

# Ventilation Strategies to Control COVID-19 Transmission in Skilled Nursing Facilities – Part 2

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# Introduction

- Options for isolation to prevent disease transmission to residents and staff
- Cases of COVID-19 will continue to occur in SNFs
- Emergency preparedness goal: SNFs are ready to quickly isolate suspect or known cases of any infectious respiratory disease that is transmitted via inhalation

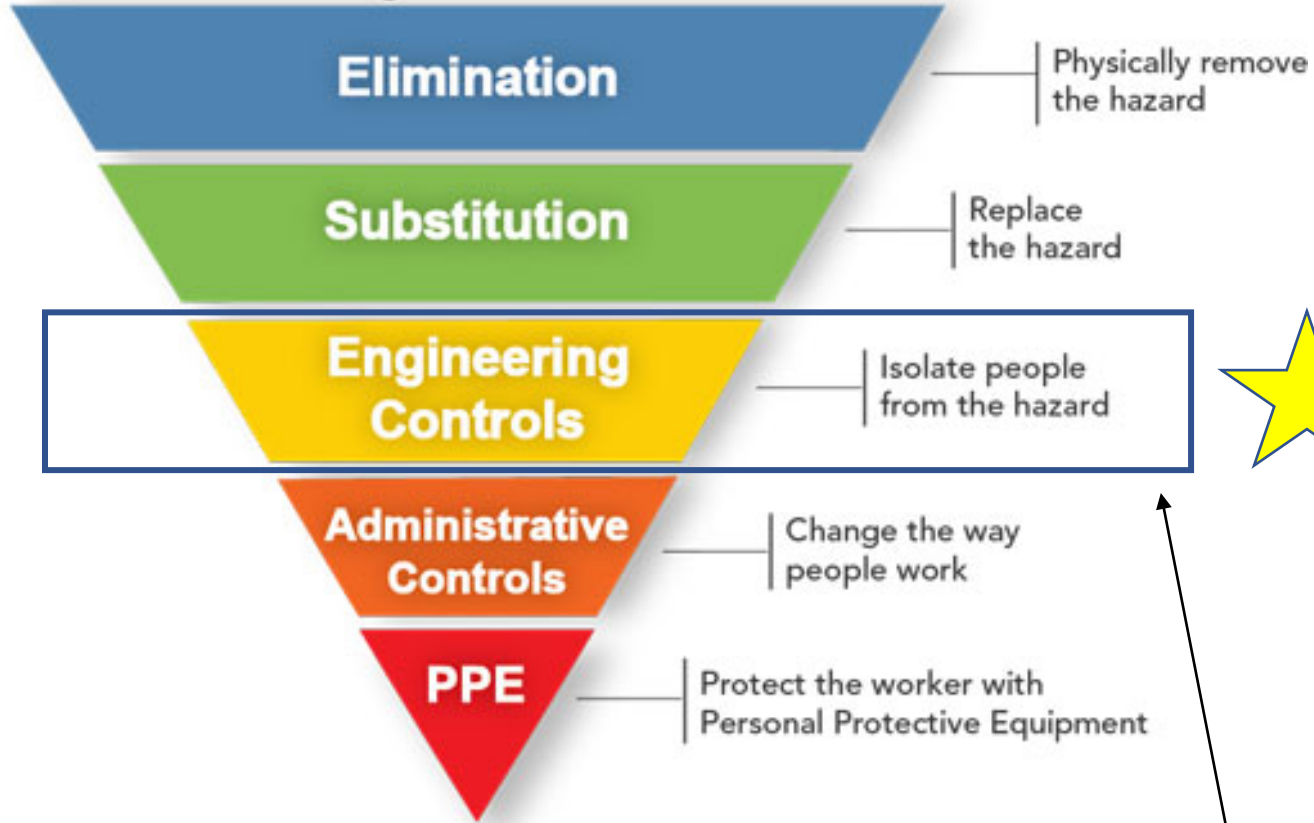
# Guidance for Isolation using Ventilation for Residential Healthcare

ASHRAE (also ASHE, NIOSH)

- Improve level of filtration
- Increase dilution by increasing outside air
- Utilize/create relative air pressure differences to direct airflow
- Local source control techniques

# Hierarchy of Controls

Most effective  
Least effective



Manipulating ventilation and indoor air conditions to isolate infectious air is an engineering control

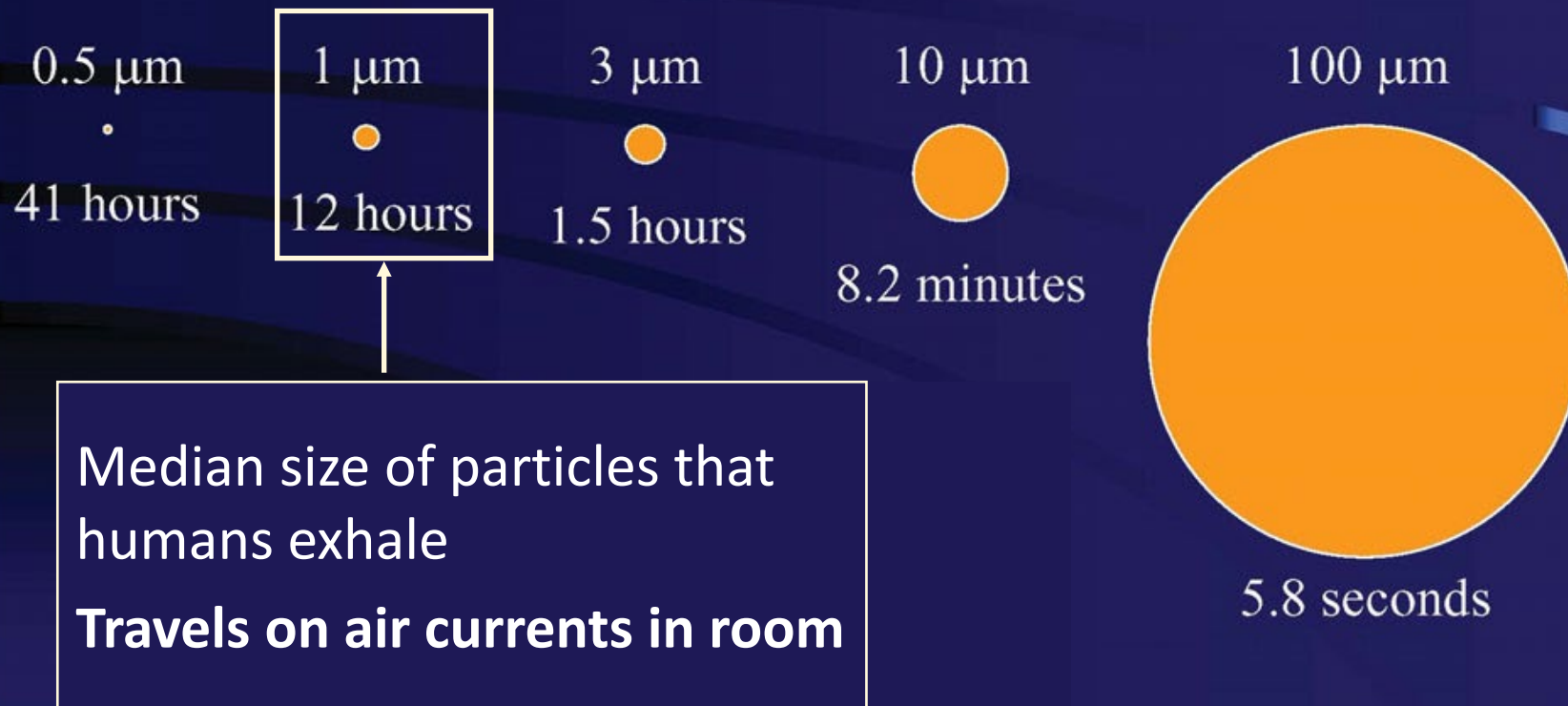
# Cigarette Smoke Analogy – Containing the smoke



- I. **Isolation/Separation** of the "smoker" from others
- II. **Exhaust/Remove** the smoke from the indoor space
- III. **Dilute** the smoke with outdoor air, opening the windows, etc.
- IV. **Filter** out the smoke particles in the air with air filter/HEPA filter

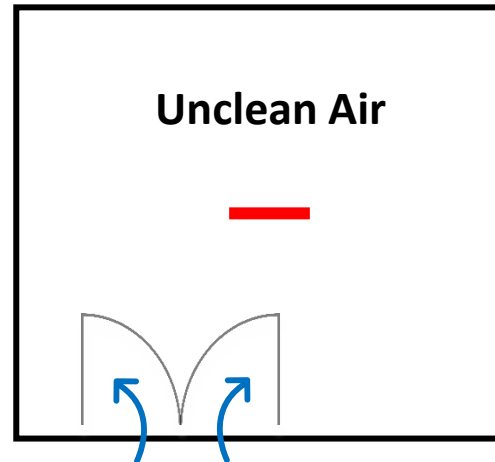
# Particle Settling in Still Air

Time to settle 5 feet by unit density spheres



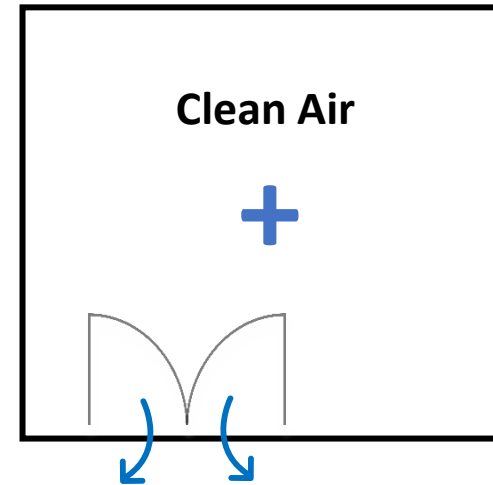
# Pressured Rooms

## Negatively Pressured Room



- Air Flow: Hallway → Room
- Cause: Increased Exhaust

## Positively Pressured Room



- Air Flow: Room → Hallway
- Cause: Increased Supply

# Regulatory Requirements for Isolation Room (AIR) Use

- Airborne Infectious Disease (AirID) cases or suspected cases "shall be placed in an Air room or area" or transferred. 5199 (e)(5)(B)
  - ❑ AirID includes novel pathogens such as COVID-19
- Required for aerosol-generating procedures ("high hazard procedures") on AirID
  - ❑ Positive pressure ventilation (BiPAP and CPAP)
  - ❑ Nebulizer treatment
    - Cal/OSHA Aerosol Transmissible Diseases regulation: <https://www.dir.ca.gov/title8/5199.html> (e)(5)(C)



# Cal/OSHA Exception to AIIR

**“Where it is not feasible to provide All rooms or areas to individuals suspected or confirmed to be infected with or carriers of novel or unknown ATPs, the employer shall provide other effective control measures to reduce the risk of transmission to employees, which shall include the use of respiratory protection in accordance with subsection (g) and Section 5144, Respiratory Protection of these orders.”**

# Airborne Isolation/Negative Pressure Techniques

Most effective



Least effective

- Airborne Infection Isolation Rooms (gold standard but absent in SNFs)

- Temporary Isolation with **negative air machines**

- Door closed with **portable air cleaner**

- Door closed

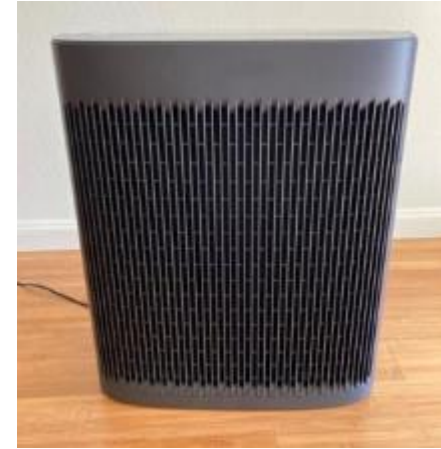
Important Strategies that SNFs should be prepared to employ



# Portable Air Cleaners vs Negative Air Machine

- **Portable Air Cleaners** filter the air in the room
- **Negative Air Machines/Air Scrubbers** take in air, filter it, and exhaust it to another location

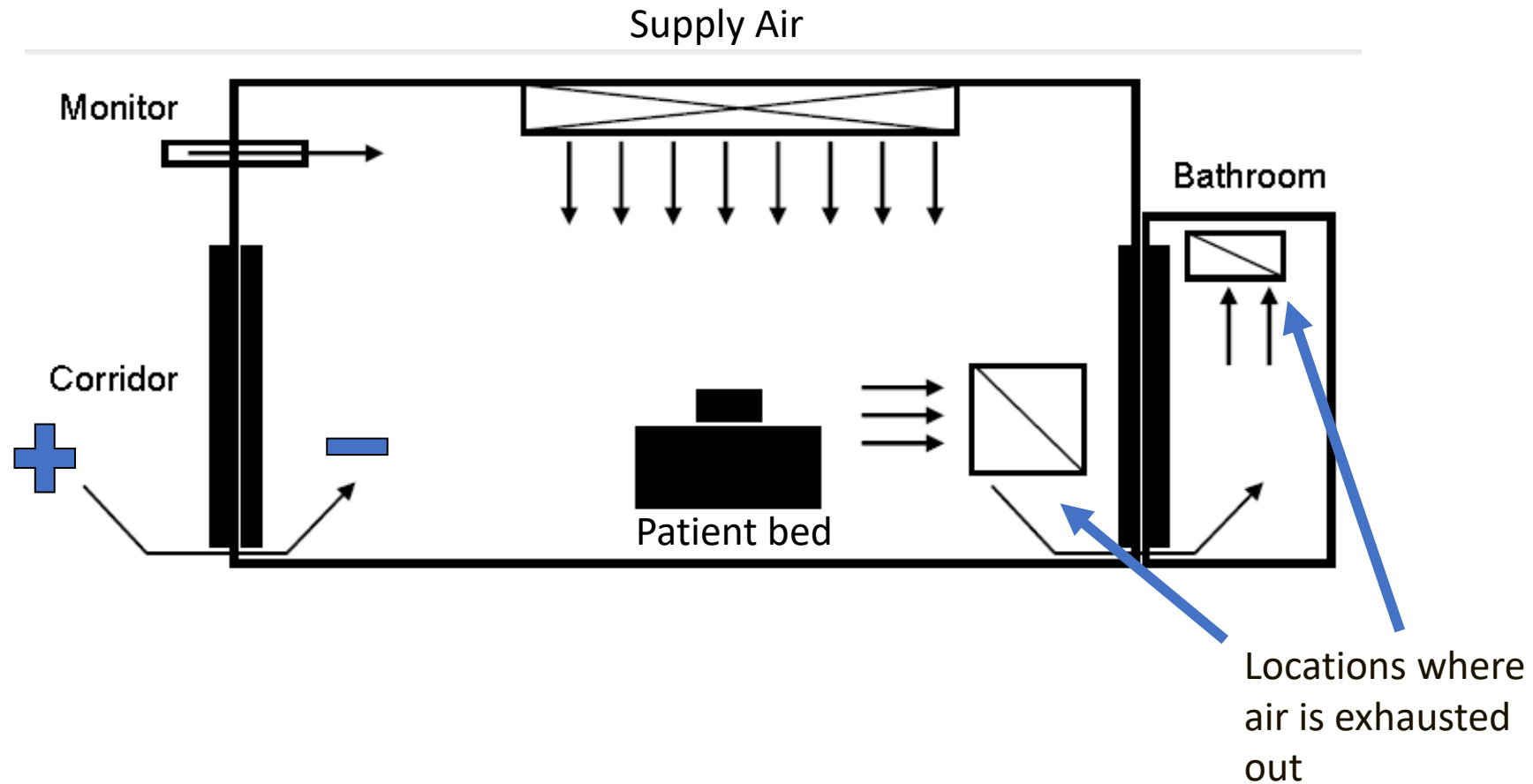
Portable  
Air Cleaner  
With HEPA  
filters



Scrubbers  
with HEPA  
filters

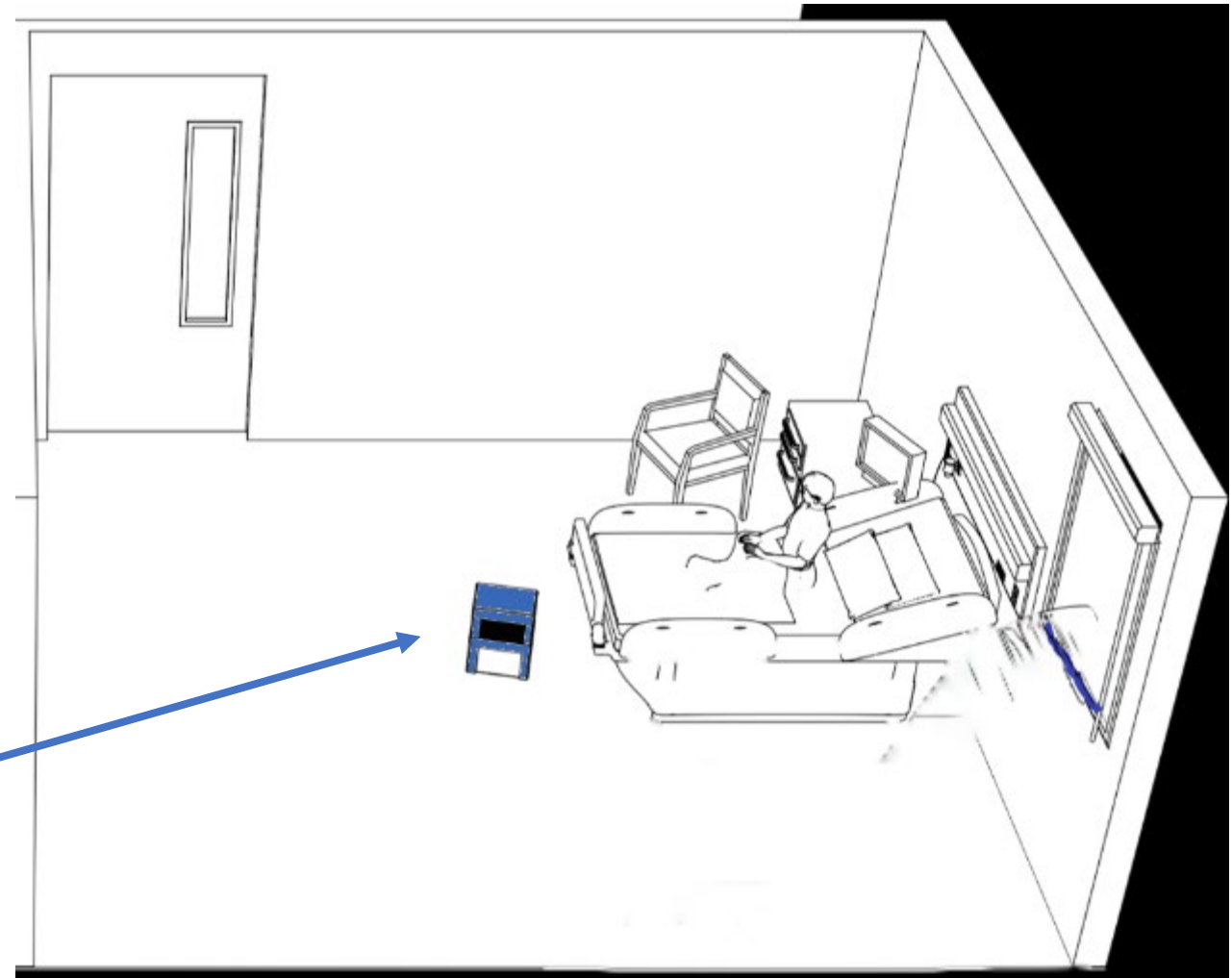


# Airborne Infection Isolation Room (AIIR)



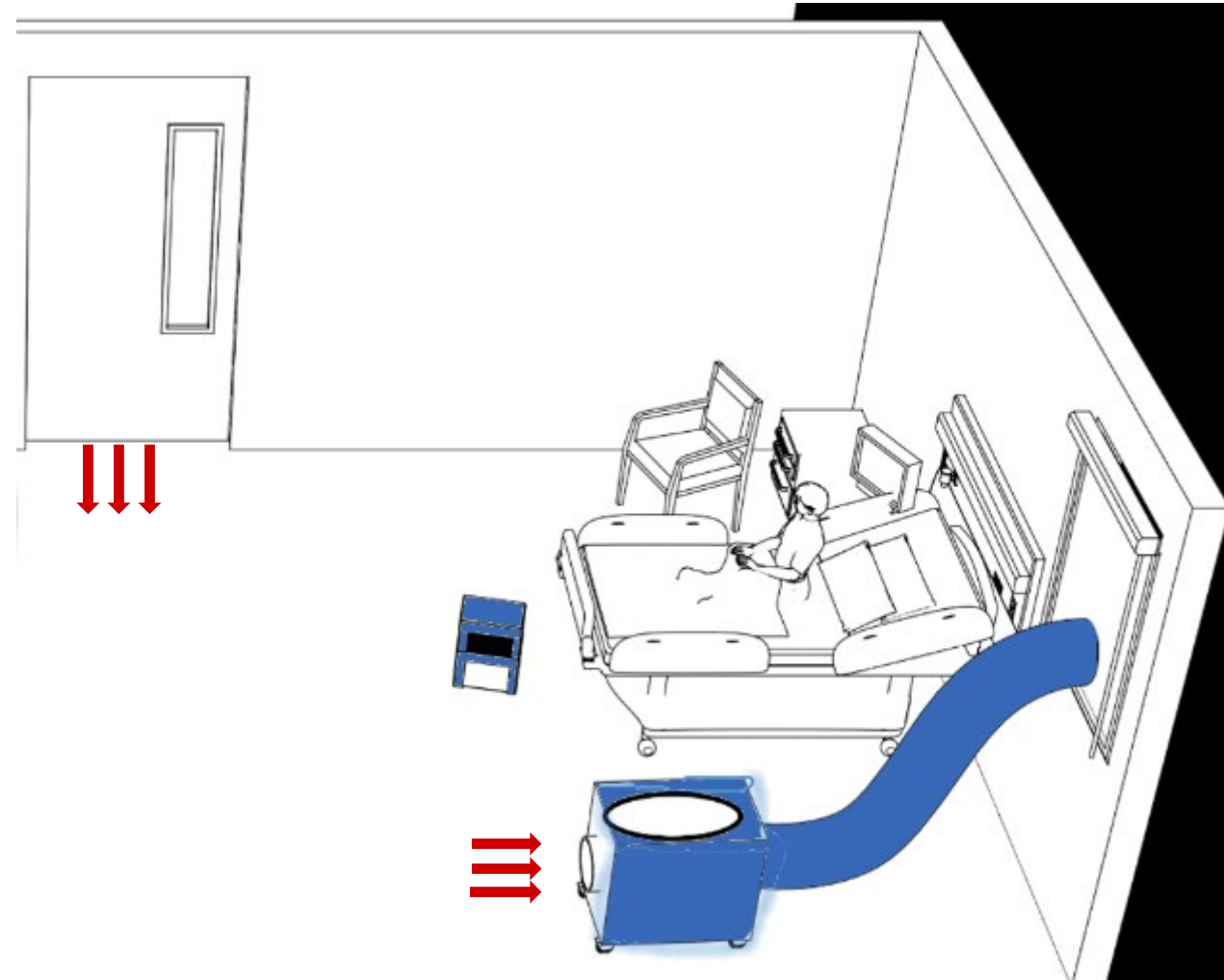
# Temporary Isolation: Easiest

- Single resident or patient room with dedicated bathroom
- Closed door creates barrier to hallway
- **Increase filtration using portable HEPA-filtered air cleaner in room**

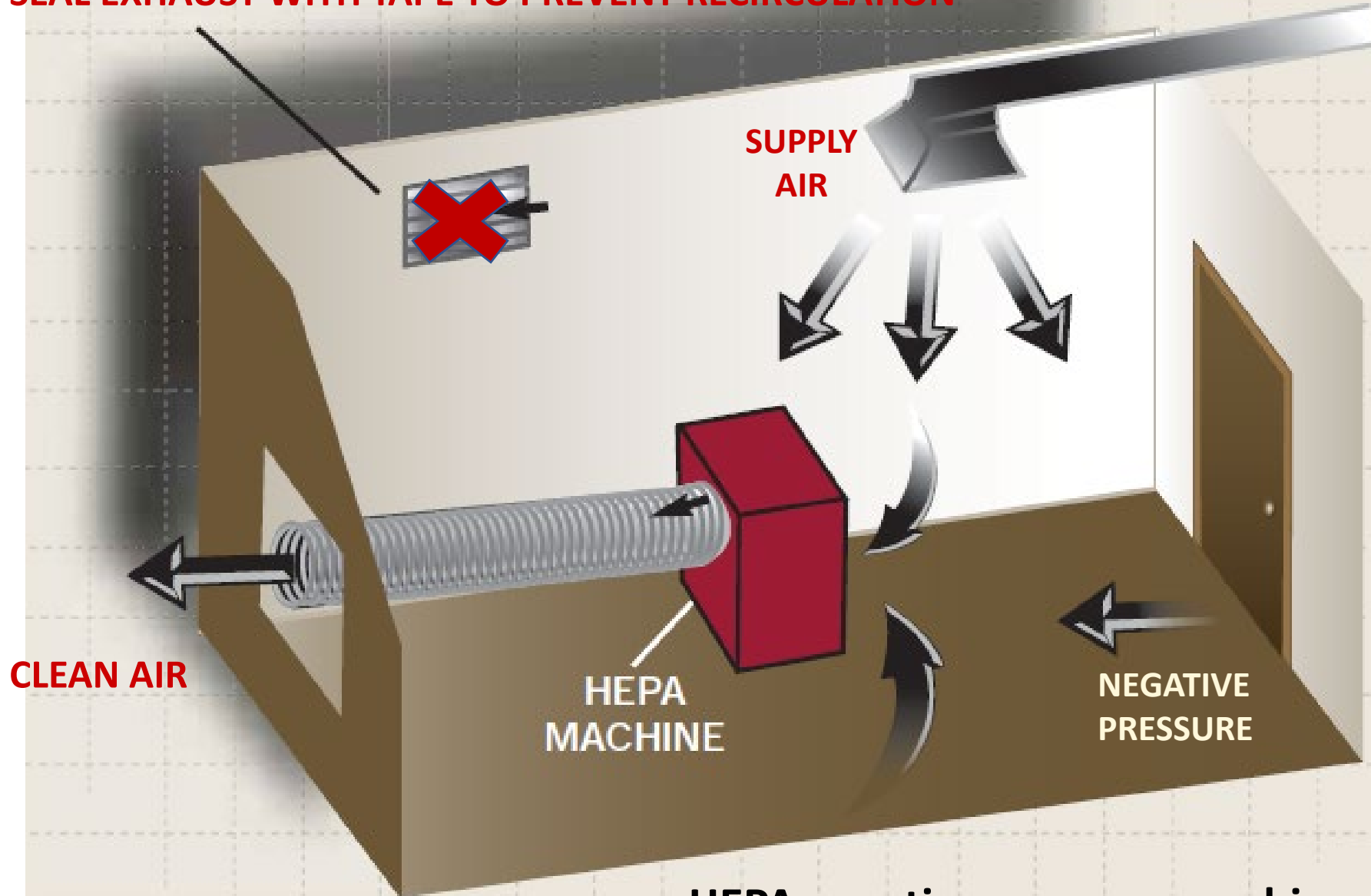


# Temporary Isolation: Intermediate

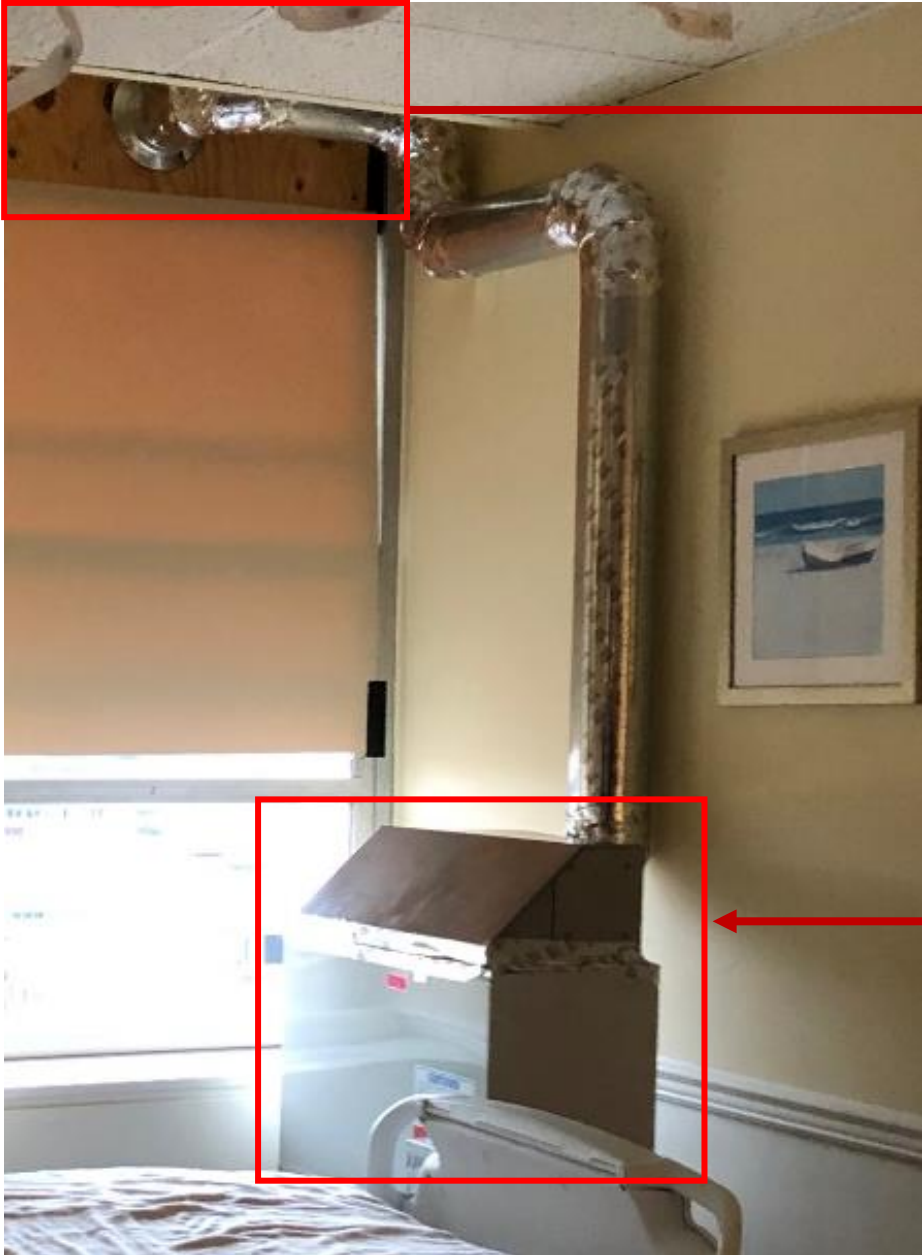
- Single resident or patient room with dedicated bathroom
- **Place HEPA-filtered scrubber in room**
  - Exhausts filtered air out window creating negative pressure room
  - Creates air curtain barrier to hallway
  - Increases dilution in room



**SEAL EXHAUST WITH TAPE TO PREVENT RECIRCULATION**



**HEPA negative pressure machine  
exhausting clean air through window**



**AIR EXHAUSTED THROUGH WINDOW VIA DUCTWORK FIT THROUGH PLYWOOD**

**NEGATIVE PRESSURE MACHINE**



# Pressure Measurement Tools



## Differential Pressure Monitor

# Simple Negative Pressure Tests



Smoke test: Use non-toxic smoke to see if it gets sucked into the room



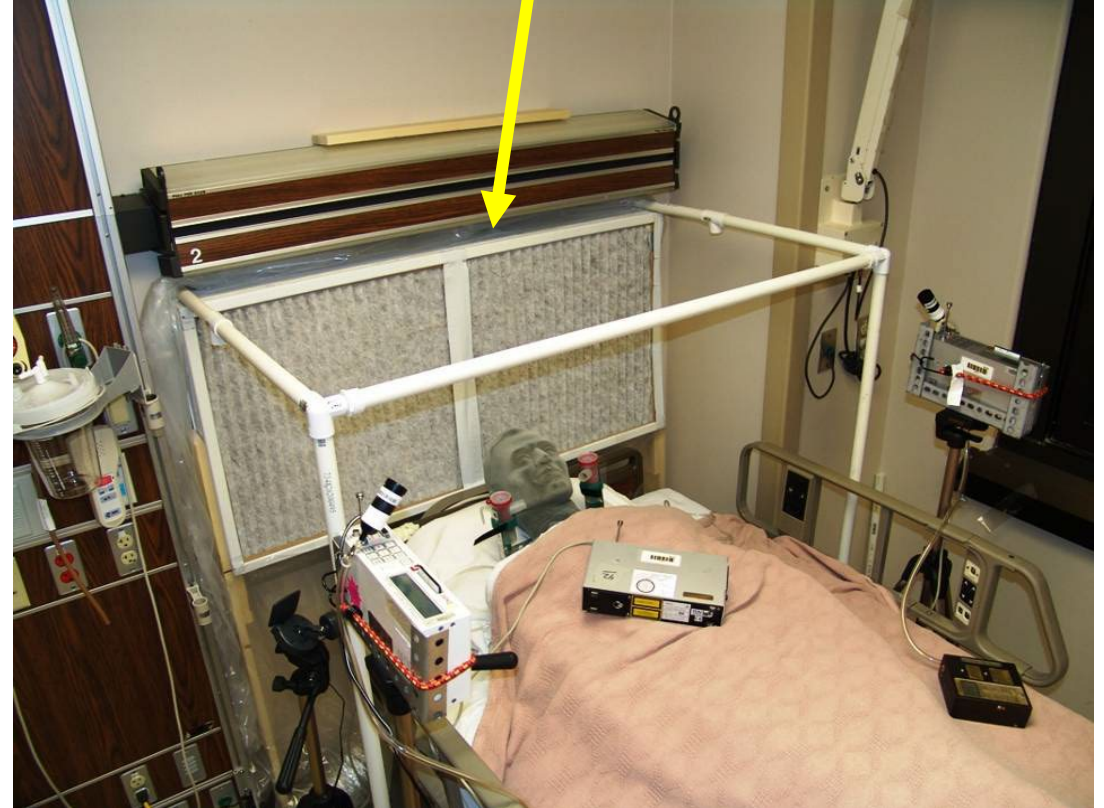
Tissue test: Place tissue outside door and see if it gets sucked into the room

# Source Control Options

**For patient with aerosol transmissible disease:**

- Local exhaust source control at head
- Especially for AGPs: such as CPAP, Bipap, or Nebulizer treatment

Local Exhaust with HEPA Filter



# One Source Control Option: Ventilated Headboards

Captures aerosols at the source (patient's head)



Used with **HEPA filtered negative air machine**, can be exhausted to the room

# Ventilation and Barriers

## “Red Zone” Room in SNF



## What are the benefits to barriers?

- Serves as visual “stop” sign and “PPE only” zone
- Can help isolate contaminated air if no other ventilation available
- Can help reinforce negative pressure conditions

# Ventilation and Barriers

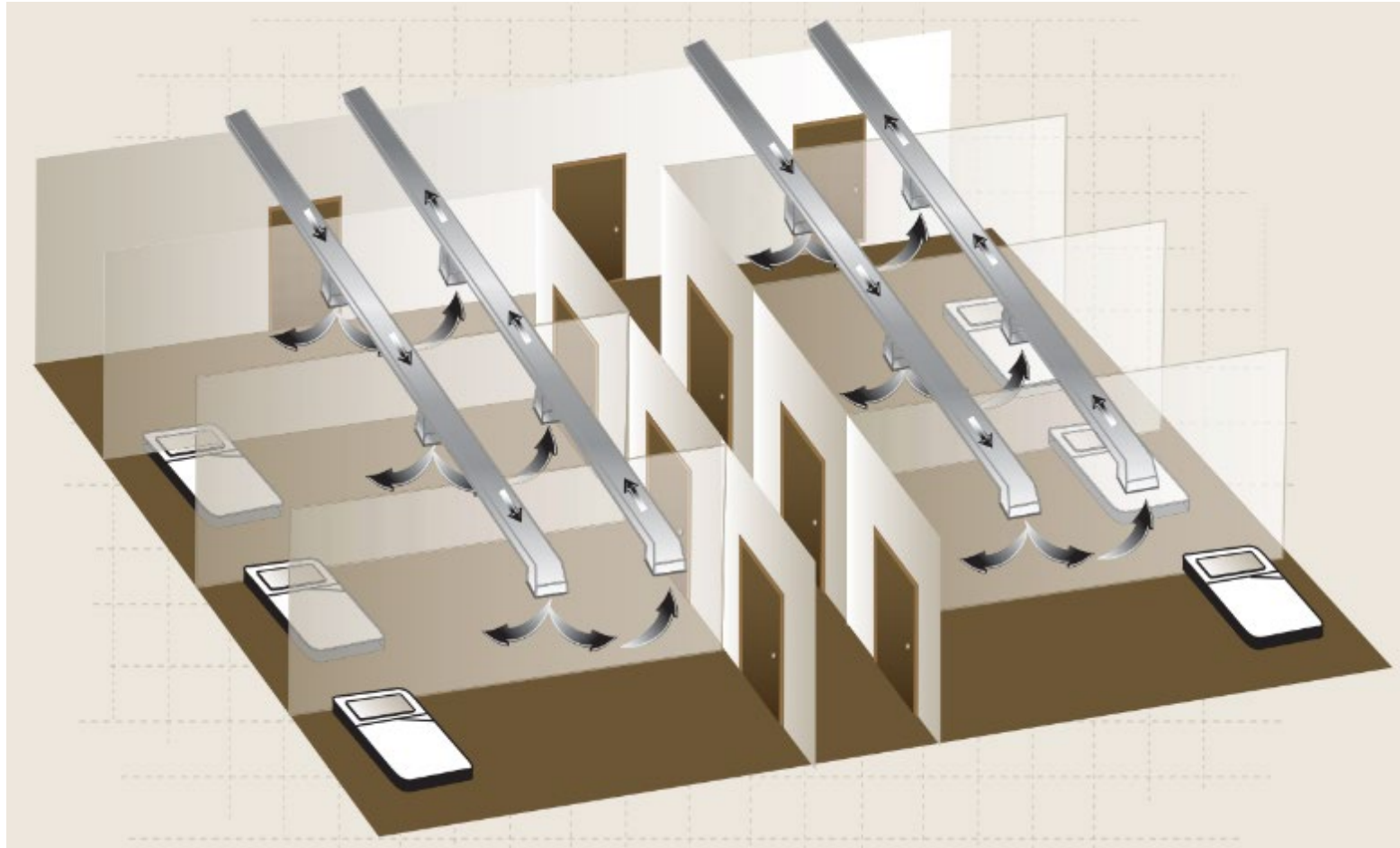
## “Red Zone” Room in SNF



## How do barriers affect ventilation systems?

- Positive pressure
  - Room -> Hallway
- Negative pressure
  - Hallway -> Room
- Hallway Barriers
  - Does it cut off air supply or exhaust?

# When installing plastic walls, consider ventilation supply



# Airborne Infectious Diseases under HICPAC\* and Cal/OSHA ATD regulation

- Chickenpox (Varicella)
- Avian influenza
- Herpes zoster (varicella-zoster, disseminated disease, per CDC)
- Measles (rubeola)
- Monkeypox
- SARS (Severe Acute Respiratory Syndrome)
- Smallpox
- Tuberculosis
- Novel or Unknown pathogen (COVID-19)

Or

Any other disease for which public health guidelines recommend airborne infection isolation



# Importance of Emergency Preparedness

- Pandemic shows situation can change quickly
- Emergency preparedness is crucial
- Procuring supplies and carrying out training to prepare to set up isolation conditions will be crucial in the industry for future pandemics
  - ❑ Preparing door frames for plastic barriers (Velcro)
  - ❑ Purchasing negative air machines and PACs
  - ❑ Purchasing and pre-cutting plywood to exhaust air through windows

# Summary and Conclusions

- There are a range of options to better protect residents, health care professionals, and staff
- Engineering controls are effective for controlling spread of infectious diseases transmitted through the air
- Facilities should establish multi-disciplinary team to identify solutions and ensure that the existing HVAC system, or temporary auxiliary ventilation, can be implemented if isolation becomes necessary

# References and Resources

- American Society for Health Care Engineering (ASHE),  
**“Current/Updated Health Care Facilities Ventilation Controls and Guidelines for Management of Patients with Suspected or Confirmed SARS-CoV-2 (COVID-19)”**, (February 4, 2021):  
<https://www.ashe.org/covid-19-ventilation-guidance-efforts>
- ASHRAE/ASHE Standard 170-2017
- Minnesota Dept of Health: HVAC for Long-term Care during COVID (May 2021):  
<https://www.health.state.mn.us/diseases/coronavirus/hcp/ltc.html>

# References and Resources

- Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings: <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>
- NIOSH, Engineering Controls To Reduce Airborne, Droplet and Contact Exposures During Epidemic/Pandemic Response: Ventilated Headboard: <https://www.cdc.gov/niosh/topics/healthcare/engcontrolsolutions/ventilated-headboard.html>
- National Emerging Special Pathogen Training and Education Center (NETEC), “Engineering Controls for Long-term Care,” *NETEC Resource Library*, accessed June 11, 2021, <https://repository.netecweb.org/items/show/1274>.

# References and Resources

- CDC/NIOSH, Engineering Controls to Reduce Airborne, Droplet and Contact Exposures During Epidemic/Pandemic Response, Expedient Patient Isolation Rooms: <https://www.cdc.gov/niosh/topics/healthcare/engcontrolsolutions/expedient-patient-isolation.html>
- ASHRAE Epidemic Task Force, Building Guides, Residential Healthcare (2021): <https://www.ashrae.org/technical-resources/residential-healthcare>
- CAHF Virtual Classroom: Airborne Infection Isolation Rooms (2021): <https://www.youtube.com/watch?v=QeopCD98Ksw>

**Thanks for your participation!**

**QUESTIONS?**

