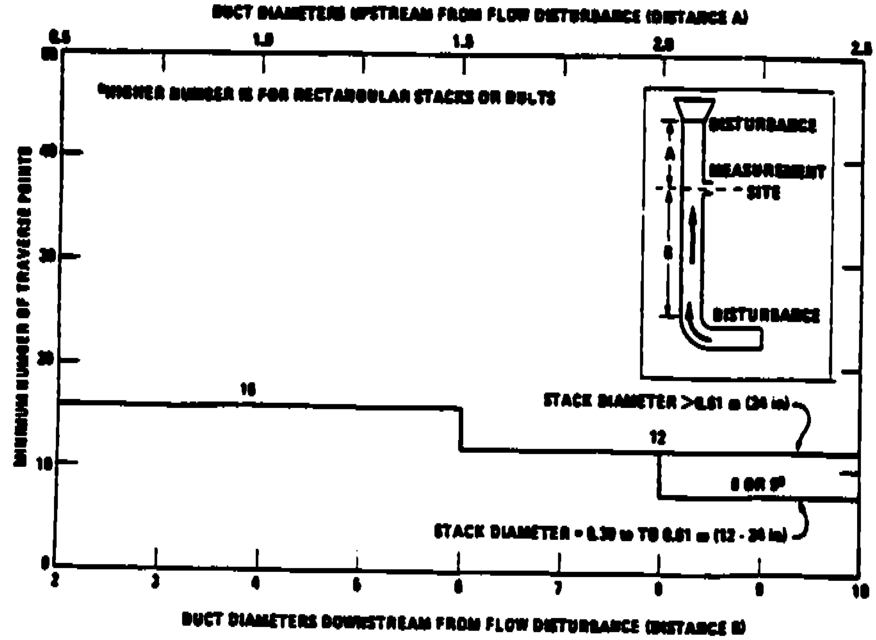


TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	38.8
13							94.3	87.5	81.2	75.0	68.5	61.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Roanoke-Koppers Industries
DATE: 5/23/90
ΔH@: 1.777 12/27/89
HOT BOX NO.: Bucket-Teledyne

LOCATION: Initial Bolt Anti-izing Process Cylinder #2
TEST NO.: Roanoke-IB-1
METER CORRECTION: 1.0350
COLD BOX NO.: " "

ACTIVITY NO.:
NOZZLE:
PITOT CORRECTION: .84
PROBE NO.: Teflon + Stainless St

CONTROL BOX OPERTOR:
STATIC PRESSURE Ps:
CONTROL BOX NO.: 1
FILTER NO.: —

PROBE HANDLER:
PORT DIRECTION: Horizontal
NOMOGRAPH SET POINT:
STACK DIA.: 4"

CLEAN UP:
BAROMETRIC PRESSURE: 29.10
LENGTHS OF UMBILICAL ____ x 25' X x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	~~Imp.~~ Temp. XAD Exit °F	~~Hot Box~~ Bucket °F Feed Down	Comments
	14:34	1038.293	7.0	0.0	0.0	88	87	16.0	265		46		
	14:39		7.0	0.0	0.0	86	87	16.0	273		48		
	14:44		6.5	0.0	0.0	86	86	15.0	273		47		
	14:49		6.0	0.0	0.0	85	85	15.0	274		47		
	14:54		6.0	0.0	0.0	86	85	16.0	275		49		
	14:59			0.0	0.0	86	86	16.0	271		48		% H_2O 98.41
	15:04			0.0	0.0	87	87	16.0	278		54		
	15:09			0.0	0.0	87	87	16.0	280		56		
	15:14			0.0	0.0	87	88	16.5	281		55	(5)	522.8
	15:19			0.0	0.0	87	87	16.5	266		53	(6)	104.4
	~~15:24~~											(7)	7.9
	~~15:29~~ ~~15:34~~	1040.552										TOTAL	2386

LEAK CHECK

	in. Hg.	Rate
Before	10.0	L.02 CFM
After	17.0	L.02 CFM

ORSAT

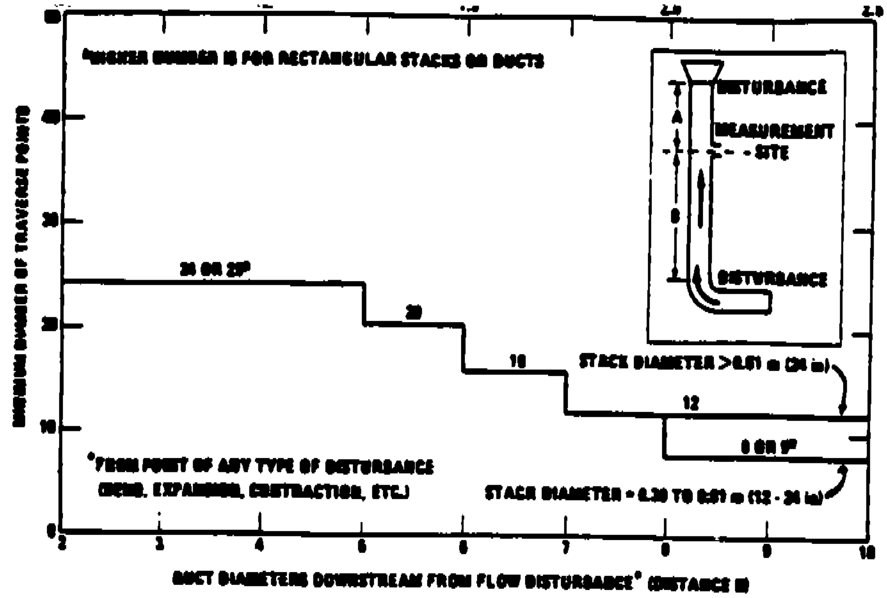
	1	2
CO_2		
O_2		
CO		
N		

PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference
1 DRY G.S.	642.2	438.7	203.5
2 100ml H_2O	860.9	596.3	264.6
3 DRY	957.9	448.1	509.8
4 Dry Coil Cond	2241.8	958.8	1283

(5) Dry 988.2-465.[illegible]
(6) Coil Cond.-XAD 1273.1-1168.[illegible]
(7) Sil. Gel 678.2-670.[illegible]



DUCT DIAMETERS UPSTREAM FROM FLOW DISTURBANCE (DISTANCE A)

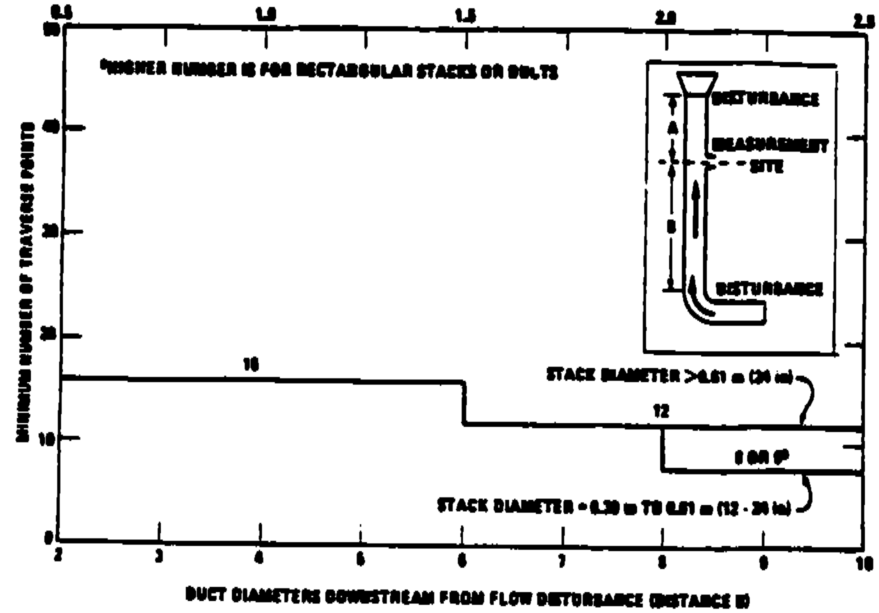


Table 1-2. Location of Traverse Points in Circular Stacks

(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Table 1-1. Cross-Section Layout for Rectangular Stacks

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Roanoke
DATE: 5/23/90
ΔH@: 1.777 12/27/89
HOT BOX NO.: Bucket #1
LOCATION: Hot Vacuum-Cylinder #2 (4 inch)
TEST NO.: Roanoke Hot Vac-Cyc #2
METER CORRECTION: 1.0350
COLD BOX NO.: Bucket #1
ACTIVITY NO.:
NOZZLE:
PITOT CORRECTION:
PROBE NO.: Teflon & stainless st
CONTROL BOX OPERTOR:
STATIC PRESSURE Ps: 7.5
CONTROL BOX NO.: 1
FILTER NO.: —
PROBE HANDLER:
PORT DIRECTION:
NOMOGRAPH SET POINT:
STACK DIA.: 4.0"
CLEAN UP:
BAROMETRIC PRESSURE: 29.10
LENGTHS OF UMBILICAL ___ x 25' X x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp °F In	Meter Temp °F Out	Vacuum in. Hg	Stack Temp °F	Probe Temp °F	Imp. Temp. XAD Exit °F	Hot Box °F	Comments
	050	012.380	9.0	0.0	0.0	66	65	25.0	275		55°F		
	055		9.0	0.0	0.0	66	66	25.0	278		55		
	0100		9.0	0.0	0.0	66	66	25.0	279		55		
	0105		9.0	0.0	0.0	66	68	25.0	280		53		H_2O 97.11%
	0110		9.0	0.0	0.0	66	68	25.0	284		53		
	0115		8.5	0.0	0.0	67	68	25.0	286		56		
	0120		8.5	0.0	0.0	68	68	25.0	286		55		
	0125	015.270	8.5	0.0	0.0	68	69	25.0	287		56	Imp #	Difference
	~~0130~~											(5)	433.3
	~~0135~~											(6)	653.3
												(7)	147
												TOTAL	2082

LEAK CHECK

	in. Hg.	Rate
efore	10.0	2.02 CFM
fter		

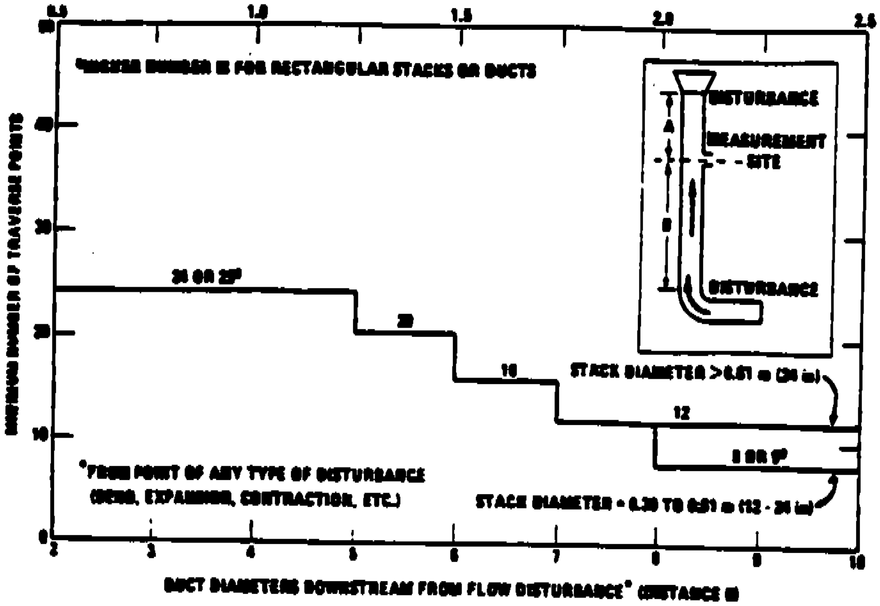
ORSAT

	1	2
CO_2		
O_2		
CO		
N		

PITOT LEAK CHECK

POS.	NEG.

Impinger No.	Final	Initial	Difference	
1 Dry	535.4	378.4	157	(5) Dry 898.6-465.
2 100ml H_2O	724.0	598.7	125.3	(6) XAD
3 Dry	669.3	438.6	230.7	1903.4-1250.1
4 Dry	783.2	447.8	335.4	(7) Sil. Gel 779.8-632.8



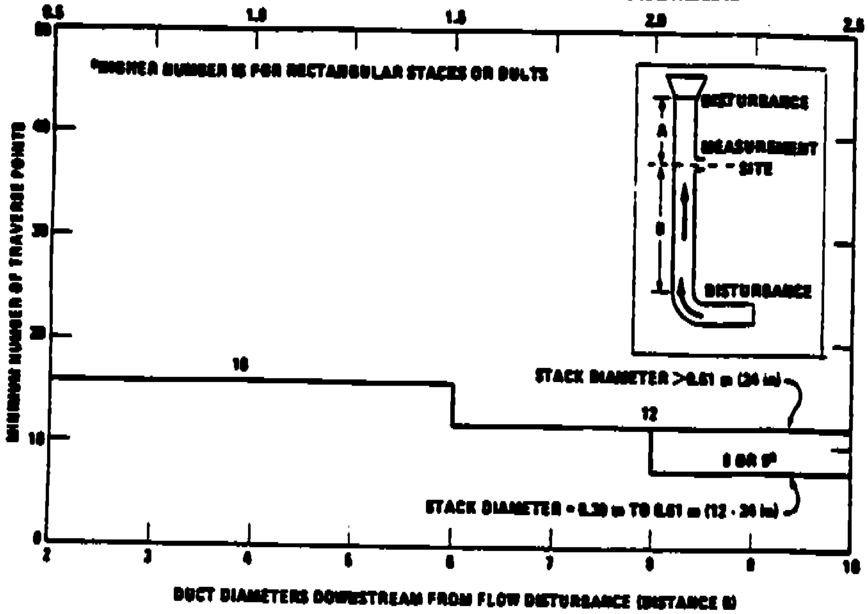


TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

APPENDIX B

ANALYTICAL RESULTS

CHESTER ENVIRONMENTAL

ORGANIC PAH ANALYSIS
CASE NARRATIVE
FOR
KOPPERS INDUSTRIES, INC.

WORK ORDER #M90-06.87

Problems Encountered During Login:

o None.

Problems Encountered During Extraction:

o All samples were extracted by the Air Group. The following Samples M90-06.87-003, M90-06.87-004, M90-06.87-005, M90-06.87-006 and M90-06.87-007, Client I.D.s SUS-FCI-1, SUS-FCO-1, SUS-FCI-2, SUS-FCO-2 and SUS-ARI-3 were concentrated to 4 mls. Sample M90-06.87-008, Client I.D. SUS-ARO-3, had a twenty fold dilution done by extraction, then it was concentrated to 1 ml.

Problems Encountered During Analysis:

o The three XAD blanks submitted with the samples all exhibited positive results for various analytes that were analyzed for.

o When samples were originally submitted for analysis in June of 1990, analytes requested were naphthane, dibenzofuran and anthracene only. Upon the request for reworking the chromatographs for all PAH components, Sample M90-06.87-007, Client I.D. SUS-ARI-3, has the analytes fluoranthene, benzo(b)fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene quantitated using values outside of the calibration curve. Sample M90-06.87-013, Client I.D. RO-FV-1, has the analyte carbazole quantitated from a value outside of the calibration curve. This is noted on the Data Report.

General Comments:

o All 610 identifications are from retention time only.

Melinda S. Harty
Melinda S. Harty
Project Manager

#R3839

WORK ORDER M90-06.87
ANALYTICAL RESULTS
KOPPERS INDUSTRIES, INC.

		Samples				
Chester I.D.		87-003	87-004	87-005	87-006	87-007
Date Sampled		24-MAY-1990	24-MAY-1990	24-MAY-1990	24-MAY-1990	25-MAY-1990
Customer I.D.		SUS-FCI-1	SUS-FCO-1	SUS-FCI-2	SUS-FCO-2	SUS-ARI-3
Parameters	Units					
LC610						
Carbazole	mg/TS	<1.60	0.108	0.223	<0.800	<0.800
Naphthalene	mg/TS	24.7	1.48	5.07	11.0	1.04
Acenaphthylene	mg/TS	9.22	<0.800	<0.800	<0.800	<0.800
Acenaphthene	mg/TS	2.93	0.2	<0.800	1.20	0.213
Fluorene	mg/TS	0.827	0.041	0.807	0.152	0.0083
Phenanthrene	mg/TS	0.217	0.0587	0.507	0.0951	0.0799
Anthracene	mg/TS	0.036	0.0096	0.007	0.0184	0.0183
Fluoranthene	mg/TS	<0.008	<0.008	<0.008	<0.008	0.0342 *
Pyrene	mg/TS	<0.008	<0.008	<0.008	<0.008	0.0282
Benzo(a)anthracene	mg/TS	<0.0008	<0.0008	<0.0008	<0.0008	0.0065
Chrysene	mg/TS	0.0126	<0.006	<0.006	<0.006	0.0069
Benzo(b)fluoranthene	mg/TS	<0.0008	<0.0008	<0.0008	<0.0008	0.0063 *
Benzo(k)fluoranthene	mg/TS	<0.0008	<0.0008	<0.0008	<0.0008	0.0024 *
Benzo(a)pyrene	mg/TS	<0.0008	<0.0008	<0.0008	<0.0008	0.0032 *
Dibenzo(a,h)anthracen	mg/TS	<0.0012	<0.0012	<0.0012	<0.0012	<0.012
Benzo(g,h,i)perylene	mg/TS	<0.002	<0.002	<0.002	<0.002	<0.020
Indeno(1,2,3-cd)pyren	mg/TS	<0.002	<0.002	<0.002	<0.002	<0.020
Dibenzofuran	mg/TS	12.1	0.736	0.984	4.58	0.686
LC610 Surrogates						
2-Fluorobiphenyl	% Rec.	Matrix Int.	Matrix Int.	Matrix Int.	Matrix Int.	Matrix Int.
Benzo-e-pyrene	% Rec.	96.8	Diluted Out	Diluted Out	Diluted Out	110

NOTES:
mg/TS - Milligram per total sample.
* - Analytes quantitated from values outside calibration curve.

WORK ORDER M90-06.87
ANALYTICAL RESULTS
KOPPERS INDUSTRIES, INC.

		Samples				
Chester I.D.		87-008	87-009	87-010	87-011	87-012
Date Sampled		25-MAY-1990	25-MAY-1990	25-MAY-1990	23-MAY-1990	23-MAY-1990
Customer I.D.		SUS-ARO-3	SUS-FVI-4	SUS-FVO-4	RO-BOL-1	RO-HV-1
Parameters	Units					
LC610						
Carbazole	mg/TS	4.44	<0.200	<0.200	2.87	0.663
Naphthalene	mg/TS	569	4.72	2.24	20.7	19.8
Acenaphthylene	mg/TS	<80.0	<0.200	<0.200	3.26	<2.00
Acenaphthene	mg/TS	107	0.700	0.300	4.00	3.33
Fluorene	mg/TS	<8.00	0.0359	<0.020	0.365	0.336
Phenanthrene	mg/TS	10.8	0.0333	0.0206	0.124	0.094
Anthracene	mg/TS	3.04	0.0062	0.0036	0.060	0.0218
Fluoranthene	mg/TS	<8.00	0.0037	<0.002	0.0123	0.0052
Pyrene	mg/TS	1.03	<0.0020	<0.002	0.0128	<0.002
Benzo(a)anthracene	mg/TS	0.374	<0.0002	0.0012	<0.002	<0.0002
Chrysene	mg/TS	0.402	0.0055	<0.0015	<0.015	<0.0015
Benzo(b)fluoranthene	mg/TS	0.239	<0.0002	<0.0002	<0.002	<0.0002
Benzo(k)fluoranthene	mg/TS	0.102	<0.0002	<0.0002	<0.002	<0.0002
Benzo(a)pyrene	mg/TS	0.107	<0.0002	<0.0002	<0.002	<0.0002
Dibenzo(a,h)anthracen	mg/TS	0.280	<0.0003	<0.0003	<0.003	<0.0003
Benzo(g,h,i)perylene	mg/TS	0.0923	<0.0005	<0.0005	<0.005	<0.0005
Indeno(1,2,3-cd)pyren	mg/TS	0.0442	<0.0005	<0.0005	<0.005	<0.0005
Dibenzofuran	mg/TS	221	1.62	0.634	12.8	11.4
LC610 Surrogates						
2-Fluorobiphenyl	% Rec.	Matrix Int.	Matrix Int.	Matrix Int.	Matrix Int.	Matrix Int.
Benzo-e-pyrene	% Rec.	Matrix Int.	123	Diluted Out	Diluted Out	Diluted Out

NOTES:
mg/TS - Milligram per total sample.
* - Analytes quantitated from values outside calibration curve.

WORK ORDER M90-06.87
ANALYTICAL RESULTS
KOPPERS INDUSTRIES, INC.

		Samples			
Chester I.D.		87-013	87-014	87-015	87-016
Date Sampled		23-MAY-1990	25-MAY-1990	25-MAY-1990	23-MAY-1990
Customer I.D.		RO-FV-1	XAD-BLK LOT 42, 44, 45, 46	XAD-BLK LOT A	XAD-BLK KPX-90-1
Parameters	Units				
LC610					
Carbazole	mg/TS	3.71 *	<0.002	<0.002	<0.002
Naphthalene	mg/TS	83.0	0.0035	<0.002	<0.002
Acenaphthylene	mg/TS	<20.0	<0.002	<0.002	<0.002
Acenaphthene	mg/TS	20.0	0.0079	<0.002	0.0045
Fluorene	mg/TS	2.91	0.0002	<0.0002	<0.0002
Phenanthrene	mg/TS	0.792	0.00088	0.00075	0.00124
Anthracene	mg/TS	0.193	<0.0005	<0.0005	<0.0005
Fluoranthene	mg/TS	<0.020	<0.0002	<0.0002	0.00032
Pyrene	mg/TS	<0.020	<0.0002	<0.0002	<0.0002
Benzo(a)anthracene	mg/TS	0.0009	<0.00002	<0.00002	<0.00002
Chrysene	mg/TS	0.0023	<0.00015	<0.00015	<0.00015
Benzo(b)fluoranthene	mg/TS	0.00024	<0.00002	<0.00002	<0.00002
Benzo(k)fluoranthene	mg/TS	<0.0002	<0.00002	<0.00002	<0.00002
Benzo(a)pyrene	mg/TS	<0.0002	<0.00002	<0.00002	<0.00002
Dibenzo(a,h)anthracen	mg/TS	<0.0003	<0.00003	<0.00003	<0.00003
Benzo(g,h,i)perylene	mg/TS	<0.0005	<0.00005	<0.00005	<0.00005
Indeno(1,2,3-cd)pyren	mg/TS	<0.0005	<0.00005	<0.00005	<0.00005
Dibenzofuran	mg/TS	57.6	0.010	<0.002	0.002
LC610 Surrogates					
2-Fluorobiphenyl	% Rec.	Matrix Int.	75.8	76.4	73.1
Benzo-e-pyrene	% Rec.	Diluted Out	76.4	78.8	61.4

NOTES:
mg/TS - Milligram per total sample.
* - Analytes quantitated from values outside calibration curve.

APPENDIX C

CHARGING INFORMATION

CHESTER
ENVIRONMENTAL

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CHARGE REPORT
KOPPERS INDUSTRIES, INC.

CYCLE	PRESSURE OR VACUUM	TEMP. °F	TIME STARTED		TIME COMPLETED		LAPSED TIME (HOURS)	
CONDITIONING								
1. STEAMING	LB.			M		M		
2. VACUUM	IN.			M		M		
3. PRESERVATIVE IN				M		M		
4. HEATING IN OIL				M		M		
5. BOULTON VACUUM	IN.			M		M		
6. PRESERVATIVE BACK				M		M		
TREATING								
7. INITIAL VACUUM	IN.			M		M		
8. INITIAL AIR	65 LB.		4	00A M	4	05 M		08
9. PRESERVATIVE IN			4	05 M	4	30 M		42
10. PRESSURE	200 LB.		4	30A M	8	00 AM	3	50
11. EXPANSION BATH				M		M		
12. PRESERVATIVE BACK			8	00 AM	8	30 AM		50
13. FINAL VACUUM	23 IN.		8	30 AM	10	30 AM	2	00
14. RECOVERING DRIPPINGS			10	30 AM	10	40 AM		17
15. SECONDARY STEAM	LB.			M		M		
16. SECONDARY VACUUM	IN.			M		M		
17. CHANGING TIME								33
TOTAL TIME							7	00

MEASURING TANK READINGS	TANK FEET Oil	TANK TEMP °F	CORRECTION FACTOR	TANK FEET AT 100° F	OIL OR SOLUTION GALLONS	OIL OR SOLUTION POUNDS
1. BEFORE INTRODUCING PRESERVATIVE		176°				370000
2. AFTER FILLING CYLINDER		182°				65,000
3. AT END OF PRESSURE PERIOD		209				56,000
4. AFTER RELEASING PRESSURE		209				60,000
5. AFTER FORCING BACK		193				362,000
6. AFTER FINAL VACUUM		158				363,400
7. PRESERVATIVE RETAINED (1-6)					13,000	66,000

TANK NO. #1 ________ GAL./FT. OIL OR SOLUTION ________ LB./GAL. AT 100° ________ PERCENT CHEMICALS IN SOLUTION

TRACK SCALE READINGS: GROSS ________ TARE ________ NET ________ CONDENSATE ________

TREATING SUPERVISOR OR SUPERINTENDENT ________

OPERATOR(S) WB. Tah

INSPECTOR ________

PRESERVATIVE RETAINED IN CHARGE	CREOSOTE TYPE PRESERVATIVE GALLONS	CREOSOTE TYPE PRESERVATIVE POUNDS	OIL OR WATER BORNE PRESERVATIVE SOLUTION GALLONS	SOLUTION POUNDS	DRY CHEMICAL POUNDS
TOTAL		19,600			
PER CU. FT.		8.23			

SALES ORDER NUMBER							SEE ATTACHED LIST FOR DETAILS OF MATERIALS
CUSTOMER	KCR	KCR					
INDICATE "TSD" OR "KOPPERS"							
SEASONED CONDITION	Boulton	Boulton					
SPECIES	TA	TA					
COMMODITY	Fl.	Br.					
SPECIFIED RETENTION PER CU. FT.	8#	8#					
QUANTITIES: PIECES AND/OR SIZES	115	143					TOTALS
☐ FBM (NOM.) OR ☒ LF.	12,147	16,418					28,565
CUBIC FEET	1012	1368					2380
PERCENTAGE OF TOTAL	43%	57%					100%
PRESERVATIVE: REQUIRED ☐ GAL. OR ☐ LB.							
USED ☐ GAL. OR ☒ LB.	8428	11172					19,600
CYLINDER HOURS: CONDITIONING	9.25	12.25					21.50
TREATING	3.01	3.99					7.00

DATE COMMENCED	DATE COMPLETED	PLANT		CYLINDER NO.
5-25-90	5-25-90	Susquehanna		#1
SPECIFIED TREATMENT	PRESERVATIVE 60/40	CONDITIONING Boulton	TREATING PROCESS Rueping	CHARGE NO. K-289

KI-81 Rev. 1 25M 3/89

CHARGE NO.	CYLINDER NO.	CUSTOMER	DATE
K-28C	#1	KCR	5-24-90

GALLONS OF WATER TO BE REMOVED	PCS OR BF	MATERIAL	CU. FT.	SPECIES
2025	258	BR. + Fl.	2380	TA

HRS	TIME AM or PM	GALLONS PER ½ HOUR	CUMULATIVE	SIDE TEMP	VACUUM	BOTTOM TEMP	HRS
1	900 AM	202	202	189	13"	189	1
2	930	31	233	191	13½"	191	2
3	1000	60	293	193	14½"	193	3
4	1030	94	387	193	17"	193	4
5	1100	89	476	195	19"	195	5
6	1130	89	565	196	20½"	196	6
7	1200	89	654	196	21½"	196	7
8	1230	28	682	192	21½"	192	8
9	100	59	741	192	21½"	192	9
10	130	59	900	176	21½"	176	10
11	200	60	860	177	21½"	177	11
12	230	30	890	177	21½"	177	12
13	300	60	950	175°	21½"	175°	13
14	330	30	980	174°	21½"	174°	14
15	400	59	1039	173°	21½"	193°	15
16	430	44	1083	190°	21½"	190°	16
17	500	43	1126	190°	21½"	190°	17
18	530	30	1156	191°	21½"	191°	18
19	600	57	1213	194°	21½"	194°	19
20	630	44	1257	195°	21½"	195°	20
21	700	44	1301	196°	21½"	196°	21
22	730	59	1360	190°	21½"	190°	22
23	800	30	1390	194°	21½"	194°	23
24	830	45	1435	191°	21½"	191°	24
25	900	45	1480	190°	21½"	190°	25
26	930	30	1510	189°	21½"	189°	26
27	1000	58	1568	190°	21½"	190°	27
28	1030	30	1598	192°	21½"	192°	28
29	1100	58	1656	193°	21½"	193°	29
30	1130	30	1626	193	21½	193°	30
31	1200/AM	29	1745	195	21½	195°	31
32	1230	29	1777	[illegible]	[illegible]	[illegible]	32
33	100	28	1804	19[illegible]	21½	192°	33
34	130	29	1833	194°	21½	194°	34
35	200	28	[illegible]	196°	21½	196°	35
36	230	29	[illegible]	19[illegible]	21½	[illegible]	36
37	300	29	1721	198°	21½	198	37
38	330	29	2010	19[illegible]	21½	19[illegible]	38
39							39
40							40
41							41
42							42
43							43
44							44
45							45
46							46
47							47
48							48

	START	END	WATER REMOVED		WT. 21	TANK NO.	TEMP.	
FILL	6[illegible]	700	HEAT	2000	[illegible],000	BEFORE FILL		
HEAT	7[illegible]	3[illegible]	VACUUM		170,000	AFTER FILL		
P.B.	[illegible]	[illegible]	FIN. VAC.	176		AFTER P.B.		
VACUUM			TOTAL	2216		DIFFERENCE		
			LBS/CU. FT.	7.74				

[illegible] BOULTON TIME

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CHARGE REPORT
KOPPERS INDUSTRIES, INC.

CYCLE	PRESSURE OR VACUUM	TEMP. °F	TIME STARTED	TIME COMPLETED	LAPSED TIME (HOURS)
CONDITIONING					
1. STEAMING	LB.		M	M	
2. VACUUM	IN.		M	M	
3. PRESERVATIVE IN			M	M	
4. HEATING IN OIL			M	M	
5. BOULTON VACUUM	IN.		M	M	
6. PRESERVATIVE BACK			M	M	
TREATING					
7. INITIAL VACUUM	IN.		M	M	
8. INITIAL AIR	65 LB.		7 25 AM	7 30 AM	.08
9. PRESERVATIVE IN			7 30 AM	7 50 AM	.33
10. PRESSURE	200 LB.		7 50 AM	12 20 PM	4 50
11. EXPANSION BATH			M	M	
12. PRESERVATIVE BACK			12 20 PM	12 50 PM	.50
13. FINAL VACUUM	19½ IN.		12 50 PM	2 50 PM	2 00
14. RECOVERING DRIPPINGS			2 50 PM	3 00 PM	.17
15. SECONDARY STEAM	LB.		M	M	
16. SECONDARY VACUUM	IN.		M	M	
17. CHANGING TIME					.33
TOTAL TIME					7 91

MEASURING TANK READINGS	TANK FEET	6/2 TEMP °F	CORRECTION FACTOR	TANK FEET AT 100° F	OIL OR SOLUTION GALLONS	OIL OR SOLUTION POUNDS
1. BEFORE INTRODUCING PRESERVATIVE		180				390,000
2. AFTER FILLING CYLINDER		180				163,000
3. AT END OF PRESSURE PERIOD		210				146,000
4. AFTER RELEASING PRESSURE		210				154,400
5. AFTER FORCING BACK		200				375,000
6. AFTER FINAL VACUUM		180				378,000
7. PRESERVATIVE RETAINED (1-6)					13,000	12,000

TANK NO. #2 ______ GAL./FT. OIL OR SOLUTION ______ LB./GAL. AT 100° ______ PERCENT CHEMICALS IN SOLUTION

TRACK SCALE READINGS: GROSS ______ TARE ______ NET ______ CONDENSATE ______

TREATING SUPERVISOR OR SUPERINTENDENT ______

OPERATOR(S) Kah

INSPECTOR ______

PRESERVATIVE RETAINED IN CHARGE	CREOSOTE TYPE PRESERVATIVE GALLONS	CREOSOTE TYPE PRESERVATIVE POUNDS	OIL OR WATER BORNE PRESERVATIVE SOLUTION GALLONS	SOLUTION POUNDS	DRY CHEMICAL POUNDS
TOTAL		25,000			
PER CU. FT.		7.20			

						TOTALS
SALES ORDER NUMBER						SEE ATTACHED LIST FOR DETAILS OF MATERIALS
CUSTOMER	KCR					
INDICATE "TSD" OR "KOPPERS"						
SEASONED CONDITION	BOULTON					
SPECIES	TA					
COMMODITY	X-Ties					
SPECIFIED RETENTION PER CU. FT.	7					
QUANTITIES: PIECES AND/OR SIZES	959					TOTALS
☐ FBM (NOM.) OR ☐ L.F.						
CUBIC FEET	3472					3472
PERCENTAGE OF TOTAL	100%					100%
PERSERVATIVE: REQUIRED ☐ GAL. OR ☐ LB.						
USED ☐ GAL. OR ☒ LB.	25,000					25,000
CYLINDER HOURS: CONDITIONING	21.00					21.00
TREATING	7.91					7.91

DATE COMMENCED	DATE COMPLETED	PLANT	CYLINDER NO.
5-25-90	5-25-90	Susquehanna	#2
SPECIFIED TREATMENT	PRESERVATIVE 60/40	CONDITIONING Boulton / TREATING PROCESS Ruep	CHARGE NO K-290

KI-81 Rev. 1 25M 3/89

CHARGE NO.	CYLINDER NO.	CUSTOMER		DATE	
K-290	#2	KCR		5/24/90	
GALLONS OF WATER TO BE REMOVED 2931	PCS OR BF 959	MATERIAL X-Ties	CU. FT. 3412	SPECIES TA	

HRS	TIME AM or PM	GALLONS PER ½ HOUR	CUMULATIVE	SIDE TEMP	VACUUM	BOTTOM TEMP	HRS
1	100 PM	50	50	180	18"	180	1
2	130	47	97	180	19½"	180	2
3	200	48	145	180	19½"	180	3
4	230	25	170	180	19½"	180	4
5	300	73	243	185°	19"	185°	5
6	330	50	293	185°	19"	185°	6
7	400	76	369	185°	19"	185°	7
8	430	64	433	185°	18½"	185	8
9	500	63	496	190°	18½"	190°	9
10	530	52	548	190°	18½"	190°	10
11	600	78	626	190°	18½"	190	11
12	630	77	703	190°	18½"	190°	12
13	700	76	779	195°	18"	195°	13
14	730	74	853	195°	18½"	195	14
15	800	50	903	195°	19"	195°	15
16	830	49	952	195°	19½"	195°	16
17	900	50	1002	195°	19½"	195°	17
18	930	52	1054	190°	19½"	190°	18
19	1000	26	1080	190°	19½"	190°	19
20	1030	50	1130	190°	19½"	190°	20
21	1100	50	1180	190°	17	190	21
22	1130	69	1249	190	17"	190°	22
23	1200 am	68	1317	190°	17"	190°	23
24	1230	67	1384	190°	[illegible]	190°	24
25	100	70	1454	190°	17"	190	25
26	130	66	1520	190°	17"	190	26
27	200	68	1588	190°	17"	190	27
28	230	69	1657	190°	17"	190	28
29	300	67	1724	190°	17"	190	29
30	330	66	1790	190°	17"	190°	30
31	400	53	1843	190°	19"	190	31
32	430	67	1910	190°	19"	190°	32
33	500	72	1982	190°	19"	190°	33
34	530	25	2007	190°	19"	190	34
35	600	52	2059	190°	19"	190°	35
36	630	25	2084	190	19"	190°	36
37							37
38							38
39							39
40							40
41							41
42							42
43							43
44							44
45							45
46							46
47							47
48							48

	START	END	WATER REMOVED		#2	TANK NO.	TEMP.	
FILL	1000 AM	1030 AM	HEAT	2084	403,000	BEFORE FILL	150	
HEAT	1030 AM	630	VACUUM		272,000	AFTER FILL	175	
P.B.	630	730	FIN. VAC.	260	290,000	AFTER P.B.	190	
VACUUM			TOTAL	2344	13,000	DIFFERENCE		
			LBS/CU. FT.					

[illegible]	BOULTON TIME	

APPENDIX D

CALCULATIONS

CHESTER
ENVIRONMENTAL

CHESTER ENVIRONMENTAL

PROJECT Koppers Industries Inc PROJECT NO. 4705-15
Susquehanna Plant SHEET 1 OF 2
Flow Calculation DWG BY JMD DATE 3/30/94
CHK BY ____ DATE ____

SAMPLE SUS-IFC-1

$$N_s = K_p \, C_p \sqrt{\Delta P_{avg}} \sqrt{\frac{T_s}{P_s M_s}}$$

K_p = 85.49 ft/sec

C_p = 0.84

ΔP_{avg} = .0479

T_s = 460+105

P_s = 29.60 + 0.6/13.6 = 29.64

M_s = 28.8(1-0.102) + 18(0.102) = 27.7

$$N_s = (85.49)(0.84)(\sqrt{.0479})\left(\sqrt{\frac{565}{(29.64)(27.7)}}\right)$$

$$N_s = (85.49)(0.84)(0.2188)(.8295)$$

$$N_s = 13.03 \frac{ft}{sec} \times 60 \frac{sec}{min} = 782.06 \frac{ft}{min}$$

A = 0.35 ft^2

$$Q = 782.06 \frac{ft}{min} \times 0.35 \, ft^2 = 273.7 \text{ ACFM}$$

$$Q_s = 273.7 \text{ ACFM} \left(\frac{528}{565}\right)\left(\frac{29.64}{29.92}\right) = 253.4 \text{ SCFM}$$

$$Q_{SD} = 253.4 \text{ SCFM} (1 - 0.102) = 227 \text{ DSCFM}$$

CHESTER ENVIRONMENTAL

PROJECT Koppers Industries, Inc. Susquehanna Plant Flow calculation
PROJECT NO. 4705.15
SHEET 2 OF 2
DWG BY JMD DATE 3/30/94
CHK BY ____ DATE ____

SAMPLE SUS-IFC-2

$$V_S = K_p \, C_p \sqrt{\Delta P_{AVG}} \sqrt{\frac{T_S}{P_S M_S}}$$

$K_p = 85.49$ ft/sec

$C_p = 0.84$

$\Delta P_{avg} = 0.05125$

$T_S = 460 + 110 = 570$

$P_S = 29.60 + \frac{0.6}{13.6} = 29.64$

$M_S = 28.8(1 - 0.1273) + (18)(0.1273) = 27.43$

$$V_S = (85.49)(0.84)\left(\sqrt{0.05125}\right)\left(\sqrt{\frac{570}{(29.64)(27.43)}}\right)$$

$$V_S = (85.49)(0.84)(0.226)(0.8371)$$

$$V_S = 13.61 \frac{ft}{sec} \times 60 \frac{sec}{min} = 816.7 \frac{ft}{min}$$

$A = 0.35 \ ft^2$

$$Q = 816.7 \frac{ft}{min} \times 0.35 \ ft^2 = 285.8 \ ACFM$$

$$Q_S = 285.8 \ ACFM \left(\frac{528}{570}\right)\left(\frac{29.64}{29.92}\right) = 262.3 \ SCFM$$

$$Q_{SD} = 262.3 \ SCFM \ (1 - 0.1273) = 228.9 \ DSCFM$$