

Concepts of Industrial Hygiene

Exposure / Exposure Control / PPE / Masks

Why Masks Do Not and Can Not Work

What Works &

Damage to Adults/Children



Stephen E. Petty, P.E., C.I.H., C.S.P. - EES Group, Inc.

January 27, 2022

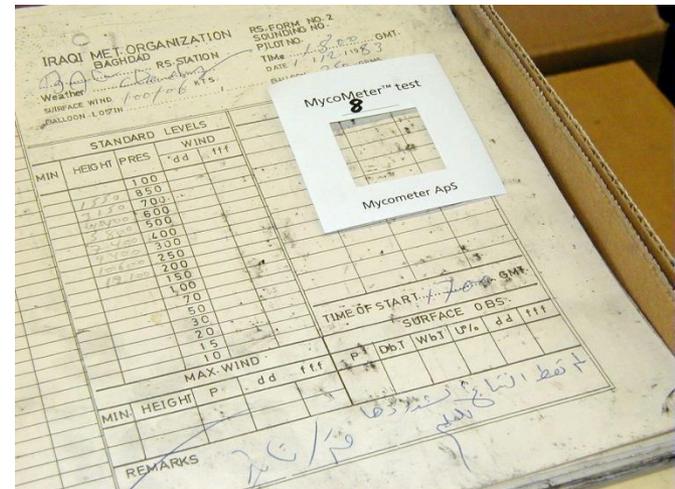
BACKGROUND



- **President and Owner of EES Group, Inc. (Forensic Engineering Company – Since 1996 – 25 years).**
- **Section Manager and Sr. Research Engineer, Columbia Gas (10 years).**
- **Sr. Research Engineer, Battelle (10 years).**

PETTY QUALIFICATIONS

- Education: B.S. Ch. E., M.S. Ch. E. (honors at both levels) and M.B.A. (1st in Class).
- Sr. Research Scientist – Battelle.
- Sr. Research Engineer/Section Manager - R&D – Columbia Gas.
- President, EES Group – Engineering EHS Company, Columbus, OH. – 100s of projects.
- C.I.H. (National Certification), C.S.P. & Professional Engineer (OH, FL, PA, WV, KY, and TX).
- National Exposure/PPE Expert (e.g., Monsanto Roundup, DuPont C-8); ~400 Cases.
- Selected to determine general causation outside of litigation on dozens of projects (e.g., Iraqi Docs – Allegany Ballistics Lab – Columbus Blue Jackets; Prof. Hockey locker room – Columbus College of Art & Design, CMH Airport RA).
- Adjunct Professor – Franklin University (Teach Environmental and Earth Sciences).
- Nine U.S. Patents – mostly with regard to Heat Pumps.



PETTY QUALIFICATIONS

➤ Memberships:

- American Industrial Hygiene Association (AIHA).
- American Board of Industrial Hygiene (ABIH).
- American Conference of Governmental Ind. Hygienists (ACGIH).
- American Institute of Chemical Engineers (AIChE).
- American Society of Refrigeration, Air Conditioning and Refrigeration Engineers (ASHRAE); Member ASHRAE 40 Std. and TC 8.3.
- American IAQ Council.
- Sigma Xi.



PETTY PODCASTS

All this information detailed in Video's at Petty Podcasts



Masks - The Truth is Leaking Out - Slowly

Petty Podcasts
994 views • 61 rumbles • Jan 17



CDC Statement on ASTM Mask Standard – Part 2

Petty Podcasts
218 views • 31 rumbles • Jan 12



Our New Book – My Other Life

Petty Podcasts
71 views • 9 rumbles • Jan 12



CDC and the ASTM Mask Standard - Part 1

Petty Podcasts
692 views • 67 rumbles • Jan 8



Masks: Why They Cannot & Do Not Work - Overview



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PETTY PODCAST
By Stephen Petty, PE, CIH, CSP

Find us at Rumble:

<https://rumble.com/c/PettyPodcasts> – see #5-6 and #11-14, #17-18, #20-21, #23-25.

Long form Interview (Jeff Davis Films):

<https://rumble.com/vrfoox-covid-revealed-episode-8b-bonus-video-stephen-petty.html>

SCHOOL DISTRICT SUPPORT

**Oakstone Academy (Special Needs School) – Westerville, OH
– Dr. Becky Morrison – Two Podcasts – No Masks/
Engineering Controls – Implemented August 2020:**



Dr Becky and Stephen Petty Pt 1

YouTube · Dr Douglas G Frank

Mar 22, 2021

3 key moments in this video



Dr Becky and Stephen Petty Pt 2

YouTube · Dr Douglas G Frank

Mar 22, 2021

Part 1 Video Link (Dr. Morrison): <https://rumble.com/vkhlrn-dr-becky-oakstone-academy> – and:

Part 2 Video Link (Stephen Petty): <https://youtu.be/oYEo4T6V25w>

School and Students Doing Well without Masks for 2020-2021 & 2021 School Years

LITIGATION SUPPORT

1. Boone County, Kentucky – Testified on May 17, 2021 against the Governor’s Mask Mandate.



Filing # 125367129 E-Filed 04/21/2021 04:23:35 PM

IN THE CIRCUIT COURT OF THE EIGHTH JUDICIAL CIRCUIT
IN AND FOR ALACHUA COUNTY, FLORIDA

JUSTIN GREEN,

Case No. 2020-CA-1249

Plaintiff,

v.

ALACHUA COUNTY,

Defendant.

PLAINTIFF'S EXPERT WITNESS DISCLOSURE

COMES NOW JUSTIN GREEN ("Plaintiff"), notifying all interested parties of the retention of Plaintiff's Expert Witness, Stephen E. Petty, P.E., C.I.H., C.S.P., and saying:

Attached hereto are the following exhibits:

Exhibit A – *Curriculum Vitae* of Stephen E. Petty, P.E., C.I.H., C.S.P.

Exhibit B – List of Prior Cases Wherein Expert Testified

Exhibit C – Expert Witness Report of Stephen E. Petty, P.E., C.I.H., C.S.P.

2. US District Court for Western District of Michigan – County Mask Mandate – Testified on 9/28/2021 in Restraining Order Hearing.

3. Filed Affidavits and Declarations in Over 30 Cases in State and Federal Courts in September (e.g., CA, FL, and NY).

DEFINITION OF INDUSTRIAL HYGIENE (AIHA)

“That science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stressors arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort among workers or among the citizens of the community.”

Key Tenets of the Field of Industrial Hygiene (to stop or limit exposures):

- 1. Anticipation**
- 2. Recognition**
- 3. Evaluation**
- 4. Control.**

INDUSTRIAL HYGIENE (IH)

- **Field Associated with Exposure, PPE, and Warnings.**
- **Not Recognized by Much of the Public, Media, & Governmental Officials – Thus Media often rely on M.D.s and not Industrial Hygienists for Information on Controlling Exposures.**
- **Not Associated with Dentistry!**

MASKING – DOES NOT WORK AT 3 LEVELS

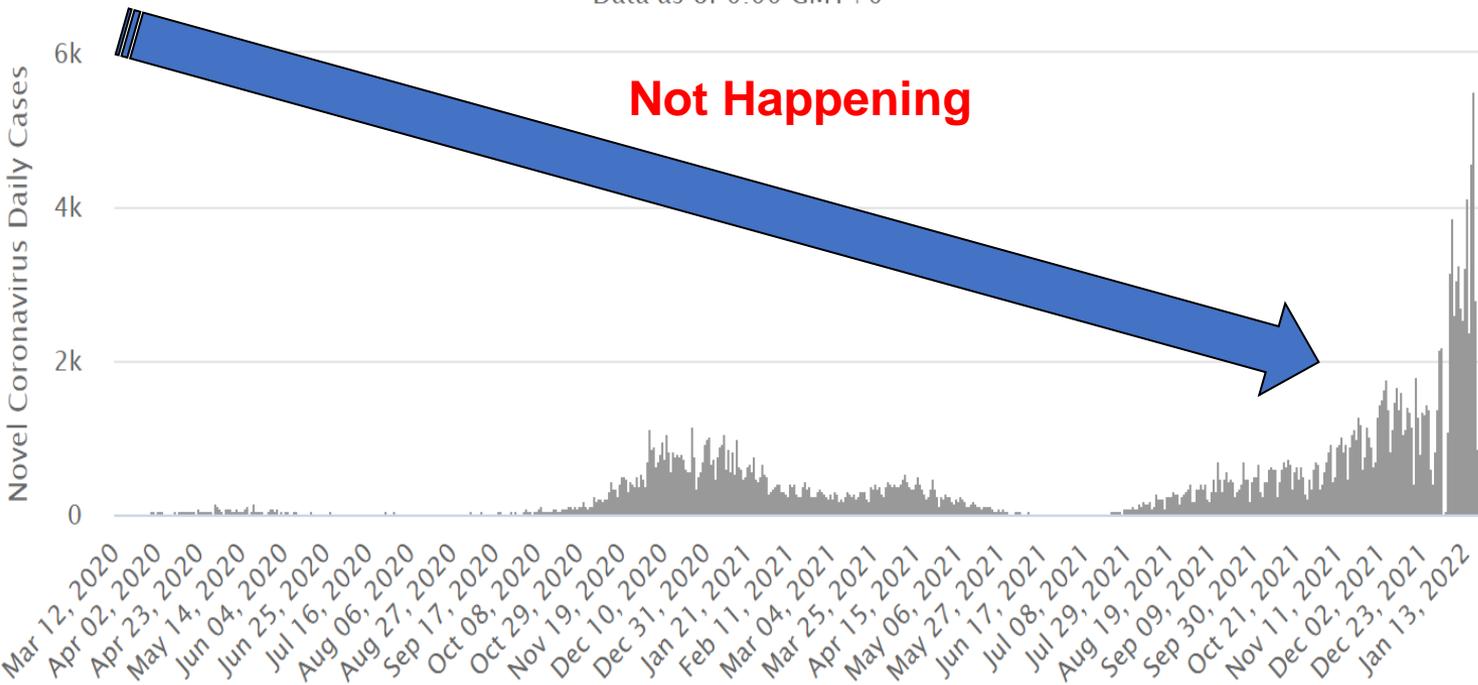
- **100,000 feet**
- **Epidemiology – ground level**
- **Micro-scale.**

MACRO VIEW REGARDING MASKS

New Hampshire – Cases (can be done for any state!)

Daily New Cases

Cases per Day
Data as of 0:00 GMT+0



If Masks Worked One Would Expect Curve to Drop with Time!

Looks More Like Winter (More Time Indoors & More Get Sick).

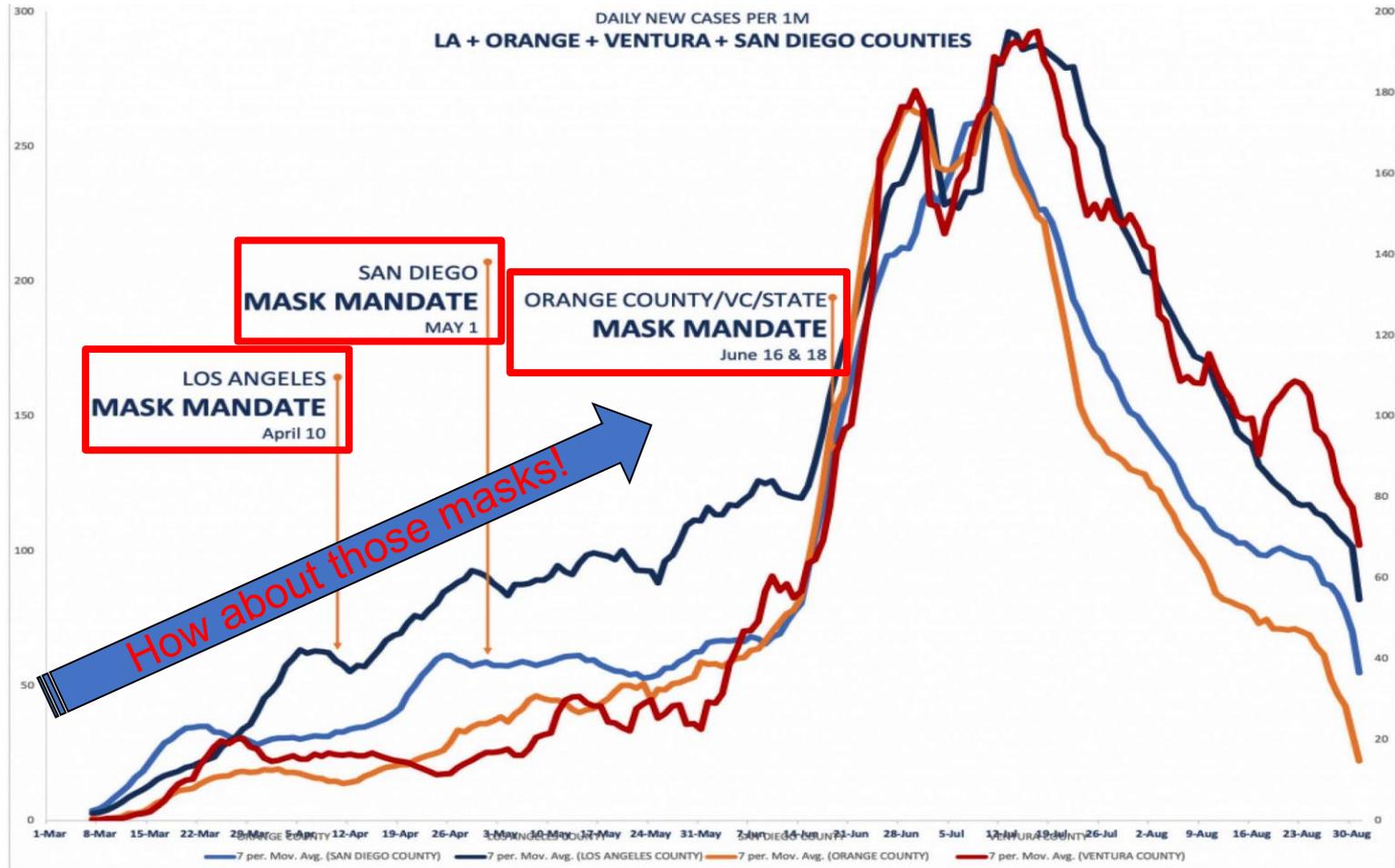
From: <https://www.worldometers.info/coronavirus/usa/new-hampshire/>

Downloaded January 22, 2022

Go to: <https://www.worldometers.info/coronavirus/country/us/> for any state's data

MACRO VIEW REGARDING MASKS

After Masks Mandates Cases Rise Dramatically!



From: <https://rationalground.com/mask-charts/>

Downloaded: January 2, 2022

EPIDEMIOLOGICAL (EPI) ARGUMENT

Ground Level

ONLY MAJOR RCT MASK STUDY - DENMARK

Annals of Internal Medicine™

Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS-CoV-2 Infection in Danish Mask Wearers FREE

A Randomized Controlled Trial

Henning Bundgaard, DMSc , Johan Skov Bundgaard, BSc ,
Daniel Emil Tadeusz Raaschou-Pedersen, BSc , Christian von Buchwald, DMSc ,
Tobias Todsen, MD , Jakob Boesgaard Norsk, MD , Mia M. Pries-Heje, MD,
Christoffer Rasmus Vissing, MD , Pernille B. Nielsen, MD, Ulrik C. Winsløw, MD, Kamille Fogh, MD,
Rasmus Hasselbalch, MD , Jonas H. Kristensen, MD , Anna Ringgaard, PhD,
Mikkel Porsborg Andersen, PhD , Nicole Bakkegård Goecke, PhD , Ramona Trebbien, PhD ,
Kerstin Skovgaard, PhD , Thomas Benfield, DMSc , Henrik Ullum, PhD ,
Christian Torp-Pedersen, DMSc , Kasper Iversen, DMSc [View fewer authors](#) 

Author, Article and Disclosure Information

<https://doi.org/10.7326/M20-6817>

Eligible for CME Point-of-Care

Wearing masks, statistically, did not affect rates of COVID-19 infection.

Took a long time to get study published – wrong answer. CDC does not like this study; only used 0.1% of Country's Population.

Bundgaard et al. Study - Denmark

~6,000 participants; split ~3,000 w/ and 3,000 w/o surgical masks – measured how many got COVID

Results:

A total of 3030 participants were randomly assigned to the recommendation to wear masks, and 2994 were assigned to control; 4862 completed the study. Infection with SARS-CoV-2 occurred in 42 participants recommended masks (1.8%) and 53 control participants (2.1%). The between-group difference was $\times 0.3$ percentage point (95% CI, $\times 0.2$ to 0.4 percentage point; $P=0.38$) (odds ratio, 0.82 [CI, 0.54 to 1.23]; $P=0.33$). Multiple imputation accounting for loss to follow-up yielded similar results. Although the difference observed was not statistically significant, the 95% CIs are compatible with a 46% reduction to a 23% increase in infection.

Masking in Schools – Do They Work?

Oster, E., R. Jack, C. Halloran, J. School, and D. McLeod, COVID-19 Mitigation Practices and COVID-19 Rates in Schools: Report on Data from Florida, New York, and Massachusetts, COVID-19 School Response Dashboard - <https://www.medrxiv.org/content/10.1101/2021.05.19.21257467v1>

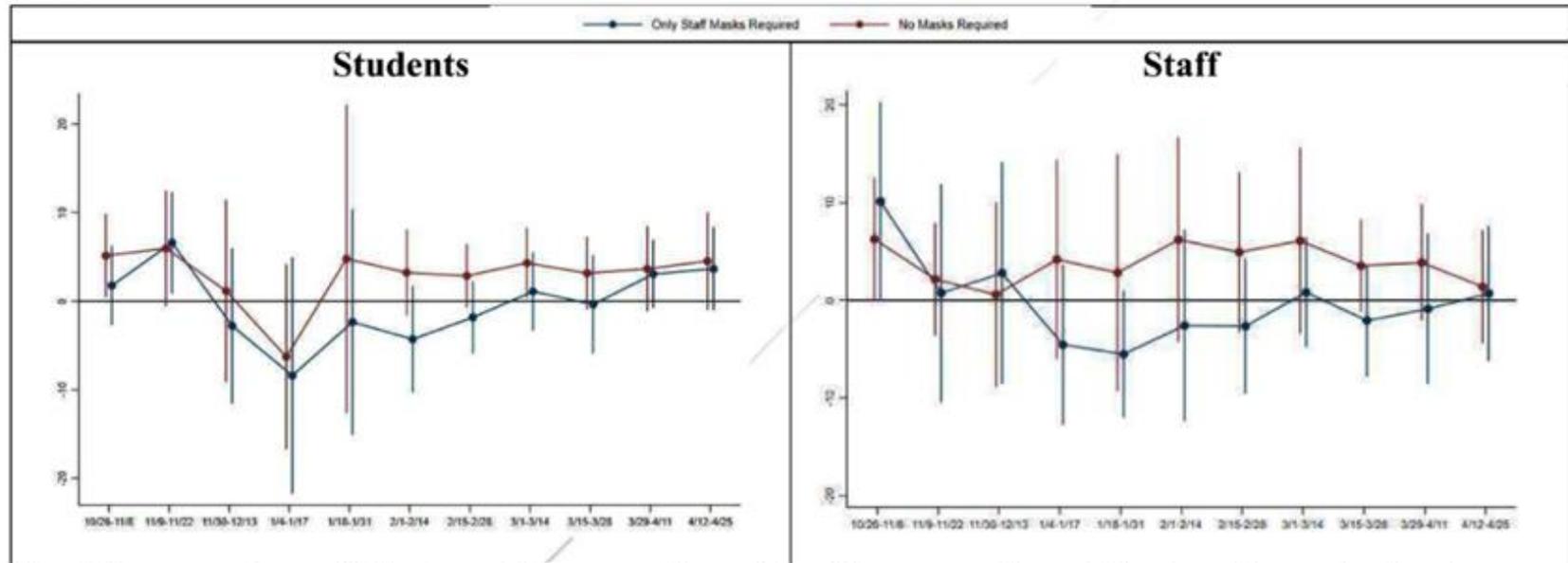
Conclusion With Regard To Florida Schools – Masks vs. No Masks:

“We do not find any correlations with mask mandate!” (RE: Infection rate and mask wearing)

Masking in Schools – Do They Work?

Data on Wearing of Masks vs. No Masks – continued:

Figure 4b. Regression Coefficients of Student and Staff Case Rates on Masking Requirements in Florida



Note. The regression coefficients are from regressions of masking groups (i.e. staff-only masks required and no masks required) interacted with each biweekly wave group on student and staff case rates. The comparison is masks required for both students and staff. Regressions control for community case rates, time fixed effects, racial demographics, density groups, ventilation upgrades, and school level. Regressions are weighted by total student enrollment and standard errors are clustered by school districts.

Data adjusted for community case rates and demographics!

Essentially no differences between wearing/not wearing masks & disease.

FLAWS WITH MOST CDC CITED MASK STUDIES

Almost all of cited CDC studies are flawed because they:

1. Are not Randomized Control Trial studies (RCT).
2. Have no control group (group not wearing masks to compare to with group wearing masks).
3. Have confounding factors in a single study (include masks along with other factors (distancing, quarantine, HVAC changes) and conclude masks had an impact).

MICRO-LEVEL ARGUMENT

RECALL SEEING DUST IN THE AIR

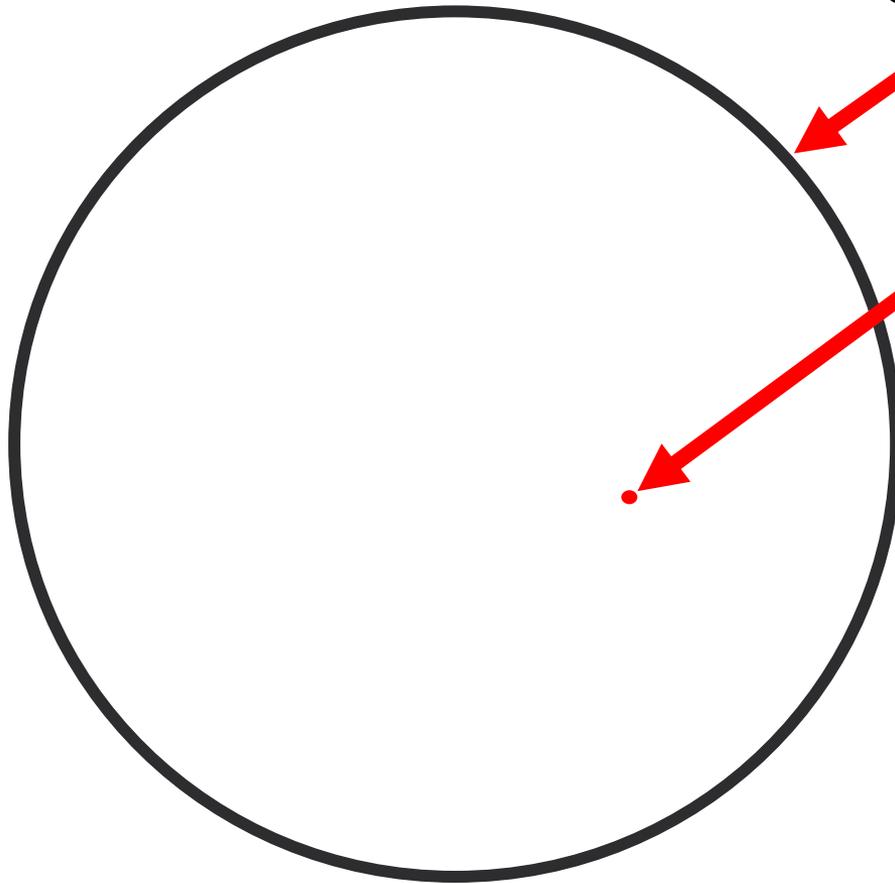


**Visible Dust in Sunlight: $>50\ \mu\text{m}$;
~500 times larger than COVID-19**



Recall How Small a Micron Is vs. a Human Hair

**Black Ring is Cross Section
of Human Hair**



**1 Micron – Small Red Dot
COVID – 1/10 Micron**

~40,000 times smaller in area

& ~1,000 times smaller in diameter

than the cross-section of human hair.

Can you get a human hair past the side of your mask?

Edwards et al. – Data Simplified

>99.9% Particles were Aerosols (small guys)

	Aerosols	Droplets	% Aerosols
Day After Infection	$\sim \leq 5 \mu\text{m}$	$\sim 10 \mu\text{m}$	% Small
-1	10,898	1.5	99.99%
1	10,900	9	99.92%
3	22,847	7	99.97%
7	20,847	3	99.99%
14	10,870	6	99.94%

COVID-19 is about aerosols, not droplets – CDC misleads here.

SMALL PARTICLES TAKE A LONG TIME TO FALL FIVE FEET IN STILL AIR

Droplets fall fast – 0.1 to 10 minutes

Particle Size (μm)	Time to Fall 5' (minutes)
10	9.6
25	1.5
100	0.1

Stokes' Law - assumes still air; in moving air times would be even longer.

SMALL PARTICLES TAKE A LONG TIME TO FALL FIVE FEET IN STILL AIR

Aerosols Fall Slowly: 0.03 to 59 days

Particle Size (μm)	Time to Fall 5' (days)	Type of Particle
0.09	58.9	COVID
0.12	46.4	
0.2	16.7	Aerosol
1	0.67	
5	0.027	

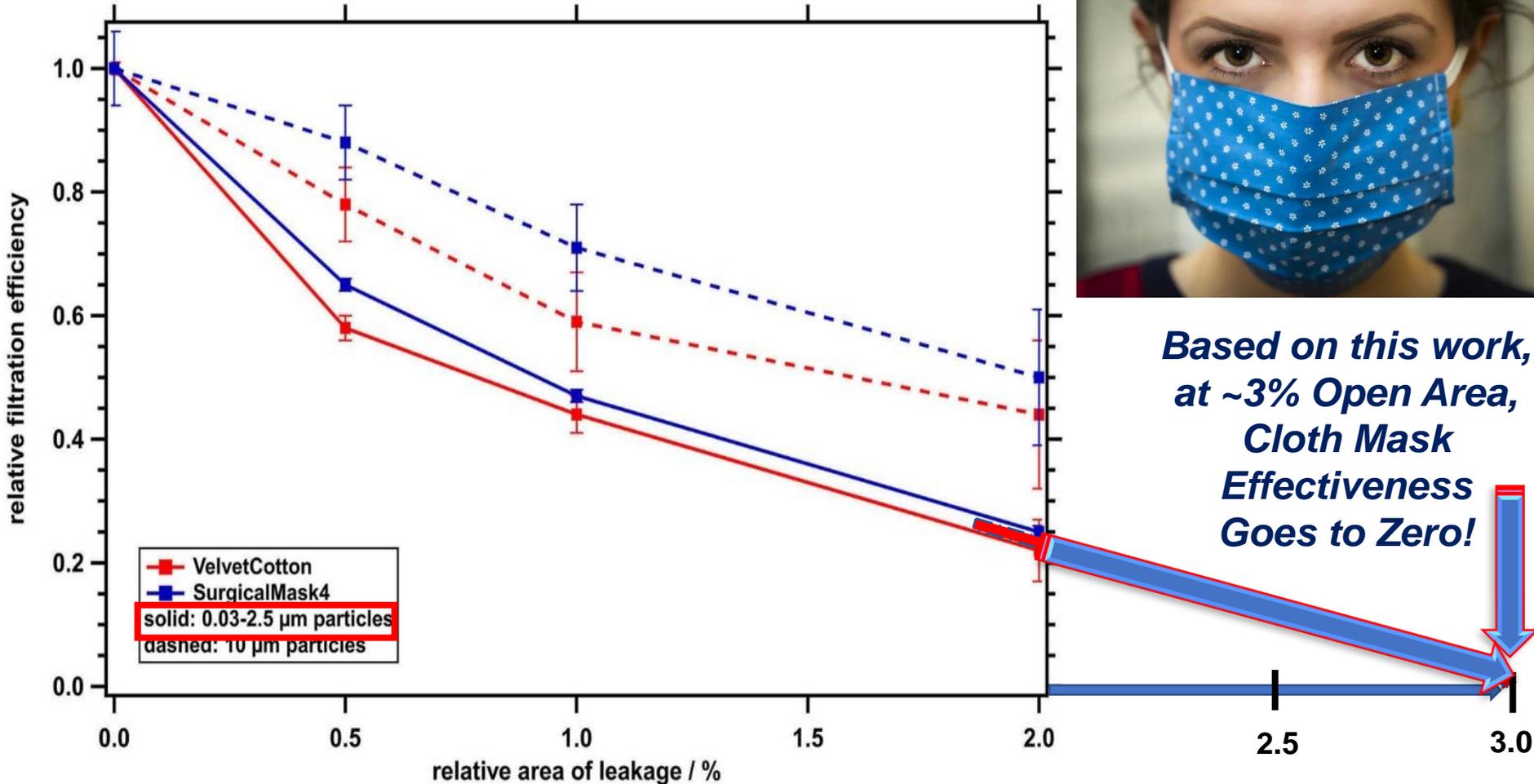
COVID-19 Fall Very Slowly: Up to 46.4 to 58.9 days

Stokes' Law - assumes still air; in moving air times would be even longer.

What About Gaps Around Masks? – Real World Results in Zero Mask Effectiveness



*Based on this work,
at ~3% Open Area,
Cloth Mask
Effectiveness
Goes to Zero!*



WHAT DOES THIS MEAN?

Issue has always been about the little guys (aerosols), not the big guys (droplets)!

Why:

- 1. Vast majority of particles are the little guys (aerosols).**
- 2. Little guys stay in the air for hours to days.**
- 3. Little guys reach the deep lung and are associated with disease.**

Real Misinformation: CDC – masks stop droplets – but aerosols are the issue, not droplets.

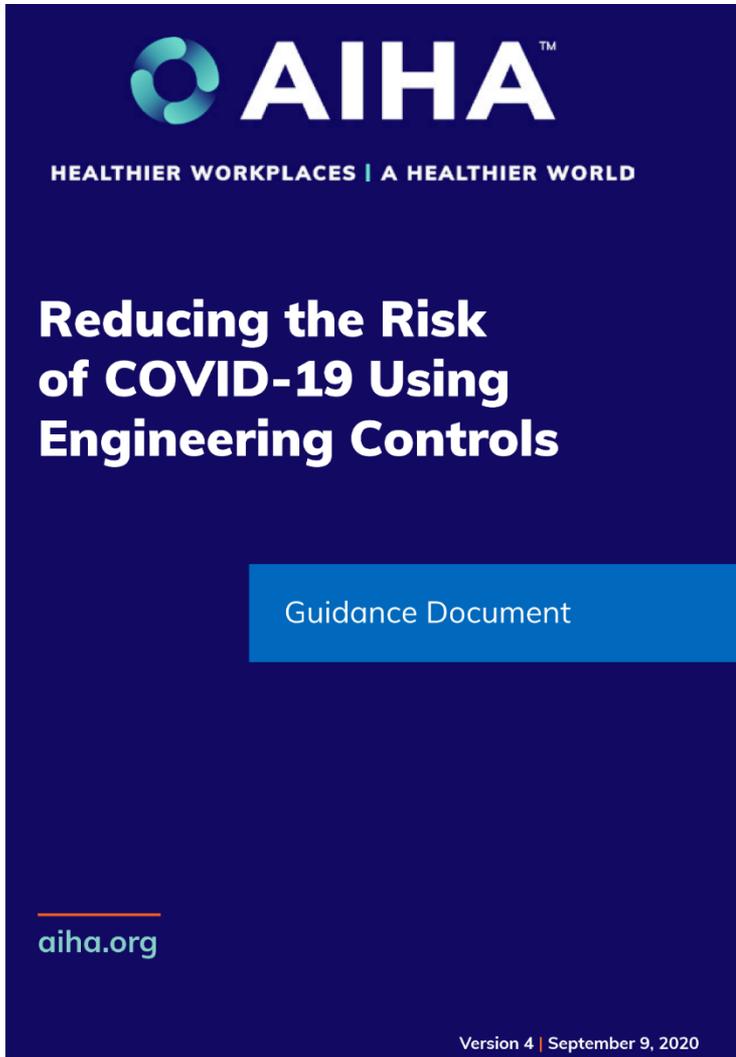
NEED TO PROVIDE SOLUTIONS WITH 90% RELATIVE RISK

In IH, our solutions must greatly minimize the risk, not help just a little bit.

(e.g., would we IH's provide solutions to asbestos workers that only resulted in relative risk of getting asbestos by 10% to 15%? – No! Asbestos is 50x larger than covid!)

AIHA GUIDANCE DOCUMENT

American Industrial Hygiene Association (AIHA)



**September 9, 2020 Guidance
on COVID-19 from AIHA**

AIHA – Relative Risk Reductions - $\geq 90\%$

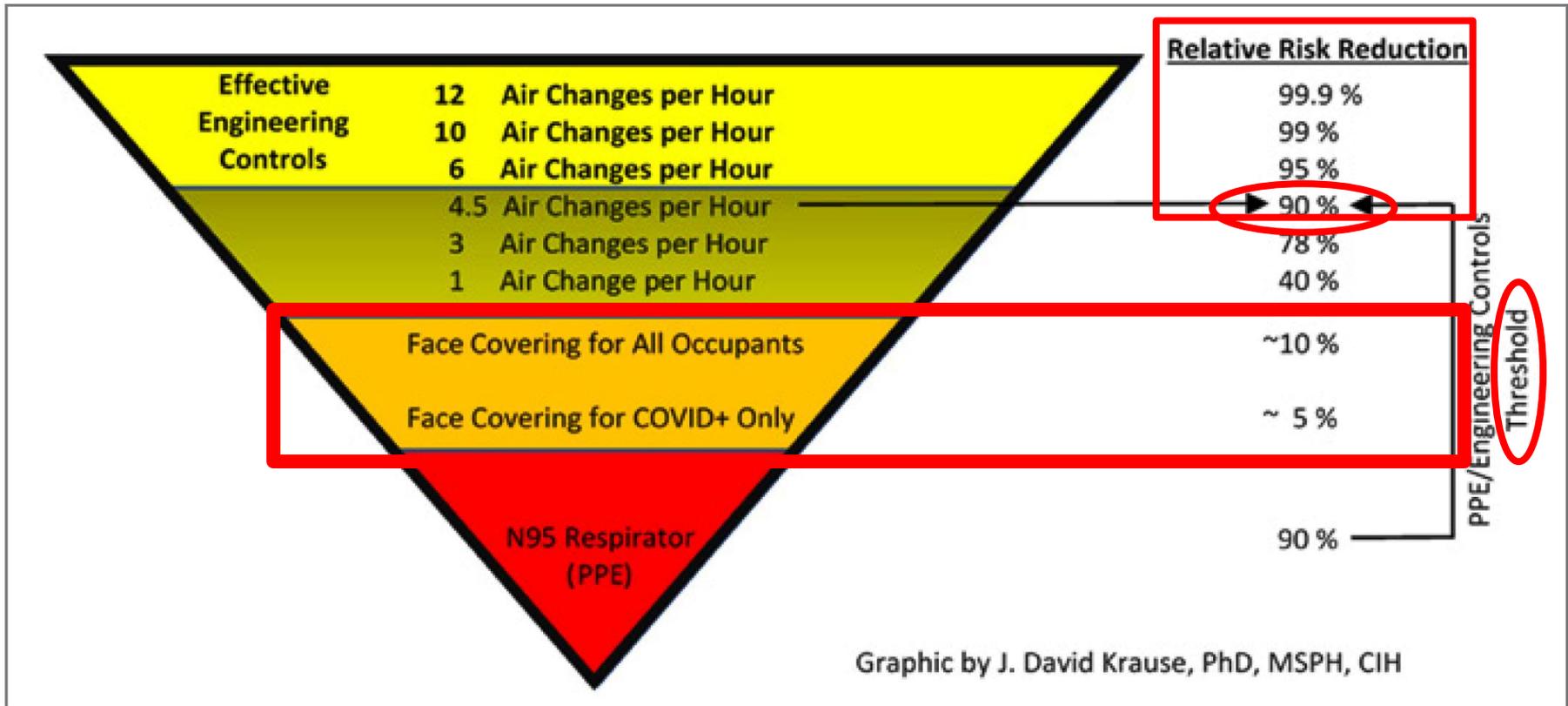


Figure 2*

*To learn how the relative risk reduction estimates were derived for Figure 2, download the [SUPPLEMENT for Reducing the Risk of COVID-19 using Engineering Controls](#).



Experimental investigation of indoor aerosol dispersion and accumulation in the context of COVID-19: Effects of masks and ventilation

Cite as: Phys. Fluids **33**, 073315 (2021); doi: [10.1063/5.0057100](https://doi.org/10.1063/5.0057100)

Submitted: 17 May 2021 · Accepted: 2 July 2021 ·

Published Online: 21 July 2021



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[CrossMark](#)

Yash Shah,  John W. Kurelek,  Sean D. Peterson,  and Serhiy Yarusevych^{a)} 

Shah et al., 2021 – Masks & N95s Do Not Appear to Work in the Real World

(Filtration Efficiencies with no Edge Gaps & 1 μ m particles (COVID ~0.1 μ m))

➤ High-efficiency masks

- **R95 (60.2%)**
- **KN95 (46.3%)**
- **KN95 w gap (3.4%).**

➤ Cloth Masks (9.8%).

➤ Surgical masks (12.4%).



From ASTM F3502-21 – Mask Standard

Even FDA and CDC Now Saying Masks DO NOT Work

Masks – Do they Work? - NO!

On January 2, 2022, Scott Gottlieb, former FDA Commissioner, on CBS's "Face the Nation," spilled the beans regarding the Government's knowledge on masks:

1/8/22, 10:43 AM

Dr. Scott Gottlieb Gives Unbelievable Confession: 'A Cloth Mask is Not Going to Protect You' from an Airborne Virus | The Paradis...



Menu

The Paradise



NEWS

Dr. Scott Gottlieb Gives Unbelievable Confession: 'A Cloth Mask is Not Going to Protect You' from an Airborne Virus



by Admin

January 2, 2022, 10:45 pm



Dr. Scott Gottlieb, the former FDA chief who quickly transitioned after leaving office to become a Pfizer board member, has made an admission about cloth masks that should make Americans question the "science" they have been told was unquestionable all along.

Gottlieb appeared on CBS's "Face the Nation" with host Margaret Brennan and punctured the widespread belief that cloth masks provide any significant protection from airborne respiratory viruses, such as Covid-19.

Masks – Do they Work? – Gottlieb - NO

Gottlieb replied:

“Cloth masks aren’t going to provide a lot of protection, that’s the bottom line,” he said. “This is an airborne illness. We now understand that. And a cloth mask is not going to protect you from a virus that spreads through airborne transmission. It could protect better through droplet transmission, something like the flu, but not this coronavirus.”

NEWS

Dr. Scott Gottlieb Gives Unbelievable Confession: 'A Cloth Mask is Not Going to Protect You' from an Airborne Virus



Dr. Scott Gottlieb, the former FDA chief who quickly transitioned after leaving office to become a Pfizer board member, has made an admission about cloth masks that should make Americans question the "science" they have been told was unquestionable all along.

Gottlieb appeared on CBS's "Face the Nation" with host Margaret Brennan and punctured the widespread belief that cloth masks provide any significant protection from airborne respiratory viruses, such as COVID-19.

Now Even CDC Effectively Saying Masks DO NOT Work

Health

CDC says N95 masks offer far better protection than cloth masks against omicron variant

But the updated guidance stops short of saying everyone should wear them.



MOST READ HEALTH >



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January 14, 2022 – New CDC Mask Guidance

TOLD TO FOLLOW CDC GUIDANCE

CDC Guidance with time:

- No-masks needed – early 2020 (Fauci).
- Masks needed – mid-2020.
- Masks not needed – summer 2021.
- Masks needed – fall and school year of 2021 – help prodding from WH and Teacher's Union.
- January 14, 2022 - now masks not so good – need to move on to respirators (not just N-95s).

WHAT CDC GUIDANCE DO WE FOLLOW?

None of the Above – Follow Engineering Controls

Masks – CDC – 1/14/22 - Do they Work? - Not really!

Choosing a Mask or Respirator for Different Situations

Masks and respirators (i.e., specialized filtering masks such as "N95s") can provide different levels of protection depending on the type of mask and how they are used. **Loosely woven cloth products provide the least protection**, layered finely woven products offer more protection, well-fitting disposable surgical masks and KN95s offer even more protection, and **well-fitting NIOSH-approved respirators (including N95s) offer the highest level of protection**.

On January 14, 2022, CDC's new mask guidance backed away from masks – now they say NIOSH respirators are the best protection – *lump N95 (bottom of the barrel) in there.*

**NOTE WORDING – “NIOSH RESPIRATORS
(Not just N95) BEST PROTECTION”
Yet everyone rushing to N95s –
bottom of the barrel respirators**



The screenshot shows the CDC website's COVID-19 section. The main navigation bar includes 'Your Health', 'Vaccines', 'Cases & Data', 'Work & School', and 'Healthcare Workers'. The 'Your Health' dropdown menu is open, showing 'Types of Masks and Respirators' as the selected item. Other items in the menu include 'About COVID-19', 'Variants of the Virus', 'Symptoms', 'Testing', and 'Prevent Getting Sick'. The 'Types of Masks and Respirators' page is noted as being updated as of January 14, 2022.

WHAT? CDC DUMPS ON KN95s – Does Public Know This Distinction?

Respirators that Meet International Standards

Some respirators are designed and tested to meet international standards. The most widely available respirators that meet an international standard are **KN95 respirators**. Other examples include 1st, DL2, DL3, DS2, DS3, FFP2, FFP3, KN100, KP95, KP100, P2, P3, PFF2, PFF3, R95, and Special.

Poor quality KN95 respirators

- About 60% of KN95 respirators NIOSH evaluated during the COVID-19 pandemic in 2020 and 2021 did not meet the requirements that they intended to meet.
 - Using a poor-quality product may not provide the level of protection indicated.

So, the KN95s from China fail NIOSH requirements 60% of the time....

Also recall: N95s are rated to stop 95% of the particles 0.3 microns or larger – COVID, a virus, is at ~0.1 microns – much smaller!

SO WHERE ARE THE BOUNDARIES?

Not PPE – Cannot be Sealed



No OSHA Requirements

Masks are not Respirators: Terms often Conflated

PPE – Can be Sealed



**N-95
(dust)**



**PAPR –
Powered Air
Purifying
Respirator

(Asbestos
workers)**

OSHA 29 CFR 1910.134 Requirements

OSHA 29 CFR 1910.134 – Respiratory Protection Standard (RPS)

<u>OSHA 1910.134 RPS Parameters</u>	<u>Mask</u>	<u>Respirator</u>
Medical Clearance to Wear	No	Yes
Ability to Wear Facial Hair – Beard	Yes	No
Initial Fit Test Requirement	No	Yes
Annual Requirement to Fit Test	No	Yes
Change-out Criteria for Filter/Cartridge	No	Yes
Training on Use of Mask/Respirator	No	Yes
Training on Storage of Mask/Resp.	No	Yes
Audit of Effectiveness of Program	No	Yes

CONCLUSIONS: Masks do not meet key OSHA RPS Requirements!

Movement to the N95 means one has to follow RPS!

EVEN SUPPLIER (3M) OF N95s WARN AGAINST USE FOR AEROSOLS & INFECTIOUS DISEASE

IMPORTANT
Before use, in
Use For
Particles such as metal, wood, aerosols or vapors of any class of respirator.
Do Not Use
Do not use for times the occupational exposure limit when the Occupational Safety and Health Administration (OSHA) substance specific standards, such as those for, arsenic, cadmium, lead in the construction industry, or 4,4'-methylene dianiline (MDA), specify other types of respiratory protection.
Biological Particles
This respirator can help reduce inhalation exposures to certain airborne biological particles (e.g. mold, *Bacillus anthracis*, *Mycobacterium tuberculosis*, etc.) but cannot eliminate the risk of contracting infection, illness or disease. OSHA and other government agencies have not established safe exposure limits for these contaminants.
Use Limitations
1. This respirator is not designed to be used for protection against...
2. Do not use when concentrations of contaminants are immediately dangerous to life or health, are unknown or when concentrations exceed 10 times the permissible exposure limit (PEL) or according to specific OSHA standards or applicable government regulations, whichever is lower.
3. Do not alter, wash, abuse or misuse this respirator.
4. Do not use with beards or other facial hair or other conditions that prevent a good seal between the face and the sealing surface of the respirator.
5. Respirators can help protect your lungs against certain airborne contaminants. They will not prevent entry through other routes such as the skin, which would require additional personal protective equipment (PPE).
6. This respirator is designed for occupational/professional use by adults who are properly trained in their use and limitations. This respirator is not designed to be used by children.
7. Individuals with a compromised respiratory system, such as asthma or emphysema, should consult a physician and must complete a medical evaluation prior to use.
8. When stored in accordance with temperature and humidity conditions specified the product may be used until the "use by" date specified on packaging.
Storage Conditions and Shelf Life
Before use, store respirators in the original packaging, away from contaminated areas, dust, sunlight, extreme temperatures, excessive moisture and damaging chemicals. When stored in accordance with temperature and humidity conditions specified the product may be used until the "use by" date specified on packaging. Always inspect product and conduct a user seal check before use as specified in these *User Instructions*. If you cannot achieve a proper seal, do not use the respirator.

Use For

Particles such as those from grinding, sanding, sweeping, sawing, bagging, or processing minerals, coal, iron ore, flour, metal, wood, pollen, and certain other substances. Liquid or non-oil based particles from sprays that do not also emit oil aerosols or vapors. Follow all applicable local regulations. For additional information on 3M use recommendations for this class of respirator please consult the 3M Respirator Selection Guide found on the 3M Personal Safety Division website at www.3M.com/respiratorselector or call 1-800-243-4630 in U.S.A. In Canada call 1-800-267-4414.

Do Not Use For

Do not use for gases and vapors, oil aerosols, asbestos, or sandblasting; particulate concentrations that exceed either 10 times the occupational exposure limit or applicable government regulations, whichever is lower. In the U.S., do not use when the Occupational Safety and Health Administration (OSHA) substance specific standards, such as those for, arsenic, cadmium, lead in the construction industry, or 4,4'-methylene dianiline (MDA), specify other types of respiratory protection. This respirator does not supply oxygen.

Biological Particles

This respirator can help reduce inhalation exposures to certain airborne biological particles (e.g. mold, *Bacillus anthracis*, *Mycobacterium tuberculosis*, etc.) but cannot eliminate the risk of contracting infection, illness or disease. OSHA and other government agencies have not established safe exposure limits for these contaminants.

Even an N95 Respirator is not recommended for larger asbestos particles, aerosols, or to stop illness or disease.

Does not Look Like N-95s are the solution; see also AIHA and Shah et al. work.

 End of Shelf Life
Use respirators before the "use by" date specified on packaging

 Storage Temperature Range
-20°C (-4°F) to +30°C (+86°F)

WHAT ELSE DOES 3M WARN ABOUT USING N95s?

Biological Particles

This respirator can help reduce inhalation exposures to certain airborne biological particles (e.g. mold, *Bacillus anthracis*, *Mycobacterium tuberculosis*, etc.) but cannot eliminate the risk of contracting infection, illness or disease. OSHA and other government agencies have not established safe exposure limits for these contaminants.

Biological Particles:

- Can reduce, but not eliminate infection etc., for larger biological particles such as mold, bacteria, and TB tuberculosis) – key: *viruses not mentioned*.
- Virus particles are the little guys when it comes to biological particles.

BIOLOGICAL PARTICLES – VIRUSES THE SMALLEST (ASHRAE FUNDAMENTALS HB – 2001 CHAPTER. 12)

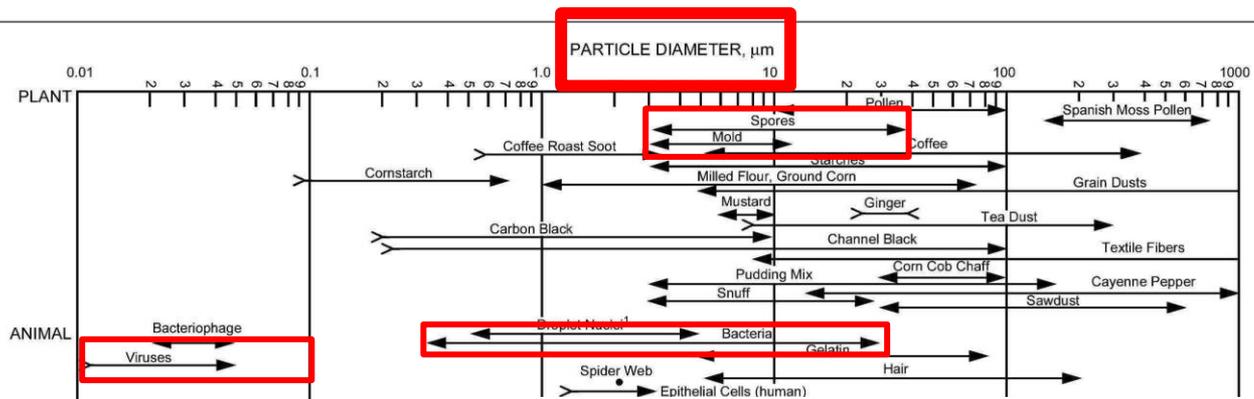


Table 1 Approximate Particle Sizes and Their Times to Settle One Metre

	Type of Particle	Diameter, μm	Settling Time
MINERAL	Carbon Dust from Graphite		
	Clay		
	Lead, Bromine	Human hair	5 s
COMBUSTION	MMMF ² : Metallurgical Dusts and Fumes	Skin flakes	
	Sea Salt	Observable dust in air	
	Tobacco Smoke, Burning Wood	Common pollens	
HOME/PERSONAL CARE	Rosin Smoke	Mite allergens	5 min
	Coal Flue Gas	Common spores	
	Air Filter Anti-Stick	Bacteria	
	Paint Pigments	Cat dander	10 h
	Alkali Fume	Tobacco smoke	
	Face Powder: Talc	Metal and organic fumes	
	Copier Toner	Cell debris	
RADIOACTIVE	Radon Progeny	Viruses	10 days

Viruses are the smallest of biological particles & toughest to filter out & 10x to 100x smaller than others!

Source: J.D. Spengler, Harvard School of Public Health.

Fig. 3 Sizes of Indoor Particles
(Owen et al. 1992)

WHAT ELSE DOES 3M WARN ABOUT USE OF N95s?

Use Limitations

1. This respirator does not supply oxygen. Do not use in atmospheres containing less than 19.5% oxygen.
2. Do not use when concentrations of contaminants are immediately dangerous to life or health, are unknown or when concentrations exceed 10 times the permissible exposure limit (PEL) or according to specific OSHA standards or applicable government regulations, whichever is lower.
3. Do not alter, wash, abuse or misuse this respirator.
4. Do not use with beards or other facial hair or other conditions that prevent a good seal between the face and the sealing surface of the respirator.
5. Respirators can help protect your lungs against certain airborne contaminants. They will not prevent entry through other routes such as the skin, which would require additional personal protective equipment (PPE).
6. This respirator is designed for occupational/professional use by adults who are properly trained in their use and limitations. This respirator is not designed to be used by children.
7. Individuals with a compromised respiratory system, such as asthma or emphysema, should consult a physician and must complete a medical evaluation prior to use.

Use Limitations:

- **“Not designed to be used by children!”**
- Only designed for adults in occupational settings and trained – Code: follow 29 CFR 1910.134.
- Adults must be medically cleared to use 3M’s N95 respirator.

WHAT ELSE DOES 3M WARN ABOUT USE OF N95s?

IMPORTANT

Before use, wearer must read and understand these *User Instructions*. Keep these instructions for reference.

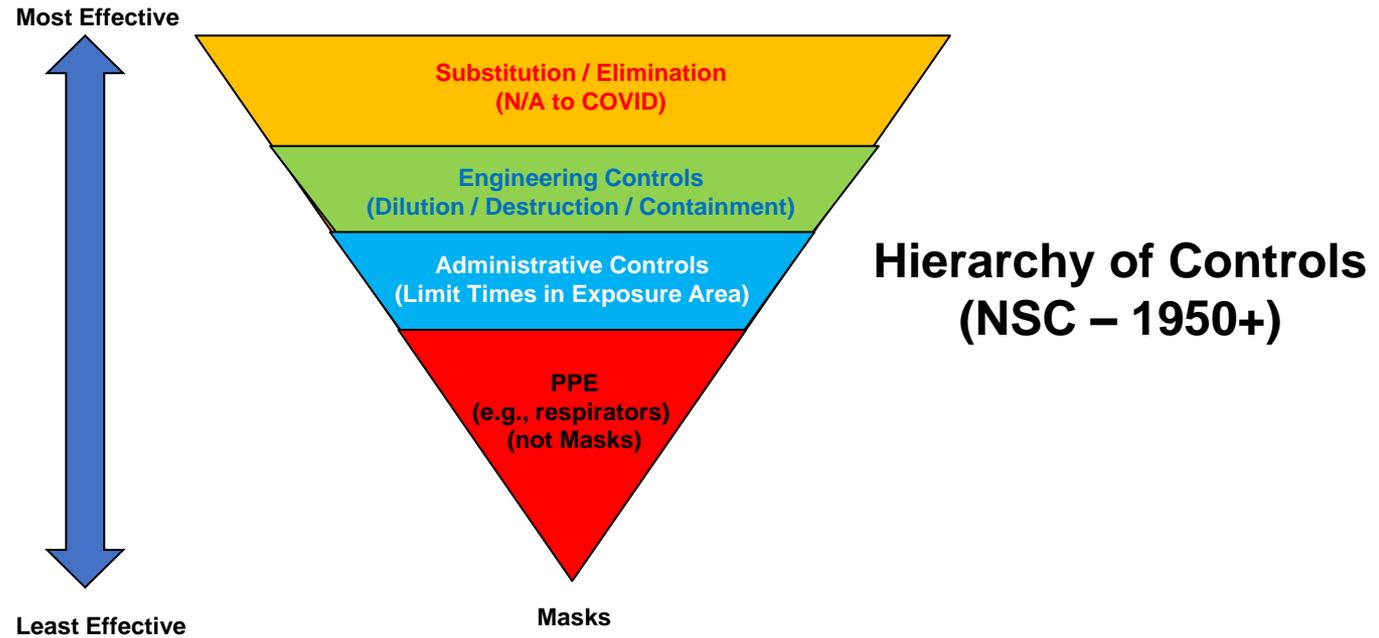
Use Instructions

1. Failure to follow all instructions and limitations on the use of this respirator and/or failure to wear this respirator during all times of exposure can reduce respirator effectiveness and **may result in sickness or death.**
2. In the U.S., before occupational use of this respirator, a written respiratory protection program must be implemented meeting all the requirements of OSHA 29 CFR 1910.134 such as training, fit testing, medical evaluation, and applicable OSHA substance specific standards. In Canada, CSA standard Z94.4 requirements must be met and/or requirements of the applicable jurisdiction, as appropriate. Follow all applicable local regulations.
7. Conduct a user seal check before use as specified in the Fitting Instructions section. **If you cannot achieve a proper seal, do not use the respirator.**

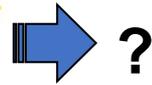
Use Instructions:

- Failure to follow instructions may result in sickness or death.
- Must follow OSHA 29 CFR 1910.134 – Respiratory Protection Standard – to use in occupational setting.
- Must be able to be sealed or do not use.

CDC vs. IH Approach to Control Exposure



CDC Approach



?

2020-2021 – Masks

2022 – Masks/N95s

vs.

Petty IH Approach



2020-2022+ – Engineering Controls

DAMAGE AND HARM TO CHILDREN

(and adults)

January 2022 England Dept. of Education Study

123 schools in England used masks and compared that to others that did not use masks during the Delta wave of Covid.

Evidence Summary

Coronavirus (COVID-19) and the use of face coverings in education settings



January 2022 England Dept. of Education Study – Masks Negatively Affected Learning

The review acknowledged the use of face coverings are harmful:

“A survey conducted by the Department for Education in April 2021 found that almost all secondary leaders and teachers (94%) thought that wearing face coverings has made communication between teachers and students more difficult, with 59% saying it has made it a lot more difficult”

“Wearing face coverings may have physical side effects and impair face identification, verbal and non-verbal communication between teacher and learner.”

January 2022 England Dept. of Education Study – Masks Negatively Affected Health

English Guidance on Masks in Schools Differs from USA:

“[English] Government guidance continues to be that children aged under 11 years old should be exempt from requirements to wear face coverings in all settings including education. UKHSA does not recommend face coverings for children under the age of 3 years for health and safety reasons!”



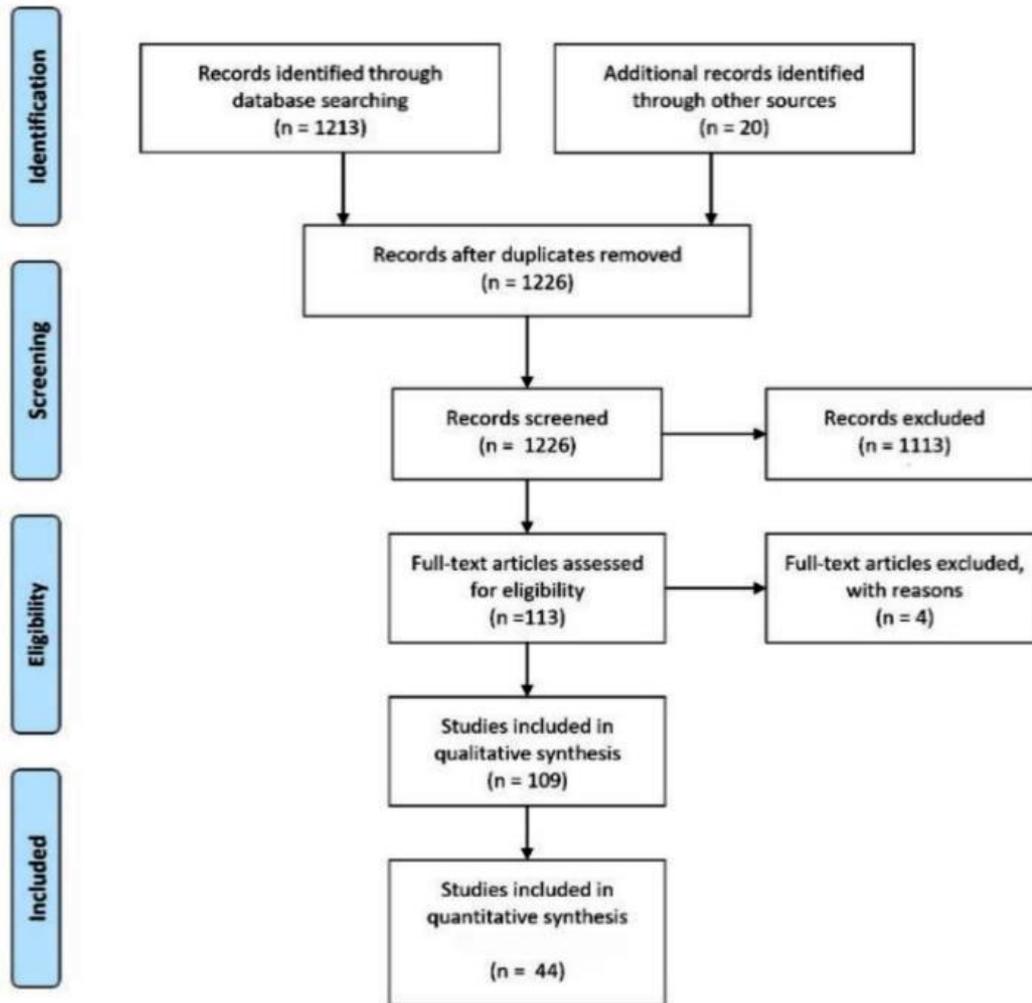
OTHER NEGATIVE EFFECTS OF WEARING MASKS

Review

Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?

Kai Kisielinski ¹, Paul Giboni ², Andreas Prescher ³, Bernd Klosterhalfen ⁴, David Graessel ⁵, Stefan Funken ⁶, Oliver Kempfski ⁷ and Oliver Hirsch ^{8,*}

KISIELINSKI et al., 2021 NEGATIVE EFFECTS OF WEARING MASKS



OTHER NEGATIVE EFFECTS OF WEARING MASKS

Increased risk of adverse effects when using masks:

Internal diseases

COPD
Sleep Apnea Syndrome
advanced renal Failure
Obesity
Cardiopulmonary Dysfunction
Asthma

Psychiatric illness

Claustrophobia
Panic Disorder
Personality Disorders
Dementia
Schizophrenia
helpless Patients
fixed and sedated Patients

Neurological Diseases

Migraines and Headache Sufferers
Patients with intracranial Masses
Epilepsy

Pediatric Diseases

Asthma
Respiratory diseases
Cardiopulmonary Diseases
Neuromuscular Diseases
Epilepsy

ENT Diseases

Vocal Cord Disorders
Rhinitis and obstructive Diseases

Dermatological Diseases

Acne
Atopic

Occupational Health Restrictions

moderate / heavy physical Work

Gynecological restrictions

Pregnant Women

Figure 5. Diseases/predispositions with significant risks, according to the literature found, when using masks. Indications for weighing up medical mask exemption certificates.

DO WE REALLY WANT TO PUT MASKS & N95s ON CHILDREN AND ADULTS?

Simple Answer: No!

- **Using N95s will likely increase harms and health effects and could incur liability on those requiring them if RPS and manufacturers' instructions are not followed.**
- **In the real world they are also ineffective.**
- **Engineering Controls are, and always have been, the solution.**

ENGINEERING CONTROLS

EXPOSURE CONTROL – DILUTION BY VENTILATION OR MAXIMUM FRESH AIR

Dilution of Virus by Dilution and/or Ventilation – More Fresh Air!

- *Spend More Time or Meet Outdoors* – condition of maximum fresh air and dilution of virus – avoid indoors.
- *Ventilation* – Residential and Commercial – Crack open windows or doors – especially with company.



EXPOSURE CONTROL – DILUTION BY VENTILATION OR MAXIMUM FRESH AIR

Dilution of Virus by Dilution and/or Ventilation – More Fresh Air!

- Ventilation – Commercial and Industrial – Increase fresh air – set fresh air dampers to maximum openings on HVAC systems to maximize fresh air intake – over-ride energy controls – will increase energy costs.



EXPOSURE CONTROL – DESTRUCTION

➤ Needle Point Ionization Technology (e.g., Nu-Calgon I-Wave & REM HALO-LED™ Whole Home In-Duct Air Purifier)

- Unit magnetized and sticks to indoor unit fan.
- Nu-Calgon will treat up to 6-RT area or ~6,000 ft².
- Efficiency reported to 64.3%, 89.1%, and 96.4% for times of 15, 30, and 45 minutes respectively.
- Nu-Calgon Cost: ~\$400 plus installation (\$800; HALO: ~\$1,180 installed. – Tube replacement at ~4.5 yrs.

Bipolar ionization has received a lot of attention since the start of the current pandemic. Ionization is typically classified as either needlepoint ionizers or corona discharge ionizers (dielectric barrier). Ionizers produce positively charged ions, negatively charged ions, or both. A study by Hyun, et al., looked at the effect of corona discharge-generated air ions on aerosolized bacteriophage MS2.¹³ The test separated the antiviral efficiency of the ozone produced in the ion creation process (30 ppb at 4.52%). The results showed that the antiviral efficiency for bipolar ions was greater than either positive or negative ions individually, and the antiviral efficiency of the bipolar air ions at 10^7 ions/cm³ concentration was 64.3%, 89.1% and 96.4% with exposure times of 15, 30 and 45 minutes.¹³



EXPOSURE CONTROL – DESTRUCTION

➤ ***Ionized Hydrogen Peroxide Systems*** (e.g., RGF's Reme Halo in-duct air purifier - <https://www.rgf.com/products/air/remehalo/#undefined>).

- **REME® Cell technology with UV-C light to create low level, airborne hydrogen peroxide throughout the air-conditioned space reducing airborne and surface bacteria, viruses, odors, and mold.**
- **Cost: \$450 to \$650 for residential unit; \$780 installed. Cell replacement ~every 2 years**
- **Must control H₂O₂ concentration.**
- **Reduces virus concentrations on surfaces by 4-log or a factor of 10,000.**

Chemical disinfectants like hypochlorite, peroxy-monosulfate, alcohols, quaternary ammonium compounds and hydrogen peroxide are typical for surface disinfection of viruses.³¹ Vaporized hydrogen peroxide (VHP) has also been used in engineered disinfection systems for control of viruses.³¹ A study by Goyal, et al., has showed a 4-log reduction or greater for viruses dried on surfaces.³² VHP requires spaces to be sealed to prevent the vapor from escaping. Also, the space must be unoccupied since high concentrations of VHP can be hazardous.¹



Other products being considered are hypochlorite, peroxy-monosulfate, alcohols, and quaternary ammonium compounds

EXPOSURE CONTROL – DESTRUCTION

➤ *Novaerus Air Purifier Technology*

3 sizes; treat 120 ft², 900 ft² and 3,000 ft².

- **“NanoStrike patented technology destroys viruses, microorganisms, and bacteria at the DNA level:**
 - **Plasma coils create energy field that kills ALL germs and pathogens in sub-second time.**
 - **99.9+% effective at eliminating Influenza pathogens, SARS-Cov-2 (Covid-19), and MRSA.**
 - **Kills ALL airborne microorganisms at the DNA level as small as 1 nanometer!”**

Hays Consolidated Independent School District in Texas considering spending ~\$4 million on technology

<https://bellmedical.com/novaerus-portable-air-purifier>



EXPOSURE CONTROL – DESTRUCTION

➤ Ultraviolet-C (UVC):

1.2 mJ/cm² to 2 mJ/cm² inactivated 95% to 99.9% of virus.

- At reg. limit of 23 mJ/cm² 90%, 95%, and 99% of virus destroyed in 8, 11, and 25 minutes respectively.
- Dangerous to eyes.
- Maint. - must ensure bulbs not burned out.



Far-UV-C refers to devices that operate in the 207 nm to 222 nm wavelength range.²⁴ UV-C light in this range is strongly absorbed by biological materials and doesn't penetrate through the outer dead-cell layers (stratum corneum) on the surface of human skin or the outer tear layer of the eye.²⁴ Since far-UV-C can only penetrate a few micrometers, it cannot reach living human cells in the skin or eyes.²⁵ However, this light can still inactivate bacteria and viruses with efficiencies comparable to UV-C in the 254 nm wavelength due to the virus's smaller cell size.²⁴ Buonanno, et al., found that low doses (1.2 mJ/cm² to 1.7 mJ/cm²) of 222 nm light inactivated 99.9% of the airborne human coronavirus tested.²⁵ Welch, et al., also found that 2 mJ/cm² of 222 nm light could inactivate 95% or more of aerosolized H1N1 influenza virus.²⁴ The threshold limit value (TLV) for 222 nm light to which the public can be exposed is 23 mJ/cm² per eight-hour exposure.²⁵ Based on far-UV-C exposure set at the regulatory limit, continuous exposure could result in 90% viral inactivation of airborne viruses in about eight minutes, 95% in 11 minutes, 99% in 16 minutes and 99.9% in 25 minutes.²⁵

EXPOSURE CONTROL – REMOVAL

Destruction or Removal:

- **Very High Efficiency Filters (at least MERV-13 to 17 filters depending on particle size).**

(<https://www.ashrae.org/file%20library/technical%20resources/covid-19/guidance-for-the-re-opening-of-schools.pdf>).



Burkett - ASHRAE J., 9/2021

TABLE 3 Minimum efficiency reporting value (MERV) performance.²⁰

MERV	COMPOSITE AVERAGE PARTICLE SIZE EFFICIENCY, % IN SIZE RANGE		
	Range 1 (0.3 μm to 1.0 μm)	Range 2 (1.0 μm to 3.0 μm)	Range 3 (3.0 μm to 10.0 μm)
8	N/A	20 ≤ E ₂	70 ≤ E ₃
9	N/A	35 ≤ E ₂	75 ≤ E ₃
10	N/A	50 ≤ E ₂	80 ≤ E ₃
11	20 ≤ E ₁	65 ≤ E ₂	85 ≤ E ₃
12	35 ≤ E ₁	80 ≤ E ₂	90 ≤ E ₃
13	50 ≤ E ₁	85 ≤ E ₂	90 ≤ E ₃
14	75 ≤ E ₁	90 ≤ E ₂	95 ≤ E ₃
15	85 ≤ E ₁	90 ≤ E ₂	95 ≤ E ₃
16	95 ≤ E ₁	95 ≤ E ₂	95 ≤ E ₃

Note: Data taken from ASHRAE Standard 52.2-2017 Table 12-1.

MERV (Minimum Efficiency Reporting Value)

Filter MERV of 16+ for 0.1 μm particles

EXPOSURE CONTROL – OZONE - NO

Ozone (O₃) Generators Alone:

- Health Effects on Respiratory Tract.
- Control of Levels in Space
Difficult – produce fixed amount of ozone over time & spaces will have different volumes and ventilation rates – Will not know concentration.

Burkett - ASHRAE J., 9/2021

Ozone, even at low levels, can produce respiratory issues in humans and actually cause other health risks through the formation of formaldehydes and aldehydes.²⁰ ASHRAE states that based on current science there is “no consensus on the safe level of ozone.”²⁰

ASHRAE Standard 62.1-2019, Table D-1²⁰ lists the eight-hour limit at 0.07 ppm, and the EPA and other agencies suggest avoiding the use of air cleaners that use ozone.^{20,40}



EXPOSURE CONTROL – DESTRUCTION

➤ Photocatalytic Oxidation (PCO)

- Used UV light to activate a catalyst such as TiO_2).
- 90% to 99.8% of virus inactivated after 30 minutes. ~80% reduction from PCO alone and essentially all eliminated accounting for the UV.
- Potential to create formaldehyde.
- Catalyst performance drops with time.
- Developing technology.

Photocatalytic oxidation (PCO) uses a UV light to enable chemical change (oxidation or reduction) by photon activated catalysis.¹⁹ The most common catalyst is titanium dioxide (TiO_2), but others are also used.²⁰ A study by Guillard, et al., showed that photocatalysis provided an 80% reduction in the avian influenza virus (A/H5N2), not counting the UV light.²¹ When the UV light was added, the virus was completely eliminated in a single pass.²¹

Studies have shown inactivation of viruses by photocatalysis is initiated by their adsorption onto the catalyst's nanoparticles followed by an attack on the protein capsid.²² Other studies suggest the inactivation is due to free hydroxyl radicals.²² Another study by Kozlova, et al., found that the vaccinia virus and influenza A virus (H3N2) were inactivated 90% to 99.8% after 30 minutes of exposure.²³ However, despite the promising results, PCO has the potential for production of by-products like formaldehyde due to incomplete oxidization.^{19,20} Also, there is a potential reduction in catalyst efficiency over time.^{19,20} These limitations should be evaluated when implementing this technology.

EXPOSURE CONTROL – DESTRUCTION

➤ Silver Nano Particles:

- Small silver particles, and silver in general, is a biocide.
- Use of 1 to 10 ppm concentrations were found to inhibit COVID-19; degree unknown.
- NIOSH REL for metal dust is 10 $\mu\text{g}/\text{m}^3$; regs. under development.
- Developing technology.

Silver nanoparticles (AgNP) have been used in commercial virus sprays for surface disinfection of viruses. Silver has broad spectrum antimicrobial action against

various bacteria, fungi and viruses.³³ Studies have shown that AgNP concentrations between 10 ppm and 100 ppm have antiviral effect.³³ Jeremiah, et al., found that concentrations between 1 ppm and 10 ppm were able to inhibit SARS-CoV-2.³³ Regulations for AgNP are still in development with the current NIOSH recommended exposure limit for silver metal dust and soluble compounds at 10 $\mu\text{g}/\text{m}^3$ as an eight-hour time-weighted average airborne concentration.^{34,35} This limit was developed to protect against argyria and argyrosis.³⁴

THANK YOU!

Questions Please

spetty@eesgroup.us

THE ONLY THING NECESSARY FOR THE TRIUMPH OF EVIL IS FOR GOOD MEN TO DO NOTHING
EDMUND BURKE