General Business Frequently Asked Questions

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What are you looking for?

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The following FAQs build on the Interim Guidance for Businesses and Employers and Guidance for Critical Infrastructure Workers. These FAQs are not intended for healthcare facilities; CDC has provided separate Guidance for Healthcare Settings.

Suspected or Confirmed Cases of COVID-19 in the Workplace

What should I do if an employee comes to work with COVID-19 symptoms?

Employees who have symptoms when they arrive at work or become sick during the day should immediately be separated from other employees, customers, and visitors and sent home. Employees who develop symptoms outside of work should notify their supervisor and stay home.

Sick employees should follow CDC-recommended steps to help prevent the spread of COVID-19. Employees should not return to work until they have met the criteria to discontinue home isolation and have consulted with a healthcare provider.

Employers should not require sick employees to provide a COVID-19 test result or healthcare provider's note to validate their illness, qualify for sick leave, or return to work. Healthcare provider offices and medical facilities may be extremely busy and not able to provide such documentation in a timely manner.

What should I do if an employee is suspected or confirmed to have COVID-19?

In most cases, you do not need to shut down your facility. But do close off any areas used for prolonged periods of time by the sick person:

- Wait 24 hours before cleaning and disinfecting to minimize potential for other employees being exposed to respiratory droplets. If waiting 24 hours is not feasible, wait as long as possible.

Follow the CDC cleaning and disinfection recommendations:

- Clean dirty surfaces with soap and water before disinfecting them.
- To disinfect surfaces, use products that meet EPA criteria for use against SARS-Cov-2 , the virus that causes COVID-19, and are appropriate for the surface.
- Be sure to follow the instructions on the product labels to ensure safe and effective use of the product.

- You may need to wear additional personal protective equipment (PPE) depending on the setting and disinfectant product you are using.

In addition to cleaning and disinfecting, employers should determine which employees may have been exposed to the virus and need to take additional precautions:

- If an employee is confirmed to have COVID-19, employers should inform fellow employees of their possible exposure to COVID-19 in the workplace but maintain confidentiality as required by the Americans with Disabilities Act (ADA).
- Employees who test positive for COVID-19 (using a viral test, not an antibody test) should be excluded from work and remain in home isolation if they do not need to be hospitalized. Employers should provide education to employees on what to do if they are sick.
- Employers may need to work with local health department officials to determine which employees may have had close contact with the employee with COVID-19 and who may need to take additional precautions, including exclusion from work and remaining at home.
- Most workplaces should follow the Public Health Recommendations for Community-Related Exposure and instruct potentially exposed employees to stay home for 14 days, telework if possible, and self-monitor for symptoms.
- Critical infrastructure workplaces should follow the guidance Implementing Safety Practices for Critical Infrastructure Employees Who May Have Had Exposure to a Person with Suspected or Confirmed COVID-19.

Sick employees should follow CDC-recommended steps. Employees should not return to work until they have met the criteria to discontinue home isolation and have consulted with a healthcare provider. Antibody test results should not be used to make decisions about returning persons to the workplace.

If employees have been exposed but are not showing symptoms, should I allow them to work?

Employees may have been exposed if they are a "close contact" of someone who is infected, which is defined as being within about 6 feet of a person with COVID-19 for a prolonged period of time:

- Potentially exposed employees who **have** symptoms of COVID-19 should self-isolate and follow CDC recommended steps.
- Potentially exposed employees who **do not have** symptoms should remain at home or in a comparable setting and practice social distancing for 14 days.

All other employees should self-monitor for symptoms and wear cloth face coverings when in public. If they develop symptoms, they should notify their supervisor and stay home.

See Public Health Recommendations for Community-Related Exposure for more information.

To ensure continuity of operations of essential functions, CDC advises that critical infrastructure employees may be permitted to continue work following potential exposure to COVID-19, provided they remain symptom-free and additional precautions are taken to protect them and the community.

- Critical infrastructure businesses have an obligation to limit, to the extent possible, the reintegration into the worksite of in-person employees who have been exposed to COVID-19 but remain symptom-free in ways that best protect the health of the employee, their co-employees, and the general public.
  - Remaining at home for 14 days may still be the most preferred and viable option for exposed employees.
- An analysis of core job tasks and workforce availability at worksites can allow the employer to match core activities to other equally skilled and available in-person employees who have not been exposed.
- A critical infrastructure employee who is symptom-free and returns to work should wear a cloth face covering at all times while in the workplace for 14 days after last exposure. Employers can issue cloth face coverings or can approve employees' supplied cloth face coverings in the event of shortages.

See Implementing Safety Practices for Critical Infrastructure Employees Who May Have Had Exposure to a Person with Suspected or Confirmed COVID-19 and COVID-19 Critical Infrastructure Sector Response Planning for more

What testing does CDC recommend for employees in a workplace?

CDC does NOT recommend that employers use antibody tests to determine which employees can work. Antibody tests check a blood sample for **past infection** with SARS-CoV-2, the virus that causes COVID-19. **CDC does not yet know if people who recover from COVID-19 can get infected again.** Viral tests check a respiratory sample (such as swabs of the inside of the nose) for **current infection** with SARS-CoV-2.

CDC has published strategies for consideration of incorporating viral testing for SARS-CoV-2 into a workplace COVID-19 preparedness, response, and control plan.

Different states and jurisdictions may have their own guidance and priorities for viral testing in workplaces. Testing in the workplace could be arranged through a company's occupational health provider or in consultation with the local or state health department.

What should I do if I find out several days later, after an employee worked, that they were diagnosed with COVID-19?

- If it has been **less than 7 days** since the sick employee used the facility, clean and disinfect all areas used by the sick employee following the CDC cleaning and disinfection recommendations.
- If it has been **7 days or more** since the sick employee used the facility, additional cleaning and disinfection is not necessary. Continue routinely cleaning and disinfecting all high-touch surfaces in the facility.
- Other employees may have been exposed to the virus if they were in "close contact" (within approximately 6 feet) of the sick employee for a prolonged period of time.
  - If an employee is confirmed to have COVID-19, employers should inform fellow employees of their possible exposure to COVID-19 in the workplace but maintain confidentiality as required by the Americans with Disabilities Act (ADA).
  - Those who have symptoms should self-isolate and follow CDC recommended steps.
  - In most workplaces, those potentially exposed but with no symptoms should remain at home or in a comparable setting and practice social distancing for 14 days.
  - Critical infrastructure employees should follow Implementing Safety Practices for Critical Infrastructure Employees Who May Have Had Exposure to a Person with Suspected or Confirmed COVID-19. A critical infrastructure employee who is symptom-free and returns to work should wear a cloth face covering at all times while in the workplace for 14 days after last exposure. Employers can issue cloth face coverings or can approve employees' supplied cloth face coverings in the event of shortages.
- Employees not considered exposed should self-monitor for symptoms. If they develop symptoms, they should notify their supervisor and stay home.

When should an employee suspected or confirmed to have COVID-19 return to work?

Sick employees should follow steps to prevent the spread of COVID-19. Employees should not return to work until they meet the criteria to discontinue home isolation and have consulted with a healthcare provider.

Employers should not require a sick employee to provide a negative COVID-19 test result or healthcare provider's note to return to work. Employees with COVID-19 who have stayed home can stop home isolation and return to work when they have met one of the sets of criteria found here.

What should I do if an employee has a respiratory illness?

Employees who appear to have COVID-19 symptoms upon arrival to work or become sick during the day with COVID-19 symptoms should immediately be separated from other employees, customers, and visitors and sent home. Sick employees should follow steps to prevent the spread of COVID-19.

CDC has a symptom self-checker chatbot that employers and employees may find helpful. It has a series of questions and recommends what level of medical care, if any, the user should seek. It is not intended to provide diagnosis or treatment.

What does “acute” respiratory illness mean?

“Acute” respiratory illness is an infection of the upper or lower respiratory tract that may interfere with normal breathing, such as COVID-19. “Acute” means of recent onset (for example, for a few days), and is used to distinguish from chronic respiratory illnesses like asthma and chronic obstructive pulmonary disease (COPD).

Are allergy symptoms considered an acute respiratory illness?

No. Allergy symptoms are not considered an acute respiratory illness. However, there is some overlap between common seasonal allergy symptoms and some of the symptoms that have been reported by people with COVID-19 (e.g., headache, sneezing, cough). It is important to take into account whether an individual’s symptoms are compatible with the usual symptoms and timing for allergy in that person.

Reducing the Spread of COVID-19 in Workplaces

How do I keep employees who interact with customers safe?

To keep your employees safe, you should:

- Consider options to increase physical space between employees in work areas and between employees and customers such as opening a drive-through, erecting partitions, and marking floors to guide spacing at least 6 feet apart.
- At least once a day, clean and disinfect surfaces that are frequently touched by multiple people. This includes door handles, desks, tables, phones, light switches, and faucets.
- Consider assigning a person to rotate throughout the workplace to clean and disinfect surfaces.
- Consider scheduling handwashing breaks so employees can wash their hands with soap and water for at least 20 seconds. If soap and water are not available, use hand sanitizer that contains at least 60% alcohol.
- Consider scheduling a relief person to give cashiers and service desk employees an opportunity to wash their hands.
- Evaluate building ventilation systems and consider upgrades or improvements.
- Consider implementing flexible sick leave and supportive policies and practices.
- Additional information on how to keep employees safe can be found in the CDC Guidance for Businesses and Employers.

What can be done to protect employees who cannot maintain social distancing of at least 6 feet from other employees or customers?

Evaluate your workplace to identify situations where employees cannot maintain a distance of at least 6 feet from each other and/or customers. Use appropriate combinations of controls following the hierarchy of controls to addresses these situations to limit the spread of COVID-19. A committee of both employees and management may be the most effective way to recognize all of these scenarios.

It is important to note that control recommendations or interventions assigned to reduce the risk of spreading COVID-19 must be compatible with any safety programs and personal protective equipment (PPE) normally required for the job task.

Approaches to consider may include the following:

Alter the workspace using engineering controls to prevent exposure to the virus that causes COVID-19.

- Make sure the workspace is well-ventilated .
- Change the alignment of workstations where feasible. For example, redesign workstations so employees are not facing each other.
- Consider making foot traffic one-way in narrow or confined areas, such as aisles and stairwells, to encourage single-file movement at a 6-foot distance.
- Set up, where possible, physical barriers between employees, and between employees and customers.
  - Use strip curtains, plastic barriers, or similar materials to create impermeable dividers or partitions.
- Move electronic payment terminals/credit card readers farther away from the cashier to increase the distance between the customer and the cashier.
- Use visual cues such as floor decals, colored tape, and signs to remind employees to maintain distance of 6 feet from others, including at their workstation and in break areas.
  - Consider these cues for customers as well, such as at the entrance or checkout line.
- Place handwashing stations or hand sanitizers with at least 60% alcohol throughout the workplace for employees and customers.
  - Use touch-free stations where possible.
  - Make sure restrooms are well-stocked with soap and paper towels.

Provide training and other administrative policies to prevent the spread of COVID-19.

- All employees should have a basic understanding of COVID-19, how the disease spreads, symptoms, and ways to prevent or minimize the spread.
- Trainings should cover the importance of social distancing (maintaining a distance of at least 6 feet), wearing cloth face coverings appropriately, covering coughs and sneezes, washing hands, cleaning and disinfecting high-touch surfaces, not sharing personal items or tools/equipment unless absolutely necessary, and not touching the face, mouth, or eyes.
- Employees should be encouraged to go home or stay home if they feel sick. Ensure that sick leave policies are flexible and consistent with local public health guidance, and that employees are aware of and understand these policies.

Use cloth face coverings as appropriate.

- Recommend employees wear a cloth face covering.
  - Cloth face coverings are intended to protect other people—not the wearer. They are not considered PPE.
  - Train employees how to put on and take off cloth face coverings to avoid contamination.
  - Cloth face coverings should be washed and dried after each use.
  - Cloth face coverings should not be worn if their use creates a new risk (e.g., interferes with driving or vision, contributes to heat-related illness) that exceeds their benefit of slowing the spread of the virus.
- Recommend that visitors to the workplace (service personnel, customers) also wear cloth face coverings.

Personal Protective Equipment (PPE)

PPE is the last step in the hierarchy of controls because it is harder to use effectively than other measures. To be protective and not introduce an additional hazard, the use of PPE requires characterization of the environment, knowledge of the hazard, training, and consistent correct use. This is why administrative and engineering controls are emphasized in guidance to slow the spread of COVID-19. In the current pandemic, use of PPE such as N-95 respirators is being prioritized for healthcare employees and other medical first responders, as recommended by current CDC guidance unless they were required for the job before the pandemic.

How can I help protect employees who may be at higher risk for severe illness?

Have conversations with employees if they express concerns. Some people may be at higher risk of severe illness. This includes older adults (65 years and older) and people of any age with serious underlying medical conditions. By using strategies that help prevent the spread of COVID-19 in the workplace, you will help protect all employees, including those at higher risk. These strategies include:

- Implementing telework and other social distancing practices
- Actively encouraging employees to stay home when sick
- Providing sick leave
- Promoting handwashing
- Providing supplies and appropriate personal protective equipment (PPE) for cleaning and disinfecting workspaces
- Requiring all employees to wear cloth face coverings

In workplaces where it is not possible to eliminate face-to-face contact (such as retail), consider assigning employees who are at higher risk of severe illness work tasks that allow them to maintain a 6-foot distance from others, if feasible.

Employers should not require employees to provide a note from their healthcare provider when they are sick and instead allow them to inform their supervisors or employee health services when they have conditions that put them at higher risk for diseases.

When is a cloth face covering not appropriate while at work, and what can employees wear instead?

Cloth face coverings can prevent the wearer from spreading COVID-19 to others, but they may not always be appropriate. Employees should consider using an alternative under certain conditions at work, including:

- If they have trouble breathing.
- If they are unable to remove it without help.
- If it interferes with vision, glasses, or eye protection.
- If straps, strings, or other parts of the covering could get caught in equipment.
- If other work hazards associated with wearing the covering are identified and cannot be addressed without removal of the face covering.

Cloth face coverings should **not** be worn if their use creates a new risk (e.g., interferes with driving or vision, contributes to heat-related illness) that exceeds their benefit of slowing the spread of the virus.

The Occupational Safety and Health Administration (OSHA) suggests that an employee wear a face shield if a cloth face covering is recommended but the employee cannot tolerate wearing a cloth face covering. If used, a face shield should cover the entire front and sides of the face and extend below the chin.

What does source control mean?

Source control is a term used to describe measures (e.g., cloth face coverings or face shields) intended to prevent people with COVID-19 from spreading the disease to others. COVID-19 is spread through droplets produced when an infected person coughs, sneezes, or talks. Evidence suggests that people who have mild symptoms or no symptoms can spread it to others without realizing they are infected. Cloth face coverings and face shields are types of source control that provide a barrier between droplets produced from a potentially infected person and other people, reducing the likelihood of transmitting the virus.

Are cloth face coverings the same as personal protective equipment (PPE)?

No, cloth face coverings are not PPE. These face coverings are not respirators and are not appropriate substitutes for them in workplaces where respirators are recommended or required for respiratory protection.

How should cloth face coverings worn at work be handled, stored, and washed?

When wearing a cloth face covering, it should fit over the nose and mouth, fit snugly but comfortably against the side of the face, and be secured with ties or ear loops. The cloth face covering should allow the wearer to breathe without restriction.

Employees should avoid touching their eyes, nose, or mouth as well as the inside or outside of the face covering while putting on, wearing, and removing it. When putting on and removing it, they should only touch the ties or ear loops.

If storing the cloth face covering while at work, employees should place the used cloth face covering into a container or paper bag labeled with the employee's name.

Cloth face coverings should not be shared with others unless they are washed and dried first.

If the cloth face covering becomes wet, visibly soiled, or contaminated at work, it should be removed and stored to be laundered later. The employee should put on a clean cloth face covering or disposable face mask. If cloth face coverings are provided by the employer, a clean face covering should be issued to replace the soiled one.

Employees should wash hands with soap and water for at least 20 seconds before and after putting on, touching, or removing cloth face coverings. If soap and water are not available, they should use a hand sanitizer with at least 60% alcohol.

Laundry instructions depend on the cloth used to make the face covering. In general, cloth face coverings should be washed regularly (e.g., daily after each shift) using water and a mild detergent and dried completely in a hot dryer. If a washing machine and dryer are not available, an alternative is to soak the cloth face covering in a diluted bleach (0.1%) solution, rinse, and air dry completely. Hands should be washed before laundering the cloth face coverings.

How often should my employees wash their hands while at work?

CDC recommends employees protect themselves from respiratory illness with everyday preventive actions, including good hand hygiene. Employees should wash hands often with soap and water for at least 20 seconds, or use a hand sanitizer that contains at least 60% alcohol if soap and water are not readily available, especially during key times when persons are likely to be infected by or spread germs:

- After blowing one's nose, coughing, or sneezing
- Before, during, and after preparing food
- After using the toilet

- After touching garbage
- Before and after the work shift
- Before and after work breaks
- After touching objects that have been handled by customers or other employees

What can I tell my employees about reducing the spread of COVID-19 at work?

Employees should take the following steps to protect themselves at work:

- Follow the policies and procedures of the employer related to illness, use of cloth masks, social distancing, cleaning and disinfecting, and work meetings and travel.
- Stay home if sick, except to get medical care.
- Practice social distancing by keeping at least 6 feet away from fellow employees or co-workers, customers, and visitors when possible.
- Wear cloth face coverings, especially when social distancing is not possible.
- Employees should inform their supervisor if they or their colleagues develop symptoms at work. No one with COVID-19 symptoms should be present at the workplace.
- Wash hands often with soap and water for at least 20 seconds, especially after blowing noses, coughing, or sneezing, or having been in a public place.
  - Use hand sanitizer that contains at least 60% alcohol if soap and water are not available.
- Avoid touching eyes, nose, and mouth.
- To the extent possible, avoid touching high-touch surfaces in public places – elevator buttons, door handles, handrails, etc.
- Where possible, avoid direct physical contact such as shaking hands with people.
- Minimize handling cash, credit cards, and mobile or electronic devices when possible.
- Avoid all non-essential travel.

Should we be screening employees for COVID-19 symptoms (such as temperature checks)? What is the best way to do that?

Screening employees is an optional strategy that employers may use. Performing screening or health checks will not be completely effective because asymptomatic individuals or individuals with mild non-specific symptoms may not realize they are infected and may pass through screening. Screening and health checks are not a replacement for other protective measures such as social distancing.

Consider encouraging individuals planning to enter the workplace to self-screen prior to coming onsite and not to attempt to enter the workplace if any of the following are present:

- Symptoms of COVID-19
- Fever equal to or higher than 100.4°F*
- Are under evaluation for COVID-19 (for example, waiting for the results of a viral test to confirm infection)
- Have been diagnosed with COVID-19 and not yet cleared to discontinue isolation

*A lower temperature threshold (e.g., 100.0°F) may be used, especially in healthcare settings.

Content of screening questions

If you decide to actively screen employees for symptoms rather than relying on self-screening, consider which symptoms to include in your assessment. Although there are many different symptoms that may be associated with COVID-19, you may not want to treat every employee with a single non-specific symptom (e.g., a headache) as a suspect

COVID-19, you may not want to treat every employee with a single non-specific symptom (e.g., a headache) as a suspect case of COVID-19 and send them home until they meet criteria for discontinuation of isolation.

Consider focusing the screening questions on “new” or “unexpected” symptoms (e.g., a chronic cough would not be a positive screen). Consider including these symptoms:

- Fever or feeling feverish (chills, sweating)
- New cough
- Difficulty breathing
- Sore throat
- Muscle aches or body aches
- Vomiting or diarrhea
- New loss of taste or smell

Protection of screeners

There are several methods that employers can use to protect the employee conducting the screening. The most protective methods incorporate social distancing (maintaining a distance of 6 feet from others), or physical barriers to eliminate or minimize the screener’s exposures due to close contact with a person who has symptoms during screening. Examples to consider that incorporate these types of controls for temperature screening include:

- **Reliance on Social Distancing:** Ask employees to take their own temperature either before coming to the workplace or upon arrival at the workplace. Upon their arrival, stand at least 6 feet away from the employee and:
  - Ask the employee to confirm that their temperature is less than 100.4° F (38.0° C) and confirm that they are not experiencing coughing or shortness of breath.
  - Make a visual inspection of the employee for signs of illness, which could include flushed cheeks or fatigue.
  - Screening staff do not need to wear personal protective equipment (PPE) if they can maintain a distance of 6 feet.
- **Reliance on Barrier/Partition Controls:** During screening, the screener stands behind a physical barrier, such as a glass or plastic window or partition, that can protect the screener’s face and mucous membranes from respiratory droplets that may be produced when the employee sneezes, coughs, or talks. Upon arrival, the screener should wash hands with soap and water for at least 20 seconds or, if soap and water are not available, use hand sanitizer with at least 60% alcohol. Then:
  - Make a visual inspection of the employee for signs of illness, which could include flushed cheeks or fatigue.
  - Conduct temperature and symptom screening using this protocol:
    - Put on disposable gloves.
    - Check the employee’s temperature, reaching around the partition or through the window. Make sure the screener’s face stays behind the barrier at all times during the screening.
    - **If performing a temperature check on multiple individuals, make sure that you use a clean pair of gloves for each employee and that the thermometer has been thoroughly cleaned in between each check.** If disposable or non-contact thermometers are used and you did not have physical contact with an individual, you do not need to change gloves before the next check. If non-contact thermometers are used, clean and disinfect them according to manufacturer’s instructions and facility policies.
  - Remove and discard PPE (gloves), and wash hands with soap and water for at least 20 seconds. If soap and water are not available, use hand sanitizer with at least 60% alcohol.

  If social distance or barrier controls cannot be implemented during screening, PPE can be used when the screener is within 6 feet of an employee during screening. However, reliance on PPE alone is a less effective control and more difficult to implement given PPE shortages and training requirements.

  - **Reliance on Personal Protective Equipment (PPE):** Upon arrival, the screener should wash their hands with soap and water for at least 20 seconds or use hand sanitizer with at least 60% alcohol, put on a face mask, eye protection (goggles or disposable face shield that fully covers the front and sides of the face), and a single pair of disposable gloves. A gown could be considered if extensive contact with an employee is anticipated. Then:

- Make a visual inspection of the employee for signs of illness, which could include flushed cheeks or fatigue, and confirm that the employee is not experiencing coughing or shortness of breath.
- Take the employee's temperature.
  - **If performing a temperature check on multiple individuals, make sure that you use a clean pair of gloves for each employee and that the thermometer has been thoroughly cleaned in between each check**. If disposable or non-contact thermometers are used and you did not have physical contact with an individual, you do not need to change gloves before the next check. If non-contact thermometers are used, you should clean and disinfect them according to manufacturer's instructions and facility policies.
- After each screening or after several screenings, where you did not have physical contact with an individual, remove and discard PPE and wash hands with soap and water for at least 20 seconds or use hand sanitizer with at least 60% alcohol.

How do I handle personal protective equipment (PPE) waste?

Discard PPE into a trash can. Facility waste does not need disinfection.

Healthy Business Operations

What is social distancing and how can my workplace do that?

Social distancing means avoiding large gatherings and maintaining distance (at least 6 feet) from others when possible. Strategies that businesses could use include:

- Allowing flexible worksites (such as telework)
- Allowing flexible work hours (such as staggered shifts)
- Increasing physical space between employees at the worksite
- Increasing physical space between employees and customers (such as a drive-through and partitions)
- Implementing flexible meeting and travel options (such as postponing non-essential meetings or events)
- Delivering services remotely (e.g., phone, video, or web)
- Delivering products through curbside pick-up or delivery

I don't provide paid sick leave to my employees. What should I do?

Employers that do not currently offer sick leave to some or all of their employees may want to draft non-punitive "emergency sick leave" policies. Ensure that sick leave policies are flexible and consistent with public health guidance and that employees are aware of and understand these policies.

The Families First Coronavirus Response Act (FFCRA or Act) requires certain employers to provide their employees with paid sick leave or expanded family and medical leave for specified reasons related to COVID-19. Employers with fewer than 500 employees are eligible for 100% tax credits for Families First Coronavirus Response Act COVID-19 paid leave provided through December 31, 2020, up to certain limits.

Should I require employees to provide a doctor's note or positive COVID-19 test result?

Employers should not require sick employees to provide a COVID-19 test result or a healthcare provider's note to validate their illness, qualify for sick leave, or to return to work. Healthcare provider offices and medical facilities may be extremely busy and not able to provide such documentation in a timely manner.

Should I cancel my meetings and conferences?

Carefully consider whether travel is necessary and use videoconferencing or teleconferencing when possible for work-related meetings and gatherings. Employers should consider canceling, adjusting, or postponing large work-related meetings or gatherings that can only occur in-person. Follow CDC guidance for events and mass gatherings and consider resuming non-essential travel in accordance with state and local regulations and guidance.

When videoconferencing or teleconferencing is not possible, hold meetings in open, well-ventilated spaces, and space chairs at least 6 feet apart. Encourage staff and attendees to stay home if sick.

What measures should be taken to protect an employee who must travel for work?

Although travel should be minimized as much as possible during the COVID-19 pandemic, many jobs require travel, and it may not be possible to conduct certain job duties using virtual tools. The following measures may be taken to protect employees while traveling:

- Schedule travel to limit the distance travelled and need for overnight lodging.
- If multi-day travel is necessary, coordinate with travel preparers to identify hotels that disinfect rooms between stays and regularly disinfect surfaces in common areas.
- Provide employees with forms of transportation that minimize close contact with others such as fleet vehicles or rental vehicles.
- If public transportation is used, ask employees to follow the CDC guidance on how to protect yourself when using transportation.
- If flying is necessary, select seats on flights that provide the greatest distance between other travelers and choose direct flights, if possible.
- Disinfect surfaces of rental cars or fleet vehicles (e.g., steering wheel, shifter, arm rests, etc.) between each use, using products that meet EPA's criteria for use against SARS-CoV-2 .
- Make sure employees are provided with the necessary supplies and understand protective measures they can take while traveling. These measures include:
  - Maintain a distance of at least 6 feet from other people (social distancing) as much as possible during travel.
  - Wear cloth face coverings when a distance of 6 feet is difficult to maintain, such as in airports, airplanes, and public transportation.
  - Use disinfecting wipes to clean commonly touched surfaces inside vehicles and airplanes.
  - Consider ordering food for pickup or delivery rather than eating out at restaurants.
  - Wash hands or use hand sanitizer regularly.
- Ensure that employees know that if they get sick they should stay home (not travel) or return home (if traveling) provided it is feasible for them to travel without endangering themselves or others.
- Make sure employees know who to contact if they are sick.

For more information, see CDC guidance for travel in the United States

Cleaning and Disinfection in the Workplace

How do I clean and disinfect machinery or equipment?

Current evidence, though still preliminary, suggests that SARS-CoV-2, the virus that causes COVID-19, may remain viable for hours to days on surfaces made from a variety of materials. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads.

If the machinery or equipment in question are not accessible to employees or have not been in contact with someone infected with COVID-19, they will not present an exposure hazard.

If machinery or equipment are thought to be contaminated and can be cleaned, follow the CDC cleaning and disinfection recommendations. First, clean dirty surfaces with soap and water. Second, disinfect surfaces using products that meet EPA's criteria for use against SARS-Cov-2 and are appropriate for the surface.

If machinery or equipment are thought to be contaminated and cannot be cleaned, they can be isolated. Isolate papers or any soft (porous) surfaces for a minimum of 24 hours before handling. After 24 hours, remove soft materials from the area and clean the hard (non-porous) surfaces per the cleaning and disinfection recommendations. Isolate hard (non-porous) surfaces that cannot be cleaned and disinfected for a minimum of 7 days before handling.

How can I safely use cleaning chemicals?

Follow safe work practices when using cleaning chemicals :

- Always wear gloves appropriate for the chemicals being used when you are cleaning and disinfecting. Additional personal protective equipment (PPE) may be needed based on the setting and product you are using.
- Never mix household bleach with ammonia or any other cleaner.
- Make sure that employees know which cleaning chemicals must be diluted and how to correctly dilute the cleaners they are using.
- Employers must ensure employees are trained on the hazards of the cleaning chemicals used in the workplace in accordance with OSHA's Hazard Communication standard (29 CFR 1910.1200).
- Follow the manufacturer's instructions for all cleaning and disinfection products for concentration, application method, and contact time.

In addition to cleaning and disinfecting, what can I do to decrease the spread of disease in my workplace?

Employers can also:

- Provide tissues and no-touch disposal receptacles.
- Provide soap and water in the workplace. If soap and water are not readily available, use alcohol-based hand sanitizer that contains at least 60% alcohol. If hands are visibly dirty, soap and water should be chosen over hand sanitizer.
- Place hand sanitizer in multiple locations to encourage good hand hygiene practices.
- Place posters that encourage staying home when sick, the importance of hand hygiene, and coughing and sneezing etiquette at the entrance to your workplace and in other workplace areas where employees are likely to see them.
- Discourage handshaking.

Should I adjust my ventilation system?

The risk of spreading the virus that causes COVID-19 through ventilation systems has not been studied but is likely low. Routine HVAC maintenance is recommended. Although it is never the first line of prevention, consider general ventilation adjustments in your workplace, such as increasing ventilation and increasing the amount of outdoor air used by the system. Maintain the indoor air temperature and humidity at comfortable levels for building occupants.

How should restrooms be cleaned and disinfected?

CDC and the Environmental Protection Agency (EPA) have jointly developed guidance for cleaning and disinfecting public spaces, including restrooms. Employers should develop a plan for routine cleaning and disinfection, including the regular cleaning and disinfection of high-touch surfaces such as doorknobs, faucets, toilets, and other restroom furnishings.

Custodial staff should wear personal protective equipment (PPE) based on the setting and cleaning product they are using. To protect your staff and ensure that the products are used effectively, staff should be instructed on how to apply the disinfectants according to label instructions and precautions. Consider posting a cleaning schedule in the restrooms and marking off when each round of cleaning is completed.

If I shut down my facility as a result of a COVID-19 case or outbreak, what is the recommended way to clean and disinfect, and what is the appropriate timeframe to resume operations?

- Follow CDC guidance for cleaning and disinfection.
- Wait 24 hours before cleaning and disinfecting to minimize potential for exposure to respiratory droplets. If 24 hours is not feasible, wait as long as possible.
- Open outside doors and windows to increase air circulation in the area.

Cleaning staff should clean and disinfect all areas including offices, bathrooms, and common areas, focusing especially on frequently touched surfaces.

- Clean dirty surfaces with soap and water prior to disinfection.
- Next, disinfect surfaces using products that meet EPA's criteria for use against SARS-Cov-2 , the virus that causes COVID-19, and that are appropriate for the surface.
- Follow the manufacturer's instructions for all cleaning and disinfection products for concentration, application method, contact time, and required PPE.

Operations can resume as soon as the cleaning and disinfection are completed.

Does germicidal ultraviolet (GUV) disinfection kill the virus that causes COVID-19?

Yes.

Germicidal Ultraviolet (GUV), or Ultraviolet Germicidal Irradiation (UVGI), is a disinfection tool used in many different settings, such as residential, commercial, educational, and healthcare. The technology uses ultraviolet (UV) energy to inactivate (kill) microorganisms, including viruses, when designed and installed correctly.

There is still a lot to learn about SARS-CoV-2, the virus that causes COVID-19, and the possibility of airborne viral particles and spread. However, GUV can inactivate viruses in the air and on surfaces*. The design and sizing of effective GUV disinfection systems requires specific knowledge and experience.

Be sure to seek consultation with a reputable GUV manufacturer or an experienced GUV system designer prior to installing GUV systems. These professionals can assist by doing necessary calculations, making fixture selections, properly installing the system, and testing for proper operation specific to the setting.

*Note: CDC's recommendation for primary surface disinfection in occupied environments is to follow the CDC/EPA guidance for surface disinfection.

What are types of germicidal ultraviolet (GUV) for cleaning and disinfection in the workplace?

- **Upper-room GUV**
  Upper-room (or upper-air) GUV uses specially designed GUV fixtures mounted on walls or ceilings to create a disinfection zone of ultraviolet (UV) energy that is focused up and away from people. These fixtures disinfect air as it circulates from mechanical ventilation, ceiling fans, or natural air movement. The advantage of upper-room GUV is that it disinfects the air closer to and above people who are in the room. Since the 1980s, GUV systems have been widely used for control of tuberculosis (TB). The CDC guidance Environmental Control for Tuberculosis: Basic Upper-Room Ultraviolet Germicidal Irradiation Guidelines for Healthcare Settings provides information on appropriate GUV system design, related safe operation, and maintenance.

  Based on data from other human coronaviruses, a GUV system designed to protect against the spread of TB should be effective at inactivating SARS-CoV-2, the virus that causes COVID-19, and therefore prevent spread. GUV systems usually require a few GUV fixtures to be effective. For example, a rectangular-shaped waiting room with 10–30 occupants will require 2–3 upper-air GUV fixtures. Of note, the potential for reflection of UV energy into the lower occupied space is a potential safety concern with upper-room GUV systems. However, a reputable GUV manufacturer or an experienced GUV system designer should know the precautionary techniques to prevent harmful UV exposures to people in the space. [**Potential Application:** Can be used in any indoor environment; most useful in spaces highly occupied with people who are or may be sick.]

- **In-Duct GUV**
  In-duct GUV systems are installed within a heating, ventilation, and air-conditioning (HVAC) system. These systems are designed to serve one of two purposes:

  Coil treatment GUV keeps HVAC coils, drain pans, and wetted surfaces free of microbial growth. These devices produce relatively low levels of UV energy. This energy is continually delivered 24 hours a day, which is why they are effective. Coil treatment GUV devices are not designed for disinfecting the air and should not be installed for the purpose of air disinfection. [**Potential Application:** Can be used to reduce HVAC maintenance and improve operational efficiency within large, commercial HVAC systems or residential HVAC systems; not recommended for inactivating airborne pathogens.]

  Air disinfection GUV systems can be effective at inactivating airborne pathogens as they flow within the HVAC duct. HVAC air disinfection GUV systems generally require more powerful UV lamps or a greater number of lamps, or both, to provide the necessary GUV required to inactivate pathogens in a short period of time. Air disinfection systems are often placed downstream of the HVAC coils. This location keeps the coil, drain pan, and wetted surfaces free of microbial growth and also disinfects the moving air. [**Potential Application:** Can be used inside any HVAC system to disinfect infectious airborne pathogens.]

- **Far-UV (or Far-UVC)**
  Far-UV is one of many emerging technologies that have become popular during the COVID-19 pandemic. While standard GUV fixtures emit UV energy at a wavelength around 254 nanometers (nm), far-UV devices use different lamps to emit UV energy at a wavelength around 222 nm. Aside from the wavelength, a major difference between the two technologies is that standard GUV systems are specifically designed to avoid exposing people to the UV energy, while many far-UV devices are marketed as safe for exposing people and their direct environment to UV energy. A review of peer-reviewed literature indicates that far-UV wavelengths can effectively inactivate microorganisms, including human coronaviruses, when appropriate UV doses are applied. Questions remain about the mechanisms of killing microorganisms and overall safety. Far-UV might prove to be effective at disinfecting air and surfaces, without some of the safety precautions required for standard GUV. Far-UV devices are best viewed as new and emerging technology. [**Potential Application**: Yet to be determined.]

Consumers considering an emerging technology such as Far-UV can research the proposed system. Ask the vendor to provide proof of effectiveness and performance that demonstrates a clear protective benefit. Engage with a ventilation engineer, and if the engineer recommends installing such a system, obtain a guarantee as to expected disinfection performance. When evaluating evidence of system effectiveness, place emphasis on research publications over anecdotal claims and consider the following questions:

- Are there independent studies that prove the desired performance of the technology?
- Did the study environments represent your environment and intended use?
- Have performance results been published in a scientific or medical journal?
- Was the technology evaluated for potential adverse health effects or occupational exposures?
- Where is the technology being used?

Critical Infrastructure

How do I know if my business is considered critical?

The Department of Homeland Security developed a list of essential critical infrastructure employees to help state and local officials as they work to protect their communities, while ensuring continuity of functions critical to public health and safety as well as economic and national security. State and local officials make the final determinations for their jurisdictions about critical infrastructure employees.

Should I allow critical infrastructure employees to work if they have been exposed but are not showing symptoms of COVID-19?

Functioning critical infrastructure is imperative during the response to the COVID-19 emergency, for both public health and safety as well as community well-being. When continuous remote work is not possible, critical infrastructure businesses should use strategies to reduce the likelihood of spreading the disease. This includes, but is not necessarily limited to, separating staff by off-setting shift hours or days and implementing social distancing. These steps can preserve and protect the workforce and allow operations to continue.

To ensure continuity of operations of essential functions, CDC advises that critical infrastructure employees may be permitted to continue work following potential exposure to COVID-19, provided they remain asymptomatic and additional safety practices are implemented to protect them and the community. However, reintegrating exposed, asymptomatic employees to onsite operations, while discussed in the critical infrastructure guidance, should not be misinterpreted as always being the first or most appropriate option to pursue in managing critical work tasks. Staying home may still be the most preferred and protective option for exposed employees. Critical infrastructure businesses have an obligation to limit, to the extent possible, the reintegration of in-person employees who have experienced an exposure to COVID-19 but remain symptom-free in ways that best protect the health of the employee, their co-employees, and the general public.

Create a critical infrastructure sector response plan. Cross-training employees to perform critical job functions so the workplace can operate even if key employees are absent and match critical job functions with other equally skilled and available employees who have not experienced an exposure to COVID-19.

Critical infrastructure employees who have been exposed but remain symptom-free and must return to in-person work should adhere to the following practices before and during their work shift:

- Pre-screen for symptoms
- Monitor regularly for symptoms
- Wear a cloth face covering
- Practice social distancing

- Clean and disinfect workspaces

Employees with symptoms should be sent home and should not return to the workplace until they have met the criteria to discontinue home isolation.

See Implementing Safety Practices for Critical Infrastructure Employees Who May Have Had Exposure to a Person with Suspected or Confirmed COVID-19 for more information.

Is other specific CDC guidance available for critical infrastructure workplaces?

CDC has guidance for first responders and law enforcement as well as a series of fact sheets for specific critical infrastructure employee groups. Unless otherwise specified, the CDC interim guidance for businesses and employers applies to critical infrastructure workplaces as well.

Ventilation

Can COVID-19 be transmitted through HVAC (ventilation) systems?

The risk of spreading the virus that causes coronavirus disease 2019 (COVID-19) through ventilation systems is not well-known at this time. Viral RNA has reportedly been found on return air grilles, in return air ducts, and on heating, ventilation, and air conditioning (HVAC) filters, but detecting viral RNA alone does not imply that the captured virus was capable of transmitting disease. One research group reported that the use of a new air-sampling method allowed them to find viable viral particles within a COVID-19 patient's hospital room with good ventilation, filtration and ultraviolet (UV) disinfection (at distances as far as 16 feet from the patient). However, the concentration of viable virus detected was believed to be too low to cause disease transmission. There may be some implications for HVAC systems associated with these findings, but it is too early to conclude that with certainty. While airflows within a particular space may help spread disease among people in that space, there is no evidence to date that viable virus has been transmitted through an HVAC system to result in disease transmission to people in other spaces served by the same system.

Healthcare facilities have ventilation requirements in place to help prevent and control infectious diseases that are associated with healthcare environments. For more information, see the CDC Guidelines for Environmental Infection Control in Health-Care Facilities.

Non-healthcare (businesses and schools) building owners and managers should maintain building ventilation systems according to state/local building codes and applicable guidelines. Ensuring appropriate outdoor air and ventilation rates is a practical step building owners and managers can take to ensure good indoor air quality. Considerations for ventilation and related engineering control interventions for businesses and schools may be found on the following CDC webpages: COVID-19 Employer Information for Office Buildings and Strategies for Protecting K-12 School Staff from COVID-19.

How long will it take to dilute the concentration of infectious particles in a room once they are generated?

While large droplets (100 micrometers [µm] and larger) will settle to surrounding surfaces within seconds, smaller particles can stay suspended in the air for much longer. It can take several minutes for particles 10 µm in size to settle, while particles 5 µm and smaller may not settle for hours or even days. Dilution ventilation and particle filtration are commonly used to remove these smaller particles from the air. Larger particles can also be removed using these strategies, but since they fall out of the air quickly, they might not have a chance to get captured by filtration systems.

The time required to remove airborne particles from a space can be estimated once the source of infectious particles is no longer present and the dilution air is free of new infectious particles (e.g. it is uncontaminated supply air or it is the clean exhaust from a High Efficiency Particulate Air (HEPA) fan/filtration system [See HEPA filtration discussion below]). Table B.1 in the CDC's Guidelines for Environmental Infection Control in Health-Care Facilities (2003) provides estimates of the time required to remove airborne contaminants, including airborne viral particles, from the air through ventilation dilution, exhaust and filtration. The table provides estimates of the time required for airborne-contaminant removal based upon the room's ventilation rate, measured in air changes per hour (ACH) and the desired removal efficiency (99% or 99.9%).

Although there are some highly contagious airborne diseases (like measles) where CDC provides specific guidance for 99.9% clearance wait times, the general recommendation in CDC's Guidelines for Environmental Infection Control in Health-Care Facilities is to wait to allow for a 99% reduction of any generated airborne particles before re-entering the room. In the absence of specific guidance specifying a longer wait period for the virus that causes COVID-19, SARS-CoV-2, the wait time associated with 99% clearance is appropriate for healthcare and other spaces. Regardless of whether the 99% or 99.9% column on Table B.1 is used, the value in the table is usually an under-estimation of the actual dilution clearance time as noted in the table's footnotes which include the following statement: "The times given assume perfect mixing of the air within the space (i.e., mixing factor = 1). However, perfect mixing usually does not occur. Removal times will be longer in rooms or areas with imperfect mixing or air stagnation." Appropriate use of Table B.1 to establish clearance times from any space requires multiplying the time in the table by a mixing factor (k) that ranges between 1 and 10. This factor represents how well the ventilation system mixes and dilutes the concentration of airborne particles within the room. As a rule of thumb, rooms with higher airflow rates (6 ACH and higher) and good placement of supply and exhaust grilles (hospital airborne infection isolation rooms) are considered to have "good" mixing and thus a mixing factor of k = 3 is often used for these spaces. In that case, the time identified from Table B.1 should be multiplied by 3 in order to determine the actual clearance time prior to re-entry. Nonventilated or poorly ventilated spaces have typical values of k ranging from 8 to 10. Increased ACH generally leads to reductions in k, although k can also be reduced by the use of a fan in the space, which does not have an impact on ACH. Ultimately, wait times can be reduced by increasing ACH, reducing k, or a combination of both.

Example 1: A room measuring 12 feet x 10 feet with a ceiling height of 9 feet is served with a 100% outdoor air ventilation system that delivers 65 cubic feet per minute (cfm) of supply air (Q_s = 65 cfm) and exhausts 72 cfm of air from the room (Q_e = 72 cfm). The room has average air mixing, so assign k = 5. How much time is required to reduce the airborne particle concentration by 99 percent?

Since Q_e is larger than Q_s by 7 cfm, the heating, ventilation, and air conditioning (HVAC) system is pulling 7 cfm of air into the room from adjacent areas (i.e., the room is under negative pressure). For this example, the 7 cfm of transfer air is assumed to be free of infectious airborne particles. The clean volumetric air flow rate (Q) is the larger value between Q_s and Q_e, so Q = 72 cfm. Now, calculate the air changes per hour:

ACH = [Q x 60] / (room volume) = (72 cfm x 60) / (12' x 10' x 9') = 4320/1080 = 4.0 ACH

Using Table B.1 the perfect mixing wait time based on 4 ACH and a 99% reduction of airborne particles is 69 minutes.

Using the mixing factor of 5, the estimated wait time for 99% reduction of airborne contaminants in the room is 5 x 69 = 345 minutes or 5 hours and 45 minutes.

Note: Determining the true value of the mixing factor is difficult and requires special equipment to measure air flows and conduct tracer gas decay testing. Thus, conservative estimates of k are often used (as described above). Also, the addition of an air cleaning device (e.g., a portable HEPA filtration unit) within the same room will reduce the wait time. The flow rate from the air cleaning device can be added to Q determined above, which will increase the overall ACH in the room. The air movement created by the air cleaning device can also decrease the value of k. Together, the increased ACH and decreased k can help substantially reduce wait times. See Example 2 for more information, including an example of the calculations.

Can ventilation filters effectively capture SARS-CoV-2 viral particles?

Filters for use in heating, ventilation, and air conditioning (HVAC) systems are generally tested under procedures outlined in ANSI/ASHRAE Standard 52.2-2017-Method of Testing General Ventilation Air-Cleaning Devices for Removal

Efficiency by Particle Size. To access the standard, the end user typically must purchase it, but ASHRAE, which is a global society focused on building systems, indoor air quality, and sustainability in the built environment, has made it available for free online viewing during the ongoing pandemic. Based on the filtration efficiency determined by the testing procedures, filters are assigned a Minimum Efficiency Reporting Value (MERV). The MERV provides a measure of the "filter efficiency" over the range of particle sizes prescribed in the test procedure. MERV values range from 1 to 16 and higher MERV values correspond to more efficient filters.

Research shows that the particle size of SARS-CoV-2, the virus that causes COVID-19, is around 0.1 micrometer (µm). However, the virus generally does not travel through the air by itself. These viral particles are human-generated, so the virus is trapped in respiratory droplets and droplet nuclei (dried respiratory droplets) that are larger than an individual virus. Most of the respiratory droplets and particles exhaled during talking, singing, breathing, and coughing are less than 5 µm in size. CDC recommends using the highest efficiency ventilation filters possible, without having detrimental effects on overall HVAC system performance. ASHRAE, has similar guidance, however, they recommend a minimum filtration efficiency target of MERV 13, provided there are not substantial negative impacts on the HVAC system performance and occupant comfort. A MERV 13 filter is at least 50% efficient at capturing particles in the 0.3 µm to 1.0 µm size range and 85% efficient at capturing particles in the 1 µm to 3 µm size range. Collectively these particles are capable of remaining airborne for hours and are most associated with deep lung penetration. A MERV 14 filter is at least 75% and 90% efficient, respectively, at capturing those same particles. Efficiencies for MERV 15 and MERV 16 filters are even higher. Thus, the recommended filters are significantly more efficient at capturing particles of concern than a typical MERV 8 filter, which is only around 20% efficient in the 1 µm to 3 µm size range and is not rated for capture efficiency of the smaller 0.3 µm to 1.0 µm particles.

Increasing filtration efficiency can increase the pressure drop across the filters. This can lead to increased fan energy, reduced airflow rates, and/or issues controlling indoor temperature and relative humidity levels. Scientific developments in filter design have reduced the amount of the increased pressure drop and its resulting impact on HVAC operations, but not all filters have adopted the newer technology. Prior to a filtration upgrade, the specific filter under consideration should be investigated for its pressure drop ratings at the flow rate(s) of intended use and the potential impacts of that pressure drop evaluated against the capabilities of the existing HVAC system.

High-efficiency particulate air (HEPA) filters are even more efficient at filtering human-generated infectious particles than MERV 16 filters. However, outside of a few unique applications, HEPA filters are rarely used in central HVAC systems. [See the question on Portable HEPA Filtration to learn more about them and their application in protective air cleaning].

What is meant by "directional airflow?" How and where should we use it?

Directional Airflow is a protective ventilation concept where air movement flows in a clean-to-less-clean direction. This ventilation concept is applied to areas where the "clean" environment requires a higher level of protection and/or where the "less-clean" environment has a higher risk of containing airborne contaminants (activities or occupancy by individuals with a higher risk of being infectious). Examples of "clean" spaces might include healthcare facility triage stations or rooms/corridors adjacent to higher risk activities. Examples of "less-clean" spaces might include spaces that contain known/suspect infectious persons or spaces where a known activity has increased likelihood of generating infectious airborne particles.

The creation of directional airflow can be accomplished within a particular space or between two adjacent spaces. This can be done passively, through intentional placement of supply and exhaust heating, ventilation, and air conditioning (HVAC) grills or by the intentional creation of pressure differentials between adjacent spaces through specification of offset exhaust and supply air flow rates. Creation of the directional airflow can also be done actively, through the use of fans exhausting through open windows, strategic placement of ductwork attached to portable HEPA filtration units, or dedicated exhaust systems (installed or portable) that generate a desired airflow by exhausting air out of windows, doorways, or through temporary ducts. In specific settings, specialized local control ventilation interventions that establish the desired airflow directions can also be used (see the NIOSH Ventilated Headboard).

Directional airflows must be evaluated carefully. Testing of the directional airflow effectiveness can be accomplished using visual tracer techniques that use "smoke tubes" or handheld "fog generators." Other tools, such electronic monitors or visual aids to monitor pressure differences can be used when directional airflow is established between

two adjacent spaces. To reduce the potential for directing airflow from infectious towards non-infectious space occupants, it is important that the “clean” and “less-clean” space determinations be established using infection control risk assessment considerations.

What is a HEPA filter and why would I want to use a portable HEPA air cleaner?

Research shows that the particle size of SARS-CoV-2, the virus that causes COVID-19, is around 0.1 micrometer (µm). However, the virus generally does not travel through the air by itself. These viral particles are human-generated, so the virus is trapped in respiratory droplets and droplet nuclei (dried respiratory droplets) that are larger. Most of the respiratory droplets and particles exhaled during talking, singing, breathing, and coughing are less than 5 µm in size. By definition, a High Efficiency Particulate Air (HEPA) filter is at least 99.97% efficient at capturing particles 0.3 µm in size. This 0.3 µm particle approximates the most penetrating particle size (MPPS) through the filter. HEPA filters are even more efficient at capturing particles larger **and** smaller than the MPPS. Thus, HEPA filters are no less than 99.97% efficient at capturing human-generated viral particles associated with SARS-CoV-2.

Portable HEPA filtration units that combine a HEPA filter with a powered fan system are a great option for auxiliary air cleaning, especially in higher risk settings such as health clinics, medical testing locations, workout rooms, or public waiting areas. Other settings that could benefit from portable HEPA filtration can be identified using typical risk assessment parameters, such as community incidence rates, facemask compliance expectations and room occupant density. In choosing a portable HEPA unit, you want to select a system that is appropriately sized for the area in which it is installed. One way to do this for room air cleaners is to select a HEPA fan system with a Clean Air Delivery Rate (CADR) [See EPA’s Guide To Air Cleaners In The Home] that meets or exceeds the square footage of the room in which it will be used. The larger the CADR, the faster it will clean the room air. If the room in which the air cleaner will be used is taller than 8 feet, choose an air cleaner with a proportionally higher CADR than that based simply on square footage. While these systems do not bring in outdoor dilution air, they are very effective at cleaning air within spaces to reduce the concentration of airborne particulates, including SARS-CoV-2 viral particles. Thus, they give effective air exchanges without the need for conditioning outdoor air.

HEPA fan systems can be used as stand-alone units, or many larger units allow flexible ductwork to be attached to the air inlet and/or outlet (note that larger ducted units don’t fall under the “room air cleaner” description and may not have a CADR rating). Using ductwork and placing the HEPA system strategically in the space can help provide desired clean-to-less-clean airflow patterns where needed. Ducted HEPA systems can also be used to establish direct source capture interventions for patient treatment and /or testing scenarios (See CDC/NIOSH discussion on Ventilated Headboard). Depending on the size of the HEPA fan/filter units and how the facility in which they are being used is configured, multiple small portable HEPA units deployed to high risk areas may be more useful than one large HEPA unit serving a combined space.

Example 2: The room described in Example 1 is now augmented with a portable HEPA air cleaning device with a CADR of 145 cfm (Q_{hepa} = 145 cfm). The added air movement within the room improves overall mixing, so assign k = 3. How much time is saved to achieve the same 99% reduction in airborne contaminants by adding the portable HEPA device to the room?

The addition of the HEPA filter device provides additional clean air to the room. Here, the clean volumetric air flow rate (Q) is: $Q = Q_e + Q_{hepa}$ = 72 cfm + 145 cfm = 217 cfm.

ACH = [Q x 60] / (room volume) = (217 cfm x 60) / (12’ x 10’ x 9’) = 13,020/1080 = 12.06 ACH (round down to 12).

Using Table B.1, the perfect mixing wait time based on 12 ACH and a 99% reduction of airborne particles is 23 minutes.

Using the mixing factor of 3, the estimated wait time for 99% reduction of airborne contaminants in the room is 3 x 23 = 69 minutes. Thus, the increased ACH and lower k value associated with the portable HEPA filtration unit reduced the wait time from the original 5 hours and 45 minutes to only 1 hour and 9 minutes, saving a total of 4 hours and 36 minutes before the room can be safely reoccupied.

In conclusion, adding the portable HEPA unit increased the effective ventilation rate and improved room air mixing, resulting in an 80% reduction in time for the room to be cleared of potentially-infectious airborne particles.

Does germicidal ultraviolet (GUV) disinfection kill the virus that causes COVID-19?

Yes.

Germicidal Ultraviolet (GUV), or Ultraviolet Germicidal Irradiation (UVGI), is a disinfection tool used in many different settings, such as residential, commercial, educational, and healthcare. The technology uses ultraviolet (UV) energy to inactivate (kill) microorganisms, including viruses, when designed and installed correctly.

There is still a lot to learn about SARS-CoV-2, the virus that causes COVID-19, and the possibility of airborne viral particles and spread. However, GUV can inactivate viruses in the air and on surfaces*. The design and sizing of effective GUV disinfection systems requires specific knowledge and experience.

Be sure to seek consultation with a reputable GUV manufacturer or an experienced GUV system designer prior to installing GUV systems. These professionals can assist by doing necessary calculations, making fixture selections, properly installing the system, and testing for proper operation specific to the setting.

*Note: CDC's recommendation for primary surface disinfection in occupied environments is to follow the CDC/EPA guidance for surface disinfection.

What are types of germicidal ultraviolet (GUV) for cleaning and disinfection in the workplace?

- **Upper-room GUV**
  Upper-room (or upper-air) GUV uses specially designed GUV fixtures mounted on walls or ceilings to create a disinfection zone of ultraviolet (UV) energy that is focused up and away from people. These fixtures disinfect air as it circulates from mechanical ventilation, ceiling fans, or natural air movement. The advantage of upper-room GUV is that it disinfects the air closer to and above people who are in the room. Since the 1980s, GUV systems have been widely used for control of tuberculosis (TB). The CDC guidance Environmental Control for Tuberculosis: Basic Upper-Room Ultraviolet Germicidal Irradiation Guidelines for Healthcare Settings provides information on appropriate GUV system design, related safe operation, and maintenance. Based on data from other human coronaviruses, a GUV system designed to protect against the spread of TB should be effective at inactivating SARS-CoV-2, the virus that causes COVID-19, and therefore prevent spread. GUV systems usually require a few GUV fixtures to be effective. For example, a rectangular-shaped waiting room with 10–30 occupants will require 2–3 upper-air GUV fixtures. Of note, the potential for reflection of UV energy into the lower occupied space is a potential safety concern with upper-room GUV systems. However, a reputable GUV manufacturer or an experienced GUV system designer should know the precautionary techniques to prevent harmful UV exposures to people in the space. [**Potential Application:** Can be used in any indoor environment; most useful in spaces highly occupied with people who are or may be sick.]
- **In-Duct GUV**
  In-duct GUV systems are installed within a heating, ventilation, and air-conditioning (HVAC) system. These systems are designed to serve one of two purposes:
  - **Coil treatment GUV** keeps HVAC coils, drain pans, and wetted surfaces free of microbial growth. These devices produce relatively low levels of UV energy. This energy is continually delivered 24 hours a day, which is why they are effective. Coil treatment GUV devices are not designed for disinfecting the air and should not be installed for the purpose of air disinfection. [**Potential Application:** Can be used to reduce HVAC maintenance and improve operational efficiency within large, commercial HVAC systems or residential HVAC systems; not recommended for inactivating airborne pathogens.]
  - **Air disinfection GUV** systems can be effective at inactivating airborne pathogens as they flow within the HVAC duct. HVAC air disinfection GUV systems generally require more powerful UV lamps or a greater number of lamps, or both, to provide the necessary GUV required to inactivate pathogens in a short period of time. Air disinfection systems are often placed downstream of the HVAC coils. This location keeps the coil, drain pan, and wetted surfaces free of microbial growth and also disinfects the moving air. [**Potential Application:** Can be used inside any HVAC system to disinfect infectious airborne pathogens.]
- **Far-UV (or Far-UVC)**
  Far-UV is one of many emerging technologies that have become popular during the COVID-19 pandemic. While standard GUV fixtures emit UV energy at a wavelength around 254 nanometers (nm), far-UV devices use

different lamps to emit UV energy at a wavelength around 222 nm. Aside from the wavelength, a major difference between the two technologies is that standard GUV systems are specifically designed to avoid exposing people to the UV energy, while many far-UV devices are marketed as safe for exposing people and their direct environment to UV energy. A review of peer-reviewed literature indicates that far-UV wavelengths can effectively inactivate microorganisms, including human coronaviruses, when appropriate UV doses are applied. Questions remain about the mechanisms of killing microorganisms and overall safety. Far-UV might prove to be effective at disinfecting air and surfaces, without some of the safety precautions required for standard GUV. Far-UV devices are best viewed as new and emerging technology. [**Potential Application**: Yet to be determined.] Consumers considering an emerging technology such as Far-UV can research the proposed system. Ask the vendor to provide proof of effectiveness and performance that demonstrates a clear protective benefit. Engage with a ventilation engineer, and if the engineer recommends installing such a system, obtain a guarantee as to expected disinfection performance. When evaluating evidence of system effectiveness, place emphasis on research publications over anecdotal claims and consider the following questions:

- Are there independent studies that prove the desired performance of the technology?
- Did the study environments represent your environment and intended use?
- Have performance results been published in a scientific or medical journal?
- Was the technology evaluated for potential adverse health effects or occupational exposures?
- Where is the technology being used?

Many new air disinfection devices are being marketed for their ability to inactivate the virus that causes COVID-19. How can I tell if they work as advertised?

CDC does not provide recommendations for, or against, any manufacturer or product. There are numerous devices being heavily marketed to provide air cleaning during the ongoing COVID-19 pandemic. Some of the most common are ionization and/or dry hydrogen peroxide devices. Some devices even include both technologies. While variations of these technologies have been around for decades, relative to other air cleaning or disinfection technologies, they have a less-documented track record when it comes to cleaning/disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems or even inside individual rooms. This does not necessarily imply the technologies do not work as advertised. However, in the absence of an established body of peer-reviewed evidence showing proven efficacy and safety under as-used conditions, the technologies are still considered by many to be “emerging.” As with all emerging technologies, consumers are encouraged to exercise caution and to do their homework. Consumers should research the technology, attempting to match any specific claims against the intended use of the product. Consumers should request testing data that quantitively demonstrates a clear protective benefit and occupant safety under conditions consistent with the intended use. Preferably, the documented performance data under as-used conditions should be available from multiple sources, some of which should be independent, third party sources. Unsubstantiated claims of performance or limited case studies with only one device in one room and no reference controls should be questioned. At a minimum, if you are considering the acquisition and use of these devices, you will want to be sure the equipment meets UL 867 standard certification (Standard for Electrostatic Air Cleaners) for production of acceptable levels of ozone, or preferably UL 2998 standard certification (Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners) which is intended to validate that no ozone is produced.

Additional Resources

- Interim Guidance for Businesses and Employers
- Cleaning and Disinfecting Your Facility
- Resources for First Responders and Law Enforcement
- EPA: Disinfectants for Use Against SARS-CoV-2
- FDA: Food Safety and the Coronavirus Disease 2019 (COVID-19)
- HHS/DOL: Guidance on Preparing Workplaces for COVID-19
- DHS: Guidance on the Essential Critical Infrastructure Workforce

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