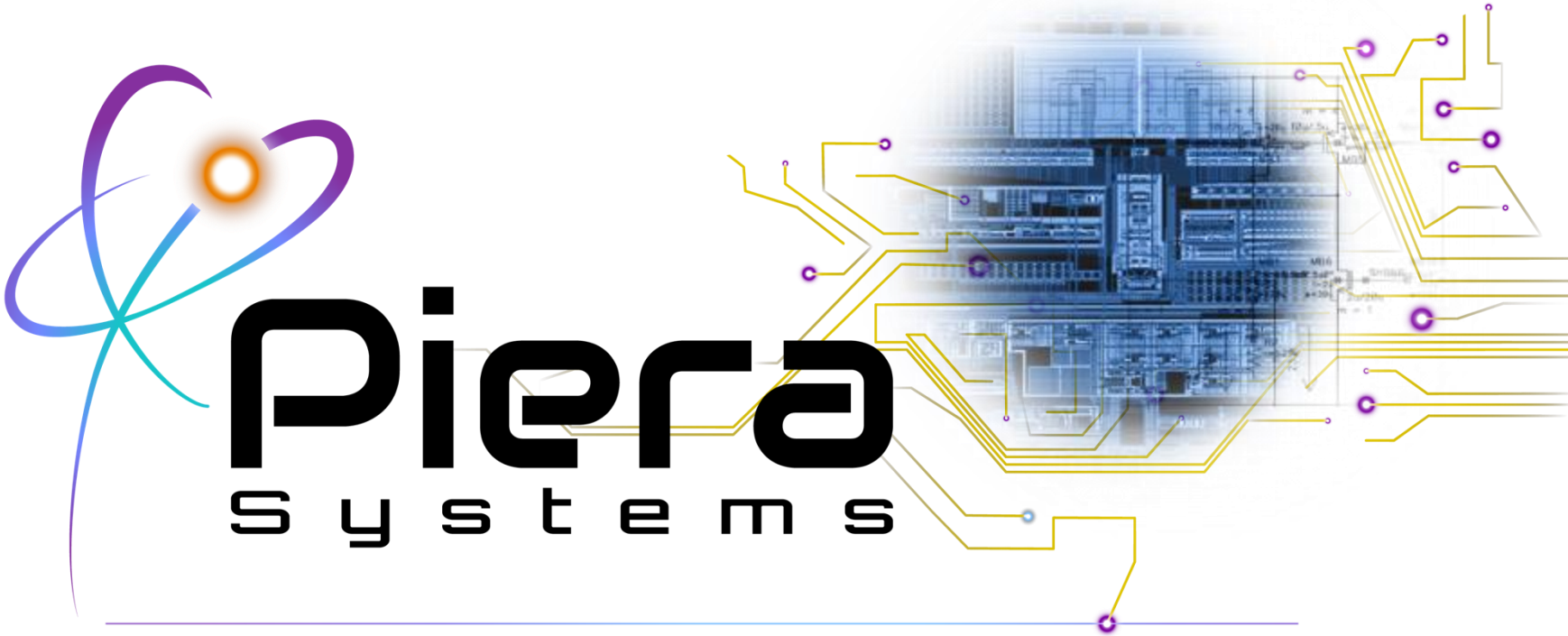
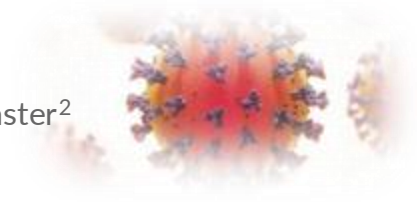


What's in your Air?

Air Pollution Affects Everyone

Causes lung cancer, alzheimer's, and cardiovascular diseases[1]



Allows Covid-19 and other respiratory diseases to spread faster[2]

Debilitates people with respiratory issues[3]

Severely reduces cognition affecting health & productivity[4]

Indoors 2-5X worse than Outdoors and as much as 100x[5]

8 million deaths/year, $5 trillion in welfare costs, $225B in lost income[6]

Particles are the biggest source of air pollution; the smallest particles are the most dangerous

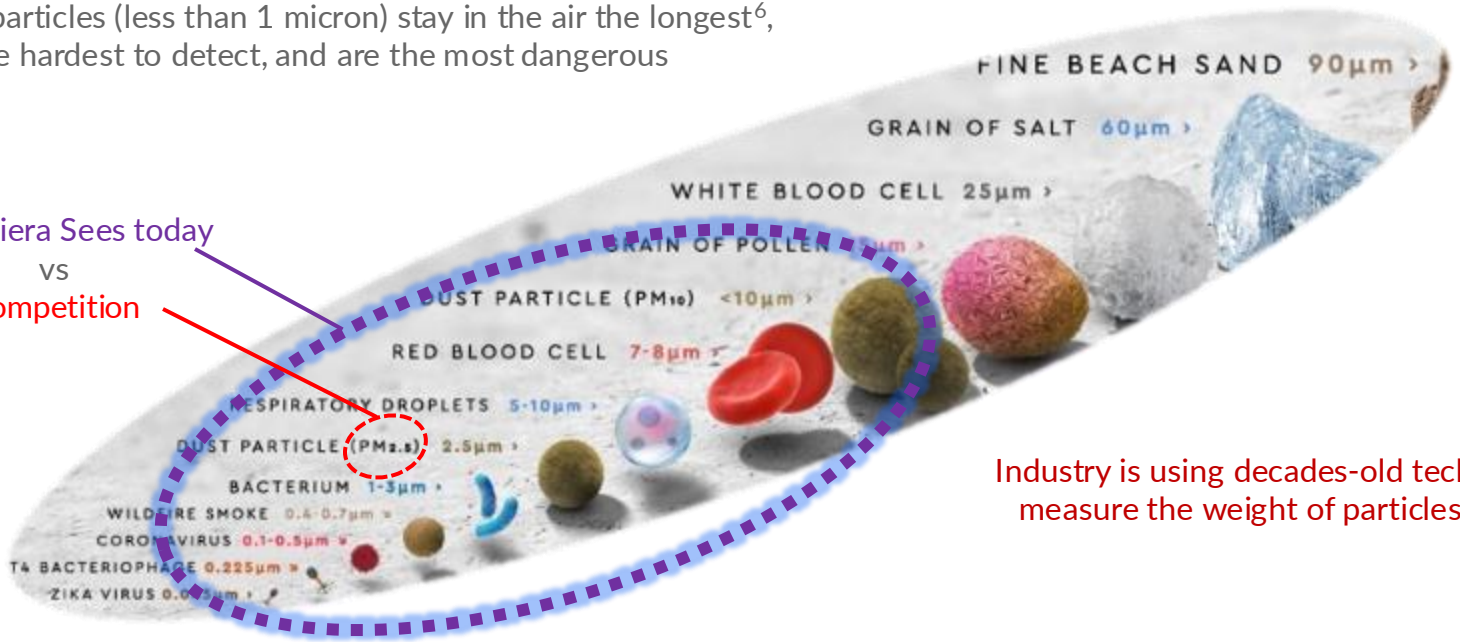
Piera Systems

The Problem

Air Quality most impacted by the smallest particles
There has not been a cost-effective solution to detect them

Smallest particles (less than 1 micron) stay in the air the longest[6], are hardest to detect, and are the most dangerous

What Piera Sees today
vs
Competition



Industry is using decades-old technology to measure the weight of particles (PM2.5)

Piera Systems

The Solution

Revolutionary technology identifies ‘What’s In the Air’ to provide actionable insights and reduce energy costs

Particle Sensors, Air Quality Monitors

Air quality data aggregated in the cloud

Software and services provide real-time alerts, insights, mitigation

AI/ML models classify pollutants for smart, healthy spaces

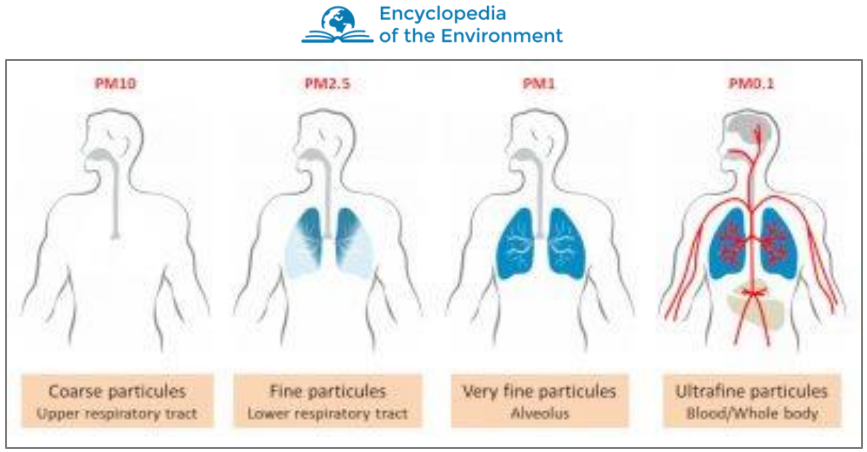
Accurately measure particles as unique signatures,
identify pollutants at a scalable price, monitor compliance to ASHRAE 241

Piera Systems

Particle Count or Mass?

PC, PM both provide valuable information

- PM2.5, only Green, Yellow, Red results
- PM2.5 does not identify sub-micron which is worse
- Sub-micron particles airborne 18 hours, much less mass
- PC data can be used to calculate mass more accurately
- PC technically challenging, expensive
- Piera's technology delivers PC and PM affordably



"Among the various air pollutants, fine suspended particles are the main cause of the health effects of pollution."

PC data gives more insights about the nature of pollutants and how to mitigate

Piera Systems

Reduce Virus Transmission Indoors

Challenge

Reduce Covid-19 Transmission Indoors by up to 90 %[1]

Aerosol Transmission highest PC 0.3-1.0 um

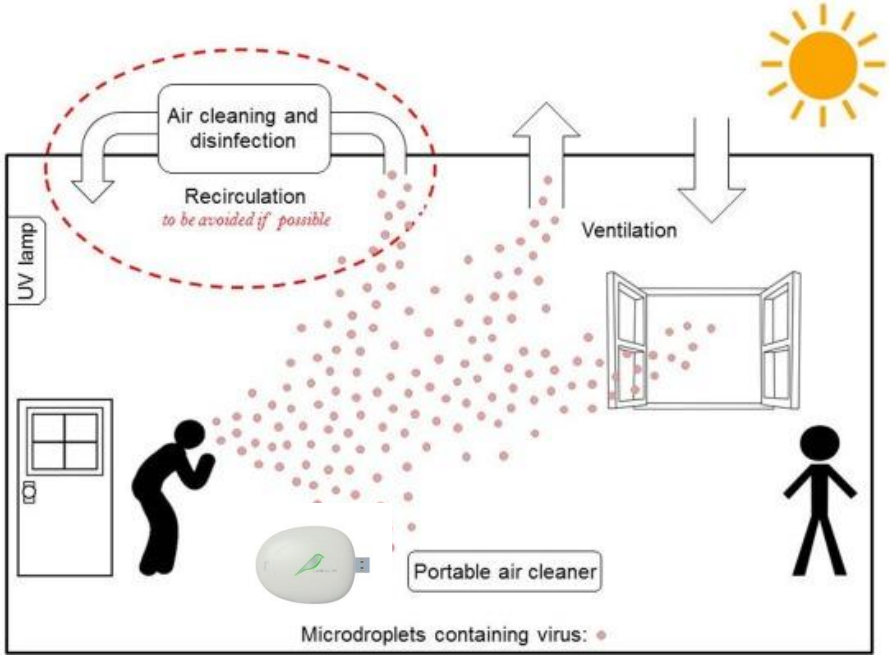
Monitor effectiveness of Mitigation Steps

Solution

5 or more Effective Air Changes based on Occupancy

Only Piera accurately detects 'aerosol' Particles <1.0 um

Accurate at all levels of concentration



Real-time monitoring detects elevated particulate levels, mitigation effectiveness, reduces energy use by 10-20%

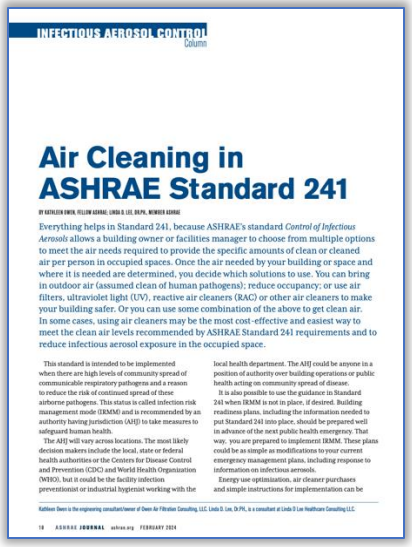
To reduce Virus transmission, you need Piera

1 - CDC, ASHRAE 241 Standard

Piera Systems

ASHRAE, CDC, EPA is Rolling Out IAQ Standards

Requires measuring PC <1.0 um in real-time


INFECTIOUS AEROSOL CONTROL Column

Air Cleaning in ASHRAE Standard 241

BY KATHLEEN OWEN, FELLOW ASHRAE; LINDA D. LEE, DR.PH., MEMBER ASHRAE

Everything helps in Standard 241, because ASHRAE's standard *Control of Infectious Aerosols* allows a building owner or facilities manager to choose from multiple options to meet the air needs required to provide the specific amounts of clean or cleaned air per person in occupied spaces. Once the air needed by your building or space and where it is needed are determined, you decide which solutions to use. You can bring in outdoor air (assumed clean of human pathogens); reduce occupancy; or use air filters, ultraviolet light (UV), reactive air cleaners (RAC) or other air cleaners to make your building safer. Or you can use some combination of the above to get clean air. In some cases, using air cleaners may be the most cost-effective and easiest way to meet the clean air levels recommended by ASHRAE Standard 241 requirements and to reduce infectious aerosol exposure in the occupied space.

This standard is intended to be implemented when there are high levels of community spread of communicable respiratory pathogens and a reason to reduce the risk of continued spread of these airborne pathogens. This status is called infection risk management mode (IRMM) and is recommended by an authority having jurisdiction (AHJ) to take measures to safeguard human health.

The AHJ will vary across locations. The most likely decision makers include the local, state or federal health authorities or the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO), but it could be the facility infection preventionist or industrial hygienist working with the local health department. The AHJ could be anyone in a position of authority over building operations or public health acting on community spread of disease.

It is also possible to use the guidance in Standard 241 when IRMM is not in place, if desired. Building readiness plans, including the information needed to put Standard 241 into place, should be prepared well in advance of the next public health emergency. That way, you are prepared to implement IRMM. These plans could be as simple as modifications to your current emergency management plans, including response to information on infectious aerosols.

Energy use optimization, air cleaner purchases and simple instructions for implementation can be

Kathleen Owen is the engineering consultant/owner of Owen Air Filtration Consulting, LLC. Linda D. Lee, Dr.PH., is a consultant at Linda D Lee Healthcare Consulting LLC.

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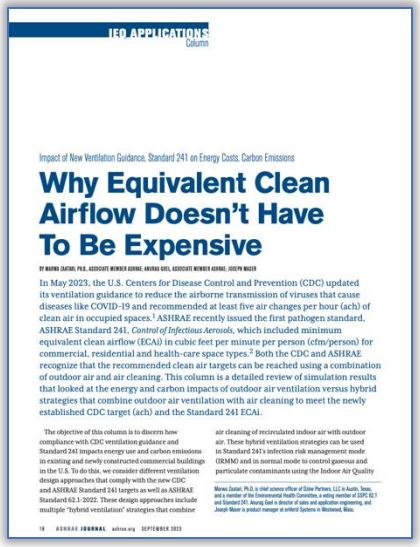
IEQ APPLICATIONS Column

Impact of New Ventilation Guidance, Standard 241 on Energy Costs, Carbon Emissions

Why Equivalent Clean Airflow Doesn't Have To Be Expensive

BY MARWA ZAITARI, PH.D., ASSOCIATE MEMBER ASHRAE; ANURAG GOEL, ASSOCIATE MEMBER ASHRAE; JOSEPH MAIER

In May 2023, the U.S. Centers for Disease Control and Prevention (CDC) updated its ventilation guidance to reduce the airborne transmission of viruses that cause diseases like COVID-19 and recommended at least five air changes per hour (ach) of clean air in occupied spaces.[1] ASHRAE recently issued the first pathogen standard, ASHRAE Standard 241, *Control of Infectious Aerosols*, which included minimum equivalent clean airflow (ECAI) in cubic feet per minute per person (cfm/person) for commercial, residential and health-care space types.[2] Both the CDC and ASHRAE recognize that the recommended clean air targets can be reached using a combination of outdoor air and air cleaning. This column is a detailed review of simulation results that looked at the energy and carbon impacts of outdoor air ventilation versus hybrid strategies that combine outdoor air ventilation with air cleaning to meet the newly established CDC target (ach) and the Standard 241 ECAI.

The objective of this column is to discern how compliance with CDC ventilation guidance and Standard 241 impacts energy use and carbon emissions in existing and newly constructed commercial buildings in the U.S. To do this, we consider different ventilation design approaches that comply with the new CDC and ASHRAE Standard 241 targets as well as ASHRAE Standard 62.1-2022. These design approaches include multiple "hybrid ventilation" strategies that combine air cleaning of recirculated indoor air with outdoor air. These hybrid ventilation strategies can be used in Standard 241's infection risk management mode (IRMM) and in normal mode to control gaseous and particulate contaminants using the Indoor Air Quality

Marwa Zaitari, Ph.D, is chief science officer at Ozone Partners, LLC in Austin, Texas, and a member of the Environmental Health Committee, a voting member of SSPC 62.1 and Standard 241. Anurag Goel is director of sales and application engineering, and Joseph Maier is product manager at enVerid Systems in Westwood, Mass.

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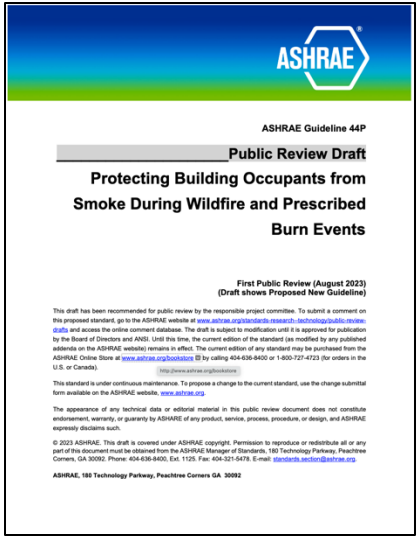
ASHRAE

ASHRAE Guideline 44P

Public Review Draft

Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events

First Public Review (August 2023)
(Draft shows Proposed New Guideline)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

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ASHRAE, 180 Technology Parkway, Peachtree Corners GA 30092

EPA is cracking down on deadly air pollution with a new rule – but it's not strong enough, some experts say

By Ella Nilsen and Jen Christensen, CNN
5 minute read · Published 8:00 AM EST, Wed February 7, 2024

Emissions from a smoke stack at the Essex County Resource Recovery Waste-to-Energy Facility in Newark, New Jersey, on January 21. Gary Hershorn/Corbis News/Getty Images

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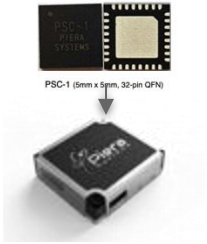
Break-through Air Monitoring Technology

World's only low-cost sensor comparable to a reference instrument

Custom Particle Processor

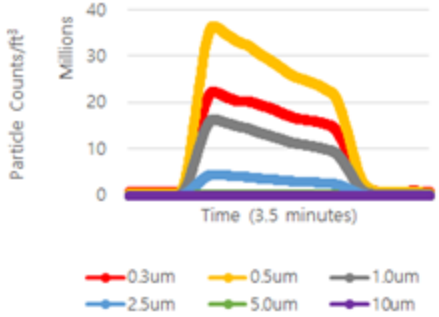


IPS PM Sensors

Canāree Air Monitors
(PM, CO2, TVOC, T, H)

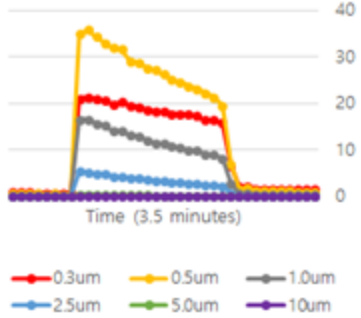
$50 - $350

Piera



$22,000

Grimm 11D



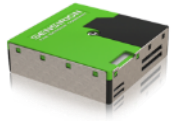
Independent particle count data a must for classification of pollutants, improving human health, and ASHRAE241

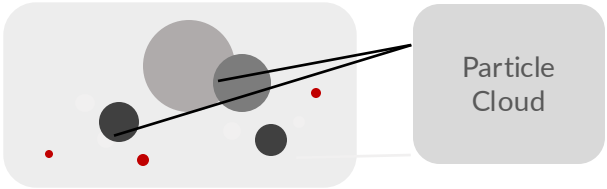
Piera Systems - Company Confidential

Differentiated Technology: Mass & Particle Count

Competition

Sensirion



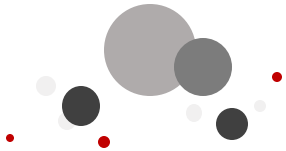


Estimates PM2.5
Green, Yellow, Red

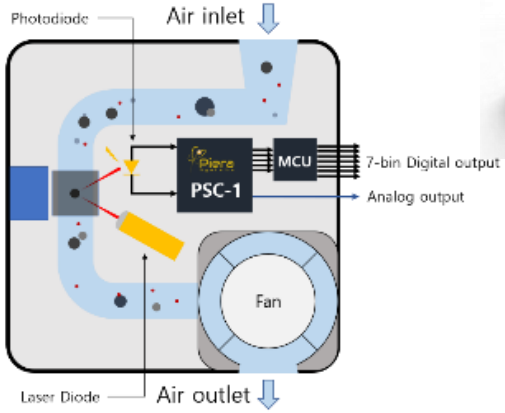
Sub-micron particles not detected

No Pollutant Sources

Piera



Photon-Counting



PSC-1: Particle Size, count in 7 unique bins
(0.1, 0.3, 0.5. 1.0, 2.5, 5.0 10 microns)

4 bins <1.0 micron

ISO 21501-4 certification available

Custom ASIC Data + AI/ML Identifies Pollutant Sources

Piera Systems

Products and Services

IPS Particle Sensors

- Integration into air quality monitors, air purifiers, and HVAC equipment

Canāree Air Quality Monitors

- Easy to deploy in Smart Spaces, Hospitals, Schools, and other verticals
- Wireless Access Points (HPE/Aruba)

SenseiAQ Software and Services

- Air quality monitoring subscription service
- Data and insights from SenseiAQ software
- Stand-alone application or connected to Piera MS Azure Cloud
- API for integration with third party applications
- Software updates

Pollutant Models

- Licensable, subscription service provided by Piera
- Customer developed in partnership with Piera
- OTA updates

Piera Systems

IPS: A Software Defined Sensor Family

IPS Family			Eval	Series 5			Series 7
			PEK	Piera-525	Piera-5100	Piera-5500	Piera-7100
# of Particle Bins			7	5	5	5	7
Dynamic Range	Binning Output in PC and PM	<0.1	X*	X			X
		0.3	X	X			X
		0.5	X	X	X		X
		1.0	X	X	X	X	X
		2.5	X	X	X	X	X
		5.0	X		X	X	X
		10	X		X	X	X
Features	Output in Particle Counts		X	X	X	X	X
	Serial Key for Networking		X	X	X	X	X
	Firmware Upload Capability		X	X	X	X	X
	Limited Programmability		X		X	X	X

Piera Systems

Canāree Family of Indoor Air Quality Monitors

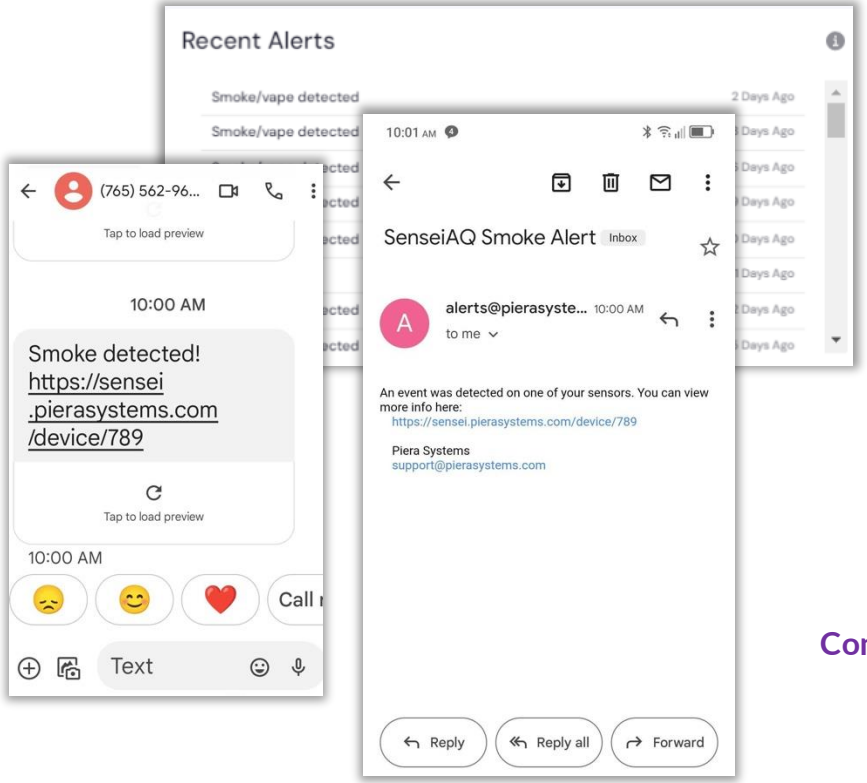
Canāree A1	Canāree I1	Canāree I5
Plug-n-Play Air Quality Monitor Measure particulates from PCs, mobile devices, and wireless access points USB powered Weight 42g	**Standalone Air Quality Monitor** Monitor particulates anywhere using WiFi, bluetooth, or ethernet & all features of A1 USB or external power Weight 42g	**Comprehensive Environmental Monitor** All features of I1 & temperature, pressure, humidity, & TVOCs USB or external power Weight 50g

Measure across entire PM range – PM0.1 to PM10
Built-in Vape/Smoke Detection
Fully integrated with the cloud. Intuitive UI included
Seamless integrations to BMS / BAS solutions
Dimensions: 8.98cm x 6.13cm x 2.06cm
Covers 100m^2, 1,000ft^2

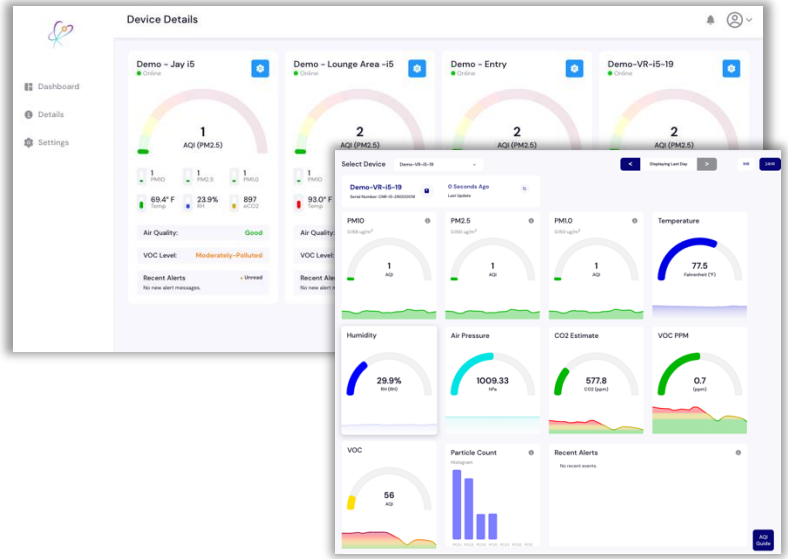
Piera Systems

Actionable Data and Alerts

Real-time text / email alerts and alert logs



SenseiAQ Software and Dashboard



Comprehensive environmental data delivers healthy, energy efficient indoor spaces

Piera Systems

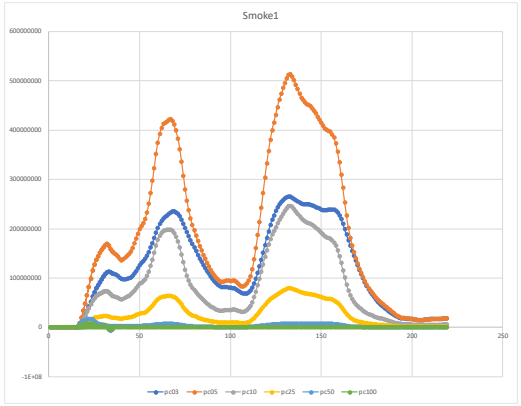
Elements for AI, Classification

Member

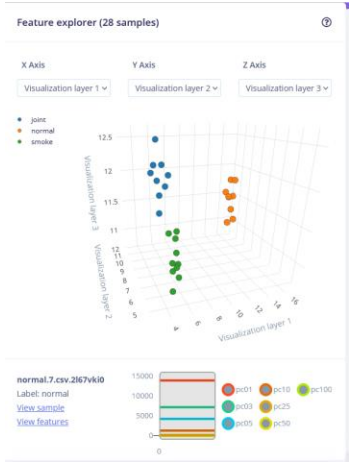
1. Data, Data and more Data
    - Labeled Training data (particle size, count) from different pollutants in controlled testing
    - Adding Chemical (gases) sensor data expands list of identifiable sources
    - Create initial ML model in cloud, reduce model size to fit onto embedded processor
2. Compute Power - to develop ML/AI models, test them (cloud)
3. Edge Inference Processing– to run the models locally, send alerts without a cloud connection
4. More Real-World Data – Improves model accuracy, add new classification sources

Piera Systems

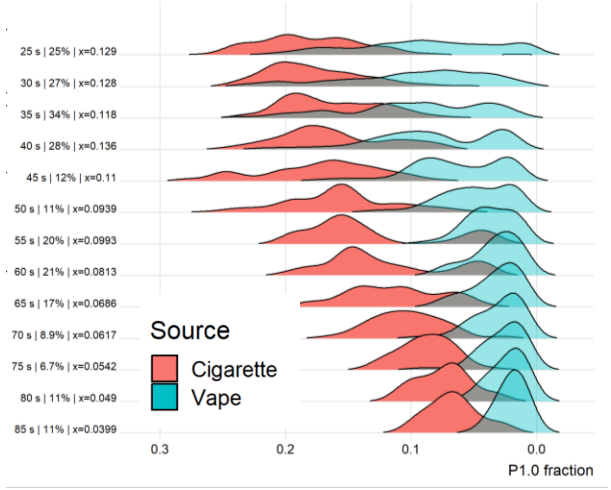
Classifying Pollution Sources with AI



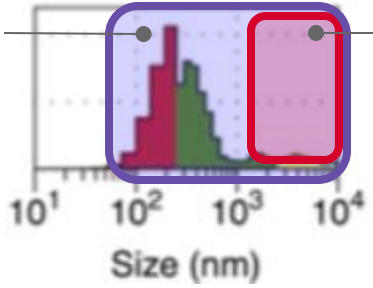
Classification requires accurate particle count and size data, from multiple ‘bins’, over time



ML/AI Model for Vape, Tobacco Smoke and Good Air



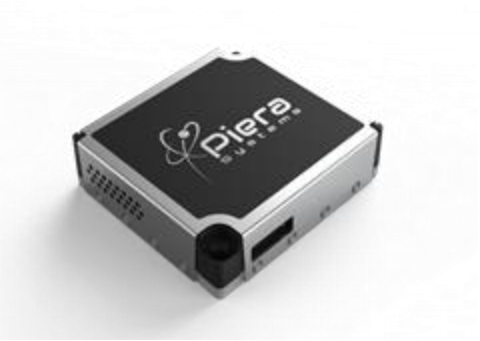
Time-Evolution of Size Fraction by Source [~5s intervals]

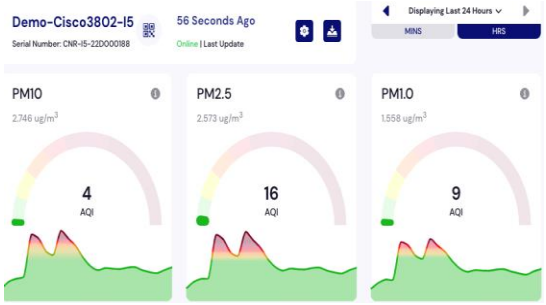


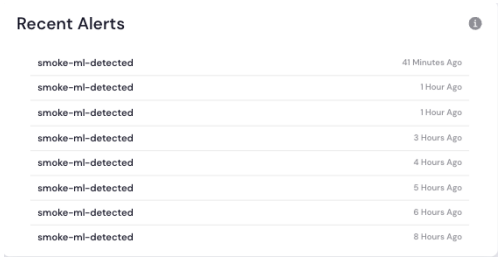
Only Piera can measure PM0.1-1.0 with 7 distinct particle sizes
Competition cannot classify particles

Vape/Smoke Detection

- Highly accurate event detection; within 30 seconds
- Identify smoke or vape from ‘masking’ (air fresheners, AXE) and ‘normal’ using ML/AI
- SenseiAQ displays events as they happen, sends alerts, logs them
- LED on Canaree flashes red for smoke and purple for vape



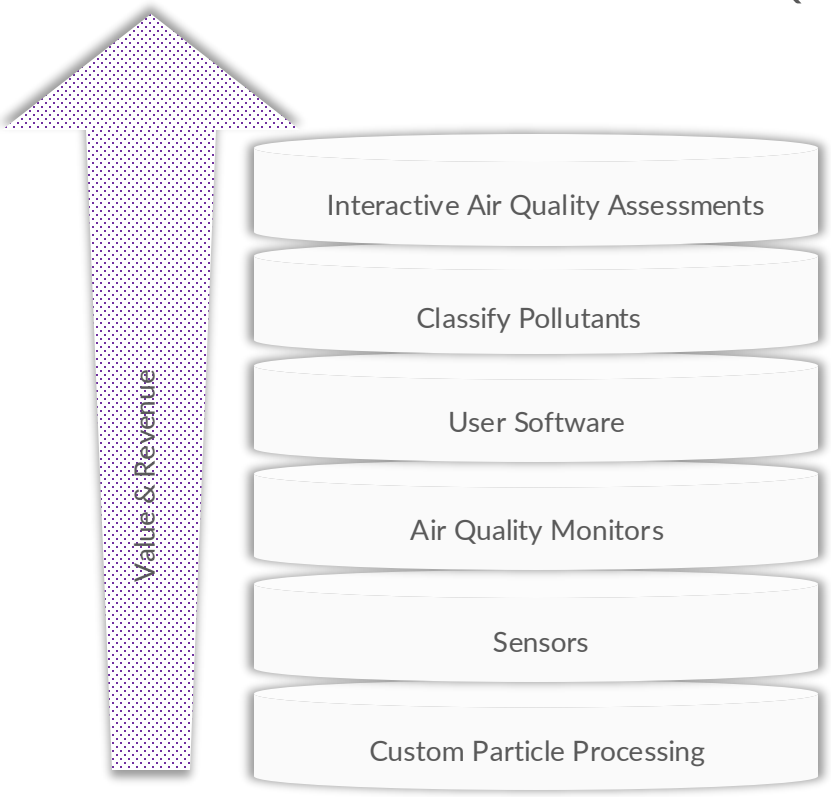




SenseiAQ Cloud Dashboard enables event detection from remote sensors

Piera Systems

The AQM Solution Stack



Microsoft Azure or cloud service of your choice

Alerts: Vape, Smoke, Masking,, ...

SenseiAQ, easy-to-use data visualization software

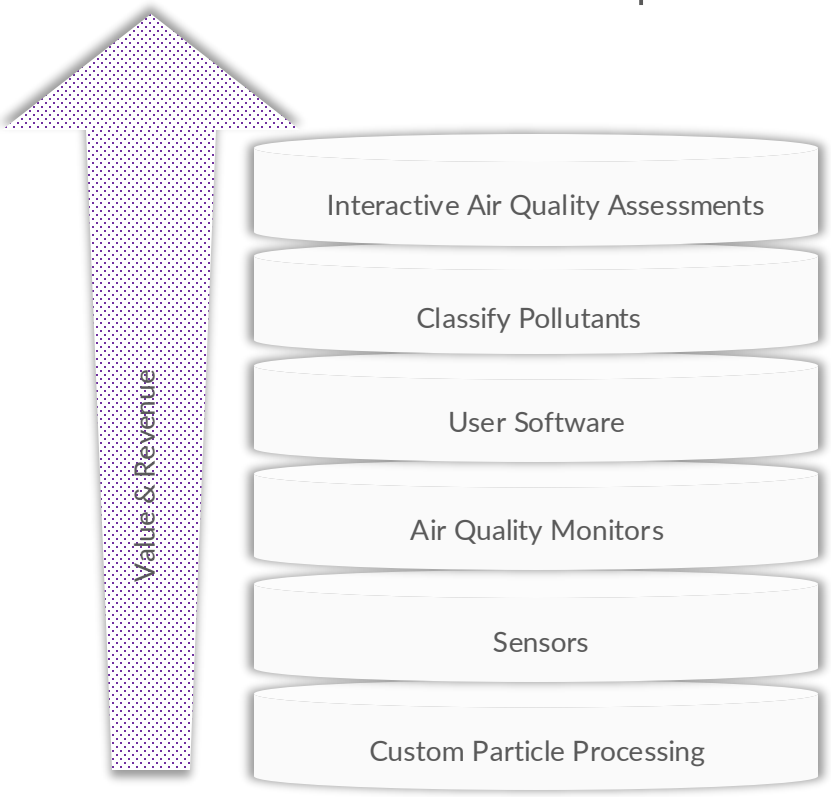
Canāree family of Air Quality Monitors

IPS, Intelligent Particle Sensors

PSC-1, proprietary ASIC, 3 US patents

Piera Systems

The Competition



	Piera Systems	Sensor Companies		AQM Companies	
		PLANTOWER 攀藤科技	SENSIRION	a	kaiterra
				Carrier	IQAir
Interactive Air Quality Assessments	✓				
Classify Pollutants	✓				
User Software	✓			✓	
Air Quality Monitors	✓			✓	
Sensors	✓	✓		✗	
Custom Particle Processing	✓	✗			

Piera Systems

Diverse Markets & Applications

Healthy Bldgs

Vape/Smoke, Schools

Industrial

Outdoors

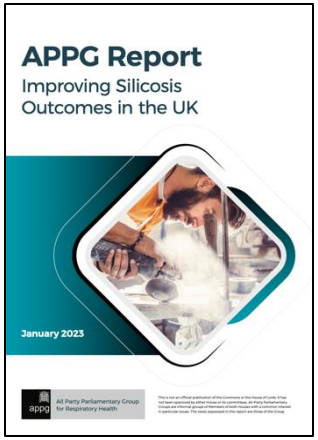
Energy Efficiency

Healthcare

Customer Spotlight: Trolex

Wearable Monitor Detects Silica Dust in Workspaces

Inhalation of respirable crystalline silica dusts (sized between 0.5 and 5.0 micrograms) causes silicosis



[US Sets New Limits on Miners' Exposure to Toxic Silica Dust]

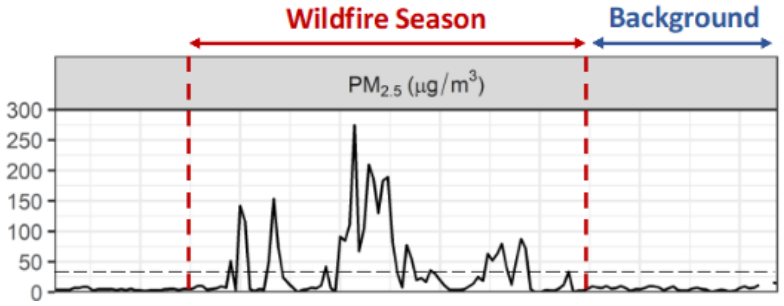
"We have picked Piera as our long-term partner to attack a vastly untouched sector with a huge demand for robust industrial sensing technology"

- CEO, Trolex, Mining and Industrial Solutions

Piera Systems

Protect Building Occupants during Wildfire Events

Focus on Fine Particulate Matter (<PM2.5),
establish background levels before wildfires arrive

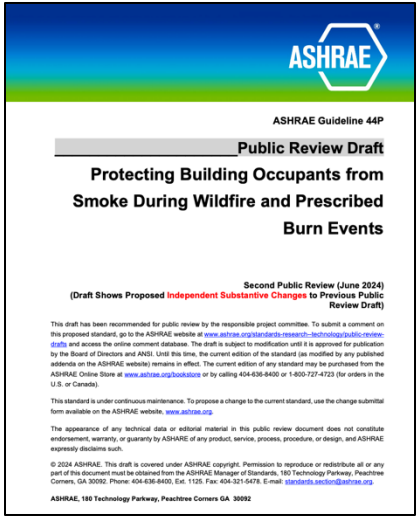


-- NAAQS value

PM2.5 Should be as Low as Reasonably Achievable (WHO <15 ug)

"Low-cost $PM_{2.5}$ sensors are increasing in availability so are highly recommended to be considered in new designs or added to existing buildings where practical. These sensors can act as one of the indicators of the effectiveness of any adaptations or design features of the HVAC system to reduce the impact of smoke on IAQ. They can also give information on when to trigger the **Smoke Readiness Plan**. In addition to measuring $PM_{2.5}$, some instruments include additional sensors such as for CO, CO_2, relative humidity (RH), or temperature"

Canāree AQM


ASHRAE

ASHRAE Guideline 44P

Public Review Draft

Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events

Second Public Review (June 2024)
(Draft Shows Proposed Independent Substantive Changes to Previous Public Review Draft)

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This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

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- Building Automation Systems
- Outdoor Infiltration – Airnow.gov

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Optimize Energy, Health, Occupancy, Usage

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- Inform — derive insights, identify pollutant sources
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Install Monitors, collect data before investing in mitigation and committing to Sustainability or ROI goals

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