



COLORADO
Department of Public
Health & Environment



Clean Air for Schools Program Overview

Program Mission: provide schools access to evidence-based building performance information (ventilation & comfort) through real-time indoor air quality monitoring.

Installing 2,400 IAQ monitors in 369 Colorado K-12 Schools
IAQ Monitors covering 25% of classrooms in each school

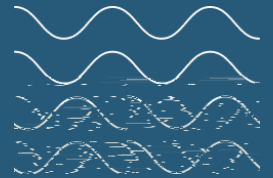
Each enrolled school receives:

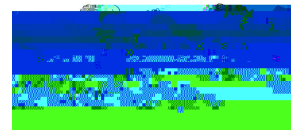
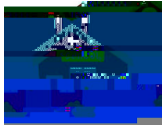
Installed indoor air quality (IAQ) monitoring system: Temperature, Humidity, CO₂, PM₁, PM_{2.5}, PM₁₀ & TVOC

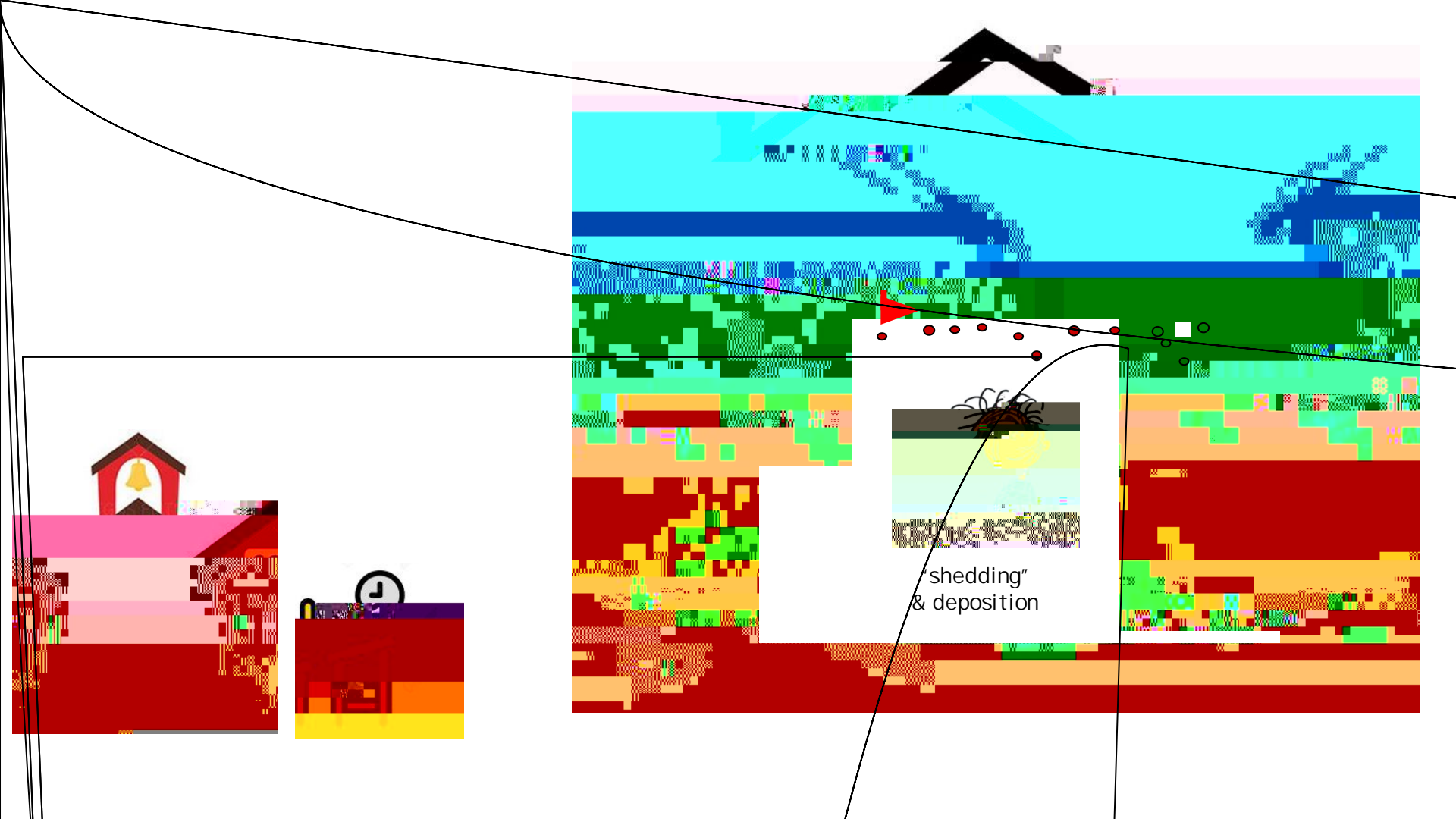
Access and ownership of IAQ Dashboard and all historical data (includes complete ownership of data): schools own all data, and decide who has access to the data. The data is secure! Includes a 2-year subscription to access dashboard and analytics software platform.

Program Funding:

Why Real-Time IAQ Monitoring?



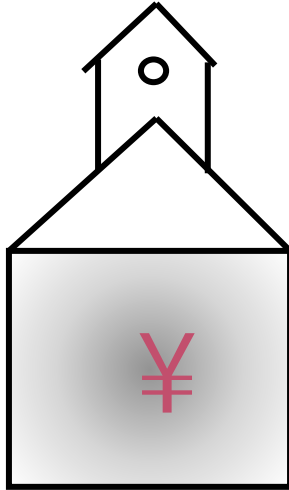




"shedding"
& deposition

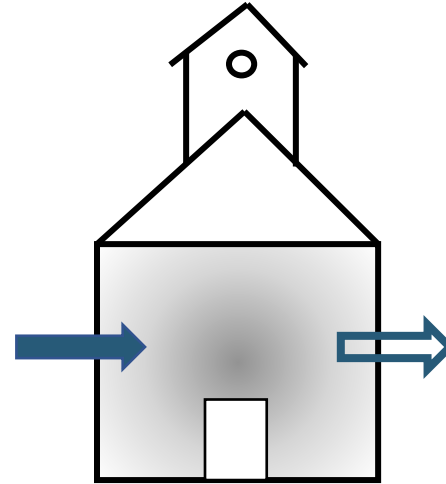
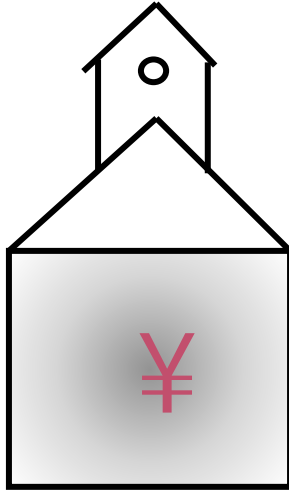


The higher the FRESH air exchange rate the better





The average amount of time it takes to replace one entire indoor room volume with "fresh" outdoor air

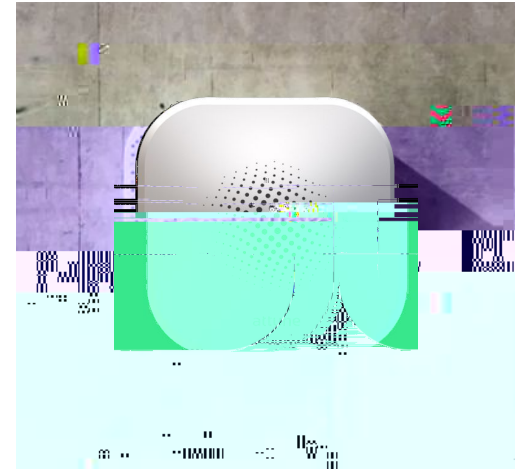
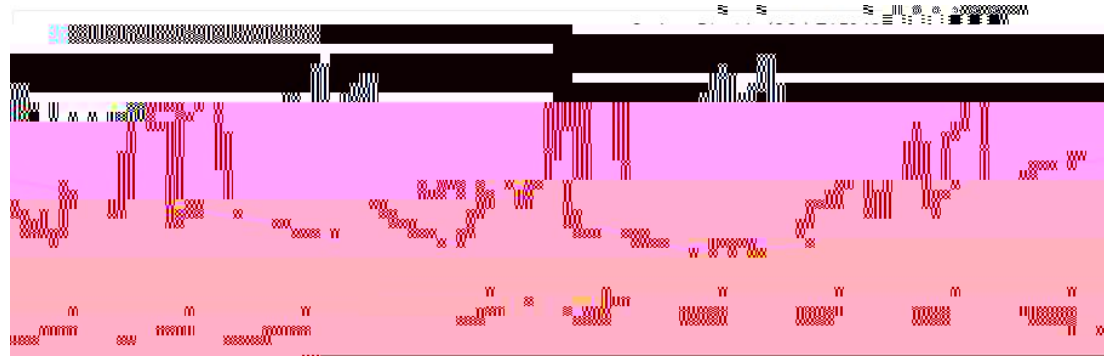


Schools decide:

What data to view

Who has access to the data

Who to share the data with



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Measured Parameters:

Temperature,

Humidity,

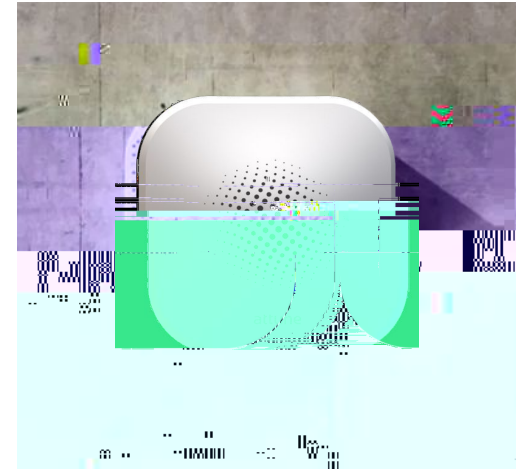
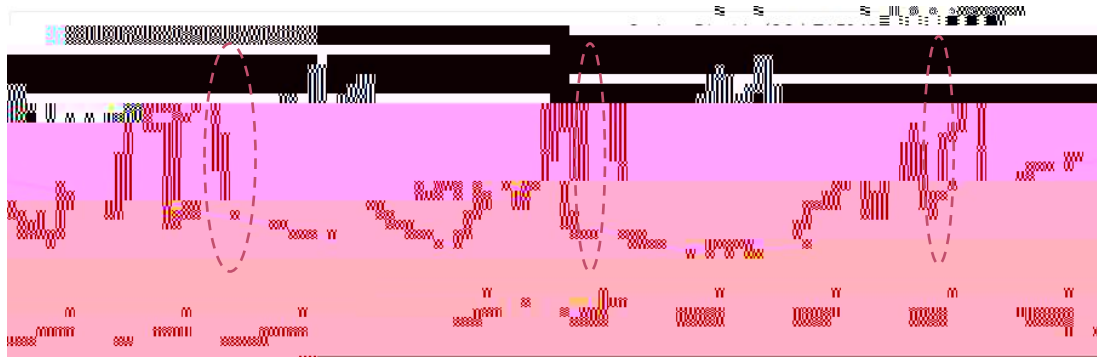
CO₂, PM₁, PM_{2.5}, PM₁₀

TVOC

All data is stored and accessible in a secure archive

~~(near)~~ real-time airborne (bio)chemical sensors

All IAQ data are securely archived



HVAC performance monitoring

Occupant density

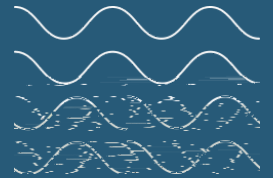
Fresh air exchange rate

You can't manage what you don't measure

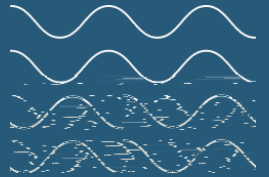
IAQ Guidelines to help understand measured IAQ data

Measurement

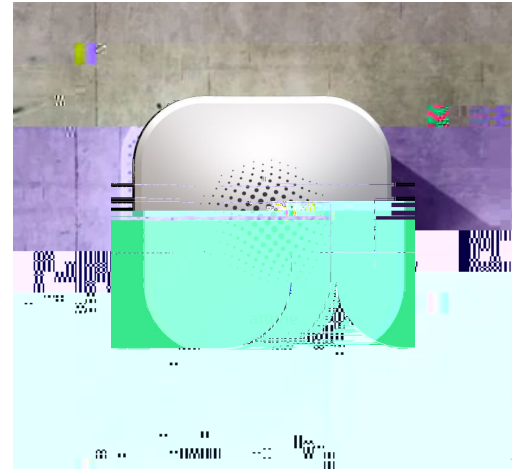
Real-Time IAQ Monitoring Use Cases



HEPA Filters



~~(near)~~ real-time airborne (bio)chemical sensors

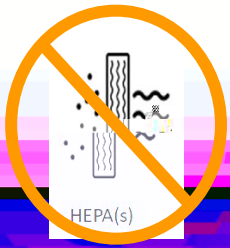


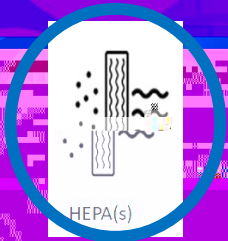
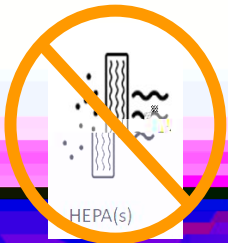
Airborne microscopic particulate matter (PM)
in respirable size ranges (includes bioaerosols)

* X | y(x) % Z y

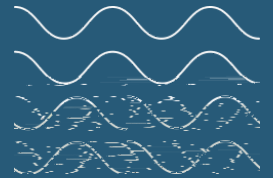
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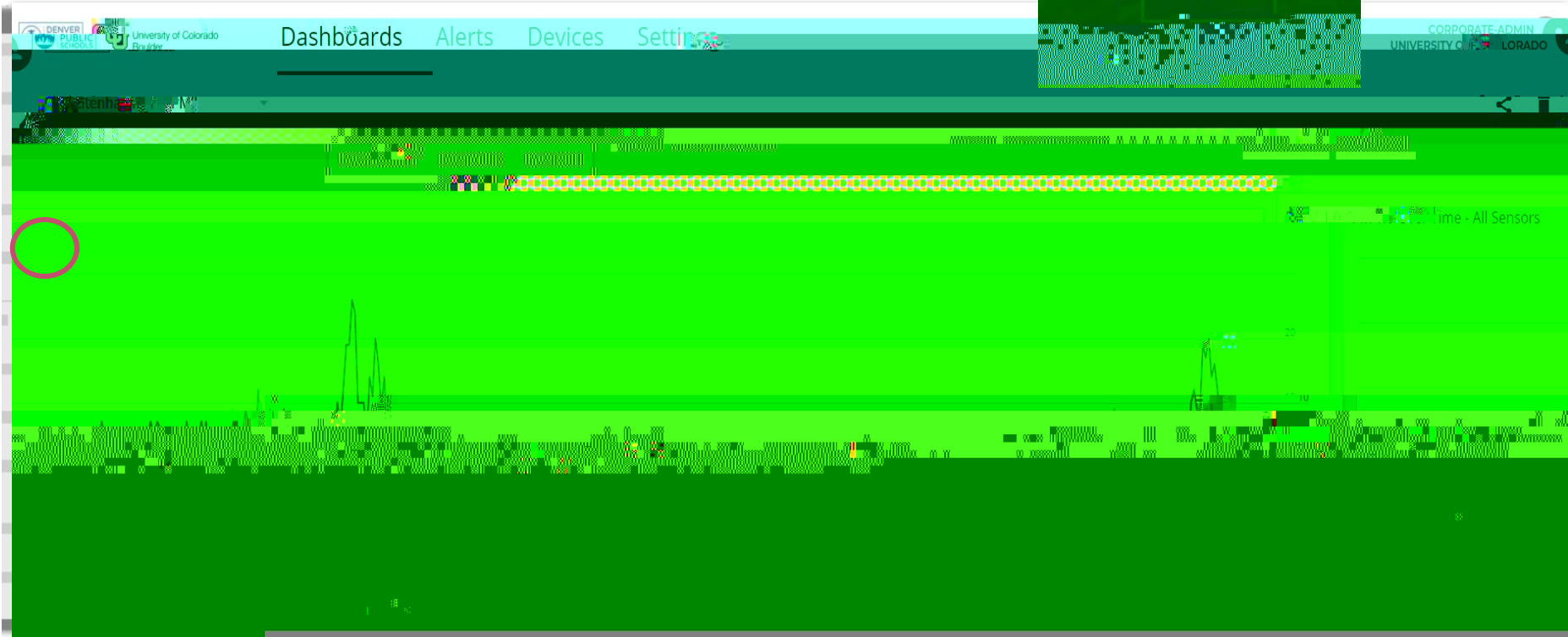
Establish Normalized Seasonal Trends for PM Exp P^{ord}s



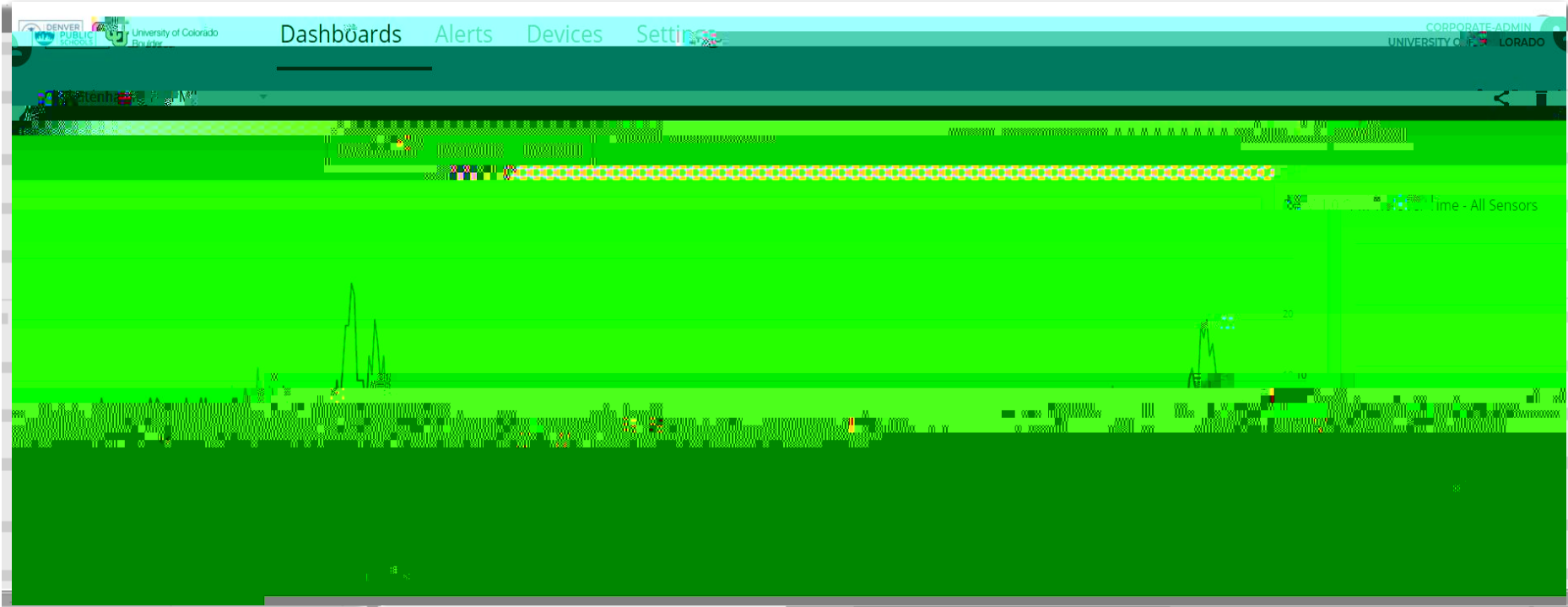
Ittenham - CO2



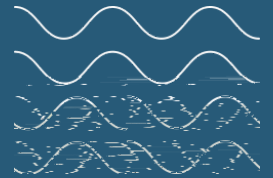
Real Time Airborne Particle Monitoring



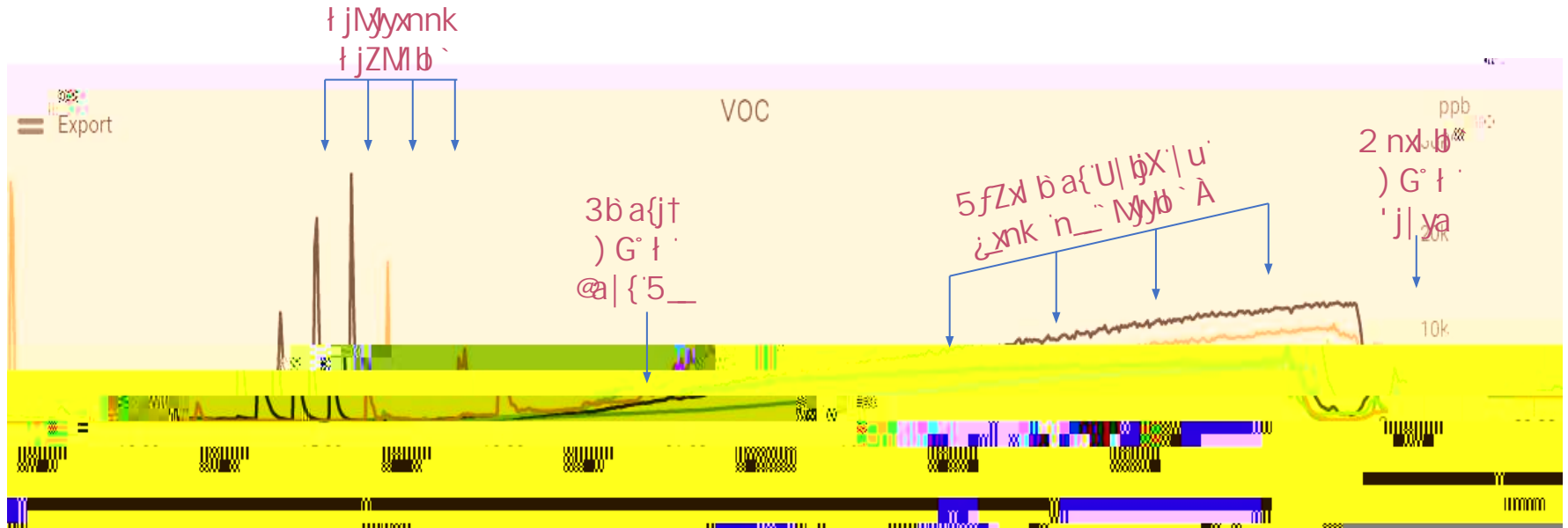
Real Time Airborne Particle Monitoring



Classroom Cleaning & Building Flushout

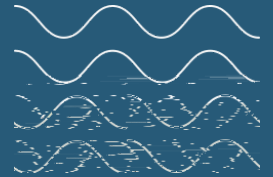


VOC patterns verify classroom cleaning and beneficial effect of building ventilation flushing

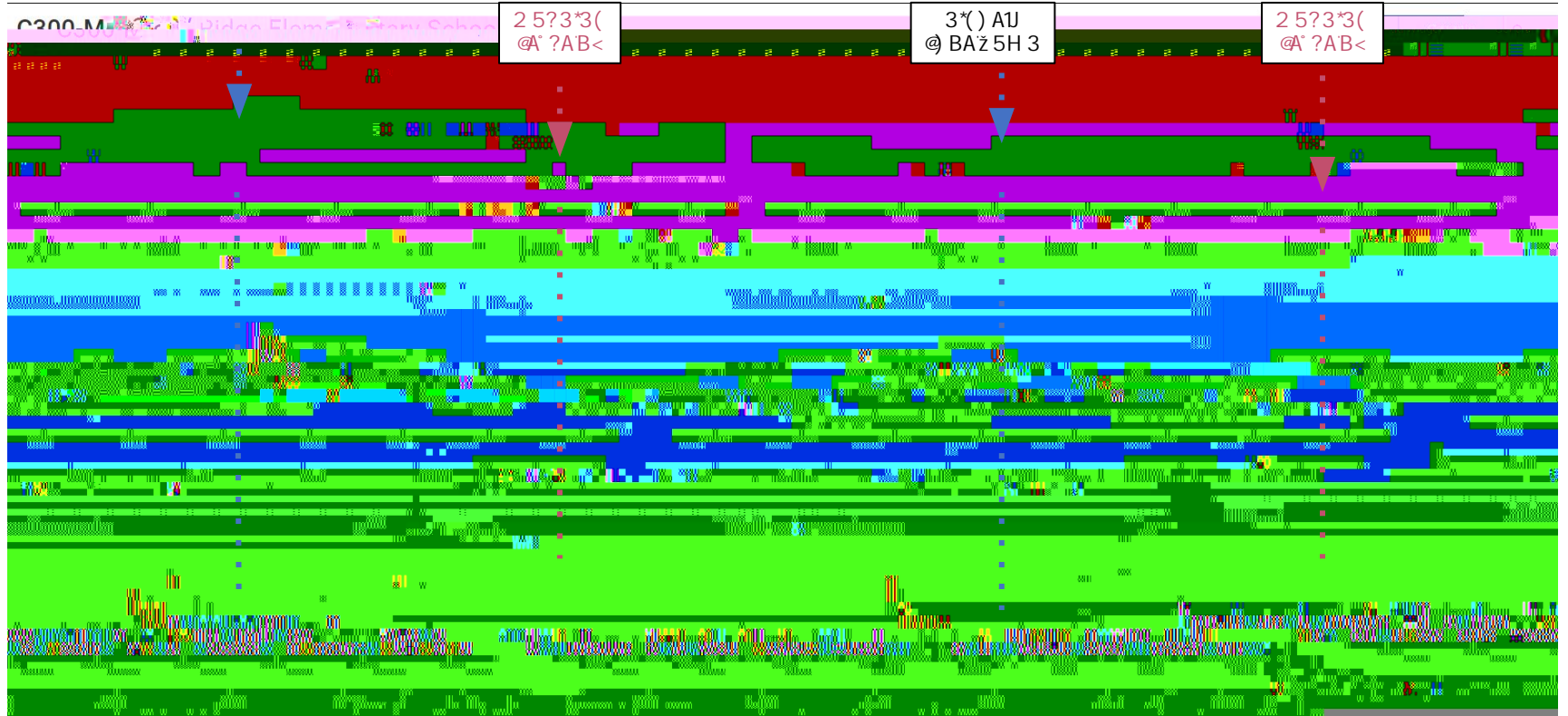


Understanding Building Hygiene Indicators -

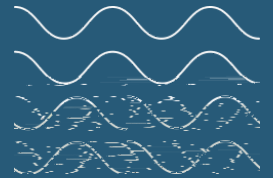
EXAMPLE FOR INDICATION OF
NEED FOR
DUCT/HVAC SYSTEM
COMPONENT CLEANING



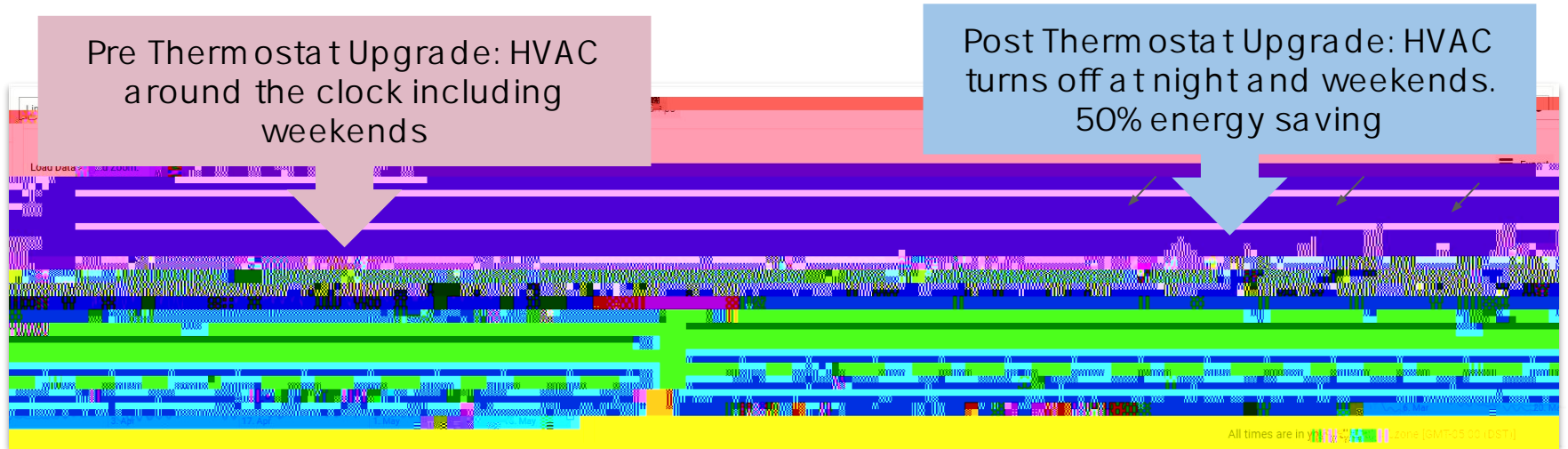
Sloughing & Resuspension of Duct PM following daily HVAC system start up



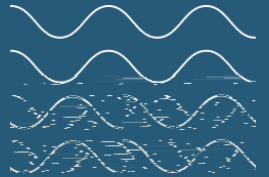
Intersection of Indoor Air Quality, Energy Efficiency, & Preventive Maintenance



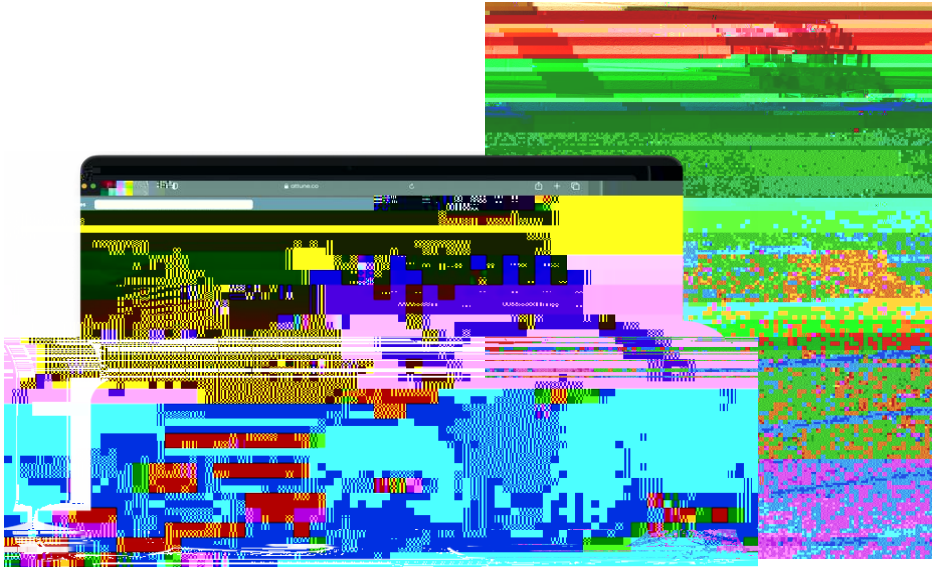
Adjusting HVAC Operations



Effect of Ventilation Strategies During Wildfires



Solution: Real Time Customizable IAQ monitors



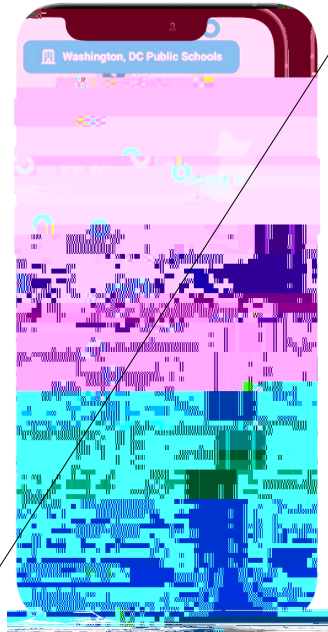
- Wireless Sensors
 - Temperature & Humidity
 - CO2
 - PM (1, 2.5, 10)
 - TVOC
 - UL2905 Certified
- Cloud - software
 - Real-time dashboard
 - Real-time alerts
 - Lobby View
 - Map View

Floor Plans

Simple snapshot of IAQ levels on a floor plan

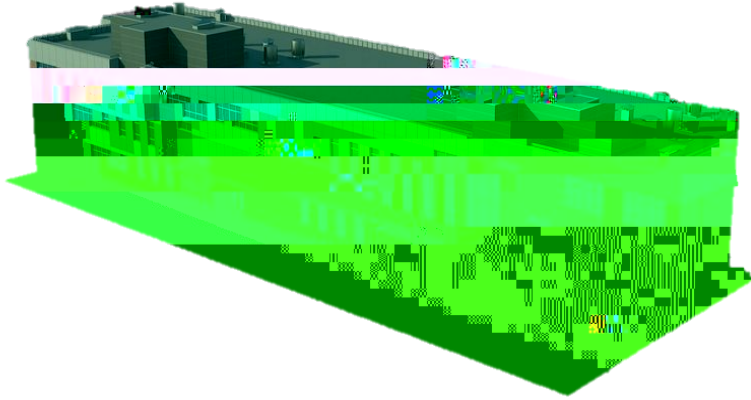
School Map View

Easily navigate a map view of the entire school district. Accessible 24/7 via URL for your staff, teachers and families.



Installation Process & Timeline

Non-intrusive & discrete



Tips for success

Learn more in an [IAQ Dashboard Training Session](#) and Additional IAQ Resources provided

Set up an IAQ monitoring and management plan. What can you learn from your IAQ data when buildings are empty and when occupied? How will you determine IAQ outliers for your school classrooms? How will, and who in, your schools will address those issues? How often do you plan to check in on the IAQ data (you can set up your own alerts)

Assign ownership of data access and monitoring to your administrators and staff appropriately. Designate a main IAQ Point of Contact with your District and/or School(s). Who will communicate and address IAQ issues at your school(s)?

Communicate your IAQ monitoring and management plan with school administrators, facility managers, staff and teachers

Educate administrators, staff, teachers, and students about what impacts school IAQ and what your school(s) are doing to maintain good IAQ

Additional IAQ Resources

What Schools Need to Know: Transitioning from Pandemic to Endemic IAQ Management (EPA Webinar)

EPA Indoor Air Quality Tools for Schools Action Kit

US Green Building Council Center for Green Schools

USGBC Green Schools Indoor Air Quality Fellow Application or Leaders in Sustainability Fellowship

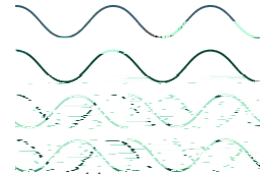
School IAQ Workshop Fall 2023

ASHRAE Technical Resources for Schools

CDC Operational Guidance for K-12 Schools and Early Care and Education Programs to Support Safe In-Person Learning

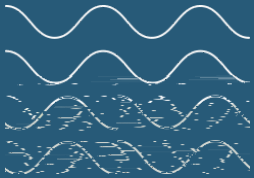
DOE Efficient and Healthy Schools Campaign & Resources

American Lung Association Clean Air at School



Key Takeaways

Can't manage what you re



The background of the slide is a collage of images. The top portion shows a close-up of several people in a meeting, with one person's face partially visible. Below this, there is a large, bright image of a group of people, possibly at a conference or event, with many people standing and talking. The bottom portion of the collage is a dark, abstract image with some light-colored shapes.

Q&A

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