COVID-19
Ventilation and Plumbing Issues

Property and Construction Services
Archdiocese of Seattle
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Building conditions can deteriorate when occupancy drops
Systems are turned off or reduced use with fewer people

Occupant health may be at risk in buildings
stagnant air, poor IAQ
stagnant water
harmful microorganisms brought in or growing
Outline

Terminology
Steps to Control the Indoor Environment
Indoor Air
Water
Personal and Material Safety
Support from Archdiocese
Terminology

ASHRAE  American Society of Heating, Refrigeration and Air conditioning Engineers
- design and operating standards for HVAC
  indoor air temperature range, humidity
  outdoor air (ventilation)
- Building Codes
- CDC and EPA defer to ASHRAE guidance

Bio-burden  microorganisms contaminating the air, water, or surface
Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Air purifier</td>
<td>portable device removes contaminants from air</td>
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<td></td>
<td>aka: portable air cleaner</td>
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<tr>
<td>CADR</td>
<td>clean air delivery rate (air purifier) cu ft/ min</td>
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<tr>
<td>HEPA</td>
<td>highly efficient particulate air (filter type)</td>
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<tr>
<td>MERV rating</td>
<td>minimum efficiency reporting value (filter rating standards for mfrs.)</td>
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**Terminology**

- **IAQ**: Indoor Air Quality
- **Total chlorine**: chlorine in water, mg/l (same as chlorine residual)
- **Free chlorine**: chlorine available to disinfect water, mg/l
- **Mg/l**: concentration in milligrams per liter (= ppm)
Steps to control the environment and reduce health risks

**Indoor Air-** per ASHRAE*

Ventilation – increase outside air
Filtration – improve entrapment, higher MERV rating
Relative humidity – 40 to 60%
Ultraviolet Germicidal Irradiation (UVGI) to reduce virus
Other (emerging technologies but not proven, safety?)

(*for reduction of bioburden, including coronavirus)
Steps to control the environment and reduce health risks

**Water**
flushing to ensure fresh* water
Cleaning of aerators
traps filled to block sewer gas
Managing building occupants/use

*free chlorine kills most infectious microorganisms
Indoor Air

Reducing the virus, reduce risk of infection

Source Control: fewer occupants, masks, less airborne droplets

Source Removal: filtration, exhaust, treatment (e.g. UVGI)

Dilution: increase outside air (fresh air, ventilation air)
Indoor Air

Reducing the virus, reduce risk of infection

Virus transfer from one room to another via ducting?
   Very unlikely – time, dehydration of droplet, filter, etc.

Virus transfer from one person to another in same room?
   More likely (prevent with spacing, mask etc.)

ASHRAE: proper use of HVAC reduces infection risk
Indoor Air

Reducing the virus reduces risk of infection

• Continue operating the HVAC systems
• HVAC will support a healthier environment
• Maintain the usual comfort levels if possible
• Keep outside air at 20% minimum even in winter
• 4 to 6 air changes/hour
Indoor Air

Reducing the virus reduces risk of infection

Parishes and Schools:
• Buildings without mechanical ventilation
• Buildings with mechanical ventilation (forced air in ducts)
Indoor Air

Buildings without mechanical ventilation

• Assessment by an HVAC professional (mechanical engineer)
• Open doors and windows
• Consider air flow direction vs. occupants
• Run exhaust fans, kitchen hoods, etc.
• Avoid short circuiting the air flow from a window
Indoor Air

Buildings without mechanical ventilation

- Consider air purifiers (HEPA filters)
- Example 158 CADR, 250 sq. ft. room
- $170 at Fred Meyer
- Place in nurse/sick room
- Offices with visitors
- Derate 50%: this suits 125 sq. ft.
Indoor Air

Buildings **without** mechanical ventilation

- Air purifier with HEPA filter
- Example: CADR 100 for 155 sq. ft.
- $155 \times 9 \text{ ft. ceiling/CADR} = 14 \text{ minutes}$
- 14 minutes to filter room air once
- About 4 air changes per hour
Indoor Air

Buildings with mechanical ventilation

- Assessment by an HVAC professional (mechanical engineer)
- Total supply air = return air + outside air
- Return Air filter increase to MERV 13
- MERV 8 is common
- MERV 13 more restrictive: motor overload? duct pressure?
- Verify filter edges are sealed – mind the gaps!
Indoor Air

Buildings with mechanical ventilation

- Override controls to allow more outside air
- Unit ventilator filters may also be retrofitted
- Open windows/doors may assist
- If building is pressurized air will exit an open window
Indoor Air
Buildings with mechanical ventilation

- Supply air near floor, remove air near ceiling
- Avoid air flow path that “short circuits” to exhaust
- Avoid strong air currents among occupants
- Filter change frequency could increase
- Consider air purifiers (HEPA filters)

Note:
Outside air “demand” controls use a sensor to keep CO2 below 1000 ppm by adjusting outside air
Indoor Air

All Buildings

• Assessment by an HVAC professional (mechanical engineer)
• Use daily air purge cycles pre- and post-occupancy, 2 hrs ea.
• Run local exhaust fans during occupied times
• Air purifiers/HEPA in stagnant rooms with occupants
• Air changes/hour: 4 to 6 including air purifiers/ventilation
Indoor Air

All Buildings

• If possible keep relative humidity in the 40-60% range
• More energy will be consumed with increased outside air
• Moisture buildup is a concern, can cause mold
• Building pressurization may be affected, door closing etc.

• Distancing, Masks, Handwashing, Cleaning still needed!
Water

• Domestic water system primary concern
• Inhalation of microorganisms in aerosols
• Coronavirus in the water? Not the main concern
Water

• Stagnant from lack of use, disinfectant weakens with time
• Temperature and iron rich inside piping, tanks, etc.
• Biofilm growth, promotes growth of microorganisms
• Higher levels of metals leach into water (e.g. lead)
Water

- Some “bugs” are infectious and cause diseases (e.g. Legionella)
- Hot water piping may cool even if it recirculates
- P-traps and u-traps can dry out
- Other systems using water: HVAC, heating
Plumbing

• Familiarize with all piping systems, components
• Identify: recirculating systems
• Identify: domestic hot & cold, heating
• Find as-built drawings or schematics
Water

Plumbing

• Determine fixtures closest to incoming service
• Fixtures furthest from the service
• Create a written/graphical flushing plan
• Safety training – see OSHA worker safety for Legionella control

Traps

• Flush all p-traps, u-traps, floor drains – no sewer gas!
Water

Flushing steps

• Removal of aerators in advance
• Flush main hot and cold water lines with toilets and janitor sinks
• Handwash sinks, drinking fountains, appliances
Water

Flushing steps

• Use hot water to flush janitor sinks and showers
• Empty and clean icemakers in kitchen, athletic training rooms, etc.
• Run all dishwashers for at least 2 cycles
• Flush emergency eyewash and emergency showers
Water

Flushing steps
• Health room and locker room showers
• Repeat every ___?? weeks – follow local public school district
• Flush even if the building has been partially occupied
• Fixture that sprays? wear PPE to protect from aerosols
Water

Water quality parameters

• Fresh water has free chlorine  0.2 mg/l minimum
• 1.8 at treatment,  0.8 in public mains average
• 1.5- 0.5 arrive at the service – how long to drop to 0.2?
• Days not weeks, longer for copper than iron pipe
• Utility staff, public school practices for fresh water
Water

Water temperature

- Water temperature to prevent bacterial growth:
- Hot water above 122 F, cold water below 74 F
- Set water heaters at 140F but with mixing valve
- Prevent scalding – 120F for 5 minutes can burn
Personal and Material Safety

- Wear gloves when cleaning water system components
- Water system flushing may generate aerosols
- Remove shower heads and aerators first
- Weakened immune system? avoid this task OR
- Wear gloves and half-face air-purifying respirator with N95 cartridges (per CDC)
Personal and Material Safety

- Potential viral contamination during air filter changes
- Wear appropriate PPE
- Disinfect air filters before removal
- Filters wrap in plastic, put in garbage
- Wash or sanitize hands

(per ASHRAE, see below)
Personal and Material Safety

HVAC System Maintenance and Filter Replacement during the COVID-19 Pandemic:

- For HVAC systems suspected to be contaminated with SARS-CoV-2, it is not necessary to suspend HVAC system maintenance, including filter changes but additional safety precautions are warranted.
- The risks associated with handling filters contaminated with coronaviruses in ventilation systems under field-use conditions have not been evaluated.
- Workers performing maintenance and/or replacing filters on any ventilation system with the potential for viral contamination should wear appropriate personal protective equipment (PPE).
- When feasible, filters can be disinfected with a 10% bleach solution or another appropriate disinfectant, approved for use against SARS-CoV-2, before removal. Filters (disinfected or not) can be bagged and disposed of in regular trash, or applicable local health and safety standards.
- When maintenance tasks are completed, maintenance personnel should immediately wash their hands with soap and water or use an alcohol-based hand sanitizer.
Support from Property and Construction

The Archdiocese does not have specific requirements but defers to the local jurisdictions, state (Dept. of Health), and Federal (CDC and EPA) guidance.

Review of guidance and prioritizing, summarizing and disseminating

Referrals to professionals

Large volume of guidance available, sometimes with differing opinions

Guidance is changing

Adherence to ASHRAE approved components, systems, standards

All staff are encouraged to review the details of referred guidance