MANN+HUMMEL
LS&E R&D
O'Dell Associates Webinar
Air Filtration and Pandemic

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Tri-Dim, Louisa VA

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MANN+HUMMEL

Who Am I?

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Short Bullet -Talking Points

- 1. The pandemic has created a frenzy of customer inquires that are all *so site specific* as to not lend themselves to any kind of white paper or market segment blanket response. Our current reality.
- 2. ACH design theory and building reality.
- 3. Natural Ventilation and KISS.
- 4. Virus filtering; pathogen or particle size.
- 5. Filters in bank(s); upgrade or not?
- 6. Fixed speed or variable speed ventilation availability.
- 7. Standalone units.
- 8. Cycle time and ductwork changes.
- 9. Addition of UV light, bipolar ionization and other “trap and kill” features.
- 10. Are used filters hazardous waste?
- 11. Are HVAC insides such that service techs need exceptional PPE?

Air Changes per Hour (ACH) theory and reality

https://www.contractingbusiness.com/service/article/20868246/use-the-air-changes-calculation-to-determine-room-cfm
https://www.hvacrschool.com/air-changes-confusion/

- Wells-Riley Equation *number density reduction and dilution* Titus Timeout Podcast - Wells Riley Equation and HVAC System Design, https://www.youtube.com/watch?v=EvuFOeLOWn0
- One of many ACH guidance lists comes from "the Engineering Toolbox website at **www.engineeringtoolbox.com** and is a reasonable reference for ACH's.
- In the absence of a pandemic customers we serve that care about ACH: hospitals, schools, casinos. We have many customers with other primary metrics. Spray paint shops, in vitro fertilization…
- Journal of Thoracic Disease, 10 (2018) S2295-S2304. "Ventilation control for airborne disease transmission of human exhaled bio-aerosols in buildings." H. Qian and X. Zheng.

Natural Ventilation and KISS

Natural Ventilation for Infection Control in Health-Care Settings (especially section 3)
https://www.who.int/water_sanitation_health/publications/natural_ventilation.pdf

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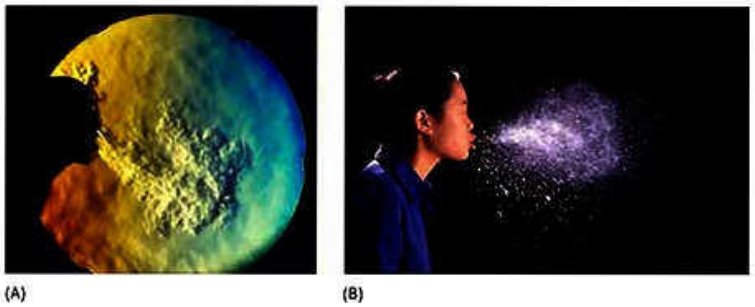
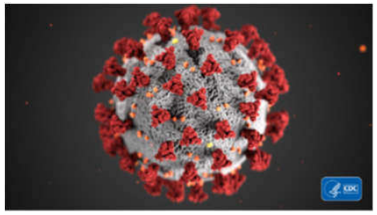
Virus Filtering; Pathogen or Particulate Nuclei. Size Matters…





(A) and (B) Sneeze and Cough imaged with optical techniques.

Coronavirus itself is sub-micrometer in size.

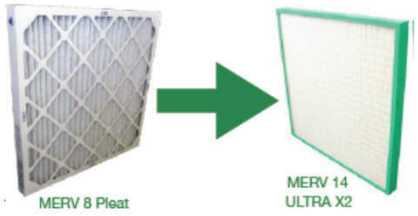
Droplet nuclei are typically 1 – 5 micrometer in size after moisture evaporation. Airborne suspension times consistent with particle size and impact of gravity and local air currents in space.

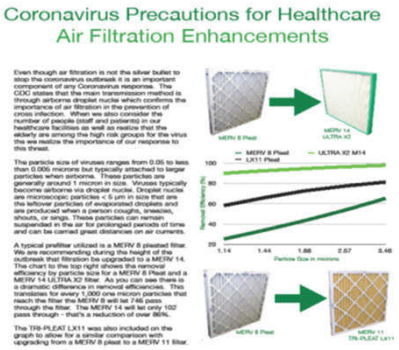
Early press releases INCORRECTLY reported NEJM only hours of airborne activity, when in fact the testing was simply suspended after 3 hours.

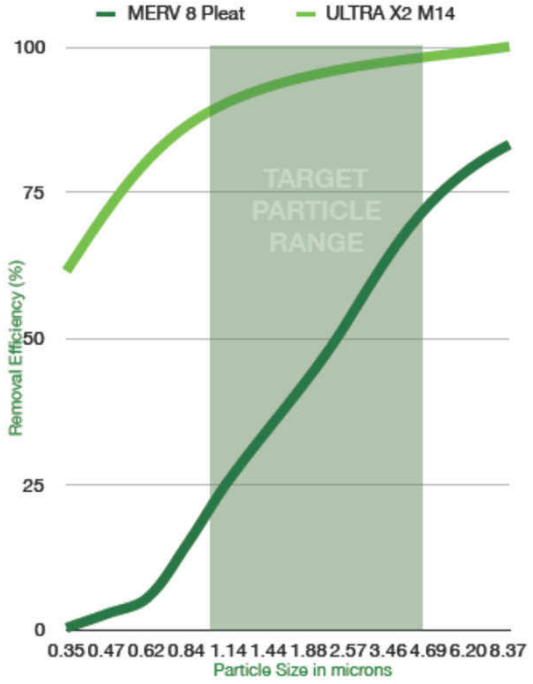
https://www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces

Virus Filtering; Pathogen or Particulate Nuclei. Size Matters…

A typical filter utilized in schools is a MERV 8 pleated filter. We are recommending during the height of the outbreak that filtration be upgraded to a MERV 14. The chart to the right shows the removal efficiency by particle size for a MERV 8 Pleat and a MERV 14 ULTRA X2 filter. As you can







Can You Increase the Airspeed Employed?

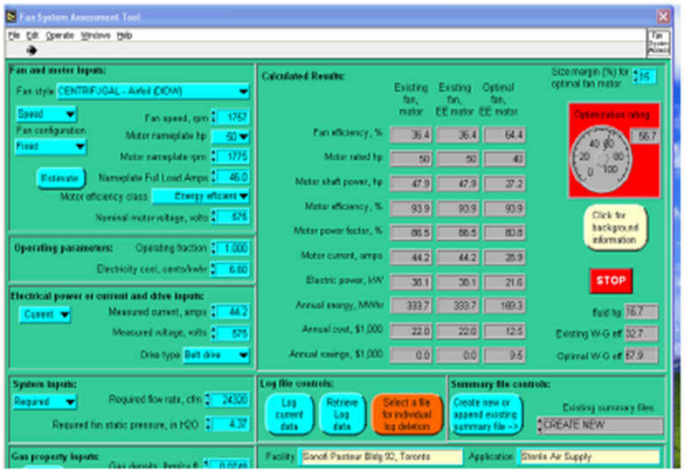
- Fixed gear bike.

- Ten speed racing bike. Takes equipment and intelligence to change gears!

Fan System Assessment Tools

- Ford Motors , Michigan
- Sanofi Pasteur , Toronto

FSAT worksheet, bldg 92, SAS 1086



FSAT worksheet, bldg 92, SAS 1086

EngA, submittal record, B92-SAS-005

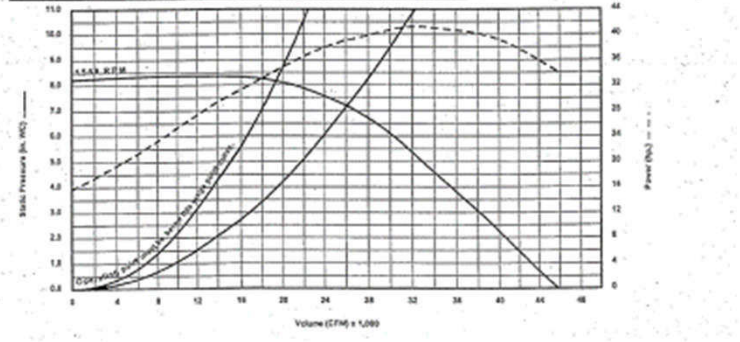
PERFORMANCE (Elevation ft. = 0, Airstream Temperature °F = 70, Start Up Temperature °F = 70)

Qty	Model	Volume (CFM)	SP (in. WC)	CSP (in. WC)	TS (ft./min)	OV (ft./min)	FRPM	Max Class FRPM	Operating Power (hp.)	SE %
1	36-AFDW-21	26,000	7.13	7.13	12,472	2,793	1,588	1757	40.13	73

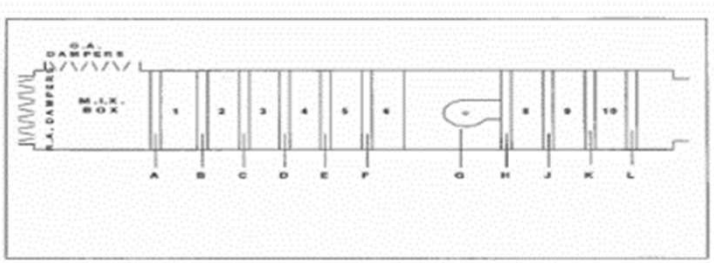
SOUND

Inlet / Outlet Sound Power by Octave Band								LwA	dBA	Noise Criteria
63	125	250	500	1000	2000	4000	8000			
104 / 105	95 / 101	105 / 100	95 / 94	93 / 92	90 / 88	86 / 84	84 / 81	100 / 98	89 / 87	81 / 81

LwA - A weighted sound power level, based on ANSI S1.4. dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5.0 ft. Noise Criteria (NC) based on an average attenuation of 11.5 dB per octave band at 5.0 ft.



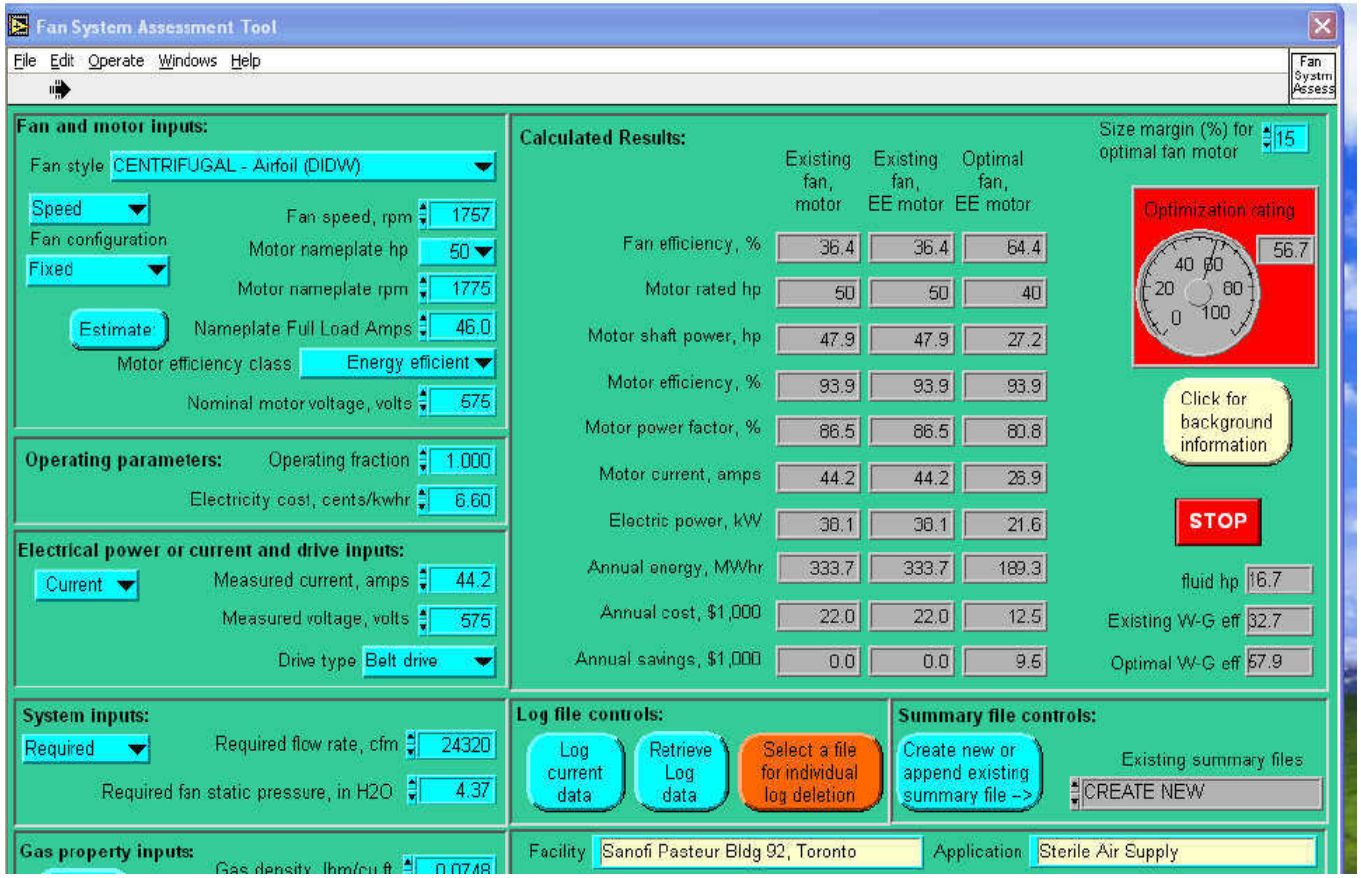
Designtest & Balance Co. Ltd
Static Pressure Profile Sheet



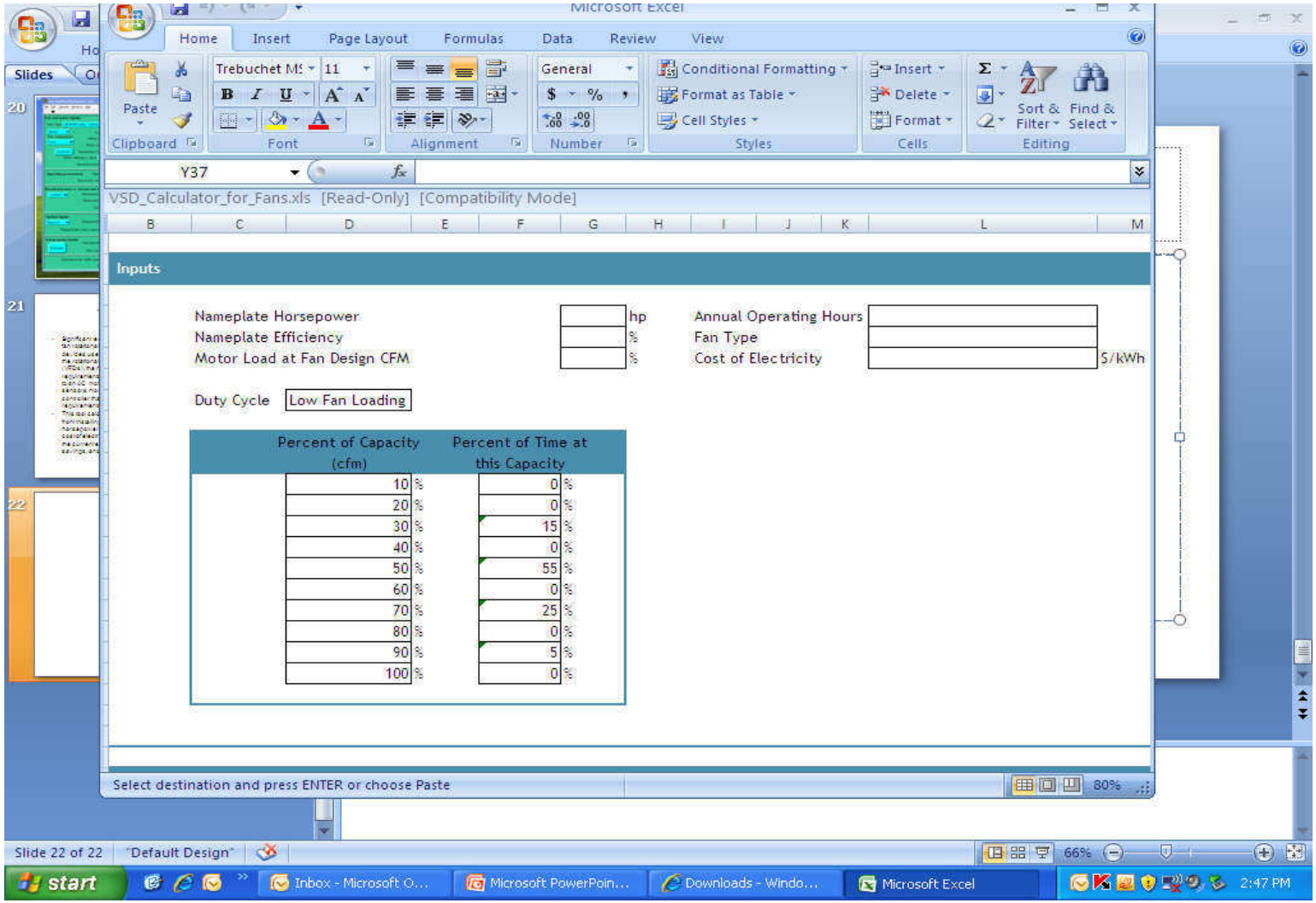
1	FILTERS
2	GLYCOL HEATING COIL
3	COOLING COIL
4	REHEAT COIL
5	
6	
7	
8	FILTERS
9	DAMPER
10	

Unit	a	b	c	d	e	f	g	h	j	k	l
B92.SAS.005	-1.16	-2.04	-2.16	-2.75	-	-	-2.91	4.86	4.71	1.99	

FSAT worksheet, bldg 92, SAS 1086



VFD modeling granularity required

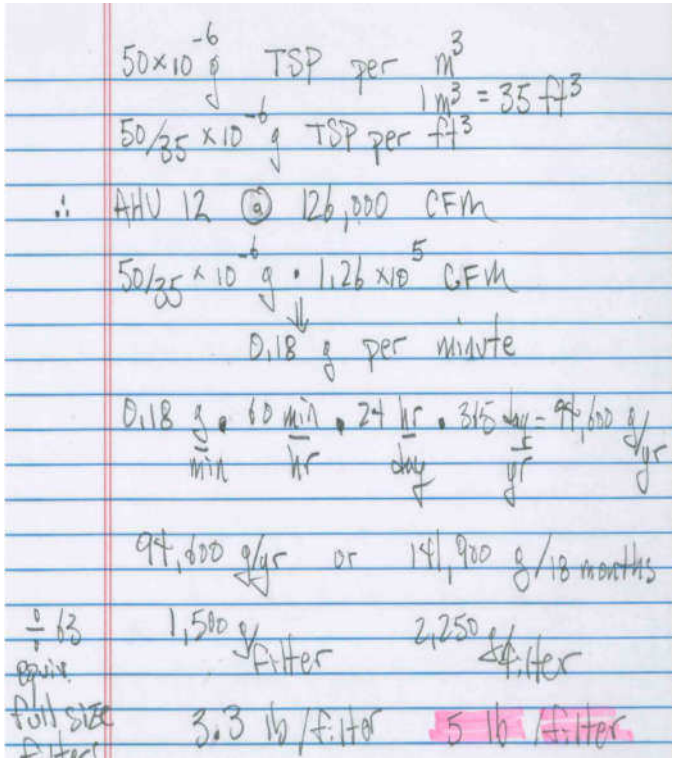


Standalone Units

Tri-Kleen 400 with UV

Fine Dust Eater

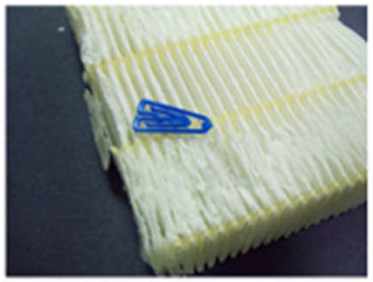
Cycle Time Impact - Calculation for Giorgio Mushroom AHU 12



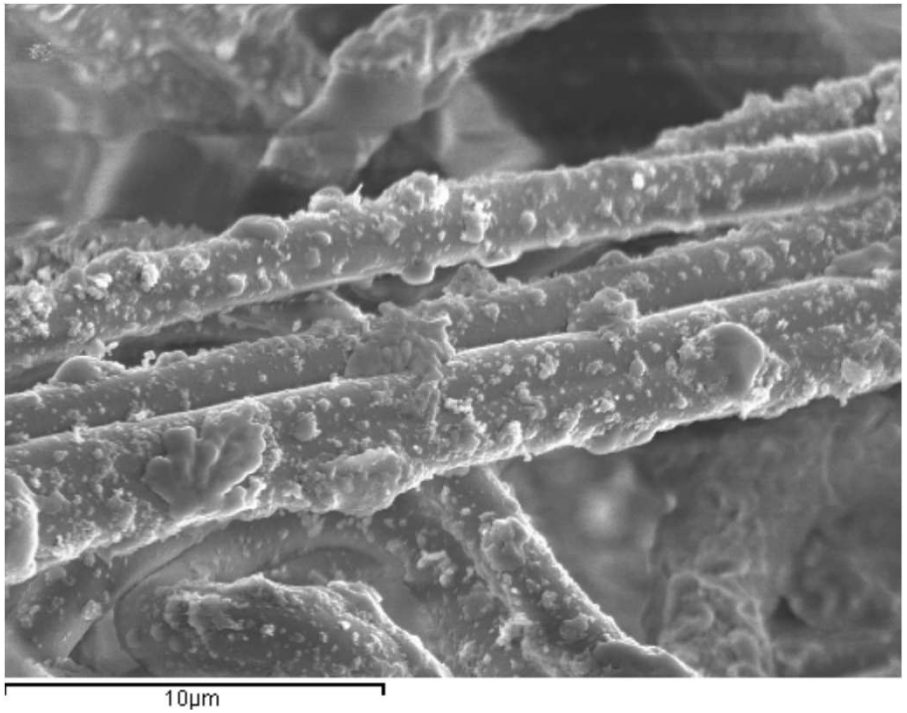
UV light, bipolar ionization and other *Twilight Zone* variations.

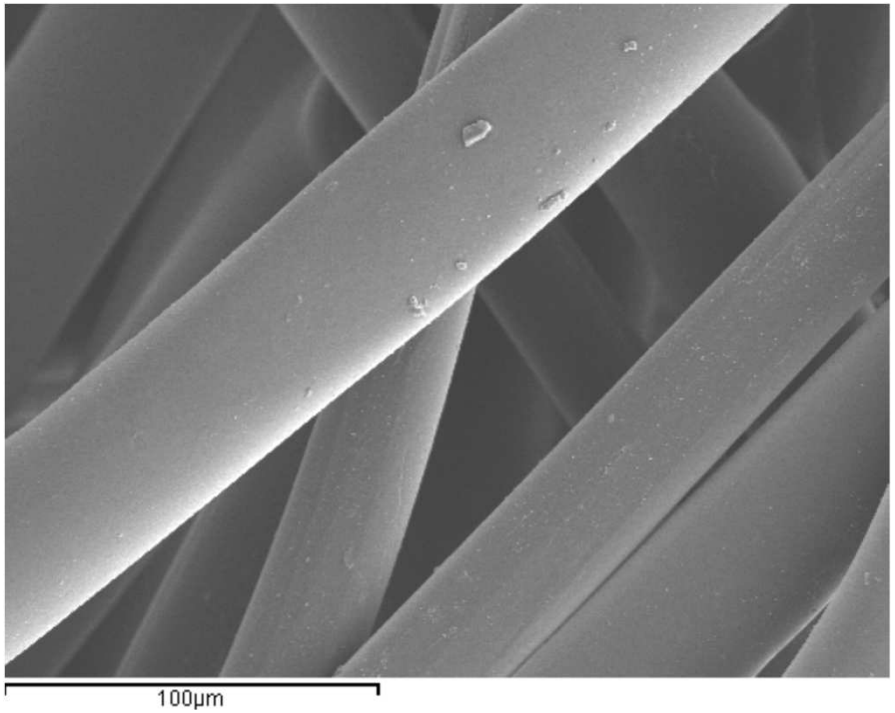
KOCH synthetic

- 4 months of UV irradiation.
- Media basically crumbles when touched.



UV light 24/7 on Tri-Dim “ULTRA” V-bank Merv 16 hospital filter for 2.5 years. Returned to Louisa for reverse engineering and integrity testing.



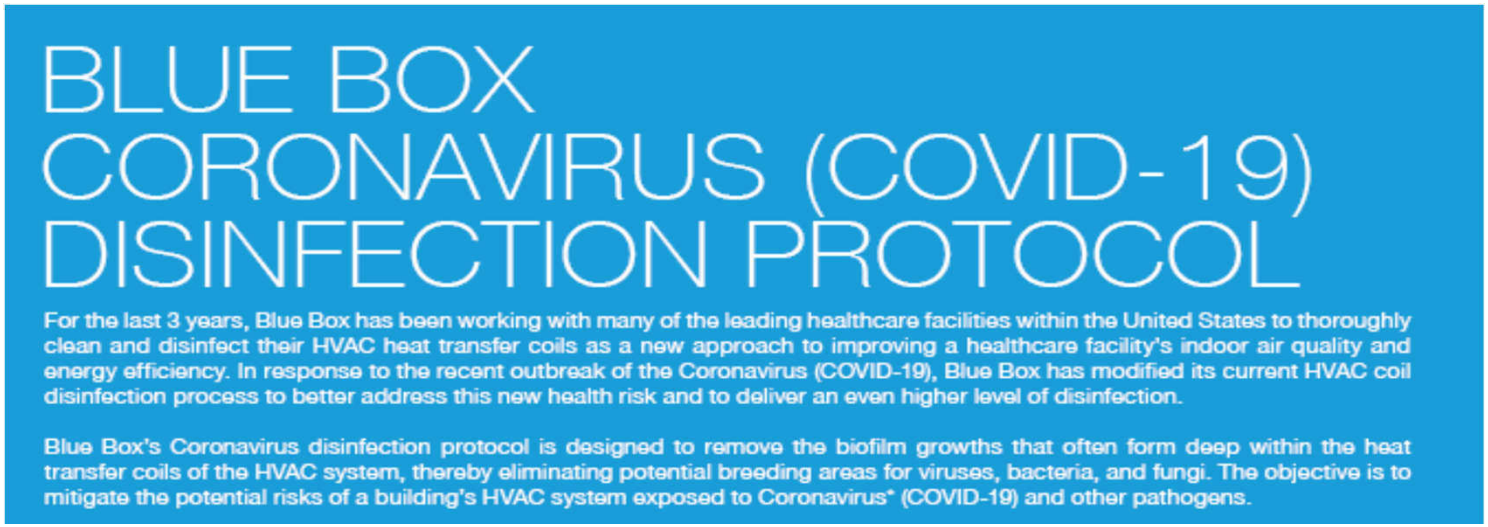


Bipolar ionization and other *Twilight Zone* variations.

The Reactor 1, Louisa County VA

Guess what is going on here?

Capitalizing or serendipity solution?



BLUE BOX CORONAVIRUS (COVID-19) DISINFECTION PROTOCOL

For the last 3 years, Blue Box has been working with many of the leading healthcare facilities within the United States to thoroughly clean and disinfect their HVAC heat transfer coils as a new approach to improving a healthcare facility's indoor air quality and energy efficiency. In response to the recent outbreak of the Coronavirus (COVID-19), Blue Box has modified its current HVAC coil disinfection process to better address this new health risk and to deliver an even higher level of disinfection.

Blue Box's Coronavirus disinfection protocol is designed to remove the biofilm growths that often form deep within the heat transfer coils of the HVAC system, thereby eliminating potential breeding areas for viruses, bacteria, and fungi. The objective is to mitigate the potential risks of a building's HVAC system exposed to Coronavirus* (COVID-19) and other pathogens.

The chemical comes with lots of warnings, not the least of which is that the sodium chlorite and other versions such as hypochlorite are used to make BOMBS! Yes I am not kidding they are common components is homemade bombs.

Capitalizing on brand name.

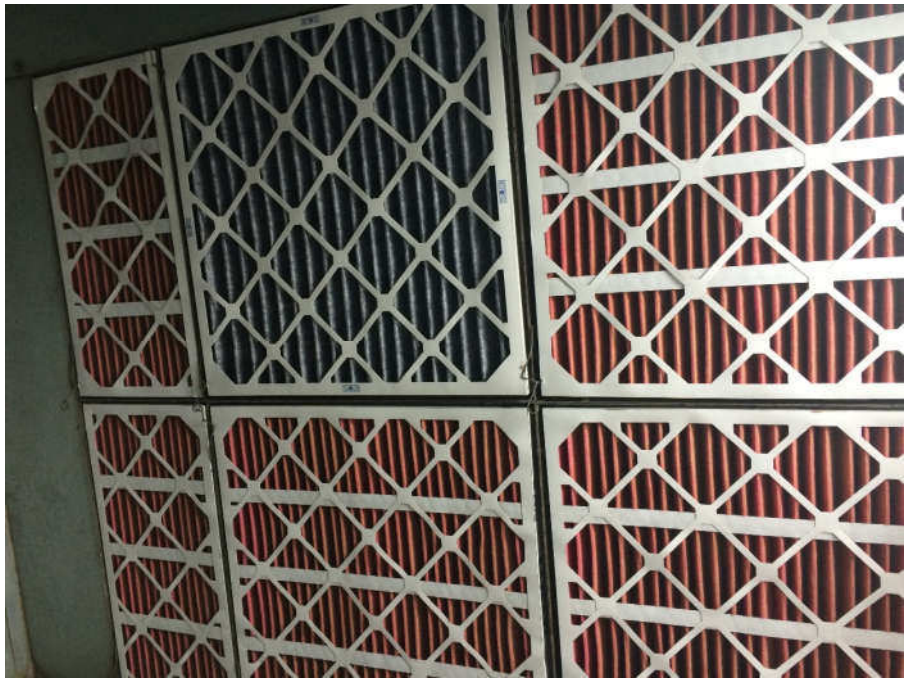
- **Clorox® *Total 360®* System**
- Due to the COVID-19 outbreak, we've increased production of our Total 360® devices and Total 360® Disinfectant Cleaner[1]. Please contact your distributor to place an order.

  Keep your facility healthier while saving time, money and labor. The innovative electrostatic sprayer, with the patented PowerWrap™ nozzle, delivers trusted Clorox solutions to the front, back and sides of surfaces. Superior coverage for better germ protection.

List N: Disinfectants for Use Against SARS-CoV-2
https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2

- **How does EPA know that these products work on SARS-CoV-2?**
- While the products included in List N: Disinfectants for Use Against SARS-CoV-2 have not been tested against SARS-CoV-2, the cause of COVID-19, they are expected to be effective based on:
- Demonstrated efficacy against a harder-to-kill virus;
- Qualified for the emerging viral pathogens claim; or
- Demonstrated efficacy against another human coronavirus similar to SARS-CoV-2.

Serionix converted media; antiviral effectiveness?



Are used filters and the insides of HVAC bldg. systems hazardous now?

https://www.hvacrschool.com/hvac-contractors-guide-to-covid-19-sars-cov-2-coronavirus/

- On the Grand Princess, SARS-CoV-2 RNA was identified on a variety of surfaces in cabins of both symptomatic and asymptomatic infected passengers up to 17 days after cabins were vacated on the Diamond Princess but before disinfection procedures had been conducted. (Takuya Yamagishi, National Institute of Infectious Diseases, personal communication, 2020).

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 69
March 23, 2020