FIVE CONCERNS OVER AIR IONIZATION FOR ENHANCING IAQ – ESPECIALLY IN SCHOOLS

Air ionization can emit dangerous ozone, lacks validation, can impair student performance, has questionable effectiveness and is unreliable

By Nick Agopian

Air-Sealed Buildings Suffer from Deficient IAQ
With buildings becoming increasingly air-sealed, a consequence is a rise in deficient indoor air quality (IAQ), which is a serious—yet often unnoticed—threat to occupant health, productivity and well-being. Deficient IAQ is especially concerning since people are indoors about 90% of the time (the elderly 95%) and the Environmental Protection Agency (EPA) found that indoor air may be two to five times, and occasionally greater than 100 times, more polluted than outdoor air. Hence the EPA ranks indoor air pollution among the top-five environmental risks to public health.1

Deficient IAQ causes many negative health and cognitive issues. On the health side, it can lead to acute problems such as allergies, headaches, coughs, asthma, skin irritations and breathing difficulties, as well as severe illnesses such as cancer, liver disease, kidney damage and nervous-system failures. It also causes cognitive impairment and sickness/absenteeism, which harms student and worker performance and costs the U.S. economy $168 billion annually, according to the Building Ecology Research Group.2

Schools are at Particular Risk of Suffering from Deficient IAQ
At particular risk of suffering from deficient IAQ are our nation’s schools due to their high occupant densities and aging facilities. Deficient IAQ can be very potent for students as the EPA found that poor-quality indoor air is one of the highest environmental threats to children’s health and welfare, especially because their bodies are still developing. The EPA also found that deficient IAQ can significantly impair students’ academic performance.3

Causes of Deficient IAQ
A complex array of internally generated contaminants, such as toxins, vapors, gases, chemicals and other Volatile Organic Compounds (VOCs), can build up and diminish IAQ. Contaminants are introduced in many ways, but the primary means is by being off-gassed from such sources as construction materials, furniture, fabrics, carpets, paints, sealants, finishes, cleaning supplies and even the human metabolic process that emits bioeffluents.

How do you remove indoor air contaminants? Several options exist, but one specifically that’s growing in popularity—especially in schools—is needlepoint air ionization. Needlepoint air ionization one specifically that’s growing in popularity—especially in schools—is

Air ionization is a process that’s claimed to decrease indoor air contaminants by charging particles in the air and removing them through an electrostatic force. However, many concerns exist about the safety, effectiveness and reliability of this technology, and it’s important to be aware of these issues—especially in schools where this technology is gaining ground. With that, below are the five reasons why air ionization is concerning when it comes to enhancing IAQ.

1. Ionization Can Emit Harmful Ozone
A study by the University of California, Irvine found that certain ionic air purifiers are capable of maintaining steady-state levels of ozone that are well in excess of the health-protective standards.4 In addition, Consumer Reports tested several ionization air cleaners and also found that many emitted significant levels of ozone.5 Why is this important? Ozone inhalation can be harmful to both adults and children, and therefore its generation should be avoided indoors.

Ozone is known to have many adverse health effects. According to the EPA, breathing in ozone can result in chest pain, coughing, throat irritation, congestion, lung issues and even premature death at high levels, as well as toxins. According to the EPA, breathing in ozone can result in chest pain, coughing, throat irritation, congestion, lung issues and even premature death at high levels, as well as toxins. According to the EPA, breathing in ozone can result in chest pain, coughing, throat irritation, congestion, lung issues and even premature death at high levels, as well as toxins.

1. All EPA facts from this paragraph are sourced from: “Why Indoor Air Quality is Important to Schools,” U.S. Environmental Protection Agency (EPA), https://www.epa.gov/iaq-schools/why-indoor-air-quality-important-schools.
as worsen bronchitis, emphysema and asthma.\(^6\) Also, according to a study 
by Columbia and Rutgers Universities, high doses of ozone can cause a 
transformation in animal cells similar to cancer.\(^7\)

Furthermore, ozone’s harmful effects are magnified when it dissipates 
indoors and creates more invisible contaminants. For example, when ozone 
reacts with the terpenes in lemon- and pine-scented cleaning products and 
air fresheners, it creates formaldehyde—an extremely potent carcinogen—
as well as other irritants and ultra-fine particles that are hard to filter and 
can penetrate deep into a person’s lungs.\(^8\)

2. Ionization’s Validation Falls Short

Ionization manufacturers say they meet the IAQ requirements as outlined in 
ASHRAE’s Indoor Air Quality Procedure (IAQP) from Section 6.2 of Standard 
62, but this threshold falls short. IAQP is inadequate for ensuring acceptable 
IAQ because it only considers a minimal list of contaminants (thus leaving 
many in the air), the odor test it uses is subjective, ongoing building-system 
vigilance is required and clear guidelines for meeting acceptable IAQ aren’t 
provided.\(^9\)

Moreover, the International Mechanical Code requires that the registered 
design professional demonstrate that an engineered ventilation 
system, such as ionization, will prevent the maximum concentration of 
contaminants from exceeding that obtainable by the rate of outdoor air 
ventilation determined in accordance with the minimum ventilation rates in 
the code.

3. Ionization Causes CO\(_2\) Buildup and Impaired Student Performance

A contaminant not included in the IAQP list is carbon dioxide (CO\(_2\)), which 
can negatively impact cognitive abilities and decision-making, according to 
the Harvard School of Public Health and the Lawrence Berkeley National 
Laboratory.\(^10\) Of particular alarm is that cognitive impairment was observed 
at CO\(_2\) levels commonly found inside homes, offices and schools. These 
study have prompted many organizations to take action in order to 
remove CO\(_2\) from indoor spaces.

We now know that too much CO\(_2\) in an indoor space should be avoided 
since it can cause cognitive impairment, yet air 
ionization actually increases CO\(_2\) levels indoors. 
This is because air ionization breaks down 
contaminants into different compounds, 
one of which being CO\(_2\), thus causing it 
to build up. In addition, air ionization 
uses the IAQP as its IAQ guideline, 
but the IAQP doesn’t even include 
CO\(_2\) as a contaminant, so it’s not 
addressed.

4. Ionization’s Filtration Effectiveness is Questionable

On top of the concerns already mentioned above over air ionization, another 
one is the fact that its filtration effectiveness is questionable at best. For 
example, Consumer Reports looked at five ionizing air cleaners, and after 
conducting months of testing and expert investigation into their ability to 
remove dust, cigarette smoke and pollen, all five models were found to do a 
poor job of cleaning the air.\(^12\)

5. Ionization Systems are Unreliable and Prone to Malfunctioning

A final concern over air ionization is that these systems were shown to 
be unreliable and prone to malfunctioning. This was demonstrated in a 
study by Purdue University’s School of Mechanical Engineering and Birck 
Nanotechnology Center showing that as air molecules are ionized, positive 
ions impact the cathode surface and typically force an electron to be 
released, thus degrading system performance over time.\(^13\)
Ventilation is the Best Option for Enhancing IAQ
What’s the best way to provide cleaner and healthier indoor air? The answer is more and better ventilation. As long as enough fresh outdoor air is coming in and stale indoor is exhausted out, the indoor space will enjoy high-quality air. In fact, the Occupational Safety and Health Administration (OSHA) found that inadequate ventilation is the number one cause of deficient IAQ in workplaces.14

Ventilation’s critical role in achieving high-quality indoor air is underscored in ASHRAE’s other, more comprehensive, IAQ guideline – the Ventilation Rate Procedure (VRP) from Section 6.1 of Standard 62. As opposed to the IAQP, the VRP focuses on ventilation as the best way to dilute indoor air contaminants. The VRP clearly dictates both the quantity and quality of ventilation air, and because it’s so prescriptive, is the top choice for the majority of building designers.

Boost Energy Efficiency & Savings with Energy Recovery Ventilation
Energy recovery ventilation takes the effectiveness of ventilation one step further by enhancing IAQ both energy-efficiently and cost-effectively. This ventilation technology optimizes energy efficiency by preconditioning the outside air coming in with the otherwise-wasted heat and humidity of the exhaust air going out. The result is reduced HVAC loads, minimized carbon footprints and significant annual energy savings generated over the long-term.

Additionally, energy recovery ventilation is the perfect complement to increasingly air-sealed homes and buildings. The goal of air-sealing methodologies is to boost energy efficiency by reducing air leaks, but as we know, this decreased ventilation can lead to deficient IAQ. With energy recovery ventilation, the energy efficiency obtained through air sealing is maintained and cleaner and healthier indoor air is provided.

In Sum
With deficient IAQ on the rise, one option to reduce indoor air contaminants that should be avoided—especially in schools—is air ionization since it can emit dangerous ozone, lacks validation, can impair student performance, has questionable effectiveness and is unreliable. The best option for enhancing IAQ is energy recovery ventilation, which provides cleaner and healthier indoor air, optimizes energy efficiency, reduces HVAC loads and generates significant long-term savings.

Nick Agopian is Vice President of Sales and Marketing at RenewAire, a pioneer in enhancing indoor air quality in commercial and residential buildings of all sizes through high-efficiency, enthalpic-core, static-plate Energy Recovery Ventilation (ERV) systems. For more information, visit: www.renewaire.com.