



University of California
LOS ALAMOS SCIENTIFIC LABORATORY
Post Office Box 1663 Los Alamos, New Mexico 87545

In reply refer to: WX-8-2715
Mail stop: 928

February 15, 1979

Mr. Donald E. Solberg
Systems Performance Branch
Division of Safeguards, Fuel Cycle
and Environmental Research
United States Nuclear Regulatory Commission
Washington, DC 20555

Dear Don:

SUBJECT: R-295 QUARTERLY PROGRESS LETTER (OCTOBER 1 - DECEMBER 31, 1978)

Our major effort this quarter was the structural testing of American Air Filter (AAF) High Efficiency Particulate Air (HEPA) filters with aluminum separators. We also structurally tested four 24- by 24- by 5-7/8-in. HEPA filters and continued work on the laser particle counter.

Our structural tests indicated the following.

1. For AAF HEPA filters, the aluminum-separators did not significantly increase the filter strength against tornado transients over filters with asbestos separators.
2. The breaking pressure of the aluminum separator types is not a function of pressurization rate.
3. There is much data scatter.
4. Edge failures typical of AAF HEPA filters also occur for AAF HEPA filters with aluminum separators.
5. The 5-7/8 in.-thick HEPA filters failed catastrophically at or below three psi.
6. Cambridge and Mine Safety Appliance (MSA) 5-7/8 in.-thick HEPA filters are stronger than AAF or Flanders 5-7/8-in.-thick HEPA filters.

1323 001
NRC Research and Technical Assistance Report

February 15, 1979

7. Failure pressure of the 5-7/8-in.-thick HEPA filters is about the same as that for the 11-1/2-in.-thick HEPA filters. However, catastrophic failure occurs in the 5-7/8-in. filters rather than fold breakage.

STRUCTURAL TESTING OF AAF HEPA FILTERS WITH ALUMINUM SEPARATORS

Nine AAF HEPA filters were subjected to a constant pressurization rate airflow until they failed. These tests were conducted in a manner identical to previous structural tests. All pressures were measured as static pressure drop across the filter and did not include velocity pressure. The pressurization rates were obtained from the time-static pressure data. The results are presented as Table A-I in the Appendix.

The test data for AAF HEPA filters with aluminum separators were compared to previous test data for AAF HEPA filters with asbestos separators. Data on filter-break pressure as a function of pressurization rate appeared, based on our earlier tests, to be the most useful. Therefore, the latest AAF aluminum separator HEPA filter test data and the previous AAF asbestos separator HEPA filter test data were plotted together (Fig. 1) on a graph of break pressure vs pressurization rate. Also, a linear regression analysis was performed on the new data. For filters with aluminum separators, the resulting equation is

$$P_{BRK} = 0.002136 P_{RATE} + 2.54 \text{ (psi) ,}$$

where P_{BRK} is the initial failure pressure of the filter and P_{RATE} is the test pressurization rate. The asbestos separator HEPA filter data yield a similar formula:

$$P_{BRK} = -0.14 P_{RATE} + 2.73 \text{ (psi) .}$$

1323 002

24- by 24- by 11-1/2-in. AAF HEPA Filters

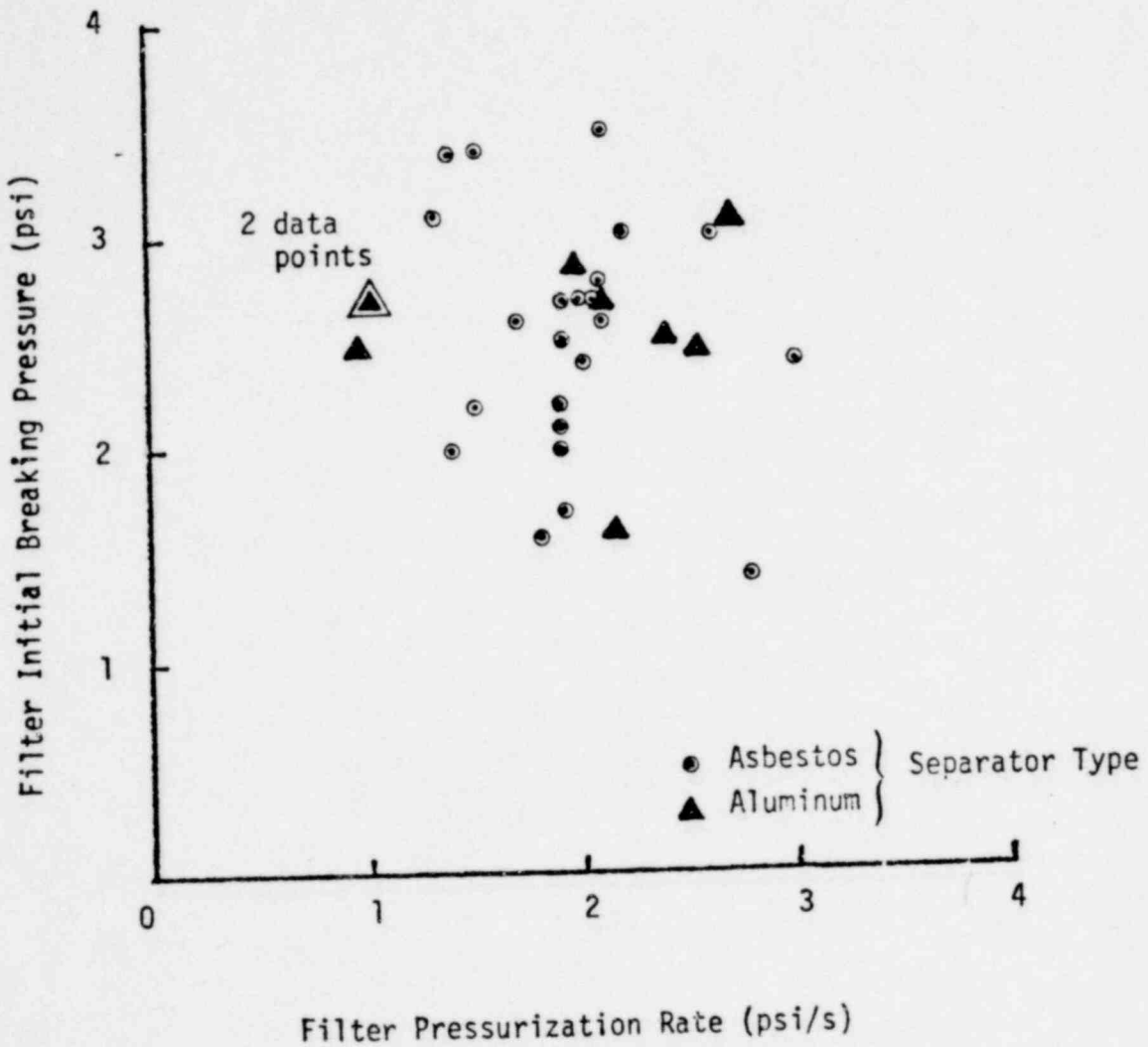


Fig. 1. Plot shows similar behavior of AAF HEPA filters with either asbestos or aluminum separators.

1323 003

Thus the AAF aluminum separator HEPA filters display much less change in break pressure as a function of pressurization rate. If $P_{RATE} = 2.0$ psi/s is inserted into both equations, the following results:

$$\begin{aligned} \text{asbestos: } P_{BRK} &= -0.14 (2.0) + 2.73 = 2.45 \text{ psi} \\ \text{aluminum: } P_{BRK} &= 0.002136 (2.0) + 2.54 = 2.54 \text{ psi} . \end{aligned}$$

Considering the data scatter, the aluminum separators seem to have little effect on filter strength. AAF HEPA filters with either aluminum or asbestos separator material have a tendency to fail along the glued edge.

Another interesting data comparison is between Cambridge and AAF aluminum separator HEPA filters. The equations resulting from a linear regression analysis of the data from each yield:

$$\begin{aligned} \text{AAF: } P_{BRK} &= 0.002136 P_{RATE} + 2.54 \text{ (psi)} \\ \text{Cambridge: } P_{BRK} &= 0.155 P_{RATE} + 2.56 \text{ (psi)} , \end{aligned}$$

and the strengths at a 2.0 psi/s pressurization rate are:

$$\begin{aligned} \text{AAF: } & 2.54 \text{ psi} \\ \text{Cambridge: } & 2.99 \text{ psi} . \end{aligned}$$

Thus of the filters tested so far, the Cambridge filters are stronger than AAF filters and are more sensitive to pressurization rate.

STRUCTURAL TESTING OF 5-7/8-IN.-THICK HEPA FILTERS

Four 24- by 24- by 5-7/8-in.-thick HEPA filters (one each from AAF, Cambridge, Flanders, and MSA) were structurally tested. Air-flow through the test filter was maintained at a constant pressurization rate until the filter failed. Results of these four tests are presented in Table A-II.

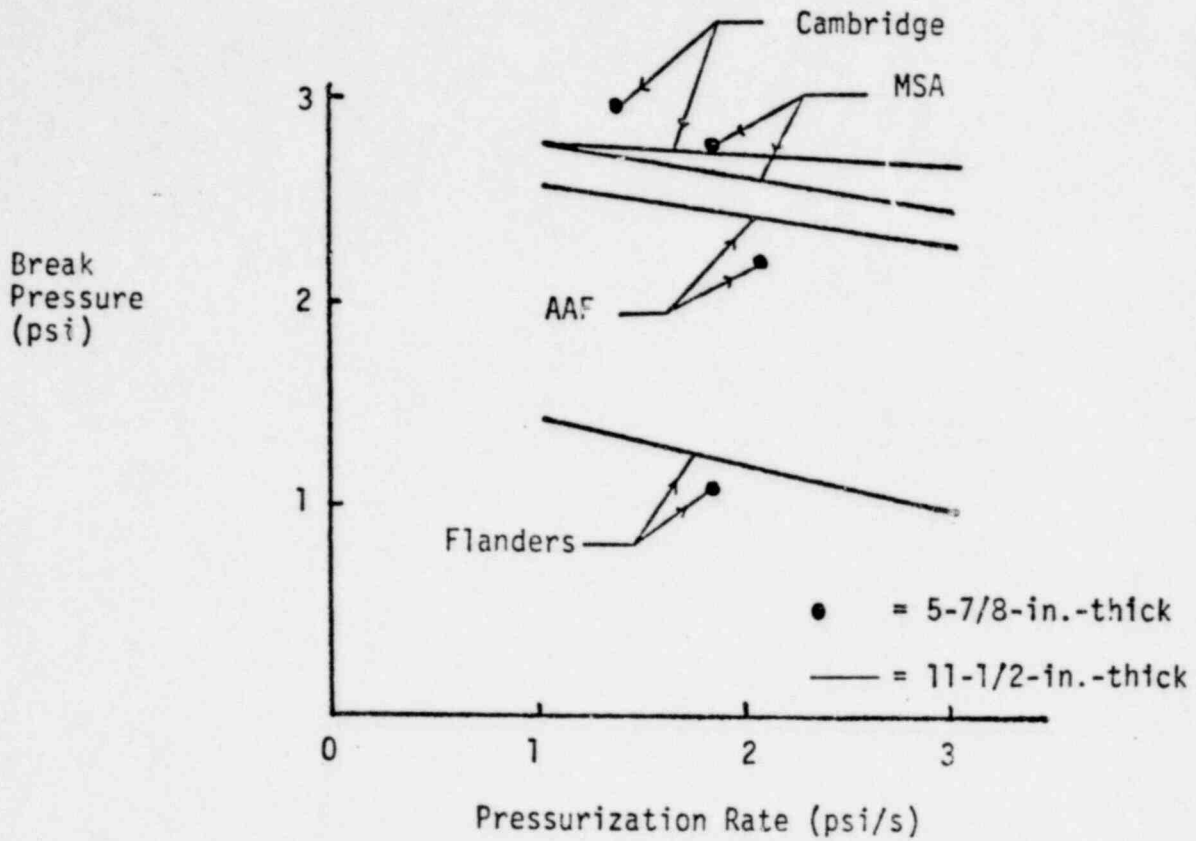


Fig. 2. Plot shows similar strengths of 5-7/8 in. thick and 11-1/2-in.-thick HEPA filters for respective manufacturers.

1323 005

Mr. Donald E. Solberg
WX-8-2715

-6-

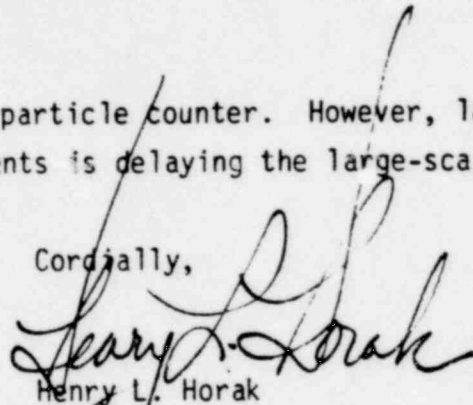
February 15, 1979

Because there is only one data point per manufacturer, no curve fits were possible. However, the 5-7/8-in.-thick filter data point for each manufacturer is close to the respective least-squares-fit line for previous 11-1/2-in.-thick filter tests (Fig. 2). Again, the Flanders HEPA filter appears weaker. Also, the Flanders filter showed preliminary minor failure before catastrophic failure. The other manufacturers' filters also failed catastrophically.

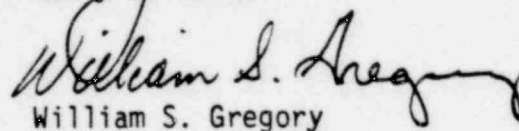
LASER PARTICLE COUNTER

Work continues on the laser particle counter. However, late delivery of some optical components is delaying the large-scale counter testing.

Cordially,



Henry L. Horak



William S. Gregory

HLH/WSG: jr

Cys: R. N. Thorn/T. J. Hirons, ADW, MS 100
A. D. McGuire, SPO, MS 120
R. F. Taschek, ADR, MS 102
M. L. Brooks/L. W. Hantel, WX-DO, MS 686
W. G. Davey, Q-DO, MS 561
W. A. Bradley, WX-8, MS 928
H. A. Lindberg, WX-8, MS 928
ISD-5 (2), MS 150
File

1323 006

APPENDIX

TABLE A-I

STRUCTURAL TEST DATA OF AAF HEPA FILTERS WITH ALUMINUM SEPARATORS

<u>Serial Number</u>	<u>Number of Folds</u>	<u>Break Pressure (psi)</u>	<u>Pressurization Rate (psi/s)</u>	<u>Break Time (s)</u>	<u>Break Fold Number</u>
41316765	0	2.45	2.55	1.30	1
41316802	1	3.06	2.73	1.45	48
41316806	60	1.59	2.18	1.02	1
41318266	60	2.51	2.21	1.52	17
41316804	62	2.84	1.98	1.87	49
41316806	60	2.67	2.12	1.85	60
41316809	60	2.45	0.96	3.28	1
41316803	61	2.67	1.02	3.19	30
41316767	62	2.67	1.02	3.34	62

1323 007

TABLE A-II
STRUCTURAL TEST DATA OF 5-7/8-in.-THICK HEPA FILTERS

<u>Manufacturer</u>	<u>Serial Number</u>	<u>Number of Folds</u>	<u>Break Pressure (psi)</u>	<u>Pressurization Rate (psi/s)</u>	<u>Break Time (s)</u>	<u>Break Fold Number</u>
AAF	41313944	66	2.25	2.14	1.44	23-42
Cambridge	8005858	65	3.00	1.44	3.05	18-34
Flanders	N017934	69	1.12	1.84	0.97	68
MSA	69884	64	2.79	1.85	3.96	23-40

1323 008

OCT 26 1979

INTERIM REPORT

Accession No. _____

Contract Program or Project Title: *Experimental Evaluation of Ventilation
System Components During Large Pressure Pulses*
Subject of this Document: *Research Project Progress*

Type of Document: *Quarterly Progress Letter*

Author(s): *H. L. Horok, W. S. Gregory*

Date of Document: *February 15, 1979*

Responsible NRC Individual and NRC Office or Division: *D. F. Solberg, Office of Nuclear
Regulatory Research*

This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

POOR ORIGINAL

Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

1323 009

INTERIM REPORT

NRC Research and Technical
Assistance Report