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Indoor Air Quality (IAQ) Monitoring Tool Pilot: Progress & Next Steps

New York State Department of Health
School Environmental Health Program

November 2025 | SEHP Conference & Webinar Series

PRESENTATION OBJECTIVES

- Purpose & Overview
- IAQ Parameter Information
- Instrumentation
- Data Collection & Analysis
- IAQ Reports
- Progress to Date
- Preliminary Conclusions & Next Steps

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Benefits of a Healthy School Environment

- Improved student and staff health
- Decreased rates of absenteeism for students and teachers
- Reduced asthma and allergy triggers
- Stronger academic performance and improved test scores
- Increased teacher retention, and job satisfaction
- Cost savings for the school

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Why Focus on Indoor Air Quality (IAQ)?

Building Condition

- Indoor air quality (IAQ) is a concern in many schools due to the age and condition of the buildings and ventilation systems

Comfort & Health

- Poor indoor air quality can contribute to the incidence of asthma, allergies, and respiratory illnesses such as influenza, RSV, and Covid-19

No Indoor Air Standards

- Many IAQ Investigations at schools are prompted by staff, student, or parent complaints
- No standard method to evaluate acceptable IAQ within schools outside of building code requirements

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Indoor Air Quality Monitoring Tool for Schools

- Indoor Air Quality is a nearly universal concern in schools
- A standard procedure for evaluating indoor air quality is needed
- Use a tool to assess IAQ relative to acceptable and optimal targets
- IAQ Monitoring can be used for interventions

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IAQ MONITORING TOOL PILOT PROGRAM - GOALS

- Evaluate and grade IAQ parameters during a typical school week in both the heating and cooling seasons

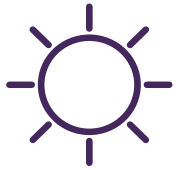
  A – Excellent

  B – Good

  C – Needs Improvement

- Provide general insight into school's air quality and direct focus for improving IAQ
- Establish a procedure schools and BOCES can use to independently monitor and evaluate their own IAQ using low-cost sensors
- 85 economically disadvantaged schools will receive free low-cost sensors and support

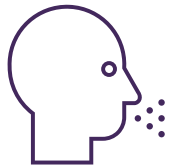
IAQ PARAMETERS:



Temperature

Relative Humidity

Carbon Dioxide



Particulate Matter

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IAQ PARAMETER - TEMPERATURE & RELATIVE HUMIDITY

- Interact to affect body temperature regulation
- Uniformity of temperature and relative humidity (RH) improves student and staff comfort and ability to focus
- High RH (> 60%) increases mold and mildew growth and microbial spread
- Low RH (< 30%) dries out skin, eyes, nose, and throat, leading to discomfort
- Maximum Temperature Law in NYS Public Schools

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IAQ PARAMETER – CARBON DIOXIDE (CO_2)

- Natural component of Earth's atmosphere
- Byproduct of respiration
- Indoor CO_2 levels increase as occupancy increases
  - Can be used to evaluate ventilation efficacy
- High CO_2 levels can lead to headaches, reduced focus, increased perception of odors

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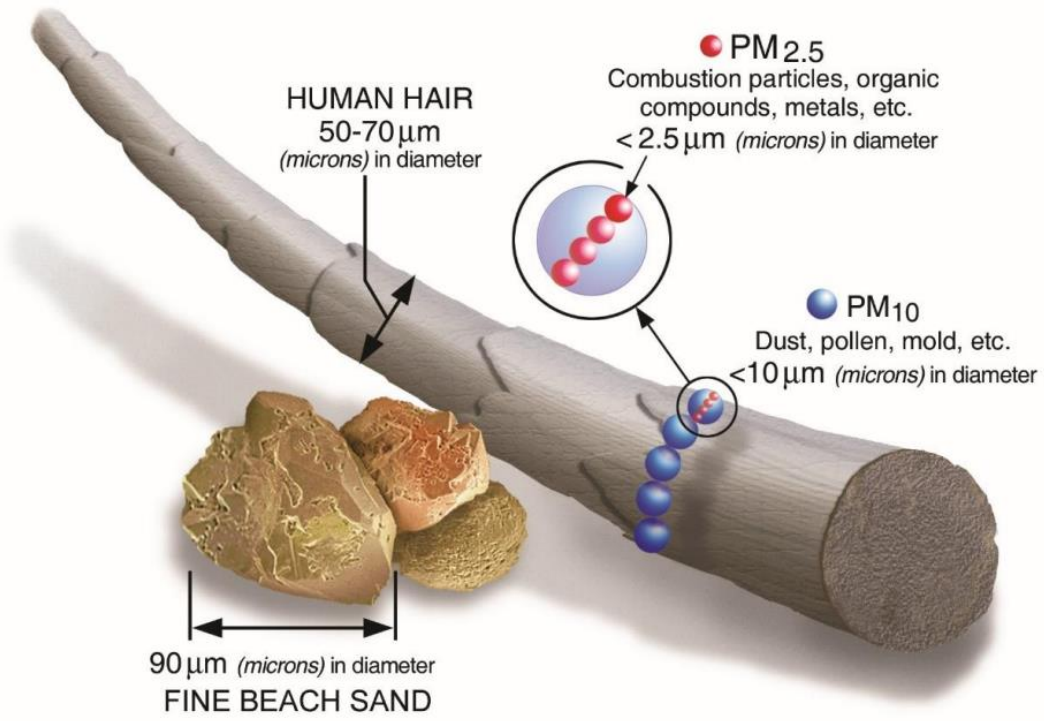
IAQ PARAMETER – PARTICULATE MATTER ($PM_{2.5}$)



- Tiny particles of solids or liquids in air
  - Dust, pollen, mold, animal dander, and other common allergens
- Indoor PM is affected by outdoor sources
  - Fires, road construction, and vehicle exhaust
- Indoor PM increases due to activities
  - Cleaning, cooking, shop class, and building maintenance
- Filtration can reduce indoor PM
  - High-efficiency filter (MERV 13 rating or higher)
- Exposure to PM can harm respiratory and cardiac health

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IAQ MONITORING TOOL PILOT OVERVIEW

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IAQ MONITORING TOOL PILOT – PROCESS

- Set up low-cost sensors in occupied classrooms for 1 week
- Reduced data from occupied times to 1-hour rolling averages
- Evaluate 1hr averaged data against comfort standard criteria (or thresholds)
- Graph parameter results and provide targeted suggestions for improvement to IAQ parameters in an IAQ Report

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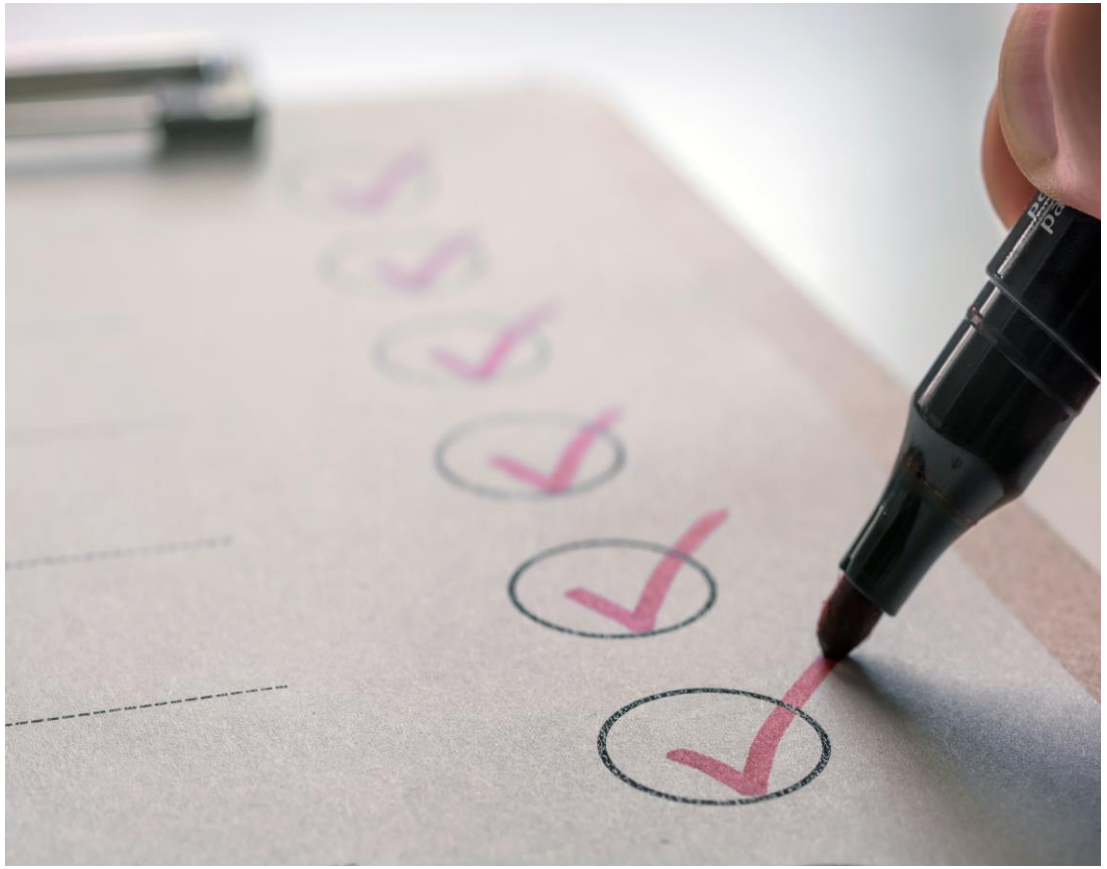
IAQ MONITORING TOOL PILOT – CRITERIA



- **There are no nationally accepted indoor quality air standards**
- **Our Criteria (thresholds) based on:**
  - NYS Mechanical Codes
  - ASHRAE – Ventilation, Thermal Comfort, Infectious Aerosols
  - EPA – Reference Guide for Indoor Air Quality in Schools
  - CDC – Ventilation in Schools and Childcare Programs
  - Harvard School of Public Health – Healthy Buildings Program
  - NYS DOH indoor air investigation data and pilot testing
  - Other technical references and academic publications

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IAQ MONITORING TOOL PILOT - CRITERIA

Heating Season Criteria
Oct. 1st – Mar. 31st

Grade	Parameters			
	Temperature (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	PM 2.5 (µg/m³)
Excellent	68° to 72°	45% to 55%	< 800ppm	< 15
Good	65° to < 68° or >72° to 80°	30% to < 45% or >55% to 60%	800ppm to 1000ppm	15 - 35
Needs Improvement	< 65° or > 80°	< 30% or > 60%	> 1000ppm	> 35

Cooling Season Criteria
Apr. 1st – Sept. 30th

Grade	Parameters			
	Temperature (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	PM 2.5 (µg/m³)
Excellent	68° to 75°	45% to 55%	< 800ppm	< 15
Good	65° to < 68° or >75° to 80°	30% to < 45% or >55% to 60%	800ppm to 1000ppm	15 - 35
Needs Improvement	< 65° or > 80°	< 30% or > 60%	> 1000ppm	> 35

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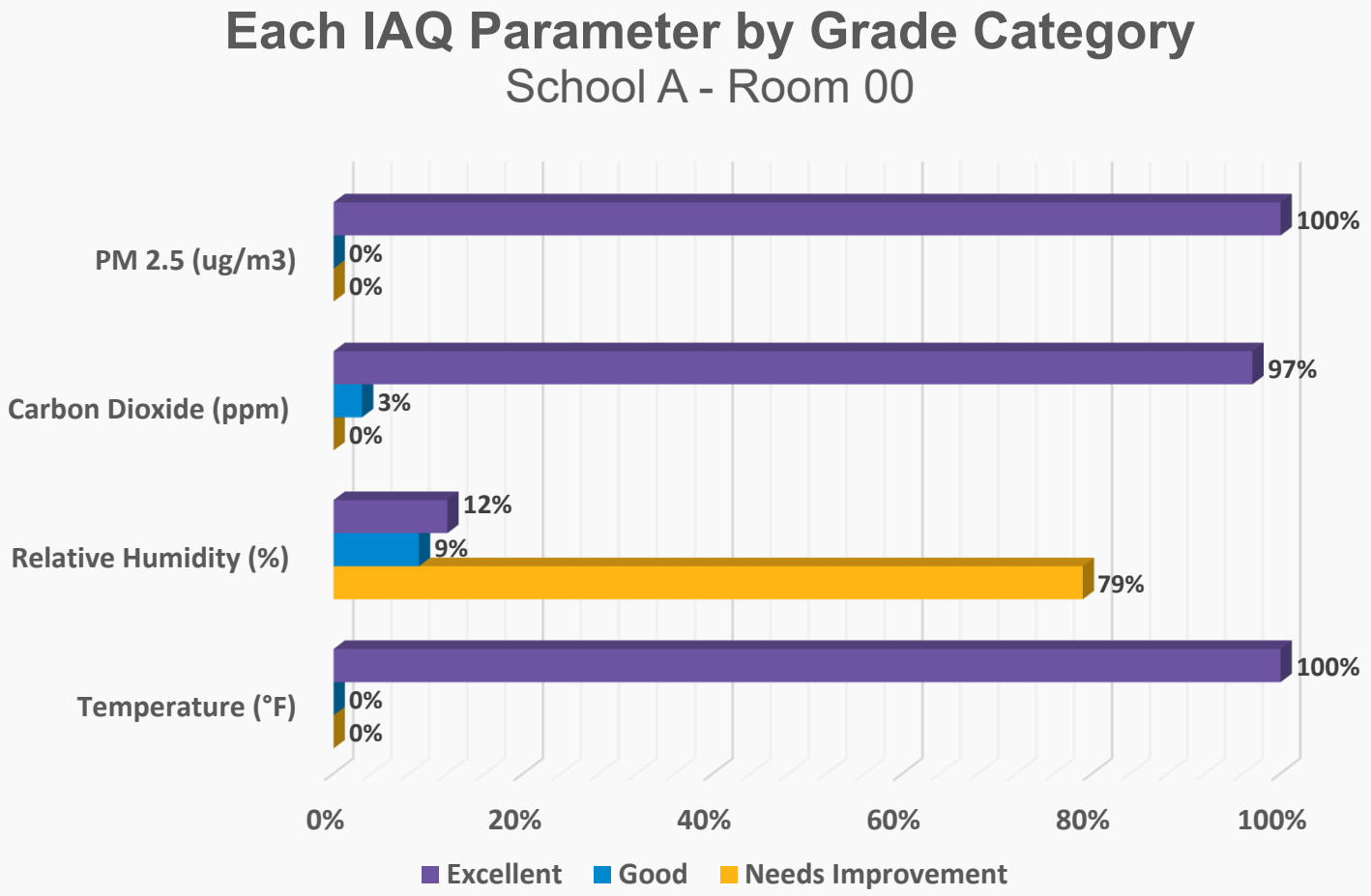
IAQ MONITORING TOOL PILOT - DATA CATEGORIZATION



- All 1-hour averaged data is categorized as either A (Excellent), B (Good), or C (Needs Improvement) for each IAQ parameter evaluated
- The data for each parameter is displayed as the percent of 1-hour averages within each category

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IAQ MONITORING TOOL PILOT – GRADING RUBRIC

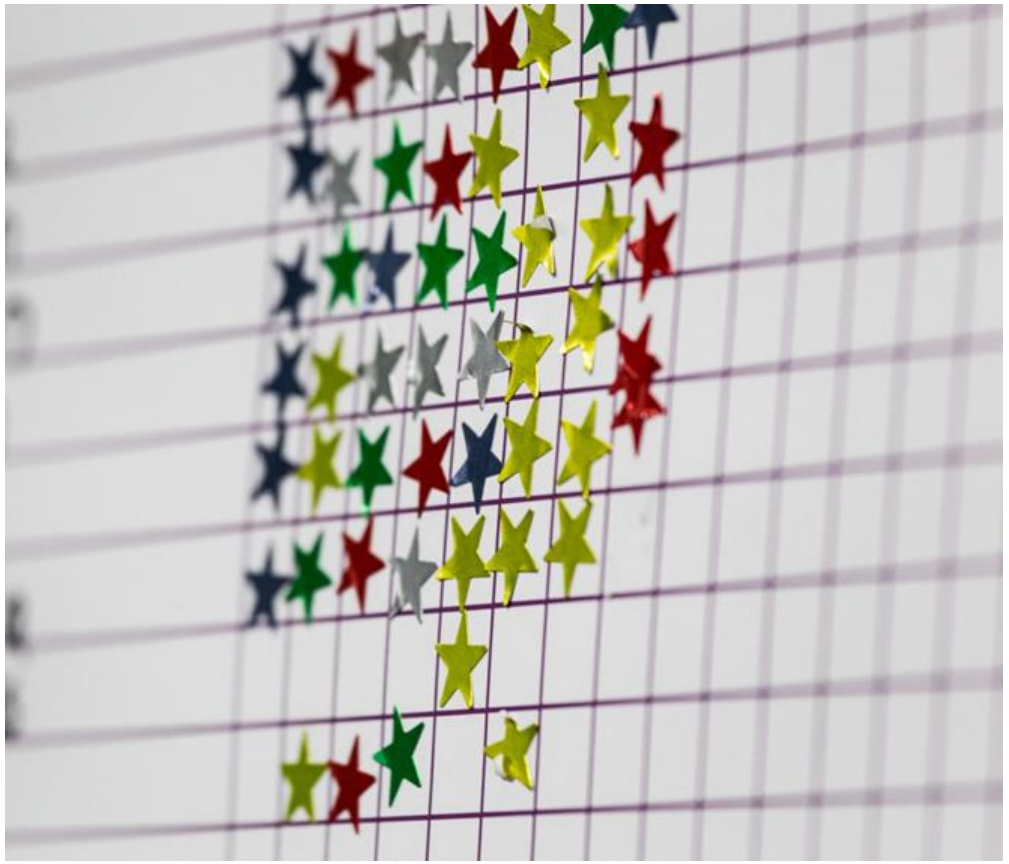
The grading rubric includes two key rules:

Majority Rule (Greater than 50% threshold):

If more than 50% of the total results fall within a specific grade category, that grade becomes the overall grade for the IAQ parameter. This rule emphasizes the dominant trend seen in that IAQ parameter.

Notable Improvement Needed Rule (25% Needs Improvement threshold):

If 25% or more of the total results fall into the “Needs Improvement” category for an IAQ parameter, regardless of other grade results, the overall grade is automatically deemed “Needs Improvement.” This rule highlights significant IAQ deficits and prioritizes addressing these results.



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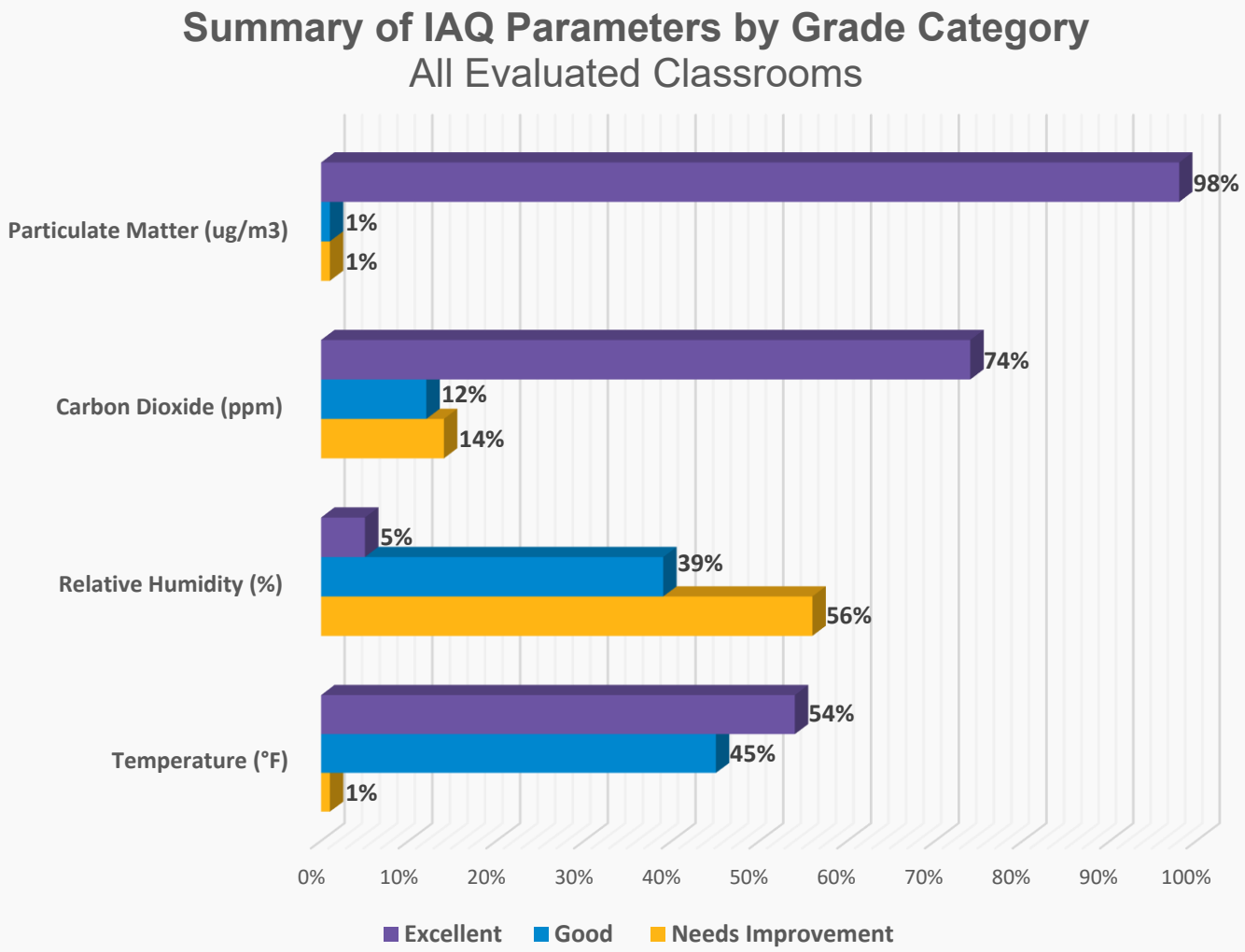
IAQ MONITORING TOOL PILOT – OVERALL GRADES



An overall school grade for each parameter is determined based on the results from all evaluated classrooms

IAQ Parameter Grade Report			
	Excellent	Good	Needs Improvement
Particulate Matter (µg/m³)	A		
Carbon Dioxide (ppm)	A		
Relative Humidity (%)			C
Temperature (°F)	A		

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Instrumentation

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INSTRUMENTATION - OVERVIEW

Low-Cost Sensors:

- **Onset "Hobo"** – Analyze Carbon Dioxide (CO_2), Relative Humidity (RH), & Temperature
- **Dylos Laser Particle Counters** - Analyze Particulate Matter (PM) (Counts and Mass)
- **Airthings** - Analyze RH, Temperature, CO_2, PM (Mass), Pressure, Volatile Organic Compounds (VOCs), & Radon
- **Atmocubes** - Analyze RH, Temperature, CO_2, PM (Mass), VOCs, Light, & Sound

High-Cost Scientific Grade Monitors:

- Optical Particle Sizer (OPS)
- DustTrak (DRX) Particle Instrument

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LOW-COST SENSOR - USES & APPLICATIONS

- EPA classification: Non-regulatory Supplemental and Informational Monitoring applications (NISM)
  - Spatiotemporal Variability
  - Long-term Trend
  - Comparison
- Lightweight, inexpensive, and easy to use
- Require little continuing calibration
- Features Include:
  - Data hold/logging
  - Min/Max Readings
  - Time Stamps
  - Alarms
  - Easily accessible batteries

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AQ-SPEC Home Page

INSTRUMENTATION – REGULATORY MONITORS

Low-Cost Sensors are <u>NOT</u> regulatory air monitors

- Regulatory Air Monitors:
  - ✓ Establish standards to protect public health
  - ✓ Data values are averaged over 1, 8, or 24 hours, depending on the pollutant.
  - ✓ Monitoring air for pollution requires comparison against National Institute of Standards and Technology (NIST) and EPA measurement standards
  - ✓ External and internal quality assurance
  - ✓ Co-Location of instrumentation
  - ✓ Replicate analysis to ensure analytical consistency
  - ✓ Continue review of measured data to ensure accuracy

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Data Collection & Analysis

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DATA COLLECTION

- Low-cost sensors are deployed in five to ten classrooms of the school's choosing
- Data is collected at one-minute intervals throughout an occupied school week

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IAQ MONITORING TOOL - DATA ANALYSIS

- Check for obvious errors
- Remove them (and note why) where applicable
- Double check the time zone!!
- Reduce to 1-Hour Rolling Averages

Date-Time (EDT)	Hour	Temperature , °C	RH , %	CO2 , ppm
07/15/2025 10:30:00	07/15HOUR:10	23.26	69.897	566.0
07/15/2025 10:31:00	07/15HOUR:10	23.21	69.678	582.0
07/15/2025 10:32:00	07/15HOUR:10	23.21	69.189	567.0
07/15/2025 10:33:00	07/15HOUR:10	23.21	69.092	570.0
07/15/2025 10:34:00	07/15HOUR:10	23.26	68.286	583.0
07/15/2025 10:35:00	07/15HOUR:10	23.18	67.700	613.0
07/15/2025 10:36:00	07/15HOUR:10	23.18	67.261	609.0
07/15/2025 10:37:00	07/15HOUR:10	23.18	67.261	623.0
07/15/2025 10:38:00	07/15HOUR:10	23.11	66.211	632.0
07/15/2025 10:39:00	07/15HOUR:10	23.14	65.771	633.0
07/15/2025 10:40:00	07/15HOUR:10	23.14	65.283	620.0
07/15/2025 10:41:00	07/15HOUR:10	23.11	64.624	631.0
07/15/2025 10:42:00	07/15HOUR:10	23.11	64.868	625.0
07/15/2025 10:43:00	07/15HOUR:10	23.11	65.381	625.0
07/15/2025 10:44:00	07/15HOUR:10	23.14	66.016	630.0
07/15/2025 10:45:00	07/15HOUR:10	23.16	66.797	647.0
07/15/2025 10:46:00	07/15HOUR:10	23.14	67.383	630.0
07/15/2025 10:47:00	07/15HOUR:10	23.21	68.115	641.0
07/15/2025 10:48:00	07/15HOUR:10	23.33	68.579	619.0
07/15/2025 10:49:00	07/15HOUR:10	23.40	69.165	621.0
07/15/2025 10:50:00	07/15HOUR:10	23.52	69.751	633.0

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DATA ANALYSIS - EVALUATE AGAINST IAQ CRITERIA

Date-Time (EDT)	Ch:1 - Temperature (°C)	Temp Rating	Ch:2 - RH (%)	RH Rating	Ch:3 - CO2 (ppm)	CO2 Rating	PM 2.5 ug/m3	PM 2.5 Rating
07/14HOUR:08	22.69	Excellent	61.197	Needs Impro	614.6	Excellent	4.4	Excellent
07/14HOUR:09	23.09	Excellent	61.776	Needs Impro	674.0	Excellent	4.8	Excellent
07/14HOUR:10	23.33	Excellent	62.114	Needs Impro	696.0	Excellent	9.0	Excellent
07/14HOUR:11	23.73	Excellent	58.892	Good	741.8	Excellent	11.3	Excellent
07/14HOUR:12	24.00	Good	57.413	Good	774.4	Excellent	12.8	Excellent
07/14HOUR:13	24.19	Good	57.592	Good	744.4	Excellent	55.3	Needs Impro
07/14HOUR:14	24.12	Good	55.321	Excellent	723.1	Excellent	12.4	Excellent
07/15HOUR:08	22.80	Excellent	60.088	Needs Impro	642.6	Excellent	5.6	Excellent
07/15HOUR:09	23.18	Excellent	59.672	Good	710.7	Excellent	6.9	Excellent
07/15HOUR:10	23.51	Excellent	60.631	Needs Impro	728.5	Excellent	10.1	Excellent
07/15HOUR:11	23.86	Excellent	56.413	Good	728.9	Excellent	15.9	Good
07/15HOUR:12	24.92	Good	57.013	Good	820.3	Good	23.6	Good
07/15HOUR:13	24.81	Good	49.096	Excellent	775.2	Excellent	28.4	Good
07/15HOUR:14	24.52	Good	49.080	Excellent	696.6	Excellent	25.7	Good
07/16HOUR:08	23.22	Excellent	56.262	Good	582.6	Excellent	10.1	Excellent
07/16HOUR:09	23.63	Excellent	56.855	Good	641.0	Excellent	9.3	Excellent
07/16HOUR:10	23.90	Good	54.722	Excellent	688.8	Excellent	9.7	Excellent
07/16HOUR:11	24.19	Good	54.059	Excellent	714.0	Excellent	10.6	Excellent
07/16HOUR:12	24.44	Good	54.534	Excellent	698.3	Excellent	12.9	Excellent
07/16HOUR:13	24.62	Good	53.433	Excellent	718.4	Excellent	11.1	Excellent
07/16HOUR:14	24.38	Good	52.321	Excellent	668.1	Excellent	8.0	Excellent

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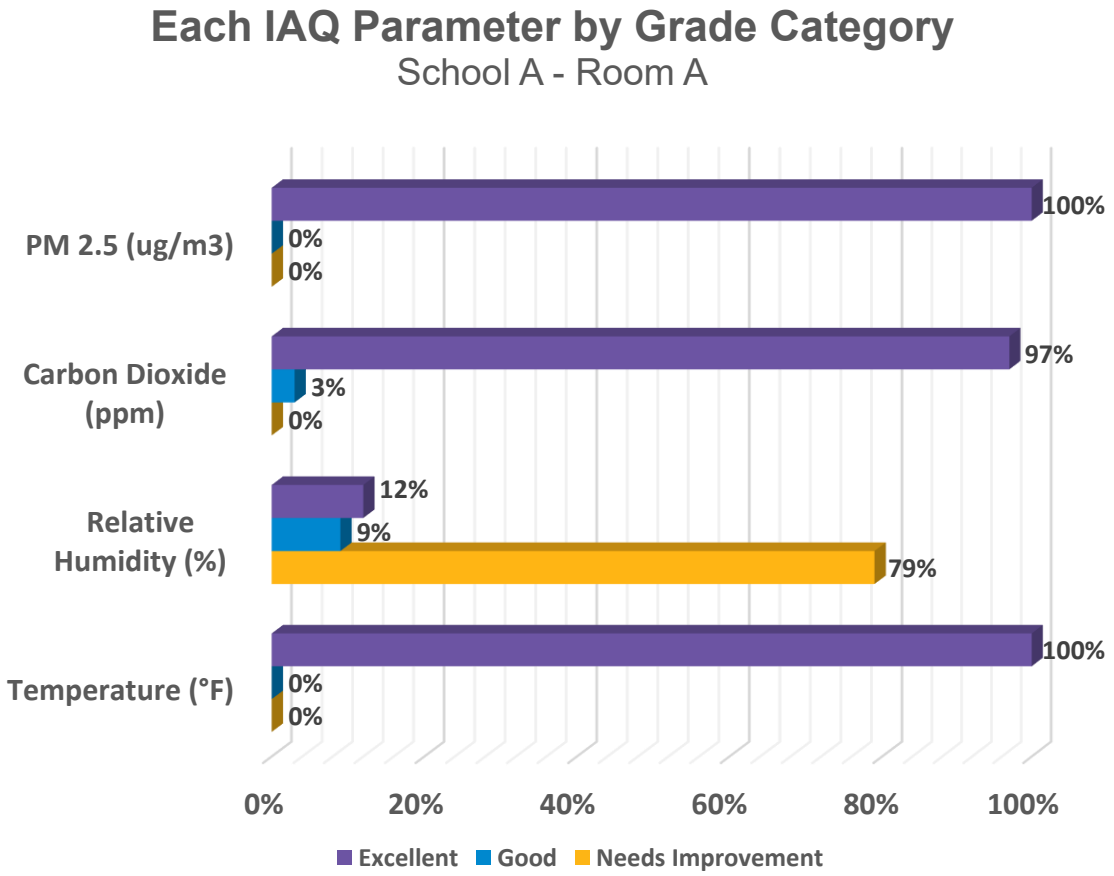
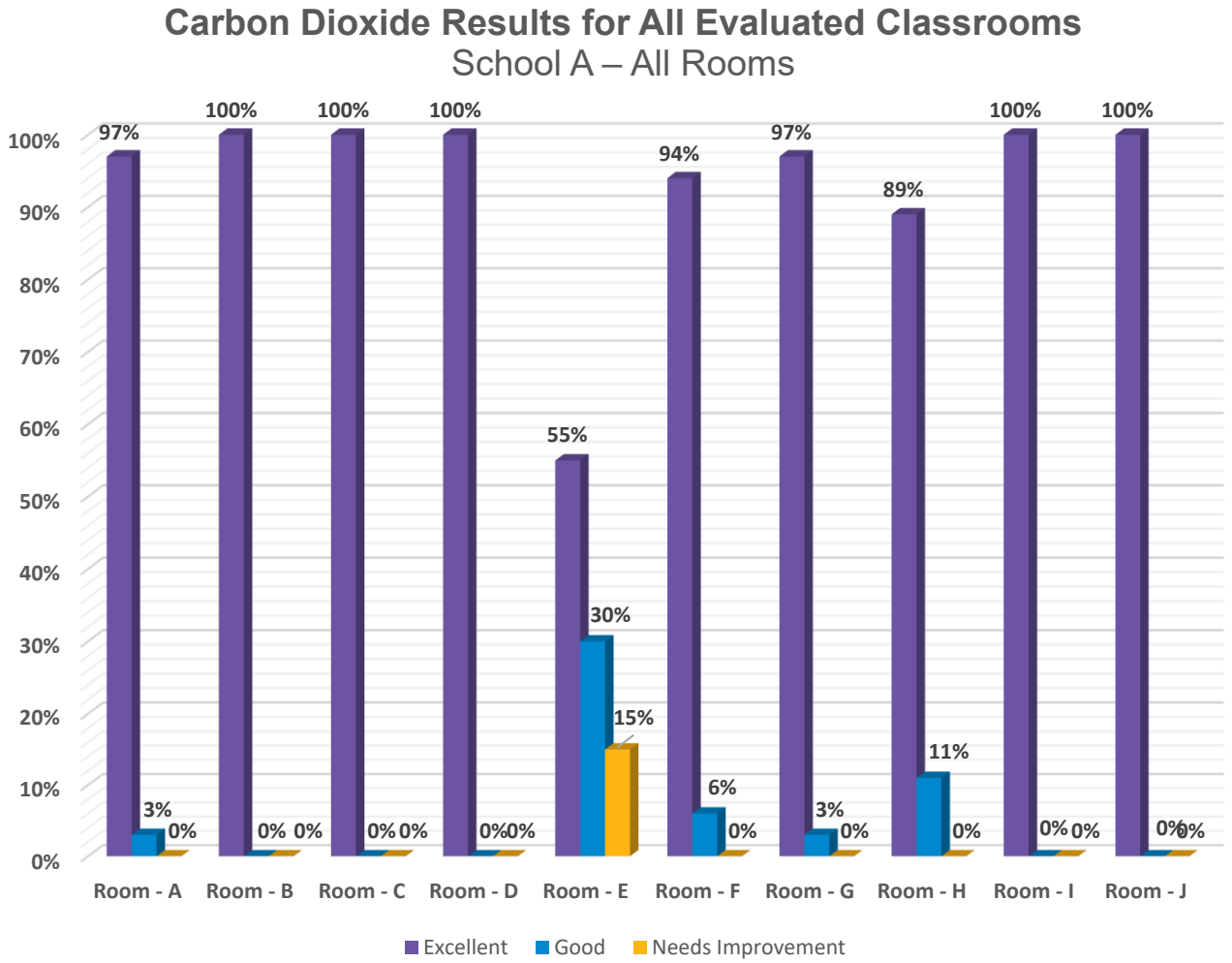
DATA INTERPRETATION – GRAPH THE RESULTS





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IAQ Monitoring Tool Pilot Reports

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IAQ Report - Components

Scope & Introduction

Background & Field Observations

Indoor Air Quality Monitoring

- Classroom Data
- Graphs
- Temperature Summary
- Relative Humidity Summary
- Carbon Dioxide Summary
- Particulate Matter Summary
- Ventilation Rate

Indoor Air Quality Parameter Grades

Discussion of Findings

- On-Site Monitoring
- Additional Considerations

Wrap Up

Additional Information

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IAQ Report - Discussion of Findings

8.1.3 Finding:

Many classrooms had classroom materials or furniture blocking unit ventilators. Good IAQ requires proper ventilation and filtration of particles from the air, as well as effective administrative controls and space configuration.

8.1.3 Recommendations:

Keeping classroom spaces and unit ventilators clean and free of dust and clutter is a simple and cost-effective measure that greatly improves indoor air quality. Maintaining a robust custodial routine is essential to help schools achieve excellent IAQ. Implementing an integrated pest management program can also contribute to improved indoor air quality as dander and droppings from pests can be a trigger for asthma and allergies in sensitive people. Using green cleaning products and establishing a school-wide fragrance-free policy are also great ways to reduce air quality issues as both cleaning and fragranced products can be triggers for children and adults who suffer from asthma or have sensory issues.

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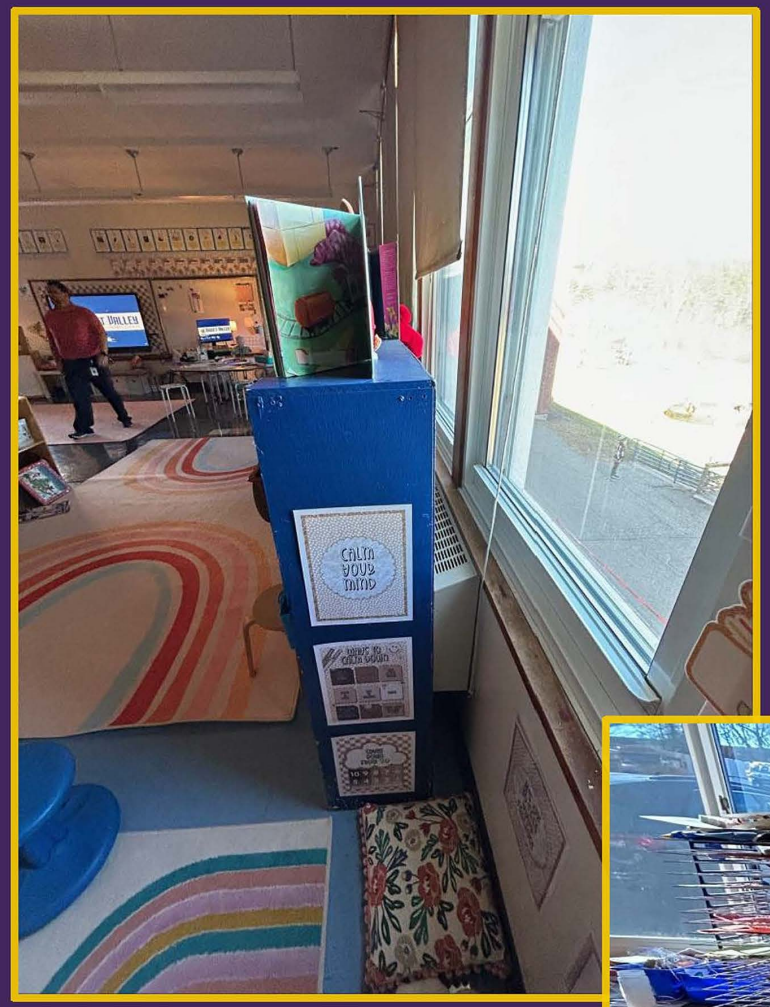

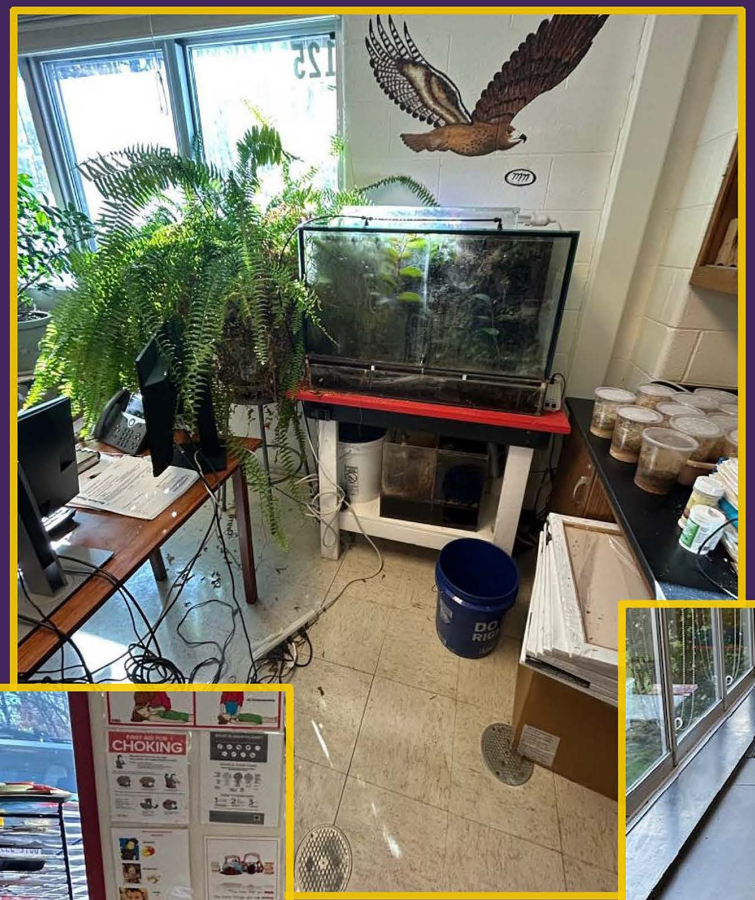

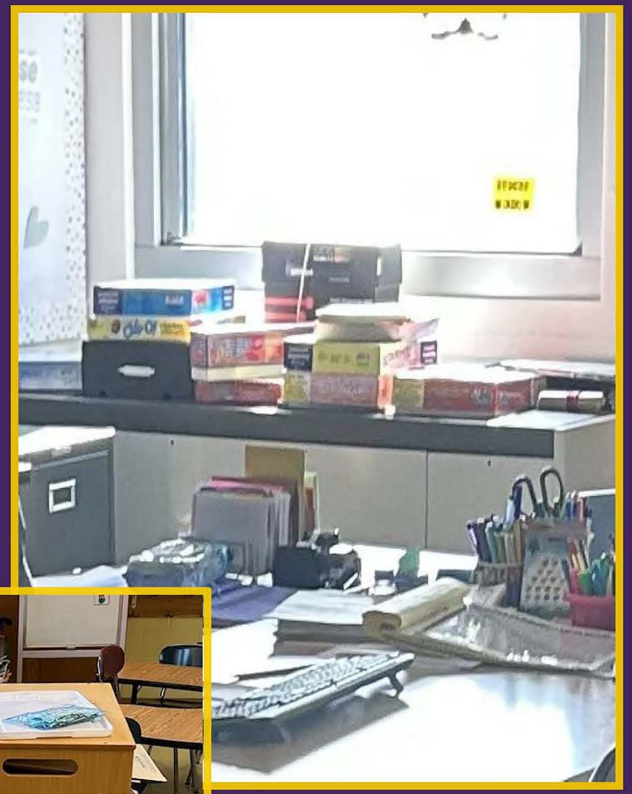

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IAQ REPORTS – WRAP UP

Low-Cost Administrative & Cleanliness Controls to Improve IAQ:

- Keep floors and surfaces free of dust, clutter, and decomposing organic material
- Routinely dust surfaces, including HVAC vents and ceiling diffusers with a damp cloth
- Routinely wet mop and/or auto-scrub floors
- Regularly vacuum using machines with a HEPA filter or vacuum bag installed
- Use portable air purifiers with HEPA filters in classrooms
- Remove trash daily
- Store food items inside pest-proof containers
- Use green cleaning products
- Adopt a school-wide fragrance-free policy

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IAQ REPORT - ADDITIONAL RESOURCES

10.1. State Department of Health – SEHP Infographics

- Green Cleaning Infographic
- Indoor Air Quality Infographic
- Lead Testing in School Drinking Water Infographic
- Managing Chemicals in Schools Infographic
- Mold & Moisture Prevention/Remediation Infographic
- Radon Infographic

10.2. Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health

Ventilation in Schools and Childcare Programs | Ventilation | CDC

10.3. State Education Department (NYSED) - Ionization Air Cleaners

Statement Regarding Ionization Air Cleaners 12.14.21.pdf

10.4. United States Environmental Protection Agency (EPA)

Creating Healthy Indoor Air Quality in Schools
Renovation and Repair, Part of Indoor Air Quality Design Tools for Schools | US EPA

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Progress To Date

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IAQ PILOT – PROGRESS TO DATE

Data Collection

- Collected and evaluated data from 9 schools (7 districts)
- In Columbia, Saratoga, Essex, Oneida, Tompkins, Greene and Onondaga counties

IAQ Reports

- 6 IAQ Reports (for 8 schools) have been sent to schools
- Follow up/Feedback meetings have occurred
- 9th School's IAQ Report in progress

Coming Up

- Develop Supplemental Materials
- Co-Location Study with DEC Reference Monitors
- 10th IAQ Monitoring Pilot School scheduled for December
- Launch IAQ Monitoring Tool Program in Winter 2026

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PROGRESS TO DATE

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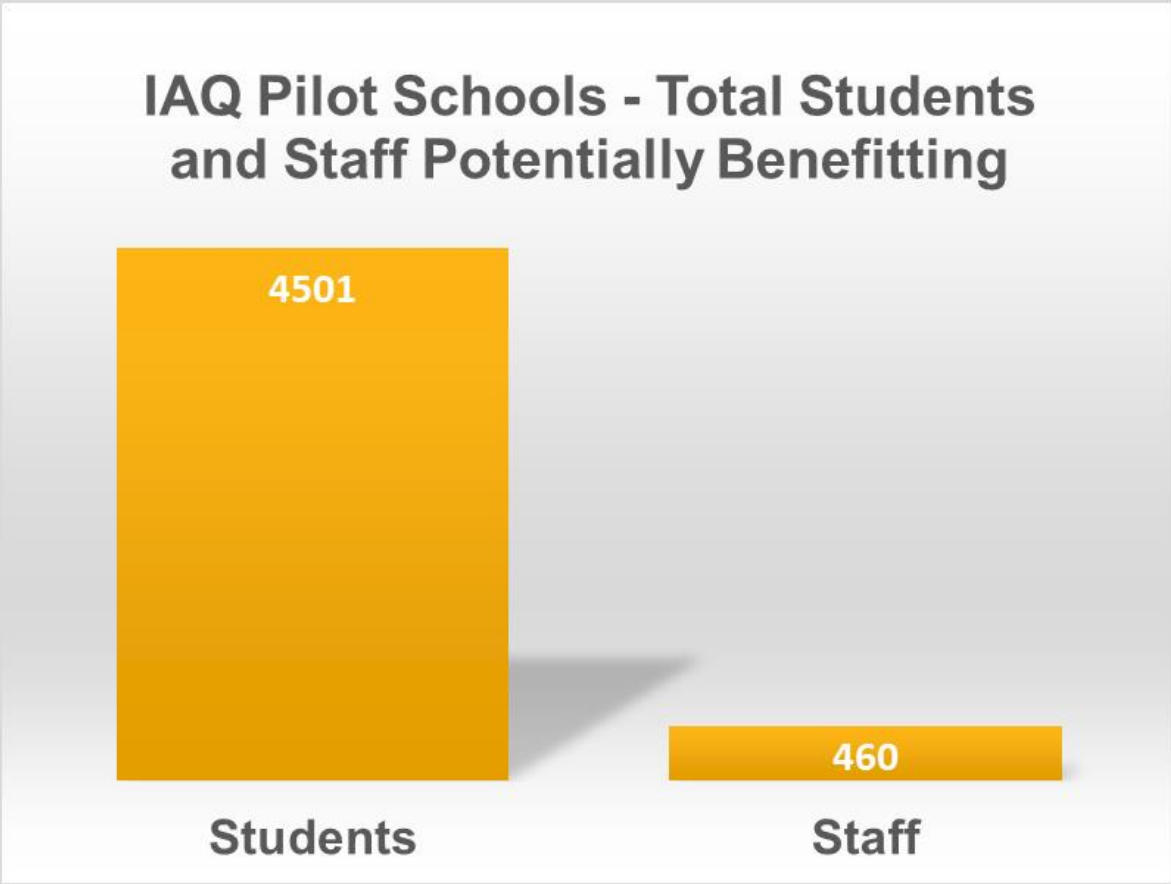
IAQ PILOT – PROGRESS TO DATE



Collected Data at 8 Pilot Schools

- 64 Classrooms evaluated
- 379 Days of data
- 2,350+ 1-Hour averaged data points evaluated for each parameter per sensor

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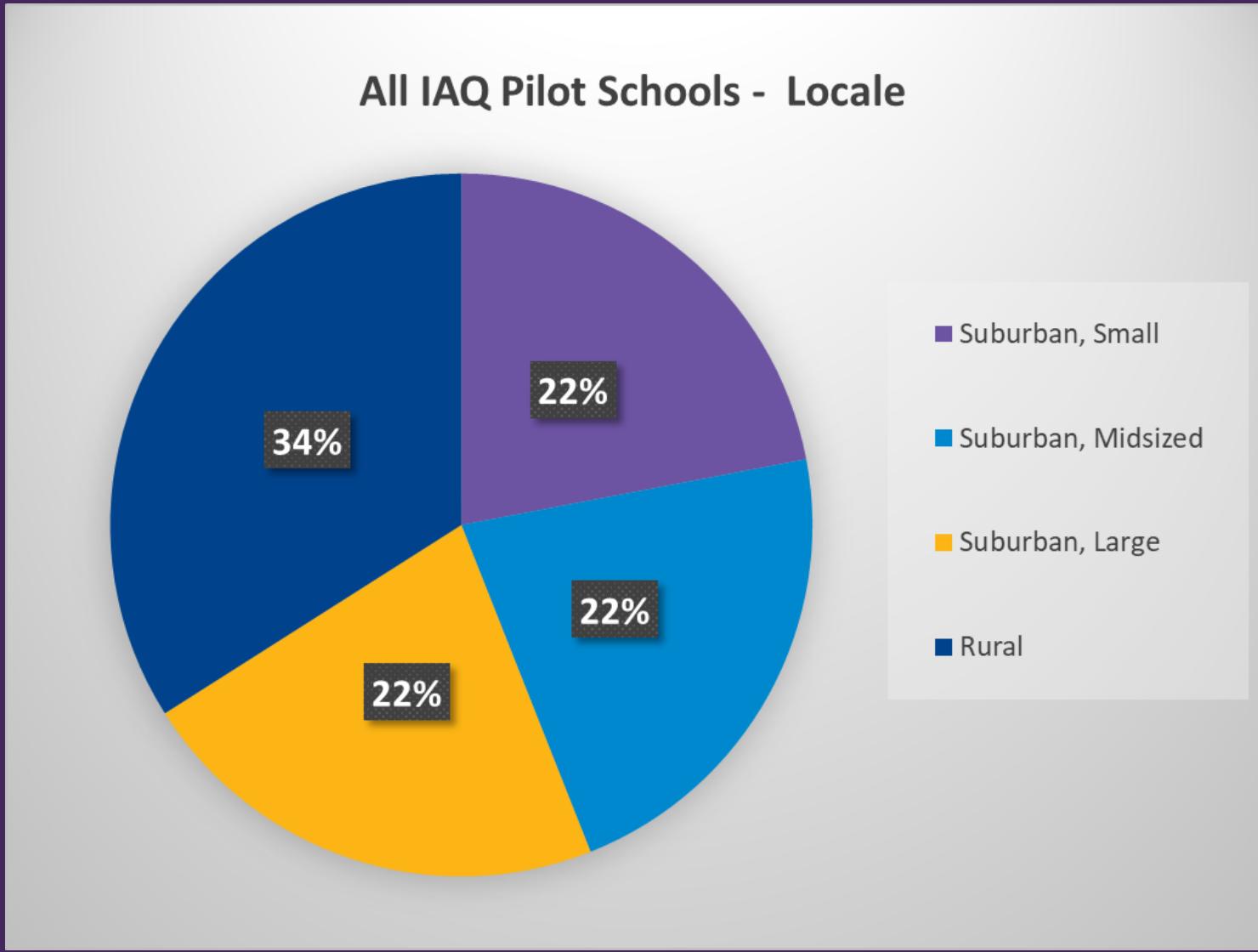
IAQ PILOT - PROGRESS TO DATE



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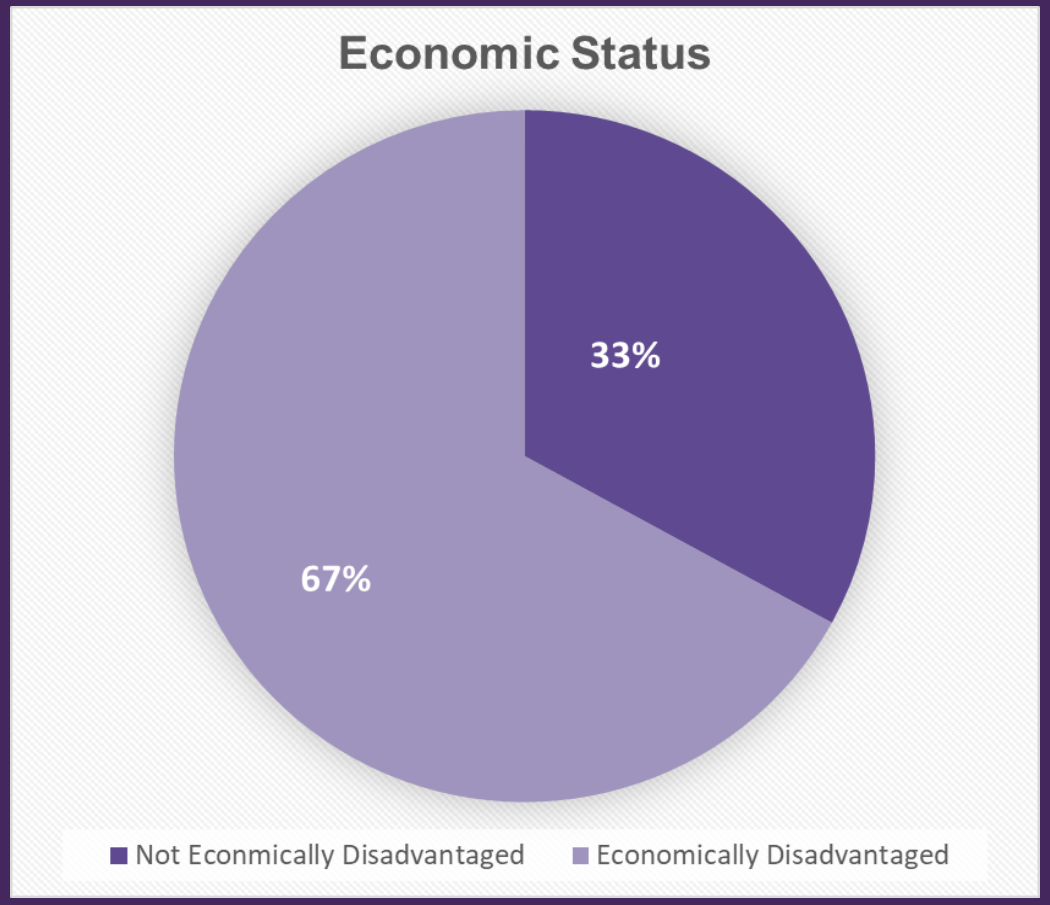
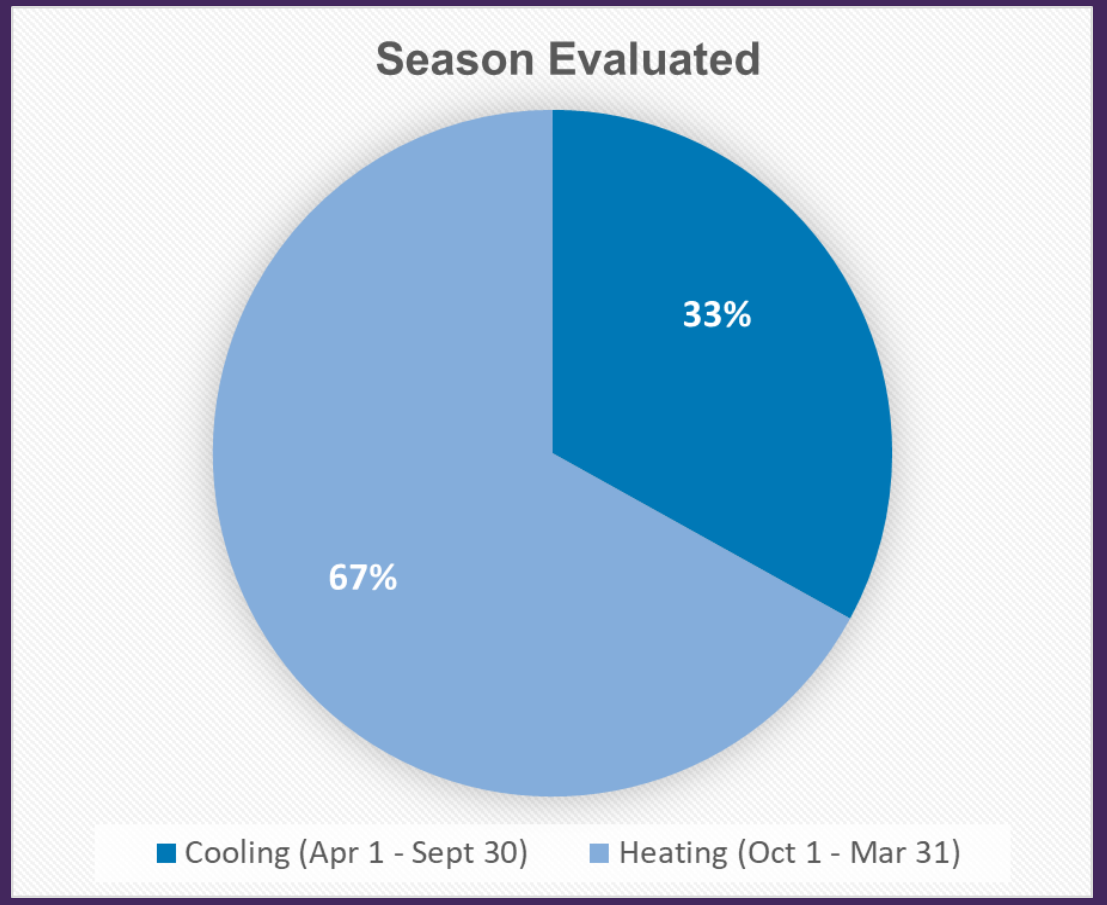
IAQ PILOT - PROGRESS TO DATE





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Preliminary Conclusions & Next Steps

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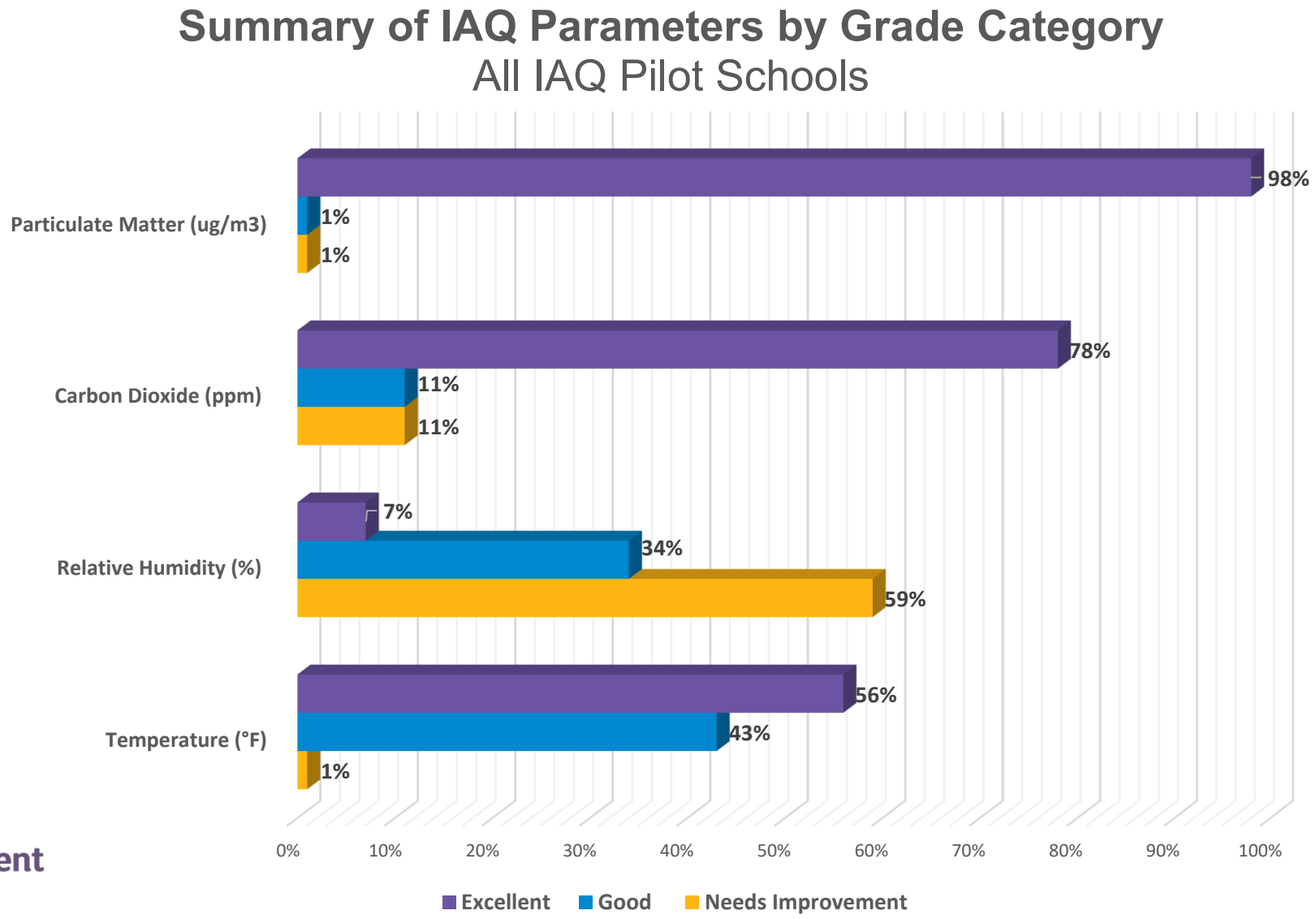
IAQ PILOT – PRELIMINARY CONCLUSIONS



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NEXT STEPS

Train school staff within disadvantaged communities to evaluate their own IAQ using this method

- A number of disadvantaged schools will receive free low-cost sensors

Conduct train-the-trainer events with Boards of Cooperative Educational Services (BOCES) staff to allow them to help train school staff across the state to use this method to evaluate their own IAQ

Develop Supplemental Materials

- IAQ Tool Infographics, IAQ Management Plan, Best Practice Guides

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New York State
School
Environmental
Health
Program

health.ny.gov/SchoolEnviroHealth

CONTACT INFORMATION:

- Phone: 518-402-7800
- Email: School.Environmental.Health@health.ny.gov
- Website: https://www.health.ny.gov/SchoolEnviroHealth

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