AP42 Section:	11.7
Reference:	22
Title:	Report To American Standard On Stack Particulate Samples Collected At Tiffin, OH (Test Date February 8, 1994), Affiliated Environmental Services, Inc., Sandusky, OH, February 15, 1994.

affiliated Environmental services, inc.

American Standard, Inc.
U.S. Plumbing Products
Attn: Mr. Dave Keisel
P.O. Box 279
324 4th Ave.
Tiffin, OH 44883-0279

REPORT TO AMERICAN STANDARD

ON

STACK PARTICULATE SAMPLES
COLLECTED AT
TIFFIN, OH

SUBMITTED BY

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OH 44870

DATE OF TESTING: 2-8-94

DATE OF REPORT: 2-15-94

Tom Sattler
FIELD TEST SUPERVISOR

Don Dauch
MANAGER, AIR SAMPLING DIVISION

TABLE OF CONTENTS

INTRODUCTION

On 2-8-94 Affiliated Environmental Services, Inc. (AES) conducted particulate emissions testing at American Standard, Inc., Tiffin, OH. Testing was performed on the exhaust from the Tank Line Source R008. The test results will be used by American Standard to demonstrate compliance with OEPA Regulation 3745-17-11 which limits emission of particulate matter from industrial process.

Testing was performed on 2-8-94 by Tom Sattler and Brad Pean, both are employees of AES. The stack test was witnessed by Mr. Jim Alfred of the OEPA.

In addition to particulate emission data, tests were also conducted for stack gas flow rates, and moisture content. Plant personnel monitored operating conditions and provided production data which can be found in the Appendix.

Source R008 is a ceramic toilet tank spray line. Tanks are sprayed with a ceramic glaze with the exhaust air being cleaned by a wet scrubber then exhausting out a 22 inch diameter stack.

STACK PARTICULATE DATA SHEET

Run No.	gr/dscf(A)	x10^{-6} lbs/dscf(B)	lbs/hr
1	0.0039	0.55790	0.30
2	0.0048	0.6876	0.37
3	0.0036	0.5092	0.27

(A) = Grains per dry standard cubic feet at 68°F and 29.92 inches Hg

(B) = Pounds per dry standard cubic feet at 68°F and 29.92 inches Hg

0.313.

150 %
98.3
100
98.7
99%

STACK GAS DATA SUMMARY

Run No.	Flow Rate[(A)]	Temp °F	Moisture %	CO_2 %	O_2 %	CO %
1	8,949	60	2.0	0.0	21.0	0
2	8,926	60	2.3	0.0	21.0	0
3	8,971	60	1.7	0.0	21.0	0

(A) = Dry standard cubic feet per minute at 68°F and 29.92 inches Hg

DESCRIPTION OF PARTICULATE

Particulate samples were collected following EPA Methods 1-5. Sample port locations were located 10 feet down from the exit of the stack (distance A) and up 10 feet from the nearest disturbance (distance B). The stack diameter is 22 inches. A 20 point sampling set was selected due to the port locations as outlined in EPA Method 1. Each point was sampled for 3 minutes for a total of a 60 minute test. Three one hour test repetitions were performed. The equipment used for testing consisted of a Burrell Orsat Analyzer and a Research Appliance Corp. (RAC) Train Stack Sampler (EPA type). A RAC type "S" pitot and heated stainless steel sampling probe was used with the sampling train. All equipment was calibrated in the laboratory prior to the test. The sampling nozzle and the pitot tubes were measured on the day of the test. All calibrations can be found in the Appendix. Gas samples were analyzed on site using the Fyrite Gas Analyzer.

The dust ladden gases are passed through a heated glass lined probe and a heated glass cyclone separator followed by a four inch filter holder containing Whatman type 934AH fiberglass filter media. The gases leaving the filter were cooled in a series of three impingers packed in ice. The first and third impingers were the modified Greenburg-Smith type and the second one was a standard Greenburg-Smith type. The first and second impingers contained 100 ml of distilled water while the third one was used as a dry trap. After leaving the dry trap, the gases passed through a fourth impinger containing about 550 grams of silica gel desiccant to remove any remaining water vapor. The dry gas then passed through the hose portion of the umbilical cord to a Research Appliance Corp. Model 2343 "Stack Sampler" module. In the module the gas was moved through the system by a

leakless air pump to a Rockwell 175-S dry test meter. The dry test meter exhausted to a calibrated orifice to measure the flow rate of the gases passing through the sampling apparatus. A type "S pitot tube was attached to the sheath of the heated probe nozzle. The orfice pressure taps and the pitot tube were connected to a Dwyer dual 10 inch combination inclined-well type manometer. One half of the manometer measured the orifice differential pressure (ΔH) and the other half measured the flue gas velocity head (ΔP). The temperature of the flue gas was measured by a type "K" thermocouple connected to an Omega 873F thermometer readout. The CO_2 and O_2 levels were measured with a Burrell "Industro" Model B Orsat. An integrated sample was collected by drawing a constant flow rate of gas from the stack and injecting it into a tedlar bag during each test.

PARTICULATE TEST PROCEDURES

The Probe, filter and glass ware were assembled and leak tested in our laboratory before transporting to the job site. Three sets of equipment were used. At the job site a preliminary pitot traverse was performed to select the proper nozzle size. The nozzles were measured with an inside vernier caliber. The impingers were filled with distilled water and the silica impinger was connected just prior to elevating the probe into position. After leak testing the apparatus the probe was inserted at the first sample point to start the test. The apparatus was leak tested after the test was completed at a vacuum exceeding that encountered during the test. The moisture content was determined from the amount of condensate collected in the impingers and the difference of the tare and gross weight of the silica impinger. The silica impinger was weighed on a Baxter Scientific Lab Balance to the nearest one tenth of a gram. The filter media was dried in a desiccator at room temperature for 48 hours before tare and gross weighing on a Mettler H30 analytical balance. The probe liner, nozzle, cyclone or bypass and front half of the filter holder were washed with acetone and brush after testing and evaporated to dryness on a steam bath in 250 ml beakers. The beakers were dried and tare weighed prior to sample evaporation and gross weighed after allowing the samples to desiccate for 24 hours. These weights were accomplished with the Mettler Balance. The contents of the impingers were measured in a 100 ml graduate and poured into a 250 ml beaker. After evaporating on a steam bath, the beakers were put into the desiccator to cool and dry for at least 24 hours before weighing. The tare and gross weights were accomplished in the same manner as the probe washings. The weight of the material collected in the impingers was not used in the calculations to obtain the weight of the particulate catch.

METHOD 1

Sample and Velocity Traverses for Stationary Sources.

The location of the sampling site and traverse points are determined based on stack diameters and length of the stack.

METHOD 2

Determination of Stack Gas Velocity and Volumetric Flow Rate.

Velocities are measured with a type "S" pitot tube. Temperatures are measured with thermocouples.

METHOD 3

Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight.

A gas sample is extracted by using a bag simultaneously with the particulate tests. Analyses are performed using an Orsat and/or Fyrite Analyzer.

METHOD 4

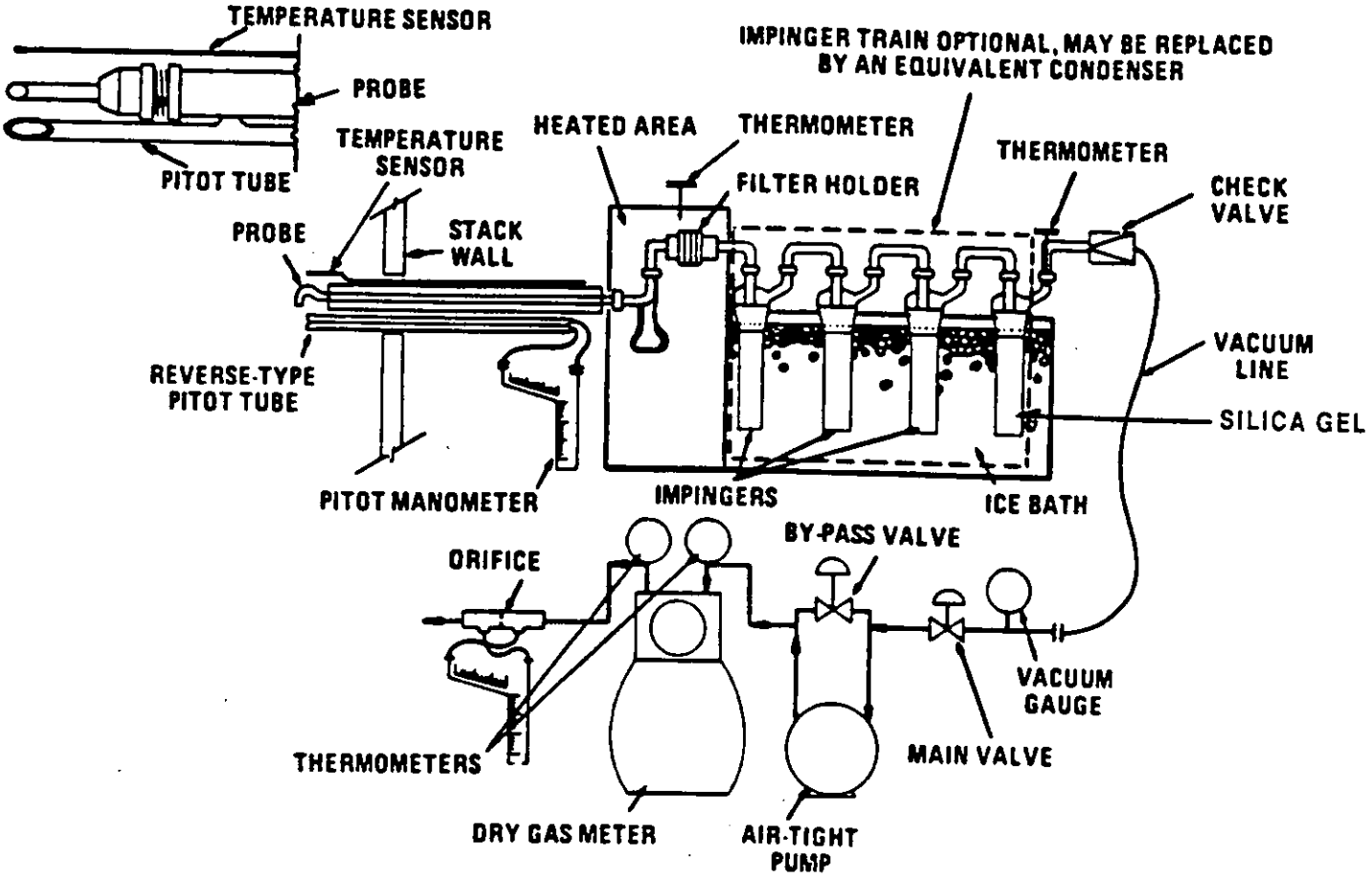
Determination of Moisture Content.

A gas sample is extracted at a constant rate from the source. Moisture is determined either volumetrically or gravimetrically.

METHOD 5

Determination of Particulate Emissions from Stationary Sources.

Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at 248 ± 25° F. A schematic of the sampling train is shown in Figure 1.



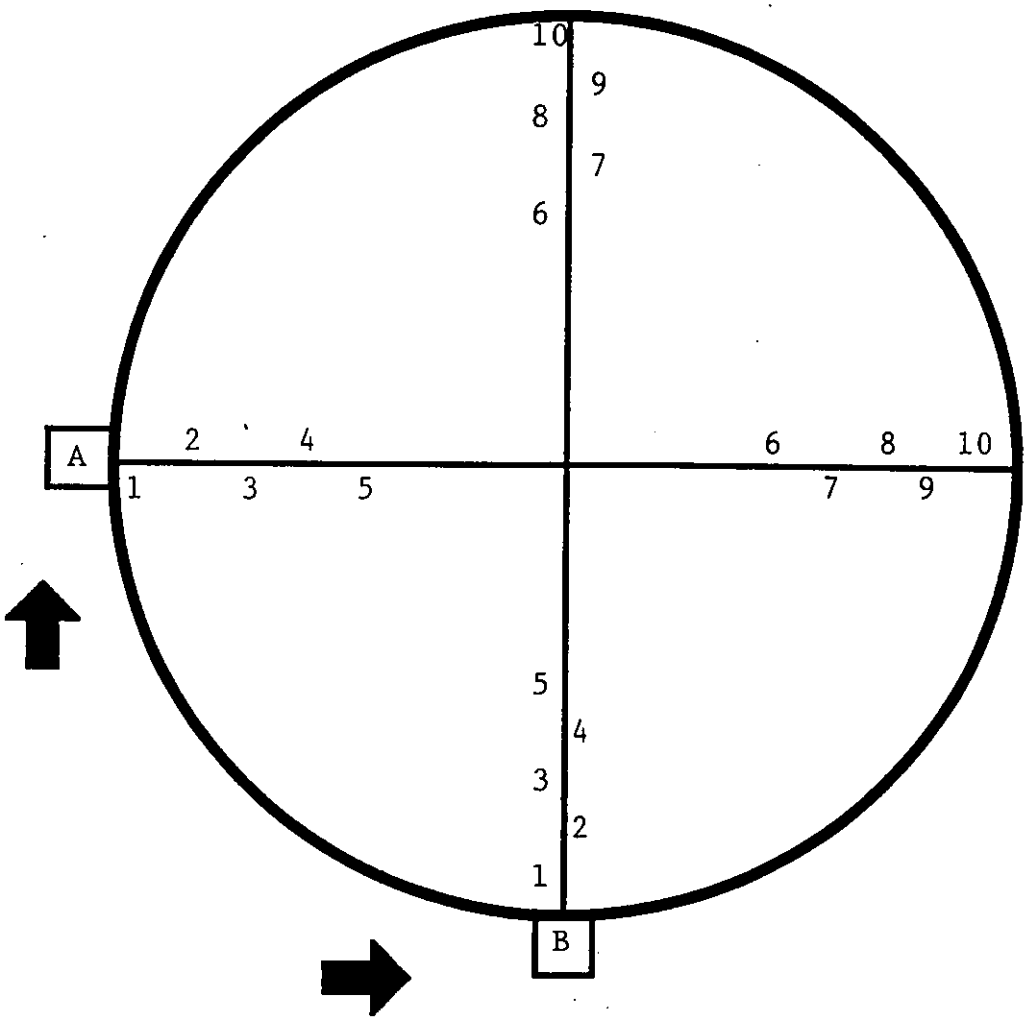
Particulate-sampling train.

LOCATION OF SAMPLING POINTS DURING PARTICULATE EMISSIONS TESTING

Distance A= 10'

Distance B= 10'

22" Diameter



Sample Point #	Distance from Inside of Stack Wall (inches)	Sample Point #	Distance from Inside of Stack Wall (inches)
1	1.0	6	14.5
2	1.8	7	17.0
3	3.2	8	18.8
4	5.0	9	20.2
5	7.5	10	21.0

FORMULAS USED IN CALCULATIONS

Gas Volume Sampled - Standard cubic feet = Vmc

$$17.64 \times (Vm) \times (Y) \times \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Tm} \right)$$

Volume of Water Vapor - Standard cubic feet =Vwc

$$Vlc \times \left(\frac{PH20}{MH20} \right) \times \left(\frac{RTstd}{Pstd} \right) = (0.0471 \text{ ft/ml}) \times Vlc$$

Stack Moisture Content - Bws

$$Bws = \frac{Vwc}{Vwc + Vmc}$$

Dry Molecular Weight - Md

$$Md = 0.44 \times (\%CO2) + 0.32 \times (\%02) + 0.28 \times (\%CO+N2)$$

Stack Gas Molecular Weight - Ms

$$Ms = 18 \times (Bws) + Md \times (1-Bws)$$

Average Stack Velocity - Vs

$$Vs = 85.48 \times (Cp) \times \sqrt{(\Delta P)} \times \sqrt{\frac{Ts + 460}{Ps \times Ms}}$$

Stack Gas Volumetric Flow Rate - SCFH

$$3600 \times (1-Bws) \times Vs \times A \times \left(\frac{Tstd}{Ts} \right) \times \left(\frac{Ps}{Pstd} \right)$$

Isokinicity %

$$\frac{TS \times (1.667) \times (Vwc + Vmc)}{(min.) \times (17.64) \times Ps \times Vs \times Atip}$$

Stack Particulate Concentration - Pounds/hour

$$2.205 \times 10^{-6} \left(\frac{Mn}{Vm\ std} \right) \times SCFH$$

Grains/standard cu ft

$$0.0154 \left(\frac{Mn}{Vm\ std} \right)$$

Y = Calibration factor of sampling train

Pbar = Barometric pressure

R Tstd = 460 + 68 = 528

Pstd = 29.92 in Hg

Cp = Pitot tube coefficient

Ps = Stack static pressure + Pbar

A = Area of stack - sq ft

min = Minutes of test

Atip = Area of sampling nozzle sq ft

Mn = Weight gain of filter + probe wash

Vlc = Volume of liquid and silica collected

QUALITY CONTROL/QUALITY ASSURANCE

All equipment was fully calibrated at our laboratory prior to the test. The sampling nozzles were measured using a vernier caliper. The pitots were measured for proper alignment and dimensions. All thermometers and thermocouples were calibrated against ASTM glass thermometers. The RAC base units are checked in the field by comparison of a 10 minute run at 0.75 cfm (ΔH) to dry gas meter integration and single point check against critical orifice. Blank solutions (acetone, distilled water) are taken and analyzed at the laboratory to see if they are within specifications. A chain of custody was maintained by the field supervisor from the start of the test program to its completion. When the samples were returned to the laboratory they were placed under the control of the laboratory supervisor until analysis is completed.

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OHIO 44870

PLANT NAME: American Standard Inc.
SAMPLE LOCATION: Tank Line exhaust
DATE OF TEST: 2-8-94

STACK SAMPLING PARAMETERS

TEST RUN NUMBER 1

MINUTES OF TEST	60
VOLUME OF GAS COLLECTED cubic feet	39.272
METER CALIBRATION FACTOR Y	.97
BAROMETRIC PRESSURE	30.12
PRESSURE DIFFERENTIAL ACROSS ORIFICE delta H	1.37
METER TEMPERATURE (+460)	527
STACK STATIC PRESSURE (Hg)	.08
STACK TEMPERATURE (+460)	520
AVERAGE SQUARE ROOT OF VELOCITY HEAD	1.01
VOLUME OF IMPINGER WATER COLLECTED grams	12
WEIGHT OF SILICA COLLECTED grams	4.3
AREA OF SAMPLING NOZZLE square feet	.0001928
PITOT TUBE COEFFICIENT	.84
AREA OF STACK square feet	2.64
CARBON DIOXIDE (DRY FRACTION)	0
CARBON MONOXIDE (DRY FRACTION)	0
OXYGEN (DRY FRACTION)	21
NITROGEN (DRY FRACTION)	79

STACK PARTICULATE DATA

GAS VOLUME STANDARD CONDITIONS DSCF	38.534
VOLUME OF WATER VAPOR cubic feet	.768
PERCENT MOISTURE IN STACK GAS	2
DRY GAS MOLECULAR WEIGHT	28.84
STACK GAS MOLECULAR WEIGHT	28.623
VELOCITY OF STACK GAS feet per second	56.248
FLOW RATE OF STACK GAS DSCFH	536927
FLOW RATE OF STACK GAS DSCFM	8949
ISOKINICITY %	98.3
WEIGHT GAIN OF IMPINGERS mg	1.1
WEIGHT GAIN OF FILTER mg	.1
WEIGHT GAIN OF PROBE WASH mg	9.8
PARTICULATES COLLECTED POUNDS/HOUR	.3
PARTICULATES COLLECTED GRAINS/DSCF	.0039
PARTICULATES COLLECTED POUNDS/DSCF	5.579E-07

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OHIO 44870

PLANT NAME: American Standard Inc.
SAMPLE LOCATION: Tank Line exhaust
DATE OF TEST: 2-8-94

STACK SAMPLING PARAMETERS

TEST RUN NUMBER 2

MINUTES OF TEST	60
VOLUME OF GAS COLLECTED cubic feet	39.975
METER CALIBRATION FACTOR Y	.97
BAROMETRIC PRESSURE	30.12
PRESSURE DIFFERENTIAL ACROSS ORIFICE delta H	1.4
METER TEMPERATURE (+460)	535
STACK STATIC PRESSURE (Hg)	.08
STACK TEMPERATURE (+460)	520
AVERAGE SQUARE ROOT OF VELOCITY HEAD	1.01
VOLUME OF IMPINGER WATER COLLECTED grams	14
WEIGHT OF SILICA COLLECTED grams	5.6
AREA OF SAMPLING NOZZLE square feet	.0001907
PITOT TUBE COEFFICIENT	.84
AREA OF STACK square feet	2.64
CARBON DIOXIDE (DRY FRACTION)	0
CARBON MONOXIDE (DRY FRACTION)	0
OXYGEN (DRY FRACTION)	21
NITROGEN (DRY FRACTION)	79

STACK PARTICULATE DATA

GAS VOLUME STANDARD CONDITIONS DSCF	38.64
VOLUME OF WATER VAPOR cubic feet	.923
PERCENT MOISTURE IN STACK GAS	2.3
DRY GAS MOLECULAR WEIGHT	28.84
STACK GAS MOLECULAR WEIGHT	28.591
VELOCITY OF STACK GAS feet per second	56.279
FLOW RATE OF STACK GAS DSCFH	535579
FLOW RATE OF STACK GAS DSCFM	8926
ISOKINICITY %	100
WEIGHT GAIN OF IMPINGERS mg	2.7
WEIGHT GAIN OF FILTER mg	.2
WEIGHT GAIN OF PROBE WASH mg	12
PARTICULATES COLLECTED POUNDS/HOUR	.37
PARTICULATES COLLECTED GRAINS/DSCF	.0048

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE RD.
SANDUSKY, OHIO 44870

PLANT NAME: American Standard Inc.
SAMPLE LOCATION: Tank Line exhaust
DATE OF TEST: 2-8-94

STACK SAMPLING PARAMETERS

TEST RUN NUMBER 3

MINUTES OF TEST	60
VOLUME OF GAS COLLECTED cubic feet	40.027
METER CALIBRATION FACTOR Y	.97
BAROMETRIC PRESSURE	30.12
PRESSURE DIFFERENTIAL ACROSS ORIFICE delta H	1.37
METER TEMPERATURE (+460)	534
STACK STATIC PRESSURE (Hg)	.08
STACK TEMPERATURE (+460)	520
AVERAGE SQUARE ROOT OF VELOCITY HEAD	1.01
VOLUME OF IMPINGER WATER COLLECTED grams	8
WEIGHT OF SILICA COLLECTED grams	6.2
AREA OF SAMPLING NOZZLE square feet	.0001928
PITOT TUBE COEFFICIENT	.84
AREA OF STACK square feet	2.64
CARBON DIOXIDE (DRY FRACTION)	0
CARBON MONOXIDE (DRY FRACTION)	0
OXYGEN (DRY FRACTION)	21
NITROGEN (DRY FRACTION)	79

STACK PARTICULATE DATA

GAS VOLUME STANDARD CONDITIONS DSCF	38.76
VOLUME OF WATER VAPOR cubic feet	.669
PERCENT MOISTURE IN STACK GAS	1.7
DRY GAS MOLECULAR WEIGHT	28.84
STACK GAS MOLECULAR WEIGHT	28.656
VELOCITY OF STACK GAS feet per second	56.215
FLOW RATE OF STACK GAS DSCFH	538255
FLOW RATE OF STACK GAS DSCFM	8971
ISOKINICITY %	98.7
WEIGHT GAIN OF IMPINGERS mg	2
WEIGHT GAIN OF FILTER mg	.1
WEIGHT GAIN OF PROBE WASH mg	9
PARTICULATES COLLECTED POUNDS/HOUR	.27
PARTICULATES COLLECTED GRAINS/DSCF	.0036
PARTICULATES COLLECTED POUNDS/DSCF	5.092E-07

APPENDICES

A Plant Data

B Field Data Sheets

C Laboratory Data Sheets

D Calibration DAta

American Standard Inc.
United States Plumbing Products Group
324 4th Avenue
P.O. Box 279
Tiffin OH 44883-0279
Telephone 419 447-7515
Fax 419 448-8105

FEB. 14, 1994

AFFILIATED ENVIRONMENTAL SERVICES, INC.
3606 VENICE ROAD
SANDUSKY, OHIO 44870

ATTN: TOM SATTLER

REFERENCE: STACK TEST R008

DEAR TOM,

IN REFERENCE TO THE STACK TEST OF OUR TANK SPRAY BOOTH (R008) CONDUCTED ON FEBRUARY 8TH, 1994, THE SPRAY BOOTH USED 188 GALLONS OF GLAZE DURING THAT SHIFT WHICH IS 23.5 GALLONS PER HOUR.

IF YOU HAVE ANY QUESTIONS, PLEASE FEEL FREE TO CALL ME.

DAVID KIESEL

FACILITIES ENGINEER

American Standard
LIVING UP TO A HIGHER STANDARD™

[illegible]E. [illegible]RV[illegible]S, [illegible]. [illegible]TIC[illegible]TE [illegible]PLE[illegible]TA [illegible]ET

A[illegible]Fyrit[illegible]alys[illegible]

(Method 5)

0 % CO_2 21.0 % O_2

Location	[illegible]	Ambient Temp.	[illegible]
Stack	[illegible]	Barometric Pres.	[illegible]
Operator	[illegible]	Assumed Moisture %	[illegible]
Date	[illegible]	Heater Box Setting	[illegible]
Run Number	2	Probe Length & No.	3.55 /#
Pitot Tube Coeff.	[illegible] /#	Nozzle Diameter & No.	.188 /# 0000928
Area of Stack	22" = 2.640 ft²	Probe Heater Setting	[illegible]

Additional Information:

START	STOP
4 9:00 - 937	
8 9:39 - 10.07	

Base Unit # 5 Y = 0.97

STATIC PRESSURE	LEAK CHECK "Hg	PITOT LEAK CHECK	10 MIN. CHECK
"H2O (Ps)	Initial [illegible]	Initial o/k	Final [illegible]
= "Hg. +.06	Final [illegible]	Final o/k	Initial 26.553

Witnessed by

Pt. #	Time Min.	Stack temp f	Δ P	√ Δ P	Δ H	Gas Sample Volume ft	Dry gas temp. inlet °f	Dry gas temp. outlet °f	Probe temp. °f	Box temp. °f	Vac. "Hg	Imp. gas temp. °f
A-1	0-3	57	.92	.959	1.20	693.412	58	50	255	256	4.6	36
2	3-6	60	1.1	1.05	1.44	695.0	60	50	255	253	4.5	36
3	6-9	59	1.1	1.05	1.44	697.1	62	50	251	254	4.5	36
4	9-12	61	1.2	1.10	1.60	699.1	65	52	248	257	5.0	36
5	12-15	60	.92	.959	1.20	701.2	70	52	250	254	4.0	36
6	15-18	62	.72	.849	.95	703.1	70	54	251	253	4.0	36
7	18-21	59	.84	.917	1.10	704.8	72	54	255	257	4.0	34
8	21-24	60	1.1	1.05	1.44	706.6	74	54	253	260	4.5	34
9	24-27	62	1.4	1.18	1.83	708.6	76	54	258	253	5.0	34
10	27-30	62	1.4	1.18	1.53	710.8	78	56	260	255	5.0	34
B-1	3	58	1.2	1.10	1.60	713.4	78	58	253	247	5.0	34
2	6	59	1.4	1.18	1.83	715.2	80	60	250	245	5.0	34
3	9	61	1.5	1.22	2.00	717.4	80	60	256	243	5.0	34
4	12	62	1.5	1.22	2.00	719.8	80	60	253	247	5.0	34
5	15	63	1.3	1.14	1.70	722.3	82	60	254	251	5.0	34
6	18	60	.64	.800	.84	724.6	84	62	257	253	4.0	34
7	21	58	.62	.787	.82	726.2	86	64	255	252	4.0	34
8	24	58	.62	.787	.82	727.8	86	64	253	255	4.0	34
9	27	60	.65	.825	.59	729.4	86	64	256	251	4.0	34
10	30	59	.68	.825	.59	731.0	86	64	255	254	4.0	34
						732.[illegible]4						
total							avg. 76	avg. 57				
Avg.		60		1.01	1.37	37.272	Avg. [illegible]	527				

E. RV S, C. — RTIC TE PLI TA ET — Fyri nalys

(Method 5)

0 % CO_2 21.0 % O_2

Location	AMBIENT STANDARD	Ambient Temp.	10°
Stack	2003 TANK LINE	Barometric Pres.	30.12
Operator	TOM SIMMS	Assumed Moisture %	2.2
Date	2-8-94	Heater Box Setting	245 ± 25
Run Number	II	Probe Length & No.	3'S5 /#
Pitot Tube Coeff.	.84 /#	Nozzle Diameter & No.	157 /# 0.0001907
Area of Stack	3.640 ft²	Probe Heater Setting	245 ± 25

Additional Information:

START **STOP**

A 10:50 - 11:20

B 11:29 - 11:59

Base Unit # 3

STATIC PRESSURE "H2O (Ps) _____ = "Hg. +.08

LEAK CHECK "Hg Initial OK < 0.02 Final OK < 0.02

PITOT LEAK CHECK Initial OK Final OK

10 MIN. CHECK Final _____ Initial _____

Witnessed by _____

Pt. #	Time Min.	Stack temp f	Δ P	√ Δ P	Δ H	Gas Sample Volume ft	Dry gas temp. inlet °f	Dry gas temp. outlet °f	Probe temp. °f	Box temp. °f	Vac. "Hg	Imp. gas temp. °f
1 - 1	0 - 3	62	1.1	1.05	1.44	736.112	60	60	253	241	4.0	38
2	3 - 6	60	1.4	1.15	1.83	737.7	62	60	255	244	4.5	38
3	6 - 9	62	1.5	1.22	2.00	739.9	20	60	264	246	5.0	38
4	9 - 12	60	1.5	1.22	2.00	742.1	72	62	266	245	5.0	38
5	12 - 15	60	1.5	1.22	2.00	744.5	74	62	263	251	5.0	38
6	15 - 18	58	.65	.806	.85	746.9	80	62	260	253	4.0	38
7	18 - 21	58	.62	.787	.82	748.7	86	62	256	250	4.0	38
8	21 - 24	59	.62	.787	.82	750.2	86	64	253	255	4.0	38
9	24 - 27	59	.65	.806	.85	752.1	86	64	251	256	4.0	40
10	27 - 30	61	.75	.866	.98	753.6	88	64	250	257	4.0	40
1 - B	3	58	.75	.866	.98	755.6	88	64	248	251	4.0	40
2	6	59	1.2	1.10	1.60	757.0	86	65	245	253	4.5	40
3	9	61	1.2	1.10	1.60	759.2	86	65	243	254	4.5	40
4	12	62	1.2	1.10	1.60	761.3	86	68	246	253	4.5	40
5	15	63	.97	.955	1.30	763.6	90	70	249	256	4.5	40
6	18	61	.72	.849	.95	765.6	90	70	251	255	4.0	40
7	21	60	.78	.883	1.02	767.4	92	70	253	257	4.0	40
8	24	60	1.2	1.10	1.60	769.1	92	72	254	260	4.5	40
9	27	59	1.4	1.18	1.53	771.2	92	72	252	256	5.0	40
10	30	60	1.4	1.18	.53	773.6	92	72	251	255	5.0	40
						776.027						
total							avg 83	avg 66				
Avg.		60 520		1.01	1.40	39.975	Avg 75	535				

A.E. SERVICES, INC. — PARTICULATE SAMPLE DATA SHEET (Method 5)

Avg. Fyrite Analysis: 0.0 % CO_2 21.0 % O_2

Location	Johnson Station	Ambient Temp.	10
Stack	200' OUTLET	Barometric Pres.	30.12
Operator	Tom Smith	Assumed Moisture %	12
Date	2-5-94	Heater Box Setting	245±25
Run Number	III	Probe Length & No.	3'SS /#
Pitot Tube Coeff.	.84 /#	Nozzle Diameter & No.	.158 /# 0.0001928
Area of Stack	2.640 ft²	Probe Heater Setting	245±25

Additional Information:

START A - 12:30 - 12:50

STOP B - 12:51 - 1:21

Base Unit # 5

STATIC PRESSURE "H2O (Ps) ____ = "Hg. +.08

LEAK CHECK "Hg " Initial OK L.013 AT 10" Final ____

PITOT LEAK CHECK Initial OK Final ____

10 MIN. CHECK Final ____ Initial ____

Witnessed by ____

Pt. #	Time Min.	Stack temp f	Δ P	√ Δ P	Δ H	Gas Sample Volume ft	Dry gas temp. inlet °f	Dry gas temp. outlet °f	Probe temp. °f	Box temp. °f	Vac. "Hg	Imp. gas temp. °f
1 - 1	0 - 3	58	1.1	1.05	1.44	776.450	60	60	237	249	4.0	40
2	3 - 6	58	1.4	1.15	1.53	778.0	64	60	240	253	5.0	40
3	6 - 9	61	1.5	1.22	2.00	780.4	70	60	242	257	5.0	40
4	9 - 12	60	1.5	1.22	2.00	782.3	72	62	244	261	5.0	40
5	12 - 15	61	1.5	1.22	2.00	785.1	72	62	247	263	5.0	40
6	15 - 18	55	.64	.800	.84	787.4	72	62	250	258	4.0	40
7	18 - 21	60	.62	.787	.82	789.1	76	62	251	255	4.0	40
8	21 - 24	60	.62	.787	.82	790.7	80	62	254	257	4.0	40
9	24 - 27	59	.65	.806	.85	792.4	84	62	257	259	4.0	38
10	27 - 30	61	.65	.806	.85	794.0	86	64	258	263	4.0	38
1 - 2	3	57	1.1	1.05	1.44	795.8	84	64	253	260	4.5	38
2	6	59	1.2	1.10	1.60	797.6	84	66	251	259	4.5	38
3	9	62	1.2	1.10	1.60	799.9	86	66	255	257	4.5	38
4	12	60	1.1	1.05	1.44	802.1	86	66	257	256	4.5	38
5	15	61	.93	.964	1.20	804.2	92	70	259	251	4.0	38
6	18	60	.75	.866	~~1.08~~ .98	806.1	92	70	260	250	4.0	38
7	21	60	.85	.922	1.11	807.9	94	72	261	256	4.0	38
8	24	61	1.1	1.05	1.44	809.7	94	72	258	253	4.0	38
9	27	61	1.2	1.10	1.60	811.7	94	72	255	250	4.5	38
10	30	60	1.2	1.10	1.60	814.0	94	72	253	251	4.5	38
						816.477						
total							avg 82	avg 65				
Avg.		60 520		1.01	1.37	40.027	Avg 74	534				

PLANT NAME: American Standard, Inc.

SOURCE I.D.: Tank line exhaust DATE: 2-8-94

STACK PARTICULATE SAMPLE LABORATORY DATA SHEET

Run # 1 Lab Analysis by: Don Rauch

Date: 2-10-94

	FINAL WEIGHT mg	INITIAL WEIGHT mg	NET WEIGHT GAIN mg
Filter	592.5	592.4	0.1
Probe wash	105,693.8	105,684.0	9.8
Impingers	105,108.0	105,106.9	1.1

SILICA	IMPINGER
Final Weight = 554.3	Final Volume = 212
Initial Weight = 550	Initial Volume = 200
Total Gain 4.3gm	Total Gain 12 ml

Total gain mg	11.0
Filter & Wash mg	9.9
- Acetone blank mg	-.15
Net Particulate Weight mg	9.75

Net particulate weight refers to the filter and wash minus the acetone blank.

PLANT NAME: American Standard, Inc.

SOURCE I.D.: Tank Line exhaust DATE: 2-8-94

STACK PARTICULATE SAMPLE LABORATORY DATA SHEET

Run # 2 Lab Analysis by: [signature]

Date: 2-10-94

	FINAL WEIGHT mg	INITIAL WEIGHT mg	NET WEIGHT GAIN mg
Filter	602.6	602.4	0.2
Probe wash	102,583.3	102,571.3	12.0
Impingers	108,072.3	108,069.6	2.7

SILICA	IMPINGER
Final Weight = 555.6	Final Volume = 214
Initial Weight = 550	Initial Volume = 200
Total Gain 5.6 gm	Total Gain 14 ml

Total gain mg	14.9
Filter & Wash mg	12.2
- Acetone blank mg	-.15
Net Particulate Weight mg	12.05

Net particulate weight refers to the filter and wash minus the acetone blank.

PLANT NAME: American Standard, Inc.

SOURCE I.D.: Tank Line exhaust DATE: 2-8-94

STACK PARTICULATE SAMPLE LABORATORY DATA SHEET

Run # 3 Lab Analysis by: Don Dauch

Date: 2-10-94

	FINAL WEIGHT mg	INITIAL WEIGHT mg	NET WEIGHT GAIN mg
Filter	619.6	619.5	0.1
Probe wash	104,102.5	104,093.5	9.0
Impingers	104,020.9	104,018.9	2.0

SILICA	IMPINGER
Final Weight = 556.2	Final Volume = 208
Initial Weight = 550	Initial Volume = 200
Total Gain 6.2gm	Total Gain 8ml

Total gain mg	11.1
Filter & Wash mg	9.1
- Acetone blank mg	-.15
Net Particulate Weight mg	8.95

Net particulate weight refers to the filter and wash minus the acetone blank.

Date 1-15-94

Metering System Identification: #3

Barometric pressure, P_b = 30.5 in. H_g

Calibrated by: [signature]

Orifice manometer setting ΔH in. H_2O	Spirometer (wet meter) gas volume V_w ft^3	Dry gas meter volume V_m ft^3	Temperatures				Time θ min.
			Spirometer (wet meter) t_w °F	Dry Gas Meter			
				Inlet T_i °F	Outlet T_o °F	Average T_m °F	
.5	7.865	8.260	58	80	68	74	20
1.0	10.922	11.693	60	90	74	82	20
1.5	13.080	14.230	60	96	80	88	20
2.0							

CALCULATIONS

ΔH in. H_2O	Y $\frac{V_w P_b (t_m + 460)}{V_m \left[P_b + \frac{\Delta H}{13.6}\right](t_w + 460)}$	ΔHθ $\frac{0.0317\ \Delta H}{P_b (t_o + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w}\right]^2$
.5	Y = .98	ΔH = 1.71
1.0	Y = .97	ΔH = 1.76
1.5	Y = .97	ΔH = 1.83
2.0	Y = .96	ΔH = 1.98
Average	Y = .97	ΔH = 1.82

Y = Ratio of reading wet test meter to dry test meter; tolerance for individual values ± 0.02 from average.

ΔHθ = Orifice pressure differential that equates to 0.75 cfm of air θ 68°F and 29.92 inches of mercury, in. H_2O; tolerance for individual values ± 0.20 from average.

Figure 5.6. Example data sheet for calibration of metering system (English units).

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 1-3-94 Thermocouple number 3'SS

Ambient temperature 21 °C Barometric pressure 30.21 in. Hg

Calibrator Q.C. Reference: mercury-in-glass ASTM

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
3A	Boiling water	99.9	99	0.2
			1	0.3
3B	Ice Bath	0.2	98	0.5
			1	0.3
3C			95	0.5
			1	0.3

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 1-3-94 Thermocouple number RAC Meter Boxes

Ambient temperature 60°F (15.5 °C Backroom) Barometric pressure 30.21 in. Hg

Calibrator Don Rausch Reference: mercury-in-glass _____

other _____

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
RAC	Inlet	Outlet		
1	62	62		
2	62	63		
3	63	63		
4	63	63		
6	62	62		

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

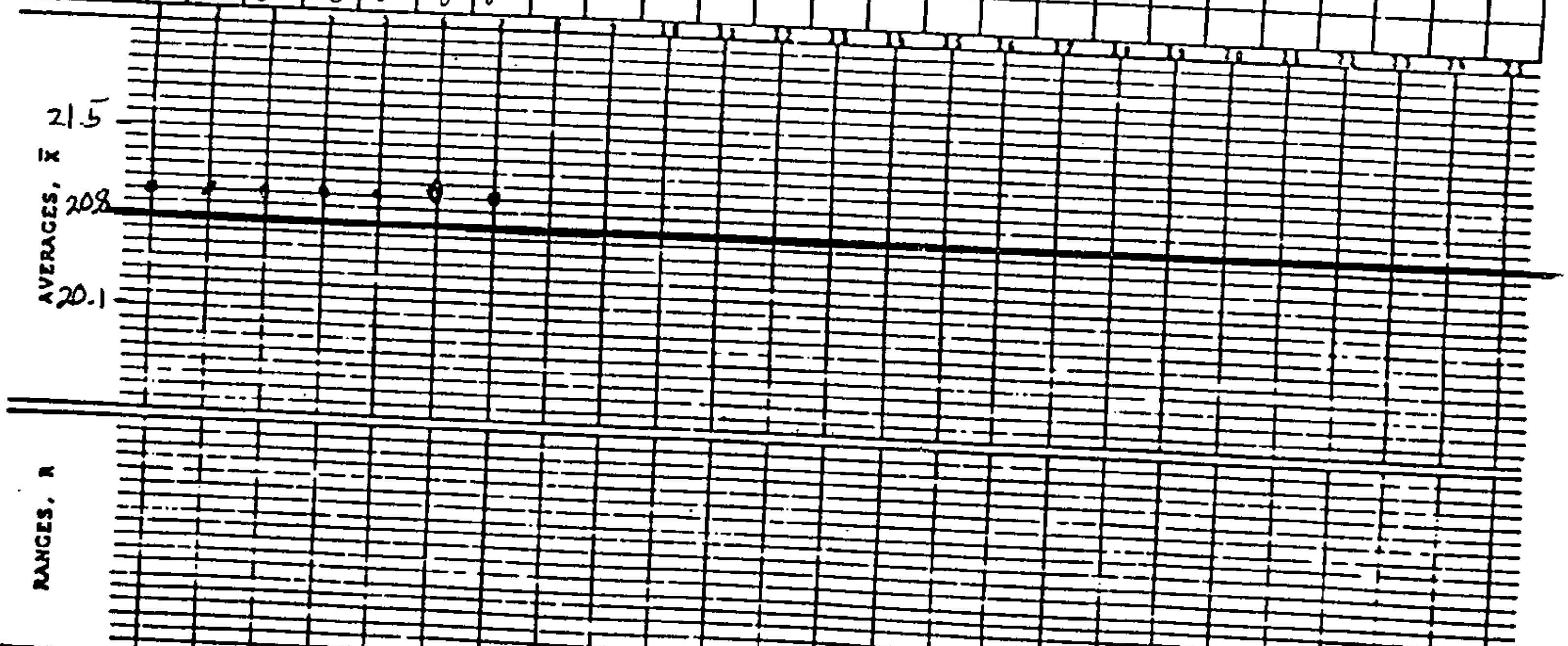
[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

Quality Assurance Handbook M2-2.10

$\bar{X}$ AND R CHART

PROJECT NAME: Fyrite Calibration MEASUREMENT PERFORMED: AIR MEASUREMENT UNITS: oxygen Percent v/v

DATE							
MEASUREMENT CODE 1							
MEASUREMENT CODE 2							
MEASUREMENT CODE 3							
MEASUREMENT RESULT 1	21.0	21.0	21.0	21.0	21.0	21.0	21.0
MEASUREMENT RESULT 2	21.0	21.0	21.0	21.0	21.0	21.0	21.0
MEASUREMENT RESULT 3	21.0	21.0	21.0	21.0	21.0	21.0	21.0
SUM	63.0	63.0	63.0	63.0	63.0	63.0	63.0
AVERAGE, $\bar{X}$	21.0	21.0	21.0	21.0	21.0	21.0	21.0
RANGE, R	0	0	0	0	0	0	0



Comments (Correct Action, etc.)	2-1-93	12-3-93	12-9-93	new 1-4-94	1-7-94	2-2-94	2-8-94
	HLC	HLC	MI	Harrod	CS	CFD	A.S.I

Quality Assurance Handbook M3-2.1

ANALYTICAL BALANCE CALIBRATION FORM

Balance name Mettler Number H30

Classification of standard weights NBS

Date	0.2000 g	1.0000 g	10.000 g	50.0000 g	100.0000 g	Analyst
9-10-93	200.0				100,000.1	
9-23-93	200.0				100,000.1	
10-1-93	200.0				100,000.1	
10-13-93	200.0				100,000.1	
10-18-93	200.0				100,000.1	
10-22-93	200.0				100,000.1	
10-25-93	200.0				100,000.1	
11-1-93	200.0				100,000.1	
11-9-93	200.0				100,000.1	
11-17-93	200.0				100,000.1	
11-22-93	200.0				100,000.1	
11-23-93	200.0				100,000.1	
12-3-93	200.0				100,000.1	
12-7-93	200.0				100,000.1	
12-13-93	200.0				100,000.1	
12-20-93	200.0				100,000.1	
12-21-93	200.0				100,000.1	
12-22-93	200.0				100,000.1	
12-24-93	200.0				100,000.1	
1-7-94	200.0				100,000.1	
1-10-94	200.0				100,000.1	
1-13-94	200.0				100,000.1	
1-14-94	200.0				100,000.1	
1-17-94	200.0				100,000.1	
1-24-94	200.0				100,000.1	
2-4-94	200.0				100,000.1	
2-7-94	200.0				100,000.1	
2-10-94	200.0				100,000.1	

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

α_1 = 2 ° (<10°), α_2 = 2 ° (<10°), β_1 = 2 ° (<5°),

β_2 = 1 ° (<5°)

γ = 2 °, θ = 1 °, A = 1.10 cm (in.)

z = A sin γ = 0.038 cm (in.); <0.32 cm (<1/8 in.),

w = A sin θ = 0.019 cm (in.); <.08 cm (<1/32 in.)

P_A 0.550 cm (in.) P_b 0.549 cm (in.)

D_t = 0.375 cm (in.)

Comments: 3'SS A

1-11-94 RO Dome 2-8-94 RO

0.84

Calibration required? _____ yes ✓ no

Quality Assurance Handbook M2-1.7

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

α_1 = 2 ° (<10°), α_2 = 2 ° (<10°), β_1 = 1 ° (<5°),
β_2 = 2 ° (<5°)

γ = 1 °, θ = 1 °, A = 1.10 cm (in.)

z = A sin γ = 0.019 cm (in.); <0.32 cm (<1/8 in.),
w = A sin θ = 0.019 cm (in.); <.08 cm (<1/32 in.)

P_A 0.551 cm (in.) P_b 0.550 cm (in.)

D_t = 0.375 cm (in.)

Comments: 3'ssB
1-11-94 OK Same 2-8-94 OK
0.84

Calibration required? _____ yes X no