

Low-cost air quality monitoring pilot study

FOCUS GROUP: COMMUNITY MONITORING SITES

FEBRUARY 25, 2022



Hillsborough TPO
Transportation
Planning Organization



U.S. Department of Transportation
Federal Highway
Administration



Introductions & Project Overview

INTRODUCTIONS



Name



Organization



Why are you interested in
this pilot study?

What we want to accomplish today

- ▶ Share information on air quality monitoring
- ▶ Provide a project update and get feedback
- ▶ Identify potential community monitoring sites and desired future sites
- ▶ Explore ways to get involved and gauge interest

Goals and Objectives

Purpose: Study air quality in communities most impacted by transportation related air pollution (TRAP) and provide access to air quality data.

- Increase access to air quality data
- Inform future transportation planning
- Equitably improve air quality

Goals



- Establish pilot monitoring sites in communities
- Collect community air quality data and share with communities
- Develop methods to establish a larger community monitoring network

Objectives



Timeline

Install monitors at control site and begin testing

Identify community monitoring areas

Engage community partners

Oct – Dec
2021

Community Focus Group

Select community monitoring pilot sites

Install community monitors

Jan – Mar
2022

Collect and analyze community air quality data

Public engagement with community sites

Apr – June
2022

Report findings

July – Aug
2022

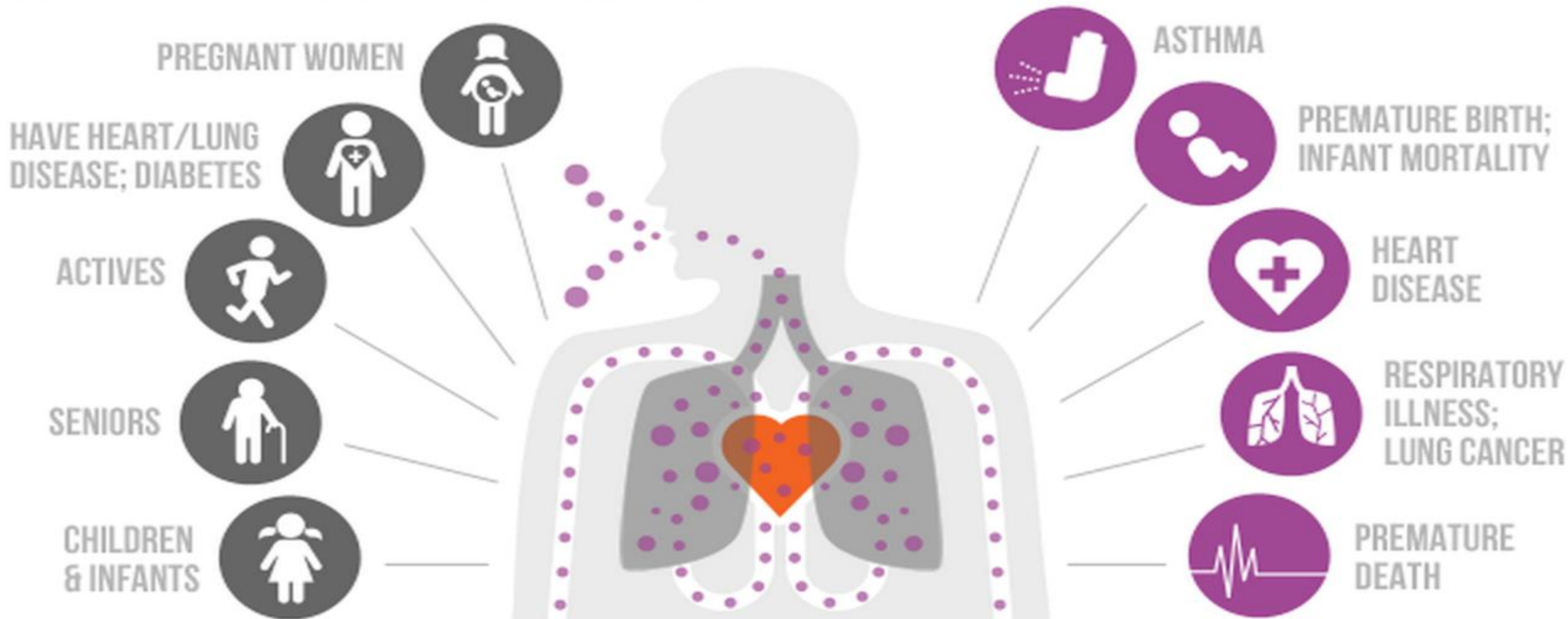


About Air Quality and Monitoring

Why Air Quality?

HEALTH EFFECTS

AT RISK PEOPLE / INCREASED EFFECTS



Inequality in effects

▶ Asthma

- ▶ Prevalence rates are higher for African Americans and people with low incomes
- ▶ Children living in poverty are more likely to develop asthma
- ▶ Black children are 3 times more likely to die of asthma as non-Hispanic whites
- ▶ Hispanic children are 2 times more likely to die of asthma

▶ Cardiovascular mortality

- ▶ African Americans are 20 percent more likely to die from heart disease than non-Hispanic whites.

▶ Lung cancer mortality is higher in blacks than whites

▶ Overall life expectancy is lower for those with lower incomes and for blacks

▶ Disparities in exposures to air pollution contribute to this inequality



Graphic by Stephanie King
(healthblog.uofmhealth.org/)

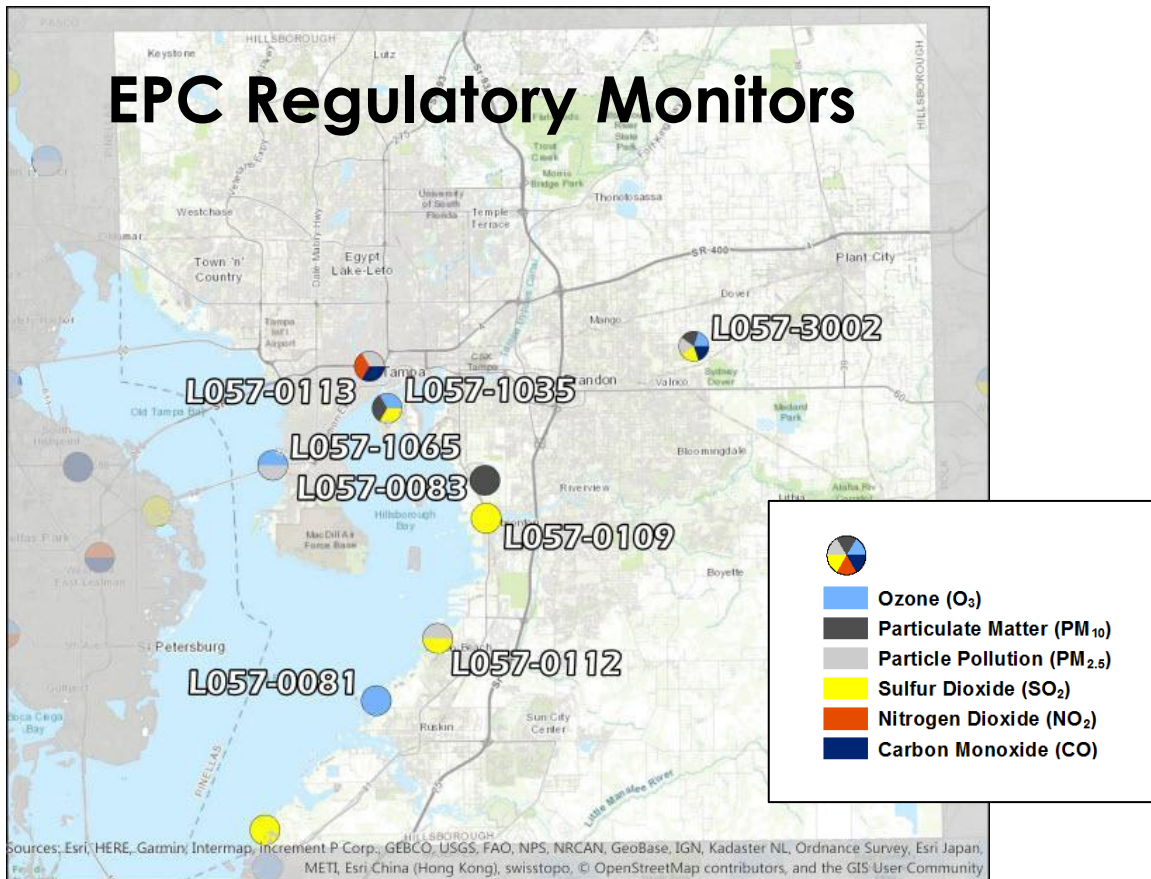
Traffic-related air pollution (TRAP)

- ▶ The complex mix of air pollutants that are elevated near roadways
 - ▶ highest within a few hundred meters of roadway
 - ▶ from fuel combustion, solvent/fuel evaporation, wear of tires, brakes, and road surfaces
- ▶ Important pollutants
 - ▶ nitrogen oxides (NO_x , including NO_2)
 - ▶ particles
 - ▶ ultrafine ($\text{PM}_{0.1}$), fine ($\text{PM}_{2.5}$), and coarse (PM_{10})
 - ▶ black carbon (BC/EC)
 - ▶ diesel PM
 - ▶ carbon monoxide (CO)
 - ▶ toxic organics: benzene, 1,3-butadiene, acetaldehyde, formaldehyde
 - ▶ metals: Pb, Sb, Mn, Fe, Cu, Zn, Ba



Source: ehsdailyadvisor.blr.com/2015/01/impacts-of-near-roadway-air-pollution/

Regulatory & Low-Cost Monitoring



Low-Cost Sensors/Monitors

- ▶ Refers to emerging types of sensors that are smaller and more affordable.
 - ▶ Ongoing innovation to develop and evaluate low-cost monitors that provide reliable data.
- ▶ Benefits:
 - ▶ Greater coverage of air quality measurements
 - ▶ Gain localized understanding

Real-Time Air Quality Map | PurpleAir



Data layer: US EPA PM2.5 AQI

Apply conversion: No

Averaging period: 1-week

Base map type: Detailed

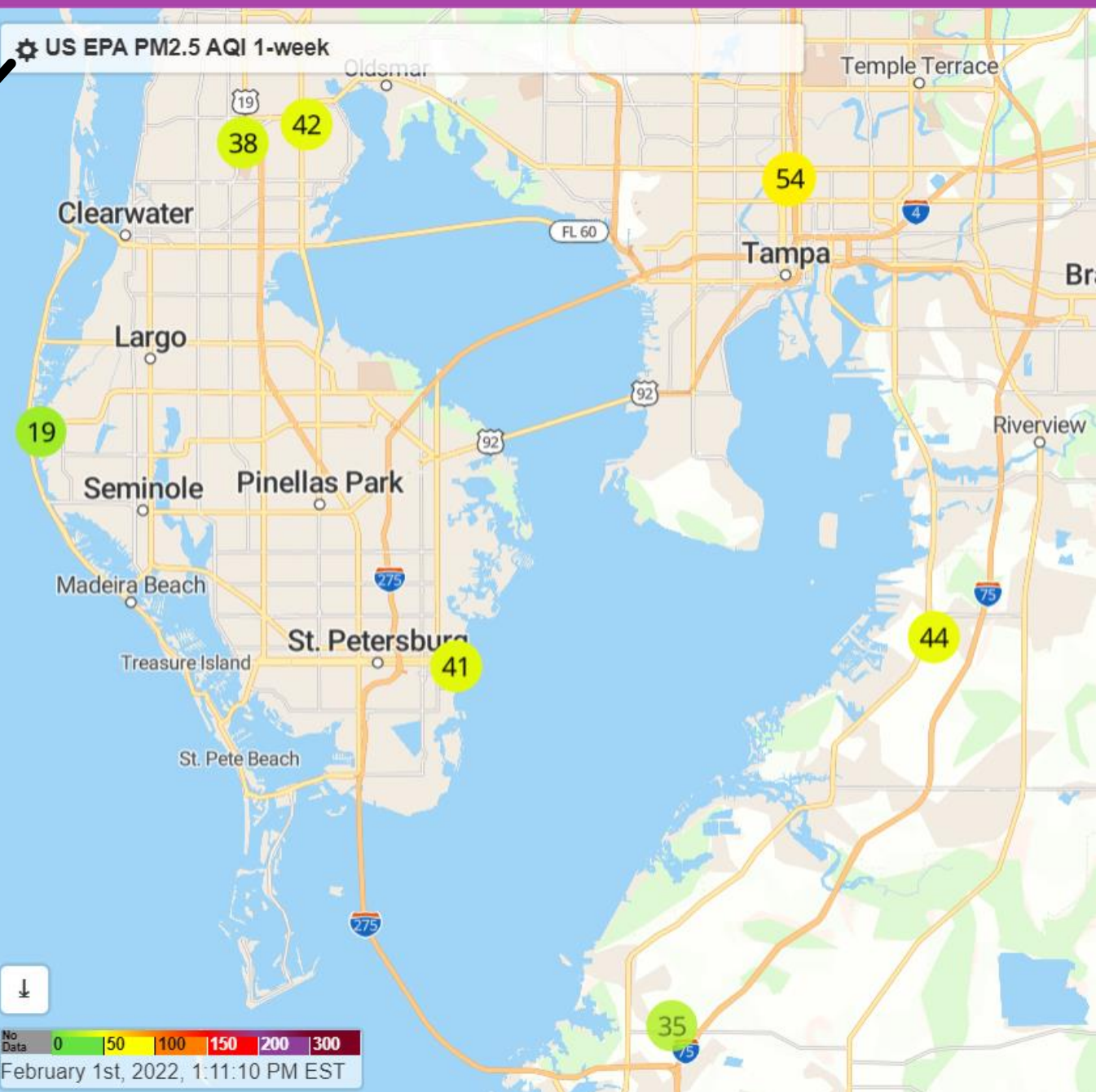
Show outside , show inside and show my sensors

Reporting or modified within: 10-minutes

Show averages as rings:

Experts tip: After choosing options, zoom and pan, bookmark the page or copy and share the url to open the map with those options pre-defined.

For a limited time: [revert back to the old map](#) but please let us know why by emailing contact@purpleair.com with your comments.



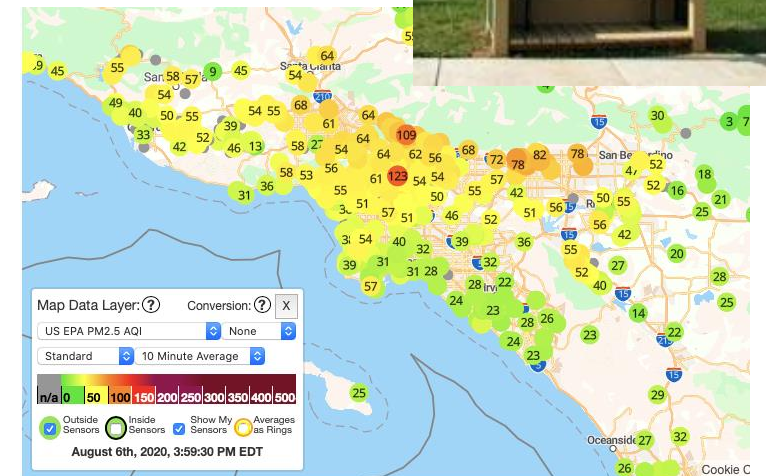
Examples of other AQ community monitoring

▶ Village Green Stations

- ▶ 8 stations around country (including original in Durham, NC)
- ▶ Located in parks, near libraries, science center, school
- ▶ Measure O_3 , $PM_{2.5}$, NO_2 , VOCs, BC, meteorological parameters
- ▶ Solar power; Wireless data transmittal for real-time cellphone access

▶ IVAN Air Monitoring Network, Imperial Co., CA

- ▶ High environmental risk, predominantly Hispanic community
- ▶ 40 monitors in county (schools, near roadways, other)
- ▶ Measure $PM_{2.5}$, PM_{10} , temperature, humidity
- ▶ AQ mapping and violation reporting web tool





Pilot Study Preparations

Monitor Selection

Selection criteria:

Price	Pollutants	Data Quality	Data Collection	Logistics
Low	PM _{2.5} , NO ₂	≥ moderate R ² vs FRM/FEM	Easy, + for public sharing website	Easy, few ancillaries

PM Candidate Monitors:

✓ Purple Air

✓ Air Beam



NO₂ Candidates:

✓ Envea Cairsens

✓ Unitec SENS-IT



Multipollutant Candidates:

✓ Clarity Node

✓ Airly

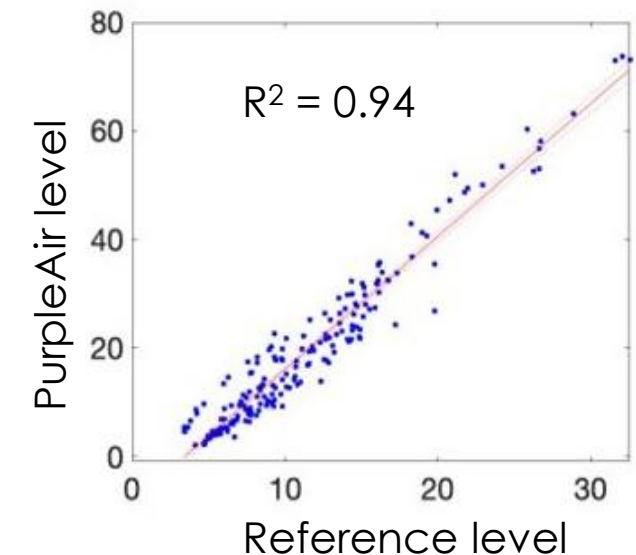
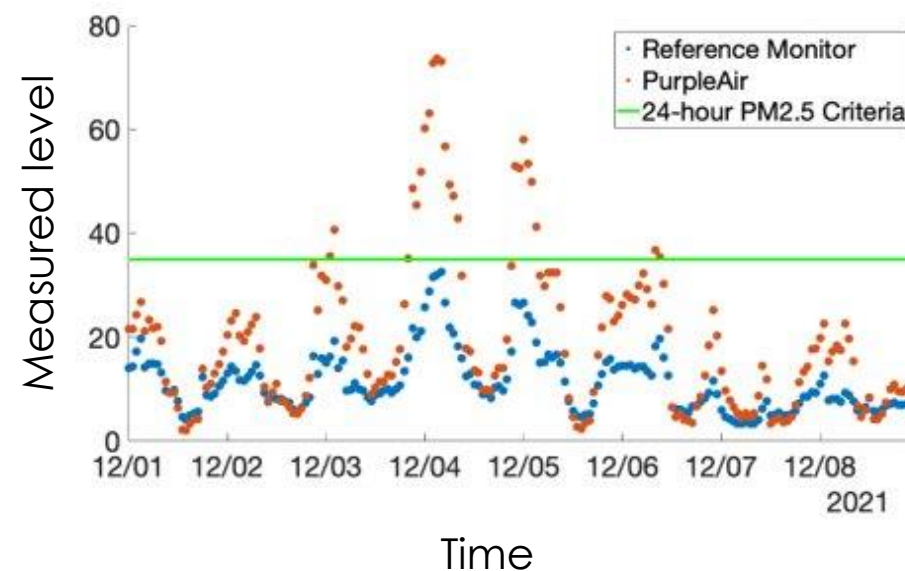
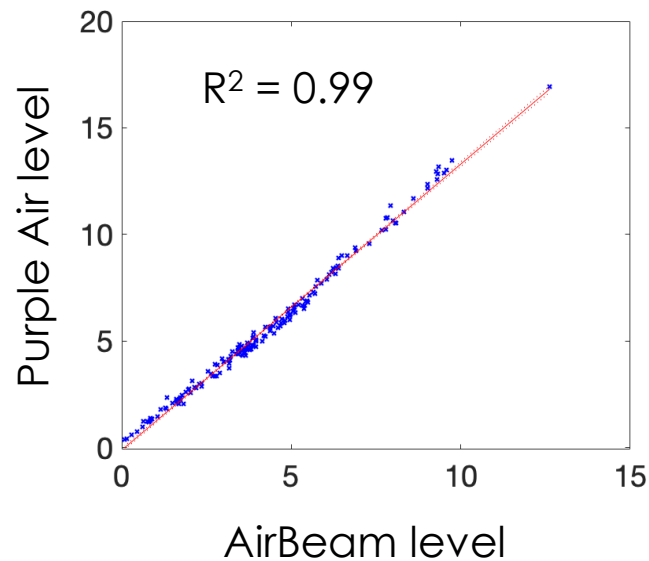


Field Monitor Testing

- ▶ Intercomparison
 - ▶ Co-location of PurpleAir and AirBeam
- ▶ Evaluation against reference monitor
 - ▶ Co-location of 2 PurpleAirs at EPC near-road monitoring site (Munro)



Comparisons of hourly $PM_{2.5}$ levels ($\mu g/m^3$)

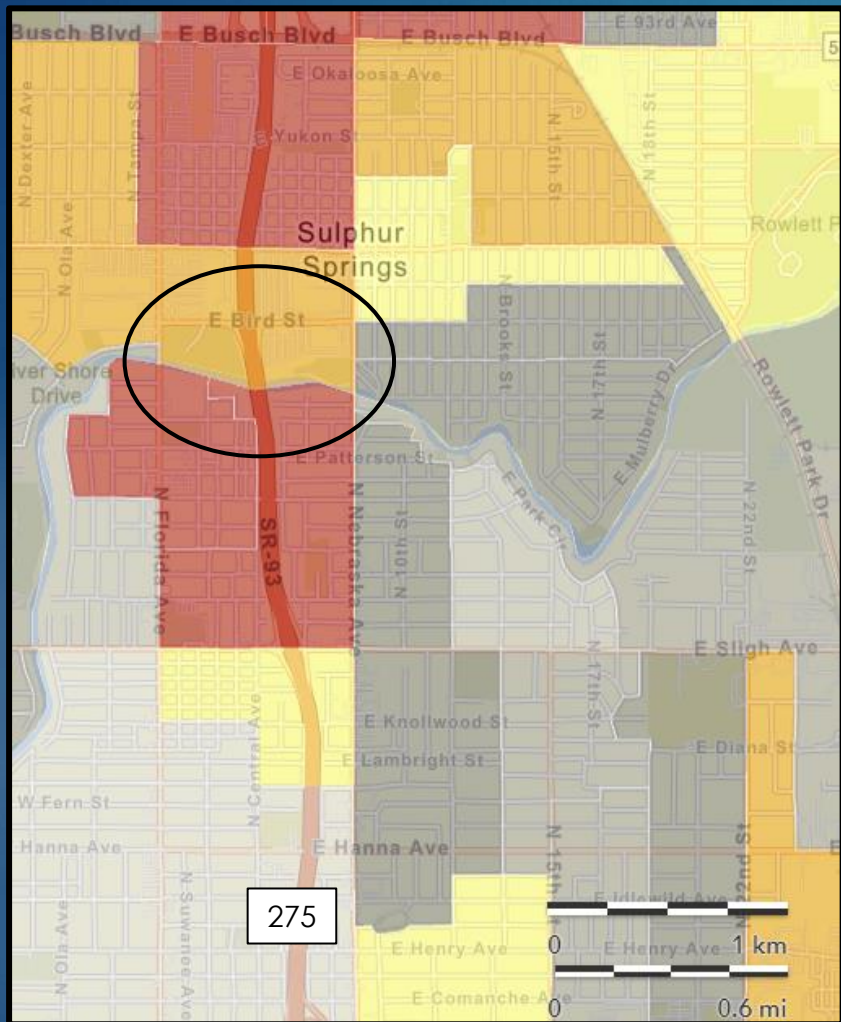


Pilot Study Location Selection Pt. 1

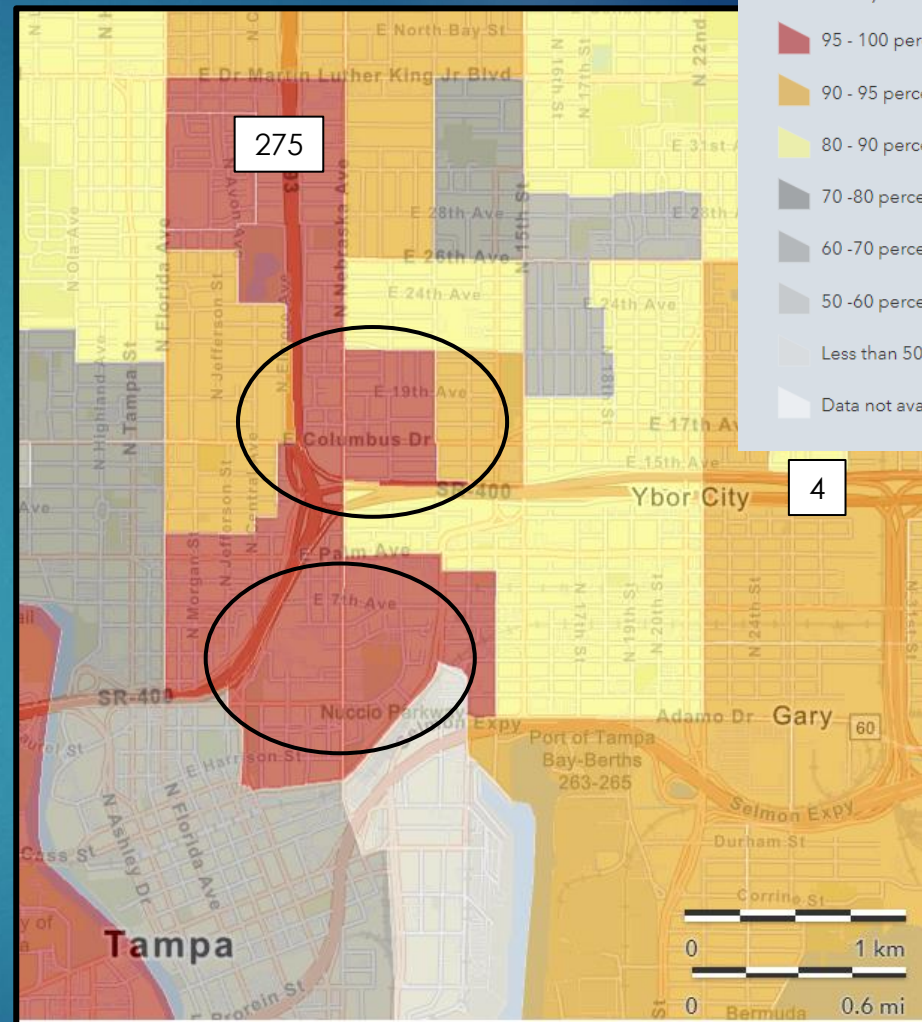
Community selection criteria:

1. Environmental factor
 - ▶ Proximity to I-275 and I-4
2. Demographic factors
 - ▶ Low-income
 - ▶ Majority people of color
 - ▶ Identified via EJSCREEN and the Plan Hillsborough Nondiscrimination and Equity Plan
3. Opportunities for community access and engagement

Indicate a community's potential susceptibility to harmful environmental impacts



EJ Index: Traffic Proximity near Sulphur Springs along I-275



EJ Index: Traffic Proximity near downtown Tampa and I-275 and I-4 interchange

Select Map Contents

- EJSCREEN Map
- Traffic Proximity (National Percentiles)
 - 95 - 100 percentile
 - 90 - 95 percentile
 - 80 - 90 percentile
 - 70 - 80 percentile
 - 60 - 70 percentile
 - 50 - 60 percentile
 - Less than 50 percentile
 - Data not available

DISCUSSION

- ▶ What are your thoughts on the community selection criteria?
- ▶ What else should be considered when selecting future communities to monitor transportation related air pollution?



Where are we now?

<https://www.notebookcast.com/en/board/hxrlt3c183140>

Pilot Study Location Selection Pt. 2: Site Selection Criteria

Community access and public engagement opportunities

- An area where members of the public frequently walk and/or congregate

Proximity to the interstate (I-275 and I-4)

Interest in potentially being a long-term community monitoring site

Logistical needs

- Power, internet, damage/loss prevention, and a place to mount the monitor and informational display

Logistical Considerations

GENERAL LOCATION



Considering the purpose of the measurements, where should the site be located?"

SECURITY



Ensure that the sensor is secure and protected from vandalism or theft and that site operators can remain safe.

ACCESS



Determine the requirements (permissions, keys, etc.) to visit the site to install/service the sensor(s).

PLACEMENT



In general, place the sensor at least 6 feet above ground level, rooftop, or other objects and away from obstructions, vegetation, or emission sources that would interfere with the measurement.

POWER



Determine requirements and establish power early.

PHOTOS



Take photos of the sensor installation and area around the site.

COMMUNICATIONS



Ensure reliable communications (cellular, Wi-Fi, etc.) before installation.

DOCUMENTATION



Record information about the site, including latitude, longitude, elevation, nearby obstacles, date of installation, etc.

DISCUSSION

- ▶ What other factors should we consider as we identify pilot community monitoring sites?
- ▶ In what type of location do you want to learn about your community's traffic related air quality?



Mapping Activity

Review and identify potential
monitoring sites

<https://www.notebookcast.com/en/board/hxrlt3c183140>

<http://getethermap.org/m/air-quality-monitoring-pilot-study-2022>

Map password: airquality

DISCUSSION



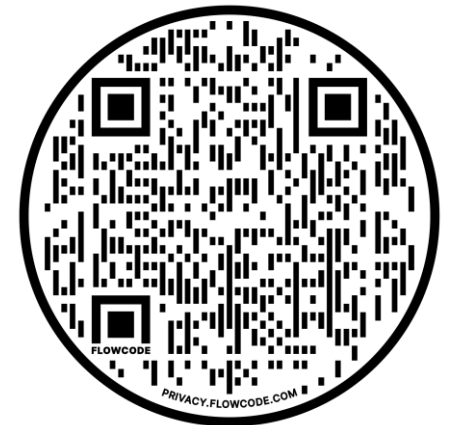
tinyurl.com/mv7xaabe

- How do you want to get involved? For example:
 - Volunteer to be a potential community monitoring site?
 - Be considered for future community monitoring sites if your community is outside one of the three pilot communities?
 - Participate in future focus groups or other community interactions?
 - Participate in any other capacity? If yes, please explain.

Wrap Up

- ▶ Questions, concerns, or additional suggestions?
- ▶ Contact information

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AQ Project Website:
tinyurl.com/TPOAirQuality