Building HVAC Operations and COVID-19

May 14, 2020

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Today's Presenters

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Lincoln Property Company

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Project Engineer, Servidyne

A WORKPLACE EVOLUTION

How LPC West is responding to COVID-19 and leading the way toward a healthy and resilient work environment.

LPCWEST
LINCOLN PROPERTY COMPANY

COMPANY OVERVIEW

8,550
Employees nationwide

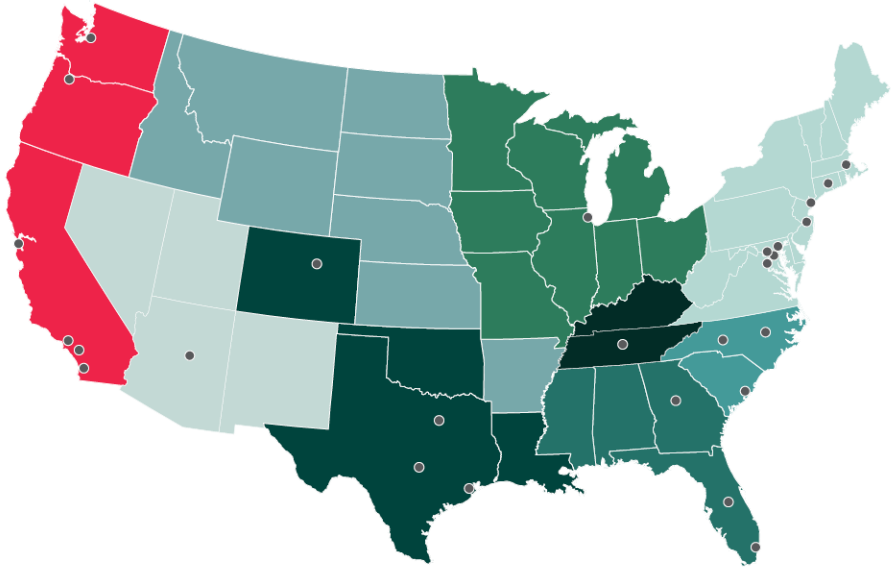
433m
SF under leasing and/or management

$94b
In managed assets

$22b
Acquisitions over 15 years

55+
Years of experience in commercial development

Top 10
Developer Ranking in the United States



OUR PEOPLE AND OUR CLIENTS ARE EVERYTHING. WE MAXIMIZE OUR POTENTIAL BY INSTILLING A CULTURE OF SUPPORT, HUMILITY, AND INTEGRITY.

THROUGH OUR PEOPLE'S EFFORTS, LPC WEST PROVIDES VISIONARY REAL ESTATE SERVICES WHICH CREATES VALUE FOR OUR CLIENTS.

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PREPARING FOR WORKFORCE RE-ENTRY

OCCUPANT EDUCATION/PHYSICAL DISTANCING:

- Informational signage has been posted in common area restrooms regarding the effectiveness of handwashing in preventing the spread of disease.
- Physical distancing has been encouraged among building staff and service providers.
- Signage is being installed to remind tenants and visitors to maintain safe distances in high traffic or confined areas such as lobbies, parking, amenity areas and elevator cabs.
- Where possible, building inspections and non-urgent repairs will occur at times when offices are least crowded. Staff will wear personal protective equipment (PPE), as appropriate.

JANITORIAL EFFORTS:

- Janitorial scopes have been adjusted to focus on the cleaning and disinfection of high touch surfaces using products that meet the US EPA's criteria for use against SARS-CoV-2, the virus that causes COVID-19.
- As supplies are available, we will place additional alcohol-based (70%) hand sanitizer stations in common areas which contain high touch surfaces such as elevator buttons and door handles.

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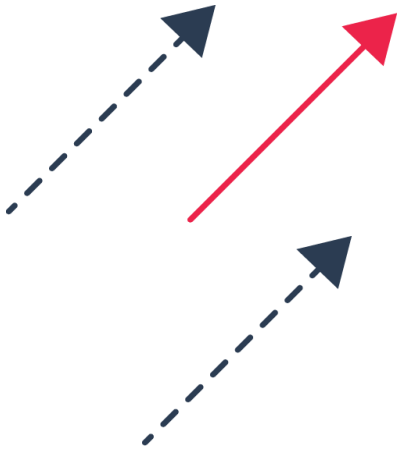
PREPARING FOR WORKFORCE RE-ENTRY



REDUCING TOUCH POINTS:

- Where not already present, the installation of automated faucets, soap dispensers, and towel dispensers is being considered.
- Propping open interior doors is under consideration where it is not a security or safety risk.

TRAVEL PATHS:

- To limit person-to-person contact in common areas we taking the following steps:
- Limiting the capacity of the elevator cabs where possible.
- Providing open access to stairwells (where possible) for those who want to avoid elevators.
- In accordance with CDC guidance, outside air introduction was maximized where possible to provide additional dilution ventilation. Outside air introduction will continue to be maximized when it is not detrimental to the building or to occupant comfort.

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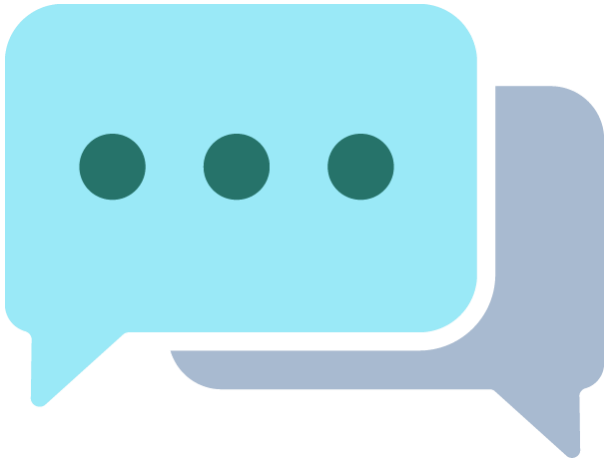
EASY STEPS YOU CAN TAKE TO MAKE YOUR OFFICE SAFE



COMMUNICATION WITH EMPLOYEES

- Install signage with CDC Guidelines in break rooms, tenant bathrooms, conference rooms, etc.
- Develop physical distancing guidelines and travel patterns within your space.
- Consider staggering breaks so employees are not in break room areas at the same time.
- Consider 6’ markings on floors to encourage and remind occupants of physical distancing.

BREAK ROOM / CONFERENCE AREAS

- Remove some tables and seating to encourage physical distancing.
- Frequently clean and disinfect refrigerator, microwave, coffee stations, etc.
- Supply additional soap and paper towels in break rooms.
- Have disinfectant wipes available to disinfect tables, handles, and equipment before and after each use.

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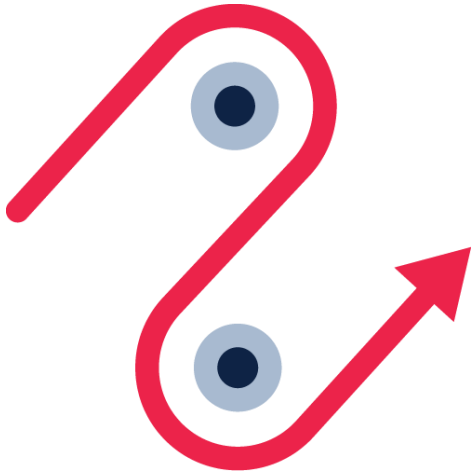
EASY STEPS YOU CAN TAKE TO MAKE YOUR OFFICE SAFE



WORKSTATIONS

- Do not share headsets, phones, keyboards, mouse, or workstations
- Disinfect workstations before and after each use.
- Consider the installation of shields between desks that face each other.
- Consider new seating arrangements – more space between employees.

OPERATIONS

- Communicate with management about any additional cleaning requests.
- Consider limiting conference room capacity.
- Have disinfectant wipes available for workstations, copier, supply room, vending areas, file rooms, etc.
- Wipes available to disinfect tables, handles, and equipment before and after each use.

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STAY SAFE!

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May 14, 2020

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Agenda

- Introduction
- Virus Transmission
- HVAC Measures
  - Fundamental
  - Higher-Risk Situations
- Myth Busters
- Preparing for Re-Entry
- Summary and Conclusions
- Resource Materials

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Introduction

Disclaimer

- Presentation and remarks do not represent the views or policies of the U.S. EPA
- Sources:
  - ASHRAE, CDC, WHO, OSHA
  - Survey of studies and reports available online
- Guidelines are for office buildings, not healthcare facilities.
- Recommended measures must be applied to individual buildings based on specific circumstances.
- Risks can be reduced, but not eliminated.
- Current industry knowledge is as of 5/13/2020.

Virus Transmission

Perspective on Priorities

- Physical Distancing
- Respiratory Etiquette
- Hand Hygiene
- Surface Cleaning and Disinfection
- Face Masks
- Engineering Controls (aka HVAC)

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Some Science

- How big is the virus?
  - The virus itself: 0.125 Microns
  - Respiratory droplets: > 5 Microns
- How far can the virus travel in respiratory droplets?
  - Typically 3 to 6 feet
  - Further if propelled
- How long can the virus survive in the air?
  - Several hours
- How long can the virus survive on surfaces?
  - Several days
- How do temperature and humidity affect the virus?
  - Studies are inconclusive, but 40-60% indoor rH seems best

Transmission

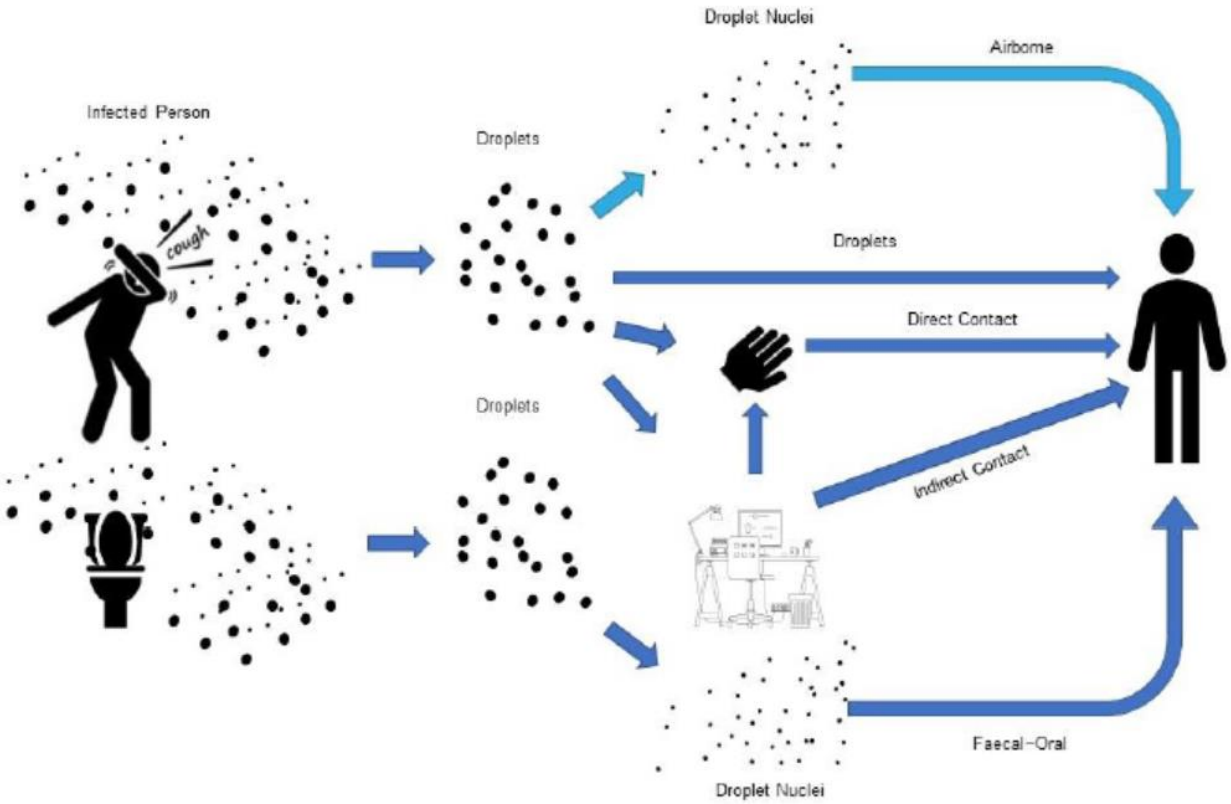

Figure 1. WHO reported exposure mechanisms of COVID-19 SARS-CoV-2 droplets (dark blue colour). Light blue colour: airborne mechanism that is known from SARS-CoV-1 and other flu, currently there is no reported evidence specifically for SARS-CoV-2 (figure: courtesy Francesco Franchimon).

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HVAC Transmission?

AIR CONDITIONING APPEARS TO SPREAD CORONAVIRUS—BUT OPENING WINDOWS COULD STOP IT, STUDIES SUGGEST

COVID-19: Can air-conditioning systems aid in spreading coronavirus?

Cruise ship AC systems could promote rapid coronavirus spread, prof says

The Use of Air Con Could Further Spread the Coronavirus: 10 Cases Suggest

Coronavirus could be spread by air-conditioning and may be more contagious than previously thought, scientists believe after finding traces of the virus in hospital air-duct

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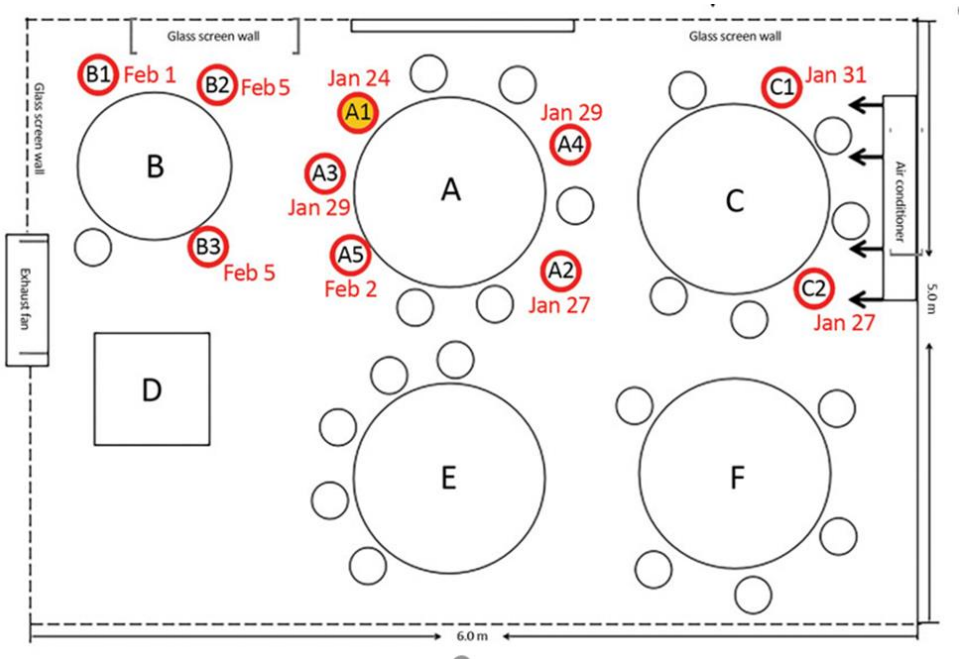
HVAC Transmission?

The Case of the Restaurant Dining Room



The study authors said, "The key factor was the direction of the airflow."

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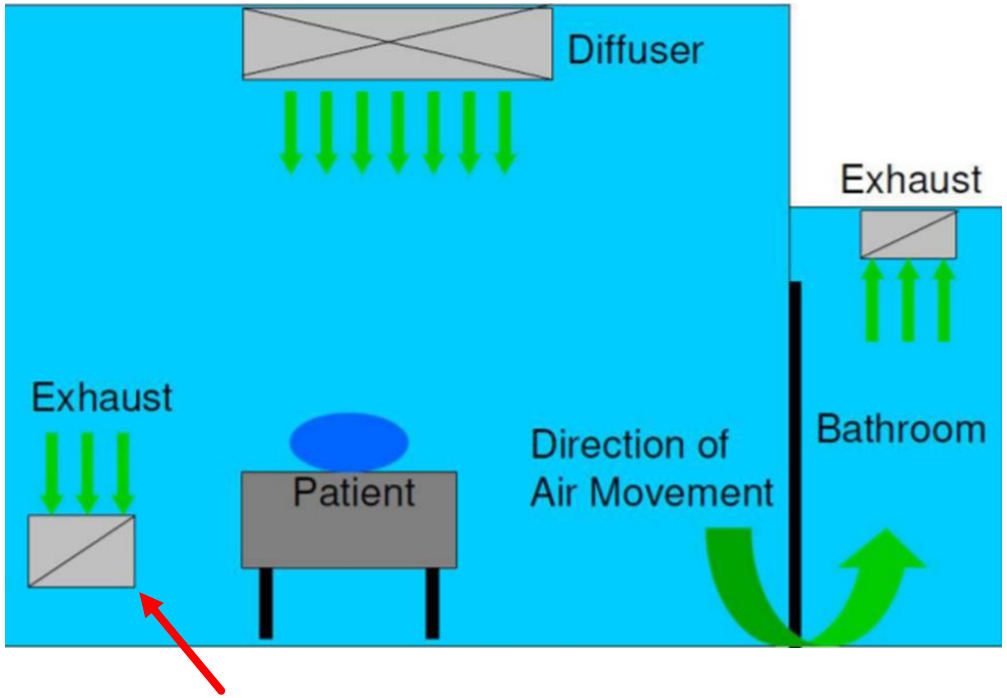
HVAC Transmission?

The Case of the Hospital Ductwork



Virus found at both Univ of Nebraska and Singapore hospitals on exhaust register.

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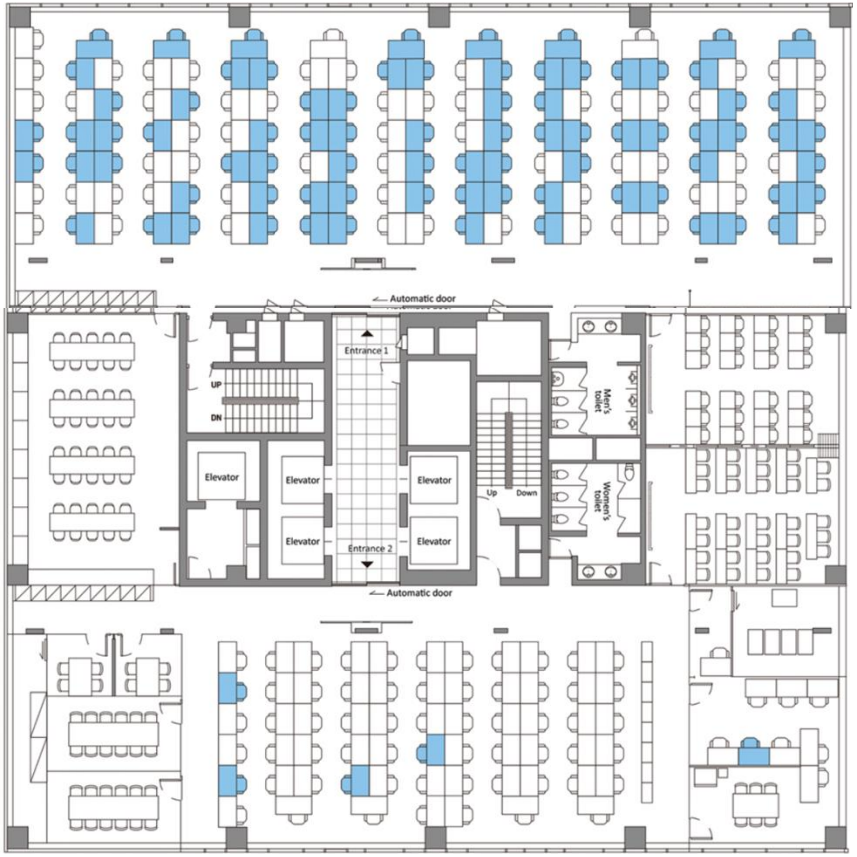
HVAC Transmission?

The Case of the Crowded Call Center



Floor	People	Cases
1-10	706	3
11	216	94
Total	922	97

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HVAC Measures

ASHRAE Position

Statement on airborne transmission of SARS-CoV-2

Transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, **can reduce airborne exposures.**

HVAC systems can play a positive role in occupant health

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HVAC Measure Categories

- Fundamental Measures
  - Dilution
  - Filtration
- Additional Measures for Higher-Risk Situations
  - Vulnerable populations
  - Space types with high-density occupancy

ASHRAE Commercial Building Guidance:
https://www.ashrae.org/technical-resources/commercial

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Dilution

- ASHRAE Guidance:
  - Increase outdoor air ventilation (disable demand-controlled ventilation and open outdoor air dampers to 100% as indoor and outdoor conditions permit).
- Specific Measures:
  - Enable OA economizer mode
  - Increase minimum OA
  - Disable DCV
  - Check airflow to large office areas, conference rooms
  - Maintain proper pressurization
    - Building pressure
    - Toilet exhaust
  - Consider early startup and delayed shutdown (2 hours)

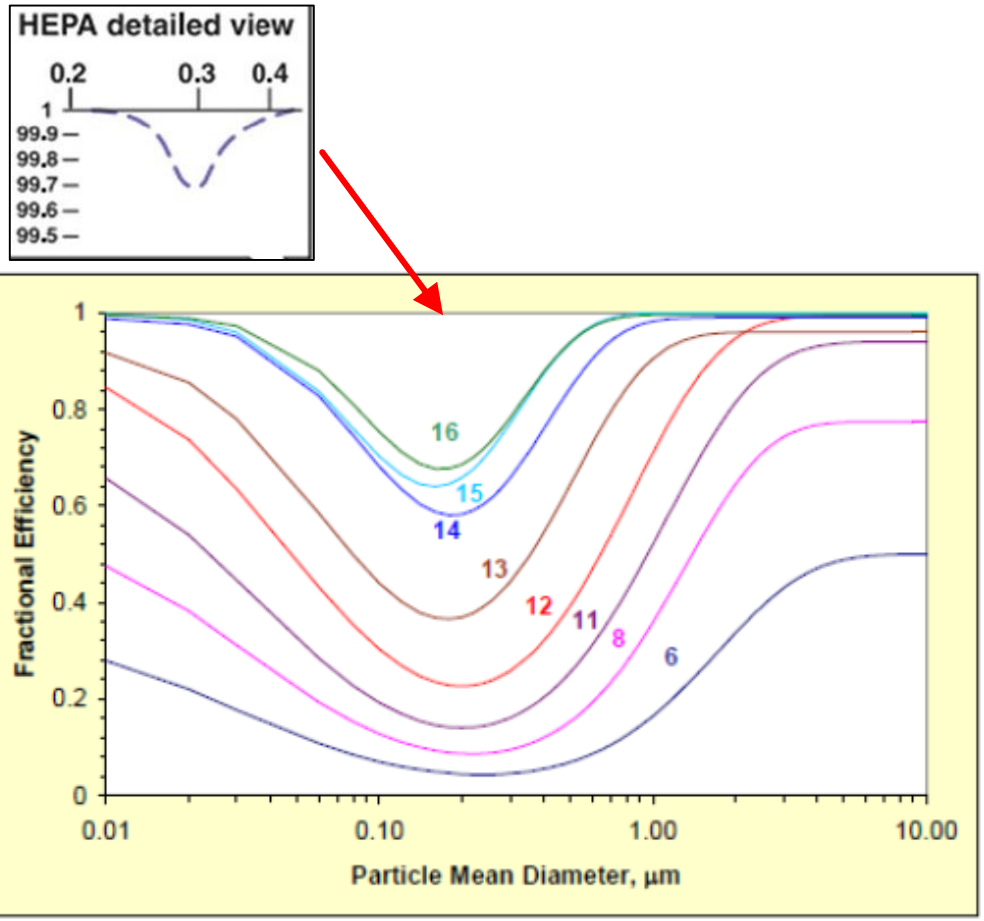
Dilution

Example Space	Air Changes per Hour	Time per Air Change
Hospital Operating Room	20	3 min
Hospital Infection Isolation Room	12	5 min
Office w/OA Economizer	5	12 min
Office w/ASHRAE Min OA	0.5	2 hr
Office w/ASHRAE Min OA @ 50% CFM	0.25	4 hr

Filtration

- ASHRAE Guidance:
  - Improve central air and other HVAC filtration to MERV-13 or the highest level achievable.
- Specific Measures:
  - Upgrade to MERV-13 filters in AHUs where possible
    - MERV-8 is current commercial minimum standard
  - Seal filters to minimize bypass air

Filter Efficiency



Filter Type	Rated 0.3-1.0 Micron Capture
HEPA	>99%
MERV 14	75%
MERV 13	50%
MERV 8	---

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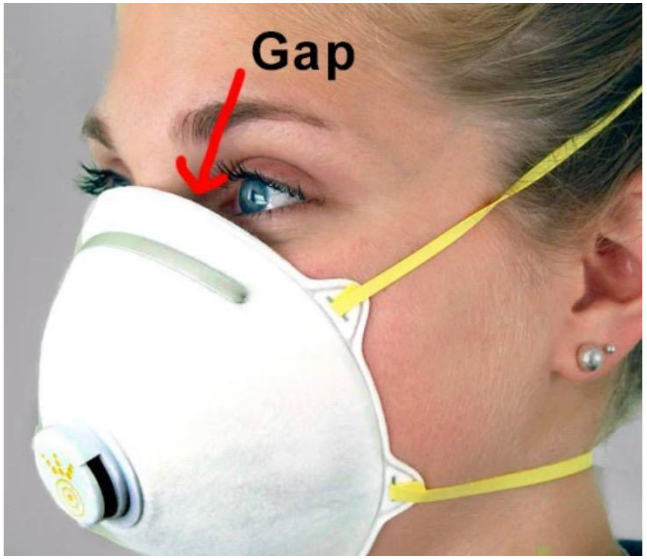
Filter Bypass



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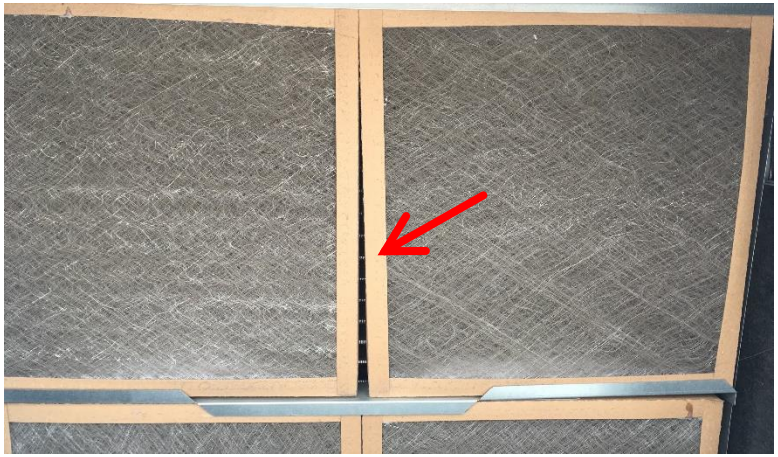
Filter Bypass



- ASHRAE Research: filter gap smaller than ½-inch
  - 20% to 25% of air bypasses the filters
  - MERV-15 drops to MERV-8

Additional Measures for Higher-Risk Situations

- ASHRAE Emergency Response Guidance:
  - To enhance dilution and filtration, keep systems running longer hours (24/7 if possible).
  - Add portable room air cleaners with HEPA or high-MERV filters.
  - Add upper room and/or portable UVGI devices in high-density spaces (waiting rooms, prisons, shelters).
  - Bypass energy recovery ventilation systems that may leak contaminated exhaust back into the supply air.

ASHRAE Position Document on Infectious Aerosols:
https://www.ashrae.org/file%20library/about/position%20documents/pd_infectiousaerosols_2020.pdf

Myth Busters

Myth Busters

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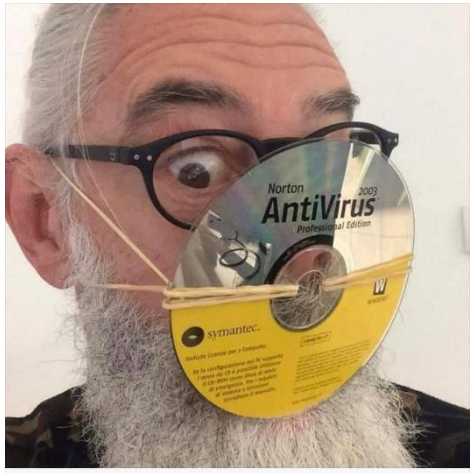
Myth Busters



- Don't shut down HVAC systems
- Don't apply healthcare solutions without careful consideration, such as HEPA filters, UVGI, vaporized H2O2
- Don't rely on unproven technologies or ones that may worsen conditions, such as ozone generation and reactive ionization products
- Don't expect a "magic bullet" solution
- **Don't ignore fundamental IAQ measures of ventilation and filtration**

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ASHRAE Guide on Filtration and Disinfection

https://www.ashrae.org/file%20library/technical%20resources/covid-19/ashrae-filtration_disinfection-c19-guidance.pdf

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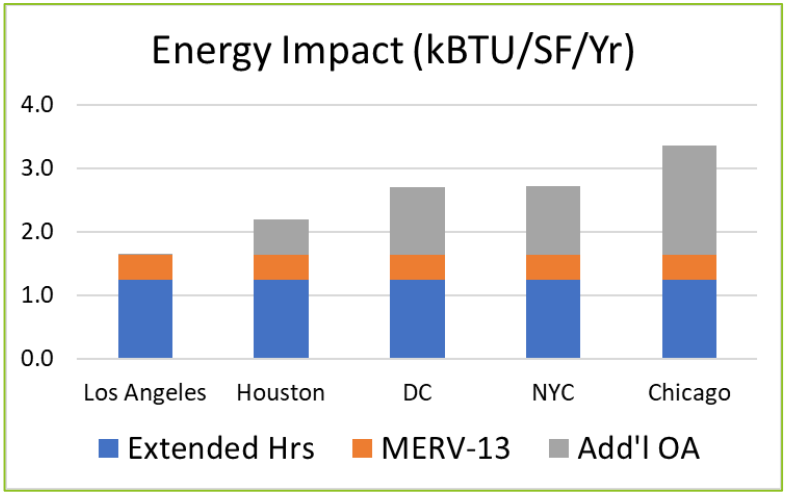
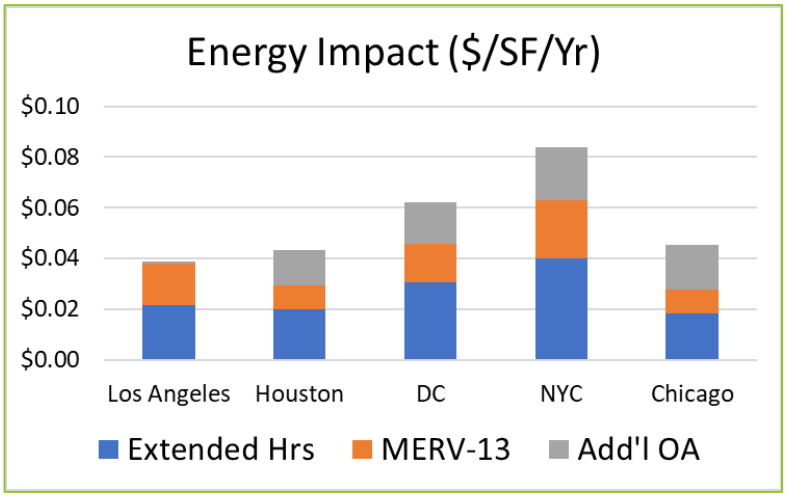
Preparing for Re-Entry

Energy Impact





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Reduced Occupancy Operation

- Minimum System Performance
  - Maintain humidity control with maximum indoor dewpoint temperature of 60 °F for mold prevention

Indoor Temp:	75 °F	80 °F	85 °F
Max Indoor rH:	60%	50%	45%

  - Ensure proper building pressurization and toilet exhaust
  - Continue cooling tower water treatment with appropriate adjustments
  - Maintain domestic hot water minimum temperature of 140 °F with periodic circulation to minimize Legionella risk
  - Keep P and U traps filled with water

ASHRAE Checklist for HVAC Operation during Building Shutdown:
https://www.ashrae.org/technical-resources/frequently-asked-questions-faq

Preparing for Re-Entry

- Perform air and water system flush-outs prior to re-entry:
  - Run OA and exhaust for minimum of 4 hours
  - Flush all water systems
- Check filter condition and replace as necessary
- Return all control setbacks and setpoints to normal operating mode
- Confirm proper HVAC system operating parameters
  - Space temperatures and humidity levels
  - Air and water system temperatures and pressures
  - Building pressurization and exhaust
- Review HVAC measures implemented previously and assess continuing needs

ASHRAE Checklist for Returning the HVAC System to Normal Operation:
https://www.ashrae.org/technical-resources/frequently-asked-questions-faq

Summary and Conclusions

Summary and Conclusions

- Keep in mind that HVAC is not the primary virus transmission mechanism but can help prevent the spread of COVID-19
- Focus on fundamental measures
  - Provide more outside air to increase air change rates
  - Use higher efficiency filters that are sealed properly, to remove contaminants effectively
  - Maintain comfortable indoor temperatures and relative humidity between 40% and 60%
- Assume infected people will be present in the building
  - Measures are most important when people are present, +/- a few hours
  - Additional measures can be considered for higher-risk situations, but may not be appropriate for all cases
- Maintain minimum system performance during reduced occupancy conditions
- For re-entry, conduct pre- flush-outs for air and water systems, check filters, and ensure HVAC systems are operating properly

Resource Materials

Links to Resource Materials

- ASHRAE main COVID-19 technical resource page: https://www.ashrae.org/technical-resources/resources
- CDC guidance for businesses and workplaces: https://www.cdc.gov/coronavirus/2019-ncov/community/guidance-business-response.html
- WHO guidance for workplaces: https://www.who.int/docs/default-source/coronaviruse/advice-for-workplace-clean-19-03-2020.pdf
- OSHA guidance for workplaces: https://www.osha.gov/Publications/OSHA3990.pdf

Upcoming ENERGY STAR Webinars

Week of June 1 *(tentative date)*	**Maintaining and Restoring Water Quality in Buildings During the COVID-19 Response**
May 20 @ 2 PM ET	**Tracking GHG Emissions in Portfolio Manager**
May 21 @ 2 PM ET	**Renewable Energy Options for Small Businesses and Congregations**
May 27 @ 2 PM ET	**Just Add WaterSense to your Energy Efficiency Efforts**
May 28 @ 1 PM ET	**Strategies for Setting Effective Energy Performance Goals**
June 18 @ 12 PM ET	**Engaging Process Staff in Energy Management**

Register for upcoming webinars at: http://esbuildings.webex.com

Thank you for attending!

Questions?

Slides will be sent to all webinar registrants after today's session

If you have any questions on Portfolio Manager
or the ENERGY STAR program, contact us at:
www.energystar.gov/BuildingsHelp