

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.

AP42 Section: 11.1

Reference Number: 378

**Title: Carbon Monoxide Stack Emission Test, Payne
And Dolan, Inc., Control 31 Plant, Racine, WI,**

**Environmental Technology and Engineering
Corporation, Elm Grove, WI,**

May 26, 1998.

Sec. 11.1
Ref. 37B

CO

Report to

PAYNE & DOLAN, INC.

Waukesha, Wisconsin

for

**CARBON MONOXIDE STACK EMISSION TEST
CONTROL 31 PLANT
WDNR FID 255013190**

May 26, 1998

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION

13000 West Bluemound Road

Elm Grove, Wisconsin 53122

Phone 414-784-2434

Fax 414-784-2436

ETE

SUMMARY

On May 26, 1998, Environmental Technology & Engineering Corp. personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 31 stationary asphalt plant located in Racine, Wisconsin. The tests were performed in order to establish carbon monoxide (CO) emission factors for specific types of asphalt plants. This plant is a batch plant fired with natural gas. The test results are summarized in the following table:

TEST NO.	CARBON MONOXIDE
1	0.12 lb/ton
2	0.11
3	0.11
AVERAGE	0.11 lb/ton

1.0 GENERAL

On May 26, 1998, Environmental Technology & Engineering Corp. (ETE) personnel performed stack emissions testing at the Payne & Dolan, Inc. Control 31 stationary asphalt plant located in Racine, Wisconsin. The purpose of the testing was to determine the carbon monoxide (CO) emissions from the plant as a part of a study to establish emission factors for various types of asphalt plants fired with different types of fuel.

Roger Mayer and Pete Tolsma of Payne & Dolan were responsible for assuring proper operating conditions throughout the testing. During the test the plant production rate was in the range of 170 to 180 tons per hour and included approximately 15 % recycled asphalt. The plant was fired with natural gas. A log of plant activity throughout the test was kept and is included in the APPENDIX. All testing was coordinated with Roger Mayer at the plant control room. Jim Meyers of the WDNR was notified of the tests and witnessed the field testing and plant operation. The field tests, corresponding laboratory analysis, and report preparation were performed by ETE personnel; Bill Dick was the test team leader.

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

2.0 RESULTS

Sampling for carbon monoxide (CO) was performed in accordance with the procedures outlined in EPA Method 10. Flow rate and velocity were determined using EPA Methods 1 through 4. A brief summary of the methods is included in Section 3.0 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 velocity test points relative to the stack wall. Detailed results of the testing to determine CO emissions are shown in Tables 2-1 through 2-3. All results were well below the permit limits. The results are summarized below:

TEST NO.	CARBON MONOXIDE
1	0.12 lb/ton
2	0.11
3	0.11
AVERAGE	0.11 lb/ton

PAYNE & DOLAN CONTROL 31
FIGURE 2-1

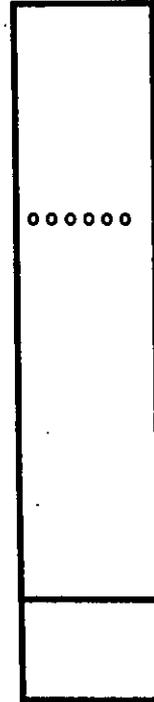
SAMPLE POINT LOCATION

Point	Distance in
1	5.125
2	15.375
3	25.625
4	35.875

TEST PORT LOCATION

L
W

58
41



CARBON MONOXIDE EMISSION TEST

METHOD 10

TABLE 2-1

**LOCATION
DESCRIPTION
DATE
TEST**

**PAYNE & DOLAN
CONTROL 31 PLANT
26-May-98
1**

**DIMENSIONS
STACK AREA
STACK TEMPERATURE
PITOT COEFFICIENT
PERCENT WATER**

**58
16.51
272
0.84
11.64**

**BAR PRESSURE IN HG
STATIC PRESSURE IN H2O
STACK PRESSURE IN HG
CARBON MONOXIDE PPM
PRODUCTION RATE TPH**

**29.32
-0.7
29.27
111
179**

ORSAT CONSTITUENTS

**O2 17.2
CO2 2.0
CO 0.0
N2 80.8**

**MOLECULAR WEIGHT DRY
MOLECULAR WEIGHT WET
NUMBER OF POINTS**

**29.01
27.73
24**

POINT

DELTA P

VELOCITY

1	0.67	55.83
2	0.80	61.00
3	0.85	62.88
4	0.60	52.83
5	0.92	65.42
6	0.95	66.48
7	0.60	52.83
8	0.52	49.18
9	1.40	80.70
10	1.00	68.20
11	0.60	52.83
12	0.50	48.23
13	1.60	86.27
14	1.10	71.53
15	0.90	64.70
16	0.80	61.00
17	2.00	96.45
18	1.50	83.53
19	1.20	74.71
20	1.10	71.53
21	2.20	101.18
22	1.70	88.93
23	1.30	77.76
24	1.30	77.76

AVERAGE VELOCITY, AFPS

69.66

FLOW RATE

**ACFM
DSCFM
M3/HR**

**69018
43031
73118**

CARBON MONOXIDE EMISSIONS

**LB/HR
LB/TON**

**20.76
0.12**

CARBON MONOXIDE EMISSION TEST

METHOD 10

TABLE 2-2

**LOCATION
DESCRIPTION
DATE
TEST**

**PAYNE & DOLAN
CONTROL 31 PLANT
26-May-98
2**

**DIMENSIONS
STACK AREA
STACK TEMPERATURE
PITOT COEFFICIENT
PERCENT WATER**

**58
16.51
270
0.84
11.50**

**BAR PRESSURE IN HG
STATIC PRESSURE IN H2O
STACK PRESSURE IN HG
CARBON MONOXIDE PPM
PRODUCTION RATE TPH**

**29.32
-0.7
29.27
102
179**

ORSAT CONSTITUENTS

**O2 17.2
CO2 2.0
CO 0.0
N2 80.8**

**MOLECULAR WEIGHT DRY
MOLECULAR WEIGHT WET
NUMBER OF POINTS**

**29.01
27.74
24**

POINT

DELTA P

VELOCITY

1	0.65	54.90
2	0.82	61.68
3	0.85	62.78
4	0.50	48.15
5	1.10	71.41
6	0.90	64.60
7	0.60	52.74
8	0.55	50.50
9	1.40	80.57
10	1.20	74.59
11	0.70	56.97
12	0.50	48.15
13	1.80	91.35
14	1.20	74.59
15	0.80	60.90
16	0.80	60.90
17	1.70	88.78
18	1.30	77.64
19	1.10	71.41
20	1.10	71.41
21	1.70	88.78
22	1.50	83.39
23	1.30	77.64
24	1.20	74.59

AVERAGE VELOCITY, AFPS

68.68

FLOW RATE

**ACFM 68053
DSCFM 42613
M3/HR 72408**

CARBON MONOXIDE EMISSIONS

**LB/HR 18.89
LB/TON 0.11**

CARBON MONOXIDE EMISSION TEST

METHOD 10

TABLE 2-3

**LOCATION
DESCRIPTION
DATE
TEST**

**PAYNE & DOLAN
CONTROL 31 PLANT
26-May-98
3**

DIMENSIONS		58	41
STACK AREA		16.51	
STACK TEMPERATURE		274	
PITOT COEFFICIENT		0.84	
PERCENT WATER		11.88	

BAR PRESSURE	IN HG	29.32
STATIC PRESSURE	IN H2O	-0.7
STACK PRESSURE	IN HG	29.27
CARBON MONOXIDE	PPM	102
PRODUCTION RATE	TPH	174
ORSAT CONSTITUENTS		
	O2	17.0
	CO2	2.0
	CO	0.0
	N2	81.0

MOLECULAR WEIGHT DRY	29.00
MOLECULAR WEIGHT WET	27.69
NUMBER OF POINTS	24

POINT	DELTA P	VELOCITY
1	0.90	64.83
2	0.72	57.99
3	0.60	52.93
4	0.56	51.14
5	1.00	68.34
6	0.98	67.65
7	0.72	57.99
8	0.60	52.93
9	1.30	77.92
10	1.10	71.67
11	1.00	68.34
12	0.70	57.17
13	1.50	83.70
14	1.10	71.67
15	1.00	68.34
16	0.70	57.17
17	1.60	86.44
18	1.40	80.86
19	1.20	74.86
20	1.00	68.34
21	2.00	96.64
22	1.60	86.44
23	1.60	86.44
24	1.20	74.86

AVERAGE VELOCITY, AFPS 70.19

FLOW RATE

ACFM	69550
DSCFM	43127
M3/HR	73282

CARBON MONOXIDE EMISSIONS	LB/HR	19.12
	LB/TON	0.11

3.0 METHODS

Sampling for carbon monoxide was performed in accordance with the procedures outlined in EPA Method 10 - "Determination of Carbon Monoxide Emissions from Stationary Sources" - as published in the Federal Register. Time integrated bag samples were extracted from the exhaust gas stream and analyzed for carbon monoxide concentration using a Horiba nondispersive infrared analyzer (NDIR). The analyzer was calibrated with span gas and zero gas prior to and following each hour of testing. The calibration gas was introduced into a Tedlar bag through the sampling apparatus, similar to the exhaust gas sampled. The calibration span gases for the analyzer were 601, 217, and 45 ppm CO in nitrogen.

Carbon monoxide calculations:

$$\text{CO (mg/m}^3\text{)} = \text{CO (ppm)} \cdot 28 \text{ (molecular weight)}/24.05 \text{ (liters/mole)}$$

$$\text{CO (lb/hr)} = \text{CO (mg/m}^3\text{)} \cdot \text{Flow Rate (m}^3\text{/hr)}/453600 \text{ (mg/lb)}$$

4.0 CALIBRATIONS

The pitot tubes, dry gas meters, and instruments were calibrated prior to the test according to standard procedures as to procedures published by the EPA. The values obtained were:

Pitot tube coeff.	0.84
Dry Gas Meter	1.065
Low Calibration Gas	45 ppm CO
Mid Calibration Gas	201 ppm CO
High Calibration Gas	601 ppm CO

APPENDIX A

Field and Laboratory Data

FIELD SAMPLING DATA

Facility RAINE #Dolan Contact ROGER / PETE TWAMA
 Address RAINE Test Date 5-26-98
 Witnesses JIM METERS DNY

Process Description BATCH PLANT CONTROL 31
~180 MPH ~15% CAP NATURE GAS

Stack Number _____ Analyte H₂O & CO Pump # _____

SAMPLING DATA

Sample ID	Time	Meter Rdg/ Rotameter	Flow Rate	GAZ(ml) Minutes	Volume	
H ₂ O - 1	0900	610.08	66	11.5		111
	1000	614.08	88			
		4.00	77			
H ₂ O - 2	1005	611.10	90	11.0		102
	1105	618.10	98			
		4.00	94			
H ₂ O - 3	1110	618.12	98	11.5		102
	1210	622.12	82			
		4.00	90			

V = 1.065

FLOW DATA

Diam = _____
 L x W = 58 x 41
 Cp = 0.84
 Est Moist 14.5%

Point	Run 1		Run 2		Run 3	
	Del P					
1	0.7	1.6	0.7	1.7	0.9	1.5
2	0.8	1.6	0.8	1.7	1.2	1.1
3	0.9	0.9	0.8	0.8	0.6	1.0
4	0.6	0.8	1.5	0.8	0.5	0.7
5	0.7	2.0	1.1	1.7	1.0	1.6
6	0.7	1.5	0.7	1.3	1.0	1.6
7	0.6	1.2	0.6	1.1	1.2	1.2
8	1.2	1.1	0.7	1.1	1.6	1.0
9	1.4	2.2	1.0	1.7	1.3	2.0
10	1.0	1.7	1.2	1.3	1.1	1.6
11	0.6	1.3	0.7	1.3	1.0	1.6
12	0.5	1.3	0.5	1.2	0.7	1.2

Ps	T	CO ₂	O ₂	N ₂
0.7	212	2.0	17.7	80.8
0.7	210	2.0	17.2	80.8
0.7	214	2.0	17.0	81.0

COMMENTS

Date 5/26/98
 FID # 255 013 190

ASPHALT PLANT STACK TEST DATA

Plant Location RACINE

Time*	Production TPH	Aggregate TPH	RAP TPH	Aggregate Moisture %	VOC Type	VOC Feed Rate	Mix Temp	Stack Temp	Photo-helic	Magne-helic	Fuel Flow Rate	CO ppm	CO2 ppm	O2 %
9:00	180	150	15	5				270	.25	49	428			
9:15	180	150	15	5				286	.20	42	428			
9:30	175	150	15	5				286	.23	49	428			
9:45	180	150	15	5				278	.23	49	428			
10:00	180	150	15 ^b	5				260	.23	42				
10:15	180	150	15	5				274	.22	49				
10:30	180	150	15	5				260	.20	38				
10:45	180	150	15	5				275	.21	40				
11:00	175	145	15	5				278	.20	43				
11:15	180	150	15	5				256	.24	40				
11:30	180	150	15	5				260	.20	40				
11:45	170	140	15	5				283	.22	40				
12:00	170	140	15	5				283	.20	39				
12:15	170	140	15	5				283	.20	39				

Fuel Type Natural Gas Sulfur in Fuel _____ %
 VOC Addition Location Batch Plant Plant Drum Type _____
 * Record time in 15-minute intervals during stack test runs.

PAYNE & DOLAN CONTROL 31
26-May-88
METHOD 4 RESULTS

Sample No.	Meter Vol. ft3	Meter Temp deg F	Standard Vol FT3	Water Captured ml	Water Volume ft3	Total Volume ft3	Percent Water % Vol
H2O-1	4.00	77	4.10	11.5	0.54	4.65	11.64
H2O-2	4.00	94	3.98	11	0.52	4.50	11.50
H2O-3	4.00	90	4.01	11.5	0.54	4.55	11.88
							11.67
Meter Gama	1.065						
Bar.Pressure	29.32						

Calculations Standard Volume = Meter Vol * Meter Gama*Bar.Pressure*528/(29.92*(460+Meter Temp))
 Water Volume = .047*Water Captured
 Total Volume= Water Volume + Standard Volume
 Percent Water = Water Volume/Total Volume