FAQs: General Ventilation

September 10, 2021

The following FAQs was developed by the San Francisco Department of Public Health for use by local facilities, and will be posted at www.sfcdcp.org/COVID-Ventilation. These FAQs may change as knowledge, community transmission, and availability of vaccines change.

AUDIENCE: Non-healthcare organizations (including businesses, companies, offices, schools, faith-based and similar organizations) and the general public. Healthcare personnel and first responders need to check with their infection control and safety & health groups for guidance as there are specific hazards or hazardous activities which ventilation systems are set to control. Additional information for healthcare organizations can be found at www.sfcdcp.org/covid19hcp under Health Care Exposures.

Summary of revisions from the previous version

- Minor format changes

BACKGROUND: On June 15, 2021, the California Blueprint for a Safer Economy was terminated, however statewide COVID-19 guidance continues for some settings. The San Francisco Health Officer’s declaration of a health emergency arising from the pandemic continues to be in effect, and the main health order governing the emergency remains in place. This document answers FAQs regarding general ventilation.

FAQs

1) What is SFDPH’s opinion of using Bipolar Ionization to charge the supply air to the building and be able to reduce the spread of the COVID19 Virus.

The US Centers for Disease Control and Prevention (CDC), the US Environmental Protection Agency, and the American Society of Heating, Refrigeration, and Airconditioning Engineers (ASHRAE) all consider Bipolar Ionization, also referred to as needlepoint bipolar ionization, or needlepoint ionization, to be an emerging technology of interest. At present, however, there is a lack of sufficient independent testing and/or documentation in peer-reviewed journals demonstrating that it works in real-world settings and conditions.

Some equipment on the market may be either repurposed from other applications or rushed to the market because of COVID-19. Potential purchasers are cautioned to carefully review manufacturer’s information and demand independent testing data before agreeing to purchase. Additionally, some ionization equipment generates considerable amounts of ozone (O3), a hazardous form of oxygen; users should request suppliers provide information regarding ozone emissions such as testing in accordance with Underwriter’s Laboratory Standard 2998, Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.

2) Can you recommend specific portable air purifiers?

SFDPH recommends first checking in with your building manager, stationary engineer, or other person familiar with the building’s design to identify the best possible scenarios for ventilation in your building. Having multiple ventilation measures (fully operational HVAC systems, all available windows and doors accessible to fresh air are kept open, and appropriate sized portable air cleaners (PACs)) all working concurrently will produce the best scenario for indoor ventilation.
Unfortunately, SFDPH cannot recommend specific brands and models of portable air cleaners. In our Interim Guidance for Ventilation, Section 7 discusses general considerations and features for PACs. In our Portable Air Cleaner FAQ, Question #4 specifically addresses how to choose the right sized PAC. Is indicated in both the Ventilation Guidance and the PAC FAQ, PAC ratings are based on the PAC operating at full speed; as the sound level of a PAC operating at full speed may be obtrusive you might wish to purchase a larger PAC (or multiple units) which you could operate at lower speeds and still get the necessary air cleaning. This online PAC size calculator may help you simulate what operating an PAC at lower speeds will do to the overall air cleaning.

3) I am the owner of a fitness studio. We have overhead fans, should we turn them on? We worry that it actually spreads droplets rather than allow for ventilation.

You may turn your ceiling fans on. Section 6.3 of the SF DPH Ventilation Guidance states:

For rooms with high ceilings, ceiling fans may help dilute potentially contaminated air with cleaner air in the higher parts of the room. Use of such fans do not bring additional fresh air into the room and is considered to be supplemental to fresh air ventilation. Set ceiling fans to draw air upwards. If the ceiling fans do not have a directional switch, consider rotating fan blades counterclockwise so that air is drawn upward in the room. Pushing air downwards increases the risk of air blowing from person to person.

4) Large portable air cleaners with HEPA filters seem to blow air around. Are they safe to run while the space is occupied? It feels like another form of fan that would spread droplets.

Ideally Portable Air Cleaners (PACs) should be operated at the highest speeds possible both during and after the space is occupied.

You can choose the optimum orientation (placement) of the PACs to reduce the person to person air movement by affixing a small strip of tissue or a down feather to the end of a stick, and circling the air cleaner observing the direction of air movement indicated by the tissue or feather movement (using a stick prevents your body from interfering with airflow during your assessment).

For maximum effectiveness PACs should be positioned in the middle of the group, so they all benefit from the potentially contaminated air collection and clean air dispersal; however if PAC orientation doesn’t correct person to person air movement you can consider moving the PAC further away from the group.

If you move your PACs please note that they are most effective away from windows and doors where fresh air is entering the room. Placing them beneath tables or in corners of the room reduces their effectiveness because people are not usually present in these locations to benefit from the filtered air.

5) It has come to my attention that there are established technologies for providing disease-free air that have been used in hospitals for decades. Does SF-DPH have any regulations, inspectors, certification, etc. on the use of:

- increased use of clean, outdoor air in the ventilation mix
- MERV-13 or HEPA filtration
- increasing the Air Changes per Hour to 20 (so that clearance time for a room would be 15 min or less)
- the use of UV-C or Germicidal UV to sterilize the air either above people's heads and/or inside the HVAC ducts.
• airflow designs to enhance the effectiveness of these measures and reduce the exposure of people "downstream" in the room to other people's infectious particles.

**What is already being done in San Francisco?**

Hospitals and healthcare facilities have specialized ventilation requirements under Title 24 of the California Code of Regulations, the Building Standards Code. Implementation of these typically requires new construction or significant renovations because the mechanical ventilation systems required are considerably larger and at times more complex than those used in other commercial and residential construction. Under normal conditions Title 24 wouldn’t allow other types of businesses and occupancies to use hospital/healthcare type ventilation because of the energy costs. For hospitals/healthcare settings these costs are accepted but if applied on a larger scale this results in significantly higher costs for building operators, and strain on California’s fragile energy grid.

Long prior to COVID-19 the City and County of San Francisco (CCSF) and the San Francisco Department of Public Health (DPH) had enhanced ventilation requirements codified as Article 38 of the San Francisco Health Code for new sensitive use development/construction within the designated Air Pollutant Exposure Zone as well as for a building to be identified as being “Green”. For COVID-19 DPH has issued guidance on building ventilation improvements. Requiring substantial upgrades, such as hospital/healthcare-type ventilation would however require both changes at the State and CCSF level. The large dollar cost of such upgrades would need to be considered closely against impacts against already financially devastated businesses.

Learn more about Article 38 here at [www.sfdph.org/dph/EH/Air/Article38.asp](http://www.sfdph.org/dph/EH/Air/Article38.asp)

**6) I have read that carbon dioxide measurements will identify where there’s a risk of COVID transmission in a building. What are your thoughts?**

Carbon dioxide measurements can be useful but require careful planning to ensure that representative measurements are made.

As background, carbon dioxide is present in the air we breathe from both natural and man-made processes; typical concentrations range from 350-450 parts per million (PPM). It is also a component of your exhaled breath at much higher concentrations, typically in the range of 40,000-50,000 PPM (4-5%) range. Absent of processes which make use of carbon dioxide such as soft drink production, specialized welding, and “inerting” of vessels, or which generate large quantities of carbon dioxide such as during some types of fermentation, carbon dioxide levels above the “background” 350-450 PPM suggest that ventilation may not be keeping up with people’s breathing in a room or enclosed area. In such cases the elevated carbon dioxide levels may also be accompanied by greater levels of small exhaled droplets (bioaerosols) which could contain the SARS-CoV2 virus. Ideally carbon dioxide levels indoors should be the same as outdoors (350-450 PPM); realistically keeping concentrations below 600 PPM is strongly suggestive that room or area ventilation is purging the area.

To make accurate, representative carbon dioxide measurements the following need to be considered:

• Low-cost carbon dioxide monitors may not be sufficiently reliable in the concentrations of interest (background to 600 PPM); depending on the instrument readings may be low, high, or both (i.e. unpredictable) when compared to reference meters. At least some of the low-cost monitors are being sold for a completely different purpose, monitoring indoor horticultural activities where carbon dioxide is introduced to spaces at much higher concentrations to stimulate plant growth.
• It is imperative that you have a way to validate monitor function before using it to assess spaces for COVID-19 acceptability. You can ask an industrial hygiene or indoor air quality professional to compare the function of your monitor against professional equipment or you can purchase and use calibration gases with known concentrations of carbon dioxide. Extended runs in known environments such as outdoor air can tell you about meter fluctuation, and sharply exhaling on a monitor and verifying that readings increase can give you clues about meter reliability.

• Carbon dioxide monitors cannot be arbitrarily affixed to a convenient wall or location in the room or area. Because of room-specific airflow and low-mixing zones (“dead spots”) to monitor needs to be used to survey multiple locations in a room or space, while it is fully occupied. Occupied areas of the room with the highest levels of carbon dioxide should be targeted for routine monitoring.

7) If my personal services business provides services to customers who remove their face covering and I provide those services in a separate room or curtained off area, should I use a Portable Air Cleaner (PAC) in each area?

SFDPH strongly recommends that you use a separate PAC in each space where you are providing personal services where the customer removes their face covering.

8) I live in a large apartment building with 42 units. Should the hallway windows and doors should be open to ventilate the hallways to minimize COVID accumulation in the air?

Because natural ventilation in common areas like corridors has both fire code compliance and safety implications, building manager/landlord participation in the discussion is imperative; our comments here cannot be used as a replacement. In general, increasing fresh air ventilation in any area used by more than one group of people (“social bubble”) is encouraged. Opening windows and selected doors may be one way to increase fresh air ventilation as is changing settings on mechanical ventilation systems. Portable air cleaners can be used in some types of common areas to filter air of contaminants; because of their extended length and narrow width hallways are not always a good candidate for portable air cleaners.

9) If my restaurant, gym, or personal services business has multiple rooms or enclosed spaces, but the only ventilation I have is to open my front door, is this enough to satisfy the requirements of the Health Order?

In order to comply with applicable building codes, it is likely your business either has adequate natural ventilation (windows and doors open to outside air) or a mechanical ventilation system that may be adjusted to provide additional outside air. If you are not sure what type of ventilation you have, please consult with your landlord or facilities manager. If you are still unsure whether you have adequate ventilation, SFDPH strongly recommends that you also use appropriate portable air cleaners for each enclosed area and room in your business.

10) If my business has doors that open to another interior space, but not to outside fresh air, does that satisfy the requirement to open doors and windows? What if the space is within a mall or gym?

No, if your business does not have windows or doors that open to fresh outside air, opening your windows and doors to another interior space does not satisfy your ventilation requirements. However, if your business is in a mall or gym or other fully enclosed space that is
building code compliant, it should have a mechanical ventilation system that can be adjusted to satisfy your ventilation requirements. To improve safety, you may also add one or more portable air cleaners to your space. You should generally not open doors and windows to other interior spaces as this may cause cross-contamination, unbalance ventilation systems, and/or compromise the fire/life safety of the building.

11) We have read reports that when indoor air is heated, the virus spreads more easily. Is your advice not to use the heater in the cold weather, and to simply bundle up?

We are not familiar with any peer-reviewed literature suggesting changes in virus spread because of temperature. Colder temperatures do, however, tend to increase eye and respiratory tract secretions which increase the risk of hand-to-mucus membrane (eye, nose, or mouth) contact as you involuntarily touch your eyes or wipe your nose. Unless careful hand hygiene is followed this could increase the risk of COVID-19 exposure.

12) What about air circulation - in the warm months we turned on the AC to filter the air. But in the cold weather do we leave it off or turn on simple fan function with no cooling nor heating?

In basic ventilation systems setting the fan to run continuously will not impact heating or cooling. If the thermostat “identifies” proper room temperature the fan will run without heating or cooling; however, if the temperature goes outside of the set range heating or cooling would be added to the air being circulated.

13) What about ultraviolet light (UV) for disinfecting air?

There are multiple ways in which UV can be used, some more successful than others for COVID-19 protection:

- **Upper Room UV systems** which place high-energy UV lamps irradiating the upper parts of a room, out of the reach of room occupants, and use ceiling fans to draw air up into the irradiation zone. Details such as electrical power, lamp and fan placement, and protective baffles around the lamps to prevent exposures all require experienced professionals for a safe and effective installation. The CDC does recognize Upper Room UV systems as an option for COVID-19 as well as other infectious diseases like TB.

- **In-Duct UV systems**, which place high-energy UV lamps inside of ventilation supply ductwork. Again, these systems require professional sizing, installation, and maintenance but are identified as being effective by the CDC.

- **In-Room Mobile Systems** which at their very basic are one or more high-energy UV lamps mounted on wheels and intended for disinfection of surfaces in unoccupied rooms. These units are intended for disinfection of pre-cleaned surfaces, not air. The CDC has not identified these systems for use for COVID-19, and there is limited peer-reviewed literature on efficacy for surface disinfection against other pathogenic organisms.

- **UV Lamps in Portable Air Cleaners (PACs)** - Some manufacturers equip their PACs with UV lamps. There’s no peer-reviewed literature indicating that such lamps add anything to the air filtration of the PAC and groups such as the Consumer’s Union (Consumer’s Reports) and the Harvard School of Public Health / University of Colorado Boulder COVID-19 schools working group recommend against spending extra to purchase PACs with UV lamps.

- **UV “Disinfecting Wands”** - Sellers including many on the internet sell “disinfection wands” intended to disinfect surfaces and/or the air. There is no evidence that these wands have value for COVID-19 or other pathogenic organisms.
• Note: Fluorescent tube-type UV lamps typically contain mercury at much higher concentrations than other types of fluorescent tubes. Caution must be taken in handling and using such lamps. Ultraviolet light emitting LEDs have not been identified to provide any type of disinfection.

Resources

San Francisco Department of Public Health (SFDPH)
• www.sfcdcp.org/covid19
• www.sfcdcp.org/COVID-Ventilation

Centers for Disease Control (CDC)
• Operating schools during COVID-19: CDC’s Considerations
• Wildfire Smoke and COVID-19: Frequently Asked Questions and Resources for Air Resource Advisors and Other Environmental Health Professionals
• Ventilation in buildings

AIHA (formerly the American Industrial Hygiene Association)
• Reducing the Risk of COVID-19 Using Engineering Controls

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
• Guidance for Building Operations During the COVID-19 Pandemic
• ASHRAE Resources Available to Address COVID-19 Concerns
• ASHRAE Reopening Schools and Universities C19 Guidance
• Standard 62.1-2019 Ventilation for Acceptable Indoor Air Quality (note – this is a for-fee document. ASHRAE provides free web-access to a read-only version from the linked web page; look for Standard 62.1-2019)

Association of Home Appliance Manufacturers
• Directory of Certified Portable Air Cleaners
• Information Regarding Portable Air Cleaner Testing

Environmental Protection Agency (EPA)
• Ventilation and COVID-19
• Indoor Air in Homes and COVID-19

Harvard University School of Public Health and University Colorado, Boulder School of Engineering
• Harvard-CU Boulder Portable Air Cleaner Calculator for Schools

World Health Organization
• Q&A: Ventilation and air conditioning in public spaces and buildings and COVID-19

Yale University School of Public Health
• Ventilation Key to Reducing Risk