



SAFE AND HEALTHY SCHOOLS

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Fall School Environmental Health and Safety Workshop

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Washington State Department of Health School Environmental Health & Safety Program

Our Mission

To protect and improve the
Environmental Health and Safety
condition of schools in Washington state.



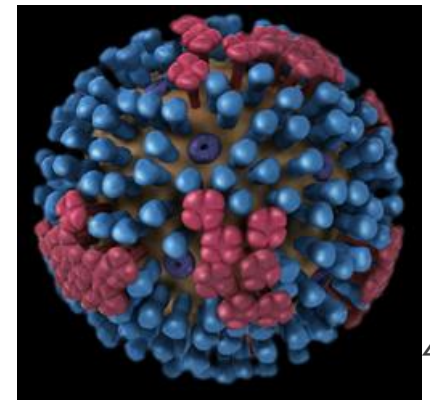
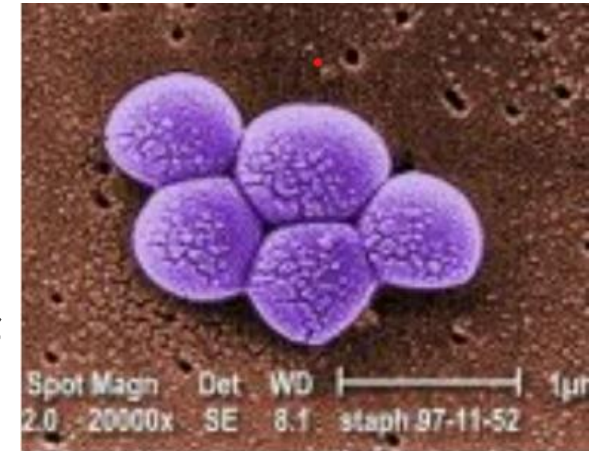
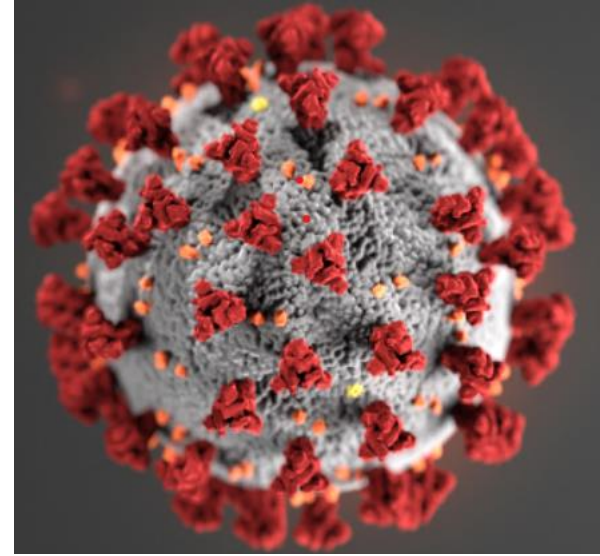
School Environmental Health & Safety

- **Animals**
- **Control of Communicable & Zoonotic Diseases**
 - Disinfection and Green Cleaning
- **Facility Design**
- **Hazardous Chemicals**
 - Arts, Science Labs, CTE
- **Indoor Air Quality**
 - Asthma, Mold, Ventilation, Filtration
- **Injury Prevention**
 - Athletics, Playgrounds, Fall Protection
- **Integrated Pest Management**
- **Lighting**
- **Noise**
- **School Siting**
- **Thermal Comfort**

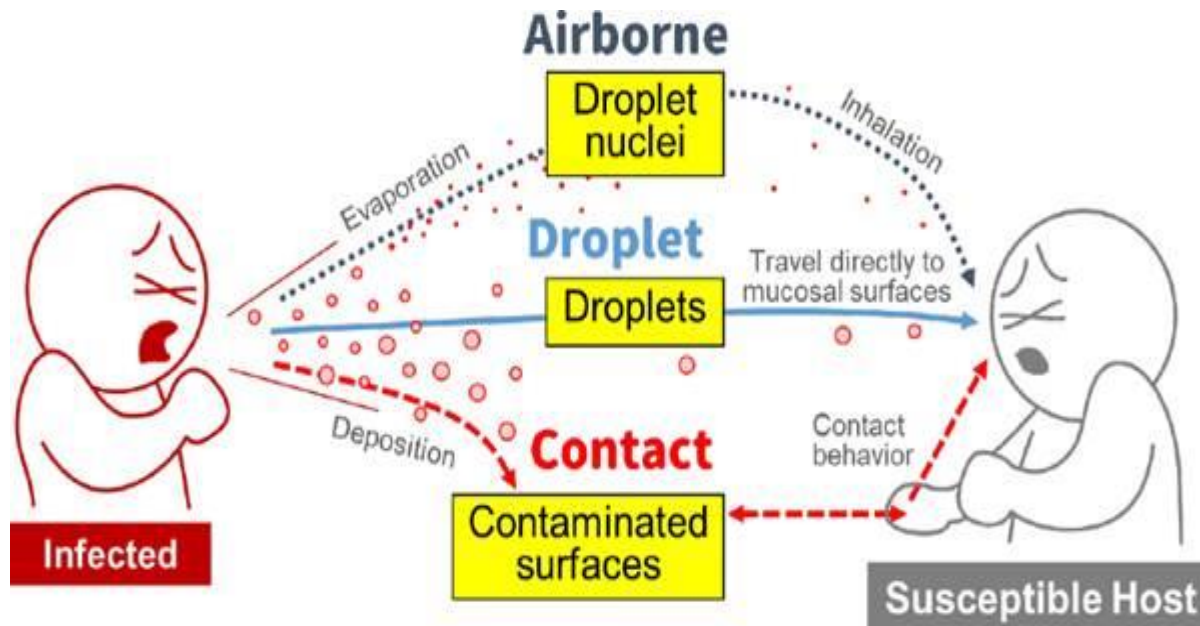


Pathogens in Schools

- Influenza
- Measles
- *Pertussis* (Whooping Cough)
- COVID-19
- MRSA
Methicillin Resistant Staphylococcus aureus
- Norovirus
- *Clostridium difficile* (C. diff)
- *Salmonella*



How Do Viral Particles Spread?

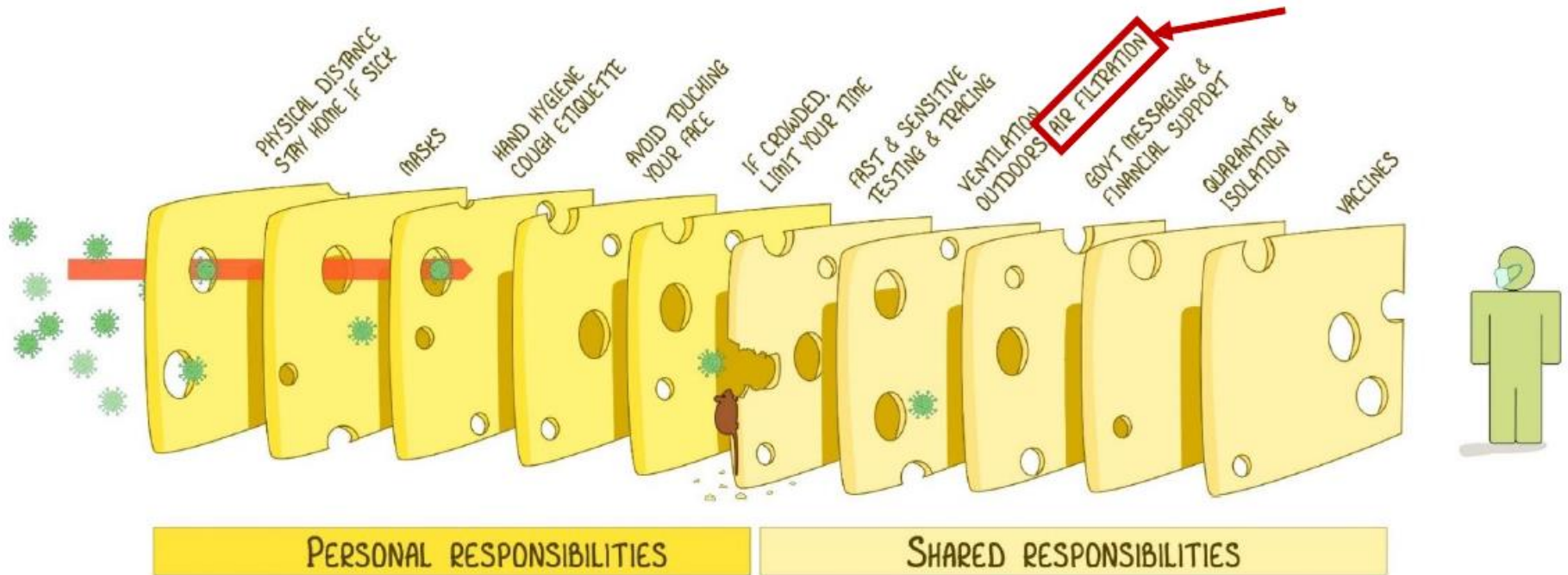


Modes of Transmission from Exhaled Pathogens (adapted from leaflet of the Office of the Prime Minister and the Ministry of Health, Labor and Welfare of Japan (2020))

Need for Layered Risk Reduction

THE SWISS CHEESE RESPIRATORY VIRUS PANDEMIC DEFENCE

RECOGNISING THAT NO SINGLE INTERVENTION IS PERFECT AT PREVENTING SPREAD



EACH INTERVENTION (LAYER) HAS IMPERFECTIONS (HOLES).
MULTIPLE LAYERS IMPROVE SUCCESS.

IAN M MACKAY
VIRIOLOGYDOWNUNDER.COM
WITH THANKS TO JODY LANARD, KATHERINE ARDEN & THE UNI OF QLD
BASED ON THE SWISS CHEESE MODEL OF ACCIDENT CAUSATION, BY JAMES T REASON, 1990
VERSION 3.0
UPDATE: 24oct2020

Prevention – Everyone's Job!

- Wash your hands with plain soap and water – often!
- Cover your cough or sneeze.
- Avoid touching your eyes, nose, or mouth.
- Stay out of spit zones.
- Get vaccinations.
- Good ventilation.
- Stay home when ill.
- Support Public Health.

I have used this slide for many years in presentations.
It's the basics!



Soap

- Fragrance Free
- Dye Free
- Scrub for 20 seconds
- NO antibacterial soaps



THE CORONAVIRUS has a membrane of oily lipid molecules, which is studded with proteins that help the virus infect cells.

← Spike protein (helps the virus enter cells)

← Genetic material

← Lipid membrane and other proteins

SOAP MOLECULES have a hybrid structure, with a head that bonds to water and a tail that avoids it.

← Hydrophilic head (bonds with water)

← Hyphobic tail (avoids water, bonds with oil and fat)

SOAP DESTROYS THE VIRUS when the water-shunning tails of the soap molecules wedge themselves into the lipid membrane and pry it apart.

SOAP TRAPS DIRT and fragments of the destroyed virus in tiny bubbles called micelles, which wash away in water.

← Micelle

By Jonathan Corum and Ferris Jabr

Wash with Soap and Water

Make time for handwashing!!!!

- **When coming inside from playing**
- **After going to the bathroom**
- **Before preparing food**
- **Before eating**
- **After touching animals**

- **Remove oils/dirt/feces**
- **Remove lead/pesticides**

- If you absolutely do not have access to soap and water – scrub with an unscented baby wipe and then use an alcohol-based hand sanitizer.



Electric Hand Dryers

“Modern hand dryers are much worse than paper towels when it comes to spreading germs, according to new research. Airborne germ counts were 27 times higher around jet air dryers in comparison with the air around paper towel dispensers.”

“jet-air” and warm air dryers studied



E.L. Best, P. Parnell, M.H. Wilcox. **Microbiological comparison of hand-drying methods: the potential for contamination of the environment, user, and bystander.** *Journal of Hospital Infection*, 2014.

Restrooms

- Clean/disinfect bathroom at least daily.
- Soap and paper towel dispensers full.
- Tempered (85°-105°F) water for handwashing.
- Maximize exhaust ventilation.

WAC 246-366-060: “Adequate, conveniently located toilet and handwashing facilities shall be provided for students and employees.



Hand Sanitizer

- Not a substitute for hand washing
- Not effective on dirty hands
- At least 60% alcohol (isopropyl or ethyl)
- Hands should stay wet for 20+ seconds
- Not considered effective on non-enveloped viruses or spores
- Flammable / poison
- **Fragrance free**
- Be careful of dangerous products (methanol, 1-propanol)
 - <https://www.fda.gov/drugs/drug-safety-and-availability/fda-updates-hand-sanitizers-consumers-should-not-use>
- Not recommended:
 - Benzalkonium chloride, “quat” based / non-alcohol / “natural”



CDC: Show Me the Science:

<http://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html>

Sinks, Sinks, and more Sinks



Local School Credits Handwashing Stations with Drop in Absences

Lake Charles, Louisiana

**Posted: Nov 21, 2014 3:50 AM PST , By Britney Glaser,
KPLCtv.com**



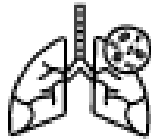
Schools Need An Infection Control Plan

- Clear Protocol
- Independent third party certified cleaning products
 - Ingredients not known to contribute to asthma, cancer, respiratory irritation, liver and kidney disease
- EPA registered sanitizers-disinfectants
- Best practices & procedures
- Cleaning equipment designed to reduce the amount of chemicals required
 - Walk-off mats, HEPA filters, microfiber, etc.
- Training programs

Why Promote safer Cleaning/Disinfection?

Health Impacts:

- Asthma, allergies, respiratory issues
- Skin, eyes, nose, throat irritation
- Headaches
- Disrupt hormones
- Cancer risk



Benefits of Safer Products:

- Improved Indoor Air Quality
- Better Health
- Higher Attendance
- Academic Improvement
- Reduce Asthma
- Reduce Sensitization
- Improved Environment
- Reduced Exposure to Toxics



Choosing Products

(not disinfectants/sanitizers)



Third Party Certified

- Independent verification of product safety and performance.
- Green Seal
- UL GREENGUARD
- EPA (Fragrance-free) Safer Choice
(<https://www.epa.gov/saferchoice>)
 - ▶ Neutral pH
 - ▶ Low hazard rating
 - ▶ Use only when and where needed
 - ▶ Meets or exceeds the California VOC requirements
 - ▶ Avoid:
 - ▶ phosphates, dye, fragrance, butyl cellusolve, nonylphenol ethoxylate



NIOSH

Work-related Asthma: Occupational Exposures Cleaning Services

- **Acetic acid**
- Acids
- Ammonia (ammonium hydroxide)
- Biocides
- **Bleach (sodium hypochlorite)**
- Chloramines
- Formaldehyde
- Glutaraldehyde
- **Quaternary ammonium compounds (e.g., benzalkonium chloride)**
- **Spray products**

<https://www.cdc.gov/niosh/topics/asthma/exposures.html>

Choose Safer Disinfectants

EPA's

Design for the Environment



- Safer Antimicrobial Pesticide Project
- The DfE logo on an EPA-authorized antimicrobial pesticide label means that the product:
 - Is in the least-hazardous classes (III & IV) of EPA's acute toxicity)
 - Is unlikely to have carcinogenic or endocrine disruptor properties
 - Is unlikely to cause developmental, reproductive, mutagenic, or neurotoxicity issues
 - All ingredients reviewed
 - Does not require the use of agency mandated PPE
 - Has no unresolved efficacy failures
 - Has no unresolved compliance/enforcement actions

[Design for the Environment Logo for Antimicrobial Pesticide Products | US EPA](#)

Safer Products and Practices for Disinfecting and Sanitizing Surfaces

San Francisco Department of the Environment 2014 (alcohol products not on the market)

Table 1. Summary of Health and Environmental Attributes of 11 Active Ingredients Commonly Found in Surface Disinfectants and Non-food Contact Sanitizers

ACTIVE INGREDIENT	CANCER	REPRODUCTIVE TOXICITY	ASTHMA	SKIN SENSITIZATION	AQUATIC TOXICITY	PERSISTENCE
Caprylic Acid	No	No	No	No	Med acute	Low
Citric Acid	No	No	No	No	None	Low
Hydrogen Peroxide	No ¹	No	No	No	High acute	Low
Lactic Acid	No	No	No	No	None	Low
Ortho-Phenylphenol (OPP)	Known	Suspected	No	No	Very high acute	Low
Peroxyacetic Acid (PAA)	No	No	Yes	No	Very high acute	Low
Pine Oil	No ²	No	No ³	Yes	None	Low
Quaternary Ammonium Chloride Compounds (Quats)	No	Suspected	Yes	One compound ⁴	High acute, med	Very High
Silver	No	No	No	No	High acute	Very High
Sodium Hypochlorite (Chlorine Bleach)	No	No	Yes	No	Very high acute	Low
Thymol	No	No ⁵	No	Yes	High acute	Low

Quaternary Ammonia Compounds

- Benzalkonium chloride, alkyl dimethyl benzyl ammonium chlorides, etc.
- Skin, respiratory irritation
- Asthmagen
- Potential reproductive toxicity
- The overuse of quats and bleach can promote antibacterial resistant bacteria
- Aquatic toxicity

[Quaternary Ammonium Compounds Fact Sheet / TURI Chemical Fact Sheets / TURI Publications / TURI - TURI - Toxics Use Reduction Institute](#)

[Alternatives / Quaternary Ammonium Compounds Fact Sheet / TURI Chemical Fact Sheets / TURI Publications / TURI - TURI - Toxics Use Reduction Institute](#)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6316403/#:~:text=Antibiotic%20resistance%20may%20occur%20after,with%20a%20proven%20health%20benefit.>

Bleach

- Disinfectant, NOT a cleaner
- Asthma/respiratory hazard
- Skin and extreme eye hazard
- Corrosive
- Make a fresh solution daily
- Always use in a well-ventilated area
- Never mix with ammonia, acids, or anything!
- Always wear gloves and eye protection
- Always have an emergency eye wash station
 - DOSH Directive 13.0 July 15, 2011



Active Ingredients to Look For or Avoid

Safer Ingredients for Asthma	Ingredients that may cause respiratory irritation/Asthma
Hydrogen Peroxide	Quaternary ammonium compounds (alkyl dimethyl benzyl ammonium chloride, benzalkonium chloride, lauryl dimethyl benzyl ammonium chloride, dodecyl dimethyl ammonium chloride)
Lactic Acid	Bleach (sodium hypochlorite)
Citric Acid	Acetic Acid (found in vinegar)
Ethyl Alcohol/Isopropyl Alcohol	Thymol (skin sensitizer, suspected asthmagen)
	Glutaraldehyde
	Peracetic acid (peroxyacetic acid)

Clean – Sanitize – Disinfect?

- **Cleaners, Soaps, Detergents**

- Remove dirt/organics and most germs.
- **Always clean before sanitizing or disinfecting – dirt and oils prevent sanitizers and disinfectants from reaching/killing germs.**
- Soap/water/microfiber cloths
- Scrub to remove biofilms



- **Sanitizers**

- Reduce germs on surfaces – 99.9%.
- Kitchens/food prep/childcare
- Do not leave harmful residues
- Cannot claim killing viruses or fungi

- **Disinfectants**

- Destroy 99.99% of microbial life, bacteria, viruses, but not necessarily spores. Various levels.
- Cannot disinfect a dirty surface!



Cleaning and/or Disinfecting ?

- High-risk areas
 - Athletics
 - Bathrooms
 - Health rooms
 - Cafeterias/Kitchens (sanitizers)
 - High touch surfaces
 - Door handles
 - Faucets
 - Keyboards
 - Railings
 - Phones
 - Drinking Fountains
- Floors—not usually
- Where someone is ill – vomit/blood/feces



Disinfection

- CLEAN FIRST
- Use the proper concentration of disinfectant.
 - Do not mix chemicals!
 - Check expiration dates.
 - Read the label!
- Allow the required wet contact time.
- Follow the product label hazard warnings and instructions for personal protective equipment (PPE) such as gloves, eye protection, and adequate ventilation.
- Use disinfectants in a **well-ventilated space and not around children.**
- Obtain the Safety Data Sheet (SDS).
- Parents, teachers and staff should **not** supply disinfectants and sanitizers.
- **Keyboards and other sensitive electronics: Use alcohol wipes. Wash hands before and after use and do not touch your face while using. Do not assume they are sterile.**

No Spraying/Fogging Chemicals Into the Air



Disinfecting Wipes

- Choose safer disinfecting wipes – **alcohol or hydrogen peroxide**
- **“Keep out of the reach of children” – under 18 years of age**
- Use according to the label
- Not for use on skin!
 - There are hand wipes for skin – baby wipes, etc.
 - Choose fragrance-free.
 - Increasingly wipes with alcohol are available – check the label!
- Clean first
- **Required wet time** – these should be very wet and there is potential splash/eye exposure

EPA-Regulated Disinfecting Devices

- **Instrument used to destroy bacteria and viruses**
 - Works by physical means
 - Electricity, light, mechanics or heat
 - <https://www.epa.gov/safepestcontrol/pesticide-devices-guide-consumers#1>
- **Do not require registration**
 - But are regulated to prevent “false or misleading claims”
 - Manufacturer must have scientific data to support the claims

[09 08 21 Safer Disinfectant Use Mini Webinar Series: Disinfecting Devices and Best Practices - YouTube](#)

Electrostatic Sprayers – caution!

- EPA requires the listing of any approved application equipment (e.g., electrostatic sprayers) on the label. If the electrostatic application is not listed on the label, it is not an approved application method and will not provide information on proper respiratory protection.
- There are electrostatic sprayers that products are registered to use with - BUT surfaces still need to be cleaned first and then the disinfectant applied for the required wet time.
- **N95 filtering respirators are likely required** when applying any disinfectant via electrostatic spray gun. Depending on the vapor pressure, chemical-specific cartridges may be required.
- Large droplets to avoid misting as much as possible.
- High touch surfaces, **not every surface in a room.**
- Indiscriminate spraying – violating the law (the label is the law), and causing asthma, skin, eye, and respiratory irritation, wasting toxic chemicals and not reducing the transmission of COVID

Other Options

- **Superheated steam vapor device**

- **Very effective for cleaning and rapid sanitizing/disinfecting**

- **Harder-to-kill viruses, such as canine parvovirus**
- **Similar human coronavirus, such as coronavirus 229E**
 - **Kill rates 99.99% under 10 seconds**
 - **Expected to be effective on Sars-CoV-2 according to the EPA**

- **They are not conventional "steam" cleaners or pressure washers**

- **They are devices that use only a little water and a little electricity to clean, disinfect, and deodorize most surface**



[09 08 21 Safer Disinfectant Use Mini Webinar Series: Disinfecting Devices and Best Practices - YouTube](#)

High temperature steam

- Temperature cools off the further from the device
- Need to keep close to surface to work best
- Risk of injury is minimal past 6"

[09 08 21 Safer Disinfectant Use Mini Webinar Series: Disinfecting Devices and Best Practices - YouTube](#)



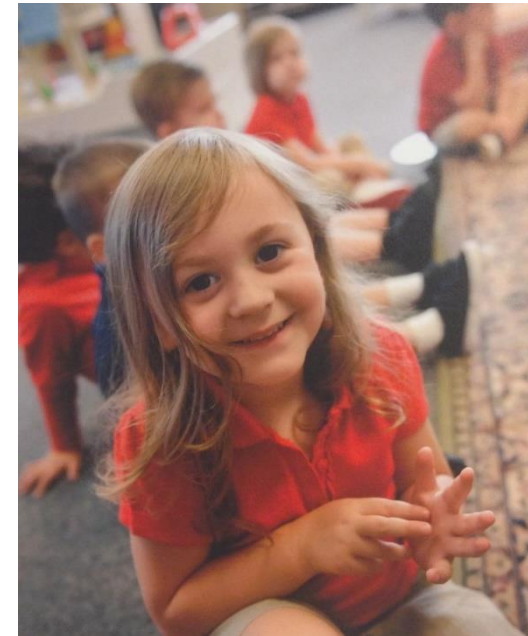
Microfiber

- The most effective type of cloth to use for cleaning and removing dirt and microorganisms
- Little to no cleaning chemicals
- Less effort, absorbent, durable
- Prevent injuries, illnesses
- Avoid cross-contamination
 - 8 fold method
- Simple to clean- wash and dry, on-site or laundering service
- **Damp dusting removes many contaminants!**



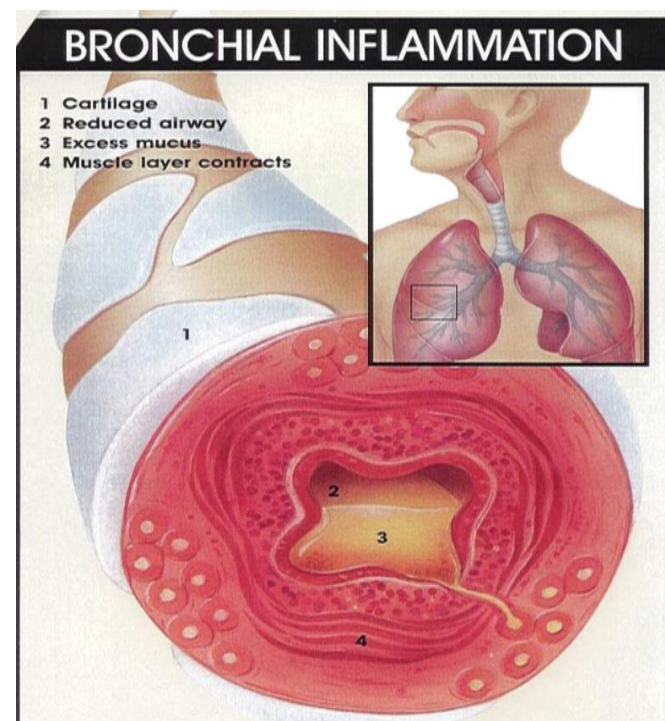
Say NO....

- Cake toilet deodorizers
 - paradicholorobenzene
- Citrus & Terpene Solvents
 - D-Limonene
 - [Mopping can create air pollution that rivals city streets | Science | AAAS](#)
 - “One molecule of concern is limonene, which is commonly added to cleaners and furniture polish to help remove oil and grease. The lemon-scented molecule reacts readily with ozone, an outdoor pollutant that is the main ingredient in smog. When ozone wafts into buildings, it reacts with limonene and similar molecules called monoterpenes, turning them into peroxides, alcohols, and other molecules that grow into airborne particles. Small particles can lodge deep in the lungs, irritating cells and—at high enough exposure—leading to health problems, such as asthma. In vulnerable people, particulate air pollution can cause heart attacks and strokes.”
- Nano Technology
 - nano-silver
- “Air Fresheners”
- Ozone generators
- Fragrances
- Anti-microbial soaps
 - Triclosan / Triclocarban
 - Quaternary Ammonia compounds



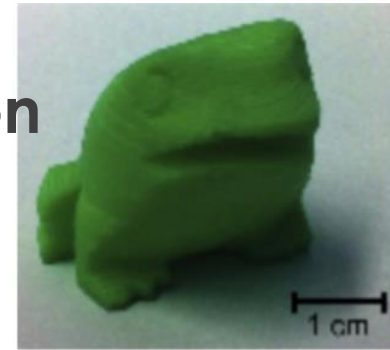
Control Asthma Triggers

- Door mats
- Avoid clutter / cleanable surfaces
- Limit hanging items/ T-bar clips
- Vinyl/leather furniture
- Animals
- Food storage
- Water based/low VOC markers
- No fragranced products
- No chemicals from home
- Premixed clay
- Carpet cleaning
- Wash stuffed toys in hot water every 2 weeks



3D Printers

- Heated thermoplastic extrusion/deposition
- Significant aerosol emission potential
 - “High emitters” of ultrafine particles
 - Gases/fumes
- Provide exhaust ventilation
- “caution should be used when operating many printer and filament combinations in enclosed or poorly ventilated spaces or without the aid of gas and particle filtration systems” Azimi, P et. al. [Emissions of Ultrafine Particles and Volatile Organic Compounds from Commercially Available Desktop Three-Dimensional Printers with Multiple Filaments](#), *Environmental Science and Technology*, 2016, 50(3), 1260-1268



(<https://pubs.acs.org/doi/full/10.1021/acs.est.5b04983>)

Makerspaces

What requires local exhaust ventilation?

What other safety requirements?

WAC 246-360-080/110/120/140

- **3D Printers**
- **Laser Engravers**
- Hot Wheels
- LEGO WeDo coding sets
- **Paints**
- **Glue/Hot Glue**
- **Clay/Glazes/Kilns**
- Printers
- Cardboard Cutters
- Sewing Machines
- Circular Knitting looms
- Blenders & Cooking Supplies



Adequate mechanical ventilation must be provided whenever kilns, paints, glues or other vaporous materials are being used. All sources producing air contaminants of public health importance shall be controlled by the provision and maintenance of a local mechanical exhaust ventilation system.

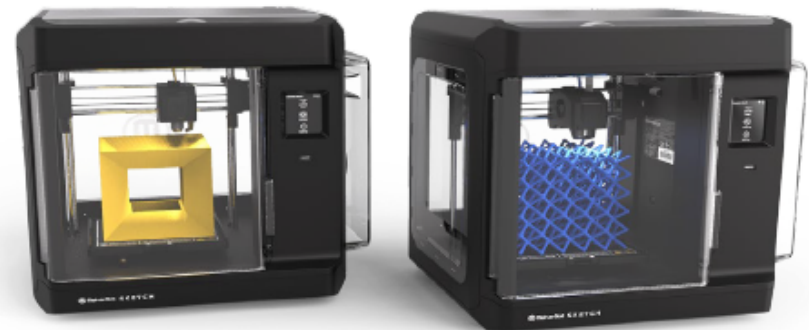
Using 3D Printers Safely



Three dimensional (3D) printers are a great education tool. They provide rapid prototyping and the ability to create small-scale manufacturing for various lessons in science, technology, engineering, math, and art. Although a great educational tool, 3D printers produce hazardous byproducts including fine and ultra-fine particulates, volatile organic compounds, and heavy metals.

When using 3D printers, required safety precautions protect students from inhaling hazardous particles and chemical vapors and avoid physical hazards such as burns, cuts, and pinches. The State Board of Health Rule for Primary and Secondary Schools, [WAC 246-366-080](#), requires 3D printers to have local mechanical exhaust ventilation.

A recent National Institute of Safety and Health (NIOSH) study evaluated the hazards associated with using different 3D printers and recommended ways to minimize exposure to these hazards. This document focuses on the safe use of fused filament fabrication (FFF) 3D printers (functionally similar to fused deposition modeling, or FDM printers), which are most common in K–12 schools.



Two examples of FFF 3D printers.

[Using 3D Printers Safely \(wa.gov\)](#)

Perfumed, Fragranced, & Scented

- **Added fragrances can trigger asthma attacks, allergies, sensitization.**
 - People on the autism spectrum particularly impacted.
- **Eye, skin, and respiratory irritation.**
- **“Fragrance” – a thousand components.**
 - Limonene, pinenes, acetone, ethanol, camphor, benzyl alcohol, ethyl acetate, limonene, **benzene**, **formaldehyde**, 1,4-dioxane, methylene chloride, acetaldehyde, synthetic musks, **phthalates**, etc.
- **A primary source of IA and OA pollutants.**
- **Look for “fragrance-free,” not “unscented”.**
- **New Fragrance-Free Toolkit from UCLA**
<https://csw.ucla.edu/about/fragrance-free/>



Essential Oils / Natural Air Fresheners

- All air fresheners tested – even those advertised as “natural,” “green,” “organic,” or with essential oils – emitted chemicals classified as toxic or hazardous, including some with no safe exposure level.
Hidden Hazards in Air Fresheners and Deodorizers
<http://www.drsteinemann.com/Resources/Air%20Freshener%20Fact%20Sheet.pdf>
- Persistent exposure to lavender products is associated with premature breast development in girls, according to new research by NIEHS scientists.
 - The findings also reveal that chemicals in lavender oil and tea tree oil are potential endocrine disruptors...
https://factor.niehs.nih.gov/2019/9/feature/3-feature-lavender/index.htm?utm_source=efactor-newsletter&utm_medium=email&utm_campaign=efactor-newsletter-2019-September
- Not okay in schools/public places
- Sensitization reactions/asthma
- Respiratory, eye, skin irritation, headaches
- No diffusers, plug-ins, Sensei, candles, etc.
- Particulates/oils spread throughout room

American Lung Association **Sample Fragrance-Free School Policy**

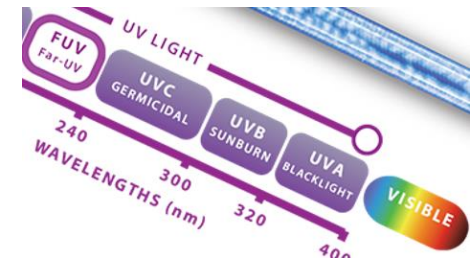
<http://www.healthyschools.org/documents/fragrance-free-policy-sample-updated.pdf>

Ultraviolet Light Disinfection



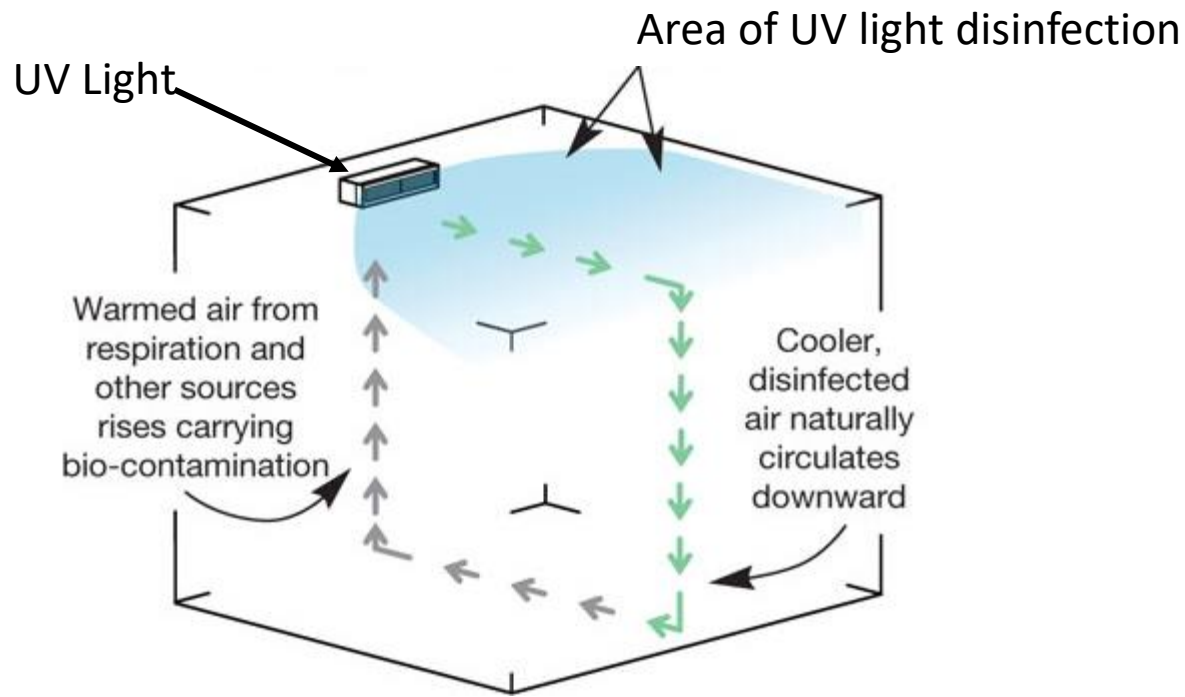
Ultraviolet Light Disinfection

- Damages DNA and RNA by causing mutations that prevent replication
- UVC spectrum is most effective
 - Most lamps emit radiation at 254 nm which is hazardous to eyes and skin
 - Lamp wavelengths in Far UVC (205-230 nm) currently being studied as less hazardous option
 - Some UVC systems can produce ozone
- Dependent on dose
 - Distance from surface
 - Duration of exposure
- Applications for Air and Surface Disinfection



Air Disinfection: Upper Room Ultraviolet Germicidal Irradiation (UVGI)

How it Works



Air Disinfection: Upper Room Ultraviolet Germicidal Irradiation (UVGI)

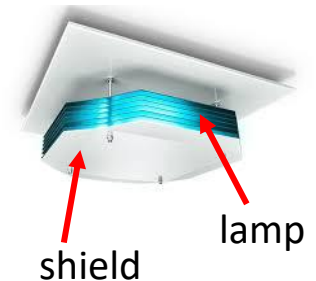
Considerations

- Kills germs, but does NOT remove particles
- Potentially more effective with a ceiling fan installed
- Costs include:
 - UV light fixture (~ \$1100)
 - Wiring for Installation
 - Periodic inspection and maintenance
 - Can be done internally with radiometer or dosimetry card
 - Installation of fan, if used (~ \$400.)
 - Replacement of UV bulb- annual (~ \$150)

Air Disinfection: Upper Room Ultraviolet Germicidal Irradiation (UVGI)

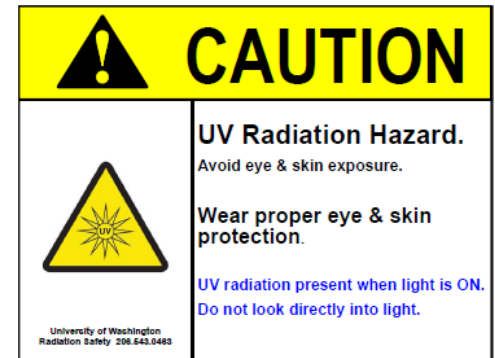
Safety Considerations

- Direct exposure to the UVGI lamp can harm eyes and skin
- Need to work with a reputable manufacturer and building engineer to install
- Need to follow recommended maintenance and bulb replacement schedule (maintenance needs to shut off light before accessing system)
- UVGI bulbs contain mercury- need to follow EPA guidance for safe handling and disposal if broken
- UV dose should be monitored regularly

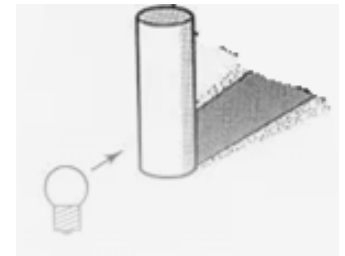


Surface Disinfection: Portable Units

Not recommended at this time.



- Frequently used in hospitals
- Requires pre-cleaning
- Need to leave room while in use- eye and skin hazard
- Need to reposition to hit shadows
- Only effective for non-porous surfaces
- Can degrade certain materials such as plastics and dyed textiles



Surface Disinfection: Portable Wands

Not Recommended at this time.

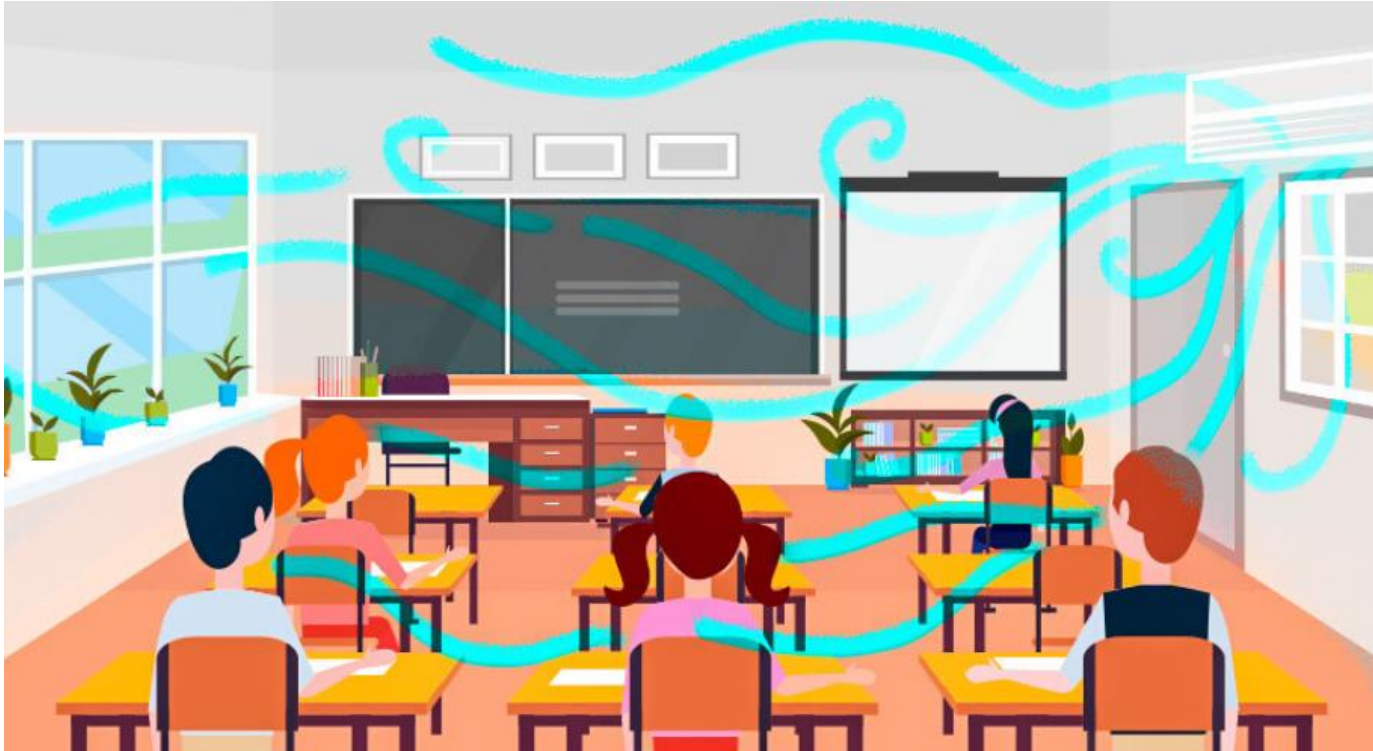
- Effectiveness depends on wavelength
- Low energy -must be held to surface for several seconds
- Pre-cleaning required
- Can be eye hazard depending on wavelength
- [Beware of Ultraviolet \(UV\) Wands That Give Off Unsafe Levels of Radiation | FDA](#)



Ultraviolet Light Disinfection – Some Take Home Messages

- Air disinfection systems require specialized installation and maintenance
- Pre-cleaning is required for surface disinfection
- Systems may present eye and skin hazards
- Consider side-by-side with other available options

Ventilation



Ventilation in the Codes

These are Minimums!

- International Mechanical Code (WAC 51-52)
- IMC ventilation requirements are based on ASHRAE 62.1
- Classrooms/computer labs: **10 cfm/person + 0.12 x square footage of room**
 - Default: 15 cfm/person
- Science, art, wood/metal shops: **10 cfm/person + 0.18 x square footage of room**
 - Default: 17 cfm/person for science labs,
19 cfm/person for art and wood/metal shops.
 - Air from these rooms may not be recirculated to other parts of the building.
- **GOOD NEWS!** ASHRAE updated default values in 2022 to provide increased ventilation in schools. Next step: values adopted by IMC and then the Building Code Council

Ventilation in the Codes (continued)

SBOH School Rule WAC 246-366-080 Ventilation.

- (1) All rooms used by students or staff shall be kept reasonably free of all objectionable odor, excessive heat or condensation.

- (2) All sources producing air contaminants of public health importance shall be controlled by the provision and maintenance of local mechanical exhaust ventilation systems as approved by the health officer.

Ventilation and School Performance

Increases in classroom ventilation rates up to approximately **20 cfm per student** are associated with improvements in student performance of a few to several percent, with the magnitude of improvement depending on the initial ventilation rate.

Increases of ventilation rates up to approximately **15 cfm per student** are associated with a higher proportion of students passing standardized reading and math tests.

If ASHRAE 2022 values are adopted, school ventilation rates will exceed these rates!

[Lawrence Berkeley National Labs Indoor Air Quality Scientific Finding Resource Bank
https://www.iaqscience.lbl.gov/performance-summary](https://www.iaqscience.lbl.gov/performance-summary)

How Ventilation Systems Can Improve Air Quality

- Dilute airborne concentrations
 - particles
 - gases
- Filter out particles
 - wildfire particulates
 - Infectious aerosols
- Direct Air Movement
(negative/positive pressure, direct exhaust)

Improving Dilution in a Ducted System

- Have system tested and balanced if necessary to ensure that the design ventilation rate is being achieved.
- Increase amount of air coming into air handling unit

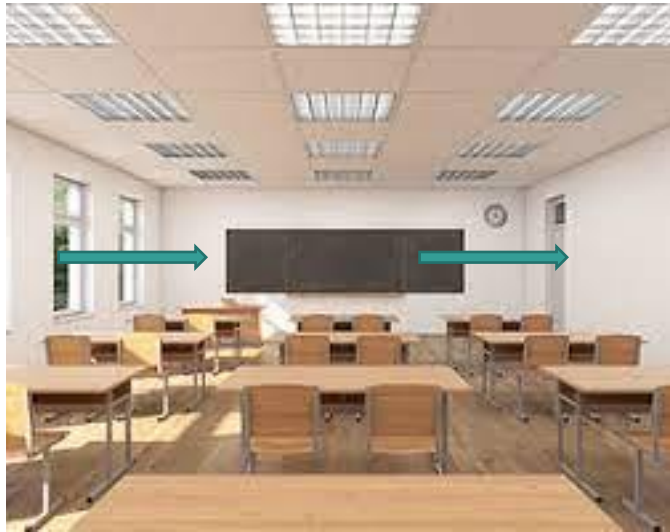


- Disable demand-control system
- Energy recovery designs can reduce cost associated with these measures

Another way to Improve Dilution

Opening windows and doors

Depends on outdoor conditions
Unpredictable source

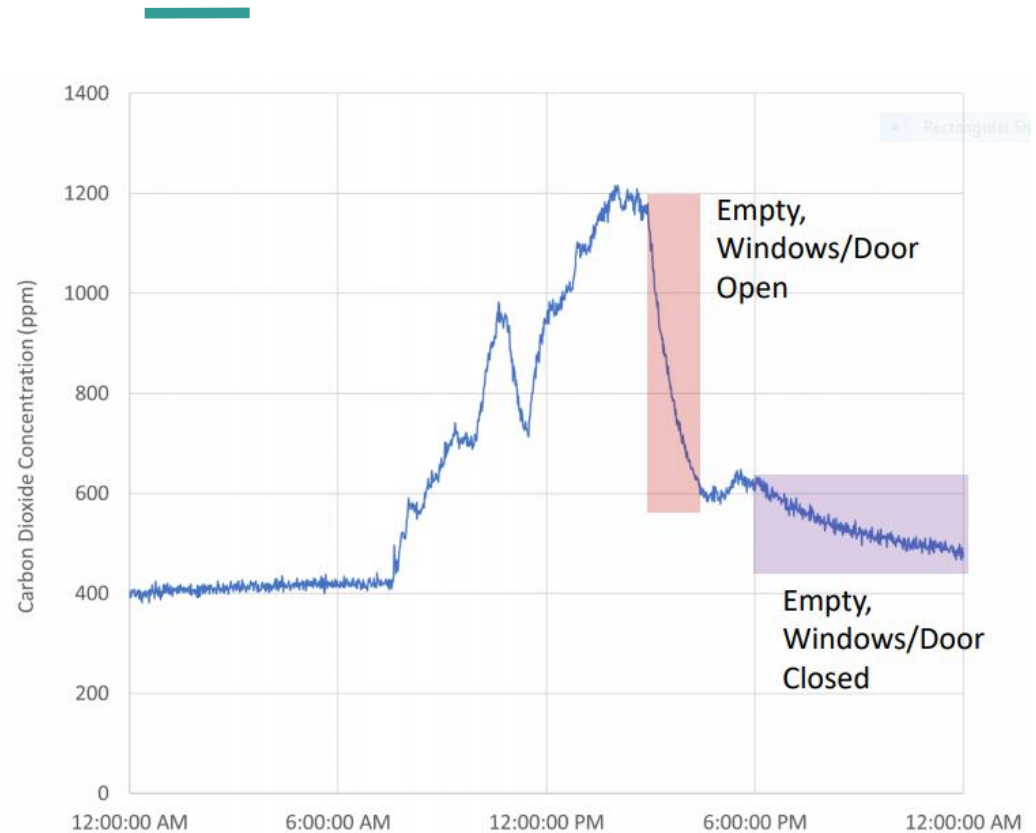


CO₂ as a Measure of Dilution

Important Considerations:

- Must be compared to outside concentration
- Measure near center of room
- No one should breathe on monitor
- Don't measure near supply ventilation
- Helpful to log for an entire day
- Concentration is a function of:
 - room size
 - ventilation rate
 - number of occupants
 - activity level

***Goal is to keep CO₂ below 700-800 if possible**



Example Classroom CO₂ Data

Source: Collaborative on Health and the Environment Webinar-
<https://www.healthandenvironment.org/webinars/96581>

Take Home on Improving Dilution

- Testing and balancing to verify you are getting the designed amount of dilution
- Setting up air distribution system to serve a fully occupied building will provide fewer people with more air volume (understand demand/control settings)
- Maximize outside air, reduce recirculated air
- Monitor CO₂ – keep below ~700 - 800 ppm if possible
- Open windows and doors when feasible

Filtering Indoor Air



Examples of Contaminants we Want to Filter Out

- Respiratory Particles

- Infectious aerosols



- Environmental Particles

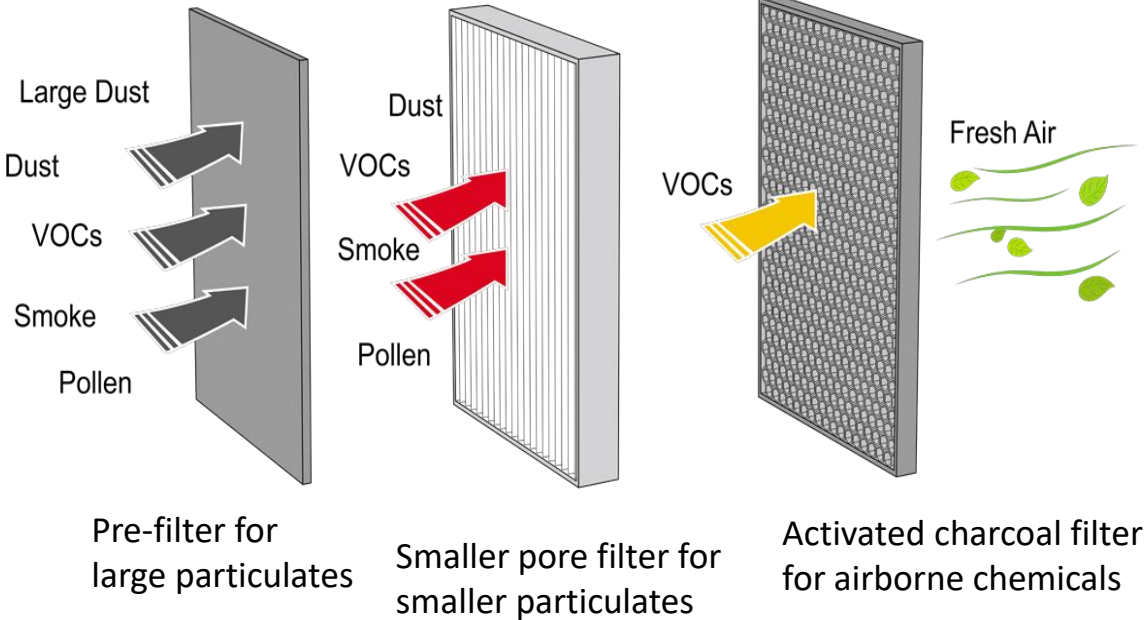
- Wildfire Smoke
- Traffic Related Air Pollution



- Indoor Air Chemicals

- Volatile organic compounds (VOCs) produced by cleaners, personal care products, etc.

Different Filters for Different Contaminants



Particulate Filtration Recommendations

Filtering within Building Ventilation System

- Minimum of MERV 13 for Recirculated Air (COVID-19)
 - Placed in AHU after return air duct enters
- Minimum of MERV 13 for Outside Air (wildfire smoke)
 - Typically placed in air handling unit after a coarser filter (prolongs usage)
- MERV 13 filters with deeper pleats that reduce air resistance are available

Particulate Filtering Recommendations

Filtering inside of a Room

Do you see a use for a portable HEPA unit?

- Is there a common area, high use area with minimal airflow?

Portable HEPA units can provide localized room filtration

- They can be sized to a room
- Some available for \$200



Other HEPA Unit Selection Considerations

- Select a unit that has been certified by the California Air Resources Board (CARB) to have no ozone emissions
- Look for Association of Home Appliance Manufacturer (AHAM) Certification- this is a third-party certifying organization that verifies unit function
- **Look for one that does NOT have additional features such as UV lights, ionizers, electrostatic precipitators, plasma, etc. (nothing additive).**
- Look for a noise rating of 45 decibels or less with other equipment running.
- You may need more than one unit for your room

HEPA Unit Placement and Maintenance

- Do not place next to corners, doorways, curtains, walls, or furniture
- Units should be about 3 feet away from obstructions
- Place away from open windows (units are meant to filter air from inside, not outside)
- Have a filter replacement schedule that is easy to follow and based on the manufacturer's recommendations
- Ensure good fit of filters in the frame during maintenance

Selection and Use of Portable Air Cleaners

Selection and Use of Portable Air Cleaners to Protect Workers from Exposure to SARS-CoV-2

This fact sheet provides guidance to help employers, building operators, and union officials select and use portable air cleaners to remove virus-contaminated air in indoor spaces.

Overview

Ventilation and filtration are important to prevent transmission of COVID-19. SARS-CoV-2, the virus that causes COVID-19, is mainly spread through inhalation of virus-contaminated air when an infected person speaks, laughs, coughs, sings, or sneezes. Physical distancing alone will not prevent the build-up of viral particles in a room or workspace (Figure 1).

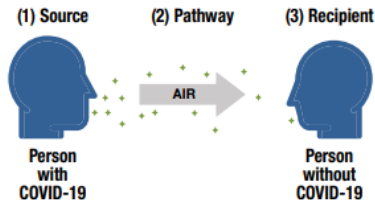


Figure 1. For transmission to occur via tiny airborne particles, three things are necessary: source, pathway, and recipient.¹

Approximately 40% of people who are infectious are asymptomatic (no symptoms) or presymptomatic (before symptoms begin) and may contaminate air unknowingly. Work settings with inadequate ventilation and/or those that require people to be close together for extended periods of time, increase the risk of COVID-19 transmission. The illustration at right outlines the recommended steps to improve ventilation in buildings (Figure 2).

¹ Based on an image from the Center for Infectious Disease Research and Policy. <https://www.cidrap.umn.edu/covid-19/preparedness-and-response/protecting-essential-workers>

The Centers for Disease Control and Prevention defines close contact as within 6 feet of a person for 15 minutes or more during a 24-hour period. Wearing a cloth or surgical mask, while helpful, cannot be relied upon to prevent the spread of COVID-19.



Figure 2. Illustration of the order in which to consider improvements to ventilation in buildings.²

² Source, Jones et al, 2020. Schools for Health, Risk Reduction Strategies for Reopening Schools. Harvard Healthy Buildings Program.

Key point: If feasible, increase outside air and filtration in the building’s mechanic ventilation system. If this can’t be done or is insufficient, **then** consider using portable air cleaning units.

Summary of Filtration Recommendations

Should be provided in HVAC system

- Filters are placed in the Air Handling Unit
 - Can pull out virus-containing particles and other pollutants
 - Filtering efficiency depends on rating of filter
 - Filter chosen by HVAC engineer- depends on ability of fan

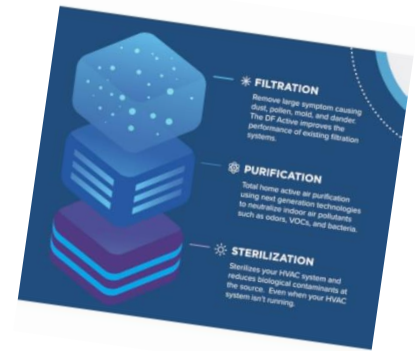
Can be enhanced locally within rooms

- Portable High Efficiency Particulate Air (HEPA) filtering units
 - Can be sized to a room
 - Most effective in rooms where you can close the door

A Note of Warning: Additive Technologies Are Being Marketed and are Problematic



<https://ultraviolet.com/ultraviolet-air-ozone-generator/>



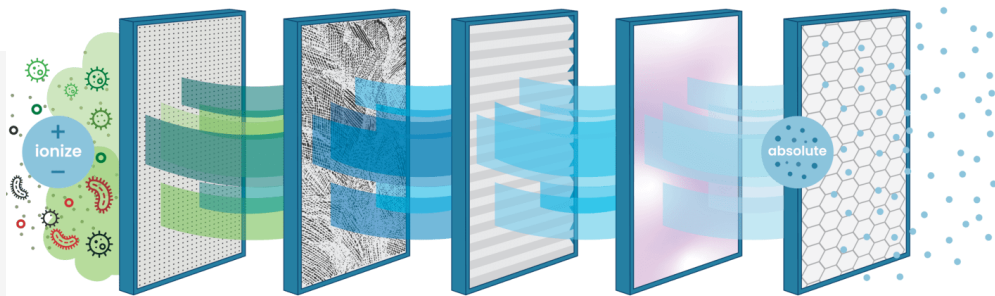
Stage 1 Of 5: Negative Ionization & Pre-Filter

ionize

Negative ionization attracts air particulate & clumps them together for easier capture during the filtration process.

clumps particles

Clumps together small particles



<https://www.sanalifewellness.com/air-purifier-technologies/multi-stage-air-filtration>

Stage 4 Of 5: Photocatalytic UV-C (PCO Technology)

pco

UV-C light activated by a titanium dioxide catalyst results in the removal of viruses & bacteria.

bacteria

Bacteria, mildew, & mold spores (airborne)

virus

Viruses (airborne viral particles)

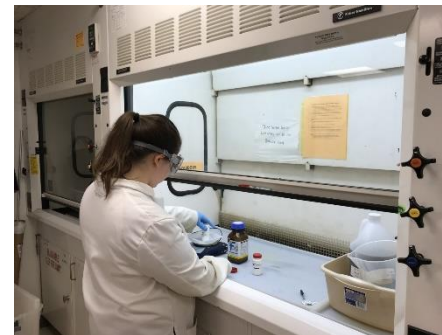
organism

Airborne microorganisms

Directing Air Movement

Move Air from Clean to Less-Clean Area through increasing exhaust

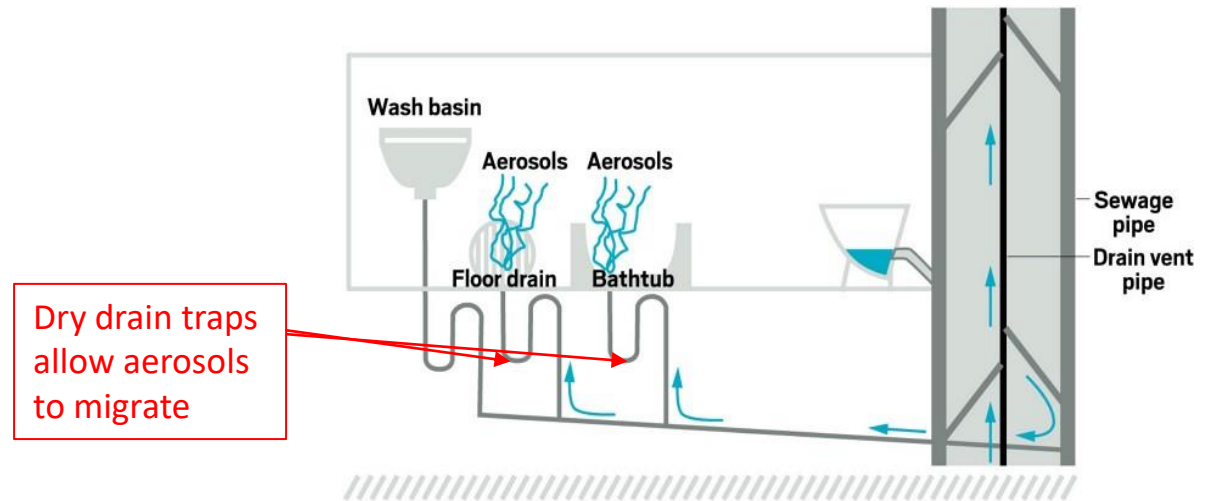
- Nurse's Exam Room
Negative pressure
- Laboratories
- Art and Shop Rooms
Local exhaust and enclosures



Other Important Ventilation

Keep restroom exhaust fan ON at all times when building is occupied.

Keep water in drain traps



Maintaining Ventilation System for Best Performance

- **Periodic Testing and Balancing is Important**
 - Done by certified HVAC contractor
 - Done after any system modification
- **Conduct Timely Preventive Maintenance**
 - Should be on a set schedule
- **Conduct Periodic Visual Inspections**
 - Air handling unit-inside and outside
 - Inside rooms

Preventative Maintenance is KEY

HVAC - dirty filters



When filter changes aren't timely

- Lack of air flow/IAQ complaints
- Harder to pull air through them
- HVAC fans can burn out

Changing filters is cheaper than replacing fans!

When fan belts break:

- Fan doesn't work- lack of air flow
- IAQ complaints
- Lack of confidence in maintenance

HVAC: Broken exhaust fan belt



Periodic Inspections – Air Intake

- **Look at Air Intake**
 - Is it near a source of air pollution?
 - Above an exhaust vent?
 - Below the roof and next to a parking garage?
 - Is there mold growth?
 - Check for excessive mold growth on roof near intake



Periodic Inspections- Inside Air Handling Unit

Look Inside Unit -Proper Installation of Filters is Critical

Is filter seated properly in frame

Look for cracks in seams-
places for air to bypass filter



Periodic Inspections- Inside Air Handling Unit

- Look at Coils



- Look for standing water, rust, and mold in drain pan



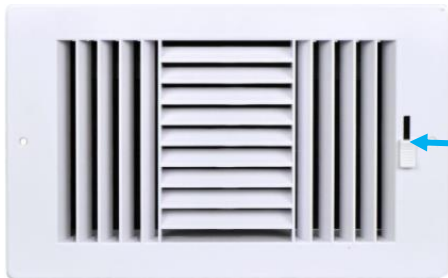
Periodic Inspections – Inside Building



- Are you blocking ceiling diffusers?
- Is furniture blocking wall diffusers?

Periodic Inspections – Inside Building

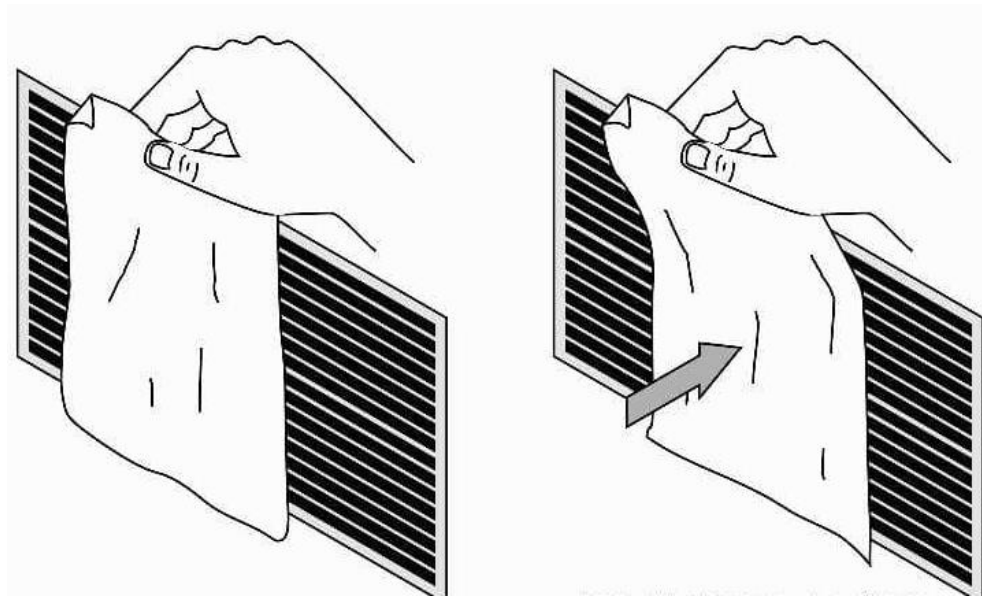
Are return grills blocked/dirty?



Is adjustable damper closed?

Periodic Inspections – Inside Building

Can you detect air movement? (tissue test)



Ventilation Recommendations Summary

- Have ventilation system checked and balanced by an HVAC engineer
- Provide filtration on HVAC system
- Open windows and doors to the extent possible to enhance dilution
- Increase outside air
- Consider CO₂ monitoring
- Supplement with portable HEPA filters if necessary
- Conduct periodic inspections of indoor environment
- NO additive technologies such as ozone, electrostatic precipitators, ionizers, negative ion air purifiers

[Supplemental Considerations to Mitigate Infectious Aerosol Transmission in K-12 Schools \(wa.gov\)](#)



- “At minimum fully open the front two windows and the second to last two windows.”

And NO Fogging!

Great Ventilation Resource from EPA

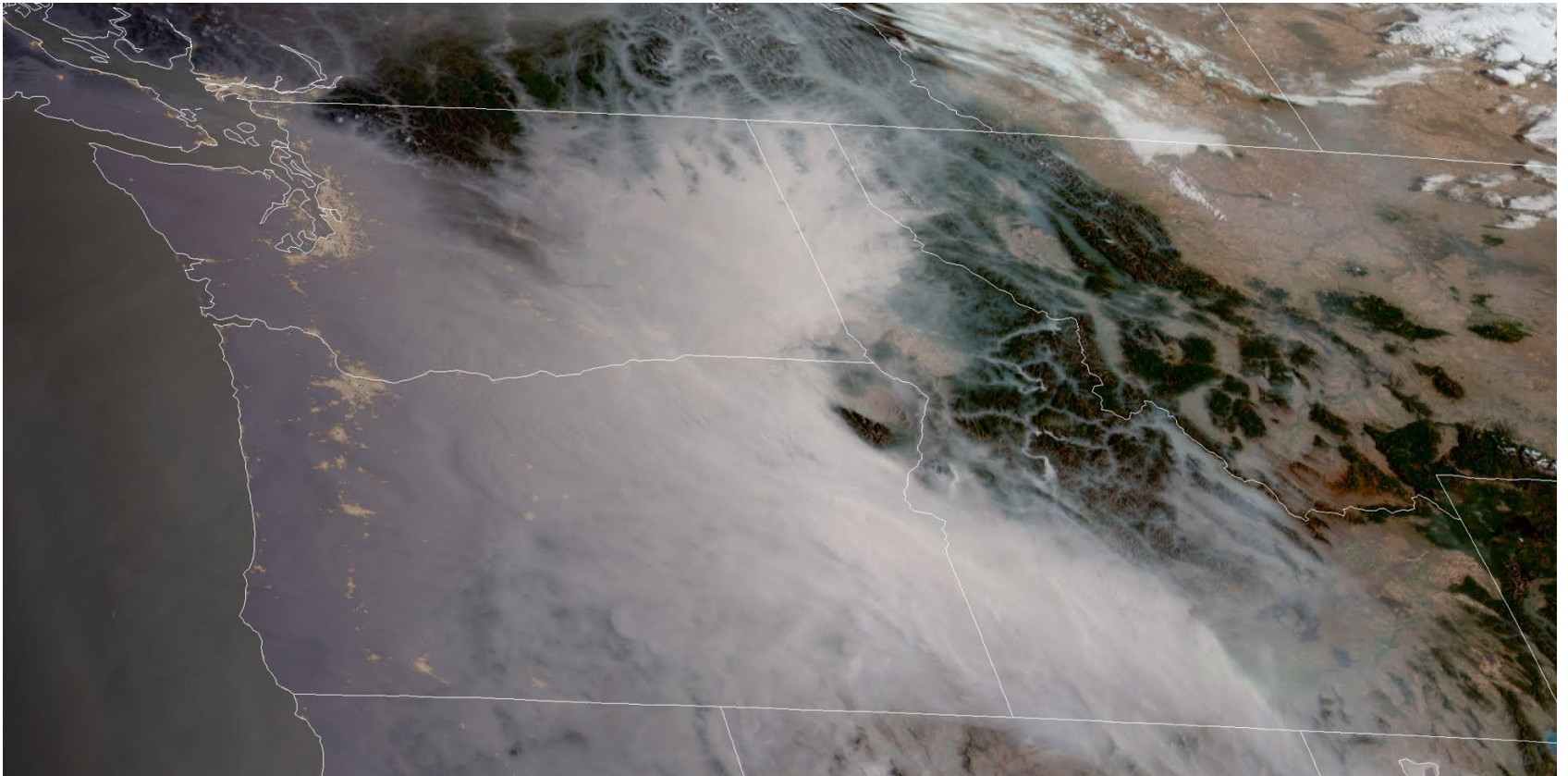
Clean Air In Buildings Challenge (epa.gov)

Scope:

Provides basic principles and general actions recommended to improve indoor air quality (IAQ) in buildings and reduce the risk of airborne spread of viruses and other contaminants.

1. CREATE AN ACTION PLAN FOR CLEAN INDOOR AIR IN YOUR BUILDING(S)
2. OPTIMIZE FRESH AIR VENTILATION by bringing in and circulating clean outdoor air to indoor areas.
3. ENHANCE AIR FILTRATION AND CLEANING using the central HVAC system and in-room air cleaning devices.
4. GET YOUR COMMUNITY ENGAGED IN YOUR ACTION PLAN

Wildfire Smoke



Keeping Smoke Out

- **Close up building, restrict entry**
 - “air lock” entries with plastic sheeting
 - Large air scrubbers near entries
- **Increase filtration efficiency – MERV 13**
 - **Secondary charcoal filter**
- **Change filters more frequently**
- **Keep buildings under positive air pressure**
- **Monitor CO₂**
- **Problems**
 - **Univentilators**
 - **Buildings with only windows for ventilation**
- **New/remodel:** Separate ventilation from heating/cooling/energy recovery. Bring in outside air through a minimum MERV 13. DOAS - Dedicated OA Systems.
- **DOH: Improving Ventilation & IAQ during WFS Events (updated)**
 - <https://www.doh.wa.gov/Portals/1/Documents/Pubs/333-208.pdf>



Smoke From Fires

English



COVID-19 and Wildfire Smoke

There is concern about health impacts of wildfire smoke overlapping with COVID-19 because both impact the respiratory and immune systems. COVID-19 recommendations may conflict with how we can reduce our exposure to wildfire smoke. Additional COVID-19 considerations are below to help address wildfire smoke during the pandemic.

For public health and air quality officials: [Guidance for wildfire smoke and COVID-19 \(PDF\)](#). This guidance is intended to help respond to wildfire smoke events during the pandemic.

Stay up to date on the current [COVID-19 situation in Washington](#).

Outdoor smoke contains very small particles and gases, including carbon monoxide. These particles can get into your eyes and lungs where they can cause health problems. The main sources of outdoor smoke in Washington are:

- Wildfires
- Wood stoves, pellet stoves, and fireplaces
- Agricultural burning
- Prescribed fires (used to manage forests)



Smoke From Wildfires - Toolkit

COVID-19 and Wildfire Smoke

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For public health and air quality officials: [Guidance for Wildfire Smoke and COVID-19 \(PDF\)](#). This guidance is intended to help respond to wildfire smoke events during the pandemic.

Stay up to date on the current [COVID-19 situation in Washington](#).

Below are technical guidance and risk communication resources for public health, air quality, and other officials to use during a wildfire smoke response. Many of these tools were created with input from partners across the state, including the [Wildfire Smoke Impacts Advisory Group \(PDF\)](#). This interagency group was formed in 2018 to develop and improve evidence-based health guidance and achieve more consistent health messaging across agencies.

Health Resources

Washington Air Quality Guide for Particle Pollution: [English](#) / [Spanish](#) / [Arabic](#) / [Chinese Simplified](#) / [Chinese Traditional](#) / [Korean](#) / [Punjabi](#) / [Russian](#) / [Somali](#) / [Tagalog](#) / [Ukrainian](#) / [Vietnamese](#)

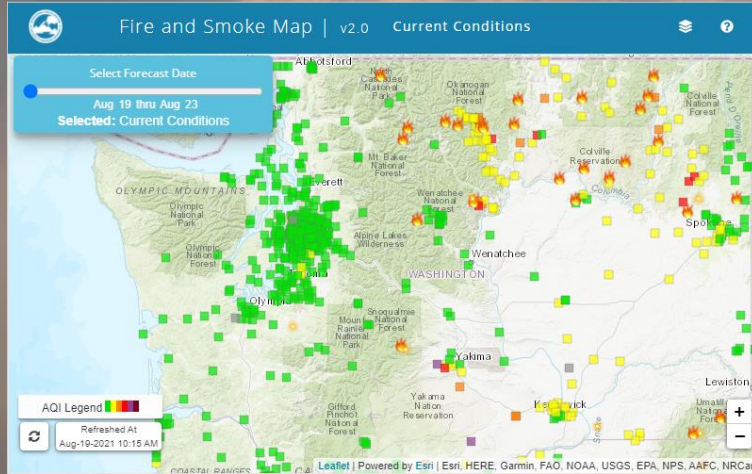
Washington Air Quality Guide for School Child Care Activities: [English](#) / [Spanish](#)

Washington Guide for Public Health Actions for Wildfire Smoke: [English](#)

Wildfire Smoke Guidance for Canceling Outdoor Events or Activities and Closing Schools: [English](#)

Washington Smoke Information

Welcome to the Washington Smoke blog, a partnership between state, county, and federal agencies, and Indian Tribes. We coordinate to collectively share info for Washington communities affected by wildfire smoke. If the air monitoring map doesn't display here, links to additional monitoring maps can be found under the 'Monitoring & Forecasting' tab.



FRIDAY, AUGUST 13, 2021

Wildfire Smoke and Heat: A Double Whammy

When there is smoke, there is often heat. Combined, heat and smoke can become especially dangerous. How can I protect myself from both?

Staying inside and keeping doors and windows closed will keep smoky air out of our homes, but it can be hard to manage indoor temperatures while doing so. If it's hot indoors and you don't have air conditioning, these [steps](#) can help you stay cooler inside during poor air quality:

WA Smoke Blog

wasmoke.blogspot.com

LATEST INFORMATION | MONITORING & FORECASTING | FIRE INFORMATION | HEALTH INFORMATION

HEALTH INFORMATION

[INFORMACIÓN EN ESPAÑOL](#)

COVID-19 AND WILDFIRE SMOKE

This wildfire season is going to be unique as we continue to respond to COVID-19. This year we are especially concerned about health impacts as breathing in wildfire smoke may worsen symptoms for those with COVID-19 and many of those vulnerable to wildfire smoke are also vulnerable to COVID-19.

How we protect ourselves from wildfire smoke is going to be different with COVID-19. It will be more difficult to go to public spaces where the air is cleaner and cooler than our homes may be. N95 respirators should be reserved for healthcare and frontline workers because N95 respirator supplies are limited. Cloth face coverings do not provide much protection from wildfire smoke. Take steps to prepare your home for wildfire smoke by improving air filtration and creating a clean air space.

For additional information visit the WA DOH [Smoke From Fires Webpage](#)

Health Guidance for Decision Makers - Updated

Wildfire Smoke

LOCAL PUBLIC
HEALTH OFFICERS

Guidance for
Canceling Outdoor
Events or Activities
and Closing Schools

April 2022



DOH 334-431 April 2022

Summary Wildfire Smoke Guidance for Closing Schools

This is a summary of the Washington State Departments of Health and Ecology guidance for canceling or moving outdoor children's activities and closing schools when smoke may be a health threat. For more information: [Wildfire Smoke Guidance for Canceling Outdoor Events or Activities and Closing Schools](#).

Health effects from smoke

Symptoms of wildfire smoke exposure range from minor irritation, such as burning eyes, runny nose and coughing, to life threatening.

Sensitive populations include people with heart and lung diseases, people with respiratory infections, people with diabetes, people 18 and younger or older than 65, pregnant people, people of color, tribal and indigenous people, and people with low income. Children with pre-existing diseases, such as asthma and diabetes, are especially at-risk for experiencing adverse health effects from smoke exposure.

Factors to consider for school closures

- What is the forecast for how long wildfire smoke levels will remain high?
- Have all options to improve indoor air quality been attempted?
- Are students and staff who are sensitive to smoke allowed to stay home if it is safer?
- Is it safe to walk or bike to school?
- Where will children be relocated if schools are closed? Is the air quality better there?

(More in full guidance report)

Measuring wildfire smoke levels

The concentration of PM_{2.5} – particles less than 2.5 micrometers in diameter – is the most useful measurement of smoke levels to protect health. PM_{2.5} concentrations are reported across six health hazard levels in the Air Quality Index.

Current outdoor PM_{2.5} levels from agency monitors are available as Air Quality Index (AQI) values that are updated hourly on the [Washington Smoke Blog](#) and [EPA's AirNow App](#). Forecasts are often available during wildfire season on the WA Smoke Blog and Washington State Department of Ecology's [Smoke Forecast website](#).

Low-cost sensors can be used to take PM_{2.5} measurements indoors to check indoor air quality and outside when there is not a nearby agency monitor, though these are less accurate than agency monitors and uncorrected sensor data should not be directly compared to PM_{2.5} action levels. Publicly reported PM_{2.5} outdoor sensor measurements with an applied correction factor are also available on the WA Smoke Blog.

For more information:

- [Air Pollution and School Activities Guide](#)
- [Improving Ventilation and Indoor Air Quality during Wildfire Smoke Events](#)
- [DOH Smoke from Fires](#)



When outdoor forecasted 24-hour or NowCast PM_{2.5} concentrations:

- Equal or exceed 35.5 µg/m³ (AQI value 101, "Unhealthy for Sensitive Groups" category or worse), cancel children's outdoor athletic events and practices or move them to an area with safer air quality, either indoors or to a different location.

When school is in session and indoor PM_{2.5} concentrations:

- Equal or exceed 150.5 µg/m³ (indoor equivalent to AQI value 201, "Very Unhealthy" category or worse), discuss school closure with administrators.

Washington Air Quality Guide for School & Child Care Activities

Vehicle exhaust, woodstove emissions, industrial emissions, wildfire smoke, windblown dust, and other sources contain fine particle pollution (PM2.5) that can seriously affect children's health. The following public health recommendations to protect children from PM2.5 are designed for school activities and can be applied to child care, before/after school programs, camp, and sports programs for children (18 years and younger) by considering the duration of outdoor activities.

Outside Air Quality Index: PM2.5					
Check current and forecast air quality at enviwa.ecology.wa.gov					
	Good (0-50)	Moderate (51-100)	Unhealthy for Sensitive Groups (101-150)	Unhealthy (151-200)	Very Unhealthy/ Hazardous (>200)
Recess (15 minutes)	No restrictions.	Allow children with health conditions (see below*) to stay indoors.	Keep children with health conditions indoors. Keep activity levels light for these children unless indoor PM2.5 levels are below 35.5 µg/m ³ (see following page).	Keep all children indoors. Keep activity levels light unless indoor PM2.5 levels are below 35.5 µg/m ³ .	Keep all children indoors. Keep activity levels light unless indoor air is filtered, and indoor PM2.5 levels are below 35.5 µg/m ³ .
P.E. (1 hour)	No restrictions.	Allow children with health conditions to stay indoors and monitor symptoms for those who participate. Increase rest periods for these children as needed.	Keep children with health conditions indoors. Keep activities light for these children unless indoor PM2.5 levels are below 35.5 µg/m ³ . For others, limit to light outdoor activities. Allow any children to stay indoors if they do not want to go	Keep all children indoors. Keep activity levels light unless indoor PM2.5 levels are below 35.5 µg/m ³ .	Keep all children indoors. Keep activity levels light unless indoor air is filtered, and indoor PM2.5 levels are below 35.5 µg/m ³ .
Athletic Events and Practices (Vigorous activity 2-3 hours)	No restrictions.	Allow children with health conditions to opt out and monitor symptoms for those who join. Increase rest periods for these children.	Cancel children's outdoor athletic events and practices or move them to an area with safer air quality, either indoors or to a different location.	Cancel children's outdoor athletic events and practices or move them to an area with safer air quality, either indoors or to a different location. Consider time spent in poor air quality during transit before relocating.	Cancel children's outdoor athletic events and practices or move them to an area with safer air quality, either indoors with filtered air or to a different location. Consider time spent in poor air quality during transit before relocating.

***Health conditions include asthma and other lung disease, respiratory infection, heart disease, and diabetes. See the following page for more details about children's health, improving indoor air quality, and steps to reduce exposure.**

To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email civil.rights@doh.wa.gov.

[Air Pollution and School Activities - Public Health Recommendations for Schools \(wa.gov\)](#)

Air Pollution and School Activities - Public Health Recommendations for Schools (wa.gov)

Health	Children are more sensitive to health effects from breathing in PM _{2.5} because their lungs are still developing, and they breathe in more air than adults for their body weight. Children with health conditions, such as asthma, have an even higher risk of health effects, including asthma attacks. Adult staff and volunteers may also be sensitive to air pollution, see WA Air Quality Guide for Particle Pollution . Symptoms from PM _{2.5} exposure range from minor to severe and include burning eyes, coughing, throat and nose irritation, fatigue, headache, wheezing, and shortness of breath. For children with asthma, follow their Asthma Action Plans . If symptoms become serious, seek medical attention.
Reducing Exposures	As PM _{2.5} pollution increases, each step is increasingly important to protect health: limit duration and intensity of outside physical activity and stay indoors and keep indoor air clean. Consider a child's total exposures throughout the day such as during transportation and longer duration activities like overnight camp. When it is not possible to stay indoors with cleaner air, consider N95 or other particulate respirators as a last option for limited use outside. Effective use requires proper selection, size and fit. See Western States PEHSU guidance on respirator use by children.
Physical Activity	<p>CDC recommends children exercise 60 minutes or more every day. Doing so safely when PM_{2.5} levels are high, especially for days or weeks, requires precautions, such as limiting activity levels. People breathe deeper and take more air into their lungs when exercising.</p> <ul style="list-style-type: none"> • Light Activities: Playing board games, playing catch, and stacking blocks • Moderate Activities: Yoga, shooting basketballs, dance instruction, and table tennis • Vigorous Activities: Running, jogging, basketball, football, soccer, swimming, and jumping rope
Improving Indoor Air Quality	Outside PM _{2.5} gets indoors through windows, doors, small openings, and some ventilation systems. Buildings with well-maintained and enhanced filtration (i.e. MERV 13) in the ventilation system have improved indoor air quality. Supplementing with properly sized, CARB-Certified HEPA portable air cleaners or DIY box fan filters can reduce PM _{2.5} in single rooms. Extreme heat can overlap with wildfire season. Establish building cooling resources in advance to help avoid opening windows when wildfire smoke increases PM _{2.5} levels. If you're not sure whether indoor PM _{2.5} levels are lower than outside, assume levels are similar and increase steps to reduce exposure, including filtration methods. See Improving IAQ and Ventilation in Schools During Wildfire Smoke Events and ASHRAE Protecting Building Occupants from Smoke .
Indoor Air Monitoring	Outdoor PM _{2.5} levels from the nearest agency monitor are updated hourly and daily forecasts are often available. Low-cost sensors can be used to take PM _{2.5} measurements indoors to check indoor air quality and outside when there is not a nearby agency monitor. However, they are generally less accurate than agency monitors. Correction factors can sometimes be used to increase accuracy. If using a correction factor is not possible, do not directly compare uncorrected sensor data to AQI cut-points or action levels. Compare indoor sensor measurements to outdoor sensor measurements (ensure that either both are uncorrected or they have the same correction factor). Then apply this comparison to the nearest agency monitor. For example, if the indoor sensor measurements are half of the outdoor sensor measurements, assume that the indoor PM _{2.5} concentrations are half of what the agency monitor is reporting. Assess variation across the building(s) using a portable sensor when outside PM _{2.5} levels have reached "Unhealthy for Sensitive Groups". Include measurements in rooms used by children that are expected to have worse ventilation or indoor air quality (like no air filtration), rooms where physical activity is usually more vigorous (like the gym), rooms where external doors are opened frequently, and any external buildings (like portables). Repeat the portable sensor measurements in different conditions, such as changes in occupancy. A stationary indoor sensor can be used to track changes in indoor air quality over longer time periods. Prioritize steps to reduce exposure in the rooms with highest PM _{2.5} levels. See "Indoor PM _{2.5} Measurements in Schools", Wildfire Smoke Guidance for Canceling Events or Activities and Closing Schools , for more information. For technical assistance with indoor measurements, contact: airquality@doh.wa.gov .
School Closures	School and facility closures may be the best option if you cannot maintain indoor PM _{2.5} at lower levels after considering alternatives, such as improving indoor air filtration and relocating children. School closures are the decision of the school district, usually in consultation with the local health department. See Summary Wildfire Smoke Guidance for Closing Schools .
More Resources	Air Quality Flag Program , Air Quality and Health , Smoke from Fires and Health , WA L&I's Worker Health and Smoke

Wildfires and Indoor Air Quality in Schools and Commercial Buildings | Indoor Air Quality (IAQ) | US EPA

- Actions that should be taken before and during a smoke event,
- A checklist to determine if the HVAC system is ready for a smoke event,
- Information on how to properly use portable air cleaners,
- An overview of how to determine the safe operation of HVAC systems when using higher efficiency air filters, and
- References and additional resources.

Planning-Framework-for-Protecting-Commercial-Building-Occupants-from-Smoke-During-Wildfire-Events.pdf (ashrae.org)

SECTION 2.3: CONSIDERATIONS FOR SARS-COV-2

HVAC filtration and air cleaning recommendations for smoke and SARS-CoV-2 are similar due to similar respirable particle sizes. The difference is the outdoor air ventilation rate: a low rate is desirable for smoke control and a high rate is desirable for removal of SARS-CoV-2 virus particles (8,9). Additionally, improved HVAC filtration must be located in the recirculation air to mitigate risk from SARS-CoV-2. The building manager's challenge is to monitor system components and indoor conditions and change system settings as outdoor air quality changes to balance potential tradeoffs between smoke and SARS-CoV-2 exposure. Portable air cleaners with a HEPA filter (or other high efficiency filters) may be helpful in removing virus particles as well as smoke particles without increasing the amount of outdoor air. Additional COVID-19 considerations for cleaner air spaces and cleaner air shelters are available (10).

10 Elements of a Smoke Readiness Plan

The planning framework identifies the following elements that building managers should include in a written, building-specific Smoke Readiness Plan:

1. Purchase smoke preparation supplies, such as portable air cleaners and extra filters.
2. Evaluate the ability of the HVAC system to handle a higher efficiency filter. (The planning framework recommends MERV 13 or higher filters during smoke events.)
3. Conduct a full maintenance check on the HVAC system and make repairs if needed.
4. Assess and maintain adequate air flows to protect occupant health and equipment during smoke events.

[Recommendations for Reducing Wildfire Smoke in Commercial Buildings and Schools \(epa.gov\)](#)

5. Prepare to add supplemental filtration at the intake air vent where possible.
6. Assess filter conditions by adding a port or pressure gauge to measure the filter pressure drop on at least one air-handling unit.



Technician examining HVAC system

7. Weatherize the building to limit smoke intrusion. Consider measures such as limiting allowable entrances to reduce smoke entry.

8. Prepare to monitor indoor $PM_{2.5}$ by purchasing one or more low-cost air sensors designed to measure the pollutant. These low-cost sensors can be used to show trends in $PM_{2.5}$ levels (i.e., whether $PM_{2.5}$ is increasing or decreasing). These low-cost sensors will not be as accurate as regulatory monitors, but can show whether your interventions are reducing indoor $PM_{2.5}$.



Checking air handling unit pre-filter

9. Determine how to create temporary cleaner air spaces within the building.
10. Anticipate sources of indoor $PM_{2.5}$, such as cooking, vacuum cleaning, use of printers or copiers and smoking, that can increase levels of $PM_{2.5}$ within the building.

Low-Cost Portable Air Sensors

- Increasing public use
- Potentially helpful in areas without nearby monitors, but issues with reliability and accuracy
 - Testing indicates results differ from agency monitors by 2X
- Issues to consider in use:
 - EPA: <https://www.epa.gov/air-sensor-toolbox>
- Comparison of analytical capability
 - South Coast AQMD: <http://www.aqmd.gov/aq-spec>

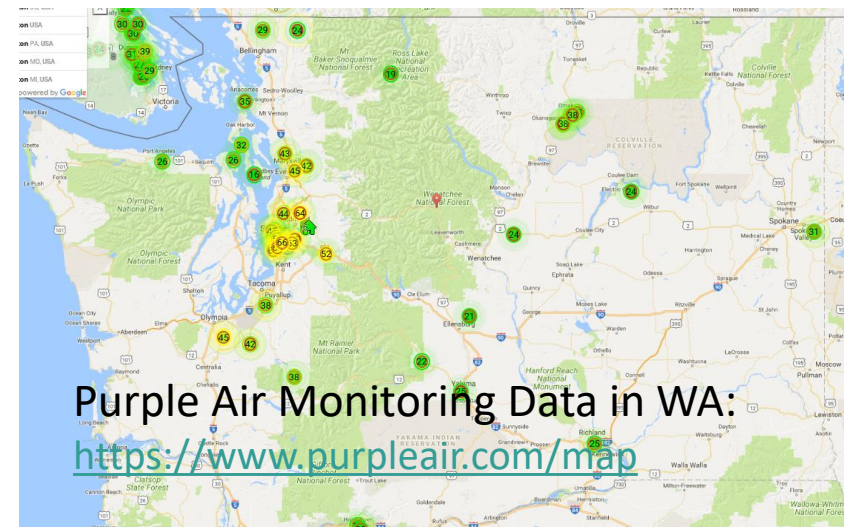


Image Source: EPA, <https://www.epa.gov/air-sensor-toolbox>





[Environmental Factor - May 2021: Indoor air a neglected source of chemical, particulate exposures \(nih.gov\)](#)

DOH School Environmental Health and Safety Program

Provide technical support & training

- Local Health Jurisdictions (LHJs)
- Schools

Authority

- RCW 43.20.050(2)(c) Adopt rules controlling public health related to environmental conditions including but not limited to heating, lighting, ventilation, sanitary facilities, cleanliness and space in all types of public facilities including but not limited to food service establishments, schools, institutions, ...
- State Board of Health WAC 246-366
- DOH / OSPI K12 Health & Safety Guide
2000, 2003 – current edition. **Being updated this year.**

Chapter 246-366

Washington Administrative Code

- 1955 – earliest version, but not earliest rules
- Covers all new, major remodel, public, private K-12
- Local Health Jurisdictions required to do:
 - Site Approval
 - Plan Review
 - Pre-opening Inspections
 - Annual inspections
 - **1971 - “Periodic” inspections**
- 2004-2009 – latest rule revision
- State Board of Health adopted WAC 246-366A
 - State Legislation prohibited implementation until they fund it.

Chapter 246-366 WAC

001 Introduction	080 Ventilation
005 Purpose	090 Heating
010 Definitions	100 Temperature control
020 Substitutions	110 Sound control
030 Site Approval	120 Lighting
040 Plan Review and inspection of schools	130 Food handling
050 Buildings	140 Safety
060 Plumbing, water supply, and fixtures	150 Exemption
070 Sewage disposal	160 Severability

Which Leads Us To 2022

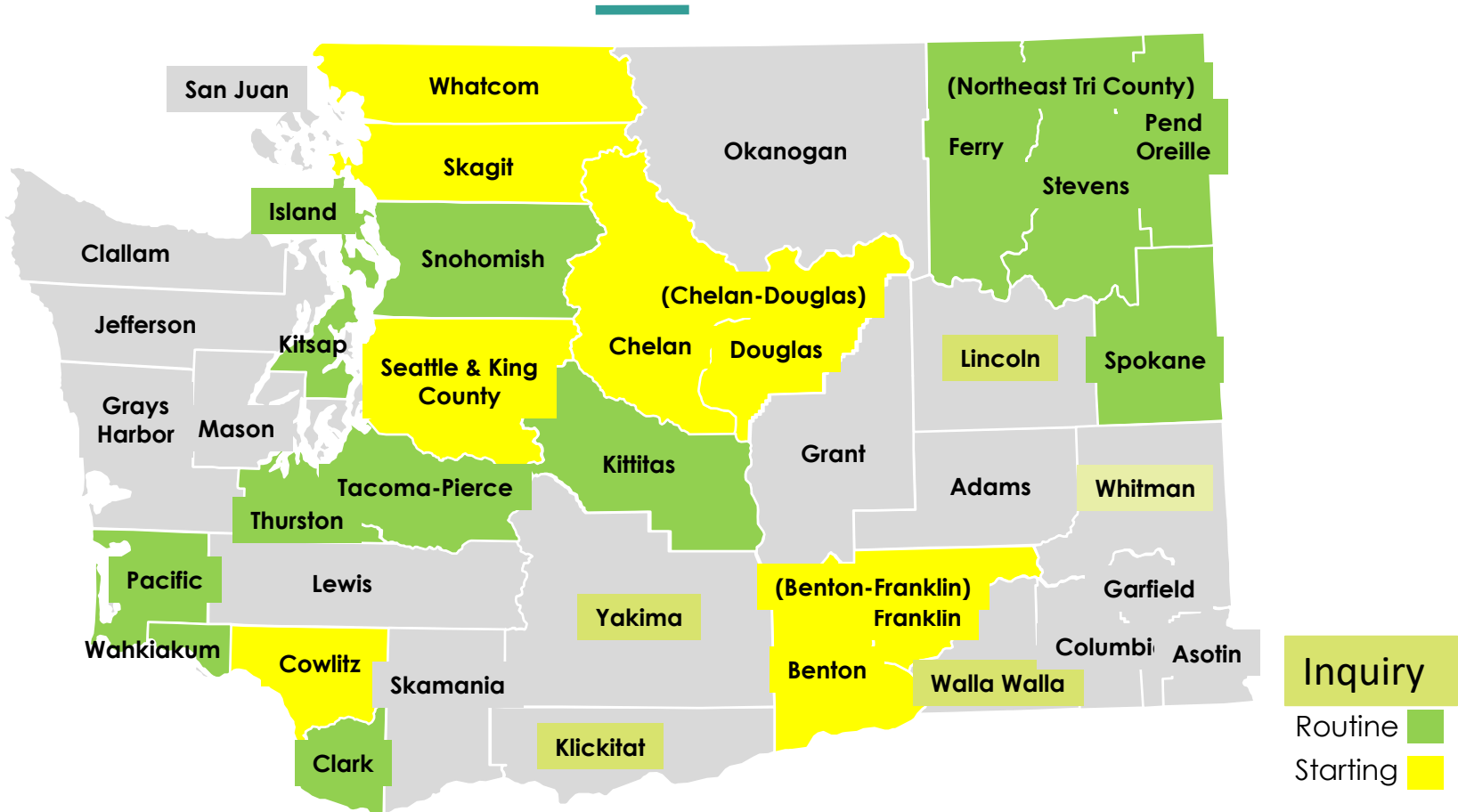
- Foundational Public Health Services Funding allowing more LHJs to increase School EHS work under WAC 246-366

The legislature ordered a report regarding school environmental health policies, recommendations, and standards by the University of Washington Department of Environmental and Occupational Health Sciences

- A review of policies and regulations in other states pertaining to environmental health in K-12 schools;
- Literature and recommendations for exposure standards and remediation levels which are protective of health and safety for students in schools;
- A summarization of activities, such as inspections, management, control levels, and remediation of a variety of contaminants and issues, including PCBs, lead, asbestos, poor ventilation, and mold; and
- Recommendations for next steps for policies and standards in Washington schools.
- Due by December 31, 2022.

Local Health Jurisdiction

School Environmental Health & Safety Inspection Programs



- Schools in all 39 counties in the state receive food service inspections, construction plan review and complaint response from their local health jurisdiction.
- Eighteen identified Local Health Jurisdictions have or are starting school programs with periodic routine inspections.

Supplemental Materials

Resources

- Why Soap Works
<https://www.nytimes.com/2020/03/13/health/soap-coronavirus-handwashing-germs.html>
- UW Safer Cleaning, Sanitizing & Disinfecting Strategies to Prevent Infection Transmission
[fact sheet - safer cleaning 2022 7-29-22.pdf \(washington.edu\)](#)
- Cleaning for Asthma-Safe Schools (CLASS), CDPH
<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/WRAPP/Pages/CLASS.aspx>
- *Cleaning for Healthier Schools – Infection Control Handbook*
[Infection Control Handbook for Schools - 2021 update.pdf \(turi.org\)](#)
- Informed Green Solutions
<http://www.informedgreensolutions.org/>
- Characteristics of Selected Disinfectants
<http://www.cfsph.iastate.edu/Disinfection/Assets/CharacteristicsSelectedDisinfectants.pdf>
- *Safer Products and Practices for Disinfecting, 2014*, SFDE, RPN
http://www.sfenvironment.org/sites/default/files/fliers/files/sfe_th_safer_products_and_practices_for_disinfecting.pdf

Resources

- Coronavirus Response Resources from ASHRAE and Others: <https://www.ashrae.org/technical-resources/resources>
- ASHRAE EPIDEMIC TASK FORCE *Core Recommendations for Reducing Airborne Infectious Aerosol Exposure* <https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf>
- EPA Ventilation and Coronavirus <https://www.epa.gov/coronavirus/ventilation-and-coronavirus-covid-19>
- NIST online tool for comparing impacts of ventilation, filtration, etc., on indoor aerosols: <https://www.nist.gov/services-resources/software/fatima>
- ASHRAE Epidemic Task Force: Filtration and Disinfection, 10-20-2020 Update [ashrae-filtration disinfection-c19-guidance.pdf](https://www.ashrae.org/technical-resources/covid-19/ashrae-filtration-disinfection-c19-guidance.pdf)
- Illuminating Engineering Society. IES Committee Report: Germicidal Ultraviolet (GUV)- Frequently Asked Questions. IES CR-2-20-V1. <https://media.ies.org/docs/standards/IES-CR-2-20-V1-6d.pdf>



Cleaning for Health in the Classroom Best Practices for Teachers

School Environmental Health and Safety Program

School custodial staff is responsible for cleaning schools. Some teachers choose to do additional cleaning. Here is how to ensure those efforts tackle dirt and germs safely and effectively.

Teach good handwashing habits - the #1 way to keep germs from spreading.

Use plain soap and water for handwashing – before eating, after using the bathroom, after recess, etc. Antibacterial soap is not recommended. Use plain fragrance-free soap. When there is no access to a sink, as on a field trip, alcohol-based (at least 60% alcohol, dye-free and fragrance-free) hand sanitizer or alcohol-based sanitizer wipes can be used. Hand sanitizers are not a substitute for handwashing. They are not effective when hands are dirty or greasy.

Cleaning for Health benefits all

- Lowers absenteeism
- Increases productivity
- Improves indoor air quality
- Reduces asthma and allergy triggers

Good to know:

- Kids are more vulnerable to chemical exposures.
- Many common cleaning products have ingredients that can harm health, especially the lungs.

Know the difference between Cleaning, Sanitizing, and Disinfecting.

Use the right product for the task:

- **CLEANING** removes dirt and most germs. Use soap and water. A third party certified green cleaner is preferred. In the classroom, cleaning is the focus.
- **SANITIZING** reduces germs to safe levels, for example in food service environments. Food code regulations have specific requirements for sanitizers in the cafeteria and kitchen.
- **DISINFECTING** kills most germs, depending on the type of chemical, and only when used as directed on the label.
- In schools, custodial staff use disinfectants and sanitizers regularly only in high-risk areas – nurse’s office, bathrooms, cafeterias, kitchens, drinking fountains, sink and door handles, and athletic facilities; preferably, when students are not present. Overuse does not provide any additional protection and can expose students and staff to harmful chemicals.

Teachers can rely on basic *cleaning* to remove dirt and germs in the classroom.

If staff, besides trained custodial staff, needs to assist with classroom cleaning, they should use a school or district provided basic cleaner. A third party certified green cleaner is preferred.

- Custodial staff can make a simple all-purpose cleaner for classrooms. Mix one teaspoon of fragrance-free dish soap in a spray bottle filled with water. Spray on surface and scrub with paper towels or a microfiber cloth. Rinse and wipe dry to remove any residue.
- Microfiber cleaning cloths improve cleaning – the removal of dirt and germs. Dampened with water they are great dust removers. With soap and water, they remove most germs.
- Disinfecting is the responsibility of school custodial staff. They are trained to use disinfectants in a safe and effective manner and to clean up potentially infectious materials and body fluid spills – blood, vomit, feces, and urine. Contact your custodian or school nurse if students are ill and your classroom needs cleaning and disinfection. If teachers use disinfectants, the district must provide training and supply the appropriate cleaner and sanitizer or disinfectant.

Students should never use disinfectants. Disinfectant wipes should not be used to clean hands. This includes Clorox wipes.

If students are helping:

- They should only use soap and water.
- Fragrance-free baby wipes could be used for quick cleaning.
- Most store-bought cleaning products are not safe for children to use.

Cleaning for Health in the Classroom Frequently Asked Questions

School and Indoor Air Quality Program



How does cleaning reduce germs?

Cleaning works by removing dirt and organic matter that contains and protects germs. Soap breaks down oils and allows dirt, contaminants, and germs to be more easily removed. Cleaning with soap, water, and a microfiber cloth will remove most germs.

Why is handwashing better than hand sanitizer?

Soap and rubbing hands together under running water removes oil, dirt, and harmful surface germs. Hand sanitizer does not remove dirt in which germs hide and only kills a few easy-to-kill ones.

Why use plain soap for handwashing?

Antibacterial ingredients, in particular triclosan and quaternary ammonia compounds (quats), only kill a few types of germs and are unnecessary when washing hands. It doesn’t matter if germs are alive or dead when they are washed down the drain.

What about non-alcohol hand sanitizers?

The U.S. Centers for Disease Control and Prevention only recommends hand sanitizers with at least 60% alcohol. Non-alcohol ones are even less effective than alcohol hand sanitizers.

How does this guidance affect fall classroom supply request lists?

Okay to Request

- Fragrance-free baby wipes.
- Paper towels (recycled content preferred).

DO NOT Request

- Disinfecting wipes.
- Non-alcohol-based hand sanitizer.

What are the issues with disinfecting wipes?

- Disinfecting wipes are often overused. They are not appropriate for general cleaning when an all-purpose cleaner or soap and water would suffice.
- Disinfecting wipes (e.g. Clorox, Lysol) usually contain quats and fragrance chemicals. These ingredients can trigger asthma and are associated with adverse health effects.
- Disinfectants can give a false sense of security because when they are not used exactly to label instructions, they don’t work properly. Most disinfecting wipes require the surface to be cleaned first, and then remain visibly wet 4-10 minutes (dwell time) to be effective, requiring multiple wipes.

Why is it important to use fragrance-free products in school?

Fragrance is one of the most frequently identified allergens, can irritate the respiratory system, cause headaches, and exacerbate asthma.

What’s so great about microfiber cloths?

Their split fibers create more surface area and are superior for removing dust, dirt, and germs. They are reusable and can be laundered or washed by hand.

Why should teachers not bring common cleaning products (including bleach) from home into the classroom?

- Some common cleaning products are dangerous when mixed. Never mix bleach with ammonia, acids, or other disinfectants. An example: Comet, containing bleach, would react with Windex, which contains ammonia, to form poisonous vapors.
- Common household cleaners and disinfectants may not be appropriate for schools and may cause allergic reactions or have other health impacts.
- Schools and districts must have a Safety Data Sheet for each chemical used in the school.



Healthy Air for Healthy Schools

Use Only:

- Approved chemicals, cleaners, or disinfectants provided by the school or district. Never bring in products from home.
- Fragrance-free soap and water or fragrance-free baby wipes to clean surfaces. Disinfection is for trained custodians with approved effective products.
- Pens, markers, and board cleaners that are water-based, unscented, crayon, or low-odor.
- Spray paints and spray glues where there is mechanical exhaust ventilation.

Avoid Products That Reduce Air Quality — Do Not Use:

- Room deodorizing sprays, plug-ins, scented candle warmers, scented reeds, candles, incense, essential oils, or potpourris.
- Air-cleaning devices that generate ozone or are called "ionizers" – ozone is a respiratory irritant.
- Perfumes, colognes, body sprays and other strongly scented personal care products.
- Permanent, solvent-based, or scented pens, markers, and board cleaners.
- Disinfectant wipes.
- Urinal cakes.
- Rubber cement or spray adhesives with hexane or toluene.



Using classroom products that are free of airborne irritants means healthy indoor air quality!

- > Eliminate unnecessary chemicals.
- > Reduce asthma and headaches.
- > Increase attendance and performance!

Learn more at www.doh.wa.gov/schoolenvironment



DOH 333-243 August 2019

For people with disabilities, this document is available on request in other formats.

Call 1-800-525-0127 (TDD/TTY call 711).

Healthy Air Quality in Schools - Tips for Administrators, Custodians, and Teachers



Healthy Air Quality in Schools

Achieving healthy air quality in schools takes administrators, custodians, and teachers working together. Good ventilation and source control of pollutants means healthy indoor air quality.

General Tips

- Teachers and staff need to know who to contact for indoor air quality concerns in the school.
- There should be a written school or district indoor environmental quality plan that includes indoor air quality and integrated pest management.
- Notify school or district indoor air quality contact or maintenance staff if you detect odors or dust from locations such as shops, copy rooms, science labs, laminators, locker rooms, graphic arts, custodial supply rooms, storage areas, combustion equipment, kitchens, or bus exhaust. Document your concerns.
- Immediately report any water leaks, water stains, damp materials, or unusual odors (such as musty or moldy smells) to maintenance staff.
- Maintenance staff should respond to water leaks and moisture problems within 24 hours.
- Relative humidity levels between 30 and 50 percent are better for health. Low relative humidity leads to dry eyes and respiratory irritation. High relative humidity allows dust mites to grow and promotes condensation.
- Dispose of food wastes promptly in covered containers.

Ventilation

- Operate the ventilation system continually when the school is in use, including during custodial work. Supply at least 15 cubic feet per minute per person of fresh outside air whenever the school is in use. See [WSU Energy Program's Good Ventilation is Essential for a Healthy and Efficient Building \(PDF\)](#). (www.energy.wsu.edu/Portals/0/Documents/Good_Ventilation_is_Essential.pdf).
- An occupied room is considered to be receiving the minimum amount of fresh air when indoor carbon dioxide (CO₂) levels are approximately 700 parts per million (ppm) over outside ambient CO₂ levels. See [WSU Energy Program's Measuring Carbon Dioxide Inside Buildings \(PDF\)](#). (www.energy.wsu.edu/Portals/0/Documents/Measuring_CO2_Inside_Buildings-Jan2013.pdf).
- Maintain three feet of clearance around unit ventilators and do not put items on top of them to block airflow.
- Change ventilation filters regularly. Use the highest rated, deepest pleat filters the system can accommodate.
- Check to make sure that supply air diffusers, exhaust, and return grills are not blocked. They should be clean and dry.
- Don't turn off unit ventilators – ask maintenance staff to repair noisy units, control temperatures, and control drafts.
- Monitor windows – they should not show condensation except on the very coldest of days.
- Don't allow vehicle idling on school property.
- Maintenance staff should follow integrated pest management strategies. Don't use pesticides in the building.

Control Asthma Triggers

Reduce Animal Allergens, including Dust Mites

- Animals shouldn't be classroom residents and should only come to school for educational purposes.
- Use integrated pest management practices to prevent cockroach and rodent infestations.
- Store food in tightly sealed containers.
- Seal all cracks and crevices.
- Grate all foundation and roof ventilation.
- Use barriers to discourage birds roosting.
- Wash stuffed animals and blankets in hot water every two weeks, or remove them.

Control Dust

- All outside doors should have large entry mat barriers (walk-off mats) outside and just inside the door. The mats should provide at least four to seven footfalls.
- Maintain cleanable surfaces and avoid clutter. Put loose items into plastic boxes with lids that can be wet-wiped.
- Damp-wipe surfaces weekly with a micro-fiber cloth.
- Don't hang items from the ceiling T-bars without special clips to prevent fraying fiberglass. Remove or clean items when dusty.
- Discourage clutter by removing as many unnecessary dust-collecting items as possible.
- Use pre-mixed and pre-wetted clay art supplies whenever possible to reduce dusts.
- Replace fabric upholstered furniture with furniture easily dusted.
- Remove area rugs that cannot be regularly cleaned and that trap dirt and moisture.

Reduce Chemicals

- Don't use permanent, solvent-based or scented pens, markers, and board cleaners. Use water-based, unscented, crayon-based, or low-odor items.
- Don't use room deodorizing sprays, plug-ins, scented candle warmers, scented reeds, candles, incense, therapeutic oils, or potpourris.
- Don't use urinal cakes in bathrooms.
- Avoid spray adhesives, contact cement, and volatile paints. If spray adhesives are necessary, use hexane and toluene-free products. Wear solvent-resistant gloves. Spray in an area with local exhaust ventilation and away from children. See [King County's Selecting Safer Art Adhesives](#) (www.hazwastehelp.org/publications/publications_detail.aspx?DocID=z%2F70%2F2BLUUM%3d).
- Don't bring chemicals, cleaners, or disinfectants from home. Use only those provided by the school or district.
- Never use air-cleaning devices that generate ozone. Ozone is a respiratory irritant.
- Discourage the use of perfumes, colognes, body sprays and other strongly scented personal care products.
- Hazardous chemicals in laboratories, chemical storages, shops, art rooms, and any other areas need to be properly stored and managed to prevent air contamination.

Carpet Care

- Whenever possible, don't allow food or beverages in classrooms. If possible, vacuum daily (when children are not present). Use a vacuum with a HEPA (high efficiency particulate air) filter – or use HEPA vacuum bags. Having both is even better.
- Avoid use of area rugs. They can trap moisture and dirt under them. Clean carpets thoroughly with truck-mounted hot water and steam extraction once or twice per year.
 - Spot treat carpet as needed first.
 - Use the minimum amount necessary of low-odor and low-sudsing carpet shampoo.
 - All shampoo and cleaner needs to be thoroughly extracted until the water runs clean.
 - Carpet should dry thoroughly within 24 to 48 hours after cleaning.

Resources

- [School Environmental Health and Safety, Department of Health](#) (www.doh.wa.gov/schoolenvironment)
- [School Indoor Air Quality Best Management Practices Manual, 2003 \(PDF\)](#) (www.doh.wa.gov/Documents/Pubs/333-044.pdf)
- [Integrated Pest Management for Schools, WSU](#) (<http://schoolipm.wsu.edu/>)
- [Creating Healthy Indoor Environments in Schools, EPA](#) (www.epa.gov/iaq/schools/index.html)
- [Taking Asthma Care To School, Washington Asthma Initiative \(PDF\)](#) (<http://waasthma.org/wp-content/uploads/2014/05/AMES2014Final.pdf>)
- [Art Hazards, King County Local Hazardous Waste Management Program](#) (<http://hazwastehelp.org/ChemToxPesticides/artchemicals.aspx>)

Resources - Safer Disinfectants



Safer Cleaning, Sanitizing and Disinfecting Strategies to Prevent Infection Transmission

Proper cleaning and disinfecting are important for reducing the spread of infectious disease. This fact sheet provides best practices for cleaning, sanitizing and disinfecting surfaces to prevent the spread of disease while minimizing harmful chemical exposures. These practices focus on the workplace, however they can be applied in any setting. Consult the U.S. Centers for Disease Control and Prevention and the U.S. National Institute for Occupational Health and Safety for the most current information.

► **Remember:** When possible for handwashing and cleaning surfaces, using soap and water is always the best option.

Why are we talking about safer practices?

 Hazardous chemicals are common in cleaning, sanitizing, and disinfecting products.

People using these products, and people in the spaces where they are used, can get sick or develop illnesses, including asthma. Others harm reproductive health or may cause cancer if too much exposure occurs. Some damage skin or other body systems. For example, custodians using cleaning products and disinfectants may suffer from work-related asthma due to exposure on the job.

 Safer options are available.

Look for Safer Choice, Green Seal®, Ecologo® and Design for the Environment (DfE) labels on products.



These labels are on environmentally preferable cleaning products and disinfectants that have a lesser or reduced effect on human health and the environment. These labels have strict requirements and can help you avoid chemicals that have negative impacts.

Key Terms

Cleaner
Removes germs, dirt, and impurities from surfaces or objects. Works by using soap/detergent, water and friction to physically remove dirt and germs from surfaces. Cleaning before disinfecting reduces spreading infection more than disinfecting alone.

Sanitizer
Reduces germs on surfaces to levels considered safe for public health (usually 99.99%). Products must be EPA registered.

Disinfectant
Destroys almost all infectious germs, when used as the label directs on a surface. No effect on dirt, soil, or dust. Should be used where required by law, in high-risk and high-touch areas, or in case of infectious disease. Products must be EPA registered.

Photo: iStockphoto.com/Tommaso

DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES | SCHOOL OF PUBLIC HEALTH | deohs.washington.edu

6 Steps for Safe & Effective Disinfectant Use



Step 1: Check that your product is EPA-approved

Find the EPA registration number on the product. Then, check to see if it is on EPA's list of approved disinfectants at: [epa.gov/listn](https://www.epa.gov/listn)



Step 2: Read the directions

Follow the product's directions. Check "use sites" and "surface types" to see where you can use the product. Read the "precautionary statements."

Step 3: Pre-clean the surface

Make sure to wash the surface with soap and water if the directions mention pre-cleaning or if the surface is visibly dirty.



Step 4: Follow the contact time

You can find the contact time in the directions. The surface should remain wet the whole time to ensure the product is effective.

Step 5: Wear gloves and wash your hands

For disposable gloves, discard them after each cleaning. For reusable gloves, dedicate a pair to disinfecting COVID-19. Wash your hands after removing the gloves.



Step 6: Lock it up

Keep lids tightly closed and store out of reach of children.

[Six Steps for Safe & Effective Disinfectant Use \(epa.gov\)](https://www.epa.gov)

CLEANING AND DISINFECTING

Best Practices During the COVID-19 Pandemic

Good Idea	Be Careful	Don't Do It
<p>Follow CDC, State, and Local Public Health Guidelines</p> <p>According to the Centers for Disease Control and Prevention (CDC), COVID-19 is mainly spread through the air. The risk of getting the virus by touching a contaminated surface is thought to be low.</p> 	<p>Be Careful Using Disinfectants Around People with Asthma</p> <p>Disinfectants can trigger an asthma attack. If you have asthma, you may need to take extra precautions like avoiding areas where people are cleaning and disinfecting or making sure the space is well ventilated.</p> 	<p>Don't Ask Children or Students to Apply Disinfectants</p> <p>Disinfectants are powerful tools for controlling the spread of disease, and they can harm kid's health if used or stored incorrectly. Children and students should not apply disinfectants, and they should be kept out of children's reach.</p> 
<p>Clean Surfaces with Soap and Water</p> <p>Normal routine cleaning with soap and water lowers the risk of spreading COVID-19 by removing germs and dirt from surfaces. In most situations, cleaning is enough to reduce risk.</p> 	<p>Be Careful with Fogging, Fumigating, and Wide-Area or Electrostatic Spraying</p> <p>Make sure your product's label includes directions for the application method. Follow all directions, including precautions. If a product isn't labeled for these application methods, using it that way might be risky or ineffective.</p> 	<p>Don't Ignore the Label Directions</p> <p>If you don't follow the label directions, disinfectant products may be ineffective or unsafe. Do not apply disinfectants to skin, pets or food. Do not dilute disinfectants or mix them with other chemicals unless the label tells you to. Don't think that twice the amount will do twice the job.</p>  
<p>Use EPA-Registered Disinfectants According to Label Directions</p> <p>Disinfectants further lower the risk of spreading COVID-19 by using chemicals to kill germs. Use disinfectants on high-touch surfaces when you know or suspect someone around you is sick with COVID-19.</p>	<p>Be Careful With UV Lights or Ozone Generators</p> <p>UV lights or ozone generators may be risky or ineffective. EPA cannot verify if or when it is appropriate to use these devices. Check out the guidance at: go.usa.gov/xHckJ</p> 	<p>Don't Use Unregistered Disinfectants</p> <p>If a product says that it kills SARS-CoV-2 (COVID-19), but it doesn't have an EPA registration number, it may not be safe or effective. Federal law requires disinfectants to be registered with EPA.</p> 

US EPA - Cleaning and Disinfecting Best Practices During the COVID-19 Pandemic

For some or all the pages.



Cleaning and Disinfection Protocol

Remove all grossly visible debris.

The presence of gross contamination or organic material, especially feces, will inactivate most disinfectants.

Wash the area or item with water and detergent.

Thoroughly rinse the cleaned area to remove any detergent residue.

Some disinfectants may be inactivated by detergents; therefore, it is very important to rinse well after washing the area or item.

Allow the area to dry completely.

Select and apply an appropriate, effective disinfectant.

Allow the proper contact time!

This is one of the most overlooked steps!!
Contact time may vary depending on the disinfectant selected, but is usually at least 10 minutes. Consult the product label.

Thoroughly rinse away any residual disinfectant and allow the area or item to dry.

Infection Control Handbook for Schools

Edition 2

[Infection Control Handbook for Schools - 2021 update.pdf \(turi.org\)](https://www.turi.org/infection-control-handbook-for-schools-2021-update.pdf)



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Acknowledgements

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Funding

This report was prepared with funding from and in collaboration with the Toxics Use Reduction Institute (TURI) at the University of Massachusetts Lowell in 2010 and 2020-2021.

Using Disinfecting Wipes at School



What disinfectants can be used on hard surfaces to kill the virus that causes COVID-19?

Antimicrobial Pesticides



- Disinfectants – approved by EPA to be effective against specific viruses.
- EPA List N for Emerging Pathogens – lists disinfectants for use for COVID-19 on surfaces.

See fact sheet "Choosing Safer Disinfectants" from the EPA List N.

What are disinfectant wipes?



- Disposable material soaked in disinfectant.

While wipes are convenient, if used incorrectly, they can spread germs, give a false sense of security that surfaces are disinfected, and cause unnecessary exposures.

What should wipes not be used for?



- They are NOT handwipes or baby wipes, and should NOT be used on skin.
- They should NOT be used on produce, or have contact with food.

How can I safely and effectively use wipes?



1. Protect hands - put on chemical resistant gloves, even if label doesn't mention it.
2. Wash and rinse surface to enable disinfectant to be in direct contact with germs.
3. Shake wipe container with lid securely on to wet wipes with any liquid that settled.
4. Disinfectants only work when wet! Use enough wipes to keep surface wet for the "contact time" listed on label, which can vary by product and type of germ. Use wipe(s) *only once on one surface* to prevent spreading germs around.
5. Rinse surface if it will be in contact with skin or food, and label directs you to do so.

Who can use wipes in school?

- Only adults should use disinfecting wipes.
- Children under 18 should NOT use wipes.



Where can I get more information?



www.informedgreensolutions.org
Poster funded by: Toxics Use Reduction Institute, UMass, Lowell

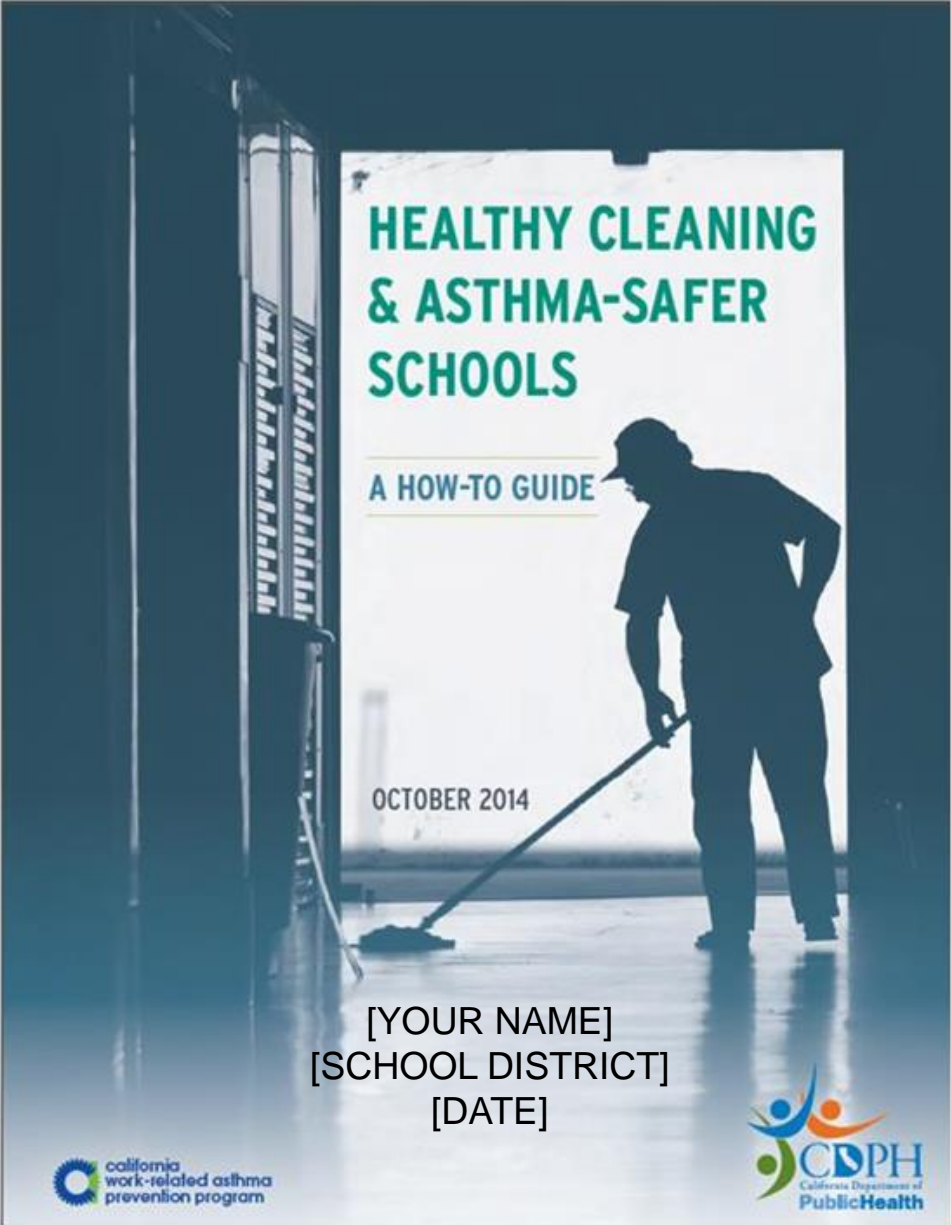


Sources: NPIC, 1.800.858.7378, npic@ace.orst.edu
Health News, 6/3/08 Study Antibacterial wipes can spread superbugs, Michael Kahn

[Using Disinfecting Wipes / Safer Cleaning and Disinfection for Schools / COVID-19: Safely Clean & Disinfect / Cleaning Laboratory / Our Work / TURI - Toxics Use Reduction Institute](#)

or all the pages.

Staff and students deserve to work and learn in a safe and healthy school environment, and they can, since safer cleaning products and methods exist.



California DPH Occupational Health Watch January 2021

- Fragrance ingredients such as those found in perfumes, essential oils, air fresheners, and cleaning products can cause and trigger asthma. Fragrance products are used in many California workplaces and have been associated with over 350 cases of work-related asthma investigated by the Occupational Health Branch.
- To help California workers and employers address fragrances and work-related asthma, WRAPP created a [web page](#) dedicated to this issue. It features publications in multiple languages, a model fragrance-free workplace policy, and resources to find products that do not contain fragrances.

Resources

- [Volatile chemical emissions from car air fresheners](#) (Journal article abstract)
- [Volatile chemical emissions from essential oils with therapeutic claims](#) (Journal article abstract)
- [Work-Related Asthma Fragrance Web Page](#)
- [Work-Related Asthma Prevention Program](#)

Asthma-Safer Cleaning and Disinfecting Update - CaDPH

- [Work-Related Asthma, Cleaning Products, and Disinfectants](#) – OHB web page

[Reminders for Using Disinfectants at Schools and Child Cares \(PDF\)](#) | [Spanish](#) – California Department of Pesticide regulation InfoSheet

[Fragrances and Work-Related Asthma](#) – OHB web page

[Cleaning for Asthma-Safe Schools \(CLASS\)](#) – OHB web page

[Work-Related Asthma Prevention Program \(WRAPP\)](#) – OHB website

Hazard Alert: Rubbing/Isopropyl Alcohol can be Hazardous to Workers' Health and Safety

COVID-19 created the need to wipe down and disinfect all surfaces touched by people in the workplace. Isopropyl or rubbing alcohol is a common chemical found in most disinfecting wipes and sprays. When workers breathe in the fumes in high concentrations or over a long period of time, it can make them sick.



[Read about two Washington workers](#) overexposed to hazardous amounts of isopropyl alcohol and how you can prevent it from happening in your workplace.

Available in [English](#), [Spanish](#), [Russian](#), [Vietnamese](#), [Cambodian](#), [Chinese Simplified](#), [Chinese Traditional](#), [Korean](#) and [Somali](#). Find a list of previous alerts at <https://lni.wa.gov/safety-health/preventing-injuries-illnesses/hazardalerts>.

If you would like assistance with your Hazard Communication Plan or help measuring workers' personal exposures to chemicals, please contact [your local L&I safety & health consultant](#).

Only products with EPA registration numbers should be used. This number indicates the product has been reviewed by the EPA and poses minimal risk to animals, people and the environment when used in accordance with their label.

EPA Reg. No.
1658 – XX



EPA Est. No.
16XX – MO – 1

PRODUCT X

Disinfect-Cleaner-Sanitizer-Fungicide-Mildewstat-Virucide™-Deodorizer for Hospitals, Institutional and Industrial Use
Effective in hard water up to 400 ppm hardness (calculated as CaCO₃) in the presence of 5% serum contamination

ACTIVE INGREDIENTS:

Octyl decyl dimethyl ammonium chloride.....	1.650%
Diocetyl dimethyl ammonium chloride.....	0.825%
Didecyl dimethyl ammonium chloride.....	0.825%
Alkyl (C14, 50%, C12, 40%, C16, 10%) Dimethyl benzyl ammonium chloride.....	2.200%
INERT INGREDIENTS:	94.500%
TOTAL:	100.000%

KEEP OUT OF REACH OF CHILDREN

DANGER HAZARD TO HUMANS AND DOMESTIC ANIMALS

PRECAUTIONARY STATEMENTS

CORROSIVE: Causes severe eye and skin damage. Do not get into eyes, on skin or clothing. Wear goggles or face shield and rubber gloves when handling Product X. Harmful or fatal if swallowed. Wash thoroughly with soap and water after handling.

ENVIRONMENTAL HAZARDS: This product is toxic to fish. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. For guidance contact your State Water Board or Regional Office of the EPA.

PHYSICAL AND CHEMICAL HAZARDS: Do not use or store near heat or open flame.

STATEMENT OF PRACTICAL TREATMENT: In case of contact, immediately flush eyes or skin with plenty of water for at least 20 minutes. For eyes, call a physician. Remove and wash contaminated clothing before reuse. If ingested, call a physician immediately.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage.

Manufactured by
Company Y Chemical Company, Somelown, Somestate 12345

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

DIRECTIONS FOR USE

Product X is a germicide, soapless cleaner and deodorant which is effective in water up to 400 ppm hardness in the presence of organic soil (5% serum). When used as directed, will not harm tile, terrazo, resilient flooring, concrete, painted or varnished wood, glass or metals.

FOR USE IN VETERINARY CLINICS, ANIMAL CARE FACILITIES, LIVESTOCK FACILITIES AND ANIMAL QUARANTINE AREAS

Apply Product X to walls, floors and other hard (inanimate) non-porous surfaces with a cloth, mop or mechanical spray device so as to thoroughly wet surfaces. Prepare a fresh solution daily or when use solution becomes visibly dirty.

Disinfection – To disinfect hard surfaces, use 1 fluid ounce of Product X per gallon of water. Apply by immersion, flushing solution over treated surfaces with a mop, sponge or cloth to thoroughly wet surfaces. Allow treated surfaces to remain moist for at least 15 minutes before wiping or rinsing. Product X will disinfect hard non-porous surfaces in veterinary clinics, animal care facilities, livestock facilities and animal quarantine areas. For heavily soiled areas, a preliminary cleaning is required.

2 oz. gallon use-level. The activity of Product X has been evaluated in the presence of 5% serum and 400 ppm hard water by the AOAC use dilution test and found to be effective against a broad spectrum of gram negative and gram positive organisms as represented by:

Pseudomonas aeruginosa	Pasteurella multocida
Enterobacter aerogenes	Enterococcus faecium
Staphylococcus aureus	Streptococcus faecalis
Salmonella choleraesuis	Shigella dysenteriae
Escherichia coli	Brevibacterium ammoniagenes
Streptococcus pyogenes	Salmonella typhi
Klebsiella pneumoniae	Serratia marcescens
Streptococcus agalactiae	Actinomyces pyogenes

Boot bath: Use 1.5 fluid ounces per gallon in boot baths. Change solution daily and anytime it becomes visibly soiled. Use a bristle brush to clean soil from boots before disinfecting with Product X. **Disinfecting trucks and farm vehicles:** Clean and rinse vehicles and disinfect with 1 fluid ounce per gallon of Product X. If desired, rinse after 12 minutes contact or leave unrinsed. Do not use Product X on vaccination equipment, needles or diluent bottles as the residual germicide may render the vaccines ineffective. **Sanitizing-Non-Food Contact Surfaces** (such as floors, walls, tables, etc.). At 1 oz. per 2% gallon use-level, Product X is an effective sanitizer against Staphylococcus aureus and Klebsiella pneumoniae on hard porous and non-porous environmental surfaces. Treated surfaces must remain wet for 60 seconds.

Some products may have multiple uses (i.e., cleaning versus disinfection) and require different dilutions and contact times for such actions.

This section describes what disease organism the product controls, as well as where, how and when to use it.

Specialty applications for the product (i.e., boot baths, vehicle disinfection) will also be listed.

This section will describe the hazards related to humans and animals when using this product. It recommends personal protective gear that should be worn, what effects it will have on the environment and treatment information should it be splashed into the eyes or ingested.

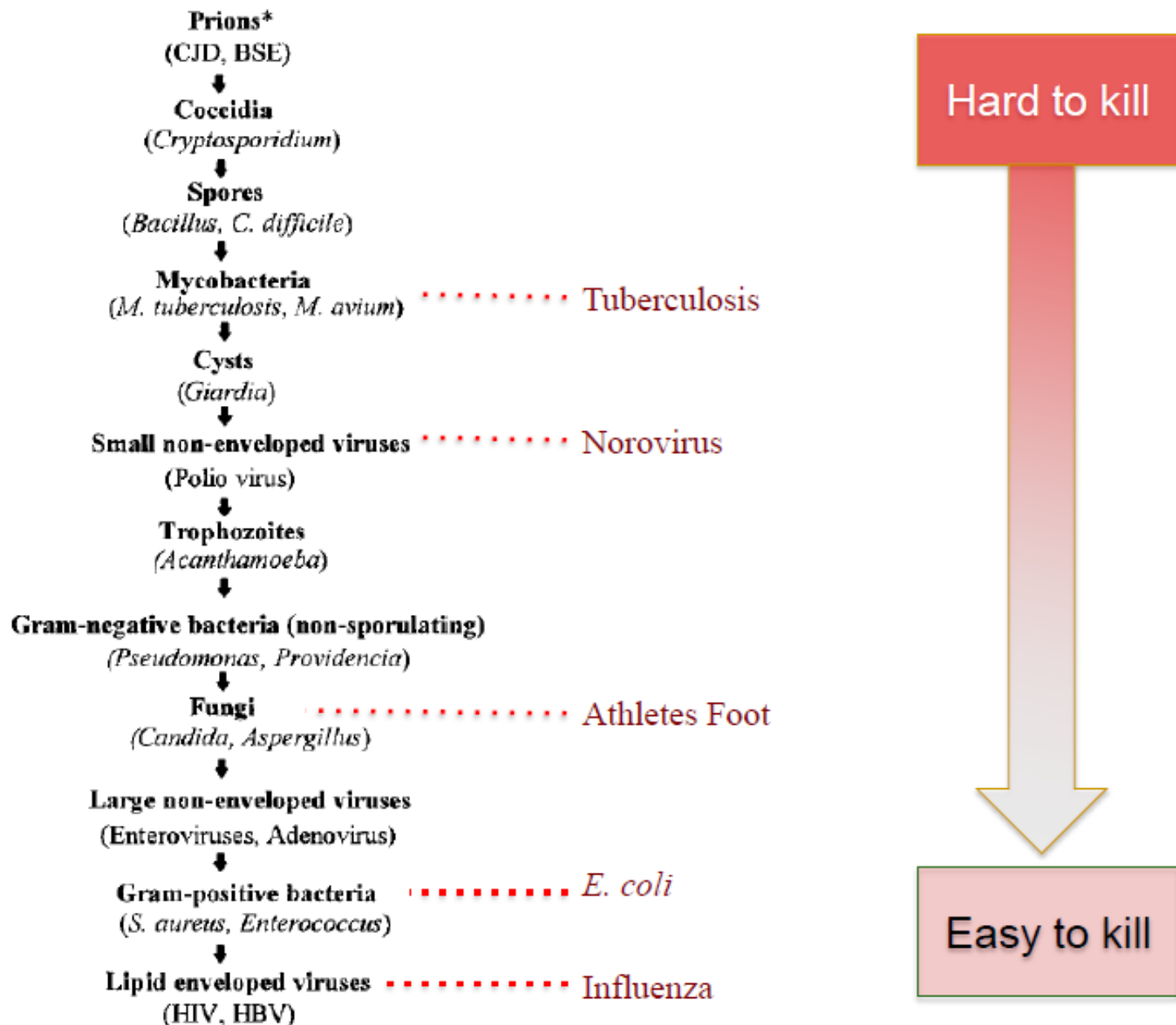


FIG. 1. Descending order of resistance to antiseptics and disinfectants. The asterisk indicates that the conclusions are not yet universally agreed upon.

WA State Janitorial Supplies Contract

Cleaning Products – Master Contract #00812

- **Benefits**
 - Extremely competitive pricing
 - Maximizes collective buying reduces cost by 1/3
 - Exclusively environmentally friendly products
 - Safer and healthier products
 - 1,631 state approved organizations
 - Stable supply chain
 - \$50min purchase, statewide delivery, work with distributor
- **Eligibility**
 - State and local governments
 - Higher education, Tribal entities, Nonprofits

Contract: <https://apps.des.wa.gov/DESContracts/Home/ContractSummary/00812>

Signatory Requirements: <https://www.des.wa.gov/services/contracting-purchasing/purchasing/master-contracts-usage-agreement>

Finding Products Without Fragrances

- [New York State's Green Cleaning Program](#) keeps a list of asthma-safer cleaning products without fragrance: (Under Product Category, choose "cleaning products." Click the "No" button next to the "Prefer products with fragrance" question)
- Some cleaning products have earned the [U.S. EPA's Safer Choice Fragrance-Free Label](#).
- The [Canadian Center for Occupational Health and Safety web page](#) includes steps for implementing a fragrance-free policy in the workplace.

Research Study

Fragranced consumer products: exposures and effects from emissions, Anne Steinemann

Air Qual Atmos Health, 20 October 2016

- 35% of population reported health problems
 - Half disabled
- 15% have lost workdays or a job due to exposure in the workplace
- 20% would leave quickly if fragranced products
- 50%+ would prefer fragrance-free public places – hotels, airlines, healthcare, work
- 53% support fragrance-free workplace policies
 - 20% opposed
- 18% unable/reluctant to use public toilets due to scented sprays
- 14% unable/reluctant to wash hands with fragranced soap

Efficient and Healthy Schools Campaign

[Framework for Effective School IAQ Management | US EPA](#)

EPA is excited to partner with Department of Energy on the [Efficient and Healthy Schools campaign](#), which aims to help K-12 schools—especially those serving low-income student populations—identify practical HVAC solutions and upgrades to improve energy efficiency while promoting healthier spaces for teaching and learning. This campaign will promote peer-to-peer learning among school participants and will recognize schools for their best practices and exemplary solutions. The campaign will also engage supporters such as designers, engineers, consultants, and program implementers, to better support schools that are investing in efficient and healthy school buildings.

You can find out more about integrated energy management solutions as a technical solution to common IAQ issues in schools in the [Framework for Effective School IAQ Management](#) and learn about how to optimize energy efficiency upgrades without compromising occupant health through the resources below:

- [Energy Savings Plus Health: Indoor Air Quality Guidelines for School Building Upgrades](#): This guidance outlines how you can equip your school district to integrate IAQ protections into energy efficiency retrofits and other building upgrade projects. Use the [Basic Steps to Using the Energy Savings Plus Health Guidelines](#) to find examples of typical school energy efficiency and building upgrade projects, as well as the potential IAQ and health risks and opportunities that may be encountered when executing these upgrades.
- [IAQ Tools for Schools On-Demand Webinars](#): Find recorded webinars from technical experts, industry leaders and model school districts, such as [Indoor Air Quality Plus Energy Efficiency: A Formula for Saving Money While Protecting Your School's Indoor Environment](#). This webinar explains the critical connection between IAQ and energy efficiency and the importance of properly integrating the two for optimal occupant health and building performance and proactive cost and energy savings.
- [EnergySTAR Event Recordings](#): Find recordings from recent EnergySTAR events, including the August 17, 2021 webinar, *K-12 Schools: Resources and Approaches to Manage Indoor Air Quality and Energy Efficiency Together* (be sure to click on "View Events by Date" in the upper right corner of the page). This webinar builds the case for managing IAQ and energy efficiency together and outlines a variety of resources from partners to get schools started on the track to cost savings through preventive maintenance.
- [Back-to-School Webinar on Energy Savings and Healthy Indoor Air](#): Watch this webinar from the Healthy Schools Network to learn more about how schools can achieve both energy efficiency and healthy indoor air, even in areas with high heat and humidity.

Installing air filters in classrooms has surprisingly large educational benefits

\$1,000 can raise a class's test scores by as much as cutting class size by a third.

By [Matthew Yglesias@mattyglesiasmatt@vox.com](mailto:Matthew.Yglesias@mattyglesiasmatt@vox.com) Jan 8, 2020, 1:30pm EST

An emergency situation that turned out to be mostly a false alarm led a lot of schools in Los Angeles to install air filters, and something strange happened: Test scores went up. By a lot. And the gains were sustained in the subsequent year rather than fading away.

NYU's Michael Gilraine "[Air Filters, Pollution, and Student Achievement](#)" that looks at the surprising consequences of [the Aliso Canyon gas leak](#) in 2015.

The impact of the air filters is strikingly large given what a simple change we're talking about. The school district didn't reengineer the school buildings or make dramatic education reforms; they just installed \$700 commercially available filters that you could plug into any room in the country. But it's consistent with a [growing literature on the cognitive impact of air pollution](#), which finds that everyone from [chess players](#) to [baseball umpires](#) to [workers in a pear-packing factory](#) suffer deteriorations in performance when the air is more polluted.

[\[2207.02678\] Increasing ventilation reduces SARS-CoV-2 airborne transmission in schools: a retrospective cohort study in Italy's Marche region \(arxiv.org\)](#)

[Submitted on 5 Jul 2022]

Increasing ventilation reduces SARS-CoV-2 airborne transmission in schools: a retrospective cohort study in Italy's Marche region

[Luca Ricolfi](#), [Luca Stabile](#), [Lidia Morawska](#), [Giorgio Buonanno](#)

Background: While increasing the ventilation rate is an important measure to remove inhalable virus-laden respiratory particles and lower the risk of infection, direct validation in schools with population-based studies is far from definitive.

Methods: We investigated the strength of association between ventilation and SARS-CoV-2 transmission reported among the students of Italy's Marche region in more than 10,000 classrooms, of which 316 were equipped with mechanical ventilation. We used ordinary and logistic regression models to explore the relative risk associated with the exposure of students in classrooms.

Findings: For classrooms equipped with mechanical ventilation systems, the relative risk of infection decreased with the increase in ventilation: ventilation ranging from 10 to 14 L s⁻¹ student⁻¹ reduced the likelihood of infection for students by 80% compared with a classroom with only natural ventilation. From the regression analysis, as confirmed by the predictive theoretical approach, we obtained a relative risk reduction in the range 12%-15% for each additional unit of ventilation rate per person.

Interpretation: We need high ventilation rates ($> 10 \text{ L s}^{-1} \text{ student}^{-1}$) to protect students in classrooms from airborne transmission; this is higher than the rate needed to ensure indoor air quality. The excellent agreement between the results from the retrospective cohort study and the outcomes of the predictive theoretical approach makes it possible to assess the risk of airborne transmission for any indoor environment.



New Video Released

Watch our 8 Minute Video on the Importance of
Filtration in Schools



[The Importance of Filtration In Schools - YouTube](#)

[Importance of Ventilation in Schools - YouTube](#)

Children spend a large portion of their day indoors at school. Ensuring adequate filtration and ventilation in classrooms is essential and will help support the health and productivity of students and teachers.

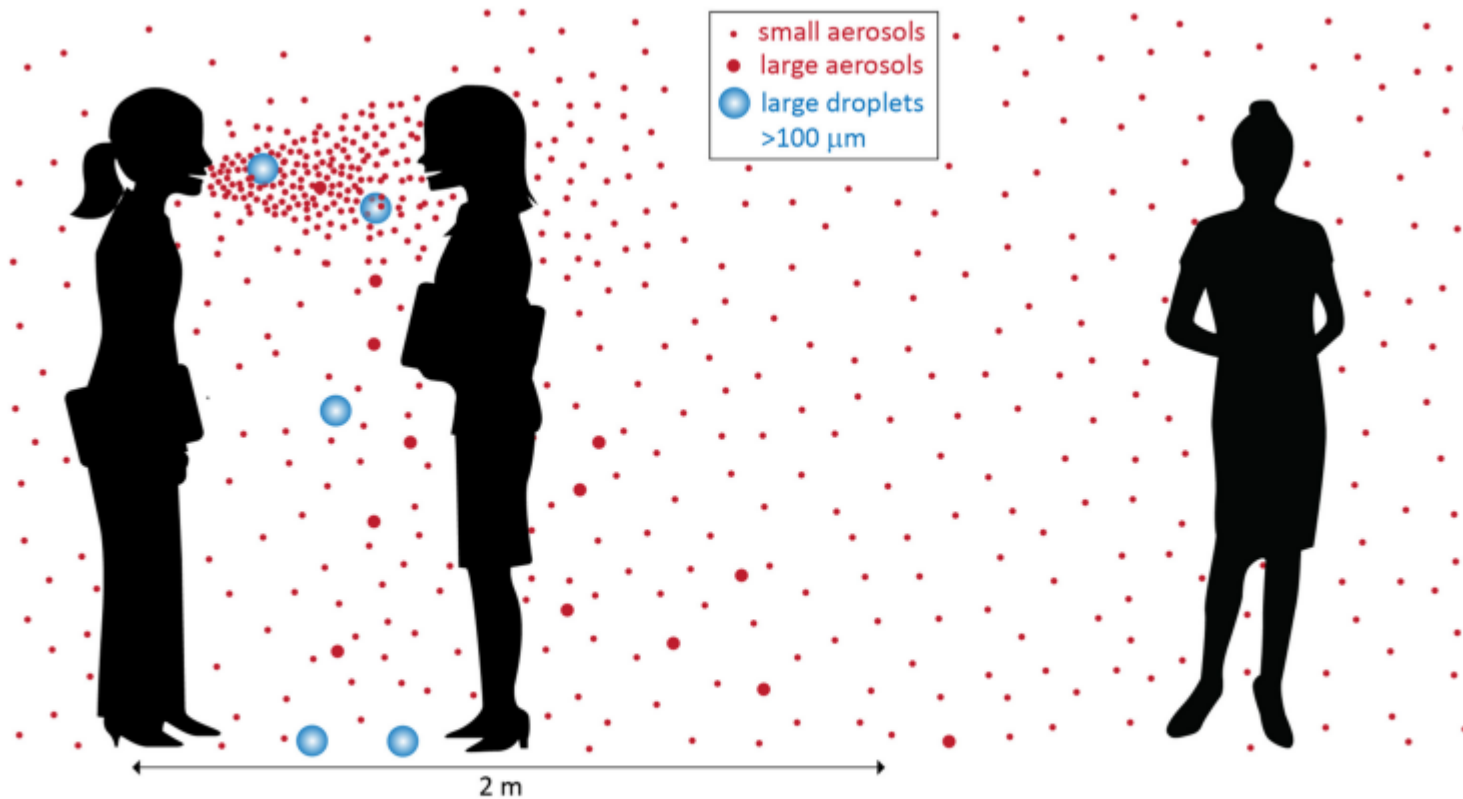


FIGURE 1 Illustration of droplets and aerosols released during talking; these may carry viruses if the person is infected. The large droplets fall rapidly to the ground in close proximity. The small aerosols are much more concentrated in close proximity, and they can remain floating in the air and spread throughout the room, leading to (reduced) exposure at a distance. Adapted from Tang et al.⁹¹

Received: 12 November 2021 | Revised: 25 May 2022 | Accepted: 30 May 2022
DOI: 10.1111/ina.13070

REVIEW

WILEY

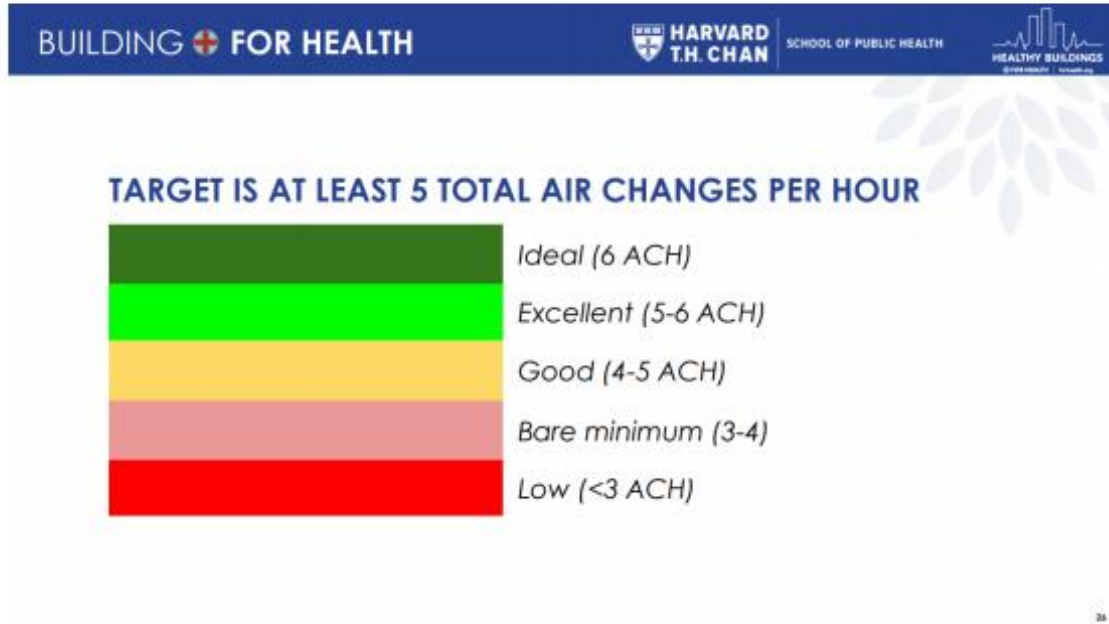
[What were the historical reasons for the resistance to recognizing airborne transmission during the COVID-19 pandemic? \(wiley.com\)](https://www.wiley.com)

Indoor Air 2022

What were the historical reasons for the resistance to recognizing airborne transmission during the COVID-19 pandemic?

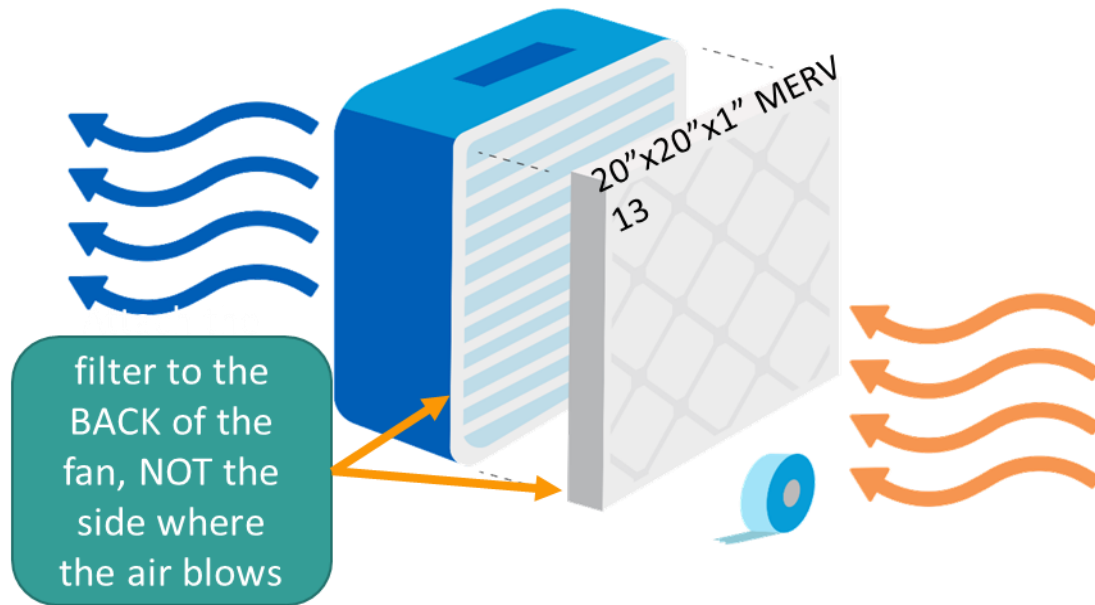
Jose L. Jimenez¹ | Linsey C. Marr² | Katherine Randall³ | Edward Thomas Ewing⁴ | Zeynep Tufekci⁵ | Trish Greenhalgh⁶ | Raymond Tellier⁷ | Julian W. Tang⁸ | Yuguo Li⁹ | Lidia Morawska¹⁰ | Jonathan Mesiano-Crookston¹¹ | David Fisman¹² | Orla Hegarty¹³ | Stephanie J. Dancer¹⁴ | Philomena M. Bluysen¹⁵ | Giorgio Buonanno¹⁶ | Marcel G. L. C. Loomans¹⁷ | William P. Bahnfleth¹⁸ | Maosheng Yao¹⁹ | Chandra Sekhar²⁰ | Pawel Wargocki²¹ | Arsen K. Melikov²¹ | Kimberly A. Prather²²

Ventilation



<https://schools.forhealth.org/wp-content/uploads/sites/19/2020/08/Harvard-Healthy-Buildings-program-How-to-assess-classroom-ventilation-08-28-2020.pdf>

Another Option: Create a Do-it-Yourself Box Fan Filter



Resources:

- [WA Department of Ecology's video on how to make your own clean air fan](#)
- [Puget Sound Clean Air Agency's info on DIY air filters](#)
- [Colville Tribes Air Quality Program box fan filter a DIY users guide](#)
- [Case-Study_DIY-Portable-Air-Cleaners-083121.pdf \(ucdavis.edu\)](#)
- [High Quality DIY Box Fan Air Purifier "Comparetto Cube" - YouTube](#)

An excellent presentation
[Navigating the Landscape of Air Cleaning Technologies for COVID-19 - YouTube](#)
(Slides 34, 49,50 from this presentation.)



Indoor Environments

Please join us for EPA's next Indoor Air Quality Science Webinar

Navigating the Landscape of Air Cleaning Technologies for COVID-19

With guest speakers Brent Stephens, Ph.D., Illinois Institute of Technology and Elliott Gall, Ph.D., Portland State University

	<u>Date</u> Wednesday, June 16, 2021	<u>Time</u> 1:00 – 3:00 P.M. EDT	
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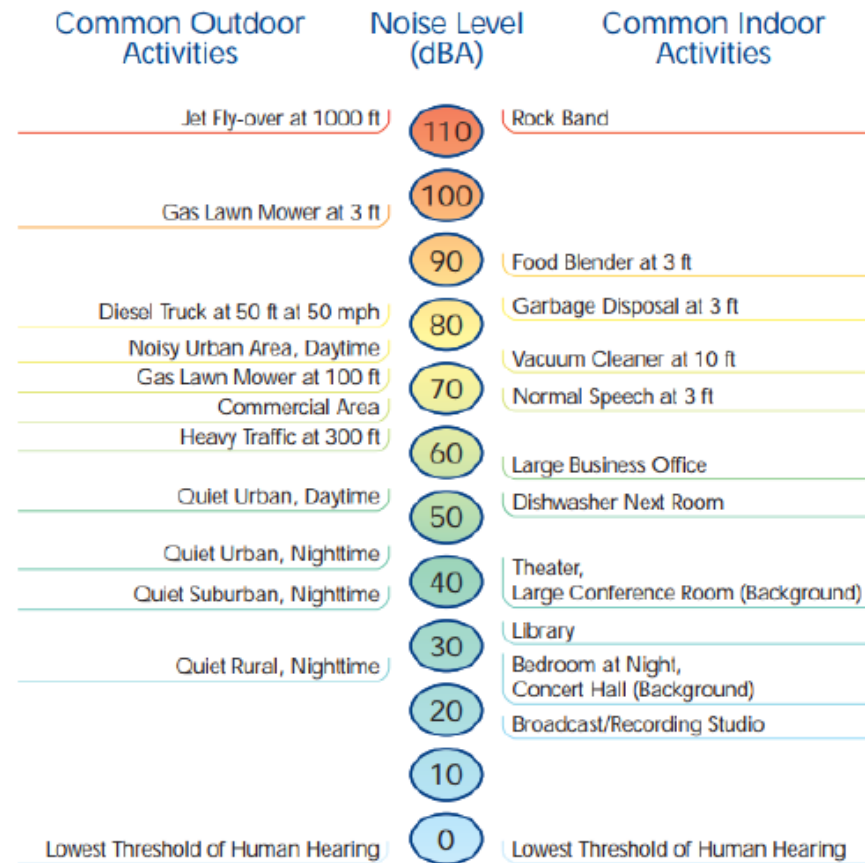
Noise Affects Use of Portable Air Cleaners

- Portable air cleaners are often used less frequently over time.
 - Some studies have noted/speculated that may be because of noise.

Sulser et al. 2009 *Int Arch All Immunol*;
Batterman et al. 2012 *Indoor Air*

- EPA maintains that interference and annoyance occurs at indoor noise levels above 45 dBA.*

- Many portable air cleaners exceed this threshold.
 - But quantified noise is not used as a standardized performance factor in the United States and is not routinely available on product packaging.

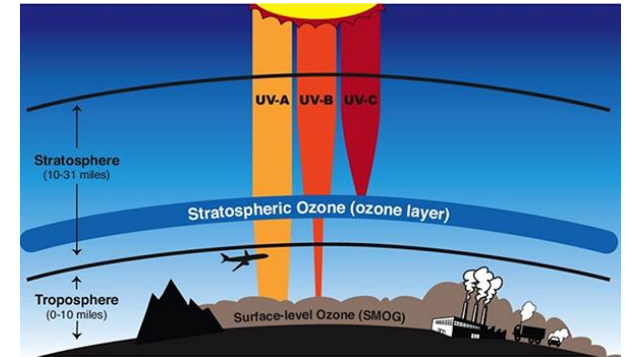


www.dot.ca.gov/dist2/projects/sixer/loud.pdf

Ozone concerns



- Ozone (O₃) is a reactive gas
- Harmful for human respiratory tract
- Safe levels below 10 ppb

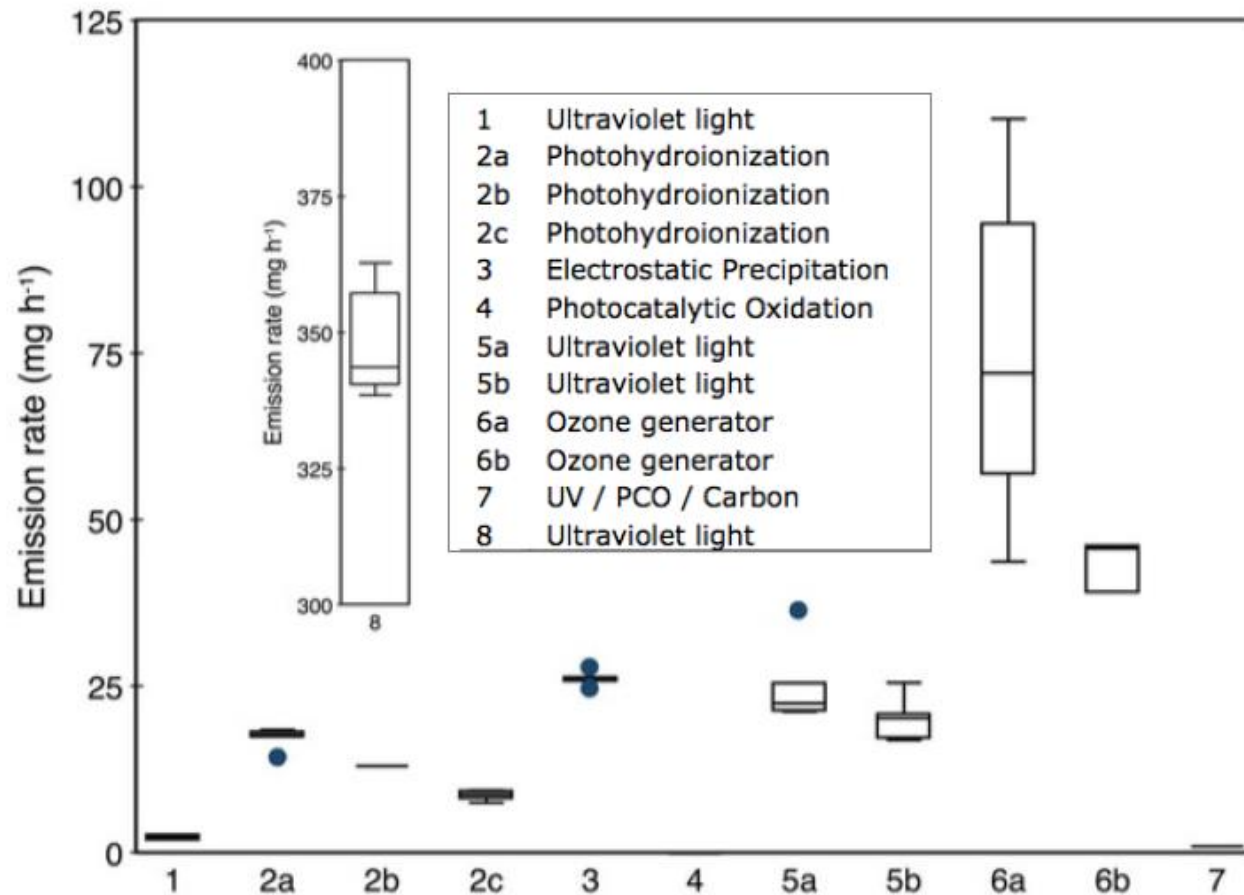


- **AVOID** ionization or oxidation (may generate harmful ozone).
- Purchase technologies that have been **third party verified**.



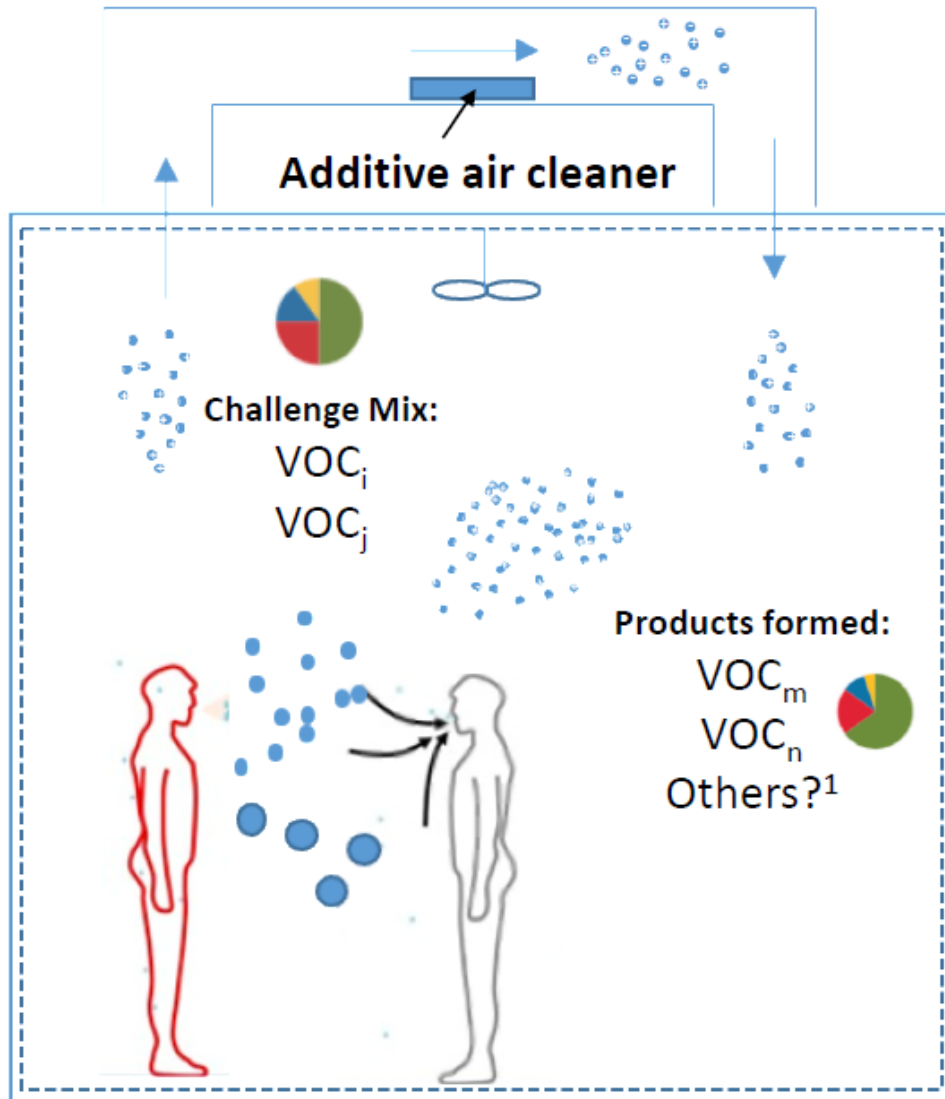
Ozone Emissions From Electronic Air Cleaners

- Some electronic air cleaners emit ozone (O_3) during operation.¹
 - Ensure products meet UL 2998 standard (<5 ppb O_3 in chamber)

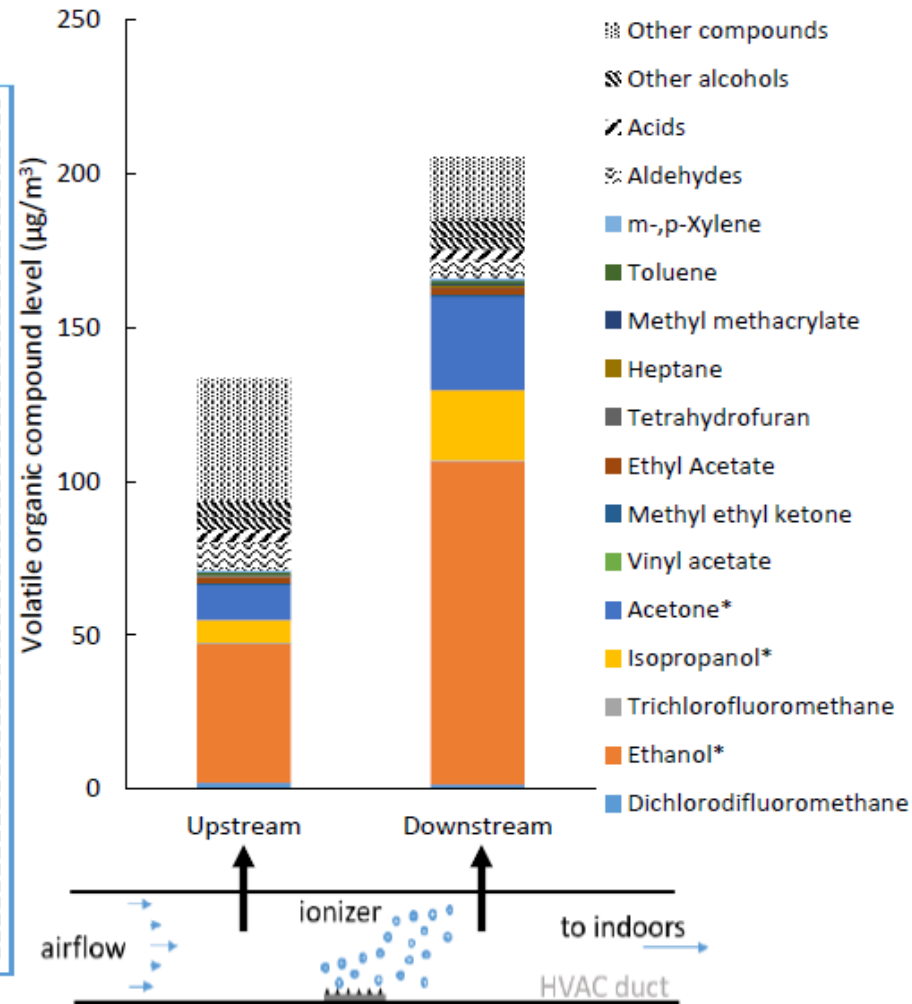


¹Morrison et al., 2014 CARB Report "In-duct air cleaning devices: Ozone emission rates and test methodology"

Potential for Byproduct Formation



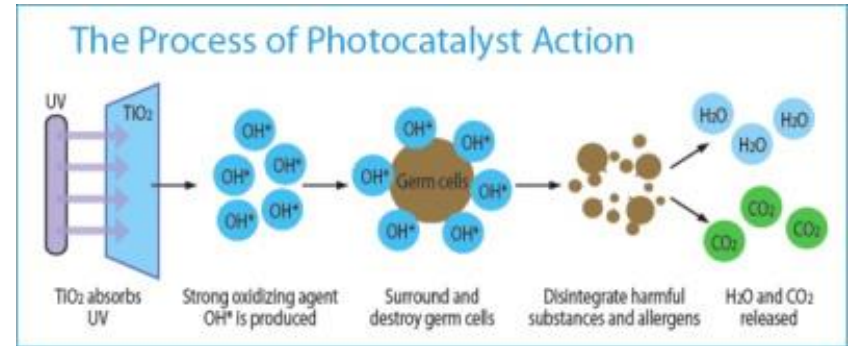
Example of byproduct measurements²



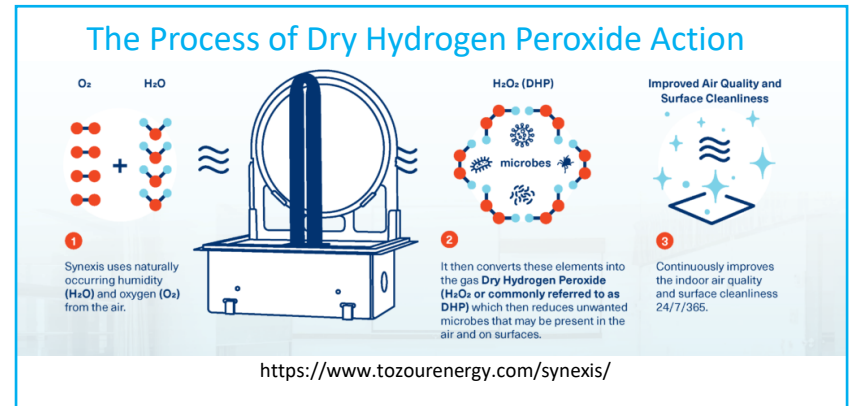
¹Liu et al. 2020, *Indoor Air* 31:220-228; ²Zeng et al. 2021, *Building and Environment* 195:107750

Photocatalytic Oxidation (PCO) and Dry Hydrogen Peroxide

- PCO uses UV light and a metal oxide (TiO_2)
- Some units claim disinfection by H_2O_2 gases formed
- Causes redox reaction of gases that destroy microbes
- By product formation possible
- ASHRAE statement:
 - Some air cleaners using PCO remove harmful contaminants to levels below limits for reducing health risks set by recognized cognizant authorities.
 - Some are ineffective in reducing concentrations significantly; manufacturer data should be considered carefully.



<https://sciencedatacloud.wordpress.com/2013/11/22/photocatalyst-technology/>



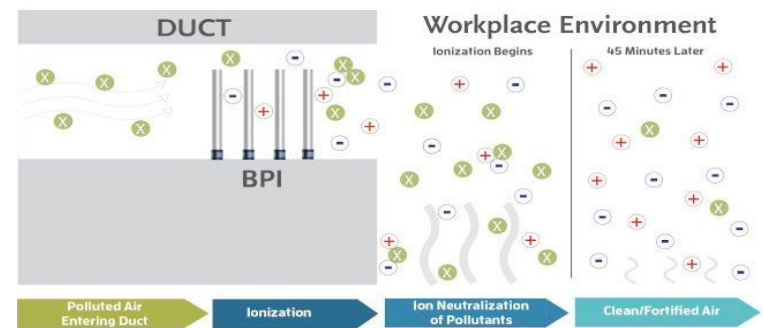
<https://www.tozouenergy.com/synexis/>

Bipolar Ionization/Corona Discharge/Needlepoint Ionization/Plasma Ion Generators/Other

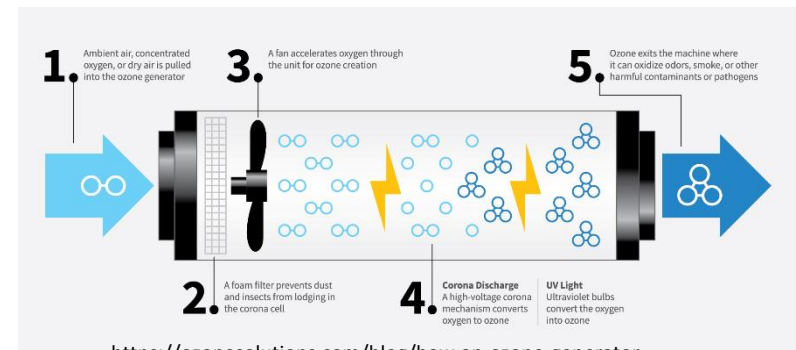
- Use reactive oxygen species (ROS) or reactive ions (ozone, hydroxyl radicals, superoxide anions).
- Charged ions react with contaminants and germs in air.
- ASHRAE Statement:
 - Convincing scientifically-rigorous, peer-reviewed studies do not currently exist on these emerging technologies; manufacturer data should be carefully considered.
 - Systems may emit ozone, some at high levels. Manufacturers are likely to have ozone generation test data.
- Zhang et al. 2021 paper, other papers

■ Some Portable HEPA Air Cleaners use these technologies!

■ [Air Cleaners, HVAC Filters, and Coronavirus \(COVID-19\) | US EPA](#)



<https://www.csemag.com/articles/covid-19-and-the-impacts-to-the-workplace/>

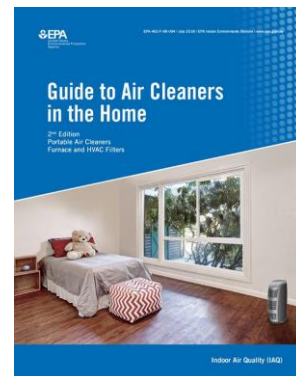


<https://ozonesolutions.com/blog/how-an-ozone-generator-works/>

Portable Air Cleaners

How to Select a Portable HEPA Unit

- The CADR rating is made at the highest running speed, so consider over sizing it to reduce noise.
- **Do not use ozone generators, electrostatic precipitators, plasma, UV, ionizers, or negative ion air purifiers because they can produce harmful by-products and are not necessary.**
- Choose HEPA air cleaners that meet the UL 2998 standard of less than 5 ppb ozone.
- [Air Cleaners and Air Filters in the Home | US EPA](#)
- [Air Cleaner Information for Consumers | California Air Resources Board](#)
- Association of Home Appliance Manufacturers
 - [Certified Room Air Cleaners – Aham Verifide \(ahamdir.com\)](#)



CDC Resources for Improving Ventilation in Schools

Ventilation in Schools and Childcare Programs

<https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/ventilation.html>

Interactive School Ventilation Tool

<https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/interactive-ventilation-tool.html>

Ventilation in Buildings

<https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html>

Upper-Room Ultraviolet Germicidal Irradiation (UVGI)

<https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation/UVGI.html>



Federal Resources to Support Ventilation and Comprehensive IAQ Improvements in Schools

Department of Education Grants Guidance on Ventilation and IAQ Activities

Improving Ventilation in Schools, Colleges, and Universities to Prevent COVID-19:
ed.gov/coronavirus/improving-ventilation

EPA's IAQ Tools for Schools Resources

Indoor Air Quality in Schools:
epa.gov/iaq-schools



- [Framework for Effective IAQ Management](#)
- [Action Kit](#)
- [On-Demand Training Webinars](#)
- [Preventive Maintenance Guidance](#)
- [Energy Savings Plus Health Guidelines](#)
- [Mobile App](#)



Other EPA Resources

Indoor Air and Coronavirus:
epa.gov/coronavirus/indoor-air-and-coronavirus-covid-19

Schools:

- [Healthy Indoor Environments in Schools During the COVID-19 Pandemic and Beyond](#)

Homes

- [Indoor Air in Homes and COVID-19](#)
- [Air Cleaners and Air Filters in the Home](#)

Clean Air in Buildings Challenge:
epa.gov/indoor-air-quality-iaq/clean-air-buildings-challenge

Tool Lending Library

Smart Buildings Center, NW Energy Efficiency Council (NEEC)

<https://www.smartbuildingscenter.org/tool-library/>

Lending “library” of diagnostic tools.

CO, CO₂, data loggers, power meters, lighting loggers, infrared cameras, liquid and air flow measurement devices, etc.

Free of charge. Shipping or pick up Tues-Thurs 9-4.

Guidance on how to use/interpret data.

Library of videos and application notes.

Tool-library@smartbuildingscenter.org

206-538-0685

You can subscribe for updates.





Thank You

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Resources available:

www.doh.wa.gov/schoolenvironment

Join my list serve for timely information!



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