July 1999

Environmental Technology Verification Report

Paint Overspray Arrestor
Koch Filter Corporation
Multi-Sak 6FZ159-S

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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Koch Filter Corporation Multi-Sak 6FZ159-S

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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:	**Multi-Sak 6FZ159-S**		
COMPANY:	**Koch Filter Corporation**		
ADDRESS:	**P.O. Box 3186** **Louisville, KY 40201-3186**	**PHONE:** **FAX:**	**(502) 634-4796** **(502) 637-2280**
WEB SITE:	**http:\\www.kochfilter.com**		
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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 Koch Filter Corporation Multi-Sac 6FZ159-S.

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 Koch Multi-Sak 6FZ159-S arrestor is a six-pocket bag filter with nominal dimensions of 24 x 24 x 15 in. (0.61 x 0.61 x 0.38 m). The arrestor has a metal frame, and the filter media color is white on the upstream side and yellow on the downstream side. The label is dark blue, 5/8 x 5 in. (1.59 x 12.70 cm) in size, and is affixed to the front of the metal frame. The label includes the following information: Koch Filter Corporation, Louisville, Kentucky 40208, MULTI-SAK. In addition, a white box in the center of the label states 6FZ159-S MFG Code 12308-ZB. 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 Koch Multi-Sak 6FZ159-S was performed from March 19 through 23, 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 0.15 to 0.18 in. H_2O (37 to 45 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 statement is valid for 12 months after the publication date 8/11/99.

Paint Overspray Arrestor Brand/Model: Koch Multi-Sak 6FZ159-S

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	98

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	98
> 1.0	> 80	89
> 0.42	> 65	79

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	95
> 0.70	> 75	91

*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
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7/27/99

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National Risk Management Research Laboratory
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United States Environmental Protection Agency

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Jack R. Farmer
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Jack R. Farmer Date
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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 Koch Filter Corporation's Multi-Sak 6FZ159-S during the period March 19-23, 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 Multi-Sak 6FZ159-S 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
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 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 David Koch and Mike Snow of Koch Filter Corporation.

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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	
03229906	X				Solid-Phase
03229907				X	
03199908	X				
03229901		X			
03229902	X				
03229903		X			
03229904	X				
03229905		X			
03199907			X		
03229908	X				Liquid-Phase
03229909		X			
03229910	X				
03239901		X			
03239902	X				
03239903		X			

2.1 SELECTION OF TESTED PAINT OVERSPRAY ARRESTORS

The test arrestors (Multi-Sak 6FZ159-S) were supplied to the test laboratory directly from the manufacturer (Koch Filter Corporation) with a letter signed by the David Koch, National Sales Manager, attesting that the arrestors were selected in an unbiased manner from a minimum of 100 similar arrestors and had 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 Koch Multi-Sak 6FZ159-S arrestor is a six-pocket bag filter with nominal dimensions of 24 x 24 x 15 in. (0.61 x 0.61 x 0.38 m). The arrestor has a metal frame, and the filter media color is white on the upstream side and yellow on the downstream side. The label is dark blue, 5/8 x 5 in. (1.59 x 12.70 cm) in size, and is affixed to the front of the metal frame. The label includes the following information: Koch Filter Corporation, Louisville, Kentucky 40208, MULTI-SAK. In addition, a white box in the center of the label states 6FZ159-S MFG Code 12308-ZB. 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. 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 0.15 to 0.18 in. H_2O (37 to 45 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
Koch 6FZ159-S																
Run #1	03229901	89	92	94	95	96	98	98	99	99	99	100	100	100	100	100
Run #2	03229903	89	92	93	95	96	98	98	99	99	99	100	100	100	100	100
Run #3	03229905	86	88	91	92	94	96	97	98	99	99	99	100	99	100	100
Average		88	91	92	94	96	97	98	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):	91
1.10 um (> 85% required):	95
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	03229907	1	2	4	4	9	16	25	44	60	74	89	94	94	94	93
Baseline	03189903	1	3	4	5	8	15	26	44	61	75	90	94	94	95	95
Difference		0	0	0	-1	0	0	-1	0	-1	-1	-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	03199908	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.02	1.02	1.05	1.02	0.97	0.98	0.96
Run #2	03229902	0.99	1.00	0.98	0.99	1.00	1.00	1.00	1.02	1.03	1.04	1.04	1.04	0.95	1.00	0.91
Run #3	03229904	1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.02	1.04	1.04	1.06	1.00	0.99	0.96	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
Koch 6FZ159-S																
Run #1	03229909	70	73	75	76	81	85	89	94	97	98	99	100	100	100	100
Run #2	03239901	79	81	83	85	88	91	94	97	98	99	99	100	100	100	100
Run #3	03239903	81	83	84	86	90	93	95	97	99	99	100	100	100	100	100
Average		77	79	81	82	86	90	93	96	98	99	99	100	100	100	100

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

2.20 um (> 10% required):	98
4.10 um (> 50% required):	100
5.70 um (> 90% required):	100

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

0.42 um (> 65% required):	79
1.00 um (> 80% requried):	89
2.00 um (> 95% required):	98

"No Filter" Control Tests		Penetration For Each Size Range														
Run #1	03229908	1.01	1.01	1.01	1.01	1.01	1.02	1.02	1.00	1.02	1.04	1.07	1.05	1.06	1.06	1.03
Run #2	03229910	0.99	1.00	0.99	0.99	1.00	1.00	1.01	0.99	1.01	1.04	1.06	1.07	1.07	1.07	1.01
Run #3	03239902	0.99	0.99	1.00	1.00	1.00	1.01	1.00	0.99	1.03	1.04	1.08	1.08	1.07	1.08	1.05

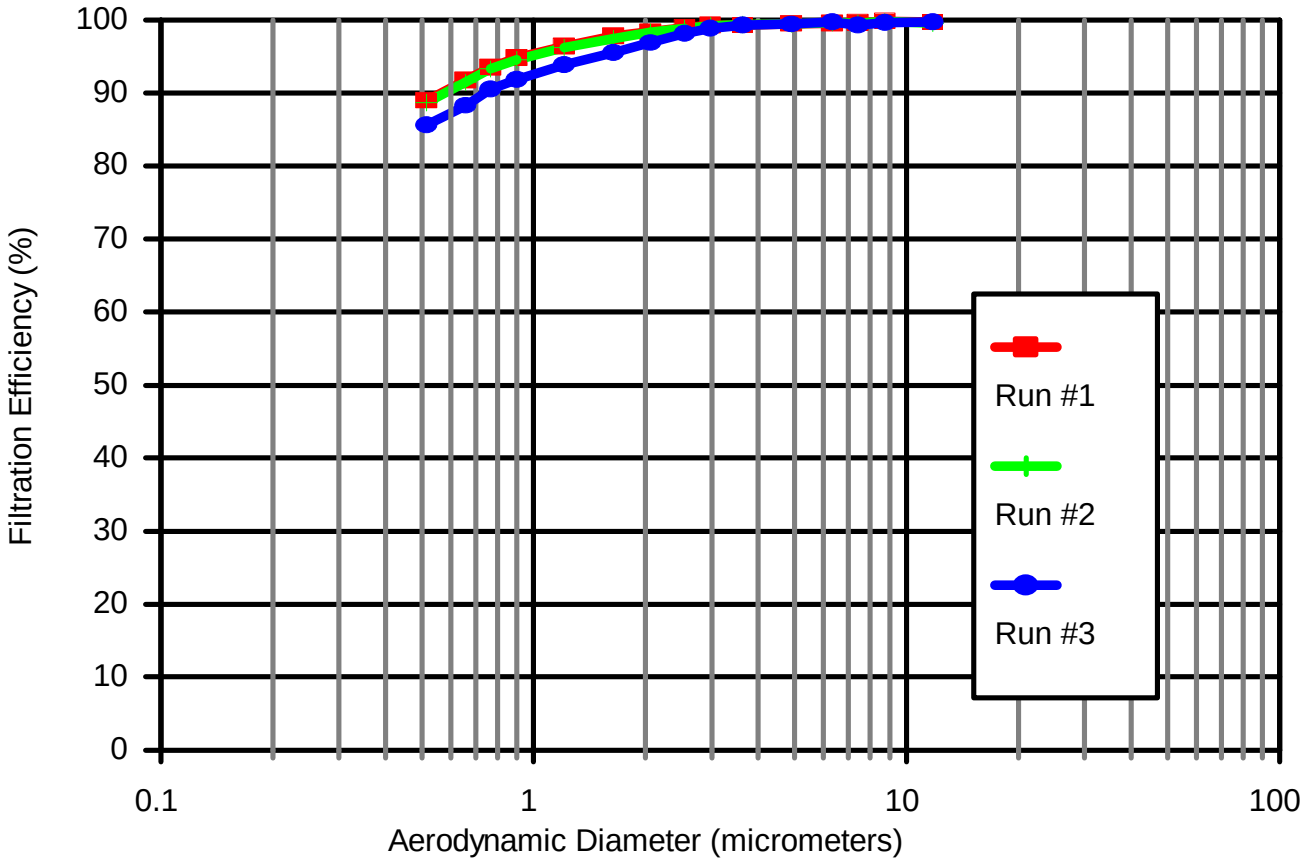

Figure 1. Triplicate solid-phase particle removal efficiency curves for Koch Multi-Sak 6FZ159-S paint overspray arrestor.

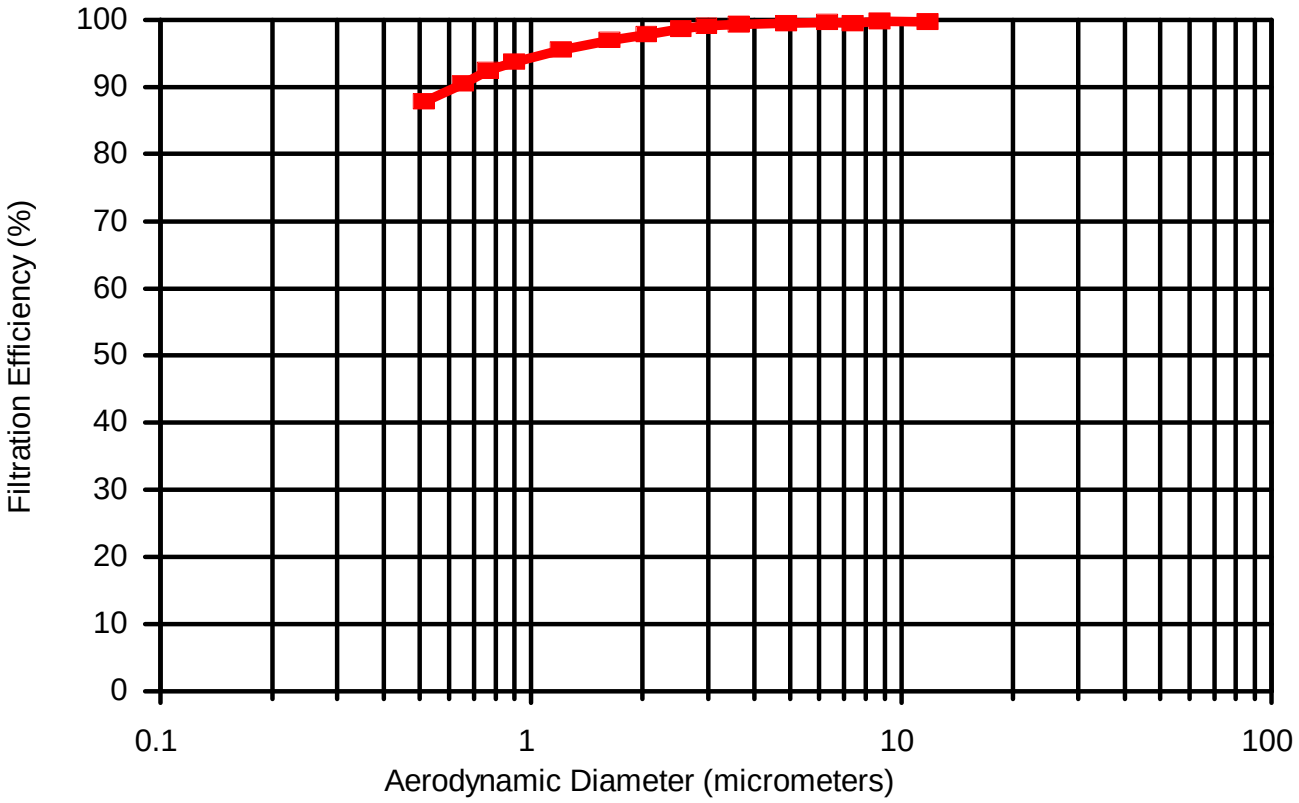

Figure 2. Average of the solid-phase particle removal efficiency curves for Koch Multi-Sak 6FZ159-S paint overspray arrestor.

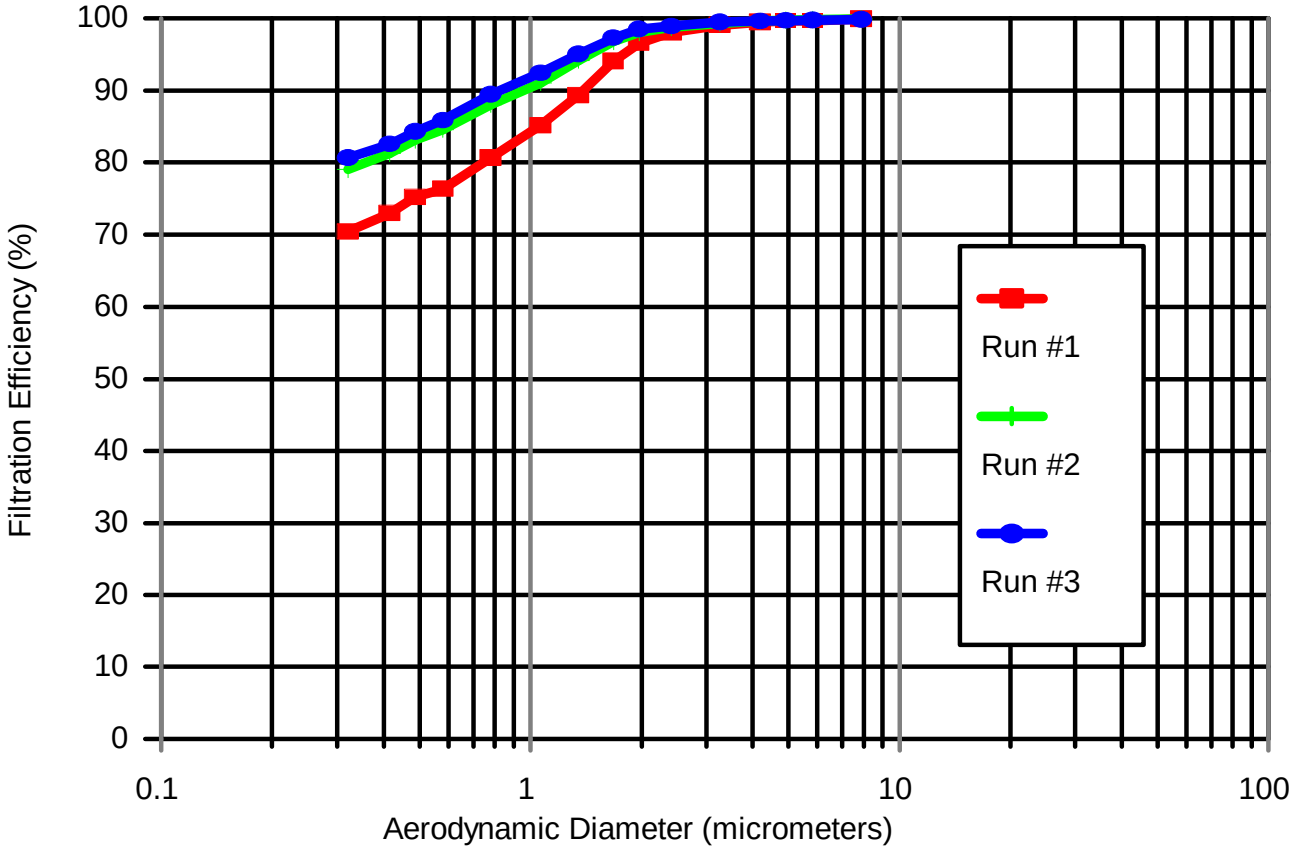

Figure 3. Triplicate liquid-phase particle removal efficiency curves for Koch Multi-Sak 6FZ159-S paint overspray arrestor.

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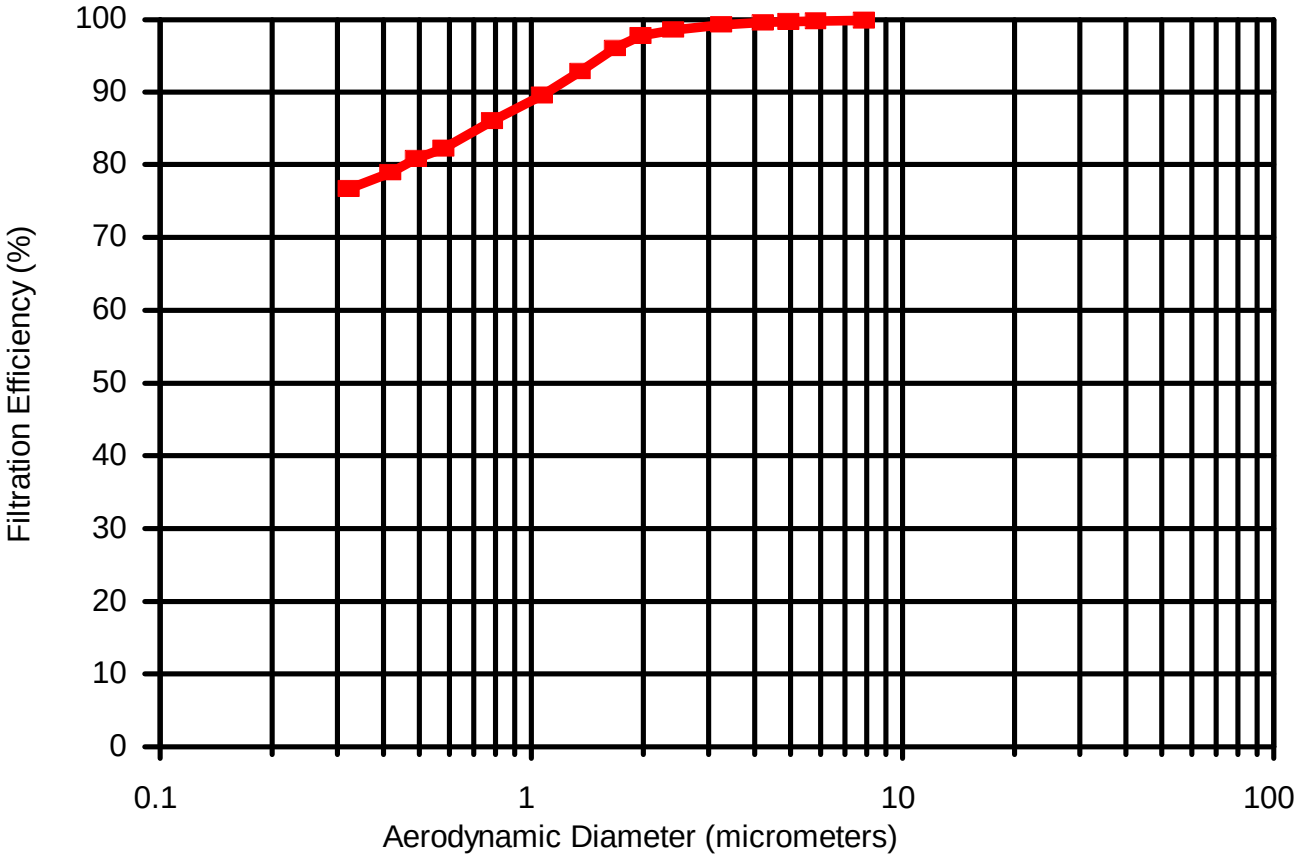


Figure 4. Average of the liquid-phase particle removal efficiency curves for Koch Multi-Sak 6FZ159-S paint overspray arrestor.

TABLE 4

SUMMARY OF PRESSURE DROP MEASUREMENTS

Test No.	Initial Pressure Drop (inch H_2O)
03229901	0.15
03229903	0.18
03229905	0.18
03229909	0.17
03239901	0.16
03239903	0.16

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	98

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	98
> 1.0	> 80	89
> 0.42	> 65	79

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	95
> 0.70	> 75	91

* 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.

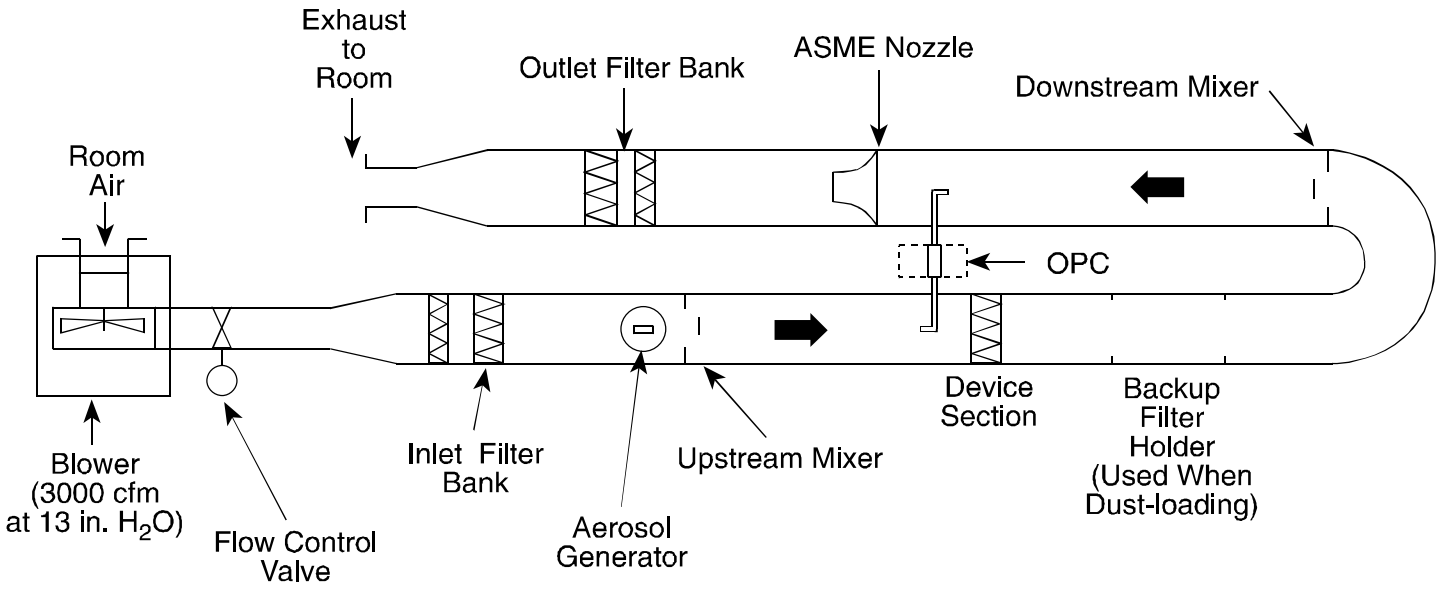
AIRFLOW

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.

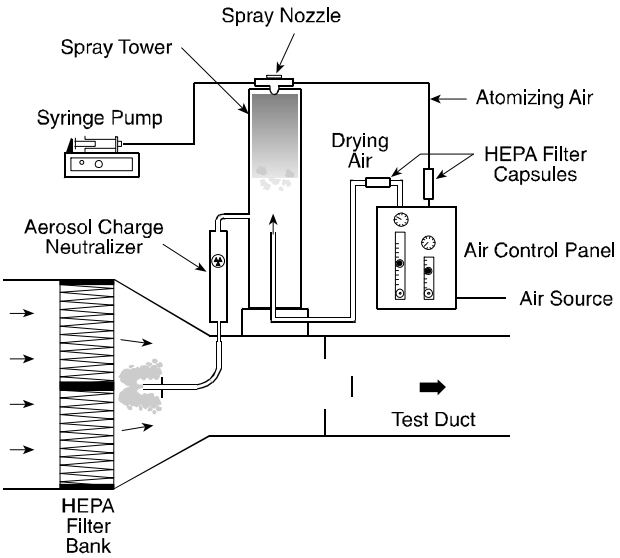
OPTICAL PARTICLE COUNTER (OPC)

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).

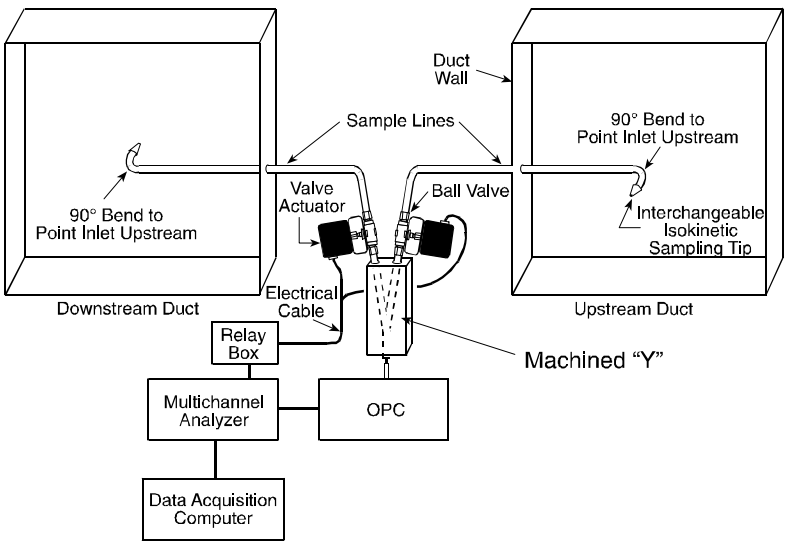
The output of the OPC was input to a Climet Instruments Model 8040 multichannel analyzer equipped with Model 05872005 and 05872006 input boards. These boards provide 16 sizing channels covering the range from 0.3 to 10 µm. The 8040 was also equipped with a Model CI-298 sequential interface board. This 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:

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

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:

$$D_{Aero} = D_{Physical} \sqrt{\frac{\rho_{Particle}}{\rho_o} \frac{CCF_{Physical}}{CCF_{Aero}} \frac{1}{\chi}}$$

where

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

ρ_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}.

χ is the dynamic shape factor.

For oleic acid droplets having a density of 0.89 g/cm^3 and being spherical (χ = 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. Aubin
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

Jan R. Custer
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. 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. 03229906
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	03-22-1999	12:56:43	01:00	4	2	0	3	1	0	0	0	0	1	0	0	0	0	0
Upstream	1	01	03-22-1999	13:04:25	01:00	10140	15370	4936	8978	13330	8250	10750	10470	2682	5590	3450	1163	175	341	226
Upstream	1	01	03-22-1999	13:06:55	01:00	9862	15150	4744	8597	13090	8058	10460	10450	2687	5620	3521	1182	205	327	229
Upstream	1	01	03-22-1999	13:09:25	01:00	9949	14860	4714	8627	12870	7953	10440	10290	2530	5452	3431	1192	187	354	283
Upstream	1	01	03-22-1999	13:11:55	01:00	9846	14650	4765	8404	12770	7930	10190	10010	2515	5375	3317	1123	204	301	229
Upstream	1	01	03-22-1999	13:14:25	01:00	9909	14690	4800	8521	12800	7809	10450	9943	2545	5351	3253	1122	206	321	218
Upstream	1	01	03-22-1999	13:16:55	01:00	9752	14540	4648	8493	12920	7785	10120	10190	2406	5351	3325	1198	190	322	220
Upstream	1	01	03-22-1999	13:19:25	01:00	9231	13600	4341	7804	11620	7318	9531	8954	2252	4764	2883	969	173	269	211
Upstream	1	01	03-22-1999	13:21:55	01:00	10140	14900	4761	8467	12720	7947	10170	9806	2444	5402	3271	1166	218	318	213
Upstream	1	01	03-22-1999	13:24:25	01:00	10160	14780	4658	8523	12760	7897	10370	9846	2370	5202	3049	1074	154	298	212
Upstream	1	01	03-22-1999	13:26:55	01:00	9985	14730	4826	8535	12910	7922	10260	9929	2345	5155	3128	1081	172	317	209
U. Bckgrnd	1	01	03-22-1999	13:35:08	01:00	2	6	2	2	0	3	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-22-1999	12:57:58	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	13:05:40	01:00	9924	14670	4863	8666	12920	8055	10490	10480	2620	5707	3471	1216	192	342	244
Downstream	2	01	03-22-1999	13:08:10	01:00	9910	14730	4709	8683	13050	7971	10420	10220	2603	5672	3412	1189	206	364	236
Downstream	2	01	03-22-1999	13:10:40	01:00	9920	14520	4640	8583	13290	8066	10190	10360	2613	5565	3608	1218	183	362	264
Downstream	2	01	03-22-1999	13:13:10	01:00	10000	14920	4818	8492	12890	8108	10330	10360	2544	5725	3530	1194	224	329	245
Downstream	2	01	03-22-1999	13:15:40	01:00	9902	14730	4657	8564	13170	8082	10390	10170	2632	5486	3474	1185	224	348	240
Downstream	2	01	03-22-1999	13:18:10	01:00	9852	14770	4654	8378	12700	7848	10150	10210	2620	5503	3424	1207	192	327	235
Downstream	2	01	03-22-1999	13:20:40	01:00	9742	14710	4588	8258	12520	7817	10120	9991	2448	5341	3196	1094	204	278	202
Downstream	2	01	03-22-1999	13:23:10	01:00	9845	14540	4517	8534	12870	7791	10200	9990	2564	5309	3133	1127	188	322	183
Downstream	2	01	03-22-1999	13:25:40	01:00	9754	14700	4687	8425	12650	7794	9970	10130	2483	5388	3294	1128	185	288	199
Downstream	2	01	03-22-1999	13:28:10	01:00	10210	15190	4781	8684	13230	7786	10280	9917	2443	5362	3278	1138	184	308	217
D. Bckgrnd	2	01	03-22-1999	13:36:23	01:00	0	2	3	1	2	0	2	0	0	0	0	0	0	0	0
Meas. Penetration						1.00	1.00	0.99	1.00	1.01	1.01	1.00	1.02	1.03	1.03	1.04	1.04	1.05	1.03	1.01
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	1.00	0.99	1.00	1.01	1.01	1.00	1.02	1.03	1.03	1.04	1.04	1.05	1.03	1.01
Corrected Efficiency (%)						0	0	1	0	-1	-1	0	-2	-3	-3	-4	-4	-5	-3	-1
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						98974	147270	47193	84949	127790	78869	102741	99888	24776	53262	32628	11270	1884	3168	2250
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	0.03	0.04	0.04	0.04	0.04	0.03	0.05	0.07	0.06	0.08	0.08	0.14	0.12	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):						13.6														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03229907
Reference 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	03-22-1999	13:51:41	01:00		1	1	0	1	0	0	0	1	0	0	0	0	0	0	0
Upstream	1	01	03-22-1999	13:59:25	01:00		10190	15010	4771	8708	13130	7967	10640	10290	2572	5467	3347	1146	217	345	255
Upstream	1	01	03-22-1999	14:01:55	01:00		10090	15020	4625	8591	12800	8119	10540	10360	2532	5546	3302	1160	211	340	249
Upstream	1	01	03-22-1999	14:04:25	01:00		9989	14480	4681	8481	12850	7811	10190	10010	2539	5422	3277	1077	191	305	260
Upstream	1	01	03-22-1999	14:06:55	01:00		9829	14660	4621	8325	12750	7807	10190	10120	2435	5229	3234	1136	172	338	247
Upstream	1	01	03-22-1999	14:09:25	01:00		9618	14540	4707	8607	12840	7859	10130	10120	2563	5371	3295	1219	186	328	266
Upstream	1	01	03-22-1999	14:11:55	01:00		9755	15020	4747	8307	12840	7892	10120	9941	2430	5184	3188	1110	195	307	241
Upstream	1	01	03-22-1999	14:14:25	01:00		8702	12820	4180	7332	10890	6828	8863	8539	2090	4458	2648	922	174	249	197
Upstream	1	01	03-22-1999	14:16:55	01:00		9658	14160	4743	8398	12310	7578	9907	9802	2325	5085	3106	1044	164	276	213
Upstream	1	01	03-22-1999	14:19:25	01:00		10020	14560	4745	8285	12420	7895	10110	9711	2383	5057	3001	1106	180	327	221
Upstream	1	01	03-22-1999	14:21:55	01:00		10020	14750	4754	8603	12810	7931	10300	9928	2322	5096	3131	1056	171	305	212
U. Bckgrnd	1	01	03-22-1999	14:32:01	01:00		4	1	1	0	2	0	3	0	0	0	0	0	0	0	0
ENTER DATA BELOW																					
D. Bckgrnd	2	01	03-22-1999	13:52:56	01:00		8	5	1	0	1	1	0	1	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	14:00:40	01:00		9823	14310	4503	8336	11820	6787	7707	5908	1059	1591	446	91	16	23	27
Downstream	2	01	03-22-1999	14:03:10	01:00		9784	14260	4503	8215	11960	6762	7818	5948	1048	1530	434	84	18	23	14
Downstream	2	01	03-22-1999	14:05:40	01:00		9690	14240	4351	8014	11670	6707	7773	5959	1068	1468	438	83	17	25	21
Downstream	2	01	03-22-1999	14:08:10	01:00		9318	13870	4287	7860	11450	6660	7611	5816	999	1466	399	84	9	23	16
Downstream	2	01	03-22-1999	14:10:40	01:00		9574	13910	4538	7955	11550	6509	7581	5701	1011	1486	361	73	14	23	15
Downstream	2	01	03-22-1999	14:13:10	01:00		9564	13860	4492	7971	11490	6432	7415	5766	1048	1461	413	92	18	23	23
Downstream	2	01	03-22-1999	14:15:40	01:00		9721	14240	4569	7903	11480	6422	7476	5507	974	1312	381	65	9	22	20
Downstream	2	01	03-22-1999	14:18:10	01:00		9825	14430	4540	8271	11430	6499	7412	5318	907	1223	288	50	8	14	12
Downstream	2	01	03-22-1999	14:20:40	01:00		9982	14080	4543	7995	11710	6567	7447	5186	896	1198	268	65	6	15	11
Downstream	2	01	03-22-1999	14:23:10	01:00		9825	14480	4342	8099	11670	6665	7548	5253	883	1211	307	49	3	15	12
D. Bckgrnd	2	01	03-22-1999	14:33:16	01:00		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration							0.99	0.98	0.96	0.96	0.93	0.85	0.75	0.57	0.41	0.27	0.12	0.07	0.06	0.07	0.07
P100 correction values							1.00	1.00	0.99	1.00	1.01	1.01	1.00	1.02	1.03	1.03	1.04	1.04	1.05	1.03	1.01
Corrected Penetration							0.99	0.98	0.96	0.96	0.91	0.84	0.75	0.56	0.40	0.26	0.11	0.06	0.06	0.06	0.07
Corrected Efficiency (%)							1	2	4	4	9	16	25	44	60	74	89	94	94	94	93
Data Acceptance Criteria:																					
Total Challenge Counts for Each Channel:							97871	145020	46574	83637	125640	77687	100990	98821	24191	51915	31529	10976	1861	3120	2361
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 :							0.05	0.05	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.02	0.02	0.03	0.01	0.02
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):							13.3														
Data Quality Objective: max. allowable conc. (#/cc):							< 23														
Does this meet the DQO:							Yes, (applies to all channels)														

Test No. 03199908
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	03-19-1999	16:39:49	01:00		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-19-1999	17:01:40	01:00		10730	16140	5203	9293	13910	8506	11190	10400	2503	5196	3324	1217	211	336	233
Upstream	1	01	03-19-1999	17:04:10	01:00		10740	16000	4982	9206	13790	8425	11340	10220	2390	5421	3356	1163	221	329	231
Upstream	1	01	03-19-1999	17:06:40	01:00		10630	15820	5117	9174	13550	8477	11080	10360	2458	5285	3217	1179	206	298	211
Upstream	1	01	03-19-1999	17:09:10	01:00		10260	15850	4941	9042	13410	8252	10980	10400	2446	5364	3323	1146	184	331	254
Upstream	1	01	03-19-1999	17:11:40	01:00		10350	15430	4860	9001	13430	8191	10880	10270	2389	5371	3384	1184	202	334	233
Upstream	1	01	03-19-1999	17:14:10	01:00		10260	15230	4811	8909	13170	8063	10670	10070	2436	5234	3262	1185	193	338	222
Upstream	1	01	03-19-1999	17:16:40	01:00		10340	14980	4814	8828	13090	8156	10720	9943	2513	5292	3252	1153	178	318	216
Upstream	1	01	03-19-1999	17:19:10	01:00		10330	15480	4876	9041	13470	8354	10850	10200	2536	5432	3372	1156	218	296	201
Upstream	1	01	03-19-1999	17:21:40	01:00		10220	15230	4939	8832	13380	8314	10810	10030	2373	5141	3186	1082	187	313	203
Upstream	1	01	03-19-1999	17:24:10	01:00		10700	15690	4965	9239	13650	8364	10910	10300	2353	5285	3356	1142	183	317	229
U. Bckgrnd	1	01	03-19-1999	17:32:24	01:00		13	1	1	0	0	0	9	1	0	2	0	0	0	0	0
ENTER DATA BELOW																					
D. Bckgrnd	2	01	03-19-1999	16:41:04	01:00		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-19-1999	17:02:55	01:00		10650	15940	5147	9175	13760	8592	11150	10280	2508	5440	3423	1214	191	337	207
Downstream	2	01	03-19-1999	17:05:25	01:00		10470	15640	4847	9181	13690	8375	10900	10270	2471	5467	3398	1181	204	318	226
Downstream	2	01	03-19-1999	17:07:55	01:00		10510	15580	4905	8953	13450	8364	10880	10460	2518	5470	3562	1179	182	303	240
Downstream	2	01	03-19-1999	17:10:25	01:00		10440	15390	5061	8991	13280	8300	10660	10210	2560	5470	3561	1152	193	322	204
Downstream	2	01	03-19-1999	17:12:55	01:00		10200	15300	4778	8798	13090	8265	10590	10430	2431	5450	3451	1203	183	313	217
Downstream	2	01	03-19-1999	17:15:25	01:00		10260	15240	4918	8929	13240	8261	10630	10240	2389	5208	3476	1264	190	332	189
Downstream	2	01	03-19-1999	17:17:55	01:00		10220	15510	4724	8872	13350	8196	10680	10070	2486	5485	3498	1276	204	307	220
Downstream	2	01	03-19-1999	17:20:25	01:00		10250	15540	5022	9020	13600	8320	10720	10400	2489	5380	3462	1132	195	327	209
Downstream	2	01	03-19-1999	17:22:55	01:00		10370	15280	4906	9178	13690	8251	10890	10200	2490	5389	3309	1184	190	278	224
Downstream	2	01	03-19-1999	17:25:25	01:00		10630	15840	5003	9208	13810	8303	10840	10030	2443	5337	3398	1099	191	316	209
D. Bckgrnd	2	01	03-19-1999	17:33:39	01:00		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Meas. Penetration							1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.02	1.02	1.05	1.02	0.97	0.98	0.96
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	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.02	1.02	1.05	1.02	0.97	0.98	0.96
Corrected Efficiency (%)							0	0	0	0	0	0	1	0	-2	-2	-5	-2	3	2	4
Data Acceptance Criteria:																					
Total Challenge Counts for Each Channel:							104560	155850	49508	90565	134850	83102	109430	102193	24397	53021	33032	11607	1983	3210	2233
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	0.03	0.04	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.03	0.06	0.08	0.07	0.09
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):							13.9														
Data Quality Objective: max. allowable conc. (#/cc):							< 23														
Does this meet the DQO:							Yes, (applies to all channels)														

Test No. 03229901
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	03-22-1999	05:25:25	01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-22-1999	05:34:09	01:00	10950	16420	5219	9490	14140	8718	11300	10300	2394	5403	3216	997	141	298	194
Upstream	1	01	03-22-1999	05:36:39	01:00	10840	16310	5129	9250	14070	8907	11280	10340	2431	5452	3146	1013	163	272	194
Upstream	1	01	03-22-1999	05:39:09	01:00	11050	16500	5198	9353	13910	8627	11180	10300	2514	5347	3030	1084	161	278	192
Upstream	1	01	03-22-1999	05:41:39	01:00	11330	16710	5314	9525	14200	8803	11380	10460	2399	5280	3146	1064	190	271	167
Upstream	1	01	03-22-1999	05:44:09	01:00	11230	16500	5235	9382	14070	8882	11420	10220	2384	5351	3121	1050	164	291	206
Upstream	1	01	03-22-1999	05:46:39	01:00	11100	16720	5209	9498	14060	9010	11460	10290	2418	5283	3111	1049	171	275	214
Upstream	1	01	03-22-1999	05:49:09	01:00	11180	16540	5369	9588	14300	8942	11500	10680	2523	5475	3298	1067	148	319	222
Upstream	1	01	03-22-1999	05:51:39	01:00	11100	16350	5214	9304	13910	8734	11190	10440	2481	5424	3287	1062	167	292	207
Upstream	1	01	03-22-1999	05:54:09	01:00	10970	16440	5222	9517	13890	8642	11480	10470	2495	5570	3169	1067	182	293	198
Upstream	1	01	03-22-1999	05:56:39	01:00	11020	16310	5190	9159	13760	8744	11250	10510	2457	5522	3300	1086	168	281	217
U. Bckgrnd	1	01	03-22-1999	06:02:33	01:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-22-1999	05:26:40	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	05:35:24	01:00	1281	1391	399	543	586	212	186	115	20	31	12	5	0	0	1
Downstream	2	01	03-22-1999	05:37:54	01:00	1254	1432	349	503	493	186	196	115	15	31	21	4	1	1	1
Downstream	2	01	03-22-1999	05:40:24	01:00	1200	1353	330	468	510	196	184	120	15	37	16	4	0	0	0
Downstream	2	01	03-22-1999	05:42:54	01:00	1151	1219	300	438	483	188	176	92	20	32	7	6	1	0	0
Downstream	2	01	03-22-1999	05:45:24	01:00	1127	1304	281	463	456	180	163	89	21	44	16	3	0	0	0
Downstream	2	01	03-22-1999	05:47:54	01:00	1122	1263	295	435	441	173	160	129	12	32	20	6	1	1	0
Downstream	2	01	03-22-1999	05:50:24	01:00	1204	1377	315	448	503	186	165	101	25	29	18	1	0	0	0
Downstream	2	01	03-22-1999	05:52:54	01:00	1309	1453	341	547	490	223	202	115	14	41	13	6	1	0	0
Downstream	2	01	03-22-1999	05:55:24	01:00	1187	1395	371	508	529	218	185	114	8	35	17	6	0	1	1
Downstream	2	01	03-22-1999	05:57:54	01:00	1240	1347	368	465	519	190	194	116	18	41	18	4	1	0	2
D. Bckgrnd	2	01	03-22-1999	06:03:48	01:00	0	0	0	1	3	5	0	1	0	0	0	0	0	0	0
Meas. Penetration						0.11	0.08	0.06	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
P100 correction values						1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.02	1.02	1.05	1.02	0.97	0.98	0.96
Corrected Penetration						0.11	0.08	0.06	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						89	92	94	95	96	98	98	99	99	99	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						110770	164800	52299	94066	140310	88009	113440	104010	24496	54107	31824	10539	1655	2870	2011
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	0.00	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):						14.3														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03229902
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	03-22-1999	06:13:48	01:00	4	0	0	1	0	2	3	1	0	2	0	0	0	0	0
Upstream	1	01	03-22-1999	06:20:24	01:00	10780	16010	5025	9163	13740	8514	11060	10450	2549	5288	3240	1109	200	308	251
Upstream	1	01	03-22-1999	06:22:54	01:00	10830	16390	5177	9109	13570	8523	11080	10440	2439	5276	3180	1095	189	292	217
Upstream	1	01	03-22-1999	06:25:24	01:00	10800	16110	5097	9064	13570	8450	11010	10290	2452	5193	3186	1033	181	317	225
Upstream	1	01	03-22-1999	06:27:54	01:00	10740	16070	5104	9196	13790	8653	11040	10190	2484	5351	3214	1047	175	281	230
Upstream	1	01	03-22-1999	06:30:24	01:00	10550	15610	4884	8946	13310	8360	10730	9914	2375	5261	3198	1018	164	267	198
Upstream	1	01	03-22-1999	06:32:54	01:00	10550	15770	5076	9081	13590	8413	10720	10190	2409	5290	3233	1064	153	304	213
Upstream	1	01	03-22-1999	06:35:24	01:00	10550	16030	4998	9183	13680	8523	10880	10090	2366	5409	3251	1013	208	327	242
Upstream	1	01	03-22-1999	06:37:54	01:00	10740	15570	4984	9310	13620	8270	10950	10110	2481	5263	3149	1089	162	302	216
Upstream	1	01	03-22-1999	06:40:24	01:00	10790	16030	5181	9125	13800	8438	11080	10160	2514	5144	3185	1080	179	295	202
Upstream	1	01	03-22-1999	06:42:54	01:00	10710	15870	5016	9236	13460	8459	10830	10050	2390	5297	3248	1014	181	293	215
U. Bckgrnd	1	01	03-22-1999	06:49:34	01:00	3	1	0	2	1	2	4	1	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-22-1999	06:15:03	01:00	1	0	1	0	3	0	2	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	06:21:39	01:00	10660	16110	4875	9129	13580	8507	10970	10480	2479	5526	3470	1118	185	279	186
Downstream	2	01	03-22-1999	06:24:09	01:00	10690	15880	5048	9064	13820	8426	10990	10420	2513	5524	3325	1065	176	329	202
Downstream	2	01	03-22-1999	06:26:39	01:00	10820	16200	5097	9171	13880	8458	11120	10500	2560	5675	3344	1167	172	325	240
Downstream	2	01	03-22-1999	06:29:09	01:00	10780	15840	4893	9024	13590	8430	10930	10500	2515	5591	3402	1060	151	299	219
Downstream	2	01	03-22-1999	06:31:39	01:00	10590	15560	4876	8852	13300	8257	10590	10230	2457	5352	3330	1142	165	322	196
Downstream	2	01	03-22-1999	06:34:09	01:00	10350	15850	4944	9164	13530	8395	10670	10150	2542	5392	3284	1106	183	282	185
Downstream	2	01	03-22-1999	06:36:39	01:00	10640	15750	4905	9003	13700	8461	10890	10190	2443	5517	3317	1020	151	263	205
Downstream	2	01	03-22-1999	06:39:09	01:00	11100	16240	5175	9231	14030	8714	11070	10600	2633	5586	3396	1130	167	293	197
Downstream	2	01	03-22-1999	06:41:39	01:00	10470	15840	4974	9031	13750	8567	10890	10490	2543	5413	3331	1091	183	291	196
Downstream	2	01	03-22-1999	06:44:09	01:00	10240	15390	4902	9005	13080	8284	10710	10270	2433	5480	3293	1065	163	303	187
D. Bckgrnd	2	01	03-22-1999	06:50:49	01:00	2	0	0	1	1	2	2	7	0	2	0	0	0	0	0
Meas. Penetration						0.99	1.00	0.98	0.99	1.00	1.00	1.00	1.02	1.03	1.04	1.04	1.04	0.95	1.00	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						0.99	1.00	0.98	0.99	1.00	1.00	1.00	1.02	1.03	1.04	1.04	1.04	0.95	1.00	0.91
Corrected Efficiency (%)						1	0	2	1	0	0	0	-2	-3	-4	-4	-4	5	0	9
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						107040	159460	50542	91413	136130	84603	109380	101884	24459	52772	32084	10562	1792	2986	2209
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	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.06	0.11	0.09	0.10
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): 14.1
Data Quality Objective: max. allowable conc. (#/cc): < 23
Does this meet the DQO: Yes, (applies to all channels)

Test No. 03229903
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	03-22-1999	08:30:30	01:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Upstream	1	01	03-22-1999	08:40:45	01:00	10270	15530	4782	8824	13390	8351	10550	10250	2444	5300	3280	1054	171	285	216
Upstream	1	01	03-22-1999	08:43:15	01:00	10530	16010	5030	8939	13560	8405	10810	10440	2415	5384	3209	1126	197	314	215
Upstream	1	01	03-22-1999	08:45:45	01:00	10470	15560	5071	8907	13590	8139	10740	10130	2421	5332	3147	1077	181	308	192
Upstream	1	01	03-22-1999	08:48:15	01:00	10410	15660	4984	8973	13340	8483	11080	10220	2485	5251	3196	1046	182	293	210
Upstream	1	01	03-22-1999	08:50:45	01:00	10610	15590	5064	8975	13570	8414	10840	10390	2467	5281	3267	1066	191	308	202
Upstream	1	01	03-22-1999	08:53:15	01:00	10430	16030	5014	9200	13940	8546	10850	10040	2478	5464	3215	1098	187	294	194
Upstream	1	01	03-22-1999	08:55:45	01:00	10510	15970	5035	9025	13470	8346	11000	10230	2523	5431	3204	1083	192	302	213
Upstream	1	01	03-22-1999	08:58:15	01:00	10400	15700	4944	8953	13510	8141	10650	10230	2489	5386	3252	1117	176	330	223
Upstream	1	01	03-22-1999	09:00:45	01:00	10430	15560	4870	8899	13320	8357	10860	10020	2483	5219	3160	1018	196	282	208
Upstream	1	01	03-22-1999	09:03:15	01:00	10470	15500	4854	8769	12980	8146	10460	9674	2296	4941	2993	987	156	264	178
U. Bckgrnd	1	01	03-22-1999	09:13:21	01:00	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-22-1999	08:31:45	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	08:42:00	01:00	1158	1330	334	513	527	225	169	123	25	33	12	7	1	2	1
Downstream	2	01	03-22-1999	08:44:30	01:00	1150	1393	326	484	564	236	217	128	17	36	17	7	1	1	0
Downstream	2	01	03-22-1999	08:47:00	01:00	1203	1367	330	506	496	196	197	110	18	29	16	4	0	2	0
Downstream	2	01	03-22-1999	08:49:30	01:00	1150	1296	297	445	502	214	172	94	22	17	13	4	0	0	0
Downstream	2	01	03-22-1999	08:52:00	01:00	1099	1169	316	429	451	185	162	115	9	36	23	1	2	0	0
Downstream	2	01	03-22-1999	08:54:30	01:00	1135	1245	302	478	439	184	148	111	17	31	18	2	0	0	0
Downstream	2	01	03-22-1999	08:57:00	01:00	1233	1369	320	488	497	212	176	119	22	30	20	3	1	0	2
Downstream	2	01	03-22-1999	08:59:30	01:00	1217	1422	363	502	507	223	209	98	26	42	22	3	0	0	2
Downstream	2	01	03-22-1999	09:02:00	01:00	1187	1338	308	484	500	196	172	116	19	37	11	3	2	1	1
Downstream	2	01	03-22-1999	09:04:30	01:00	1138	1324	355	457	508	195	171	113	16	34	13	2	0	0	1
D. Bckgrnd	2	01	03-22-1999	09:14:36	01:00	1	1	0	3	2	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.11	0.08	0.07	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
P100 correction values						0.99	1.00	0.98	0.99	1.00	1.00	1.00	1.02	1.03	1.04	1.04	1.04	0.95	1.00	0.91
Corrected Penetration						0.11	0.08	0.07	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						89	92	93	95	96	98	98	99	99	99	100	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						104530	157110	49648	89464	134670	83328	107840	101624	24501	52989	31923	10672	1829	2980	2051
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):						13.7														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03229904
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	03-22-1999	09:50:55	01:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Upstream	1	01	03-22-1999	09:59:48	01:00	10260	15210	4836	8646	12970	8090	10400	10030	2425	5279	3175	1151	176	294	203
Upstream	1	01	03-22-1999	10:02:18	01:00	10110	15320	4845	8647	13160	8358	10490	10020	2530	5339	3257	1120	195	327	230
Upstream	1	01	03-22-1999	10:04:48	01:00	9947	14780	4748	8599	13070	7832	10290	9842	2393	5223	3141	1073	190	309	221
Upstream	1	01	03-22-1999	10:07:18	01:00	9794	14820	4729	8665	12690	7972	10380	9934	2444	5271	3163	1102	161	335	230
Upstream	1	01	03-22-1999	10:09:48	01:00	9985	14530	4758	8485	12800	7944	10090	9788	2339	5237	3056	1093	185	327	209
Upstream	1	01	03-22-1999	10:12:18	01:00	9778	14260	4639	8429	12530	7758	10330	9895	2349	5019	3107	1044	183	294	225
Upstream	1	01	03-22-1999	10:14:48	01:00	9294	13810	4416	7966	11920	7266	9745	9338	2346	5078	3036	1123	177	307	208
Upstream	1	01	03-22-1999	10:17:18	01:00	9748	14550	4558	8651	12630	7822	10220	9923	2517	5290	3181	1145	186	313	197
Upstream	1	01	03-22-1999	10:19:48	01:00	9900	14560	4711	8672	12850	7850	10340	10200	2454	5324	3266	1149	177	320	262
Upstream	1	01	03-22-1999	10:22:18	01:00	10020	15080	4808	8583	12830	8039	10420	10140	2478	5345	3342	1149	184	308	223
U. Bckgrnd	1	01	03-22-1999	10:31:39	01:00	2	0	1	2	2	1	2	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-22-1999	09:52:10	01:00	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	10:01:03	01:00	10290	15250	4845	8712	13200	8094	10330	10360	2510	5663	3317	1047	194	297	230
Downstream	2	01	03-22-1999	10:03:33	01:00	10080	15220	4788	8672	12900	8149	10400	10140	2570	5459	3452	1136	202	317	197
Downstream	2	01	03-22-1999	10:06:03	01:00	9965	14760	4794	8831	13060	8045	10450	10260	2554	5480	3375	1117	170	280	229
Downstream	2	01	03-22-1999	10:08:33	01:00	9859	14770	4612	8650	12770	8033	10230	10040	2501	5436	3436	1126	168	317	222
Downstream	2	01	03-22-1999	10:11:03	01:00	9910	14870	4782	8667	12710	7932	10130	9902	2462	5222	3289	1116	171	296	199
Downstream	2	01	03-22-1999	10:13:33	01:00	9630	14560	4556	8357	12570	7668	9876	9935	2457	5460	3115	1087	164	283	214
Downstream	2	01	03-22-1999	10:16:03	01:00	9681	14470	4635	8427	12620	7808	9931	9959	2504	5391	3457	1142	185	323	210
Downstream	2	01	03-22-1999	10:18:33	01:00	9810	14490	4737	8587	12920	8041	10480	10270	2645	5472	3316	1128	197	337	216
Downstream	2	01	03-22-1999	10:21:03	01:00	10110	14530	4671	8714	13250	8079	10200	10280	2561	5520	3335	1168	166	299	201
Downstream	2	01	03-22-1999	10:23:33	01:00	9953	14670	4710	8650	13060	7917	10200	10210	2430	5471	3484	1112	180	266	240
D. Bckgrnd	2	01	03-22-1999	10:32:54	01:00	0	0	0	2	3	0	0	3	0	0	0	0	0	0	0
Meas. Penetration						1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.02	1.04	1.04	1.06	1.00	0.99	0.96	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						1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.02	1.04	1.04	1.06	1.00	0.99	0.96	0.98
Corrected Efficiency (%)						0	0	0	-1	-1	-1	0	-2	-4	-4	-6	0	1	4	2
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						98836	146920	47048	85343	127450	78931	102705	99110	24275	52405	31724	11149	1814	3134	2208
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	0.04	0.03	0.03	0.03	0.04	0.03	0.03	0.04	0.03	0.05	0.04	0.09	0.08	0.10
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. 03229905
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	03-22-1999	11:56:18	01:00	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0
Upstream	1	01	03-22-1999	12:04:33	01:00	10150	15020	4899	8614	13330	8206	10270	10400	2475	5466	3405	1162	192	334	236
Upstream	1	01	03-22-1999	12:07:03	01:00	10050	14770	4792	8763	12940	8082	10440	10460	2621	5422	3440	1156	209	338	240
Upstream	1	01	03-22-1999	12:09:33	01:00	9949	14870	4733	8521	12780	7904	10180	9829	2466	5061	3072	1132	173	305	206
Upstream	1	01	03-22-1999	12:12:03	01:00	10180	15180	4806	8683	12790	8002	10510	9986	2436	5330	3163	1075	194	315	217
Upstream	1	01	03-22-1999	12:14:33	01:00	9886	14770	4701	8441	12740	7984	10060	9723	2434	5200	3198	1070	161	329	210
Upstream	1	01	03-22-1999	12:17:03	01:00	9920	14480	4576	8108	12440	7693	9920	9748	2295	5021	3099	1008	176	269	212
Upstream	1	01	03-22-1999	12:19:33	01:00	9705	14380	4458	8362	12330	7727	10040	9462	2358	5122	3032	1059	202	325	218
Upstream	1	01	03-22-1999	12:22:03	01:00	9754	14480	4714	8396	12560	7861	10070	9594	2349	5085	3053	1003	201	280	218
Upstream	1	01	03-22-1999	12:24:33	01:00	9719	14500	4678	8312	12580	7871	10150	9671	2263	5134	3082	1022	189	287	226
Upstream	1	01	03-22-1999	12:27:03	01:00	9822	14620	4717	8260	12620	7710	10250	9540	2385	4943	2974	1070	189	291	223
U. Bckgrnd	1	01	03-22-1999	12:37:08	01:00	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-22-1999	11:57:33	01:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	12:05:48	01:00	1509	1788	439	768	825	369	347	196	32	40	15	2	1	2	1
Downstream	2	01	03-22-1999	12:08:18	01:00	1440	1826	483	763	861	377	338	203	23	47	14	2	1	0	1
Downstream	2	01	03-22-1999	12:10:48	01:00	1524	1784	455	682	794	356	318	181	37	25	23	4	1	3	0
Downstream	2	01	03-22-1999	12:13:18	01:00	1566	1798	459	694	830	387	303	194	22	32	15	1	1	1	0
Downstream	2	01	03-22-1999	12:15:48	01:00	1399	1844	440	680	788	346	349	190	30	37	15	1	2	0	0
Downstream	2	01	03-22-1999	12:18:18	01:00	1444	1742	474	702	798	355	299	171	23	35	19	7	0	1	0
Downstream	2	01	03-22-1999	12:20:48	01:00	1342	1639	443	703	767	306	315	189	33	41	12	3	2	1	0
Downstream	2	01	03-22-1999	12:23:18	01:00	1339	1693	413	612	744	339	280	174	27	51	17	1	1	1	2
Downstream	2	01	03-22-1999	12:25:48	01:00	1360	1589	404	664	736	353	293	156	32	29	20	4	3	1	1
Downstream	2	01	03-22-1999	12:28:18	01:00	1381	1602	433	694	759	328	296	176	23	41	19	5	1	0	0
D. Bckgrnd	2	01	03-22-1999	12:38:23	01:00	5	5	0	2	2	0	1	0	0	0	0	0	0	0	0
Meas. Penetration						0.14	0.12	0.09	0.08	0.06	0.04	0.03	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.00
P100 correction values						1.00	1.00	1.00	1.01	1.01	1.01	1.00	1.02	1.04	1.04	1.06	1.00	0.99	0.96	0.98
Corrected Penetration						0.14	0.12	0.09	0.08	0.06	0.04	0.03	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.00
Corrected Efficiency (%)						86	88	91	92	94	96	97	98	99	99	99	100	99	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						99135	147070	47074	84460	127110	79040	101890	98413	24082	51784	31518	10757	1886	3073	2206
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	0.01	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	< 0.30	< 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):						13.3														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03229908
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	03-22-1999	14:55:20	01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-22-1999	15:28:51	01:00	9367	14130	5094	9432	14080	10110	17210	13080	2703	6353	3766	1223	203	286	177
Upstream	1	01	03-22-1999	15:31:21	01:00	9397	14530	4982	9845	14270	10080	17560	13550	2755	6581	4137	1212	175	296	172
Upstream	1	01	03-22-1999	15:33:51	01:00	9575	14780	5272	9873	14640	10390	17940	13560	2691	6530	4014	1180	210	317	169
Upstream	1	01	03-22-1999	15:36:21	01:00	9279	14430	5257	9748	14150	10170	17690	13370	2679	6574	4012	1145	163	303	179
Upstream	1	01	03-22-1999	15:38:51	01:00	9459	14450	5140	9547	14590	10340	17450	13080	2693	6350	4045	1193	183	314	182
Upstream	1	01	03-22-1999	15:41:21	01:00	9550	14820	5277	9890	14740	10400	18280	13740	2821	6744	4164	1196	163	308	167
Upstream	1	01	03-22-1999	15:43:51	01:00	8670	13700	4843	8972	13360	9909	16440	11640	2466	5998	3569	1053	170	275	164
Upstream	1	01	03-22-1999	15:46:21	01:00	10050	15360	5512	10110	15330	11030	18550	13640	2751	6800	4070	1144	181	318	174
Upstream	1	01	03-22-1999	15:48:51	01:00	9772	15480	5657	10030	14890	11160	18620	13130	2787	6595	3888	1053	160	267	174
Upstream	1	01	03-22-1999	15:51:21	01:00	9664	15100	5497	9986	14590	10960	18150	12960	2743	6438	3786	1119	183	299	176
U. Bckgrnd	1	01	03-22-1999	15:58:57	01:00	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	03-22-1999	14:56:35	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	15:30:06	01:00	9672	14780	5352	10090	14690	10580	18400	13760	2811	6827	4411	1250	184	330	193
Downstream	2	01	03-22-1999	15:32:36	01:00	9255	14250	5237	9660	14520	10390	17940	13290	2685	6664	4230	1133	183	325	174
Downstream	2	01	03-22-1999	15:35:06	01:00	9280	14500	5155	9763	14380	10260	17740	13060	2809	6645	4214	1237	200	364	192
Downstream	2	01	03-22-1999	15:37:36	01:00	9362	14440	5186	9866	14430	10270	17640	13300	2785	6615	4338	1206	189	309	174
Downstream	2	01	03-22-1999	15:40:06	01:00	9491	14570	5311	9639	14590	10470	18140	13420	2828	7021	4333	1301	198	324	191
Downstream	2	01	03-22-1999	15:42:36	01:00	9678	14800	5433	10020	14720	10680	18580	13780	2879	6954	4430	1254	215	351	173
Downstream	2	01	03-22-1999	15:45:06	01:00	9783	15360	5583	9956	15100	10950	18510	13070	2860	7028	4123	1162	206	310	187
Downstream	2	01	03-22-1999	15:47:36	01:00	9765	15080	5320	9898	14880	10970	18510	12780	2827	6601	4036	1165	177	276	164
Downstream	2	01	03-22-1999	15:50:06	01:00	9800	15030	5334	10050	14870	10960	18360	12540	2699	6696	4093	1175	170	295	188
Downstream	2	01	03-22-1999	15:52:36	01:00	9551	14960	5335	9754	14540	10690	17900	12360	2578	6509	4059	1186	185	281	158
D. Bckgrnd	2	01	03-22-1999	16:00:12	01:00	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0
Meas. Penetration						1.01	1.01	1.01	1.01	1.01	1.02	1.02	1.00	1.02	1.04	1.07	1.05	1.06	1.06	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						1.01	1.01	1.01	1.01	1.01	1.02	1.02	1.00	1.02	1.04	1.07	1.05	1.06	1.06	1.03
Corrected Efficiency (%)						-1	-1	-1	-1	-1	-2	-2	0	-2	-4	-7	-5	-6	-6	-3
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						94783	146780	52531	97433	144640	104549	177890	131750	27089	64963	39451	11518	1791	2983	1734
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	0.05	0.04	0.04	0.05	0.04	0.06	0.05	0.05	0.06	0.07	0.13	0.11	0.08
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)														

Test No. 03229909
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	03-22-1999	16:14:01	01:00		1	2	2	1	1	0	0	1	0	0	0	0	0	0	0
Upstream	1	01	03-22-1999	16:21:44	01:00		9864	15260	5590	10120	15270	10860	18440	14200	2892	6944	4351	1247	198	298	164
Upstream	1	01	03-22-1999	16:24:14	01:00		10000	15780	5571	10410	15420	10950	18840	14580	2917	7035	4478	1293	205	322	213
Upstream	1	01	03-22-1999	16:26:44	01:00		9937	15010	5431	10050	14880	10560	18380	14000	2804	6964	4206	1107	224	340	191
Upstream	1	01	03-22-1999	16:29:14	01:00		9692	14830	5221	9996	14690	10510	17820	13950	2839	6807	4018	1152	200	317	187
Upstream	1	01	03-22-1999	16:31:44	01:00		9614	14770	5326	10060	14600	10450	18030	13990	2780	6686	4175	1182	194	291	196
Upstream	1	01	03-22-1999	16:34:14	01:00		9634	14680	5329	10050	15090	10550	18360	14220	2863	6822	4252	1275	203	308	169
Upstream	1	01	03-22-1999	16:36:44	01:00		9222	14730	5135	9475	14320	10650	17540	12320	2674	6401	3808	1094	177	309	162
Upstream	1	01	03-22-1999	16:39:14	01:00		9814	15540	5374	10170	15150	11020	18520	13080	2658	6670	4003	1181	200	268	173
Upstream	1	01	03-22-1999	16:41:44	01:00		10120	15630	5410	10180	15030	11130	18450	12980	2761	6506	3844	1114	173	290	164
Upstream	1	01	03-22-1999	16:44:14	01:00		9824	15030	5548	10320	14980	11070	18780	13770	2875	6715	4231	1197	195	320	187
U. Bckgrnd	1	01	03-22-1999	16:53:14	01:00		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
ENTER DATA BELOW																					
D. Bckgrnd	2	01	03-22-1999	16:15:16	01:00		2	3	0	2	2	1	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-22-1999	16:22:59	01:00		2928	4124	1345	2359	2993	1621	2038	809	112	128	32	5	0	1	0
Downstream	2	01	03-22-1999	16:25:29	01:00		2990	4184	1440	2547	3046	1737	2077	828	119	125	48	9	1	3	0
Downstream	2	01	03-22-1999	16:27:59	01:00		2912	4142	1376	2382	2928	1572	2004	889	110	162	33	3	0	1	0
Downstream	2	01	03-22-1999	16:30:29	01:00		2793	4103	1290	2376	2937	1565	2008	859	97	127	30	6	0	0	0
Downstream	2	01	03-22-1999	16:32:59	01:00		2773	3966	1304	2518	3012	1564	2053	863	110	130	35	2	1	0	0
Downstream	2	01	03-22-1999	16:35:29	01:00		2982	3994	1381	2463	3003	1668	2005	899	83	164	47	6	1	0	1
Downstream	2	01	03-22-1999	16:37:59	01:00		2934	4147	1359	2392	2790	1641	1900	727	81	105	30	7	2	2	0
Downstream	2	01	03-22-1999	16:40:29	01:00		2871	4267	1354	2332	2806	1684	1886	707	81	111	42	3	0	0	0
Downstream	2	01	03-22-1999	16:42:59	01:00		2957	4134	1322	2293	2854	1574	1959	790	100	141	36	4	0	1	0
Downstream	2	01	03-22-1999	16:45:29	01:00		2992	4052	1349	2452	2880	1591	1912	714	79	127	44	8	0	1	0
D. Bckgrnd	2	01	03-22-1999	16:54:29	01:00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration							0.30	0.27	0.25	0.24	0.20	0.15	0.11	0.06	0.03	0.02	0.01	0.00	0.00	0.00	0.00
P100 correction values							1.01	1.01	1.01	1.01	1.01	1.02	1.02	1.00	1.02	1.04	1.07	1.05	1.06	1.06	1.03
Corrected Penetration							0.30	0.27	0.25	0.24	0.19	0.15	0.11	0.06	0.03	0.02	0.01	0.00	0.00	0.00	0.00
Corrected Efficiency (%)							70	73	75	76	81	85	89	94	97	98	99	100	100	100	100
Data Acceptance Criteria:																					
Total Challenge Counts for Each Channel:							97721	151260	53935	100831	149430	107750	183160	137090	28063	67550	41366	11842	1969	3063	1806
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	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	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): 16.7
Data Quality Objective: max. allowable conc. (#/cc): < 23
Does this meet the DQO: Yes, (applies to all channels)

Test No. 03229910
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	03-22-1999	17:06:35	01:00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-22-1999	17:14:25	01:00		9055	14310	5142	9566	14110	10100	17440	13360	2791	6457	4154	1188	167	311	181
Upstream	1	01	03-22-1999	17:16:55	01:00		9198	14190	5042	9650	14090	10100	17280	13360	2744	6576	4055	1226	201	302	177
Upstream	1	01	03-22-1999	17:19:25	01:00		9415	14330	5136	9828	14510	10330	17800	13760	2804	6588	4128	1205	173	322	191
Upstream	1	01	03-22-1999	17:21:55	01:00		9158	14430	5134	9760	14190	10350	17540	12950	2645	6676	3989	1205	183	296	181
Upstream	1	01	03-22-1999	17:24:25	01:00		9296	14370	5192	9678	14220	10070	17440	13420	2673	6356	4001	1184	178	320	177
Upstream	1	01	03-22-1999	17:26:55	01:00		9635	14720	5111	9742	14510	10330	17630	13570	2763	6710	4061	1139	223	271	180
Upstream	1	01	03-22-1999	17:29:25	01:00		9294	14490	5138	9171	14110	10350	17170	12230	2596	6191	3739	1040	219	270	146
Upstream	1	01	03-22-1999	17:31:55	01:00		9726	14900	5305	10130	14860	10650	17980	13060	2674	6441	3997	1128	177	291	178
Upstream	1	01	03-22-1999	17:34:25	01:00		9494	15310	5377	9935	14780	10670	18160	12990	2748	6456	4072	1147	177	292	181
Upstream	1	01	03-22-1999	17:36:55	01:00		9818	15100	5433	9724	14820	10850	18100	13010	2746	6635	3927	1112	172	271	170
U. Bckgrnd	1	01	03-22-1999	17:46:41	01:00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENTER DATA BELOW																					
D. Bckgrnd	2	01	03-22-1999	17:07:50	01:00		0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Downstream	2	01	03-22-1999	17:15:40	01:00		9177	14040	5066	9386	13900	10170	17170	13290	2690	6728	4282	1241	210	314	188
Downstream	2	01	03-22-1999	17:18:10	01:00		9015	14320	5094	9445	14150	10120	17940	13220	2740	6790	4288	1276	210	350	163
Downstream	2	01	03-22-1999	17:20:40	01:00		9430	14340	4951	9610	14520	10100	17500	13060	2741	6795	4200	1245	207	314	176
Downstream	2	01	03-22-1999	17:23:10	01:00		9078	13960	5074	9436	14240	9832	17590	13040	2766	6729	4243	1230	219	294	177
Downstream	2	01	03-22-1999	17:25:40	01:00		9480	14290	5195	9648	14180	10260	17640	13020	2714	6721	4278	1257	195	318	173
Downstream	2	01	03-22-1999	17:28:10	01:00		9288	14830	5128	9733	14340	10400	17970	13170	2754	6999	4402	1241	193	331	205
Downstream	2	01	03-22-1999	17:30:40	01:00		9494	14900	5244	9641	14540	10790	17820	12770	2759	6561	4143	1246	198	318	160
Downstream	2	01	03-22-1999	17:33:10	01:00		9579	14910	5208	9877	14760	10730	18320	13050	2674	6655	4154	1218	207	303	202
Downstream	2	01	03-22-1999	17:35:40	01:00		9530	15080	5422	9721	14620	10820	18450	12990	2757	6981	4170	1209	189	285	183
Downstream	2	01	03-22-1999	17:38:10	01:00		9555	14970	5292	9657	14690	10820	18190	12790	2858	6674	4174	1189	178	338	158
D. Bckgrnd	2	01	03-22-1999	17:47:56	01:00		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration							0.99	1.00	0.99	0.99	1.00	1.00	1.01	0.99	1.01	1.04	1.06	1.07	1.07	1.07	1.01
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	0.99	0.99	1.00	1.00	1.01	0.99	1.01	1.04	1.06	1.07	1.07	1.07	1.01
Corrected Efficiency (%)							1	0	1	1	0	0	-1	1	-1	-4	-6	-7	-7	-7	-1
Data Acceptance Criteria:																					
Total Challenge Counts for Each Channel:							94089	146150	52010	97184	144200	103800	176540	131710	27184	65086	40123	11574	1870	2946	1762
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	0.04	0.04	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.04	0.06	0.13	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	< 0.10	< 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):							15.9														
Data Quality Objective: max. allowable conc. (#/cc):							< 23														
Does this meet the DQO:							Yes, (applies to all channels)														

Test No. 03239901
Arrester
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	06:23:02	01:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	06:30:57	01:00	10330	16170	5549	10300	15480	11520	18700	13000	2720	6694	3877	1088	173	277	138
Upstream	1	01	03-23-1999	06:33:27	01:00	10550	16260	5774	10390	15460	11680	18790	12870	2725	6752	3864	1081	177	281	154
Upstream	1	01	03-23-1999	06:35:57	01:00	10360	15790	5695	10080	14860	11240	18080	12420	2554	6387	3685	1007	166	252	164
Upstream	1	01	03-23-1999	06:38:27	01:00	10120	15590	5407	9812	14520	11330	17480	12280	2632	6206	3671	1006	148	230	148
Upstream	1	01	03-23-1999	06:40:57	01:00	10230	15730	5581	9919	14830	11330	17850	11940	2578	6487	3592	983	175	236	158
Upstream	1	01	03-23-1999	06:43:27	01:00	10090	15760	5622	9827	14700	11240	18140	12180	2664	6452	3632	975	165	256	153
Upstream	1	01	03-23-1999	06:45:57	01:00	9340	14460	5215	9473	14260	9889	17260	13010	2639	6453	3889	1082	166	266	154
Upstream	1	01	03-23-1999	06:48:27	01:00	9990	15370	5523	10370	15110	10780	18410	14340	2998	7031	4355	1259	211	287	170
Upstream	1	01	03-23-1999	06:50:57	01:00	10230	15580	5665	10560	15390	11020	18980	14440	2917	6968	4267	1224	185	347	198
Upstream	1	01	03-23-1999	06:53:27	01:00	9859	15340	5365	10340	15320	10830	18500	14090	2871	6779	4242	1150	202	294	188
U. Bckgrnd	1	01	03-23-1999	07:02:36	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	06:24:17	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	06:32:12	01:00	2163	2949	922	1558	1833	1001	1060	376	50	70	30	2	0	0	0
Downstream	2	01	03-23-1999	06:34:42	01:00	2175	3010	956	1541	1790	1018	1125	378	56	77	30	0	0	0	1
Downstream	2	01	03-23-1999	06:37:12	01:00	2042	2906	908	1494	1770	988	1034	381	50	69	22	4	0	0	0
Downstream	2	01	03-23-1999	06:39:42	01:00	2171	2966	918	1558	1756	967	1062	316	50	76	18	3	0	1	0
Downstream	2	01	03-23-1999	06:42:12	01:00	2059	3036	920	1473	1686	938	970	350	56	78	18	2	0	0	0
Downstream	2	01	03-23-1999	06:44:42	01:00	2088	2820	922	1432	1758	976	1008	377	42	60	17	3	0	1	0
Downstream	2	01	03-23-1999	06:47:12	01:00	2056	2760	921	1541	1828	1006	1115	479	47	96	24	6	1	1	0
Downstream	2	01	03-23-1999	06:49:42	01:00	2092	2973	929	1550	1858	975	1103	481	47	93	25	6	1	0	0
Downstream	2	01	03-23-1999	06:52:12	01:00	2073	2748	952	1584	1787	978	1092	441	52	88	20	2	1	0	0
Downstream	2	01	03-23-1999	06:54:42	01:00	2104	2856	929	1610	1776	975	1046	463	63	90	33	8	1	1	0
D. Bckgrnd	2	01	03-23-1999	07:03:51	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.21	0.19	0.17	0.15	0.12	0.09	0.06	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
P100 correction values						0.99	1.00	0.99	0.99	1.00	1.00	1.01	0.99	1.01	1.04	1.06	1.07	1.07	1.07	1.01
Corrected Penetration						0.21	0.19	0.17	0.15	0.12	0.09	0.06	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
Corrected Efficiency (%)						79	81	83	85	88	91	94	97	98	99	99	100	100	100	100
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						101099	156050	55396	101071	149930	110859	182190	130570	27298	66209	39074	10855	1768	2726	1625
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	0.01	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):						16.7														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03239902
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	07:16:27	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	03-23-1999	07:24:00	01:00	9996	15440	5562	10040	14680	10870	18080	13020	2652	6503	3910	1080	159	275	161
Upstream	1	01	03-23-1999	07:26:30	01:00	9837	15430	5594	9873	14890	10750	18260	13150	2654	6530	3907	1115	187	276	152
Upstream	1	01	03-23-1999	07:29:00	01:00	10000	15520	5461	10100	14890	10720	18090	13280	2801	6586	3898	1112	182	253	163
Upstream	1	01	03-23-1999	07:31:30	01:00	9987	15070	5565	10070	14780	10800	18200	13040	2582	6602	3892	1086	184	263	151
Upstream	1	01	03-23-1999	07:34:00	01:00	9980	15520	5478	9900	15030	10800	18100	13160	2679	6708	3828	1087	164	299	140
Upstream	1	01	03-23-1999	07:36:30	01:00	9819	15100	5492	9796	14540	10730	18080	12900	2652	6497	3924	1082	192	248	131
Upstream	1	01	03-23-1999	07:39:00	01:00	9550	14450	5167	9848	14450	9867	17110	13660	2663	6592	4119	1182	188	300	168
Upstream	1	01	03-23-1999	07:41:30	01:00	9960	15220	5493	10330	15060	10670	18210	14480	3028	7031	4350	1253	211	299	193
Upstream	1	01	03-23-1999	07:44:00	01:00	9891	15380	5451	10250	15260	10780	18480	14650	2912	7010	4353	1209	179	326	198
Upstream	1	01	03-23-1999	07:46:30	01:00	10120	15680	5372	10510	15220	10780	18620	14810	2944	6957	4406	1259	168	307	190
U. Bckgrnd	1	01	03-23-1999	07:56:27	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	07:17:42	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	07:25:15	01:00	9692	15350	5569	9967	14790	10950	18230	13070	2698	6813	4161	1154	161	285	145
Downstream	2	01	03-23-1999	07:27:45	01:00	9826	15120	5555	9921	14770	10970	18340	13100	2865	6619	4134	1169	196	304	142
Downstream	2	01	03-23-1999	07:30:15	01:00	10030	15330	5600	10270	14870	10910	18390	13100	2827	6927	4240	1199	183	286	154
Downstream	2	01	03-23-1999	07:32:45	01:00	9789	15430	5411	10050	14730	10750	18250	13010	2861	6984	4216	1148	199	283	165
Downstream	2	01	03-23-1999	07:35:15	01:00	10000	15370	5586	9948	14830	11010	18410	12760	2768	6850	4277	1180	169	300	163
Downstream	2	01	03-23-1999	07:37:45	01:00	9514	14850	5276	9609	14440	10600	17600	12750	2605	6660	4128	1205	175	282	163
Downstream	2	01	03-23-1999	07:40:15	01:00	9755	14790	5226	10010	14880	10350	17790	14250	2915	7263	4617	1301	223	343	179
Downstream	2	01	03-23-1999	07:42:45	01:00	9697	15090	5378	10150	14930	10760	18330	14460	2913	7277	4727	1322	220	333	224
Downstream	2	01	03-23-1999	07:45:15	01:00	10080	15160	5426	10450	15040	10520	18400	14390	2998	7101	4527	1387	204	347	208
Downstream	2	01	03-23-1999	07:47:45	01:00	9864	15090	5461	10340	15250	10530	18030	14330	2899	7111	4680	1321	205	319	186
D. Bckgrnd	2	01	03-23-1999	07:57:42	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration						0.99	0.99	1.00	1.00	1.00	1.01	1.00	0.99	1.03	1.04	1.08	1.08	1.07	1.08	1.05
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	1.00	1.00	1.00	1.01	1.00	0.99	1.03	1.04	1.08	1.08	1.07	1.08	1.05
Corrected Efficiency (%)						1	1	0	0	0	-1	0	1	-3	-4	-8	-8	-7	-8	-5
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:						99140	152810	54635	100717	148800	106767	181230	136150	27567	67016	40587	11465	1814	2846	1647
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	0.02	0.03	0.03	0.08	0.07	0.05	0.08	0.10	0.15	0.13	0.22
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):						16.6														
Data Quality Objective: max. allowable conc. (#/cc):						< 23														
Does this meet the DQO:						Yes, (applies to all channels)														

Test No. 03239903
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	08:08:47	01:00		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Upstream	1	01	03-23-1999	08:16:49	01:00		10430	15880	5745	10510	15410	11150	18890	13890	2836	6935	4122	1055	179	280	180
Upstream	1	01	03-23-1999	08:19:19	01:00		10350	15840	5556	10320	15220	11110	18550	13870	2827	6950	4101	1140	191	302	176
Upstream	1	01	03-23-1999	08:21:49	01:00		10280	15710	5505	10190	15330	11100	18510	13620	2751	6810	4208	1206	176	294	183
Upstream	1	01	03-23-1999	08:24:19	01:00		9784	15160	5389	10100	14710	10720	17740	13140	2620	6625	3922	1149	177	287	170
Upstream	1	01	03-23-1999	08:26:49	01:00		10070	15410	5546	10280	14870	11010	18390	13370	2730	6765	4002	1155	185	308	154
Upstream	1	01	03-23-1999	08:29:19	01:00		10140	15350	5515	10220	15080	10890	18150	13440	2738	6645	3964	1126	165	285	147
Upstream	1	01	03-23-1999	08:31:49	01:00		10000	15390	5535	10330	15300	10470	18580	14670	3041	7154	4472	1259	189	328	182
Upstream	1	01	03-23-1999	08:34:19	01:00		10120	15300	5396	10450	15170	10750	18390	14080	2912	6992	4312	1232	205	316	195
Upstream	1	01	03-23-1999	08:36:49	01:00		10240	15670	5647	10660	15720	10950	18850	14910	3008	7166	4517	1288	194	308	202
Upstream	1	01	03-23-1999	08:39:19	01:00		10030	15370	5496	10370	15200	10940	18580	14420	2924	6971	4293	1199	200	361	188
U. Bckgrnd	1	01	03-23-1999	08:50:05	01:00		1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
ENTER DATA BELOW																					
D. Bckgrnd	2	01	03-23-1999	08:10:02	01:00		0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Downstream	2	01	03-23-1999	08:18:04	01:00		2035	2859	858	1456	1602	913	917	357	36	67	30	2	0	1	0
Downstream	2	01	03-23-1999	08:20:34	01:00		1928	2657	842	1491	1517	808	866	361	32	70	25	8	1	1	1
Downstream	2	01	03-23-1999	08:23:04	01:00		1920	2657	908	1433	1647	836	861	337	42	68	23	5	1	0	0
Downstream	2	01	03-23-1999	08:25:34	01:00		1907	2580	837	1411	1548	750	902	330	44	69	20	2	1	0	0
Downstream	2	01	03-23-1999	08:28:04	01:00		1916	2671	850	1423	1599	820	910	335	48	81	22	5	0	0	0
Downstream	2	01	03-23-1999	08:30:34	01:00		1984	2721	845	1383	1546	812	864	343	43	63	16	9	0	1	0
Downstream	2	01	03-23-1999	08:33:04	01:00		1865	2573	870	1507	1624	820	951	388	54	63	16	5	1	1	0
Downstream	2	01	03-23-1999	08:35:34	01:00		1983	2735	841	1528	1627	807	932	376	46	69	18	2	1	1	1
Downstream	2	01	03-23-1999	08:38:04	01:00		1946	2733	904	1485	1585	821	957	391	42	96	22	4	0	0	0
Downstream	2	01	03-23-1999	08:40:34	01:00		1936	2607	855	1420	1634	827	944	425	40	87	30	2	0	1	0
D. Bckgrnd	2	01	03-23-1999	08:51:20	01:00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration							0.19	0.17	0.16	0.14	0.10	0.08	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
P100 correction values							0.99	0.99	1.00	1.00	1.00	1.01	1.00	0.99	1.03	1.04	1.08	1.08	1.07	1.08	1.05
Corrected Penetration							0.19	0.17	0.16	0.14	0.10	0.07	0.05	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Corrected Efficiency (%)							81	83	84	86	90	93	95	97	99	99	100	100	100	100	100
Data Acceptance Criteria:																					
Total Challenge Counts for Each Channel:							101444	155080	55330	103430	152010	109090	184630	139410	28387	69013	41913	11809	1861	3069	1777
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	0.01	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):							16.9														
Data Quality Objective: max. allowable conc. (#/cc):							< 23														
Does this meet the DQO:							Yes, (applies to all channels)														