

US EPA ARCHIVE DOCUMENT

Environmental Technology Verification Report

Paint Overspray Arrestor
AAF International
Dri-Pak 40-45%

US EPA ARCHIVE DOCUMENT

Prepared by



Research Triangle Institute

Under a Cooperative Agreement with



U.S. Environmental Protection Agency

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Environmental Technology Verification Report

Paint Overspray Arrestor

AAF International Dri-Pak 40-45%

Prepared by

Kathleen Owen
James Hanley
Jack Farmer

Air Pollution Control Technology Program
Research Triangle Institute
Research Triangle Park, NC 27709-2194

EPA Cooperative Agreement CR 826152-01-2

EPA Project Manager: Theodore G. Brna
Air Pollution Prevention and Control Division
National Risk Management Research Laboratory
Research Triangle Park, NC 27711

March 2000

Notice

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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**

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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 AAF International's Dri-Pak 40-45% during the period September 2-3, 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 Dri-Pak 40-45% met the NESHAP requirements for existing sources.

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List of Abbreviations and Acronyms

APCT	Air Pollution Control Technology
APPCD	Air Pollution Prevention and Control Division
ASME	American Society of Mechanical Engineers
cfm	cubic feet per minute
cm	centimeter
Diam.	Diameter
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
ETV	Environmental Technology Verification
fpm	feet per minute
ft ³	cubic foot
g	gram
Geo.	geometric
HEPA	high efficiency particulate air
ID	inside diameter
in.	inch
kW	kilowatt
L	liter
mL	milliliter
mm	millimeter
m/s	meters per second
NESHAP	National Emission Standards for Hazardous Air Pollutants
OPC	optical particle counter
Pa	pascal
POA	paint overspray arrestor
PSL	polystyrene latex
QA	quality assurance
RTI	Research Triangle Institute
s or sec	second
µm or um	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 Ron Long of AAF International.

For more information on the Paint Overspray Arrestor Verification Testing, contact

James Hanley
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709-2194
(919) 541-5811

For more information on the AAF Dri-Pak 40-45%, contact

Ron Long
AAF International
215 Central Ave.
Louisville, KY 40208
(502) 637-0195

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 319³ 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 covered 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 particle counts for each channel, 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 first removed from the upstream air 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 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):

- C Three arrestors were tested using a liquid-phase aerosol challenge,
- C 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 5. Additional details on the test procedure are provided in Appendix A.

TABLE 5. TEST SERIES

RTI Test No.	TYPE OF TEST				Challenge Aerosol
	No-Filter	Test Arrestor	HEPA Filter	Reference Filter	
09039901	X				Solid-Phase
09039902				X	
09039903	X				
09039904		X			
09039905	X				
09039906		X			
09039907	X				
09039908		X			
08319904			X		
09029906	X				Liquid-Phase
09029907		X			
09029908	X				
09029909		X			
09029910	X				
09029911		X			

2.1 SELECTION OF PAINT OVERSPRAY ARRESTORS FOR TESTING

The test arrestors (Dri-Pak 40-45%) were supplied to the test laboratory directly from the manufacturer (AAF International) with a letter signed by Bill Erdmann, Vice President Operations, Global AF, AAF International, attesting that the arrestors were manufactured and chosen in an unbiased manner. The filters were produced using standard materials and processes with no additional inspection beyond the normal.

SECTION 3 DESCRIPTION OF ARRESTOR

As shown in Figure 1 (page iii), the AAF Dri-Pak 40-45% 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 yellow. The label is 7 x 1/2 in. (0.18 x 0.01 m) in size. The label included the following information: Dri-Pak Extended Surface Filter, 40-45% ASHRAE Efficiency, AAF International. 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 EPA-approved Test/Quality Assurance (QA) Plan.² The EPA Quality Manager conducted an independent assessment of the test laboratory in August 1999 and found that the test laboratory was being operated as specified in the Test/QA Plan. Additionally, APCT Quality Assurance staff have reviewed the results of this test and have found that the results meet data quality objectives in the Test/QA Plan. Certificates of Calibration for the optical particle counter and the airflow reference devices are provided in Appendix B.

4.2 RESULTS

Tables 6 and 7 and Figures 2 through 5 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 m³/s)] is shown in Table 8. This pressure drop across the tested arrestors ranged from 0.04 to 0.06 in. H₂O (10 to 15 Pa) for each of the six arrestors tested.

Tables 1-4 (page iv) 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 1 and 2 for existing sources but not those listed in Tables 3 and 4 for new sources.

4.3 LIMITATIONS AND APPLICATIONS

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 Statement is applicable to paint overspray arrestors manufactured between the publication date of the Verification Statement and 12 months thereafter.

As stated in Section 1.3 of Method 319³, "for a paint arrestor system or subsystem which has been tested by this method, adding additional filtration devices to the system or subsystem shall be assumed to result in an efficiency of at least that of the original system without additional testing."

SECTION 5 REFERENCES

1. Generic Verification Protocol for Paint Overspray Arrestors, Research Triangle Institute, Research Triangle Park, NC, August 1999.
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 6. 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
AAF DriPak 40 - 45%																
Run #1	09039904	10	12	14	14	18	24	30	39	46	58	76	90	96	98	99
Run #2	09039906	9	11	12	16	19	25	32	42	53	63	81	93	96	98	99
Run #3	09039908	7	10	12	13	19	25	30	41	52	62	79	92	96	97	99
Average		9	11	13	14	19	25	31	41	50	61	79	92	96	98	99
Interpolated Efficiency Values (%) for Existing Source Criteria:																
	2.60 um (> 10% required):	42														
	5.00 um (> 50% required):	80														
	8.10 um (> 90% required):	97														
Interpolated Efficiency Values (%) for New Source Criteria:																
	0.70 um (> 75% required):	11														
	1.10 um (> 85% required):	17														
	2.50 um (> 95% required):	40														
HEPA Filter Control Test (applicable to both solid and liquid phase conditions)																
Run #1	08319904	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Reference Filter QA Test																
Current	09039902	0	2	3	3	5	4	4	5	9	15	37	64	78	81	90
Baseline	08279902	1	1	0	1	1	4	4	7	14	19	42	68	81	86	92
Difference		-1	1	3	2	4	0	-1	-3	-4	-4	-4	-4	-3	-5	-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	09039903	1.01	1.00	1.00	0.99	1.00	1.00	1.00	0.98	0.98	0.97	0.93	0.87	0.85	0.79	0.75
Run #2	09039905	1.00	1.01	1.00	1.01	1.00	1.00	0.99	0.99	0.99	0.98	0.94	0.88	0.80	0.78	0.82
Run #3	09039907	0.99	1.00	0.99	0.99	1.01	1.00	0.99	0.99	1.00	0.99	0.94	0.88	0.80	0.84	0.77

TABLE 7. 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
AAF DriPak 40 - 45%																
Run #1	09029907	6	8	9	10	13	17	22	33	43	51	68	85	94	95	98
Run #2	09029909	6	8	10	10	13	18	24	35	44	53	70	88	93	96	99
Run #3	09029911	7	9	9	11	15	20	25	36	45	54	71	88	95	96	99
Average		6	8	9	11	14	18	24	35	44	53	70	87	94	96	99
Interpolated Efficiency Values (%) for Existing Source Criteria:																
	2.20 um (> 10% required):	48														
	4.10 um (> 50% required):	85														
	5.70 um (> 90% required):	96														
Interpolated Efficiency Values (%) for New Source Criteria:																
	0.42 um (> 65% required):	8														
	1.00 um (> 80% required):	17														
	2.00 um (> 95% required):	44														
"No Filter" Control Tests		Penetration For Each Size Range														
Run #1	09029906	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.01	1.00	1.01	1.02	1.04	1.02	0.97
Run #2	09029908	1.00	0.99	1.00	1.00	0.99	0.99	0.99	1.00	1.00	1.01	1.02	1.05	1.03	1.03	0.95
Run #3	09029910	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.02	1.02	1.02	1.08	0.99	0.96

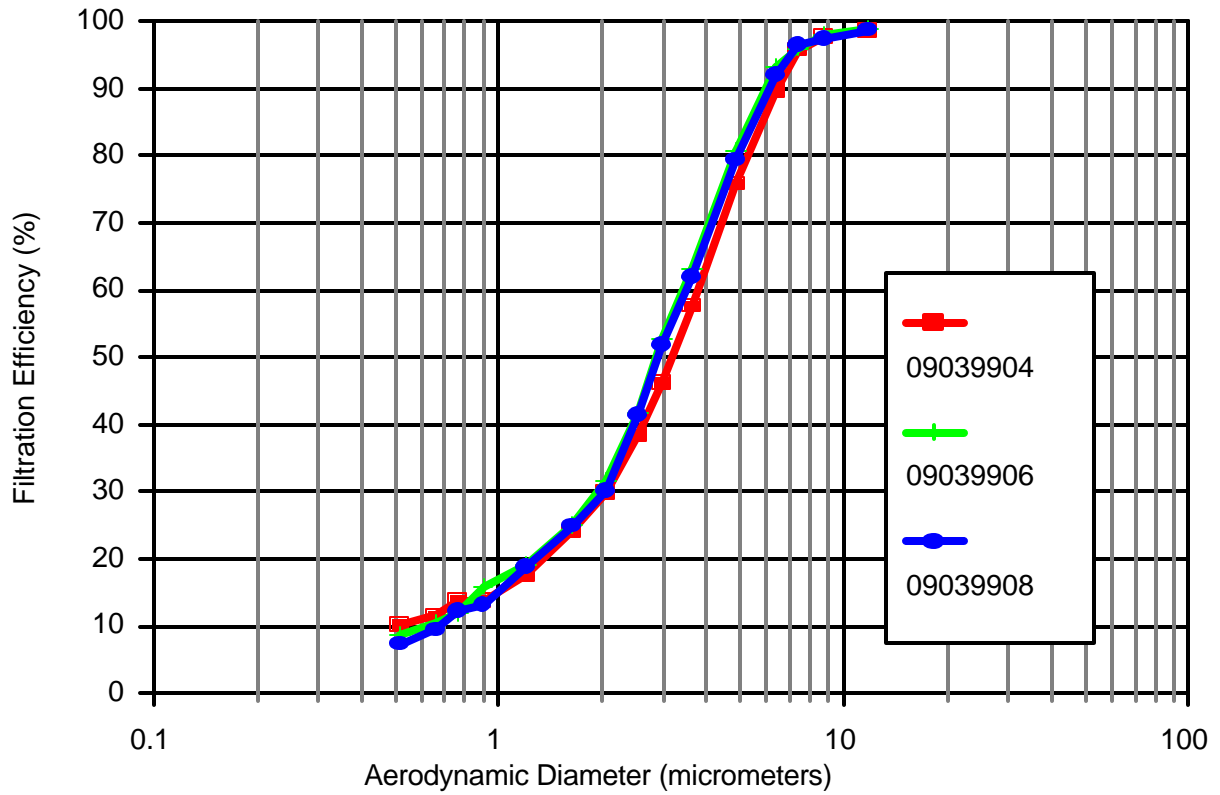


Figure 2. Triplicate solid-phase particle removal efficiency curves for AAF Dri-Pak 40-45% paint overspray arrestor.

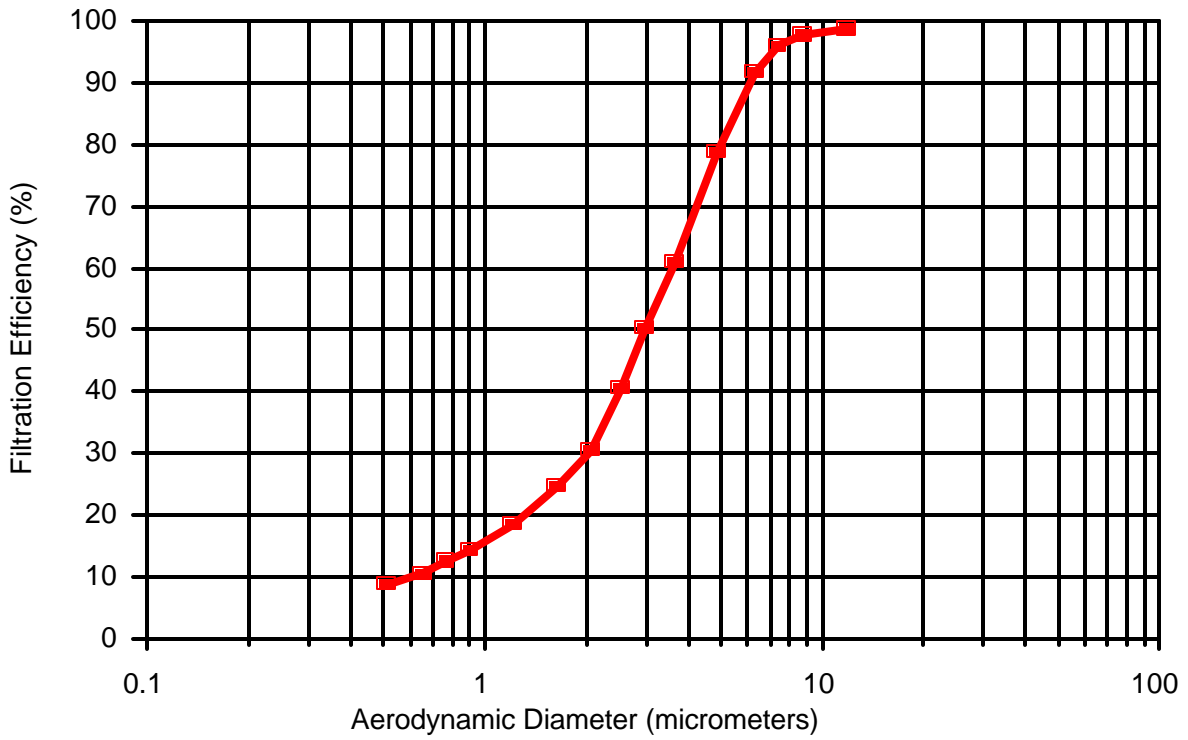


Figure 3. Average of the solid-phase particle removal efficiency curves for AAF Dri-Pak 40-45% paint overspray arrestor.

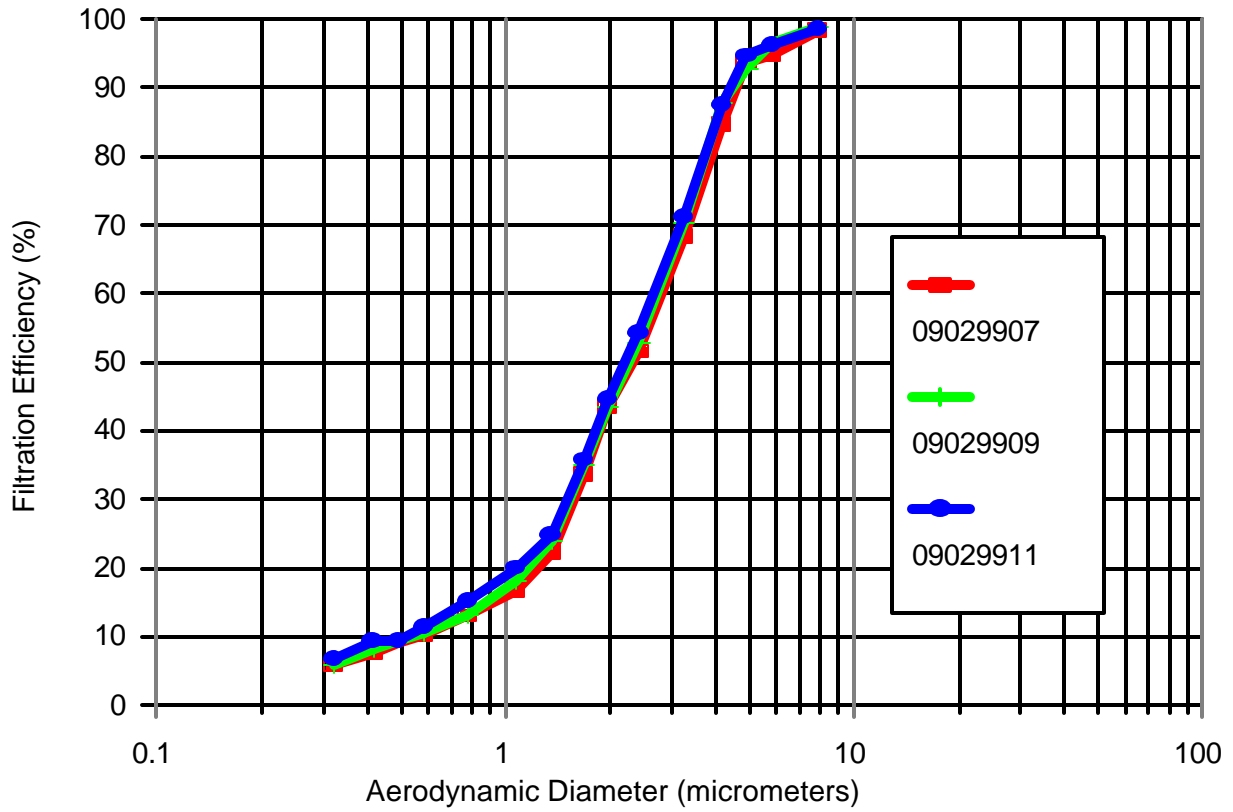


Figure 4. Triplicate liquid-phase particle removal efficiency curves for AAF Dri-Pak 40-45% paint overspray arrestor.

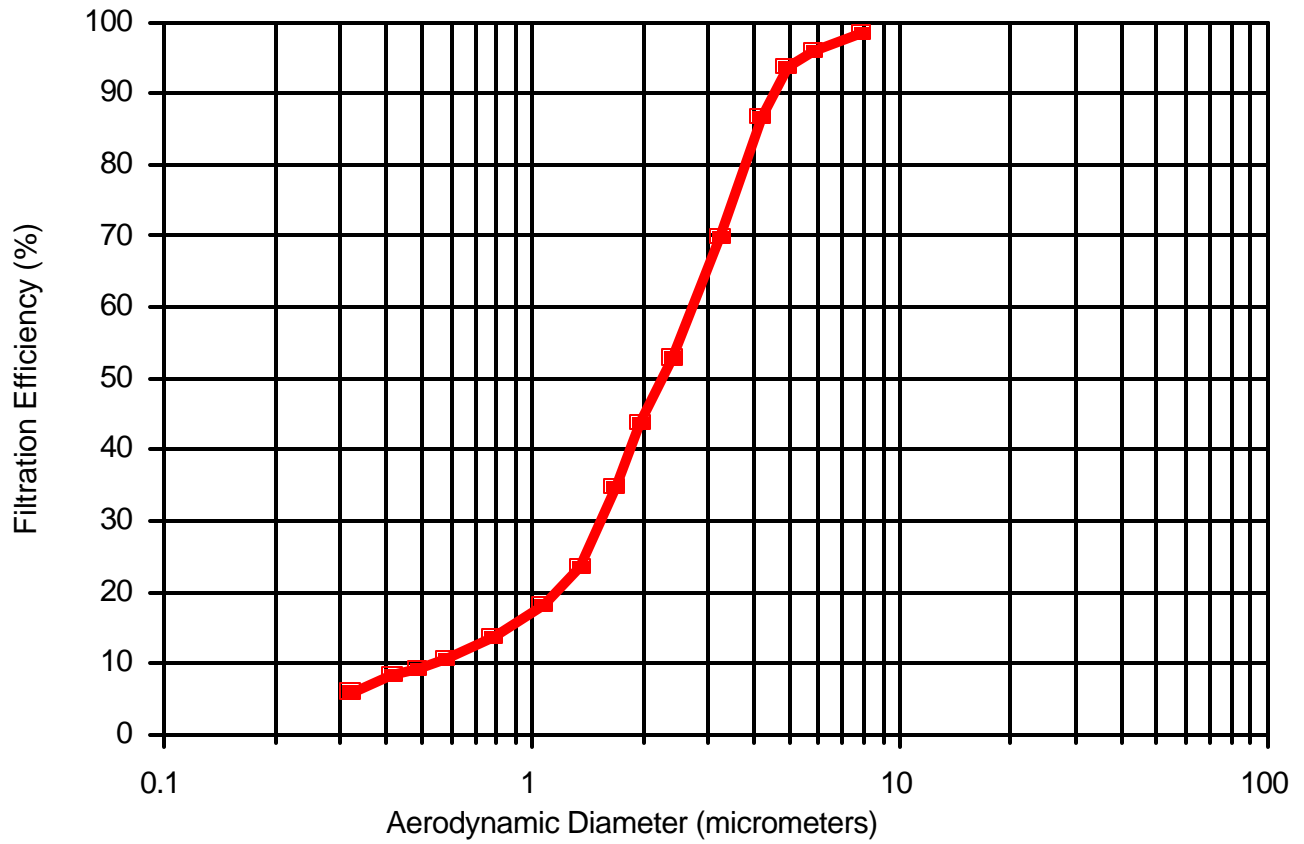


Figure 5. Average of the liquid-phase particle removal efficiency curves for AAF Dri-Pak 40-45% paint overspray arrestor.

TABLE 8
SUMMARY OF PRESSURE DROP MEASUREMENTS

Test No.	Initial Pressure Drop (inch H ₂ O)	Initial Pressure Drop (Pa)
09039904	0.05	15
09039906	0.06	15
09039908	0.06	15
09029907	0.04	10
09029909	0.04	10
09029911	0.05	12

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 m³/s) at 13 in. H₂O (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 m³/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.

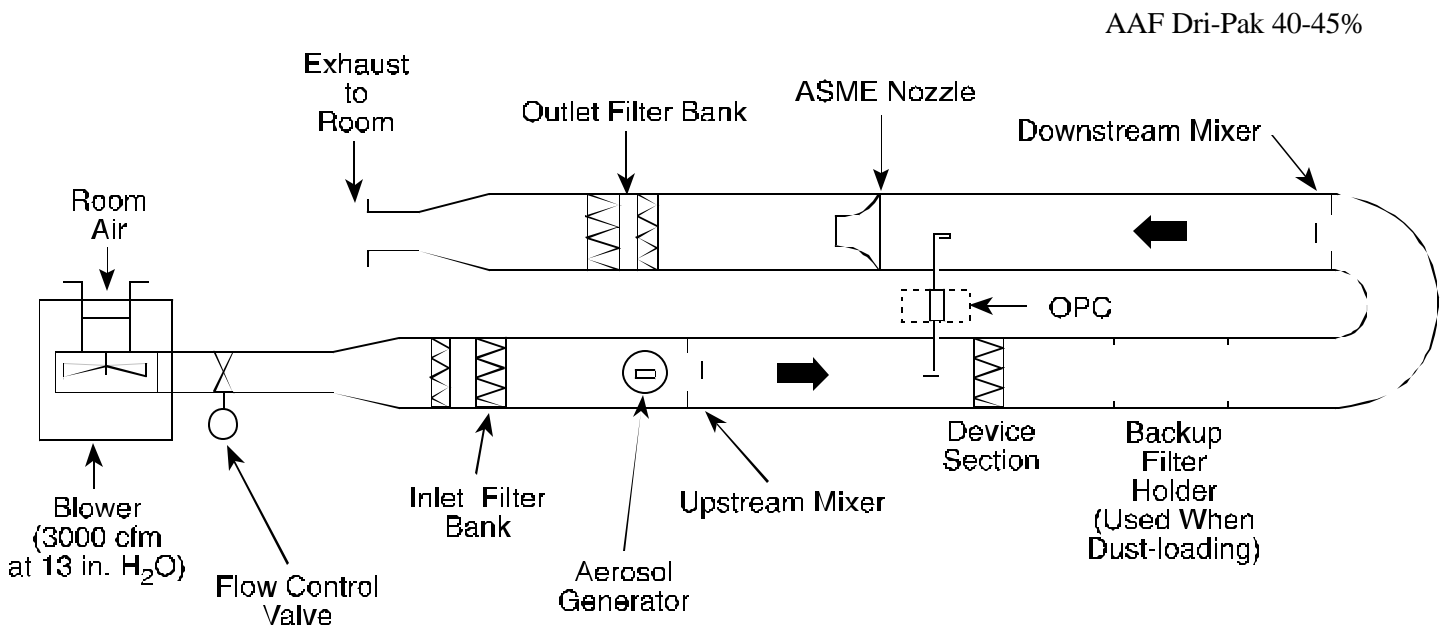
AIRFLOW

Airflow was measured with a 4.00 in. (0.102 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.

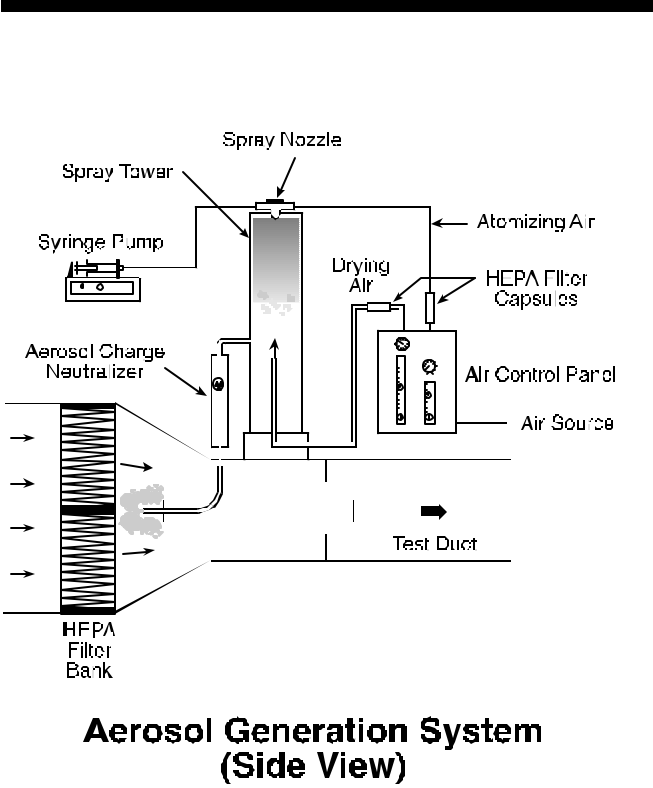
OPTICAL PARTICLE COUNTER (OPC)

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 m³/s).

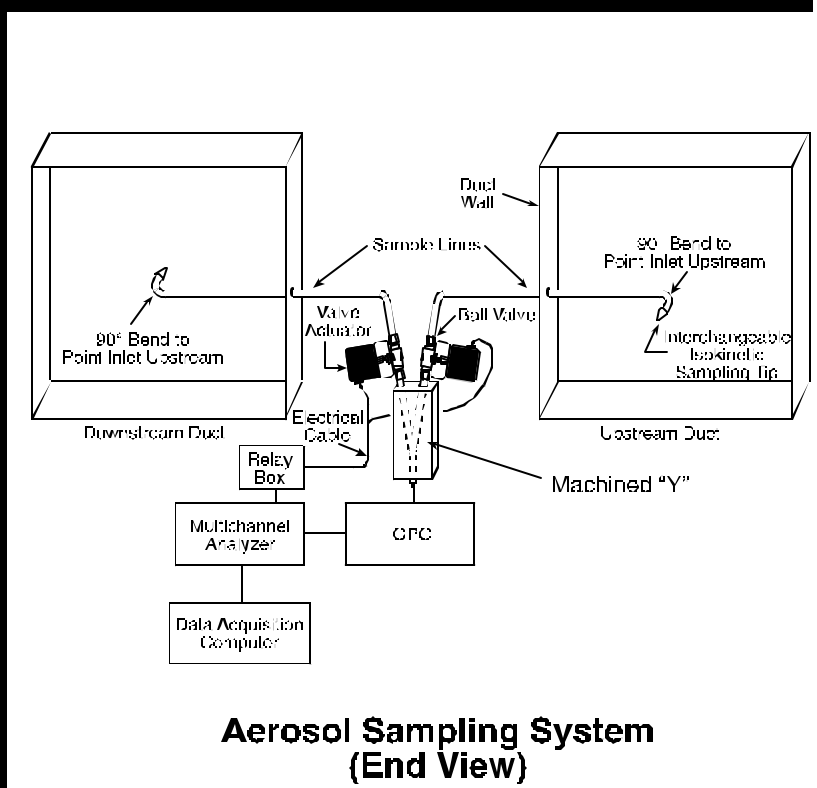
The output of the OPC was input to a Climet Instruments Model 8040 multichannel analyzer equipped with Model 05872005 and 05872006 input boards. These boards provide 16 sizing channels covering the range from 0.3 to 10 μm. The 8040 was also equipped with a Model CI-298 sequential interface board. This 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 ft³ (1 L) of distilled water. Both oleic acid and KCl are compatible with accurate measurement by the OPC.

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 by means of a pump. Varying the operating air pressure of the generator allows control of the output aerosol concentration.

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 one measurement each 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 one additional upstream and downstream background measurement.

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

- P = Penetration corrected for P_{100} value
- D = Downstream particle count
- D_b = Downstream background count
- U = Upstream particle count
- U_b = Upstream background count
- P_{100} = 100% penetration value determined from the control tests
- 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:

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

where

ρ_{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} .

X is the dynamic shape factor.

Note: due to the interdependence of D_{aero} and CCF_{Aero} , the equation is solved iteratively.

For oleic acid droplets having a density of 0.89 g/cm^3 and being spherical ($X = 1$), 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**

OPC Channel Number	Particle Diameter Size Range (μm)*		
	PSL	OLEIC ACID	KCl
	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

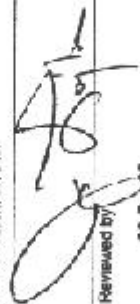
Model No. 8500D-II Serial No. 3810 Part No. 634493200

Certificate Number: 1946 Date: 28-Oct-88 P.O. 00328 Order/RMA: 104638
 Customer Number:

*Certification Standards information
 The following standards and equipment were used as references for this calibration.*

Tested By	Date Tested	Inst. No.	Cal. Due	MIST Test Numbers
LOZADA	10/23/88	747	4/9/00	259340; 257602; 258905; 258659; 261222; 811/255622
		746	4/3/00	811/259522; 811/280176;
		922	5/9/00	5387238947-68 ;
		881	11/10/88	811/257079 ; 247770 ; 253906 ; 811/255474 ; 253669 U3N22730C ; Chem. Const. ; 25-4227 ; 811/256730 ; 8-1/251962 ; 251971 ; 811/251741 ; 811/253662 ; 811/256210 ; 811802 ;
		857	5/9/00	536/259947-68 ; ;
		784	3/18/09	
		888	2/21/00	811/256765 ; 251971 ; 811/259004-88 ; 811/257773 ; 255216 ; ;
		359	11/12/88	P-8531A ; P-8531B ; 3812B ; 25-1160 ; 255332 ;
		326	2/9/90	P-8631A ; P-8631B ; 3812B ; 254160 ; 255009 ;
		319	11/12/88	P-8531A ; P-8531B ; 3812B ; 25-4160 ; 255332 ;
		321	12/11/88	856/257123-56 ; ;

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 related physical constants. This policy and procedures used comply with MIL-STD-46550A. This certificate shall not be reproduced except in full, without the written consent of Alnor.

Reviewed by: 

28-Oct-88

Date



Alnor Instrument Company
 7555 N. Under Avenue, Skokie, IL 60077
 Tel. 847-577-3500 Fax. 847-677-3539



FILE NO. 040FB:001-19
PAGE 1 OF 1

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. [Signature]
 QUALITY ASSURANCE INSPECTOR
 MERIAM INSTRUMENT

Jack Weigand [Signature]
 QUALITY ASSURANCE MANAGER
 MERIAM INSTRUMENT

US EPA ARCHIVE DOCUMENT

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 61882CONTROL NUMBER: LCS23102DATE CALIBRATED: 8/19/99 NEXT CALIBRATION: 2/19/2000RECOMMENDED CALIBRATION INTERVAL: 6 monthsL. Sparks
CALIBRATED BYJohn R. Guston
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:

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

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:

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

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

Test No. 09039901

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	09-03-1999	06:50:56	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-03-1999	07:02:31	01:00	9946	14750	4726	8702	13150	7836	10370	10580	2613	5412	2931	912	115	209	108
Upstream	1	01	09-03-1999	07:05:01	01:00	10710	16310	5185	9405	14160	8664	11110	11250	2690	5986	3189	888	152	220	153
Upstream	1	01	09-03-1999	07:07:31	01:00	11130	16640	5196	9310	14470	8551	11300	11400	2694	5924	3171	1009	139	216	107
Upstream	1	01	09-03-1999	07:10:01	01:00	10980	16170	5021	9431	14160	8498	11150	11040	2629	5759	3095	883	139	186	110
Upstream	1	01	09-03-1999	07:12:31	01:00	10550	15820	5038	8943	13690	8338	10840	10820	2549	5628	2942	866	120	241	130
Upstream	1	01	09-03-1999	07:15:01	01:00	9888	14540	4678	8385	12760	7678	10200	9930	2353	5282	2866	843	129	182	116
Upstream	1	01	09-03-1999	07:17:31	01:00	10680	15780	5095	9326	14160	8606	11140	11220	2651	5661	3141	927	144	217	135
Upstream	1	01	09-03-1999	07:20:01	01:00	10440	15130	4856	8775	13690	8275	10610	10830	2576	5622	3141	884	143	216	125
Upstream	1	01	09-03-1999	07:22:31	01:00	10080	14880	4822	8570	13280	8036	10480	10320	2490	5421	3027	847	149	210	128
Upstream	1	01	09-03-1999	07:25:01	01:00	10280	15230	4985	8892	13600	8261	10650	10670	2459	5518	2944	867	127	223	116
U. Bckgrnd	1	01	09-03-1999	07:35:24	01:00	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2	01	09-03-1999	06:52:11	01:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Downstream	2	01	09-03-1999	07:03:46	01:00	10730	16100	5164	9367	14620	8712	10840	10890	2582	5569	2849	804	113	161	96
Downstream	2	01	09-03-1999	07:06:16	01:00	10860	16830	5237	9644	15160	9022	11340	11130	2671	5789	3041	798	104	142	97
Downstream	2	01	09-03-1999	07:08:46	01:00	10810	16160	5068	9375	14280	8404	10770	10690	2481	5375	2743	731	108	150	87
Downstream	2	01	09-03-1999	07:11:16	01:00	10930	16510	5176	9569	14440	8548	10940	10570	2445	5417	2832	790	113	126	100
Downstream	2	01	09-03-1999	07:13:46	01:00	10540	16090	4932	9205	14280	8327	10790	10340	2414	5280	2858	782	101	142	85
Downstream	2	01	09-03-1999	07:16:16	01:00	10580	16010	5089	9195	14210	8056	10690	10380	2438	5205	2763	779	100	157	93
Downstream	2	01	09-03-1999	07:18:46	01:00	10130	15400	4866	8969	13910	8117	10350	10170	2401	5354	2854	782	115	166	88
Downstream	2	01	09-03-1999	07:21:16	01:00	10370	15380	5096	8960	13930	8028	10490	10340	2419	5198	2825	771	99	176	83
Downstream	2	01	09-03-1999	07:23:46	01:00	10120	15470	4834	8928	13760	8047	10270	10170	2337	5095	2814	734	103	146	92
Downstream	2	01	09-03-1999	07:26:16	01:00	10210	15560	4877	8963	13590	7992	10220	9884	2278	5029	2752	714	97	126	84
D. Bckgrnd	2	01	09-03-1999	07:36:39	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Meas. Penetration	1.01	1.03	1.01	1.03	1.04	1.01	0.99	0.97	0.95	0.95	0.93	0.86	0.78	0.70	0.74
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	1.03	1.01	1.03	1.04	1.01	0.99	0.97	0.95	0.95	0.93	0.86	0.78	0.70	0.74
Corrected Efficiency (%)	-1	-3	-1	-3	-4	-1	1	3	5	5	7	14	22	30	26

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	104684	155250	49602	89739	137120	82743	107850	108060	25704	56213	30447	8926	1357	2120	1228
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	0.06	0.05	0.05	0.05	0.06	0.05	0.05	0.06	0.06	0.05	0.06	0.09	0.10	0.10
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):	18.4
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

Test No. 09039902
Reference
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	09-03-1999	07:50:45	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-03-1999	07:59:56	01:00	10250	15750	5055	9173	13800	8187	10680	11310	2780	5856	3319	1050	163	264	158
Upstream	1	01	09-03-1999	08:02:26	01:00	9991	14820	4768	8742	13360	7882	10230	10850	2644	5788	3210	983	143	232	152
Upstream	1	01	09-03-1999	08:04:56	01:00	10250	14570	4614	8408	12860	7678	10090	10640	2548	5655	3234	973	164	230	129
Upstream	1	01	09-03-1999	08:07:26	01:00	9640	14430	4609	8377	12960	7836	9921	10470	2619	5511	3160	1052	144	252	135
Upstream	1	01	09-03-1999	08:09:56	01:00	9542	14130	4632	8136	13050	7594	9989	10410	2668	5647	3161	1013	156	257	128
Upstream	1	01	09-03-1999	08:12:26	01:00	9731	14170	4680	8164	12890	7631	9885	10290	2630	5649	3172	1006	165	257	156
Upstream	1	01	09-03-1999	08:14:56	01:00	9003	13070	4144	7399	11560	7053	9215	9312	2282	4917	2686	798	123	191	114
Upstream	1	01	09-03-1999	08:17:26	01:00	9668	14260	4518	8127	12660	7479	9966	10070	2324	5183	2929	919	134	210	145
Upstream	1	01	09-03-1999	08:19:56	01:00	10290	15110	4793	8554	13360	7880	10180	10230	2484	5283	3011	915	138	221	133
Upstream	1	01	09-03-1999	08:22:26	01:00	10040	14550	4642	8305	13070	7753	10200	10110	2511	5220	3047	920	139	205	141
U. Bckgrnd	1	01	09-03-1999	08:30:12	01:00	2	1	0	0	0	7	2	0	1	0	0	0	0	0	0
ENTER DATA BELOW																				
D. Bckgrnd	2	01	09-03-1999	07:52:00	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	09-03-1999	08:01:11	01:00	10600	15570	4781	8934	13710	8101	10170	10290	2484	4918	2039	336	26	31	7
Downstream	2	01	09-03-1999	08:03:41	01:00	10070	15030	4699	8311	13220	7640	9820	9633	2273	4553	1867	318	30	23	13
Downstream	2	01	09-03-1999	08:06:11	01:00	9582	14620	4711	8364	13020	7516	9923	9722	2235	4463	1810	302	28	18	13
Downstream	2	01	09-03-1999	08:08:41	01:00	9482	14230	4637	8498	12530	7535	9492	9783	2276	4610	1925	321	31	43	17
Downstream	2	01	09-03-1999	08:11:11	01:00	9664	14290	4479	8257	12340	7431	9381	9639	2303	4450	1890	354	29	41	9
Downstream	2	01	09-03-1999	08:13:41	01:00	9432	13780	4429	7964	11980	7057	9157	9508	2173	4375	1805	312	33	45	9
Downstream	2	01	09-03-1999	08:16:11	01:00	9765	14450	4418	7965	12320	7418	9311	9319	2071	4171	1704	288	18	33	9
Downstream	2	01	09-03-1999	08:18:41	01:00	9975	14450	4391	8068	12750	7226	9406	9251	2029	4129	1660	236	24	26	7
Downstream	2	01	09-03-1999	08:21:11	01:00	10100	15050	4615	8577	13040	7479	9650	9531	2099	4173	1709	267	16	20	7
Downstream	2	01	09-03-1999	08:23:41	01:00	9839	14430	4589	8216	12440	7273	9368	9025	2091	4094	1641	276	19	23	9
D. Bckgrnd	2	01	09-03-1999	08:31:27	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meas. Penetration	1.00	1.01	0.98	1.00	0.98	0.97	0.95	0.92	0.86	0.80	0.58	0.31	0.17	0.13	0.07					
P100 correction values	1.01	1.03	1.01	1.03	1.04	1.01	0.99	0.97	0.95	0.95	0.93	0.86	0.78	0.70	0.74					
Corrected Penetration	1.00	0.98	0.97	0.97	0.95	0.96	0.96	0.95	0.91	0.85	0.63	0.36	0.22	0.19	0.10					
Corrected Efficiency (%)	0	2	3	3	5	4	4	5	9	15	37	64	78	81	90					
Data Acceptance Criteria:																				
Total Challenge Counts for Each Channel:	98405	144860	46455	83385	129570	76973	100356	103692	25490	54709	30929	9629	1469	2319	1391					
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 :																				
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):	17.7																			
Data Quality Objective: max. allowable conc. (#/cc):	< 23																			
Does this meet the DQO:	Yes, (applies to all channels)																			

US EPA ARCHIVE DOCUMENT

Test No. 09039903
 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 09-03-1999 08:53:40 01:00	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
Upstream	1 01 09-03-1999 09:01:44 01:00	10500	15880	4985	8998	13960	8172	10760	11030	2752	5958	3316	1042	173	287	155
Upstream	1 01 09-03-1999 09:04:14 01:00	10460	15640	4985	9145	13860	8359	10670	11380	2769	5926	3417	1145	146	224	133
Upstream	1 01 09-03-1999 09:06:44 01:00	10290	15040	4955	8856	13610	8188	10490	10960	2631	5767	3277	1046	169	235	170
Upstream	1 01 09-03-1999 09:09:14 01:00	10790	15830	4999	9113	14210	8207	10740	11210	2766	5791	3294	994	180	220	166
Upstream	1 01 09-03-1999 09:11:44 01:00	10500	15590	4894	8858	13890	8190	10530	11110	2757	5882	3369	1032	150	236	134
Upstream	1 01 09-03-1999 09:14:14 01:00	10610	15720	5005	9108	14050	8355	10730	11420	2703	5871	3440	1116	144	239	157
Upstream	1 01 09-03-1999 09:16:44 01:00	9425	14430	4716	8477	12550	7536	9927	10020	2419	5185	2926	881	107	195	136
Upstream	1 01 09-03-1999 09:19:14 01:00	10320	15210	4873	8763	13330	7851	10330	10540	2547	5356	3004	910	139	233	112
Upstream	1 01 09-03-1999 09:21:44 01:00	9912	14730	4735	8375	12780	7749	9860	10010	2435	5149	2944	829	146	205	130
Upstream	1 01 09-03-1999 09:24:14 01:00	9983	14980	4830	8644	13320	7851	10170	10170	2560	5362	2950	886	120	237	128
U. Bckgrnd	1 01 09-03-1999 09:39:32 01:00	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2 01 09-03-1999 08:54:55 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Downstream	2 01 09-03-1999 09:02:59 01:00	10090	15220	4941	8801	13430	8104	10500	10910	2703	5749	3121	881	130	195	113
Downstream	2 01 09-03-1999 09:05:29 01:00	10280	15240	4906	8606	13390	7947	10440	10980	2622	5678	3080	903	128	209	123
Downstream	2 01 09-03-1999 09:07:59 01:00	10100	15100	5016	8781	13430	7980	10220	10840	2679	5672	3094	862	139	172	114
Downstream	2 01 09-03-1999 09:10:29 01:00	10780	15850	5026	9108	14040	8375	10650	11010	2706	5790	3028	886	128	186	103
Downstream	2 01 09-03-1999 09:12:59 01:00	10860	15900	5069	9327	14440	8409	10730	11110	2746	5829	3216	964	121	216	108
Downstream	2 01 09-03-1999 09:15:29 01:00	10660	15990	4958	9117	14330	8421	10680	10940	2653	5692	3067	894	135	213	128
Downstream	2 01 09-03-1999 09:17:59 01:00	10420	15450	4910	8778	13340	8022	10450	10470	2420	5158	2766	809	132	156	91
Downstream	2 01 09-03-1999 09:20:29 01:00	9989	14770	4716	8401	12920	7776	10100	10010	2466	5055	2771	766	124	176	88
Downstream	2 01 09-03-1999 09:22:59 01:00	10090	15270	4863	8572	13050	7784	10240	10130	2415	5132	2877	809	108	157	109
Downstream	2 01 09-03-1999 09:25:29 01:00	10160	14980	4738	8400	13110	7666	10130	9752	2320	5070	2627	816	104	153	93
D. Bckgrnd	2 01 09-03-1999 09:40:47 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Meas. Penetration	1.01	1.00	1.00	0.99	1.00	1.00	1.00	0.98	0.98	0.97	0.93	0.87	0.85	0.79	0.75
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	1.00	1.00	0.99	1.00	1.00	1.00	0.98	0.98	0.97	0.93	0.87	0.85	0.79	0.75
Corrected Efficiency (%)	-1	0	0	1	0	0	0	2	2	3	7	13	15	21	25

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	102790	153050	48977	88337	135560	80458	104207	107850	26339	56247	31937	9881	1474	2311	1421
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	0.04	0.03	0.05	0.06	0.05	0.04	0.07	0.08	0.08	0.09	0.11	0.15	0.13	0.14
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):	17.9
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09039904
 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	09-03-1999	09:57:19	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-03-1999	10:06:33	01:00	9760	14560	4570	8250	12530	7566	9941	10050	2388	5168	2970	888	140	176	148
Upstream	1	01	09-03-1999	10:09:03	01:00	10080	15110	4734	8501	12730	7721	10410	10430	2450	5260	3028	892	132	218	132
Upstream	1	01	09-03-1999	10:11:33	01:00	9636	14610	4554	8321	12640	7747	10230	10070	2467	5211	2980	882	145	195	136
Upstream	1	01	09-03-1999	10:14:03	01:00	9956	14950	4749	8554	12940	7874	9979	10430	2406	5306	2981	867	162	217	147
Upstream	1	01	09-03-1999	10:16:33	01:00	10040	15090	4742	8633	13250	8218	10330	10390	2300	5226	2977	890	140	198	131
Upstream	1	01	09-03-1999	10:19:03	01:00	9719	14720	4640	8198	12960	7746	9995	10150	2415	5086	2967	893	140	201	132
Upstream	1	01	09-03-1999	10:21:33	01:00	9529	14120	4668	8266	12610	7485	9787	10540	2636	5531	3104	1021	155	266	146
Upstream	1	01	09-03-1999	10:24:03	01:00	9493	14110	4677	8233	12680	7582	9905	10350	2490	5558	3194	974	172	236	179
Upstream	1	01	09-03-1999	10:26:33	01:00	9436	14030	4502	8231	12810	7734	9950	10510	2649	5534	3203	1074	141	255	161
Upstream	1	01	09-03-1999	10:29:03	01:00	9621	14310	4705	8428	13160	7852	10130	10570	2673	6058	3406	1072	158	279	149
U. Bckgrnd	1	01	09-03-1999	10:39:23	01:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2	01	09-03-1999	09:58:34	01:00	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Downstream	2	01	09-03-1999	10:07:48	01:00	8649	12940	3966	6810	10230	5695	6892	6177	1288	2129	614	82	5	4	0
Downstream	2	01	09-03-1999	10:10:18	01:00	8985	13180	4180	7241	10640	5922	7065	6429	1235	2074	676	79	4	5	1
Downstream	2	01	09-03-1999	10:12:48	01:00	8878	13070	4095	7314	10820	5920	7046	6264	1265	2150	651	88	7	6	2
Downstream	2	01	09-03-1999	10:15:18	01:00	9232	13550	4275	7419	10900	5968	7135	6143	1314	2162	644	77	2	1	3
Downstream	2	01	09-03-1999	10:17:48	01:00	8906	13140	4100	7476	10860	5961	6947	5978	1239	2093	621	59	6	1	1
Downstream	2	01	09-03-1999	10:20:18	01:00	9193	13130	3942	7020	10260	5716	7053	6019	1191	2006	550	58	1	3	0
Downstream	2	01	09-03-1999	10:22:48	01:00	8695	12830	3924	7095	10230	5858	7005	6352	1340	2355	750	101	8	4	3
Downstream	2	01	09-03-1999	10:25:18	01:00	8569	12640	4004	7211	10710	6014	7281	6515	1386	2500	758	102	2	3	2
Downstream	2	01	09-03-1999	10:27:48	01:00	8517	12350	3962	7086	10640	5881	7075	6343	1395	2396	812	96	13	4	3
Downstream	2	01	09-03-1999	10:30:18	01:00	8271	12490	3819	7042	10470	5938	7075	6394	1398	2372	825	96	5	8	0
D. Bckgrnd	2	01	09-03-1999	10:40:38	01:00	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0

Meas. Penetration	0.90	0.89	0.87	0.86	0.82	0.76	0.70	0.60	0.52	0.41	0.22	0.09	0.04	0.02	0.01
P100 correction values	1.01	1.00	1.00	0.99	1.00	1.00	1.00	0.98	0.98	0.97	0.93	0.87	0.85	0.79	0.75
Corrected Penetration	0.90	0.88	0.86	0.86	0.82	0.76	0.70	0.61	0.54	0.42	0.24	0.10	0.04	0.02	0.01
Corrected Efficiency (%)	10	12	14	14	18	24	30	39	46	58	76	90	96	98	99

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	97270	145610	46541	83615	128310	77525	100657	103490	24874	53938	30810	9453	1485	2241	1461
Data Quality Objective:	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard Deviation of Penetration for Each Channel :	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.04	0.04	0.03	0.02	0.02	0.01	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):	16.7
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

Test No. 09039905
 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 09-03-1999 10:52:41 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1 01 09-03-1999 10:59:19 01:00	9724	14510	4622	8320	12500	7557	10020	10000	2409	5264	2844	873	130	203	132
Upstream	1 01 09-03-1999 11:01:49 01:00	10010	14940	4876	8445	13100	7947	10270	10200	2529	5261	2897	916	174	229	138
Upstream	1 01 09-03-1999 11:04:19 01:00	9698	14490	4844	8236	12740	7727	10130	10110	2421	5311	2902	875	145	211	101
Upstream	1 01 09-03-1999 11:06:49 01:00	9706	14510	4676	8154	12610	7904	10240	10080	2512	5251	3000	888	132	238	133
Upstream	1 01 09-03-1999 11:09:19 01:00	9812	14500	4681	8270	12850	7720	10130	10130	2501	5297	2944	936	136	212	115
Upstream	1 01 09-03-1999 11:11:49 01:00	10090	15290	4865	8847	13370	7981	10390	10560	2524	5675	3142	984	150	218	169
Upstream	1 01 09-03-1999 11:14:19 01:00	9270	13750	4412	8101	12400	7374	9592	9941	2403	5296	3007	928	134	242	151
Upstream	1 01 09-03-1999 11:16:49 01:00	9408	14020	4556	8334	12770	7741	9958	10470	2521	5674	3182	1083	180	267	152
Upstream	1 01 09-03-1999 11:19:19 01:00	9351	14140	4530	8199	12700	7717	9847	10260	2633	5427	3145	998	165	252	174
Upstream	1 01 09-03-1999 11:21:49 01:00	9238	13540	4395	7999	12700	7407	9745	10400	2671	5657	3373	1097	159	291	166
U. Bckgrnd	1 01 09-03-1999 11:30:53 01:00	1	0	3	2	0	0	1	1	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2 01 09-03-1999 10:53:56 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2 01 09-03-1999 11:00:34 01:00	9872	15060	4789	8553	13040	7706	10070	10160	2405	5274	2770	793	129	156	129
Downstream	2 01 09-03-1999 11:03:04 01:00	9924	14710	4647	8198	12750	7794	10180	10260	2481	5109	2754	776	128	161	116
Downstream	2 01 09-03-1999 11:05:34 01:00	9717	14340	4696	8227	12540	7611	9954	9904	2427	4964	2665	794	102	147	105
Downstream	2 01 09-03-1999 11:08:04 01:00	10050	14980	4704	8513	13010	7784	9906	10300	2537	5274	2847	831	120	172	124
Downstream	2 01 09-03-1999 11:10:34 01:00	9918	14730	4693	8527	12800	7783	10090	9926	2420	5194	2751	809	102	175	94
Downstream	2 01 09-03-1999 11:13:04 01:00	9777	14390	4486	8430	12930	7560	9885	9589	2280	5060	2712	831	112	178	128
Downstream	2 01 09-03-1999 11:15:34 01:00	9574	14480	4626	8534	13180	7802	10060	10280	2483	5433	3008	905	120	200	118
Downstream	2 01 09-03-1999 11:18:04 01:00	9313	14200	4627	8200	12660	7538	9856	10200	2544	5386	2993	901	134	188	119
Downstream	2 01 09-03-1999 11:20:34 01:00	9445	13900	4594	8158	12670	7640	9832	10180	2507	5451	2876	870	127	224	115
Downstream	2 01 09-03-1999 11:23:04 01:00	9146	13900	4461	8057	12720	7736	9686	10290	2697	5643	3279	909	125	235	130
D. Bckgrnd	2 01 09-03-1999 11:32:08 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Meas. Penetration	1.00	1.01	1.00	1.01	1.00	1.00	0.99	0.99	0.99	0.98	0.94	0.88	0.80	0.78	0.82
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	1.01	1.00	1.01	1.00	1.00	0.99	0.99	0.99	0.98	0.94	0.88	0.80	0.78	0.82
Corrected Efficiency (%)	0	-1	0	-1	0	0	1	1	1	2	6	12	20	22	18

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	96307	143690	46457	82905	127740	77075	100322	102151	25124	54113	30436	9578	1505	2363	1431
Data Quality Objective:	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard Deviation of Penetration for Each Channel :	0.04	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.06	0.05	0.08	0.09	0.12	0.15	0.16
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):	17.0
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09039906
 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	09-03-1999	11:57:05	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-03-1999	12:15:05	01:00	10330	15360	4963	8900	13620	8166	10260	10600	2616	5510	3121	999	156	215	140
Upstream	1	01	09-03-1999	12:17:35	01:00	10000	14730	4703	8649	13370	7967	10490	10320	2491	5400	3036	938	125	202	116
Upstream	1	01	09-03-1999	12:20:05	01:00	9801	14870	4778	8700	13270	7773	10240	10360	2529	5329	3072	961	159	233	122
Upstream	1	01	09-03-1999	12:22:35	01:00	9667	14360	4717	8278	12800	7502	9902	9996	2374	5262	2906	875	139	228	150
Upstream	1	01	09-03-1999	12:25:05	01:00	9850	14720	4649	8527	12670	7743	10140	10170	2508	5228	3004	894	131	235	154
Upstream	1	01	09-03-1999	12:27:35	01:00	9803	14590	4694	8519	13090	7715	9955	10050	2392	5311	2847	924	137	216	165
Upstream	1	01	09-03-1999	12:30:05	01:00	9405	14070	4458	8232	12870	7455	9632	10060	2528	5261	3092	989	147	246	167
Upstream	1	01	09-03-1999	12:32:35	01:00	9672	14700	4713	8512	13360	7940	10220	10560	2584	5667	3268	1023	150	253	160
Upstream	1	01	09-03-1999	12:35:05	01:00	9698	14650	4723	8688	13160	7771	10100	10440	2688	5631	3313	995	166	271	152
Upstream	1	01	09-03-1999	12:37:35	01:00	9845	14680	4654	8627	13350	7918	10250	10660	2530	5808	3251	1056	143	262	153
U. Bckgrnd	1	01	09-03-1999	12:45:56	01:00	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2	01	09-03-1999	11:58:20	01:00	7	4	4	3	3	5	1	0	0	1	0	0	0	0	0
Downstream	2	01	09-03-1999	12:16:20	01:00	9155	13550	4155	7246	10880	5828	6894	5795	1126	1869	539	46	3	1	1
Downstream	2	01	09-03-1999	12:18:50	01:00	9320	13530	4238	7312	10860	5957	6904	5916	1170	1868	494	50	8	4	1
Downstream	2	01	09-03-1999	12:21:20	01:00	8903	13020	4156	7120	10410	5821	6790	5973	1173	1868	546	60	8	4	0
Downstream	2	01	09-03-1999	12:23:50	01:00	8796	12950	4164	7006	10400	5817	6859	5738	1163	1956	536	53	5	2	1
Downstream	2	01	09-03-1999	12:26:20	01:00	8729	13100	4022	7130	10270	5785	6679	5766	1091	1840	512	50	3	3	4
Downstream	2	01	09-03-1999	12:28:50	01:00	9317	13480	4175	7286	10710	5752	6779	5753	1106	1816	510	49	1	1	4
Downstream	2	01	09-03-1999	12:31:20	01:00	9086	13270	4161	7498	11080	6017	6940	6097	1289	2139	618	66	4	6	3
Downstream	2	01	09-03-1999	12:33:50	01:00	9072	13820	4117	7476	11120	5976	7097	6028	1260	2127	624	63	2	4	2
Downstream	2	01	09-03-1999	12:36:20	01:00	8782	12840	4136	7154	10620	5693	6846	6235	1225	2069	623	69	5	5	0
Downstream	2	01	09-03-1999	12:38:50	01:00	8793	12580	4032	7159	10360	5679	6894	6201	1184	2000	590	67	6	3	1
D. Bckgrnd	2	01	09-03-1999	12:47:11	01:00	2	0	2	2	3	1	5	5	1	0	6	3	0	0	1

Meas. Penetration	0.92	0.90	0.88	0.85	0.81	0.75	0.68	0.58	0.47	0.36	0.18	0.06	0.03	0.01	0.01
P100 correction values	1.00	1.01	1.00	1.01	1.00	1.00	0.99	0.99	0.99	0.98	0.94	0.88	0.80	0.78	0.82
Corrected Penetration	0.91	0.89	0.88	0.84	0.81	0.75	0.68	0.58	0.47	0.37	0.19	0.07	0.04	0.02	0.01
Corrected Efficiency (%)	9	11	12	16	19	25	32	42	53	63	81	93	96	98	99

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	98071	146730	47052	85632	131560	77950	101189	103216	25240	54407	30910	9654	1453	2361	1479
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	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.01	0.02	0.01	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): 17.1
 Data Quality Objective: max. allowable conc. (#/cc): < 23
 Does this meet the DQO: Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09039907

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 09-03-1999 12:59:56 01:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Upstream	1 01 09-03-1999 13:06:30 01:00	10370	15610	5002	9120	13730	8255	10730	10750	2577	5641	3198	972	179	257
Upstream	1 01 09-03-1999 13:09:00 01:00	10130	15160	4937	8795	13400	7884	10350	10430	2558	5347	3124	946	127	209
Upstream	1 01 09-03-1999 13:11:30 01:00	10070	15180	4825	8701	13430	8094	10520	10500	2533	5549	3144	940	154	245
Upstream	1 01 09-03-1999 13:14:00 01:00	10160	15040	4867	8731	13450	8048	10420	10580	2488	5455	3139	968	140	229
Upstream	1 01 09-03-1999 13:16:30 01:00	12320	17840	5729	9899	14680	8286	10920	10940	2609	5603	3114	997	158	197
Upstream	1 01 09-03-1999 13:19:00 01:00	10530	15580	4961	9056	14000	8447	10790	10960	2543	5654	3151	978	145	250
Upstream	1 01 09-03-1999 13:21:30 01:00	9689	14750	4743	8738	13320	7900	10250	10350	2594	5546	3206	999	161	228
Upstream	1 01 09-03-1999 13:24:00 01:00	10150	15070	4830	8600	13510	7955	10910	10950	2632	5821	3409	1096	171	271
Upstream	1 01 09-03-1999 13:26:30 01:00	9734	14880	4804	8637	13410	7936	10610	10750	2709	5684	3334	1050	175	270
Upstream	1 01 09-03-1999 13:29:00 01:00	9681	14660	4869	8654	13250	7767	10140	10550	2617	5599	3377	1013	167	257
U. Bckgrnd	1 01 09-03-1999 13:40:53 01:00	4	0	0	0	0	0	5	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2 01 09-03-1999 13:01:11 01:00	3	4	0	1	1	0	0	0	0	0	0	0	0	0
Downstream	2 01 09-03-1999 13:07:45 01:00	10330	15660	4820	8874	13640	8274	10430	10740	2513	5503	2987	812	144	197
Downstream	2 01 09-03-1999 13:10:15 01:00	10480	15470	5101	9068	13720	8191	10540	10820	2576	5574	3052	838	132	185
Downstream	2 01 09-03-1999 13:12:45 01:00	10150	15040	4888	8723	13470	7848	10330	10440	2530	5303	2950	885	109	197
Downstream	2 01 09-03-1999 13:15:15 01:00	10140	15000	4957	8638	13460	7898	10340	10410	2559	5228	2890	863	121	219
Downstream	2 01 09-03-1999 13:17:45 01:00	10590	15850	4921	9094	14080	8313	10710	10550	2536	5378	2983	802	94	185
Downstream	2 01 09-03-1999 13:20:15 01:00	10550	15700	4983	9192	14330	8359	10580	10470	2488	5569	3035	892	111	207
Downstream	2 01 09-03-1999 13:22:45 01:00	10430	15710	4963	9005	14480	8404	10840	10780	2692	5734	3184	880	136	199
Downstream	2 01 09-03-1999 13:25:15 01:00	9929	15030	4717	8940	13590	7904	10360	10730	2799	5813	3206	996	146	223
Downstream	2 01 09-03-1999 13:27:45 01:00	9831	15000	4890	8530	13120	7806	10290	10670	2649	5640	3041	860	146	209
Downstream	2 01 09-03-1999 13:30:15 01:00	9735	14650	4718	8374	13130	7641	10080	10490	2566	5455	3007	961	115	212
D. Bckgrnd	2 01 09-03-1999 13:42:08 01:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Meas. Penetration	0.99	1.00	0.99	0.99	1.01	1.00	0.99	0.99	1.00	0.99	0.94	0.88	0.80	0.84	0.77
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	1.01	1.00	0.99	0.99	1.00	0.99	0.94	0.88	0.80	0.84	0.77
Corrected Efficiency (%)	1	0	1	1	-1	0	1	1	0	1	6	12	20	16	23

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	102834	153770	49567	88931	136180	80572	105640	106760	25860	55899	32196	9959	1577	2413	1565
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 :	0.08	0.07	0.06	0.05	0.05	0.04	0.03	0.03	0.04	0.04	0.04	0.07	0.14	0.10	0.11
Data Quality Objective:	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Does this meet DQO:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Maximum observed particle concentration (#/cc): 18.7
 Data Quality Objective: max. allowable conc. (#/cc): < 23
 Does this meet the DQO: Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09039908
 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	09-03-1999	13:53:42	01:00	0	0	0	0	0	0	0	0	0	0
Upstream	1	01	09-03-1999	14:00:23	01:00	10450	15670	5046	9137	14140	8448	10520	10620	2423	5397
Upstream	1	01	09-03-1999	14:02:53	01:00	10470	16140	5156	9121	13950	8365	10770	11060	2652	5697
Upstream	1	01	09-03-1999	14:05:23	01:00	10130	15410	4953	8677	13220	7972	10400	10580	2422	5320
Upstream	1	01	09-03-1999	14:07:53	01:00	10180	15240	4830	8740	13340	7943	10380	10570	2420	5434
Upstream	1	01	09-03-1999	14:10:23	01:00	10590	15600	5006	8983	13700	8155	10860	10740	2584	5396
Upstream	1	01	09-03-1999	14:12:53	01:00	10280	15510	4996	8766	13560	8057	10610	10500	2541	5446
Upstream	1	01	09-03-1999	14:15:23	01:00	9397	13550	4434	8016	12470	7485	9536	9795	2429	5127
Upstream	1	01	09-03-1999	14:17:53	01:00	10120	15240	5005	9015	13740	8268	10900	10880	2785	5842
Upstream	1	01	09-03-1999	14:20:23	01:00	10040	14780	4821	8682	13590	8179	10440	10850	2645	5706
Upstream	1	01	09-03-1999	14:22:53	01:00	9997	14700	4892	8544	13460	7840	10210	10690	2623	5637
U. Bckgrnd	1	01	09-03-1999	14:32:53	01:00	0	0	0	0	1	0	0	1	0	0
ENTER DATA BELOW															
D. Bckgrnd	2	01	09-03-1999	13:54:57	01:00	3	4	3	1	2	1	1	2	0	1
Downstream	2	01	09-03-1999	14:01:38	01:00	9694	14050	4312	7802	11250	6213	7305	6103	1186	2012
Downstream	2	01	09-03-1999	14:04:08	01:00	9288	13640	4204	7390	10640	5869	7238	5964	1206	1950
Downstream	2	01	09-03-1999	14:06:38	01:00	9578	13850	4363	7513	10890	5946	7132	5987	1166	1999
Downstream	2	01	09-03-1999	14:09:08	01:00	9236	13690	4303	7513	10780	5926	7061	6001	1135	1956
Downstream	2	01	09-03-1999	14:11:38	01:00	9298	13660	4180	7505	10900	6195	7205	6271	1156	1964
Downstream	2	01	09-03-1999	14:14:08	01:00	9713	14020	4377	7730	11220	6261	7270	6027	1185	1943
Downstream	2	01	09-03-1999	14:16:38	01:00	9277	13600	4226	7599	11680	6161	7194	6314	1293	2169
Downstream	2	01	09-03-1999	14:19:08	01:00	9155	13550	4231	7435	11150	6157	7201	6488	1360	2247
Downstream	2	01	09-03-1999	14:21:38	01:00	9325	13290	4261	7621	11130	5920	7372	6296	1244	2177
Downstream	2	01	09-03-1999	14:24:08	01:00	8993	13450	4146	7579	10760	5967	7411	6376	1357	2210
D. Bckgrnd	2	01	09-03-1999	14:34:08	01:00	1	0	0	0	0	1	0	0	0	0
Meas. Penetration	0.92	0.90	0.87	0.86	0.82	0.75	0.69	0.58	0.48	0.37	0.19	0.07	0.03	0.02	0.01
P100 correction values	0.99	1.00	0.99	0.99	1.01	1.00	0.99	0.99	1.00	0.99	0.94	0.88	0.80	0.84	0.77
Corrected Penetration	0.93	0.90	0.88	0.87	0.81	0.75	0.70	0.59	0.48	0.38	0.21	0.08	0.04	0.03	0.01
Corrected Efficiency (%)	7	10	12	13	19	25	30	41	52	62	79	92	96	97	99
Data Acceptance Criteria:															
Total Challenge Counts for Each Channel:	101654	151840	49139	87681	135170	80712	104626	106285	25524	55002	31309	9701	1502	2391	1522
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 :															
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):	17.7														
Data Quality Objective: max. allowable conc. (#/cc):	< 23														
Does this meet the DQO:	Yes, (applies to all channels)														

US EPA ARCHIVE DOCUMENT

Test No. 08319904
 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 08-31-1999 13:21:20 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream	1 01 08-31-1999 13:30:30 01:00	9906	15210	4721	8631	13060	7586	10050	11040	2743	5920	3442	1149	191	297
Upstream	1 01 08-31-1999 13:33:00 01:00	10140	15260	4804	8950	13360	7959	10180	11250	2837	6030	3564	1170	200	303
Upstream	1 01 08-31-1999 13:35:30 01:00	10410	15560	4867	9101	13840	8060	10440	11550	2828	6156	3569	1175	204	309
Upstream	1 01 08-31-1999 13:38:00 01:00	10020	14890	4814	8556	13350	7905	10220	11320	2790	6017	3444	1167	201	320
Upstream	1 01 08-31-1999 13:40:30 01:00	10100	14850	4829	8570	13280	7877	10120	11290	2726	5961	3453	1288	211	336
Upstream	1 01 08-31-1999 13:43:00 01:00	9782	14920	4769	8396	12730	7719	10000	11070	2828	5833	3446	1167	174	328
Upstream	1 01 08-31-1999 13:45:30 01:00	8866	13340	4235	7393	11380	6768	8732	9584	2284	5022	2752	939	160	254
Upstream	1 01 08-31-1999 13:48:00 01:00	9952	14880	4725	8314	12550	7560	9809	10470	2506	5235	3100	1034	182	302
Upstream	1 01 08-31-1999 13:50:30 01:00	10040	14910	4738	8308	12870	7608	9800	10540	2540	5386	3184	1015	158	261
Upstream	1 01 08-31-1999 13:53:00 01:00	9933	14870	4601	8359	12770	7614	9846	10330	2503	5398	3046	1069	168	289
U. Bckgrnd	1 01 08-31-1999 14:03:28 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2 01 08-31-1999 13:22:35 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2 01 08-31-1999 13:31:45 01:00	12	21	2	11	12	6	10	9	6	2	1	1	0	0
Downstream	2 01 08-31-1999 13:34:15 01:00	10	14	3	9	17	8	13	13	2	1	5	0	0	0
Downstream	2 01 08-31-1999 13:36:45 01:00	8	19	4	5	14	8	17	10	1	7	0	2	0	1
Downstream	2 01 08-31-1999 13:39:15 01:00	7	14	6	10	14	10	8	7	1	5	0	2	0	0
Downstream	2 01 08-31-1999 13:41:45 01:00	9	18	4	8	15	8	5	4	1	5	1	0	0	0
Downstream	2 01 08-31-1999 13:44:15 01:00	12	17	2	7	19	11	11	9	0	8	1	1	0	0
Downstream	2 01 08-31-1999 13:46:45 01:00	5	20	4	5	13	7	9	7	3	3	2	0	0	0
Downstream	2 01 08-31-1999 13:49:15 01:00	12	16	5	6	11	4	9	6	2	2	4	0	0	0
Downstream	2 01 08-31-1999 13:51:45 01:00	9	17	5	10	5	10	7	6	3	8	0	0	0	0
Downstream	2 01 08-31-1999 13:54:15 01:00	7	20	1	6	16	9	8	11	1	3	2	0	0	0
D. Bckgrnd	2 01 08-31-1999 14:04:43 01:00	0	2	0	2	1	0	2	2	1	1	0	0	0	0

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	1.01	1.00	1.01	1.01	1.02	1.03	0.99	1.01	1.01	1.01	1.01	0.95	0.88
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:	99149	148690	47103	84578	129190	76656	99197	108444	26585	56958	33000	11173	1849	2999	1924
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):	17.7
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09029906

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	09-02-1999	11:45:29	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-02-1999	11:52:06	01:00	10100	15890	5710	10020	15380	11110	18210	13890	2977	7293	4381	1224	187	306	176
Upstream	1	01	09-02-1999	11:54:36	01:00	10460	16660	5876	10590	16180	11590	19370	14380	3097	7528	4534	1218	230	302	176
Upstream	1	01	09-02-1999	11:57:06	01:00	9707	15690	5478	9932	15210	11120	18360	13710	2926	7378	4330	1182	182	300	147
Upstream	1	01	09-02-1999	11:59:36	01:00	10160	15920	5622	10040	15770	11420	18810	13760	3035	7381	4396	1181	168	273	142
Upstream	1	01	09-02-1999	12:02:06	01:00	10110	16000	5589	10110	15890	11390	18710	13850	3111	7478	4414	1215	161	302	188
Upstream	1	01	09-02-1999	12:04:36	01:00	10310	16200	5825	10560	16250	11270	19240	14710	3278	7723	4786	1250	194	324	209
Upstream	1	01	09-02-1999	12:07:06	01:00	10150	16260	5855	10310	16100	11470	18920	13990	3043	7498	4420	1257	199	293	148
Upstream	1	01	09-02-1999	12:09:36	01:00	10340	16030	5674	10380	15820	11220	18300	13550	2958	7339	4358	1169	199	254	138
Upstream	1	01	09-02-1999	12:12:06	01:00	10040	15870	5700	10280	15410	11340	18690	13610	3150	7429	4369	1155	166	282	168
Upstream	1	01	09-02-1999	12:14:36	01:00	10020	16290	5780	10240	15700	11630	18830	13590	3066	7437	4322	1229	197	302	156
U. Bckgrnd	1	01	09-02-1999	12:21:22	01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2	01	09-02-1999	11:46:44	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	09-02-1999	11:53:21	01:00	9865	15710	5518	9972	15180	11040	18190	13600	2986	7219	4242	1230	194	279	155
Downstream	2	01	09-02-1999	11:55:51	01:00	10240	16300	5774	10280	15920	11610	18900	14200	3150	7652	4500	1279	196	311	154
Downstream	2	01	09-02-1999	11:58:21	01:00	9864	16120	5503	9986	15370	11030	18260	13720	3055	7339	4531	1161	179	275	137
Downstream	2	01	09-02-1999	12:00:51	01:00	10050	15970	5722	10170	15750	11290	18360	13740	3030	7341	4431	1273	218	312	156
Downstream	2	01	09-02-1999	12:03:21	01:00	10270	16180	5756	10470	16240	11380	19130	14280	3142	7613	4614	1274	187	324	172
Downstream	2	01	09-02-1999	12:05:51	01:00	10000	15780	5688	10540	16000	11000	18760	15420	3388	7923	5048	1378	231	313	190
Downstream	2	01	09-02-1999	12:08:21	01:00	10240	16080	5757	10290	15990	11400	18970	14080	3147	7495	4575	1244	195	297	142
Downstream	2	01	09-02-1999	12:10:51	01:00	9990	15620	5533	9933	15120	10890	18140	13290	2924	7199	4282	1231	170	295	163
Downstream	2	01	09-02-1999	12:13:21	01:00	10040	16270	5681	10210	15740	11490	18600	13530	3214	7516	4410	1179	188	299	180
Downstream	2	01	09-02-1999	12:15:51	01:00	9778	15430	5568	9740	15150	11080	17990	13180	3027	7344	4309	1122	207	278	148
D. Bckgrnd	2	01	09-02-1999	12:22:37	01:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0

Meas. Penetration	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.01	1.00	1.01	1.02	1.04	1.02	0.97
P100 correction values	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.01	1.00	1.01	1.02	1.04	1.02	0.97
Corrected Efficiency (%)	1	1	1	1	1	1	1	0	-1	0	-1	-2	-4	-2	3

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	101397	160810	57109	102462	157710	113560	187440	139040	30641	74484	44310	12080	1883	2938	1648
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	0.03	0.03	0.03	0.03	0.03	0.05	0.06	0.03	0.06	0.07	0.15	0.09	0.17
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):	17.3
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09029907
 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	09-02-1999	13:17:08	01:00	0	0	0	0	0	0	0	0	0	0	0	0			
Upstream	1 01	09-02-1999	13:23:43	01:00	10020	15730	5588	9904	15660	11050	18200	13660	3103	7246	4378	1176	174	267	156
Upstream	1 01	09-02-1999	13:26:13	01:00	9995	15890	5677	10320	15910	11310	18530	14050	3088	7492	4442	1200	205	294	158
Upstream	1 01	09-02-1999	13:28:43	01:00	10200	16150	5587	10180	15780	11190	18340	13620	3016	7363	4417	1275	175	307	172
Upstream	1 01	09-02-1999	13:31:13	01:00	10200	16410	5672	10390	16310	11320	18960	14110	3105	7509	4554	1213	177	303	161
Upstream	1 01	09-02-1999	13:33:43	01:00	10510	16670	5988	10900	16680	11760	19670	14670	3285	7863	4637	1284	189	289	175
Upstream	1 01	09-02-1999	13:36:13	01:00	10350	16270	5723	10480	15710	11570	19140	14340	3103	7491	4480	1214	222	296	173
Upstream	1 01	09-02-1999	13:38:43	01:00	9350	14380	5191	9622	14890	10060	17280	14030	3025	7179	4506	1256	188	339	163
Upstream	1 01	09-02-1999	13:41:13	01:00	9921	15550	5668	10200	15850	10890	18150	15360	3187	7751	4847	1308	211	320	184
Upstream	1 01	09-02-1999	13:43:43	01:00	10190	15780	5700	10590	15850	11010	18680	15240	3302	7951	4880	1352	228	320	198
Upstream	1 01	09-02-1999	13:46:13	01:00	9769	15470	5545	10210	15580	10810	18280	15350	3353	7779	4943	1387	218	357	185
U. Bckgrnd	1 01	09-02-1999	13:54:15	01:00	0	0	0	1	0	1	1	1	1	3	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2 01	09-02-1999	13:18:23	01:00	6	4	2	1	3	0	2	0	0	5	0	0	0	0	1
Downstream	2 01	09-02-1999	13:24:58	01:00	9749	15210	5241	9360	13850	9525	14690	9358	1760	3684	1443	191	9	11	1
Downstream	2 01	09-02-1999	13:27:28	01:00	9349	14360	4966	8841	13270	9084	13970	8948	1684	3343	1413	166	14	14	2
Downstream	2 01	09-02-1999	13:29:58	01:00	9202	14550	5057	8899	13380	9068	14110	9194	1762	3435	1389	167	14	12	4
Downstream	2 01	09-02-1999	13:32:28	01:00	9301	14380	5023	9049	13400	9206	14220	9123	1720	3638	1276	188	16	14	5
Downstream	2 01	09-02-1999	13:34:58	01:00	9369	14720	5098	9123	13450	9063	14180	8949	1744	3502	1371	155	11	16	2
Downstream	2 01	09-02-1999	13:37:28	01:00	9431	14920	5323	9377	14130	9592	14800	9658	1815	3694	1490	208	12	13	2
Downstream	2 01	09-02-1999	13:39:58	01:00	9324	14120	4983	9087	13520	8745	14030	10110	1966	3834	1549	232	10	27	4
Downstream	2 01	09-02-1999	13:42:28	01:00	9425	14320	5081	9335	13910	9045	14240	10400	1873	3868	1670	236	13	19	2
Downstream	2 01	09-02-1999	13:44:58	01:00	9265	14520	4947	9375	13760	9086	14190	10230	1873	3928	1637	229	19	16	4
Downstream	2 01	09-02-1999	13:47:28	01:00	9327	14050	4909	9027	13550	8961	14040	10090	1907	3875	1592	225	16	20	6
D. Bckgrnd	2 01	09-02-1999	13:55:30	01:00	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0

Meas. Penetration	0.93	0.92	0.90	0.89	0.86	0.82	0.77	0.67	0.57	0.49	0.32	0.16	0.07	0.05	0.02
P100 correction values	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.01	1.00	1.01	1.02	1.04	1.02	0.97
Corrected Penetration	0.94	0.92	0.91	0.90	0.87	0.83	0.78	0.67	0.57	0.49	0.32	0.15	0.06	0.05	0.02
Corrected Efficiency (%)	6	8	9	10	13	17	22	33	43	51	68	85	94	95	98

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	100505	158300	56339	102796	158220	110970	185230	144430	31567	75624	46084	12665	1987	3092	1725
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	0.04	0.03	0.04	0.03	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.01
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):	17.6
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

Test No. 09029908

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	09-02-1999	14:17:07	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-02-1999	14:22:24	01:00	10750	16970	5914	10910	17140	11930	19750	15110	3336	7983	4772	1338	210	349	170
Upstream	1	01	09-02-1999	14:24:54	01:00	10760	17020	6040	10710	16810	11970	20180	15080	3281	7890	4852	1234	200	323	194
Upstream	1	01	09-02-1999	14:27:24	01:00	10580	16960	6046	10860	16830	11890	20050	14970	3305	8034	4830	1270	232	290	196
Upstream	1	01	09-02-1999	14:29:54	01:00	10760	16750	5926	10440	16420	11820	19580	14770	3222	7717	4756	1286	183	295	162
Upstream	1	01	09-02-1999	14:32:24	01:00	10570	16940	5903	10610	16380	11700	19730	14560	3312	7743	4562	1269	207	317	159
Upstream	1	01	09-02-1999	14:34:54	01:00	10450	16570	5904	10670	16590	11950	19710	14910	3288	7901	4807	1266	189	329	170
Upstream	1	01	09-02-1999	14:37:24	01:00	10510	16430	5819	10470	16410	11690	19370	14570	3237	7622	4727	1263	179	333	184
Upstream	1	01	09-02-1999	14:39:54	01:00	10700	16660	5917	10940	16870	11920	19940	15580	3473	8198	4930	1433	233	320	192
Upstream	1	01	09-02-1999	14:42:24	01:00	10340	16310	5737	10660	16050	11380	19330	14720	3316	7684	4709	1290	205	324	178
Upstream	1	01	09-02-1999	14:44:54	01:00	10440	16240	5844	10520	16260	11380	19160	14840	3211	7738	4772	1259	217	291	181
U. Bckgrnd	1	01	09-02-1999	14:59:54	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2	01	09-02-1999	14:18:22	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	09-02-1999	14:23:39	01:00	10610	16570	6045	10660	16440	11860	20060	14830	3361	7926	4873	1313	206	323	161
Downstream	2	01	09-02-1999	14:26:09	01:00	10560	16390	5782	10610	16380	11510	19510	14350	3252	7611	4672	1310	188	327	167
Downstream	2	01	09-02-1999	14:28:39	01:00	10320	16290	5682	10310	15770	11430	18800	14540	3212	7597	4621	1306	177	306	152
Downstream	2	01	09-02-1999	14:31:09	01:00	11080	16810	6106	11020	16830	11880	20130	15080	3342	8174	4890	1373	225	374	173
Downstream	2	01	09-02-1999	14:33:39	01:00	10850	17060	6001	10980	16670	11890	19830	14940	3289	8056	4728	1265	200	332	182
Downstream	2	01	09-02-1999	14:36:09	01:00	10420	16570	5835	10820	16560	11600	19430	15270	3247	8018	4972	1431	207	308	167
Downstream	2	01	09-02-1999	14:38:39	01:00	10500	16860	6121	10730	16590	11520	19480	14510	3289	7852	4773	1316	215	315	141
Downstream	2	01	09-02-1999	14:41:09	01:00	10250	15970	5700	10490	16350	11400	19220	15600	3352	7978	5191	1421	240	338	202
Downstream	2	01	09-02-1999	14:43:39	01:00	10270	16020	5739	10540	15970	11340	18800	15020	3197	7939	4883	1380	226	337	166
Downstream	2	01	09-02-1999	14:46:09	01:00	10710	16790	6098	10880	17360	11820	19740	15490	3342	8158	5052	1415	239	303	193
D. Bckgrnd	2	01	09-02-1999	15:01:09	01:00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Meas. Penetration	1.00	0.99	1.00	1.00	0.99	0.99	0.99	1.00	1.00	1.01	1.02	1.05	1.03	1.03	0.95
P100 correction values	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corrected Penetration	1.00	0.99	1.00	1.00	0.99	0.99	0.99	1.00	1.00	1.01	1.02	1.05	1.03	1.03	0.95
Corrected Efficiency (%)	0	1	0	0	1	1	1	0	0	-1	-2	-5	-3	-3	5

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	105860	166850	59050	106790	165760	117630	196800	149110	32981	78510	47717	12908	2055	3171	1786
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	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.06	0.14	0.09	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):	18.0
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

Test No. 09029909
 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 09-02-1999 15:37:24 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Upstream	1 01 09-02-1999 15:51:01 01:00	10060	15950	5569	10020	15510	11220	18720	13430	2949	7246	4362	1186	174	275	136
Upstream	1 01 09-02-1999 15:53:31 01:00	10380	16490	5767	10230	15970	11690	18840	14020	3106	7417	4439	1156	162	318	170
Upstream	1 01 09-02-1999 15:56:01 01:00	9960	16480	5795	10450	16050	11600	19320	13830	2893	7259	4379	1148	205	292	164
Upstream	1 01 09-02-1999 15:58:31 01:00	10340	16420	5925	10360	16140	11410	19290	14130	3115	7439	4501	1228	188	284	170
Upstream	1 01 09-02-1999 16:01:01 01:00	10390	16570	5789	10510	16120	11710	19320	14220	3238	7483	4589	1266	203	303	174
Upstream	1 01 09-02-1999 16:03:31 01:00	10340	16170	5720	10270	15710	11380	19180	14060	2960	7468	4451	1227	193	304	173
Upstream	1 01 09-02-1999 16:06:01 01:00	10190	16200	5651	10210	15820	11470	18950	14200	3034	7385	4658	1213	199	319	150
Upstream	1 01 09-02-1999 16:08:31 01:00	10160	16140	5604	10290	16130	11440	18740	14110	3116	7470	4509	1276	202	317	170
Upstream	1 01 09-02-1999 16:11:01 01:00	10420	16450	5711	10160	15990	11620	19280	14190	3216	7419	4659	1301	205	314	175
Upstream	1 01 09-02-1999 16:13:31 01:00	10210	16760	5911	10690	16660	11920	19820	14440	3211	7769	4738	1198	188	299	170
U. Bckgrnd	1 01 09-02-1999 16:23:31 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

ENTER DATA BELOW

D. Bckgrnd	2 01 09-02-1999 15:38:39 01:00	1	0	0	0	0	2	0	0	1	1	0	0	0	0	
Downstream	2 01 09-02-1999 15:52:16 01:00	9504	14880	5210	9407	14060	9407	14620	9246	1725	3688	1359	137	18	7	2
Downstream	2 01 09-02-1999 15:54:46 01:00	9878	15150	5308	9492	14150	9538	14650	9084	1711	3561	1338	177	10	9	5
Downstream	2 01 09-02-1999 15:57:16 01:00	10120	15600	5406	9625	14230	9803	15070	9522	1853	3564	1404	171	14	15	2
Downstream	2 01 09-02-1999 15:59:46 01:00	9653	15020	5345	9289	13740	9463	14500	9173	1772	3540	1371	164	15	10	2
Downstream	2 01 09-02-1999 16:02:16 01:00	9241	14350	5097	8852	13510	9094	14110	8940	1680	3458	1325	174	13	14	1
Downstream	2 01 09-02-1999 16:04:46 01:00	9320	14360	4902	9104	13330	8977	14030	9030	1649	3465	1334	165	13	10	3
Downstream	2 01 09-02-1999 16:07:16 01:00	9484	14180	5065	8826	13350	8969	13950	9028	1724	3368	1365	140	12	7	0
Downstream	2 01 09-02-1999 16:09:46 01:00	9569	14840	5154	9191	13840	9187	14480	9111	1725	3554	1402	146	14	13	2
Downstream	2 01 09-02-1999 16:12:16 01:00	9864	15400	5396	9564	14170	9597	14660	9391	1782	3635	1339	156	20	13	1
Downstream	2 01 09-02-1999 16:14:46 01:00	9644	15000	5148	9294	13850	9380	14350	9054	1738	3596	1427	135	17	12	2
D. Bckgrnd	2 01 09-02-1999 16:24:46 01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Meas. Penetration	0.94	0.91	0.91	0.90	0.86	0.81	0.75	0.65	0.56	0.48	0.30	0.13	0.08	0.04	0.01
P100 correction values	1.00	0.99	1.00	1.00	0.99	0.99	0.99	1.00	1.00	1.01	1.02	1.05	1.03	1.03	0.95
Corrected Penetration	0.94	0.92	0.90	0.90	0.87	0.82	0.76	0.65	0.56	0.47	0.30	0.12	0.07	0.04	0.01
Corrected Efficiency (%)	6	8	10	10	13	18	24	35	44	53	70	88	93	96	99

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	102450	163630	57442	103190	160100	115460	191460	140630	30838	74355	45285	12199	1919	3025	1652
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 :

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):

Data Quality Objective: max. allowable conc. (#/cc):	17.5
Does this meet the DQO:	< 23
	Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09029910

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	09-02-1999	16:38:09	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-02-1999	16:51:25	01:00	9435	14660	5249	9572	14650	10370	17420	14120	3042	7081	4550	1257	194	345	175
Upstream	1	01	09-02-1999	16:53:55	01:00	9566	14970	5252	9882	14780	10270	18010	14050	3041	7292	4580	1305	176	310	182
Upstream	1	01	09-02-1999	16:56:25	01:00	9658	15070	5233	9798	15110	10700	17720	14050	3122	7319	4627	1318	215	315	186
Upstream	1	01	09-02-1999	16:58:55	01:00	9035	14000	5072	9274	14120	9635	16500	13650	3001	7106	4432	1217	192	294	178
Upstream	1	01	09-02-1999	17:01:25	01:00	9097	14100	5088	9274	14420	9971	16690	14150	3066	7060	4501	1273	198	303	211
Upstream	1	01	09-02-1999	17:03:55	01:00	8964	14230	5001	9484	14420	9807	16560	14290	3046	7087	4749	1342	188	330	154
Upstream	1	01	09-02-1999	17:06:25	01:00	8439	13240	4696	8431	13070	9285	15390	11630	2458	6242	3638	1036	153	246	131
Upstream	1	01	09-02-1999	17:08:55	01:00	9423	14860	5159	9338	14390	10410	17200	12650	2709	6713	4079	1086	168	247	144
Upstream	1	01	09-02-1999	17:11:25	01:00	9734	15150	5251	9357	14430	10360	17180	12720	2823	6757	4144	1097	145	255	147
Upstream	1	01	09-02-1999	17:13:55	01:00	9315	14560	5228	9333	14160	10530	17170	12390	2716	6729	3831	1066	148	244	133
U. Bckgrnd	1	01	09-02-1999	17:21:25	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2	01	09-02-1999	16:39:24	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream	2	01	09-02-1999	16:52:40	01:00	9175	14260	5033	9211	14200	10050	16860	13470	2890	7090	4463	1215	208	283	168
Downstream	2	01	09-02-1999	16:55:10	01:00	9332	14520	5296	9569	14480	10360	17220	13730	3052	7206	4421	1289	170	312	152
Downstream	2	01	09-02-1999	16:57:40	01:00	9684	15120	5402	10050	15380	10720	17720	14910	3164	7634	4780	1297	202	317	180
Downstream	2	01	09-02-1999	17:00:10	01:00	9270	14430	5082	9605	14720	10170	17060	14200	3007	7207	4777	1317	196	341	187
Downstream	2	01	09-02-1999	17:02:40	01:00	9130	14460	4981	9560	14630	9723	16730	14210	2924	7349	4655	1275	216	312	177
Downstream	2	01	09-02-1999	17:05:10	01:00	8790	13840	4858	9244	14240	9528	16320	13910	2924	7075	4595	1346	190	285	159
Downstream	2	01	09-02-1999	17:07:40	01:00	9040	13980	5079	9159	13940	10010	16540	12310	2750	6622	4001	1063	177	241	142
Downstream	2	01	09-02-1999	17:10:10	01:00	9483	15060	5298	9561	14760	10570	17370	12480	2857	6937	4201	1161	174	250	128
Downstream	2	01	09-02-1999	17:12:40	01:00	9570	14730	5168	9272	14520	10280	17170	12320	2761	6754	3981	1081	183	258	168
Downstream	2	01	09-02-1999	17:15:10	01:00	9607	14990	5435	9678	14780	10410	17570	12790	2874	6823	4117	1141	199	268	115
D. Bckgrnd	2	01	09-02-1999	17:22:40	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Meas. Penetration	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.02	1.02	1.02	1.02	1.08	0.99	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	1.00
Corrected Penetration	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.02	1.02	1.02	1.08	0.99	0.96	
Corrected Efficiency (%)	0	0	-1	-1	-1	0	0	0	-1	-2	-2	-2	-8	1	4	

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	92666	144840	51229	93743	143550	101338	169840	133700	29024	69386	43131	11997	1777	2889	1641
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	0.05	0.05	0.05	0.06	0.05	0.098	0.09	0.06	0.11	0.13	0.17	0.17	0.21
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	

Maximum observed particle concentration (#/cc):	16.5
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT

Test No. 09029911
 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	09-02-1999	17:36:25	01:00	0	0	0	0	0	0	0	0	0	0	0				
Upstream	1	01	09-02-1999	17:45:57	01:00	9466	14520	5325	9604	14620	10210	17180	13970	3002	7153	4546	1319	189	317	203
Upstream	1	01	09-02-1999	17:48:27	01:00	9284	14800	5156	9788	15150	10380	17500	14870	3151	7439	4779	1326	201	318	197
Upstream	1	01	09-02-1999	17:50:57	01:00	9313	14720	5156	9753	14850	10210	17000	14900	3057	7278	4827	1354	194	325	203
Upstream	1	01	09-02-1999	17:53:27	01:00	9477	15030	5287	9817	14920	10480	17590	14350	3011	7428	4801	1283	186	282	188
Upstream	1	01	09-02-1999	17:55:57	01:00	9736	15190	5119	9911	15120	10350	17570	14510	3182	7434	4749	1369	205	327	199
Upstream	1	01	09-02-1999	17:58:27	01:00	9659	15030	5212	9955	15440	10390	17920	15500	3187	7600	5024	1380	240	342	198
Upstream	1	01	09-02-1999	18:00:57	01:00	8762	13820	4939	8727	13510	9817	15830	12080	2713	6220	3901	1069	177	250	149
Upstream	1	01	09-02-1999	18:03:27	01:00	9621	15170	5346	9438	14920	10710	17620	13620	2909	7185	4254	1265	185	315	171
Upstream	1	01	09-02-1999	18:05:57	01:00	9526	14960	5440	9645	14750	10630	17750	13260	2859	7018	4303	1207	194	292	170
Upstream	1	01	09-02-1999	18:08:27	01:00	9600	15160	5340	9723	14820	10750	17710	13340	2853	6975	4335	1132	169	294	163
U. Bckgrnd	1	01	09-02-1999	18:18:27	01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENTER DATA BELOW

D. Bckgrnd	2	01	09-02-1999	17:37:40	01:00	4	12	1	4	7	2	4	3	2	2	4	3	0	0	0
Downstream	2	01	09-02-1999	17:47:12	01:00	8876	13350	4637	8737	12750	8283	13030	9370	1706	3503	1332	181	18	15	0
Downstream	2	01	09-02-1999	17:49:42	01:00	8511	13150	4612	8471	12330	8040	12580	9266	1686	3358	1388	152	6	8	5
Downstream	2	01	09-02-1999	17:52:12	01:00	8800	13120	4717	8554	12760	8273	12930	9287	1759	3335	1293	180	12	18	1
Downstream	2	01	09-02-1999	17:54:42	01:00	8976	13790	4999	8861	13120	8512	13560	9500	1708	3493	1514	203	18	8	2
Downstream	2	01	09-02-1999	17:57:12	01:00	9018	13430	4806	8829	12970	8338	13320	9880	1723	3498	1529	193	12	16	2
Downstream	2	01	09-02-1999	17:59:42	01:00	8751	13390	4708	8632	12860	8322	13340	9443	1787	3498	1366	165	9	15	4
Downstream	2	01	09-02-1999	18:02:12	01:00	8815	13590	4922	8587	12560	8527	13160	8428	1626	3217	1213	141	6	7	1
Downstream	2	01	09-02-1999	18:04:42	01:00	9305	14120	5073	8903	13140	8622	13570	8627	1615	3179	1276	130	8	2	1
Downstream	2	01	09-02-1999	18:07:12	01:00	8775	13480	4639	8206	12260	8395	12870	8138	1581	3113	1181	142	11	13	3
Downstream	2	01	09-02-1999	18:09:42	01:00	8754	13700	4688	8596	12750	8223	12910	8679	1518	3163	1279	145	12	10	5
D. Bckgrnd	2	01	09-02-1999	18:19:42	01:00	3	2	0	0	1	2	0	2	0	0	0	2	0	0	0

Meas. Penetration	0.94	0.91	0.91	0.90	0.86	0.80	0.76	0.65	0.56	0.46	0.29	0.13	0.06	0.04	0.01
P100 correction values	1.00	1.00	1.01	1.01	1.01	1.00	1.00	1.00	1.01	1.02	1.02	1.02	1.08	0.99	0.96
Corrected Penetration	0.93	0.91	0.91	0.89	0.85	0.80	0.75	0.64	0.55	0.46	0.29	0.12	0.05	0.04	0.01
Corrected Efficiency (%)	7	9	9	11	15	20	25	36	45	54	71	88	95	96	99

Data Acceptance Criteria:

Total Challenge Counts for Each Channel:	94444	148400	52320	96361	148100	103927	173670	140400	29924	71730	45519	12704	1940	3062	1841
Data Quality Objective:	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500
Does this meet DQO:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard Deviation of Penetration for Each Channel :	0.04	0.03	0.04	0.04	0.04	0.03	0.03	0.06	0.04	0.03	0.03	0.02	0.02	0.02	0.01
Data Quality Objective:	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.30	<0.30	<0.30	<0.30
Does this meet DQO:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Maximum observed particle concentration (#/cc):	16.5
Data Quality Objective: max. allowable conc. (#/cc):	< 23
Does this meet the DQO:	Yes, (applies to all channels)

US EPA ARCHIVE DOCUMENT