

E-BOOK

Smarter buildings add up to **healthier students + better learning**

Learn how to not only improve IAQ, but also deliver
greater energy and operational efficiencies

SIEMENS



Did you know...

...indoor air pollution can be 2x to 5x higher than typical outdoor pollution?*

*U.S. Environmental Protection Agency (EPA). "What are the trends in indoor air quality and their effects on human health?" 14 July 2023.

What's **at stake**

K-12 school districts spend nearly **\$8 billion annually on energy costs**. Aging facilities combined with limited school budgets result in deferred maintenance of facilities with an estimated **\$270 billion needed for infrastructure repairs**.

Better Building US DOE – K-12 School Districts

38% of facilities management leaders report that their current budget is consumed by contingencies and deferred maintenance, which constrains the potential for regular upkeep and modernization.

The Strength of Strategic Partnerships in Educational Facilities Management: Forrester survey of K-12 public school facilities leaders



Challenges educators face today

Building age + aging infrastructure

The age of America's school buildings present a range of obstacles for today's educators—from outdated technology to inadequate HVAC systems that struggle to maintain safe and comfortable learning environments.



Funding + budget constraints

Funding and resource allocation play significant roles in addressing today's education challenges. Limited budgets make it difficult to invest in training, infrastructure, and support systems.



Safety, security, and resiliency

Ensuring the physical safety of students and staff, navigating health and wellness concerns, and creating long-term resiliency for the future of education are key concerns for K-12 educators.



Space utilization + management

Some older school buildings were designed for smaller student populations, so today's overcrowded classrooms can make it more difficult to provide individualized instruction. Moreover, older buildings may not be fully accessible to all students, affecting their comfort and dignity.



Sustainability + climate goals

Implementing sustainable practices and climate-friendly infrastructure often requires upfront financial investments. Shifting political and administrative priorities can also hamper districts' ability to achieve their sustainability and climate goals.



Workforce challenges

Today's educators face a wide array of workforce challenges, from teacher shortages and retention issues to heavy workloads, professional burnout, safety and security issues, and engagement from parents and the community.

Understanding Particulates in the Breathing Zone

Types of indoor airborne contaminants



Particulates

Dust, lint, hair, dirt, wildfire smoke, soot, and so on



Biological

Bacteria, viruses, molds, and pollen



Gaseous

Vapors from chemicals used in labs, cleaning solvents, CO₂

From the COVID-19 pandemic to the wildfires, some of the biggest threats now are also the most microscopic.

A particle needs to be 10 microns (μm) or less before it can be inhaled into your respiratory tract. **But just how small are these specks?**
Let's take a closer look!

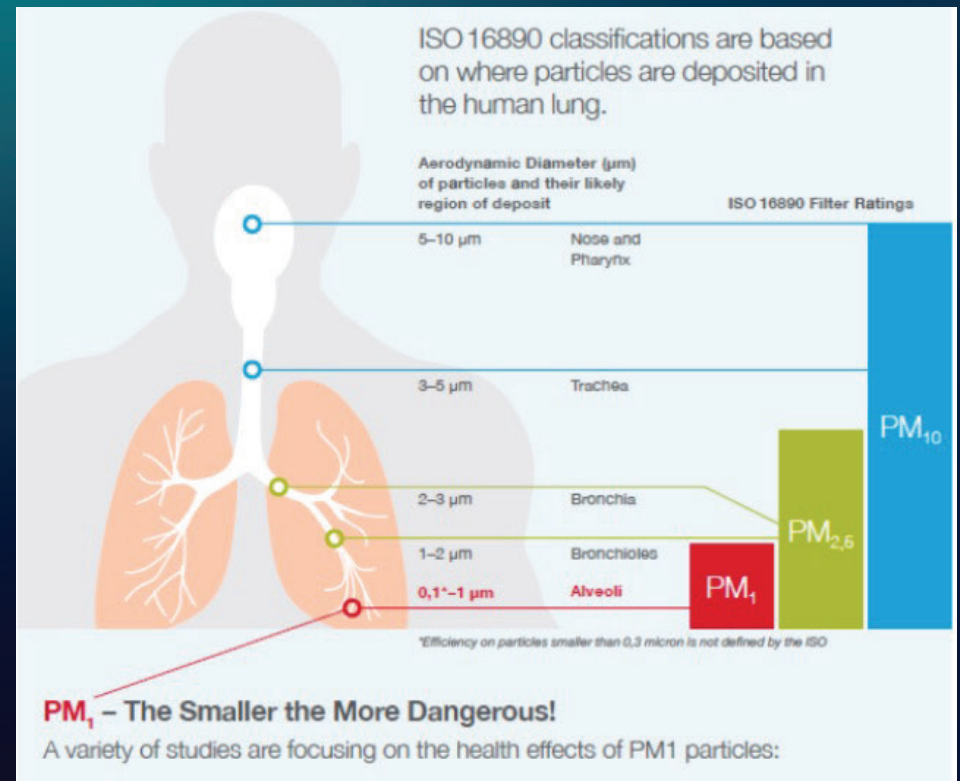


The smaller the particle, the **more dangerous** it can be.

More than **99% of particles in the air are less than 1 micron** and these particles behave very differently than the larger particles. Larger particles are normally removed by filtration which generally fall out of the breathing zone more easily.

And yet, when we measure particulates in the air, we have used PM2.5 as a measurement of particulate mass in a volume of air.

How can you determine what good IAQ means?



Optimizing the indoor environment



But one approach to managing indoor air quality is not enough to create the healthier learning environments that today's students and educators depend on."

David Santo

Director, Smart Air Quality Program



IAQ101: Why it's so important and what have we learned



IAQ102: How IAQ can be monitored effectively



IAQ103: Doing more with technology

How can you **get started?**

Needle Point Bipolar Ionization (NPBI™)

This technology can be installed in the air conditioning equipment where ion generators create millions of positive and negative ions to treat the air within your building.



HVAC + automation systems: optimize + maintain

Good HVAC maintenance is one of the best first steps in a healthy building environment. Properly maintaining mechanical equipment and controls means your automation system can achieve and maintain desired temperature, humidity, and building pressure.



Improved filtration + ventilation

Improve the effectiveness of filtration and ventilation to reduce fine particulates in the air and optimize for efficiency and IAQ.



AI-enabled Dynamic VAV Optimization (DVO)

Precise system control maintains temperature, humidity, and building pressure in ranges that can reduce the risk of viral spread. AI-powered optimization adapts to energy efficiency needs.



Continuous air quality monitoring

Continuously measure the most important aspects of indoor air quality with alarming for out-of-optimal results.

Smarter Schools:

Better learning starts with the air we breathe



Smart Air Quality™ Program for education

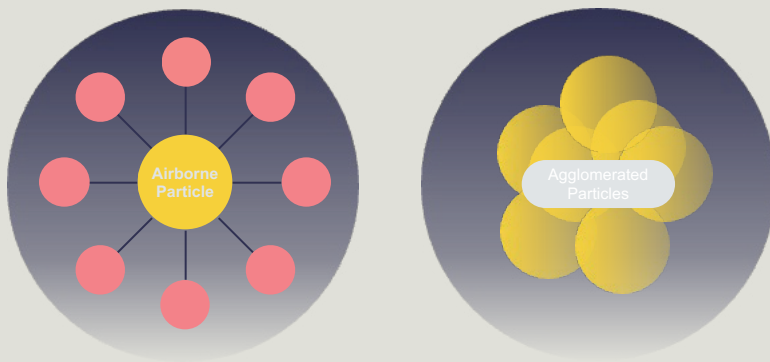
-  Continuous Air Quality Monitoring
-  Needle Point Bipolar Ionization - NPBI™
-  Improved Filtration & Ventilation
-  AI-enabled Dynamic VAV Optimization (DVO)
-  HVAC & Automation Systems Optimize and Maintain

Needle Point Bipolar Ionization



How it works

- Positive and negative Ions generated cause fine particles to be attracted to each other.
- As a result, particles becomes larger and can be captured more effectively by filters in the HVAC system.



Advantages

Needle Point Bipolar Ionization is typically installed in your air conditioning equipment where ion generators create millions of positive and negative Ions to treat the air in a building. These ions effectively treat the coil, ductwork, indoor air, and the surfaces in the rooms where they land. Unlike other ion generation, NPBI is certified by UL 867 and UL 2998 to be ozone free, making it safe to use in your school.

Ionization works continuously as long as the air conditioning fan runs and is effective against:



Improved filtration



Challenges

- Poorly installed filters are ineffective given the fine particles we are trying to capture at the HVAC air handler.
- As filters get overloaded, pressure creates pathways for particles to bypass filtration.

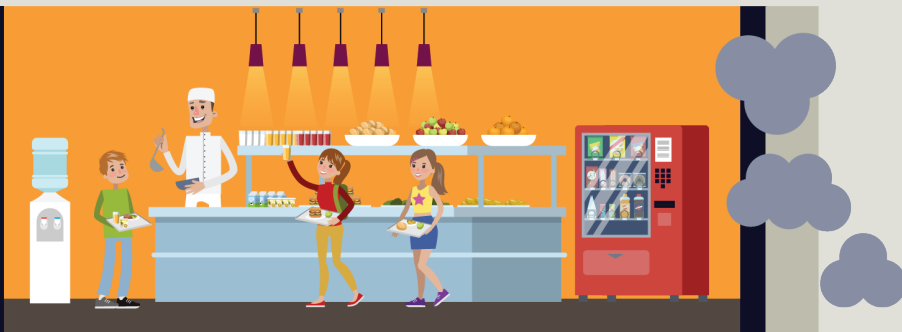
Recommendations

ASHRAE® recommends MERV 13 or better

- < 50% effective 0.3 to 1.0 mm
- < 85% effective 1.0 to 3.0 mm
- < 90% effective 3 to 10 mm

2021 Revised ASHRAE Recommendation MERV 14 or BETTER

- < 75% effective 0.3 to 1.0 mm
- < 90% effective 1.0 to 3.0 mm
- < 95% effective 3 to 10 mm



Dynamic VAV Optimization



Machine learning and artificial intelligence (AI) continue to evolve and adapt, and today they have given us Dynamic VAV Optimization (DVO). It's our answer to dynamically and automatically optimizing HVAC systems based on your priorities. Relying on a patent-pending software solution, DVO integrates with your existing Building Management System for rapid deployment in your school building.

How it works



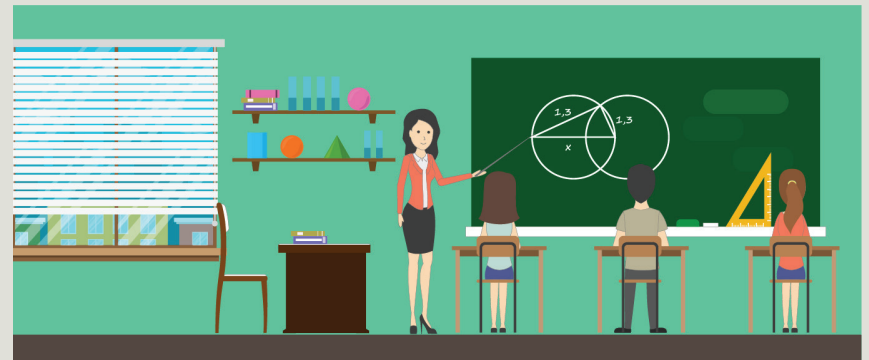
Green Mode – Control AHU fan speed and supply temperature to dynamically adapt to occupants' comfort requirements, minimize energy consumption and costs, and reduce hot/cold calls. DVO helps enable energy savings that can continue to provide value.



Defense Mode – Establish environmental conditions, pursuant to ASHRAE recommendations, that may help minimize virus transmission while still operating within acceptable comfort bounds.

Advantages

- Leverages existing control devices and sensors.
- Configures operations remotely for rapid deployment.
- Collects data from sensors and other external sources.
- Applies machine learning to make intelligent HVAC control decisions according to comfort, health, and safety requirements.

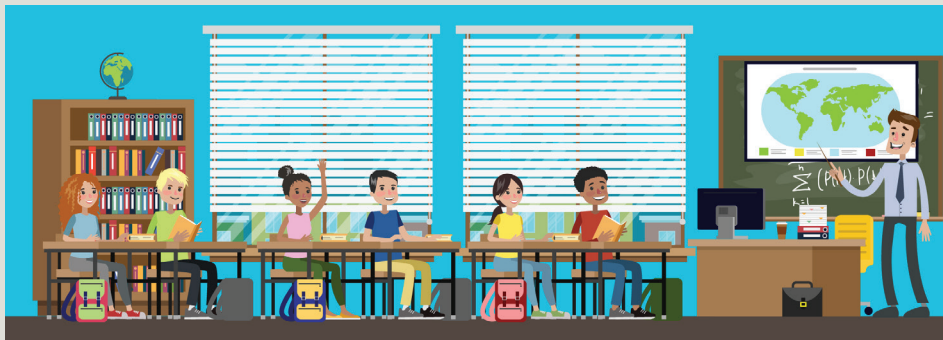


HVAC + Automation systems – optimize and maintain



How it works

Your building as a system made up of three core components of environmental controls: mechanical equipment, Building Management System, and the network interconnecting them. When an issue affects one of these components, it affects all of them, resulting in facility issues that can compromise your learning environment. So it's essential to ensure the health and efficiency of all three systems together over their entire life cycles.



Issues with ignoring maintenance

- Poor coil and drain pan cleaning can lead to the severe microbial contamination of HVAC systems.
- Poorly installed filter can allow air to bypass the filtration altogether.
- Infrequent replacement of filters increases fine particles in the ductwork.
- Inadequate humidifier maintenance can lead to microbiological problems.



Getting started

Step 1 Assess



Assess your current situation, priorities, needs and plan ahead.

Step 2 Select



Select the appropriate technology and operational solutions for your organization.

Step 3 Implement



Implement quickly and efficiently to leverage funding and improve IAQ in your schools.

Step 4 Monitor



Continuously monitor your environments and adjust if needed.

Learn more at:
usa.siemens.com/education

Ready to talk to an expert?
Contact us today.

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