

# 9/22/22

### **Ventilation Verification Fundamentals Presentation – Citations**

Slide 2 – The 9 Foundations of a Healthy Building

• 9 foundations of a healthy building. 9 Foundations. (n.d.). Retrieved September 17, 2022, from <a href="https://9foundations.forhealth.org/">https://9foundations.forhealth.org/</a>

### Slide 3 - ASHRAE Core Recommendations

 ASHRAE Epidemic Task Force - Core Recommendations for Reducing Airborne Infectious Aerosol Exposure. 19 Oct. 2021, <a href="https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf">https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf</a>

## Slide 4 - Ventilation Verification & Energy Optimization White Paper

- Pistochini, T., & Distochini, Distochini,
- Pistochini, T., & Distochini, T., &

## Slide 5 - Educational Facility Opportunity - Existing Infrastructure

- Schools. ASCE's 2021 Infrastructure Report Card |. (2021, March 25). Retrieved May 8, 2022, from <a href="https://infrastructurereportcard.org/cat-item/schools/">https://infrastructurereportcard.org/cat-item/schools/</a>
- (2) K-12 Education School Districts Frequently Identified Multiple Building Systems Needing
  Updates or Replacement (Rep. No. GAO-20-494). (June 4th, 2020). United States Government
  Accountability Office. <a href="https://www.gao.gov/assets/710/707374.pdf">https://www.gao.gov/assets/710/707374.pdf</a>

## Slide 6 - Educational Benefits Adequate Ventilation and Thermal Health

U. Haverinen-Shaughnessy, R.J. Shaughnessy, E.C. Cole, O. Toyinbo, D. J. Moschandreas, An assessment of indoor environmental quality in schools and its association with health and performance, Build. Environ. 93 (2015) 35–40. <a href="https://www.semanticscholar.org/paper/An-assessment-of-indoor-environmental-quality-in-Haverinen-Shaughnessy-d8ce5901edcd7401e118bf43d4bce436a77cb82e">https://www.semanticscholar.org/paper/An-assessment-of-indoor-environmental-quality-in-Haverinen-Shaughnessy-Shaughnessy/d8ce5901edcd7401e118bf43d4bce436a77cb82e</a>

#### Slide 7 & 8 - Wildfire IAQ Concerns - Stanford Center for Innovation and Global Health

• Stanford Center for Innovation in Global Health. "Wildfires and Health." Global Health, 21 July 2022, https://globalhealth.stanford.edu/planetary-health/wildfires-and-health.html/







# Slide 9 - ASTHMA Concerns EPA - Managing ASTHMA in The School Environment

- EPA, Environmental Protection Agency, <a href="https://www.epa.gov/iaq-schools/managing-asthma-school-environment">https://www.epa.gov/iaq-schools/managing-asthma-school-environment</a>
- Centers for Disease Control and Prevention. (2022, August 11). Hierarchy of controls. Centers for Disease Control and Prevention. Retrieved September 17, 2022, from https://www.cdc.gov/niosh/topics/hierarchy/default.html

### Slide 12 - Filtration - Field Results

- McNulty, M. K., Kono, J., & Abramson, B. (2022 ASHRAE Winter Conference). From Guidance to Implementation: Applying ASHRAE Epidemic Task Force Building Readiness Strategies in 95 Commercial Office Buildings.
  - https://www.thefreelibrary.com/ /print/PrintArticle.aspx?id=713048616
- Azimi P, Stephens B, 2013. HVAC filtration for controlling infectious airborne disease transmission in indoor environments: Predicting risk reductions and operational costs. Build Environ. 2013(70):150-160. doi: 10.1016/j.buildenv.2013.08.025 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7127325/

### Slide 13 - Portable Air Cleaners

 ASHRAE. (2021). ASHRAE Position Document on Filtration and Air Cleaning - Developed by the Society's Filtration and Air Cleaning Position Document Committee. <a href="https://www.ashrae.org/file%20library/about/position%20documents/filtration-and-air-cleaning-pd-feb.2.2021.pdf">https://www.ashrae.org/file%20library/about/position%20documents/filtration-and-air-cleaning-pd-feb.2.2021.pdf</a>

### Slide 14 - Case Study - Portable Classroom Level Air Cleaning

- Yoon-Hendricks, A. (2021, January 24). Sac City schools paid \$6 million for costly air cleaners with unnecessary features. Sacramento Bee www.sacbee.com/news/local/article248431190.html
- Yoon-Hendricks, A. (2021, February 5). Sacramento Schools remove controversial air cleaners after experts, teachers raise concerns. Sacramento Bee.
   www.sacbee.com/news/local/article248965569.html

### Slide 16 - Health Benefits

- Allen, Joseph and Macomber, John. "What Makes an Office Building "Healthy"". Harvard Business Review. April 2020. <a href="https://hbr.org/2020/04/what-makes-an-office-building-healthy">https://hbr.org/2020/04/what-makes-an-office-building-healthy</a>
- Marche Region\_Italy. (n.d.). Controlled Mechanical Ventilation (Cmv) works.
   <a href="https://www.fondazionehume.it/data-analysis/controlled-mechanical-ventilation-cmv-works/">https://www.fondazionehume.it/data-analysis/controlled-mechanical-ventilation-cmv-works/</a>

#### Slide 17 - Ventilation – Minimum Ventilation

American Society of Heating, Refrigerating and Air-Conditioning Engineers. (2022). Ventilation for acceptable indoor air quality: ASHRAE Standard 62.1 - 2022.
 <a href="https://ashrae.iwrapper.com/ASHRAE\_PREVIEW\_ONLY\_STANDARDS/STD\_62.1\_2022">https://ashrae.iwrapper.com/ASHRAE\_PREVIEW\_ONLY\_STANDARDS/STD\_62.1\_2022</a>

### Slide 18 - Ventilation - Field Results



 McNulty, M. K., Kono, J., & Abramson, B. (2022 ASHRAE Winter Conference). From Guidance to Implementation: Applying ASHRAE Epidemic Task Force Building Readiness Strategies in 95 Commercial Office Buildings.

https://www.thefreelibrary.com/ /print/PrintArticle.aspx?id=713048616

### Slide 20 - Energy Benefits

- U.S. Energy Information Administration May 14th 2019, How much energy is consumed in U.S. residential and commercial buildings? https://www.eia.gov/tools/faqs/faq.php?id=86&t=1
- Department of Energy September 2015, An Assessment of Energy Technologies and Research Opportunities, Ch.5: Increasing Efficiency of Building Systems and Technologies, https://www.energy.gov/sites/prod/files/2017/03/f34/qtr-2015-chapter5.pdf

#### Slide 23 - Educational Benefits

• Fisk, W. J., The ventilation problem in schools: literature review, Indoor Air. 2017;27:1039–1051 https://onlinelibrary.wiley.com/doi/epdf/10.1111/ina.12403

### Slide 27 - Workforce Standards

California Energy Commission, Strategic Plan to Reduce the Energy Impact of Air Conditioners
(June 2008), CEC-400-2008-010, at p. (v) (<a href="https://docplayer.net/6285926-Staff-report-strategic-plan-to-reduce-the-energy-impact-of-air-conditioners-california-energy-commission-june-2008-cec-400-2008-010.html">https://docplayer.net/6285926-Staff-report-strategic-plan-to-reduce-the-energy-impact-of-air-conditioners-california-energy-commission-june-2008-cec-400-2008-010.html</a>); see also Zabin, et. al, Workforce Issues and Energy Efficiency
Programs: A Plan for California's Utilities, Don Vial Center for Employment in the Green
Economy (2014), at pp. 32-34 and Appendix 2B (<a href="http://laborcenter.berkeley.edu/workforce-issues-and-energy-efficiency-programs-a-plan-for-californias-utilities/">http://laborcenter.berkeley.edu/workforce-issues-and-energy-efficiency-programs-a-plan-for-californias-utilities/</a>).

#### Slide 28 - Workforce Standards

Chan, et al, Ventilation rates in California classrooms: Why many recent HVAC retrofits are not delivering sufficient ventilation, Building and Environment Journal 167 (2020)
 (https://www.sciencedirect.com/science/article/pii/S0360132319306365).