Polar Shift: The Benefits of Polarized Media

(Chosen for print)

Polar Shift: THE BENEFITS OF POLARIZED MEDIA

utilizing new methods to solve an old problem, technicians have more than one way to clear the air and meet the requirements of ASHRAE standard 62 indoor air quality procedure.

BY DUKE WISER

In the drive to improve indoor air quality and save energy, there is a tremendous shift on the horizon. While conventional wisdom has held that the best IAQ strategy involves increasing ventilation rates in HVAC systems, this method is not always the best choice from either a health or a cost standpoint.

Technological advances in cost-effectively cleaning the air already inside of a building has enabled the industry to not only equal, but often improve IAQ compared to outdoor air, while achieving far greater efficiency. ASHRAE Standard 62 provides two ways to achieve "acceptable" IAQ in buildings:

The Ventilation Rate Procedure—This prescriptive method is based primarily on occupancy, where a minimum amount of outdoor air per person is constantly introduced into the building. This procedure assumes that there is no air cleaning taking place inside the building; the only means of addressing indoor contaminants is by diluting them with clean outdoor air; and the outdoor air is clean.

The IAQ Procedure—This method looks at actual potential levels of contaminants in a building and takes into account things such as air cleaning, good air-flow patterns, low-emitting materials and no-smoking policies.

Pollution Solution = Dilution?

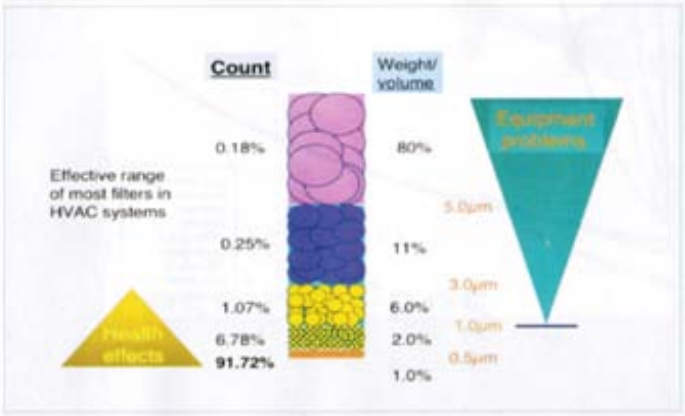
The origin of this aphorism is polluter humor, implying that anything can be dumped in the ocean, for example, because it is so vast. However, several trends are changing things: improved IAQ, increased awareness of outdoor-air problems, increased focus on energy savings and improvements in air-cleaning technologies.

In many ways, IAQ has improved because of awareness, green-building trends and the near-total ban of smoking in buildings. The Ventilation Rate Procedure used to accommodate "moderate smoking," which was measured by estimating that 30% of the occupants smoke one cigarette an hour. Although smoking is no longer in the standard, the ventilation rates have not changed much. Without smoking, indoor contaminants essentially have four sources: people, activities and equipment, furnishings, and outdoor air. Green-building trends, regulation and the use of low-emitting materials have curtailed many of these sources.

In many buildings, measurable contaminants have only two primary sources: cleaning supplies and outdoor air. In fact, in non-industrial settings, outdoor air is far more likely to cause an IAQ problem than an inside source. A building's surroundings are a huge factor. For example, what if the building is in a city, or next to a busy highway or a construction site? In this case, the quality of the air being drawn in is often horrendous and can be filled with particulate matter, VOCs, dangerous ultrafine particles (those that measure less than 0.1 micron), and other combustion byproducts. This defeats the whole purpose of ventilation.

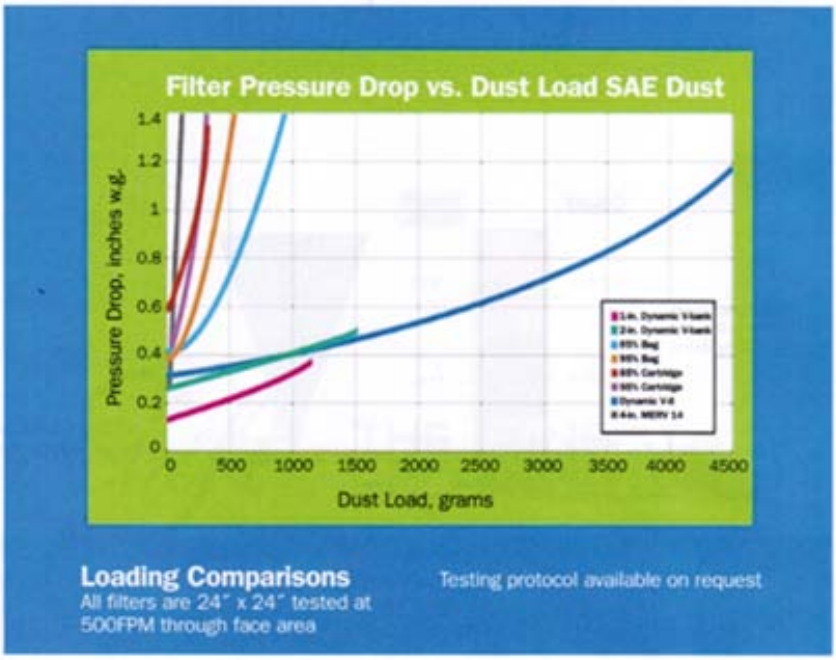
Another issue with outdoor air is energy consumption. It must be conditioned for the comfort of occupants, and that costs a lot of energy and money (each cfm of outdoor air costs $2–$4 per year to condition). The more ventilating that occurs, the more it costs to condition that outside air.

If the outdoor air quality is unacceptable, ASHRAE requires that air cleaning be used to bring down contaminant



<< Figure 1 **Particle count and mass distribution.**

levels. With modern design practices and air-cleaning technologies, it is fairly easy to make indoor air better than outdoor air. One example rests in the LEED Platinum renovation of AHSRAE's headquarters in Atlanta, GA. Identified contaminants of concern also can be an extremely helpful tool, but getting it right is worth it. The IAQ Procedure, when employing the proper air-cleaning system and overall system design, opens the door to tremendous benefits and cost savings—and living up to greener standards—for building owners and managers. In many applications, ventilation rates can be reduced by 50% or more over the Ventilation Rate Procedure and still have better IAQ.



>> Figure 2 **This graph shows pressure drop as a function of dust load.**

The small stuff matters

The number and weight of contaminating particles are inversely related. A few big particles make up the bulk of the mass, while the millions of ultra-fine particles—which can cause the most health problems—make up the bulk of the particle count but just a tiny fraction of the mass (see Figure 1). Coils and equipment care mostly about the larger particles, and historically that is what filters and buildings are meant to protect. However, occupants' lungs and respiratory systems—as well as very sensitive electronics—care more about the sub-micron and ultrafine particulate. Particles in this size range bypass a body's defenses and carry with them a wide range of VOCs and reactive gas-phase contaminants.

Biological contaminants are a subset of particles. There are a number of sources both inside and outside of the building. MERV-13+ filtration can help control biological contaminants; the moisture control also is important.

Gas-phase contaminants also have a number of sources. Inside a building, they can come from furnishings; cleaning supplies; paints and finishes; and people. Outdoor sources tend to be from combustion processes such as vehicles, kitchen exhaust, diesel generators, etc.

Using technology

There are a number of ways to remove contaminants from the air. One technology that is being used increasingly is active-field polarized media. Besides effectively cleaning the air and helping in the application of the IAQ Procedure, it also can save significant fan energy and maintenance dollars.

Polarized media is an active filtration technology that uses a high-voltage, low-current electric field to polarize both the fibers of a media pad and contaminants that pass through it. With power from a 24-V source, the affected particles are then attracted to the polarized fibers of the filter media, which attracts them just like opposite poles of a magnet. Polarized filtration improves air-cleaning performance by utilizing three-dimensional loading of particles to media fibers, as opposed to one-dimensional trapping seen in traditional passive filtration.

Another inherent benefit of polarization is the process of agglomeration, where particles are attracted to each other and form bigger groupings that are more easily captured. This mechanism is especially helpful in the superior ability of polarized-media air cleaners to capture ultrafine particles.

The net result is a system that clears the air of all three types of contaminants at one-third the operational cost of conventional alternatives. Polarized media can achieve a MERV-13 to a MERV-16 performance, capture dangerous ultrafine particles and biological contaminants, and reduce VOCs and odors. There is a strong value proposition without outdoor-air reduction. Where the IAQ Procedure makes sense, the combination can be extremely compelling.

Conclusion

Engineers are constantly on a quest to design healthier buildings for its occupants that are more economical to operate. Appropriate use of the IAQ Procedure and air cleaning are helping an increasing number of designers achieve both goals.

Duke Wiser is the President of Dynamic Air Quality Solutions. For more information, e-mail dwiser@dynamicaqs.com or visit www.dynamicaqs.com.