

#### **Ventilation At School Sites**

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1)elcome

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#### Goals for Today's Meeting

- Overview of <u>Guidance for Ventilation and Air Filtration Systems</u> (COVID-19)
- The role that preventative measures such as wearing a face mask play in reducing risk of COVID-19 transmission.
- Understanding how outdoor air exchange is critical in increasing indoor air quality
- Understanding what must be done to upgrade and maintain HVAC systems
- Walk through scenarios for unique situations



#### **Components of Indoor Air Quality**





#### Wear a Face Covering



#### **Face Coverings**

- Face coverings can help reduce the risk of transmission in an indoor environment by as much as 50%.
- Face coverings must be worn by everyone when in shared indoor spaces.
- Face shields may be used in addition to face coverings, but not in lieu of them.



#### **Physical Distancing**

- A typical 1,000 square foot classroom with 30 students would require a minimum of 450 CFM at a rate of 15 CFM per student.
- With the new social distancing guidelines reducing occupancy will increase the ventilation per person.

#### **Cautions in this Approach:**

- Is the system currently providing the design Outside Air (OSA)?
- Are all ventilation components functioning to continually provide the design OSA?
- Does the design OSA match the actual occupancy?



#### Increase Outdoor Air Exchange



#### Outdoor Air Exchange

- Increase outdoor air circulation by opening doors and windows when safe to do so.
- If your building has a mechanical ventilation system, evaluate the impact of open windows/doors.
- Create an airflow plan to maximize the movement of indoor air to the outside.

#### How Outdoor Air Enters Buildings

Outdoor Air





#### **Portable Fans**

- Consider using portable fans to maximize the effectiveness of open windows and doors.
- Position fans to point away from occupants and to avoid blowing air from one person to another (which may spread the virus).
- Position fans near doors and windows and use them to draw or blow air from the inside of the facility to the outside, instead of blowing air inside.

### AIRFLOW DIRECTION

COUNTER-CLOCKWISE / FORWARD This direction is used during the warmer months of the year as it makes a room feel cooler. By blowing the air downward, you will be able to feel a draft directly from the ceiling fan.



#### CLOCKWISE / REVERSE

This direction is used during the cooler months as it makes a room feel warmer by creating a draft that pushes warm air to the ceiling, along the walls and into the room. You will not feel much of a breeze in this setting.







## Upgrade Existing Mechanical Ventilation System



#### AB 841 (Ting)

AB 841 (Ting) -Energy: Transportation Electrification: Energy Efficiency Programs: School Energy Efficiency Stimulus Program

(1) The School Reopening Ventilations and Energy Efficiency Verification and Repair Program to provide grants to local educational agencies (defined as school districts, county offices of education, and charter schools) to reopen schools with functional ventilation systems that are tested, adjusted, and, if necessary or cost effective, repaired, upgraded or replaced to increase efficiency and performance, and ...

#### Upgrades to Your HVAC

- Upgrade the efficiency of your system's mechanical filter to the highest efficiency compatible with the air handling system and currently installed filter rack; ideally, filter efficiency should be MERV 13 or greater.
- Increase the percentage of outdoor air through the HVAC system, readjusting or overriding recirculation ("economizer") dampers.
- Keep the humidity between 40% and 60%.

Table 1. MERV Ratings*							
MERV Rating	Average Particle Size Efficiency (PSE), microns – % Removal			Typical Controlled Contaminant or Material Sources (ASHRAE 52.2)	Typical Building Applications		
	0.3-1.0	1.0-3.0	3.0-10.0				
1-4			<20%	> 10 Microns Textile Fibers Dust Mites, Dust, Pollen	Window AC units Common Residential Minimal Filtration		
5			20-35	3.0 to 10.0 Microns Cement Dust, Mold Spores, Dusting Aids Industrial Workplace Better Residential Commercial	Industrial Workplace		
8			>70		Commercial		
9	14	<50	>85	1.0 to 3.0 Microns Legionella, Some Auto Emissions, Humidifier Dust	Hospital Laboratories		
12		>80	>90		Superior Residential		
13	<75	>90	>90	0.3 to 1.0 Microns Bacteria, Droplet Nuclei	Superior Commercial Smoking Lounge		
16	>95	>95	>90	(sneeze), Most Tobacco Smoke, Insecticide Dust	Hospital Care General Surgery		
17**	<u>≥</u> 99.97			<0.3 Microns	Clean Rooms		
18**		≥ 99.99		(HEPA/ULPA filters)	Carcinogenic & Radioactive Matle		
19, 20**		≥ 99.999		Fine Combustion Smoke	Orthopedic Surgery		

\* Adapted from EPA 2009; originally from ANSI/ASHRAE Standard 52.2-2007. Not all levels are shown.

\*\* Not part of the official ASHRAE Standard 52.2 test, but added by ASHRAE for comparison purposes.

#### MERV 8



#### MERV 13

VS.

WARRAN STATE
DXQXQX
DX(DX(DX)

#### Pressure Drops of Tested Filters

Brand	Depth	MERV	∆P at 295 ft/min
Nordic Pure	2"	13	0.25
FilterBuy	2" 2"	13 13	0.13 0.17
Flanders			
3M	1"	13	0.18
Nordic Pure	1"	13	0.37
FilterBuy	1"	13	0.22
Flanders	1"	13	0.30
3M	1"	7	0.22
Nordic Pure	1"	7	0.23
Flanders	1"	7	0.20

Source: California Energy Commission

Source: UC Davis

#### Updates to Your HVAC

- Run air handling systems for longer hours, including before and after the space is occupied.
- Seal edges of the filter to limit bypass.
- Disable demand-control ventilation (DCV) controls that reduce air supply based on temperature or occupancy, and maintain systems that increase fresh air supply.



#### Updates to Your HVAC

- Increase total airflow supply to occupied spaces, if possible.
- Ensure ongoing, routine maintenance of the HVAC system in all areas, but especially smaller rooms with exhaust fans, such as restrooms, laundry rooms, and kitchens.
- Monitor the effectiveness of the system by measuring ventilation directly, when possible. If possible, review specific components such as air flow rates (outdoor air vs. recirculated air) and the pressure differences between higher risk areas (e.g., bathrooms and dining areas) and other areas.



#### Verification of Ventilation & Filtration Performance

- Verify through commissioning and testing.
- Work with an expert to evaluate building systems, ventilation, filtration, and air cleaning.
- Measure carbon dioxide (CO2) as a proxy for ventilation
- Monitor the effectiveness of the system by measuring ventilation directly, when possible. Building owners/operators can review specific components such as air flow rates (outdoor air vs. recirculated air) and the pressure differences between higher risk areas (e.g., bathrooms and dining areas) and other areas.



#### Install Portable Air Cleaners



#### **Portable Air Cleaners**

- Commonly called HEPA filters
- Consider using these filters where there is no or poor outdoor ventilation, no HVAC system, or when upgrades to the HVAC system are not feasible
- Recommended to purchase units which are certified for ozone emissions and electrical safety by the California Air Resources Board (CARB)
- Avoid <u>ozone-producing air cleaners</u>

### **Types of Air Cleaners**

- •Mechanical Air Cleaners •HEPA
- •Electronic Air Cleaners
  - •Ozone generators- NEVER USE
  - •Electrostatic precipitators (ESPs)
  - Ionizers
- •Gas and chemical vapor removal
  - Activated charcoal
  - •Photocatalytic oxidation (PCO) air cleaners
  - •Ultraviolet germicidal irradiation (UVGI)

Before purchasing any portable air cleaner, be sure to check <u>CARB's list of certified</u> <u>air cleaners</u>.

#### How to Choose Portable Air Cleaners

- Choose a device that is the correct size for the room where it will be used.
- One metric to consider is the clean air delivery rate (CADR). The CADR reflects both the amount of air that a unit can process per unit time and the particle removal efficiency of the filter.
- Rule of thumb for every 250 square feet of space, a CADR of about 100 cfm is desirable.
- It may be beneficial to have several units that meet the target CADR values rather than a single larger unit.



#### How to Choose Portable Air Cleaners

- In larger spaces, industrial-sized supplemental ventilation and filtration units are available and should be considered.
- Room airflow patterns and the distribution of people in the room should be considered when deciding on placement that maximizes source control and prevents airflow from crossing people.
- Since air cleaners should be operated while people are present, it may be important to compare different models to find one that does not generate disruptive noise.





### **Other Considerations**

- Consult with an HVAC expert
- Locate indoor activities in large rooms that have high ceilings.
   Control the number of people entering the room.
- Set ceiling fans to pull air upward, rather than pushing it downward toward room occupants.
- Note that ventilation and air filtration measures also apply to enclosed tents. Open tent sides as much as possible to increase outdoor air exchange, and note that tents with two or more closed sides qualify as indoor spaces under the County's Health Officer Order.



# Ultraviolet Germicidal Irradiation (UVGI)

- Consider, where appropriate, installing appropriately designed and deployed ultraviolet germicidal irradiation (UVGI) to deactivate airborne virus particles. (Guidance)
- Potential Issues with UVGI in schools include:
  - a. cost
  - b. maintenance
  - c. potential health concerns of inadvertent UV exposure





#### Scenario 1

Each classroom has its own heating /cooling system. What is the most economical way to improve indoor air quality?

- Test and repair existing ventilation systems. All commercial buildings, includings schools, were required to have a ventilation system. Economizer failure is the most common problem.
- 2. Install a MERV 13 filter or the best filter your HVAC system can handle. They are installed the same way as the MERV 8 filter you may currently be using. Installation can be done by your internal maintenance staff.
- Install a CO2 monitor to validate that the space is being vented while occupied.
- 4. Keep the HVAC fan running at all times. That is how most systems continually bring in fresh air once the temperature set point has been achieved.

#### Scenario 2

The weather is changing and it's getting cold. What adjustments should I make to maintain air quality during the winter?

Once testing and repair of existing 1. ventilation systems are complete, make sure to keep the fan running when classrooms are occupied. Most automated systems do not allow fans to be turned off, but many older systems without EMS do not always keep the fan running. On the thermostat, set the fan function to the ON position to keep fans running at all times. That is how most systems continually bring in fresh air once the temperature set point has been achieved.

2. Install MERV 13 filters.

#### Scenario 3

Our classrooms have inoperable windows and doors that open to an interior hallway. How can we maintain air quality?

- 1. Test and repair existing ventilation systems. All commercial buildings, includings schools, were required to have a ventilation system.
- Install a MERV 13 filter or the best filter your HVAC system can handle.
- 3. Install a CO2 monitor to validate the space is being vented while occupied.
- 4. Keep the HVAC fan running at all times. That is how most systems continually bring in fresh air once the temperature set point has been achieved.



#### **ASHRAE Checklists for Reopening Schools**

• Includes guidance on summer/winter settings, ventilating other spaces such as nurse's office, and other topics.



#### **Other Resources**

- <u>Santa Clara County Guidance for Ventilation and Air</u> <u>Filtration Systems</u> (10/20)
- <u>School Ventilation for COVID 19</u> (White Paper Collaborative for High Performance Schools)
- <u>Schools for Health, Risk Reduction Strategies for Reopening</u> <u>Schools</u>
- <u>Video on roof top system maintenance, including replacing</u> <u>the filter</u>

### Emergency Operations Schools Unit

## got questions?

- What guidance applies?
- My school is struggling to implement . . .
- Are there resources for . . .



EOC Schools Unit M - F • 8 a.m. - 5 p.m. <u>schools@eoc.sccgov.org</u> (408) 808-7812

#### **Connect with SCCOE**

Social Media



- <u>Ed Bulletin (e-newsletter)</u>
- <u>www.sccoe.org</u>

### Connect with SCCPHD

## Social Media

## For COVID-19 information: <u>www.sccgov.org/covid19</u>

For school-specific guidance: <a href="https://www.sccgov.org/sites/covid19/Pages/school-guidance.aspx">https://www.sccgov.org/sites/covid19/Pages/school-guidance.aspx</a>

