

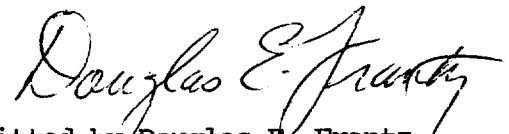
Stack Test Report No. 84-3

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.

James Julian, Inc.
North East, Cecil Co.
Boeing Drum Mix Asphalt Plant
May 1984

Division of Stationary Source Enforcement
Air Management Administration
Office of Environmental Programs
Department of Health and Mental Hygiene
State of Maryland


Submitted by Douglas E. Frantz


Approved by Ronald E. Lipinski
May 31, 1984

Abstract

Introduction:

Particulate stack tests were conducted in May, 1984 on the exhaust emissions from the Boeing drum mix asphalt plant operated by James Julian, Inc. located in North East, Cecil County. The tests were conducted in an effort to determine whether or not the facility was being operated within compliance of applicable Maryland State air quality regulations.

The emissions are controlled by a venturi scrubber followed by a cyclone demister. Although the plant is normally rated at 600 TPH, the tests were conducted at the normal production rate of 275 TPH. The capacity of the storage silo (100 tons) necessitated running each test in two halves. By starting with an empty silo and having several trucks standing by, the plant was able to operate for the required 45 minutes needed to make a sample traverse. This included the 36 minutes of sampling plus a period to allow the plant to stabilize. During all three tests, the plant was using virgin material.

Procedure:

This facility was tested in accordance with method 1005 as contained in AMA TM 83-05, Stack Test Methods for Stationary Sources. The controlling standard for this source is the federal New Source Performance Standard of .04 gr/scfd.

Results:

A summary of the results is presented in table 1-1. Complete results and primary data are contained in the appendix.

Table 1-1. Summary of Particulate Sampling Results For:
84-3 James Julian, Inc. - Boeing drum mix asphalt plant

Run ID	Production rate (TPH)	Isokinetic Variation (%)	Average Stack Gas Data					Concentration* (grains/scfd)	Emission Rate* (lbs/hr)	Allowed Concentration
			flow rate (scfm dry)	temp (°F)	% O ₂	% CO ₂	% H ₂ O			
5/2/84-1	275	99.8	27282	144	12.8	3.5	22.2	.092	21.5	.04
5/3/84-1	275	101.6	25495	143	13.0	4.6	22.3	.025	5.4	.04
5/3/84-2	275	102.2	25731	145	13.0	3.5	23.4	.077	16.9	.04
Average								.065	14.6	

*based on front half catch

26169 144 12.9 3.9 22.6

APPENDIX:

Nomenclature
Calculated Results
Data Summaries
Laboratory Analyses
Primary Data
Calibration Data
Preliminary Stack Test Survey

MARYLAND STATE
Air Management Administration

STACK SAMPLING NOMENCLATURE

A_s	: cross sectional area of stack at sample site, (ft ²)
B_w	: mole fraction moisture in stack gas, (dimensionless)
C_d	: concentration of front half catch, (grains/scfd)
C_{d12}	: concentration at 12% CO ₂ , front half catch, (grains/scfd)
C_{d50}	: concentration at 50% EA, front half catch, (grains/scfd)
C_m	: dry gas meter correction factor, (dimensionless)
C_p	: pitot tube coefficient, (dimensionless)
C_t	: concentration of total catch, (grains/scfd)
C_{t12}	: concentration at 12% CO ₂ , total catch, (grains/scfd)
C_{t50}	: concentration at 50% EA, total catch, (grains/scfd)
D_n	: diameter of sampling nozzle inlet, (in)
EA	: percent excess air in stack gas, (%)
E_d	: emission rate, front half, (lbs/hr)
E_t	: emission rate, total, (lbs/hr)
ΔH_G	: orifice meter pressure differential that provides a flow rate of .75 ft ³ /min at 70°F and 29.92 in.Hg, (in. H ₂ O)
ΔH_{avg}	: average orifice pressure differential, (in. H ₂ O)
I	: percent isokinetic, (%)
M_d	: molecular weight of stack gas, dry basis, (lb/lb mole)
M_w	: molecular weight of stack gas, wet basis, (lb/lb mole)
N_{ti}	: normality of titrant for SO _x sample, (g-eq/l)
P_{bar}	: barometric pressure, (in. Hg)
P_{savg}	: average absolute stack pressure, (in. Hg)

NOMENCLATURE

ΔP	: velocity pressure differential, (in. H ₂ O)
Q_{alq}	: volume of SO _x sample aliquot titrated, (ml)
Q_m	: net dry sample gas volume, (acfd)
Q_{mstd}	: standard dry gas sample volume, (scfd)
Q_s	: actual stack gas volumetric flow rate, dry basis, (acfm dry)
Q_{soln}	: total volume of SO _x sample solution, (ml)
Q_{sstd}	: standard stack gas volumetric flow rate, dry basis, (scfm dry)
Q_{ti}	: volume of titrant required to neutralize SO _x sample aliquot, (ml)
Q_{tib}	: volume of titrant required to neutralize blank solution, (ml)
Q_{tstd}	: total standard sample volume, (scf)
Q_w	: total volume of water collected, (ml)
Q_{wstd}	: standard vapor volume of water collected, (scf)
T_{mavg}	: average dry gas meter temperature, (°F)
T_{savg}	: average stack temperature, (°F)
V_s	: average velocity of stack gas at sample site, (ft/sec)
W_d	: front half particulate catch, (mg)
W_t	: total particulate catch, (mg)
θ	: sampling time, (min.)

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PARTICULATE STACK SAMPLING CALCULATED RESULTS

Plant JAMES JULIAN ASPHALT, CECIL CO.

Source Asphalt Plant

RUN ID	5/2/84 - 1 1209 - 1423	5/3/84 - 1 942 - 1130	5/3/84 - 2 1400 - 1545		
1. Q_{mstd}	39.863	37.906	38.509		
2. Q_{wstd}	11.358	10.883	11.771		
3. Q_{tstd}	51.222	48.789	50.281		
4. B_w	.222	.223	.234		
5. M_d	29.072	29.256	29.080		
6. M_w	26.617	26.745	26.486		
7. EA	*	*	*		
8. V_s	42.78	40.20	41.39		
9. Q_s	30604	28709	29143		
10. Q_{sstd}	27282	25495	25731		
11. C_d	.092	.025	.077		
12. C_t	.106	.044	.087		
13. C_{d12}	*	*	*		
14. C_{t12}	*	*	*		
15. C_{d50}	*	*	*		
16. C_{t50}	*	*	*		
17. E_d	21.5	5.4	16.9		
18. E_t	24.8	9.6	19.2		
19. I	99.8	101.6	102.2		

*Not Applicable

MARYLAND STATE
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PARTICULATE STACK SAMPLING DATA SUMMARY

Plant James Julian Asphalt, Cecil County

Source Asphalt Plant

RUN ID	5/2/84-1 7209-1423	5/3/84-1 942-1130	5/3/84-2 1400-1545		
1. C_p	.84	.84	.84		
2. Q_m	40.174	38.026	38.855		
3. T_{mavg}	84.7	79.0	80.7		
4. P_{bar}	30.04	29.87	29.79		
5. ΔH_{avg}	1.01	0.904	0.928		
6. Q_w	236.7	226.8	245.3		
7. W_d	237.5	60.4	191.2		
8. W_t	273.4	108.0	217.0		
9. $\%CO_2$	3.5	4.6	3.5		
10. $\%O_2$	12.8	13.0	13.0		
11. T_{savg}	144.4	143.3	145.2		
12. $(\Delta P)_{avg}^{1/2}$	0.685	0.644	0.658		
13. P_{savg}	30.02	29.85	29.77		
14. A_g	15.321	15.321	15.321		
15. D_n	0.239	0.239	0.239		
16. ϕ	72	72	72		

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PARTICULATE STACK SAMPLING LABORATORY RESULTS

Plant James Julian Completed 5/24/84
 Facility Tested asphalt plant By S.D. [Signature]
 Test Date 5/2/84
 Run ID 5/2/84-1 #

WEIGHT OF PARTICULATE COLLECTED

Container		Final Weight (grams)	Initial Weight (grams)	Weight Gain (mg)
Probe	2	135.1418	134.9812	160.6
Filter	D	160.2284 159.5502	.6782 .6421	36.1
Cyclone	35	151.8673	151.8265	40.8
Subtotal, (mg)				237.5
Water Soluble	18	140.6905	140.6625	28.0
Organics	15	145.8923	145.8891	3.2
Acetone Wash	33	146.5069	146.5022	4.7
Subtotal, (mg)				35.9
Total Weight of Particulate Collected, (mg)				273.4

	Sulfate	Acidity
Probe	_____ mg.	_____ meq. N ₂ OH
Filter	_____ mg.	_____ meq. N ₂ OH

VOLUME OF MOISTURE COLLECTED

	Final Volume (ml)	Initial Volume (ml)	Volumetric Gain (ml)
Impingers	420.0	200.0	220.0
Silica Gel D ₁	436.7	420.0	16.7
Total Gain, (ml)			236.7

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PARTICULATE STACK SAMPLING LABORATORY RESULTS

Plant James Julian Completed 5/24/84
 Facility Tested asphalt plant By S.D. Hargul
 Test Date 5/3/84
 Run ID 5/3/84-1 #

WEIGHT OF PARTICULATE COLLECTED

Container		Final Weight (grams)	Initial Weight (grams)	Weight Gain (mg)
Probe	36	146.3184	146.2980	20.4
Filter	E	141.0686 140.3547	.7139 .6759	38.0
Cyclone	68	145.5927	145.5907	2.0
Subtotal, (mg)				60.4
Water Soluble	43	146.7547	146.7327	22.0
Organics	66	146.4716	146.4552	16.4
Acetone Wash	1000	135.5448	135.5356	9.2
Subtotal, (mg)				47.6
Total Weight of Particulate Collected, (mg)				108.0

	Sulfate	Acidity
Probe	_____ mg.	_____ meq. NaOH
Filter	_____ mg.	_____ meq. NaOH

VOLUME OF MOISTURE COLLECTED

		Final Volume (ml)	Initial Volume (ml)	Volumetric Gain (ml)
Impingers		410.0	200.0	210.0
Silica Gel	E,	240.8	224.0	16.8
Total Gain, (ml)				226.8

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PARTICULATE STACK SAMPLING LABORATORY RESULTS

Plant James Julian Completed 5/24/84
 Facility Tested asphalt plant By S. D. Hayfield
 Test Date 5/3/84
 Run ID 5/3/84-2 #

WEIGHT OF PARTICULATE COLLECTED

Container		Final Weight (grams)	Initial Weight (grams)	Weight Gain (mg)
Probe	6	135.0400	135.0924	147.6
Filter	A	137.1340 136.4163	.7177 .6780	39.7
Cyclone	63	147.1522	147.1483	3.9
Subtotal, (mg)				191.2
Water Soluble	65	146.0964	146.0744	22.0
Organics	16	139.8115	139.8106	.9
Acetone Wash	26	147.3482	147.3453	2.9
Subtotal, (mg)				25.8
Total Weight of Particulate Collected, (mg)				217.0

	Sulfate	Acidity
Probe	_____ mg.	_____ meq. N ₂ OH
Filter	_____ mg.	_____ meq. N ₂ OH

VOLUME OF MOISTURE COLLECTED

		Final Volume (ml)	Initial Volume (ml)	Volumetric Gain (ml)
Impingers		430.0	200.0	230.0
Silica Gel	F ₁	394.5	379.2	15.3
Total Gain, (ml)				245.3

1

DHMH 1630

pre $\frac{.01}{.003}$ $\frac{.02}{.012}$ @ 13" H₂O

$T_s = 150$ $\Delta P = .88$

NL-2 Test

pt. no.	TIME (min)	DRY GAS METER			VELOCITY HEAD		ORIFICE DIFFERENTIAL (IN H ₂ O)		PUMP VAC. "Hg.	TEMPERATURES OF		
		Volume (acfd)	Temp (°F)		ΔP (in. H ₂ O)	$(\Delta P)^{1/2}$ (in. H ₂ O) ^{1/2}	actual	desired		stack ③	probe	oven ④
			in ①	out ②								
1	0	133.619	62	63	.22	.469	←	.46	1	140		239
2	3	134.82	64	63	.28	.529	←	.59	1	140		261
3	6	136.04	67	64	.28	.529	←	.59	1	141		238
4	9	137.33	71	66	.28	.529	←	.59	1	141		255
5	12	138.61	75	67	.27	.52	←	.57	1	143		275
6	15	139.88	80	69	.32	.566	←	.68	1	138		231
7	18	141.26	84	72	.52	.721	←	1.10	2	144		275
8	21	143.00	89	74	.58	.762	←	1.25	3	143		235
9	24	145.02	94	76	.60	.775	←	1.25	3	143		262
10	27	146.89	97	79	.60	.775	←	1.25	3	142		266
11	30	148.84	100	81	.58	.762	←	1.25	3	143		238
12	33	150.82	103	82	.58	.762	←	1.25	3	148		275
1	36	152.786	73	69	.22	.469	←	.46	1.5	135		280
2	39	153.96	76	69	.28	.529	←	.59	1.5	145		267
3	42	155.25	78	70	.31	.557	←	.65	1.5	145		276
4	45	156.613	83	71	.33	.574	←	.70	1.5	145		280
5	48	158.035	85	71	.34	.583	←	.72	2	145		273
6	51	159.475	88	72	.40	.632	←	.85	2	145		278
7	54	161.04	91	74	.41	.64	←	.87	2	145		267
8	57	162.635	95	75	.50	.707	←	1.05	2.5	145		288
9	60	164.365	97	76	.55	.742	←	1.16	2.5	146		275
10	63	166.21	99	77	.59	.768	←	1.26	2.5	147		288
11	66	168.125	101	78	.64	.781	←	1.28	3	146		281
12	69	170.085	102	78	.61	.781	←	1.28	3	145		266
	72	172.068										
TOT		38.449	85.6	72.3		15.462		21.7				
AVG.			79			0.644		0.904		143.3		

OFFICE OF ENVIRONMENTAL PROGRAMS
AIR MANAGEMENT ADMINISTRATION
STACK SAMPLING DATA

Plant James Julian
Source asphalt plant
Run ID 5/3/84-1 Operators DF DR FS
Start 942 Finish 1130
Sampling for: particulate
Pitot ID 5-1 Cp .84
Meter Box green Cm .989 Hg 1.84
DGM ID 593221 C Factor .70
Filter ID .6759 Noz ID .239
Baro. (in. Hg.) 29.87 at 200'
Ambient °F 55
Psavg: (in. H₂O) -.31
(in. Hg) -.023
Avg. % CO₂ 4.6 % O₂ 13.0
Leak Rate Pre .003 @ 15" Hg.
(acfm) Post .012 @ 13" Hg.
Duct Dimensions 53"
Area 15.321 ft²
Diameters Upstream 3
Diameters Downstream 1 1/2
Assumed H₂O (%) 25

NOTES

$$Q_m = .989(172.068 - 133.619)$$

DHMH 1630

38.026

CO₂
5.0 4.0
4.5 5.0
5.0 4.5
5.0 4.5
4.5 4.5
4.0 4.5
AVG. 4.6

pre. 1058

OFFICE OF ENVIRONMENTAL PROGRAMS
AIR MANAGEMENT ADMINISTRATION
STACK SAMPLING DATA

Plant James Julian
Source asphalt plant
Run ID 5/3/84-2 Operators DF DR FS
Start 1400 Finish 1545
Sampling for: particulate
Pitobe ID 5-1 Cp .84
Meter Box G Cm .989 Hg 1.84
DGM ID 593221 C Factor .70
Filter ID .6780 Noz. ID .239
Baro. (in. Hg.) 29.79 at 200'
Ambient °F ~ 58°
P_{savg}: (in. H₂O) -.33
(in. Hg) -.024
Avg. % CO₂ 3.5 % O₂ 13.0
Leak Rate Pre .01 @ 15" Hg.
(acfm) Post .00 @ 2" Hg.
Duct Dimensions 53"
Area 15.321 ft²
Diameters Upstream 3
Diameters Downstream 1/2
Assumed H₂O (%) 25

.33

pt. no.	TIME (min)	DRY GAS METER			VELOCITY HEAD		ORIFICE DIFFERENTIAL (IN H ₂ O)		PUMP VAC. "Hg.	TEMPERATURES OF		
		Volume (acfd)	Temp (°F)		Δ P (in. H ₂ O)	(ΔP) ½ (in. H ₂ O)½	actual	desired		stack (4)	probe	oven (3)
			in	out								
1	0	172.764	70	67	.24	.491	←	.51	1	144	260	
2	3	173.90	72	69	.32	.566	←	.68	1	144	275	
3	6	175.36	79	71	.35	.592	←	.73	1	143	270	
4	9	176.83	81	72	.32	.566	←	.67	1	147	250	
5	12	178.23	84	75	.32	.566	←	.67	1	144	244	
6	15	179.63	86	76	.35	.592	←	.73	1	143	247	
7	18	181.09	89	79	.52	.721	←	1.10	2	146	257	
8	21	182.79	91	79	.54	.735	←	1.15	2	146	255	
9	24	184.65	94	79	.58	.762	←	1.20	2	144	257	
10	27	186.57	96	80	.59	.768	←	1.20	2	148	253	
11	30	188.52	97	81	.61	.781	←	1.25	2	144	272	
12	33	190.45	98	80	.54	.735	←	1.15	2	146	264	
1	36	192.328	70	68	.24	.49	←	.51	1	142	228	
2	39	193.50	72	70	.28	.529	←	.58	1	146	274	
3	42	194.75	75	72	.32	.566	←	.68	1	145	280	
4	45	196.12	79	73	.34	.583	←	.72	1	145	227	
5	48	197.65	82	74	.37	.608	←	.78	2	146	282	
6	51	199.04	85	75	.44	.663	←	.92	2	147	227	
7	54	200.64	87	75	.43	.656	←	.91	2	145	275	
8	57	202.28	91	79	.50	.707	←	1.05	2	146	225	
9	60	204.00	93	77	.56	.748	←	1.17	2	147	245	
10	63	206.00	96	78	.62	.787	←	1.30	2	146	277	
11	66	208.09	98	80	.62	.787	←	1.30	2	145	234	
12	69	210.09	98	80	.62	.787	←	1.30	2	145		
	72	212.051										
TOT		39.287	86	75.4		15.785		22.26				
AVG.			80.7			0.658		0.928		145.2		

NOTES

$$Q_m = .989(212.051 - 172.764)$$

DHMH 1630

38.855

CO₂
4.0 4.5
3.5 4.0
2.5 3.5
4.0 3.5
3.0 3.0
3.0 3.0
AVG.
3.5

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date FEB 9, 1984

Meter box number 593 221

Barometric pressure, $P_b =$ 30.23 in. Hg Calibrated by FJS

Orifice manometer setting (ΔH), in. H ₂ O	Gas volume		Temperatures				Time (θ), min	Y_i	$\Delta H @_{i10}$ in. H ₂ O
	Wet test meter (V_w), ft ³	Dry gas meter (V_d), ft ³	Wet test meter (t_w), °F	Dry gas meter					
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Avg ^a (t_d), °F			
0.5	5	5.341	79.5	102.3	92.7	97.5	13.08	.966	1.793
1.0	5	5.224	79.5	109.3	96	102.7	9.07	.996	1.820
1.5	10	10.528	79.5	118.3	98.7	108.5	14.99	.997	1.831
2.0	10	10.653	79.5	121	99.7	110.4	13.13	.988	1.857
3.0	10	10.582	79.5	121.7	99.3	110.5	11.17	.992	1.997
4.0	10	10.558	79.5	124	99.3	111.7	9.13	.994	1.771
Avg								.989	1.845

ΔH , in. H ₂ O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H @_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460) \theta^2}{V_w} \right]^2$
0.5	0.0368	$\frac{(5)(30.23)(557.5)}{5.341(30.27)(539.5)}$	$\frac{0.0317(0.5)}{30.23(557.5)} \left[\frac{(539.5)(13.08)}{5} \right]^2$
1.0	0.0737	$\frac{(5)(30.23)(562.7)}{5.224(30.3)(539.5)}$	$\frac{0.0317(1)}{30.23(562.7)} \left[\frac{(539.5)(9.07)}{5} \right]^2$
1.5	0.110	$\frac{10(30.23)(568.5)}{10.528(30.34)(539.5)}$	$\frac{0.0317(1.5)}{30.23(568.5)} \left[\frac{(539.5)(14.99)}{10} \right]^2$
2.0	0.147	$\frac{10(30.23)(570.4)}{10.653(30.38)(539.5)}$	$\frac{0.0317(2)}{30.23(570.4)} \left[\frac{(539.5)(13.13)}{10} \right]^2$
3.0	0.221	$\frac{10(30.23)(570.5)}{10.582(30.45)(539.5)}$	$\frac{0.0317(3)}{30.23(570.5)} \left[\frac{(539.5)(11.17)}{10} \right]^2$
4.0	0.294	$\frac{10(30.23)(571.7)}{10.558(30.52)(539.5)}$	$\frac{0.0317(4)}{30.23(571.7)} \left[\frac{(539.5)(9.13)}{10} \right]^2$

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

MARYLAND STATE
BUREAU OF AIR QUALITY & NOISE CONTROL
STACK SAMPLING PRELIMINARY SURVEY

I. General Information:

Plant James Julian Asphalt
Address North East, Md.
Telephone 301-287-9171 Survey Date 5/1/84
Source Drum Mix Asphalt plant

Contact(s):

Ron McGuirk Title foreman Ext. 301-287-9171
Title _____ Ext. _____
Title _____ Ext. _____

Process Description (including type, operating schedule, feed composition and rates, production rate, maximum rated capacity, and type of fuel): _____

600 TPH - operated at 275 TPH
100 ton silo

Air Pollution Control Equipment:

venturi scrubber
followed by rotoclone demister

Notes:

MARYLAND STATE
BAQNC
PRELIMINARY SURVEY

Plant James Julian
Source _____
Survey Date 5/2/84

II. Stack Data:

Material of Construction	<u>steel</u>
Height of Sample Site from Ground Level, (ft).	<u>~20</u>
Inside Cross Sectional Dimensions at Test Site	<u>53"</u>
Inside Cross Sectional Area at Test Site, (ft ²).	<u>15.321</u>
Port Length, (in).	<u>3"</u>
Straight Duct Distance Before Test Site (stack diameters).	<u>3</u>
Straight Duct Distance After Test Site (stack diameters)	<u>1/2</u>
Number of Points to be Sampled	<u>24</u>

Point Identification:

