

Setting a breathable standard: Q&A with architectural engineer William Bahnfleth

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In June, the American Society of Heating and Air-Conditioning Engineers (ASHRAE) approved [Standard 241](#), which establishes minimum requirements for building owners, operators and professionals

to improve indoor air quality and reduce the risk of disease transmission through infectious aerosols. The task force that created Standard 241 was led by William Bahnfleth, professor of architectural engineering at Penn State.

Bahnfleth discussed the new standard and the importance of [indoor air quality](#) to overall health in the Q&A below.

During the pandemic, we learned the importance of clean indoor air, but is it as simple as opening a window? What all contributes to indoor air quality?

Bahnfleth: Sadly, [we've had the data to show how important indoor air quality \(IAQ\) is for a long time](#). There were ventilation standards for [infection control](#) in the 1890s. Sick building syndrome emerged as a major problem in the 1970s. Research over the past 30 years has documented adverse effects on sleep quality, productivity and cognitive function when IAQ is poor.

Maintaining good IAQ may be as simple as flushing a building with lots of outdoor air, but that is rarely the best solution. All of that air must be heated or cooled, humidified or dehumidified to bring it to indoor conditions. That can require a lot of energy. Filtration, other kinds of air cleaning, and air disinfection can complement outdoor air and provide good IAQ more efficiently and at lower overall cost.

How does ASHRAE factor in? What does the new standard represent for the general public?

Bahnfleth: ASHRAE's minimum standards for acceptable IAQ and energy use of buildings have been the basis of building codes since the 1970s. Today, ASHRAE is developing new standards and guidelines for

decarbonizing buildings, mitigating the effects of wildfire smoke, and reducing risk of airborne disease transmission indoors—Standard 241.

It's the first standard in a century to establish minimum requirements for reducing infection risk by controlling infectious aerosols, the small pathogen-containing particles emitted when an infected person exhales, and it does so in a way that can be adopted and enforced by authorities. It is intended to apply to periods of elevated risk, like the emergence of a dangerous new pathogen, and could also be applied to periods of high risk from influenza and other established diseases.

What are the key takeaways?

Bahnfleth: The most important thing Standard 241 does is to establish what we call "equivalent clean air" delivery requirements for different types of spaces. A building has a minimum air quality value that can be met by providing outdoor air to dilute infectious aerosols, filtering indoor air to remove them, or using other technologies to inactivate them.

This is a new and powerful concept in indoor air standards because it allows the user to choose among different options to develop the best situation for their circumstances. For example, increasing outdoor air above the levels required for normal operation may be a poor solution because of the cost of conditioning it or if outdoor air quality is poor where the building is located.

The standard also provides strong requirements for determining the performance of air cleaners; addresses safety, which is important because some air cleaners produce byproducts that are potentially harmful; and sets requirements for assessment and planning, operation and maintenance of systems that control infection risk.

What happens now? How does the standard make its way into building codes and day-to-day operations?

Bahnfleth: That's an important question. I want to emphasize that adoption of Standard 241 should be part of a broader and much needed effort to improve IAQ. A promising path for early adoption is referencing the standard in the requirements of large government landlords.

Cities are often able to move faster than states or the federal government, so I am optimistic we will see that happening soon. It has been announced recently that [New York City is considering groundbreaking indoor air quality regulations](#) that could reference Standard 241.

Another path is by incorporating it into existing standards that are referenced in building codes. The consensus committees—committees with balanced representation of interested parties—that write the code-referenced standards for acceptable indoor air quality like ASHRAE Standard 62.1 have been tasked with doing this.

Is there anything the public can do to help implement the standard in their homes and/or where they work?

Bahnfleth: Awareness is a starting point, and there are lots of good resources on the causes and effects of poor IAQ and ways to achieve better IAQ. Unfortunately, awareness doesn't necessarily stimulate action. I think the public has an important role to play in making authorities at all levels—from the [school board](#) to Congress—aware that this is an important issue that needs to be addressed.

That includes advocating for reasonable regulation of IAQ in operation.

Someone having dinner in a restaurant should be able to know that the air quality is good just as they can tell whether the kitchen has passed inspection.

Wildfire smoke is on the minds of many this summer—do the new standards help in this regard?

Bahnfleth: One of the main objectives of wildfire smoke control is to minimize the amount that gets into the building by reducing outdoor air intake as much as is allowed and putting high-efficiency filters on outdoor air intakes. For infection risk mitigation, as I've described, we need a high-equivalent clean air delivery rate. Standard 241 shows how that can be done without increasing outdoor air flow, so it is compatible in that sense.

Beyond that, air cleaning systems installed as part of complying with Standard 241 that remove particles from the air also help clean up wildfire smoke that enters a [building](#). I put a portable high-efficiency particulate air cleaner in every occupied room of my house. They were able to keep the indoor particulate level from the wildfire smoke at the level recommended by the World Health Organization, even under the worst conditions we experienced.

Provided by Pennsylvania State University

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