# Air Emissions Source Test Report

## VALID RESULTS

Air Emissions Testing Specialists
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Seattle, WA 98105
Tel: (206) 522-5665
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CLIENT: Associated Sand and Gravel Company, Inc.
P.O. Box 2037
Everett, WA 98105
(206) 624-0301

SOURCE:

Associated Sand and Gravel Company asphalt plant number 14, a 300 ton per hour Boeing MS 300 asphalt drum mixer connected to a Standard Havens baghouse with a 50,000 cubic feet per minute exhaust fan and an asphalt storage silo, located in Arlington, Washington.

TEST DATE: November, 10 1993

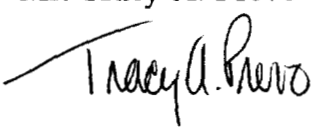
PARTICULATE AIR EMISSIONS TEST RESULTS:

| | lbs/hour | grains/dscf | milligrams/dscm |
|---|---|---|---|
| Front Half Averages | 4.19 | 0.020 | 45.6 |
| Front and Back Half Averages | 4.65 | 0.022 | 50.6 |

*Note: Averages are based upon the results of test runs number two and three.

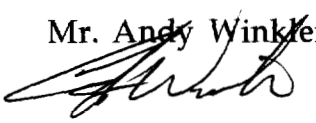
CERTIFICATION:

Mr. Tracy A. Prevo



Project Manager

Mr. Andy Winkler



Independent Consultant

*We certify that the information contained within is accurate and complete to the best of our knowledge.*

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INTRODUCTION:

On November 10, 1993 VALID RESULTS performed three one-hour United States Title 40 Code of Federal Regulations Part 60 (40CFR60) Appendix A Method 5 particulate air emission test runs on the outlet of a standard havens baghouse attached to a Boeing MS 300 asphalt drum mixer at plant 14 of Associated Sand and Gravel Company (PSAPCA registration #28469) located in Arlington, Washington.

This testing was performed to determine compliance with State of Washington Department of Ecology (WDOE) and Puget Sound Air Pollution Control Agency (PSAPCA) requirements. No regulatory agency observers were present to witness the testing.

Test results are presented in units of grains per dry standard cubic feet and milligrams per dry standard cubic meter for comparison with the emission limit guidelines listed in PSAPCA Notice of Construction number 5028 dated August 9, 1993, chapter 1 section 60.8 and sub-part I of the 40CFR60 as well as section 173.400 of the Washington State Administrative Code (WAC). Summaries of these regulations are contained in appendix A of this report.

SUMMARY OF RESULTS:

| | lbs/hour | grains/dscf | milligrams/dscm |
|---|---|---|---|
| Front Half Averages | 4.19 | 0.020 | 45.6 |
| Front and Back Half Averages | 4.65 | 0.022 | 50.6 |

*Note: Averages are based upon the test results of runs number two and three.

All calculations are made using the applicable equations as shown in the 40CFR60 Appendix A. An example calculation for the second test run is contained in Appendix F of this report.

The run one sample train failed its final leak check. An O-ring at the back of the filter holder blew out during the test resulting in a stack gas moisture content one half that of the other two runs. The second and third test runs were both valid, passing both initial and final leak checks, meeting the minimum dry standard sample volume and isokinetic sampling rate requirements.

The results from test run one are presented in this report, but are not included in the reported average particulate air emissions rates. The 40CFR60 Chapter 1 Section 60.8 allows for such uncontrollable circumstances. A summary of this section is contained in appendix A of this report.

A fourth test run was not performed due to an end in the demand for the product, a full storage silo and approaching darkness.

# VALID RESULTS: Particulate Air Emission Rate Calculation Summary

Client: ASSOCIATED SAND AND GRAVEL

| | | | | |
|---|---|---|---|---|
| Test Date: | 11/10/1993 | Standard Temperature (Tstd): | ° Rankin | 528 |
| Operator: | T. Prevo | Standard Pressure (Pstd): | inches HG | 29.92 |
| Plant Location: | Arlington, WA | Pitot Tube Coefficient (Cp): | | 0.84 |
| Source: | Asphalt Plant #14 | Meter Coefficient (Yd): | | 1.0334 |
| Stack Diameter: | 34.7 inches | Stack Outlet Area (As): | square feet | 8.444 |

| | Units | Symbol | Run 1 | Run 2 | Run 3 | <Averages>* |
|---|---|---|---|---|---|---|
| Total Emission Rate | lbs/hour | | *7.25* | 5.92 | 3.38 | 4.65 |
| Total Emission Rate | grains/dscf | | *0.0297* | 0.0282 | 0.0160 | **0.022** |
| Total Emission Rate | mg/dscm | | *67.9* | 64.4 | 36.7 | 50.6 |
| Total Weight Gain | milligrams | Totalmg | *47.8* | 73.6 | 40.5 | 57.1 |
| Front Half Emission Rate | lbs/hour | | *4.44* | 5.30 | 3.08 | **4.19** |
| Front Half Emission Rate | grains/dscf | | *0.0182* | 0.0252 | 0.0146 | **0.020** |
| Front Half Emission Rate | mg/dscm | | *41.6* | 57.7 | 33.4 | 45.6 |
| Front Half Weight Gain | milligrams | FHmg | *29.3* | 65.9 | 36.9 | 51.4 |
| Corrected Sample Volume | dscf | Vm(std) | *24.856* | 40.332 | 39.000 | 39.666 |
| Corrected Sample Volume | dscm | | *877.665* | 1424.123 | 1377.090 | 1400.606 |
| Stack Gas Flow Rate | dscf/min | | *28,500.6* | 24,537.1 | 24,605.0 | 24,571.1 |
| Stack Gas Flow Rate | acf/min | | *41,782.6* | 46,160.0 | 42,745.2 | 44,452.6 |
| Stack Gas Moisture | %/100 | Bws | *0.1225* | 0.2705 | 0.2368 | 0.2537 |
| Stack Gas Velocity | feet/sec | Vs | *82.47* | 91.11 | 84.37 | 87.74 |
| Stack Pressure | inches HG | Ps | *29.98* | 29.99 | 29.99 | 29.99 |
| Stack Temperature | degrees R | Ts | *680.6* | 726.3 | 701.7 | 714.00 |

Where:

lbs/hour = (grains/dscf)*(dscf/minute)*(60 minutes/hour)/( 7000 grains/1 lb)
grains/dscf = (0.001 grams/milligram)*(15.43 grains/gram)*(mg)/(Vm(std))
mg/dscm = (35.31 dscf/dscm)*(milligrams)/(Vm(std)
dscf/minute = 3600*(hour/60 minutes)*(1-Bws)*Vs*As*Tstd*Ps/(Ts*Pstd)
acf/min = Vs*As*(60 sec/minute)
Tmg and FHmg are calculated on the Test Sample Weight Gain Summary (Appendix C).
Vm(std), Bws, Vs and Ps are calculated on each test runs isokinetic sample rate calculation form.

* Averages are calculated from the results of test runs two and three only.
The final leak check for test run number one did not meet EPA specifications.

# VALID RESULTS: Individual Test Run Isokinetic Calculation Form

Client: ASSOCIATED SAND AND GRAVEL
Test Date: 11/10/93
Operator: T. Prevo
Plant Location: Arlington, WA
Source: Asphalt Plant #14
Run#: 1

**Calculated Parameters:**

| Name: | Symbol: | Value: | Units: | Equation: |
|---|---|---|---|---|
| Isokinetic Sampling Rate | Isokinetics | 74.36 | % | 100*Ts*Vm(std)*Pstd/(60*Tstd*Vs*Time*An*Ps*(1-Bws)) |
| Standard Meter Volume | Vm(std) | 24.856 | dry standard cubic feet | (Vm*Y*Pm*Tstd/(Pstd*Tm))-(Lp-La)*60 |
| Stack Gas Velocity | Vs | 82.47 | feet per second | 85.49*Cp*<SQRT(Delta P)>*SQRT(Ts/(Ps*Ms)) |
| Wet Molecular Weight | Ms | 28.07 | gram/gram-mole | Md*(1-Bws) + 18.0*Bws |
| Dry Molecular Weight | Md | 29.48 | gram/gram-mole | 0.44*(%CO2) + 0.32*(%O2) + 0.28*(%N2 + %CO) |
| Stack Gas Moisture | Bws | 0.1225 | %/100 | Vwc(std)/(Vwc(std) + Vm(std)) |
| Standard Water Volume | Vwc(std) | 3.4696 | dry standard cubic feet | 0.04707*(Imp ml) + 0.04715*(Silica ml) |
| Nozzle Area | An | 0.000165 | square feet | (3.14*(Dn/2)*(Dn/2))/144 |

**Measured Parameters:**

| Name: | Symbol: | Value: | Units: | Equation: |
|---|---|---|---|---|
| Standard Temperature | Tstd | 528 | degrees rankin | |
| Standard Pressure | Pstd | 29.92 | inches mercury | |
| Barometric Pressure | Pbar | 30.12 | inches mercury | |
| Stack Static Pressure | Pstatic | -1.9 | inches water | |
| Pitot Tube Coefficient | Cp | 0.84 | dimensionless | |
| Nozzle Diameter | Dn | 0.174 | inches | |
| Meter Coefficient | Y | 1.0334 | dimensionless | |
| Meter Volume | Vm | 23.46 | cubic feet | |
| Sample Time | Time | 60 | minutes | |
| Avg. SQRT Pitot Pressure | <SQRT(Delta P)> | 1.2771 | inches water | |
| Avg. Orifice Pressure | <Delta H> | 1.046 | inches water | |
| Avg. Stack Temperature | <Tstk> | 220.6 | degrees fahrenheit | |
| Avg. Meter Temperature | <Tm> | 47.5 | degrees fahrenheit | |
| Stack Temperature | Ts | 680.6 | degrees rankin | <Tstk> + 460 |
| Stack Pressure | Ps | 29.98 | inches mercury | Pbar + (Pstatic/13.6) |
| Meter Temperature | Tm | 507.5 | degrees rankin | <Tm> + 460 |
| Meter Pressure | Pm | 30.20 | inches mercury | Pbar + (<Delta H>/13.6) |
| Carbon Dioxide | %CO2 | 6.2 | % | |
| Oxygen | %O2 | 12.2 | % | |
| Nitrogen/Carbon Monoxide | %N2 + %CO | 81.6 | % | |
| Impinger Water | Imp ml | 67.5 | milliliters | |
| Silica Water | Silica ml | 6.2 | milliliters | |

# VALID RESULTS: Individual Test Run Isokinetic Calculation Form

Client: ASSOCIATED SAND AND GRAVEL
Test Date: 11/10/93
Operator: T. Prevo
Plant Location: Arlington, WA
Source: Asphalt Plant #14
Run#: 2

**Calculated Parameters:**

| Name: | Symbol: | Value: | Units: | Equation: |
|---|---|---|---|---|
| Isokinetic Sampling Rate | Isokinetics | 95.31 | % | 100*Ts*Vm(std)*Pstd/(60*Tstd*Vs*Time*An*Ps*(1-Bws)) |
| Standard Meter Volume | Vm(std) | 40.332 | dry standard cubic feet | Vm*Y*Pm*Tstd/(Pstd*Tm) |
| Stack Gas Velocity | Vs | 91.11 | feet per second | 85.49*Cp*<SQRT(Delta P)>*SQRT(Ts/(Ps*Ms)) |
| Wet Molecular Weight | Ms | 26.41 | gram/gram-mole | Md*(1-Bws) + 18.0*Bws |
| Dry Molecular Weight | Md | 29.532 | gram/gram-mole | 0.44*(%CO2) + 0.32*(%O2) + 0.28*(%N2 + %CO) |
| Stack Gas Moisture | Bws | 0.2705 | %/100 | Vwc(std)/(Vwc(std) + Vm(std)) |
| Standard Water Volume | Vwc(std) | 14.9520 | dry standard cubic feet | 0.04707*(Imp ml) + 0.04715*(Silica ml) |
| Nozzle Area | An | 0.000243 | square feet | (3.14*(Dn/2)*(Dn/2))/144 |

**Measured Parameters:**

| Name: | Symbol: | Value: | Units: | Equation: |
|---|---|---|---|---|
| Standard Temperature | Tstd | 528 | degrees rankin | |
| Standard Pressure | Pstd | 29.92 | inches mercury | |
| Barometric Pressure | Pbar | 30.12 | inches mercury | |
| Stack Static Pressure | Pstatic | -1.8 | inches water | |
| Pitot Tube Coefficient | Cp | 0.84 | dimensionless | |
| Nozzle Diameter | Dn | 0.211 | inches | |
| Meter Coefficient | Y | 1.0334 | dimensionless | |
| Meter Volume | Vm | 38.735 | cubic feet | |
| Sample Time | Time | 60 | minutes | |
| Avg. SQRT Pitot Pressure | <SQRT(Delta P)> | 1.325 | inches water | |
| Avg. Orifice Pressure | <Delta H> | 2.77 | inches water | |
| Avg. Stack Temperature | <Tstk> | 266.3 | degrees fahrenheit | |
| Avg. Meter Temperature | <Tm> | 71.1 | degrees fahrenheit | |
| Stack Temperature | Ts | 726.3 | degrees rankin | <Tstk> + 460 |
| Stack Pressure | Ps | 29.99 | inches mercury | Pbar + (Pstatic/13.6) |
| Meter Temperature | Tm | 531.1 | degrees rankin | <Tm> + 460 |
| Meter Pressure | Pm | 30.32 | inches mercury | Pbar + (<Delta H>/13.6) |
| Carbon Dioxide | %CO2 | 6.6 | % | |
| Oxygen | %O2 | 11.9 | % | |
| Nitrogen/Carbon Monoxide | %N2 + %CO | 81.5 | % | |
| Impinger Water | Imp ml | 285.5 | milliliters | |
| Silica Water | Silica ml | 32.1 | milliliters | |

# VALID RESULTS: Individual Test Run Isokinetic Calculation Form

Client: ASSOCIATED SAND AND GRAVEL
Test Date: 11/10/93
Operator: T. Prevo
Plant Location: Arlington, WA
Source: Asphalt Plant #14
Run#: 3

**Calculated Parameters:**

| Name: | Symbol: | Value: | Units: | Equation: |
|---|---|---|---|---|
| Isokinetic Sampling Rate | Isokinetics | 91.92 | % | 100*Ts*Vm(std)*Pstd/(60*Tstd*Vs*Time*An*Ps*(1-Bws)) |
| Standard Meter Volume | Vm(std) | 39.000 | dry standard cubic feet | Vm*Y*Pm*Tstd/(Pstd*Tm) |
| Stack Gas Velocity | Vs | 84.37 | feet per second | 85.49*Cp*<SQRT(Delta P)>*SQRT(Ts/(Ps*Ms)) |
| Wet Molecular Weight | Ms | 26.83 | gram/gram-mole | Md*(1-Bws) + 18.0*Bws |
| Dry Molecular Weight | Md | 29.564 | gram/gram-mole | 0.44*(%CO2) + 0.32*(%O2) + 0.28*(%N2 + %CO) |
| Stack Gas Moisture | Bws | 0.2368 | %/100 | Vwc(std)/(Vwc(std) + Vm(std)) |
| Standard Water Volume | Vwc(std) | 12.1039 | dry standard cubic feet | 0.04707*(Imp ml) + 0.04715*(Silica ml) |
| Nozzle Area | An | 0.000243 | square feet | (3.14*(Dn/2)*(Dn/2))/144 |

**Measured Parameters:**

| Name: | Symbol: | Value: | Units: | Equation: |
|---|---|---|---|---|
| Standard Temperature | Tstd | 528 | degrees rankin | |
| Standard Pressure | Pstd | 29.92 | inches mercury | |
| Barometric Pressure | Pbar | 30.12 | inches mercury | |
| Stack Static Pressure | Pstatic | -1.8 | inches water | |
| Pitot Tube Coefficient | Cp | 0.84 | dimensionless | |
| Nozzle Diameter | Dn | 0.211 | inches | |
| Meter Coefficient | Y | 1.0334 | dimensionless | |
| Meter Volume | Vm | 37.338 | cubic feet | |
| Sample Time | Time | 60 | minutes | |
| Avg. SQRT Pitot Pressure | <SQRT(Delta P)> | 1.258 | inches water | |
| Avg. Orifice Pressure | <Delta H> | 2.59 | inches water | |
| Avg. Stack Temperature | <Tstk> | 241.7 | degrees fahrenheit | |
| Avg. Meter Temperature | <Tm> | 69.2 | degrees fahrenheit | |
| Stack Temperature | Ts | 701.7 | degrees rankin | <Tstk> + 460 |
| Stack Pressure | Ps | 29.99 | inches mercury | Pbar + (Pstatic/13.6) |
| Meter Temperature | Tm | 529.2 | degrees rankin | <Tm> + 460 |
| Meter Pressure | Pm | 30.31 | inches mercury | Pbar + (<Delta H>/13.6) |
| Carbon Dioxide | %CO2 | 6.9 | % | |
| Oxygen | %O2 | 11.5 | % | |
| Nitrogen/Carbon Monoxide | %N2 + %CO | 81.6 | % | |
| Impinger Water | Imp ml | 230 | milliliters | |
| Silica Water | Silica ml | 27.1 | milliliters | |

QUALITY ASSURANCE:

VALID RESULTS has developed and utilizes equipment preparation, field sampling, sample chain of custody, laboratory analysis and calibration data sheets designed to follow the quality assurance guidelines outlined in the Environmental Protection Agency document EPA-600/4-77-027b "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 3". These data sheets are contained in appendices B, C, D, E and G of this report.

Tracy Prevo, the project manager, completed the EPA Air Pollution Training Institute (APTI) Course #SI:414 "Quality Assurance for Source Emission Measurements" in March of 1993. A copy of his certificate of completion for this course is included in appendix D of this report.

Calibration data sheets for the sample nozzles, s-type pitot tube, probe pitot-tube nozzle alignment, type K thermocouples, thermocouple readout and dry gas meter-critical orifice are contained in appendix E of this report.

All calculations, including field data averages, relating to these air emission test results have been checked at least twice by Tracy Prevo. A final quality assurance review was performed, prior to final publication, by independent consultant Mr. Andy Winkler. A manual calculation of the test results for run two are included in appendix F of this report.

SOURCE OPERATIONS:

Source operating conditions during the source test were recorded by and considered to be representative of normal operations by Mr. William Doane of Associated Sand and Gravel. His written record is contained in appendix B of this report.

The Boeing Construction Company model MS-300 (I.D.# BCE-542) drum mix asphalt plant tested was constructed in 1979 and modified in 1989. A Standard Havens model 211-2139 (I.D. #93633) baghouse with 608 bags abates particulate air emissions from the plant to the atmosphere. The unit was last tested in August of 1992. New NOMEX bags (6.25" x 104.75") were installed in the baghouse in August of 1993. The pressure drop across the baghouse averaged 2.5 inches of water during the test. According to plant operators the plant produced an averaged of 250 tons per hour, using a six percent fine gravel mix with a gravel moisture content of five percent at an asphalt discharge temperature of 304 degrees Fahrenheit on the day of the test.

SAMPLING AND ANALYSIS PROCEDURE:

A diagram of the stack dimensions including sample port and point locations and the sample point labeling system is located on the VALID RESULTS Method 1,2 Field Data Sheet in appendix B of this report.

VALID RESULTS' particulate sampling train conforms to the EPA 40CFR60 Appendix A method 5 requirements with modifications including a 316 stainless steel heated probe liner, a heated filter box attached to the end of the probe with a heated teflon sample line running from the back-half of the filter holder to the inlet of the first impinger. A detailed equipment checklist is contained in appendix D of this report.

On November 10, 1993 VALID RESULTS performed three one-hour 40CFR60 Appendix A method 5 particulate air emission test runs. Isokinetic (nozzle velocity = stack gas velocity) sampling rates were maintained with the assistance of an isokinetic sampling program written on a hand-held HP-48 calculator.

40CFR60, Appendix A methods 1, 2, 3 and 4 were performed in conjunction with the method 5 particulate air emissions tests. Sample point locations were determined by method 1. Stack gas velocity and volumetric flow rate were determined by method 2. Integrated bag samples were taken during each method 5 test run and analyzed with an ORSAT to determine stack gas molecular weight according to method 3. Stack gas moisture content was determined by impinger water volume gain and silica gel weight gain according to method 4.

Front-half particulate was recovered from the probe liner and nozzle by brushing and rinsing six times with acetone. Particulate matter from the front half of the glass filter holder was rinsed with acetone into the probe liner and nozzle rinse container.

Recovery and analysis of particulate matter from the back half of the sample train, including the heated teflon sample line, was performed according to section II of the PSAPCA Particulate Source Test Procedure.

Duplicate organic extractions were performed with 100 milliliter aliquots of methylene chloride. Liquid samples were evaporated in aluminum weighing tins. All samples were weighed to the nearest 0.1 milligrams on an analytical balance.

# APPENDIX A:

Environmental Regulations

PSAPCA Notice of Construction #5028:

EPA 40 CFR 60 Chapter 1 Section 60.8 Summary:

EPA 40 CFR 60 Chapter 1 Subpart I Summary:

WAC 173.400 Summary:

# Puget Sound Air Pollution Control Agency

## HEREBY ISSUES AN ORDER OF APPROVAL TO CONSTRUCT, INSTALL, OR ESTABLISH

Registration No. 28469

Notice of Construction No. 5028 9

Date AUG 9 1993

**A 300 TPH Boeing MS 300 Asphalt Drum Mixer connected to a Standard Havens Baghouse at 50,000 cfm, and an Asphalt Storage Silo.**

APPLICANT

GERALD CRANE

ASSOCIATED SAND & GRAVEL (~~#7~~ #14)

PO BOX 2037

EVERETT WA 98203

OWNER

ASSOCIATED SAND & GRAVEL (~~#7~~ #14)

PO BOX 2037

EVERETT WA 98203

INSTALLATION ADDRESS

ASSOCIATED SAND & GRAVEL (#7), 23621 STATE RT 99, ARLINGTON, WA, 98223

THIS ORDER IS ISSUED SUBJECT TO THE FOLLOWING RESTRICTIONS AND CONDITIONS

1. Approval is hereby granted as provided in Article 6 of Regulation I of the Puget Sound Air Pollution Control Agency to the applicant to install or establish the equipment, device or process described hereon at the INSTALLATION ADDRESS in accordance with the plans and specifications on file in the Engineering Division of PSAPCA.
2. Compliance with this ORDER and its conditions does not relieve the owner or operator from the responsibility of compliance with Regulations I, II or III, RCW 70.94 or any other emission control requirements, nor from the resulting liabilities and/or legal remedies for failure to comply. Section 5.05(e) of Regulation I requires that the owner or operator must develop and implement an operation and maintenance (O&M) plan to assure continuous compliance with Regulations I, II, and III.
3. This approval does not relieve the applicant or owner of any requirement of any other governmental agency.
4. This plant is subject to 40 CFR 60 Subpart I, Standards of Performance for Hot Mix Asphalt Facilities.
5. Associated Sand & Gravel (ASG) shall submit a source test plan for Agency approval within 30 days of this Order of Approval.
6. ASG shall conduct source tests within 30 days after plant startup.
7. ASG shall report source test results within 60 days after plant startup.
8. ASG shall not exceed 0.020 gr/dscf from the baghouse.
9. After demonstration of compliance, the Agency will modify this Order of Approval for operation of this plant within conditions established during the source test including the amount of recycled material.
10. ASG shall not exceed 10% opacity aggregated for 3 minutes in any hour from the baghouse stack.
11. ASG shall not cause or allow the emission of fugitive dust from any manufacturing equipment including the drum mixer, baghouse, material handling equipment and asphalt storage silo to exceed 10% opacity aggregated for 3 minutes in any 1 hour. If fugitive emissions are observed from any manufacturing equipment, a Notice of Construction Application for controlling the emissions must be submitted.

FREDRICK L. AUSTIN P.E.
Reviewing Engineer

JAY M. WILLENBERG P.E.
Reviewing Engineer

for JAMES L. NOLAN
Director of Compliance

MEJ

Form 50-118, (1/91)

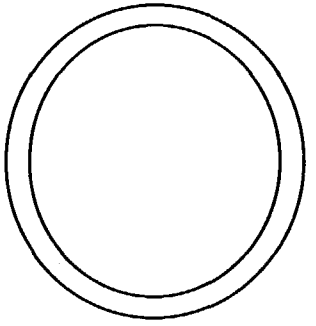
## APPENDIX B:

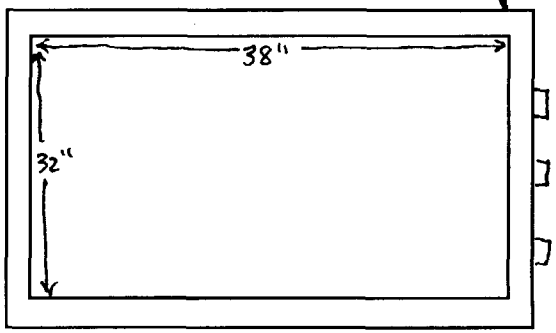
Field Data Sheets:

| |
|---|
| M1,2 Sample Point Determination |
| M5 Particulate Sampling |
| Plant Operating Conditions |

## VALID RESULTS , EPA Method 1 & 2: Sample Point Location and Volumetric Flow Rate Determination

| | | | |
|---|---|---|---|
| Client: | Assoc 5: 6 | Stack Diameter (De or Ds): | 34.7 |
| Date: | 11-10-93 | Upstream (A): | 12 1/4" |
| Operator: | T. Prevo | Downstream (B): | 83 3/4" |
| Plant Location: | Arlington, WA | Minimum # Points: | 24 |
| Source: | Asphalt Ckt #14 | Pitot Tube ID#: | 48 |
| Fuel Type: | Diesel #2 | Pitot Tube Coeff. (Cp): | 0.84 |
| Load Rating: | ~ 250 tons/hr | Pitot Cal Date: | 11/8/93 |
| Barometric Pressure (Pbar): | 30.12 | Stack Temp TC ID#: | 1-A-48 |
| Standard Temperature (Tstd): | 68°F | TC Cal Date: | 11/8/93 |
| Standard Pressure (Pstd): | 29.92 | % Oxygen (%O2): | 11.5 |
| Stack Static Pressure (Pstatic): | -1.9 | % Carbon Dioxide (%CO2): | 6.5 |
| Time: | ~ 830am | Moisture Content (%H2O): | 30% |






Equivalent Diameter = Stack Diameter (Ds) or 2*Length*Width/(Length + Width) = 34.7"

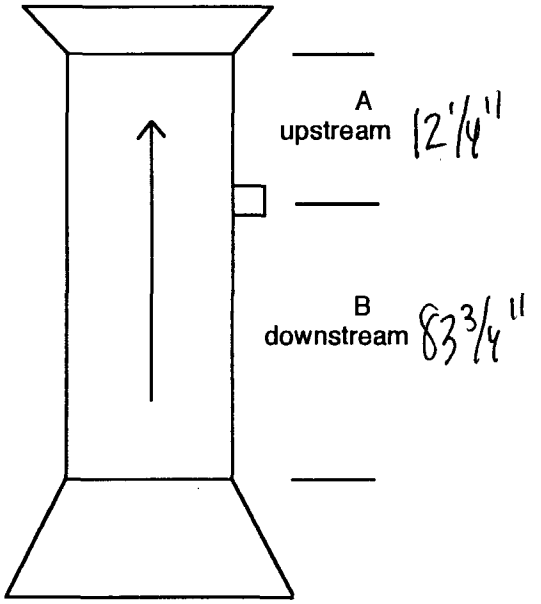
Stack Area (As) = (1/4*PIE*(Ds)*(Ds)) or [redacted] (32"x38")/144 = 8.444 ft2

Stack Pressure (Ps) = Pbar + (Pstatic/13.6)

Run #: | Pre-Test: | Equipment Checklist: N/A | Pitot Tube Leak Check: ✓

| Port ID# | Point # | % Stack ID | Port Depth | Probe Marks | Cyclonic Zero Angle | Pitot Tube Delta P | Stack Temp. Ts Deg F | SQRT (Delta P) |
|---|---|---|---|---|---|---|---|---|
| A1 | | 2.37 | 1.25" | 3.6" | 0 | 7.5 | 260 | |
| 2 | | 7.12" | | 8.4" | 0 | 6.5 | | |
| 3 | | 11.87 | | 13.1" | 0 | 4.0 | | |
| 4 | | 16.62" | | 17.9" | -5 | 2 | | |
| 5 | | 21.38 | | 22.6" | -5 | 1.5 | 250 | |
| 6 | | 26.12 | | 27.4" | -10 | 0.8 | | |
| 7 | | 30.87 | | 32.1" | -15 | 0.5 | | |
| 8 | | 35.62 | | 36.9" | -15 | 0.1 | 230 | |
| | | | | | 0 | | | |
| B1 | | | | | 0 | 7.5 | 270 | |
| 2 | | | | | 0 | 7 | | |
| 3 | | | | | 0 | 3 | | |
| 4 | | | | | -5 | 1.5 | | |
| 5 | | | | | -5 | 1 | 220 | |
| 6 | | | | | -10 | 1 | | |
| 7 | | | | | -10 | 0.5 | | |
| 8 | | | | | -15 | 0.1 | 200 | |
| | | | | | | | | |
| C1 | | | | | 0 | 7.5 | | |
| 2 | | | | | 0 | 5.5 | 240 | |
| 3 | | | | | 0 | 2 | | |
| 4 | | | | | 0 | 1 | | |
| 5 | | | | | -5 | 1 | | |
| 6 | | | | | -5 | 0.5 | 200 | |
| 7/8 | | | | | -10/-15 | 0.5/0.2 | | |
| Averages | | | | | | | | |

Post-Test: Pitot Tube Leak Check:




Molecular Weight Wet (MWs) = ((0.44(%CO2) + 0.32(%O2) + 0.28(%CO + %N2))*(1-%H2O) + 18(%H2O))

Stack Gas Velocity (Vs) = (85.49*Cp*(SQRT(Delta P))*(Ts + 460)/(Ps*MWs))

Stack Gas Volumetric Flowrate = (60*(1-%H2O)*Vs*As*((Tstd + 460)/((Ts + 460))*(Ps/Pstd))

Tracy A. Prevo

## VALID RESULTS , EPA Method 5: Particulate Air Emissions Test

| | |
|---|---|
| Client: | Associated Sand & Gravel |
| Date: | 11-10-93 |
| Operator: | T. Prevo |
| Plant Location: | Arlington, WA |
| Source: | Asphalt Plant #14 - Baghouse |
| Fuel Type: | Diesel |
| Load Rating: | ~250 tph |
| Barometric Pressure (Pbar): | 30.12 |
| Stack Equiv. Diameter (De): | 34.7" |
| Stack Moisture (%H2O): | 30 |
| Run #: | 1 |

| Equipment | Material | ID# | Cal Date | Value |
|---|---|---|---|---|
| Nozzle | 316 SS | | 11/10/93 | Dn = 0.174" |
| Pitot Tube: | 316 SS | | 11/8/93 | Cp = 0.84 |
| Stack TC: | 316SS | | 11/8/93 | Yd = 1.0334 |
| Meter: | | 1694716 | 10/25/93 | Delta H@= 1.9528 |
| Filter: | Glass fiber | VR1016F | | |

| Impinger Weight Gain # | Vfinal | Vinitial | Net Gain | Charge Solution |
|---|---|---|---|---|
| 1 | 150.5 | 100.0 | 50.5 | DI $H_2O$ |
| 2 | 116.0 | 100.0 | 16.0 | DI $H_2O$ |
| 3 | 1.0 | ø | 1.0 | wet |
| 4 | 243.4 | 237.2 | 6.2 | Silica Gel |

Probe Liner: 316 SS X, Pyrex Glass ___, Quartz Glass ___,

Total Moisture Gain = 73.7

| | |
|---|---|
| Standard Temperature (Tstd): | 528 °R |
| Standard Pressure (Pstd): | 29.92 |
| Stack Static Pressure (Pstatic): | -1.9 |

Tracy A. Prevo

ORSAT leak ✓ $O_2$ 12.3, 12.2, 12.2 $CO_2$ 6.2, 6.2, 6.1 leak ✓

Pre-Test: Equipment Checklist: ✓ VREPAM1,2 ✓ Sample Train Leak Check: Pre-Test 0.006 @ 13 "Hg, Post-Test 0.030 @ 5 "Hg

| Port ID# / Point # | Time: | Meter Value: | Pitot Tube Delta P | Stack Temp. Degrees F | Meter Temp. Tmin | Meter Temp. Tmout | Delta H | SQRT (Delta P) | CFM | Filter Temp | Probe Temp | Imping Temp | Pump Vacuum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pay Meter Side | | | | | | | | | | | | | |
| 1 | 8423Ø | 573.863 | 7.2 | 272 | 32 | 32 | 2.93 | 2.68 | | 252 | 248 | 30 | ø |
| 2 | 845 | 576.— | 6.4 | 272 | 48 | 33 | 2.65 | 2.53 | | 261 | 258 | 31 | ø |
| 3 | 8473Ø | 578.— | 4.3 | 262 | 52 | 34 | 1.78 | 2.07 | | 254 | 254 | 34 | ø |
| 4 | 850 | 579.— | 2.1 | 252 | 50 | 35 | 0.89 | 1.45 | | 250 | 256 | 34 | ø |
| 5 | 8523Ø | 581.286 | 1.5 | 244 | 49 | 35 | 0.64 | 1.23 | | 242 | 252 | 34 | ø |
| 6 | 855 | 582.208 | 0.65 | 231 | 49 | 35 | 0.28 | 0.81 | | 240 | 248 | 35 | ø |
| 7 | 8573Ø | 582.663 | 0.28 | 218 | 49 | 35 | 0.12 | 0.53 | | 246 | 250 | 36 | ø |
| 8 | 900 | 582.922 | 0.04 | 208 | 47 | 36 | 0.02 | 0.20 | | 252 | 254 | 37 | ø |
| End | 9023Ø | 583.007 | | | | | | | | | | | |
| 1 | 911 | 583.007 | 7.5 | 273 | 45 | 39 | 3.10 | 2.74 | | 256 | 250 | 37 | ø |
| 2 | 9133Ø/9153 | 584.302 / 584.836 | 6.8 | 234 | 45 | 39 | 2.98 | 2.61 | | 255 | 248 | 37 | ø |
| 3 | 95530 | 587.026 | 2.8 | 218 | 60 | 45 | 1.26 | 1.67 | | 260 | 250 | 38 | ø |
| 4 | 958 | 588.427 | 0.91 | 196 | 61 | 45 | 0.43 | 0.95 | | 255 | 248 | 37 | ø |
| 5 | 100030 | 589.222 | 0.34 | 190 | 46 | 39 | 0.16 | 0.58 | | 253 | 242 | 36 | ø |
| 6 | 1003 | 589.509 | 0.20 | 186 | 47 | 40 | 0.09 | 0.45 | | 255 | 243 | 36 | ø |
| 7 | 10:0530 | 589.683 | 0.15 | 184 | 46 | 40 | 0.07 | 0.39 | | 258 | 245 | 36 | ø |
| 8 | 10:08 | 589.857 | 0.10 | 180 | 46 | 40 | 0.05 | 0.32 | | 260 | 246 | 35 | ø |
| End | 10:1030 | 590.078 | | | | | | | | | | | |
| 1 | 10:2430 | 590.078 | 7.8 | 235 | 46 | 45 | 3.48 | 2.79 | | 258 | 239 | 43 | 1.5 |
| 2 | 10:27 | 592.468 | 5.2 | 232 | 56 | 48 | 2.29 | 2.28 | | 260 | 242 | 42 | 1.0 |
| 3 | 10:2930 | 594.467 | 2.4 | 228 | 58 | 48 | 1.07 | 1.55 | | 264 | 250 | 42 | ø |
| 4 | 11:32 | 595.776 | 0.82 | 218 | 66 | 49 | 0.37 | 0.91 | | 260 | 255 | 42 | ø |
| 5 | 11:3430 | 596.448 | 0.39 | 198 | 63 | 50 | 0.18 | 0.62 | | 262 | 254 | 44 | ø |
| 6 | 11:37 | 596.749 | 0.27 | 194 | 62 | 50 | 0.13 | 0.52 | | 256 | 252 | 44 | ø |
| 7 | 11:3930 | 597.025 | 0.20 | 186 | 60 | 48 | 0.09 | 0.45 | | 254 | 248 | 46 | ø |
| 8 | 11:42 | 597.323 | 0.10 | 180 | 58 | 46 | 0.05 | 0.32 | | 258 | 246 | 46 | ø |
| End | 11:4430 | 597.323 | | | | | | | | | | | |
| | | 23.460 | | | | | | | | | | | |
| Averages | | | 2.135 | 220.6 | 53.9 | 41.0 | 1.016 | 1.271 | | | | | |

(47.5)

## VALID RESULTS , EPA Method 5: Particulate Air Emissions Test

| | |
|---|---|
| Client: | Associated Sand & Gravel |
| Date: | 11-10-93 |
| Operator: | T. Prevo |
| Plant Location: | Arlington, WI |
| Source: | Asphalt Plant #14 |
| Fuel Type: | Diesel |
| Load Rating: | ~250 tph |
| Barometric Pressure (Pbar): | 30.12 |
| Stack Equiv. Diameter (De): | 34.7" |
| Stack Moisture (%H2O): | 30 |
| Run #: | 2 |

| Equipment | Material | ID# | Cal Date | Value |
|---|---|---|---|---|
| Nozzle | SS | | 11/10/93 | Dn = 0.211" |
| Pitot Tube: | SS | | 11/8/93 | Cp = 0.84 |
| Stack TC: | SS sheath | | 11/8/93 | Yd = 1.0334 |
| Meter: | | 1694716 | 10/25/93 | Delta H@= 1.9528 |
| Filter: | Glass Fiber | VR1026F | | |

Probe Liner: 316 SS ✓, Pyrex Glass ___, Quartz Glass ___,

| Standard Temperature (Tstd): | 528°R |
|---|---|
| Standard Pressure (Pstd): | 29.92 |
| Stack Static Pressure (Pstatic): | -1.8 |

| Impinger # | Vfinal | Vinitial | Net Gain | Charge Solution |
|---|---|---|---|---|
| 1 | 252 | 100 | 152 | DI $H_2O$ |
| 2 | 192.5 | 100 | 92.5 | DI $H_2O$ |
| 3 | 41 | | 41 | |
| 4 | 288.5 | 256.4 | 32.1 | Silica Gel |

Total Moisture Gain = 317.6 ml

Tracey A. Prevo ORSAT $O_2$ 12.0, 11.9, 11.9 leak✓
leak✓ $CO_2$ 6.6, 6.6, 6.6 leak✓

Pre-Test: Equipment Checklist: RI VREPAM1,2 RI Sample Train Leak Check: Pre-Test 0.006 @ 15 "Hg, Post-Test 0.008 @ 12 "Hg

| Port ID# / Point # | Time: | Meter Value: | Pitot Tube Delta P | Stack Temp. Degrees F | Meter Temp. Tmin | Meter Temp. Tmout | Delta H | SQRT (Delta P) | CFM | Filter Temp | Probe Temp | Imping Temp | Pump Vacuum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12:04 | 613.397 | 7.7 | 281 | 59 | 50 | 8.62 | 2.77 | | 263 | 239 | 62 | 7.5 |
| 2 | 12:0630 | 616.624 | 5.6 | 280 | 74 | 60 | 6.41 | 2.37 | | 258 | 248 | 53 | |
| 3 | 12:09 | 619.451 | 3.9 | 277 | 80 | 60 | 4.46 | 1.97 | | 263 | 252 | 60 | 8.5 |
| 4 | 12:1130 | 622.201 | 1.4 | 265 | 87 | 66 | 1.63 | 1.18 | | 265 | 254 | 60 | |
| 5 | 12:14 | 624.662 | 0.55 | 248 | 79 | 61 | 0.65 | 0.74 | | 266 | 250 | 61 | |
| 6 | 12:1630 | 625.644 | 0.10 | 232 | 76 | 60 | 0.12 | 0.32 | | 270 | 248 | 61 | ϕ |
| 7 | 12:19 | 625.871 | 0.08 | 230 | 71 | 60 | 0.10 | 0.28 | | 272 | 246 | 61 | |
| 8 | 12:2130 | 626.022 | 0.10 | 225 | 68 | 60 | 0.12 | 0.32 | | 268 | 244 | 60 | ϕ |
| End | 12:24 | 626.251 | | | | | | | | | | | |
| 8 1 | 12:25 | 626.251 | 0.10 | 238 | 66 | 59 | 0.12 | 0.32 | | 260 | 238 | 63 | ϕ |
| 7 2 | 12:2730 | 626.484 | 0.19 | 245 | 69 | 60 | 0.23 | 0.44 | | 264 | 242 | 61 | |
| 6 3 | 12:30 | 626.783 | 0.55 | 262 | 72 | 60 | 0.65 | 0.74 | | 270 | 254 | 58 | ϕ |
| 5 4 | 12:3230 | 627.543 | 0.97 | 271 | 76 | 61 | 1.15 | 0.98 | | 265 | 252 | 56 | |
| 4 5 | 12:35 | 628.736 | 1.85 | 278 | 82 | 62 | 2.20 | 1.36 | | 263 | 250 | 56 | 0.5 |
| 3 6 | 12:3730 | 630.541 | 3.2 | 283 | 86 | 62 | 3.7 | 1.79 | | 260 | 248 | 56 | |
| 2 7 | 12:40 | 632.862 | 4.6 | 284 | 96 | 60 | 5.36 | 2.44 | | 263 | 250 | 58 | |
| 1 8 | 12:4230 | 635.373 | 5.8 | 281 | 96 | 60 | 6.75 | 2.41 | | 265 | 254 | 58 | 7.5 |
| End | 12:45 | 637.834 | | | | | | | | | | | |
| 1 | 12:4730 | 637.834 | 6.8 | 277 | 79 | 61 | 7.87 | 2.61 | | 260 | 270 | 62 | 6.5 |
| 2 | 12:50 | 640.278 | 4.9 | 280 | 86 | 61 | 5.67 | 2.21 | | 272 | 263 | 64 | |
| 3 | 12:5230 | 642.747 | 3.5 | 282 | 92 | 62 | 4.05 | 1.87 | | 268 | 260 | 64 | 7.0 |
| 4 | 12:55 | 645.198 | 2.4 | 281 | 99 | 64 | 2.81 | 1.55 | | 264 | 256 | 63 | 6 |
| 5 | 12:5730 | 647.546 | 1.8 | 280 | 99 | 65 | 2.11 | 1.34 | | 260 | 252 | 63 | 2.5 |
| 6 | 13:00 | 649.951 | 0.85 | 278 | 91 | 67 | 0.99 | 0.92 | | 258 | 254 | 62 | 1 |
| 7 | 13:0230 | 651.142 | 0.32 | 269 | 85 | 65 | 0.37 | 0.56 | | 254 | 255 | 61 | ϕ |
| 8 | 1305 | 651.666 | 0.35 | 265 | 80 | 64 | 0.41 | 0.59 | | 250 | 256 | 60 | ϕ |
| End | 130730 | 652.132 | | | | | | | | | | | |
| | | 38.735 | | | | | | | | | | | |
| Averages | | | | 266.3 | 81 | 60 | 2.77 | 1.25 | | | | | |

(111)

away bottom

16

## VALID RESULTS , EPA Method 5: Particulate Air Emissions Test

| | |
|---|---|
| Client: | Associated Sand & Gravel |
| Date: | 11-10-93 |
| Operator: | T. Pierce |
| Plant Location: | Arlington, VA |
| Source: | Asphalt Plant #14 |
| Fuel Type: | Diesel |
| Load Rating: | ~250 tph |
| Barometric Pressure (Pbar): | 30.12 |
| Stack Equiv. Diameter (De): | 34.7" |
| Stack Moisture (%H2O): | 30 |
| Run #: | 3 |
| Pre-Test: Equipment Checklist: | RI |

| Equipment | Material | ID# | Cal Date | Value |
|---|---|---|---|---|
| Nozzle | SS | | 11/10/93 | Dn = 0.211" |
| Pitot Tube: | SS | | 11/8/93 | Cp = 0.84 |
| Stack TC: | SS Sheath | | 11/8/93 | Yd = 1.0334 |
| Meter: | | 1694716 | 10/25/93 | Delta H@= 1.9528 |
| Filter: | Glass fiber | 481036F | | |

| Impinger Weight Gain # | Vfinal | Vinitial | Net Gain | Charge Solution |
|---|---|---|---|---|
| 1 | 281.0 | 100 | 181 | DI $H_2O$ |
| 2 | 144.0 | 100 | 44 | DI $H_2O$ |
| 3 | 5.0 | 0 | 5 | |
| 4 | 281.6 | 254.5 | 27.1 | Silica Gel |

Probe Liner: 316 SS X, Pyrex Glass ___, Quartz Glass ___,

Total Moisture Gain = 257.1

| | |
|---|---|
| Standard Temperature (Tstd): | 528°R |
| Standard Pressure (Pstd): | 29.92 |
| Stack Static Pressure (Pstatic): | −1.8 |

Tracy A. Pierce ORSAT $O_2$ 11.5, 11.5, 11.4 leak✓ leak✓ $CO_2$ 6.9, 7.0, 6.9

VREPAM1,2 RI Sample Train Leak Check: Pre-Test 0.004 @ 15 "Hg, Post-Test 0.006 @ 13 "Hg

| Port ID# / Point # | Time: | Meter Value: | Pitot Tube Delta P | Stack Temp. Degrees F | Meter Temp. Tmin | Meter Temp. Tmout | Delta H | SQRT (Delta P) | CFM | Filter Temp | Probe Temp | Imping Temp | Pump Vacuum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14:25 30 | 673.613 | 7.6 | 270 | 73 | 57 | 7.22 | 2.76 | | 258 | 246 | 48 | 5.5 |
| 2 | 14:28 | 677.443 | 4.9 | 272 | 80 | 58 | 4.98 | 2.21 | | 272 | 242 | 48 | 6 |
| 3 | 14:30 30 | 680.228 | 3.0 | 268 | 85 | 58 | 3.05 | 1.73 | | 268 | 244 | 47 | 5.5 |
| 4 | 14:33 | 682.683 | 0.98 | 256 | 84 | 59 | 1.02 | 0.99 | | 264 | 248 | 47 | ϕ |
| 5 | 14:35 30 | 684.139 | 0.48 | 252 | 78 | 60 | 0.50 | 0.69 | | 260 | 252 | 48 | ϕ |
| 6 | 14:38 | 684.824 | 0.12 | 246 | 73 | 59 | 0.13 | 0.35 | | 262 | 256 | 50 | ϕ |
| 7 | 14:40 30 | 685.012 | 0.08 | 222 | 71 | 59 | 0.09 | 0.28 | | 265 | 258 | 51 | ϕ |
| 8 | 14:43 | 685.185 | 0.05 | 214 | 70 | 59 | 0.06 | 0.22 | | 263 | 260 | 53 | ϕ |
| End | 14:45 30 | 685.313 | | | | | | | | | | | |
| 8 | 14:47 | 685.313 | 0.05 | 208 | 67 | 58 | 0.06 | 0.22 | | 260 | 254 | 50 | ϕ |
| 7 | 14:49 30 | 685.436 | 0.10 | 212 | 69 | 58 | 0.11 | 0.32 | | 258 | 256 | 49 | ϕ |
| 6 | 14:52 | 685.618 | 0.15 | 226 | 70 | 56 | 0.17 | 0.39 | | 254 | 258 | 48 | ϕ |
| 5 | 14:54 30 | 685.863 | 0.27 | 225 | 72 | 56 | 0.31 | 0.52 | | 250 | 260 | 48 | ϕ |
| 4 | 14:57 | 686.246 | 0.86 | 223 | 77 | 56 | 0.92 | 0.93 | | 248 | 261 | 47 | ϕ |
| 3 | 14:59 30 | 687.88 | 3.2 | 224 | 90 | 54 | 3.41 | 1.79 | | 246 | 258 | 48 | ϕ |
| 2 | 15:02 | 690.014 | 5.3 | 232 | 97 | 55 | 5.64 | 2.30 | | 250 | 254 | 49 | 6 |
| 1 | 15:04 30 | 692.734 | 7.8 | 254 | 96 | 55 | 7.95 | 2.79 | | 255 | 249 | 51 | 6.5 |
| End | 15:07 | 696.245 | | | | | | | | | | | |
| 1 | 15:08 30 | 696.245 | 6.9 | 268 | 84 | 55 | 6.89 | 2.63 | | 255 | 250 | 50 | 6.5 |
| 2 | 15:11 | 699.963 | 6.0 | 267 | 93 | 55 | 5.99 | 2.45 | | 252 | 254 | 50 | 5.0 |
| 3 | 15:13 30 | 702.503 | 4.2 | 257 | 96 | 56 | 4.26 | 2.05 | | 250 | 258 | 49 | 3.5 |
| 4 | 15:16 | 705.097 | 2.8 | 249 | 98 | 57 | 2.92 | 1.67 | | 248 | 252 | 49 | 1.0 |
| 5 | 15:18 30 | 707.700 | 1.9 | 252 | 96 | 57 | 1.98 | 1.38 | | 248 | 250 | 50 | ϕ |
| 6 | 15:21 | 709.569 | 0.58 | 252 | 94 | 58 | 0.61 | 0.76 | | 256 | 244 | 51 | ϕ |
| 7 | 15:23 30 | 710.463 | 0.20 | 238 | 75 | 57 | 0.21 | 0.45 | | 258 | 240 | 51 | ϕ |
| 8 | 15:26 | 710.734 | 0.10 | 218 | 68 | 57 | 0.10 | 0.32 | | 260 | 239 | 51 | ϕ |
| End | 15:28 30 | 710.951 | | | | | | | | | | | |
| | | (37.338) | | | | | | | | | | | |
| Averages | | | | (241.7) | (81.3) | (57.0) | (2.57) | (1.258) | | | | | |

(69.7)

Valid Results: Asphalt Plant Operating Conditions during Source Test

Client: Associated Sand & Gravel

Location: Arlington

Plant Type: Drum Mixer

Manufacturer: Barber/Modified

Model #: 300

Constructed/Installed: 1979 / Mod 1989

Identification Number: BCE542

Date Last Tested: 8-4-92

Operating Personnel: Bill Doane

Process Rate: 200 TPH to 300 TPH

Discharge Temp: 304

Fuel Type: #2

Firing Rate: 1.8 gal/ton

A/C Injection Location: Drum Ends

Fines in Gravel ( < 200 mesh ): 6% +-

Gravel Moisture: 5%

Asphalt Type: AR4000W

Density ( lbs/gallon ): 8.5 @ 60°F

Flash Point: 475° +-

Fan Amperage: 175-198

Control Equipment:

Manufacturer: Standard Havens

Model: 211-2139

Serial Number: 93633

Bag Material: Nomex

Number of Bags: 608

Bag Size: 6 1/4 x 104 3/4

Date Bags Last Changed: 8-93

Air to Cloth Ratio: 5.22 : 1 @ 45K CFM

Type of Bag Cleaning: Pulse Jet

Baghouse Inlet Temp: 312°F

Baghouse Pressure Drop: 2" - 3"

Cleaning Cycle Duration: 5 MIN

Disposition of Collected Dust: 100% to Mix

Authorized Plant Operator Signature:

William S Doane

## APPENDIX C:

Laboratory Data Sheets:

| |
|---|
| Sample Weight Gain Summary |
| Sample Chain of Custody |
| Gravimetric Sample Analysis |

## VALID RESULTS: EPA Method 5 Sample Weight Gain Summary Data Sheet

Client: Associated Sand and Gravel
Test Date: 11/10/93
Plant Location: Arlington, WA
Source: Asphalt Plant #14
Recovery Date: 11/11/93
Analysis Date: 11/18/93-12/1/93

Total and Front Half Particulate Sample Weight Gain Summary

| | Run 1 | | Run 2 | | Run 3 | | Run 4 | |
|---|---|---|---|---|---|---|---|---|
| Total Particulate | 47.8 | mg | 73.6 | mg | 40.5 | mg | -1.2 | mg |
| Front Half Particulate | 29.3 | mg | 65.9 | mg | 36.9 | mg | -0.3 | mg |

Particulate Sample Weight Gain Summary

| | Run 1 | | Run 2 | | Run 3 | | Run 4 | |
|---|---|---|---|---|---|---|---|---|
| Front Half Acetone | 18.5 | mg | 26.5 | mg | 19.0 | mg | -0.2 | mg |
| Front Half Filter | 10.5 | mg | 39.1 | mg | 17.6 | mg | -0.1 | mg |
| Back Half Organic 1 | 7.4 | mg | 1.9 | mg | -0.3 | mg | -0.25 | mg |
| Back Half Organic 2 | 2.0 | mg | 2.2 | mg | 0.0 | mg | -0.25 | mg |
| Back Half Water | 7.5 | mg | 3.1 | mg | 2.7 | mg | | |
| Back Half Acetone | 0.7 | mg | -0.4 | mg | 0.3 | mg | -0.4 | mg |
| Blank Correction | 1.2 | mg | 1.2 | mg | 1.2 | mg | | |

Back Half Water Sample Particulate Weight Gain (Volume Correction)

| | Run 1 | | Run 2 | | Run 3 | | Run 4 | |
|---|---|---|---|---|---|---|---|---|
| Aliquot Weight Gain | 2.2 | mg | 0.8 | mg | 0.8 | mg | 0.3 | mg |
| Aliquot Volume | 110 | ml | 110 | ml | 110 | ml | 110 | ml |
| Net Weight Gain | 1.9 | mg | 0.5 | mg | 0.5 | mg | | |
| Total Volume | 431.5 | ml | 671.5 | ml | 589 | ml | | |
| Total Weight Gain | 7.45 | mg | 3.05 | mg | 2.68 | mg | | |

# VALID RESULTS: Air Emission Sample - Chain of Custody



5223 22nd Ave. N.E., Unit B
Seattle, WA 98105
(206) 522-5665

Project Manager: Tracy Prevo
Laboratory Name: Best Environmental, Inc.

Client: Associated Sand & Gravel Company, Inc.
Location: Arlington, WA
Source: Asphalt Baghouse
Test Method: EPA Method 5
Instructions: See attached note

| Sample Identification | Date Tested | Volume | Preservative | Analysis | Special |
|---|---|---|---|---|---|
| R1M5FH Acetone | 11-10-93 | DRY | NONE | EPA M5 | |
| R2 " | | | | | |
| R3 " | | | | | |
| R4 " | | | | | |
| R1 M5 Filter | | | | | |
| R2 " | | | | | |
| R3 " | | | | | |
| R4 " | | | | | |
| R1M5BH ORGanic 1 | | | | | |
| R2 " | | | | | |
| R3 " | | | | | |
| R4 " | | | | | |
| R1 M5 BH ORGanic 2 | | | | | |
| R2 " | | | | | |
| R3 " | | | | | |
| R1M5BH $H_2O$ | | 110 ml | | | evaporate |
| R2 " | | | | | |
| R3 " | | | | | |
| R4 " | | | | | |
| R1M5BH Acetone | | 110ml | | | |
| R2 " | | | | | |
| R3 " | | | | | |
| R4 " | | | | | |
| | | | | | |

| Relinquished By: | Date: | Time: | Received By: |
|---|---|---|---|
| Tracy Prevo | 11-15-93 | @1500 | Michael J. Wiley |

| Relinquished By: | Date: | Time: | Received By: |
|---|---|---|---|
| | | | |

VALID RESULTS: Gravimetric Sample Analysis - Aluminum Weighing Tins

| Client | Sampling Date | Sample ID | Media ID | Weight Date Initial | Initial Weights | Weight Date Final | Final Weights | Net Weight Gain (Final - Initial) | Total Volume |
|---|---|---|---|---|---|---|---|---|---|
| Associated Sand & Gravel Arlington | 11-10-93 | R1M5FH Acetone Front Half | T328 | 10/18/93 | 2.2994 | 11/18/93 | 2.3178 | 18.5mg | 95ml |
| | | | | 10/20/93 | 2.2994 | 11/22/93 | 2.3181 | | |
| | | | | | | 11/24/93 | 2.3177 | | |
| <Averages> | | | | | < 2.2994 > | | < 2.3179 > | | |
| AS:6 Arlington | 11-10-93 | R2M5FHAcetone | T329 | 10/18/93 | 2.2865 | 11/18/93 | 2.3131 | 26.5mg | 100ml |
| | | | | 10/20/93 | 2.2866 | 11/22/93 | 2.3131 | | |
| | | | | | | 11/24/93 | 2.3130 | | |
| <Averages> | | | | | < 2.2866 > | | < 2.3131 > | | |
| AS:6 Arlington | 11-10-93 | R3M5FHAcetone | T330 | 10/18/93 | 2.2854 | 11/18/93 | 2.3045 | 19.0mg | 110ml |
| | | | | 10/20/93 | 2.2855 | 11/22/93 | 2.3046 | | |
| | | | | | | 11/24/93 | 2.3044 | | |
| <Averages> | | | | | < 2.2855 > | | < 2.3045 > | | |
| AS:6 Arlington | 11-10-93 | R4M5FHAcetone | T331 | 10/18/93 | 2.2749 | 11/18/93 | 2.2748 | -0.2mg | 100ml |
| | | | | 10/20/93 | 2.2751 | 11/22/93 | 2.2748 | | |
| | | | | | | 11/24/93 | 2.2748 | | |
| <Averages> | | | | | < 2.2750 > | | < 2.2748 > | | |

VALiD RESULTS: Gravimetric Sample Analysis - 102 mm Glass Fiber Filters

| Client | Sampling Date | Sample ID | Media ID | Weight Date Initial | Initial Weights | Weight Date Final | Final Weights | Net Weight Gain (Final - Initial) | Total Volume |
|---|---|---|---|---|---|---|---|---|---|
| Associated Sand & Gravel - Arlington | 11-10-93 | R1M5 Filter<br>Filter | VR101GF | 10/22/93 | 0.5865 | 11/18/93 | 0.5972 | 10.5 | NA |
| | | | | 10/25/93 | 0.5866 | 11/22/93 | 0.5972 | | |
| | | | | | | 11/24/93 | 0.5968 | | |
| | | | | | | 11/29/93 | 0.5971 | | |
| <Averages> | | | | | < 0.5866 > | | < 0.5971 > | | |
| AS:6 Arlington | 11-10-93 | R2M5 Filter | VR102GF | 10/22/93 | 0.5825 | 11/18/93 | 0.6217 | 39.1 | NA |
| | | | | 10/25/93 | 0.5825 | 11/22/93 | 0.6217 | | |
| | | | | | | 11/24/93 | 0.6214 | | |
| | | | | | | 11/29/93 | 0.6216 | | |
| <Averages> | | | | | < 0.5825 > | | < 0.6216 > | | |
| AS:6 Arlington | 11-10-93 | R3M5 Filter | VR103GF | 10/22/93 | 0.5823 | 11/18/93 | 0.6000 | 17.6mg | NA |
| | | | | 10/25/93 | 0.5823 | 11/22/93 | 0.5999 | | |
| | | | | | | 11/24/93 | 0.5999 | | |
| | | | | | | 11/29/93 | 0.6000 | | |
| <Averages> | | | | | < 0.5823 > | | < 0.5999 > | | |
| AS:6 Arlington | 11-10-93 | R4M5 Filter | VR104GF | 10/22/93 | 0.5856 | 11/18/93 | 0.5855 | -0.1mg | NA |
| | | | | 10/25/93 | 0.5855 | 11/22/93 | 0.5856 | | |
| | | | | | | 11/24/93 | 0.5854 | | |
| | | | | | | 11/29/93 | ~~0.5855~~ 0.5857 | | |
| <Averages> | | | | | < 0.5856 > | | < 0.5855 > | | |

VALID RESULTS: Gravimetric Sample Analysis - Aluminum Weighing Tins

| Client | Sampling Date | Sample ID | Media ID | Weight Date Initial | Initial Weights | Weight Date Final | Final Weights | Net Weight Gain (Final - Initial) | Total Volume |
|---|---|---|---|---|---|---|---|---|---|
| Associated S:6 - Arlington | 11-10-93 | R1M5BH0RG1 (Back Ave First Extraction) | T332 | 10/18/93 | 2.2827 | 11/18/93 | 2.2903 | 7.4 mg | 100.0ml |
| | | | | 10/20/93 | 2.2829 | 11/22/93 | 2.2903 | | |
| | | | | | | 11/24/93 | 2.2900 | | |
| | | | | | | 11/29/93 | 2.2902 | | |
| <Averages> | | | | | < 2.2828 > | | < 2.2902 > | | |
| AS:6 - Arlington | 11-10-93 | R2M5BH0RG1 | T333 | 10/18/93 | 2.2602 | 11/18/93 | 2.2623 | 1.9 mg | 100.0ml |
| | | | | 10/20/93 | 2.2603 | 11/22/93 | 2.2622 | | |
| | | | | | | 11/24/93 | 2.2622 | | |
| <Averages> | | | | | < 2.2603 > | | < 2.2622 > | | |
| AS:6 - Arlington | 11-10-93 | R3M5BH0RG1 | T334 | 10/18/93 | 2.2701 | 11/18/93 | 2.2701 | -0.3 mg | 100.0ml |
| | | | | 10/20/93 | 2.2702 | 11/22/93 | 2.2699 | | |
| | | | | | | 11/24/93 | 2.2698 | | |
| <Averages> | | | | | < 2.2702 > | | < 2.2699 > | | |
| AS:6 Arlington | 11-10-93 | R4M5BH0RG1 | T335 | 10/18/93 | 2.2592 | ~~11/18/93~~ | ~~2.2610~~ | -0.5 mg | 200.0ml |
| | | | | 10/20/93 | 2.2594 | 11/22/93 | 2.2588 | | |
| | | | | | | 11/24/93 | 2.2587 | | |
| | | | | | | 11/29/93 | 2.2589 | | |
| <Averages> | | | | | < 2.2593 > | | < 2.2588 > | | |

VALID RESULTS: Gravimetric Sample Analysis - Aluminum Weighing Tins

| Client | Sampling Date | Sample ID | Media ID | Weight Date Initial | Initial Weights | Weight Date Final | Final Weights | Net Weight Gain (Final - Initial) | Total Volume |
|---|---|---|---|---|---|---|---|---|---|
| Associated Sand: Gravel - Arlington | 11-10-93 | R1M5BH0R62<br>Back½ 2nd Extraction | T336 | 10/18/93 | 2.2192 | 11/18/93 | 2.2215 | 2.0 mg | 100.0 ml |
| | | | | 10/20/93 | 2.2193 | 11/22/93 | 2.2213 | | |
| | | | | | | 11/24/93 | 2.2211 | | |
| | | | | | | 11/29/93 | 2.2213 | | |
| <Averages> | | | | | < 2.2193 > | | < 2.2213 > | | |
| AS: 6 Arlington | 11-10-93 | R2M5BH0R62 | T337 | 10/18/93 | 2.2476 | 11/18/93 | 2.2501 | 2.2 mg | 100.0 ml |
| | | | | 10/20/93 | 2.2477 | 11/22/93 | 2.2498 | | |
| | | | | | | 11/24/93 | 2.2497 | | |
| <Averages> | | | | | < 2.2477 > | | < 2.2499 > | | |
| AS: 6 - Arlington | 11-10-93 | R3M5BH0R62 | T338 | 10/18/93 | 2.2523 | 11/18/93 | 2.2660 | 0.0 mg | 100.0 ml |
| | | | | 10/20/93 | 2.2524 | 11/22/93 | 2.2525 | | |
| | | | | | | 11/24/93 | 2.2523 | | |
| <Averages> | | | | | < 2.2524 > | | < 2.2524 > | | |
| | | | | | | | | | |
| <Averages> | | | | | < > | | < > | | |

VALID RESULTS: Gravimetric Sample Analysis - Aluminum Weighing Tins

| Client | Sampling Date | Sample ID | Media ID | Weight Date Initial | Initial Weights | Weight Date Final | Final Weights | Net Weight Gain (Final - Initial) | Total Volume |
|---|---|---|---|---|---|---|---|---|---|
| Associated Sand & Gravel - Arlington | 11-10-93 | R1M5BH Acetone | T372 | 11/23/93 | 2.2931 | 11/29/93 | 2.2937 | 0.7 mg | 110 ml |
| | | | | 11/24/93 | 2.2931 | 11/30/93 | 2.2938 | | |
| | | | | | | 12/1/93 | 2.2938 | | |
| <Averages> | | | | | < 2.2931 > | | < 2.2938 > | | |
| AS:6 Arlington | 11-10-93 | R2M5BH Acetone | T373 | 11/23/93 | 2.2618 | 11/29/93 | 2.2615 | -0.4 mg | 110 ml |
| | | | | 11/24/93 | 2.2619 | 11/30/93 | 2.2616 | | |
| | | | | | | 12/1/93 | 2.2615 | | |
| <Averages> | | | | | < 2.2619 > | | < 2.2615 > | | |
| AS:6 Arlington | 11-10-93 | R3M5BH Acetone | T374 | 11/23/93 | 2.2630 | 11/29/93 | 2.2633 | 0.3 mg | 110 ml |
| | | | | 11/24/93 | 2.2630 | 11/30/93 | 2.2633 | | |
| | | | | | | 12/1/93 | 2.2632 | | |
| <Averages> | | | | | < 2.2630 > | | < 2.2633 > | | |
| AS:6 Arlington | 11-10-93 | R4M5BH Acetone | T375 | 11/23/93 | 2.2600 | 11/29/93 | 2.2597 | -0.4 mg | 110 ml |
| | | | | 11/24/93 | 2.2600 | 11/30/93 | 2.2596 | | |
| | | | | | | 12/1/93 | 2.2596 | | |
| <Averages> | | | | | < 2.2600 > | | < 2.2596 > | | |

VALID RESULTS: Gravimetric Sample Analysis - Aluminum Weighing Tins

| Client | Sampling Date | Sample ID | Media ID | Weight Date Initial | Initial Weights | Weight Date Final | Final Weights | Net Weight Gain (Final - Initial) | Total Volume |
|---|---|---|---|---|---|---|---|---|---|
| Associated Sand: Gravel Arlington | 11-10-93 | R1M5BHH$_2$O Rack 4 water (Ivory) | T368 | 11/23/93 | 2.2284 | | 2.2308 | 2.2 mg | 431.5mL (100mL Aliquot) |
| | | | | 11/24/93 | 2.2286 | | 2.2307 | | |
| | | | | | | | 2.2307 | | |
| <Averages> | | | | | < 2.2285 > | | < 2.2307 > | 1.9 net × 431.5mL/100 = 8.2mg | |
| Associated Sand: Gravel Arlington | 11-10-93 | R2M5BHH$_2$O | T369 | 11/23/93 | 2.2478 | | 2.2487 | 0.8 mg | 671.5mL (100mL Aliquot) |
| | | | | 11/24/93 | 2.2479 | | 2.2488 | | |
| | | | | | | | 2.2487 | | |
| <Averages> | | | | | < 2.2479 > | | < 2.2487 > | 0.5 net × 671.5mL/100 = 3.4mg | |
| Associated Sand: Gravel Arlington | 11-10-93 | R3M5BHH$_2$O | T370 | 11/23/93 | 2.3027 | | 2.3037 | 0.8 mg | 589.0mL (100mL Aliquot) |
| | | | | 11/24/93 | 2.3028 | | 2.3036 | | |
| | | | | | | | 2.3036 | | |
| <Averages> | | | | | < 2.3028 > | | < 2.3036 > | 0.5net × 589mL/100 = 2.9mg | |
| Associated Sand: Gravel Arlington | 11-10-93 | R4M5BHH$_2$O | T371 | 11/23/93 | 2.3011 | | 2.3016 | 0.3 mg | (100mL Aliquot) |
| | | | | 11/24/93 | 2.3012 | | 2.3015 | | |
| | | | | | | | 2.3015 | | |
| <Averages> | | | | | < 2.3012 > | | < 2.3015 > | | |

## APPENDIX D:

Quality Assurance:

| |
|---|
| M5 Equipment Preparation |
| SI:414 Certificate of Completion |

## VALID RESULTS, EPA Method 5: Particulate Air Emissions Pre-Test Equipment Checklist

Client: Associated Sand & Gravel
Date: 11-9-93
Preparer: T. Provo
Plant Location: Arlington, WA
Source: Asphalt Plant #14

| | | | | |
|---|---|---|---|---|
| Nozzles: | Material | SS | Size | 5x |
| Probe Liner | Material | SS | Length | 48" |
| Tared Filters | Material | glass fibre | Number | 8x |
| Filter Holders | Material | glass | Number | 3x |
| Filter Frit | Material | glass | Number | 3x |

Personal Protective Equipment:

| | |
|---|---|
| Hard Hat | ✓ |
| Steel Toe Boots | ✓ |
| Gloves | ✓ |
| Hot Gloves | ✓ |
| Respirator | ✓ |
| Ear Plugs | ✓ |
| Safety Glasses | ✓ |
| Coveralls | ✓ |
| Rain Gear | ✓ |

Sample Recovery:

| | |
|---|---|
| Triple Beam Balance | ✓ |
| Graduated Cylinder | ✓ |
| Distilled Water | ✓ |
| Acetone | ✓ |
| Probe Brush | ✓ |
| Nozzle Brush | ✓ |
| Sample Jars | ✓ |
| Aluminum Foil | ✓ |
| Parafilm | ✓ |

| | | |
|---|---|---|
| Field Data Sheets | 3x M1,2 | ✓ |
| Field Data Sheets | 7x M5 | ✓ |
| Calculator - Isokinetics Program | | ✓ |
| Clip Board, Pens | | ✓ |
| Heated Filter Box | Number | 2 |
| Probe Stand | Number | N/A |
| Heated Sample Line | Length | 48" |
| Umbilical | Length | 50' |
| Impinger Buckets | Number | 1x |
| Sample Pump | Type | Teflon Head Dia |
| Dry Gas Meter | Yd | 1.0334 |
| Critical Orifice | Delta H@ | 1.9528 |
| Dual Slant Tube Manometer | Range | 0-10" |
| Thermocouple Readout | Number | TC5A |
| Variac Heat Controllers | Number | 3x |
| Plug Strips | Number | 2x |
| 100' Extension Cords | Number | 3x |
| 15' Extension Cords | Number | 3x |
| Rope | Length | 50' |
| Ice Chests | Number | 3x |
| Ice | Number | 6bags |
| Tared Silica Gels | Number | 6x |
| ~~Probe Stand~~ | ~~Number~~ | |
| Unirails | Length | N/A |
| Port Adaptors | Type | None |
| Tarps | Number | 2x |
| Tedlar Bags | Number | 4x |
| White Out | | ✓ |
| Misc. Tubing | | ✓ |
| Glass Tape | | ✓ |
| Huge Pipe Wrench | | ✓ |
| Tool Bucket | | ✓ |

EPA

United States
Environmental Protection Agency

# Air Pollution Training Institute

## Tracy Allen Prevo

**has successfully completed**

**COURSE # SI:414**
**QUALITY ASSURANCE FOR SOURCE EMISSION MEASUREMENTS**

Lonnie E. Townsend

**Chief, Air Pollution Training Branch**

apti

Jennifer Dunn

**Registrar**

**03-26-93** **3.5 CEU**

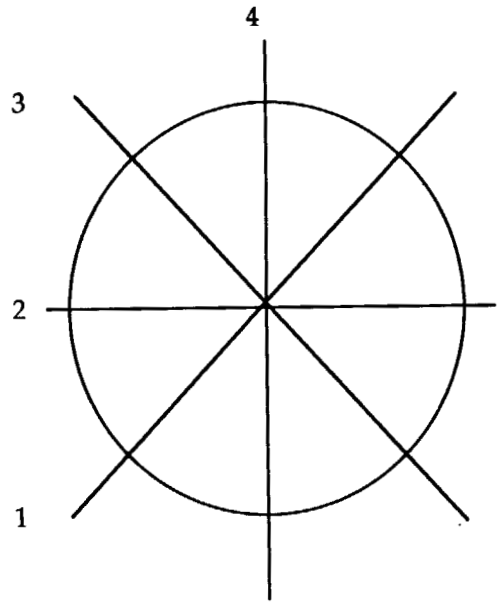
## APPENDIX E:

Calibrations

| |
|---|
| Nozzle |
| Pitot Tube |
| Pitot Tube-Nozzle Alignment |
| Type K Thermocouple |
| Thermocouple Readout |
| Dry gas meter and Critical Orifice |

## VALID RESULTS: Nozzle Calibration Data Form

| | |
|---|---|
| Date: | 11-8-93 |
| Operator: | T. Prevo |
| Nozzle Type: | 316 SS |
| Nozzle ID: | SS-5A |
| Ambient Temperature: | 54°F |

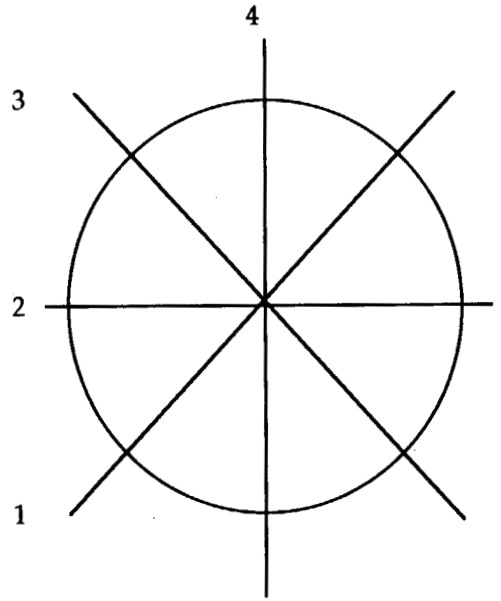



Measured Nozzle Diameters:

| | |
|---|---|
| D1 = | 0.174" |
| D2 = | 0.173" |
| D3 = | 0.174" |
| D4 = | 0.174" |
| Average | < 0.174" > |

## VALID RESULTS: Nozzle Calibration Data Form

| | |
|---|---|
| Date: | 11-8-93 |
| Operator: | T. Prevo |
| Nozzle Type: | 316 ss |
| Nozzle ID: | SS-7A |
| Ambient Temperature: | 54° F |

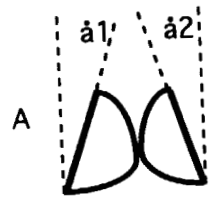



Measured Nozzle Diameters:

| | |
|---|---|
| D1 = | 0.211" |
| D2 = | 0.211" |
| D3 = | 0.210" |
| D4 = | 0.211" |
| Average | < 0.211" > |

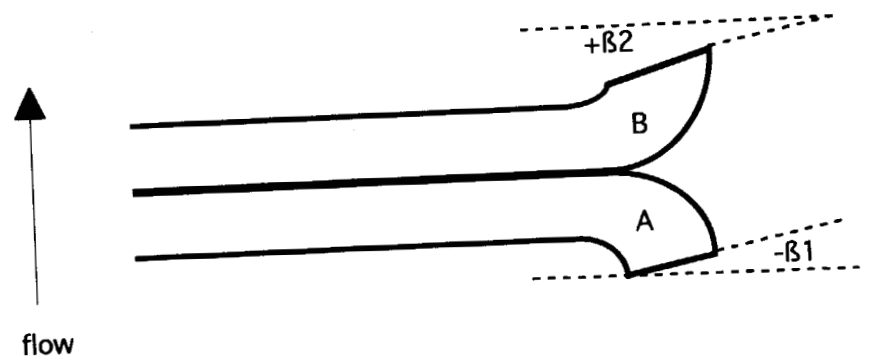
## VALID RESULTS: Pitot Tube Calibration Data Form

Date: 11-8-93
Operator: T. Pavo
Pitot Tube ID: 48"A



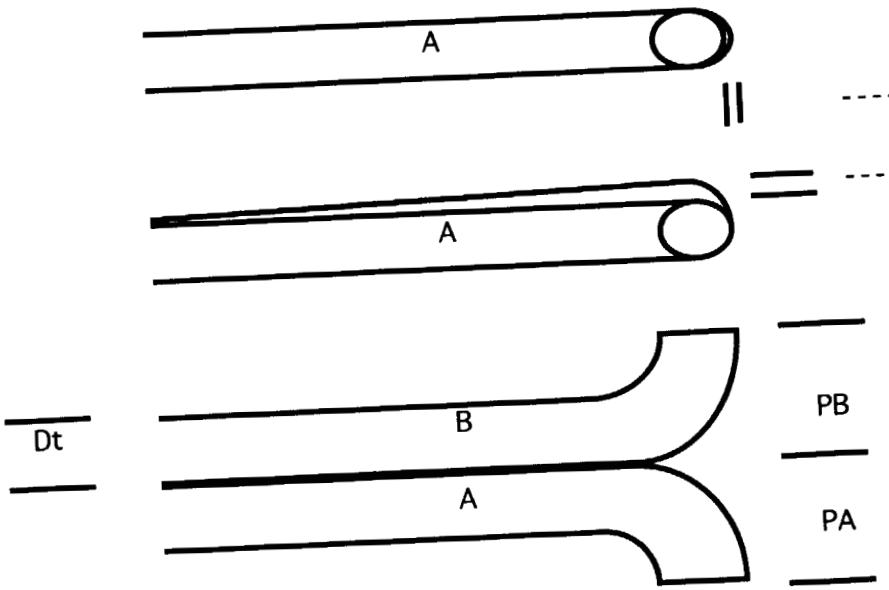

å1 = 1° < 10°

å2 = 0° < 10°




ß2 = 0° < 5°

ß1 = 0° < 5°




Z = 0" <= 1/8"

W = 0" <= 1/32"

Dt = 0.389" 1.05*Dt <= P <= 1.50*Dt

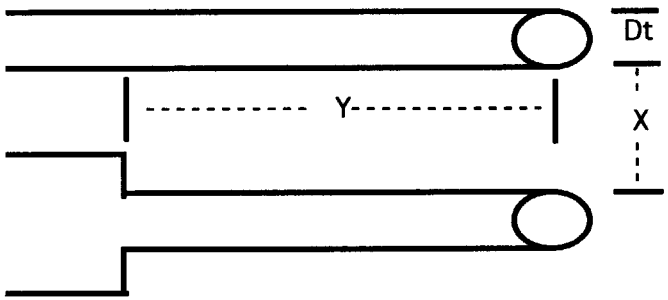
PB = 0.485" ✓

PA =PB

PA = 0.485"

## VALID RESULTS: Pitot Tube Nozzle Alignment Calibration Data Form

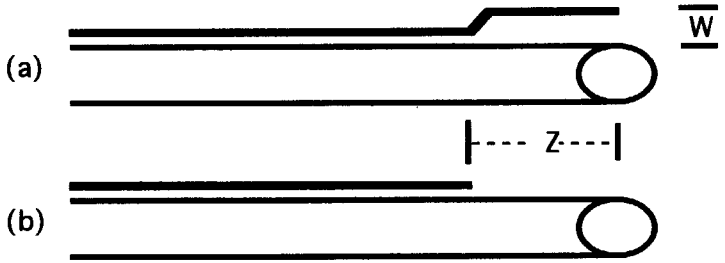
Date: 11-9-93
Operator: T. Pinero
Probe ID: 48"
Pitot Tube ID: 48"A
Nozzle ID: VR 555A




Dt = 0.389" 3/16" <= Dt <= 3/8"

X = 0.762" >= 3/4" for Dn = 1/2"

Y = 3" >= 3"




W = N/A >= 3/4"

Za = N/A >= 3"

Zb = 2 1/8" >= 2"

Nozzle opening even with or in front of pitot tube opening? ✓

## VALID RESULTS: Type-K Thermocouple Calibration Data Form

Date: 11-8-93
Operator: T. Provo
Reference Thermometer: Mercury
Barometric Pressure: 31.00
Ambient Temperature: 54°F

| Thermocouple # | Identification | Reference Point | Thermocouple Reading | Reference Thermometer Reading | % Difference |
|---|---|---|---|---|---|
| 1-A-48 | Stack | Ice Water | 32 | 32 | ϕ |
| | | Boiling Water | 214 | 214 | ϕ |
| | | Boiling Oil | 322 | 322 | ϕ |
| 2-A-48 | Probe | Ice Water | 32 | 32 | ϕ |
| | | Boiling Water | 214 | 214 | ϕ |
| | | Boiling Oil | | | |
| 3-A | Filter | Ice Water | 32 | 32 | ϕ |
| | | Boiling Water | 214 | 215 | 0.47 |
| | | Boiling Oil | | | |
| 4-A | Imp. Out | Ice Water | 32 | 32 | ϕ |
| | | Boiling Water | 214 | 214 | ϕ |
| | | Boiling Oil | | | |
| 5-A | Meter In | Ice Water | 32 | 32 | ϕ |
| | | Boiling Water | 214 | 215 | 0.47 |
| | | Boiling Oil | | | |
| 6-A | Meter Out | Ice Water | 32 | 32 | ϕ |
| | | Boiling Water | 214 | 214 | ϕ |
| | | Boiling Oil | | | |

# APPENDIX F:

Example Calculation (Run 2)

## Particulate Air Emission Rates Example Calculation Sheet

Client: Associated Sand and Gravel
Test Date: November 10, 1993
Location: Arlington, WA
Source: Asphalt Plant #14
Test Run #: 2

pounds per hour = (0.0282 grains/dscf)*(24,537 dscf/min)*(60 min/hr)/(7000 grains/pound) = 5.92 (lbs/hr)

grains per dry standard cubic foot = ((73.6 mg)/(40.332 Vm(std)))*(15.43 grains/gm)*(0.001 gm/mg) = 0.0282 (grains/dscf)

standard meter volume = (38.735 Vm)*(1.0334 Y)*(30.32 Pm)*(528 Tstd)/((29.92 Pstd)*(531.1 Tm)) = 40.332 (dscf)

stack gas flow rate = 60*(91.11 Vs)*(8.444 As)*(528 Tstd)*(29.99 Ps)*( 1 - 0.2705 Bws)/((726.3 Ts)*(29.92 Pstd)) =

24,537 (dscf/min)

stack gas velocity = 85.49*(0.84 Cp)*(1.325 <SQRT(DeltaP)>)*SQRT((726.3 Ts)/((29.99 Ps)*(26.41 Ms))) = 91.11 (feet/sec)

molecular weight wet = (29.532 Md)*( 1 - 0.2705 Bws) + 18.0*(0.2705 Bws) = 26.41 (gm/gm-mole)

molecular weight dry = 0.44*(6.6 %CO2) + 0.32*(11.9 %O2) + 0.28*( 100 - ((6.6 %CO2) + (11.9 %O2)) = 29.532 (gm/gm-mole)

stack gas moisture content = (14.952 Vwc(std))/((14.952 Vwc(std) + (40.332 Vm(std)) = 0.2705 ( %/100)

standard water volume = 0.04707*(285.5 Imp ml) + 0.04715*(32.1 Silica ml) = 14.952 (dscf)

milligrams per dry standard cubic meter = (35.31 dscf/dscm)*(73.6 mg)/(40.332 Vm(std)) = 64.4 (mg/dscm)

actual cubic feet per minute = (60 sec/minute)*(91.11 Vs)*(8.444 As) = 46,160 (acfm)