Environmental Justice Tools for Engagement, Capacity Building, and Action

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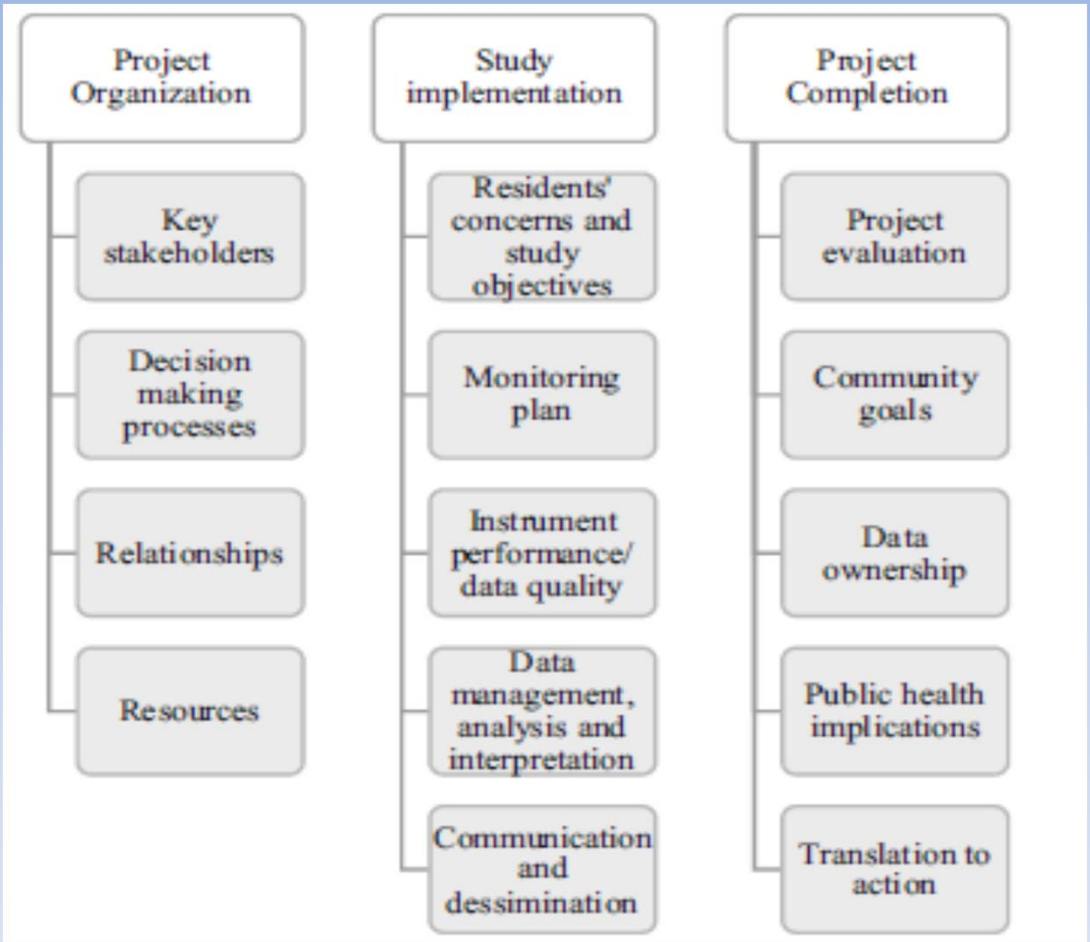
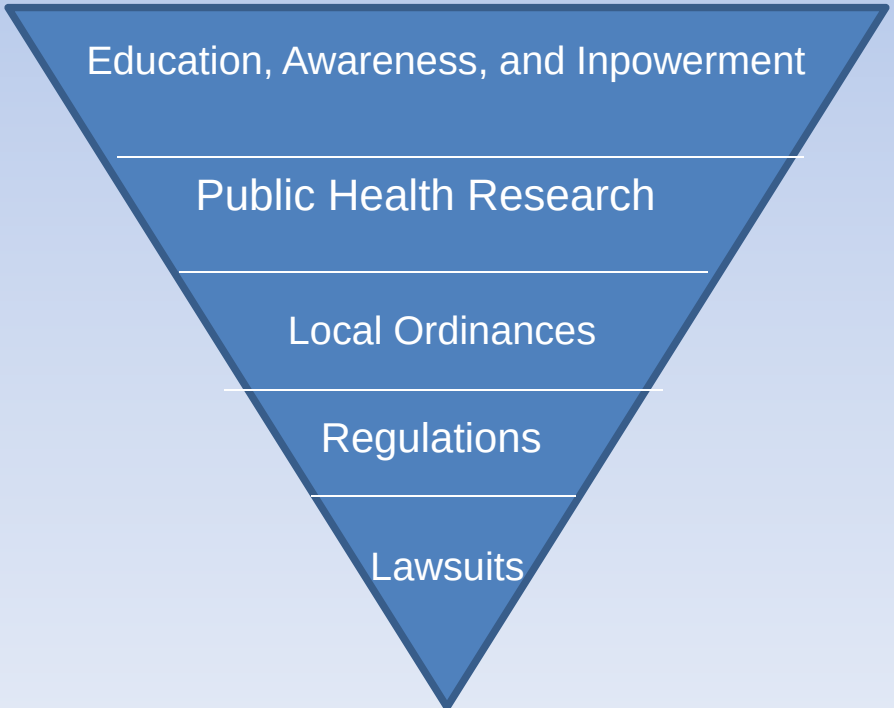
Anticipated Challenges of Air Pollution Monitoring at the Community Level



Commodore A, Wilson S, Muhammad O, Svendsen E, Pearce J. Community-based participatory research for the study of air pollution: a review of motivations, approaches, and outcomes. Environmental Monitoring and Assessment (2017).

Types of Monitors



Study Area

- Historic sites
- 2010 census - 9,148 people, 3,542 households and 1,960 families
- 65.6% African-American
- Hispanic or Latino (26.9%)
- Median household income (dollars) - $34,966
- Families below poverty level – 11.7%
- People below poverty level – 12.1%

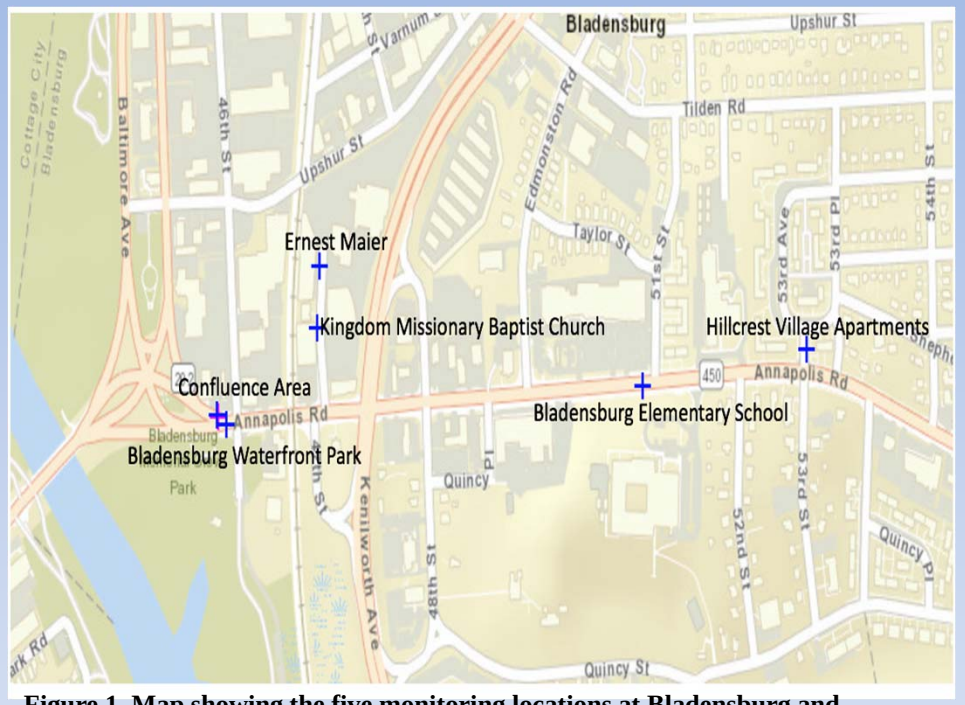
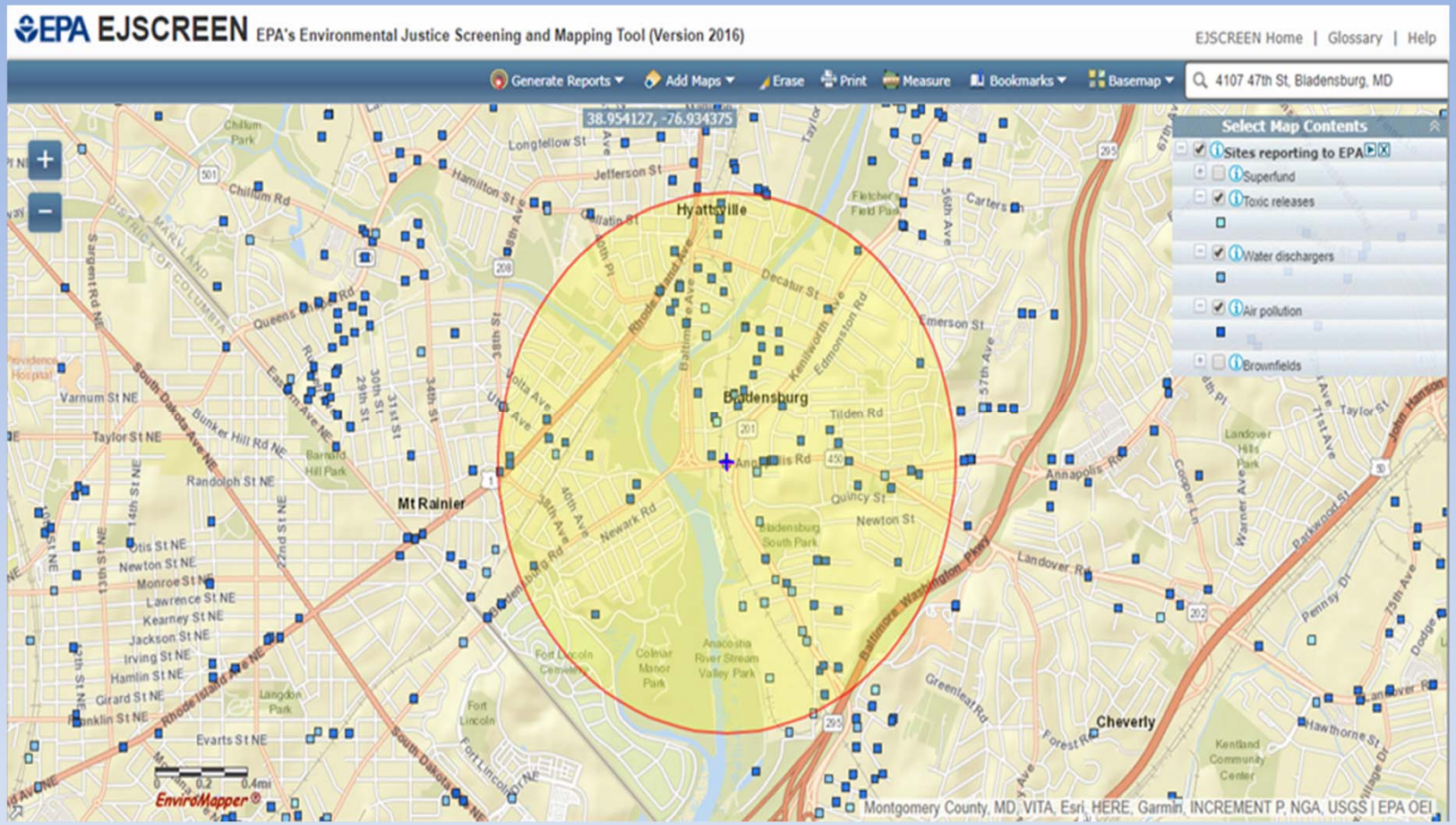
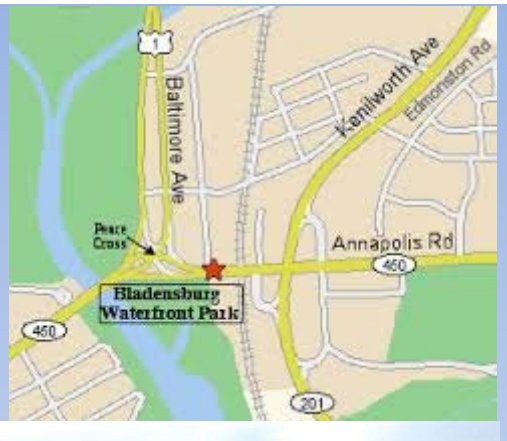


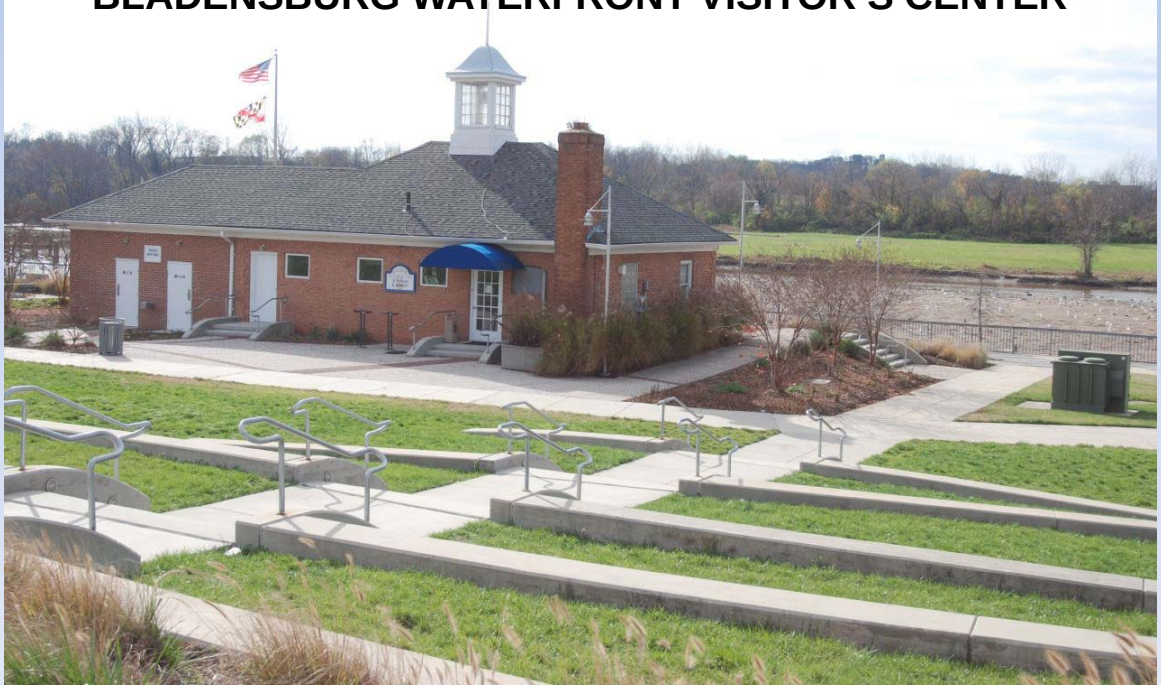
Figure 1. Map showing the five monitoring locations at Bladensburg and the concrete block plant (EJScreen)



Sites Reporting to the EPA in an 1 mile radius to the concrete plant



BLADENSBURG WATERFRONT VISITOR'S CENTER



Kingdom Missionary Baptist Church

BLADENSBURG ELEMENTARY SCHOOL

EMCO BLOCK PLANT

EM Aggregate Stockpiles

VIEW from Kingdom Missionary Baptist Church – Site of Concrete Batching Plant < 40 ft.

HEALTH EFFECTS OF DIESEL EXHAUST

- Diesel exhaust contains arsenic, benzene formaldehyde, and nickel
- long term exposure to diesel exhaust particles pose the **highest cancer risk** of any toxic air contaminant
- Immediate effects include irritations of the eyes, nose, throat and lungs
- Exposure can cause coughs, headaches, lightheadedness and nausea

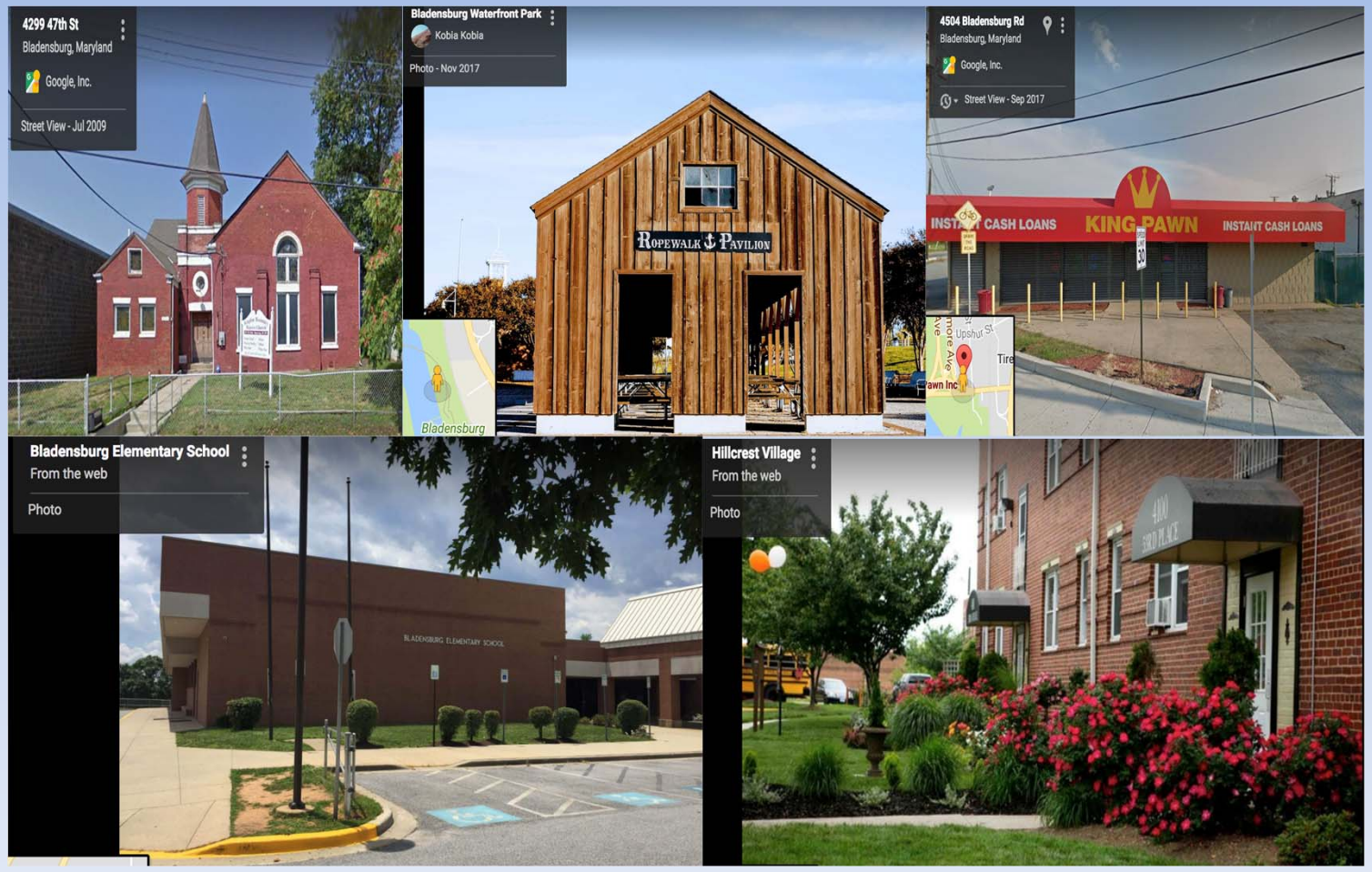
Bladensburg is in the 90-95th percentile in the United States for NATA Cancer Risk

DIESEL EXHAUST CONTAINS MORE THAN

40

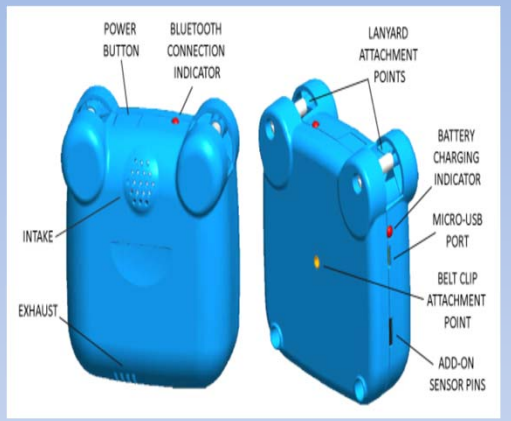
TOXIC CANCER-CAUSING AIR CONTAMINANTS

Monitoring Locations

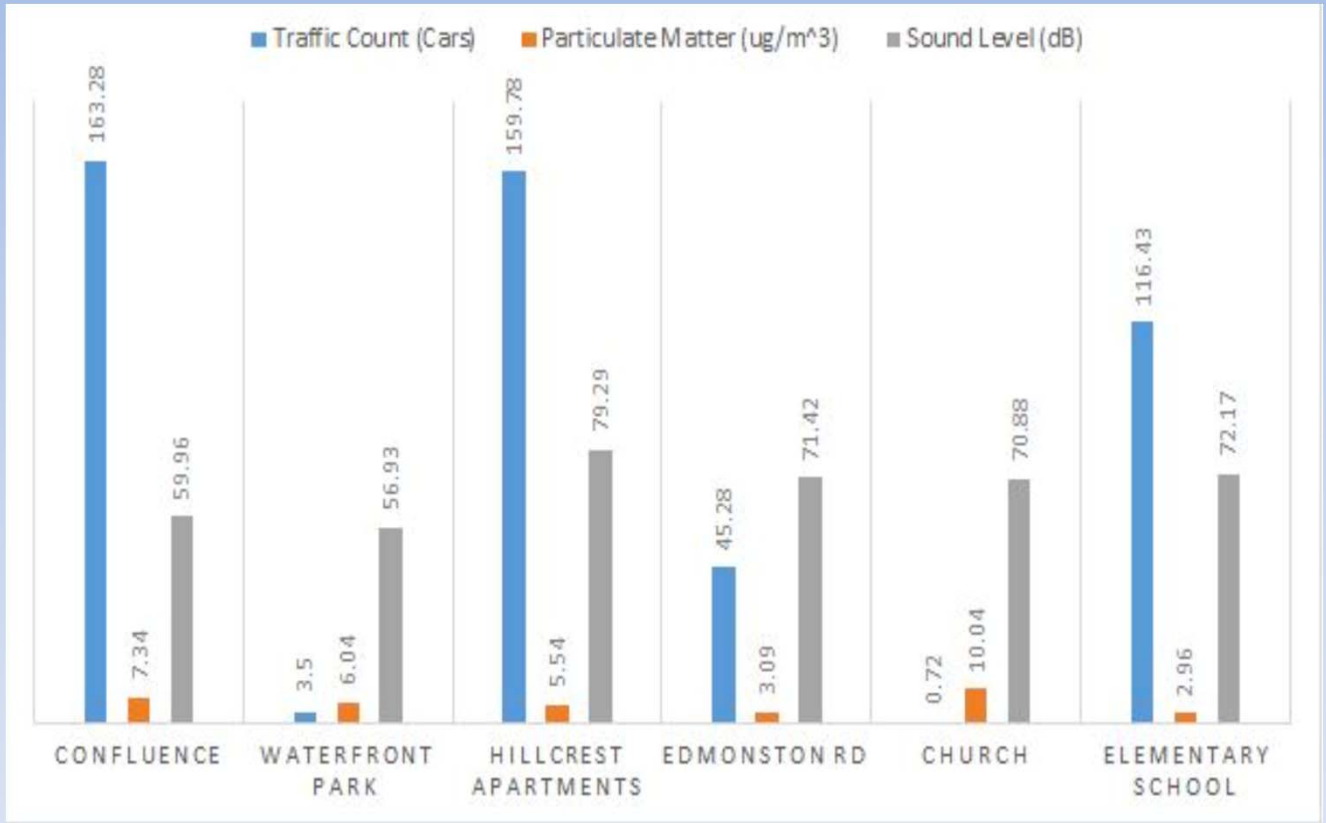


Methods

- Low-cost, easy-to-use, portable air pollution sensors which provide high-time resolution data in near real time
- AirBeams - monitor $PM_{2.5}$ at five monitoring locations
- Atmotubes - monitor VOCs at five monitoring locations
- Morning on-peak (8.30am -9.15am)
- Afternoon off peak (11.00am – 12.15pm)
- Evening on-peak (4.00pm – 5.15pm)
- Traffic counts
- EJSCREEN – environmental and demographic indicators

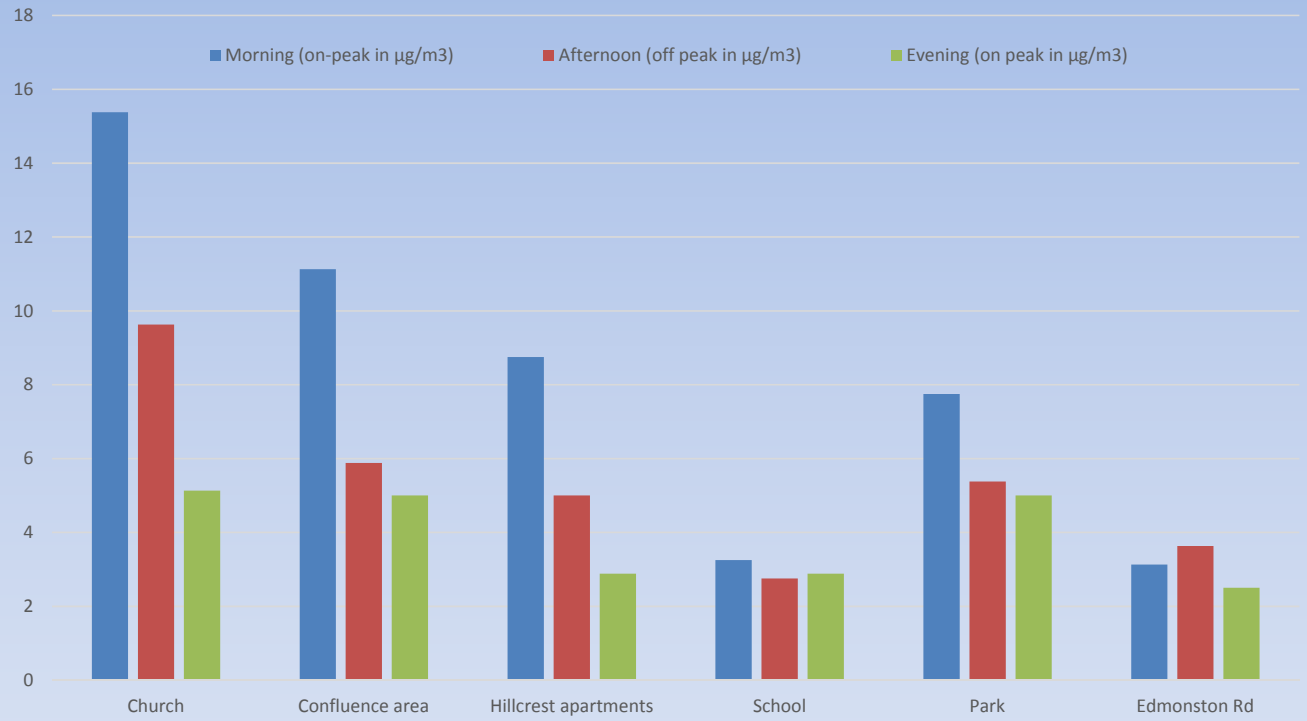


Summer Pilot Study (2017)



Mean values of PM, traffic count and noise level at various locations on July 26, 2017

Summer Pilot Study (2017)



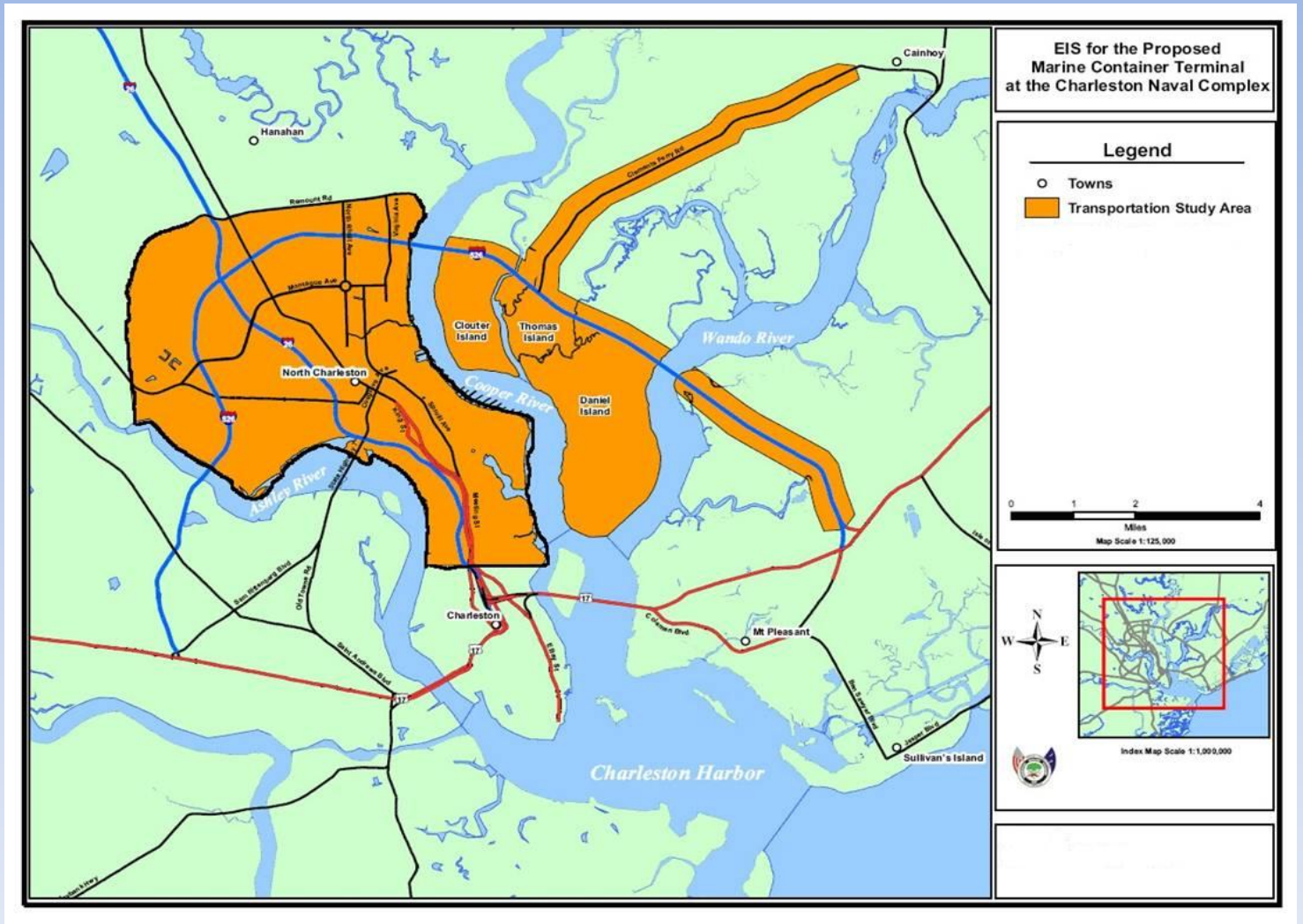
Morning on-peak, afternoon off-peak and evening on-peak mean values for PM on July 26, 2017

Mean and Standard Deviation of PM Concentrations at Five Sites in Bladensburg

Day	Sites	Mean (SD)	Mean (SD)	Mean (SD)
Wednesday 0606	Church	28.87 (22.55)	27.93 (23.22)	30 (31.07)
	Waterfront Park	3.71 (0.86)	4.51 (1.02)	5.86 (3.07)
	Elementary School	3.84 (1.71)	4.06 (0.81)	3.4 (1.3)
	Hillcrest Apartments	3.27 (0.69)	2.89 (0.64)	3.21 (0.92)
	Confluence	7.21 (3.34)	8.75 (4.25)	4.41 (1.83)
Thursday 0607	Church	27.44 (23.34)	20.67 (18.62)	11.73 (15.94)
	Waterfront Park	9.39 (1.08)	7.6 (1.43)	4.06 (0.96)
	Elementary School	11.39 (1.04)	7.5 (1.15)	
	Hillcrest Apartments	9.24 (1.25)	5.65 (1.48)	4.1 (1.06)
	Confluence	10.47 (1.79)	6.68 (1.81)	4.58 (1.01)
Saturday 0609	Church	27.74 (19.91)	18.18 (11.22)	7.02 (1.18)
	Waterfront Park	12.69 (1.322)		
	Elementary School	17.62 (1.79)	18.18 (11.22)	6.27 (0.95)
	Hillcrest Apartments	11.14 (1.24)	8.66 (1.17)	7.82 (1.69)
	Confluence		12.69 (1.32)	
Wednesday 0613	Church	28.36 (33.76)	25.14 (24.12)	22.38 (21.03)
	Waterfront Park	10.53 (1.34)	11.94 (1.15)	18.93 (1.5)
	Elementary School	10.75 (1.34)	11.68 (2.31)	9.5 (3.55)
	Hillcrest Apartments	10.22 (1.38)	13.09 (2.73)	16.5 (1.6)
	Confluence	10.22 (1.29)	13.08 (1.65)	17.69 (1.39)
Thursday 0614	Church	33.91 (27.96)	42.62 (26.07)	14.85 (12.26)
	Waterfront Park	3.37 (1.69)	2.07 (0.63)	2.11 (0.64)
	Elementary School	4.55 (2.45)	7.4 (6.4)	3.65 (1.3)
	Hillcrest Apartments	3.29 (1.7)	2.94 (1.23)	3.1 (1.13)
	Confluence	2.75 (1)	2.42 (0.68)	2.2 (0.67)
Saturday 0616	Church	46.71 (51.26)	21.2 (30.74)	8.06 (18.58)
	Waterfront Park	8.4 (1.16)	2.8 (0.66)	2.79 (0.62)
	Elementary School	8.45 (1.25)	3.64 (0.94)	3.87 (1.44)
	Hillcrest Apartments	7.38 (1.83)	5.69 (5.72)	3.3 (0.97)
	Confluence	5.72 (1.21)	3.17 (0.97)	3.88 (1.46)

Use of Citizen Science and Participatory Action Research to Address Environmental Stressors in Charleston, SC

Map of Transportation Study Area for the Port expansion in Charleston, SC



Charleston Area Pollution Prevention Partnership (CAPs)

- Our **long-term goal** is to use a community-university partnership between the Low-Country Alliance for Model Communities (LAMC), the University of Maryland-College Park and the University of South Carolina (USC), the community-based participatory research (CBPR) framework, and collaborative-problem solving model (CPSM) principles to address environmental injustice, public health, and revitalization issues in North Charleston, SC.

- Perform a baseline exposure and health assessment before the Port is scheduled to expand in 2019

Project Excellence

- Mission: to promote environmental awareness, literacy, and empowerment in the African-American community.
- Goal: to increase community capacity to address local environmental health issues in North Charleston neighborhoods through community-based outreach, education, and training.
- Focus on capacity building, education and outreach, pipeline development, and training of community scientists

Community EH Education Workshops (Spring 2011)

•One-Day workshop held on air pollution monitoring and training
•Discussed air pollution issues in the region
•Overview of current air pollution monitoring including different types of monitors
•Training on the use of the partisol for PM monitoring
•Interactive exercises on plans for air monitoring related to the Mitigation Agreement and Port Expansion

Community EH Education Workshops (Spring 2011)

•Dr. David Padgett, a geographer and GIS expert from Tenn State University led a one-day workshop on GIS mapping for residents
•Workshop included a laboratory tutorial on the use of online mapping tools
•Outside field exercise in the use of GPS units for mapping air monitoring locations

Goods Movement, Air Pollution, and Environmental Justice

Map of Air Monitors in Relation to Proposed Port Expansion in Charleston, SC

- Our analysis of saturation data show that PM levels range from 2 to 28 µg/m^3 across four sites (Accabee, Union Heights, Chicora-Cherokee, and Howard Heights). In general, $PM_{2.5}$ levels were highest in Union Heights. $PM_{2.5}$ was highest in September and lowest in December.
- Follow-up monitoring was performed using three dichot $PM_{2.5}/PM_{10}$ monitors in Rosemont, Union Heights, and Accabee
- $PM_{2.5}$ concentrations collected in Accabee (3.6µg/m^3 - 12.3µg/m^3) was similar to the concentrations found in Rosemont (3.2µg/m^3 - 12.9µg/m^3). However, these concentrations were lower than the range of mean $PM_{2.5}$ concentrations measured at the Gethsemane community center in Union Heights (4.1µg/m^3 - 15.2µg/m^3).
- The higher values obtained in Gethsemane may be due in part to the proximity of the station to heavier traffic and the port.
- Despite the differences in mean $PM_{2.5}$ concentrations in each community, most of the levels were still lower than those collected at the FAA monitoring station (0.35µg/m^3 - 17µg/m^3) and none of the average $PM_{2.5}$ values exceeded the 24-hour NAAQS (35µg/m^3).

Phase II Soil Sampling (June 21-22, 2012)

- 150 soil samples were collected in Union Heights, Accabee, Chicora-Cherokee, Liberty Hills, Rosemont, and Green Grove Communities

Phase I Soil Sampling Results

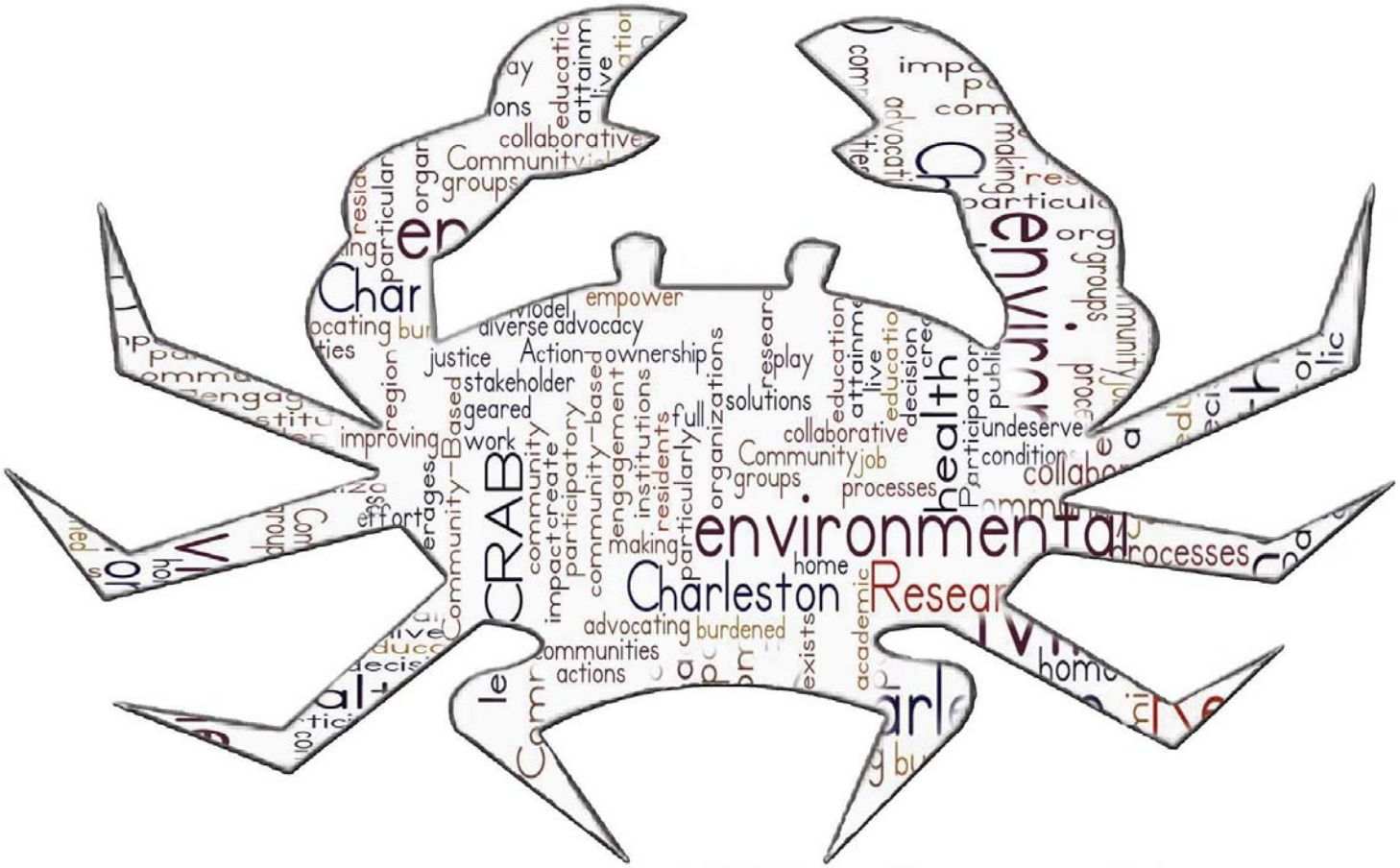
	Mean (mg/kg)	Mean (% of EPA SL)	EPA Residential Screen Level (mg/kg)
Arsenic	4.4	1129%	0.39 mg/kg
Barium	54.6	0.4%	1500 mg/kg
Beryllium	0.238	0.2%	160 mg/kg
Cadmium	0.482	0.7%	70 mg/kg
Chromium	45.5	N/A for total Cr	37.0 mg/kg (ASTDR)
Copper	61.1	2.0%	3100 mg/kg
Iron	7,694	14.0%	55,000 mg/kg
Lead	148	37.0%	400 mg/kg
Magnesium	1,126		N/A
Manganese	95.8	5.3%	1800 mg/kg
Mercury	0.058	0.6%	10 mg/kg
Nickel	11.9	0.8%	1500 mg/kg
Zinc	255	0.2%	23,000 mg/kg

Phase II Soil Sampling Results

	Accabee Mean (mg/kg	Chicora Cherokee Mean (mg/kg	Green Grove Mean (mg/kg	Rosemont Mean (% of EPA SL)	Union Heights Mean (mg/kg)	EPA Residential Screen Level (mg/kg)
Arsenic	4.6	4.5	1.8	7.0	7.4	0.39 mg/kg
Barium	34.9	42.7	19.7	51.2	53.0	1500 mg/kg
Beryllium	0.187	0.200	0.118	0.272	0.270	160 mg/kg
Cadmium	0.294	0.652	0.139	0.651	0.830	70 mg/kg
Chromium	15.4	27.5	12.1	44.0	55.1	37.0 mg/kg (ASTDR)
Copper	15.1	23.6	9.5	44.0	46.2	3100 mg/kg
Iron	6,067	6,529	3,814	6,753	7,277	55,000 mg/kg
Lead	80.9	120	59.7	146	133	400 mg/kg
Magnesium	544	655	364	778	1,540	N/A
Manganese	44.2	60.9	46.0	107	99.6	1800 mg/kg
Mercury	0.036	0.044	0.038	0.094	0.088	10 mg/kg
Nickel	3.0	5.9	2.6	6.6	11.5	1500 mg/kg
Zinc	147	174	69.4	221	372	23,000 mg/kg

- Phase I sampling occurred in Union Heights, Accabee, Chicora-Cherokee, and Rosemont (n=50) in July 2011. Phase II sampling occurred in Union Heights, Accabee, Chicora-Cherokee, Liberty Hill, Green Grove, and Rosemont (n=150)

- The team found high levels of arsenic, mercury, and lead at sampling locations. Both arsenic and lead were above residential and industrial screening levels (Phase I and II)


CCRAB
environmental
Charleston
health
Community
groups
collaborative
processes
stakeholder
justice
Action
ownership
solutions
empower
diverse advocacy
Charleston Community Research to Action Board

Charleston County Incinerator

The incinerator, built in the late 1980s, converts 230,000 tons of trash a year, or 80 percent of the county's garbage, into smoke, steam and a thick black ash.

The plant, on Shipyard Creek Road in North Charleston, also is one of the state's biggest sources of mercury pollution, releasing about 129 pounds a year, more than some of the state's larger coal-fired power plants and twice as much as Nucor's smelter in Berkeley County.

What’s Next?

Community-Based Air Monitoring Network

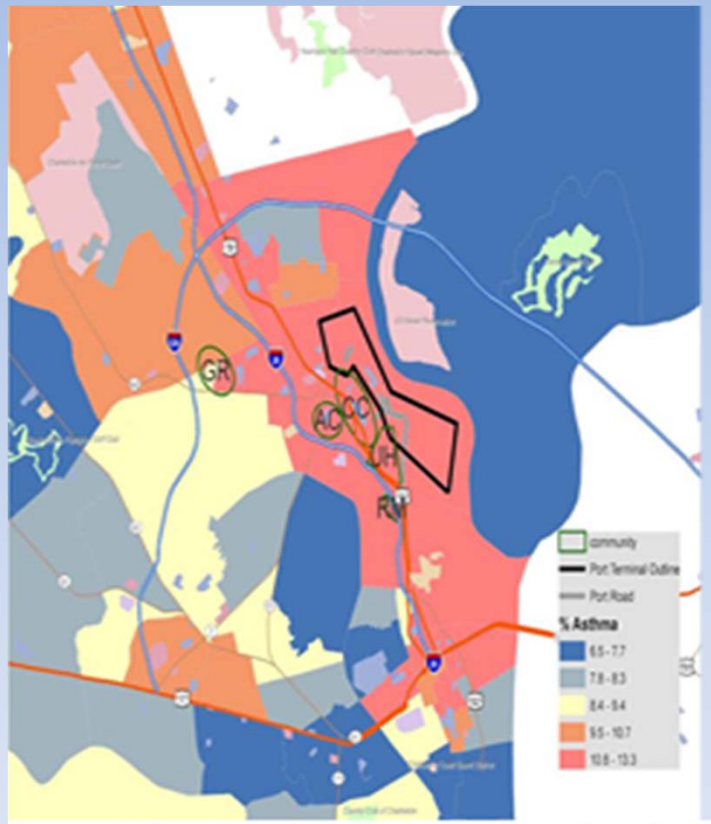


Figure 1. Concentration of people with asthma in the Charleston region.

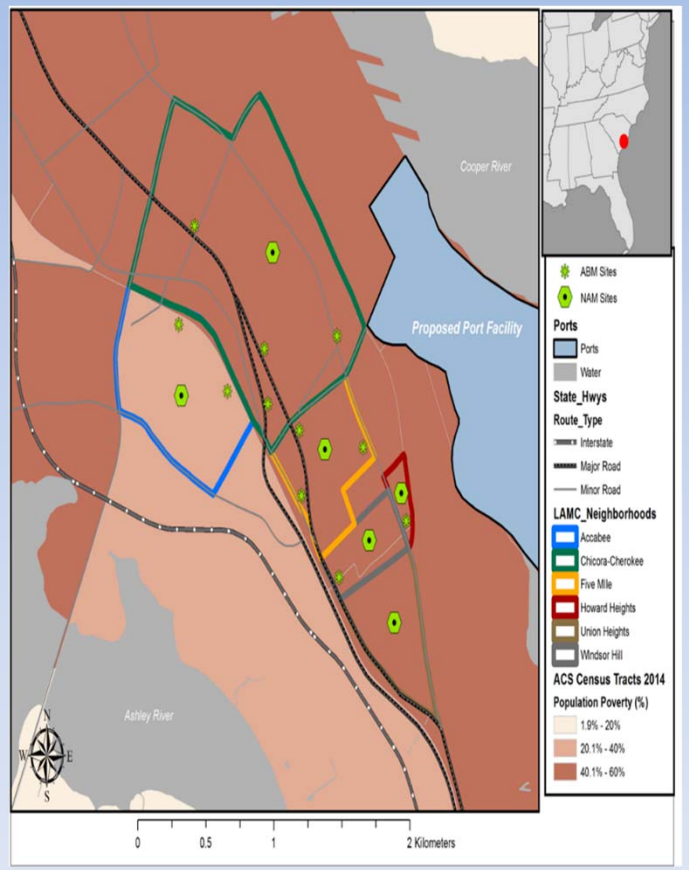
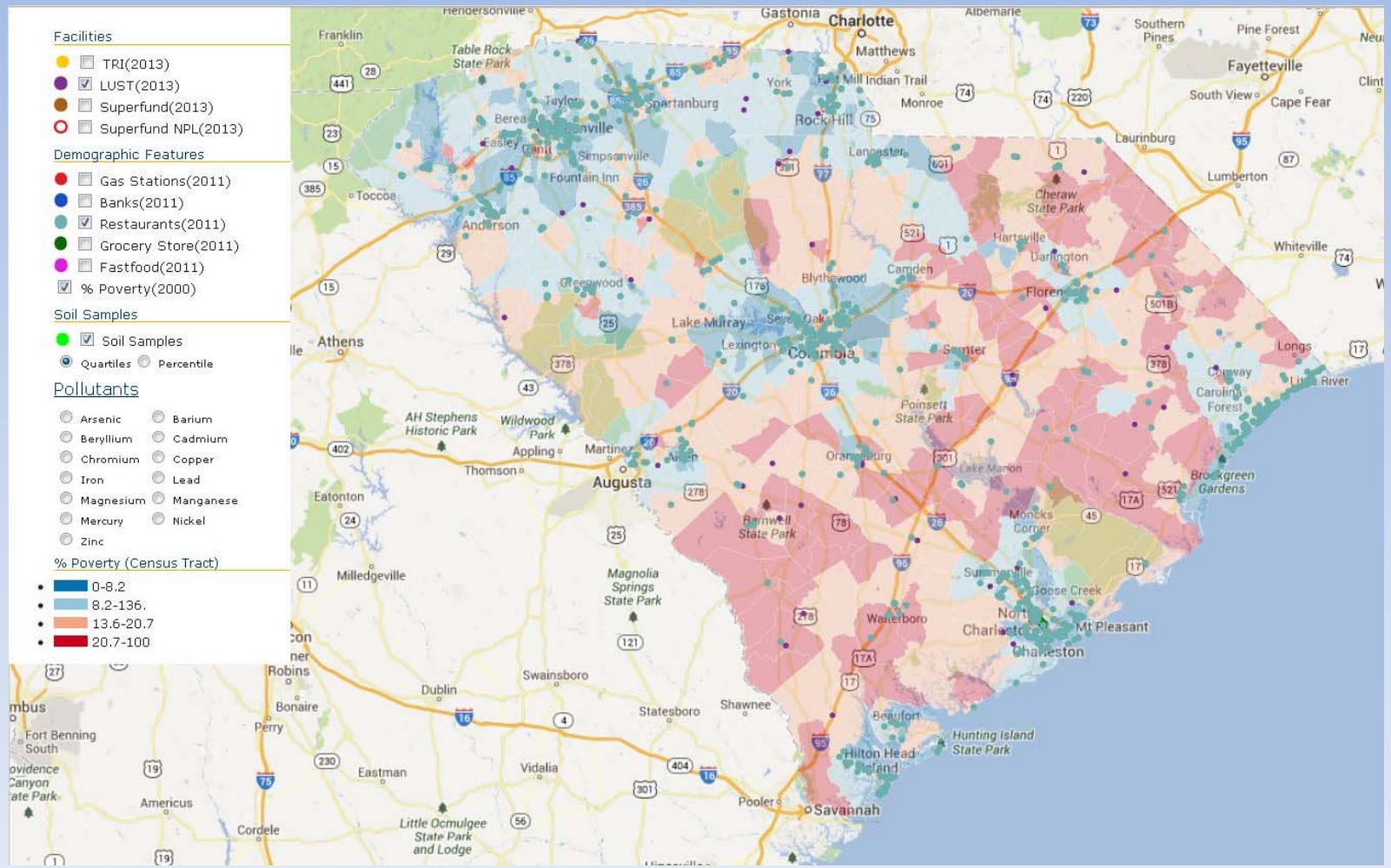


Fig 3. Proposed Sites of Air Pollution Monitors in Study Area

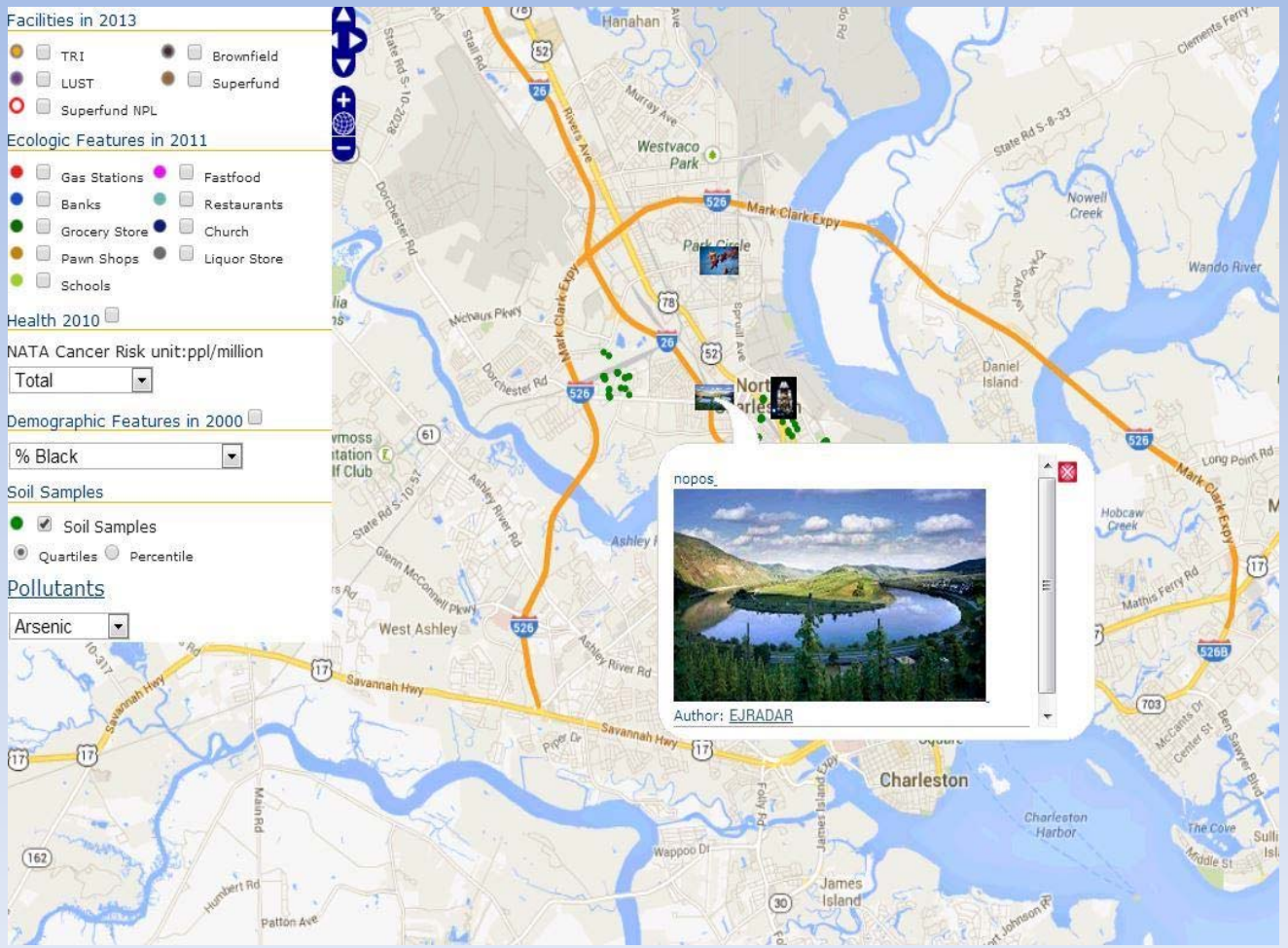
What is EJ RADAR?

- The Environmental Justice Radar(EJRADAR) is a PPGIS *website* designed for SC residents to know and share environmental information about the burden of physical and social environmental hazards with linkage to health disparities
- The use of PPGIS will help residents map environmental health data, build capacity, and empower residents to be more engaged in environmental decision-making

EJRADAR Examples: % Poverty in South Carolina



Active Photovoice



Environmental Injustice in Brandywine, MD

Brandywine Health Impact Assessment

HIA

Health impact assessment → Changes to decision & implement-ation → Changes to determinants of health → Changes to health outcomes

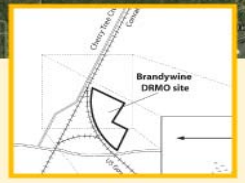
POLLUTION MATTERS

Thousands of studies have shown how air pollution can harm people, causing heart attacks, lung problems and other ailments, and shortening lives. New research is finding possible link between certain pollutants and autism, birth defects and childhood obesity, among other conditions.

Environmental Justice & Health Effects:
Environmental Pollution • Water Pollution
Toxic Pollution • Bacteriological Danger
Atmospheric Pollution • Particulate Matter
Dust • Fumes • Combustion Products

Chronic Disease Prevention... **environmental and zoning inequality** and chronic diseases such as heart disease, cancer, diabetes and asthma are the leading causes of death and disability in disproportionately affect communities of color populations. Developing successful prevention strategies starts with recognizing the complex interplay of social factors that drive chronic diseases, and Brandywines' community Local Resilience and Responsible Planning. adverse effects of development projects on human health, and on the promotion of healthy environments. Therefore, the development and promotion of instruments for the systematic evaluation and mitigation of health impacts of development is a primary concern. Prince George's County, Brandywine, Maryland has poorer health outcomes compared to the rest of the counties over 60% of deaths are related to chronic diseases.

Fossil Fuel | Gas Power Plant



Brandywine DRMO Superfund

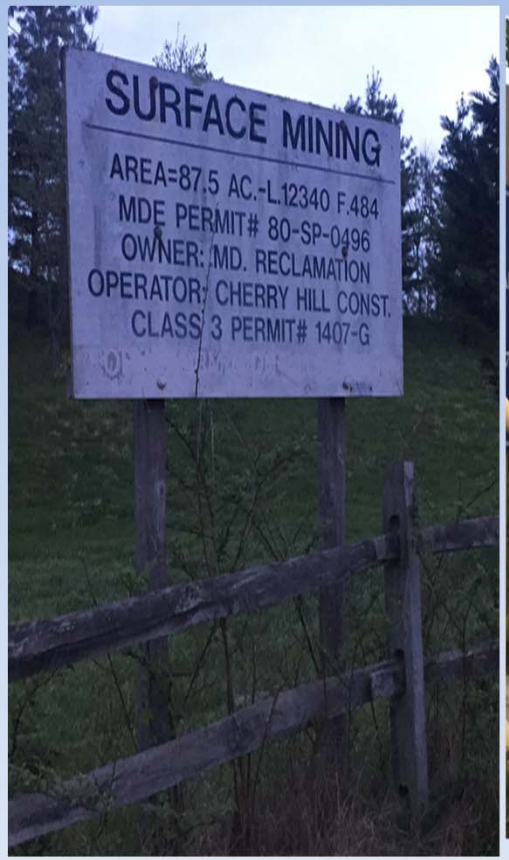
Aggregate Surface Mining Wash Plants

Diesal Fumes

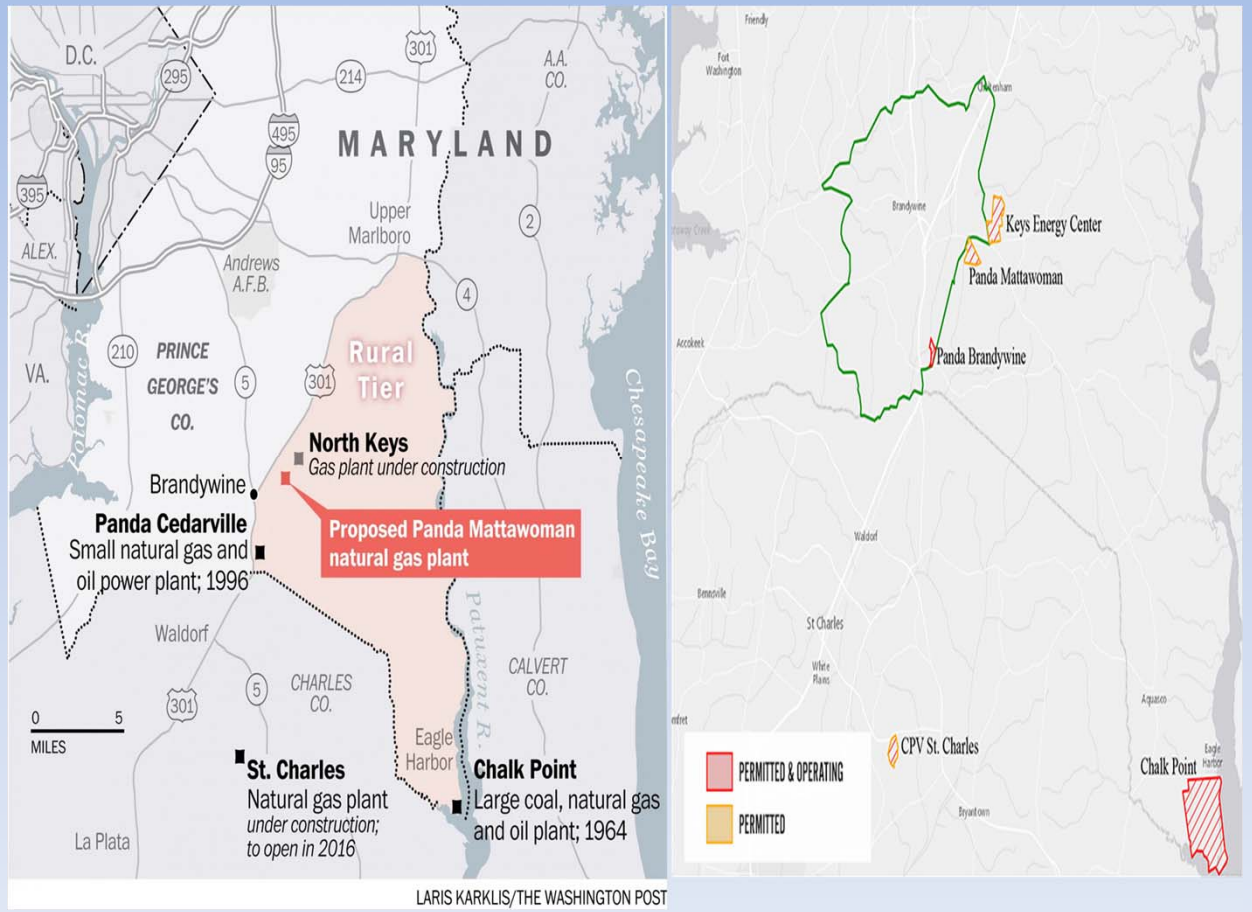
Sludge Lagoon

Fly Ash Site

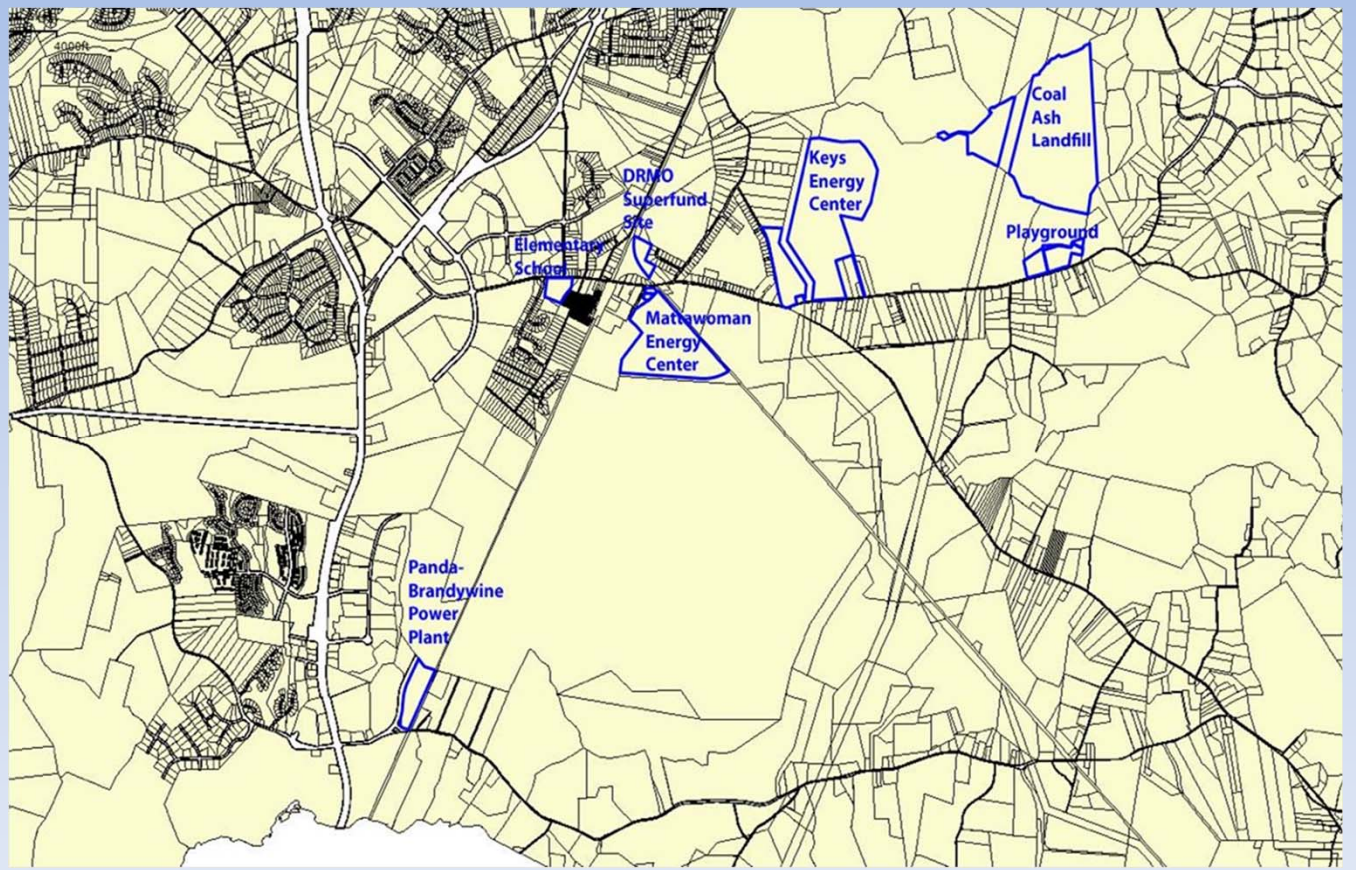
Surface Mining Operations



Environmental Injustice and Power Plants



Location of Power Plants and Sensitive Sites



Coal Ash Landfill and Playground

Air Monitoring Results

Table 1. Airbeam Air Monitoring Data 11-06-2015 (in ug/m^3)				
Time Stamp	Facility	Monitor1	Monitor2	Overall Average
9:25-9:40 am	Brandywine elementary school average	23	22	22.5
	Brandywine elementary school peak	37	38	37.5
10:10-10:25 am	Panda Brandywine power plant average	14	15	14.5
	Panda Brandywine power plant peak	19	22	20.5
10:55-11:10 am	Proposed incinerator site average	12	15	13.5
	Proposed incinerator site peak	19	22	20.5

Table 2. Diesel Truck Counts in 15 min interval		
Facility	Number of diesel trucks	Diesel trucks per minute
Brandywine elementary school	19	1.27
Panda Brandywine power plant	11	0.73
Proposed incinerator site	4	0.27

Where do we go from here in EJ-focused citizen science research?

Citizen Science

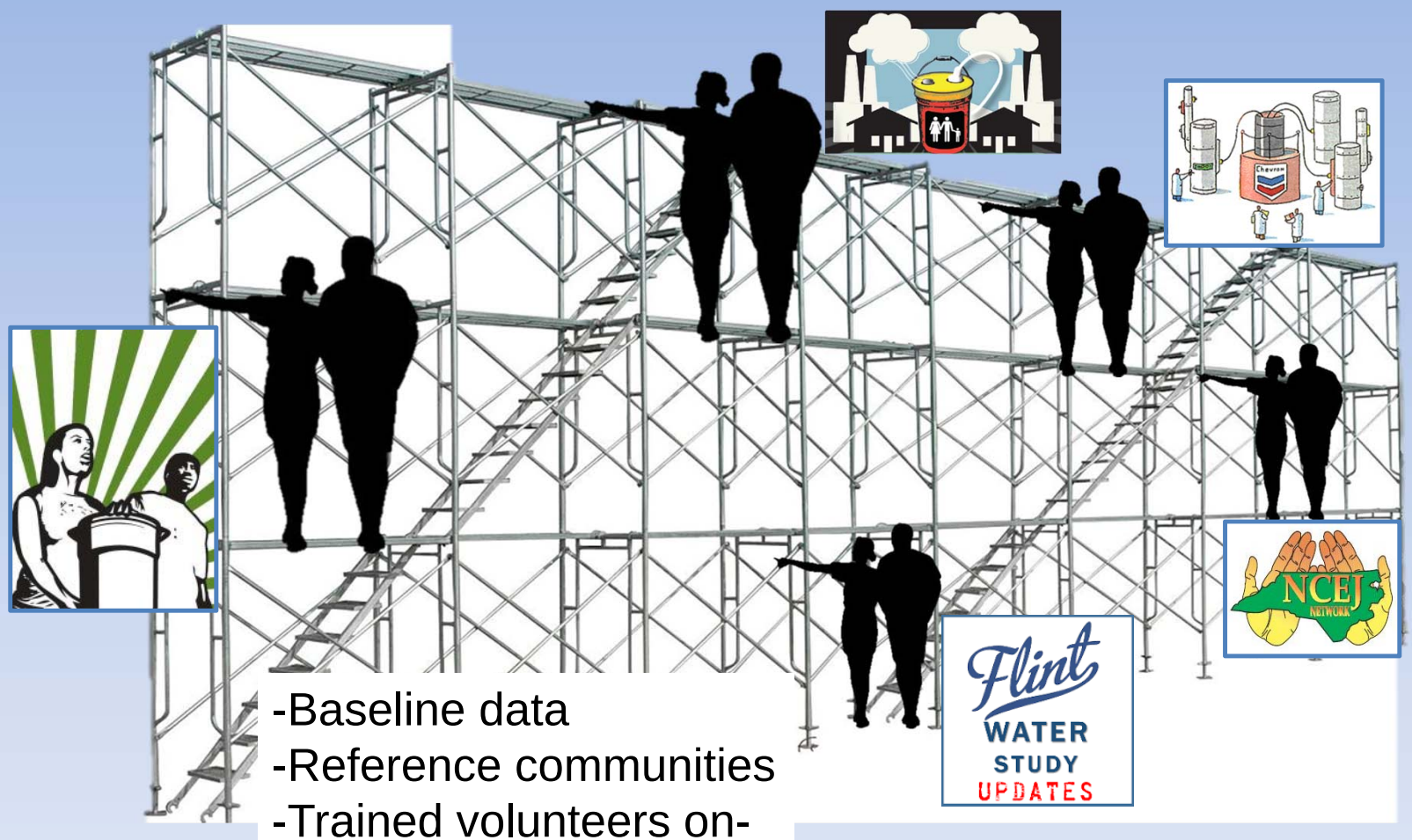
Community-based

Crowd-based

Regulatory → Science Peer

Scientists

Ways of handling data quality



-Baseline data
-Reference communities
-Trained volunteers on-call
-Infrastructure to share

Crowdmapping for Environmental Justice

Box 1. National partner with civil rights mission.

NAACP

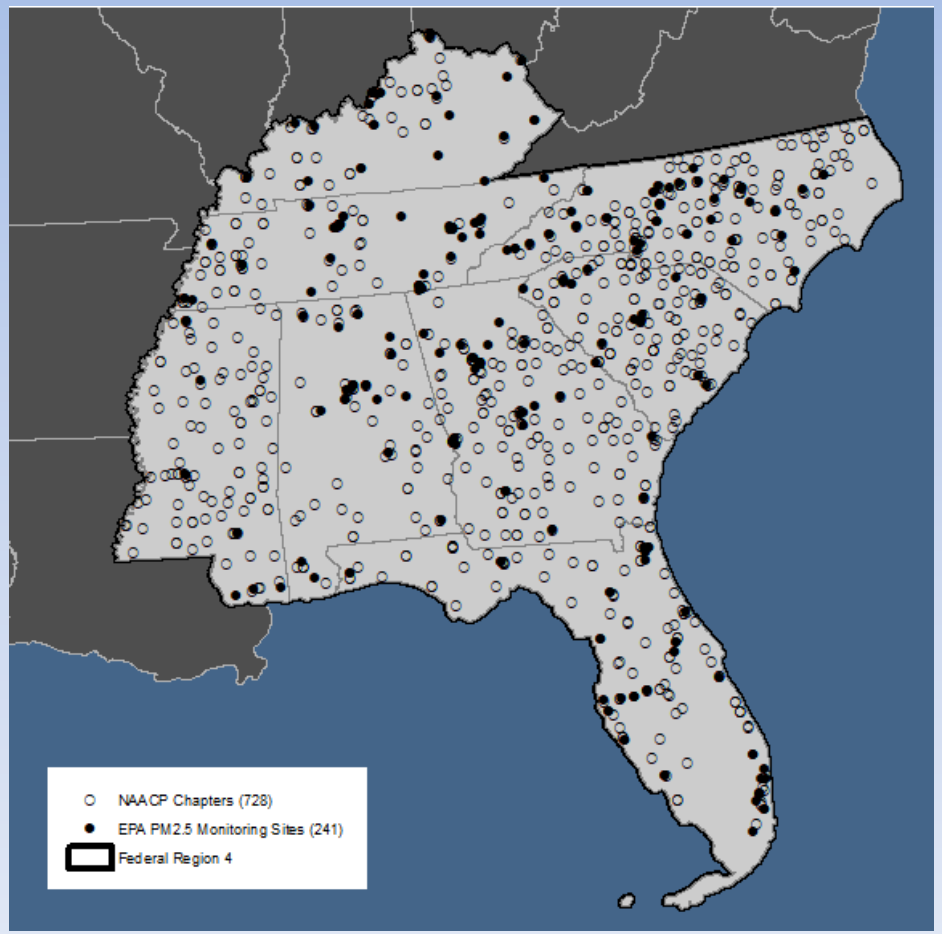
The National Association for the Advancement of Colored People (NAACP) is a civil rights organization founded in 1909 to advance justice for African Americans and today has over **400,000** members. The NAACP has headquarters in Baltimore, seven staffed regional offices, state chapters, and more than 600 youth and college chapters (more than 30,000 people) organized by the Youth and College Department and over 2,000 local chapters supported by the Branch and Field Services department. Although most known for their legal department and fights against segregation, one of their top issues is environmental and climate justice, which are viewed as human and civil rights issues.

Box 2. National partner with service mission.

Alpha Phi Alpha Fraternity

Alpha Phi Alpha, the first Greek-letter fraternity for African American men, initially at Cornell in 1906, then quickly at other institutions of higher education, particularly historically black colleges and universities (HBCUs), and with its first alumni chapter in 1911. The Fraternity currently has approximately 700 college and alumni chapters with over **70,000** current members volunteering over 850,000 hours of community service and advocacy annually. With notable alumni leaders such as W.E.B. DuBois, Martin Luther King, Jr., and Thurgood Marshall, fraternity members are committed to life-long service to help correct the educational, economic, political, and social injustices faced by African Americans. Alpha Phi Alpha runs national programs via its chapters, for example, "Go-to-High-School, Go-to-College", which is a role-model program for young African Americans to learn strategies that facilitate success.

Why Citizen Science and Crowdmapping?



- Sparse number of EPA Air Pollution Monitors
- Data is not being collected in areas with a high number of mobile and industrial pollution sources
- Monitors are not capturing cumulative impacts from multiple environmental stressors
- Chapters can fill a gap by collecting air pollution data in overburdened communities without an air pollution monitor
- Participation will improve EH Literacy and STEM learning

THANKS!