LA-12792-PR
Progress Report

UC-907
Issued: September 1994

In-Place Testing Summary (1992)

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IN-PLACE TESTING SUMMARY (1992)

by

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ABSTRACT

This report is the latest in a series of annual reports regarding the ongoing in-place testing program for high-efficiency filtration and chemical adsorber systems at the Los Alamos National Laboratory. This testing is conducted to maintain regulatory permits and to verify that the performance levels, installation, and function of these filtration systems have not deteriorated since the last operating cycle. Furthermore, the performance data obtained from the testing of high efficiency particulate air-filtered vacuums and negative pressure machines aid in the implementation and continuing activities of the asbestos management program at Los Alamos National Laboratory. In addition, this report provides an overview of the testing procedures used to conduct the in-place tests, a summary of the individual system performance, and any trend that has been observed since the last operating cycle.

1.0 Scope

1.1 This report is the latest in a series of reports regarding the ongoing in-place testing program for high-efficiency filtration and chemical adsorber systems at the Los Alamos National Laboratory. This testing is required to verify that the performance levels of these systems have not deteriorated during the operating cycle.

1.2 This report provides an overview of the performance of air-cleaning systems and the testing procedures used.

2.0 Applicable Documents

ASTM F321-80, Standard Practice for Determining Counting and Sizing Accuracy of an Airborne Particle Counter Using Near-Monodisperse Particulate Material.

ASTM F1471-93, Standard Test Method for Air Cleaning Performance of a High-Efficiency Particulate Air-Filter System.

DOE/NEF 3-41T, In-Place Testing of HEPA Filter Systems by the Single-Particle, Particle-Size Spectrometer Method, September 1986.

ERDA 76-21, Nuclear Air Cleaning Handbook, October 1979.

3.0 Introduction

3.1 Periodic in-place testing, along with stack air sampling, determines whether air cleaning systems are maintaining acceptable filtration performance levels. These tests can identify problems with filter systems so that corrective action can be made before a loss of system integrity results in the significant release of toxic effluents to the atmosphere.

3.2 The in-place tests are conducted in most instances without disrupting plant operations.[1] Only if a filtering system fails the established performance criteria would it become necessary to consider taking the filter system out of service. Testing is conducted on single and multiple stage filter systems and other filtration devices using laser aerosol spectrometer (LAS) methods[2]. The procedure requires that the filter system be challenged with a heterodisperse aerosol in the diameter range of 0.1 to 1.0 micrometers. Samples of the aerosol, both upstream and downstream of the filter system are collected, counted, and sized by the LAS. The filter system penetration is then calculated as a function of the entire size spectrum of the challenge particles.

3.3 This report presents results of 1992 tests, including procedures used in the testing and calibration of the LAS and aerosol diluter system.

4.0 Testing Schedule

In-place testing schedules are prepared for each filter system at the beginning of the calendar year. If operational conflicts interfere with the testing schedule, then the schedule can be modified.

5.0 Terminology

5.1 Laser aerosol spectrometer (LAS). A precision particle detector that allows single-particle sampling by collecting scattered light from individual particles through the use of a solid state photodetector.

5.2 Diluter. A device used to reduce the aerosol particle concentration from sampled airstreams. A diluter is sometimes necessary to eliminate coincidence counting in the LAS.

5.3 Dilution ratio. The ratio of the undiluted particle concentration entering the diluter to the diluted particle concentration leaving the diluter.

5.4 Penetration. The ratio of the concentration of test particles passing through the filter stage to the concentration of test particles challenging the upstream side of the filter stage. The penetration may be associated with particle sizes of interest.

5.5 Percent efficiency. The percent value of the amount of particles which the high efficiency particulate air (HEPA) filter removes from the airstream. This value is equal to 100 x (1-Penetration).

5.6 Percent penetration. The percent penetration is the percentage of test particles that pass through a single or multiple stage HEPA system. The percent penetration is calculated by subtracting 100 from the percent efficiency.

5.7 Aerosol. A stable suspension of solid or liquid particles in air.

5.8 Challenge. To expose a filter, adsorber, or other air-cleaning device to an aerosol or gas of known characteristics, under specific conditions, for the purpose of testing.

5.9 Halide gas detection instrument. An instrument capable of distinguishing halide challenge gas from background and detecting halide gas with a linear range of at least 1.0×10^5.

5.10 In-place leak test. A test to measure bypass leakage around or through a specific test boundary.

6.0 Policy for In-Place Testing[3]

6.1 New Installations. All new filter installations including chemical adsorbers intended for air cleaning of highly toxic materials will be tested before starting operations.

6.2 Test Frequency. Each air-cleaning system, including adsorbers, that handle toxic materials such as asbestos, beryllium, thallium, plutonium and enriched uranium will be tested once every 12-month period. In the event that regulations or operating permits require more frequent testing, those requirements shall be followed.

6.3 Filters/Adsorber Changes. All systems containing HEPA or Aerosolve-95 filters and/or charcoal adsorbers will be tested within two working days after the filter change.

6.4 Other Filtration. The testing frequency for filter systems handling less toxic materials such as depleted uranium, lead, etc., will be determined on a case-by-case basis.

6.5 Supply Systems. Supply air systems installed to protect the environment during upset conditions shall be tested once every 12-month period and within two working days following a filter change.

6.6 Entry box HEPA filters shall be tested once every 12-month period and within two working days following a filter change.

6.7 Glove Box Filters. No routine tests are conducted on these filters except for new installations. The primary purpose of these filters is to protect the interior of the ventilation ducts, and they are not considered a stage of filtration between the glove box and the environment.

6.8 Aerosolve-95-type filtration systems used to control the release of highly toxic materials shall be tested every 12-month period and within two working days after a filter change.

6.9 HEPA vacuum cleaners and HEPA filtered negative air pressure machines used for air cleaning highly toxic materials, must be tested and certified upon procurement of the unit, once every 12-month period, and prior to use following a filter change.

6.10 Chemical adsorber air cleaning systems are to be tested once every 12-month period and within two working days following an adsorber change.

7.0 Test Requirements[4]

The following is required to properly conduct an in-place test on a filtering system:

7.1 To obtain meaningful in-place test results, as a minimum, the system must have been built in accordance with ASME Standard N509-1989,[5] Nuclear Power Plant Air-Cleaning Units and Components. In the event the filtering system is not constructed in accordance with ASME Standard N509-1989, an in-place test may still be performed on the system. However, the results of the test would only indicate a point of reference for the system, which could be used as a comparison with a previous test or a future test.

7.2 Aerosol or Test Injection Ports. Proper location and installation of the test injection ports is required to properly mix the challenge aerosol. Ideally, the injection port should be located approximately ten-straight duct diameters ahead of the upstream sample probe.

7.3 Sampling Probes and Manifolds. Proper location and installation of sampling manifolds and probes are required to obtain representative aerosol samples. The upstream sample probe should ideally be located immediately upstream of the first bank of filters and away from any types of obstructions. The downstream sample probe should ideally be located approximately ten straight-duct diameters away from the downstream face of the last bank of filters.

8.0 Calibration

8.1 LAS. The primary calibration of the LAS is performed by the instrument manufacturer or by qualified personnel using standard methods in accordance with ASTM F321-80. Calibrations must be performed at regular 12-month intervals and following any repair or modification of the instrument. A label showing the due date of the next calibration is placed on the instrument.

8.2 LAS. A calibration check by the operator is conducted periodically if the instrument is used continuously or is moved to a new test location in a manner that requires vehicle transportation or rough handling. The calibration checks consist of testing the LAS with at least two sizes of polystyrene latex spheres (PSLs). A calibration certificate traceable to National Institute of Standard Technology (NIST) must accompany the PSLs. The LAS must correctly size the calibration aerosols and reproduce the spectral peak to within 0.05 micrometers. If the instrument cannot be adjusted to within those calibration limits, then the instrument must be returned to the manufacturer for service and calibration.

8.3 Aerosol Diluter. Calibration of a diluter is very similar to that of the filter penetration-test measurement. However, generation of lower particle concentrations is required for the diluter calibration than is required for the actual filter test. If more than one diluter stage is used, each must be calibrated independently. The dilution ratio holds true for each size diameter and can be calculated as:

$$D = (C_u / C_d)$$

where:

D = dilution ratio,

C_u = upstream particle counts, and

C_d = downstream particle counts.

9.0 Summary of Procedure

9.1 Shown in Appendix A, Figure 1 is a typical multiple-stage filter system configuration in test mode. A challenge aerosol is generated upstream of the filter stage and allowed to mix thoroughly with the airstream. Samples of the test aerosol are collected with the LAS from the airstream both upstream and downstream of the filter system. With this method, the penetration can be calculated either as a function of particle size or as a function of the entire spectrum of challenge particles. Because of the high particle counts required to evaluate a HEPA filtered system, it is necessary to dilute the upstream sample to avoid coincidence counting by the LAS. A schematic of the aerosol diluter is shown in Appendix A, Figure 2.

9.2 Aerosol. The test aerosol should be heterodisperse, spanning the diameter range 0.1 to 1.0 micrometers. The required upstream concentration to challenge a one-stage HEPA filter system is 2.5×10^5 particles per cubic centimeter (P/cc) or about 30 micrograms per liter (assuming unit density). The proper evaluation of a two-stage HEPA filter system requires an upstream concentration of 2.0×10^6 P/cc. This can be accomplished by using thermal or compressed air aerosol generators.

9.3 Penetration Criteria. The maximum penetration for one HEPA filter stage is 5.0×10^{-4} and is 2.5×10^{-7} for two stages in series. If the filter system fails the tests, then a series of other tests may be required to identify and correct the problem.

9.4 Adsorbers. Adsorber stages are tested individually to determine the percent efficiency or mechanical efficiency of the adsorber bed and to detect the presence of leaks that may develop under service conditions. The test method utilizes a refrigerant gas (Freon 11, Flurotrichloromethane) as the test agent in accordance with Section 12, ASME N-510 1989. Analysis of the upstream and downstream gas is accomplished with a Halide detector. The maximum penetration criteria for an adsorber systems is 1.0×10^{-3}.

9.5 Portable Filtered Exhaust. Portable filtered exhaust systems are used primarily for asbestos removal operations. Figure 3 in Appendix A shows a typical HEPA filtered negative air pressure machine and Figure 4 is a HEPA filtered vacuum cleaner. The maximum penetration for these systems is 5.0×10^{-4}.

9.6 Aerosolve-95-Filtration. These systems are used on a variety of air-cleaning operations. The maximum penetration criteria for this type of air cleaning is 2.0×10^{-1}.

10.0 Test Procedure (Two-Stage HEPA Filter Systems)

10.1 Background. Because of the expected low concentrations of test particles that penetrate two stages of HEPA filtration, it may be necessary to measure the background concentration of nontest particles in the airstream to determine if a sufficient concentration of injected particles is obtained in the subsequent test. To perform a background test, no aerosol generation and no sample dilution is required. Collect samples with the LAS from the downstream side of two-filter stages. Do not accumulate these particle counts with the computer unless they are significant (i.e. 1 P/sec). The sampling time may vary depending on the collected particle counts; a 10-minute sample is usually sufficient.

10.2 Challenge Aerosol. Inject the aerosol and collect samples from the upstream sample probe and establish the challenge particle count (approximately 2.0×10^6 P/cc). This is accomplished by switching to the diluter to reduce the aerosol particle count.

10.3 Penetration Measurements. Collect samples with the LAS from the downstream probe. Sampling periods should be selected to yield net particle counts over background of at least 100. Calculate penetration (see Section 10.4). If the system fails to meet the performance criteria, then additional testing is required to identify the problems. Corrections will need to be made to the system so that the system can operate satisfactorily.

10.4 Calculations. Penetration can be calculated either as a function of particle size or as a function of the entire size spectrum of the challenge aerosol. The penetration values in Tables 2 and 3 are a function of the entire size spectrum of the challenge aerosol. This equation holds true for each particle size diameter:

$$P = (C_d - C_b) / (C_u D)$$

where,
P = penetration,
C_d = particle counts downstream,
C_b = particle counts of background,
C_u = particle counts upstream, and
D = dilution ratio.

Reported penetration values are calculated using a computer program that has been specifically developed for the different LAS systems. Information is compiled from the three test locations by test personnel and imput to the computer. The program calculates the penetration using the above stated equation.

11.0 Test Procedure (Single-Stage HEPA-Filter Systems)

11.1 Perform the test as described in Section 10 except that the challenge concentration is lower; 2.5 x 10^5 P/cc. Shorter sampling times may be used than with two stages because of higher particle concentrations. If coincidence counting in the LAS is suspected, above 3000 particles per second, the sample must be routed through the diluter. After a background measurement is performed and if the particle count is significant (i.e., above 10 P/sec), then enter that test into the computer program.

11.2 Perform the penetration measurements downstream of the filter stage. Calculate the penetration (see Section 10.4).

12.0 Summary of Tests (Table 1)

Listed below is a summary of all HEPA and Aerosolve-95 filter systems tested in 1992. The summary includes the number of systems that met the maximum penetration criteria, did not meet the maximum penetration criteria, and how many were retested satisfactory.

12.1 Main Exhaust and Supply Filter Systems

12.1.1 Met penetration criteria 150
12.1.2 Did not meet penetration criteria 5

12.1.3 Retested Satisfactory 1

12.2 Portable Filtered Exhaust Systems

12.2.1 Met penetration criteria 15
12.2.2 Did not meet penetration criteria 0
12.2.3 Retested Satisfactory 0

13.0 HEPA and Aerosolve-95 In-Place Test Results

13.1 Table 2. Table two show the individual test results of all the in-place tests performed in 1992. The performance of each filter system is expressed as the fractional penetration across one stage, two stages, and three stages in series.

13.2 Table 3. Table three shows the individual test results of all the in-place tests performed on HEPA filtered vacuums and negative air machines done in 1992. As previously done, the performance is expressed as the fractional penetration across the single HEPA filter.

TABLE #2

TEST PENETRATION

HS. No.	ENG. No.	LOCATION	FILTER Chg Dt	TEST Date	STG 1	STG 1&2	STG 2&3	STG 3&4
100	FE-1	TA-2-1		6\26\92	1.8E-4			
110	FE-2	TA-2-1		6\26\92	1.2E-4			
140	FE-14	TA-3-29		6\18\92		2.1E-7		
150	FE-15	TA-3-29		5\5\92	6.6E-5	2.2E-7		
160	FE-17	TA-3-29		6\17\92	1.0E-6			
170	FE-18	TA-3-29		6\17\92	1.6E-4			
(A) 180	FE-19	TA-3-29			3.4E-1*			
190	FE-28	TA-3-29		6\19\92		1.7E-7		
200	FE-29	TA-3-29		6\4\92		9.5E-9		
210	FE-30	TA-3-29		6\5\92	2.1E-5			
220	FE-31	TA-3-29		6\5\92	4.5E-4			
230	FE-32	TA-3-29		6\23\92		2.1E-7		
240	FE-33	TA-3-29		5\13\92	5.6E-5	1.4E-7		
250	FE-34	TA-3-29		6\5\92	1.0E-5			
260	FE-35	TA-3-29		6\5\92	5.2E-5			
270	FE-42	TA-3-29		7\13\92	1.9E-6			
280	FE-42	TA-3-29		6\30\92	5.9E-6			
300	FE-42	TA-3-29		7\13\92	7.8E-5			
310	FE-41	TA-3-29		7\6\92	2.3E-6			
320	FE-41	TA-3-29		7\13\92	1.3E-5			
330	FE-40	TA-3-29		7\6\92	1.7E-5			
340	FE-40	TA-3-29		7\13\92	9.6E-6			
350	FE-40	TA-3-29		7\6\92	7.6E-5			
360	FE-40	TA-3-29		7\13\92	6.2E-6			
370	FE-40	TA-3-29		7\20\92	1.2E-5			
380	FE-40	TA-3-29		7\13\92	4.3E-5			
390	FE-40	TA-3-29		7\20\92	6.9E-6			
400	FE-40	TA-3-29		7\13\92	7.5E-6			
410	FE-41	TA-3-29		7\14\92	3.7E-5			
420	FE-42	TA-3-29		7\13\92	4.3E-5			
430	FE-42	TA-3-29		7\14\92	6.7E-4*			
440	FE-43	TA-3-29		7\20\92	1.7E-6			
(A) 450	FE-44	TA-3-29		7\29\92	5.9E-3			
630	FE-2	TA-21-313		4\28\92	1.6E-4			
640	FE-3	TA-21-313		4\28\92	7.4E-5			
840	FE-25	TA-50-1		11\16\92	1.8E-2*			
840	FE-25	TA-50-1	11\18\92	11\18\92	3.0E-4+			
850	FE-3	TA-50-1		11\17\92		8.8E-8		
860	FE-2	TA-50-1		11\17\92	5.6E-6			
(A)1100	FE-20	TA-3-29		6\4\92	3.1E-4			
1120	FE-27	TA-50-1	6\9\92	6\11\92	6.9E-5			
1150	FE-3	TA-50-69		2\25\93	4.1E-6	2.0E-7		
1160	FE-3	TA-53-M		10\26\92	1.6E-4			
1170	FE-3	TA-53-M		10\26\92	1.6E-4			

TABLE #2 (cont.)

TEST PENETRATION

HS. No.	ENG. No.	LOCATION	FILTER Chg Dt	TEST Date	STG 1	STG 1&2	STG 2&3	STG 3&4
1210	FA-801	TA-55-4		8\18\92	2.3E-4	1.9E-7		
1220	FA-802	TA-55-4		8\18\92	2.1E-4	3.2E-8		
1230	FA-803	TA-55-4		8\19\92	4.5E-4	6.5E-8		
1240	FA-804	TA-55-4		8\18\92	3.3E-5	2.8E-8		
1250	FA-805	TA-55-4		8\19\92	8.2E-5	1.8E-8		
1260	FA-806	TA-55-4		8\20\92	2.0E-4	7.9E-8		
1270	FA-807	TA-55-4		8\20\92	5.0E-4	1.3E-7		
1280	FA-808	TA-55-4		8\19\92	1.4E-4	2.2E-8		
1290	FA-809	TA-55-4		9\29\92	3.6E-5			
1300	FA-810	TA-55-4		9\29\92	4.2E-5			
1310	FA-811	TA-55-4		8\13\92	2.2E-4	2.2E-8		
1320	FA-812	TA-55-4		8\13\92	2.7E-4	1.9E-8		
1330	FA-820	TA-55-4		8\5\92	1.6E-4	6.7E-8		
1340	FA-821	TA-55-4		7\21\92	4.1E-5	4.7E-8		
1350	FA-822	TA-55-4		8\11\92	9.2E-5	6.3E-8		
1360	FA-823	TA-55-4		7\17\92	4.2E-5	1.9E-7		
1370	FA-828	TA-55-4		8\11\92	6.2E-5	9.5E-8		
1380	FA-829	TA-55-4		8\11\92	2.0E-5	2.8E-8		
1390	FA-840	TA-55-4		9\29\92	1.1E-5			
1400	FA-841	TA-55-4		9\29\92	8.3E-5			
1410	FA-850	TA-55-4	3\30\92	9\7\92		9.6E-8		
1420	FA-851	TA-55-4	1\22\92	1\27\92	4.8E-7			
1420	FA-851	TA-55-4	3\30\92	3\31\92		6.8E-8		
1420	FA-851	TA-55-4		9\7\92		9.7E-8	5.5E-10	
1420	FA-851	TA-55-4	11\3\92	11\9\92			2.3E-8	
1430	FA-852	TA-55-4		9\8\92	5.0E-5	1.4E-8		
1440	FA-853	TA-55-4		9\8\92	1.0E-4	5.6E-8		
1450	FA-854	TA-55-4		9\22\92	2.1E-4	1.7E-8		
1460	FA-855	TA-55-4		9\23\92	4.9E-4	5.8E-9		
1470	FA-856	TA-55-4	10\8\92	10\14\92	3.6E-5	1.6E-7		
1480	FA-857	TA-55-4		9\24\92	5.5E-5	4.3E-8		
1490	FA-870A	TA-55-4		9\30\92	1.2E-6			
1500	FA-870B	TA-55-4		9\30\92	1.2E-6			
1510	FA-871A	TA-55-4		9\30\92	1.1E-6			
1520	FA-871B	TA-55-4		9\30\92	1.5E-6			
1550	FA-873A	TA-55-4		9\28\92	1.7E-6			
1560	FA-873B	TA-55-4		9\28\92	8.4E-6			
1570	XB-103	TA-55-4		8\19\92	6.0E-5			
1580	XB-104	TA-55-4		8\19\92	2.6E-5			
1590	XB-105A	TA-55-4		8\19\92	2.5E-4			
1600	XB-105B	TA-55-4		8\19\92	1.8E-4			
1620	XB-107A	TA-55-4		8\19\92	1.7E-6			
1630	XB-107B	TA-55-4		8\18\92	2.7E-5			
1640	XB-109	TA-55-4		8\18\92	7.3E-6			

TABLE #2 (cont.)

TEST PENETRATION

HS. No.	ENG. No.	LOCATION	FILTER Chg Dt	TEST Date	STG 1	STG 1&2	STG 2&3	STG 3&4
1650	XB-110	TA-55-4		8\18\92	9.9E-6			
1660	XB-111A	TA-55-4		8\18\92	4.8E-6			
1670	XB-111B	TA-55-4		8\18\92	7.7E-6			
1680	XB-112	TA-55-4		8\19\92	4.6E-6			
1690	XB-221	TA-55-4		9\3\92	9.3E-6			
1710	XB-114	TA-55-4		8\19\92	6.4E-6			
1720	XB-115B	TA-55-4		8\20\92	1.6E-3*			
1790	XB-223	TA-55-4		8\20\92	1.0E-5			
1840	XB-204A	TA-55-4		9\1\92	9.1E-6			
1860	XB-206A	TA-55-4		9\2\92	2.3E-6			
1870	XB-206B	TA-55-4		9\2\92	9.6E-6			
1880	XB-207	TA-55-4		9\1\92	2.0E-6			
1890	XB-208	TA-55-4		9\2\92	8.5E-6			
1900	XB-209A	TA-55-4		9\8\92	4.8E-6			
1920	XB-215A	TA-55-4		9\1\92	5.2E-6			
1930	XB-215B	TA-55-4		9\1\92	5.4E-6			
1940	XB-216	TA-55-4		9\1\92	3.9E-6			
1950	XB-217	TA-55-4		9\1\92	4.3E-6			
1960	XB-218	TA-55-4		9\2\92	4.3E-6			
1970	XB-219A	TA-55-4		9\2\92	9.1E-6			
1990	XB-220A	TA-55-4		8\11\92	1.9E-6			
2000	XB-220B	TA-55-4		8\11\92	1.9E-6			
2010	XB-301	TA-55-4		9\9\92	8.3E-6			
2020	XB-302	TA-55-4		9\8\92	1.6E-6			
2030	XB-304	TA-55-4		9\21\92	2.5E-6			
2040	XB-303	TA-55-4		9\21\92	1.0E-6			
2050	XB-306A	TA-55-4		9\9\92	1.9E-5			
2070	XB-303	TA-55-4		9\8\92	8.9E-6			
2080	XB-306B	TA-55-4		9\8\92	1.1E-6			
2100	XB-405	TA-55-4		9\22\92	2.5E-6			
2110	XB-401	TA-55-4		9\23\92	3.4E-6			
2140	XB-412	TA-55-4		8\19\92	5.9E-5			
2150	XB-478	TA-55-4		9\23\92	9.0E-6			
2220	XB-213	TA-55-4		9\2\92	2.1E-6			
2850	XB-308	TA-55-4		9\21\92	1.5E-6			
(A)2870	FE-37	TA-48	3\31\92	4\7\92	1.4E-2			
(A)2880	FE-40	TA-48	3\31\92	4\7\92	1.4E-1			
(A)2900	FE-2	TA-50-1		11\17\92	4.3E-2			
2990	BE-EXH	TA-35-213		10\6\92	5.5E-5			
3900	XB-201A	TA-55-4		8\20\92	1.0E-5			
3910	XB-201B	TA-55-4		8\20\92	2.6E-6			
3920	XB-203	TA-55-4		8\20\92	1.8E-6			
3930	XB-202	TA-55-4		8\20\92	9.0E-5			
3980	FE-2	TA-50-69		10\23\92	2.9E-4			

TABLE #2 (cont.)

TEST PENETRATION

HS. No.	ENG. No.	LOCATION	FILTER Chg Dt	TEST Date	STG 1	STG 1&2	STG 2&3	STG 3&4
5870	FA-854SR	TA-55-4		9\22\92	7.6E-5	5.5E-9		
5880	FA-855SR	TA-55-4		9\23\92	3.4E-4	2.9E-8		
6000	XB-390	TA-55-4		9\21\92	1.3E-6			
6010		TA-55-4		9\21\92	1.0E-5			
6020		TA-55-4		9\21\92	3.4E-6			
6070	XB-113A	TA-55-4		8\20\92	2.3E-6			
6080	XB-113B	TA-55-4		8\20\92	1.0E-6			
6120	FB-1	TA-3-29	12/15/92	12\24\92	2.6E-2	2.1E-5		
6130	FE-37	TA-3-29	12/15/92	12\24\92	6.0E-5	1.8E-7		
6140	FE-3	TA-3-102		10\29\92	3.8E-4			
6150	FE-1	TA-3-141		3\16\92	4.2E-4			
6180	FE-1	TA-35-213		9\3\92	1.6E-4			
6200	XB-432	TA-55-4		9\23\92	1.5E-6			
6300		TA-55-4		9\30-92	3.8E-5			
6470	FE-1	TA-41-1		10\2\92	3.2E-6	3.2E-8		
6720	XB-1580	TA-55-4		8\19\92	4.3E-6			
6800	FAH-1	TA-3-1819		7\30\92	1.0E-3* (+)			
6940		TA-55-4		9\23\92	2.1E-6			
6950		TA-55-4		9\23\92	3.5E-6			
6980		TA-55-4		9\22\92	9.9E-6			
7010		TA-54	3\26\92	4\13\92		1.2E-7		
7020		TA-54	3\26\92	4\13\92		1.7E-7		
7030	FE-1	TA-3-29	9\9\92	9\11\92	2.4E-5			
7040	FE-2	TA-3-29	9\9\92	9\11\92	2.2E-4			
7050		TA-35-213		10\13\92	1.2E-4			
7100	FE-3	TA-3-2009		11\23\92	1.5E-4			
7690		TA-3-66	9\26\92	11\2\92	1.6E-5			

* - Indicates system did not meet maximum penetration test criteria.
A - Indicates Aerosolve 95 Type Filter.
+ - Indicates system was retested successfully.

TABLE #3

PORTABLE FILTRATION 1992
(VACUUM CLEANERS & NEGATIVE AIR MACHINES)

	SERIAL #	TYPE	TEST DATE	PENETRATION
1.	83-302299	VAC.	4-21-92	1.4E-6
2.	8	NEG.AIR	4-30-92	3.7E-5
3.	NA54776	NEG.AIR	4-30-92	3.7E-5
4.	J.C.I.#5	NEG.AIR	5-4-92	1.9E-5
5.	844562	VAC.	5-5-92	3.9E-5
6.	54231	VAC.	5-4-92	4.3E-5
7.	GS-83297	VAC.	5-5-92	1.4E-7
8.	GS-82714	VAC.	5-5-92	1.8E-6
9.	HS5-8470	NEG.AIR	8-8-92	4.5E-5
10.	HS5-8130	NEG.AIR	8-8-92	1.3E-4
11.	J.C.I.#12	NEG.AIR	8-14-92	8.9E-5
12.	54778	VAC.	10-29-92	4.4E-4
13.	54331	VAC.	10-29-92	1.8E-4
14.	R057162	VAC.	12-1-92	3.3E-4
15.	BO72993	VAC.	11-24-92	4.1E-4

All systems listed above meet the maximum penetration test criteria.

14.0 Conclusions

A High-Sensitivity Laser Aerosol Spectrometer (HSLAS) (one size range, 32-size bins) has been implemented this year for field in-place filter testing. The HSLAS was implemented because of its ability to accurately detect particles down to 0.065 micrometers in diameter. Although the majority of particles that penetrate multi-stage HEPA-filter systems are in the 0.12 micrometer- size range, the added sensitivity can be used under special circumstances. This one-size-range system, as opposed to the three-size-range LAS, will reduce the sampling time by approximately 30%. Including the HSLAS, there are now a total of three operating test setups for field in-place filter testing, with a forth under construction. In addition, computer programs have been developed for the three LAS systems and are now being integrated into the testing program. Each computer program has been specifically programmed for the type of LAS (16, 32, or 48 bin) used on the test setup. This program can be run on any IBM compatible compact lap-top computer.

There was a substantial increase, 11.62%, in the number of systems that met or exceeded the acceptable penetration test criteria in 1992 in comparison to 1991. In 1992, 96.77% of the systems tested met or exceeded the acceptable penetration criteria, while in 1991, 85.15% of the systems tested satisfactorily. There were less filter changes in 1992 than 1991, which indicates the filters have stabilized and sealed correctly after the change of filters in 1991. In the systems where failures did occur, the primary cause appeared to be inadequate sealing of filters during installation, especially on fluid seal filters. Other failures were due to filter medium flaws and the lack of clean and straight knife edges on fluid seal housings. A total of four systems failed to meet the maximum penetration criteria and were not retested. In the systems located at TA-3, SM-29, TA-59, and PF-4, the operating group was notified of the failure and informed the system would need to be repaired and retested. The decision made by the operating group was to operate these systems while replacement filters are being obtained. These systems would continue to run as long as the secondary stage of filtration downstream of the filters in question met the maximum penetration criteria.

ASTM Standard F-1471-93[6] has been successfully implemented. The addition of two new test personnel in the filter testing program has helped in maintaining the equipment and in following the filter testing schedule. Furthermore, the additional personnel support should provide more time to develop new technologies and equipment needed in the program. Each year the program is continually redefined and updated with changing technology. New instrumentation and equipment which may apply to the testing program will be taken into consideration and developed for the next test year.

15.0 References

1. In-Place Testing of Multiple Stage Filter Systems Without Disruption of Plant Operations at the Plutonium Facility at Los Alamos, 18th DOE Nuclear Airborne Waste Management and Air Cleaning Conference 1984.

2. Nuclear Standard NEF 3-41T, In-Place Testing of HEPA Filter Systems by the Single-Particle, Particle-Size Spectrometer Method, September 1986.

3. Los Alamos National Laboratory Policy for In-Place Testing of Air Filters/Chemical Adsorber Systems, 1991.

4. Nuclear Air Cleaning Handbook, ERDA, 76-21.

5. American Society of Mechanical Engineers, ASME N509-1989, Nuclear Power Plant Air-Cleaning Units and Components.

6. ASTM Standard F-1471-93, Standard Test Method for Air Cleaning Performance of a High-Efficiency Particulate Air-Filter System, February 1993.

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APPENDIX A

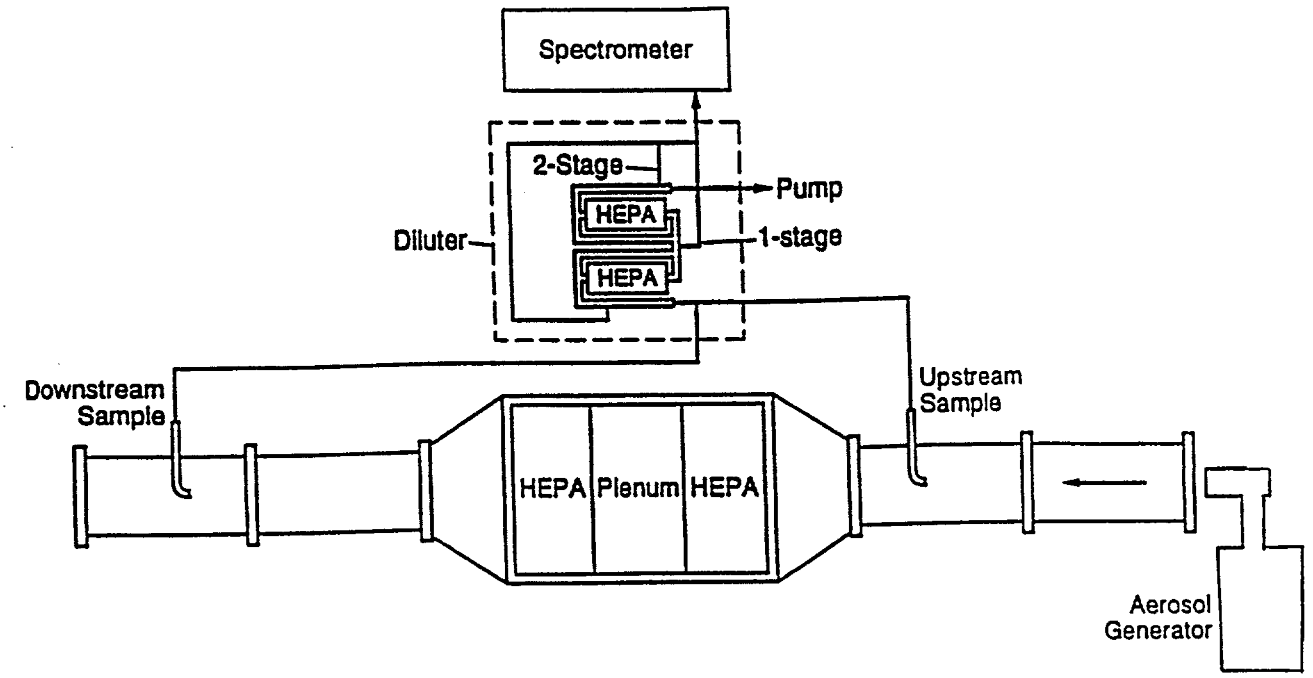

Figure 1. Schematic View of an In-Place Test Setup

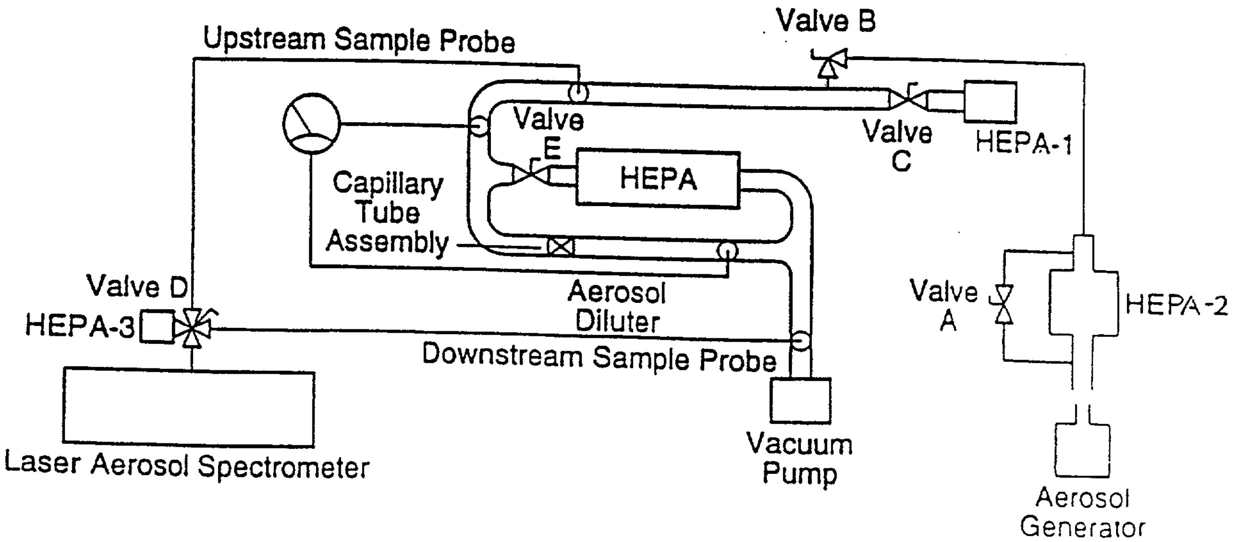

Figure 2. Schematic View of an Aerosol Diluter

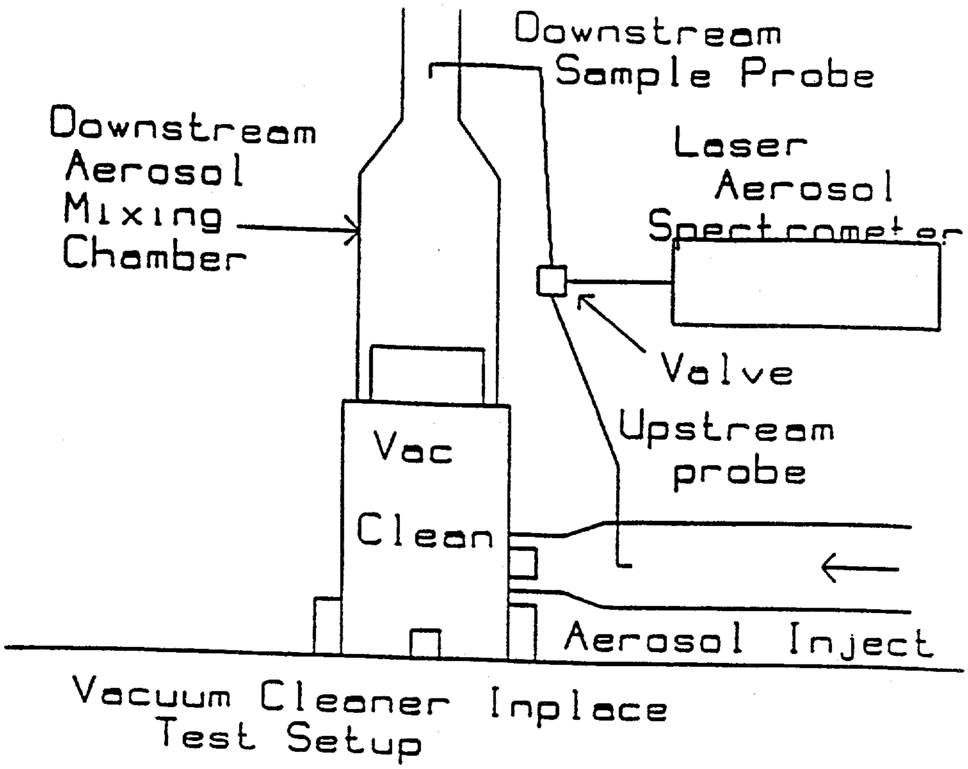

Figure 3. Schematic View of a Negative Air Machine

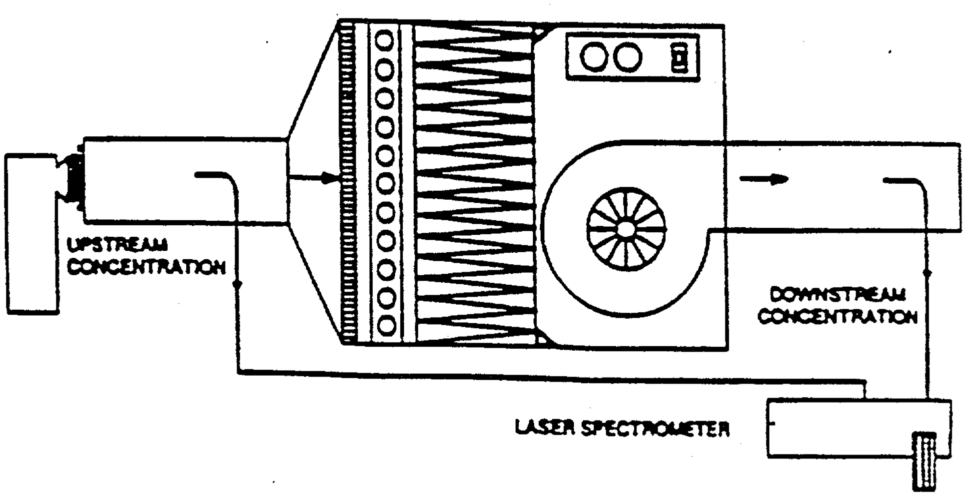

Figure 4. Schematic view of an HEPA Filtered Vacuum Cleaner