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.

AP42 Section: 11.1

Reference Number: 353

Title: Measurement Of NOx and VOC Emissions, General Crushed Stone, Inc., Glen Mills #2 Asphalt Plant Baghouse Exhaust, Easton, PA,

United Energy Services Corp., Reading, PA,

November 10, 1995.

Sect. 11.1
Ref. 353

GENERAL CRUSHED STONE, INCORPORATED

MEASUREMENT OF NO_X AND VOC EMISSIONS

GLEN MILLS #2 ASPHALT PLANT BAGHOUSE EXHAUST

November 10, 1995

UESC, REPORT 733-002-001

Prepared by

United Energy Services Corporation
Air Quality Testing Services
240 Corporate Drive
Reading, Pennsylvania 19605

United Energy Services Corporation

The Critical Link.

November 10, 1995

Mr. Vern Snyder
General Crushed Stone
P.O. Box 231
Easton, PA 18044

Re: Submittal of Report for Compliance NO_x and VOC Emissions Testing, Glen Mills Plant UESC Report 733-002-001

Dear Mr. Snyder:

We are pleased to submit three (3) copies of our Final Report 733-002-001, dated November 1995. This report contains results for compliance NO_x and VOC emission testing performed on the Number Two Asphalt Plant Baghouse Exhaust at your Glen Mills, PA facility.

The source sampling program defined by this report incorporates standard sampling procedures. The results of the sampling program are representative of flue gas emissions at the exhaust sampling location under normal operating conditions.

United Energy Services Corporation is pleased to have been of service to General Crushed Stone and trusts that this report will meet with your acceptance.

Very truly yours,

Stephen S. Schell
Senior Air Quality Specialist
Air Quality Testing Services

SSS/sss

240 Corporate Drive
Reading, PA 19605
Telephone: 610-916-4930 FAX: 610-916-4944
A Gilbert/Associates, Inc. Company

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SUMMARY OF TEST RESULTS

The compliance testing performed on October 19, 1995 consisted of conducting three NO_x and three VOC emissions tests, each one hour in duration. One Air Flow Traverse and one Moisture test were also performed during the day of testing. The NO_x and VOC emission rates (lbs/hr), as calculated from the emission concentration (ppm) and the volumetric flow rate (DSCFM), were used in determining NO_x and VOC lbs/ton of asphalt produced. Test run numbers one, two and four were used in calculating the NO_x and VOC emissions. Test run number three was discarded when the final calibration drift test for the VOC Analyzer was above acceptable limits.

The average NO_x emission rate for the three tests conducted is 0.062 lbs/ton of asphalt. At this rate, under identical operating conditions, the asphalt plants could produce approximately 830,000 tons of hot mix asphalt per year and remain under the limit of 25.0 tons of NO_x.

Concurrent with each VOC test run, tedlar bag samples were collected so that laboratory analysis could be performed in order to determine the Methane and Ethane portions of the exhaust gas. These portions of the sample are typically subtracted from the Total Hydrocarbon ppm value determined by the analyzer. In the case of General Crushed Stone, the Methane and Ethane portions were non-detectable and thus, no deductions were made from the Total Hydrocarbon figure. The average VOC emission rate for the three tests conducted is 0.02 lbs/ton of asphalt. With this factor of 0.02 lb VOC/ton of hot mix asphalt, the two plants producing 830,000 tons of hot mix asphalt/year would be well under the limit of 25.0 tons of VOC.

A summary of the test results has been included in this report as Tables 1 and 2.

TABLE 1

Results of NO_x Emissions Testing

on the Baghouse Exhaust

Date: 10/19/95

Run No.:	1	2	4
Time:	9:05 - 10:05	10:31 - 11:31	1320 - 14:20
Fuel:	No. 5 Oil	No. 5 Oil	No. 5 Oil
O_2 (%):	18.20	18.20	18.20
CO_2 (%):	1.90	1.90	1.90
Moisture (%):	6.5	6.5	6.5
Air Flow Volume (DSCFM):	37,830	37,830	37,830
NO_x ppm:	36.22	41.34	35.22
NO_x lbs/hr:	9.82	11.20	9.55
Asphalt Production (ton/hr):	157.7	163.53	171.42
NO_x lbs/ton of asphalt:	0.062	0.068	0.056

TABLE 2

Results of VOC Emissions Testing

on the Baghouse Exhaust

Date: 10/19/95

Run No.:	1	2	4
Time:	9:05 - 10:05	10:31 - 11:31	1320 - 14:20
Fuel:	No. 5 Oil	No. 5 Oil	No. 5 Oil
O_2 (%):	18.20	18.20	18.20
CO_2 (%):	1.90	1.90	1.90
Moisture (%):	6.5	6.5	6.5
Air Flow Volume (DSCFM):	37,830	37,830	37,830
Methane/Ethane Fraction:		Non - Detectable	
VOC ppm:	43.43	32.77	45.35
VOC lbs/hr:	4.11	3.10	4.29
Asphalt Production (ton/hr):	157.7	163.53	171.42
VOC lbs/ton of asphalt:	0.026	0.019	0.025

VOC #'s are incorrect were corrected in letter memo which is not included

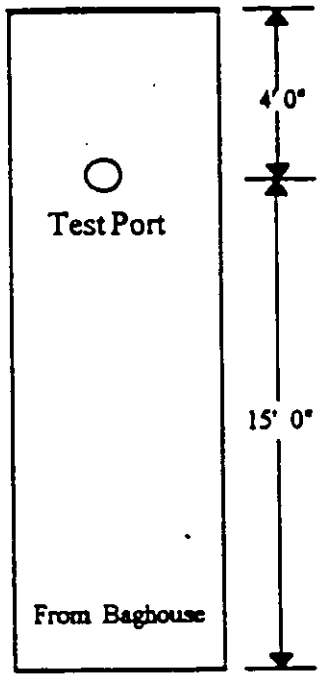
JBW

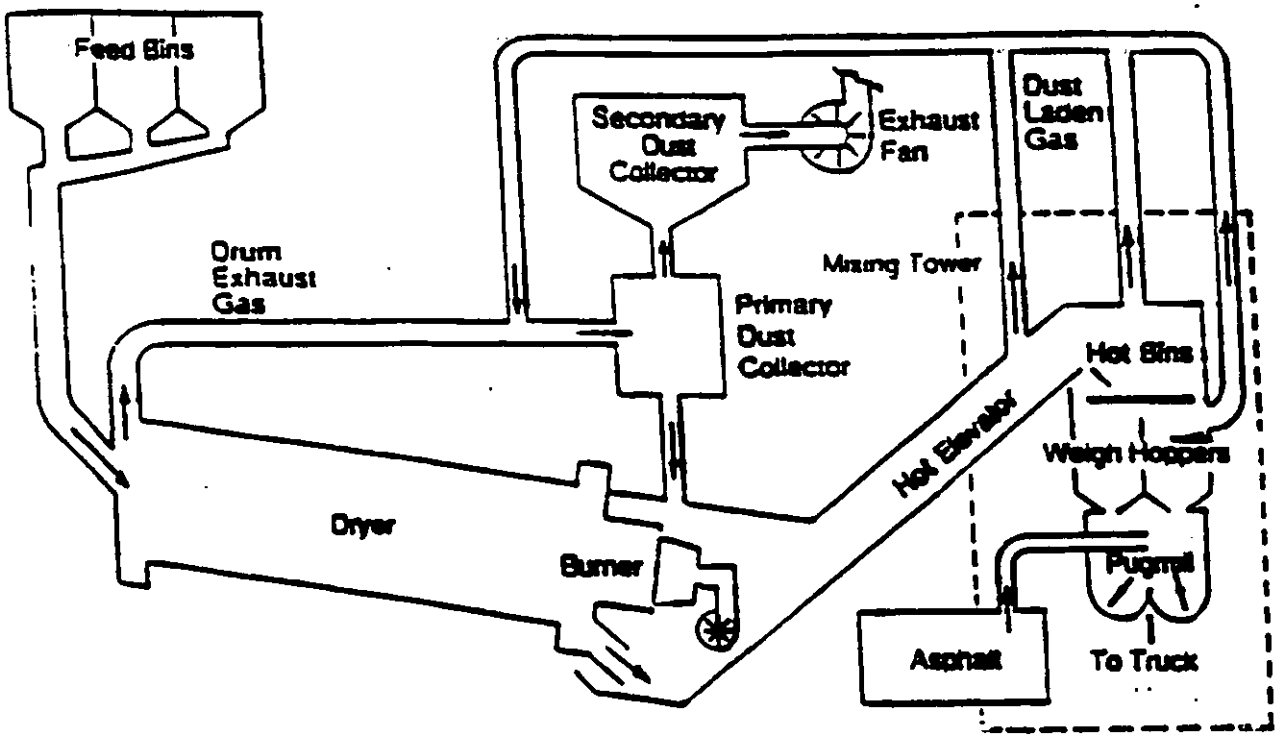
FIGURE 1

BAGHOUSE EXHAUST - GLEN MILLS ASPHALT PLANT

EXHAUST STACK
48 inch Diameter

Total of 16 Traverse Points





SECTION II - ANALYSIS

1. Testing and Analytical Procedures

To satisfy the objectives established for the testing program, EPA Method 7E was employed during the NO_x test runs and EPA Method 25A was used for the determination of Total Hydrocarbon emissions. Tedlar bag samples were collected simultaneously, in accordance with EPA Method 18, with each VOC test run in order to quantify the Methane and Ethane portions of the flue gas sample. The VOC emissions were calculated by converting the ppm measured as propane, to methane.

The air flow traverse and moisture test runs were conducted in accordance with EPA Methods 1-4.

The location and number of sampling ports and traverse points used for the flow traverse performed during the NO_x and VOC test runs are detailed in Figure 1.

2. Description of Process

UESC conducted the emissions tests on the baghouse exhaust stack of the No. 2 Asphalt Batch plant located in Glen Mills, PA. General Crushed Stone Co. operates a H&B Model No. T50 with a baghouse manufactured by Astec Industries Inc. Model No. SDF-46 at the No. 2 Asphalt Batch plant.

Aggregate is metered from the feed bins and conveyed into the dryer fired with waste oil. When hot aggregate leaves the dryer, it is taken to vibrating screens via a hot elevator and is classified into different sizes and dropped into hot bins. To control aggregate size distribution in the final batch mix, the operator opens various hot bins and allows a certain amount of aggregate into the weigh hopper. More aggregate is added until the desired mix and weight of materials are obtained. Material in the weigh hoppers is dropped into the pugmill and dry mixed. A weighed amount of liquid asphalt is put into the pugmill and mixed with the aggregate to achieve the desired aggregate to liquid asphalt ratio in the final mix

3. Operating Conditions

In the execution of this program, an attempt was made to operate the plant at maximum normal capacity while burning Number 5 (waste) Oil. Operating conditions were monitored throughout the duration of the sampling program by General Crushed Stone personnel. The control room of the asphalt plant is not capable of storing or printing asphalt feed rates or baghouse pressure drops, and for this reason, there is no operating data included in this report. However, the baghouse pressure drop was monitored by General Crushed Stone personnel and remained constant at 5 inches throughout the day of testing. Asphalt production rates were calculated by summing the total quantity of asphalt loaded in trucks for each hour in which testing was conducted. This figure was given to UESC and appears in the Test Results Appendix of this report.

APPENDIX I

PROJECT PARTICIPANTS

APPENDIX I

PROJECT PARTICIPANTS

The following personnel participated in the planning and execution of this project and the preparation of this report.

UESC Crew

Steve Folk	Manager
Stephen Schell	Senior Air Quality Specialist
Bruce Finnie	Air Quality Technician

APPENDIX II

TEST RESULTS

MOISTURE DETERMINATION

DATE 10/19/95
CLIENT Gen. Crushed Stone
PLANT Glen Mills

RUN # 1
LOCATION: Baghouse Exhaust

POINT	ACTUAL TIME	RUN TIME	GAS VOL CUBIC FT	ORIFICE IN. H20	METER TEMP. INLET	METER TEMP. OUTLET	BAR. PRESS. IN. Hg	METER Y FACT.
	08:11	0	659.810	1.60	67	46	30.02	0.99
		5	663.5	1.60	76	47		
		10	667.3	1.60	77	49		
		15	670.9	1.60	79	50		
		20	674.7	1.60	79	51		
		25	678.2	1.60	80	52		
	8:41	30	681.943					
			22.133	1.60		62.75		

CONTROL BOX NUMBER 40939

VOLUME OF MOISTURE (ml)		SILICA GEL WT. (g)		TOT. MOISTURE (ml)	33
IMPINGE	177	FINAL	244		
	152	INITIAL	240	VM(STD)=	22.284
	0	NET	4	VW(GAS)=	1.554
FINAL	329				
INITIAL	300				
NET	29			%MOISTURE =	6.5

AIR QUALITY TESTING SERVICES
GAS FLOW ANALYSIS

CLIENT: Gen. Crushed Stone PLANT: Glen Mills

UNIT TESTED: Baghouse Exhaust TEST: Gas FLow

TEST LOCATION: Stack Ports

RUN NO: 1 DATE: 10/19/95 START TIME: 07:45
END TIME: 07:55

PB=	30.02 IN. Hg		AS=	48.00	IN.
Cp=	0.84		AS=	12.6	SQ. FT
O2=	18.20 %		PST=	-1.05	IN. H2O
CO2=	1.90 %		%M=	6.50	%

SAMPLE POINT	STACK TEMP.	VELOCITY HEAD	VELOCITY SQRT	STATIC INPUTS	
A-1	200	0.87	0.933		-1.10
2	203	1.10	1.049		-1.00
3	203	1.20	1.095	AVG	-1.05
4	204	1.20	1.095		
5	205	1.10	1.049		
6	205	1.20	1.095		
7	206	1.20	1.095		
8	205	1.20	1.095		
B-1	203	0.82	0.906		
2	206	1.10	1.049		
3	207	1.10	1.049		
4	208	1.10	1.049		
5	208	1.10	1.049		
6	209	1.20	1.095		
7	208	1.20	1.095		
8	207	1.30	1.140		

RESULTS

TS	PIT	SQRT(PIT)
205	1.124	1.059

VS= 67.36 MD= 29.03 MS= 28.31

AS= 12.6 SQFT PS= 29.94

STACK GAS VOLUME= 50,924 ACFM

STACK GAS VOLUME= 37,830 DSCFM

UESC AIR QUALITY TESTING SERVICES
INSTRUMENTAL ANALYZER DATA ACQUISITION

CLIENT: Gen. Crushed Stone
PLANT: Glen Mills
LOCATION: Baghouse Exhaust

DATE: 10/19/95
TEST RUN: 1
TEST START: 09:05
TEST END: 10:05

Log Interval(min): 1 Channels: 2

DATE	TIME	NOx	VOC
19-Oct-95	9:05:45	38.41	49.64
19-Oct-95	9:06:45	38.79	48.10
19-Oct-95	9:07:45	39.44	47.41
19-Oct-95	9:08:45	38.18	53.98
19-Oct-95	9:09:45	38.07	50.15
19-Oct-95	9:10:45	39.12	47.85
19-Oct-95	9:11:45	38.94	55.39
19-Oct-95	9:12:45	39.17	44.46
19-Oct-95	9:13:45	37.16	45.91
19-Oct-95	9:14:45	35.02	50.97
19-Oct-95	9:15:45	36.55	50.08
19-Oct-95	9:16:45	35.89	43.03
19-Oct-95	9:17:45	35.85	44.01
19-Oct-95	9:18:45	36.79	41.74
19-Oct-95	9:19:45	37.88	42.36
19-Oct-95	9:20:45	38.09	40.37
19-Oct-95	9:21:45	37.20	40.48
19-Oct-95	9:22:45	35.79	41.32
19-Oct-95	9:23:45	33.56	45.69
19-Oct-95	9:24:45	32.92	50.53
19-Oct-95	9:25:45	33.00	51.53
19-Oct-95	9:26:45	32.67	51.23
19-Oct-95	9:27:45	35.38	48.13
19-Oct-95	9:28:45	35.96	45.80
19-Oct-95	9:29:45	35.63	50.13
19-Oct-95	9:30:45	34.64	48.07
19-Oct-95	9:31:45	34.69	50.89
19-Oct-95	9:32:45	34.21	53.61
19-Oct-95	9:33:45	34.59	55.62
19-Oct-95	9:34:45	33.63	54.66
19-Oct-95	9:35:45	33.54	58.13
19-Oct-95	9:36:45	33.54	60.04
19-Oct-95	9:37:45	35.23	56.95
19-Oct-95	9:38:45	40.64	45.43
19-Oct-95	9:39:45	41.06	38.47
19-Oct-95	9:40:45	39.50	39.31
19-Oct-95	9:41:45	38.31	38.01
19-Oct-95	9:42:45	36.57	40.26
19-Oct-95	9:43:45	37.65	38.97
19-Oct-95	9:44:45	39.34	36.69
19-Oct-95	9:45:45	39.66	34.99
19-Oct-95	9:46:45	39.48	35.40
19-Oct-95	9:47:45	39.37	35.44
19-Oct-95	9:48:45	40.01	35.14
19-Oct-95	9:49:45	39.60	35.68
19-Oct-95	9:50:45	38.71	36.60
19-Oct-95	9:51:45	38.17	38.76
19-Oct-95	9:52:45	38.86	39.28
19-Oct-95	9:53:45	41.83	36.89
19-Oct-95	9:54:45	42.68	33.87
19-Oct-95	9:55:45	42.30	36.67
19-Oct-95	9:56:45	42.38	36.52
19-Oct-95	9:57:45	44.01	33.26
19-Oct-95	9:58:45	45.24	33.17
19-Oct-95	9:59:45	44.16	33.39
19-Oct-95	10:00:45	43.14	34.07
19-Oct-95	10:01:45	42.69	34.74
19-Oct-95	10:02:45	40.12	37.03
19-Oct-95	10:03:45	38.82	39.17
19-Oct-95	10:04:45	38.09	39.08
19-Oct-95	10:05:45	37.93	34.69
		NOx	VOC
		38.03	43.43
		ppm	ppm

UESC AIR QUALITY TESTING SERVICES
ANALYZER CALIBRATION DATA
CLIENT: Gen. Crushed Stone
LOCATION: Baghouse Exhaust

DATE: 10/19/95
TEST RUN: 1
TEST START: 09:05
TEST END: 10:05

GAS UNITS	ANALYZER SCALE	CYLINDER VALUE	ANALYZER VALUE	DIFF PPM	% SPAN
NOx		0.00	1.60	1.6	1.60
NOx	100	47.90	47.70	0.2	0.20
NOx		82.90	84.00	1.1	1.10

SYSTEM CALIBRATION BIAS AND DRIFT DATA

GAS UNITS	ANALYZER SCALE	ANALYZER VALUE	PRE-TEST CHECK	% SPAN	POST-TEST CHECK	% SPAN	% DRIFT
NOx		1.60	1.80	0.2	2.80	1.2	1.0
NOx	100	47.70	48.60	0.9	50.50	2.8	1.9

UNCORRECTED ANALYZER VALUES

NOx,ppm=	38.03	
VOC, ppm=	43.43	
Velocity Traverse:	37,830	DSCFM
Production Rate =	157.7	Tons Asphalt

ANALYZER VALUES CORRECTED FOR DRIFT

NOx,ppm=	36.22
NOx, lbs/hr =	9.82
NOx, lbs/ton =	0.062
VOC, lbs/hr =	4.11
VOC, lbs/ton =	0.026

METHOD 25A - Flame Ionization Analyzer

Test Run:	1	Scale:	100	Start:	9:05
Date:	10/19/95			Stop:	10:05

Pre-test calibration							Post-test calibration	
Calib. gas	Tag value	Adjusted response	Predicted response	Actual response	Calibration error (5%)		Final response	Calibration drift (3%)
zero	0	0.39					1.3	0.9
low	30.9		31.3	31.3	0.0			
mid	50.5		50.9	51	0.2		50.0	-1.0
high	86.5	86.9						

Instructions:

1. Introduce zero and high level calibration gases at probe and adjust analyzer.
2. Introduce low and mid level calibration gases at probe and compare to predicted linear response. Must be less than 5 % different than predicted response.
3. Perform drift test at end of test or hourly during test longer than one hour. Introduce zero and mid level gases at probe and compare to pre-test values. Drift must be less than 3 % (of span) different than pre-test values.

UESC AIR QUALITY TESTING SERVICES
INSTRUMENTAL ANALYZER DATA ACQUISITION

CLIENT: Gen. Crushed Stone
PLANT: Glen Mills
LOCATION: Baghouse Exhaust

DATE: 10/19/95
TEST RUN: 2
TEST START: 10:31
TEST END: 11:31

Log Interval(min): 1 Channels: 2

DATE	TIME	NOx	VOC
19-Oct-95	10:31:50	45.59	29.32
19-Oct-95	10:32:50	46.01	29.69
19-Oct-95	10:33:50	44.27	30.44
19-Oct-95	10:34:50	43.10	30.49
19-Oct-95	10:35:50	43.39	29.50
19-Oct-95	10:36:50	44.70	28.97
19-Oct-95	10:37:50	46.15	26.45
19-Oct-95	10:38:50	45.18	26.37
19-Oct-95	10:39:50	43.69	29.55
19-Oct-95	10:40:50	43.42	31.00
19-Oct-95	10:41:50	43.67	32.14
19-Oct-95	10:42:50	44.18	32.56
19-Oct-95	10:43:50	46.11	31.16
19-Oct-95	10:44:50	46.83	30.05
19-Oct-95	10:45:50	45.46	30.57
19-Oct-95	10:46:50	45.04	31.93
19-Oct-95	10:47:50	46.34	32.01
19-Oct-95	10:48:50	45.89	32.15
19-Oct-95	10:49:50	45.08	32.08
19-Oct-95	10:50:50	42.65	33.96
19-Oct-95	10:51:50	43.60	32.42
19-Oct-95	10:52:50	41.83	32.11
19-Oct-95	10:53:50	42.05	30.63
19-Oct-95	10:54:50	42.22	28.34
19-Oct-95	10:55:50	41.12	29.16
19-Oct-95	10:56:50	41.71	29.80
19-Oct-95	10:57:50	42.35	30.61
19-Oct-95	10:58:50	42.57	30.49
19-Oct-95	10:59:50	43.71	30.08
19-Oct-95	11:00:50	45.24	28.76
19-Oct-95	11:01:50	45.61	29.61
19-Oct-95	11:02:50	45.91	26.21
19-Oct-95	11:03:50	45.78	26.21
19-Oct-95	11:04:50	44.85	27.97
19-Oct-95	11:05:50	44.00	33.26
19-Oct-95	11:06:50	44.87	33.72
19-Oct-95	11:07:50	48.25	30.17
19-Oct-95	11:08:50	47.17	30.42
19-Oct-95	11:09:50	46.56	31.75
19-Oct-95	11:10:50	44.98	33.18
19-Oct-95	11:11:50	42.92	37.50
19-Oct-95	11:12:50	45.59	35.51
19-Oct-95	11:13:50	48.51	27.50
19-Oct-95	11:14:50	48.81	27.85
19-Oct-95	11:15:50	47.09	28.23
19-Oct-95	11:16:50	45.72	28.03
19-Oct-95	11:17:50	45.36	28.58
19-Oct-95	11:18:50	45.44	28.54
19-Oct-95	11:19:50	45.22	28.35
19-Oct-95	11:20:50	36.78	41.47
19-Oct-95	11:21:50	35.89	45.60
19-Oct-95	11:22:50	32.42	44.84
19-Oct-95	11:23:50	31.90	49.77
19-Oct-95	11:24:50	33.07	52.67
19-Oct-95	11:25:50	41.06	46.57
19-Oct-95	11:26:50	48.52	32.98
19-Oct-95	11:27:50	46.99	31.34
19-Oct-95	11:28:50	38.43	41.48
19-Oct-95	11:29:50	34.10	53.14
19-Oct-95	11:30:50	44.44	44.24
19-Oct-95	11:31:50	47.60	29.65
		NOx	VOC
		43.72	32.77
		ppm	ppm

UESC AIR QUALITY TESTING SERVICES
ANALYZER CALIBRATION DATA
CLIENT: Gen. Crushed Stone
LOCATION: Baghouse Exhaust

DATE: 10/19/95
TEST RUN: 2
TEST START: 10:31
TEST END: 11:31

GAS UNITS	ANALYZER SCALE	CYLINDER VALUE	ANALYZER VALUE	DIFF PPM	% SPAN
NOx		0.00	1.60	1.6	1.60
NOx	100	47.90	47.70	0.2	0.20
NOx		82.90	84.00	1.1	1.10

SYSTEM CALIBRATION BIAS AND DRIFT DATA

GAS UNITS	ANALYZER SCALE	ANALYZER VALUE	PRE-TEST CHECK	% SPAN	POST-TEST CHECK	% SPAN	% DRIFT
NOx		1.60	2.80	1.2	2.30	0.7	-0.5
NOx	100	47.70	50.50	2.8	50.00	2.3	-0.5

UNCORRECTED ANALYZER VALUES

NOx,ppm=	43.72	
VOC, ppm=	32.77	
Velocity Traverse:	37,830	DSCFM
Production Rate =	163.53	Tons Asphalt

ANALYZER VALUES CORRECTED FOR DRIFT

NOx,ppm=	41.34
NOx, lbs/hr =	11.20
NOx, lbs/ton =	0.068
VOC, lbs/hr =	3.10
VOC, lbs/ton =	0.019

METHOD 25A - Flame Ionization Analyzer

Test Run:	2	Scale:	100	Start:	10:31
Date:	10/19/95			Stop:	11:31

Pre-test calibration							Post-test calibration	
Calib. gas	Tag value	Adjusted response	Predicted response	Actual response	Calibration error (5%)		Final response	Calibration drift (3%)
zero	0	1.3					-0.6	-1.9
low	30.9		31.3	30.9	-1.2			
mid	50.5		50.3	50.0	-0.6		49.8	-0.2
high	86.5	85.2						

Instructions:

1. Introduce zero and high level calibration gases at probe and adjust analyzer.
2. Introduce low and mid level calibration gases at probe and compare to predicted linear response. Must be less than 5 % different than predicted response.
3. Perform drift test at end of test or hourly during test longer than one hour. Introduce zero and mid level gases at probe and compare to pre-test values. Drift must be less than 3 % (of span) different than pre-test values.

UESC AIR QUALITY TESTING SERVICES
INSTRUMENTAL ANALYZER DATA ACQUISITION

CLIENT: Gen. Crushed Stone
PLANT: Glen Mills
LOCATION: Baghouse Exhaust

DATE: 10/19/95
TEST RUN: 4
TEST START: 13:20
TEST END: 14:20

Log Interval(min): 1 Channels: 2

DATE	TIME	NOx	VOC
19-Oct-95	13:20:08	30.79	51.58
19-Oct-95	13:21:08	28.98	58.87
19-Oct-95	13:22:08	28.97	61.41
19-Oct-95	13:23:08	28.65	62.82
19-Oct-95	13:24:08	27.79	64.50
19-Oct-95	13:25:08	27.72	66.22
19-Oct-95	13:26:08	26.89	70.95
19-Oct-95	13:27:08	30.74	65.92
19-Oct-95	13:28:08	35.13	57.70
19-Oct-95	13:29:08	41.05	44.39
19-Oct-95	13:30:08	42.44	38.17
19-Oct-95	13:31:08	43.16	37.94
19-Oct-95	13:32:08	41.86	38.19
19-Oct-95	13:33:08	41.52	38.54
19-Oct-95	13:34:08	42.04	38.87
19-Oct-95	13:35:08	42.41	36.26
19-Oct-95	13:36:08	40.38	34.98
19-Oct-95	13:37:08	40.21	35.25
19-Oct-95	13:38:08	36.71	38.58
19-Oct-95	13:39:08	35.66	38.78
19-Oct-95	13:40:08	35.45	40.38
19-Oct-95	13:41:08	35.15	40.48
19-Oct-95	13:42:08	33.57	42.46
19-Oct-95	13:43:08	34.84	41.18
19-Oct-95	13:44:08	34.92	39.85
19-Oct-95	13:45:08	35.84	38.43
19-Oct-95	13:46:08	35.51	39.25
19-Oct-95	13:47:08	34.09	39.55
19-Oct-95	13:48:08	33.27	46.20
19-Oct-95	13:49:08	35.35	44.17
19-Oct-95	13:50:08	34.14	46.08
19-Oct-95	13:51:08	34.85	46.58
19-Oct-95	13:52:08	34.97	46.26
19-Oct-95	13:53:08	36.10	46.22
19-Oct-95	13:54:08	36.57	45.37
19-Oct-95	13:55:08	36.94	43.52
19-Oct-95	13:56:08	35.63	47.10
19-Oct-95	13:57:08	38.34	45.91
19-Oct-95	13:58:08	40.49	40.90
19-Oct-95	13:59:08	41.11	37.29
19-Oct-95	14:00:08	41.36	34.69
19-Oct-95	14:01:08	42.30	32.69
19-Oct-95	14:02:08	39.18	35.13
19-Oct-95	14:03:08	36.07	42.22
19-Oct-95	14:04:08	34.73	44.80
19-Oct-95	14:05:08	34.91	44.87
19-Oct-95	14:06:08	34.97	44.39
19-Oct-95	14:07:08	34.70	45.39
19-Oct-95	14:08:08	35.08	45.49
19-Oct-95	14:09:08	34.74	45.70
19-Oct-95	14:10:08	34.63	47.46
19-Oct-95	14:11:08	35.18	47.16
19-Oct-95	14:12:08	34.94	48.95
19-Oct-95	14:13:08	34.81	50.20
19-Oct-95	14:14:08	34.89	50.34
19-Oct-95	14:15:08	34.72	50.44
19-Oct-95	14:16:08	35.98	46.95
19-Oct-95	14:17:08	38.01	46.02
19-Oct-95	14:18:08	40.10	43.03
19-Oct-95	14:19:08	40.24	41.71
19-Oct-95	14:20:08	39.60	41.56
		NOx	VOC
		36.09	45.35
		ppm	ppm

UESC AIR QUALITY TESTING SERVICES
ANALYZER CALIBRATION DATA
CLIENT: Gen. Crushed Stone
LOCATION: Baghouse Exhaust

DATE: 10/19/95
TEST RUN: 4
TEST START: 13:20
TEST END: 14:20

GAS UNITS	ANALYZER SCALE	CYLINDER VALUE	ANALYZER VALUE	DIFF PPM	% SPAN
NOx		0.00	1.60	1.6	1.60
NOx	100	47.90	47.70	0.2	0.20
NOx		82.90	84.00	1.1	1.10

SYSTEM CALIBRATION BIAS AND DRIFT DATA

GAS UNITS	ANALYZER SCALE	ANALYZER VALUE	PRE-TEST CHECK	% SPAN	POST-TEST CHECK	% SPAN	% DRIFT
NOx		1.60	2.20	0.6	3.80	2.2	1.6
NOx	100	47.70	48.50	0.8	47.50	-0.2	-1.0

UNCORRECTED ANALYZER VALUES

NOx,ppm=	36.09	
VOC, ppm=	45.35	
Velocity Traverse:	37,830	DSCFM
Production Rate =	171.42	Tons Asphalt

ANALYZER VALUES CORRECTED FOR DRIFT

NOx,ppm=	35.22
NOx, lbs/hr =	9.55
NOx, lbs/ton =	0.056
VOC, lbs/hr =	4.29
VOC, lbs/ton =	0.025

METHOD 25A - Flame Ionization Analyzer

Test Run:	4	Scale:	100	Start:	13:20
Date:	10/19/95			Stop:	14:20

Pre-test calibration							Post-test calibration	
Calib. gas	Tag value	Adjusted response	Predicted response	Actual response	Calibration error (5%)		Final response	Calibration drift (3%)
zero	0	0.25					0.35	0.1
low	30.9		31.2	31.5	1.0			
mid	50.5		50.8	51.5	1.3		49.7	-1.8
high	86.5	86.9						

Instructions:

1. Introduce zero and high level calibration gases at probe and adjust analyzer.
2. Introduce low and mid level calibration gases at probe and compare to predicted linear response. Must be less than 5 % different than predicted response.
3. Perform drift test at end of test or hourly during test longer than one hour. Introduce zero and mid level gases at probe and compare to pre-test values. Drift must be less than 3 % (of span) different than pre-test values.

APPENDIX III

ANALYTICAL RESULTS

Lancaster Laboratories
Where quality is a science.

LLI Sample No. AQ 2402798
Collected:

Submitted: 10/20/95 Reported: 10/25/95
Discard: 10/25/95

Run GCS-1 Tedlar Bag Sample

Account No: 07345
United Energy Services
240 Corporate Drive
Reading PA 19605

P.O. 240569
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED RESULTS	LIMIT OF QUANTITATION	UNITS
7056	Methane	< 3.	3.	ppm (v)
9501	Ethane as Propane	< 10.	10.	ppm(v)

1 COPY TO United Energy Services ATTN: Mr. Steven Folk

Questions? Contact your Client Services Representative
Wendy K. Park at (717) 656-2300
08:27:25 D 0001 3 488853
70.00 00009000 DIS000

Respectfully Submitted
Michele McClarin, B.A.
Group Leader, GC/MS Volatiles

MEMBER ACIL
Lancaster Laboratories
2425 New Holland Pike
P.O. Box 12425
Lancaster, PA 17605-2425
717 656 2300 FAX 717 656 2681

See reverse side for explanation of symbols and abbreviations

#2215

Lancaster Laboratories
Where quality is a science.

LLI Sample No. AQ 2402799
Collected:

Submitted: 10/20/95 Reported: 10/25/95
Discard: 10/25/95

Run GCS-2 Tedlar Bag Sample

Account No: 07345
United Energy Services
240 Corporate Drive
Reading PA 19605

P.O. 240569
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED RESULTS	LIMIT OF QUANTITATION	UNITS
7056	Methane	< 3.	3.	ppm (v)
9501	Ethane as Propane	< 10.	10.	ppm(v)

1 COPY TO United Energy Services ATTN: Mr. Steven Folk

Questions? Contact your Client Services Representative
Wendy K. Park at (717) 656-2300
08:27:31 D 0001 3 488853
70.00 00009000 DIS000

Respectfully Submitted
Michele McClarin, B.A.
Group Leader, GC/MS Volatiles

MEMBER ACIL

Lancaster Laboratories
2425 New Holland Pike
P.O. Box 12425
Lancaster, PA 17605-2425
717 656 2300 FAX 717 656 2681

See reverse side for explanation of symbols and abbreviations

#2216

Lancaster Laboratories
Where quality is a science.

LLI Sample No. AQ 2402800
Collected:

Submitted: 10/20/95 Reported: 10/25/95
Discard: 10/25/95

Run GCS-4 Tedlar Bag Sample

Account No: 07345
United Energy Services
240 Corporate Drive
Reading PA 19605

P.O. 240569
Rel.

CAT NO.	ANALYSIS NAME	AS RECEIVED RESULTS	LIMIT OF QUANTITATION	UNITS
7056	Methane	< 3.	3.	ppm (v)
9501	Ethane as Propane	< 10.	10.	ppm(v)

1 COPY TO United Energy Services ATTN: Mr. Steven Folk

Questions? Contact your Client Services Representative
Wendy K. Park at (717) 656-2300
08:27:41 D 0001 3 488853
70.00 00009000 DIS000

Respectfully Submitted
Michele McClarin, B.A.
Group Leader, GC/MS Volatiles

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Lancaster, PA 17605-2425
717-656-2300 FAX 717-656-2681

See reverse side for explanation of symbols and abbreviations

APPENDIX IV

CALIBRATION DATA

4.1 Calibration Gas Certificates

4.2 NO_x Converter Test

APPENDIX IV

CALIBRATION DATA

4.1 Calibration Gas Certificates

MG INDUSTRIES

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

UNITED ENERGY SERVICES
525 LANCASTER AVENUE

READING , PA 19611

DATE: 05/17/94

P.O. NO.

ORDER NO. 1125305-01

REF. #

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1, Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (/ /)	2nd Anal (05/13/94)	Actual
150-121	Propane	NOT ppm REQUIRED ppm	30.9 ppm 30.9 ppm 30.9 ppm	30.9 ppm
	Nitrogen	Balance		

Last Analysis Date: 05/13/94 Expiration Date: 05/13/97
Pressure of Contents: 2000 psig

John T. Sansone by JTT
ANALYST
John Timothy Sansone

MG 23301/C

... Products and Chemicals, Inc.
SPECIALTY GAS DEPARTMENT
12722 S. WENTWORTH AVENUE
CHICAGO, IL 60628

Certificate of Analysis - EPA Protocol Gas Standard

PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS (PROCEDURE #G1)

Customer:
AIR PRODUCTS AND CHEMICALS
ATTN: G. GOODIN
D.G.&S. LEHIGH DISTRICT
7201 HAMILTON BLVD.
ALLENTOWN PA 18195
PO: UNITED E Rel:

Notes:

Order No: 146-061770-
Batch No: 861-21493
Cylinder No: SG9120892
Cylinder Pressure*: 2000 psig
Certification Date: 10/26/94
Expiration Date: 10/26/97

*** Certified Concentration ***			********* Reference Standards *********		********** Analytical Instrumentation **********			
Component	Certified Concentration	Cylinder #	Standard Number	Concentration	Instrument Make/Model	Serial Number	Last Calibration	Measurement Principal
PROPANE	50.5 ±.15 PPM	SG9128557BAL	GMIS	50.4500 PPM	Gow-Mac 750	59405U	10/24/94	GC-FID

Balance Gas: Nitrogen

* Standard should not be used below 150 psig

Analyst: James Laas

Approved By: Robert McNear

Air Products and Chemicals, Inc.
SPECIALTY GAS DEPARTMENT
12722 S. WENTWORTH AVENUE
CHICAGO, IL 60628

Certificate of Analysis - EPA Protocol Gas Standard

PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS (PROCEDURE #G1)

Order No: 146-061770-
Batch No: 861-21295

Customer:
AIR PRODUCTS AND CHEMICALS
ATTN: G. GOODIN
D.G.&S. LEHIGH DISTRICT
7201 HAMILTON BLVD.
ALLENTOWN PA 18195
PO: UNITED E Rel:

Notes:

Cylinder No: SG9114989B
Cylinder Pressure*: 2000 psig
Certification Date: 10/26/94
Expiration Date: 10/26/97

*** Certified Concentration ***		********* Reference Standards *********			********** Analytical Instrumentation *********			
Component	Certified Concentration	Cylinder #	Standard Number	Concentration	Instrument Make/Model	Serial Number	Last Calibration	Measurement Principal
PROPANE	86.5 ±.64 PPM	SG9128479BAL	GMIS	100.5000 PPM	Gow-Mac 750	59405U	10/24/94	GC-FID

Balance Gas: Nitrogen

* Standard should not be used below 150 psig

Analyst: Jaime Haas

Approved By: Robert McNear

Air Products and Chemicals, Inc.
P.O. BOX 351
R.D. #1
TAMAQUA, PA 18252

Certificate of Analysis - EPA Protocol Gas Standard

PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS (PROCEDURE #G1)

Customer:
AIR PRODUCTS AND CHEMICALS
LEHIGH DISTRICT
ROUTE 222
TREXLERTOWN PA 18087

Notes:

PO: Rel:

Order No: CSS-218801-
Batch No: 255-71623

Cylinder No: SG9132429BA
Cylinder Pressure*: 2000 psig
Certification Date: 07/26/95
Expiration Date: 07/26/97

*** Certified Concentration ***		********* Reference Standards *********			********** Analytical Instrumentation **********			
Component	Certified Concentration	Cylinder #	Standard Number	Concentration	Instrument Make/Model	Serial Number	Last Calibration	Measurement Principal
NITRIC OXIDE	82.9 ±0.48 PPM	SG9148745BAL	GMIS	245.0000 PPM	Thermal Enviro	10S-4502	07/12/95	CHEMILUMINESCEN

Balance Gas: Nitrogen

Cyl. # SG9132429 BAL

* Standard should not be used below 150 psig

Analyst: Andrea Kline
Andrea Kline

Approved By: K. Roubik/MK
Ken Roubik

Air Products and Chemicals, Inc.
P.O. BOX 351
R.D. #1
TAMAQUA, PA 18252

Certificate of Analysis - EPA Protocol Gas Standard

PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS (PROCEDURE #G

Order No: CSS-21880
Batch No: 255-72069

Customer:
AIR PRODUCTS AND CHEMICALS
LEHIGH DISTRICT
ROUTE 222
TREXLERTOWN PA 18087

Notes:

Cylinder No: SG9161345
Cylinder Pressure*: 2000 psig
Certification Date: 08/08/95
Expiration Date: 08/08/97

PO: Rel:

*** Certified Concentration *** ********* Reference Standards ********* ********** Analytical Instrumentation *******

Component	Certified Concentration	Cylinder #	Standard Number	Concentration	Instrument Make/Model	Serial Number	Last Calibration	Measurement Principal
NITRIC OXIDE	47.9 ±0.19 PPM	SG9139453BAL	GMIS	57.5000 PPM	THERMO ENVIRON	42-51501	07/19/95	CHEMILUMINES

Balance Gas: Nitrogen

* Standard should not be used below 150 psig

Analyst: Mike Pascolini /MK
Mike Pascolini

Approved By: K. Roubik /MK
Ken Roubik

APPENDIX IV

CALIBRATION DATA

4.2 NO_x Converter Test

UNITED ENERGY SERVICES CORPORATION
AIR QUALITY TESTING SERVICES

ANALYZER: TECO 10AR
SERIAL #: 10AR 16387-161
TIME: 10:00 10:30
DATE: 10\31\95
TEST: NO2 CONVERTER EFFICIENCY

DATE	TIME	NOx ppm
31-Oct-95	10:00:46	61.59
31-Oct-95	10:01:46	61.48
31-Oct-95	10:02:46	61.69
31-Oct-95	10:03:46	61.96
31-Oct-95	10:04:46	61.89
31-Oct-95	10:05:46	61.74
31-Oct-95	10:06:46	61.90
31-Oct-95	10:07:46	61.88
31-Oct-95	10:08:46	61.99
31-Oct-95	10:09:46	61.96
31-Oct-95	10:10:46	61.95
31-Oct-95	10:11:46	61.80
31-Oct-95	10:12:46	61.82
31-Oct-95	10:13:46	61.93
31-Oct-95	10:14:46	62.01
31-Oct-95	10:15:46	61.87
31-Oct-95	10:16:46	61.95
31-Oct-95	10:17:46	61.92
31-Oct-95	10:18:46	61.81
31-Oct-95	10:19:46	61.94
31-Oct-95	10:20:46	62.01
31-Oct-95	10:21:46	61.81
31-Oct-95	10:22:46	62.07
31-Oct-95	10:23:46	62.00
31-Oct-95	10:24:46	62.16
31-Oct-95	10:25:46	61.92
31-Oct-95	10:26:46	62.06
31-Oct-95	10:27:46	62.05
31-Oct-95	10:28:46	62.12
31-Oct-95	10:29:46	62.10
31-Oct-95	10:30:46	61.94

AVG
61.91
ppm

Starting Concentration: 61.59
Lowest Concentration: 61.48
Drift: [redacted]

CALIBRATION GASES
NOx: 82.5 ppm
O2: 20.90 %

ANALYZER SCALE : 100 ppm

APPENDIX V

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

NO_x Emissions

Conversion Factor = 1.194×10^{-7}

NO_x lbs/scf = ppm x conversion factor

NO_x lbs/hr = NO_x lbs/scf x DSCFM x 60

NO_x lbs/ton of asphalt = (NO_x lbs/hr) / (Tons of asphalt/hr)

VOC Emissions

Conversion Factor = 4.165×10^{-8}

VOC lbs/scf =ppm x conversion factor

VOC lbs/hr = VOC lbs/scf x DSCFM x 60

VOC lbs/ton of asphalt = (VOC lbs/hr) / (Tons of asphalt/hr)

SAMPLE CALCULATIONS

VOC EMISSIONS (lbs/hr) as methane

ppm = parts per million measured as propane(wet basis) by flame ionization detector Method 25A

SCFM= Standard Cubic feet/minute

MW= Molecular weight

ppm(propane) X 3 = ppm expressed as methane

$$\frac{16.04 \text{ (mw methane)}}{385.1\times10^{6}} = \frac{\text{lbs/scf}}{\text{ppm}} = 4.165\times10^{-8}$$

lbs/hr = ppm(methane) (SCFM)(60)(4.165×10^{-8})

$$\text{lbs(VOC)/TON of Asphalt} = \frac{\text{lbs(VOC)/hr}}{\text{Tons of Asphalt/hr}}$$

SAMPLE EQUATIONS

Particulate Isokinetic Sampling

I. Calculations for flue gas volume and Isokinetic Ratio

Time	Dry Gas Meter Ft^3	Pitot ΔP In. H_2O	Orifice ΔH In. H_2O	Dry Gas Temp. °F In Out	Flue Gas Static Pressure In. H_2O	Stack Temp. °F
T	V_m	Δp	ΔH	TMI TMO	P_g	t_s

1. D_n = Nozzle Diameter (inches)

1a. A_n = Area of Nozzle (ft^2)

2. P_{bar} = Barometric Pressure (in. Hg)

3. TT = Net Sampling Time (minutes)

4. V_m = V_m Final - V_m Initial = Sample Gas Volume (Ft^3)

5. T_m = Average Dry Gas Temperature at Meter (°F)

$$T_m = \frac{Avg.TMI + Avg.TMO}{2}$$

6. Δp = Velocity head of stack gas (in. H_2O)

7. ΔH = Average Orifice Pressure Drop (in.H_2O)

8. Volume of dry gas sampled at standard conditions[a] (DSCF)

$$V_{m(std)} = \frac{(17.64)(V_m)(Y)\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{(T_m + 460)}$$

9. V_{lc} = Total Water Collected = gm H_2O Silica gel + ml Imp. H_2O = ml

10. Volume of water vapor at standard conditions[b] (SCF)

$$V_{w(std)} = 0.0471(V_{lc}) = SCF$$

11. Percent moisture in flue gas

$$\%M = \frac{100(V_{w(std)})}{V_{m(std)} + V_{w(std)}}$$

12. Mole fraction of water vapor in flue gas

$$B_{ws} = \frac{\%M}{100}$$

13. Molecular Weight of dry flue gas

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$

13a. %EA = % Excess Air =

$$\frac{[(\%O_2) - 0.5(\%CO)]}{[0.264(\%N_2)] - [(\%O_2) - 0.5(\%CO)]} x100$$

14. Molecular weight of wet flue gas

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

15. A = Cross-sectional area of stack (Ft^2)

$$\frac{\pi r^2}{144}$$

16. P_s = Flue gas pressure (in, Hg)

$$P_s = P_{bar} + P_g$$

NOTE: $$P_g(Hg) = \frac{P_g(in.H_2O)}{13.6}$$

17. T_s = Absolute stack temperature (°R)

$$T_s = 460 + t_s$$

18. Flue velocity at stack conditions (FT/SEC)

$$V_s = (K_p)(C_p)\left[\left(\sqrt{\Delta p}\right)avg\right]\sqrt{\frac{T_s(avg)}{P_s * M_s}}$$

C_p = pitot tube coefficient
K_p = pitot tube constant = 85.49ft/sec

19. Flue gas volumetric flow rate at standard conditions[b] (SCFM)

$$Q_s = (V_s)(A)\left(\frac{528}{T_s(avg.)}\right)\left(\frac{P_s}{29.92}\right)(60)$$

20. Flue gas volumetric flow rate at standard conditions[c] (DSCFM)

$$Q_{std} = (1 - B_{ws})(V_s)(A)\left(\frac{528}{T_s(avg.)}\right)\left(\frac{P_s}{29.92}\right)(60)$$

21. Flue gas volumetric flow rate at stack conditions (ACFM)

$$Q_a = (V_s)(A)(60)$$

22. Percent Isokinetic

$$\%I = \frac{K_4(T_s)(V_{m(std)})}{P_s V_s A_n \Theta(1 - B_{ws})}$$

K_4 = 0.09450
$\Theta = time(\text{min})$

NOTES: [a]Dry standard cubic feet at 68°F, 29.92 in. Hg
[b]Standard conditions at 68°F, 29.92 in. Hg
[c]Dry standard cubic feet per minute at 68°F, 29.92 in. Hg

United Energy Services Corporation

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Reading, PA 19605
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