Community-driven Air Quality Monitoring in Curtis Bay, MD

Christopher D. Heaney (cheaney1@jhu.edu)

Environmental Health and Engineering, Johns Hopkins Bloomberg School of Public Health

Baltimore City Informational Hearing

August 24, 2022

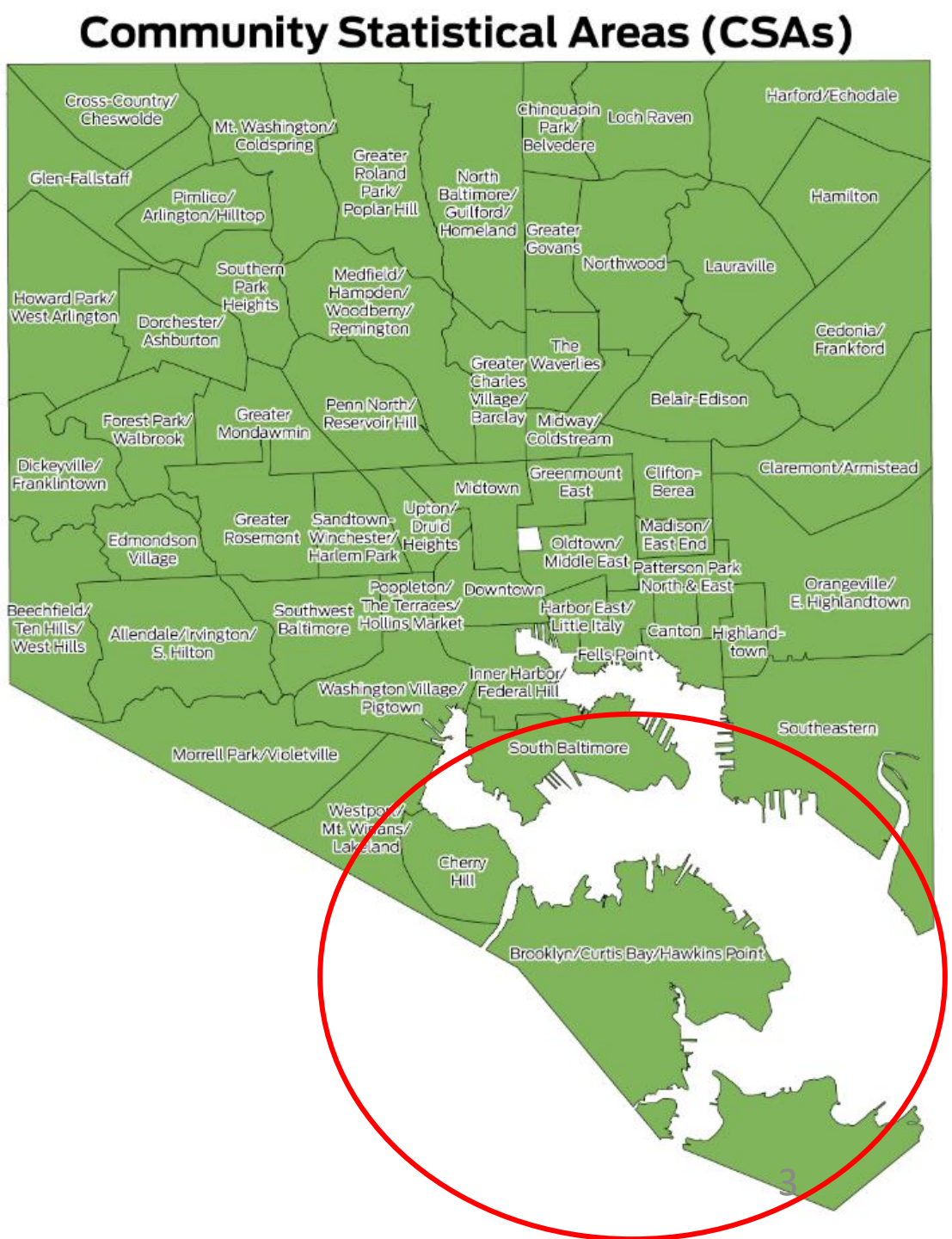
Community-driven air quality monitoring partners

SCHOOL OF
PUBLIC HEALTH

- Community of Curtis Bay Association / South Baltimore Community Land Trust
  - **Ray Conaway**
  - Shashawnda Campbell
  - Natalia Figueredo
  - Raychel Gadson
  - Kellie Gaither
  - Edith Gerald
  - Carlos Sanchez
  - Greg Sawtell
  - Angie Shaneyfelt
  - Cheyenne Shongo
  - Meleny Thomas
  - Kennet Walker
  - Many more Curtis Bay residents, volunteers and small businesses
- Johns Hopkins Bloomberg School of Public Health
  - Dr. Chris Heaney
  - Dr. Ana Rule
  - Lauren Deanes
  - Kris Spicer
- Maryland Department of the Environment (MDE)
  - George "Tad" Aburn
  - Ryan Auvil
  - Angelo Bianca
  - Joel Dreessen
  - Thomas Frey
  - David Krask
- University of Maryland
  - Dr. Sacoby Wilson
  - Vivek Ravichandran

Difference in Life Expectancy between Neighborhoods in Baltimore, 2018

Community Statistical Area	Life Expectancy (Years)
Upper Roland Park / Poplar Hill	82.7
Greater Charles Village / Barclay	73.8
Cherry Hill	**70.3**
Brooklyn / Curtis Bay / Hawkins Point	**69.5**

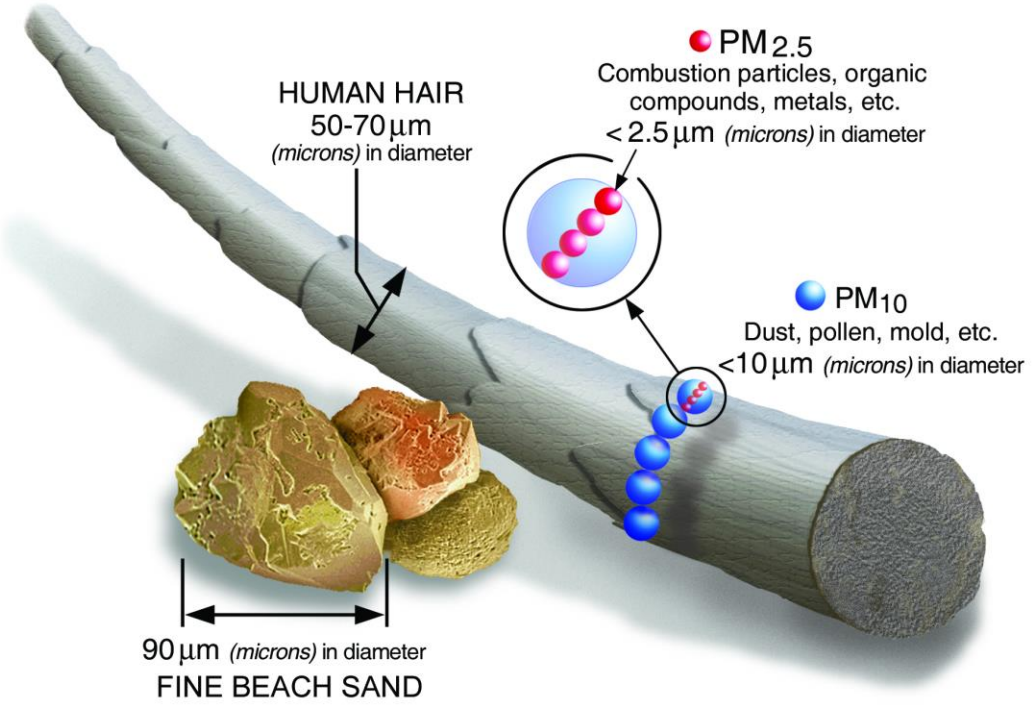


Map and data source: Baltimore Neighborhood Indicators Alliance
https://bniajfi.org/

How does air pollution affect health?

Particulate matter ($PM_{2.5}$ and PM_{10})

- **World Health Organization (WHO):**
  - PM causes significant morbidity and mortality
  - ***Short-term health:*** Asthma exacerbation, respiratory infections, reduced lung function
  - ***Long-term health*:** Stroke, ischemic heart disease, chronic obstructive pulmonary disease (COPD), and cancer
- **$PM_{2.5}$**
  - Smaller particles can travel further into the lung
  - ***Black carbon:*** Smaller, darker particles generated from partial combustion
- **PM_{10}**
  - Larger particles
  - Can be useful to understand more ***local sources*** of air pollution



Source: https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

Sources: https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health, https://www.who.int/teams/environment-climate-change-and-health/air-quality-and-health/health-impacts

Goals of community-driven air monitoring in Curtis Bay and South Baltimore, MD

Near term (from May, 2022 to present):

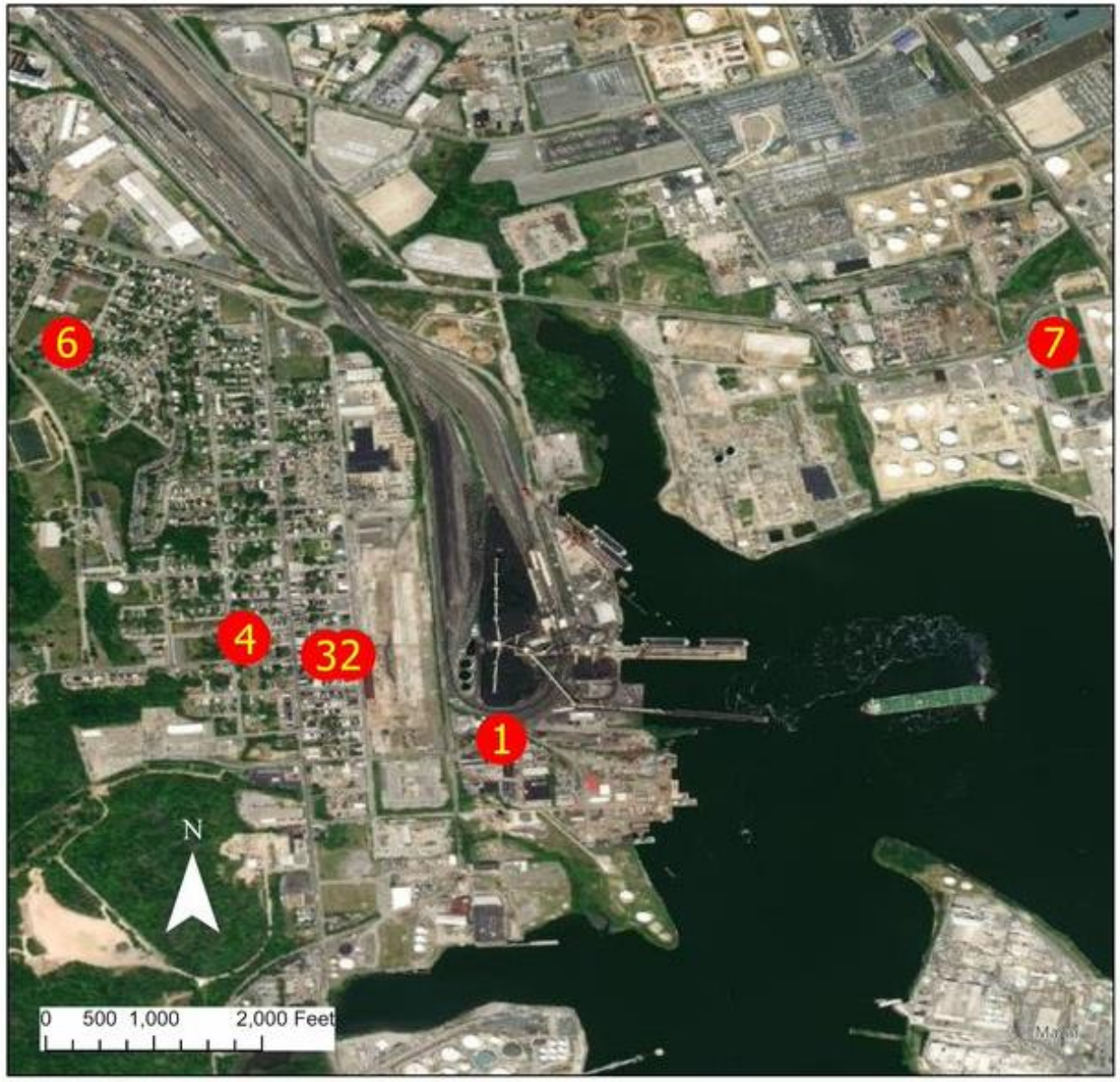
- To figure out how coal terminal and other facilities might be impacting air quality in Curtis Bay and South Baltimore

Mid-to-long-term:

- To help understand ***cumulative impacts*** of multiple sources of air pollution in Curtis Bay
- To work together with partners to figure out how to ***sustain*** community-driven air monitoring in Curtis Bay
- To ***share*** information with stakeholders to help improve air quality in Curtis Bay

Example of what our air monitoring instruments look like

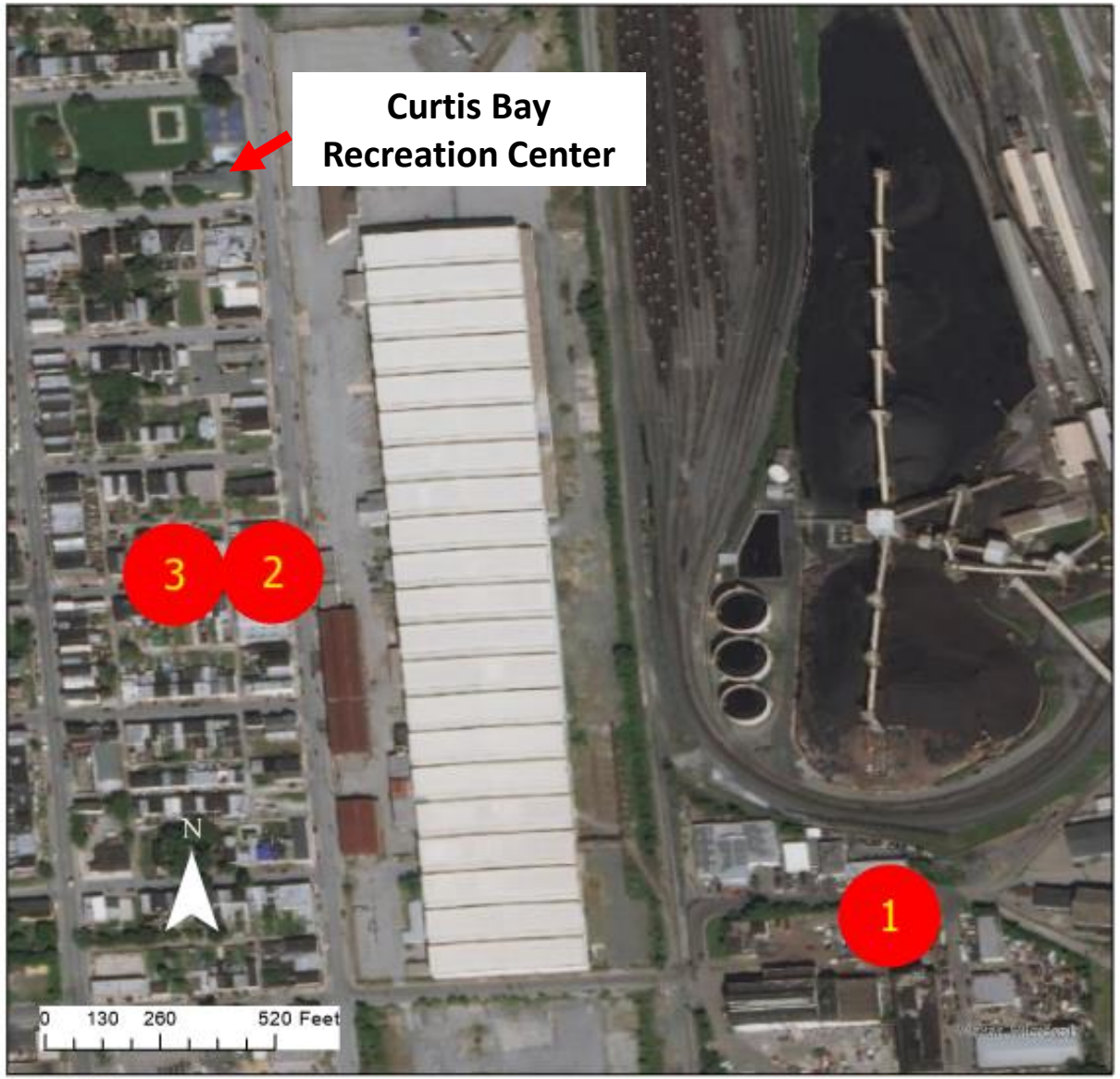
Locations of Air Monitors in Curtis Bay



Note: Monitors 4 and 5 are at the same place

- **When did we start monitoring?**
  - First monitor: **May 25, 2022** (Monitors 3 & 5)
  - Most recent monitor set up **July 13, 2022** (Monitor 1)
- **What are we measuring?**
  - Particulate matter (PM_{10}, $PM_{2.5}$, PM_1)
  - Black carbon
  - Gases (carbon monoxide, nitric oxide, nitrogen dioxide, ozone)
  - Temperature, relative humidity, wind direction, wind speed
- **What air monitors are we using:**
  - QuantAQ MODULAIR https://www.quant-aq.com/
  - DSTech ObservAir https://www.dstech.io/products
- Farthest *residential site* from coal terminal is **Monitor 6**
- Farthest *industrial site* from coal terminal is **Monitor 7**

Locations of Air Monitors in Curtis Bay



- **When did we start monitoring?**
  - First monitor: **May 25, 2022** (Monitors 3 & 5)
  - Most recent monitor set up **July 13, 2022** (Monitor 1)
- **What are we measuring?**
  - Particulate matter (PM_{10}, $PM_{2.5}$, PM_1)
  - Black carbon
  - Gases (carbon monoxide, nitric oxide, nitrogen dioxide, ozone)
  - Temperature, relative humidity, wind direction, wind speed
- **What air monitors are we using:**
  - QuantAQ MODULAIR https://www.quant-aq.com/
  - DSTech ObservAir https://www.dstech.io/products
- Farthest *residential site* from coal terminal is **Monitor 6**
- Farthest *industrial site* from coal terminal is **Monitor 7**

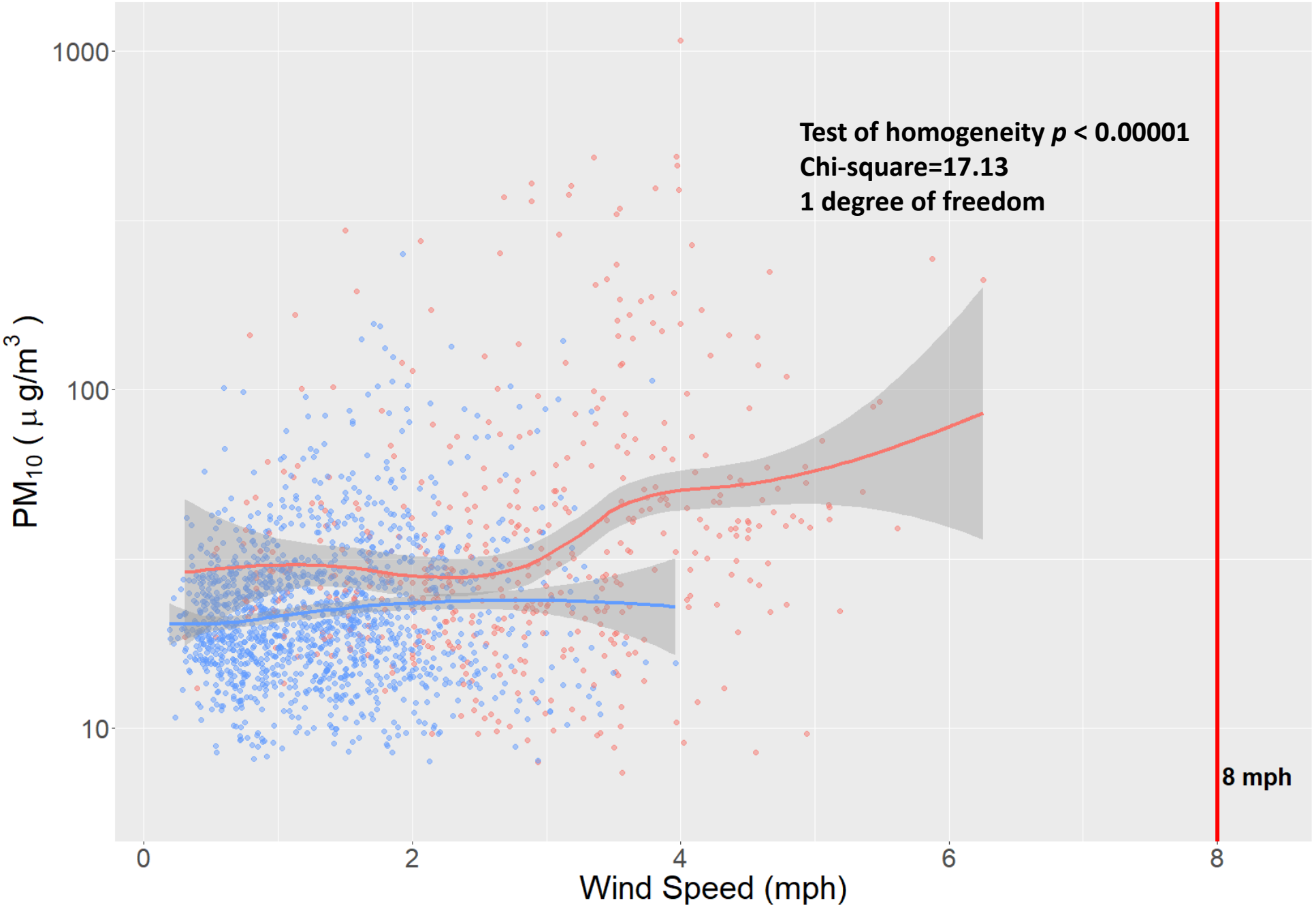
Distance (feet) between air monitoring locations and nearest edge of coal terminal

Monitoring location	Distance from coal terminal edge (feet)	Downwind direction
Monitor 1 – place of work	230 feet	NW to ENE
Monitor 2 – residential, near rec center	712 feet	NE to SE
Monitor 3 – residential, near rec center	876 feet	NW to NE
Monitor 4 – residential	1457 feet	NE to SE
Monitor 5 – residential	1457 feet	NE to SE
Monitor 6 – residential	2795 feet	S to E
Monitor 7 – former residential; now industrial place of work	4199 feet	S to W

What have we found so far (preliminarily)?

- **Levels of air pollution <u>change</u> as wind speed and wind direction changes:**
  - We see ***<u>higher</u>*** PM_{10} levels as wind speed ***<u>increases</u>***
  - We see **<u>higher</u>** PM_{10} levels when wind is blowing **<u>from coal terminal towards community</u>** (downwind) compared to **<u>not downwind</u>**
- **Ground-truthing:**
  - Using “on-the-ground” visual observations to attribute air pollutant profiles to exposures that residents spot

Relation of hourly average PM_{10} and wind speed by wind direction at Monitor 2, June 1-Aug 18, 2022



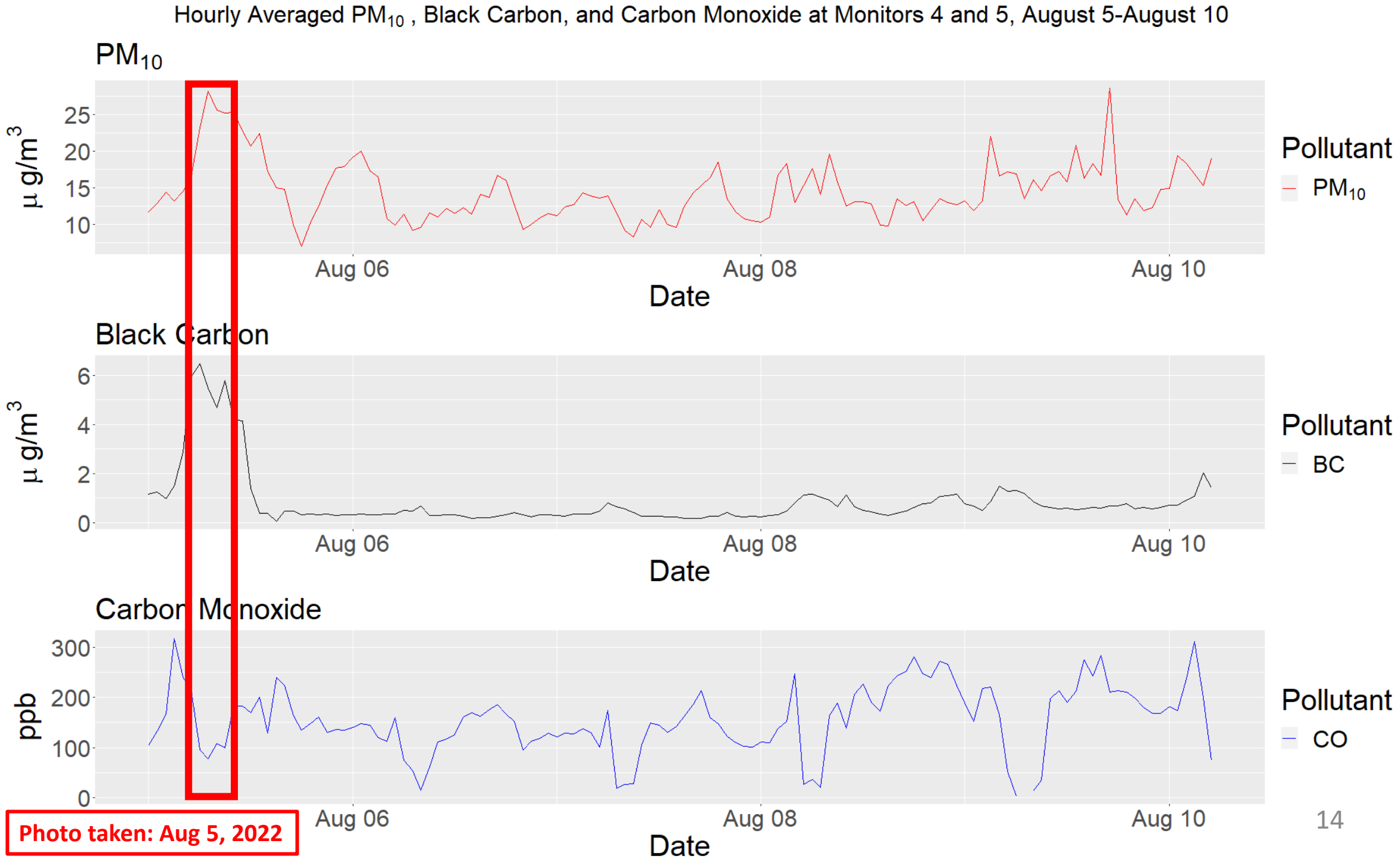
Downwind means air is coming from coal terminal toward the Curtis Bay community

What have we found so far (preliminarily)?

- **Levels of air pollution change as wind speed and wind direction changes:**
  - We see ***higher*** PM10 levels as wind speed ***increases***
  - We see **higher** PM10 levels when wind is blowing **from coal terminal towards community** (downwind) compared to **not downwind**
- **Ground-truthing:**
  - Using “on-the-ground” visual observations to attribute air pollutant profiles to exposures that residents spot

Example of visual *ground-truthing*

Photos taken August 5, 2022


Hourly Averaged PM10 , Black Carbon, and Carbon Monoxide at Monitors 4 and 5, August 5-August 10
PM10
μ g/m3
25
20
15
10
Aug 06
Aug 08
Aug 10
Date
Pollutant
PM10
Black Carbon
μ g/m3
6
4
2
0
Aug 06
Aug 08
Aug 10
Date
Pollutant
BC
Carbon Monoxide
ppb
300
200
100
0
Aug 06
Aug 08
Aug 10
Date
Pollutant
CO
Photo taken: Aug 5, 2022

Next steps

- To ***sustain*** air monitoring in Curtis Bay and South Baltimore
- Use “ground-truth” scenarios to identify air pollution profiles that can be ***attributed*** to specific sources
- Regularly, ***check in*** and ***share*** preliminary data with residents, stakeholders, and policy-makers

Questions?