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ENGINEERING DATA TRANSMITTAL

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1	1	Cog.Eng. M. C. Prather	<i>[Signature]</i>	8/31/94	S3-31
1	1	Cog. Mgr. D. W. Wilson	<i>[Signature]</i>	8/31/94	S3-30
1	1	QA D. J. Leonard	<i>[Signature]</i>	8/31/94	S3-31
1	1	Safety P. A. Moorman	<i>[Signature]</i>	9/1/94	H4-10
1	1	Env. R. E. Johnson	<i>[Signature]</i>	8/31/94	H1-30
1	1	L. L. Curfman	<i>[Signature]</i>	8/31/94	S3-31
1	1	R. A. Evans	<i>[Signature]</i>	8/31/94	H0-31
18. <i>[Signature]</i> M. C. Prather Signature of EDT Originator Date 8/31/94		19. <i>[Signature]</i> D. W. Wilson Authorized Representative for Receiving Organization Date 8/31/94		20. <i>[Signature]</i> D. W. Wilson Cognizant Manager Date 8/31/94	
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Document Number: WHC-SD-WM-TRP-209, REV 0

Document Title: TEST REPORT FOR INITIAL TEST OF 6266 BUILDING FILTER ASSEMBLIES

Release Date: 9/1/94

* * * * *

This document was reviewed following the
procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

* * * * *

WHC Information Release Administration Specialist:

Kara Broz

(Signature)

9/1/94

(Date)

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7. Abstract This is the test report for the initial test of the Waste Sampling and Characterization Facility (WSCF) 6266 Building high efficiency particulate air (HEPA) filter assemblies. This supports the start-up of WSCF.		
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9. Impact Level ESQ		

TEST REPORT
FOR
INITIAL TEST OF 6266 BUILDING FILTER ASSEMBLIES
Revision 0

August 1994

M. C. Prather

Westinghouse Hanford Company
P.O. Box 1970
Richland, Washington 99352

MASTER

87D ✓

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**TEST REPORT FOR
INITIAL TEST OF 6266 BUILDING FILTER ASSEMBLIES**

1.0 INTRODUCTION

The Waste Sampling and Characterization Facility (WSCF) 6266 Building includes seven high efficiency particulate air (HEPA) filter assemblies (PV-F-1-NL, VAS-F-2-NL, VAS-F-3-NL, HVAC-ACT-1-NL, HVAC-ACT-2-NL, HVAC-ACT-1-NSL, and HVAC-ACT-301-NSL). These filter assemblies were installed by Project W011H. This report documents the initial testing of these filters, supporting the startup of the facility.

Following is a chronology of events:

07/25/94	Westinghouse Hanford Company (WHC) Laboratory Engineering, in preparation for startup of the facility, arranged for testing of the filters by originating TOD-42 (Appendix A), which arranged funding for the test and defined the scope of the testing.
07/26/94	WHC Project Engineering sent Letter of Instruction 34 (Appendix B) to ICF Kaiser Hanford.
07/29/94	Northwest Air, Inc., wrote the test procedure (Appendix C).
07/29/94	Laboratory Engineering initiated the Job Control System (JCS) Work Package 6D-94-00352/W J-1 (work request), and incorporated the test procedure into the package with a J-4 (resolution). A copy of the J-1 and J-4 are included in this report as Appendix D.
08/01-08/94	The test was performed. Results of the test are included in Appendix E.

Note that the contents of Appendices B through E were copied directly from JCS Work Package 6D-94-00352/W.

2.0 DESCRIPTION OF TEST

The Building 6266 HEPA filter assemblies are filter housings in ventilation and vacuum system supply, recirculation and exhaust duct work. The location of the assemblies in their respective systems is as follows:

PV-F-1-NL	Process Vacuum (PV) system exhaust
VAS-F-2-NL & VAS-F-3-NL	Vacuum Air Sample (VAS) system exhaust
HVAC-ACT-1-NL & HVAC-ACT-2-NL	North Laboratory (NL) exhaust
HVAC-ACT-1-NSL	Nuclear Spectroscopy Laboratory (NSL) recirculation/exhaust
HVAC-ACT-301-NSL	NSL outside air inlet

These systems are Safety Class 3. Accordingly, a graded approach was applied to the testing. The American Society of Mechanical Engineers (ASME) N510 standard, Testing of Nuclear Air Treatment Systems, was used as a basis for the testing. However, the ASME N510 standard was written for nuclear power plants (ASME N510, Section 1, Scope). Therefore, using the graded approach, the criteria in ASME N510 were reviewed and applied only as judged necessary.

The tests performed included the airflow capacity test, airflow distribution test, air-aerosol mixing test, and in-place HEPA filter test.

The airflow capacity test verifies that airflow can be maintained as filters load. The airflow distribution test determines if airflow is uniform over the face of the filter bank. The air-aerosol mixing test determines if the challenge aerosol (for the in-place HEPA test) is uniformly mixed with the air entering the filter bank. The in-place HEPA filter test verifies that penetration of the filter bank is below the limit.

Certain tests only apply to certain systems. Airflow distribution and air-aerosol mixing tests are only for housings with multiple filters. Therefore, these tests were not performed on housings containing a single filter (PV-F-1-NL, VAS-F-2-NL, VAS-F-3-NL, and HVAC-ACT-301-NSL). The airflow capacity tests were not performed for PV-F-1-NL, VAS-F-2-NL, and VAS-F-3-NL, due to the low airflow of these systems.

Criteria for the tests were as follows:

Airflow distribution: Since the three housings that do contain multiple filters (HVAC-ACT-1-NL, HVAC-ACT-2-NL, and HVAC-ACT-1-NSL) do not have smooth transitions into and out of the housings, they were clearly not designed for uniform airflow. The airflow distribution test was performed for information only.

Accordingly, no ports were added to the housings to accommodate accurate measurement of airflow distribution over the HEPA filter bank. Ideally, new ports would be installed in order to traverse with a hot wire anemometer close to the upstream face of the HEPA filters or with a pitot tube with the tip very close to the downstream face of the HEPA filters. The test performed placed plywood (with a hole in it) over the pre-filter doors, and used a pitot tube to measure the distribution upstream of the pre-filters. Since this test is for information only, the method used is acceptable.

Airflow capacity: Airflow capacity tests for HVAC-ACT-1-NL, HVAC-ACT-2-NL, and HVAC-ACT-1-NSL were to verify that flow at change-out pressure is acceptable. The results of the HVAC-ACT-1-NL test (performed in July 1994) were reviewed and determined to be acceptable based on engineering judgment and the original design flow rate (flow was within 16 percent of design).

For HVAC-ACT-2-NL and HVAC-ACT-1-NSL acceptable flow was within 10 percent of design flow.

For HVAC-ACT-301-NSL the test was reversed. Flow was not verified given a pressure; rather, the pressure drop corresponding to 90 percent of design flow was measured (for use in specifying filter changeout pressure).

Air-aerosol mixing: Air-aerosol mixing criteria was taken from ASME N510 (aerosol concentration within +/-10 percent of average across face of filter bank).

In-place HEPA test: Allowable penetration for the in-place HEPA testing is 0.05 percent.

Note that single point downstream sample ports for the in-place HEPA test are chosen downstream of a fan, or far enough downstream to ensure adequate mixing of the aerosol penetrating the filter bank and the airstream. The downstream sample ports for HVAC-ACT-1-NL, HVAC-ACT-2-NL and HVAC-ACT-301-NL are downstream of fans. The PV-F-1-NL, VAS-F-2-NL, and VAS-F-3-NL housings have factory installed downstream sample locations, which were used for this test. The housing HVAC-ACT-1-NL does not have a factory provided downstream sample section, and a location downstream of a fan is not available. Therefore, engineering judgement was used to choose a sample port location. For a straight duct, a length of ducting equivalent to 10 times the diameter of the duct between the filter bank and sample port provides adequate mixing. Since there is a drastic transition immediately downstream of the filter housing followed by an elbow, the equivalent (with respect to mixing) of ten duct diameters of straight ductwork is provided between the HVAC-ACT-1-NL bank and the chosen sample port.

Reference Appendix C and Appendix E for specific information on the tests.

Test instrumentation used and calibration certificates are included in the procedure (Appendix C) and test results (Appendix E), respectively.

3.0 TEST RESULTS

Test results are available in Appendix E. All test criteria were met except air-aerosol mixing test for HVAC-ACT-1-NSL (Exception 1, Appendix E).

Airflow distribution: Again, the airflow distribution test was performed for information only. The housings were clearly not designed for uniform airflow. The airflow distribution test was expected to show that airflow is not uniform over HVAC-ACT-1-NL, HVAC-ACT-2-NL and HVAC-ACT-1-NSL. This non-uniformity was verified as shown on the data sheets in Appendix E.

Airflow capacity: Airflow capacity test verifies that systems have enough capacity at clean and dirty conditions. The results are summarized in Table 1.

Air-aerosol mixing: The air-aerosol mixing tests for HVAC-ACT-1-NL and HVAC-ACT-2-NL passed.

The test for HVAC-ACT-1-NSL did not pass. The exception (Exception 1) included the recovery. When the air-aerosol mixing test passes, then the upstream sample for the in-place HEPA filter test may be taken at any location at the face of the filter bank. Since this test did not pass for HVAC-ACT-1-NSL, the upstream sample port with the lowest aerosol concentration was used for the in-place HEPA filter test. This produces a test that is more conservative than the normal test. Since an adequate in-place test can be performed, the system is accepted with non-uniform air-aerosol mixing. If the less conservative test (with uniform aerosol) could be performed, then filter life may be extended.

In-place HEPA test: The in-place HEPA test passed for all of the filter assemblies. The results are summarized in Table 2.

Table 1.

Assembly	Design Flow $\frac{\text{L}}{\text{S}}$ (ft^3/min)	Flow Range $\frac{\text{L}}{\text{S}}$ (ft^3/min)	Simulated Clean Filter DP Pa (Inches Water Gauge)	Clean Filter Flow $\frac{\text{L}}{\text{S}}$ (ft^3/min)	Simulated Dirty Filter DP PA (Inches Water Gauge)	Dirty Filter Flow $\frac{\text{L}}{\text{S}}$ (ft^3/min)
HVAC- ACT-1-NL	12851 (27253) (H-6- 13325, Rev. 0)	10854 to 14147 (23000 to 29978)	124 (0.50)	10883 (23064)	1000 (4.0)	10926 (23153)
HVAC- ACT-2-NL	10666 (22603) (H-6- 13325, Rev. 0)	9721.1 to 11733 (20600 to 24863)	187 (0.75)	9479.0 (20659)	1060 (4.25)	9763.6 (20690)
HVAC- ACT-1- NSL	11798 (25000) (H-6- 1732, Rev. 1)	10617 to 12977 (22500 to 27500)	391 (1.57)	11798 (25000)	1310 (5.28)	11662 (24713) (cor- rected)
HVAC- ACT-301- NSL	471.9 (1000) (H-6- 1732, Rev. 1)	424.7 to 519.1 (900 to 1100)	250 (1.0) (HEPA + Pre- Filter)	495.5 (1050)	750 (3.0) (HEPA + Pre- Filter)	424.7 (900)

Table 2.

Assembly	Allowable Penetration	Penetration
PV-F-1-NL	0.05	0.000
VAS-F-2-NL	0.05	0.006
VAS-F-3-NL	0.05	0.002
HVAC-ACT-1-NL	0.05	0.005
HVAC-ACT-2-NL	0.05	0.003
HVAC-ACT-1-NSL	0.05	0.011
HVAC-ACT-301-NSL	0.05	0.003

4.0 CONCLUSIONS AND RECOMMENDATIONS

The HEPA filter systems are ready for operation. Filter installation acceptance stickers have been attached to the filter housings.

While the current test is adequate, it is recommended that a study should be performed to evaluate options to obtain uniform air-aerosol mixing for HVAC-ACT-1-NSL. Refer to Section 3.0 for a discussion of the air-aerosol mixing test and benefits of uniform aerosol distribution.

5.0 REFERENCES

ASME N510-1989 Testing of Nuclear Air Treatment Systems, The American Society of Mechanical Engineers

APPENDIX A - TASK ORDER REQUISITION/DESCRIPTION

WSCF START-UP MASTER TRACKING LIST
TASK ORDER REQUISITION/DESCRIPTION

DATE: 7/25/94 OUTAGE REQUIRED: YES/NO START-UP PLATEAU: 1/2/3 DWG.#: _____
PROBLEM NO.: TOD-42 SYSTEM: NL/NSL EQUIPMENT NAME: _____

ORIGINATOR/PHONE NO.: M. C. PRATHER / 373-7172 COST ESTIMATE: \$ 5000
DISCIPLINE: (circle one) Civil/Structural Mechanical Electrical I&C Other

PROBLEM DESCRIPTION: Test NSL exh and inl HEPA filter systems. Test NL exh HEPA filter systems and vacuum HEPA systems.

SUGGESTED ACTION REQUIRED TO SOLVE PROBLEM: _____

See attached special instructions.

ACTION ASSIGNED TO: Proj DUE DATE: 7/31/94

WSCF APPROVALS: [Signature] / 7/25/94
Laboratory Engineering Date

R2 Brown / 7/25/94 Overtime Approval: Yes/No
WSCF Start-up Date

[Signature] / 7/25/94 TPCN YL5C9
Business Management Date

PROBLEM RESOLUTION: LEAD/PHONE NO.: _____ / _____ LOI/Work Pkg No. _____
RESOLUTION DESCRIPTION: _____

OUTAGE DURATION: None/Number of days _____ RETEST REQUIRED: Y/N RETEST COMPLETE: Y/N
COMMENTS: _____

COMPLETED: _____ ACCEPTED: _____
Lead Engineer Cognizant Engineer

Special Instructions for HEPA Testing

Martin Prather, 7/23/94

These are special instructions for testing the North Lab exhaust HEPA filter systems, North Lab vacuum system HEPA filter systems, and the NSL inlet and exhaust HEPA filter systems.

General:

- Add ports to ductwork as required.
- Perform tests per ASME N509 and N510.
- Provide test plan with procedures and catalog cuts on equipment prior to testing for review and approval.
- Provide test report after testing for review and approval. Include sketches identifying all flow measurement, injection, and sampling ports used.
- Visually inspect systems for access, housekeeping, damage, leakage, prior to each test.
- Use Emery 3004 aerosol.
- Bank fails test if aerosol penetration is greater than 0.05%.
- Remove grille faces if possible when injecting into exhaust grilles.
- For flow distribution tests, place plywood cover with hole for flow measurement device over pre-filter door opening.

NSL Exhaust HEPA Test:

- Include in test report results of airflow capacity and distribution test already performed, or repeat test. Minimum HEPA bank pressure is as-found pressure of existing clean filters. HEPA filter bank maximum dP is 4" WG. Test program airflow rate is 25000 CFM.
- Perform air-aerosol mixing test.
 - Use exhaust grille in instrument shop for aerosol injection (don't forget to identify exhaust grille on sketch in test report).

- Use sample ports identified on sketch below. These ports sample the center of each filter.

Sketch of Mixing Test Sample Ports - NSL Exhaust

- If any reading exceeds +/- 20% of calculated average, then repeat test using a different exhaust grille.
- Perform HEPA filter bank in-place test.
 - Test flow rate shall be 25000 CFM +/- 20%.
 - Inject using the exhaust grille used in air-aerosol mixing test.
 - Use one of the mixing test sample ports for baselining (don't forget to identify port on sketch in test report).
 - Add a sample port at approximately eye level in return duct in room S29 for single point downstream sample (do not test each filter separately).

NSL Inlet HEPA Test:

- Perform airflow capacity test (airflow distribution and air-aerosol mixing tests are not required for banks containing a single filter). Minimum HEPA bank pressure is as-found pressure of existing clean filter. Maximum HEPA bank pressure is 4" WG or pressure corresponding to 100% output of controller or pressure corresponding to 900 CFM, whichever is lower. Record maximum pressure. Test program airflow rate is 1000 CFM.
- Perform HEPA filter bank in-place test.
 - Test flow rate shall be 1000 CFM +/- 20%.

NL Exhaust HEPA Test:

- Include in test report results of airflow capacity test already performed, or repeat test. Minimum HEPA bank pressure is as-found pressure of existing clean filter. HEPA filter bank maximum dP is 4" WG. Test program airflow rate for EF-1 housing is 23000 to 29978 CFM. Test program airflow rate for EF-2 housing is 20600 to 24863 CFM.
- Perform airflow distribution test for each housing.
- Perform air-aerosol mixing test for each housing.
 - Inject at a single location upstream of each housing.

- Use sample ports between pre-filter bank and HEPA filter bank to sample the center of each filter. See sketch:

EF-1 HOUSING TEST SECTIONS

EF-2 HOUSING TEST SECTIONS

Sketch of Mixing Test Sample Ports - NL Exhaust

- If any reading exceeds +/- 20% of calculated average, then repeat test using a different injection location.
- Perform HEPA filter bank in-place test for each housing.
 - Test flow rate shall be 23000 to 29978 CFM for the EF-1 housing. Test flow rate shall be 20600 to 24863 CFM for the EF-2 housing.
 - Inject using the injection location used in air-aerosol mixing test.
 - Use one of the mixing test sample ports for baselining (don't forget to identify port on sketch in test report).
 - Add a sample port downstream of each fan (prior to any T) for the single point downstream sample (do not test each filter separately).

NL Vacuum System HEPA Test:

- Perform HEPA filter bank in-place test for each vacuum system HEPA (airflow capacity test, airflow distribution and air-aerosol mixing tests will not be performed).
- Test with flow through each filter. Test flow rate shall be as-measured. Record measured flow rate.

APPENDIX B - LETTER OF INSTRUCTION

Westinghouse
Hanford CompanyInternal
Memo

From: Effluent Treatment and Laboratory Projects 94W011H-45
 Phone: 372-3952 R3-35
 Date: July 26, 1994
 Subject: PROJECT W-011H, "WASTE SAMPLING AND CHARACTERIZATION FACILITY,"
 START-UP SUPPORT, LETTER OF INSTRUCTION NUMBER 34

To: G. C. Lengas E6-21

cc: R. L. Brown	S3-31	J. R. Kelly	R3-28
V. J. Chamberlain	S2-55	M. C. Prather	S3-31
K. A. Ealden	S3-31	J. L. Spahr	S3-30
J. M. Frank	S2-55	D. W. Wilson	S3-30
K. E. Hawk	S2-55	Project Files	R1-28
T. G. Howell	S3-30	JEW-File/LB	R3-35
D. P. Hughes	R3-35		

This memorandum transmits TOD-42 (attached). This requests the support of Northwest Air (through Roberts Construction), for services on July 29, 30, and 31, 1994 to assist in testing HEPA filters at the Waste Sampling and Characterization Facility. In addition, it will be necessary to have the work witnessed by ICF Kaiser Hanford Acceptance Inspection.

You are requested to determine the cost to have this effort performed and provide this information to the undersigned prior to close of business July 27, 1994 so that arrangements can be made to supplement Work Order ER4633 in the required amount prior to the start of the effort.

If there are any questions, please call me.

 J. E. Witherspoon
 Project Engineer

nw

Attachment

APPENDIX C - PROCEDURE

NORTHWEST AIR SYSTEMS, INC.

VOICE # 509-735-7129

FAX # 735-7399

TELEFAX COVER SHEET

TO:

WESTINGHOUSE HANFORD CO

ATT:

MARTIN PRATHER

TOTAL NUMBER OF PAGES: 10 INCLUDING COVER SHEET.

DATE:

7/29/94

SENDER:

JERRY ENSMINGER

NOTE:

- HEPA TEST PROCEDURE
- CAL CERT.

IF YOU DO NOT RECEIVE ALL PAGES, OR HAVE ANY QUESTIONS,

PLEASE CALL BACK AS SOON AS POSSIBLE.

WASTE SAMPLING AND CHARACTERIZATION FACILITY

KEH-5251

HEPA Filter In Place Test Procedure**1.0 Purpose and Scope**

This procedure is utilized to verify the acceptability of HEPA filter housings at the Waste Sampling and Characterization Facility (WSCF) in accordance with ASME N510. The filters to be tested are the Nuclear Spectroscopy Laboratory (NSL) exhaust filters, the NSL-AHU-3 Make Up Air Unit inlet filter, the North Labs (NL) exhaust filters, and the NL Vacuum System filters. Airflow capacity and distribution tests, air-aerosol mixing uniformity tests, and HEPA filter bank in-place tests will be performed as required. Results will be recorded on the attached data sheets and submitted to the cognizant engineer for review and approval. The filter banks may be tested in any order.

2.0 References**2.1 ASME N510: Testing of Nuclear Air Treatment Systems****3.0 Equipment and Materials**

- 3.1 Emery 3004 aerosol.
- 3.2 NUCON Model F-1000 Thermal Aerosol Generator or equivalent.
- 3.3 NUCON Model F-1000 Aerosol Detector or equivalent with calibration certificate.
- 3.4 Airflow measuring device with calibration certificates.

4.0 Additional Requirements

- 4.1 Add ports to ductwork as required to obtain samples.
- 4.2 Visually inspect systems for access, housekeeping, damage and leakage prior to each test. Record any problems on the data sheets provided.
- 4.3 Remove grille faces when injecting into exhaust grilles, if possible.
- 4.4 Follow all manufacturer's instructions regarding operation of test equipment.
- 4.5 The person in charge of the test shall be experienced in the operation of the equipment and knowledgeable in the conduct of the test.
- 4.6 Identify all injection and sample points used during the tests on a sketch to be included with the data sheets.
- 4.7 Provide labels for each filter housing tested and accepted. The labels will include the following information as a minimum: system ID, date, airflow, % penetration.

NSL EXHAUST HEPA TEST

- 1.0 The airflow capacity and distribution tests have previously been performed on this filter bank. The results of the test shall be included in this test report.
- 1.1 Establish the test flow rate of 25,000 cfm +/- 20%. Record on the test form.
- 2.0 Air-Aerosol Mixing Test
Use the exhaust grille in the NSL instrument shop for aerosol injection. Identify the locations used for injection and sampling on the system sketch. See the attached Sketch of Mixing Test Sample Ports - NSL Exhaust for port location and identification. These ports sample the center of each filter.
- 2.1 Record the sample results in the spaces provided on the sketch.
- 2.2 If any reading exceeds +/- 20% of the calculated average reading, repeat the test using a different exhaust grille. The test is acceptable when all readings are within +/- 20% of the calculated average reading. Show the actual injection location used on the system sketch.
- 3.0 HEPA Filter Bank In-Place Test.
- 3.1 Record the HEPA filter bank pressure drop.
- 3.2 Add a sample port in Room S29 for single point downstream sample.
- 3.3 Record the background particulate concentration upstream and downstream of the HEPA filter bank.
- 3.4 Connect the aerosol generator to the exhaust grille used for the mixing test.
- 3.5 Record the upstream concentration reading at a single mixing test sample port. Identify the port used on the sketch.
- 3.6 Record the downstream concentration reading at the sample port in Room S29.
- 3.7 Repeat steps 3.5 and 3.6 until readings are repeatable within +/- 5% of previous readings.
- 3.8 Calculate the penetration. $P = 100(D_s/U_s)$ where: P = penetration %
 D_s = downstream concentration
 U_s = upstream concentration
If the penetration is less than or equal to 0.05%, the filter bank passes the test.

NSL-AHU-3 MAKE UP AIR UNIT INLET HEPA TEST

- 1.0 Airflow Capacity Test
- 1.1 Measure and record the airflow and pressure drop in the "as found" condition. The allowable airflow is 1000 cfm +/- 10%. This satisfies the clean system airflow requirement.
- 1.2 Simulate a 4.0" w.g. pressure drop or the pressure corresponding to 900 cfm, whichever is lower. Record the airflow and pressure drop. The allowable airflow is 1000 cfm +/- 10%.
- 1.3 Remove the pressure drop simulation.
- 2.0 HEPA Filter Bank In-Place Test
- 2.1 Establish the test flow rate of 1,000 cfm +/- 20%. Record on the test form.
- 2.2 Record the HEPA filter bank pressure drop.
- 2.3 Connect the aerosol generator to the injection port on the filter housing.
- 2.4 Record the upstream and downstream particulate concentrations. Utilize the installed test ports on the filter housing and outlet duct.
- 2.5 Repeat step 2.4 until readings are repeatable within +/- 5% of previous readings.
- 2.6 Calculate the penetration. $P = 100(D_s/U_s)$ where: P = penetration %

Ds = downstream concentration

Us = upstream concentration

If the penetration is less than or equal to 0.05%, the filter bank passes the test.

NL EXHAUST HEPA TEST

- 1.0 The airflow capacity test has previously been performed on this filter bank. The results of the test shall be included in this test report.
 - 1.1 The combined systems test flow rate shall be greater than 43,600 cfm and less than 54,841 cfm. Measure and record the actual flow rate.
 - 1.2 Perform the following tests on EF-1 and the associated filter housing. Then repeat the steps for EF-2.
 - 2.0 Airflow Distribution Test
 - 2.1 Perform pitot traverse of housing by placing a plywood cover with hole over the prefilter door openings. Take measurements aligned to the center of each filter. Record results on a Rectangular Duct Traverse Report and include the form with this test report for record only.
 - 3.0 Air-Aerosol Mixing Test
 - 3.1 Select an injection location upstream of the housing that will provide adequate air mixing. Identify the locations used for injection and sampling on the system sketch. See the attached Sketch of Mixing Test Sample Ports - NL Exhaust for port location and identification. These ports sample the center of each filter.
 - 3.2 Record the sample results in the spaces provided on the sketch.
 - 3.3 If any reading exceeds +/- 20% of the calculated average reading, repeat the test using a different injection location. The test is acceptable when all readings are within +/- 20% of the calculated average reading. Show the actual injection location used on the system sketch.
 - 4.0 HEPA Filter Bank In-Place Test
 - 4.1 Record the HEPA filter bank pressure drop.
 - 4.2 Add a sample port downstream of the exhaust fan (prior to any tee) for single point downstream sample.
 - 4.3 Record the background particulate concentration upstream and downstream of the HEPA filter bank.
 - 4.4 Connect the aerosol generator to the same injection location used for the mixing test.
 - 4.5 Record the upstream concentration reading at a single mixing test sample port. Identify the port used on the sketch.
 - 4.6 Record the downstream concentration reading at the sample port downstream of the exhaust fan.
 - 4.7 Repeat steps 4.5 and 4.6 until readings are repeatable within +/- 5%.
 - 4.8 Calculate the penetration. $P = 100(D_s/U_s)$ where: P = penetration %
D_s = downstream concentration
U_s = upstream concentration
- If the penetration is less than or equal to 0.05%, the filter bank passes the test.

WMC-SD-WM-TRP-209, Rev. 0

NL VACUUM SYSTEM HEPA TEST

- 1.0 HEPA Filter Bank In-Place Test
- 1.1 Connect a portable air blower to the connection provided on the filter housing.
- 1.2 Record the air flow rate and HEPA filter pressure drop. Maximum airflow allowed for this test is 105 cfm.
- 1.3 Determine a suitable injection location .
- 1.4 Connect the aerosol generator to the injection location. Identify the location used on the sketch.
- 1.5 Record the upstream and downstream concentrations using the installed sample ports.
- 1.6 Repeat step 1.5 until readings are repeatable within +/- 5% of previous readings.
- 1.7 Calculate the penetration. $P = 100(D_s/U_s)$ where: P = penetration %

 D_s = downstream concentration U_s = upstream concentration

If the penetration is less than or equal to 0.05%, the filter bank passes the test.

WHC-SD-WM-TRP-209, Rev. 0

IN-PLACE FILTER TEST RECORD

FILTER BANK					
Differential Pressure					
Airflow (cfm):					
<p>This is to certify that the above named final HEPA filter bank has been successfully in-place tested, and has demonstrated a penetration of less than 0.05% at the specified flow and efficiency of greater than 99.95%.</p>					
% Penetration:			% Efficiency:		
Test No.1:			Test No.1:		
Test No.2:			Test No.2:		
Test No.3:			Test No.3:		
Remarks:					
Signature:			Date:		
Witness:			Date:		

WMC-SD-WM-TRP-209, Rev. 0

AIR-AEROSOL MIXING TEST SAMPLE PORTS

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

AIR
←
FLOW

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

AIR
→
FLOW

HOUSING: _____

1: _____

2: _____

3: _____

4: _____

5: _____

6: _____

7: _____

8: _____

9: _____

10: _____

11: _____

12: _____

Average: _____

HOUSING: _____

1: _____

2: _____

3: _____

4: _____

5: _____

6: _____

7: _____

8: _____

9: _____

10: _____

11: _____

12: _____

Average: _____

Insert values for air-aerosol mixing test above. Signature denotes acceptance of the test as satisfactory. All readings within 20% of the average.

Remarks:

Signature:

Date:

Witness:

Date:

accepted as satisfactory. Any discrep

ns: Donald R. Jussmurg

e: M.D. East

Date:

8/17/94

Owner Representative:

Date:

8-17-94

Comments:

WHC-SD-WM-TRP-209, Rev. 0

QA-67 (Rev.1 2/94)

Nuclear Consulting Services, Inc.

CALIBRATION CERTIFICATE

July 28, 1994

CLIENT: Northwest Air Systems
6951 West Grand Ridge Blvd.
Suite 209
Kennewick, WA.

NUCON PROJECT NO.: 12NF615
CLIENT PURCHASE ORDER NO.: 2902
RELEASE NO.: N/A

TEST EQUIPMENT

CALIBRATION STANDARDS

LOG NO.
EQUIP. TYPE

CALIBRATION DATE
CALIBRATION DUE

STANDARD & NIST NUMBER

L0779
Aerosol Detector

07/19/1994
11/19/1994

Ratio-Type self calibrating
device.

This is to certify that the above listed equipment has been calibrated traceable to the National Institute of Standards and Technology, has been derived from accepted values of natural physical constants, or has been derived by the ratio-type of self calibration technique and meets the requirements of MIL-STD-45662 and NUCON QA Manual 045 Revision 13.

BY:

Mark Preston

for Quality Assurance Dept.
Nuclear Consulting Services, Inc.

APPENDIX D - WORK PACKAGE 6D-94-00352/W J-1 AND J-4

*** RECORD COPY ***

*** RECORD COPY ***

=====J-1 WORK REQUEST (W110)=====

Page: 1

13:31:58 29 JUL 1994

1. Document Number 6D-94-00352/W GENERIC WORK ITEM
2. Work Item Title WSCF:STARTUP ACCEPT. TEST HEPA FILTERS IN 6266

=====

3. System HPA HIGH PURITY AIR

4. Components

Component Number

Name

Temporary Number

Name

VAS-F-2-NL

INLET HEPA FILTER

VAS-F-3-NL

INLET HEPA FILTER

PV-F-1-NL

INLET HEPA FILTER

HVAC-ACT-1-NL

FINAL HEPA FILTER

HVAC-ACT-2-NL

FINAL HEPA FILTER

HVAC-ACT-1A-NSL

HEPA FILTER

HVAC-ACT-1B-NSL

HEPA FILTER

HVAC-ACT-301-NSL

INLET HEPA FILTER

5. Location

Facility 6D WSCF

Bldg/Rm 6266

Other N/A

Other N/A

6. Associated Components

Component Number

Name

N/A

7. Originator Name MELOY,RT
- Telephone No. 373-7161

MSIN S3-31

Date Organization

07/28/94 8E710

8. Charge Code YL5R5

9. Work Item Description

PERFORM START-UP/ACCEPTANCE TEST OF BUILDING'S HEPA FILTER/
HOUSINGS.

10. Operations Review
11. Priority

Signature

X OLSON,BK

Date

07/29/94

12. Phase Designator N/A
13. Correct Maint. Assessment N
14. Personnel Safety Related N

15. Cognizant Engineer
16. Cognizant Manager

MELOY,RT

WILSON,DW

17. Reference Documents

Type

=====J-1 WORK REQUEST (W110)=====

*** RECORD COPY ***

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*** RECORD COPY ***

=====J-1 WORK REQUEST (W110)=====

Page: 2

13:31:58 29 JUL 1994

1. Document Number 6D-94-00352/W GENERIC WORK ITEM
 2. Work Item Title WSCF:STARTUP ACCEPT. TEST HEPA FILTERS IN 6266
- =====

18. Comments

=====

=====J-1 WORK REQUEST (W110)=====

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

=====J-4 RESOLUTION/RETEST (W140)=====

Page: 1

14:31:57 29 JUL 1994

1. Document Number 6D-94-00352/W GENERIC WORK ITEM
 Work Item Title WSCF:STARTUP ACCEPT. TEST HEPA FILTERS IN 6266

2. Essential Systems

3. Resolution
 SEE J-4A

4. Impact Level/Approval Designators 4-

5. Tech Spec/OSR Requirements/Reference

6. Reference Documents Type
 LO-161-447
 LO-161-452

7. Comments

8. Retest Requirement N

9. Mode

10. Retest

11. QC Involvement in Retest

12. PIC

13. PIC Org.

14. Resolution By Signature Date
 X MELOY,RT 07/29/94

15. Plant Forces Work Review Required Number

16. Approvals Signature Date
 Cognizant Engineer X MELOY,RT 07/29/94
 Cognizant Manager *[Signature]* 7/29/94
 Environmental Assurance N/A
 Health/Safety Assurance N/A
 Quality Assurance N/A
 Additional Approvals

17. Resources Required

Res Code	Description	No.	Est Hrs	Act Hrs
91	SYSTEM OR COG. ENGINEER	2	24	
	Chem Tech	1	24	

18. Field Work Complete

19. Retest Satisfactory

20. QC Verify Retest

=====J-4 RESOLUTION/RETEST (W140)=====

*** RECORD COPY ***

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*** RECORD COPY ***

*** RECORD COPY ***

=====J-4 RESOLUTION/RETEST (W140)=====

Page: 2

14:31:57 29 JUL 1994

1. Document Number 6D-94-00352/W GENERIC WORK ITEM
Work Item Title WSCF:STARTUP ACCEPT. TEST HEPA FILTERS IN 6266

=====

(If Required)

=====

=====J-4 RESOLUTION/RETEST (W140)=====

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

=====J-4a RESOLUTION/RETEST (W145)=====

Page: 1

(Cont.)

14:32:09 29 JUL 1994

1. Document Number 6D-94-00352/W *GENERIC WORK ITEM*
Work Item Title WSCF:STARTUP ACCEPT. TEST HEPA FILTERS IN 6266

=====

3. Resolution

Prerequisites:

Calibration certificates for airflow measuring device shall be provided before start of test.

Evidence that the person in charge of the test is experienced in operation of the equipment and knowledgeable in the conduct of the test shall be provided before start of test.

Perform HEPA filter testing per attached procedure.

ICF KH Acceptance Inspection (AI) shall monitor the test. When testing is completed, AI shall document acceptance of the completed test by signing below:

HEPA Filter Test Data:

MD Smith 18-17-94

Changes: In the event that a change is required at any step or series of steps during the testing, it shall be the responsibility of the test director, witnesses and inspector to document the change and reason on a test exception sheet. Exception sheets shall become part of the test report.

Configure systems for each HEPA test. Follow the following special instructions for the Process Vacuum and Vacuum Air Sampling systems.

To configure the Process Vacuum system for the test:

- 1 Start Process Vacuum system per Operating Procedure LO-161-447.
- 2 Close valves PV-V-102-NL and PV-V-103-NL.

Note: When valves PV-V-102-NL and PV-V-103-NL are closed, filter PV-F-1-NL is ready to be tested in accordance with Northwest Air Inc procedure titled "HEPA Filter In Place Test Procedure".

- 3 Partially open valve PV-V-103-NL as directed by filter test personnel to increase flow for test.

Note: Do not exceed 10" WG differential

=====J-4a RESOLUTION/RETEST (W145)=====

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

=====J-4a RESOLUTION/RETEST (W145)=====

Page: 2

(Cont.)

14:32:09 29 JUL 1994

1. Document Number 6D-94-00352/W GENERIC WORK ITEM
Work Item Title WSCF:STARTUP ACCEPT. TEST HEPA FILTERS IN 6266

pressure across filter.

4 Remove test equipment and close ports.

5 Restore system to as-found condition.

To configure the Vacuum Air Sampling system for the test:

1 Start Vacuum Air Sampling system per Ope
Procedure LO-161-452.

2 Close valves VAS-V-102-NL and VAS-V-104-NL.

Note: When valves VAS-V-102-NL and VAS-V-104-NL
are closed, filter VAS-F-2-NL is ready to be
tested in accordance with Northwest Air Inc
procedure titled "HEPA Filter In Place Test
Procedure".

3 Partially open valve VAS-V-104-NL as directed by
filter test personnel to increase flow for test.

Note: Do not exceed 10" WG differential
pressure across filter.

4 Remove test equipment and close ports.

5 Open valves VAS-V-102-NL and VAS-V-104-NL.

6 Close valves VAS-V-103-NL and VAS-V-105-NL.

Note: When valves VAS-V-103-NL and VAS-V-105-NL
are closed, filter VAS-F-3-NL is ready to be
tested in accordance with Northwest Air Inc
procedure titled "HEPA Filter In Place Test
Procedure".

7 Partially open valve VAS-V-105-NL as directed by
filter test personnel to increase flow for test.

Note: Do not exceed 10" WG differential
pressure across filter.

8 Remove test equipment and close ports.

9 Restore system to as-found condition.

Attachments:

=====J-4a RESOLUTION/RETEST (W145)=====

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

*** RECORD COPY ***

=====J-4a RESOLUTION/RETEST (W145)=====

Page: 3

(Cont.)

14:32:09 29 JUL 1994

1. Document Number 6D-94-00352/W GENERIC WORK ITEM

Work Item Title WSCF:STARTUP ACCEPT. TEST HEPA FILTERS IN 6266

=====

- 1) Page 1 of Internal Memo 94W011H-45, J. E. Witherspoon to G. C. Lengas, "Waste Sampling and Characterization Facility, Start-Up Support, Letter of Instruction Number 34," dated 7/26/94
- 2) HEPA Filter In Place Test Procedure
- 3) Calibration Certificate for Aerosol Detector.
- 4) Test Exception Sheet

=====

=====J-4a RESOLUTION/RETEST (W145)=====

*** RECORD COPY ***

*** RECORD COPY ***

EXCEPTION SHEET

Exception No. _____

Section No. _____ Requirement _____

Statement of Required Revision _____

Approval and Acceptance

Test Director

Witness

ICF KH Acceptance Insp

APPENDIX E - TEST RESULTS

Appendix E contents:	Page
1. Copies of acceptance stickers for HVAC-ACT-1-NSL, PV-F-1-NL, VAS-F-2-NL, VAS-F-3-NL, HVAC-ACT-301-NSL, HVAC-ACT-1,2-NL.	E-3
2. HEPA filter bank in-place test data sheet: HVAC-ACT-1-NSL.	E-5
3. Air-aerosol mixing uniformity test data sheet: HVAC-ACT-1-NSL.	E-6
4. Rectangular duct traverse report: NSL-AHU-1 return duct.	E-7
5. HEPA filter bank in-place test/air-aerosol mixing uniformity test system diagram: HVAC-ACT-1-NSL.	E-8
6. HEPA filter bank in-place test and airflow capacity test data sheet: HVAC-ACT-301-NSL (NSL-AHU-3 inlet).	E-9
7. HEPA filter bank in-place test system diagram: HVAC-ACT-301-NSL (NSL-AHU-3 inlet).	E-10
8. HEPA filter bank in-place test data sheet: ACT-1 North Lab.	E-11
9. Air-aerosol mixing uniformity test data sheet: ACT-1 North Lab.	E-12
10. HEPA filter bank in-place test data sheet: ACT-2 North Lab.	E-13
11. Air-aerosol mixing uniformity test data sheet: ACT-2 North Lab.	E-14
12. Airflow distribution test data sheet: ACT-1 North Lab.	E-15
13. Airflow distribution test data sheet: ACT-2 North Lab.	E-16
14. Round duct traverse report: EF-1 exhaust duct.	E-17
15. Round duct traverse report: EF-2 exhaust duct.	E-18
16. Round duct traverse report: Lab Room N-29 exhaust duct.	E-19
17. HEPA filter bank in-place test/air-aerosol mixing uniformity test system diagram: ACT-1, ACT-2 North Lab.	E-20
18. HEPA filter bank in-place test data sheet: PV-F-1-NL.	E-21
19. HEPA filter bank in-place test system diagram: PV-F-1-NL.	E-22
20. HEPA filter bank in-place test data sheet: VAS-F-2-NL.	E-23
21. HEPA filter bank in-place test system diagram: VAS-F-2-NL.	E-24
22. HEPA filter bank in-place test data sheet: VAS-F-3-NL.	E-25

23.	HEPA filter bank in-place test system diagram: VAS-F-3-NL.	E-26
24.	Airflow capacity test results: ACT-1, ACT-2 North Lab. Results from WHC-SD-W011H-TP-002, Draft, 8/15/94.	E-27
25.	Airflow capacity test results: HVAC-ACT-1-NSL. Results from Work Package 6D-94-00250, as of 8/15/94.	E-34
26.	Airflow distribution test results: HVAC-ACT-1-NSL. Results from Work Package 6D-94-00250, as of 8/15/94.	E-37
26.	Certificates of calibration.	E-38
27.	Course completion records of person in charge of test.	E-40
28.	Exception No. 1	E-42

ACCEPTED

DATE

8-8-94

SYSTEM I.D.

11410-ACT-201-NSI

AIRFLOW CFM

1050

% PENETRATION

0.00%

TESTED BY

M. RICHARDSON

THIS CERTIFICATION IS VALID FOR THIS
FILTER INSTALLTION ONLY. IF THE FILTER
SEAL IS DISRUPTED, CERTIFICATION IS
INVALIDATED.

NORTHWEST AIR SYSTEMS, INC.
P.O. BOX 5481
6951 W. GRANDRIDGE BLVD.
KENNEWICK WA 99336
(509) 735-7129

ACCEPTED

DATE

8-4-94

SYSTEM I.D.

11410-ACT-2-1NL

AIRFLOW CFM

% PENETRATION

0.00%

TESTED BY

M. RICHARDSON

THIS CERTIFICATION IS VALID FOR THIS
FILTER INSTALLTION ONLY. IF THE FILTER
SEAL IS DISRUPTED, CERTIFICATION IS
INVALIDATED.

NORTHWEST AIR SYSTEMS, INC.
P.O. BOX 5481
6951 W. GRANDRIDGE BLVD.
KENNEWICK WA 99336
(509) 735-7129

ACCEPTED

DATE

8-4-94

SYSTEM I.D.

11410-ACT-2-1NL

AIRFLOW CFM

% PENETRATION

0.00%

TESTED BY

M. RICHARDSON

THIS CERTIFICATION IS VALID FOR THIS
FILTER INSTALLTION ONLY. IF THE FILTER
SEAL IS DISRUPTED, CERTIFICATION IS
INVALIDATED.

NORTHWEST AIR SYSTEMS, INC.
P.O. BOX 5481
6951 W. GRANDRIDGE BLVD.
KENNEWICK WA 99336
(509) 735-7129

NORTHWEST AIR SYSTEMS, INC.
P.O. BOX 5481
6951 W. GRANDRIDGE BLVD
KENNEWICK, WA 99336
(509) 735-7129

THIS CERTIFICATION IS VALID FOR THIS
FILTER INSTALLATION ONLY. IF THE FILTER
SEAL IS DISRUPTED, CERTIFICATION IS
INVALIDATED.

TESTED BY M. RICHARDSON

% PENETRATION 0.006

AIRFLOW CFM 76

SYSTEM ID VAS-E-2-N

DATE 8-3-94

ACCEPTED

NORTHWEST AIR SYSTEMS, INC.
P.O. BOX 5481
6951 W. GRANDRIDGE BLVD
KENNEWICK, WA 99336
(509) 735-7129

THIS CERTIFICATION IS VALID FOR THIS
FILTER INSTALLATION ONLY. IF THE FILTER
SEAL IS DISRUPTED, CERTIFICATION IS
INVALIDATED.

TESTED BY M. RICHARDSON

% PENETRATION 0.002

AIRFLOW CFM 94

SYSTEM ID VAS-E-3-N

DATE 8-3-94

ACCEPTED

NORTHWEST AIR SYSTEMS, INC.
P.O. BOX 5481
6951 W. GRANDRIDGE BLVD
KENNEWICK, WA 99336
(509) 735-7129

THIS CERTIFICATION IS VALID FOR THIS
FILTER INSTALLATION ONLY. IF THE FILTER
SEAL IS DISRUPTED, CERTIFICATION IS
INVALIDATED.

TESTED BY M. RICHARDSON

% PENETRATION 0

AIRFLOW CFM 74

SYSTEM ID PV-E-1-N

DATE 8-3-94

ACCEPTED

NORTHWEST AIR SYSTEMS, INC.
P.O. BOX 5481
6951 W. GRANDRIDGE BLVD
KENNEWICK, WA 99336
(509) 735-7129

THIS CERTIFICATION IS VALID FOR THIS
FILTER INSTALLATION ONLY. IF THE FILTER
SEAL IS DISRUPTED, CERTIFICATION IS
INVALIDATED.

TESTED BY M. RICHARDSON

% PENETRATION 0.011

AIRFLOW CFM 24370

SYSTEM ID WAF-M-E-1-N

DATE 8-3-94

ACCEPTED

E-5

AIR-AEROSOL MIXING TEST SAMPLE PORTS

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

AIR
FLOW

AIR
FLOW

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

HOUSING: HVAC-ACT-1B-NSL

1: 90
2: 105 *
3: 105 *
4: 40 *
5: 65
6: 105 *
7: 57 *
8: 70
9: 80
10: 68
11: 67
12: 65
Average: 76.9

SAC

HOUSING: HVAC-ACT-1A-NSL

1: 100 *
2: 70
3: 60 *
4: 105 *
5: 85
6: 67
7: 80
8: 78
9: 75
10: 70
11: 70
12: 69

Average: 76.9 (OF 24 READINGS)

AVERAGE + 20% = 92.3%

AVERAGE - 20% = 61.5%

Insert values for air-aerosol mixing test above. Signature denotes acceptance of the test as satisfactory. All readings within 20% of the average. (SEE EXCEPTION #1)

Remarks: * READINGS OUTSIDE OF 20% OF AVERAGE.
TOP 12 PREFILTERS ON BOTH HOUSINGS WERE CHANGED TO CLEAN FILTERS PRIOR TO THE TEST.

Signature: *Walter Plutemba*

Date: 8-8-94

Witness: *MD. Hunt*

Date: 8-8-94

TAB 6-93

RECTANGULAR DUCT
TRAVERSE REPORT

PROJECT: WSCF
LOCATION/ZONE: MAIN RETURN
ALTITUDE: DENSITY:

SYSTEM/UNIT: NSL-AHU-1 RETURN
SERVICE:
CORR. FACTOR:

DUCT			REQUIRED		ACTUAL	
S.P. -2.69	Air Temp	deg F(C)	SCFM (sL/s)		SCFM (sL/s)	
Size: Width	48"		CFM(L/s) =		CFM(L/s) 24,370	
Length	36"	Area 12.0 ft ²	FPM (m/s) =		FPM(m/s)	

DISTANCE FROM BOTTOM	POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2070	2190	2150	2040	2330	2290	1830						
	2	2250	2050	2130	2170	2360	2240	2250						
	3	2350	2120	1980	1930	2100	2140	2060						
	4	1970	1940	1960	1760	2130	2110	1800						
	5	1970	1880	2100	1800	2150	2100	2150						
	6	1760	1640	1750	1520	1960	1870	1900						
	7													
	8													
	9													
	10													
	11													
	12													
	13													
DISTANCE FROM DUCT EDGE														
VELOCITY		12410	11820	12070	11220	13030	12750	11990						
SUB-TOTALS														

Note: Take readings with air blowing toward the observer.

Velocity Total = 85290
No. of Points 42
Avg. 2030 · 12 ft²

REMARKS:

TEST DATE: AUGUST 8, 1994

READINGS BY:

24368.5

TAB6-93.WKS

E-7

PROJECT WSCFSYSTEM HVAC-ACT-1A/1B - NSL

LOCATION _____

DATE 8/8/94

Waste Sampling and Characterization Facility
NSL Basement Level HVAC Plan

IN-PLACE FILTER TEST RECORD

FILTER BANK	HVAC - ACT-301-NSL (NSL-AHU-3 INLET)		
Differential Pressure	1.0" W.C.		
Airflow (cfm):	1050		
This is to certify that the above named final HEPA filter bank has been successfully in-place tested, and has demonstrated a penetration of less than 0.05% at the specified flow and efficiency of greater than 99.95%.			
% Penetration:		% Efficiency:	
Test No.1:	0.002	Test No.1:	99.998
Test No.2:	0.003	Test No.2:	99.997
Test No.3:	0.002	Test No.3:	99.998
Remarks:	AIRFLOW CAPACITY: CLEAN 1050 cfm @ 1.0" ACT AP DIRTY: 900 cfm @ 3.0" ACT AP		
Signature:			Date: 8-8-94
Witness:			Date: 8-8-94

PROJECT WSCF SYSTEM HVAC-ACT-301-NSL (NSL-AHU-3 INLET)
LOCATION _____ DATE 8/8/94

NOTE: AIRFLOW MEASURED WITH FLOW HOOD AT OUTSIDE AIR INTAKE OPENING

IN-PLACE FILTER TEST RECORD

FILTER BANK	ACT-1	NORTH LABS - WSCF
Differential Pressure	0.55	
Airflow (cfm):	44689	TOTAL SYSTEM AIR FLOW
This is to certify that the above named final HEPA filter bank has been successfully in-place tested, and has demonstrated a penetration of less than 0.05% at the specified flow and efficiency of greater than 99.95%.		
% Penetration:		% Efficiency:
Test No.1:	0.002	Test No.1: 99.998
Test No.2:	0.001	Test No.2: 99.999
Test No.3:	0.005	Test No.3: 99.995
Remarks:		
UPSTREAM BACKGROUND READING = 0.002		
DOWNSTREAM BACKGROUND READING = 0.001		
USED PORT 2 ^{1A} 1B ^{1A} FOR UPSTREAM SAMPLE		
1A-8		
Signature:	<i>Michael R. Sullivan</i>	Date: 8-4-94
Witness:	<i>MD R. J.</i>	Date: 8-4-94

AIR-AEROSOL MIXING TEST SAMPLE PORTS

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

AIR
←
FLOW

AIR
→
FLOW

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

NORTH LABS - WSCF -

HOUSING: ACT-1B

1: 70
2: 68
3: 69
4: 77
5: 76
6: 74
7: 75
8: 70
9: 72
10: 64
11: 74
12: 70

Average: 70

NORTH LABS

HOUSING: ACT-1A

1: 70
2: 70
3: 71
4: 72
5: 73
6: 70
7: 69
8: 73
9: 72
10: 73
11: 72
12: 71

Average: 71.46 (OF 24 READINGS)

Insert values for air-aerosol mixing test above. Signature denotes acceptance of the test. as satisfactory. All readings within 20% of the average.

Remarks:

Signature: Walter Kukulski

Date: 8-4-94

Witness: MD. L. J.

Date: 8-4-94

IN-PLACE FILTER TEST RECORD

FILTER BANK	ACT-2 - NORTH LABS - WSCF		
Differential Pressure	0.70" W.G.		
Airflow (cfm):	44689 cfm TOTAL SYSTEM AIR FLOW		
This is to certify that the above named final HEPA filter bank has been successfully in-place tested, and has demonstrated a penetration of less than 0.05% at the specified flow and efficiency of greater than 99.95%.			
% Penetration:	% Efficiency:		
Test No.1: 0.002	Test No.1: 99.998		
Test No.2: 0.003	Test No.2: 99.997		
Test No.3: 0.002	Test No.3: 99.998		
Remarks:			
UPSTREAM BACKGROUND READING: 0.002			
DOWNSTREAM BACKGROUND READING: 0.001			
USED PORT 2A-8 FOR UPSTREAM READING			
Signature:	[Signature]		Date: 8-4-94
Witness:	[Signature]		Date: 8-4-94

AIR-AEROSOL MIXING TEST SAMPLE PORTS

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

AIR
Flow

AIR
Flow

Upstream Sample Ports

0	0	0
1	2	3
0	0	0
4	5	6
0	0	0
7	8	9
0	0	0
10	11	12

NORTH LABS-WSCF

HOUSING:

ACT-2B

1: 59
2: 57
3: 55
4: 56
5: 53
6: 55
7: 56
8: 58
9: 58
10: 60
11: 59
12: 59

Average:

50%

HOUSING:

ACT-2A

1: 60
2: 63
3: 60
4: 58
5: 55
6: 55
7: 58
8: 60
9: 58
10: 66
11: 66
12: 60

Average:

58.5 (OF 24 READINGS)

Insert values for air-aerosol mixing test above. Signature denotes acceptance of the test. as satisfactory. All readings within 20% of the average.

Remarks:

Signature:

M. K. R.

Date:

8-4-94

Witness:

M. K. R.

Date:

8-4-94

Northwest Air Systems, Inc.

TAB 6-93

RECTANGULAR DUCT
TRAVERSE REPORT

PROJECT: WSCF
 LOCATION/ZONE: NORTH LABS
 ALTITUDE: DENSITY:

SYSTEM/UNIT: ACT-1
 SERVICE: EXHAUST - AIR UNIFORMITY TEST
 CORR. FACTOR:

DUCT			REQUIRED		ACTUAL	
S.P.	Air Temp	deg F(C)	SCFM (sL/s)		SCFM (sL/s)	
Size: Width			FPM (m/s) =		FPM (m/s)	
Length	Area		CFM(L/s) =		CFM(L/s)	

DISTANCE FROM BOTTOM	POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13
105"	1	0	0	400		100	0	200						
75"	2	375	550	1600		800	0	0						
45"	3	0	200	700*		500	225	340						
15"	4	475	200	250		240	0	240						
	5													
	6													
	7													
	8													
	9													
	10													
	11													
	12													
	13													
DISTANCE FROM DUCT EDGE		17"	40"	60"		60"	40"	17"						
VELOCITY														
SUB-TOTALS														

Note: Take readings with air blowing toward the observer.

Velocity Total =
 No. of Points
 Avg.

REMARKS: * READING VARIED FROM 300 fpm to 1800 fpm - TOP OF FILTER = 1800 fpm
 BOTTOM OF FILTER = 300 fpm
 READINGS TAKEN AT PREFILTER ACCESS DOORS - UPSTREAM OF PREFILTERS

TEST DATE: 8-1-94
 8-1-94

READINGS BY:

TAB6-93.WKS

E-15

Northwest Air Systems, Inc.

TAB 6-93

RECTANGULAR DUCT
TRAVERSE REPORT

PROJECT: *WSCF*
 LOCATION/ZONE: *NORTH LABS*
 ALTITUDE: DENSITY:

SYSTEM/UNIT: *ACT-2*
 SERVICE: *EXHAUST - AIR UNIFORMITY TEST*
 CORR. FACTOR:

DUCT			REQUIRED		ACTUAL	
S.P.	Air Temp	deg F(C)	SCFM (sL/s)		SCFM (sL/s)	
Size: Width			CFM(L/s) =		CFM(L/s)	
Length	Area		FPM (m/s) =		FPM(m/s)	

DISTANCE FROM BOTTOM	POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13
105"	1	200**	0	1850		0	0	0						
75"	2	0*	0	1350		800	750	560						
45"	3	0	630	1700		950	450	0						
15"	4	400	0	420		0	600	200						
	5													
	6													
	7													
	8													
	9													
	10													
	11													
	12													
	13													
DISTANCE FROM DUCT EDGE		17"	40"	60"		60"	40"	17"						
VELOCITY														
SUB-TOTALS														

Note: Take readings with air blowing toward the observer.

Velocity Total =
 No. of Points
 Avg.

REMARKS: * - Read VELOCITY PRESSURE VARYING FROM $-0.02"$ TO $-0.06"$ ** - VELOCITY PRESS. VARIES FROM $-0.01"$ TO $+0.10"$

READINGS TAKEN AT PREFILTER ACCESS DOORS - UPSTREAM OF PREFILTERS

TEST DATE: *8/1/94*
8/1/94

READINGS BY:

Jimmy Cunningham
Jeff Munday

TAB6-93.WKS

ROUND DUCT TRAVERSE REPORT

WHC-SD-WM-TRP-209, Rev. 0

1385-144

PROJECT WSCF SYSTEM/UNIT Ex. 42" Ø EF-1
LOCATION/ZONE MAIN EXHAUST ACTUAL AIR TEMP. _____ DUCT S.P. 3.47

DUCT		REQUIRED		ACTUAL	
SIZE <u>42" Ø</u>	SQ. FT. <u>9.62</u>	FPM _____	CFM _____	FPM <u>2216</u>	CFM <u>21320</u>

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

2282
21320
21087
44689 cfm
TOTAL

TEST DATE 8-3-94 READINGS BY [Signature]Sheet Metal & Air Conditioning Contractors
National Association

TAB 8-82

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ROUND DUCT TRAVERSE REPORT

WHC-SD-WM-TRP-209, Rev. 0

PROJECT WSCF SYSTEM/UNIT EX 38" Ø EF-2
LOCATION/ZONE MAIN EXH ACTUAL AIR TEMP. _____ DUCT S.P. 3.35

DUCT		REQUIRED		ACTUAL	
SIZE	<u>38"</u>	SQ. FT.	<u>7.876</u>	FPM	<u>2677.5</u>
				CFM	<u>21087</u>

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

TEST DATE 8-3-94 READINGS BY [Signature]

Sheet Metal & Air Conditioning Contractors
National Association

TAB 8-82

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10.12

ROUND DUCT TRAVERSE REPORT

WHC-SD-WM-TRP-209, Rev. 0

PROJECT WSCF SYSTEM/UNIT N-29 Exhaust
LOCATION/ZONE MAIN N29 ACTUAL AIR TEMP. _____ DUCT S.P. _____

DUCT		REQUIRED		ACTUAL	
SIZE	<u>16" Ø</u>	SQ. FT.	<u>1.396</u>	FPM	CFM
				FPM	CFM <u>2282</u>

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

TEST DATE 8-3-94 READINGS BY [Signature]

Sheet Metal & Air Conditioning Contractors
National Association

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10.12

PROJECT WASTE SAMPLING & CHARACTERIZATION FACILITY NORTH LABS ACT-1/ACT-2
LOCATION 600 AREA, HANFORD, BUILDING 6266 DATE 8/4/94

PROJECT WSCF SYSTEM PV-F-I-NL
LOCATION NORTH LABS - N30 DATE 8-3-94

IN-PLACE FILTER TEST RECORD

FILTER BANK	VAS-F-2-NL		
Differential Pressure	0.83" W.G.		
Airflow (cfm):	3500 $\frac{\text{cfm}}{\text{ft}^2} = 76 \text{ CFM}$		
This is to certify that the above named final HEPA filter bank has been successfully in-place tested, and has demonstrated a penetration of less than 0.05% at the specified flow and efficiency of greater than 99.95%.			
% Penetration:		% Efficiency:	
Test No.1:	.006%	Test No.1:	99.994%
Test No.2:	.005%	Test No.2:	99.995%
Test No.3:	.006%	Test No.3:	99.994%
Remarks:			
Signature: <i>M. J. [Signature]</i>		Date: 8-3-94	
Witness: <i>M. D. [Signature]</i>		Date: 8-5-94

PROJECT WSCF SYSTEM VAS-F-2-NL
LOCATION NORTH LABS - N30 DATE 8-3-94

IN-PLACE FILTER TEST RECORD

FILTER BANK	VAS-F-3-NL		
Differential Pressure	0.86" W.G.		
Airflow (cfm):	4300 fpm = 94 CFM		
This is to certify that the above named final HEPA filter bank has been successfully in-place tested, and has demonstrated a penetration of less than 0.05% at the specified flow and efficiency of greater than 99.95%.			
% Penetration:		% Efficiency:	
Test No.1:	.001 %	Test No.1:	99.999 %
Test No.2:	.002 %	Test No.2:	99.998 %
Test No.3:	.002 %	Test No.3:	99.998 %
Remarks:			
Signature: <i>Walter Bulgheroni</i>		Date: 8-3-94	
Witness: <i>M.D. Hunt</i>		Date: 8-3-94

PROJECT WSCE SYSTEM VAS-F-3-NL
LOCATION NORTH LABS - N30 DATE 8-3-94

PROJECT WSCF SYSTEM NORTH L.A.S. SUPPLY AND EXHAUST
LOCATION _____ DATE 7/16/94

100% FLOW

CLEAN FILTERS

ACTAP=0.50" EF-1: 23064
ACTAP=0.75" EF-2: 20659
43,723

AHU-1: 22003 FILTER DP=0.85"
AHU-2: 20755 FILTER DP=0.85"
42,758

DIRTY FILTERS

ACTAP=4.0" EF-1: 23153
ACTAP=4.25" EF-2: 20690
43,843

AHU-1: 22225 FILTER DP=1.9"
AHU-2: 20180 FILTER DP=2.02
42,405

PROJECT KEH5251 WSCF SYSTEM/UNIT EF-1LOCATION/ZONE _____ ACTUAL AIR TEMP. _____ DUCT S.P. 3.62

SIZE <u>42^H</u>	DUCT <u>9.621</u>	REQUIRED	ACTUAL
SQ. FT. _____	FPM _____	CFM <u>27253</u>	FPM <u>2165</u> CFM <u>20829</u>

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

TEST w/ Pressure Drop Renoted

MUST ADD N29 EXHAUST FLOW: 2235
20829

100% FLOW

23064

EF1 - TOTAL

TEST DATE 7/15/94READINGS BY PJC

PROJECT KEH5251: WSCF SYSTEM/UNIT N-29 EXHAUST
 LOCATION/ZONE _____ ACTUAL AIR TEMP. _____ DUCT S.P. 1.07

SIZE <u>16" Ø</u>	DUCT SQ. FT. <u>1.396</u>	FPM <u>1636</u>	REQUIRED CFM <u>2284</u>	FPM <u>1601</u>	ACTUAL CFM <u>2235</u>
-------------------	---------------------------	-----------------	--------------------------	-----------------	------------------------

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS: Test w/ pressure
Dmp removed
100% Flow

TEST DATE 7/15/94 READINGS BY ABC

PROJECT KEH5251: WSCF SYSTEM/UNIT EF-2
LOCATION/ZONE MAIN EXHAUST ACTUAL AIR TEMP. _____ DUCT S.P. 3.35

DUCT		REQUIRED		ACTUAL	
SIZE <u>38" Ø</u>	SQ. FT. <u>7.87</u>	FPM <u>2872</u>	CFM <u>22603</u>	FPM <u>2625</u>	CFM <u>20659</u>

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

TEST W/ pressure Drop Removed
100% Flow

TEST DATE 7/15/94 READINGS BY _____

PROJECT KEH 2521: WSCF SYSTEM/UNIT EF-1
LOCATION/ZONE MAIN EXHAUST ACTUAL AIR TEMP. _____ DUCT S.P. 3.60

SIZE <u>42" Ø</u>	DUCT SQ. FT. <u>9.621</u>	REQUIRED FPM _____ CFM <u>27253</u>	ACTUAL FPM _____ CFM <u>20916</u>
-------------------	---------------------------	-------------------------------------	-----------------------------------

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

Must add N-29 Exhaust Flow: 2237
MAIN: 20916
EF-1 Total: 23153

TEST DATE 7/15/94 READINGS BY JE/CC

Sheet Metal & Air Conditioning Contractors
National Association

PAGE _____ OF _____

PROJECT KEH5251: WSCF SYSTEM/UNIT EF-2
LOCATION/ZONE MAIN Exhaust ACTUAL AIR TEMP. _____ DUCT S.P. 3.42

SIZE <u>38"Ø</u>	DUCT SQ. FT. <u>7.87</u>	REQUIRED FPM <u>2872</u>	CFM <u>22603</u>	ACTUAL FPM _____	CFM <u>20690</u>
------------------	--------------------------	--------------------------	------------------	------------------	------------------

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

TEST DATE

7/15/94

READINGS BY

JE/CCSheet Metal & Air Conditioning Contractors
National Association

PAGE _____ OF _____

PROJECT KEH5251: WSCF SYSTEM/UNIT N-29 EXHAUST
LOCATION/ZONE _____ ACTUAL AIR TEMP. _____ DUCT S.P. 1.05

SIZE <u>16" Ø</u>	DUCT SQ. FT. <u>1.396</u>	REQUIRED FPM <u>1636</u>	REQUIRED CFM <u>2284</u>	ACTUAL FPM <u>1603</u>	ACTUAL CFM <u>2237</u>
-------------------	---------------------------	--------------------------	--------------------------	------------------------	------------------------

(SEE REVERSE SIDE FOR INSTRUCTIONS)

REMARKS:

TEST DATE 7/15/94 READINGS BY JE/CC

Sheet Metal & Air Conditioning Contractors
National Association

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NSL Flow Capacity Test

Work Package 6D-94-00250/K

Purpose: The purpose of this test was to demonstrate that the NSL ventilation systems (HVAC-AHU-1-NSL and HVAC-AHU-2-NSL) can maintain operating flows and zone differential pressures under both clean and simulated dirty filter conditions.

Note: This document was developed after the actual testing was performed. As the test proceeded, problems with the ventilation systems were identified and the test method was modified to provide additional data.

Method: Loaded filter conditions were simulated by adjusting the isolation dampers located downstream of the filter housing towards the closed position. The high pressure leg to pressure switch HVAC-PDI-103-NSL was disconnected and attached to a calibrated micro-manometer. The low leg of the manometer was attached to tubing which was inserted into a flow test port located downstream of flow element HVAC-FE-103-NSL. The measurement obtained included pressure drop from pre-filters, HEPA filters, housing exit losses, duct losses and pressure drop through the flow element. At design flow (25000 cfm) the combined pressure drop across the pre-filters and HEPAs was 1" wg. It was assumed the pre-filters represented an initial pressure drop of 0.25" wg and the HEPAs 0.75 "wg.

A. ESTABLISH HVAC-AHU-1-NSL BASELINE INFORMATION

1. Modify controller setpoint to achieve design flowrate (25000 cfm).

Note: The flow transmitter HVAC-FT-103-NSL does not reflect actual flow conditions. Flowrate is greater than the displayed amount. NorthWest Air determined 25000 cfm actual can be obtained with a displayed flowrate of approximately 23000 cfm. Therefore, the controller setpoint was adjusted to 23000 cfm for this test.

2. After the control loop is stable and at setpoint read the pressure drop across the filters for HVAC-ACT-1A-NSL and HVAC-ACT-1B-NSL.

$$\frac{0.95''}{0.95''} \text{ " wg}$$

3. Disconnect the high leg to pressure switch HVAC-PDI-103-NSL and attach to micro-manometer. Attach low leg of manometer to tubing and insert into any flow test port located downstream of the flow element.
4. Measure and Record the pressure under normal operating conditions (clean filters with HVAC-AHU-1-NSL running, ADM ventilation system was also running.)

$$\frac{1.57}{1.57} \text{ " wg}$$

B. SIMULATE FILTER DP OF APPROXIMATELY 3" WG

1. Temporarily disconnect the damper linkages to damper actuators HVAC-DZ-105-NSL and HVAC-DZ-106-NSL. Manually position the dampers towards the closed position. Each damper should be placed in approximately same position. Lock dampers in the test position and record total pressure drop.

4.08 " wg

2. After control system stabilizes to setpoint print NSL Standard Summary.

C. SIMULATE FILTER DP OF APPROXIMATELY 4.5" WG

1. Reposition the damper linkage to damper actuators HVAC-DZ-105-NSL and HVAC-DZ-106-NSL to achieve required test pressure. Manually position the dampers further towards the closed position. Each damper should be placed in approximately same position. Lock dampers in the test position and record total pressure drop.

5.28 " wg

2. After control system stabilizes to setpoint print NSL Standard Summary.

Note: To shorten the time between tests, I overrode automatic control and manually controlled damper position until setpoints were achieved.

3. Return damper linkage to the isolation dampers to the original position "OPEN".

D. ESTABLISH HVAC-AHU-2-NSL BASELINE DATA

1. To start AHU-2, software override SF STAT and RF STAT to the AHU-1 ventilation system. This will cause AHU-1 to stop. After the required time delays are satisfied, AHU-2 will start.
2. Print the NSL standard Summary.

Note: The results of the standard summary were unexpected. NSL zone pressure was positive. After inspection of AHU-2 we discovered the damper linkage to the exhaust damper was not working properly (damper would not OPEN). Damper was manually forced OPEN to its predetermined position. A second Standard summary was printed.

3. Allow the HVAC-AHU-2-NSL ventilation system to operate for 12 hours to determine resulting zone pressure.
4. Print the Standard Summaries for both the ADM and NSL systems.

Note: After reviewing system parameters, we discovered operating HVAC-AHU-2-NSL impacted the operation of HVAC-AHU-1-ADM.

Standard Summary
Requested from: NSL\PC-1

Initial Pressure Drop 4.08"wg.
Total Pressure Drop 5.28"wg

06/16/94 14:18:22 Page 1

System: NSL\NSLAHU-1

Status	Item	Description	Value	Units
	RET-TEMP	Temperature Alarm Point	72.9	DEG F
	SFSTAT	NSL Supply Fan Status	ON	
	RFSTAT	NSL Return Fan Status	ON	
	AHU3STAT	AHU-3 Fan Status	ON	
	RETURN	Return Air & Setpnt CS	72.9	F
	RET-SP	Return Air Setpoint	74.0	F
	AHU3-SS	AHU-3 START/STOP	ON	
	SFAN-SS	Supply Fan START/STOP	ON	
	RFAN-SS	Return Fan START/STOP	ON	
	AHU2-SS	NSL Ahu-2 START/STOP	STOP	
	AHU1ISOD	AHU-1 Isolation Dampers	OPEN	
	AHU2ISOD	AHU-2 Isolation Dampers	CLOSE	
	ISO2STAT	AHU-2 Iso Damper Status	CLOSE	
	AHU2STAT	NSL AHU-2 Fan Status	OFF	
	X-SWITCH	Emer Gen Transfer Switch	NORMAL	
	PURGE	Smoke Purge Switch	OFF	
	SMOKEDET	Smoke Detector Status	NORMAL	
	PREFILTR	Pre-Filter Status	CLEAN	
	OA-TEMP	Outside Air Temp	79.1	F
	FAN-ON	Wall Switch Position	OFF	
	NSLRH	NSL Return Humidity	30.1	% RH
	COND-ENA	Condensor OSA Enable SP	50.0	F
	ACC1-SS	Condensor START/STOP	START	
	AHU3VANE	AHU-3 Inlet Vanes	46.9	% Open
	SAFIVANE	AHU-1 Supply Inlet Vanes	57.4	% Open
	SUP-CFM	Supply Fan CFM	21879	CFM
	PRSR-CTL	NSL PRESSURE CONTROL	-0.030	WG
	RMPRESS	NSL Area Room Pressure	-0.031	WG
	VOL-CTRL	Return CFM Setpoint	23000	CFM
	RET-CFM	Return Fan CFM	22736	CFM
	RAFIVANE	AHU-1 Return Inlet Vanes	83.0	% Open
	AHU3-CFM	Outdoor Air Supply CFM	1013	CFM
	AH3-CNTL	AHU-3 CFM Setpoint	1000	CFM
	FILT-ISO	Select Filter Bank A/B	FLT-A	
	ACT1A-ST	Filter Bank A Dampers	OPEN	
	ACT1ASS	ACT-1A Filter Damper Cmd	OPEN	
	FILTER1A	ACT-1A Filter Status	CLEAN	
	ACT1B-ST	Filter Bank B Dampers	OPEN	
	ACT1BSS	ACT-1B Filter Damper Cmd	OPEN	
	FILTER1B	ACT-1B Filter Status	CLEAN	
	COOLING	Pseudo Cooling Command	87.9	% CMD
	HEATING	Pseudo Heating Command	0.0	% CMD
	EDADELAY	EDA Shutdown Delay	ON	
SWO	ALARM-BO	ALARM Output to pax	OFF	
	COOL-ON	Wall Switch Position	COOL	
SWO	P-ALM1	Pressure Alm-1 Nsl > Adm	NORMAL	
SWO	P-ALM2	Pressure Alm-2 Nsl > 0	NORMAL	
SWO	P-ALM3	Pressure Alm-3 Nsl < -.06	NORMAL	
SWO	SHUTDWN	SHUT DOWN FROM PRESS	NORMAL	
	STATIC-P	Supply Static Pressure	0.51	WG

*And made use of
shorter test
duration.*

RPT

SWO

...END...

TAB 6-93

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Page ____ of ____

RECTANGULAR DUCT TRAVERSE REPORT

PROJECT WSCF - KEH5251 SYSTEM UNIT NSL-AHU-1
 LOCATION/ZONE A.C.T. - RETURN SERVICE RETURN AIR FILTRATION
 ALTITUDE N/A DENSITY N/A CORR. FACTOR N/A

DUCT		REQUIRED		ACTUAL	
S.P. _____	Air Temp _____ °F	SCFM (sL/s) _____		SCFM (sL/s) _____	
(°C) _____	Size <u>6' x 10'</u> Area <u>60 ft²</u>	FPM (m/s) _____	CFM (L/s) _____	FPM (m/s) _____	CFM (L/s) _____

DISTANCE FROM BOTTOM	POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13
Top FILTERS	1	0	950	1080	1140	970	0							
	2	0	420*	540*	880*	940*	0							
	3	360	250	330	0	0	210							
Bottom FILTERS	3	380	230	390	400	0	160							
	4													
	5	"A" TRAIN		"B" TRAIN										
	6													
	7													
	8													
	9													
	10													
	11													
	12													
	13													
DISTANCE FROM DUCT EDGE														
VELOCITY SUB-TOTALS														

→ NOTE: Take readings with air blowing toward the observer.

REMARKS

* READINGS VARY FROM 1100 fpm TO ZERO.
 ** READINGS VARY FROM 600 fpm TO ZERO.
 ALL READINGS ARE IN feet per minute. "0" READINGS INDICATE NEGATIVE PITOT.
 TEST DATE 4/12/94

→ MEASUREMENTS TAKEN TO SATISFY REQUIREMENTS OF ASHRAE 55.1; SECTION 9.5.2: AIRFLOW DISTRIBUTION TEST. READINGS WERE TAKEN BY PITOT TUBE UPSTREAM AND CENTER ON EACH PREFILTER. TEST INSTRUMENT IS "AIRDATA" MULTIMETER ADITY-950, S/N: M92703. CAL DATE: 1-18-94
 READINGS BY Jerry Insinger NORTHWEST AIR S

15.10

Shortridge Instruments, Inc.

7855 EAST REDFIELD ROAD SCOTTSDALE, ARIZONA 85260
TELEPHONE (602) 991-6744 FAX (602) 443-1267

CERTIFICATE OF CALIBRATION

INSTRUMENT AirData Multimeter

MODEL ADM-850 SERIAL NO M92483

TEST BY L. Laubmeier DATE 5-16-94

This is to certify that this instrument has been calibrated using instrumentation which is traceable to masters at the National Institute of Standards and Technology. Quality Assurance Program and calibration procedures meet the requirements for 10CFR50, Appendix B; 10CFR21; ANSI/N45.2; and MIL-STD45662A.

CERTIFIED BY

Nuclear Consulting Services, Inc.

CALIBRATION CERTIFICATE

July 28, 1994

CLIENT: Northwest Air Systems
6951 West Grand Ridge Blvd.
Suite 209
Kennewick, WA.

NUCON PROJECT NO.: 12NF615
CLIENT PURCHASE ORDER NO.: 2902
RELEASE NO.: N/A

TEST EQUIPMENT

CALIBRATION STANDARDS

LOG NO.
EQUIP. TYPE

CALIBRATION DATE
CALIBRATION DUE

STANDARD & NIST NUMBER

L0779
Aerosol Detector

07/19/1994
11/19/1994

Ratio-Type self calibrating
device.

This is to certify that the above listed equipment has been calibrated traceable to the National Institute of Standards and Technology, has been derived from accepted values of natural physical constants, or has been derived by the ratio-type of self calibration technique and meets the requirements of MIL-STD-45662 and NUCON QA Manual 045 Revision 13.

BY:

Mark Preston

for Quality Assurance Dept.
Nuclear Consulting Services, Inc.

University of Wisconsin-Madison
College of Engineering

The Department of Engineering Professional Development

proudly presents this award for
educational achievement to

Mike Richardson

for participation in

**Air-Conditioning Design
Testing, Adjusting and Balancing**

April 6 - 10, 1992

Keith J. Kempinski

Program Director

Ellen E. Fitzmaurice

Chairman of the Department

HARVARD SCHOOL OF PUBLIC HEALTH

BOSTON, MASSACHUSETTS

THIS CONFIRMS THAT

MICHAEL R. RICHARDSON

participated in the short course entitled

IN-PLACE FILTER TESTING WORKSHOP

*conducted by the
Office of Continuing Education
and the Department of Environmental Health*

June 21 -- 25, 1993

This program has been awarded the following certification:

Continuing Education Units (ceu) -- 3.3

American Board of Industrial Hygiene (abih) -- 4.0

American Academy of Health Physics (aahp) -- 16

Melvin W. First

Melvin W. First, Sc.D.

Course Director

David A. Shore

David A. Shore, Ph.D.

Director for Continuing Education and
Educational Development

EXCEPTION SHEET

Exception No. 1 NSL EXH. HEPA TEST
Section No. 3.5 Requirement PROCEDURE ALLOWS
UPSTREAM READING AT ANY MIXING TEST SAMPLE
PORT. MIXING TEST FAILED ⇒

Statement of Required Revision REPLACE "... READING AT A
SINGLE MIXING TEST SAMPLE PORT." WITH "... READING
AT THE SINGLE MIXING TEST SAMPLE PORT WITH
LOWEST CONCENTRATION FROM MIXING TEST."

Approval and Acceptance

M.C. PRATHER
Test Director

8/8/94
B/8/94

Larry C. Cuffman
Witness

MD. Huss 8-8-94
ICF KH Acceptance Insp