July 1999

Environmental Technology Verification Report

Paint Overspray Arrestor
Columbus Industries Inc.
SL-90B 8 Pocket Bag

Prepared by

RTI

Research Triangle Institute

Under a Cooperative Agreement with

EPA U.S. Environmental Protection Agency

ETV ETV ETV

July 1999

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Paint Overspray Arrestor

Columbus Industries Inc. SL-90B 8 Pocket Bag

Prepared by

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EPA Cooperative Agreement CR 826152-01-1

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Notice

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Office of Research and Development

Washington, D.C. 20460

ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM VERIFICATION STATEMENT

TECHNOLOGY TYPE:	**PAINT OVERSPRAY ARRESTOR**		
APPLICATION:	**CONTROL OF PARTICLE EMISSIONS FROM AEROSPACE PAINT SPRAYING FACILITIES**		
TECHNOLOGY NAME:	**SL-90B 8 Pocket Bag**		
COMPANY:	**Columbus Industries Inc.**		
ADDRESS:	**2938 State Route 752** **Ashville, OH 43103**	**PHONE:** **FAX:**	**(740) 983-2552** **(740) 983-4622**
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PROGRAM DESCRIPTION

The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high quality, peer reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups which consist of buyers, vendor organizations and permitters, and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The Air Pollution Control Technology (APCT) program, one of 12 technology areas under ETV, is operated by the Research Triangle Institute (RTI), in cooperation with EPA's National Risk Management Research Laboratory. APCT has recently evaluated the performance of paint overspray arrestors used primarily in the aerospace industry. This verification statement provides a summary of the test results for the Columbus Industries Inc. SL-90B 8 Pocket Bag.

VERIFICATION TEST DESCRIPTION

All tests were performed in accordance with the APCT "Generic Verification Protocol for Paint Overspray Arrestors." The protocol incorporates all requirements of EPA Method 319: Determination of Filtration Efficiency for Paint Overspray Arrestors. [Method 319 is part of the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Aerospace Manufacturing and Rework Facilities and was published in the *Federal Register* on March 27, 1998 (40 CFR Part 63).] The protocol also includes requirements for quality management, quality assurance, procedures for product selection, auditing of the test laboratories, and test reporting format.

Filtration efficiency is computed from aerosol concentrations measured upstream and downstream of an arrestor installed in a laboratory test rig. The aerosol concentrations upstream and downstream of the arrestor are measured with an aerosol analyzer that simultaneously counts and sizes the particles in the aerosol stream. The aerosol analyzer covers the particle diameter size range from 0.3 to 10 µm in a series of contiguous sizing channels. Each sizing channel covers a narrow range of particle diameters. By taking the ratio of the downstream to upstream counts on a channel by channel basis, the filtration efficiency is computed for each of the sizing channels.

The following series of tests were performed at a face velocity of 120 fpm (0.61 m/s):

- Three arrestors were tested using a liquid-phase aerosol challenge,
- Three arrestors were tested using a solid-phase aerosol challenge,
- Six "no-filter" control tests (one performed prior to each arrestor test),
- One high efficiency particulate air (HEPA) filter control test, and
- One reference filter control test.

TECHNOLOGY DESCRIPTION

The Columbus SL-90B 8 Pocket Bag arrestor is an eight-pocket bag filter with nominal dimensions of 24 x 24 x 21 in. (0.61 x 0.61 x 0.53 m). The arrestor has a metal frame, and the filter media color is yellow. The label is white, ½ x 3 ½ in. (1.27 x 8.89 cm) in size, and is affixed to the metal frame. The label includes the following information: Columbus Industries, SL-90B, Sept. 30, 1998. There is no label indication of the flow direction or filter orientation, so the industry standard orientation with the bags extended horizontally in the direction of the airflow and the individual bags side-by-side, as opposed to stacked vertically, was used in the tests.

VERIFICATION OF PERFORMANCE

Verification testing of the arrestor was performed from March 23 through 24, 1999, at the test facilities of RTI. For ready comparison, the filtration efficiency requirements of the NESHAP are tabulated with the test results in Tables 1 through 4. The test results indicate that the tested arrestor exceeded the requirements listed in Tables 1 and 2 for existing sources and those listed in Tables 3 and 4 for new sources. The pressure drop across the tested arrestors at 120 fpm (0.61 m/s) ranged from 0.10 to 0.12 in. H_2O (25 to 30 Pa) for the six arrestors tested.

The APCT quality assurance officer has reviewed the test results and the quality control data and has concluded that the data quality objectives given in the generic verification protocol have been attained.

This verification statement addresses two aspects of paint overspray arrestor performance: filtration efficiency and pressure drop. Users of this technology may wish to consider other performance parameters such as service life and cost when selecting a paint overspray arrestor for their use.

In accordance with the generic verification protocol, this verification report is valid for 12 months after the publication date 8/11/99.

Paint Overspray Arrestor Brand/Model: Columbus SL-90B 8 Pocket Bag

TABLE 1. EXISTING SOURCES*:
LIQUID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 5.7	> 90	>99
> 4.1	> 50	>99
> 2.2	> 10	99

TABLE 2. EXISTING SOURCES*:
SOLID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 8.1	> 90	>99
> 5.0	> 50	>99
> 2.6	> 10	99

TABLE 3. NEW SOURCES*:
LIQUID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 2.0	> 95	99
> 1.0	> 80	94
> 0.42	> 65	87

TABLE 4. NEW SOURCES*:
SOLID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 2.5	> 95	99
> 1.1	> 85	97
> 0.70	> 75	95

*A new source is any affected source that commenced construction after October 29, 1996. An existing source is any affected source that is not new.

Original Signed By
E. Timothy Oppelt
7/27/99

E. Timothy Oppelt Date
Director
National Risk Management Research Laboratory
Office of Research and Development
United States Environmental Protection Agency

Original Signed By
Jack R. Farmer
7/29/99

Jack R. Farmer Date
Program Manager,
Air Pollution Control Technology Program
Research Triangle Institute

NOTICE: EPA verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA and RTI make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of commercial product names does not imply endorsement.

Availability of Verification Statement and Report

Copies of the public Verification Statement and Verification Report are available from the following:

1. **Research Triangle Institute**
   P.O. Box 12194
   Research Triangle Park, NC 27709-2194

   Web site: http://etv.rti.org/apct/index.html
   or http://www.epa.gov/etv *(click on partners)*

2. **USEPA / APPCD**
   MD-4
   Research Triangle Park, NC 27711

   Web site: http://www.epa.gov/etv/library.htm *(electronic copy)*
   http://www.epa.gov/ncepihom/

Abstract

Paint overspray arrestors (POAs) were evaluated by the Air Pollution Control Technology (APCT) pilot of the Environmental Technology Verification (ETV) Program. The performance factor verified was the particle filtration efficiency as a function of size for particles smaller than 10 µm. The APCT ETV Program developed a generic verification protocol for testing filtration efficiency that is based on EPA Method 319. The protocol was developed by RTI, reviewed by a technical panel of experts, and approved by EPA. The protocol addresses several issues that Method 319 does not cover, including periodic testing, acquisition of POAs for testing, and product definition. A Test/Quality Assurance Plan was prepared which addresses the test procedure and quality assurance and quality control requirements for obtaining verification data of sufficient quantity and quality to satisfy the data quality objectives.

RTI performed tests on Columbus Industries Inc.'s SL-90B 8 Pocket Bag during the period March 23-24, 1999. Filter efficiencies were determined. For ready comparison, the filtration efficiency requirements of the National Emission Standards for Hazardous Air Pollutants (NESHAP) are tabulated with the test results. The results indicate that the SL-90B 8 Pocket Bag exceeded the NESHAP requirements for new and existing sources.

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List of Abbreviations and Acronyms

APCT	Air Pollution Control Technology
APPCD	Air Pollution Prevention and Control Division
cfm	cubic feet per minute
cm	centimeter
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
ETV	Environmental Technology Verification
ETVR	Environmental Technology Verification Report
fpm	feet per minute
HEPA	high efficiency particulate air
in.	inch
mm	millimeter
m/s	meters per second
NESHAP	National Emission Standards for Hazardous Air Pollutants
Pa	pascal
POA	paint overspray arrestor
QA	quality assurance
RTI	Research Triangle Institute
µm	micrometer

Acknowledgments

RTI acknowledges the support of all those who helped plan and conduct the verification activities. In particular, we would like to thank Ted Brna, EPA Project Manager, and Paul Groff, EPA Project Quality Manager, of EPA's National Risk Management Research Laboratory in Research Triangle Park, NC. Finally we would like to acknowledge the assistance and participation of Mike Haufe of Columbus Industries Inc.

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SECTION 1
INTRODUCTION

The U. S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved technologies through performance verification and information dissemination. The ETV Program is intended to assist and inform those involved in the design, distribution, permitting, and purchase of environmental technologies.

The U.S. EPA's partner in the Air Pollution Control Technology (APCT) Program is Research Triangle Institute (RTI). The APCT Program, with the full participation of the technology developer, develops plans, conducts tests, collects and analyzes data, and reports findings. The evaluations are conducted according to a rigorous protocol and quality assurance and quality control oversight. The APCT Program verifies the performance of commercial-ready technologies used to control air pollutant emissions, with an emphasis on technologies for controlling particulate matter, volatile organic compounds, nitrogen oxides, and hazardous air pollutants. The Program develops standardized verification protocols and test plans, conducts independent testing of technologies, and prepares verification test reports and statements for broad dissemination.

SECTION 2
VERIFICATION TEST DESCRIPTION

The paint overspray arrestor was tested in accordance with the APCT "Generic Verification Protocol for Paint Overspray Arrestors"[1] and the "Test/QA Plan for Paint Overspray Arrestors."[2] This protocol incorporates all requirements of EPA Method 319: Determination of Filtration Efficiency for Paint Overspray Arrestors. Method 319[3] is part of the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Aerospace Manufacturing and Rework Facilities.[4] The protocol also includes requirements for quality management, quality assurance, procedures for product selection, auditing of the test laboratories, and reporting format.

Filtration efficiency was computed from aerosol concentrations measured upstream and downstream of an arrestor installed in a laboratory test rig. The aerosol concentrations upstream and downstream of the arrestors were measured with an aerosol analyzer that simultaneously counts and sizes the particles in the aerosol stream. The aerosol analyzer covered the particle diameter size range from 0.3 to 10 µm in a series of contiguous sizing channels. Each sizing channel covered a narrow range of particle diameters. For example, channel 1 may cover from 0.3 to 0.4 µm, channel 2 from 0.4 to 0.5 µm, and channel 15 from 7 to 10 µm. By taking the ratio of the downstream to upstream counts on a channel by channel basis, the filtration efficiency was computed for each of the sizing channels.

The upstream and downstream aerosol measurements were made while a test aerosol was injected into the air stream upstream of the arrestor [ambient aerosol is removed with high efficiency particulate air (HEPA) filters on the inlet of the test rig]. This test aerosol spanned the particle size range from 0.3 to 10 µm and provided a sufficient upstream concentration in each of the sizing channels to allow accurate calculation of filtration efficiencies up to 99%.

The following series of tests were performed at a face velocity of 120 fpm (0.61 m/s):

- Three arrestors were tested using a liquid-phase aerosol challenge,
- Three arrestors were tested using a solid-phase aerosol challenge,

- C "No-filter" control tests (one performed prior to each arrestor test) ,
- C One HEPA filter control test, and
- C One reference filter control test.

The test series is exhibited in Table 1. Additional details on the test procedure are provided in Appendix A.

TABLE 1. TEST SERIES

RTI Test No.	TYPE OF TEST				Challenge Aerosol
	No-Filter	Test Arrestor	HEPA Filter	Reference Filter	
03239911	X				Solid-Phase
03249901				X	
03249902	X				
03249903		X			
03249904	X				
03249905		X			
03249906	X				
03249907		X			
03199907			X		
03239904	X				Liquid-Phase
03239905		X			
03239906	X				
03239907		X			
03239908	X				
03239909		X			

2.1 SELECTION OF TESTED PAINT OVERSPRAY ARRESTORS

The test arrestors (SL-90B 8 Pocket Bag) were supplied to the test laboratory directly from the manufacturer (Columbus Industries Inc.) with a letter signed by T. Wayne Vickers, President, Columbus Industries Supraloft, Inc., attesting that the arrestors were selected in an unbiased manner from a minimum of 100 similar arrestors and have not been treated in any manner different from the arrestors they offer to the public. The manufacturer supplied the test laboratory with 18 arrestors; from these 18, the test laboratory randomly selected six for testing.

SECTION 3
DESCRIPTION OF ARRESTOR

The Columbus SL-90B 8 Pocket Bag arrestor is an eight-pocket bag filter with nominal dimensions of 24 x 24 x 21 in. (0.61 x 0.61 x 0.53 m). The arrestor has a metal frame, and the filter media color is yellow. The label is white, ½ x 3 ½ in. (1.27 x 8.89 cm) in size, and is affixed to the metal frame. The label includes the following information: Columbus Industries, SL-90B, Sept. 30, 1998. There is no label indication of the flow direction or filter orientation, so the industry standard orientation with the bags extended horizontally in the direction of the airflow and the individual bags side-by-side, as opposed to stacked vertically, was used in the tests.

SECTION 4
VERIFICATION OF PERFORMANCE

4.1 QUALITY ASSURANCE

The verification tests were conducted in accordance with an approved Test/Quality Assurance (QA) Plan.[2] As part of the Test/QA Plan, periodic audits are performed of the testing laboratory to ensure compliance with Method 319 facilities, equipment, and procedures. Additionally, the test results were reviewed by APCT personnel to ensure they met data quality objectives of Method 319, the Test Protocol, and the Test/QA Plan. Certificates of Calibration for the optical particle counter and the airflow reference device are provided in Appendix B.

4.2 RESULTS

Tables 2 and 3, and Figures 1 through 4, summarize the fractional filtration efficiency measurements for the solid- and liquid-phase tests, respectively. Upstream and downstream particle count data for each test are provided in Appendix C.

The initial (new condition) pressure drop across each test arrestor at the 120 fpm (0.61 m/s) test velocity [for a flowrate of 480 cfm (0.23 m^3/s)] is shown in Table 4. This pressure drop ranged from 0.10 to 0.12 in. H_2O (25 to 30 Pa) for the six arrestors tested.

Tables 5-8 present the filtration efficiency requirements of the Aerospace NESHAP and the corresponding efficiencies measured for the tested arrestor system. The test results indicate that the tested arrestor exceeded the requirements listed in Tables 5 and 6 for existing sources and those listed in Tables 7 and 8 for new sources.

4.3 LIMITATIONS

This verification report addresses two aspects of paint overspray arrestor performance: filtration efficiency and pressure drop. Users of this technology may wish to consider other performance parameters such as service life and cost when selecting a paint overspray arrestor for their use.

In accordance with the generic verification protocol, this verification report and the associated verification statement are valid for 12 months after the publication date.

SECTION 5
REFERENCES

1. Generic Verification Protocol for Paint Overspray Arrestors, Research Triangle Institute, Research Triangle Park, NC, October 1998.

2. Test/QA Plan for Paint Overspray Arrestors, Research Triangle Institute, Research Triangle Park, NC, February 1999.

3. Method 319: Determination of Filtration Efficiency for Paint Overspray Arrestors. *Code of Federal Regulations*, Appendix A to 40 CFR Part 63.

4. National Emission Standards for Hazardous Air Pollutants for Aerospace Manufacturing and Rework Facilities. *Code of Federal Regulations*, Title 40, Part 63, Subpart GG (40 CFR 63.741).

TABLE 2. SUMMARY OF SOLID-PHASE TEST RESULTS

Filtration Efficiency (%) at Indicated Size Range

OPC Channel Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)		0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)		0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)		0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
Columbus SL-90B																
Run #1	03249903	92	94	95	96	97	98	99	99	99	99	100	100	100	100	100
Run #2	03249905	93	94	96	96	98	98	99	99	99	100	100	100	100	100	100
Run #3	03249907	93	94	95	96	97	98	99	99	99	99	100	100	100	100	100
Average		92	94	96	96	97	98	99	99	99	99	100	100	100	100	100

Interpolated Efficiency Values (%) for Two-Stage Criteria:

2.60 um (> 10% required):	99
5.00 um (> 50% required):	100
8.10 um (> 90% required):	100

Interpolated Efficiency Values (%) for Three-Stage Criteria:

0.70 um (> 75% required):	95
1.10 um (> 85% required):	97
2.50 um (> 95% required):	99

HEPA Filter Control Test (applicable to both solid and liquid phase conditions)

Run #1	03199907	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Reference Filter QA Test

Current	03249901	1	2	5	4	10	18	29	49	67	78	90	94	94	94	93
Baseline	03189903	1	3	4	5	8	15	26	44	61	75	90	94	94	95	95
Difference		1	-1	1	-1	1	3	3	5	5	3	1	-1	0	-1	-2
Acceptable (< 10%)		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

"No Filter" Control Tests — Penetration For Each Size Range

Run #1	03249902	1.00	0.99	0.99	0.99	1.00	1.00	0.99	1.00	1.01	1.03	1.02	0.98	1.05	0.94	0.94
Run #2	03249904	1.00	0.99	0.98	1.00	1.00	0.99	1.00	1.01	1.02	1.03	1.04	1.00	1.05	0.94	0.89
Run #3	03249906	1.01	1.01	1.00	1.01	1.02	1.01	1.01	1.04	1.05	1.05	1.06	1.03	0.99	1.04	0.98

TABLE 3. SUMMARY OF LIQUID- PHASE TEST RESULTS

Filtration Efficiency (%) at Indicated Size Range

OPC Channel Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)		0.28	0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60
Max. Diam. (um)		0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60	9.43
Geo. Mean Diam (um)		0.32	0.418	0.49	0.58	0.78	1.07	1.36	1.68	1.97	2.42	3.26	4.21	4.94	5.85	7.89
Columbus SL-90B																
Run #1	03239905	86	87	88	90	92	95	97	99	99	99	100	100	100	100	100
Run #2	03239907	85	87	88	89	92	94	97	98	99	99	100	100	100	100	100
Run #3	03239909	86	87	88	89	92	95	97	99	99	99	100	100	100	100	100
Average		86	87	88	89	92	95	97	99	99	99	100	100	100	100	100

Interpolated Efficiency Values (%) for Two-Stage Criteria:

2.20 um (> 10% required):	99
4.10 um (> 50% required):	100
5.70 um (> 90% required):	100

Interpolated Efficiency Values (%) for Three-Stage Criteria:

0.42 um (> 65% required):	87
1.00 um (> 80% requried):	94
2.00 um (> 95% required):	99

"No Filter" Control Tests		Penetration For Each Size Range														
Run #1	03239904	0.99	1.00	0.98	0.99	1.00	1.00	1.01	0.98	1.02	1.03	1.08	1.08	1.08	1.01	1.02
Run #2	03239906	0.99	0.99	0.99	0.99	1.00	1.00	1.01	0.98	1.01	1.04	1.08	1.08	0.97	1.10	1.04
Run #3	03239908	0.99	0.99	0.98	0.99	0.99	1.00	1.01	0.98	1.01	1.04	1.06	1.05	1.09	1.01	1.03

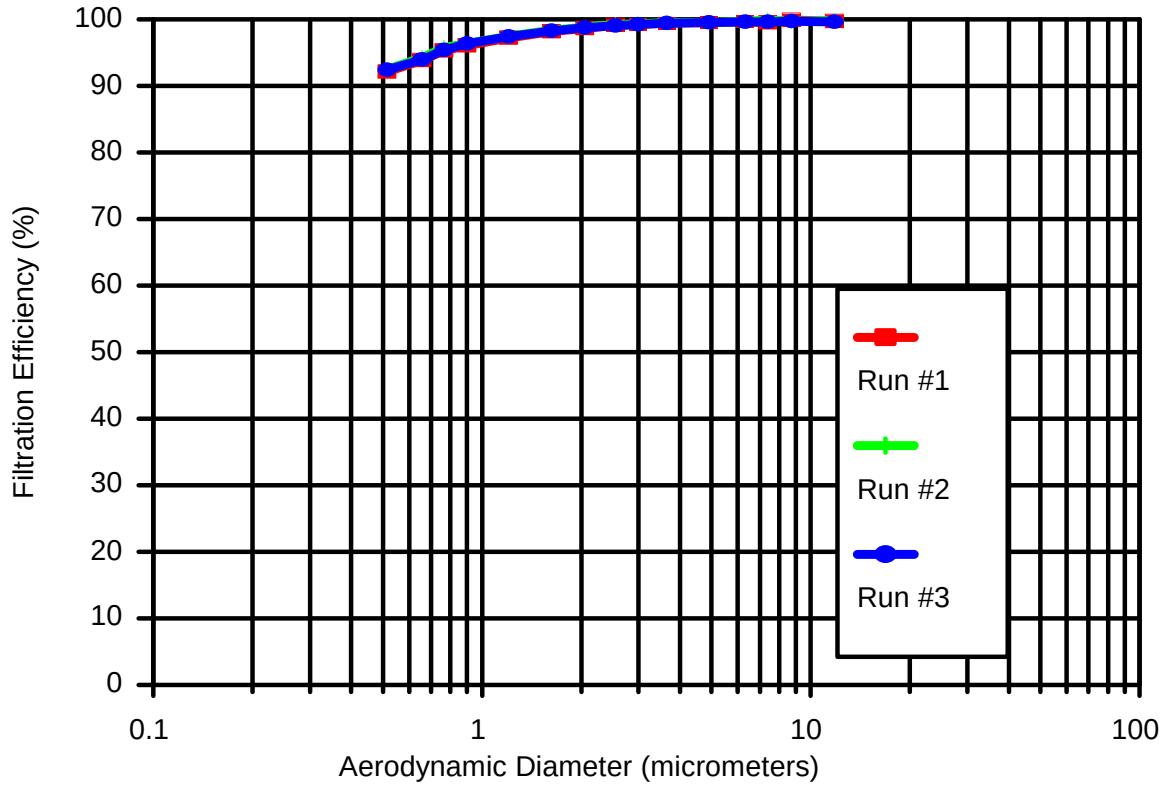


Figure 1. Triplicate solid-phase particle removal efficiency curves for Columbus SL-90B 8 Pocket Bag paint overspray arrestor.

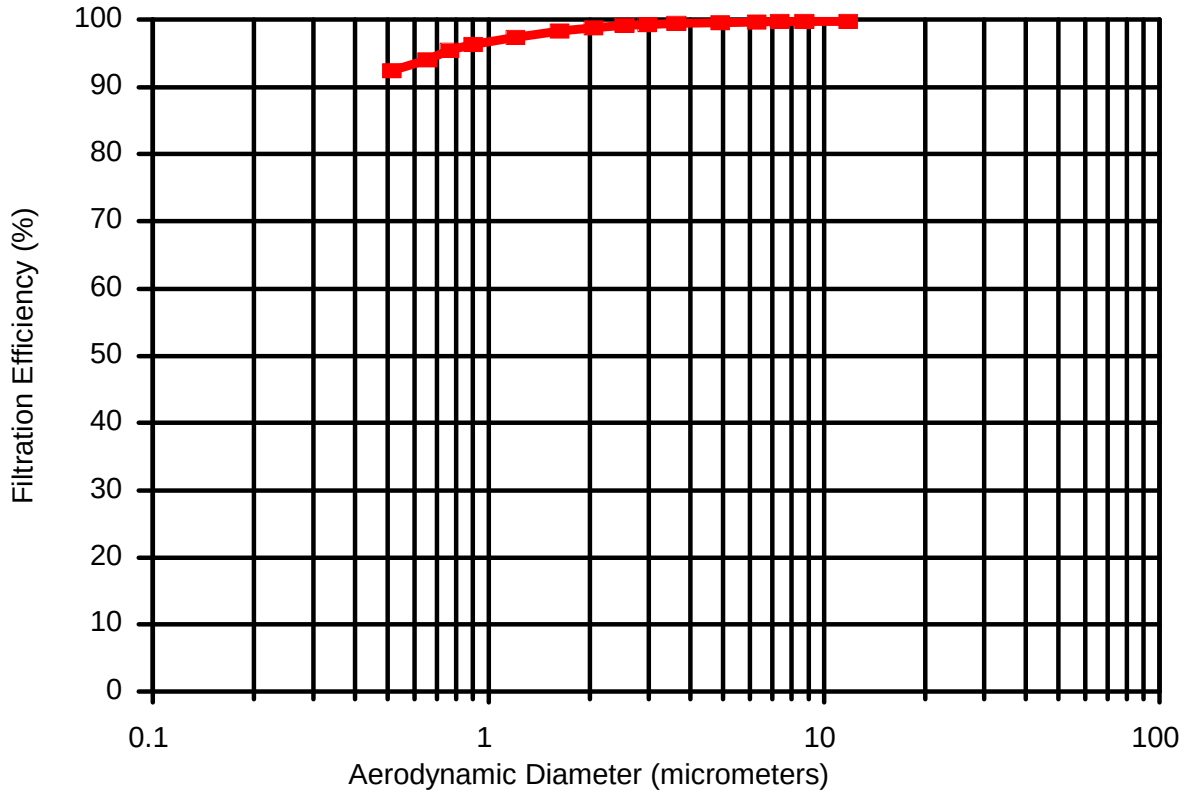


Figure 2. Average of the solid-phase particle removal efficiency curves for Columbus SL-90B 8 Pocket Bag paint overspray arrestor.

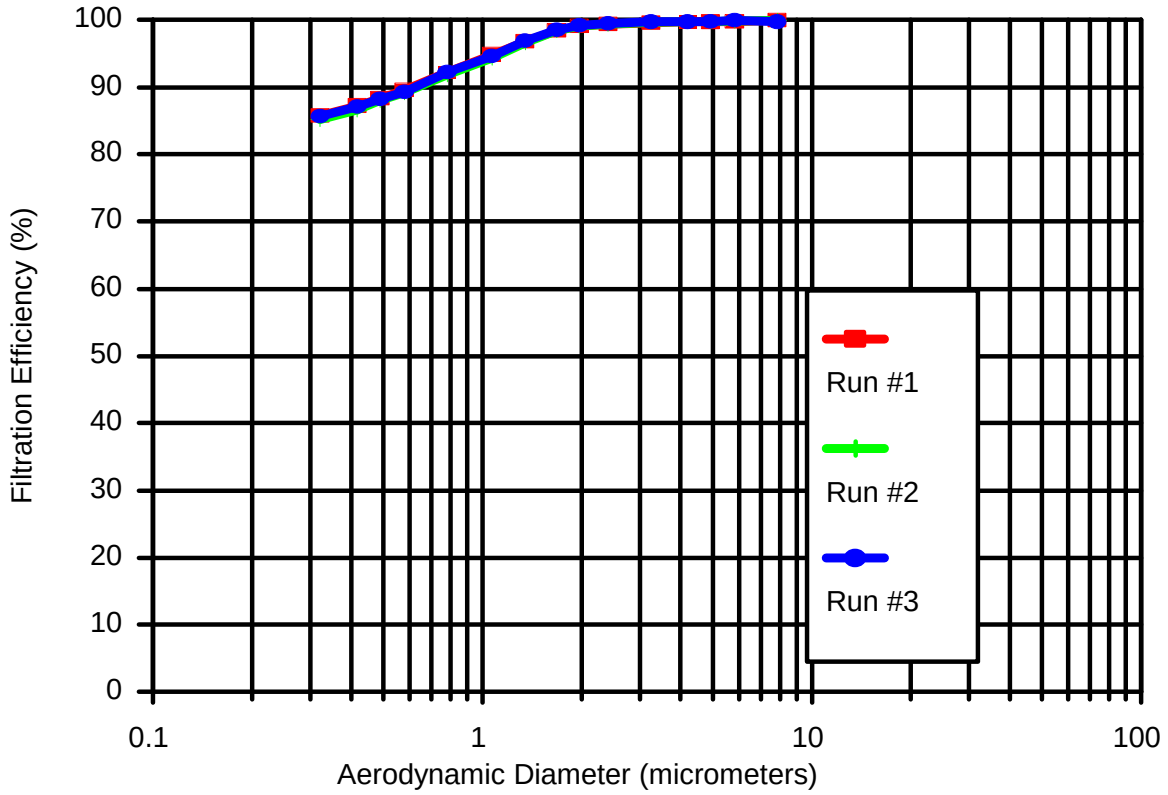


Figure 3. Triplicate liquid-phase particle removal efficiency curves for Columbus SL-90B 8 Pocket Bag paint overspray arrestor.

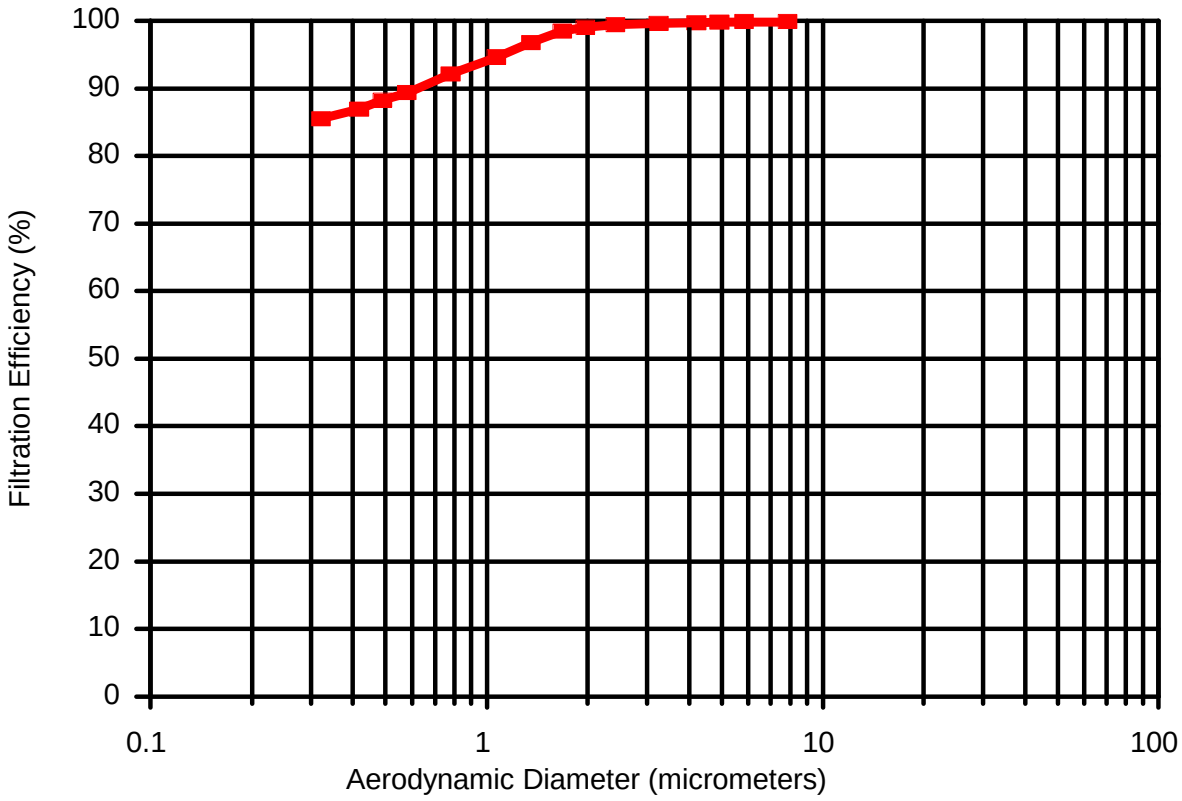


Figure 4. Average of the liquid-phase particle removal efficiency curves for Columbus SL-90B 8 Pocket Bag paint overspray arrestor.

TABLE 4

SUMMARY OF PRESSURE DROP MEASUREMENTS

Test No.	Initial Pressure Drop (inch H_2O)
03249903	0.10
03249905	0.10
03249907	0.11
03239905	0.12
03239907	0.12
03239909	0.12

TABLE 5. EXISTING SOURCES*:
LIQUID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 5.7	> 90	>99
> 4.1	> 50	>99
> 2.2	> 10	99

TABLE 6. EXISTING SOURCES*:
SOLID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 8.1	> 90	>99
> 5.0	> 50	>99
> 2.6	> 10	99

TABLE 7. NEW SOURCES*:
LIQUID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 2.0	> 95	99
> 1.0	> 80	94
> 0.42	> 65	87

TABLE 8. NEW SOURCES*:
SOLID-PHASE CHALLENGE AEROSOL PARTICLES

Aerodynamic particle diameter range, µm	Filtration efficiency requirement, %	Filtration efficiency achieved, %
> 2.5	> 95	99
> 1.1	> 85	97
> 0.70	> 75	95

*A new source is any affected source that commenced construction after October 29, 1996. An existing source is any affected source that is not new.

Appendix A

DESCRIPTION OF THE TEST RIG AND METHODOLOGY

TEST DUCT

The tests were conducted in RTI's air cleaner test facility (Figure A-1). The test rig's ducting was primarily of 24 x 24 in. (0.61 x 0.61m) cross section and made of 14-gauge stainless steel. The blower is rated at 15 hp (11 kW) with a flow capacity of 3000 cfm (1.4 m^3/s) at 13 in. H_2O (3200 Pa). The inlet and outlet filter banks consist of two 24 x 24 x 2 in. (0.61 x 0.61 x 0.05 m) prefilters and two 24 x 24 x 12 in. (0.61 x 0.61 x 0.30 m) high efficiency particulate air (HEPA) filters rated at 2000 cfm (0.9 m^3/s) each. The system operates at positive pressure to minimize infiltration of room air.

To mix the test aerosol with the air stream, an orifice plate and mixing baffle were located immediately downstream of the aerosol injection point and upstream of the test arrestor. An identical orifice plate and mixing baffle were added after the 180° bend. The latter downstream orifice served two purposes. It straightened out the flow after going around the bend, and it mixed any aerosol that penetrated the air cleaning device. Mixing the penetrating aerosol with the air stream is necessary to obtain a representative downstream aerosol measurement.

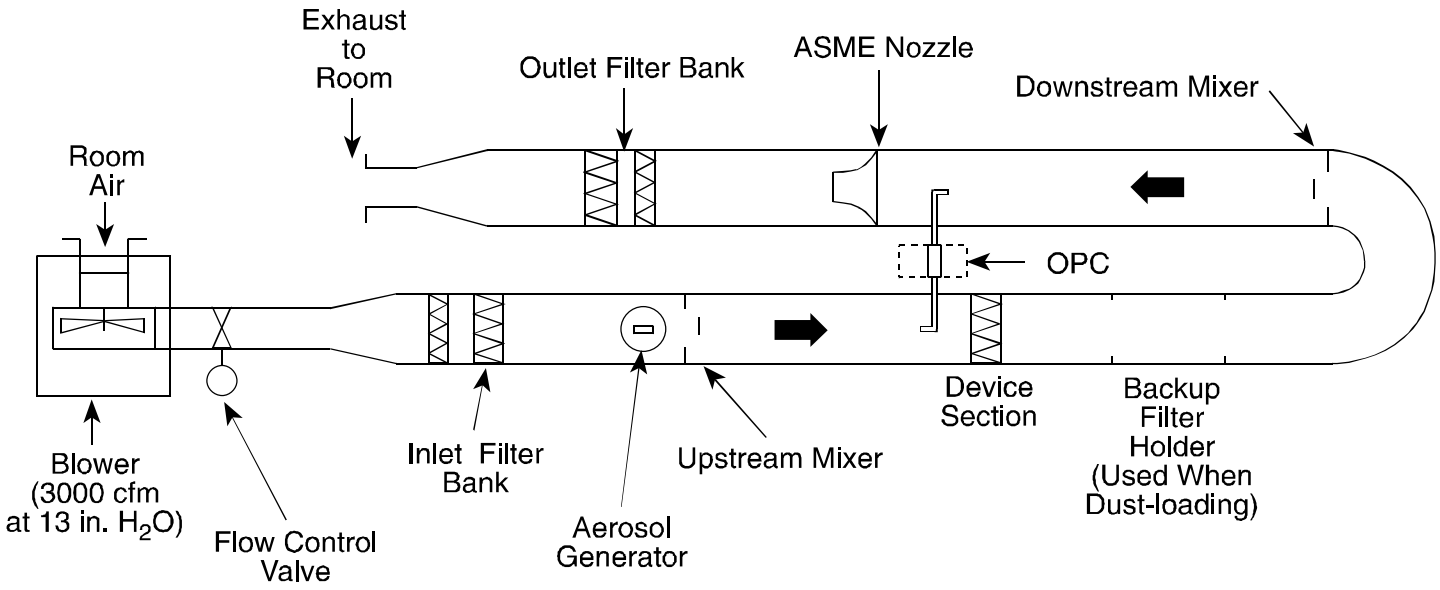
AIRFLOW

Airflow was measured with a 4 in. (0.1 m) ID American Society of Mechanical Engineers (ASME) flow nozzle. The nominal velocity through the arrestor was computed by dividing the volumetric flow by the nominal face area of the device. Airflow was manually controlled by a 14 in. (0.36 m) diameter butterfly valve.

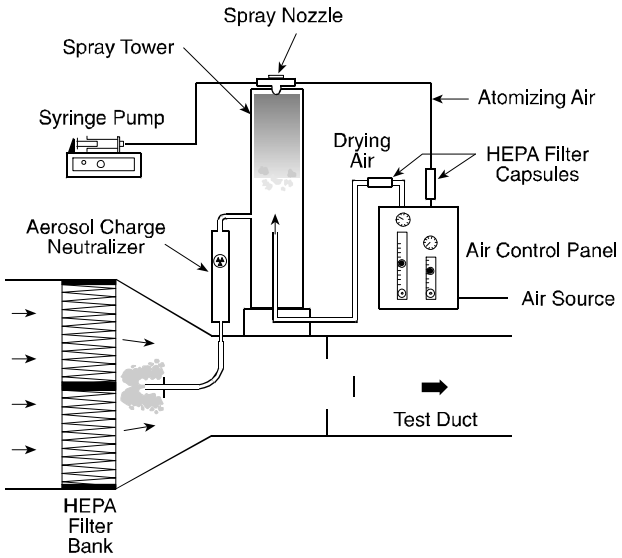
OPTICAL PARTICLE COUNTER (OPC)

Aerosol concentrations were measured with a Climet Instruments Model 226 OPC. This OPC uses a white-light illumination source and has a wide collection angle for the scattered light. The OPC's sampling rate was 0.25 cfm (0.00012 m^3/s).

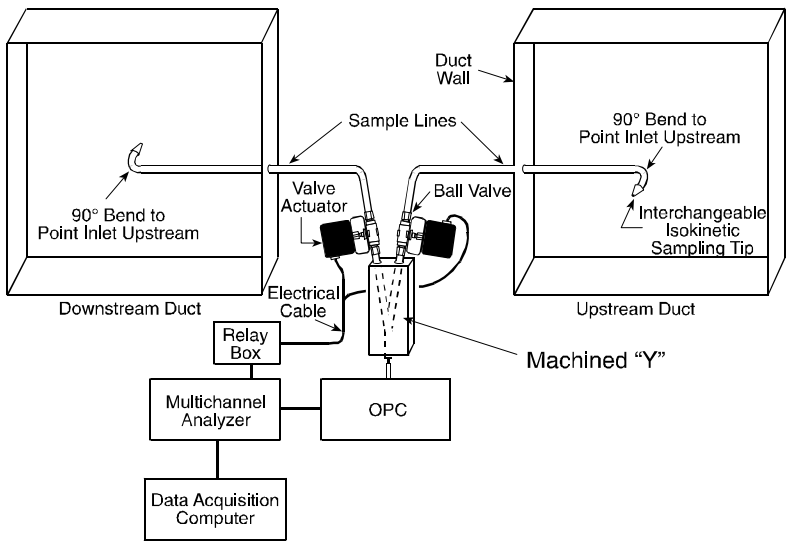
The output of the OPC was input to a Climet Instruments Model 8040 multichannel analyzer equipped with Model 05872005 and 05872006 input boards. These boards provide 16 sizing channels covering the range from 0.3 to 10 µm. The 8040 was also equipped with a Model CI-298 sequential interface board. This interface provides a contact closure at the end of each sample and also provides a 15-sec delay in particle counting after each sample. The contact closure was used to control the operation of electromechanical valve actuators in the upstream and downstream sample lines. The 15-sec delay allows time for the new sample to be acquired.



Overview of Test Duct Configuration (Top View)



Aerosol Generation System (Side View)



Aerosol Sampling System (End View)

Figure A-1. Schematic illustration of the fractional efficiency test rig.

AEROSOL GENERATION

Two types of challenge aerosols were used: liquid- and solid-phase. The selection of liquid- or solid-phase challenge aerosol particles is important because for some types of paint arrestors significantly different filtration efficiencies will be achieved depending upon the phase of the challenge aerosol particles. (This is due to particle "bounce" associated with solid-phase particles.) The liquid-phase challenge aerosol is oleic acid, a non-toxic, low-volatility liquid. The solid-phase aerosol is potassium chloride (KCl) generated from an aqueous solution. KCl was selected as the solid-phase aerosol because of its relatively high water solubility, high deliquescence humidity (85% relative humidity), known crystalline structure (facilitates complete drying), and low toxicity. The KCl solution was prepared by combining 0.66 lb (300 g) of KCl with 0.035 ft^3 (1 L) of distilled water. Both oleic acid and KCl are compatible with accurate measurement by the optical particle counter.

The oleic acid or the KCl solution was nebulized using a two-fluid (air and liquid) air atomizing nozzle (Spray Systems 1/4 J siphon spray nozzle) as illustrated in Figure A-1 (aerosol generation system). The nozzle was positioned at the top of a 12 in. (0.30 m) diameter, 51 in. (1.3 m) tall transparent acrylic spray tower. The tower served two purposes. It allowed the salt droplets to dry by providing an approximate 40 sec. mean residence time, and it allowed larger-sized particles (of either KCl or oleic acid) to fall out of the aerosol. After generation, the aerosol passed through a TSI Model 3054 aerosol neutralizer (Kr-85 radioactive source) to neutralize any electrostatic charge on the aerosol (electrostatic charging is an unavoidable consequence of most aerosol-generation methods).

The KCl solution or oleic acid was fed to the atomizing nozzle at 1.2 mL/min (4.2×10^{-5} ft^3/min) by means of a pump. Varying the operating air pressure of the generator allows control of the mean diameter of the challenge aerosol.

AEROSOL SAMPLING SYSTEM

The aerosol sampling lines were 0.55 in. (14 mm) ID stainless steel lines and used gradual bends [radius of curvature = 2.25 in. (57 mm)] when needed. These dimensions were chosen to minimize particle losses in the sample lines. A custom-made "Y" fitting connected the upstream and downstream lines to the OPC. The two branches of the "Y" merged gradually to minimize particle loss in the intersection of the "Y" due to centrifugal or impaction forces.

Immediately above the "Y," electrically actuated ball valves were installed in each branch (Parker Model EA Electro-Mechanical Valve Actuator). The opening and closing of the valves were automatically controlled by the OPC's sequential sampling interface board. The valves take approximately 2 sec. to complete an opening or closing maneuver.

Isokinetic sampling nozzles of the appropriate entrance diameter were placed on the ends of the sample probes to maintain isokinetic sampling for all the test flow rates.

TEST PROCEDURES

The aerosol penetration of the test device was calculated from the average of 10 upstream and 10 downstream samples taken sequentially (i.e., one upstream, one downstream, one upstream, one downstream, . . . until 10 each were obtained). This sequential sampling scheme was selected to minimize the effect of aerosol generator variability. Each sample was 2 minutes in duration. The sampling also included background upstream and downstream measurements at the beginning and end of each test. The test sequence was as follows:

1. Warm up OPC and install proper sample tips for isokinetic sampling.
2. Install air cleaner test device and bring test duct to desired flow rate.
3. With the aerosol generator off, obtain five measurements of the upstream and downstream background particle counts.
4. Turn on the aerosol generator and allow it to run for a minimum of 10 minutes to stabilize.
5. After the stabilization period, obtain 10 upstream and 10 downstream particle counts using a repeated upstream-downstream sampling sequence until 10 each are obtained.
6. Turn off the aerosol generator. Wait 10 minutes, then obtain five additional upstream and downstream background measurements.

CONTROL TESTS:

In addition to evaluating the test arrestor, 0 and 100% penetration control tests and a reference filter control test were conducted to ensure that reliable measurements are obtained. The 100% penetration test was a relatively stringent test of the adequacy of the overall duct, sampling, measurement and aerosol generation system. These tests were performed as normal penetration tests except that the paint arrestor was not used. A perfect system would yield a measured penetration of 1 at all particle sizes. Deviations from 1 can occur due to particle losses in the duct, differences in the degree of aerosol uniformity (i.e., mixing) at the upstream and downstream probes, and differences in particle-transport efficiency in the upstream and downstream sampling lines. Results from the 100% penetration tests were used during data analysis to correct penetration measurements obtained during the arrestor tests.

The 0% penetration test was performed by using a HEPA filter rather than a paint arrestor. This test confirmed the adequacy of the instrument response time and sample line lag. The 0% penetration test was performed on a monthly basis.

The reference filter control test consisted of performing a solid-phase efficiency test on the same filter during each ETV test. The reference filter data from each test were compared to the original, baseline reference filter data to determine if there was any substantial change in the test system between the tests.

DATA ANALYSIS

Nomenclature

U = Upstream particle count
D = Downstream particle count
U_b = Upstream background count
D_b = Downstream background count
P_o = observed penetration = $\bar{D}/\bar{U}$

P_{100} = 100% penetration value determined from the control tests
P = Penetration corrected for P_{100} value
Overbar: denotes arithmetic mean of quantity

Analysis of each test involves the following quantities:

- P_{100} value for each sizing channel from the blank (no-filter) test,
- 2 upstream background values,
- 2 downstream background values,
- 10 upstream values with aerosol generator on, and
- 10 downstream values with aerosol generator on.

Using the values associated with each sizing channel, the penetration associated with each particle sizing channel was calculated as:

$$P = \{(\bar{D} - \bar{D}_b) / (\bar{U} - \bar{U}_b)\} / P_{100} \quad .$$

Filtration efficiency was then calculated as:

$$\text{Filtration Efficiency (\%)} = 100\ (1 - P).$$

DEFINITION OF PARTICLE DIAMETER

Over the 0.3 to 10 µm diameter size range, the "aerodynamic" particle diameter is often of more significance than the physical diameter (as measured by the OPC) relative to aerosol filtration and aerosol deposition within the human respiratory tract. The aerodynamic diameter (D_{Aero}) is related to the physical diameter ($D_{Physical}$) by:

$$D_{Aero} \quad ' \quad D_{Physical} \sqrt{\frac{?_{Particle}}{?_o} \quad \frac{CCF_{Physical}}{CCF_{Aero}} \quad \frac{1}{?}}$$

where

$?_{Particle}$ is the density of the particle in g/cm^3.

$?_o$ is unit density of 1 g/cm^3.

$CCF_{Physical}$ is the Cunningham Correction Factor at $D_{Physical}$.

CCF_{Aero} is the Cunningham Correction Factor at D_{Aero}.

? is the dynamic shape factor.

For oleic acid droplets having a density of 0.89 g/cm^3 and being spherical (? = 1), the aerodynamic diameter will be about 6% smaller than the measured diameter.

KCl has a density of 1.98 g/cm^3. The KCl particles form from the evaporation of aqueous solution droplets. Because KCl has an inherent cubic crystalline structure, it is expected that the KCl particles will be cubic or relatively compact cubic clusters; however, their actual shape, or range of shapes, is unknown. Because the shape factor is

unknown, the shape factor for KCl is assigned a value of 1 and the diameter is termed the "nominal" aerodynamic diameter.

The aerodynamic diameters associated with the 15 OPC sizing channels are tabulated in Table A-1 for oleic acid and KCl. Also listed is the physical diameter size range for each channel based on the manufacturer's calibration curve using monodisperse polystyrene latex (PSL) spheres.

Table A-1. Physical and Aerodynamic Sizing Channels for the Calibration and Test Aerosols

	Particle Diameter Size Range (μm)*		
	PSL	OLEIC ACID	KCl
OPC Channel Number	Physical Diameter	Aerodynamic Diameter	Nominal Aerodynamic Diameter
1	0.3 - 0.4	0.28 - 0.37	0.45 - 0.59
2	0.4 - 0.5	0.37 - 0.47	0.59 - 0.73
3	0.5 - 0.55	0.47 - 0.52	0.73 - 0.80
4	0.55 - 0.7	0.52 - 0.66	0.80 - 1.02
5	0.7 - 1.0	0.66 - 0.94	1.02 - 1.44
6	1.0 - 1.3	0.94 - 1.22	1.44 - 1.86
7	1.3 - 1.6	1.22 - 1.51	1.86 - 2.28
8	1.6 - 2	1.51 - 1.88	2.28 - 2.85
9	2 - 2.2	1.88 - 2.07	2.85 - 3.13
10	2.2 - 3	2.07 - 2.83	3.13 - 4.25
11	3 - 4	2.83 - 3.77	4.25 - 5.66
12	4 - 5	3.77 - 4.71	5.66 - 7.07
13	5 - 5.5	4.71 - 5.18	7.07 - 7.77
14	5.5 - 7	5.18 - 6.60	7.77 - 9.88
15	7 - 10	6.60 - 9.43	9.88 - 14.1

*The particle diameter size ranges are defined as greater than the indicated lower limit and less than or equal to the indicated upper limit.

APPENDIX B

Certificates of Calibration

Certificate of Traceability

8500D-II THERMOANEMOMETER

Model No. 8500D-II **Serial No. 3810** **Part No. 634493200**

Certificate Number: **1046** Date: **26-Oct-98** P.O. **00329** Order/RMA: **104538**

Customer Number:

Calibration Standards Information

The following standards and equipment were used as references for this calibration.

Tested By	Date Tested	Inst. No.	Cal. Due	NIST Test Numbers
LOZADA	10/23/98	747	4/9/00	259340;257602;258909;258599;260222;811/258622;
		746	4/9/00	811/258522;811/260178;
		922	6/8/00	836/259947-98 ;
		881	11/16/98	811/257078 ; 247770 ; 253806 ; 811/255474 ; 253699 ; USN22783C ; Chem. Const. ; 254227 ; 811/254736 ; 811/251992 ; 251971 ; 811/251741 ; 811/253662 ; 811/256216 ; 611802 ;
		857	6/8/00	836/259947-98 ; ;
		794	3/18/99	
		666	2/21/00	811/255765 ; 251971 ; 811/259304-98 ; 811/257773 ; 256216 ; ;
		399	11/12/98	P-8531A ; P-8531B ; 38126 ; 254160 ; 255302 ;
		326	2/4/99	P-8531A ; P-8531B ; 38126 ; 254160 ; 259009 ;
		319	11/12/98	P-8531A ; P-8531B ; 38126 ; 254160 ; 255302 ;
		301	12/11/98	836/257126-96 ;

Alnor Instrument Company hereby certifies that the above designated equipment was found to meet or exceed manufacturing specifications. Their calibration is traceable to the National Institute of Standards and Technology (NIST) or natural physical constants. The policies and procedures used comply with MIL-STD-45662A. This certificate shall not be reproduced except in full, without the written consent of Alnor.

Reviewed by

26-Oct-98

Date

ALNOR
A TSI® Company

Alnor Instrument Company
7555 N. Linder Avenue, Skokie, IL 60077
Tel. 847-677-3500 Fax. 847-677-3539

Meriam Instrument
a Scott Fetzer company

LETTER OF CERTIFICATION
LAMINAR FLOW ELEMENT

CUSTOMER NAME: RESEARCH TRIANGLE INST

CUSTOMER ORDER NUMBER: 00161

MERIAM ORDER NUMBER: 772900

Meriam Instrument certifies that the completed LFE unit has been calibrated and correlated at several points of flow rate using a Meriam Standard, which is controlled per the calibration system requirements of ANSI Z540-1 and traceable to the National Institute of Standards and Technology. The collective uncertainty of the measurement standards has a 1:1 ratio to the acceptable tolerance for the flow rate being calibrated.

The total rss uncertainty of the completed laminar flow unit is +/- .72 % of reading.

CUSTOMER ID NO.: 013716

MODEL NO.: 50MH10-8 SERIAL NO.: 758860-K1

FLOW CURVE/TABLE NO.: 30624

DATE OF CALIBRATION 11-11-1998 BY GEORGE ROBOTKAY

AS RECEIVED CONDITION: √ In Tolerance ____Out of Tolerance ____NA

AS LEFT CONDITION : √ In Tolerance ____Out of Tolerance ____NA

CALIBRATION INTERVAL: TO BE DETERMINED BY CUSTOMER BASED ON USAGE OF LFE.

FLOW STANDARD SERIAL NO.	DATE OF LAST CAL	DATE OF NEXT CAL
WMMC2-6	JAN 1998	JAN 1999

The LFE unit listed hereon has been successfully calibrated in accordance with Meriam Instrument Procedure A-35822.

Michael V. St. Hilaire
QUALITY ASSURANCE INSPECTOR
MERIAM INSTRUMENT

Jack Weigand
QUALITY ASSURANCE MANAGER
MERIAM INSTRUMENT

10920 Madison Avenue • Cleveland, Ohio 44102 • (216) 281-1100 • FAX (216) 281-0228
www.meriam.com

CLIMET INSTRUMENTS COMPANY

1320 WEST COLTON AVE., REDLANDS, CA 92374 • PHONE: (909) 793-2788 • FAX: (909) 793-1738

CERTIFICATE OF CALIBRATION

INSTRUMENT CALIBRATED

MODEL: 226 aerosol particle counter, S/N 61882

CONTROL NUMBER: LC503501

DATE CALIBRATED: 2/4/99 NEXT CALIBRATION: 8/4/99

RECOMMENDED CALIBRATION INTERVAL: 6 months

L. Sparks
CALIBRATED BY

Jean R. Gruter
APPROVED BY

TRACEABILITY STATEMENT

This instrument has been calibrated in accordance with ISO 10012-1/ANSI Z540-1 (which replaces MIL-STD-45662A) and relevant portions of Federal Standards 209, ASTM F-50, F322, and F328.

Temperature and Relative Humidity are not controlled during calibration because of the wide operating range of the instrument. The operating limits of this instrument are:

TEMPERATURE: 30°F TO 122°F
HUMIDITY: 0-100%, non-condensing

All test equipment used in the calibration of Climet Instruments' products is calibrated at six-month intervals by an outside calibration service. Calibration certificates for each piece of test equipment are on file at Climet; copies will be supplied if requested.

Calibration traceability to a National Measurement Standard (NMS) is established by using mono-disperse latex spheres as a calibration standard. These spheres are sized by methods traceable, by lot number, to the National Institute of Science and Technology.

APPENDIX C

Fractional Efficiency Data Sheets

Key to notation used in the following tables:

Diam.	Particle Diameter (µm)
U. Bckgrnd:	The upstream background particle counts measured with the aerosol generator off.
Upstream:	The upstream particle counts measured with the aerosol generator on.
D. Bckgrnd:	The downstream background particle counts measured with the aerosol generator off.
Downstream:	The downstream particle counts measured with the aerosol generator on.
Meas. Penetration:	The penetration computed as:

$$Meas.\ Penetration = \frac{(\ Downstream\ \ \&\ \ D.\ Bckgrnd\ )}{(\ Upstream\ \ \&\ \ U.\ Bckgrnd\ )}$$

P100 Correction Values:	Penetration values measured with no filter in the test section. These values are used to correct subsequent penetration measurements for particle losses within the test duct and sampling system.
Corrected Penetration:	The measured penetration corrected by the P100 values:

$$Corrected\ Penetration = \frac{Meas.Penetration}{P100\ \ Correction\ \ Values}$$

Corrected Efficiency (%):	100 x (1 - Corrected Penetration)
DQO	Data Quality Objective

Test No. 03239911
No Filter
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-23-1999	17:02:14	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	17:10:14	01:00	10470	15740	4906	9228	13530	8334	11070	10990	2570	5720	3351	1107	170	298	202
Upstream	1	01	03-23-1999	17:12:44	01:00	10320	15500	5028	9065	13470	8146	10730	10740	2581	5591	3434	1120	165	328	212
Upstream	1	01	03-23-1999	17:15:14	01:00	10090	15370	4780	8661	13180	7922	10770	10270	2455	5305	3028	1057	152	259	172
Upstream	1	01	03-23-1999	17:17:44	01:00	10010	15010	4812	8846	12870	7870	10600	10310	2491	5345	3169	1019	167	289	182
Upstream	1	01	03-23-1999	17:20:14	01:00	10410	14840	4902	8683	12860	7850	10720	10130	2460	5248	3254	1070	153	255	186
Upstream	1	01	03-23-1999	17:22:44	01:00	10290	14830	4775	8666	12940	7865	10550	10170	2475	5424	3163	974	177	272	194
Upstream	1	01	03-23-1999	17:25:14	01:00	10050	14840	4866	8666	12880	7874	10510	10210	2544	5252	3233	1001	174	267	184
Upstream	1	01	03-23-1999	17:27:44	01:00	10330	15240	4832	8912	13170	7955	10720	10440	2495	5337	3232	1110	165	288	203
Upstream	1	01	03-23-1999	17:30:14	01:00	10320	15390	4718	8783	13100	8074	10710	9970	2344	5075	3103	962	170	280	143
Upstream	1	01	03-23-1999	17:32:44	01:00	10020	15060	4759	8664	12620	7867	10280	9772	2296	5050	3080	948	164	245	182
U. Bckgrnd	1	01	03-23-1999	17:43:19	01:00	1	2	0	1	1	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-23-1999	17:03:29	01:00	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	17:11:29	01:00	10550	15290	4810	8930	13440	8290	10570	10790	2775	5811	3676	1133	177	297	205
Downstream	2	01	03-23-1999	17:13:59	01:00	10520	15340	4836	8921	13070	8195	10520	10380	2557	5424	3301	1110	161	260	151
Downstream	2	01	03-23-1999	17:16:29	01:00	10270	15020	4950	8686	12960	8100	10600	10490	2565	5519	3365	1061	172	287	177
Downstream	2	01	03-23-1999	17:18:59	01:00	10120	15010	4915	8752	13210	8014	10480	10230	2570	5528	3323	1147	177	263	168
Downstream	2	01	03-23-1999	17:21:29	01:00	10120	14730	4815	8590	12950	7918	10430	10460	2625	5640	3248	1098	176	298	167
Downstream	2	01	03-23-1999	17:23:59	01:00	10190	15110	4763	8823	12950	8096	10380	10350	2579	5589	3423	1112	190	264	172
Downstream	2	01	03-23-1999	17:26:29	01:00	10250	15030	4780	8754	13190	8110	10650	10430	2658	5535	3459	1044	169	260	167
Downstream	2	01	03-23-1999	17:28:59	01:00	10220	15100	4687	8720	12970	8010	10560	10100	2485	5365	3362	1041	129	260	171
Downstream	2	01	03-23-1999	17:31:29	01:00	10330	15160	4910	8609	13090	8044	10360	10140	2356	5325	3176	1040	149	268	155
Downstream	2	01	03-23-1999	17:33:59	01:00	10200	14830	4853	8516	12830	7970	10380	10100	2396	5352	3135	1002	171	254	166
D. Bckgrnd	2	01	03-23-1999	17:44:34	01:00	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Meas. Penetration						1.00	0.99	1.00	0.99	1.00	1.01	0.98	1.00	1.03	1.03	1.04	1.04	1.01	0.97	0.91
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration						1.00	0.99	1.00	0.99	1.00	1.01	0.98	1.00	1.03	1.03	1.04	1.04	1.01	0.97	0.91
Corrected Efficiency (%)						0	1	0	1	0	-1	2	0	-3	-3	-4	-4	-1	3	9
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						102310	151820	48378	88174	130620	79757	106660	103002	24711	53347	32047	10368	1657	2781	1860
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.04	0.06	0.05	0.06	0.08	0.11	0.10	0.12
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						13.8														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03249901
Reference Filter
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-24-1999	05:11:29	01:00	1	2	3	1	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-24-1999	05:19:46	01:00	10810	15930	5018	8719	13230	8316	10750	9287	2168	4660	2723	880	133	249	160
Upstream	1	01	03-24-1999	05:22:16	01:00	10790	16040	5079	9107	13410	8580	11060	10080	2302	5070	2895	959	169	252	193
Upstream	1	01	03-24-1999	05:24:46	01:00	11000	15960	5061	8979	13490	8549	11180	9889	2277	4977	2943	969	130	231	173
Upstream	1	01	03-24-1999	05:27:16	01:00	10890	16080	5126	8951	13320	8629	11090	9565	2262	4937	2925	996	166	254	163
Upstream	1	01	03-24-1999	05:29:46	01:00	10840	16140	5041	8945	13200	8386	10960	9601	2232	4954	2939	939	159	268	150
Upstream	1	01	03-24-1999	05:32:16	01:00	10750	15970	4823	8951	13020	8189	10550	9459	2202	4795	2768	923	144	236	159
Upstream	1	01	03-24-1999	05:34:46	01:00	10750	15580	4881	8727	13020	8130	10530	9391	2149	4666	2724	933	135	263	177
Upstream	1	01	03-24-1999	05:37:16	01:00	10100	14890	4886	8673	12910	7779	10540	9860	2260	5094	3095	963	176	286	202
Upstream	1	01	03-24-1999	05:39:46	01:00	10370	15410	4862	8632	12980	8056	10590	9841	2363	5091	3106	1018	186	256	212
Upstream	1	01	03-24-1999	05:42:16	01:00	10420	15410	4865	8750	13110	8085	10800	9814	2358	5128	3052	1087	167	273	176
U. Bckgrnd	1	01	03-24-1999	05:49:29	01:00	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-24-1999	05:12:44	01:00	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Downstream	2	01	03-24-1999	05:21:01	01:00	10930	15610	4690	8520	11810	6805	7405	4666	739	1044	275	62	8	13	11
Downstream	2	01	03-24-1999	05:23:31	01:00	10850	15720	4780	8662	12180	7038	7720	5014	790	1086	247	58	12	18	8
Downstream	2	01	03-24-1999	05:26:01	01:00	10800	15630	4905	8994	12330	7005	7760	4855	756	1048	271	38	9	7	7
Downstream	2	01	03-24-1999	05:28:31	01:00	10890	15480	4768	8588	11990	6880	7509	4778	682	1013	226	40	4	10	10
Downstream	2	01	03-24-1999	05:31:01	01:00	10430	15380	4622	8309	11690	6783	7591	4798	722	1107	302	65	8	14	16
Downstream	2	01	03-24-1999	05:33:31	01:00	10680	15090	4636	8327	11610	6703	7352	4700	670	1016	258	72	10	18	14
Downstream	2	01	03-24-1999	05:36:01	01:00	10410	15500	4618	8311	11750	6622	7200	4617	816	1015	331	66	8	16	8
Downstream	2	01	03-24-1999	05:38:31	01:00	10190	14900	4713	8256	11840	6637	7707	5403	906	1267	362	81	11	20	15
Downstream	2	01	03-24-1999	05:41:01	01:00	10240	14700	4657	8258	11940	6972	7636	5537	919	1257	371	91	16	24	22
Downstream	2	01	03-24-1999	05:43:31	01:00	10230	14890	4749	8152	11910	6799	7747	5159	805	1144	289	73	9	19	8
D. Bckgrnd	2	01	03-24-1999	05:50:44	01:00	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0
Meas. Penetration						0.99	0.97	0.95	0.95	0.90	0.83	0.70	0.51	0.35	0.22	0.10	0.07	0.06	0.06	0.07
P100 correction values						1.00	0.99	1.00	0.99	1.00	1.01	0.98	1.00	1.03	1.03	1.04	1.04	1.01	0.97	0.91
Corrected Penetration						0.99	0.98	0.95	0.96	0.90	0.82	0.71	0.51	0.33	0.22	0.10	0.06	0.06	0.06	0.07
Corrected Efficiency (%)						1	2	5	4	10	18	29	49	67	78	90	94	94	94	93
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						106720	157410	49642	88434	131690	82699	108050	96787	22573	49372	29170	9667	1565	2568	1765
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.04	0.03	0.03	0.03	0.02	0.03	0.02	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.03
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						13.6														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03249902
No Filter
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-24-1999	05:58:50	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-24-1999	06:06:43	01:00	10740	15980	5070	9404	13980	8470	11340	10760	2595	5634	3334	1117	210	292	187
Upstream	1	01	03-24-1999	06:09:13	01:00	10760	15880	4981	9297	13510	8453	11310	10340	2448	5351	3124	1006	172	296	191
Upstream	1	01	03-24-1999	06:11:43	01:00	10680	15630	5007	8964	13480	8455	10940	10020	2468	5107	3162	1072	161	291	211
Upstream	1	01	03-24-1999	06:14:13	01:00	10670	15750	5022	8831	13430	8232	10850	10310	2435	5253	3152	1073	177	270	197
Upstream	1	01	03-24-1999	06:16:43	01:00	10800	15670	4916	9097	13360	8495	10940	10010	2394	5361	3140	1101	164	298	183
Upstream	1	01	03-24-1999	06:19:13	01:00	10280	15550	4976	8854	13090	8209	10620	9961	2432	5111	3013	1044	173	273	174
Upstream	1	01	03-24-1999	06:21:43	01:00	10320	15530	4965	8806	13180	8179	10780	9857	2392	4980	3089	1067	194	283	190
Upstream	1	01	03-24-1999	06:24:13	01:00	10380	15510	4958	8918	13290	8265	10750	10060	2363	5166	3085	1025	160	284	201
Upstream	1	01	03-24-1999	06:26:43	01:00	10580	15850	4903	9165	13550	8272	10940	10030	2432	5206	3197	1043	172	284	197
Upstream	1	01	03-24-1999	06:29:13	01:00	10740	15470	4972	9193	13570	8518	11070	10200	2419	5226	3195	1067	155	292	182
U. Bckgrnd	1	01	03-24-1999	06:36:11	01:00	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-24-1999	06:00:05	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-24-1999	06:07:58	01:00	10820	15850	5117	9294	14290	8740	11160	10700	2574	5519	3397	1139	205	308	158
Downstream	2	01	03-24-1999	06:10:28	01:00	10750	15770	5028	9028	13390	8299	11010	10100	2466	5412	3233	1032	224	286	176
Downstream	2	01	03-24-1999	06:12:58	01:00	10370	15640	5039	8952	13500	8467	10960	10520	2441	5515	3251	1069	188	285	183
Downstream	2	01	03-24-1999	06:15:28	01:00	10540	15500	4848	8832	13190	8217	10630	10090	2403	5361	3160	1020	160	247	186
Downstream	2	01	03-24-1999	06:17:58	01:00	10640	15710	4871	8956	13230	8179	10680	10150	2390	5401	3228	1016	157	234	184
Downstream	2	01	03-24-1999	06:20:28	01:00	10310	15260	4896	8795	12990	7982	10830	9818	2425	5283	3165	1069	195	256	177
Downstream	2	01	03-24-1999	06:22:58	01:00	10240	15330	4926	8794	13100	8239	10700	10010	2487	5352	3110	1034	177	287	187
Downstream	2	01	03-24-1999	06:25:28	01:00	10560	15260	4818	9010	13260	8363	10940	10150	2477	5241	3256	1029	181	261	167
Downstream	2	01	03-24-1999	06:27:58	01:00	10600	15530	4953	9018	13740	8400	10850	10180	2499	5315	3261	991	174	274	191
Downstream	2	01	03-24-1999	06:30:28	01:00	10780	15560	4911	9114	13260	8391	10810	10010	2397	5314	3190	1024	163	264	180
D. Bckgrnd	2	01	03-24-1999	06:37:26	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						1.00	0.99	0.99	0.99	1.00	1.00	0.99	1.00	1.01	1.03	1.02	0.98	1.05	0.94	0.94
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration						1.00	0.99	0.99	0.99	1.00	1.00	0.99	1.00	1.01	1.03	1.02	0.98	1.05	0.94	0.94
Corrected Efficiency (%)						0	1	1	1	0	0	1	0	-1	-3	-2	2	-5	6	6
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						105950	156820	49770	90529	134440	83548	109540	101548	24378	52395	31491	10615	1738	2863	1913
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.05	0.16	0.08	0.07
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						14.0														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03249903
Arrestor
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-24-1999	08:56:56	01:00	1	3	0	1	2	0	1	0	0	0	0	0	0	0	0
Upstream	1	01	03-24-1999	09:10:00	01:00	10220	15160	4877	8734	13230	8143	10830	10400	2469	5435	3225	1163	191	286	216
Upstream	1	01	03-24-1999	09:12:30	01:00	9980	14830	4852	8621	13290	8010	10610	9937	2348	5259	3332	1119	189	295	205
Upstream	1	01	03-24-1999	09:15:00	01:00	10320	15170	4955	8841	13160	8129	10720	10100	2469	5385	3144	1152	162	306	207
Upstream	1	01	03-24-1999	09:17:30	01:00	10340	15250	4927	9080	13240	8235	10720	10290	2483	5279	3249	1093	170	315	189
Upstream	1	01	03-24-1999	09:20:00	01:00	10350	15230	4896	8900	13090	8050	10730	10320	2416	5466	3203	1134	198	297	184
Upstream	1	01	03-24-1999	09:22:30	01:00	9970	14630	4771	8585	12790	7784	10390	10180	2497	5310	3147	1087	187	296	206
Upstream	1	01	03-24-1999	09:25:00	01:00	9000	13350	4273	7648	11340	6995	9174	8574	2042	4573	2750	889	141	231	182
Upstream	1	01	03-24-1999	09:27:30	01:00	9981	15010	4795	8623	12680	7799	10440	9601	2356	5103	3031	1063	162	288	178
Upstream	1	01	03-24-1999	09:30:00	01:00	10040	14690	4814	8554	12480	7981	10370	9454	2269	4831	3037	999	163	298	208
Upstream	1	01	03-24-1999	09:32:30	01:00	10160	14940	4732	8318	12630	7838	10460	9608	2312	4952	2948	999	162	285	219
U. Bckgrnd	1	01	03-24-1999	09:47:23	01:00	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-24-1999	08:58:11	01:00	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-24-1999	09:11:15	01:00	802	884	225	317	346	132	158	71	18	33	14	3	0	0	0
Downstream	2	01	03-24-1999	09:13:45	01:00	732	871	222	329	339	154	137	81	14	26	17	5	1	0	0
Downstream	2	01	03-24-1999	09:16:15	01:00	780	851	191	340	329	156	122	70	16	27	9	2	1	0	0
Downstream	2	01	03-24-1999	09:18:45	01:00	774	891	192	324	354	124	135	85	18	21	7	2	0	0	0
Downstream	2	01	03-24-1999	09:21:15	01:00	792	939	218	317	335	152	151	79	16	30	16	4	1	0	2
Downstream	2	01	03-24-1999	09:23:45	01:00	787	959	246	366	374	160	124	106	17	29	7	2	0	0	0
Downstream	2	01	03-24-1999	09:26:15	01:00	818	972	256	312	360	148	148	80	11	27	16	1	1	1	1
Downstream	2	01	03-24-1999	09:28:45	01:00	848	917	222	346	349	131	155	67	13	33	9	3	2	0	0
Downstream	2	01	03-24-1999	09:31:15	01:00	765	910	224	326	341	130	109	81	23	31	20	3	1	0	1
Downstream	2	01	03-24-1999	09:33:45	01:00	773	776	217	282	320	137	112	81	7	24	14	6	0	0	0
D. Bckgrnd	2	01	03-24-1999	09:48:38	01:00	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Meas. Penetration						0.08	0.06	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
P100 correction values						1.00	0.99	0.99	0.99	1.00	1.00	0.99	1.00	1.01	1.03	1.02	0.98	1.05	0.94	0.94
Corrected Penetration						0.08	0.06	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						92	94	95	96	97	98	99	99	99	99	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						100361	148260	47892	85904	127930	78964	104444	98464	23661	51593	31066	10698	1725	2897	1994
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						13.4														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03249904
No Filter
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-24-1999	10:13:43	01:00	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Upstream	1	01	03-24-1999	10:25:13	01:00	10830	15950	5168	9141	13750	8690	11100	10800	2659	5819	3495	1203	167	311	206
Upstream	1	01	03-24-1999	10:27:43	01:00	10400	15220	4915	8935	13480	8132	10750	10520	2456	5546	3387	1154	175	312	240
Upstream	1	01	03-24-1999	10:30:13	01:00	10660	15670	5036	9206	13460	8487	11120	10750	2573	5546	3473	1243	199	319	251
Upstream	1	01	03-24-1999	10:32:43	01:00	10450	15250	4990	8930	13450	8286	10880	10460	2658	5605	3322	1187	203	321	229
Upstream	1	01	03-24-1999	10:35:13	01:00	10090	15350	4917	8781	13370	8268	10670	10340	2559	5493	3291	1229	201	342	206
Upstream	1	01	03-24-1999	10:37:43	01:00	10550	15750	5082	9126	13570	8297	10990	10780	2647	5598	3361	1141	191	320	240
Upstream	1	01	03-24-1999	10:40:13	01:00	10040	14960	4816	8751	12860	7904	10410	9732	2253	5007	3044	1008	160	272	187
Upstream	1	01	03-24-1999	10:42:43	01:00	10610	15820	5160	9263	13470	8715	11100	10180	2478	5196	3246	1105	183	291	199
Upstream	1	01	03-24-1999	10:45:13	01:00	10670	15850	5044	8951	13260	8238	10860	10180	2376	5278	3197	1043	182	312	186
Upstream	1	01	03-24-1999	10:47:43	01:00	10380	15450	4888	8780	13180	8294	10620	10000	2496	5209	3156	1089	165	326	190
U. Bckgrnd	1	01	03-24-1999	10:55:48	01:00	1	3	5	10	0	0	0	2	1	0	0	0	0	0	1
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-24-1999	10:14:58	01:00	6	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Downstream	2	01	03-24-1999	10:26:28	01:00	10760	15650	5107	9326	13690	8566	11010	11070	2680	5862	3585	1202	206	301	233
Downstream	2	01	03-24-1999	10:28:58	01:00	10530	15430	4913	9098	13370	8356	10880	10810	2689	5718	3421	1263	222	293	215
Downstream	2	01	03-24-1999	10:31:28	01:00	10310	15270	4878	9003	13710	8238	10870	10830	2659	5804	3632	1273	213	351	201
Downstream	2	01	03-24-1999	10:33:58	01:00	10350	15290	4944	8911	13160	8147	10750	10810	2663	5718	3513	1170	212	298	184
Downstream	2	01	03-24-1999	10:36:28	01:00	10260	15090	4884	9000	13410	8075	10740	10520	2576	5956	3540	1141	191	322	205
Downstream	2	01	03-24-1999	10:38:58	01:00	10480	15050	4862	9040	13550	8198	10830	10730	2654	5587	3497	1135	182	308	189
Downstream	2	01	03-24-1999	10:41:28	01:00	10660	15470	4961	9107	13220	8296	10700	10260	2422	5380	3281	1055	169	251	170
Downstream	2	01	03-24-1999	10:43:58	01:00	10530	15380	4952	9089	13600	8283	10930	10190	2450	5445	3264	1074	176	286	178
Downstream	2	01	03-24-1999	10:46:28	01:00	10520	15460	4928	8844	13240	8131	10880	9889	2460	5251	3286	1115	199	261	166
Downstream	2	01	03-24-1999	10:48:58	01:00	10160	15100	4801	8689	13210	7969	10450	10100	2434	5255	3219	1020	155	279	160
D. Bckgrnd	2	01	03-24-1999	10:57:03	01:00	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						1.00	0.99	0.98	1.00	1.00	0.99	1.00	1.01	1.02	1.03	1.04	1.00	1.05	0.94	0.89
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration						1.00	0.99	0.98	1.00	1.00	0.99	1.00	1.01	1.02	1.03	1.04	1.00	1.05	0.94	0.89
Corrected Efficiency (%)						0	1	2	0	0	1	0	-1	-2	-3	-4	0	-5	6	11
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						104680	155270	50016	89864	133850	83311	108500	103742	25155	54297	32972	11402	1826	3126	2134
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.03	0.02	0.03	0.03	0.02	0.04	0.03	0.05	0.07	0.07	0.06	0.10	0.15	0.11	0.15
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						14.0														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03249905
Arrestor
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)							0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)							0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)							0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																					
U. Bckgrnd	1	01	03-24-1999	11:23:14	01:00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-24-1999	11:34:46	01:00		10280	15340	4853	8903	13030	8088	10410	10100	2435	5183	3223	1122	192	268	176
Upstream	1	01	03-24-1999	11:37:16	01:00		10360	15180	4892	8818	13300	8130	10770	10040	2415	5351	3227	1147	182	295	226
Upstream	1	01	03-24-1999	11:39:46	01:00		10160	15130	4853	8760	12950	8071	10590	10120	2427	5198	3125	1137	171	309	191
Upstream	1	01	03-24-1999	11:42:16	01:00		10570	15130	5017	8936	13270	8124	10890	10140	2444	5367	3332	1081	186	304	196
Upstream	1	01	03-24-1999	11:44:46	01:00		10370	15480	4993	9111	13430	8113	10790	10450	2468	5406	3322	1119	186	306	233
Upstream	1	01	03-24-1999	11:47:16	01:00		10200	14870	4770	8675	13050	8121	10700	10050	2346	5251	3181	1128	162	308	205
Upstream	1	01	03-24-1999	11:49:46	01:00		9668	14690	4600	8402	12710	7635	10020	9975	2268	5239	3158	1074	193	290	181
Upstream	1	01	03-24-1999	11:52:16	01:00		9896	14910	4650	8610	12900	8143	10560	10040	2464	5348	3238	1119	171	343	211
Upstream	1	01	03-24-1999	11:54:46	01:00		10020	14690	4874	8712	12950	8068	10630	10400	2466	5325	3336	1189	193	325	194
Upstream	1	01	03-24-1999	11:57:16	01:00		10090	14630	4748	8499	13150	8007	10540	10180	2448	5359	3339	1124	195	309	201
U. Bckgrnd	1	01	03-24-1999	12:05:24	01:00		2	0	0	1	1	1	1	0	0	0	0	0	0	0	0
ENTER DATA BELOW																					
D. Bckgrnd	2	01	03-24-1999	11:24:29	01:00		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-24-1999	11:36:01	01:00		788	877	235	349	332	109	89	82	12	15	17	0	0	1	0
Downstream	2	01	03-24-1999	11:38:31	01:00		744	898	212	343	342	136	134	84	16	17	10	2	1	1	0
Downstream	2	01	03-24-1999	11:41:01	01:00		728	783	209	283	316	123	95	60	18	22	9	4	0	0	0
Downstream	2	01	03-24-1999	11:43:31	01:00		737	799	188	273	304	104	105	70	15	25	16	1	0	1	0
Downstream	2	01	03-24-1999	11:46:01	01:00		749	816	185	268	300	130	129	68	12	32	12	3	0	0	0
Downstream	2	01	03-24-1999	11:48:31	01:00		739	805	179	307	295	132	125	76	13	25	13	0	0	2	1
Downstream	2	01	03-24-1999	11:51:01	01:00		773	910	199	338	327	138	117	70	21	26	11	5	0	0	0
Downstream	2	01	03-24-1999	11:53:31	01:00		778	921	183	303	314	128	129	79	16	29	8	3	0	0	1
Downstream	2	01	03-24-1999	11:56:01	01:00		756	825	215	345	324	126	134	52	14	15	15	8	0	0	0
Downstream	2	01	03-24-1999	11:58:31	01:00		775	903	192	320	324	125	105	70	16	30	15	5	0	0	0
D. Bckgrnd	2	01	03-24-1999	12:06:39	01:00		0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Meas. Penetration							0.07	0.06	0.04	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
P100 correction values							1.00	0.99	0.98	1.00	1.00	0.99	1.00	1.01	1.02	1.03	1.04	1.00	1.05	0.94	0.89
Corrected Penetration							0.07	0.06	0.04	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)							93	94	96	96	98	98	99	99	99	100	100	100	100	100	100
Data Acceptance Criteria:																					
Total Challenge Counts for Each Channel:							101614	150050	48250	87426	130740	80500	105900	101495	24181	53027	32481	11240	1831	3057	2014
Data Quality Objective:							> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:							Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Data Quality Objective:							<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:							Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):							13.6														
Data Quality Objective: max. allowable conc. (#/cc):							< 23														
Does this meet the DQO:							Yes, (applies to all channels)														

Test No. 03249906
No Filter
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-24-1999	12:21:25	01:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Upstream	1	01	03-24-1999	12:34:10	01:00	9512	14130	4470	7870	11570	7110	9225	8608	1899	4305	2610	895	147	257	182
Upstream	1	01	03-24-1999	12:36:40	01:00	9830	14370	4536	8186	11790	7360	9812	8731	2106	4441	2724	962	145	260	161
Upstream	1	01	03-24-1999	12:39:10	01:00	9642	14390	4502	8088	11810	7228	9492	8774	2142	4549	2524	910	143	214	176
Upstream	1	01	03-24-1999	12:41:40	01:00	9501	13880	4348	7970	11480	7042	9364	8630	2031	4361	2555	902	161	257	150
Upstream	1	01	03-24-1999	12:44:10	01:00	9611	14220	4430	8013	11670	7125	9412	8593	2097	4417	2621	891	151	242	180
Upstream	1	01	03-24-1999	12:46:40	01:00	9855	14450	4641	8242	12400	7557	9731	8903	2094	4633	2655	877	147	264	147
Upstream	1	01	03-24-1999	12:49:10	01:00	9287	13560	4392	7676	11370	6987	9160	8534	1995	4435	2618	918	149	263	178
Upstream	1	01	03-24-1999	12:51:40	01:00	9648	14100	4549	8152	12150	7420	9740	9235	2309	4765	2821	985	183	247	201
Upstream	1	01	03-24-1999	12:54:10	01:00	9617	14160	4530	8227	12150	7339	9718	9239	2162	4783	2924	999	167	256	173
Upstream	1	01	03-24-1999	12:56:40	01:00	10000	14530	4666	8262	12250	7390	9848	9128	2189	4730	3002	1080	179	284	187
U. Bckgrnd	1	01	03-24-1999	13:04:34	01:00	1	1	4	0	0	0	0	0	0	1	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-24-1999	12:22:40	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-24-1999	12:35:25	01:00	9723	14250	4466	7931	11900	7221	9456	8835	2136	4599	2746	950	169	252	160
Downstream	2	01	03-24-1999	12:37:55	01:00	9767	14240	4485	8064	12100	7371	9605	8882	2216	4709	2759	880	151	287	168
Downstream	2	01	03-24-1999	12:40:25	01:00	9615	14230	4531	7836	11640	7200	9484	8969	2144	4632	2702	909	139	244	164
Downstream	2	01	03-24-1999	12:42:55	01:00	9664	14230	4517	8118	12000	7261	9462	8933	2162	4519	2685	930	133	246	180
Downstream	2	01	03-24-1999	12:45:25	01:00	9719	14260	4576	8192	12000	7182	9558	8745	2153	4525	2705	928	133	216	152
Downstream	2	01	03-24-1999	12:47:55	01:00	9924	14670	4607	8340	12330	7548	9794	9215	2169	4754	2791	974	152	235	169
Downstream	2	01	03-24-1999	12:50:25	01:00	9927	14750	4509	8290	12810	7556	9936	9608	2233	5021	3060	1067	161	272	165
Downstream	2	01	03-24-1999	12:52:55	01:00	9913	14380	4556	8298	12350	7467	9800	9494	2359	5070	3061	1016	162	318	170
Downstream	2	01	03-24-1999	12:55:25	01:00	9798	14350	4391	8233	11970	7280	9665	9483	2306	4907	3085	1024	167	284	179
Downstream	2	01	03-24-1999	12:57:55	01:00	9646	14070	4532	8402	12170	7395	9791	9335	2234	4843	2999	1068	186	280	192
D. Bckgrnd	2	01	03-24-1999	13:05:49	01:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Meas. Penetration						1.01	1.01	1.00	1.01	1.02	1.01	1.01	1.04	1.05	1.05	1.06	1.03	0.99	1.04	0.98
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration						1.01	1.01	1.00	1.01	1.02	1.01	1.01	1.04	1.05	1.05	1.06	1.03	0.99	1.04	0.98
Corrected Efficiency (%)						-1	-1	0	-1	-2	-1	-1	-4	-5	-5	-6	-3	1	-4	2
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						96503	141790	45064	80686	118640	72558	95502	88375	21024	45419	27054	9419	1572	2544	1735
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.02	0.03	0.03	0.03	0.04	0.03	0.03	0.05	0.07	0.06	0.09	0.10	0.14	0.14	0.11
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						12.6														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03249907
Arrestor
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-24-1999	13:30:45	01:00	5	1	3	0	1	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-24-1999	13:39:33	01:00	10590	15200	4954	8822	13090	8110	10610	10150	2391	5177	3202	1086	185	310	203
Upstream	1	01	03-24-1999	13:42:03	01:00	10250	15200	4904	8771	12910	7842	10640	9935	2459	5119	3147	1079	179	329	211
Upstream	1	01	03-24-1999	13:44:33	01:00	10540	14880	4856	8726	12870	7871	10220	9976	2441	5100	3082	1086	168	291	207
Upstream	1	01	03-24-1999	13:47:03	01:00	10190	14930	4809	8578	12790	7611	10200	10150	2430	5160	3237	1086	180	304	204
Upstream	1	01	03-24-1999	13:49:33	01:00	10300	15010	4900	8854	13040	8024	10460	10100	2417	5434	3196	1176	170	334	214
Upstream	1	01	03-24-1999	13:52:03	01:00	10300	15100	4838	8808	13090	7637	10380	10150	2425	5145	3224	1123	206	326	227
Upstream	1	01	03-24-1999	13:54:33	01:00	10100	14500	4739	8243	12470	7552	9923	9084	2135	4654	2703	1010	144	254	193
Upstream	1	01	03-24-1999	13:57:03	01:00	10720	16240	5028	9319	13330	8383	10920	9986	2265	4976	3188	1041	177	291	209
Upstream	1	01	03-24-1999	13:59:33	01:00	10870	16210	5109	9187	13360	8315	10820	10050	2395	5056	3077	986	178	259	193
Upstream	1	01	03-24-1999	14:02:03	01:00	10790	15920	5065	8930	13050	8138	10600	9809	2331	4874	3040	1094	168	294	201
U. Bckgrnd	1	01	03-24-1999	14:10:34	01:00	0	1	1	10	5	2	0	5	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-24-1999	13:32:00	01:00	6	2	0	1	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-24-1999	13:40:48	01:00	847	982	222	315	350	149	140	93	17	38	24	5	1	0	0
Downstream	2	01	03-24-1999	13:43:18	01:00	803	1005	249	291	335	148	115	97	25	26	18	4	1	0	1
Downstream	2	01	03-24-1999	13:45:48	01:00	776	929	258	333	343	117	136	103	17	35	9	5	0	2	2
Downstream	2	01	03-24-1999	13:48:18	01:00	847	958	232	374	326	129	139	61	19	28	12	4	0	0	2
Downstream	2	01	03-24-1999	13:50:48	01:00	765	904	221	358	332	120	128	115	17	23	18	3	1	0	0
Downstream	2	01	03-24-1999	13:53:18	01:00	693	889	215	311	353	120	138	82	20	31	17	0	0	2	0
Downstream	2	01	03-24-1999	13:55:48	01:00	754	846	206	281	313	132	110	70	15	33	14	4	0	1	0
Downstream	2	01	03-24-1999	13:58:18	01:00	729	839	215	303	327	142	112	102	11	24	16	2	1	0	0
Downstream	2	01	03-24-1999	14:00:48	01:00	865	942	230	302	302	154	114	79	20	26	7	4	1	0	1
Downstream	2	01	03-24-1999	14:03:18	01:00	884	915	214	304	377	129	128	76	22	29	12	5	0	2	0
D. Bckgrnd	2	01	03-24-1999	14:11:49	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.08	0.06	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
P100 correction values						1.01	1.01	1.00	1.01	1.02	1.01	1.01	1.04	1.05	1.05	1.06	1.03	0.99	1.04	0.98
Corrected Penetration						0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						93	94	95	96	97	98	99	99	99	99	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						104650	153190	49202	88238	130000	79483	104773	99390	23689	50695	31096	10767	1755	2992	2062
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						13.6														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03199907
HEPA
Solid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.45	0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88
Max. Diam. (um)						0.59	0.73	0.80	1.02	1.44	1.86	2.28	2.85	3.13	4.25	5.66	7.07	7.77	9.88	14.10
Geo. Mean Diam (um)						0.52	0.66	0.77	0.90	1.21	1.64	2.06	2.55	2.98	3.65	4.91	6.33	7.41	8.76	11.81
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-19-1999	15:11:42	01:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-19-1999	15:34:44	01:00	9558	14460	4529	8619	12920	7855	10470	9988	2389	5321	3340	1174	206	321	220
Upstream	1	01	03-19-1999	15:37:14	01:00	9784	14750	4659	8822	12880	8039	10430	10150	2448	5317	3422	1194	229	361	232
Upstream	1	01	03-19-1999	15:39:44	01:00	10100	14900	4827	8789	13110	8021	10580	9856	2371	5123	3179	1093	172	296	197
Upstream	1	01	03-19-1999	15:42:14	01:00	9926	14660	4826	8672	13010	7868	10500	9587	2309	5132	3218	1092	188	290	218
Upstream	1	01	03-19-1999	15:44:44	01:00	9948	14910	4765	8825	12960	8107	10550	9900	2368	5199	3165	1131	187	316	237
Upstream	1	01	03-19-1999	15:47:14	01:00	9782	14550	4628	8573	12630	7937	10340	9606	2306	5071	3154	1040	185	273	231
Upstream	1	01	03-19-1999	15:49:44	01:00	9777	14490	4571	8414	12700	7857	10320	9575	2303	4991	3260	1107	205	306	235
Upstream	1	01	03-19-1999	15:52:14	01:00	9655	14440	4469	8363	12640	7587	10110	9601	2210	5105	3077	1103	171	304	211
Upstream	1	01	03-19-1999	15:54:44	01:00	9846	14680	4671	8496	12920	7871	10060	9577	2335	4940	3279	1100	176	300	202
Upstream	1	01	03-19-1999	15:57:14	01:00	9861	14680	4627	8797	13030	7914	10530	9722	2318	5114	3173	1093	184	318	186
U. Bckgrnd	1	01	03-19-1999	16:06:17	01:00	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-19-1999	15:12:57	01:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Downstream	2	01	03-19-1999	15:35:59	01:00	4	7	4	3	4	7	9	6	2	4	1	1	0	2	0
Downstream	2	01	03-19-1999	15:38:29	01:00	9	9	2	2	6	3	7	1	3	4	1	0	0	0	0
Downstream	2	01	03-19-1999	15:40:59	01:00	8	6	1	6	4	9	3	9	1	0	2	0	0	0	0
Downstream	2	01	03-19-1999	15:43:29	01:00	3	3	0	5	11	2	2	5	1	0	2	0	1	0	0
Downstream	2	01	03-19-1999	15:45:59	01:00	9	11	3	10	8	1	7	6	2	1	0	1	0	0	0
Downstream	2	01	03-19-1999	15:48:29	01:00	16	19	9	13	8	5	3	2	0	3	2	0	0	0	0
Downstream	2	01	03-19-1999	15:50:59	01:00	7	5	0	2	7	4	0	1	2	3	2	0	0	0	0
Downstream	2	01	03-19-1999	15:53:29	01:00	3	5	3	5	8	3	4	4	0	1	3	0	0	0	0
Downstream	2	01	03-19-1999	15:55:59	01:00	2	7	2	6	6	9	5	4	1	0	0	0	0	1	0
Downstream	2	01	03-19-1999	15:58:29	01:00	6	6	2	3	2	4	4	2	0	2	3	0	0	0	1
D. Bckgrnd	2	01	03-19-1999	16:07:32	01:00	3	5	0	0	1	3	0	0	0	0	0	1	0	0	1
Meas. Penetration						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P100 correction values						1.01	1.00	0.98	0.99	1.00	1.00	0.99	1.01	1.03	1.03	1.03	1.04	0.94	1.00	0.97
Corrected Penetration						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						98237	146520	46572	86370	128800	79056	103890	97562	23357	51313	32267	11127	1903	3085	2169
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						13.1														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03239904
No Filter
Liquid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.28	0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60
Max. Diam. (um)						0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60	9.43
Geo. Mean Diam (um)						0.32	0.42	0.49	0.58	0.78	1.07	1.36	1.68	1.97	2.42	3.26	4.21	4.94	5.85	7.89
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-23-1999	09:19:31	01:00	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	09:28:01	01:00	10250	15870	5628	10480	15500	11030	18800	14240	2915	6932	4226	1205	200	319	183
Upstream	1	01	03-23-1999	09:30:31	01:00	10100	15480	5482	10020	15300	10830	18250	14150	2918	6866	4083	1145	200	291	195
Upstream	1	01	03-23-1999	09:33:01	01:00	10120	15480	5543	10140	14850	10700	18110	13720	2876	6824	4060	1183	180	306	185
Upstream	1	01	03-23-1999	09:35:31	01:00	10030	15560	5590	10170	15070	10690	18190	13840	2809	6802	4093	1207	181	309	170
Upstream	1	01	03-23-1999	09:38:01	01:00	9995	15160	5460	9856	14710	10430	17640	13480	2685	6614	3901	1097	171	327	155
Upstream	1	01	03-23-1999	09:40:31	01:00	10050	15200	5636	10040	14920	10520	18090	13840	2859	6703	4047	1200	201	276	177
Upstream	1	01	03-23-1999	09:43:01	01:00	9728	14490	5166	9936	14370	9959	17350	13880	2787	6710	4185	1191	171	319	201
Upstream	1	01	03-23-1999	09:45:31	01:00	9983	15280	5556	10370	15150	10820	18080	14570	2945	6802	4369	1220	196	311	198
Upstream	1	01	03-23-1999	09:48:01	01:00	10230	15510	5621	10420	15370	10680	18330	14380	2913	7166	4519	1288	176	323	155
Upstream	1	01	03-23-1999	09:50:31	01:00	10280	15500	5664	10580	15270	10750	18410	14540	2907	7085	4251	1244	211	289	181
U. Bckgrnd	1	01	03-23-1999	09:59:02	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-23-1999	09:20:46	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	09:29:16	01:00	9911	15480	5470	10200	15230	10980	18650	13760	2946	7170	4525	1232	169	328	177
Downstream	2	01	03-23-1999	09:31:46	01:00	10070	15290	5415	10220	15130	10710	18430	13440	2802	7037	4452	1287	212	273	160
Downstream	2	01	03-23-1999	09:34:16	01:00	10080	15490	5457	9866	14890	10820	18370	13410	2941	6961	4402	1279	191	319	190
Downstream	2	01	03-23-1999	09:36:46	01:00	9828	14970	5382	10070	14570	10690	17930	13130	2840	6866	4283	1284	203	320	176
Downstream	2	01	03-23-1999	09:39:16	01:00	9723	15300	5395	9995	14880	10530	18120	13490	2851	6946	4365	1291	217	297	176
Downstream	2	01	03-23-1999	09:41:46	01:00	9855	15130	5297	10060	14800	10760	18200	13480	2801	6896	4459	1257	198	283	169
Downstream	2	01	03-23-1999	09:44:16	01:00	9740	15260	5295	10140	14940	10410	17910	14180	2977	7185	4608	1352	193	329	213
Downstream	2	01	03-23-1999	09:46:46	01:00	10030	15230	5282	10270	15220	10500	18020	14240	2953	6991	4539	1365	215	342	197
Downstream	2	01	03-23-1999	09:49:16	01:00	10020	15410	5446	10250	15060	10620	18730	14380	3004	7396	4603	1266	224	284	192
Downstream	2	01	03-23-1999	09:51:46	01:00	10040	15550	5614	10380	15410	10640	18420	14830	3009	7357	4708	1322	222	321	193
D. Bckgrnd	2	01	03-23-1999	10:00:17	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.99	1.00	0.98	0.99	1.00	1.00	1.01	0.98	1.02	1.03	1.08	1.08	1.08	1.01	1.02
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration						0.99	1.00	0.98	0.99	1.00	1.00	1.01	0.98	1.02	1.03	1.08	1.08	1.08	1.01	1.02
Corrected Efficiency (%)						1	0	2	1	0	0	-1	2	-2	-3	-8	-8	-8	-1	-2

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	100766	153530	55346	102012	150510	106409	181250	140640	28614	68504	41734	11980	1887	3070	1800
Data Quality Objective:	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.05	0.04	0.04	0.06	0.06	0.12	0.09	0.13
Data Quality Objective:	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Maximum observed particle concentration (#/cc):	16.7
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

Test No. 03239905
Arrestor
Liquid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.28	0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60
Max. Diam. (um)						0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60	9.43
Geo. Mean Diam (um)						0.32	0.42	0.49	0.58	0.78	1.07	1.36	1.68	1.97	2.42	3.26	4.21	4.94	5.85	7.89
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-23-1999	10:16:23	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	10:27:42	01:00	10000	15430	5450	10300	15020	10960	18460	13460	2658	6724	3961	1114	174	273	180
Upstream	1	01	03-23-1999	10:30:12	01:00	10070	15380	5543	10040	14850	10600	18140	13270	2707	6678	3963	1131	183	285	166
Upstream	1	01	03-23-1999	10:32:42	01:00	10070	15430	5553	10060	14740	10740	18040	13180	2780	6596	3989	1127	171	288	154
Upstream	1	01	03-23-1999	10:35:12	01:00	9997	15180	5421	9801	14610	10580	17780	13230	2633	6480	3920	1078	183	263	167
Upstream	1	01	03-23-1999	10:37:42	01:00	9846	15290	5421	9704	14390	10780	17590	13020	2688	6593	3812	1037	160	264	172
Upstream	1	01	03-23-1999	10:40:12	01:00	9935	15260	5373	9765	14650	10750	18030	13130	2695	6577	3855	1125	147	281	166
Upstream	1	01	03-23-1999	10:42:42	01:00	9200	14210	5170	9690	14200	10030	17180	13730	2853	6786	4241	1142	184	290	159
Upstream	1	01	03-23-1999	10:45:12	01:00	9572	15080	5271	10110	14820	10250	17960	14770	2959	6935	4489	1295	215	319	184
Upstream	1	01	03-23-1999	10:47:42	01:00	9756	14890	5307	10170	14840	10460	17680	14770	2906	6955	4374	1262	183	298	164
Upstream	1	01	03-23-1999	10:50:12	01:00	9473	14600	5214	9818	14760	10090	17510	14610	2869	6949	4471	1234	201	304	202
U. Bckgrnd	1	01	03-23-1999	10:57:36	01:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-23-1999	10:17:38	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	10:28:57	01:00	1435	1902	623	1077	1148	547	554	198	19	52	14	2	0	2	0
Downstream	2	01	03-23-1999	10:31:27	01:00	1399	1951	621	1033	1109	535	571	227	22	36	12	3	1	0	0
Downstream	2	01	03-23-1999	10:33:57	01:00	1435	1980	609	990	1189	552	564	184	25	44	17	2	0	0	0
Downstream	2	01	03-23-1999	10:36:27	01:00	1370	1965	651	995	1055	578	542	176	22	33	17	3	0	2	0
Downstream	2	01	03-23-1999	10:38:57	01:00	1310	1855	589	981	1073	506	529	178	24	30	10	2	0	0	0
Downstream	2	01	03-23-1999	10:41:27	01:00	1327	1896	630	1001	1084	489	523	180	29	35	24	2	1	0	1
Downstream	2	01	03-23-1999	10:43:57	01:00	1360	1888	579	1002	1112	553	568	211	29	50	19	6	1	1	0
Downstream	2	01	03-23-1999	10:46:27	01:00	1354	1864	570	1026	1211	544	546	240	26	42	16	3	1	0	0
Downstream	2	01	03-23-1999	10:48:57	01:00	1360	1945	616	1112	1188	546	607	209	23	36	13	4	0	0	0
Downstream	2	01	03-23-1999	10:51:27	01:00	1351	1895	586	1081	1161	567	621	205	26	45	21	5	1	0	0
D. Bckgrnd	2	01	03-23-1999	10:58:51	01:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.14	0.13	0.11	0.10	0.08	0.05	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
P100 correction values						0.99	1.00	0.98	0.99	1.00	1.00	1.01	0.98	1.02	1.03	1.08	1.08	1.08	1.01	1.02
Corrected Penetration						0.14	0.13	0.12	0.10	0.08	0.05	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						86	87	88	90	92	95	97	99	99	99	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						97919	150750	53723	99458	146880	105240	178370	137170	27748	67273	41075	11545	1801	2865	1714
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Maximum observed particle concentration (#/cc): 16.1
Data Quality Objective: max. allowable conc. (#/cc): < 23
Does this meet the DQO: Yes, (applies to all channels)

Test No. 03249906
No Filter
Liquid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.28	0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60
Max. Diam. (um)						0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60	9.43
Geo. Mean Diam (um)						0.32	0.42	0.49	0.58	0.78	1.07	1.36	1.68	1.97	2.42	3.26	4.21	4.94	5.85	7.89
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-23-1999	11:09:56	01:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	11:23:46	01:00	9572	14930	5308	9874	14450	10460	17590	13370	2660	6512	3951	1099	206	241	161
Upstream	1	01	03-23-1999	11:26:16	01:00	9719	14760	5098	9760	14390	10280	17430	13620	2706	6646	4028	1144	184	285	159
Upstream	1	01	03-23-1999	11:28:46	01:00	9623	14670	5256	9639	14290	10320	17270	13380	2742	6605	3991	1164	179	262	155
Upstream	1	01	03-23-1999	11:31:16	01:00	9419	14560	5213	9544	14080	10110	17380	13040	2718	6551	3958	1097	163	273	143
Upstream	1	01	03-23-1999	11:33:46	01:00	9454	14370	5210	9592	14260	10150	17250	13210	2680	6417	3956	1131	181	283	153
Upstream	1	01	03-23-1999	11:36:16	01:00	9527	14880	5121	9835	14530	10400	17470	13570	2651	6438	3949	1132	202	272	154
Upstream	1	01	03-23-1999	11:38:46	01:00	8993	13530	4897	9300	13600	9509	16480	13310	2679	6438	3941	1191	206	300	178
Upstream	1	01	03-23-1999	11:41:16	01:00	9227	14080	5147	9464	13990	9722	16950	13810	2745	6525	4239	1137	192	279	152
Upstream	1	01	03-23-1999	11:43:46	01:00	9351	14110	5092	9541	14090	9823	16900	13990	2799	6531	4289	1138	196	326	192
Upstream	1	01	03-23-1999	11:46:16	01:00	9157	14390	5042	9675	14270	9691	16830	14070	2863	6643	4104	1179	202	331	171
U. Bckgrnd	1	01	03-23-1999	11:54:26	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-23-1999	11:11:11	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	11:25:01	01:00	9656	14600	5214	9775	14670	10450	17880	13240	2732	6906	4252	1216	188	306	145
Downstream	2	01	03-23-1999	11:27:31	01:00	9487	14700	5222	9688	14430	10240	17690	12880	2733	6649	4305	1206	169	317	147
Downstream	2	01	03-23-1999	11:30:01	01:00	9488	14750	5198	9624	14380	10430	17750	13360	2746	6862	4344	1240	159	289	148
Downstream	2	01	03-23-1999	11:32:31	01:00	9315	14500	5076	9445	14130	9966	17570	13030	2705	6677	4281	1197	168	307	156
Downstream	2	01	03-23-1999	11:35:01	01:00	9297	14510	5134	9632	14230	10060	17330	13240	2758	6755	4196	1210	186	309	161
Downstream	2	01	03-23-1999	11:37:31	01:00	9431	14360	5108	9648	14300	10330	17300	13000	2747	6754	4155	1249	203	276	150
Downstream	2	01	03-23-1999	11:40:01	01:00	9273	14040	5114	9509	14220	9749	16980	13750	2741	6738	4481	1233	213	339	195
Downstream	2	01	03-23-1999	11:42:31	01:00	8912	13940	4882	9441	13560	9633	16880	13720	2798	6779	4379	1287	173	317	183
Downstream	2	01	03-23-1999	11:45:01	01:00	9037	13930	4883	9396	14010	9706	16610	13520	2706	6769	4546	1292	186	315	196
Downstream	2	01	03-23-1999	11:47:31	01:00	8947	13750	4956	9371	14050	9683	16950	13580	2799	6855	4547	1227	204	365	194
D. Bckgrnd	2	01	03-23-1999	11:55:41	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.99	0.99	0.99	0.99	1.00	1.00	1.01	0.98	1.01	1.04	1.08	1.08	0.97	1.10	1.04
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration						0.99	0.99	0.99	0.99	1.00	1.00	1.01	0.98	1.01	1.04	1.08	1.08	0.97	1.10	1.04
Corrected Efficiency (%)						1	1	1	1	0	0	-1	2	-1	-4	-8	-8	3	-10	-4
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						94042	144280	51384	96224	141950	100465	171550	135370	27243	65306	40406	11412	1911	2852	1618
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.04	0.04	0.03	0.02	0.03	0.05	0.03	0.03	0.03	0.02	0.05	0.04	0.12	0.14	0.16
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						15.7														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03239907
Arrestor
Liquid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.28	0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60
Max. Diam. (um)						0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60	9.43
Geo. Mean Diam (um)						0.32	0.42	0.49	0.58	0.78	1.07	1.36	1.68	1.97	2.42	3.26	4.21	4.94	5.85	7.89
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-23-1999	12:16:04	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	12:24:56	01:00	9678	15100	5510	10020	15000	10560	18010	13790	2793	6846	3930	1164	197	300	154
Upstream	1	01	03-23-1999	12:27:26	01:00	9634	14890	5274	9820	14660	10560	17510	13410	2633	6544	3990	1141	216	291	160
Upstream	1	01	03-23-1999	12:29:56	01:00	9607	15170	5305	9717	14660	10530	17780	13470	2719	6560	4090	1134	172	294	187
Upstream	1	01	03-23-1999	12:32:26	01:00	9639	14910	5271	9789	14500	10540	17820	13290	2776	6620	4123	1053	181	316	149
Upstream	1	01	03-23-1999	12:34:56	01:00	10050	15500	5415	10210	15040	11100	18150	13760	2797	6626	4213	1134	167	280	156
Upstream	1	01	03-23-1999	12:37:26	01:00	9968	15660	5681	10410	15350	11160	18510	13930	2966	6937	4124	1183	195	292	161
Upstream	1	01	03-23-1999	12:39:56	01:00	9163	13960	5024	9614	14080	10030	16810	13890	2778	6658	4144	1166	182	310	164
Upstream	1	01	03-23-1999	12:42:26	01:00	9781	14930	5368	10150	15230	10580	17860	14690	2897	7110	4410	1287	200	322	185
Upstream	1	01	03-23-1999	12:44:56	01:00	9663	14520	5268	9832	14740	10340	17820	14350	2988	6826	4213	1259	187	332	186
Upstream	1	01	03-23-1999	12:47:26	01:00	9602	14700	5160	9732	14700	10450	17300	13230	2709	6458	3968	1106	192	281	164
U. Bckgrnd	1	01	03-23-1999	12:56:50	01:00	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-23-1999	12:17:19	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	12:26:11	01:00	1426	2016	655	1060	1213	608	597	210	26	48	17	1	0	1	0
Downstream	2	01	03-23-1999	12:28:41	01:00	1388	1953	574	1010	1179	594	562	184	21	34	20	1	0	0	0
Downstream	2	01	03-23-1999	12:31:11	01:00	1407	1997	663	1081	1130	584	583	209	20	40	11	2	1	0	0
Downstream	2	01	03-23-1999	12:33:41	01:00	1415	1964	627	1086	1153	588	613	196	26	46	16	4	1	0	0
Downstream	2	01	03-23-1999	12:36:11	01:00	1460	1959	632	1059	1211	572	562	199	30	48	13	0	0	1	0
Downstream	2	01	03-23-1999	12:38:41	01:00	1436	2030	629	1070	1208	594	575	201	23	35	17	2	1	0	1
Downstream	2	01	03-23-1999	12:41:11	01:00	1423	1984	585	1114	1245	628	627	209	30	49	13	3	0	1	0
Downstream	2	01	03-23-1999	12:43:41	01:00	1374	1972	605	1091	1262	625	639	257	27	42	18	4	0	1	0
Downstream	2	01	03-23-1999	12:46:11	01:00	1400	1932	635	1077	1190	575	605	215	22	45	10	1	0	0	0
Downstream	2	01	03-23-1999	12:48:41	01:00	1413	1965	643	979	1159	574	614	196	26	39	12	4	0	0	0
D. Bckgrnd	2	01	03-23-1999	12:58:05	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.15	0.13	0.12	0.11	0.08	0.06	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00
P100 correction values						0.99	0.99	0.99	0.99	1.00	1.00	1.01	0.98	1.01	1.04	1.08	1.08	0.97	1.10	1.04
Corrected Penetration						0.15	0.13	0.12	0.11	0.08	0.06	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						85	87	88	89	92	94	97	98	99	99	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						96785	149340	53276	99294	147960	105850	177570	137810	28056	67185	41205	11627	1889	3018	1666
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						16.5														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03239908
No Filter
Liquid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.28	0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60
Max. Diam. (um)						0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60	9.43
Geo. Mean Diam (um)						0.32	0.42	0.49	0.58	0.78	1.07	1.36	1.68	1.97	2.42	3.26	4.21	4.94	5.85	7.89
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-23-1999	13:17:05	01:00	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	13:28:29	01:00	9434	14460	5272	9722	14220	10310	17370	13460	2739	6423	3965	1144	177	272	145
Upstream	1	01	03-23-1999	13:30:59	01:00	9256	14470	5267	9526	14140	10340	17170	12900	2716	6470	3825	1100	189	275	176
Upstream	1	01	03-23-1999	13:33:29	01:00	9381	14670	5228	9789	14150	10250	17330	12980	2561	6412	3887	1124	164	251	132
Upstream	1	01	03-23-1999	13:35:59	01:00	9134	14190	5101	9586	13910	10030	16880	12910	2615	6400	3913	1128	157	286	192
Upstream	1	01	03-23-1999	13:38:29	01:00	9530	14750	5123	9444	14280	10150	17580	12960	2636	6315	3834	1093	162	288	174
Upstream	1	01	03-23-1999	13:40:59	01:00	9697	14980	5308	9911	14720	10460	17820	13640	2824	6607	3911	1144	190	321	172
Upstream	1	01	03-23-1999	13:43:29	01:00	9960	15350	5449	9847	14820	10940	17860	12700	2699	6470	3845	1101	171	258	144
Upstream	1	01	03-23-1999	13:45:59	01:00	9975	15790	5431	10020	14900	11220	17980	13120	2690	6649	3911	1164	178	254	148
Upstream	1	01	03-23-1999	13:48:29	01:00	10180	15670	5739	10140	15080	11200	18730	13060	2726	6680	3802	1086	187	275	145
Upstream	1	01	03-23-1999	13:50:59	01:00	9602	15250	5349	9597	14380	10660	17330	12450	2688	6361	3770	1053	151	291	153
U. Bckgrnd	1	01	03-23-1999	13:59:30	01:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-23-1999	13:18:20	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	13:29:44	01:00	9273	14340	5097	9537	13970	10230	17460	13080	2734	6739	4183	1204	193	299	165
Downstream	2	01	03-23-1999	13:32:14	01:00	9079	13990	5088	9070	13810	10060	17160	12610	2713	6547	4033	1149	176	254	154
Downstream	2	01	03-23-1999	13:34:44	01:00	9278	14140	5021	9542	14000	10150	17340	12700	2649	6720	4019	1205	196	300	163
Downstream	2	01	03-23-1999	13:37:14	01:00	9417	14480	5157	9580	14080	10320	17720	13140	2711	6911	4287	1248	188	263	164
Downstream	2	01	03-23-1999	13:39:44	01:00	9520	14630	5266	9791	14300	10300	17910	13140	2777	6739	4245	1220	194	294	168
Downstream	2	01	03-23-1999	13:42:14	01:00	9547	14820	5250	9775	14610	10690	17490	13170	2913	6926	4201	1201	198	294	185
Downstream	2	01	03-23-1999	13:44:44	01:00	9769	15500	5459	9628	14920	10920	18280	12520	2725	6744	4100	1142	183	274	153
Downstream	2	01	03-23-1999	13:47:14	01:00	9850	15550	5406	9917	14730	10870	18150	12560	2694	6841	3993	1092	198	260	172
Downstream	2	01	03-23-1999	13:49:44	01:00	9879	15280	5401	9842	14640	10900	18010	12360	2717	6628	4079	1195	163	265	129
Downstream	2	01	03-23-1999	13:52:14	01:00	9546	15090	5196	9584	14300	10620	17620	12400	2573	6545	3957	1063	190	293	175
D. Bckgrnd	2	01	03-23-1999	14:00:45	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.99	0.99	0.98	0.99	0.99	1.00	1.01	0.98	1.01	1.04	1.06	1.05	1.09	1.01	1.03
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration						0.99	0.99	0.98	0.99	0.99	1.00	1.01	0.98	1.01	1.04	1.06	1.05	1.09	1.01	1.03
Corrected Efficiency (%)						1	1	2	1	1	0	-1	2	-1	-4	-6	-5	-9	-1	-3
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						96149	149580	53267	97582	144600	105560	176050	130180	26894	64787	38663	11137	1726	2771	1581
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.04	0.05	0.04	0.03	0.04	0.05	0.04	0.04	0.04	0.03	0.03	0.06	0.11	0.10	0.16
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						16.2														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03239909
Arrestor
Liquid-Phase

Particle Counts per Indicated OPC Channel (1-Minute Samples @ 7.1 L/min)

OPC Channel Number						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Min. Diam. (um)						0.28	0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60
Max. Diam. (um)						0.37	0.47	0.52	0.66	0.94	1.22	1.51	1.88	2.07	2.83	3.77	4.71	5.18	6.60	9.43
Geo. Mean Diam (um)						0.32	0.42	0.49	0.58	0.78	1.07	1.36	1.68	1.97	2.42	3.26	4.21	4.94	5.85	7.89
ENTER DATA BELOW																				
U. Bckgrnd	1	01	03-23-1999	14:39:53	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	14:52:46	01:00	9243	14350	5117	9592	14460	9952	17250	14290	2727	6795	4107	1188	192	252	178
Upstream	1	01	03-23-1999	14:55:16	01:00	9479	14270	5209	9844	14100	9835	17170	14120	2837	6768	4135	1157	184	306	177
Upstream	1	01	03-23-1999	14:57:46	01:00	9540	14790	5413	10080	14770	10170	17610	14550	2861	6936	4321	1248	204	319	203
Upstream	1	01	03-23-1999	15:00:16	01:00	9721	14840	5246	10090	14860	10160	18080	14750	2849	7006	4331	1230	197	349	191
Upstream	1	01	03-23-1999	15:02:46	01:00	9938	15020	5345	10180	14890	10450	18190	14920	2879	7111	4379	1263	219	293	199
Upstream	1	01	03-23-1999	15:05:16	01:00	9885	15140	5334	10230	15010	10300	18090	14840	2888	7000	4342	1215	202	297	181
Upstream	1	01	03-23-1999	15:07:46	01:00	9372	14450	5231	9702	14090	10170	17390	12910	2704	6343	3812	1060	169	253	152
Upstream	1	01	03-23-1999	15:10:16	01:00	9724	15040	5431	9983	14780	10660	17910	12990	2763	6698	3889	1152	149	273	177
Upstream	1	01	03-23-1999	15:12:46	01:00	9450	14700	5174	9674	14290	10490	17600	13010	2688	6518	3853	1058	177	284	169
Upstream	1	01	03-23-1999	15:15:16	01:00	9338	14710	5183	9682	14110	10430	17140	12910	2589	6509	3883	1035	159	249	164
U. Bckgrnd	1	01	03-23-1999	15:23:11	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-23-1999	14:41:08	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	14:54:01	01:00	1381	1889	599	1089	1117	589	562	214	22	42	20	0	0	0	0
Downstream	2	01	03-23-1999	14:56:31	01:00	1315	1866	611	1066	1157	558	588	210	20	33	13	3	0	0	1
Downstream	2	01	03-23-1999	14:59:01	01:00	1351	1845	592	1068	1183	560	566	209	21	31	20	4	0	0	1
Downstream	2	01	03-23-1999	15:01:31	01:00	1402	1909	609	1009	1101	574	605	222	24	35	9	0	2	1	0
Downstream	2	01	03-23-1999	15:04:01	01:00	1363	1872	604	1130	1163	547	600	202	27	46	9	1	1	1	1
Downstream	2	01	03-23-1999	15:06:31	01:00	1375	1899	637	1075	1137	554	551	211	25	36	13	6	0	0	0
Downstream	2	01	03-23-1999	15:09:01	01:00	1376	1926	616	997	1075	518	532	176	24	30	9	1	0	0	0
Downstream	2	01	03-23-1999	15:11:31	01:00	1332	1871	587	994	1142	507	520	183	24	27	7	5	0	0	1
Downstream	2	01	03-23-1999	15:14:01	01:00	1319	1847	609	1043	1053	521	469	187	35	37	10	4	0	0	0
Downstream	2	01	03-23-1999	15:16:31	01:00	1343	1850	615	1007	1034	484	509	172	12	36	11	2	0	0	0
D. Bckgrnd	2	01	03-23-1999	15:24:26	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.14	0.13	0.12	0.11	0.08	0.05	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
P100 correction values						0.99	0.99	0.98	0.99	0.99	1.00	1.01	0.98	1.01	1.04	1.06	1.05	1.09	1.01	1.03
Corrected Penetration						0.14	0.13	0.12	0.11	0.08	0.05	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						86	87	88	89	92	95	97	99	99	99	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						95690	147310	52683	99057	145360	102617	176430	139290	27785	67684	41052	11606	1852	2875	1791
Data Quality Objective:						> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Deviation of Penetration for Each Channel :						0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Data Quality Objective:						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	< 0.10	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Does this meet DQO:						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maximum observed particle concentration (#/cc):						16.3														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														