ASSESSING HVAC SYSTEM FILTERS' IMPACT ON IAQ

Featured Science and Technology for the Built Environment article

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Using filters in HVAC systems is one way to reduce exposure to airborne particulate matter in residential buildings, which can lead to health risks for building occupants.

In a recent
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article, Masih Alavy and Jeffrey Siegel, Ph.D., Fellow Member ASHRAE, present an integrated picture of the overall performance of higher efficiency residential filters by assessing the impacts of their use in residences that incorporate a forced air recirculating HVAC system.

The article, "IAQ and Energy Implications of High Efficiency Filters in Residential Buildings: A Review (RP-1649)," has two major research questions:

What is the effectiveness of higher efficiency filters in reducing residential PM concentrations?

What is the impact of higher efficiency filters on system energy use?

Siegel discusses the significance and challenges of this article and its research. The research helped motivate an ASHRAE research project.

Why is it important to explore this topic now?

Much of human exposure to harmful particulate matter occurs indoors, especially in residences, where people spend much of their time. One approach to mitigate this exposure is the use of high efficiency filters in residential HVAC systems. However, residential HVAC systems are less standardized than commercial systems; and thus, the impact of high efficiency filters is not particularly clear. The importance of residential settings, and the uncertainties associated with filter performance in homes, motivates investigation of effective approaches to reduce PM exposure in these buildings.

What is the significance of this research?

The goal of this research was to understand what is already known about the performance of higher efficiency filters in residential HVAC systems. An integral part of this research is a thorough assessment of particle removal and energy impacts of residential filters, as well as a health benefits and costs comparison between residential and commercial filters. This research helped motivate a field project investigating the performance of filters over a year in 20 homes (ASHRAE RP-1649).

What lessons, facts and/or guidance can an engineer working in the field take away from this research?

The same filter can perform differently in seperate homes. It is important to understand the context of the home and HVAC system (e.g., how leaky it is, what particle sources are present, how often the heating and cooling system operates, what is the air flow through the system) is very important to how well the filter will work. Specifying a better filter may not be sufficient to achieve better filtration performance in homes.

How can this research further the industry's knowledge on this topic?

The examination of the long-term performance of higher efficiency filters in this research suggests caution in the application of the assumption that higher efficiency filters perform better than lower efficiency filters, and always have positive health and economic benefits. More importantly, the performance of filters and their impacts should always be viewed in the context the HVAC system and the house where they are used. We need long-term field research to really quantify the factors that impact filtration performance.

Were there any surprises or unforeseen challenges for you when preparing this research?

This paper resulted from a literature review; and thus, we were limited to studies that had been published and were available to us. There are very few long-term studies on filtration, especially in residences, which points the need for more research to further understand how filters are performing in residences and who we can do to further improve filtration performance.

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