



# ENGAGING YOUTH AND THE COMMUNITY IN CITIZEN SCIENCE WITH AIR SENSORS

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## Cleveland Division of Air Quality

- Air pollution control agency serving both the City of Cleveland and all of Cuyahoga County
- Cleveland Division of Air Quality is made up of four sections:
  - Monitoring
  - Enforcement
  - Permitting
  - Outreach



# Our Sections

## Monitoring

- Operates a network of ambient air monitoring stations throughout Cuyahoga County
- Measures “criteria pollutants”
- Provides the current air quality data that updates the Air Quality Index (AQI) information and forecasting
- **(216) 664-7442**

## Enforcement

- Ensures that industrial and commercial air pollution sources regulated by Ohio EPA are in compliance with their applicable regulations
- Inspect regulated sources
- Regulate asbestos abatement and demolition activities
- Respond to citizen complaints
- **(216) 664-7442**

## Permitting

- Prepares permits for stationary sources of air pollution
- Permits identify applicable rules to regulated sources of air pollution
- Permits provide guidelines to maintain compliance with the Clean Air Act

## Outreach

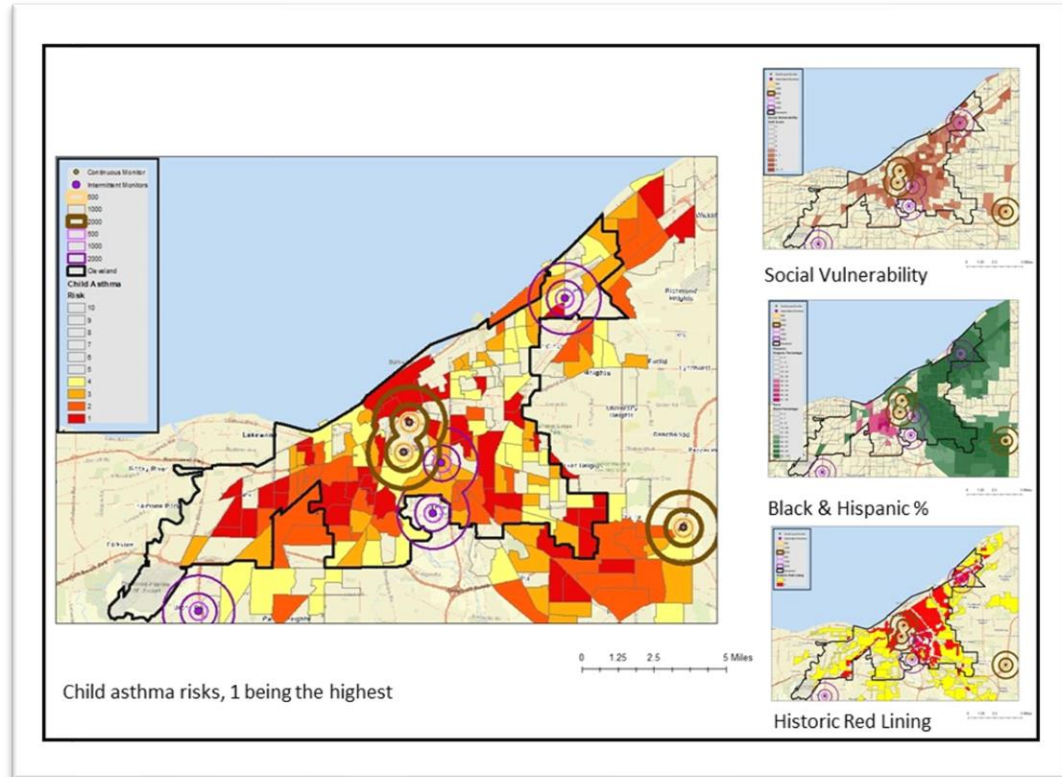
- Created in late 2017
- Enhances services to the city of Cleveland, including addressing indoor air quality complaints and concerns
- Increased regulatory oversight at smaller city of Cleveland facilities
- Responsible for all aspects of public engagement including attending/coordinating public health forums; school outreach; special projects; and citizen air sensor monitoring

## Cleveland Crescent: Air Monitoring and Community Concerns

The maps to the right document diagnosed pediatric asthma rates, social vulnerability index, minority populations and the Home Owners Loan Corporation map (AKA redlining map)

Cleveland's Air Monitoring Network is illustrated by the circles. The rings represent expected spatial scale.

Purple: Intermittent PM  
Brown: Continuous PM



*Cleveland Crescent represented through Pediatric Asthma Rates, Social Vulnerability, Percent Minority, and Historic Redlining. Maps developed at CWRU GIS Health & Hazards Lab. All maps generated at the Case Western Reserve University GIS Health and Hazards Lab*

## Community Data Collection

- CDAQ has worked with community organizations that purchased sensors on their own and/or were provided sensors by CDAQ
- CDAQ provides guidance on deployment strategies that emphasizes quality assurance and quality control for good data collection

### Purple Air Sensor Siting Checklist

Date of Install: \_\_\_\_\_ Site Name\*: \_\_\_\_\_

Device ID Number: \_\_\_\_\_ Wi-Fi Network Name: \_\_\_\_\_

Host Contact: \_\_\_\_\_ Host Contact Phone Number: \_\_\_\_\_

Host Email Address: \_\_\_\_\_

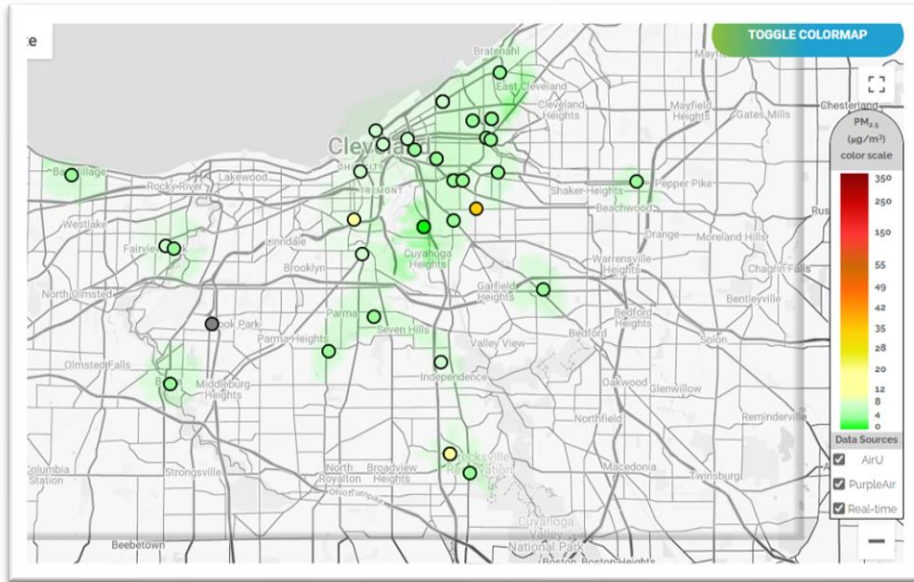
Site Address: \_\_\_\_\_

\*Attach 2 photos of sensor location to this document. One close-up photo and one overview photo.

This checklist should be completed for each site where a Purple Air Sensor is deployed in order to maintain consistency in sensor deployment across the network:

- Sensor should be mounted in a vertical position (open end facing the ground) and high enough that rain water will not splash into the open cavity. The recommended height is at least 6 feet from the ground.
- Should not be within 15 feet of building exhaust vents (recommended distance).
- Try to avoid large obstructions (very large tree, building or wall blocking the wind) in direct air pathway to the sensor.
- It is recommended that the sensor be mounted to the west side of the building to more consistent with EPA federal regulatory monitors requirements.

# US Ignite Air Quality Monitoring Project



## Project Goals:

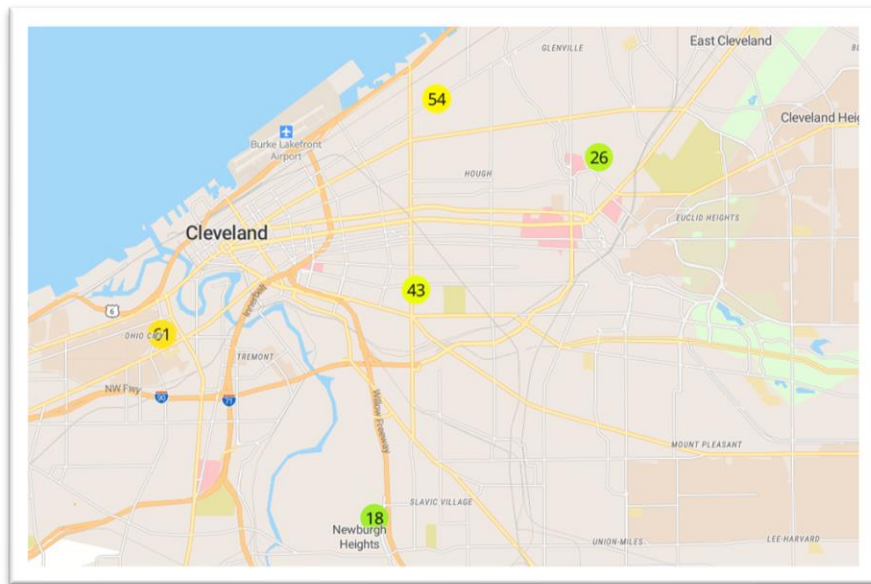
- Investigate the correlation of PM<sub>2.5</sub> air pollution on the incidence of COVID-19. Share the resulting data and insights to improve public health outcomes and policies.
- Understand the characteristics of low-cost sensors and how they can add additional information to existing data sources (e.g., EPA monitors) to gain a more detailed understanding of temporal and spatial aspects of Greater Cleveland's airshed.
- Develop a platform for the collection and analysis of air quality data to support researchers and organizations in their efforts to improve the region's health (e.g., air quality correlation to other social determinants of health, environmental exposure impact on cardiovascular health, maternal health, and infant mortality).

## CLEVELAND NEIGHBORHOOD PROGRESS





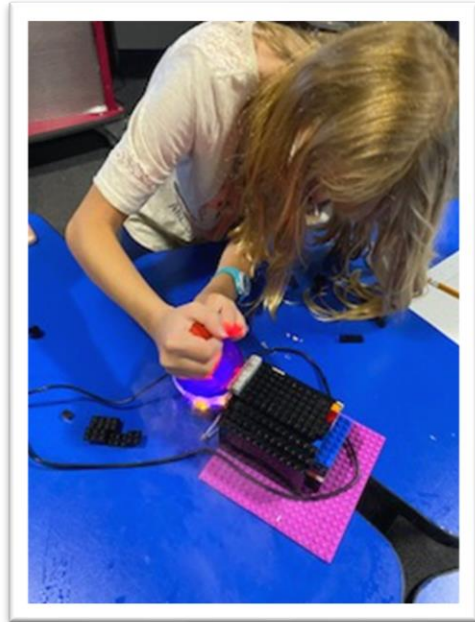
# School and Youth Engagement: Tiered Approach



1. One time “Air Sensor Lego Workshop”
2. Air sensor deployment with short(er) term engagement
3. Air sensor deployment with long(er) term engagement

# Air Sensor Lego Workshop

(Workshop Credit: AIRU University of Utah Teaching Modules)





## Short(er) Term Engagement

We meet with the educators to learn about their interests and needs for the classrooms.

Air sensor is provided to the school and they are responsible for deployment

Primary educational topics include air pollution basics, citizen science, and quality assurance



## Long(er) Term Engagement

In addition to the condensed curriculum, CDAQ provides instruction on health impacts, environmental justice, and developing air quality studies

One school developed individual air quality studies; Another school is focusing on learning how to work with data


Students are introduced to the EPA tools such as the EPA Handbook for Citizen Science and the Environmental Justice Screening Tool



# What do the students have to say?

cdph  
Team: Blue (samuel-131141) Tue, September 21, 2021

## Measuring Air Quality with Building Blocks Worksheet



**Sketch:** Draw a picture of your Air Quality Sensor design.

**Data & Reasoning:** List observations you made while rebuilding your Air Quality Sensor with Building Blocks.

**Conclusion & Evaluation:** Describe what did or did not work. Summarize your experience with the Air Quality Sensor with Building Blocks workshop.

Sketch:

When done building, draw a picture of your group's Air Quality Sensor that you made with Building Blocks. Label the different parts such as the fan, photoresistor (sensor), the indicator lights, and the LED light source.

! Drawing on the back!

**Data & Reasoning:**

- What changes to the Air Quality Sensor did your group make?

**Iteration 01:** there was no scattered light, so we moved the sensor away.

**Iteration 02:** there was no space for air to exit, so we added an exit space.

**Iteration 03:** we moved the fan back and added a complex light scattering system.

**Conclusion:**

- Did your group's Air Quality Sensor work differently after you redesigned it? How?

• The air could enter easier, the air could exit easier.

• The light was given the space to scatter.


**Evaluation:**

- Circle your choice: How much did you enjoy this workshop?

1 Not at All    2 A Little    3 So/so    4 It was Good    5 It was Great!

cdph  
Team: Vikram Tue, September 21, 2021

## Measuring Air Quality with Building Blocks Worksheet




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Sketch:

When done building, draw a picture of your group's Air Quality Sensor that you made with Building Blocks. Label the different parts such as the fan, photoresistor (sensor), the indicator lights, and the LED light source.



**Data & Reasoning:**

- What changes to the Air Quality Sensor did your group make?

! we moved the fan, and added a hood over the sensor and wiring; also fixed the indicator lights.

**Conclusion:**

- Did your group's Air Quality Sensor work differently after you redesigned it? How?

Yes, the sensor light thing didn't start at 1 it started at 6.

**Evaluation:**

- Circle your choice: How much did you enjoy this workshop?

1 Not at All    2 A Little    3 So/so    4 It was Good    5 It was Great!

# Educator Evaluation – The Good

## Presentation Evaluation Form

Your Opinion matters to us! Using this survey instrument below, please circle one answer for each question. There is space on the back for additional comments - we would love to hear from you. Thank you for attending today!

1= Poor 2 = Fair 3 = Good 4 = Very Good 5= Excellent

### The Presenters:

1. Delivered the material in a clear and structured manner  
1 2 3 4 **5**
2. Knowledgeable about the topic  
1 2 3 4 **5**
3. Maintained the campers interest during the entire workshop  
1 2 3 4 **5**
4. Answered all questions effectively  
1 2 3 4 **5**
5. Enthusiastic about the topic  
1 2 3 4 **5**
6. Well organized and prepared  
1 2 3 4 **5**

### The Workshop:

7. Relevant and informative to the campers  
1 2 3 4 **5**
8. Had all the supplies the campers needed  
1 2 3 **4** 5

9. Was age appropriate for the campers  
1 2 3 4 **5**

10. Overall, the campers enjoyed the workshop  
1 2 3 4 **5**

11. Overall, this was a valuable workshop for the campers  
1 2 3 4 **5**

12. Please share any improvements the presenters could make to better this workshop:

Was very impressed with how well this workshop went. Hoping to have our students continue with the data portion of the workshop, and then by the end, I'd like to have our same kids do the air monitor workshop again to see if they can successfully do it and/or improve the design.

13. Any Additional Comments:

We would love to help get more kids and more schools this workshop. I hope you all continue to grow this and other workshops because this is high level science high schoolers need that teachers, who are not experts in this area, may have difficulty effectively teaching.



# Educator Evaluation– The Improvements

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1 2 3 4 5

### The Workshop:

7. Relevant and informative to the campers  
1 2 3 4 5
8. Had all the supplies the campers needed  
1 2 3 4 5

- Was age appropriate for the campers

1 2 3 4 5

- Overall, the campers enjoyed the workshop

1 2 3 4 5

- Overall, this was a valuable workshop for the campers

1 2 3 4 5

- Please share any improvements the presenters could make to better this workshop:

I think this age group was a little young for this activity. They struggled with the trial and error process. Very educational but maybe a little too complex for the 4th + 5th graders.

- Any Additional Comments:

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# Future Directions

- Create Lego style booklets for younger workshop participants
- Develop EJ heat map content that can be provided to the classroom as “Gallery Walk” for instruction opportunities (this will make the air quality content more relatable to the students)
- Create template air quality study research projects for longer term school engagement
- Identify indoor air quality opportunities for education and school engagement



# Thank You!

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