ATS/CIRA Colloquium

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Who's Breathing Whom? Air Transport of Small Particles, Like Viruses

Hosted by Sonia Kreidenweis

3 p.m. Thursday, Aug. 27
via Microsoft Teams

The last six months of the COVID-19 pandemic have provided many lessons in thinking about contaminant transport. One of the lessons is that the principles of aerosol dynamics are not fully integrated into recommendations to protect public health and reduce exposure. A group of CSU faculty has been working over the summer to identify some of the important principles, and this presentation summarizes some of the findings. We defined a metric, Effective ReBreathed Volume (ERBV), that quantifies how infectious pathogens transport through air, distinguishing environmental characteristics from other factors in the chain of infection. Particle size is a key factor in transport, removal onto surfaces, and elimination by mitigation measures, so ERBV is presented for a range of exhaled particle diameters: 1 μm, 10 μm, and 100 μm. Two separate but interacting effects—proximity and confinement—govern pathogen transport. Distancing can reduce the proximity effect, but confinement in enclosed spaces overwhelms that protection after about 15 minutes for 1-μm and 10-μm particles. Changes in standard ventilation and filtration can reduce person-to-person transport of 1-μm particles (ERBV1) by 13-85% in residential and commercial situations. Deposition to surfaces competes with intentional removal for 10-μm and 100-μm particles, so the same interventions reduce ERBV10 by only 3-50%, and ERBV100 is unaffected. The analysis identified some important uncertainties in quantifying transmission and the benefits of mitigation: transport very near emitters and indoor deposition rates.

Bio

Tami Bond's research has followed a thread beginning with indoor air quality, moving to combustion, atmospheric chemistry and climate, future technology scenarios, and lately the intimate relationship between technology and human choice, leading her back indoors. Her research group spans scales from a particle's skin to national transportation systems in the quest to characterize the dance between people, energy use, and human and global environments. Dr. Bond first earned two degrees in mechanical engineering before succumbing to an interdisciplinary Ph.D. and pursuing a NOAA Climate and Global Change post-doc. After 16 years as a faculty member at the University of Illinois at Urbana-Champaign and a stint as a Leverhulme Visiting Professor at the University of Leeds, she was appointed last year as the Walter Scott, Jr. Presidential Chair in Energy, Environment and Health at Colorado State University.