

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/

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FRANK BROTHERS, INC.
Milton, WI
CMI-SVM-1500 285TPH
Asphalt plant
July, 87

Report to

FRANK BROTHERS, INC.
Janesville, Wisconsin

for

STACK EMISSION TEST
CMI DRUM MIX ASPHALT PLANT
Milton, Wisconsin

July 29, 1987

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION
13020 West Bluemound Road
Elm Grove, Wisconsin 53122
414-784-2434

CORRESPONDENCE/MEMORANDUM

STATE OF WISCONSIN

DATE: October 5, 1987

In Reply Refer To: 4530

TO: Files

FROM: Joseph Perez - AM/3 *guf*

SUBJECT: Review of Stack Test Performed at Frank Brothers, Inc., Milton

I. Source

Frank Brothers, Inc.
2919 N. Lexington Drive
Janesville, WI 53545

The asphalt plant tested was located on Highway 59, East of Milton, WI.

Test Date: July 29, 1987

Test Firm: Environmental Technology & Engineering
13020 West Bluemound Rd.
Elm Grove, WI 53122
Crew Chief: Mr. Bill Dick (414) 784-2434

Source FID #154008030, Process # P01, Stack #S01

Plant Contact: Mr. Phillip Frank (608) 754-5300

- II. The source tested was a CMI drum-mix asphalt plant, model #SVM-1500. It is rated at 285 tons per hour (TPH) at a recycle rate of 50% and an aggregate moisture content of 5%. During the test, the plant was producing about 230 TPH at a recycle rate of 35%. The emissions are controlled by a venturi scrubber followed by a cyclone separator. There is no demister section in the collector. The pressure drop across the venturi during the test was 13-14 inches of water.

III. Sampling Operation

A. Purpose of Test

The test was performed to fulfill conditions in Permit #87-SJK-021 issued to this source in May, 1987.

B. Date of Test

The test was performed on July 29, 1987. The weather on this date was hot and muggy with an ambient temperature of 95°F. The sky conditions were partly cloudy during Run 1 to overcast for Runs 2 & 3.

C. Test Method

The stack test was performed using EPA Method 5 as stated in the Federal Register, Vol. 42, #160, August 18, 1977. The backhalf was analyzed according to an approved DNR procedure. The test site was on the rectangular (40" x 34.5") steel outlet stack. Five test ports were located about 8.5 feet above the I.D. Fan and about 20 feet from the end of the stack. ET & E made a 5 point sampling traverse of the stack through each port per run. Each point was sampled for 2.5 minutes. Each run lasted 62.5 minutes and the test consisted of 3 such runs. The filters were analyzed for metals by atomic absorption.

D. Test Witness

Mr. Tom Roushar was the Department representative at this stack test.

IV. Summary of Results

Front half particulate results:

Run Number	Emission Rate (lb/hr)	Emission Concentration (gr/DSCF)	Isokinetic Ratio (%)
1	6.20	0.041	96
2	5.30	0.034	96
3	4.97	0.031	95
Ave.	5.49	0.035	96

Front and backhalf particulate results:

1	20.64	0.136	96
2	18.32	0.117	96
3	20.27	0.125	95
Ave.	19.74	0.126	96

For metal results see Table 1.

V. Applicable Emission Limit

Pollutant	Limit	
Particulate-NSPS	0.04 Grains/DSCF	Permit
Particulate-Total	0.06 Grains/DSCF	Permit
Visible Emissions	20% opacity	Permit
Lead	0.36 lb/hr	Permit
Chromium	0.013 lb/hr	Permit
Hydrogen chloride	4.38 lb/hr	Permit

VI. Discussion of Results

During the test, the plant was operating normally at about 80% of capacity. The highest 6-minute average opacity during each run was 14.6% - Run 1, 22.1% - Run 2, and 18.3% - Run 3. Therefore, the plant was not in compliance with the visible emissions limit during Run 2.

The average particulate emission concentration using only the front half catch was 0.035 grains per dry standard cubic foot which is under the limit of 0.04 Gr/DSCF.

The average total particulate (front and back half) emission concentration was 0.126 GR/DSCF which is over the limit of 0.06 Gr/DSCF. The average isokinetic ratio was 96% which is within the limits of 90% to 110% set by the Department to judge the validity of stack test data. All the metal emissions were under their permit limits.

I checked over all of ET&E's results and found them to be correct. The test report contained calibration data for the sampling equipment and production data for the plant.

cc: Jon Heinrich - SD
U.S. EPA Region V
Tom Steidl - LC/5

4895C

TABLE 1

1.0 HAZARDOUS EMISSION RESULTS

As a provision of Air Pollution Control Permit No. 87-SJK-021 the following hazardous pollutants were sampled on July 29, 1987 during the compliance stack test at the Frank Bros, Inc. new CMI drum mix asphalt in Milton: cadmium, chromium, lead, nickel, arsenic, hexavalent chromium, and hydrogen chloride. A table summarizing the results is presented below:

	TEST 1	TEST 2	TEST 3	LIMIT
Cadmium				
mg/m3	0.003	0.002	0.003	
lb/hr	0.0002	0.0001	0.0002	10*
Chromium				
mg/m3	0.024	0.012	0.016	
lb/hr	0.0016	0.0008	0.0011	0.013
Lead				
mg/m3	0.588	0.378	0.488	
lb/hr	0.038	0.026	0.034	0.36
Nickel				
mg/m3	0.020	0.010	0.012	
lb/hr	0.0013	0.0007	0.0008	**
Arsenic				
mg/m3	0.0009	0.0004	0.0004	
lb/hr	0.00006	0.00003	0.00003	**
Hexavalent Chromium				
mg/m3	0.004	0.002	0.002	
lb/hr	0.0002	0.0001	0.0001	10*
Hydrogen Chloride				
mg/m3	<0.4	<0.3	<0.3	
ppm	<0.3	<0.25	<0.25	38
lb/hr	<0.03	<0.02	<0.02	4.38

* Limit expressed in pounds per year. For emissions of 0.0002 lb/hr, 50,000 hours of operation would be required to emit 10 pounds.

** No specific limit established.

All emissions were well below the limits established in the permit. A copy of the "Specific Emission Limitations" section of the permit is included.

FRANK BROTHERS MILTON TEST 1 7-29-87 TABLE 2-1

BAROMETRIC PRESSURE, in Hg = 29.300
 TIP DIAMETER, in .2420
 STACK AREA, sq ft = 9.583
 SAMPLING TIME PER POINT, min = 2.50
 NUMBER OF POINTS = 25
 GAS METER VOLUME, acf = 37.02
 WATER COLLECTED, ml = 145.00
 PARTICULATE COLLECTED, grams = 0.0956
 CO2 = 6.40 O2 = 11.60 CO = 0.00 N2 = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	1.250	3.00	95	69.46
2	135	0.750	1.85	97	53.81
3	135	0.350	0.90	98	36.76
4	135	0.200	0.50	99	27.79
5	135	0.100	0.25	99	19.65
6	135	1.500	3.50	100	76.09
7	135	0.800	1.90	100	55.57
8	135	0.550	1.35	100	46.08
9	135	0.200	0.50	101	27.79
10	135	0.100	0.25	102	19.65
11	135	1.250	3.00	104	69.46
12	135	1.000	2.35	107	62.13
13	135	0.650	1.55	109	50.09
14	135	0.400	0.95	110	39.29
15	135	0.150	0.37	111	24.06
16	135	1.200	2.80	114	68.06
17	135	0.650	1.55	116	50.09
18	135	0.250	0.60	117	31.06
19	135	0.150	0.37	118	24.06
20	135	0.100	0.50	119	19.65
21	135	1.200	2.80	121	68.06
22	135	0.700	1.65	122	51.98
23	135	0.350	0.85	122	36.76
24	135	0.150	0.37	122	24.06
25	135	0.150	0.37	124	24.06
AVG VALUES	135		1.363	109	43.02

TOTAL GAS WITHDRAWN, scf = 42.86
 DRY GAS WITHDRAWN, scf = 36.04
 WATER VAPOR WITHDRAWN, scf = 6.83
 PERCENT WATER VAPOR = 15.92
 ACTUAL WET FLOW RATE, acfm = 24,736.06
 STANDARD DRY FLOW RATE, scfm = 18,061.67
 PARTICULATE CONCENTRATION, grains/scf = 0.041
 PARTICULATE EMISSION RATE, lb/hr = 6.204
 PERCENT OF ISOKINETIC SAMPLING = 95.79

FRANK BROTHERS MILTON

TEST 2 7-29-87

TABLE 2-2

BAROMETRIC PRESSURE, in Hg = 29.300

TIP DIAMETER, in .2420

STACK AREA, sq ft = 9.583

SAMPLING TIME PER POINT, min = 2.50

NUMBER OF POINTS = 25

GAS METER VOLUME, acf = 38.28

WATER COLLECTED, ml = 149.00

PARTICULATE COLLECTED, grams = 0.0816

CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	1.250	3.00	118	69.45
2	135	0.700	1.70	118	51.97
3	135	0.350	0.85	118	36.75
4	135	0.200	0.50	118	27.78
5	135	0.150	0.37	117	24.06
6	135	1.300	3.10	118	70.82
7	135	0.700	1.70	118	51.97
8	135	0.350	0.85	118	36.75
9	135	0.200	0.50	118	27.78
10	135	0.100	0.25	118	19.64
11	135	1.300	3.10	118	70.82
12	135	0.650	1.60	119	50.08
13	135	0.450	1.10	120	41.67
14	135	0.200	0.50	120	27.78
15	135	0.100	0.25	120	19.64
16	135	1.450	3.40	120	74.80
17	135	1.000	2.45	120	62.12
18	135	0.650	1.60	120	50.08
19	135	0.300	0.75	121	34.02
20	135	0.150	0.37	121	24.06
21	135	1.450	3.40	122	74.80
22	135	0.950	2.30	122	60.54
23	135	0.600	1.40	122	48.12
24	135	0.300	0.75	123	34.02
25	135	0.150	0.37	124	24.06
AVG VALUES	135		1.446	120	44.54

TOTAL GAS WITHDRAWN, scf = 44.33

DRY GAS WITHDRAWN, scf = 37.32

WATER VAPOR WITHDRAWN, scf = 7.01

PERCENT WATER VAPOR = 15.82

ACTUAL WET FLOW RATE, acfm = 25,611.26

STANDARD DRY FLOW RATE, scfm = 18,723.71

PARTICULATE CONCENTRATION, grains/scf = 0.034

PARTICULATE EMISSION RATE, lb/hr = 5.298

PERCENT OF ISOKINETIC SAMPLING = 95.69

FRANK BROTHERS MILTON TEST 3 7-29-87 TABLE 2-3

BAROMETRIC PRESSURE, in Hg = 29.300
 TIP DIAMETER, in .2420
 STACK AREA, sq ft = 9.583
 SAMPLING TIME PER POINT, min = 2.50
 NUMBER OF POINTS = 25
 GAS METER VOLUME, acf = 39.38
 WATER COLLECTED, ml = 135.00
 PARTICULATE COLLECTED, grams = 0.0763
 CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	1.250	3.00	106	68.92
2	130	0.700	1.70	106	51.58
3	130	0.300	0.65	106	33.77
4	135	0.200	0.50	106	27.69
5	135	0.150	0.37	106	23.98
6	135	1.400	3.40	108	73.25
7	135	1.000	2.40	108	61.91
8	135	0.650	1.60	109	49.91
9	135	0.350	0.85	110	36.63
10	135	0.150	0.37	110	23.98
11	135	1.500	3.60	111	75.82
12	135	1.000	2.40	112	61.91
13	135	0.550	1.35	112	45.91
14	135	0.350	0.85	113	36.63
15	135	0.200	0.50	114	27.69
16	135	1.250	3.00	117	69.21
17	135	0.800	1.95	118	55.37
18	135	0.400	0.95	119	39.15
19	135	0.200	0.50	120	27.69
20	135	0.150	0.37	120	23.98
21	135	1.500	3.60	121	75.82
22	135	0.700	1.70	122	51.80
23	135	0.350	0.85	122	36.63
24	135	0.200	0.50	122	27.69
25	135	0.150	0.37	122	23.98
AVG VALUES	134		1.493	114	45.23

TOTAL GAS WITHDRAWN, scf = 44.72
 DRY GAS WITHDRAWN, scf = 38.37
 WATER VAPOR WITHDRAWN, scf = 6.35
 PERCENT WATER VAPOR = 14.21
 ACTUAL WET FLOW RATE, acfm = 26,008.83
 STANDARD DRY FLOW RATE, scfm = 19,397.90
 PARTICULATE CONCENTRATION, grains/scf = 0.031
 PARTICULATE EMISSION RATE, lb/hr = 4.973
 PERCENT OF ISOKINETIC SAMPLING = 94.96

IO.	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6
1	5		51	10	16.7	101	5	8.8	151	5	10.0	201	10	12.9
2	10		52	15	16.9	102	5	8.8	152	10	10.0	202	15	12.9
3	10		53	15	17.3	103	10	8.8	153	5	10.0	203	10	12.9
4	15		54	15	17.5	104	5	8.8	154	10	10.0	204	10	12.9
5	10		55	15	17.9	105	5	8.8	155	5	9.4	205	10	12.7
6	20		56	15	18.1	106	5	8.5	156	10	9.6	206	10	12.5
7	10		57	15	18.1	107	5	8.1	157	5	9.6	207	10	12.5
8	5		58	15	18.3	108	20	8.5	158	5	9.8	208	10	12.5
9	10		59	10	17.9	109	15	8.5	159	10	10.0	209	5	12.1
0	10		60	15	17.5	110	10	8.5	160	10	10.2	210	10	11.9
1	5		61	10	17.3	111	10	8.8	161	15	10.6	211	15	11.9
2	10		62	10	16.7	112	5	8.1	162	15	10.4	212	5	11.5
3	10		63	15	16.5	113	5	7.7	163	20	10.6	213	10	11.3
4	10		64	10	16.0	114	5	7.5	164	15	10.4	214	10	11.3
5	5		65	5	15.2	115	10	7.3	165	15	10.4	215	5	11.0
6	5		66	10	14.6	116	5	7.1	166	20	10.6	216	10	10.8
7	15		67	10	14.0	117	10	7.3	167	25	11.3	217	15	11.0
8	10		68	10	13.5	118	25	8.3	168	15	11.7	218	10	10.8
9	15		69	5	12.9	119	20	9.0	169	20	11.9	219	10	10.4
0	10		70	20	13.1	120	20	9.4	170	20	12.3	220	15	10.2
1	10		71	5	12.9	121	10	9.4	171	20	12.9	221	5	9.8
2	5		72	5	12.7	122	10	9.6	172	15	13.1	222	10	9.8
3	10		73	5	11.9	123	10	9.8	173	20	13.3	223	10	9.8
4	5	9.6	74	10	11.3	124	15	10.2	174	25	14.0	224	10	10.0
5	10	9.8	75	0	10.8	125	5	10.2	175	15	14.4	225	10	10.0
6	10	9.8	76	5	10.4	126	5	10.2	176	20	14.8	226	10	9.8
7	10	9.8	77	5	10.0	127	5	10.0	177	15	15.2	227	20	10.2
8	10	9.6	78	5	9.6	128	10	10.2	178	15	15.4	228	15	10.4
9	5	9.4	79	10	9.4	129	5	10.2	179	10	15.6	229	10	10.4
0	10	9.0	80	5	9.0	130	10	10.4	180	10	15.6	230	10	10.4
1	5	8.8	81	5	8.5	131	20	11.0	181	15	16.0	231	15	10.6
2	10	9.0	82	10	8.3	132	5	10.4	182	15	16.5	232	10	10.6
3	15	9.2	83	15	8.5	133	5	10.0	183	10	16.5	233	10	10.8
4	10	9.2	84	10	8.3	134	0	9.6	184	10	16.5	234	15	11.0
5	20	9.8	85	15	8.5	135	5	9.4	185	15	16.5	235	15	11.0
6	25	10.4	86	10	8.5	136	5	9.4	186	15	16.5	236	15	11.5
7	15	10.6	87	5	8.1	137	5	9.4	187	15	16.3	237	15	11.7
8	25	11.3	88	20	8.5	138	20	10.0	188	15	16.3	238	10	11.7
9	20	11.9	89	15	9.0	139	15	10.2	189	15	16.3	239	15	12.1
0	20	12.5	90	10	9.0	140	20	10.8	190	10	15.8	240	10	12.1
1	25	12.9	91	15	9.2	141	15	11.0	191	10	15.2			
2	25	13.5	92	10	9.2	142	15	10.6	192	15	15.2			
3	25	14.0	93	5	9.2	143	10	10.2	193	10	14.8			
4	20	14.4	94	0	8.3	144	5	9.6	194	15	14.6			
5	20	14.8	95	5	8.3	145	15	9.8	195	20	14.6			
6	15	15.2	96	10	8.5	146	10	9.8	196	20	14.8			
7	10	15.2	97	10	8.8	147	5	9.6	197	15	14.6			
8	10	15.4	98	5	8.5	148	10	9.4	198	10	14.0			
9	25	16.0	99	5	8.8	149	15	9.8	199	10	13.8			
0	25	16.7	100	5	8.8	150	10	10.0	200	5	13.1			

MAXIMUM 6 MINUTE AVERAGE = 18.3 AT NO 58

FRANK BROTHERS MILTON PLANT TEST 2 7-29-87 TABLE 2-5

NO.	OP	AV. 6	NO	OP	AV. 6	NO	OP	AV. 6	NO	OP	AV. 6	NO	OP	AV. 6
1	15		51	20	19.0	101	20	17.5	151	25	20.4	201	20	17.1
2	15		52	20	18.8	102	15	17.7	152	20	20.6	202	20	17.3
3	15		53	10	18.1	103	20	17.9	153	15	20.4	203	15	17.3
4	15		54	10	17.7	104	30	18.3	154	25	20.8	204	20	17.5
5	10		55	15	17.7	105	15	18.3	155	20	20.8	205	25	17.7
6	10		56	15	17.5	106	15	18.1	156	15	20.4	206	15	17.7
7	20		57	20	17.5	107	15	18.1	157	20	20.4	207	20	17.7
8	25		58	10	16.9	108	25	18.5	158	25	20.4	208	20	17.9
9	20		59	20	17.3	109	20	18.5	159	25	20.4	209	25	18.5
0	10		60	15	16.9	110	15	18.3	160	20	20.6	210	20	18.8
1	15		61	15	16.9	111	20	18.5	161	25	20.4	211	15	18.5
2	20		62	10	16.5	112	25	18.8	162	30	20.8	212	20	18.5
3	20		63	10	16.0	113	25	19.2	163	30	21.5	213	15	18.3
4	30		64	25	16.3	114	15	19.4	164	25	21.7	214	15	18.3
5	15		65	15	16.3	115	20	19.6	165	30	22.1	215	10	18.1
6	25		66	10	15.6	116	20	19.6	166	15	21.9	216	15	18.1
7	10		67	10	15.4	117	20	19.8	167	20	22.1	217	10	17.7
8	15		68	20	15.4	118	20	19.8	168	25	22.1	218	15	17.3
9	15		69	15	15.4	119	20	19.8	169	15	22.1	219	10	17.1
0	15		70	15	15.6	120	25	19.6	170	15	21.9	220	15	17.1
1	20		71	20	15.6	121	30	20.4	171	15	21.9	221	15	17.1
2	15		72	15	15.4	122	25	20.4	172	20	21.7	222	20	17.1
3	20		73	15	15.6	123	30	20.8	173	15	21.0	223	25	17.5
4	15	16.9	74	10	15.0	124	15	20.8	174	20	21.3	224	20	17.5
5	15	16.9	75	15	14.8	125	20	20.8	175	15	20.8	225	15	17.3
6	15	16.9	76	10	14.4	126	15	20.8	176	15	20.6	226	15	17.1
7	15	16.9	77	15	14.6	127	10	20.4	177	20	20.8	227	10	16.9
8	25	17.3	78	10	14.6	128	15	19.8	178	15	20.4	228	20	16.9
9	25	17.9	79	15	14.6	129	20	20.0	179	15	20.2	229	15	16.5
0	20	18.3	80	20	14.8	130	15	20.0	180	15	20.2	230	15	16.5
1	15	18.1	81	15	14.6	131	20	20.2	181	20	20.2	231	10	16.0
2	20	17.9	82	20	15.0	132	25	20.2	182	15	19.6	232	10	15.6
3	20	17.9	83	15	14.8	133	20	20.2	183	20	19.6	233	20	15.4
4	25	18.5	84	15	14.8	134	25	20.6	184	15	19.4	234	15	15.2
5	10	18.3	85	20	15.0	135	25	20.8	185	10	18.8	235	20	15.4
6	25	18.5	86	20	15.4	136	15	20.4	186	15	18.1	236	20	15.4
7	15	18.3	87	15	15.6	137	30	20.6	187	20	17.7	237	15	15.4
8	20	17.9	88	20	15.4	138	20	20.8	188	20	17.5	238	10	15.2
9	20	18.1	89	15	15.4	139	15	20.6	189	20	17.1	239	15	15.4
0	20	17.9	90	10	15.4	140	20	20.6	190	15	17.1	240	15	15.4
1	15	18.1	91	15	15.6	141	20	20.6	191	15	16.9			
2	25	18.5	92	20	15.6	142	20	20.6	192	15	16.5			
3	15	18.5	93	15	15.6	143	15	20.4	193	20	16.7			
4	20	18.8	94	20	15.8	144	25	20.4	194	25	17.1			
5	15	18.5	95	20	15.8	145	15	19.8	195	15	17.1			
6	10	18.3	96	30	16.5	146	20	19.6	196	15	16.9			
7	20	18.3	97	10	16.3	147	15	19.0	197	15	16.9			
8	20	18.5	98	25	16.9	148	25	19.4	198	20	16.9			
9	10	18.3	99	20	17.1	149	30	19.8	199	15	16.9			
0	25	18.8	100	15	17.3	150	15	19.8	200	20	17.1			

AXIMUM 6 MINUTE AVERAGE = 22.1 AT NO 169

FRANK BROTHERS MILTON PLANT TEST 1 7-29-87 TABLE 2-4

NO.	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6
1	5		51	10	6.0	101	5	8.8	151	25	10.2	201	10	7.5
2	5		52	10	6.3	102	10	9.0	152	10	10.2	202	10	7.5
3	10		53	10	6.5	103	10	9.2	153	5	10.0	203	10	7.7
4	10		54	5	6.3	104	15	9.6	154	5	9.6	204	25	8.3
5	5		55	5	6.3	105	20	10.0	155	5	9.6	205	10	8.5
6	10		56	10	6.5	106	15	10.4	156	5	9.2	206	15	9.2
7	5		57	10	6.7	107	15	10.6	157	10	9.2	207	25	10.0
8	5		58	5	6.7	108	5	10.4	158	5	8.8	208	15	10.4
9	10		59	5	6.5	109	10	10.4	159	10	9.0	209	10	10.4
0	10		60	5	6.5	110	10	10.4	160	10	9.0	210	5	10.4
1	5		61	5	6.5	111	10	10.4	161	5	8.8	211	10	10.4
2	5		62	10	6.5	112	10	10.4	162	10	9.0	212	10	10.4
3	10		63	5	6.5	113	5	10.0	163	10	8.3	213	15	10.6
4	5		64	5	6.3	114	15	10.4	164	5	7.9	214	15	11.0
5	10		65	5	6.3	115	20	10.8	165	5	7.7	215	10	11.3
6	5		66	5	6.3	116	30	11.9	166	20	8.3	216	15	11.7
7	5		67	10	6.5	117	15	12.1	167	15	8.8	217	10	11.9
8	10		68	5	6.5	118	15	12.3	168	10	9.0	218	10	11.9
9	10		69	5	6.5	119	10	12.1	169	5	8.8	219	5	11.9
0	5		70	5	6.5	120	10	12.1	170	10	9.0	220	10	11.9
1	5		71	5	6.5	121	10	12.1	171	25	9.6	221	5	11.9
2	5		72	5	6.5	122	5	11.9	172	15	10.0	222	5	11.5
3	5		73	5	6.5	123	25	12.5	173	15	10.2	223	10	11.3
4	10	7.1	74	5	6.5	124	35	13.8	174	20	10.8	224	15	11.7
5	10	7.3	75	5	6.3	125	25	14.6	175	20	10.6	225	10	11.7
6	5	7.3	76	10	6.3	126	10	14.6	176	20	11.0	226	10	11.7
7	5	7.1	77	5	6.0	127	5	14.4	177	10	11.3	227	10	11.7
8	5	6.9	78	5	6.0	128	10	14.2	178	10	11.5	228	25	11.7
9	5	6.9	79	5	6.0	129	10	13.8	179	5	11.5	229	15	11.9
0	10	6.9	80	5	5.8	130	15	13.8	180	10	11.7	230	10	11.7
1	5	6.9	81	10	5.8	131	5	13.3	181	5	11.5	231	25	11.7
2	5	6.9	82	5	5.8	132	15	13.8	182	0	11.3	232	25	12.1
3	5	6.7	83	10	6.0	133	10	13.8	183	5	11.0	233	25	12.7
4	5	6.5	84	10	6.3	134	15	14.0	184	5	10.8	234	10	12.9
5	10	6.7	85	10	6.5	135	5	13.8	185	10	11.0	235	5	12.7
6	5	6.7	86	10	6.5	136	10	13.8	186	5	10.8	236	5	12.5
7	5	6.5	87	10	6.7	137	10	14.0	187	10	10.8	237	10	12.3
8	10	6.7	88	10	6.9	138	5	13.5	188	10	11.0	238	5	11.9
9	5	6.5	89	15	7.3	139	25	13.8	189	10	11.3	239	5	11.7
0	10	6.7	90	5	7.3	140	15	13.1	190	5	10.6	240	20	11.9
1	5	6.7	91	10	7.3	141	10	12.9	191	5	10.2			
2	5	6.5	92	5	7.3	142	5	12.5	192	5	10.0			
3	5	6.3	93	10	7.5	143	5	12.3	193	5	10.0			
4	5	6.3	94	10	7.7	144	5	12.1	194	10	10.0			
5	5	6.3	95	15	8.1	145	10	12.1	195	5	9.2			
6	5	6.3	96	10	8.3	146	5	12.1	196	10	9.0			
7	5	6.3	97	10	8.5	147	10	11.5	197	5	8.5			
8	5	6.0	98	10	8.8	148	5	10.2	198	15	8.3			
9	5	5.8	99	10	9.0	149	10	9.6	199	15	8.1			
0	5	5.8	100	5	8.8	150	5	9.4	200	5	7.5			

MAXIMUM 6 MINUTE AVERAGE = 14.6 AT NO 126

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2420
STACK AREA, sq ft = 9.583
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 25
GAS METER VOLUME, acf = 37.02
WATER COLLECTED, ml = 145.00
PARTICULATE COLLECTED, grams = 0.3181
CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	1.250	3.00	95	69.46
2	135	0.750	1.85	97	53.81
3	135	0.350	0.90	98	36.76
4	135	0.200	0.50	99	27.79
5	135	0.100	0.25	99	19.65
6	135	1.500	3.50	100	76.09
7	135	0.800	1.90	100	55.57
8	135	0.550	1.35	100	46.08
9	135	0.200	0.50	101	27.79
10	135	0.100	0.25	102	19.65
11	135	1.250	3.00	104	69.46
12	135	1.000	2.35	107	62.13
13	135	0.650	1.55	109	50.09
14	135	0.400	0.95	110	39.29
15	135	0.150	0.37	111	24.06
16	135	1.200	2.80	114	68.06
17	135	0.650	1.55	116	50.09
18	135	0.250	0.60	117	31.06
19	135	0.150	0.37	118	24.06
20	135	0.100	0.50	119	19.65
21	135	1.200	2.80	121	68.06
22	135	0.700	1.65	122	51.98
23	135	0.350	0.85	122	36.76
24	135	0.150	0.37	122	24.06
25	135	0.150	0.37	124	24.06
AVG VALUES	135		1.363	109	43.02

TOTAL GAS WITHDRAWN, scf = 42.86
DRY GAS WITHDRAWN, scf = 36.04
WATER VAPOR WITHDRAWN, scf = 6.83
PERCENT WATER VAPOR = 15.92
ACTUAL WET FLOW RATE, acfm = 24,736.06
STANDARD DRY FLOW RATE, scfm = 18,061.67
PARTICULATE CONCENTRATION, grains/scf = 0.136
PARTICULATE EMISSION RATE, lb/hr = 20.642
PERCENT OF ISOKINETIC SAMPLING = 95.79

BAROMETRIC PRESSURE, in Hg = 29.300
 TIP DIAMETER, in .2420
 STACK AREA, sq ft = 9.583
 SAMPLING TIME PER POINT, min = 2.50
 NUMBER OF POINTS = 25
 GAS METER VOLUME, acf = 38.28
 WATER COLLECTED, ml = 149.00
 PARTICULATE COLLECTED, grams = 0.2822
 CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	1.250	3.00	118	69.45
2	135	0.700	1.70	118	51.97
3	135	0.350	0.85	118	36.75
4	135	0.200	0.50	118	27.78
5	135	0.150	0.37	117	24.06
6	135	1.300	3.10	118	70.82
7	135	0.700	1.70	118	51.97
8	135	0.350	0.85	118	36.75
9	135	0.200	0.50	118	27.78
10	135	0.100	0.25	118	19.64
11	135	1.300	3.10	118	70.82
12	135	0.650	1.60	119	50.08
13	135	0.450	1.10	120	41.67
14	135	0.200	0.50	120	27.78
15	135	0.100	0.25	120	19.64
16	135	1.450	3.40	120	74.80
17	135	1.000	2.45	120	62.12
18	135	0.650	1.60	120	50.08
19	135	0.300	0.75	121	34.02
20	135	0.150	0.37	121	24.06
21	135	1.450	3.40	122	74.80
22	135	0.950	2.30	122	60.54
23	135	0.600	1.40	122	48.12
24	135	0.300	0.75	123	34.02
25	135	0.150	0.37	124	24.06
AVG VALUES	135		1.446	120	44.54

TOTAL GAS WITHDRAWN, scf = 44.33
 DRY GAS WITHDRAWN, scf = 37.32
 WATER VAPOR WITHDRAWN, scf = 7.01
 PERCENT WATER VAPOR = 15.82
 ACTUAL WET FLOW RATE, acfm = 25,611.26
 STANDARD DRY FLOW RATE, scfm = 18,723.71
 PARTICULATE CONCENTRATION, grains/scf = 0.117
 PARTICULATE EMISSION RATE, lb/hr = 18.322
 PERCENT OF ISOKINETIC SAMPLING = 95.69

FRANK BROTHERS MILTON TEST 3 7-29-87 TABLE 2-3A (INC. BACK HALF)

BAROMETRIC PRESSURE, in Hg = 29.300
 TIP DIAMETER, in .2420
 STACK AREA, sq ft = 9.583
 SAMPLING TIME PER POINT, min = 2.50
 NUMBER OF POINTS = 25
 GAS METER VOLUME, acf = 39.38
 WATER COLLECTED, ml = 135.00
 PARTICULATE COLLECTED, grams = 0.3110
 CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	1.250	3.00	106	68.92
2	130	0.700	1.70	106	51.58
3	130	0.300	0.65	106	33.77
4	135	0.200	0.50	106	27.69
5	135	0.150	0.37	106	23.98
6	135	1.400	3.40	108	73.25
7	135	1.000	2.40	108	61.91
8	135	0.650	1.60	109	49.91
9	135	0.350	0.85	110	36.63
10	135	0.150	0.37	110	23.98
11	135	1.500	3.60	111	75.82
12	135	1.000	2.40	112	61.91
13	135	0.550	1.35	112	45.91
14	135	0.350	0.85	113	36.63
15	135	0.200	0.50	114	27.69
16	135	1.250	3.00	117	69.21
17	135	0.800	1.95	118	55.37
18	135	0.400	0.95	119	39.15
19	135	0.200	0.50	120	27.69
20	135	0.150	0.37	120	23.98
21	135	1.500	3.60	121	75.82
22	135	0.700	1.70	122	51.80
23	135	0.350	0.85	122	36.63
24	135	0.200	0.50	122	27.69
25	135	0.150	0.37	122	23.98
AVG VALUES	134		1.493	114	45.23

TOTAL GAS WITHDRAWN, scf = 44.72
 DRY GAS WITHDRAWN, scf = 38.37
 WATER VAPOR WITHDRAWN, scf = 6.35
 PERCENT WATER VAPOR = 14.21
 ACTUAL WET FLOW RATE, acfm = 26,008.83
 STANDARD DRY FLOW RATE, scfm = 19,397.90
 PARTICULATE CONCENTRATION, grains/scf = 0.125
 PARTICULATE EMISSION RATE, lb/hr = 20.271
 PERCENT OF ISOKINETIC SAMPLING = 94.96

SUMMARY

On July 29, 1987, Environmental Technology & Engineering Corporation personnel performed a particulate stack emission test on the Frank Bros., Inc. drum mix asphalt plant located on Highway 59 in Milton, Wisconsin. The the average of the three tests show the emissions to be below the limit of 0.04 grains of particulate matter per dry standard cubic foot (gr/dscf) as specified by the State of Wisconsin Department of Natural Resources (DNR). The numerical test results are summarized below:

<u>Test</u>	<u>Emissions</u>	<u>% of Allowable</u>
1	0.041	102
2	0.034	85
3	0.031	78
AVG	0.035 gr/dscf	88

The opacity of the stack was also observed by a certified observer throughout the three (3) hour test period. The 6 minute average opacities for tests 1 and 3 were all less than the permit limit of 20 %. The 6 minute averages slightly exceeded the 20 % limit during periods of test 2.

	Run 1 (%)	Run 2 (%)	Run 3 (%)
Front half Catch (gm)	0.0956 (30%)	0.0816 (29%)	0.0763 (25%)
Back half Catch (gm) - Organic	0.1984 (62%)	0.1943 (69%)	0.2237 (72%)
Inorganic	0.0241 (8%)	0.0063 (2%)	0.0110 (3%)
Total Catch (gm)	0.3181	0.2822	0.3110

*% of Total Catch

1.0 GENERAL

On Wednesday, July 29, 1987, Environmental Technology and Engineering Corporation personnel performed a stack emission test on the Frank Bros., Inc. drum mix asphalt plant located on Highway 59 in Milton, Wisconsin. The U.S. EPA has established a new source performance standard (NSPS) particulate emission limit of 0.04 grains per dry standard cubic foot (gr/dscf) for plants of this type. The State of Wisconsin Department of Natural Resources (DNR) has incorporated this same limit in Chapter NR 415 of the Wisconsin Administrative Code. There is also a 20 % visible emission limit set for sources of this type. As part of a review of an application to operate a source of air pollution, the DNR required that a stack test be performed. The purpose of this test was to demonstrate the compliance status of this plant with the particulate and visible emission limits so that a permit to operate on a permanent basis could be issued.

The plant tested was a CMI Caterpillar drum mix asphalt plant equipped with a scrubber for particulate control. During the test period, the plant production rate was approximately 235 tons per hour and the mix was composed of 65 % virgin material and 35 % recycled material. The plant was fired with # 5 waste oil. The field tests, opacity observations, corresponding laboratory analysis and report preparation were performed by Chris Huenink, Mike Huenink and Bill Dick. The test procedures, plant operating conditions, and stack opacity were witnessed by Tom Roushar of the State of Wisconsin DNR Southern District Office. Roger Frank of Frank Bros. was responsible for plant and scrubber operation during the test period. Tom MacFaddin of Caterpillar Tractor was also present during the test.

The following sections of this report document the activities and results of the test program. The report presents all of the relevant data collected and discussions on the interpretation of the data are provided where appropriate. The report, therefore, includes much necessary detail. The results, however, have been summarized in the SUMMARY section at the beginning of this report for those readers not wishing to be burdened by the details.

2.0 RESULTS

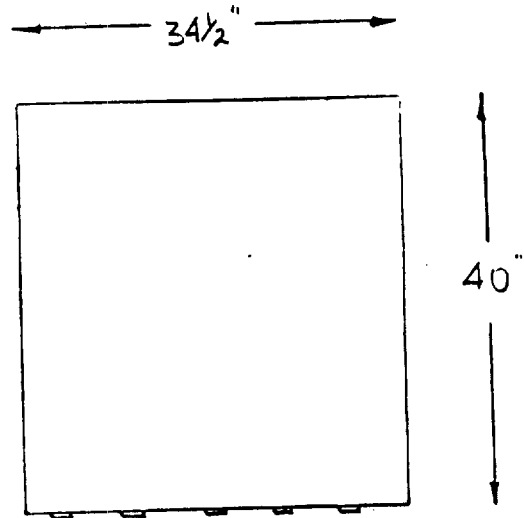
2.1 Particulate Emissions

Isokinetic sampling for particulate matter was performed in accordance with the procedures outlined in EPA Method 5 - "Determination of Particulate Emissions from Stationary Sources" - as published in the Federal Register. A brief summary of this method is included in section 4.0 of this report. The tests were performed in the final discharge stack at the location shown in Figure 2-1. This same figure also depicts the location of the exact test points relative to the stack wall. The stack flow parameters recorded during testing and the weights of particulate collected were used to compute the emissions for each test of the three-test sequence. These data were then entered into a computer and printouts showing detailed results are included as Tables 2-1, 2-2, and 2-3.

The average of the three individual tests show the emissions to be below the limit of 0.04 grains of particulate matter per dry standard cubic foot (gr/dscf) as specified by the State of Wisconsin Department of Natural Resources (DNR). The numerical test results are summarized below:

Test	Emissions	% of Allowable
1	0.041	102
2	0.034	85
3	<u>0.031</u>	<u>78</u>
AVG	0.035 gr/dscf	88

PLANT	FRANK Bros.
LOCATION	MILTON
SOURCE	CMI Drum Mix PLANT
DIMENSIONS	40" x 34 1/2"
COMMENTS	

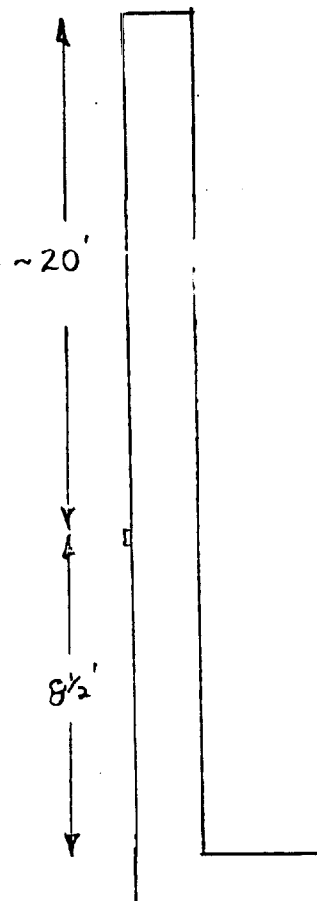


POINT	DISTANCE FROM STACK WALL
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1	4
2	12
3	20
4	28
5	36

TEST SECTION

SAMPLING LOCATION



FRANK BROTHERS MILTON

TEST 1 7-29-87

TABLE 2-1

BAROMETRIC PRESSURE, in Hg = 29.300

TIP DIAMETER, in .2420

STACK AREA, sq ft = 9.583

SAMPLING TIME PER POINT, min = 2.50

NUMBER OF POINTS = 25

GAS METER VOLUME, acf = 37.02

WATER COLLECTED, ml = 145.00

PARTICULATE COLLECTED, grams = 0.0956

CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	1.250	3.00	95	69.46
2	135	0.750	1.85	97	53.81
3	135	0.350	0.90	98	36.76
4	135	0.200	0.50	99	27.79
5	135	0.100	0.25	99	19.65
6	135	1.500	3.50	100	76.09
7	135	0.800	1.90	100	55.57
8	135	0.550	1.35	100	46.08
9	135	0.200	0.50	101	27.79
10	135	0.100	0.25	102	19.65
11	135	1.250	3.00	104	69.46
12	135	1.000	2.35	107	62.13
13	135	0.650	1.55	109	50.09
14	135	0.400	0.95	110	39.29
15	135	0.150	0.37	111	24.06
16	135	1.200	2.80	114	68.06
17	135	0.650	1.55	116	50.09
18	135	0.250	0.60	117	31.06
19	135	0.150	0.37	118	24.06
20	135	0.100	0.50	119	19.65
21	135	1.200	2.80	121	68.06
22	135	0.700	1.65	122	51.98
23	135	0.350	0.85	122	36.76
24	135	0.150	0.37	122	24.06
25	135	0.150	0.37	124	24.06
AVG VALUES	135		1.363	109	43.02

TOTAL GAS WITHDRAWN, scf = 42.86

DRY GAS WITHDRAWN, scf = 36.04

WATER VAPOR WITHDRAWN, scf = 6.83

PERCENT WATER VAPOR = 15.92

ACTUAL WET FLOW RATE, acfm = 24,736.06

STANDARD DRY FLOW RATE, scfm = 18,061.67

PARTICULATE CONCENTRATION, grains/scf = 0.041

PARTICULATE EMISSION RATE, lb/hr = 6.204

PERCENT OF ISOKINETIC SAMPLING = 95.79

FRANK BROTHERS MILTON

TEST 2 7-29-87

TABLE 2-2

BAROMETRIC PRESSURE, in Hg = 29.300

TIP DIAMETER, in .2420

STACK AREA, sq ft = 9.583

SAMPLING TIME PER POINT, min = 2.50

NUMBER OF POINTS = 25

GAS METER VOLUME, acf = 38.28

WATER COLLECTED, ml = 149.00

PARTICULATE COLLECTED, grams = 0.0816

CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	1.250	3.00	118	69.45
2	135	0.700	1.70	118	51.97
3	135	0.350	0.85	118	36.75
4	135	0.200	0.50	118	27.78
5	135	0.150	0.37	117	24.06
6	135	1.300	3.10	118	70.82
7	135	0.700	1.70	118	51.97
8	135	0.350	0.85	118	36.75
9	135	0.200	0.50	118	27.78
10	135	0.100	0.25	118	19.64
11	135	1.300	3.10	118	70.82
12	135	0.650	1.60	119	50.08
13	135	0.450	1.10	120	41.67
14	135	0.200	0.50	120	27.78
15	135	0.100	0.25	120	19.64
16	135	1.450	3.40	120	74.80
17	135	1.000	2.45	120	62.12
18	135	0.650	1.60	120	50.08
19	135	0.300	0.75	121	34.02
20	135	0.150	0.37	121	24.06
21	135	1.450	3.40	122	74.80
22	135	0.950	2.30	122	60.54
23	135	0.600	1.40	122	48.12
24	135	0.300	0.75	123	34.02
25	135	0.150	0.37	124	24.06
AVG VALUES	135		1.446	120	44.54

TOTAL GAS WITHDRAWN, scf = 44.33

DRY GAS WITHDRAWN, scf = 37.32

WATER VAPOR WITHDRAWN, scf = 7.01

PERCENT WATER VAPOR = 15.82

ACTUAL WET FLOW RATE, acfm = 25,611.26

STANDARD DRY FLOW RATE, scfm = 18,723.71

PARTICULATE CONCENTRATION, grains/scf = 0.034

PARTICULATE EMISSION RATE, lb/hr = 5.298

PERCENT OF ISOKINETIC SAMPLING = 95.60

FRANK BROTHERS MILTON TEST 3 7-29-87 TABLE 2-3

BAROMETRIC PRESSURE, in Hg = 29.300
 TIP DIAMETER, in .2420
 STACK AREA, sq ft = 9.583
 SAMPLING TIME PER POINT, min = 2.50
 NUMBER OF POINTS = 25
 GAS METER VOLUME, acf = 39.38
 WATER COLLECTED, ml = 135.00
 PARTICULATE COLLECTED, grams = 0.0763
 CO₂ = 6.40 O₂ = 11.60 CO = 0.00 N₂ = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	1.250	3.00	106	68.92
2	130	0.700	1.70	106	51.58
3	130	0.300	0.65	106	33.77
4	135	0.200	0.50	106	27.69
5	135	0.150	0.37	106	23.98
6	135	1.400	3.40	108	73.25
7	135	1.000	2.40	108	61.91
8	135	0.650	1.60	109	49.91
9	135	0.350	0.85	110	36.63
10	135	0.150	0.37	110	23.98
11	135	1.500	3.60	111	75.82
12	135	1.000	2.40	112	61.91
13	135	0.550	1.35	112	45.91
14	135	0.350	0.85	113	36.63
15	135	0.200	0.50	114	27.69
16	135	1.250	3.00	117	69.21
17	135	0.800	1.95	118	55.37
18	135	0.400	0.95	119	39.15
19	135	0.200	0.50	120	27.69
20	135	0.150	0.37	120	23.98
21	135	1.500	3.60	121	75.82
22	135	0.700	1.70	122	51.80
23	135	0.350	0.85	122	36.63
24	135	0.200	0.50	122	27.69
25	135	0.150	0.37	122	23.98
AVG VALUES	134		1.493	114	45.23

TOTAL GAS WITHDRAWN, scf = 44.72
 DRY GAS WITHDRAWN, scf = 38.37
 WATER VAPOR WITHDRAWN, scf = 6.35
 PERCENT WATER VAPOR = 14.21
 ACTUAL WET FLOW RATE, acfm = 26,008.83
 STANDARD DRY FLOW RATE, scfm = 19,397.90
 PARTICULATE CONCENTRATION, grains/scf = 0.031
 PARTICULATE EMISSION RATE, lb/hr = 4.973
 PERCENT OF ISOKINETIC SAMPLING = 94.96

2.2 Visible Emissions

The visible emissions (opacity) were observed for three one hour periods which coincided with the particulate emissions tests. The U.S. EPA now requires that three hours of observations be performed generally at the same time as the particulate test. The opacity was observed in accordance with the procedures outlined in EPA Method 9 - Visible Determination of the Opacity of Emissions from Stationary Sources. The field data was entered into a computer and printouts of the running 6 minute average opacities are included as Tables 2-4, 2-5, and 2-6. The results have also been plotted as Figures 2-4, 2-5, and 2-6. The results demonstrate that all 6 minute average opacities during tests 1 and 3 were less than the 20 % permit limit. There were occasional periods during test 2 when the 6 minute average opacity slightly exceeded the 20 % limit.

3.0 COMMENTS

The filter samples in the EPA Method 5 sampling train were all visually black in color. This color is characteristic of unburned carbon either from the burner fuel or from the volatiles in the recycled material. The stack opacity also was observed to be a blue-black color. There were also occasional periods during the tests when the steam plume seemed to disappear either due to the extreme heat or a reduction in water vapor emitted. During these periods the opacity was read at the stack discharge point resulting in high (greater than 20 %) opacities.

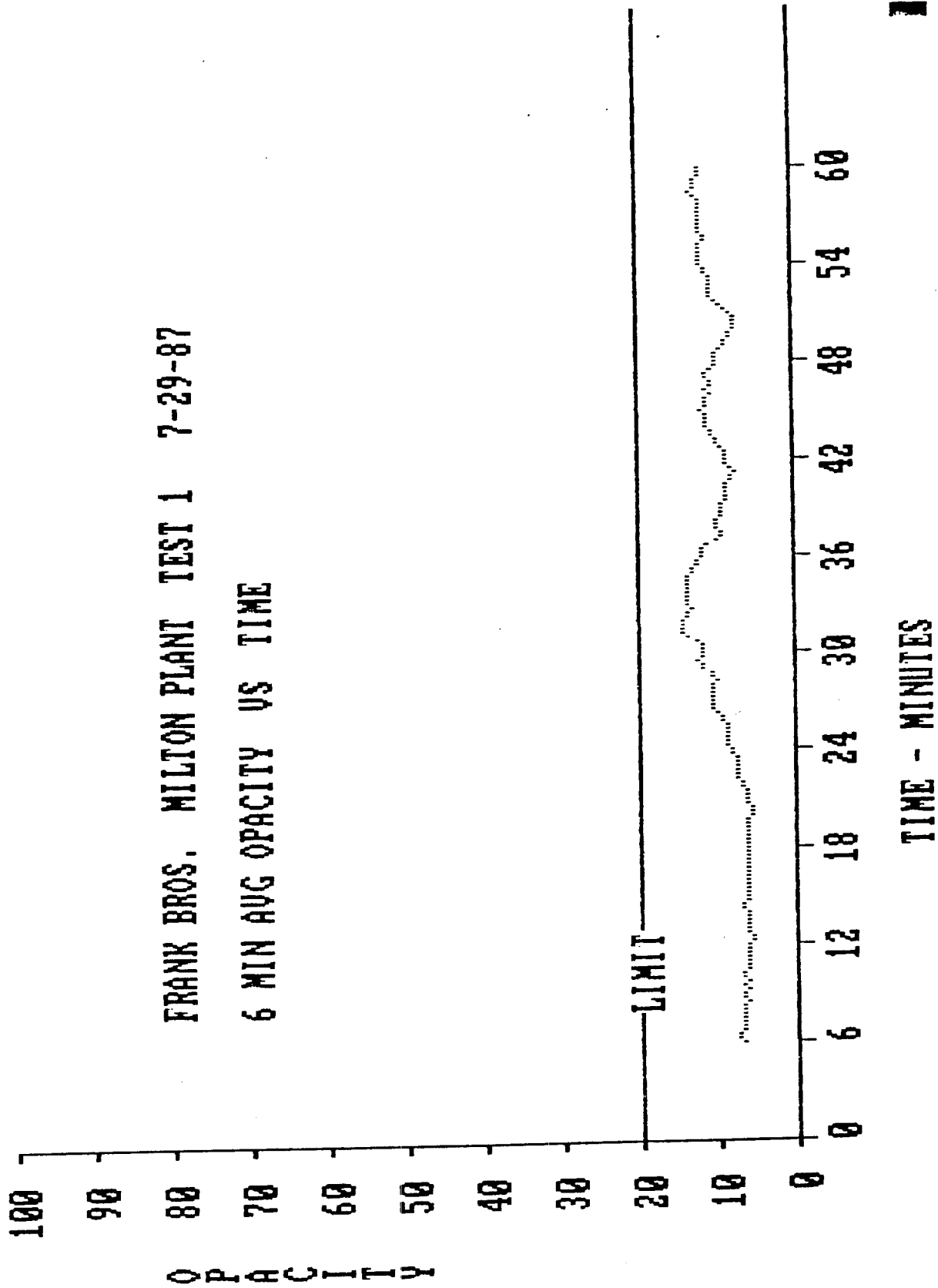
4.0 METHOD OF TEST

The equipment used to sample was the Western Precipitation Division of the Joy Manufacturing Company Emission Parameter Analyzer. Samples were collected and analyzed in accordance with procedures outlined in the Federal Register, Volume 42, Number 160, August 18, 1977, Method 5 - Determination of Particulate Emissions from Stationary Sources.

FRANK BROTHERS MILTON PLANT TEST 1 7-29-87 TABLE 2-4

NO.	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6
1	5		51	10	6.0	101	5	8.8	151	25	10.2	201	10	7.5
2	5		52	10	6.3	102	10	9.0	152	10	10.2	202	10	7.5
3	10		53	10	6.5	103	10	9.2	153	5	10.0	203	10	7.7
4	10		54	5	6.3	104	15	9.6	154	5	9.6	204	25	8.3
5	5		55	5	6.3	105	20	10.0	155	5	9.6	205	10	8.5
6	10		56	10	6.5	106	15	10.4	156	5	9.2	206	15	9.2
7	5		57	10	6.7	107	15	10.6	157	10	9.2	207	25	10.0
8	5		58	5	6.7	108	5	10.4	158	5	8.8	208	15	10.4
9	10		59	5	6.5	109	10	10.4	159	10	9.0	209	10	10.4
0	10		60	5	6.5	110	10	10.4	160	10	9.0	210	5	10.4
1	5		61	5	6.5	111	10	10.4	161	5	8.8	211	10	10.4
2	5		62	10	6.5	112	10	10.4	162	10	9.0	212	10	10.4
3	10		63	5	6.5	113	5	10.0	163	10	8.3	213	15	10.6
4	5		64	5	6.3	114	15	10.4	164	5	7.9	214	15	11.0
5	10		65	5	6.3	115	20	10.8	165	5	7.7	215	10	11.3
6	5		66	5	6.3	116	30	11.9	166	20	8.3	216	15	11.7
7	5		67	10	6.5	117	15	12.1	167	15	8.8	217	10	11.9
8	10		68	5	6.5	118	15	12.3	168	10	9.0	218	10	11.9
9	10		69	5	6.5	119	10	12.1	169	5	8.8	219	5	11.9
0	5		70	5	6.5	120	10	12.1	170	10	9.0	220	10	11.9
1	5		71	5	6.5	121	10	12.1	171	25	9.6	221	5	11.9
2	5		72	5	6.5	122	5	11.9	172	15	10.0	222	5	11.5
3	5		73	5	6.5	123	25	12.5	173	15	10.2	223	10	11.3
4	10	7.1	74	5	6.5	124	35	13.8	174	20	10.8	224	15	11.7
5	10	7.3	75	5	6.3	125	25	14.6	175	20	10.6	225	10	11.7
6	5	7.3	76	10	6.3	126	10	14.6	176	20	11.0	226	10	11.7
7	5	7.1	77	5	6.0	127	5	14.4	177	10	11.3	227	10	11.7
8	5	6.9	78	5	6.0	128	10	14.2	178	10	11.5	228	25	11.7
9	5	6.9	79	5	6.0	129	10	13.8	179	5	11.5	229	15	11.9
0	10	6.9	80	5	5.8	130	15	13.8	180	10	11.7	230	10	11.7
1	5	6.9	81	10	5.8	131	5	13.3	181	5	11.5	231	25	11.7
2	5	6.9	82	5	5.8	132	15	13.8	182	0	11.3	232	25	12.1
3	5	6.7	83	10	6.0	133	10	13.8	183	5	11.0	233	25	12.7
4	5	6.5	84	10	6.3	134	15	14.0	184	5	10.8	234	10	12.9
5	10	6.7	85	10	6.5	135	5	13.8	185	10	11.0	235	5	12.7
6	5	6.7	86	10	6.5	136	10	13.8	186	5	10.8	236	5	12.5
7	5	6.5	87	10	6.7	137	10	14.0	187	10	10.8	237	10	12.3
8	10	6.7	88	10	6.9	138	5	13.5	188	10	11.0	238	5	11.9
9	5	6.5	89	15	7.3	139	25	13.8	189	10	11.3	239	5	11.7
0	10	6.7	90	5	7.3	140	15	13.1	190	5	10.6	240	20	11.9
1	5	6.7	91	10	7.3	141	10	12.9	191	5	10.2			
2	5	6.5	92	5	7.3	142	5	12.5	192	5	10.0			
3	5	6.3	93	10	7.5	143	5	12.3	193	5	10.0			
4	5	6.3	94	10	7.7	144	5	12.1	194	10	10.0			
5	5	6.3	95	15	8.1	145	10	12.1	195	5	9.2			
6	5	6.3	96	10	8.3	146	5	12.1	196	10	9.0			
7	5	6.3	97	10	8.5	147	10	11.5	197	5	8.5			
8	5	6.0	98	10	8.8	148	5	10.2	198	15	8.3			
9	5	5.8	99	10	9.0	149	10	9.6	199	15	8.1			
0	5	5.8	100	5	8.8	150	5	9.4	200	5	7.5			

MAXIMUM 5 MINUTE AVERAGE = 14.6 AT NO 126



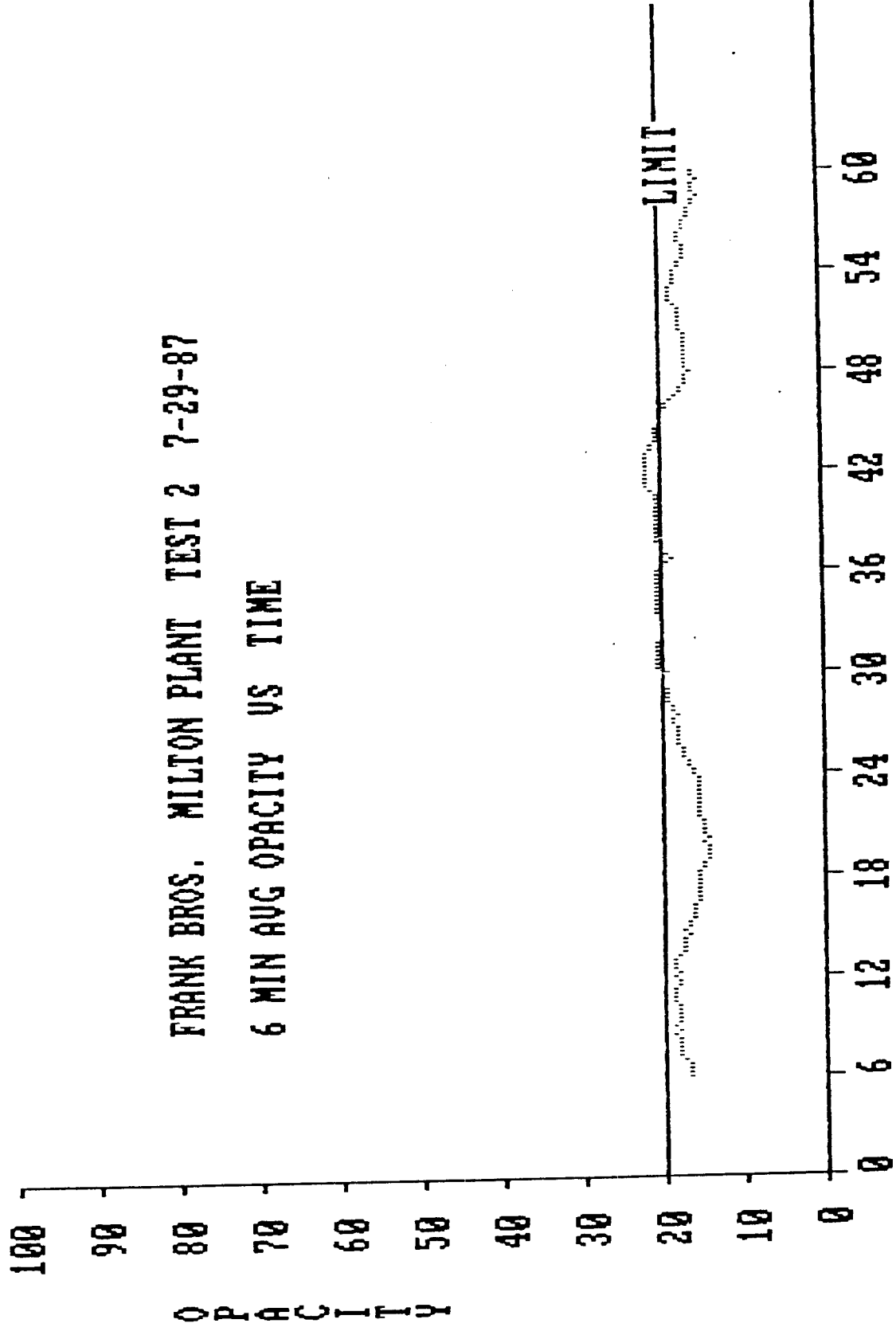
FRANK BROTHERS MILTON PLANT TEST 2 7-29-87 TABLE 2-5

NO.	OP	AV. 6	NO	OP	AV. 6	NO	OP	AV. 6	NO	OP	AV. 6	NO	OP	AV. 6
1	15		51	20	19.0	101	20	17.5	151	25	20.4	201	20	17.1
2	15		52	20	18.8	102	15	17.7	152	20	20.6	202	20	17.3
3	15		53	10	18.1	103	20	17.9	153	15	20.4	203	15	17.3
4	15		54	10	17.7	104	30	18.3	154	25	20.8	204	20	17.5
5	10		55	15	17.7	105	15	18.3	155	20	20.8	205	25	17.7
6	10		56	15	17.5	106	15	18.1	156	15	20.4	206	15	17.7
7	20		57	20	17.5	107	15	18.1	157	20	20.4	207	20	17.7
8	25		58	10	16.9	108	25	18.5	158	25	20.4	208	20	17.9
9	20		59	20	17.3	109	20	18.5	159	25	20.4	209	25	18.5
0	10		60	15	16.9	110	15	18.3	160	20	20.6	210	20	18.8
1	15		61	15	16.9	111	20	18.5	161	25	20.4	211	15	18.5
2	20		62	10	16.5	112	25	18.8	162	30	20.8	212	20	18.5
3	20		63	10	16.0	113	25	19.2	163	30	21.5	213	15	18.3
4	30		64	25	16.3	114	15	19.4	164	25	21.7	214	15	18.3
5	15		65	15	16.3	115	20	19.6	165	30	22.1	215	10	18.1
6	25		66	10	15.6	116	20	19.6	166	15	21.9	216	15	18.1
7	10		67	10	15.4	117	20	19.8	167	20	22.1	217	10	17.7
8	15		68	20	15.4	118	20	19.8	168	25	22.1	218	15	17.3
9	15		69	15	15.4	119	20	19.8	169	15	22.1	219	10	17.1
0	15		70	15	15.6	120	25	19.6	170	15	21.9	220	15	17.1
1	20		71	20	15.6	121	30	20.4	171	15	21.9	221	15	17.1
2	15		72	15	15.4	122	25	20.4	172	20	21.7	222	20	17.1
3	20		73	15	15.6	123	30	20.8	173	15	21.0	223	25	17.5
4	15	16.9	74	10	15.0	124	15	20.8	174	20	21.3	224	20	17.5
5	15	16.9	75	15	14.8	125	20	20.8	175	15	20.8	225	15	17.3
6	15	16.9	76	10	14.4	126	15	20.8	176	15	20.6	226	15	17.1
7	15	16.9	77	15	14.6	127	10	20.4	177	20	20.8	227	10	16.9
8	25	17.3	78	10	14.6	128	15	19.8	178	15	20.4	228	20	16.9
9	25	17.9	79	15	14.6	129	20	20.0	179	15	20.2	229	15	16.5
0	20	18.3	80	20	14.8	130	15	20.0	180	15	20.2	230	15	16.5
1	15	18.1	81	15	14.6	131	20	20.2	181	20	20.2	231	10	16.0
2	20	17.9	82	20	15.0	132	25	20.2	182	15	19.8	232	10	15.6
3	20	17.9	83	15	14.8	133	20	20.2	183	20	19.6	233	20	15.4
4	25	18.5	84	15	14.8	134	25	20.6	184	15	19.4	234	15	15.2
5	10	18.3	85	20	15.0	135	25	20.8	185	10	18.8	235	20	15.4
6	25	18.5	86	20	15.4	136	15	20.4	186	15	18.1	236	20	15.4
7	15	18.3	87	15	15.6	137	30	20.6	187	20	17.7	237	15	15.4
8	20	17.9	88	20	15.4	138	20	20.8	188	20	17.5	238	10	15.2
9	20	18.1	89	15	15.4	139	15	20.6	189	20	17.1	239	15	15.4
0	20	17.9	90	10	15.4	140	20	20.6	190	15	17.1	240	15	15.4
1	15	18.1	91	15	15.6	141	20	20.6	191	15	16.9			
2	25	18.5	92	20	15.6	142	20	20.6	192	15	16.5			
3	15	18.5	93	15	15.6	143	15	20.4	193	20	16.7			
4	20	18.8	94	20	15.8	144	25	20.4	194	25	17.1			
5	15	18.5	95	20	15.8	145	15	19.8	195	15	17.1			
6	10	18.3	96	30	16.5	146	20	19.6	196	15	16.9			
7	20	18.3	97	10	16.3	147	15	19.0	197	15	16.9			
8	20	18.5	98	25	16.9	148	25	19.4	198	20	16.9			
9	10	18.3	99	20	17.1	149	30	19.8	199	15	16.9			
0	25	18.8	100	15	17.3	150	15	19.8	200	20	17.1			

AXIMUM 6 MINUTE AVERAGE = 22.1 AT NO 169

FRANK BROS. MILTON PLANT TEST 2 7-29-87

6 MIN AVG OPACITY VS TIME



TIME - MINUTES

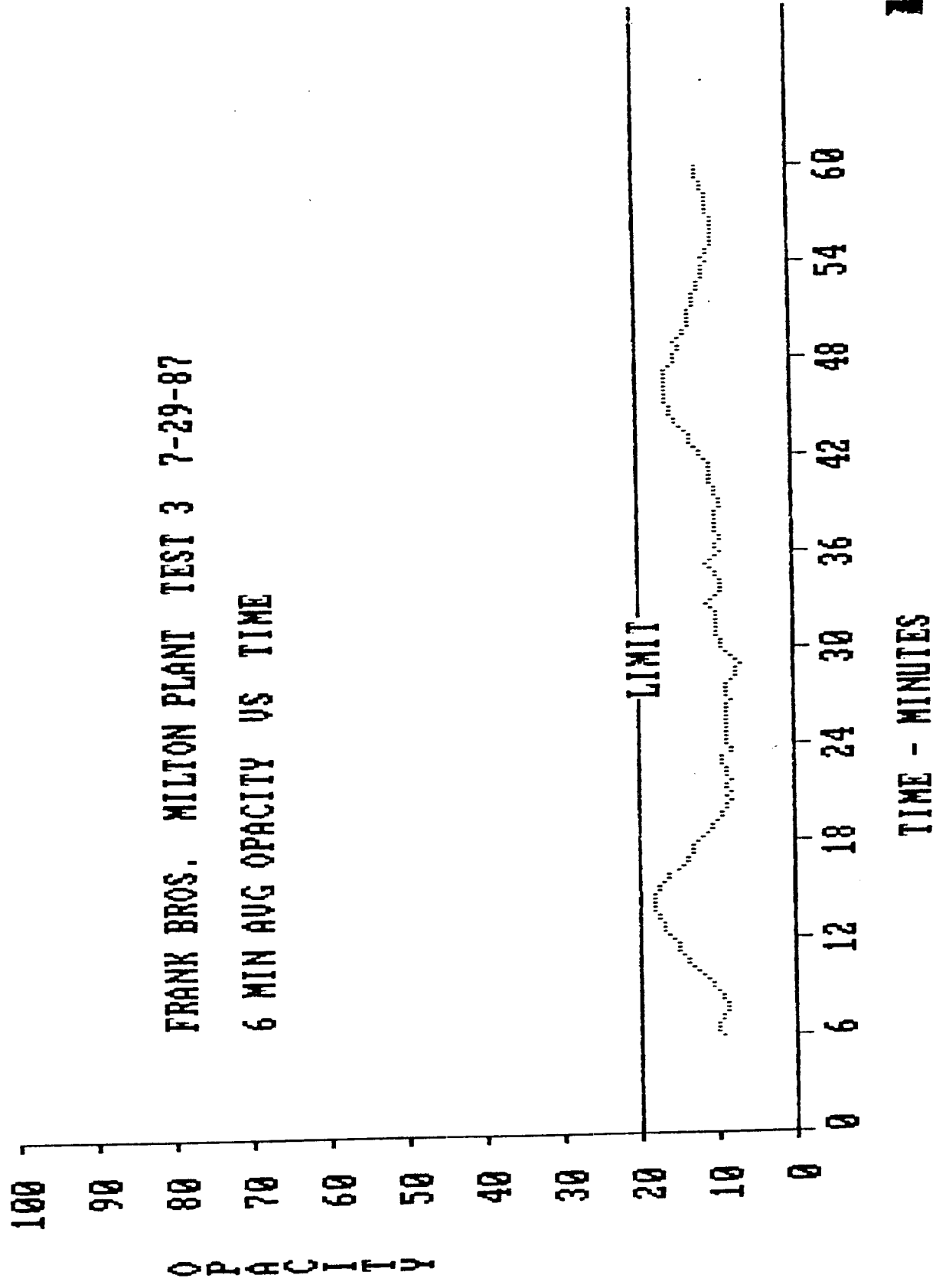
FRANK BROTHERS MILTON PLANT TEST 3 7-29-87 TABLE 2-6

IO.	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6	NO	OP	AV.6
1	5		51	10	16.7	101	5	8.8	151	5	10.0	201	10	12.9
2	10		52	15	16.9	102	5	8.8	152	10	10.0	202	15	12.9
3	10		53	15	17.3	103	10	8.8	153	5	10.0	203	10	12.9
4	15		54	15	17.5	104	5	8.8	154	10	10.0	204	10	12.9
5	10		55	15	17.9	105	5	8.8	155	5	9.4	205	10	12.7
6	20		56	15	18.1	106	5	8.5	156	10	9.6	206	10	12.5
7	10		57	15	18.1	107	5	8.1	157	5	9.6	207	10	12.5
8	5		58	15	18.3	108	20	8.5	158	5	9.8	208	10	12.5
9	10		59	10	17.9	109	15	8.5	159	10	10.0	209	5	12.1
0	10		60	15	17.5	110	10	8.5	160	10	10.2	210	10	11.9
1	5		61	10	17.3	111	10	8.8	161	15	10.6	211	15	11.9
2	10		62	10	16.7	112	5	8.1	162	15	10.4	212	5	11.5
3	10		63	15	16.5	113	5	7.7	163	20	10.6	213	10	11.3
4	10		64	10	16.0	114	5	7.5	164	15	10.4	214	10	11.3
5	5		65	5	15.2	115	10	7.3	165	15	10.4	215	5	11.0
6	5		66	10	14.6	116	5	7.1	166	20	10.6	216	10	10.8
7	15		67	10	14.0	117	10	7.3	167	25	11.3	217	15	11.0
8	10		68	10	13.5	118	25	8.3	168	15	11.7	218	10	10.8
9	15		69	5	12.9	119	20	9.0	169	20	11.9	219	10	10.4
0	10		70	20	13.1	120	20	9.4	170	20	12.3	220	15	10.2
1	10		71	5	12.9	121	10	9.4	171	20	12.9	221	5	9.8
2	5		72	5	12.7	122	10	9.6	172	15	13.1	222	10	9.8
3	10		73	5	11.9	123	10	9.8	173	20	13.3	223	10	9.8
4	5	9.6	74	10	11.3	124	15	10.2	174	25	14.0	224	10	10.0
5	10	9.8	75	0	10.8	125	5	10.2	175	15	14.4	225	10	10.0
6	10	9.8	76	5	10.4	126	5	10.2	176	20	14.8	226	10	9.8
7	10	9.8	77	5	10.0	127	5	10.0	177	15	15.2	227	20	10.2
8	10	9.6	78	5	9.6	128	10	10.2	178	15	15.4	228	15	10.4
9	5	9.4	79	10	9.4	129	5	10.2	179	10	15.6	229	10	10.4
0	10	9.0	80	5	9.0	130	10	10.4	180	10	15.6	230	10	10.4
1	5	8.8	81	5	8.5	131	20	11.0	181	15	16.0	231	15	10.6
2	10	9.0	82	10	8.3	132	5	10.4	182	15	16.5	232	10	10.6
3	15	9.2	83	15	8.5	133	5	10.0	183	10	16.5	233	10	10.8
4	10	9.2	84	10	8.3	134	0	9.6	184	10	16.5	234	15	11.0
5	20	9.8	85	15	8.5	135	5	9.4	185	15	16.5	235	15	11.0
6	25	10.4	86	10	8.5	136	5	9.4	186	15	16.5	236	15	11.5
7	15	10.6	87	5	8.1	137	5	9.4	187	15	16.3	237	15	11.7
8	25	11.3	88	20	8.5	138	20	10.0	188	15	16.3	238	10	11.7
9	20	11.9	89	15	9.0	139	15	10.2	189	15	16.3	239	15	12.1
0	20	12.5	90	10	9.0	140	20	10.8	190	10	15.8	240	10	12.1
1	25	12.9	91	15	9.2	141	15	11.0	191	10	15.2			
2	25	13.5	92	10	9.2	142	15	10.6	192	15	15.2			
3	25	14.0	93	5	9.2	143	10	10.2	193	10	14.8			
4	20	14.4	94	0	8.3	144	5	9.6	194	15	14.6			
5	20	14.8	95	5	8.3	145	15	9.8	195	20	14.6			
6	15	15.2	96	10	8.5	146	10	9.8	196	20	14.8			
7	10	15.2	97	10	8.8	147	5	9.6	197	15	14.6			
8	10	15.4	98	5	8.5	148	10	9.4	198	10	14.0			
9	25	16.0	99	5	8.8	149	15	9.8	199	10	13.8			
0	25	16.7	100	5	8.8	150	10	10.0	200	5	13.1			

AXIMUM 6 MINUTE AVERAGE = 18.3 AT NO 58

FRANK BROS. MILTON PLANT TEST 3 7-29-87

6 MIN AVG OPACITY VS TIME



The sampling train consisted of a stainless steel probe tip, a heated stainless steel lined probe, a heated glass cyclone and flask, and a heated filter holder with a tared filter. A series of four impingers followed in an ice bath. The first was a modified Greenburg-Smith impinger with 100 ml of distilled water; the second was a Greenburg-Smith impinger with 100 ml of distilled water; the third was a modified Greenburg-Smith impinger dry; the fourth was also a modified Greenburg-Smith impinger containing a tared quantity of Silica Gel. The gas then passed through a vacuum pump, calibrated dry gas meter, and a calibrated orifice. A schematic drawing of the sampling train is included.

The temperatures of the stack gas stream, as well as strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

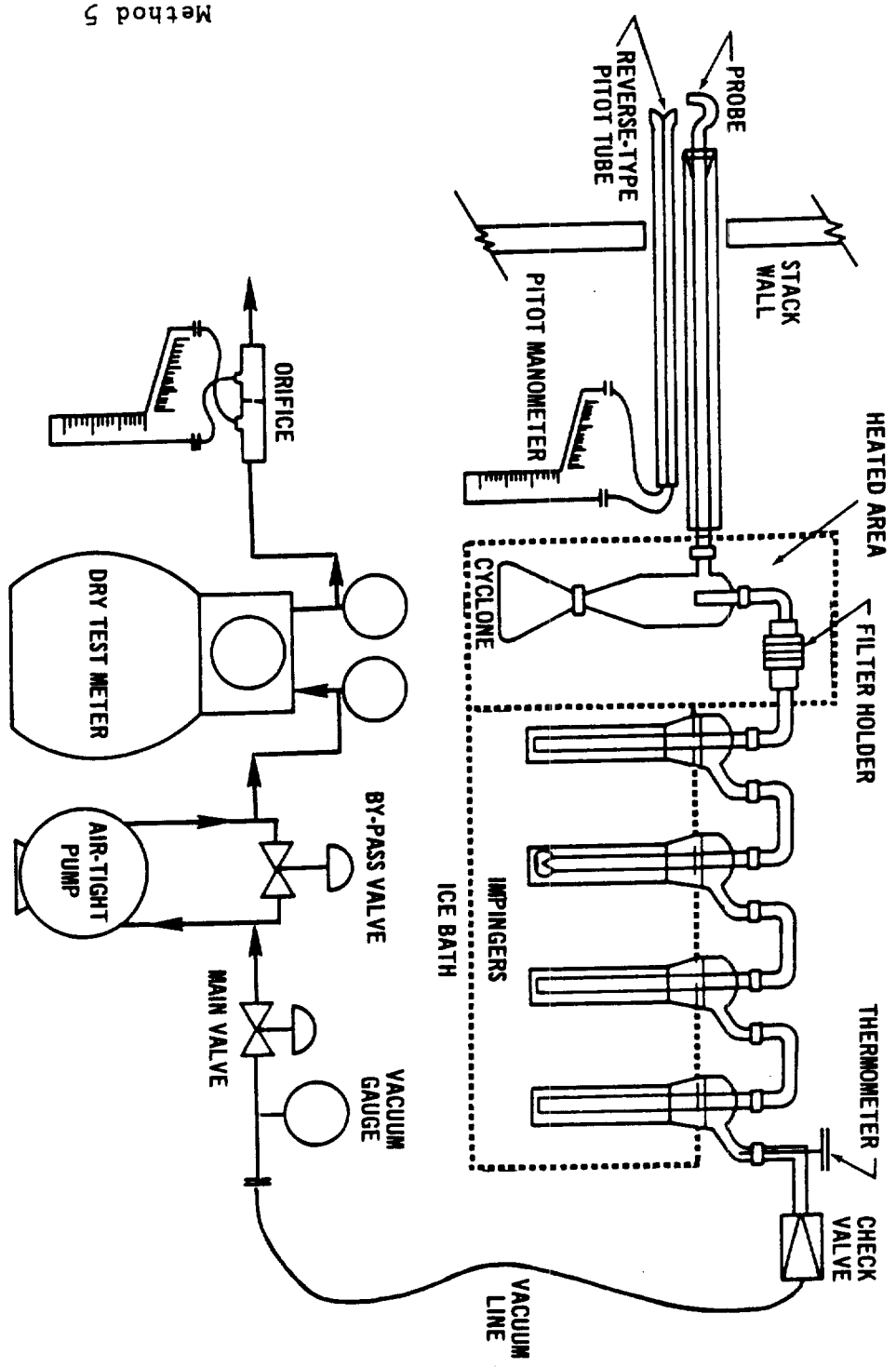
The initial gas stream velocity was obtained from a preliminary traverse using an "S" type pitot tube. The initial moisture was estimated from previous tests of similar processes. This data, along with the stack temperature, was used to set a nomograph so that rapid calculations of isokinetic sampling conditions could be made.

The principle of the method was to collect the sample representative of the exhaust by adjusting the sample collection velocity to match the exhaust gas stream velocity at the point of collection. The velocity at the point of collection was measured with an "S" type pitot tube attached to the probe and the collection velocity was matched to the stack gas velocity by adjusting the flow as indicated by the calibrated orifice.

To determine the molecular weight of the stack gas, samples were drawn into an Orsat analyzer and analyzed for percentage CO₂, CO, and N₂.

At the completion of the test, the impinger contents were measured and weighed for determination of the actual moisture content of the exhaust gas stream. The probe tip, probe, and glassware preceding the filter were washed with acetone and placed in a tared beaker and evaporated at room temperature. The filter and beaker were then desiccated to the tared humidity conditions and weighed. The combined weight of the filter catch and the washing residue was used for the determination of emission rates and emission concentrations.

A computer was used to calculate the stack velocities, emission concentrations, emission rates and volumetric flow rates using the field and laboratory data.



Method 5

Particulate sampling train.

5.0 CALIBRATIONS

The probe tip, pitot tube, dry gas meter, and orifice were calibrated prior to the test according to procedures outlined in the Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment as published by the EPA. The values obtained were:

Probe tip diameter $d = 0.242"$

Pitot tube coeff. $C_p = 0.85$

Orifice coeff. $C_{dA} = 1.912$

The dry gas meter presently installed in the control box is a temperature compensating meter. The correction factor for this dry gas meter is represented by:

$$\text{Gama} = 0.986 + (T_d - 70) \times .00012$$

where: T_d = Dry Gas Meter Temperature

The most recent calibration was performed July 24, 1987.

APPENDIX A
SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

Part I. Dry Molecular Weight (M_d) lb/lb-mole

To obtain the dry molecular weight, use the formula:

$$M_d = .44 (\%CO_2) + .32 (\%O_2) + .282 (\%N_2) + .28 (\%CO)$$

Part II. Wet Molecular Weight (M_s) lb/lb-mole

The wet molecular weight (M_s) is calculated from the dry molecular weight (M_d) and the percent water vapor content (B_{wo}) using the formula:

$$M_s = M_d (1 - B_{wo}) + 18 B_{wo}$$

Part III. Water Vapor Content (B_{wo})

The water vapor fraction is calculated directly from the volume of water captured in the condenser (impinger) portion of the sampling train as follows:

$$V_{wstd} = 0.04707 (V_f - V_i)$$

where:

V_{wstd} is volume of water vapor collected (standard conditions), cubic feet.

V_f is final volume of impinger contents, ml.

V_i is initial volume of impinger contents, ml.

$$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$$

where:

V_{mstd} is volume of gas through the dry gas meter (standard conditions), cubic feet.

Part IV. Absolute Stack Pressure (P_s) in. Hg

$$P_s = P_b + \frac{P_g}{13.6}$$

where:

P_b is barometric pressure, in. Hg

P_g is stack gauge pressure, in. of water

13.6 is specific gravity of mercury

Part V. Average Stack Gas Velocity (V_s) feet per second

The average stack gas velocity (V_s) is determined using the following formula:

$$V_s = K_p C_p \sqrt{\Delta P} \text{ avg} \sqrt{\frac{T_{s \text{ avg}}}{P_s M_s}}$$

where:

K_p 85.49, unit conversion factor

C_p 0.85, correction factor for "S" type pitot tube

$\sqrt{\Delta P} \text{ avg}$ Average of the square roots of the velocity head of the stack gas stream

$T_{s \text{ avg}}$ Average stack gas temperature in degrees Rankine

P_s Absolute Stack Pressure

M_s Wet molecular weight of stack gases

Part VI. Stack Gas Discharge Rate (Q_s) cubic feet per hour

The volumetric discharge rate is determined using the following equation:

$$Q_s = 3600 (1 - B_{wo}) (V_s) A \left[\frac{T_{std} P_s}{T_{s \text{ avg}} P_{std}} \right]$$

where:

A	Cross sectional area of stack, square feet
T_{std}	528° Rankine
P_{std}	29.92 inches of mercury
B_{wo}	Percent water vapor content, decimal form
V_s	Average stack gas velocity, ft/sec
$T_{s \text{ avg}}$	Average stack gas temperature, ° Rankine
P_s	Absolute stack pressure, in. of Hg.

Part VII. Dry Gas Volume ($V_{m \text{ std}}$) cubic feet

The dry gas volume measured through the dry gas meter is corrected to standard conditions using the formula:

$$V_{m \text{ std}} = (V_m - (AL - .02)\theta) \left[\frac{P_b + \frac{\Delta H}{13.6}}{P_{std}} \right] \gamma$$

where:

T_m	Average dry gas meter temperature, ° Rankine
ΔH	Average pressure drop across orifice meter, in. H_2O
13.6	Specific gravity of mercury
V_m	Volume of dry gas metered
AL	Post test leak rate, cubic feet per minute
θ	Total time of test, minutes
γ	Calibration factor for dry gas meter

Part VIII. Concentration of Particulate (C_s) grams per cubic foot

The concentration of particulate (C_s) in the stack gas stream is calculated as follows:

$$C_s = \frac{M_n}{V_{m \text{ std}}} \quad \text{or} \quad C'_s = \frac{M_n}{V_{m \text{ std}}} \times 15.43, \text{ grains/ft}^3$$

where:

M_n Total particulate captured, grams
 $V_{m \text{ std}}$ Dry gas volume at standard conditions
15.43 grains per gram

Part IX. Emission Rate (ER) pounds per hour

The emission rate (ER) is calculated from the particulate mass rate by area (PMRA) and the particulate mass rate by concentration (PMRC) as follows:

$$\text{PMRA} = \frac{M_n \cdot A \cdot 60}{\theta \cdot A_n \cdot 453.59} \quad \text{and} \quad \text{PMRC} = \frac{C_s \cdot Q_s}{453.59}$$

$$\text{ER} = \frac{\text{PMRA} + \text{PMRC}}{2}$$

where:

M_n Total particulate captured, grams
 A Stack area, square feet
60 minutes per hour
 θ Total sampling time, minutes
 A_n Area of sampling nozzle (probe tip), square feet
453.59 grams per pound
 C_s Concentration of particulate, grams per cubic foot
 Q_s Stack gas discharge rate, cubic feet per hour

Part X . Emission Concentration (EC) lb particulate per 1000 lb gas

To obtain the emission concentration (EC) use the following formula:

$$EC = \frac{ER \ 386,700 \ (1 - B_{wo})}{Q_s \ M_s}$$

where:

ER Emission Rate, lb per hour

386,700 Cubic feet per lb-mole x 1000

B_{wo} Water vapor content, volume fraction

Q_s Stack gas discharge rate, cubic feet per hour

M_s Wet molecular weight of stack gas, lb per lb-mole

Part XI . Emission Concentration Corrected to 12 % CO_2 (ECC) lb particulate per 1000 lb gas

$$ECC = \frac{EC \times 12}{\%CO_2}$$

where:

EC Emission concentration, lb part. per 1000 lb gas

$\%CO_2$ Percent carbon dioxide in gas stream, %

Part XII. Isokinetic Sampling Percentage (I) %

$$I = \frac{PMRA}{PMRC}$$

APPENDIX E

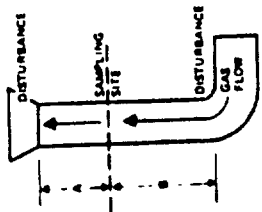
FIELD & LABORATORY DATA SHEETS

METER BOX NO. _____

HEATER BOX SETTING 70.5

ORSAT RESULTS

N2

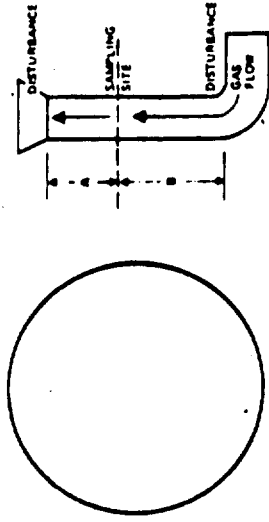


CROSS SECTION

CROSS SECTION		METER BOX NO.																
TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T ₁), °F	VELOCITY HEAD (V ₁), (ft/s) ²	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER (T _{m,i}), °F		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING OR CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY f/s						
C 1	1:20:50		135	1.25	3.50	777.00					12							
2	35-	-0.20	135	0.75	1.85	79.4												
3			135	0.35	0.90	81.3												
4	2		135	0.20	0.50	82.7												
5	2		135	0.10	0.25	83.7												
E 6	5:45+		135	1.50	3.50	84.5					13							
7	58	-0.30	135	0.80	1.90	86.8												
8	0:02		135	0.55	1.35	88.7												
9	0:05		135	0.20	0.50	90.3												
10	0:05+		135	0.10	0.25	91.3												
A 11	0:26+		135	1.25	3.00	92.1												
12	1:2	-0.25	135	1.00	2.35	94.4												
13	1:4		135	0.65	1.55	96.5												
14	1:7		135	0.40	0.95	98.2												
15	1:15		135	0.15	0.37	99.4												
D 16	2:13+		135	1.20	2.80	100.4												
17	2:4	-0.25	135	0.65	1.55	102.6												
18	2:45		135	0.25	0.60	104.4												
19	3:1		135	0.15	0.37	105.5												
20	3:2		135	0.10	0.25	106.4												
B 21	3:37		135	1.20	2.80	107.1												
22	3:45	-0.25	135	0.70	1.65	109.2												
23	4:2		135	0.35	0.85	111.1												
24	4:44		135	0.15	0.37	112.3												
25	4:5		135	0.15	0.37	113.2												
										</								

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

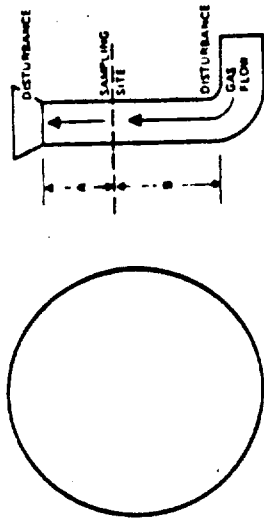
PLANT Frank 1300 AMBIENT TEMPERATURE 90 METER AM. _____
 DATE 7-29-87 BAROMETRIC PRESSURE _____ C FACTOR _____
 LOCATION Milton ASSUMED MOISTURE, % 5% PROCESS WEIGHT RATE _____
 OPERATOR WJD PROBE LENGTH, in. 50 ORSAT RESULTS _____
 STACK NO. 1 NOZZLE DIAMETER, in. 1/8 CO₂ _____
 RUN NO. 2 STACK DIAMETER, in. 30" x 40" O₂ _____
 SAMPLE BOX NO. 2 PROBE HEATER SETTING 250 CO _____
 METER BOX NO. 1 HEATER BOX SETTING 250 N₂ _____

fuel or air for burner
 from burner

TRAVERSE POINT NUMBER	SAMPLING TIME (a), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (V _p) (1/2 V _p)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m, in}), °F	OUTLET (T _{m, out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in Hg gauge	VELOCITY f/s
1	235		135	1.25	3.00	8015.00	118	118			5	
2		-0.25	135	0.70	1.70	17.9	118	118				
3			135	0.35	0.35	19.2	118	118				
4			135	0.20	0.30	20.6	118	118				
5			135	0.15	0.37	21.6	117	117				
6			135	1.30	3.10	22.5	118	118				
7			135	0.70	1.70	24.6	118	118				
8		-0.21	135	0.25	0.35	26.5	118	118				
9			135	0.20	0.30	27.8	118	118				
10			135	0.10	0.25	28.8	118	118				
11			135	1.30	3.10	29.5	118	118				
12		-0.25	135	0.65	1.60	31.9	119	119				
13			135	0.45	1.10	33.6	120	120				
14			135	0.20	0.50	35.1	120	120				
15			135	0.10	0.25	36.7	120	120				
16			135	1.45	3.60	36.7	120	120				
17		-0.21	135	1.00	2.45	39.1	120	120				
18			135	0.60	1.40	41.5	120	120				
19			135	0.30	0.75	43.2	121	121				
20			135	0.15	0.30	44.3	121	121				
21			135	1.45	3.60	45.1	122	122				
22		-0.25	135	0.95	2.30	47.5	122	122				
23			135	0.60	1.40	49.2	122	122				
24			135	0.30	0.75	51.2	123	123				
25			135	0.15	0.30	51.3	123	123				
26			135	0.15	0.30	51.3	123	123				

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT FRANK BRON AMBIENT TEMPERATURE 90 METER & H. _____
 DATE 7-29-87 BAROMETRIC PRESSURE SM C FACTOR _____
 LOCATION MILTON ASSUMED MOISTURE, % _____ PROCESS WEIGHT RATE _____
 OPERATOR WJID PROBE LENGTH, in. 52 ORSAT RESULTS _____
 STACK NO. 1 NOZZLE DIAMETER, in. 1/4 CO₂ 6.4
 RUN NO. 3 STACK DIAMETER, in. 34 1/2 x 40 CO 11.6
 SAMPLE BOX NO. 3 PROBE HEATER SETTING 230 N₂ 82.0
 METER BOX NO. 1 HEATER BOX SETTING 210 see below
P. PORTER

TRAVERSE POINT NUMBER	SAMPLING TIME (hr), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP _s) (in. H ₂ O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY f/s
C 1	155-50		130	125	3.00	325.00	106	106			4	
2		-0.25	130	0.70	1.70	58.3	106	106				
3			120	0.30	0.61	60.2	106	106				
4			135	6.20	0.50	61.4	106	106				
5			135	0.15	0.57	62.4	106	106				
6			135	1.40	3.40	63.3	108	108				
7		-0.3	13	1.00	2.40	65.2	108	108				
8			135	0.45	1.40	68.1	107	107				
9			135	0.25	0.85	67.6	107	107				
10			125	0.15	0.37	71.2	110	110				
11			141	1.50	3.60	72.1	111	111				
12		-0.25	135	1.50	2.40	74.7	112	112				
13			135	0.55	1.35	76.7	113	113				
14			135	0.35	0.85	78.3	114	114				
15			135	0.20	0.50	79.6	117	117				
16			135	1.25	3.00	82.7	118	118				
17		-0.25	135	0.80	1.95	83.0	119	119				
18			135	0.60	2.40	85.0	120	120				
19			135	0.20	0.50	86.2	121	121				
20			135	0.15	0.37	87.3	121	121				
21	156.1		135	1.50	3.60	90.6	120	120				
22	5.5	-0.3	135	0.70	1.70	92.4	120	120				
23	6		135	0.35	0.85	93.6	120	120				
24	50		135	0.20	0.50	94.6	120	120				

**LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED**

JOB NAME Frank B. Co.

DATE OF TEST 7-29-87

JOB NO. 87-813

TEST ENGINEER WJD

RUN NO. 1 STACK Acid Mine Run

Sample Box 1

Filter 963

Wash Bottle

Beaker No. 244

WATER COLLECTED

<u>Impinger No.</u>	<u>Final Wt. g</u>	<u>Initial Wt. g</u>	<u>Collected grams</u>
<u>1</u>	<u>220</u>	<u>100</u>	<u>120</u>
<u>2</u>	<u>177</u>	<u>100</u>	<u>77</u>
<u>3</u>	<u>4</u>	<u>0</u>	<u>4</u>
<u>Sil Gel</u>	<u>676</u>	<u>656</u>	<u>20</u>
TOTAL			<u><u>221</u></u>

PARTICULATE COLLECTED

	<u>Final Wt. g</u>	<u>Tare Wt. g</u>	<u>Collected grams</u>
Filter	<u>0.9044</u>	<u>0.8255</u>	<u>0.0789</u>
Washings	<u>97.7037</u>	<u>97.6870</u>	<u>0.0167</u>
TOTAL			<u><u>0.0956</u></u>

WATER COLLECTED 145 GRAMS

PARTICULATE COLLECTED 0.0956 GRAMS

NOTES: -100 H₂O in 100 ml
 Buret used 0.0001
 Filter used 0.0001

* For water in filter

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME FRANK BROS.

DATE OF TEST 7-29-87

JOB NO. 87-860

TEST ENGINEER WJP

RUN NO. 2 STACK ASPHALT PLANT

Sample Box 2 Filter 964

Wash Bottle _____

Beaker No. 9

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
<u>1</u>	<u>174</u>	<u>100</u>	<u>74</u>
<u>2</u>	<u>112</u>	<u>100</u>	<u>12</u>
<u>3</u>	<u>48</u>	<u>0</u>	<u>48</u>
<u>SIL Gel</u>	<u>671</u>	<u>656</u>	<u>15</u>
TOTAL			<u><u>149</u></u>

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	<u>0.9024</u>	<u>0.8329</u>	<u>0.0695</u>
Washings	<u>95.7771</u>	<u>95.7650</u>	<u>0.0121</u>
TOTAL			<u><u>0.0816</u></u>

WATER COLLECTED 149 GRAMS

PARTICULATE COLLECTED 0.0816 GRAMS

0.034

NOTES: -100 H₂O to CPC

Back H₂O = 0.0006
Filtrate Back = 0.0822

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Frank Bws.
JOB NO. 87-860

DATE OF TEST 7-29-87
TEST ENGINEER WJD

RUN NO. 3 STACK Asphalt Plant
Sample Box 3 Filter 965

Wash Bottle -
Beaker No. 20

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
<u>1</u>	<u>177</u>	<u>100</u>	<u>77</u>
<u>2</u>	<u>130</u>	<u>100</u>	<u>30</u>
<u>3</u>	<u>14</u>	<u>0</u>	<u>14</u>
<u>Silber</u>	<u>684</u>	<u>670</u>	<u>14</u>
TOTAL			<u><u>135</u></u>

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	<u>0.8916</u>	<u>0.8274</u>	<u>0.0642</u>
Washings	<u>94.1900</u>	<u>94.1779</u>	<u>0.0121</u>
TOTAL			<u><u>0.0763</u></u>

WATER COLLECTED 135 GRAMS

PARTICULATE COLLECTED 0.0763 GRAMS

NOTES: - 100 H₂O TO CISC

Pre-Halt - 0.7347
Front + Back - 0.3110