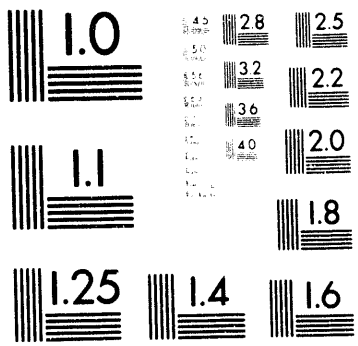
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

1 of 1

LA-UR-91-3101

Los Alamos National Laboratory is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36

TITLE: IN-PLACE TESTING SUMMARY (1990)

AUTHOR(S): John P. Ortiz

SUBMITTED TO: To be published as an LA-UR report.

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

FORM NO 836 R4
ST NO 2629 5/81

IN-PLACE TESTING SUMMARY (1990)

JOHN P. ORTIZ

GROUP HSE-5
ENGINEERING AND RESPIRATORY SERVICES SECTION
INDUSTRIAL HYGIENE GROUP
MAY 1990

LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS, NEW MEXICO 87545

TABLE OF CONTENTS

PREFACE

This is one of several reports concerning an on-going in-place testing program of high efficiency filtration and chemical adsorber systems and portable filtered exhausters at the Los Alamos National Laboratory. This testing is in support of the Laboratory's airborne waste management programs and asbestos abatement programs. Periodic in-place testing, along with health physics air sampling will determine whether the air cleaning systems are maintaining acceptable air-cleaning levels. These periodic evaluations help ensure that the plant and surrounding environment are free of any significant radioactive particulates, based on current EPA environmental levels and chemical airborne hazards from processing effluents. This report will provide an overview of system performance, testing methods and procedures.

1.0 INTRODUCTION

Periodic in-place testing of an air-cleaning system is required to monitor the air cleaning performance and to establish a record of its current operating condition. These testing evaluations along with Health Physics air sampling determine whether air-cleaning integrity is being maintained. The in-place test is conducted in most instances without disruption of plant operations, and only if the case of test failures would it become necessary to shut down the system to correct the problem. In place tests are conducted on single and multi-stage filter systems and other filtration devices, i.e. aerosolve 95 filtration, negative air machines and vacuum cleaners, using laser aerosol spectrometers, (LAS), to detect test aerosols. This type of testing is not to be confused with tests performed by the Quality Assurance Testing by DOE. Filter Test Stations,[1] whose purpose is to test filters for efficiency.

In-place testing of adsorber systems is required for several reasons: 1) chemical poisoning of the adsorbers by organic vapors; 2) settling or the charcoal in the bed due to vibration; and 3) installation errors. A fluorocarbon (Freon 11 gas), is used for testing adsorber systems and the quantitative measure of the gas is accomplished with gas chromatograph.

2.0 IN-PLACE TESTING SCHEDULE

In-place testing dates are prepared for each filter system. If operational conflicts interfere with the testing date, then a new testing date is arranged.

3.0 DEFINITIONS

3.1 Penetration (Pen). The measure of quantity of a test agent that leaks through or around the air cleaning system when tested with an aerosol, or chemical agent of know characteristics under specified conditions. The fractional penetration is expressed as the ratio of the downstream particle concentration to the upstream concentration.

3.2 Diluter. A device used to reduce high aerosol concentrations to concentrations useable by the LAS. Maximum concentrations are determined by the occurrence of coincidence counting losses when more than one particle occupies the sampling volume of the LAS.

3.3 Dilution Ratio (DR). The ratio of the undiluted to diluted aerosol concentrations. Because diluters have inherent particle losses which may vary according to the particle size, the dilution ratio may not be constant for different sizes.

3.4 Laser Aerosol Spectrometer (LAS). A precision aerosol detector which allows single particle counting and sizing by the amount of light scattered from individual particles.

3.5 HEPA. A high efficiency particulate air filter.

3.6 Other. Other terms pertinent to this report are defined in the reference material , more specifically in the Standards ASME N-510,[2] and DOE Standard NE F 3-41T[3].

4.0 POLICY FOR IN-PLACE TESTING

4.1 New Installations. All new filter installations intended for use with toxic materials will be tested before initiating any operations.

4.2 Test Frequency. Each filter system, including entry boxes and adsorbers handling toxic or radioactive materials such as asbestos, Be, Pu, and U^{235} will be tested annually.

4.3 Filter Changes. All systems containing HEPA or Aerosolve 95 filters will be tested within 2 working days of filter changes, except for glove box filters.

4.4 Other Filtration. Testing of filter systems handling moderately toxic materials such as U^{238}, Pb, etc., will be determined on a case-by-case basis.

4.5 Supply Systems. Supply air systems will be tested only at TA-55.

4.6 Glove Box In-Line Filters. No periodic testing will be conducted on these filters except for new installations, (testing would require opening valve to unfiltered zone 1 air).

5.0 TEST REQUIREMENTS

5.1 Aerosol or Test Gas Injection Ports. Proper location and installation of injection ports are required in order to properly mix the test agents.

5.2 Sampling Probes. Proper location and installation of sampling probes is required to complete the testing.

5.3 Lighting. Adequate lighting is required both inside and outside the filter system.

5.4 Electrical Power. Minimum requirements are 20 amps, 120 volts.

6.0 TEST METHODS

6.1 HEPA Filters Systems. Figure 1 shows the setup for testing a multi-stage filter system as one unit rather than the stage-by-stage photometer method described in ASME N-510 testing. A challenge aerosol is generated upstream of the filter system and allowed to mix with the airstream. Aerosol samples collected through probes both upstream and downstream of the filter system and are counted and sized with the LAS. With this method the penetration of the filter system can be calculated as a function of particle size. Because of high particle concentration which is required to evaluate

multi-stage of filter systems , an aerosol diluter must be used to reduce the upstream sample to avoid errors due to coincidence in the LAS. A schematic of the diluter is shown in Figure 2.

The test aerosol should be heterodisperse, in the range of 0.1 to 1.0 micrometers in diameter. The required upstream test concentration is 2×10^6 particles/cc, or about 30 micrograms per liter (assuming unit density) to properly evaluate a two-stage HEPA filter system. For a 1-stage system the concentration is 2.5×10^5 particles /cc. A schematic of the aerosol generator is shown in Figure 3. The established maximum penetration criteria for 1 HEPA filter stage is 5×10^{-4}, 2.5×10^{-7} for 2 stages in series as one single unit. If the filter system fails to meet the minimum penetration criteria, then a series of additional tests is required to identify and correct the problem.

6.2 Adsorbers. Adsorber stages are tested individually to establish remaining adsorption capacity and the presence of leaks that may have developed under service conditions. The test method utilizes a refrigerant gas Trichlorofluromethane, (Freon 11) as the test agent for challenging the

adsorber system. Samples are collected and are analyzed with a gas chromatograph using a detector. The maximum penetration criteria for adsorber systems is 1×10^{-3}.

6.3 Portable Filtered Exhaust. Portable filtered exhaust systems are used primarily for asbestos removal operations. Maximum penetration for these systems is 5×10^{-4}.

7.0 TEST PROCEDURE (HEPA)

7.1 Calibration (LAS). Calibration should be performed periodically (once per year), or more frequently if the possibility of mirror misalignment in the LAS due to rough handling. The calibration consists of testing the LAS with two sizes of Poly Styrene Latex Spheres (PSLS), 0.1 and 0.7 micrometers traceable to the National Institute of Standards Technology (NIST). One of the calibration aerosols should have particle size within 0.05 micrometers of the second or third channel boundary of the LAS. If the LAS cannot be adjusted to within the calibration limits, the LAS shall be returned to the manufacturer for repair and calibration. Appendix A describes a procedure for calibration. A schematic diagram of the PSL generator is shown in Figure A.

7.2 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 rather than for the actual filter test. If more than one diluter stage is used, each must be calibrated independently. The dilution ratio (DR) for each stage can be calculated by the equation in 7.3.

The procedure for calibration is described in Appendix B. Presented in Figure 4 is the diluter calibration histogram.

7.3 DR Calculations.

$$DR = (\text{Sum } C_u)\ (i) / (C_d)\ (i)$$

where C_u and C_d refer to the concentration of particles of the undiluted to the diluted portion of the aerosol in each of the size intervals. Concentrations are determined by dividing the particle counts in the specified interval by the total sample volume of the LAS.

7.4 Background. Because of the expected low concentrations of test particles penetrating 2 HEPA filter stages, it is required to measure the concentration of non-test particles in the airstream to serve as background. With no aerosol generation and no sample dilution, samples are collected with LAS from the downstream sample probe. The sampling times may vary depending on the accumulated particle counts; a 10 minute sample is usually sufficient.

7.5 Challenge Aerosol. Generate the test aerosol and accumulate samples with the LAS from the upstream probe through the diluter and establish the challenge concentration. Section 6, Paragraph 2, describes the upstream concentration requirements.

7.6 Calculations (Challenge Conc.).

$$\text{Conc} - (C_u)\ (i) * (DR)\ (i) / V * T$$

where C_u refers to the particle counts of the challenge aerosol. DR is the dilution ratio, V is the sample volume, T refers to the time, and i refers to the size interval.

7.7 Downstream Sampling. Collect samples of the test aerosol from the downstream probe. Sampling time periods should be selected to yield net particle counts over background of at least 100.

Two successive samples should be taken. The difference between counts of two samples should not exceed 15% of the larger count. With 1-stage systems, shorter sampling times may be used, if higher particle counts is suspected (above 3000 particles per second), a diluter must be used in-place to avoid coincidence counting in the LAS.

7.8 Calculations (PEN). The penetration is calculated as:

$$Pen = [Sum\ C_d(i) - B_d(i)] / C_u(i)]$$

where $B_d(i)$, $C_d(i)$, and $C_u(i)$ denote the particles in the with size interval for the background, downstream, and upstream samples, respectively. Figure 5 shows an example of the system penetration.

8.0 TEST PROCEDURE (ADSORBERS)

8.1 Challenge Agent. Freon 11 gas is injected into the upstream side of the adsorber system at a rate of $10cm^3/sec$ per 0.47 m^3/sec of system airflow.

8.2 Upstream and Downstream Sampling. Grab samples are collected upstream and downstream of the adsorber stage where satisfactory mixing of the gas is accomplished. The grab bags are transported to the laboratory for analyses, or direct measurements are made at the adsorber system using a portable gas chromatograph.

9.0 SUMMARY OF TESTS

Listed below is a summary of all filter and adsorber systems tested in 1990. The summary includes number of systems meetings or exceeding the minimum penetration criteria, including failures and how many were retested.

TABLE I

9.1	Main Exhaust and Supply Filter Systems	
9.1.1	Exceeded Test criteria	157
9.1.2	Failed Test criteria	7
9.1.3	Retested	7
9.2	Adsorber Systems	
9.2.1	Exceeded Test criteria	2
9.2.2	Failed Test	2
9.2.3	Retested	2
9.3	Negative Air Machines	
9.3.1	Exceeded Test Criteria	17
9.3.2	Failed Tests	3
9.3.3	Retested	3
9.4	Other Non (HEPA) Filtration	
9.4.1	Exceeded Test Criteria	5
9.4.2	Failed Tests	4
9.4.3	Retested	0

10.0 In-Place Test Results (HEPA)

Listed below are the results of the in-place tests for 1990. The performance of each filter system is expressed as the fractional penetration, for 1-stage and 2-stages as one unit.

TABLE II

HSE-5	ENG No.	Location	Fil Chg Date	Test Date	Pen Stg1	Pen 2 Stgs
100	FE-2	TA-2-1		6/16/90	2.9E-4	
110	FE-3	TA-2-1		6/16/90	1.2E-5	
140	FE-14	TA-3-29		6/19/90	4.7E-4	1.1E-7$
150	FE-14	TA-3-29		6/19/90	7.1E-5	5.2E-8$
160	FE-15	TA-3-29		8/01/90	5.2E-5	
170	FE-18	TA-3-29		8/01/90	4.5E-5	
190	FE-28	TA-3-29		6/25/90	3.6E-5	1.1E-8$
200	FE-29	TA-3-29		8/20/90	8.6E-5	2.0E-7$
200	FE-29	TA-3-29		6/22/90	4.2E-5	1.6E-7$
210	FE-30	TA-3-29		7/30/90	3.1E-4	
220	FE-31	TA-55-4		9/05/90	8.7E-8	
220	FE-31	TA-3-29		7/30/90	1.5E-5	
230	FE-32	TA-3-29		7/30/90	4.2E-5	1.6E-7$
240	FE-33	TA-3-29		6/22/90	2.3E-5	7.2E-8$
250	FE-34	TA-3-29		7/25/90	5.1E-5	
260	FE-35	TA-3-29		7/27/90	3.7E-6	
820	FE-17	TA-50-1		7/07/90	1.7E-4	
840	FE-25	TA-50-1		7/07/90	2.1E-4	
850	FE-3	TA-50-1		7/08/90		1.4E-7$
860	FE-2	TA-50-1		7/08/90	4.8E-4	1.1E-7$
1120	FE-27	TA-50-1		7/08/90	3.5E-5	
1130	FE-23	TA-50-1		7/08/90	2.2E-4	
1150	FE-3	TA-50-69		8/31/90	1.0E-6	
1150	FE-3	TA-50-69		3/05/90	9.4E-8	1.2E-7$
1150	FE-3	TA-50-69	4/11/90	4/12/90	3.2E-3*	
1150	FE-3	TA-50-69		3/05/90	9.4E-8	1.2E-8$
1160	FE-3	TA-53-M	7/08/90	7/06/90	7.7E-3	
1170	FE-3	TA-53-M		7/11/90	3.5E-5	
1180	FE-2	TA-53-7		3/12/90	4.6E-5	
1190	FE-1	TA-54-2		1/23/90	2.6E-3*	
1190	FE-1	TA-54-2	1/17/90	1/23/90	1.1E-6	
1210	FA-801	TA-55-4		9/13/90	1.2E-4	4.9E-9$
1220	FA-802	TA-55-4		9/13/90	4.5E-4	1.2E-8$
1230	FA-803	TA-55-4		9/14/90	3.4E-4	7.2E-8$
1240	FA-804	TA-55-4		2/16/90	1.1E-5	1.9E-7$
1240	FA-804	TA-55-4		9/14/90	1.1E-5	1.7E-7$
1250	FA-805	TA-55-4		9/12/90	3.3E-6	4.8E-9$
1260	FA-806	TA-55-4		9/12/90	7.7E-5	6.5E-8$
1270	FA-807	TA-55-4		9/12/90	1.7E-4	1.5E-7$
1280	FA-808	TA-55-4		9/12/90	8.3E-5	5.6E-8$
1290	FA-809	TA-55-4		9/18/90	1.1E-4	
1300	FA-810	TA-55-4		9/18/90	1.4E-4	
1310	FA-811	TA-55-4		9/13/90	3.4E-4	9.6E-9$
1320	FA-812	TA-55-4		9/13/90	3.8E-5	7.1E-8$
1330	FA-820	TA-55-4		4/11/90	4.4E-5	2.3E-8$
1340	FA-821	TA-55-4		9/13/90	1.1E-4	1.3E-6*$
1340	FA-821	TA-55-4	9/12/90	9/17/90	1.4E-4	1.7E-7$
1350	FA-822	TA-55-4		9/12/90	8.4E-4*	4.9E-7*$
1350	FA-822	TA-55-4	9/13/90	9/17/90	8.1E-5	9.4E-8$

HSE-5	ENG No.	Location	Fil Chg Date	Test Date	Pen Stg1	Pen 2 Stgs
1360	FA-823	TA-55-4		9/12/90	8.6E-5	2.5E-8$
1370	FA-828	TA-55-4		9/11/90	1.3E-6	2.2E-7$
1380	FA-829	TA-55-4		9/12/90	3.1E-6	2.8E-9$
1390	FA-840	TA-55-4		9/18/90	2.9E-4	
1400	FA-841	TA-55-4		9/18/90	2.3E-4	
1410	FA-850	TA-55-4		2/16/90	1.4E-7$	1.3E-8@
1410	FA-850	TA-55-4	2/17/90	2/19/90	2.1E-7$	1.2E-8@
1420	FA-851	TA-55-4	1/24/90	1/26/90	1.5E-7$	6.6E-8@
1420	FA-851	TA-55-4		9/25/90	1.1E-7$	2.7E-8@
1430	FA-852	TA-55-4	1/16/90	1/17/90	4.9E-5	1.6E-8#
1430	FA-852	TA-55-4		9/27/90	2.6E-4	5.0E-9#
1440	FA-853	TA-55-4	1/15/90	1/18/90	3.8E-5	6.8E-8#
1440	FA-853	TA-55-4		9/26/90	2.1E-4	7.2E-8#
1450	FA-854	TA-55-4		1/11/90	2.2E-6	1.8E-8#
1450	FA-854	TA-55-4		10/10/90	2.1E-6	1.1E-8#
1460	FA-856	TA-55-4		9/28/90	5.2E-5	1.7E-7#
1470	FA-856	TA-55-4		10/11/90	1.1E-4	2.8E-7#
1480	FA-857	TA-55-4		10/11/90	3.4E-4	6.6E-8#
1490	FA-870A	TA-55-4		9/19/90	5.6E-4	
1510	FA-871A	TA-55-4		9/19/90	1.4E-4	
1520	FA-871B	TA-55-4		9/19/90	3.1E-5	
1550	FA-873A	TA-55-4		9/18/90	2.8E-4	
1570	XB-103	TA-55-4		9/07/90	9.6E-7	
1580	XB-104	TA-55-4		9/07/90	7.8E-8	
1590	XB-105A	TA-55-4		9/07/90	1.7E-7	
1600	XB-105B	TA-55-4		9/19/90	4.5E-4	
1600	XB-105B	TA-55-4		9/07/90	6.2E-7	
1620	XB-107A	TA-55-4		9/07/90	1.1E-6	
1630	XB-107B	TA-55-4		9/07/90	5.1E-8	
1640	XB-109	TA-55-4		9/07/90	5.9E-7	
1650	XB-110	TA-55-4		9/07/90	1.9E-4	
1660	XB-111A	TA-55-4		9/10/90	1.1E-3*	
1660	XB-11A	TA-55-4		9/12/90	2.3E-4	
1670	XB-111B	TA-55-4		9/10/90	6.5E-7	
1680	XB-112	TA-55-4		9/07/90	2.1E-6	
1690	XB-221	TA-55-4		9/05/90	2.0E-7	
1710	XB-114	TA-55-4		9/07/90	1.7E-7	
1720	XB-115B	TA-55-4		9/06/90	1.1E-7	
1730	XB-118	TA-55-4		9/07/90	3.5E-7	
1840	XB-204B	TA-55-4		9/06/90	9.6E-7	
1860	XB-206A	TA-55-4		9/05/90	3.9E-7	
1870	XB-206B	TA-55-4		9/05/90	1.9E-7	
1880	XB-207	TA-55-4		9/05/90	3.8E-7	
1890	XB-208	TA-55-4		9/05/90	5.5E-8	
1920	XB-215A	TA-55-4		9/06/90	5.7E-7	
1930	XB-215B	TA-55-4	9/18/90	9/19/90	1.6E-6	
1930	XB-215B	TA-55-4		9/06/90	1.3E-3	
1940	XB-216	TA-55-4		9/05/90	6.3E-7	
1950	XB-217	TA-55-4		9/05/90	1.1E-7	
1960	XB-218	TA-55-4		9/05/90	8.9E-8	
1970	XB-219A	TA-55-4		9/05/90	2.0E-7	
1990	XB-220A	TA-55-4		9/10/90	5.2E-7	

HSE-5	ENG No.	Location	Fil Chg Date	Test Date	Pen Stg1	Pen 2 Stgs
2000	XB-220B	TA-55-4		9/10/90	3.5E-7	
2010	XB-301	TA-55-4		9/10/90	7.1E-8	
2020	XB-302	TA-55-4		9/10/90	6.4E-7	
2030	XB-304	TA-55-4		9/10/90	1.5E-7	
2040	XB-303A	TA-55-4		9/10/90	1.1E-7	
2050	XB-306A	TA-55-4		9/10/90	1.3E-7	
2070	XB-303B	TA-55-4		9/10/90	1.3E-7	
2080	XB-306B	TA-55-4		9/10/90	5.1E-8	
2090	XB-402	TA-55-4		9/11/90	1.0E-7	
2100	XB-405	TA-55-4	2/28/90	9/11/90	9.1E-7	
2120	XB-405	TA-55-4	1/09/90	9/11/90	1.9E-7	
2140	XB-412	TA-55-4		9/07/90	1.8E-7	
2150	XB-478	TA-55-4		9/11/90	1.8E-7	
2850	XB-308	TA-55-4		9/11/90	2.4E-7	
2990	BE-EXH	TA-35-213		5/30/90	2.8E-4	
3900	XB-201A	TA-55-4		9/06/90	5.2E-6	
3910	XB-201B	TA-55-4		9/06/90	8.0E-7	
3920	XB-203	TA-55-4		9/06/90	1.1E-7	
3930	XB-202	TA-55-4		9/06/90	2.2E-7	
5870	FA-854S	TA-55-4		10/10/90	3.3E-4	1.9E-7@
5880	FA-855S	TA-55-4		10/10/90	5.0E-4	2.9E-8@
6000	XB-390	TA-55-4		9/10/90	1.7E-6	
6010	XB-393	TA-55-4		9/10/90	4.2E-7	
6020	XB-386	TA-55-4		9/10/90	7.9E-8	
6070	XB-113A	TA-55-4		9/07/90	1.1E-4	
6080	XB-113B	TA-55-4		9/06/90	1.0E-5	
6140	FE-1	TA-3-102		11/02/90	2.2E-3*	
6140	FE-4	TA-3-102	12/12/90	12/17/90	2.9E-4	
6150	FE-1	TA-3-141	1/30/90	2/01/90	1.2E-4	
6180	FE-1	TA-35-213		5/31/90	3.3E-5	
6200	GB-432	TA-55-432		6/06/90	8.4E-9	
6200	GB-432	TA-55-4		9/11/90	1.3E-8	
6400	FAH-2	TA-55-41		9/04/90	2.8E-5	
6410	FAH-4	TA-55-41		9/04/90	1.1E-5	
6450	FE-4	TA-55-41		9/04/90	3.7E-5	
6460	FE-2	TA-55-41		9/04/90	9.0E-6	1.8E-7@
6500	FE-2	TA-55-41		9/04/90	1.0E-5	1.2E-8@
6510	FE-3	TA-55-41		9/04/90	1.4E-5	9.1E-8$
6520	FE-5	TA-55-41		9/04/90	4.9E-5	8.0E-9@
6530	FE-6	TA-55-41		9/04/90	2.2E-4	
6700	XB-1508	TA-55-4		9/07/90	4.0E-7	
6700	XB-1508	TA-55-4		9/27/90	1.7E-5	
6710	GB-7846	TA-55-4	09/27/90	9/27/90	2.4E-7	
6740	GB-243	TA-55-4	06/29/90	7/05/90	9.5E-7	
6750	GB-312A	TA-55-4	06/29/90	7/05/90	8.4E-6	
6760	GB-312B	TA-55-4	05/17/90	5/18/90	3.8E-5	
6770	GB-1472	TA-55-4	05/17/90	5/18/90	7.2E-6	
6800	FAH-1	TA-3-1819	05/21/90	5/25/90	1.6E-7	

HSE-5	ENG No.	Location	Fil Chg Date	Test Date	Pen Stg1	Pen 2 Stgs
6930	XB-310	TA-55-4	09/06/90	9/10/90	4.4E-7	
6940	GB-382	TA-55-4	09/07/90	9/11/90	7.0E-7	
6950	XB-413	TA-55-4		9/11/90	2.4E-7	
6980	XB-443	TA-55-4		9/11/90	1.2E-7	

* Systems failing to meet minimum penetration test criteria
$ Penetration measurements across filter stages 1&2
@ Penetration measurements across filter stages 2&3
# Penetration measurements across filter stages 3&4

11.0 Table III (Adsorbers)

Syst No.	Eng No.	Location	Adsorb Chg	Test Date	Pen 1	Pen 2
Omeg-1	Sur-Tk	TA-2-1		6/22/90	2.4E-4	
160	FE-3	TA-50-37		4/10/90	6.8E-4	
6210	FE-1	TA-59-1		3/19/90	3.8E-1*	7.7E-1*
6210	FE-1	TA-59-1		4/4/90	4.9E-1*	8.5E-1*

*Failed to meet the minimum test criteria

12.0 Table IV (Portable Filtration)

Ser No.	Type	Test Date	Penetration
0005	Neg Air	6/12/90	2.2E-4
0006	Neg Air	6/12/90	8.8E-5
0007	Neg Air	6/12/90	1.5E-4
0008	Neg Air	6/12/90	1.6E-4
53125	Neg Air	1/16/90	7.5E-4*
55264	Vac Cln	1/16/90	2.4E-4
54332	Vac Cln	1/16/90	2.1E-4
66935	Vac Cln	2/1/90	8.6E-6
281539	Vac Cln	2/1/90	2.9E-4
275568	Vac Cln	2/1/90	3.5E-4
53125	Neg Air	2/14/90	1.1E-3*
54746	Neg Air	2/15/90	3.6E-5
53136	Neg Air	2/27/90	2.5E-4
55264	Vac Cln	2/27/90	3.4E-4
54226	Neg Air	3/22/90	1.4E-4
53125	Neg Air	3/22/90	6.1E-5
72641	Vac Cln	3/30/90	3.3E-4
51110	Neg Air	4/30/90	3.1E-2*
51110	Neg Air	5/8/90	1.7E-4
720876	Neg Air	5/2/90	2.4E-4

* Failed to meet the minimum test criteria

13.0 Table V (Other High Efficiency Filtration)

Syst No.	Eng No.	Location	Fil Chg Date	Test Date	Penetration
180	FE-19	TA-3-29		06/19/90	4.1E-1*
1100	FE-20	TA-3-29		06/19/90	5.2E-1*
2900	FE-2	TA-50-1		03/22/90	4.6E-2
2870	FE-40	TA-48-1	01/04/90	01/09/90	2.4E-1
2880	FE-37	TA-48-1	01/04/90	01/09/90	1.8E-1
BE-SHP	FE-7	TA-3-39		11/28/90	1.1E-2
SHP-13	FE-18,21	TA-3-102		10/03/90	6.1E-1*
SHP-13	FE-22	TA-3-102		10/03/90	5.1E-2
SHP-13	FE-23	TA-3-102		10/03/90	4.3E-1*

14.0 DISCUSSION AND CONCLUSIONS

Improvements were made to improve the particle transition contours in the diluters to eliminate as much as possible particles losses due to adhesion forces. Previous reported particle losses in diluters resulted in lower particle collection efficiency which resulted in having to apply correction factors to the readings. The improved diluters are currently showing less than 3% particle losses which is within the acceptable limits of diluters or diffusion tubes.

The majority of the failed filter systems were due to inadequate sealing of the filters to the filter frame. Acid residue that accumulates on HEPA filters and on the sealing surfaces of the zone 1 systems of the plutonium facility continues to pose problems. There is some evidence that acid, residue is interfering with the proper setting of HEPA filters. Also the acid is showing migration beyond the third filter stages.

All filter systems that failed the in-place test were repaired and retested with satisfactory results. Testing non-HEPA filters increased by 50% in 1990. All of the filtering medium was Aerosolve 95, or equivalent.

REFERENCES

1. Quality Assurance, Inspection and Testing of HEPA Filters, NEF 3-43, 1986.

2 American Society of Mechanical Engineers, N-510,1989, Testing of Nuclear Air Treatment Systems.

3. DOE Nuclear Standard NEF 3-41, In-place Testing of HEPA Filter Systems by the Single-Particle, Particle-size Spectrometer Method. September 1986.

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APPENDIX A

LAS Calibration

The calibration procedure uses an aerosol having all particles of one size. An aerosol of PSLs is generated using a compressed-air nebulizer. The nebulizer is contained in a metal box with two chambers for diluting and drying the aerosol, an air pressure regulator, a dilution air control value, and rotometer to meter the gas flow. A schematic view of the calibration is shown in Figure A-1. The aerosol generator must be connected to a compressed-air source capable of allowing the generator's pressure regulator to deliver about 250cm/sec (STP of air at 10 psi). The compressed-air source should not deliver any water droplets to the generator. If this is a concern, a water trap should be used ahead of the generator. The generator's output is connected directly to sample inlet of SPS. The nebulizer is a DeVilbiss glass nebulizer that plugs into the rubber stopper in the dilution chamber. The nebulizer has small internal passages for the air jet and the feed tube. These passages can become plugged if the PSL suspension is allowed to dry in the nebulizer. Upon completion of the calibration check, flush out the nebulizer with clean distilled water.

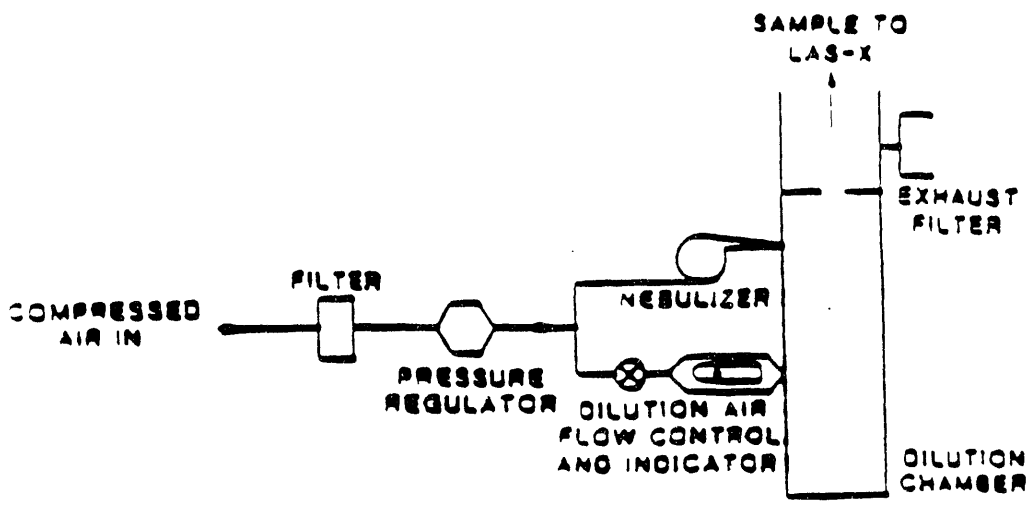

Figure A. Schematic Diagram of the PSL Generator

APPENDIX B

Diluter Calibration

The calibration of the aerosol diluter is very similar to that of the filter penetration measurement. Generation of lower particle concentration is required for the calibration. It is preferable, but not mandatory, to generate the aerosol in a separate flow system different than the filter system to prevent unnecessary loading of the filters. If more than one diluter is required, each must be calibrated independently. The diluter calibration procedure is as follows:

B-1. Connect the diluter inlet to the airflow system, (250cm^3/sec) with an absolute filter cartridge between the flow duct and the diluter. With this arrangement and no aerosol generation, accumulate a background sample with the LAS. Background particle counts are most likely due to leaks in the diluter system and must be eliminated before proceeding.

B-2. Connect the diluter calibrator to the flow system and generate the test aerosol having concentrations below that which is used for the actual filter tests. Open the line between the two absolute filters, and allow the reduced aerosol to enter the upstream side of the diluter and accumulate samples with the LAS from the sample probe. The aerosol concentration should be below that which causes coincidence in the LAS.

B-3. Change to the downstream position of the diluter and accumulate particles of the diluted aerosol. Note the ^P across the diluter stage and establish the dilution ratio. The dilution ratio for each size interval can be calculated by the equation in Section 7.1.2.

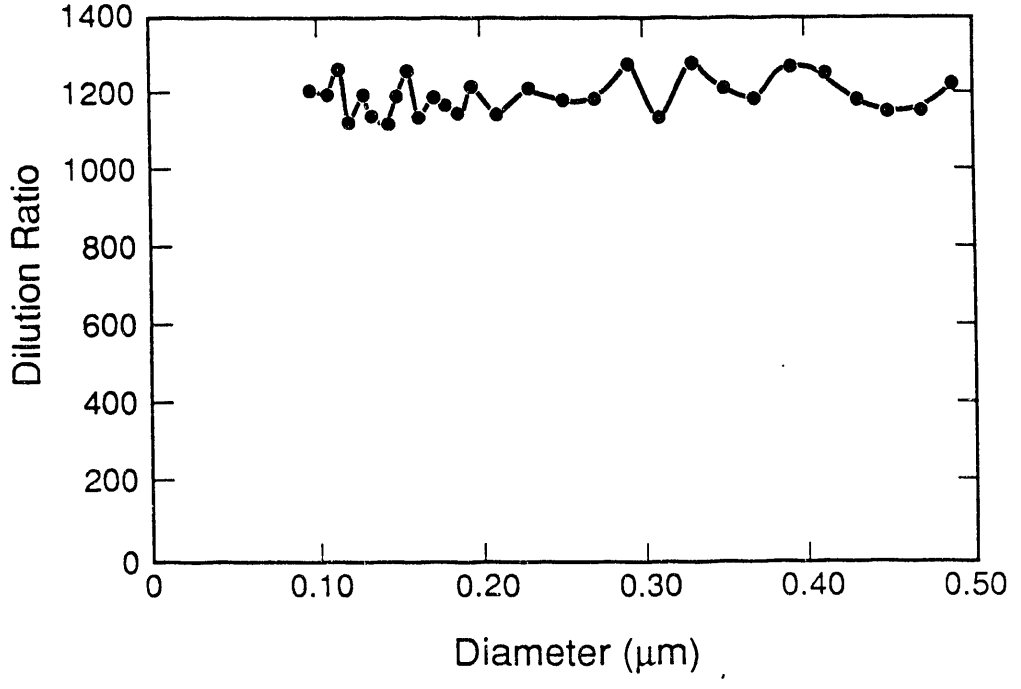

Figure B. Diluter Calibration Histogram

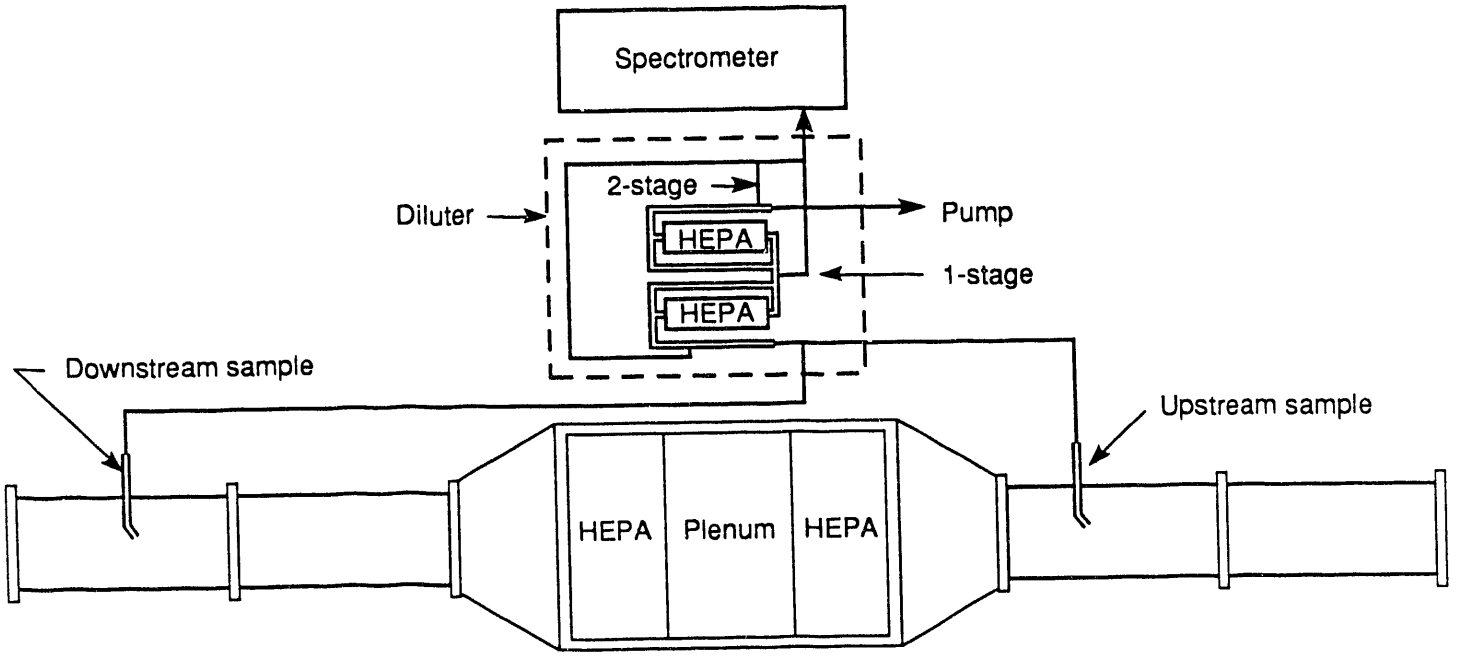

Figure 1. Schematic Diagram of In-Place Test Arrangement

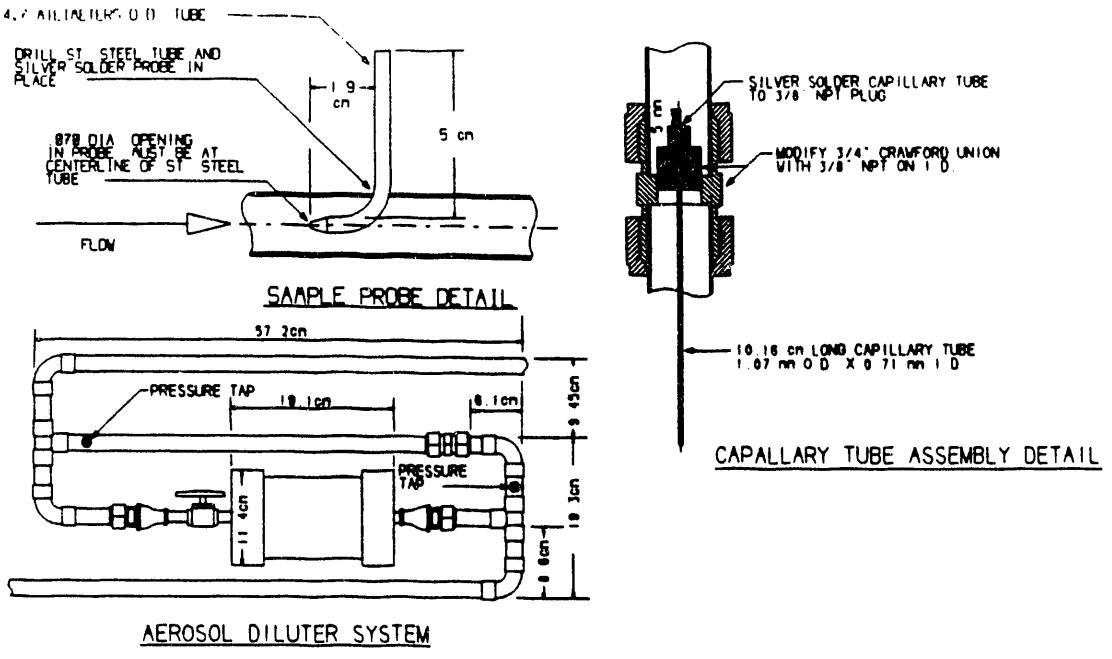

Figure 2. Aerosol Diluter

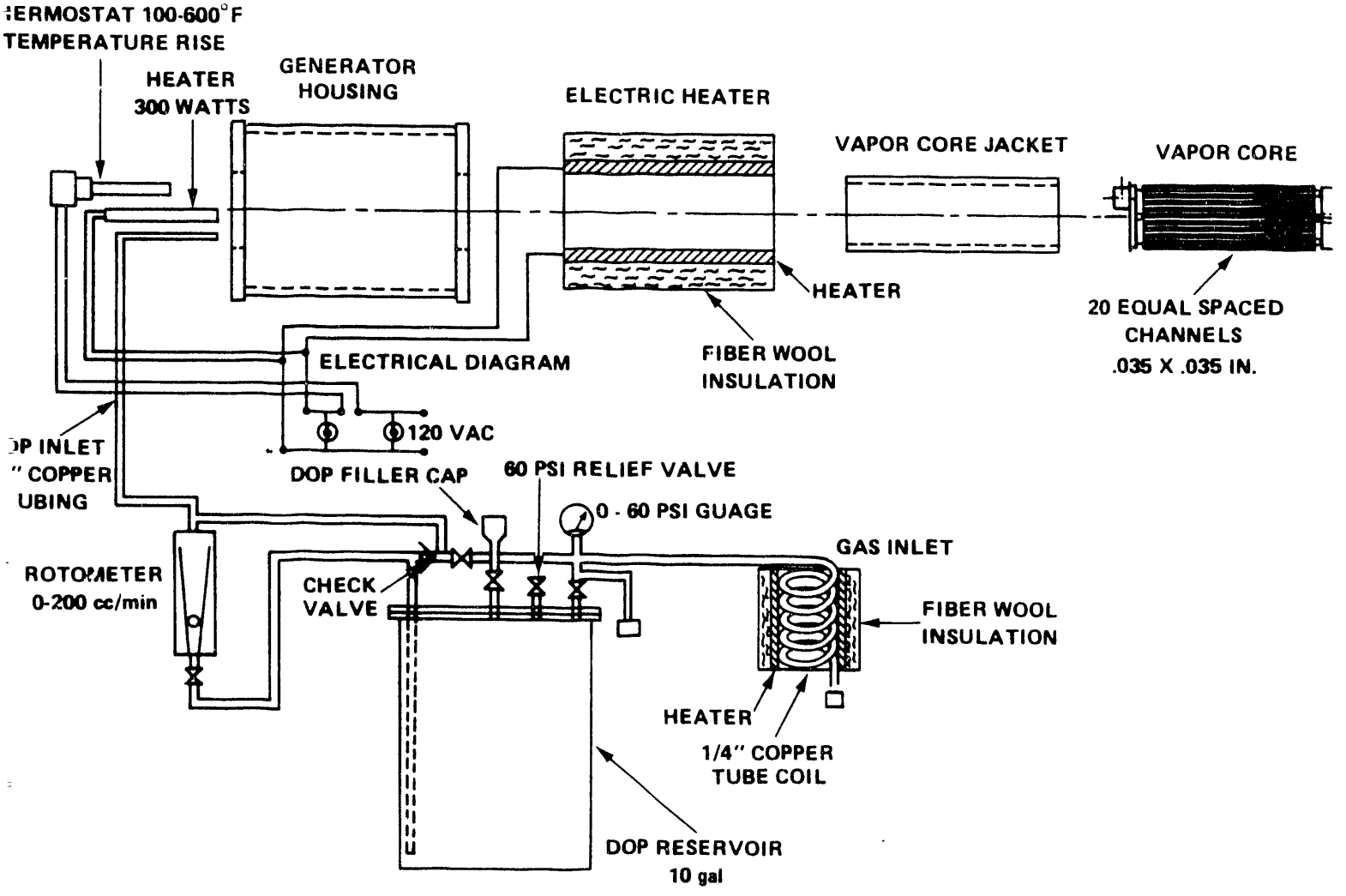

Figure 3. Schematic Diagram of Aerosol Generator

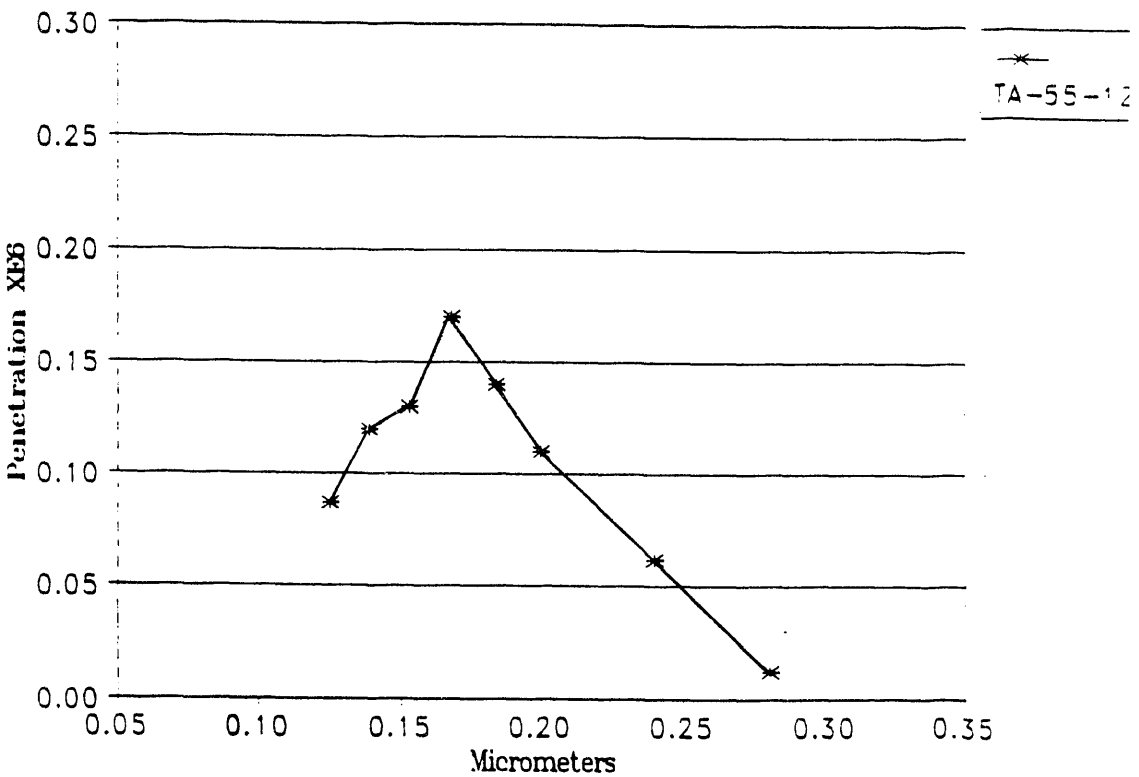

Figure 4. Example of Filter System Penetration Histogram

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