

SELECTION OF OPTIMUM FILTER MEDIA

**2002 ANNUAL AMUG
(Air Monitoring Users' Group)
MEETING
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FILTER MEDIA CHARACTERISTICS

Filter Type	Filter ΔP @ 1scfm	FWHM Po-214	Cost \$/100
Fluoropore 5u	3.2	330	242
Fluoropore 3u	4.4	290	242
SMWP 5u	5.5	550	80
SSWP 3u	13.7		82
Whatman GFA	4.6	410	95
AW19	7.8	370	45
RW19	7.6	350	45
SVLP Duropore 5u	6.9	600	86

FILTER MEDIA CHARACTERISTICS

Filter Type	Filter ΔP	FWHM Po-214	Cost \$/100
AP40	5.5	550	21
*TCTP 10 u	2.3	290	65
TMTP Isopore 5u	3.7	430	51
SCWP 8u	9.9		80
Zylon 5u	13.2		

***Collection efficiency is about 1/3 of the other filters**

FILTER MEDIA CHARACTERISTICS

	Filter	FWHM	Cost
Filter Type	ΔP	Po-214	\$/100
*Coffee Filter	2.4	390	0.50
*White Quilted Paper Towel	1.9	370	0.15
*Kleenex 4 layers	2.1	250	0.70
**Bathroom Tissue Quilted 4 layers	2.3	270	0.05

*** Collection efficiency is about $\frac{1}{2}$ that of other filters**

*** *Collection efficiency is about $\frac{1}{4}$ that of other filters**

LANL Filter Memo

Millipore quoted the following prices for the 5u Fluoropore

33 mm dia \$2.25 per filter

47 mm dia \$2.42

rolls cut to our width \$70 per square foot

If we cut our own, then we need \$5K for a new punching machine plus \$0.05 per filter for cutting.

33 mm dia \$1.00

47 mm dia \$2.05

CAM Filter Dust Loading

A gravimetric analysis of CAM and FAS filters was performed for two facilities at LANL. All of the filters analyzed were operated for one full week at 2 CFM. The highest dust loading observed was 13 mg total or 0.023 mg/M³. The next highest dust loading was 8 mg total or 0.014 mg/M³. All remaining CAM and FAS filters measured had less than detectable (approximately 0.01 mg/M³) amounts of dust loading. Approximately one-third of all of the FAS and CAM filters at two facilities were used in the gravimetric tests. All of the FAS filters from each facility, and most of the CAM filters were visually inspected for dust loading. This visual inspection indicated that maximum dust loading for CAM and FAS filters from both facilities are similar and that most of the CAM and FAS filters have very little visible dust loading.

Chalk Dust Test

The following table represents a filter dust loading test using chalk dust on a test CAM filter. Chalk dust was generated near the inlet to a test CAM and the filter was loaded up to 42 mg (approximately three times the maximum dust loading measured in the gravimetric test). Sample pressure drop and flow rate measurements were collected at different amounts of filter loading. The measurements indicated a 5% reduction in air flow rate and an increase in pressure drop from an initial 4.4 inches of mercury to a final 5.2 inches of mercury with the maximum 42 mg of dust loading.

Flow (CFM)	2.03	1.98	1.98	1.98	1.96	1.94
Dust Loading mg	0	10	15	20	30	40
Press. Drop "Hg	4.4	4.6	4.7	4.8	5.0	5.2

SAMPLE FILTER TYPES

Glass Fiber

Surface Collection Filters

Supported Filters

(Glass Fiber and Surface Collectors)

FILTER COLLECTION MECHANISMS

Filtration

Impaction

Electrostatic Attraction

FILTER COLLECTION EFFICIENCIES

Glass Fiber

- 99.997% for particles 0.3 micron and larger**

Surface Collection Filters

- 100% for the rated 5 micron and 3 micron and larger particles; 99.9% for particles 0.3 micron and larger**

FILTER DENSITY THICKNESS

SMWP and SSWP ~ 2 mg/cm²

RW19 ~ 2 mg/cm²

Fluoropore 5 micron ~ 2 mg/cm²

FAS ~ 2 mg/cm²

FILTER LAYERS

**SMWP, SSWP, RW19 consist of a single layer of
2 mg/cm² cellulose nitrate**

**Fluoropore 5 micron – collection side is 1 mg/cm²
support side is 1 mg/cm²**

**FAS – collection side is 1 mg/cm²
support side is 1 mg/cm²**

ADVANTAGES and DISADVANTAGES of Surface Collection Filters

Advantages

**High collection efficiency for particles of the
rated pore size and smaller**

Minimum attenuation of particle energy

Disadvantages

Higher pressure drop than glass fiber filters

**High dust loading results in some particles
dropping off the filter**

ADVANTAGES and DISAVANTAGES of Glass Fiber Filters

Advantages

High collection efficiency for all particle sizes

Lowest pressure drop of all filter types

Lowest cost of all filter types

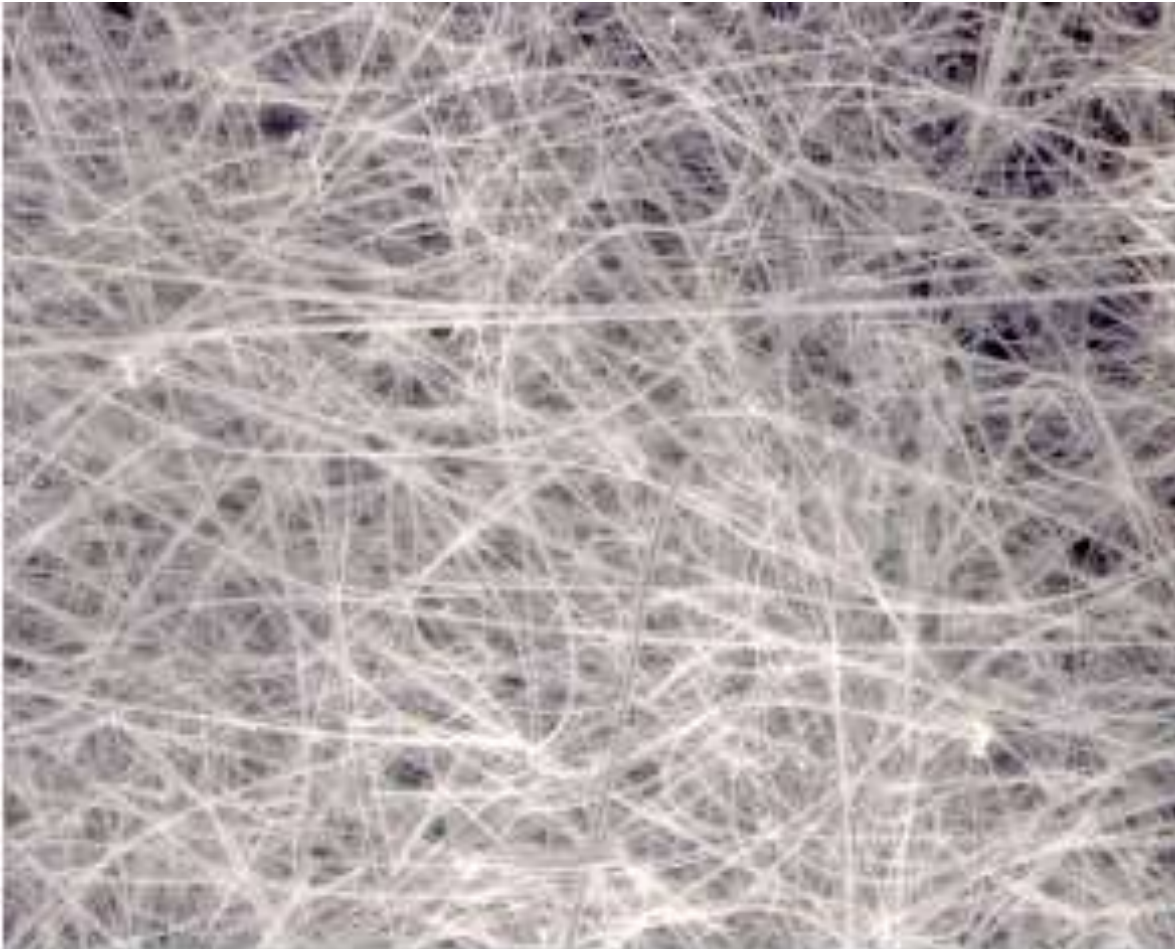
Disadvantages

**Some attenuation of particle energy due to
collection mechanism**

Millipore SMWP



Gelman A/E Glass



Fluoropore 5 micron



FILTER LAYERS

**SMWP, SSWP, RW19 consist of a single layer of
2 mg/cm² cellulose nitrate**

**Fluoropore 5 micron – collection side is 1 mg/cm²
support side is 1 mg/cm²**

**FAS – collection side is 1 mg/cm²
support side is 1 mg/cm²**

MY CONCLUSIONS

Alpha CAM filters

SMWP, SSWP, RW19, or Fluoropore

MY CONCLUSIONS

Beta CAM filters

Any of the Alpha CAM filters plus the FAS filter

MY CONCLUSIONS

FAS filters

Glass fiber

MY CONCLUSIONS

Giraffe filters

Any of the Alpha or Beta CAM filters plus the FAS filter

MY CONCLUSIONS

Use the surface collection filters for Alpha CAMs

Use any filter type for Beta CAMs

Use the glass fiber filter for high dust loading

Use the glass fiber filter for low vacuum supply

Use either side of the glass fiber filter as the collection side in low dust loading

Use any filter type for FAS and giraffe sampling in low dust loading and if the vacuum supply is adequate