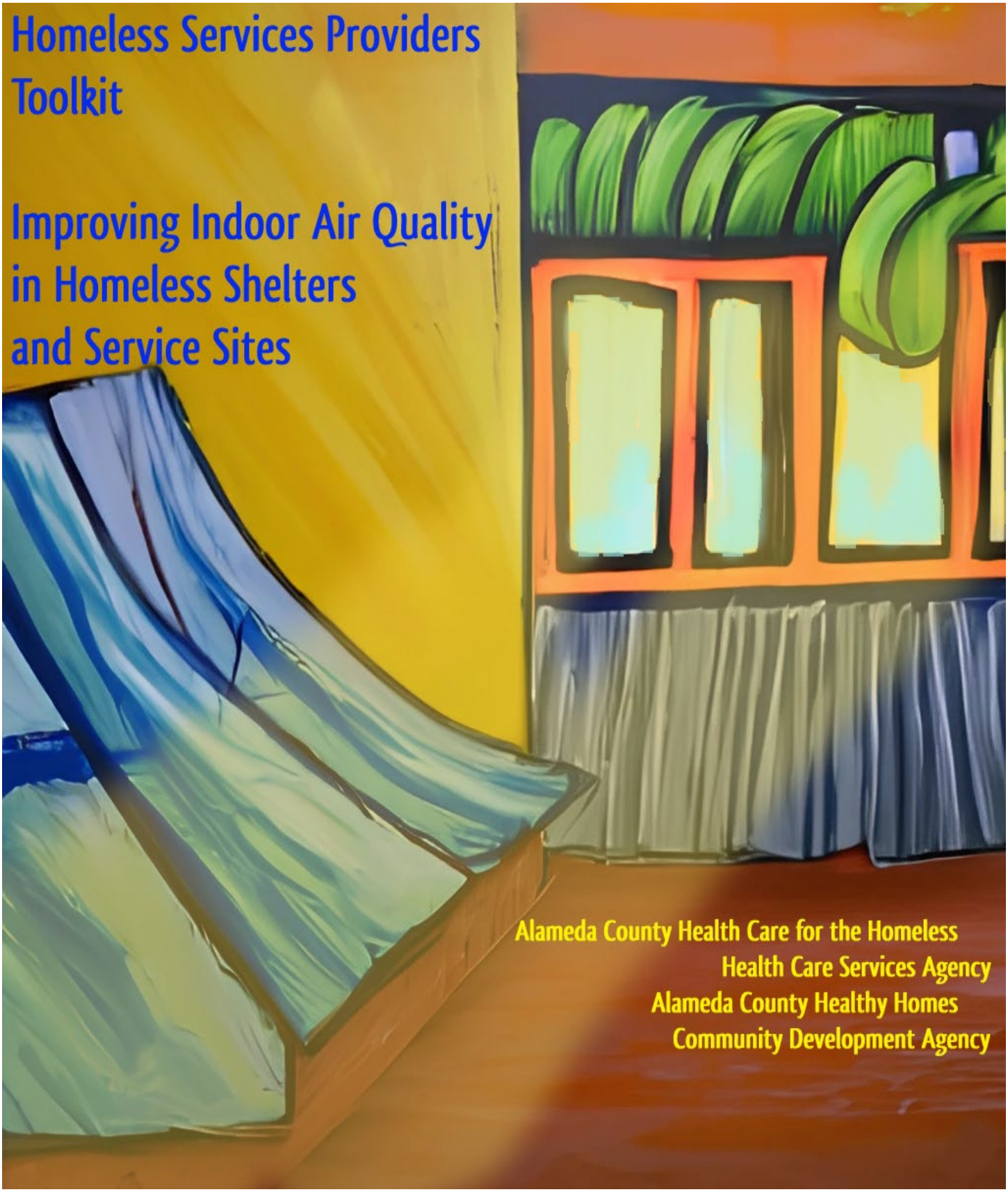
Homeless Services Providers Toolkit

Improving Indoor Air Quality in Homeless Shelters and Service Sites



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Acknowledgements

March 13, 2023 revision

This toolkit was produced February 2023 by the Alameda County Health Care Services Agency's Health Care for the Homeless (ACHCH) program and Alameda County Community Development Agency's Healthy Homes Department.

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Alameda County Health Care for the Homeless program is supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) as part of an award totaling $4,064,392 and other non-federal funding sources. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement, by HRSA, HHS, or the U.S. Government. For more information, please visit www.HRSA.gov.

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Toolkit for Improving Indoor Air Quality in Homeless Shelters and Congregate Settings

Who is this toolkit for?

This toolkit is intended for program managers, frontline staff, volunteers, and others who operate homeless shelters, housing, or services in congregate settings. It includes strategies that can help reduce the spread of airborne diseases such as COVID-19 and asthma triggers in their facilities. This document does not supersede any other mandatory requirements. Workplaces must continue to meet the requirements of Cal/OSHA ETS and all other local and state directives regarding COVID-19. Please review CAL/OSHA requirements in the appendix.

Why does indoor air quality matter?

Improving indoor air quality (IAQ) is a key strategy to reduce the risk of spreading COVID-19 and other airborne respiratory diseases like influenza, colds, and tuberculosis. Adequate ventilation and filtration are important ways to improve IAQ. Increasing ventilation by mixing, filtering, and diluting the air decreases the number of airborne germs that accumulate in shared spaces. This will create a healthier and more protective environment for staff, residents, and visitors.

Improving Indoor Air Quality is just ONE part of creating a healthy environment!

We can work on multiple levels to create environments that reduce the spread of airborne germs among residents and staff in homeless and other congregate settings. Some of the key lessons we have learned during the COVID-19 pandemic will continue to be used now and into the future:

- **Screen for Symptoms:** COVID and disease surveillance: Screening for symptoms, provide isolation, know about emerging illnesses and responding to them.
- **Mask Up:** Wear a mask in congregate settings, especially among people who are coughing.
- **Make Space:** Maintain appropriate physical distancing, reduce closely gathering people together where possible.
- **Test:** Make COVID and other testing supplies free and readily available.
- **Immunize:** Encourage and support vaccinations: Flu, COVID and other immunizations.
- **Get Treated:** Get treated for COVID and other illness rapidly.
- **Program Protocols**: Have program-level protocols to prevent and respond to airborne diseases.
- **Ventilate:** Use healthy strategies that mix, filter, and dilute the air in your facility.

This guide was developed 2/2023 by the Alameda County Health Care for the Homeless program in collaboration with the Alameda County Healthy Homes Department. For updates and information around homeless shelter environmental health resources, go to: https://www.achch.org/environmentalhealth.html.

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Chapter 1

What Are the Key Principles of Healthy Air in a Facility?

A. Remove/Reduce Sources of Possible Airborne Infection

- Screen residents daily for symptoms of COVID/flu and isolate symptomatic persons.
- Encourage everyone to wear a mask. Require masking for those who are coughing/symptomatic.
- Encourage and support vaccination to reduce illness

B. Optimize Ventilation in Your Facility

- Mechanical Ventilation – Optimize your Heating Ventilation and Air Conditioning (HVAC) systems through discussion with your HVAC maintenance staff, including contractors. Ensure your system is balanced, pulls in as much fresh air as possible, runs continuously when people are present, and maintained regularly (including changing filters).
- Natural Ventilation: Open doors and windows to bring fresh air in when an HVAC system is not available
- Remove Dirty Air: Keep clean air flowing in and dirty air flowing out
- Air exchanges per hour: Create the conditions to ensure at least 6 Air Exchanges Per Hour in your facility – sometimes more if needed.

C. Optimize Air Filtration:

- Use portable air cleaners (PACs) with the highest particle removal efficiency such as high efficiency particulate air (HEPA) filters to clean the air that is circulating in a room and reduce possible transmission of airborne illnesses. Use portable air cleaners that are the right size for your space and are approved by the California Air Resources Board. Avoid ionizers or ozone generators
- Filters used in HVAC systems are MERV-13 grade or higher. MERV 13 is necessary because it is far more effective at capturing small respiratory particles than any of lower-rated. Higher rated (greater than 13) will provide only negligible difference at greater costs and are best reserved for healthcare settings.

D. Roles and Responsibilities.

- Ensure that it is everyone's responsibility to contribute to a healthy air environment in your facility through clear procedures.

Chapter 2

Glossary

Airborne Transmission of Infectious Disease: When a person has COVID-19 or other diseases such as the flu, they release small particles that contain viruses into the air when they breathe, cough, talk, sing, or sneeze. Droplets and smaller particles or aerosols initially hover around an infected person's face— that's why keeping a distance can help reduce infection. Aerosols can also move like cigarette smoke and float in the air for hours. People nearby can become infected with COVID-19 by breathing in enough virus particles.

Air Changes per Hour (ACH): approximates how many times per hour the "dirty" air is replaced with "fresh" air in a room. ACH is a calculated value that allows standards, guidelines, and comparisons for ventilation to be made for rooms of different dimensions and which have different ventilation systems. **We recommend getting at least 6 ACH in most shelter facilities**, through a *combination* of HVAC, natural air, and supplemental equipment such as commercial exhaust fans and portable air cleaners (PAC) with HEPA filters.

> ACH = CADR* (cubic feet per minute or cfm) × 60 (minutes per hour) ÷ room volume (cubic feet).
>
> For example, if your PAC has a CADR of 350 and your room volume is 6,000 cubic feet, you will get 3.5 ACH solely through the PAC. You'll need to add more PACs or other approaches to get to 6.0 ACH.

Clean Air Delivery Rate (CADR)*:is a measurement, proven through rigorous testing, of a PAC's ability to remove pollutants. CADR is the most important metric for measuring PAC performance. For COVID-19, look for the CADR rating for smoke. Calculate the CADR for the room you plan to use a PAC with the following equation:

> CADR = (ACH 6 x Room volume 6000 cubic feet)/60 minutes
>
> For example, to achieve a recommended ACH of 6 for a room volume of 6,000 cubic feet, you'll need a PAC with CADR of 600 or more.

Central Air: Normally refers to a building's cooling system. Central air usually utilizes air conditioner that works to distribute cool air through a system of air ducts in a home or building.

CFM: Cubic Feet per Minute. Unit of measurement for CADR. .

Dilution: Dilution means both bringing in fresh air and removing stale air in a room; ventilation that reduces the concentration of potentially infectious particles in a room.

Exhaust: Pushing or pulling excess moisture, stale air, and unwanted odors out of a particular room or area. Exhaust fans are commonly found in restrooms and kitchens. Exhaust fans should be uncovered with nothing blocking them at all times.

Fans: Portable, window, or in-line duct fans are used to create a current of air. Fans help to cool and mix the air. Examples include ceiling fans, table fans, tower fans, stand fans, wall mounted fans, or floor fans.

Filtration: Air filters which trap particles to remove them from the air. Some filters can trap potentially infectious particles; some cannot. HVAC systems have MERV-rated filters in them, and portable air cleaners should contain HEPA filters.

Forced Air: Normally refers to a heating system and usually utilizes a furnace or heat pump and vents to deliver temperature-controlled air into rooms. Forced air systems frequently re-heat and recirculate air back into rooms.

High Efficiency Particulate Air (HEPA) Filter: An air filter that can remove at least 99.97% of dust, pollen, mold, bacteria, virus, and any airborne particles with a size of 0.3 micron (µm). When HEPA filters become clogged, they no longer filter air properly and must be replaced.

HVAC (Heating, Ventilation, and Air Conditioning): HVAC refers to the different technologies used for moving air between indoor and outdoor areas, along with heating and cooling both residential and commercial buildings, usually with ducting, furnaces, and air conditioners.

Minimum Efficiency Reporting Value (MERV): All HVAC systems will have built-in, replaceable air filters. MERV refers to the ability of these air filters to filter and capture particles with 1 being the lowest level of filtration and 20 the highest. Air filters for most business or residential systems have a MERV rating between MERV 5 and 13. MERV 13 filtration is efficient at capturing airborne viruses and should be the target minimum level of filtration.

Negative Pressure/Positive Pressure: The term "negative pressure" is used to indicate that air is flowing *into* a room and *out* through an exhaust route (fan in window, bathroom exhaust fan, etc.) "Positive pressure" would be when air is flowing outward *from* a room into the rest of a facility, which we want to avoid in isolation rooms.

Natural ventilation: Airflow through windows and/or doors.

Outdoor air: Clean air drawn from outside the building either by natural or mechanical ventilation. Also referred to as "fresh air."

Portable Air Cleaners (PACs): A device for cleaning indoor air.

Recirculated Air: Air that has been drawn from the inside of the building, passed through filters, conditioned, and reintroduced into the building.

Room Volume: The quantity of air in a room. Calculate by multiplying length x width x ceiling height in feet. For example: length 30' x width 20' x ceiling height 10' = 6,000 cubic feet.

Chapter 3

How to Assess Your Facility for Ventilation and Risk of Airborne Transmission

A first step is to assess your building. How you assess a building is going to be different based on your role and responsibilities at the facility:

- Building Owner
- Facility/Maintenance Technician
- Program Funder
- Program Lead/Managers
- Program Frontline Staff
- Program Participants/Residents

Based on these roles, there may be different responsibilities connected to developing and maintaining a safe and healthy indoor air environment:

Program Role	Responsibilities
Building Owner	• Maintain safe/habitable building with adequate electricity, water, ventilation, heat systems. • Invest in upgrades. • Ensure that all systems meet local codes.
Facility/Maintenance Technician	• Inspect and maintain building HVAC system regularly • Maintain adequate mechanical and natural ventilation.
Program Funder	• Confirm that providers ensure healthy environments through appropriate practices, as part of contract deliverables. • Negotiate with building owners for facility upgrades. • Develop and build in funding to pay for facility upgrades.
Program Lead/Managers	• Regularly assess building for habitability. • Submit work request to address maintenance issues. • Communicate desired ACH, outside air intake, system settings, and filter ratings with HVAC/maintenance tech and contractor. • Develop and maintain work procedures and practices to ensure healthy air environments. • Work with funders to identify and pay for facility upgrades.
Program Frontline Staff	• Follow workplace procedures. • Ensure Portable Air Cleaners are operated correctly. • Maintain adequate ventilation according to procedures (open windows, fans, HVAC, filters) Request training and assessment. • Review CO2 monitor. • Report issues or participant feedback to program lead. • Staff with direct contact to infectious persons (RN, etc)
Program participants/residents	• Follow program requirements (masking, distancing) • Raise ventilation issues to staff

Basic Questions to Guide Site Assessment

Your work will be to consider where to focus your attention, to identify the spaces that require adjustments, know the sizes of each room, and determine activities to carry out at your facility.

Establish what assistance you would like: a walk-through inspection, technical assistance, or an evaluation of your facility for program review. You might use the below information:

A. What are the uses of your facility?

a. Where do people congregate/spend time?
b. What rooms are used for what purposes?

B. Map your facility/floorplan – acquire or draw a floor plan of the main rooms, halls of the facility – don't forget to mark windows and doors.

C. Determine size (volume) of key rooms

a. When we talk about airspace for ventilation, we generally think in terms of cubic feet. **Cubic Feet** = Length x width x ceiling height (all in feet).
b. ***Example:*** *Dining/Congregate area of the facility is 30' wide, 40' long and has ceiling height of 10'. The room volume to use in ventilation calculation is 30' x 40' x 10' = 12,000 cubic feet.*

D. Identify High Risk Areas of your Facilities

Which spaces have the most risk of catching COVID and other diseases through the air? Consider the factors that help virus build up in the air and make it more likely someone will breathe in enough virus to get sick. For example:

- Places where people aren't wearing masks
- Crowded spaces, such as common areas – dining rooms or places where people line up for items.
- People spend a long time together (such as sleeping areas, waiting rooms, meeting rooms).
- Small rooms – also with low ceiling height.
- People are breathing hard (exercising) or singing – these activities mean people are expelling more particles or aerosols into the air .

E. Observation

- How does air move through your facility? Consider walking around different spaces with a burning stick of incense -- watch what happens to the smoke trails. Does it linger/settle? Does it move out of the room quickly? Note how quickly and pervasively others can smell the scent.
- You can also use a lightweight (down) feather to trace air currents.
- Where are potential sources of fresh air?
- How hard is your HVAC system blowing? Is it consistent, or automatic based on temperature? Does your HVAC/ventilation system seem to recirculate stale air?
- Attach light pieces of ribbon or tissue to ventilation supply vents to verify how a system is working.

F. What are your facility-based processes for addressing IAQ issues?

a. Maintenance: How often are systems inspected? Cleaned?

b. How are issues or problems addressed?
c. What is the chain of command/reporting/response structure?

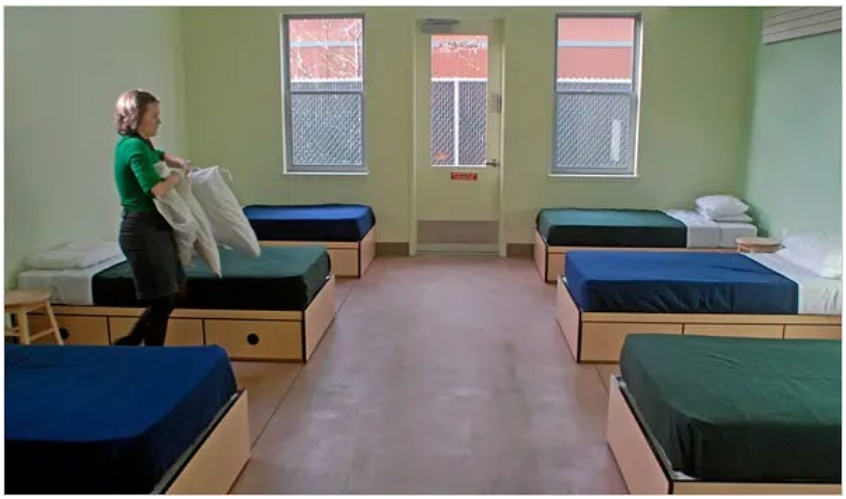
G. Annual Healthy Building Checkup for your building

Make it a policy to regularly carry out a building "checkup." This could be done by a contractor or carried out by staff. Use this checklist and check this helpful resource for HVAC and ventilation systems.

a. Equipment
    i. Yearly maintenance plan for HVAC including regular duct cleaning and replacement of HVAC MERV filters.
    ii. Windows operating, fans in working order and cleaned.
    iii. Replace HEPA filters on Portable Air Cleaners.
    iv. Ensure that portable air cleaners are appropriately located.
b. Identify activities and areas of the building that warrant special attention. Examples:
    i. Schedule building maintenance.
    ii. Clean all rooms, especially those heavily in use.
    iii. Assess places where mildew or mold might grow.
    iv. Clear out junk and items no longer needed.
    v. Determine if room utilization is changing. Establish ways to improve the air quality if you have new gathering/waiting/interview/sleeping rooms?

H. **Program Policies and Procedures:**

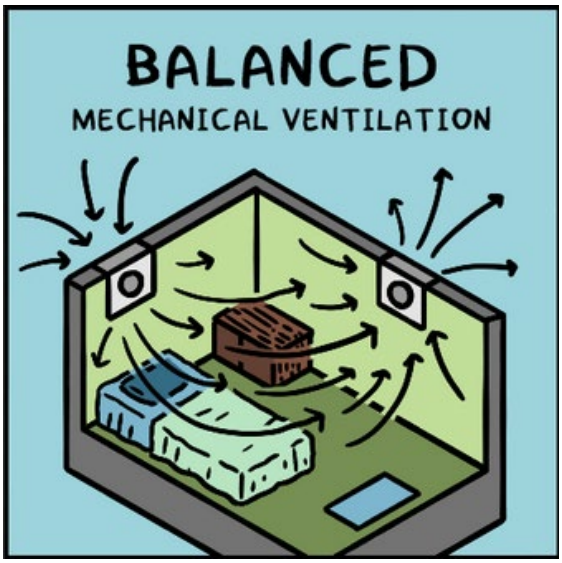
Are staff and residents following program procedures that promote healthy air environments?



Chapter 4

Heating, Ventilation, & Air Condition (HVAC) Systems

Heating, Ventilation, & Air Conditioning (HVAC) Systems are mechanical, built-in ventilation, heating and/or air conditioning systems. HVACs help increase indoor air flow by 1) pulling in outdoor air, 2) mixing the air, and 3) filtering both recirculated and outdoor air entering the system.

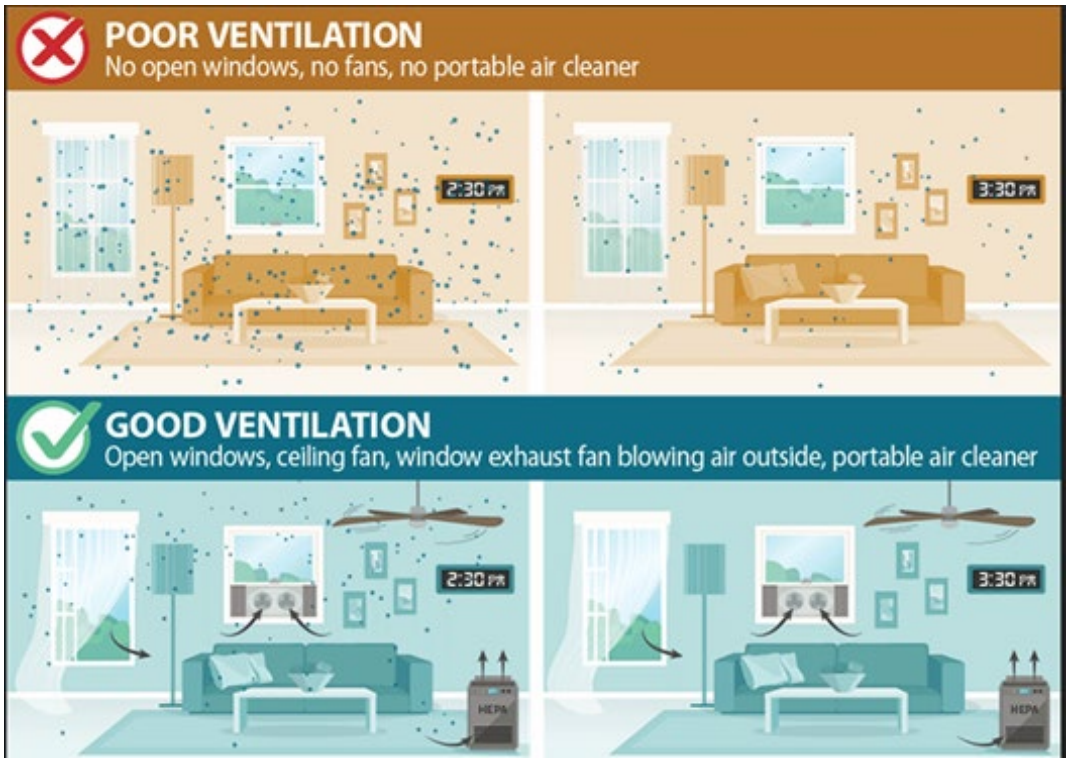


If your building has an HVAC system, follow this checklist:

- ☐ **Note:** It is recommended to consult with a certified HVAC specialist, especially before making any changes to your HVAC system. Follow recommendations by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- ☐ **Make sure your HVAC system generates at least 6 air exchanges per hour (ACH).** This means that the HVAC system is replacing unhealthy air in a room at least 6 times every hour with fresh outdoor air and/or filtered recirculated air. You can maximize Air Exchanges/Hour through a *combination* of HVAC, natural air, and air filtration, depending on the facility and circumstances (outside weather).
- ☐ **Run the HVAC system 24/7 IF the space is always OCCUPIED.** If the space is only occupied for specific hours, run the HVAC system during occupancy and a minimum of 2 hours before and after occupancy of the site. To make sure the system runs continuously, **Disable demand-control ventilation (DCV) controls on the system's thermostat.** DCV adjusts ventilation based on occupancy or temperature**.** Disabling DCV controls will allow the system to operate *continuously* regardless of temperature or occupancy. However, you might not want to do this during a smoke or air quality emergency.
- ☐ **Maintain indoor comfort according to the design temperature and relative humidity.** According to the World Health Organization (WHO) guidance, avoid setting climate control systems to "cold" low temperatures (below 70°F) and "dry" low humidity settings (below 40%). ASHRAE recommends a maximum indoor relative humidity of 60%.
- ☐ **If outdoor air quality is safe (especially important during wildfires), increase the setting on your HVAC system so that it intakes the maximum amount of outdoor air**

possible (aim for 100%). Fully open outdoor air dampers and close recirculation dampers to reduce or eliminate air recirculation.

- ☐ **Generate airflow in the direction of clean air to less-clean air:** In other words, supply filtered/fresh air to spaces with residents, and remove air from spaces with potentially infectious occupants.
- ☐ **Use the highest MERV-rated filter that your HVAC system can handle.** Install at least **MERV-13 filters** as they can capture airborne particles such as COVID-19. Some HVAC systems may not be able to handle a minimum of MERV-13 filters. Consult with a professional before upgrading your filters.
- ☐ **Follow the manufacturer's recommendations and talk with a HVAC specialist to determine how often to change the HVAC filters.** When visually inspecting HVAC filters on your own, always wear a fitted N-95 mask, eye protection, and disposable gloves. Look to see if the filter is thickly coated with dust. That is a good indication that the filter needs to be changed. Frequency may change after events such as wildfires, and for filters located near kitchen exhaust.
- ☐ **Have a HVAC specialist inspect your HVAC systems regularly – at least annually, preferably twice a year, for hot and cold seasons.** Make repairs quickly to prevent serious issues.



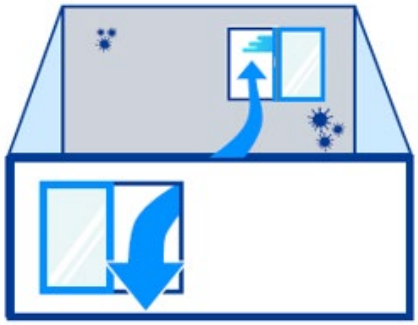
See below for questions to ask a HVAC specialist:

QUESTIONS TO ASK AN HVAC SPECIALIST REGARDING FORCED-AIR SYSTEMS	
What type of filters does my HVAC system currently use?	*Ideally your HVAC will use MERV 13 filters or higher (14, 15, etc.) (3M or Home Depot brand).*
Can my HVAC system handle a MERV 13 filter?	***If yes,*** *discuss upgrading your filters to MERV 13.* ***If no****, ask "What is the maximum pressure drop for the required airflow?" If you can't use MERV 13, get the highest MERV recommended. Discuss upgrading your HVAC system or taking other precautions such as purchasing HEPA air cleaners to remove pollutants indoors.*
How often do I need to change my filters?	*Your HVAC specialist should know how often to replace filters or describe what a dirty filter that needs replacing looks like. Ask for a filter replacement schedule.*
How often should I clean or inspect my HVAC system?	*At a minimum, your system should be inspected, serviced, and cleaned once a year. Inspection schedules will depend on type and use of the building. If a system has both heating and cooling functions, heating should be checked in the fall and air conditioning checked in the spring.*
Does airflow in my building bring clean/fresh air to the most vulnerable people and exhaust potentially infectious air away from people?	*Remember you want to avoid air flowing from isolation rooms or crowded areas into other rooms with people. Your HVAC specialist or another expert, such as an industrial hygienist, can assess the flow of air in a building using special tools. For example, if a facility has an isolation room for sick patients, the specialist can determine if HVAC system changes can prevent air from moving from that space to other areas. Remember that the direction of air flow may change over time, especially if windows are opened sometimes and the building has multiple stories.*
How do I know my HVAC system is working well?	*HVAC specialists assess how well the system is functioning during their regularly scheduled inspections. Ask how the HVAC responds to pressure drop, carbon dioxide, and other indoor air comfort sensor readings.*

This table is from Improving Indoor Air - King County https://kingcounty.gov/depts/health/covid-19/ventilation.aspx

Chapter 5

Natural Ventilation and Dilution

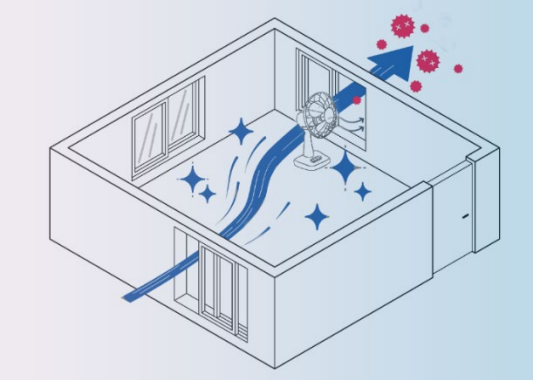


Your facility should work to bring in outside "fresh" air to add to your forced-air HVAC system, increase dilution and increase Air Exchanges per Hour (ACH) in your facility. Remember you can maximize Air Exchanges/Hour through a ***combination*** of HVAC, natural air, and air filtration, depending on the facility and circumstances (number of occupants, and outside weather).

The goal is to improve air exchange as much as possible.

During or after high occupancy, some facilities may run their HVAC system AND open windows at the same time – natural ventilation will increase Air Exchanges/Hour. Depending on your HVAC system and the circumstances, this may be effective, but may also serve to wear your HVAC system. Whether you have an HVAC system or not, you can follow the following tips to increase natural ventilation:

- ☐ **Open windows and doors when it is safe, and weather allows.**
- ☐ **Use fans to increase the effectiveness of open windows.** A commercial exhaust fan is recommended to pull air up and blow air directly outside. Meanwhile, leave other windows and doors open--ideally on the opposite side of the room. This will help promote directional air flow where stale air from inside the room will move outside. Try to position fans so that the air does not flow from one person to another. Avoid using ceiling fans unless it can be adjusted so that the blades are rotating in a direction that draws air up toward the ceiling rather than down onto occupants.



- ☐ **Reduce occupancy and use of areas where outdoor ventilation cannot be increased to the optimal amount.**
- ☐ **Encourage spending more time outside during the day and schedule activities in different, more healthy locations.**

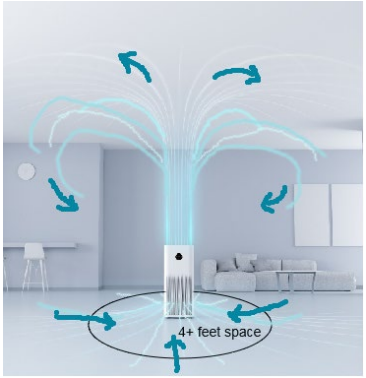
Chapter 6

Portable Air Cleaners (PACs) with High Efficiency Particulate Air (HEPA) filter

Below are the smaller and larger Portable Air Cleaners currently being distributed by ACHCH as part of our BAAQMD Clean Air Centers program. **More info (specific to Alameda County):** https://www.achch.org/environmentalhealth.html	
	
Alen BreatheSmart 75i Air Purifier Top Speed: 350 Cubic Feet Minute (CFM) CADR: 347 Noise: 49dB	**Smarter HEPA Smart Air Blast** Top Speed: 1300 Cubic Feet Minute (CFM) CADR: 1360 Noise: 43 dB

Portable Air Cleaners (PACs) with High Efficiency Particulate Air (HEPA) filters are a designed to remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size as small as 0.3 microns (µm).

A portable air cleaner should be used **constantly and at top speed** to help filter air. A PAC is especially useful in buildings with inadequate HVAC systems, when a building is crowded, during cold or extreme heat, and in air quality/smoke emergencies when it is not feasible to rely on outside natural air for ventilation.



PLACEMENT OF PORTABLE AIR CLEANER
Dirty air is pulled in from below and filtered air pushed out – be sure to have 4' of clear space around PAC.

Checklist for use and maintenance of PACs

- ☐ Place the PAC in areas where people may spend the most time and/or where ventilation is poor. Consider using multiple PACs in high-occupancy rooms.
- ☐ Do not place PACs against walls, near furniture, curtains, or other objects that will block the unit's air intake and outlet.

- ☐ Make sure PAC is placed so the cord is not a tripping hazard or cover the cords.
- ☐ Select the highest speed and leave the cleaner on for long periods of time.
- ☐ Change the HEPA filters and carbon prefilters regularly! Follow the user manual for maintenance needs, information on when to change the filter(s), and safety recommendations to reduce hazards.

Checklist for choosing a PAC

It is important to choose a PAC that is appropriate for the size of the room.

- ☐ **In general, you want to ensure <u>6 Air Changes per Hour (ACH) in most rooms</u>.** ACH is measured by how many times "dirty" air is removed from a room and replaced with "clean" air in an hour. ACH can be achieved through a *combination* of HVAC, natural air, and PAC.
- ☐ **Choose a PAC based on a clean air delivery rate (CADR) that is appropriate for the size of the room.** Purchase HEPA air cleaners that, when added together, create the minimum CADR needed. Multiple units may be placed in the same space to achieve the recommended CADR.

Choose a PAC with a CADR that will produce at least 6 air exchanges per hour (ACH) for the size of your room, using the formula below:

1. **Calculate Room Volume:**
   Room Volume = In cubic feet: length x width x height. Example: A room 20' wide x 30' wide and 10' high has a volume of 6,000 cubic feet.

2. **Determine How Much CADR you need to achieve 6 ACH:**

$$\textbf{Formula}: \frac{desired\ ACH\ x\ Room\ volume(cubic\ feet)}{60} = CADR$$

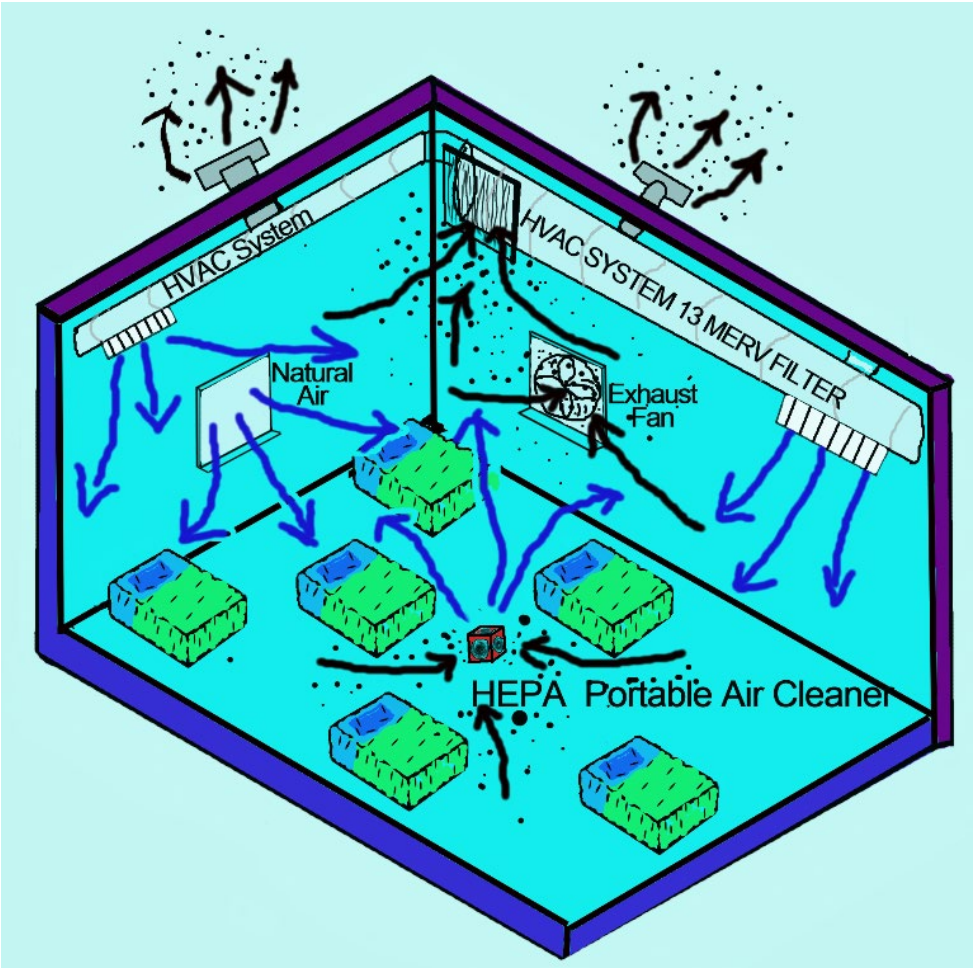
$$\textbf{Example}: \frac{6\ ACH\ x\ 6000\ cubic\ feet}{60} = 600\ CADR$$

   This means that a room with a volume of 6,000 cubic feet will need a PAC that has a CADR of 600 -- OR multiple PACS that have smaller CADRs that will add up to at least 600 -- to achieve 6 ACH.

3. **Know the CADR of your Portable Air Cleaner** (ACHCH's Alen BreatheSmart 75i = 347 CADR; Smarter HEPA Smart Air Blast = 1360 CADR). Check the PAC and find the "smoke" CADR specified by the manufacturer in the product description.

Use an online calculator to calculate your needs:
CADR Calculator: Clean Air Delivery Rate in CFM & m^3/h

- ☐ Having more than one PAC for a given space may be necessary. If possible, **choose a unit with either 1) a higher CADR than needed for the space or 2) use multiple units in the same space to achieve the recommended CADR.** These help to allow for effective filtration using **lower, quieter settings**.
- ☐ Choose a PAC that produces little to no ozone, as certified by the California Air Resources Board (CARB).
- ☐ Avoid PACs with additional technologies or features (e.g., ionization, plasma, UV lights, and oil diffusers).
- ☐ Use at the highest fan setting acceptable for the noise level (usually at or below 60 decibels).

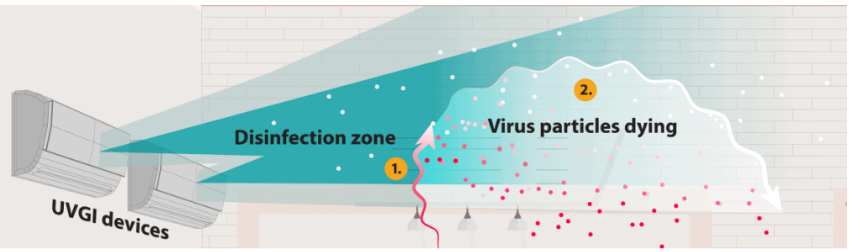


In the above diagram, an functioning HVAC system with MERV 13 filter is filtering air, replacing dirty air (black arrows) with filtered cleaner air (blue); windows are allowing entrance of fresh air, exhaust fan is forcing stale air out, and Portable Air Filter is filtering and cleaning air in the room

Chapter 7

Other strategies/technologies

Upper Room Ultraviolet Germicidal Irradiation (UVGI)



Upper room ultraviolet germicidal irradiation (UVGI) systems can be used to *inactivate* viruses in indoor air in the upper part of the room. **Upper room UVGI systems are especially valuable for spaces where ventilation and air filtration are minimal or nonexistent.** UVGI systems have been recommended to reduce the transmission of tuberculosis and COVID-19. However, these systems are extremely expensive and require ongoing maintenance and engineering for installation.

- **Consult with a UVGI specialist to determine if your space is a good fit for this technology.** More information: https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation/uvgi.html

What Not to do?

Fake Technology: Avoid air filters which are not HEPA filter based. These include many devices that use ionization, plasma, photocatalytic oxidation, hydroxyl radical and other similar approaches. Most of these air cleaners are not effective and some can release harmful by-products. Check the California CARB webpage for certified Portable Air Cleaners and tips.

Plastic Barriers/Room Dividers/ Curtains: Partitions such as plastic barriers, room dividers and curtains can be counter-productive: Partitions may restrict airflow and disrupt ventilation patterns, trapping a greater amount of contaminated air on one side or the other. There is a risk that partitions can trap virus-containing particles on one side or the other. Unless partitions are ceiling to floor, without gaps, they do little to protect people, as particles that contain viruses will find their way through small gaps. If partitions are in use, consider putting portable air filters on both sides of the partition to reduce risk.

Avoid direct airflow between people: You should strategically place and use portable fans, air-conditioning units, and ceiling fans to avoid creating strong airflow from one person directly to another person. This is a particular concern in poorly ventilated environments.

Chapter 8

Carbon Dioxide (CO_2) Sensors

Place CO_2 monitors in congregate spaces to monitor air quality.

CO_2 sensors measure the levels of carbon dioxide (CO_2) that can build up indoors. CO_2 levels rise 1) when a lot of people exhale and 2) "dirty" air is not exiting or inadequate amounts of fresh air are coming in. A monitor will show "green" when CO_2 levels are low, "yellow" when they are rising, and "red" when CO_2 levels are at a more alarming level. These sensors are visible to all room occupants.

The CO_2 level of a room can be **a <u>proxy</u>** for poor ventilation. However, CO_2 levels is NOT a proxy for your risk of transmission of COVID. Also, high CO_2 levels doesn't mean there's not enough air to breathe. There are several factors that affect transmission risk including the number of people infected in each space, proximity to infected people, masks, portable air cleaners, and the other mitigation strategies.

How to use the CO_2 sensors:

- Set up CO_2 level ranges. Low: 450 ppm Medium: 625 ppm High: 800 ppm
- Place CO_2 sensors at a height that is relatively the same as the participants. Avoid areas at or near windows, near an air vent, or within 2 meters of open flame or portable air cleaners.
- When CO_2 levels are rising and reach 800ppm (high), try to reduce CO_2 levels:
    i. Open windows and doors
    ii. Reduce occupancy
    iii. Run HVAC system
    iv. Increase outdoor air supply via HVAC system, if air quality permits
- Reducing CO_2 levels back to acceptable levels means that ventilation/fresher air has improved
- Remember that Portable Air Cleaners will filter out possible infectious particles, however they don't filter CO_2.

Chapter 9

Recommended Policies and Procedures

1. Please evaluate CAL/OSHA COVID-19 Prevention Non-Emergency Regulations, and ensure that your workplace is compliant with these requirements, including ventilation. You can use their COVID-19 Model Written Program as a template for developing workplace protocols.
2. Establish roles and responsibilities for maintaining adequate indoor air quality:
    a. Who is responsible for communicating with staff and residents about the importance of indoor air quality measures? It's important to talk to residents; for example, that:
        - Ventilation might always be running, it might be a bit cooler than usual (due to constantly flowing air), etc
        - There might be additional noise from PACs and ventilation strategies
        - PACs and fans must remain on when people are present
    b. Who is responsible for ensuring the HVAC system is operating continuously, doors/windows are open, portable air cleaners are on, for maintaining equipment logs, setting up regular maintenance, etc.?
3. Maintain up-to-date logs of equipment such as HVAC, portable air cleaners, filters and their maintenance schedules (and where the replacements are stored) -- identify staff roles for making sure these logs are kept up to date.
4. Make sure your HVAC system is regularly maintained by an HVAC professional.
5. Have an HVAC specialist determine the highest Minimum Efficiency Reporting Value or MERV for the filters that your HVAC system can handle. Use a minimum MERV of 13 or higher IF POSSIBLE.
6. Aim for a minimum of 6 ACH (Air Changes per Hour).
7. Run the HVAC system continuously when the building is occupied.
8. Bring in as much outdoor air as possible by opening windows and doors, and setting your HVAC system to bring in 100% outdoor air (if outdoor air quality and weather permits)
9. Be sure to install and maintain Portable Air Cleaners for additional air filtration in crowded or frequently-used locations.
10. Pay special attention to higher risk spaces such as congregate dining and sleeping areas
11. Make sure exhaust fans are operating smoothly, and uncovered, especially in kitchens and bathrooms
12. Room air is changed over at least three times between appointments or groups

Chapter 10

Resources

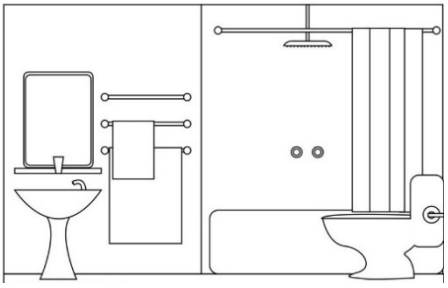
1. CA Interim Guidance for Ventilation, Filtration, and Air Quality in Indoor Environments: https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Interim-Guidance-for-Ventilation-Filtration-and-Air-Quality-in-Indoor-Environments.aspx
2. CAL/OSHA COVID-19 Prevention Non-Emergency Regulations (2023): https://www.dir.ca.gov/dosh/coronavirus/Non_Emergency_Regulations/
3. CAL/OSHA Aerosol Transmitted Diseases Standards (2020) https://www.dir.ca.gov/dosh/dosh_publications/ATD-Guide.pdf
4. Reduce Transmission of COVID-10 Through Air Quality Improvement – A Community Checklist: https://maphealth.ca/wp-content/uploads/Reducing-Transmission-of-COVID-19-Through-Improvements-to-Indoor-Air-Quality_-A-checklist-for-Community-Spaces.pdf
5. CDC Ventilation in Buildings Guidance: https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html
6. CDC Homeless Services Providers Interim Guidance: https://www.cdc.gov/coronavirus/2019-ncov/community/homeless-correctional-settings.html
7. CDC: NIOSH Building Ventilation: https://www.cdc.gov/niosh/topics/indoorenv/buildingventilation.html
8. CDC Interactive Ventilation Tool: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/interactive-ventilation-tool.html
9. American Industrial Hygiene Association: A Ventilation Checklist: https://synergist.aiha.org/202012-a-ventilation-checklist
10. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Guidance for Building Operations During the COVID-19 Pandemic: https://www.ashrae.org/file library/technical resources/ashrae journal/2020journaldocuments/72-74_ieq_schoen.pdf https://www.ashrae.org/technical-resources/filtration-and-disinfection-faq
11. EPA Clean Air in Buildings Challenge toolkit: https://www.epa.gov/indoor-air-quality-iaq/clean-air-buildings-challenge
12. Improving Indoor Air - King County https://kingcounty.gov/depts/health/covid-19/ventilation.aspx
13. Indoor CO2 sensors for COVID-19 risk mitigation: Current guidance and limitations https://ncceh.ca/documents/field-inquiry/indoor-co2-sensors-covid-19-risk-mitigation-current-guidance-and
14. Ventilation Guidance Federation of European Heating, Ventilation and Air Conditioning Associations https://www.rehva.eu/fileadmin/user_upload/REHVA_COVID-19_guidance_document_V4.1_15042021.pdf
15. California Air Resources Board Certified Air Cleaning Devices: https://ww2.arb.ca.gov/list-carb-certified-air-cleaning-devices
16. DIY Box Filters: https://cleanaircrew.org/box-fan-filters/
17. Alameda County Guide for On-Site Isolation & Quarantine for Unlicensed Group Living Settings: https://covid-19.acgov.org/covid19-assets/docs/healthcare-guidance/guide-onsite-iq-unlicensed-group-living-settings-2023.02.07.23.pdf

Appendix 1:

Bathrooms and Kitchens

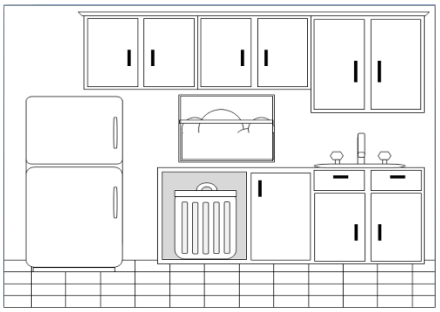
Bathrooms and Kitchens may generate a higher load of airborne particles due to their size and use.

Bathrooms/Restrooms



- **Make sure bathroom exhaust fans are in good shape and exhaust directly to the outside.** If needed, work with an HVAC professional to install new fans or upgrade existing fans. If smells linger in the bathroom, or escape out into the hallway, this may be one indication that your bathroom exhaust fan is not working well.
- **Keep doors closed and leave exhaust fans on 24/7**
- **Leave bathroom windows open**
- **Stagger and schedule use of bathrooms by different groups of users**. Let bathrooms ventilate between uses to reduce airborne particles.
- **Make sure the toilets have lids and advise people to shut toilet lids before flushing.** In rare instances, COVID-19 virus found in feces may become airborne when flushed.
- **Encourage wearing masks when using the bathroom** (except when showering or performing hygiene activities).
- **Portable Air Cleaners are not appropriate for use in bathrooms.** They will clog up due to the moisture in the air.

Kitchen and dining spaces



- **Ensure face coverings are worn in the kitchen.**
- **Run kitchen exhaust hood/fans on high, any time the kitchen is in use.** Check that exhaust fans are working. Exhaust fans reduce cooking fumes that contribute to poor air quality and aid in pulling in outdoor air.

Appendix 2:

Congregate and Dining Areas:

Dining rooms and other congregate gathering areas require special attention because the more people there are in a space and the longer, they occupy that space, the higher the risk of transmission of airborne diseases is. When there are many people using a specific room or area, try to achieve extra air ventilation and cleaning – we recommend trying to achieve **8 air changes per hour** during times of high use. Below is a summary of what to consider practicing:

- Install a CO2 monitor where it is visible. The CO2 sensor is an indicator for how well ventilation is in a space
- Try and reduce or arrange capacity to always allow for at least six feet of physical distancing for all activities. This can be difficult for dining; but try to allow for at least 3 feet of distance between individuals who are dining.
- Consider staggering mealtimes, only allowing a certain amount of people at a time
- Encourage or require residents and staff to wear face masks whenever possible, before and after eating and drinking.
- Work to "clean out the air" in the hours before and after mealtimes by increasing fresh air flow through doors and windows and fans.
- Do not use ceiling fans. If you do, only operate them in reverse flow direction to draw air upwards.
- Consider adding extra Portable Air Cleaners to a dining and congregate room during times of high occupancy in order to increase air filtration.

Appendix 3:

Dormitory and Sleeping Areas

Sleeping rooms can range from single rooms to shared dorms sleeping twenty or more persons at night. These rooms pose the highest risk for transmission of airborne illness and need a careful review to create better air conditions. However, bedrooms and dorms also need to be comfortable (noise, temperature) so people can sleep in a healthy way.

A goal is to try to get to **eight (8) Air Changes per Hour** when sleeping rooms are in use. This can be done through the techniques below and outlined throughout this toolkit:

- Ensure your HVAC systems are operating correctly, and continuously. The HVAC system should continue to run through the night.
- Use natural ventilation: Open windows or doors bringing fresh air in where possible, depending on weather and safety conditions
- If the cold makes it difficult to leave windows open, consider safely securing window fans or box fans (sealing the perimeter around the box fan) to blow air out of selected windows.
- Increase air filtration using PACs
    - Some PACs can be noisy at the maximum level. If it is too noisy, try using multiple PACs at a lower fan setting so that maximum filtration is still achieved at a lower noise level.
- Consider creating separate isolation/quarantine spaces/rooms for residents with symptoms or who are new to the program.
- If residents are sharing sleeping spaces, make sure that resident's faces are at least six feet apart. Align beds so that clients can sleep head-to-toe instead of head-to-head.
- If a facility is carpeted, use a HEPA vacuum to reduce the amount of virus and asthma-causing dander/dust particles that may re-enter the air while vacuuming.

Appendix 4:

Meeting Rooms & Interview Rooms

Many homeless services facilities have meeting rooms for group sessions, or one-on-one offices where case management or counseling services may occur. These rooms might be considered higher-risk spaces most in need of ventilation, filtration, and to be used only when appropriate (ex: confidentiality, privacy). It is recommended to try and get to eight (8) Air Changes per Hour in meeting and interview rooms.

To ensure a healthier air space for meeting and interview rooms, consider how long staff and clients spend time together, and how many people are in the meeting room. Also, assess the size of each room. Ceiling height makes a difference too, as a small space will allow virus to build up faster in the air. Encourage clients and staff to wear masks. Source control (wearing a well-fitted KN95 mask) will help protect everyone from becoming infected.

Additional tips:

- **Open windows to the outside** (weather and safety permitting).
- **Open office doors:** Keep doors to smaller offices always open.
- **Portable Air Cleaners:** Consider always running appropriately sized Portable Air Cleaners.
- **Clear the air between appointments or groups:** For example, if a group of people is using a dining or meeting room, change all the air in the room over at least three times before the next group comes in. If you change the air over three times, at least 95 per cent of contaminated air will be replaced with outside and/or filtered air by the time the next group arrives.

  Room air can be cleared using HVAC systems, portable air cleaners, open windows/doors, or some combination of the three. Even if you have an optimized HVAC system, opening windows and running portable air cleaners on their highest settings can increase the room's total air changes per hour and reduce the wait time between groups.

  If you have a PAC or an HVAC system that can provide 6 Air Changes/Hour, it will require 30 minutes to remove 95% of the stale air out of a room.

- **If you don't know the room's total air changes per hour, use all your tools (HVAC system, portable air cleaner, open windows/doors) to air the room out for as long as possible between uses.**

Appendix 5:

Shelter-Based Isolation & Quarantine Capacity for Symptomatic or Sick Individuals

The Omicron COVID surge in January to February 2022 resulted in overwhelming numbers of infections and rapid transmission of COVID within shelters across the country. The surge overwhelmed most local homeless Isolation/Quarantine (I/Q) hotel systems, and many shelter programs nationally were forced to "fend for themselves" to create emergency isolation/quarantine spaces at their facilities.

As funding for COVID I/Q programs declines so does I&Q hotel capacity, and shelter providers will need to develop capacity to shelter symptomatic persons on site. This includes planning for "surge" events where they might have to provide COVID-19 isolation and quarantine in place. Please refer also to this guide to on-site Isolation & Quarantine for unlicensed group living settings.

On-Site Care for Symptomatic Residents

- Please closely review the California Department of Public Health Infection Control Guidance for Clients in Congregate Shelters, Including Shelters for People Experiencing Homelessness
- If the client has severe symptoms, arrange for immediate medical assessment and care. Call 911 if you see a person with the following:
    - Trouble breathing
    - Persistent pain or pressure in chest
    - Pale, gray, or blue-colored skin, lips, or nail beds, depending on skin tone
    - New confusion or disorientation
- Require the use of N95 masks by staff, volunteers, and residents during times of high levels of COVID transmission.
- Follow the CDC cleaning and disinfection guidelines for community facilities if someone is sick.
- Clients with symptoms of COVID-19 should be moved to a private area of the facility for isolation and be tested as soon as possible.
- If a resident or household infected COVID-19 can isolate/quarantine in their own private room, they may do so and have meals delivered, and use either a private bath, or a shared bath that is well-ventilated between uses.
- If infected clients cannot be housed separately, they may be isolated as a cohort in a large and well-ventilated on- or off-site space with a separate bathroom and a door that can be closed to other clients.
- Symptomatic clients who have not been diagnosed with COVID-19 should not be placed with clients who test positive for COVID-19.
- Symptomatic clients should wear a surgical mask, KN/N95 mask if available, or other well-fitted mask with multiple layers.

- Shared items used by infected/symptomatic clients should be cleaned thoroughly before use by another client.

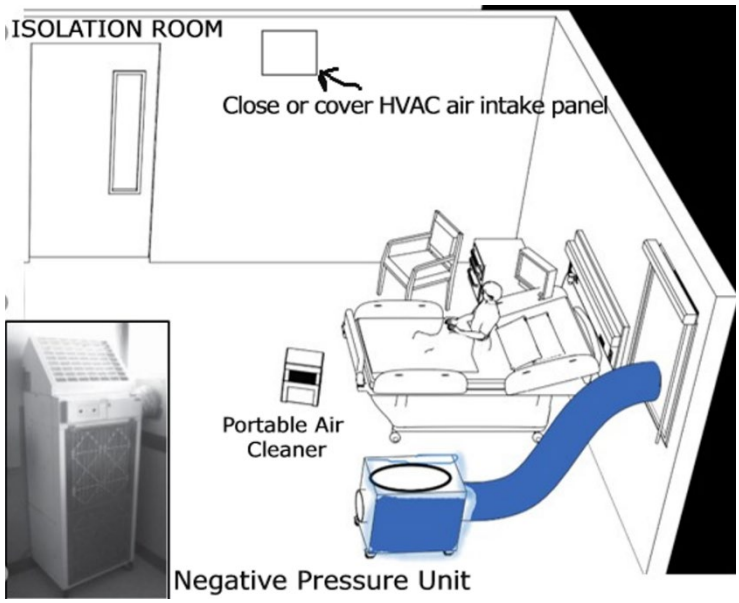
On-Site Isolation and Quarantine Rooms

Programs are also learning to develop their own ongoing capacity to provide isolation and/or quarantine rooms/quarters on-site. Shelter-based I&Q rooms can:

- Enable newly arrived residents to live temporarily in a separate cohort until it is clear they are not infectious.
- Provide special rooms where symptomatic individuals can quarantine away from the general population.
- Enable COVID-positive persons to safely isolate-in-place during their contagious isolation period.

Following are some basic guidelines in development of isolation/quarantine rooms in homeless shelter programs.

- Specify certain rooms or dorms to be used as I&Q rooms.
- Make every effort to draw in ample quantities of fresh air from windows. Be aware that using window fans to draw in additional fresh air may result in "positive pressure" that pushes infectious air into other common spaces. It's best to exhaust air from isolation rooms into the outside where it won't be recirculated..
- Isolation room airflow should bring clean air into an I/Q room with potentially infectious individuals and must exhaust "dirty air" outside the building -- and not into spaces shared by healthy individuals.
- The term "negative pressure" is used to indicate that the air is flowing into the room and out through an exhaust route (fan in window, bathroom exhaust fan, etc.) "Positive pressure" would be when the air is flowing from the room into the rest of the building, which we want to avoid in isolation rooms.
- This may mean using window fans to also force or exhaust "dirty air" out of a room.
- Keep potentially infectious dirty air from re-entering shared spaces by using a **negative air machine**. A negative air machine is a fan and HEPA filter with a known airflow rate and has its own duct that filters and exhausts dirty air out the window– this ensures that no dirty air is reused. If the space has its own bathroom, turn on the exhaust fan. This air is exhausted directly outside.



- Place HEPA Portable Air Cleaners in isolation rooms, and ensure that you can achieve **at least 8 Air Exchanges per Hour (ACH):**
    - 8 x length (feet) x width (feet) x height (feet) / 60 = minimum CFM for Portable Air Cleaner (HEPA)
- Check with a HVAC specialist to create additional ventilation and filtration such as higher MERV filter rating in I&Q rooms, and to ensure "dirty" air is not flowing from the I&Q room to other habited spaces.

On-Site Isolation and Quarantine Guidance and Recommendations during a COVID Surge:

Advanced Level: Read the Alameda County Health Care for the Homeless/ACPHD working document "Guidance and Recommendations for Providing Shelter Based Isolation and Quarantine for Individuals Experiencing Homelessness in Alameda County" for examples of on-site isolation and quarantine during a COVID surge.

Appendix 6:

Air Quality Emergencies

During certain emergencies, such as wildfires and power outages, normal procedures for maintaining adequate indoor air quality may change substantially:

Wildfires

The smoke and other particles generated from wildfires have the potential to reach indoor environments. In times of dangerously high levels of smoke or particulate matter, outside air isn't "fresh air" anymore. You will want to reduce the amount of outside air entering a facility. To reduce the number of harmful particles indoors, follow some of these tips:

Air Quality Index Levels of Health Concern	Recommendations
Good (0 to 50)	No health impacts expected
Moderate (51 to 100)	Unusually sensitive people should consider limiting prolonged outdoor exertion
Unhealthy for Sensitive Groups (101 to 150)	Stay indoors if you: • are pregnant • are an infant or young child • are elderly • have asthma or other breathing issues or heart disease • are bothered by smoke
Unhealthy (151 to 200)	Everyone, especially children, should limit prolonged outdoor activities.
Very Unhealthy (201 to 300)	Everyone, especially children, should limit prolonged outdoor activities.

1. Plan ahead: Have volunteers construct **Corsi-Rosenthal air cleaners** ahead of time to have ready.
2. Monitor your local air quality
   a. Regional/Bay Area Wide: *Air Now (EPA)*
   b. California Wildfires Smoke Forecasts: California Smoke Information
3. Keep at-risk residents indoors, especially those with breathing or heart conditions.
4. Consider creating a "clean room" especially for high-risk residents.
5. Keep outside windows and doors closed & sealed as much as possible.
6. Adjust your HVAC system so that outside air does not enter. Recirculate filtered air.
7. Use as many Portable Air Cleaners with HEPA filter as possible to filter recirculating air. Use those extra Corsi-Rosenthal air cleaners.
8. Wear N95 masks when outside.

Power outages

Power outages that last for more than a few hours have the potential to affect indoor air quality. Specifically, there is a risk of carbon monoxide poisoning if portable generators powered by fuel are not used correctly. To avoid that, follow the tips provided by the Environmental Protection Agency (EPA) outlined here:

1. Do not use portable generators powered by fuel indoors. Use them outside and at least 20 feet from building. Consider using portable generators powered by batteries or solar power.
2. Install CO_2 monitors indoors