**Bluezone® Technology for Airborne Virus Control**

It is widely understood that viruses can be transmitted through large droplets by coughing or sneezing in close proximity ("Cough into a tissue or your elbow!") or by contact with a contaminated surface ("Wash your hands! Sanitize your phone!"). A primary transmission route that is often overlooked for infectious viruses such as the novel coronavirus and influenza is via airborne aerosols. Infectious aerosols can be released into the air from coughing, sneezing or breathing. Infectious aerosols are typically very small (less than 5 μm) and remain suspended in the air for long times, typically more than 1 hour.

**Air cleaning is therefore an important approach to reducing the transmission of viruses.**

UV irradiation is a well-established technique for inactivating viruses. The Bluezone air purifier uses intense UV irradiation and ozone exposure to kill all microbes that enter it and has been demonstrated to kill viruses, bacteria and mold spores. Third party testing of Bluezone products demonstrated 99.9% removal of microbial loads. A standard Bluezone Model 420 would circulate and treat all the air in a 5 x 5 x 3 m room in 1 hour, leading to a large reduction in airborne viral load in a short time. The Bluezone can be a critical component of a systematic infection management system in medical facilities.

**Viruses can persist in the air as aerosols generated from sneezing, coughing or breathing**.

Airborne transmission of infectious viral disease, both from large droplets and aerosols, has been documented and investigated for many decades. For the case of influenza A, important aspects of aerosol transmission of virus is documented by Tellier, [1] [2] briefly summarized below:

- Coughing, sneezing, or even normal respiration produces aerosol droplets of a broad size range, from as small as less than 1 micron to several hundred microns in diameter, with a large percentage less than 5 microns.
- Aerosol droplets from normal breathing have been shown to be in the 1 micron size range.
- The long-term persistence of infectivity of these small droplet nuclei has been established.
- Aerosols of 5 μm and smaller will essentially follow air currents and remain suspended for very long times (longer than an hour).

**Viruses in airborne aerosols produced by one person can be respired by others.**

In a field study published in 2020 on airborne influenza A virus exposure in an elementary school, [3] Coleman & Sigler report that "A single infectious sneeze can result in 40,000 aerosolized droplets, and when expelled, can travel nearly 2 meters before falling to the nearest surface, or can evaporate, resulting in droplet nuclei that can persist in the air for up to 30 hours and cause severe, lower respiratory tract infections among adults and children. Airborne transmission can account for approximately half of all

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[1] Tellier R., "Review of Aerosol Transmission of Influenza A Virus," *Emerging Infectious Diseases,* www.cdc.gov/eid, Vol. 12, No. 11, November 2006. 2006
[2] Tellier R., "Aerosol transmission of influenza A virus: a review of new studies," *J. R. Soc. Interface* (2009) 6 S783-S790, September 2009
[3] Coleman K. K. & Sigler W. VB., "Airborne Influenza A Virus Exposure in an Elementary School," *Nature: Scientific Reports*, 10:1859 2020

house-hold influenza A virus transmission events, while the virus exhibits 20-fold higher infectivity through inhalation than intranasal inoculation."

- They measured airborne viral load in aerosols in an elementary school over a several-month period and noted that the high viral loads were associated with particles smaller than 4 μm.
- Other studies have shown that the lower respiratory tract is most easily reached by the smallest particles (less than 5 μm) and is the preferred site for infection.
- The spectrum of symptoms seen with aerosol infection is typically broad and includes all those seen in natural infections (including involvement of the lower respiratory tract) compared to those symptoms seen with infection by nasal inoculation. [2]

**Bluezone technology achieves the highest level of microbial kill using UV light.**

The Bluezone air purifier operates by drawing air though a reaction chamber where it is exposed to intense germicidal UV irradiation and high concentrations of ozone. These powerful sanitizing agents are retained within the Bluezone device and clean air exits back into the room being treated.

Testing the Bluezone Model 420 at the Nationally Recognized Test Lab, Intertek, demonstrated 99.9% kill of microbial loads (*Bacillus atrophaeu*s and *Penicillium citrinum*) in the test room, within one hour of operation. Bluezone technology has also demonstrated 100% per pass kill of MS2 coliphage, a virus often used as a surrogate for influenza A, and of *Staphylococcus epidermidis*.

**Kill rate of viruses in Bluezone products will be higher than the tested bacterial spores.**

Testing of the Bluezone for its efficacy in killing viruses is currently underway at an established virology laboratory. Given the test results, above, from Intertek, and the known relative UV doses needed to kill viruses compared to bacterial spores, we are confident of the high performance of Bluezone in killing influenza and corona viruses. The efficacy of UV irradiation for viral inactivation has long been demonstrated. [4] The UV doses required to inactivate many pathogens is well established: [5] Influenza virus requires one third the UV dose of the spore Intertek used—*Bacillus atrophaeu*s—to achieve one log (90%) kill, specifically 3,400 μWs/cm$^2$ for virus compared to 11,600 μWs/cm$^2$ to for *Bacillus atrophaeu*s spores. Bluezone will kill viruses at 3 times the kill rate of bacterial spores.

**One Bluezone is sized to treat rooms up to 225 ft$^2$ (25 m$^2$) in one hour.**

Effective air cleaning is a critical element of infection management and risk mitigation, and Bluezone products are highly effective at killing airborne viral loads, which are often overlooked but are easily addressed. Bluezone products are sized to process all the air in a room before aerosols settle out to the floor or surfaces. Because of its proven air cleaning capabilities, Bluezone can be key to reducing the transmission of influenza or corona viruses in medical facilities.

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[4] Jensen M. M., "Inactivation of Airborne Viruses by Ultraviolet Irradiation," *Applied Microbiology*, Vol. 12 No. 5 pp. 418-420, September 1964

[5] https://www.americanairandwater.com/uv-facts/uv-dosage.htm