

Ventilation in NJ Schools During Pandemic

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- ◆ Certified Industrial Hygienist
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- ◆ Retired from Camden County Health Department

Guidelines

- ◆ NJ Department of Public Health, Covid-19 Public Health Recommendations for Local Health Departments K-12 Schools, 3/23/21
- ◆ CDC : Operating Schools during COVID-19: CDC's Considerations, 3/19/21
- ◆ ASHRAE EPIDEMIC TASK FORCE Core Recommendations for Reducing Airborne Infectious Aerosol Exposure, 1/6/21
- ◆ ASHRAE Journal: Guidance for Building Operations During the Covid-19 Pandemic, 5/20
- ◆ EPA Supports Healthy Indoor Environments in Schools During COVID-19 Pandemic, 1/1/20

Reducing Airborne Infectious Aerosol Exposure

- ◆ Ventilation
- ◆ Filtration
- ◆ Air Cleaners
- ◆ HVAC System Operation

Ventilation

- ◆ Provide and maintain at least minimum outdoor airflow rates for ventilation.
- ◆ Open dampers on HVAC units as much as allowed by manufacturer's specifications
- ◆ If safe to do so, open windows and doors
- ◆ Use child-safe fans to increase the effectiveness of open windows. Use exhaust fans in restrooms and kitchens.

This is the formula for ACH (air changes per hour):

$$\mathbf{ACH = CFM \times 60 / (Area \times Height)}$$

The table below provides a summary of the ASHRAE recommended air changes per hour for common building types. These air changes per hour are based on typical room sizes and occupancy rates, including for homes, hotel rooms, offices, schools and shops.

Location Type		Suggested Outdoor Air Ventilation Rate (air changes per hour)
	Homes	0.35–1
	Hotel Rooms	1–2
	Offices	2–3
	Retail Shops	2–3
	Schools (except lecture halls)	5–6
	Sports Facilities	4–8
	Restaurants	6–8



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Air Distribution

- ◆ Where directional airflow is not specifically required or recommended as a risk assessment, promote mixing of space air without causing strong air currents that increases direct transmission from person to person

Checking for Ventilation

- ◆ If Ventilation is sufficient, Carbon Dioxide, CO₂ will be less than 700ppm plus the outdoor level (ppm)
- ◆ A CO₂ meter should be used to check for CO₂ levels indoors

Carbon Dioxide Measurements



FILTRATION

- ◆ MERV Rating - Minimum Efficiency Reporting Values, or MERVs, report a filter's ability to capture particles between 0.3 and 10 microns (μm).
- ◆ Generally, particles with an aerodynamic diameter around 0.3 μm are most penetrating; efficiency increases above and below this particle size.

INCREASE FILTER EFFICIENCY

- ◆ Reporting Value (MERV) under standard conditions. – MERV ranges from 1 to 16; higher MERV = higher efficiency – MERV ≥ 13 (or ISO equivalent) are efficient at capturing airborne viruses

PREFERRED FILTERS

- ◆ Overall effectiveness of reducing particle concentrations depends on several factors:
 - ❖ Filter efficiency – Airflow rate through the filter
 - ❖ Size of the particles
 - ❖ Location of the filter in the HVAC system or room air cleaner
- ◆ MERV 13 Filters are preferred for air recirculated by HVAC system.

MERV 13



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SUPPLEMENT WITH PORTABLE AIR CLEANERS

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When to Supplement with Air Cleaners

- ◆ Situations where 6-foot social distancing may not be easy to maintain
- ◆ Situations where hands on learning is necessary
- ◆ When HVAC is not sufficient
- ◆ Situations where masks may need to be temporarily removed

HEPA Portable Air Cleaner

- ◆ High Efficiency particulate air filters are more efficient than MERV 16 filters
- ◆ By definition TRUE HEPA filters are at least 99.97% efficient at filtering 0.3 um mass median diameter particles

HEPA are the most preferred type

HEPA AIR CLEANER



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Electronic Air Cleaners

- ◆ Removal occurs by electrically charging particles using corona wires or by generating ions (ionizer)
- ◆ Effectiveness of reducing particles depends on :
 - ❖ Removal efficiency
 - ❖ Airflow rate through the filter
 - ❖ Size and number of particles
 - ❖ Location of filter in HVAC system
 - ❖ Maintenance and cleanliness of filter

GAS-Phase Air Cleaners

- ◆ Used to remove ozone, VOC's, and odors from the air
- ◆ Most contain sorbent materials such as carbon (activated charcoal)
- ◆ They are not generally efficient at removing viruses from airstreams

UV-C Ultraviolet Energy

- ◆ Ultraviolet energy inactivates viral, bacterial, and fungal organisms so they are unable to replicate.
- ◆ UV-C energy (wavelengths of 100-280 nm provide the most germicidal effect with 265 nm being the optimum wavelength
- ◆ Requires special PPE to prevent damage to eyes and skin from overexposure

Types of Disinfection Systems using UV-C Energy

- ◆ In-duct air disinfection
- ◆ Upper-air disinfection
- ◆ In-duct surface disinfection
- ◆ Portable room decontamination (not recommended due to possible misuse causing harm)

UVC



HVAC SYSTEM OPERATION

- ◆ Maintain proper temperature and relative humidity
- ◆ Maintain equivalent clean air supply required for design occupancy whenever anyone is present in the space served by the system.

HVAC SYSTEM OPERATION

- ◆ When necessary to flush spaces between occupied periods, operate systems for a time required to achieve three air changes of equivalent clean air supply.
- ◆ Limit re-entry of contaminated air that may re-enter the building from energy recovery devices, outside air intakes.

Additional Risk Reduction Methods

- ◆ Masks
- ◆ Social Distancing
- ◆ PPE
- ◆ Administrative measures
- ◆ Reduced Occupancy
- ◆ Hygiene
- ◆ Sanitation

A photograph of a building under construction or renovation, with a green overlay and the text "Thank you" in white. The building is partially obscured by a green semi-transparent filter. The text "Thank you" is centered in the image in a large, white, sans-serif font. The background shows a brick wall on the left and a white building with windows on the right. The ground is covered in dirt and debris, suggesting a construction site.

Thank you