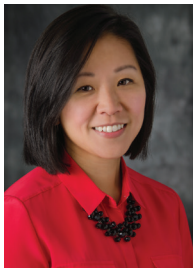

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New Tool

Helping Reduce Indoor Airborne Exposure

GAITHERSBURG, MD.—Because of residents' limited technical know-how, leveraging ventilation and filtration has been an underused strategy for many residents throughout the COVID-19 pandemic. To help more people effectively use this approach, National Institute of Standards and Technology (NIST) researchers have developed an interactive webpage featuring a new Virus Particle Exposure in Residences (ViPER) tool that helps occupants learn how certain actions may lower their risk of exposure to particles in the air that could potentially transmit COVID-19.

In 2020, the same team created a similar web-based tool: Fate and Transport of Indoor Microbiological Aerosols (FaTIMA)[1] aimed at more technical users. The program can estimate the concentration of exhaled aerosols a person would encounter in a single space with the purpose of helping people select strategies to reduce the number of airborne particles indoors in general.

Members of the ViPER team—Lisa Ng, Ph.D., Member ASHRAE; Brian Polidoro; Stephen Zimmerman, Associate Member ASHRAE; W. Stuart Dols, Member ASHRAE; Steven Emmerich, Fellow ASHRAE; and Andrew Persily, Ph.D., Fellow/Life Member ASHRAE—spoke with *ASHRAE Journal* about the tools and their significance.

What is the significance of the ViPER tool?

The ViPER tool can help identify strategies for reducing exposure to possibly contagious airborne particles emitted by a visitor to people in a residence. This simple-to-use web-based tool allows users to compare an individual scenario (base case) against multiple "what-if" scenarios related to particle exposure associated with a contagious visitor.

Users select options from a set of drop-down menus that most closely match their situation: home size, how outdoor air ventilation is provided, how long the visit will last, what type of filter is in the ventilation system (if any), whether or not a portable HEPA air cleaner is operating and whether ventilation/filtration is extended beyond the visit.

The webtool allows the user to evaluate the reduction (or increase) in particle exposure at the end of the visit and 60 minutes after the visit. The information from this webtool could support decisions to help reduce exposure to a particle generated by a contagious visitor, which the tool assumes has a diameter of 1 µm.

What went into creating the ViPER tool?

In collaboration with the Centers for Disease Control and Prevention (CDC) and the CDC Foundation, NIST developed ViPER to target homes and create an interface that was simpler (thus less customizable) than FaTIMA.

A set of parameters that a resident would most likely be able to identify were defined: home size, visit duration and portable air cleaner effectiveness as well as mechanical ventilation and HVAC strategy.

These parameters were used to generate nearly 1,300 house models that were run in CONTAM, a multizone airflow and IAQ modeling software also developed at NIST, and the simulation results serve as the database behind the user interface of ViPER. After the simulation results were packaged, a simple user interface was conceptualized and designed to effectively communicate these options and results.

What should people know about this tool?

ViPER was developed to help guide homeowners and tenants in making decisions regarding potentially contagious visitors to their residences, not to serve as an absolute determination of safety. ViPER does not define levels of exposure considered to be safe or healthy nor does it consider the impacts of these controls as part of broader risk reduction strategies that might be implemented by a resident. Because ViPER requires a user to select options from a predetermined set of parameters, the tool is easy to use and only requires basic knowledge of a home.

While HVAC, airflow and indoor air quality experts in the world of ASHRAE may find ViPER too simplistic and lacking in the details that they consider important to particle exposure, ViPER was simplified in order to be easy and quick-to-use.

If users want more control over simulation parameters, they can use FaTIMA. For the most customization, CONTAM is the tool of choice. CONTAM takes into account the physical interaction between HVAC system airflows, filtration efficiencies and the use of portable air cleaners.

What makes ViPER different from FaTIMA?

FaTIMA is a web-based tool for representing a wide variety of space types and the effects that ventilation, filtration, deposition and inactivation mechanisms have on indoor microbiological aerosols within those spaces. ViPER is a web-based tool specifically designed to represent the residential environment and the effects of ventilation and filtration on indoor microbiological aerosols with a size of 1 µm.

FaTIMA allows for a more specific, customizable and complex representation of a zone, whereas ViPER is simpler but allows only a limited, predefined residential environment.

What happens next? Is there another tool being developed?

NIST is always working to develop tools that are of interest to stakeholders and significant numbers of users. In the case of ViPER, additional modeling results could be added including different home sizes and additional ventilation scenarios.

Another tool that might be of interest to ASHRAE readers allows the user to generate indoor CO_2 concentrations versus time as a function of space geometry, ventilation rate and occupant characteristics. The beta version of the CO_2 Metric Analysis Tool is available at https://tinyurl.com/2tvx3aru

Learn more about NIST's tools:

ViPER: https://tinyurl.com/bddu7z4v

FaTIMA: https://tinyurl.com/mtztjc27

CONTAM: https://tinyurl.com/yckkkzt4

References

1. Dols, W., et al. 2021. "Tool Evaluates Control Measures for Airborne Infectious Agents." *ASHRAE Journal* 63(1):60–63. ■