

# DRAFT Minutes

## ASHRAE SSPC 52.2

MOT - General Ventilation Air-Cleaning Devices for Removal Eff. by Particle Size

Friday, January 8; 1:00 PM – 3:00 PM EDT

<https://events.rdmobile.com/Sessions/Details/1097346>

**Votes: Font is Bold, Black**

**Task Groups: Font is Bold, Blue**

**Action Items: Font is Bold, Red**

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### Code of Ethics Commitment

In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, inclusiveness and respect for others, which exemplify our core values of excellence, commitment, integrity, collaboration, volunteerism and diversity, and we shall avoid all real or perceived conflicts of interests.

- 1) Call to Order – 1:07 pm
- 2) Chair Remarks – 5 min
  - a) Appendix E revision – see attachment – vote was 20-0-0-0-20. Chair at time of next printing of 52.2 needs to remember to include this change in the submitted document; it will not happen automatically as Addenda do.
- 3) Roll call for voting committee members - 5 min

	Present?	14
Kathleen Owen	Y	
Mark A Tucker	N	
Tim Ahn	N	
Jenny M Berens	Y	
Rahul Bharadwaj	Y	
Randy Brannen	N	
Michael D Corbat	Y	
Zied Driss	N	
Leonard E Duello	Y	
Michael C Flom	Y	
Mrs Marisa Jimenez-Segovia	Y	
Chrystal Jolliffe	N	
Carolyn M L Kerr	Y	
Kevin Kwong	Y	
Bruce N. McDonald	Y	
Jonathan Rajala	Y	
Jim Rosenthal	Y	
Christine Sun	N	
Donald D Thornburg	Y	
Nathan Wittman	Y	

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- 4) Review of this agenda – Agenda was reviewed no comments.
- 5) Review of “Draft” Summer/Virtual 2020 Minutes – Motion to accept Gemma K, Second Jim R. (13-0-1-6-20) CNV (Y-N-abst-absent-Total VM)
  - a) <http://sspc522.ashraepcs.org/> to find minutes, agendas
- 6) Membership – see attachments below
- 7) Website – Todd McGrath – Agenda and minutes should be there, old documents also there
- 8) Liaison Report – Jerry Kettler [gikettler@air-engineer.com](mailto:gikettler@air-engineer.com) –
- 9) PM<sub>52.2</sub> efficiency calculation addition –
  - a) Find the addendum here <https://www.ashrae.org/technical-resources/standards-and-guidelines/standards-addenda>
  - b) As noted it will be in next reprint of 52.2
- 10) 62.2 Liaison report – Vijay – Nothing to report yet. May send notes if anything happens?
- 11) 62.1 Liaison report – Wane Baker – Not here
- 12) Presentation on Bioaerosol Filtration – John Zhang – see attached slides
- 13) Open Action Items – 14 min
  - a) Revisions to Normative Appendices: Vijay, Jon, Mike – started looking at consistency of appendix, then looking at whole method. They are now looking toward revisions that would be included in next print (for normative part); would need addenda/um for main document. Recommends getting a non-filter person to give an outside perspective.
  - b) Wikipedia - Todd and Bruce – fixed a MERV is 1-20 statement. Done (take off open list)
  - c) ASHRAE journal article covering PM<sub>52.2</sub> and 17-20. Gemma, Kathleen. Done. Take off list.
  - d) On-line free reads of ASHRAE documents – Is 52.2 one? yes
  - e) Youtube videos. 1) Explain MERV table, 2) MERV 17-20 don't exist **WG: Zied, Marissa, Not done yet. Still interested. Possibility of professionally done if sponsored (funded somehow). Asked if anyone has in-company help.**
- 14) New Business –
  - a) Jim Rosenthal – Tested 26 filters, noted low efficiencies in E1/E2 ranges. Would like us to have an Aerosol Particle Index (API) to emphasize the small particles. Geoff recommends ISO 16890's ePM1. WG: Jim, Vijay
  - b) SSPC 170 – Todd will contact 170.
    - i) Update post 52.2 meeting. We spoke with Michael Sheerin from SSPC 170 about the Appendix J reference and his response was.

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“It seems that the base text of Addendum r was established on an earlier version of Addendum a, as the language related to this MERV A designation was struck in the 2nd ISC of the addendum due to public comments. The final text is this, thus the reference to Appendix J should not be there and we will ensure that it is also be removed from our upcoming re-publication, so your comment is timely and tremendously helpful in avoiding future confusion.”

f. Minimum filter requirements shall meet the equivalent MERV-A rating when tested in accordance with ~~Appendix J~~ of ANSI/ASHRAE Standard 52.2.

In other words, SSPC 170 did not intend to change their requirements to MERV-A and have arranged to take the reference back out.

15) Adjourn 52.2 Main meeting

16) SSPC 52.2 Research – Jon R – 30 min

- a) IPA Vapor changes – impact on different fibers. RTAR **Champion: Chrystal Jolliffe with Phil Winters, Jon Rajala, Marquita Beard, Keith**. Chrystal emailed the RTAR to the WG. New version due soon.
- b) Charge Neutralization – RTAR Champion: **Bruce with Keith, Don, Vijay**. Bruce looked at it this morning. Got new RTAR form. Is working on it but needs pushing. Bruce will write narrative, the WG will try to make it fit the RTAR form. Comments on powered vs not powered. Inability to check distribution. Highly charged discussion.
- c) PMS update on 1784-RP

17) Adjourn Research

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Attendees (list based on sign-in information obtained from ASHRAE)

Name	Name	Name	Name
Kathleen Owen	Len Duello	Jim Rosenthal	Caitlin Naske
Todd McGrath	R Vijayakumar	Matt	Kevin Kwong
Marisa Jimenez de Segovia	Bruce McDonald	Geoff Crosby	Jon Rajala
Don Thornburg	Tim Johnson	Zhiqun	Jenny Berens
Nathan Wittman	Michael Corbat	Kyung Ju Choi	Himanshu Jasuja
Mick Flom	Henry Greist	Ray Rite	Gemma Kerr
Dan Haas	Vinod Venugopal	Timothy Ahn	Paolo Tronville
Sina Yousefi	Richard K Chesson	Morris R	Sanjeev Hingorani
Vinod Venugopal	Sanjeev Hingorani		

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Attachment: Vote on Revision to Informative Appendix E 10/2/20-10/15/20

**Subject:** VOTE on revision to Informative Appendix E

52.2 VM:

Many years ago, 52.2 took the references to MERV 17-20 out of Appendix E. We had never intended that table to mean that those MERVs existed only that the HEPA filter ratings listed would have put those filter types above the MERV 16 level. However, it appears that we did not ask for the matching words to be taken out. The current E1.1 is shown below. The struck out sentences need to be removed. I need a vote to show that the committee agrees with this removal in order to have the change issued as an errata to 52.2-2017.

### PLEASE VOTE:

- ☐ Yes, I agree to the changes
- ☐ No, I don't agree (send reason)
- ☐ Abstain (I don't want to vote, but this lets 52.2 report that I responded)

Vote to end on 10/16/2020, but I would love to get it done sooner. **Please vote ASAP. VOTES ONLY GO TO KATHLEEN!**

## INFORMATIVE APPENDIX E CROSS-REFERENCE AND APPLICATION GUIDELINES

### E1. INTRODUCTION

**E1.1** The purpose of this appendix is to provide an approximate cross reference of Standard 52.1-1992 reporting methods (arrestance and atmospheric dust-spot efficiency) to the air-cleaner minimum efficiency reporting system outlined in Section 12. A corollary purpose is to provide application guidance to the user and HVAC system designer. To do this most effectively, HEPA/ULPA filters have been added to the reporting system. HEPA/ULPA filters have been assigned MERVs based on their performance in accordance with Institute of Environmental Sciences and Technology (IEST) standards. Table E-1 combines all of the parameters into a single reference covering most general ventilation air-cleaner types and applications.



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### Membership Report, page 1

Full Name	Position	Category	Current		7/1/21 planned
			Start Date	End Date	
Kathleen Owen	Ch PCVM	General	07/01/2017	06/30/2021	
Todd A McGrath	VC PSVM	Man filter	07/01/2017	06/30/2021	Chair PCVM
Mark A Tucker	Sec PCVM	Man media	07/01/2019	06/30/2023	VC
Tim Ahn	PCVM	Man filter	07/01/2019	06/30/2023	
Jenny M Berens	PCVM	Man filter	07/01/2019	06/30/2023	Secretary
Rahul Bharadwaj	PCVM	Man media	10/17/2019	06/30/2021	
Randy Brannen	PCVM	Man filter	07/02/2020	06/30/2024	
Michael D Corbat	PCVM	Man filter	07/01/2019	06/30/2023	
Zied Driss	PCVM	Man filter	07/01/2017	06/30/2021	
Leonard E Duello	PCVM	User	07/02/2020	06/30/2022	
Michael C Flom	PCVM	Man filter	07/02/2020	06/30/2024	
Mrs Marisa Jimenez-Segovia	PCVM	General	07/01/2018	06/30/2022	
Chrystal Jolliffe	PCVM	Man filter	07/01/2019	06/30/2023	
Carolyn M L Kerr	PCVM	General	07/01/2017	06/30/2021	
Kevin Kwong	PCVM	General	07/01/2018	06/30/2022	
Bruce N. McDonald	PCVM	General	07/02/2020	06/30/2024	
Jonathan Rajala	PCVM	Man filter	10/17/2019	06/30/2022	
Jim Rosenthal	PCVM	Man filter	10/17/2019	06/30/2022	
Christine Sun	PCVM	General	07/02/2020	06/30/2024	
Donald D Thornburg	PCVM	Man filter	07/02/2020	06/30/2024	
Nathan Wittman	NAFA PCVM	General	02/06/2020	06/30/2021	
Roberta MacGillivray	NAFA alt	General	02/06/2020	06/30/2021	

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Membership Report, page 2

Full Name	Position	Category	Current		After 2/1/21
			Start Date	End Date	
Wane Baker	PSVM	User			2/1/21
Oludamilola Adesanya	PSVM	Man filter			2/1/21
Brandon Emil Boor	PSVM	General	09/07/2018	06/30/2022	
Keith Chesson	PSVM	Man filter	09/07/2018	06/30/2022	
Kyung-Ju Choi	PSVM	Man filter	07/01/2018	06/30/2022	
Randall L Cooper	PSVM	General	07/01/2019	06/30/2023	
Mark Davidson	PSVM	Man filter	07/02/2020	06/30/2024	
Joel Davis	PSVM	Man filter	07/01/2018	06/30/2022	
Sama Fakhimi	PSVM	Man filter	10/17/2019	06/30/2023	
Dara Marina Feddersen	PSVM	Man media	07/01/2019	06/30/2023	
Henry T Greist	PSVM	Man filter	09/07/2018	06/30/2022	
Richard L Hall	PSVM	General	02/06/2020	06/30/2024	
Himanshu Jasuja	PSVM	General	02/06/2020	06/30/2024	
Michael D Orcutt	PSVM	Man filter	10/17/2019	06/30/2023	
James S Parris	PSVM	Man filter	07/01/2018	06/30/2022	
Kartik Potukuchi	PSVM	Man media	07/01/2018	06/30/2022	
John Jay Reese	PSVM	General	09/07/2018	06/30/2022	
Raymond W Rite	PSVM	Man filter	07/01/2018	06/30/2022	
Andrew J Untz	PSVM	Man filter	07/02/2020	06/30/2024	
R Vijayakumar	PSVM	General	07/02/2020	06/30/2024	
John Zhiqun Zhang	PSVM	Man filter	07/02/2020	06/30/2024	

# Viral Filtration Performance of Residential HVAC Filters

(ASHRAE 52.2 Meeting, Jan 2021)

**John Zhang<sup>a</sup>**, Doug Huntley<sup>a</sup>, Andy Fox<sup>a</sup>, Bryan Gerhardt<sup>a</sup>  
Al Vatine<sup>b</sup>, John Cherne<sup>b</sup>

a: Construction and Home Improvement Market Division, 3M Company,  
Building 251-1E-19, MN 55144-1000

b: LMS Technologies Inc., 6423 Cecilia Cir, Minneapolis, MN 55439

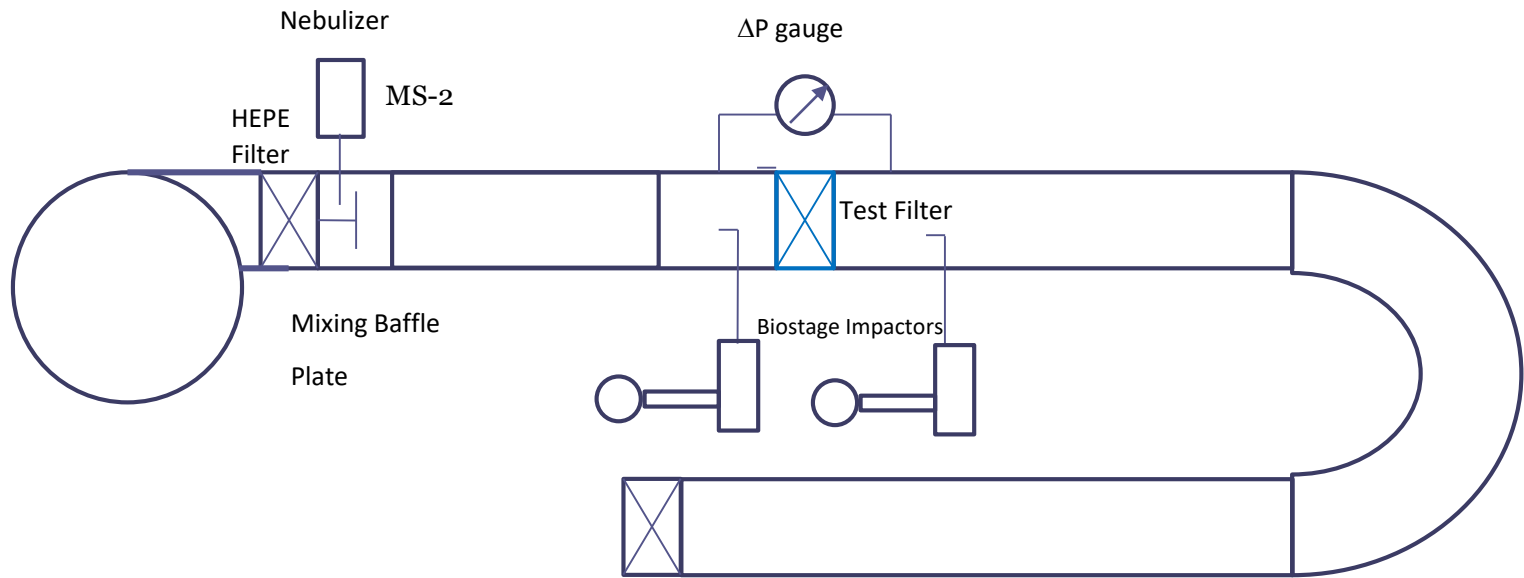




# Background

- COVID 19 pandemic
  - ❑ Over 59 million confirmed cases as of December 2020
  - ❑ Over 1.8 million deaths as of December 2020
  - ❑ SARS-CoV-2, also known as coronavirus, is known to transmit through droplets, surface contact and aerosols.
  - ❑ Aerosols from **human atomization** appears to be one of the dominant routes for the transmission of COVID 19.
- **Are HVAC filters effective at capturing virus aerosols?**

# Test Method

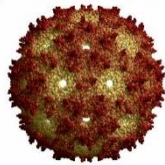


## Test Procedure

- Suspension of the MS-2 organisms was then aerosolized into the test duct.
- MS-2 aerosol was introduced upstream of the mixing baffles.
- The distance between the aerosol inject point and the upstream sampling probe was about 10 feet, allowing uniform mixing of the clean air and aerosol and complying with the AHSRAE 52.2 requirement for achieving adequate mixing.
- For each filter test, three upstream air samples and three downstream air samples were taken using SKC BioStage cascade impactors for 5-minutes at 28 liters/min.
- The collection plates, having a double layer agar consisting of a hard LB (Lysogeny Broth) bottom layer and a soft top layer, were then incubated at 35°C and 96% RH for 24-hours. After incubation, the recovered plaque-forming units (PFU) were counted.

$$Efficiency = \frac{Upstream\ PFU - Downstream\ PFU}{Upstream\ PFU}$$

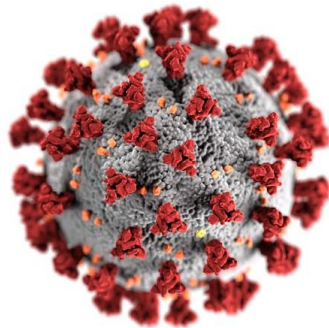
# Viral Challenge



MS-2 Virion – **27 nm**

Recommended by EPA for  
bioaerosol testing

Strauss JH, Sinsheimer RL (1963).  
"Purification and properties of  
bacteriophage MS2 and of its ribonucleic  
acid". *Journal of Molecular Biology*. 7:  
43–54. [doi:10.1016/S0022-  
2836\(63\)80017-0](https://doi.org/10.1016/S0022-2836(63)80017-0). PMID 13978804.

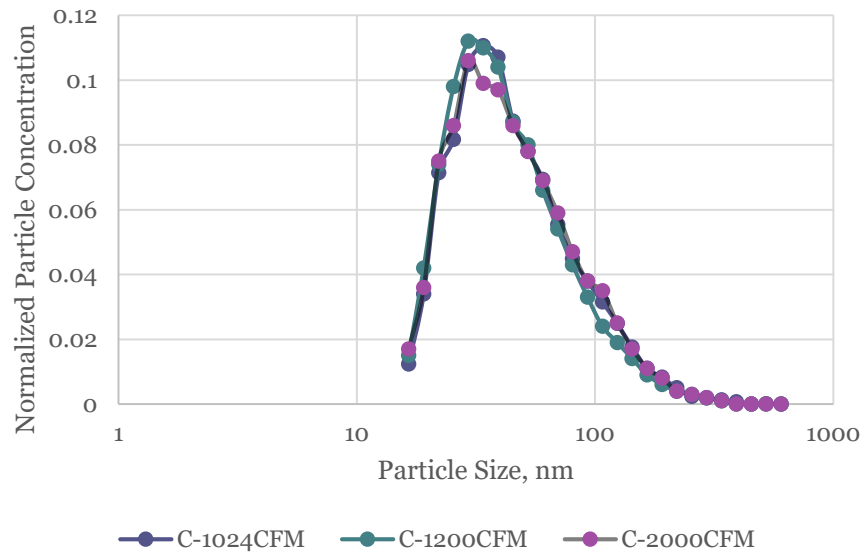


SARS-CoV-2 – **120 nm**

Na Zhu, et al., A Novel Coronavirus  
from Patients with Pneumonia in  
China, 2019. *New England Journal  
of Medicine*, **382(8)**, 727-733. [doi:  
10.1056/NEJMoa2001017](https://doi.org/10.1056/NEJMoa2001017)

# Stability of The Aerosol

Particle Size Distribution of MS-2 Bacteriophage Aerosol



A stable aerosol is critical for achieving consistent and representative particle size and distribution measurements, to ensure the reproducibility of the measurement results.

PFU measurements in Empty Duct

Sample	Upstream Counts (#)	Downstream Counts (#)	Upstream/Downstream
1	167	159	1.05
2	306	321	0.95
3	98	89	1.10
Average			1.03

# Filter Information

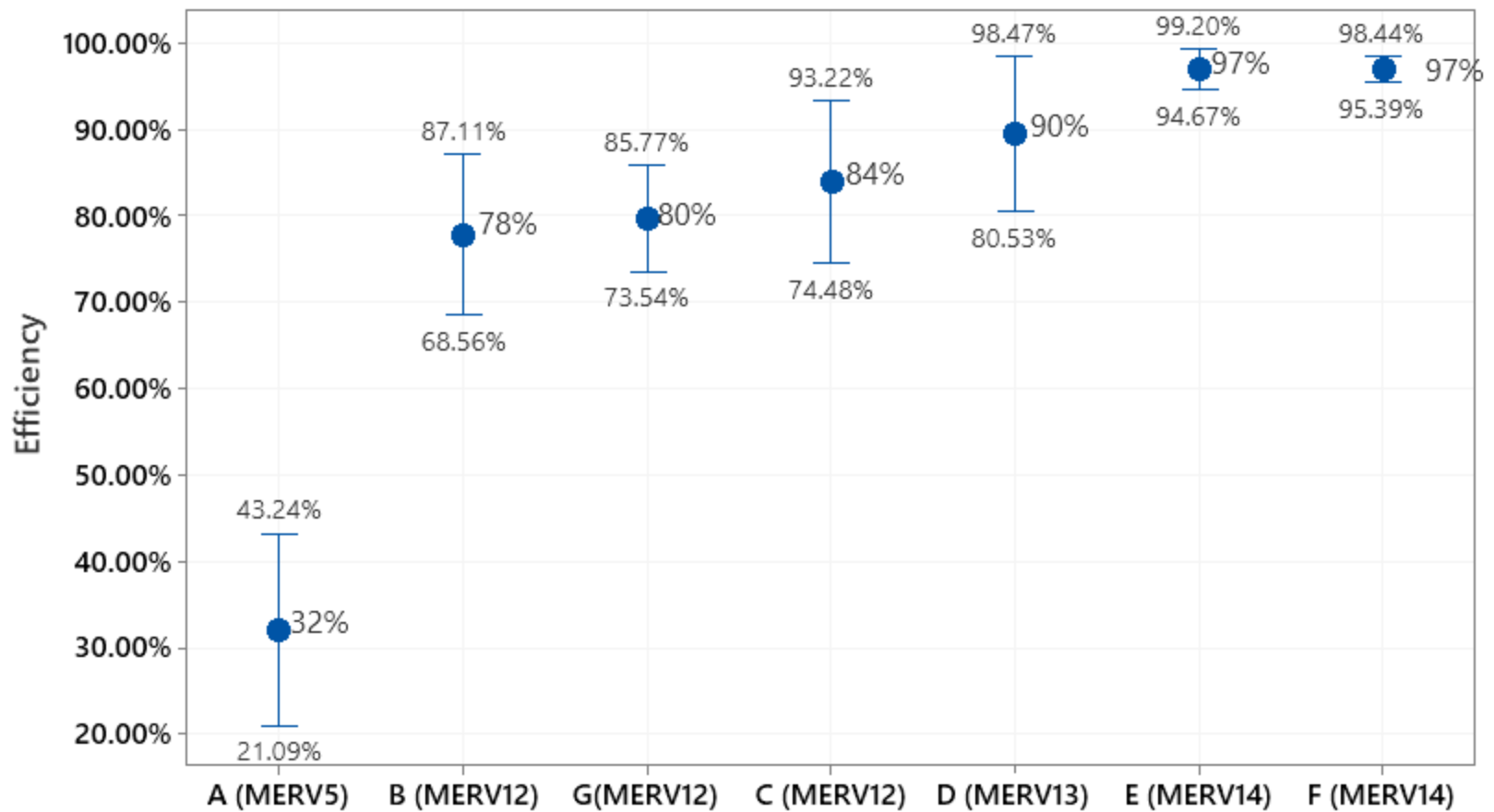
Filter ID	MERV Rating	Filter Media Basis Weight, g/m <sup>2</sup>	Electrostatic Charge	Pleat Spacing, mm	Filter Size (inch)	Quantity
A	5	50	Yes	16.7	20 x 25 x 1	6
B	12	65	Yes	7.2	20 x 25 x 1	6
C	12	65	Yes	7.2	20 x 25 x 1	6
D	13	65	Yes	7.2	20 x 25 x 1	6
E	14	75	Yes	7.2	20 x 25 x 1	6
F	14	75	Yes	5.6	20 x 25 x 1	6
G	12	75	Yes	28.2	20 x 25 x 4	6

# Test Results (Raw Data)

Filter ID	Corrected Upstream Counts (#)	Corrected Downstream Counts (#)	Single-Pass Efficiency
A	197	118	40%
A	87	53	39%
A	86	57	34%
A	82	57	30%
A	115	83	38%
A	136	120	12%
B	120	36	70%
B	198	59	70%
B	145	39	73%
B	185	36	80%
B	165	31	81%
B	136	10	93%
C	340	83	76%
C	349	5	99%
C	371	52	86%
C	348	82	76%
C	346	40	88%
C	420	92	78%
D	150	31	79%
D	138	29	79%
D	111	4	96%
D	106	9	92%
D	165	16	90%
D	44	1	98%
E	359	12	79%
E	315	10	96%
E	339	7	92%
E	254	18	90%
E	356	6	98%
E	390	4	98%
E	73	2	97%
F	107	5	95%
F	214	2	99%
F	183	6	97%
F	168	4	98%
F	112	5	96%
G	79	14	82%
G	72	11	85%
G	61	15	75%
G	56	12	79%
G	79	26	67%
G	67	13	81%

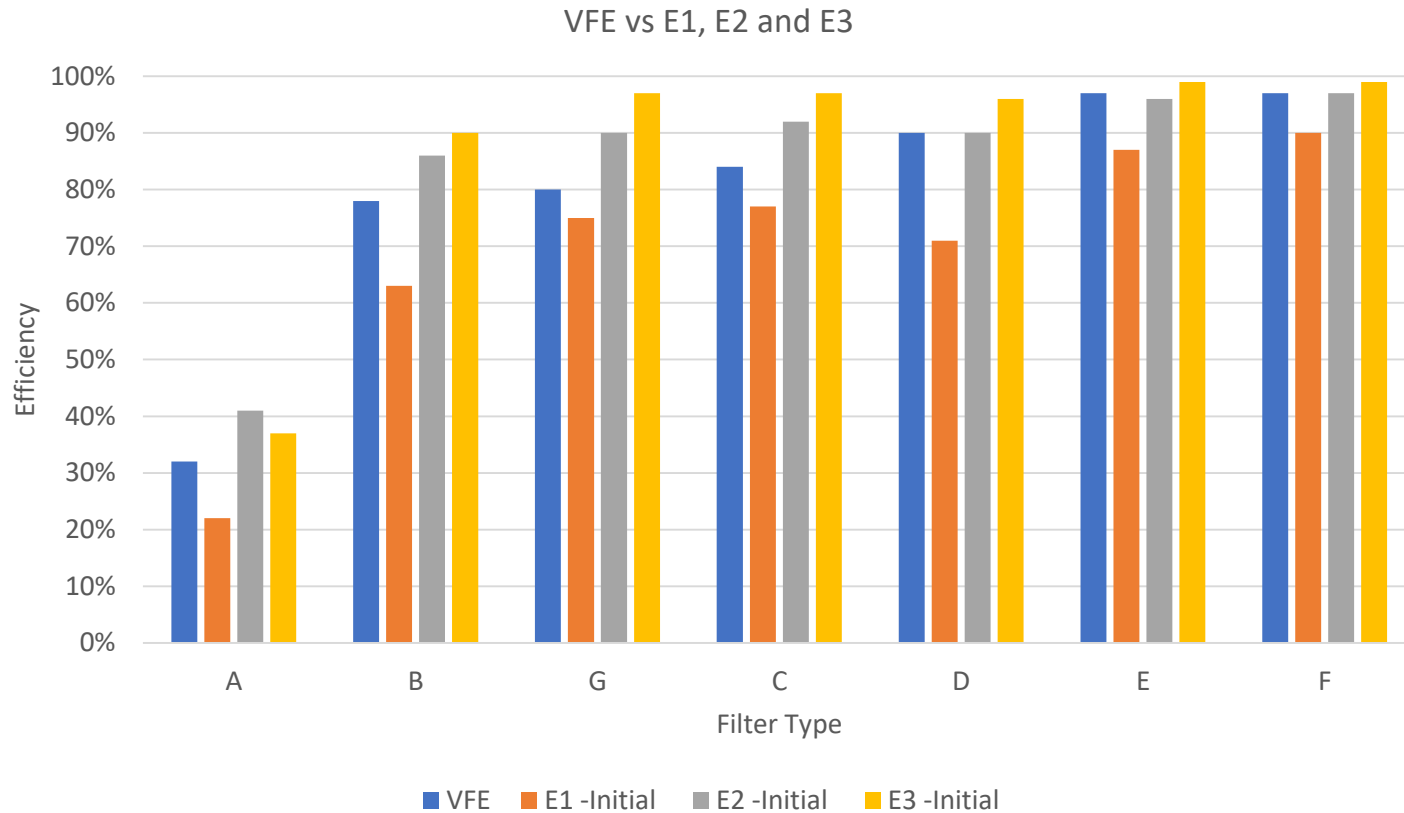
## Mean Viral Filtration Efficiency with 95% C.I.

95% CI for the Mean  
(N=6)



*Individual standard deviations are used to calculate the intervals.*





1. In general, VFE is higher than E1 (initial), lower or equal to E2 efficiency.
2. If VFE data is not available, E1 can be used as a conservative estimate of the viral filtration efficiency.

# Conclusions

- High efficiency residential HVAC filters were found to be effective at capturing airborne virus particles.
- Filter viral filtration efficiency was found to be generally correlated to its MERV rating, i.e. the higher the MERV rating, the higher the viral filtration efficiency.
- In comparison to E1, E2 and E3 efficiencies measured per ASHRAE 52.2, VFE was found to be higher than initial E1 efficiency, but lower than initial E2 and E3 efficiencies.



Thank You!