

Disclaimer: This Q&A was prepared by the Efficient and Healthy Schools Program staff. The following responses do not necessarily represent the views of the Centers for Disease Control and Prevention (CDC), ASHRAE or EPA.

Q: What are ASHRAE and CDC current recommendations for air filtration and ventilation for classrooms?

Both ASHRAE and CDC recommend improving ventilation from a combination of outdoor air, filtration, and air treatment, to help protect building students and staff from respiratory infections.

[CDC's guidance](#) includes basic strategies to make sure that HVAC systems are operating and suggest updating older systems to meet current ventilation standards. CDC suggests 5 or more air changes per hour of clean air from a combination of outdoor air, filtration, and air treatment to help reduce the number of viral particles in the air.

[ASHRAE Standards 241-Control of Infectious Aerosols](#) sets the amount of equivalent clean airflow (ECA) for different building and space types when operating under “infection risk management mode” (IRMM). Unlike CDC’s suggested 5 or more air changes of clean air per hour, ASHRAE’s ECA uses a per person metric: 20 L/s of clean air per person for classrooms. Decisions to enable IRMM would be determined by public health officials or other authorities, or can be used at the discretion of the building owner or occupant.

In addition, both ASHRAE and CDC included guidance on best practices to assess, operate, and maintain buildings to mitigate infection risks.

Q: How effective are portable air cleaners and are there recommended specifications when choosing a device?

[See CDC's guidance](#) on using HEPA air cleaners (FAQ #5):

[ASHRAE Standard 241 - Control of Infectious Aerosols](#) specifies testing requirements to verify the effectiveness and safety of air cleaning systems, whether they are installed in-room, such as portable air cleaners, or installed in-duct. For portable air cleaners that use only mechanical fibrous filters, the equivalent clean airflow rate should be determined using a method similar to that described in ANSI/AHAM AC-1 adapted with the chamber size criterion outlined in Standard 241 Normative Appendix A.

Q: How can we calculate air changes per hour (ACH)? What particular ACH do you recommend?

[CDC provides](#) an explanation and example: “How much ventilation is enough?” When multiple strategies are used, ACH calculation should be repeated for each system, and added together for a total value for comparison with the 5 ACH recommendation.

[ASHRAE's Equivalent Clean Airflow Calculator \(ECAC\)](#) can be used to determine the existing system's equivalent clean airflow for infection control and the modifications necessary to achieve the target of 20 L/s of clean air per person for classrooms.

Q: What are CDC and ASHRAE's recommendations on filter ratings (MERV ratings) that schools should use in their HVAC systems?

[CDC recommends](#) upgrading filters to MERV-13 (minimum efficiency reporting value) or higher when possible.

[ASHRAE Standard 241 - Control of Infectious Aerosols](#) specifies infectious aerosol removal efficiency of filters for ones that are rated MERV-A 11 or higher. Filters rated lower than MERV-A 11 are deemed ineffective for removing infectious aerosol. MERV-A is determined by using a test method (ANSI/ASHRAE Standard 52.2) where filter efficiency is measured after a conditioning step to mimic real-life filter efficiency degradation that can take place. Starting January 2025, ASHRAE Standard 241 recommends that only MERV-A values be used when determining the infectious aerosol removal efficiency.

Q: What are important points to consider about using far-UV (or UV-C) in classrooms?

CDC provides guidance on using UV to inactivate airborne pathogens in the air. UV systems can provide a high level of effective clean air towards lowering respiratory infection risks. However, they are not a substitute for meeting minimum outdoor air ventilation requirements for schools. [CDC provides information](#) on upper-room ultraviolet germicidal irradiation (UVGI): Discussion about whole-room UVGI, or far-UV, [are included here \(FAQ #7\)](#)

[ASHRAE Standard 241 - Control of Infectious Aerosols](#) considers ultraviolet (UV) as one of the technologies that can be used to inactivate infectious aerosols. It references ANSI/ASHRAE Standard 185.1 for testing the infectious aerosol reduction efficiency of in-duct UV. Standard 241 also sets safety requirements for all UV technologies, including upper-room UVGI and whole-room UVGI, or far-UV.

Q: What is the efficacy and safety of alternative air cleaning methods such as ionizing technologies?

CDC recommends caution when considering an emerging technology. Common among these are ionization, dry hydrogen peroxide, and chemical fogging. For more information, [see \(FAQ #8\)](#).

Recognizing that lack of information and standards related to air cleaning systems was a major problem during the COVID-19 pandemic, ASHRAE Standard 241 establishes testing requirements for effectiveness and safety for all air cleaning technologies, including UV, electrostatic, photocatalytic, and ionizing systems. For more information, see [ASHRAE Standard](#)

[241 - Control of Infectious Aerosols](#) Normative Appendix A - Determining air cleaning system effectiveness and safety.

Q: Should schools consider real-time air monitoring?

CDC considers using CO2 monitors as part of enhanced strategies that schools can use to determine how stale or fresh the air in rooms. CO2 readings above 800 ppm (parts per million) suggest that there may be a need to bring in more outside air into the building. More discussion around the use of CO2 monitoring, whether integrated with HVAC systems or as standalone measurements, [are further discussed here \(FAQ #9\)](#).

Q: Do recommendations from CDC and ASHRAE change when the outdoor air quality is poor, such as when schools are impacted by wildfire smoke?

[CDC's guidance](#) on wildfire smoke and COVID-19 recommends relying on filtration, such as portable air cleaners that are commercially available and DIY air cleaners, that are effective for removing viral particles and fine particulate matter in wildfire smoke.

More information about DIY air cleaners, see resources: [\(EPA\)](#) and [\(NIOSH\)](#).

While [ASHRAE Standard 241 - Control of Infectious Aerosols](#) does not address wildfire smoke, [ASHRAE offers guidance](#) in their Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events: Prepare the building to use higher efficiency filter, assess HVAC systems ahead of time, and use portable air cleaners are among the recommendations included in a smoke readiness plan. These strategies are also mentioned in [ASHRAE Standard 241](#).

Q: How can older schools with outdated HVAC systems meet CDC and ASHRAE recommendations without creating comfort, humidity, and/or other concerns?

Both CDC and ASHRAE prioritize assessment, planning, operation and maintenance as part of their recommendations. All schools regardless of HVAC system types can benefit from assessing their current conditions and make operational improvements, while planning to retrofit outdated systems when there is opportunity to do so.

In addition, because both CDC and ASHRAE recommend improving ventilation from a combination of outdoor air, filtration, and air treatment, schools can consider strategies that are more suitable for their buildings. Schools are not limited to increasing outdoor air ventilation, which has energy implications and may not work in existing HVAC systems, as their only option.

Q: How should schools measure or determine if their infection control strategies are effective?

Evaluation is part of EPA IAQ Tools for Schools' framework for effective school IAQ management. While it is not written specifically to address airborne infection control, the [guiding principles](#) - solicit feedback and capture return on investment, are applicable to documenting the benefits of infection control strategies.

Q: How can schools with limited funding and resources adopt CDC and ASHRAE recommendations? Are there funds available to support their efforts?

There are a number of federal, state, and other resources available that can provide funding and/or technical assistance to schools. One of the key federal funding sources is the Department of Education's Elementary and Secondary School Emergency Relief Fund (ESSER) and American Rescue Plan (ARP). Other agencies, like EPA and Department of Energy (DOE), also offer programs to support schools. For example, [DOE's Renew America's Schools](#) promotes the implementation of clean energy improvements that will lower utilities costs, improve indoor air quality, and foster healthier learning environments:

For more information about funding and resources to support school facilities improvements, please reach out to us at schools@lbl.gov.