



Co-production of community-based air quality education
intervention to reduce exposures for health promotion
and environmental justice

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Co-production of community-based air quality education intervention to reduce exposures for health promotion and environmental justice

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Overview

Dr. Jennifer Senick
Rutgers Center for Green Building
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Rutgers, The State University of New Jersey

Overview

This workshop shares knowledge and strategies related to *building just communities* and *accessing just technologies* in context of a 4-year campaign to co-produce a series of air quality interventions at a US Census low-income affordable housing site in Elizabeth, NJ, USA

Acknowledgements: Development of this material funded by: HUD Healthy Homes Program Grant NJLHH-0202-09; HUD Healthy Homes Technical Studies Grant # NJHHU0019-13; NSF Grant AGS-1645786; American Planning Association's Plan4Health Initiative, supported through the CDC, Division of Community Health #DP14-1418; and grants from Valley National Bank.

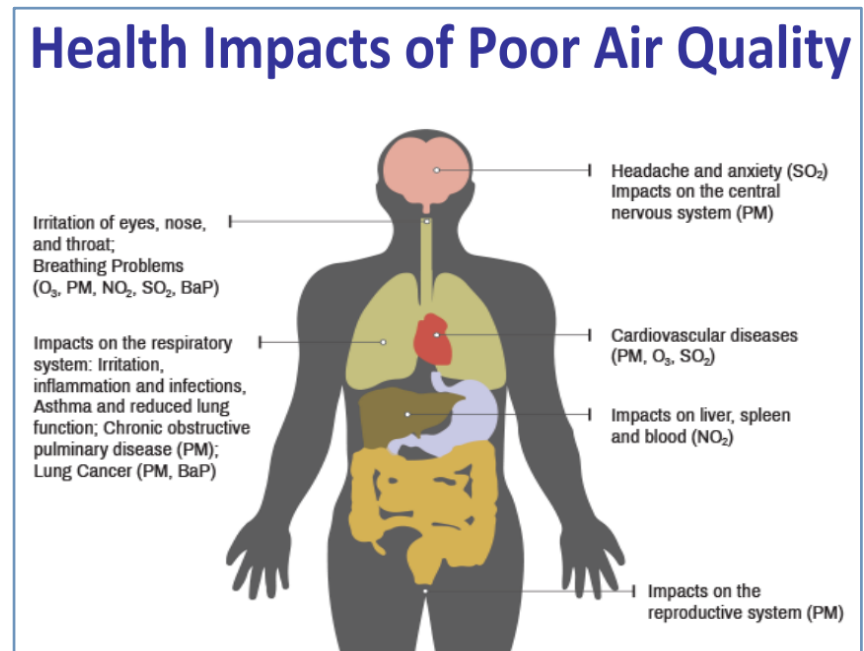
Introduction

- Motivation
 - Society needs more effective ways to address big problems such as climate change, air quality pollution
 - How much agency do individual people and low resource communities really have?
 - Who can act, in what ways?
- Approach
 - Look at a specific problem, in detail
 - How do vulnerable urban seniors living in public housing cope with poor air quality? summer heat waves? How do children living in low resource communities understand the concept of air quality and how it relates to health?
- Location
 - Housing Authority of the City of Elizabeth, NJ

Health Issues Associated with Poor Air Quality

Why focus on air pollution? Air pollution and poor air quality can affect our health in many ways:

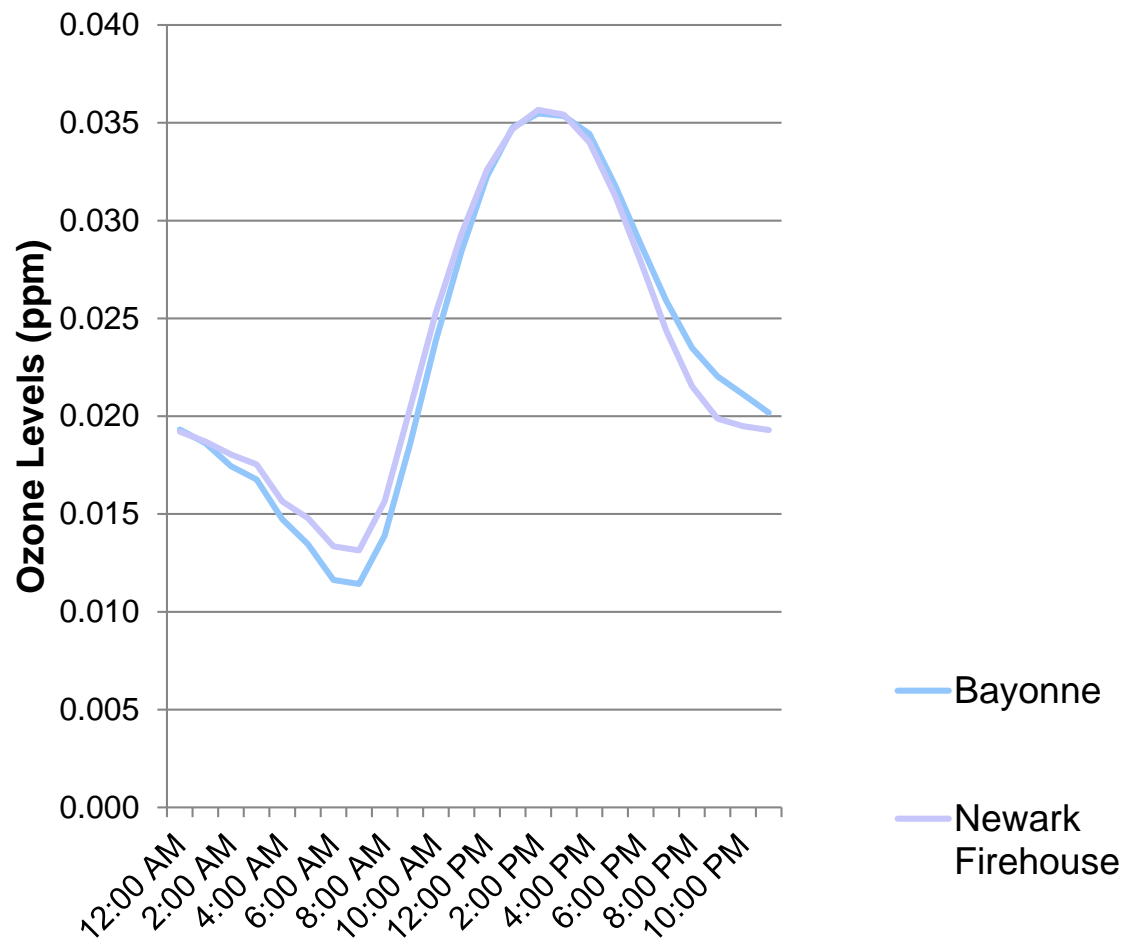
- ❖ There are both **short term effects** e.g., itchy eyes, coughing, scratchy throat, dry skin, dizziness) and
- ❖ **Long term effects** e.g., asthma, allergies, and other respiratory illnesses; heart-related conditions; brain and nervous system illnesses; cancers; child development defects; vision defects; muscle control disruptions, and
- ❖ **Indirect and economic effects** come from missed days from school or work; damage to trees and other greenery; costs for medical services; shortened life span and quality of life.



Source: LouisvilleKy.gov

Heat Waves + Air Quality

Average Hourly Ozone (2016)



Monitoring Stations

- High temperature associated with higher levels of ozone
- Ground-level Ozone levels vary significantly throughout the day
- Ozone, PM2.5, PM10, CO₂ + high temperature have **negative effects on health**



Air Quality and Affordable Housing

Factors Affecting IAQ

- Outdoor concentrations
- Building characteristics
- Occupant activities

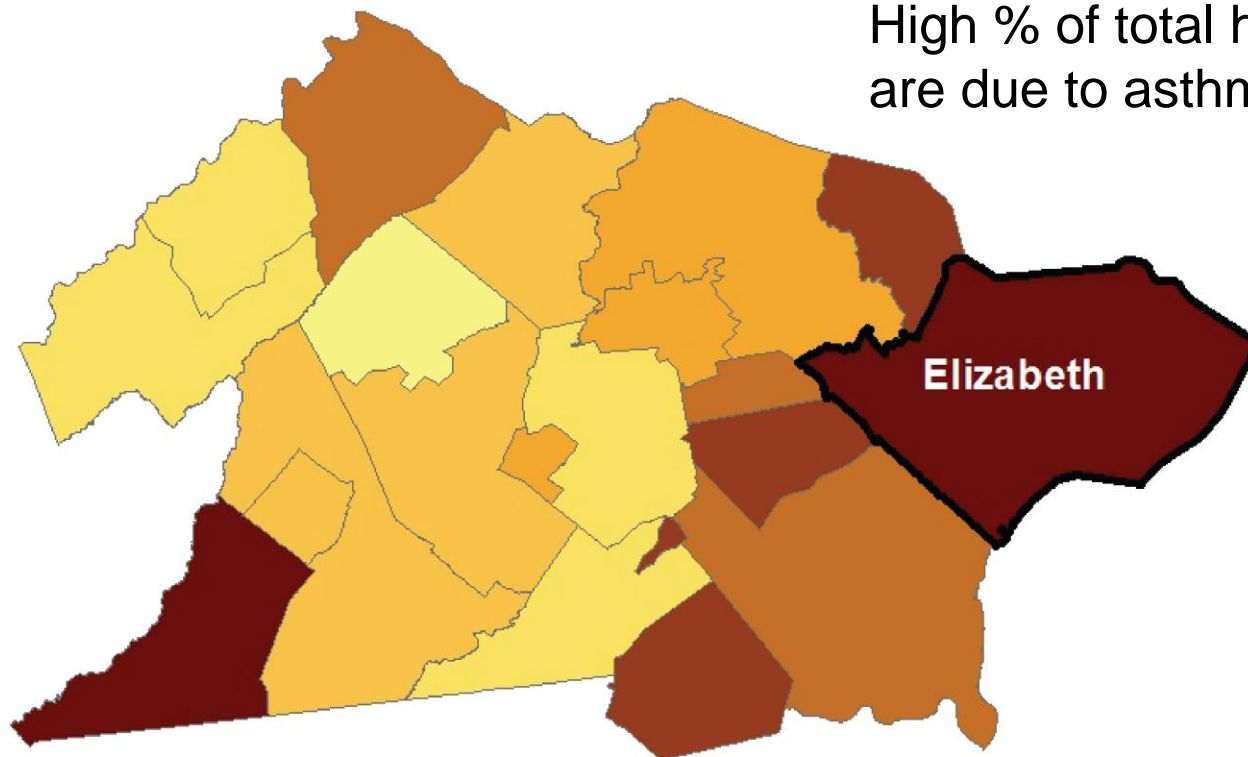


Those factors have been shown to be significantly different for low socio-economic status (SES) individuals, since they often reside in polluted sites and in tighter spaces with poor building envelopes, in addition to exhibiting different behaviors (e.g. indoor smoking patterns) (Baxter et al., 2007; Klepeis et al., 2017).

Why Elizabeth, NJ?

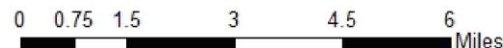
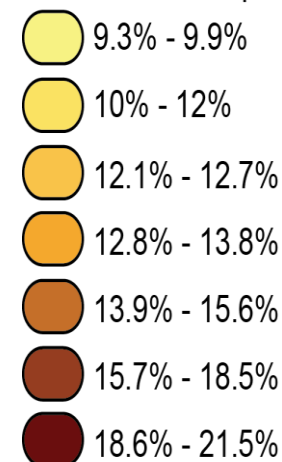
Elizabeth has some of the worst air quality levels in NJ, based on high 24-hr average PM2.5 concentrations (29.1 $\mu\text{g}/\text{m}^3$), and the highest annual PM2.5 average (9.58 $\mu\text{g}/\text{m}^3$) (NJ DEP, 2017).

High % of total hospitalizations that are due to asthma

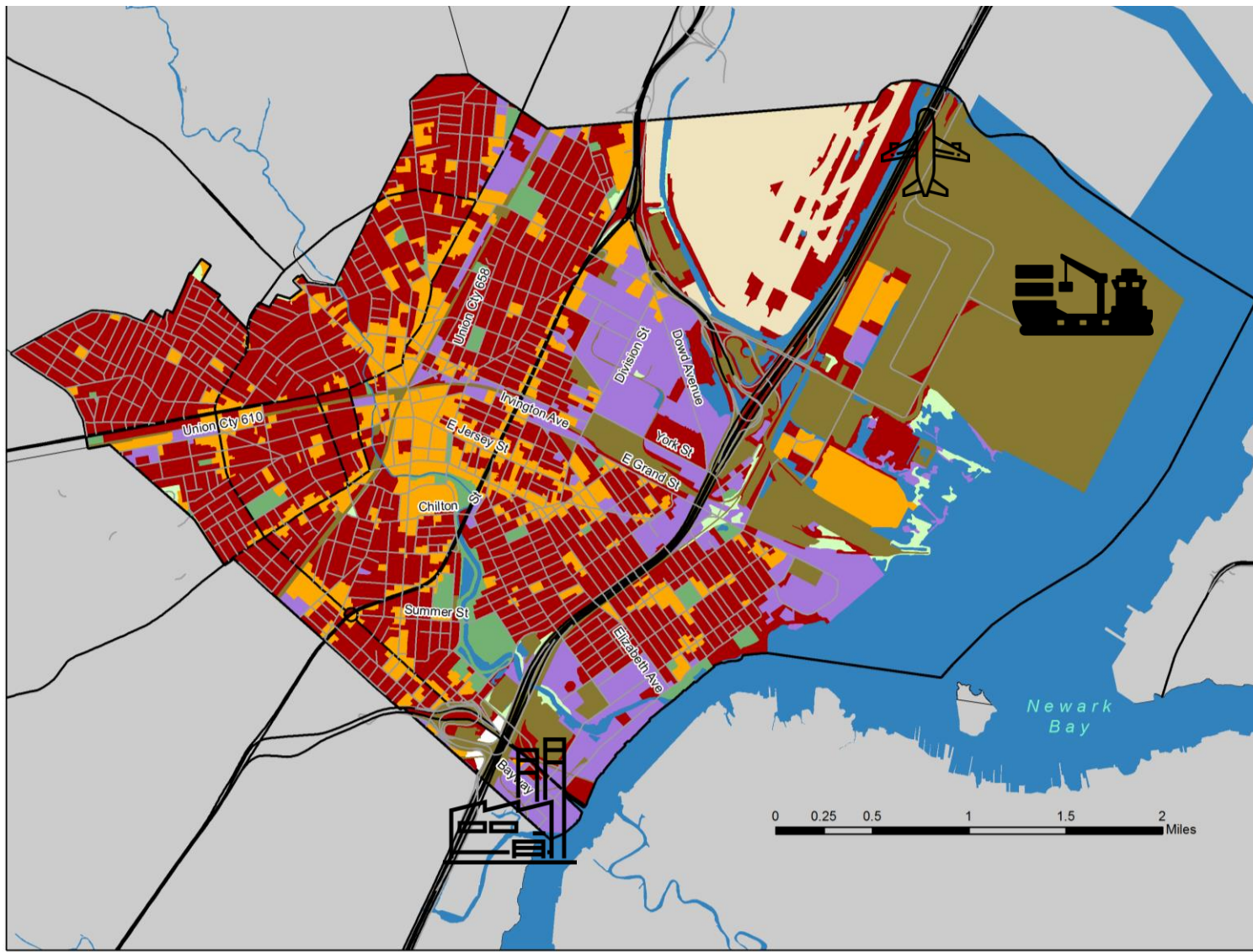


Union County, NJ (2008-2015)

% of Asthma Hospitalizations



Land Use in Elizabeth, NJ



Close proximity to:

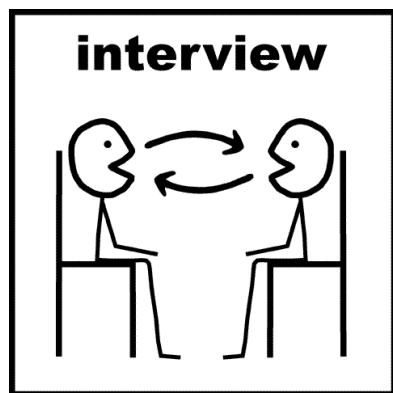
- Newark Airport
- Port Newark Marine Terminal
- Chemical refineries
- Highways



Rutgers University Community Collaboration

Rutgers Center for Green Building have been working with the HACE community for several years to help understand how residents' health might be affected by changes in air quality and how people might protect their health.

In previous years, Rutgers research work has included monitoring outside air quality near HACE buildings, indoor air quality, occupancy, window opening behavior and energy use, interviews with residents and several summer camp STEM projects on AQ and IAQ.



Energy Monitor



Temperature,
Humidity
PM2.5 CO2



Motion Detector
Window Activity





- Formed in 1938. Responsible for 1,322 units of public housing.
- Scope: to meet the housing needs and improve the quality of life for its residents.
- Delivers a broad range of services ranging from social, economic, educational, and redevelopment.

HACE:
Housing Authority of the City of Elizabeth, NJ

Timeline

2017- 2019: Research to better understand human response and adaptation to heat waves

- Objective data collection on air quality and energy use: derived from environmental engineering instruments/sensors and electricity meters installed in the study apartments
- Subjective data collection on occupant use of apartment, comfort, actions, basic demographics and health: derived from in-person questionnaires and telephone follow-up on days that heat wave advisories are in effect.

2019, Summer: Educational activities conducted during a youth STEM (Science, Technology, Engineering, Math)-based Summer camp

- Construction of an Arduino-based IAQ sensor, focus group with parents/guardians on IAQ
- Campers learned about and deployed the US EPA AirNow Flag Program, and kept a diary of IAQ adaptive actions and their dissemination to family members.

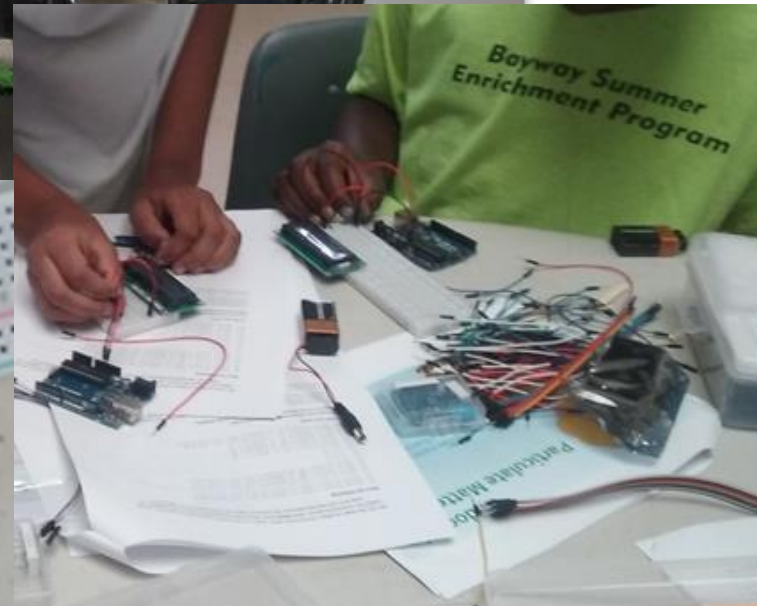
2020, Summer: the Flag Program was expanded with modifications made necessary by SARS-CoV-2. A resident-driven Air Quality Ambassadors education program among seniors was developed and implemented.

	M (N=49)	F (N=7)	L (N=4)
Adjust Fan	82%	57%	50%
Close Windows	82%	100%	100%
A/C	91%	100%	50%
Clothing Adjustment	73%	29%	25%
Avoid Oven	91%	57%	25%
Avoid Stove	73%	14%	25%
Avoid Candles	45%	0%	0%
Avoid Smoking	45%	0%	0%
Leave Apartment*	91%	71%	100%

Human response and adaptation to heat waves









Air Quality Sensor Construction (Camp 2019)



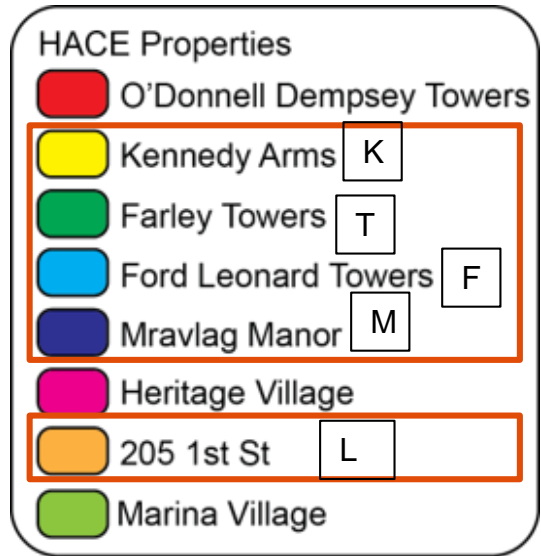
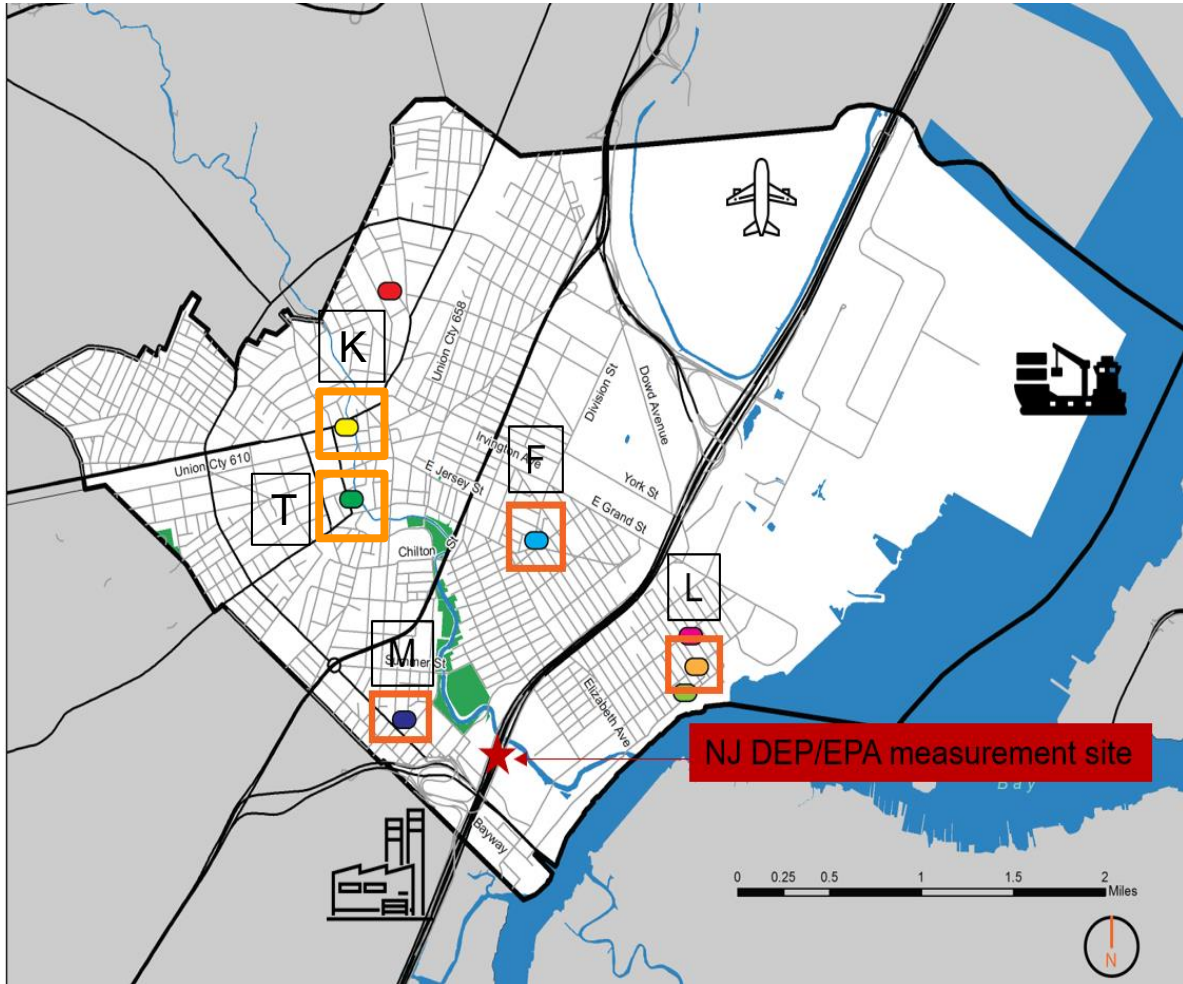
Flag Program (Camp 2019)



Date: 07/31/19

	Flag Color	App Color
Morning	 yellow	 yellow
Noon	 orange	 orange
Evening	 red	 red





RCGB has engaged five public housing sites at HACE, 4 for seniors or disabled tenants (595 apartments) and 1 for family housing with a small number of seniors also living at the site (423 apartments)

5 Affordable Housing Sites owned by the Housing Authority of the City of Elizabeth, NJ

Air Quality Explanations and Findings

Ruikang He
Department of Environmental Sciences
Rutgers, The State University of New Jersey

US AirNow Terms, Definitions, Actions







US EPA AirNow is a one-stop source for air quality data. It highlights air quality in a local area including:

- Current and forecast air quality maps and data.
- Current fire conditions.
- Health and air quality information.

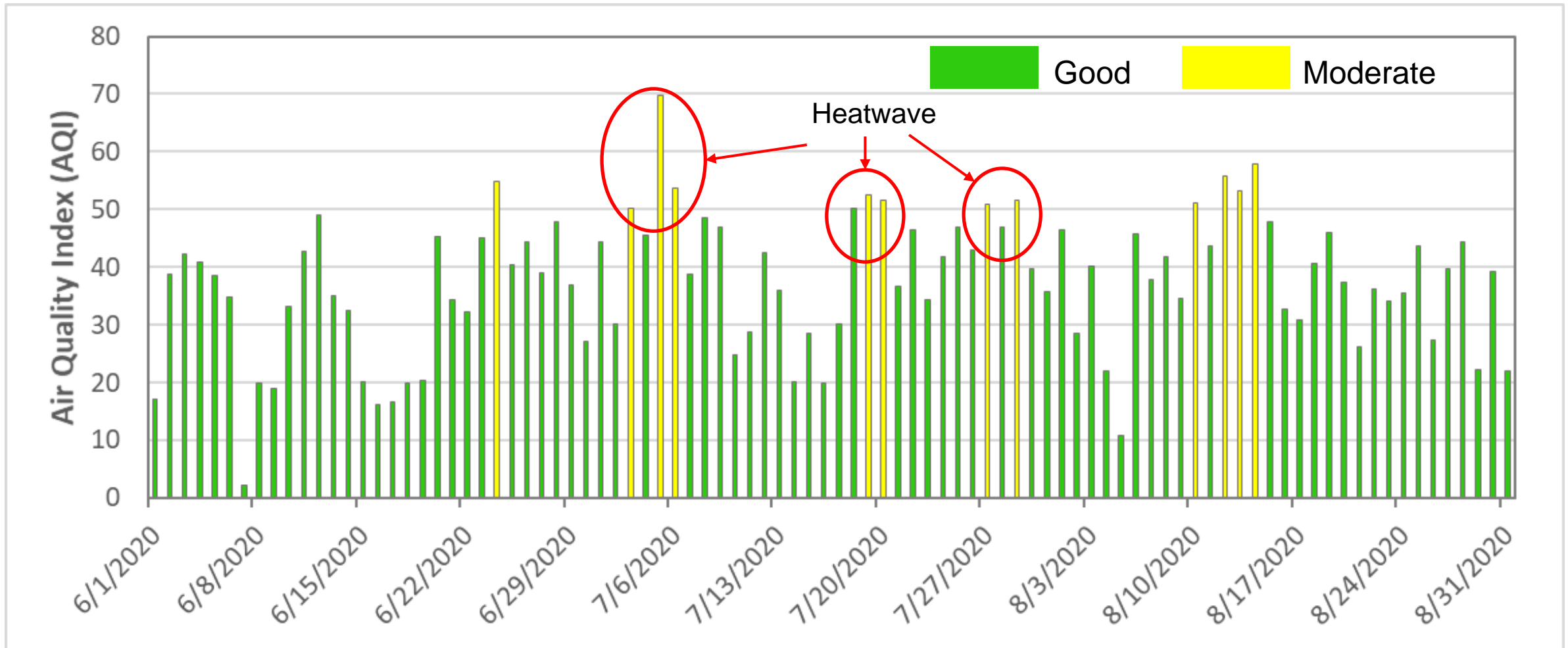
AirNow reports air quality using the official **US Air Quality Index (AQI)**, a color-coded index designed to communicate whether air quality is healthy or unhealthy, taking into consideration some individual health attributes.

US Air Quality Index

US Air Quality Index (AQI) – EPA’s index for reporting air quality.

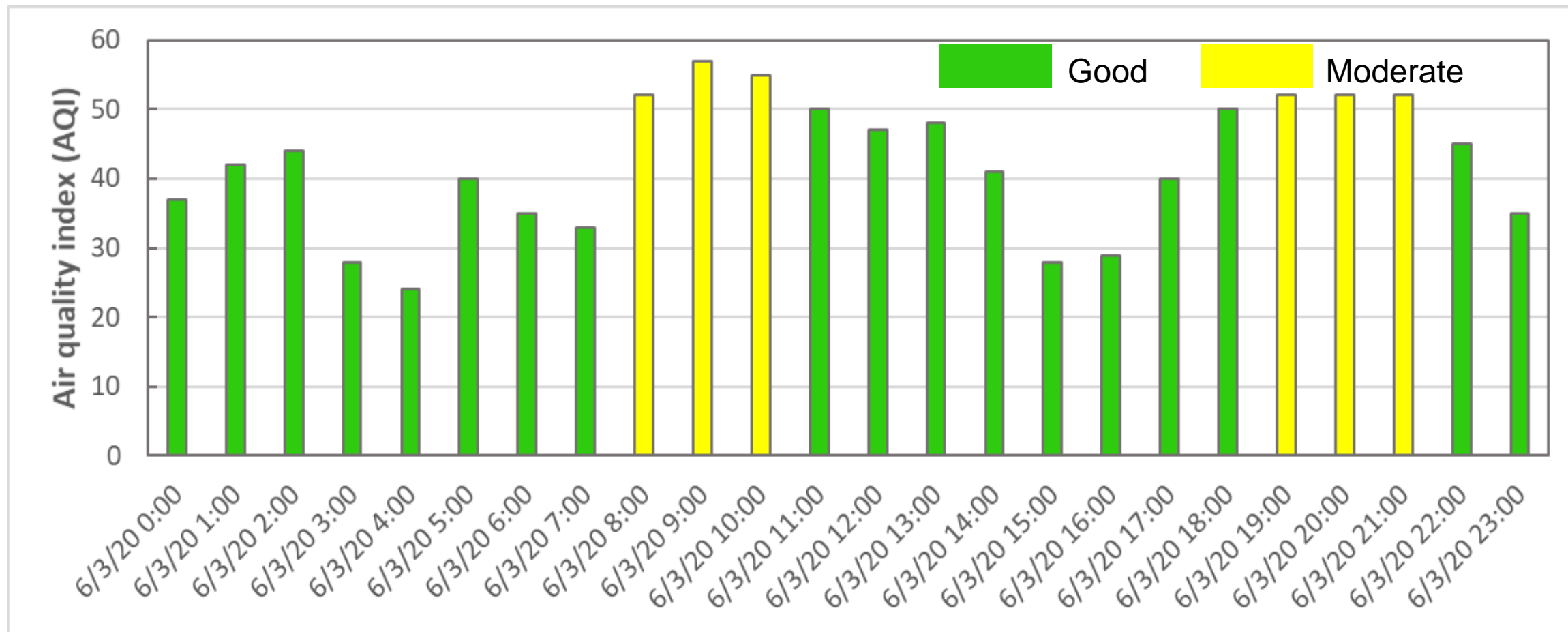
- Think of the AQI as a yardstick that runs from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern.
- AQI values above 100 means air quality is unhealthy.
- Different colors refer to different degrees of air quality. For example,
 -  **0-50:** considered **good** air quality and generally safe for people.
 -  **51-100:** the air quality is **moderately safe** but some people may be affected.
 -  **101-150:** **unhealthy for sensitive groups** who have medical conditions and they might feel symptoms from the poorer air quality.
 -  **151-200:** the air is **unhealthy** and many people may feel sick, some sensitive people may feel very sick.
 -  **201-300:** **very unhealthy**, the risk of health effects is increased for everyone
 -  **301+:** a **hazardous emergency** and everyone is more likely to be affected.

Daily average AQI during Summer 2020



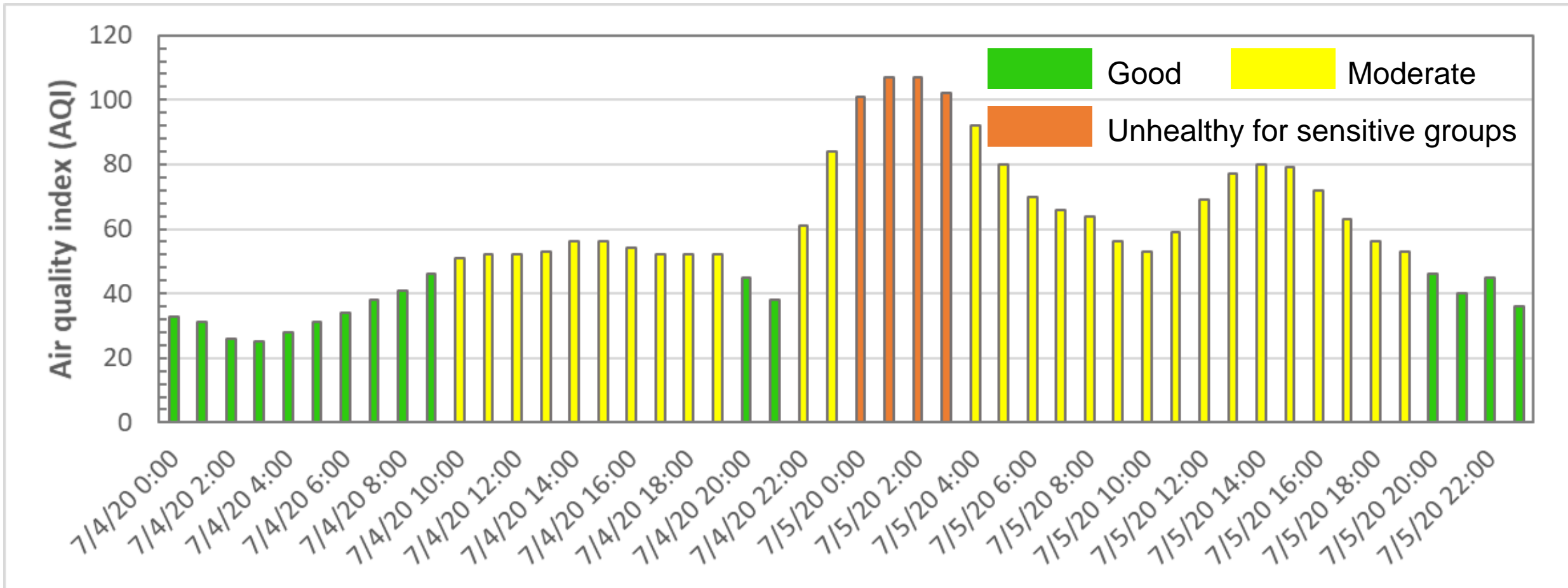
EPA air quality index measured at Elizabeth Trailer station. From 6/1/2020 to 8/31/2020

Hourly average AQI of a typical weekday: rush-hour impacts



EPA air quality index measured at Elizabeth Trailer station on 6/3/2020

Hourly average AQI on polluted days



EPA air quality index measured at Elizabeth Trailer station on 7/4/2020 and 7/5/2020

Air Ambassador Program (Summer 2020)

Air Ambassadors offered a unique role as peer educators to help other residents of the community better understand air quality, how air quality can affect health, and what people can do to reduce the effects of poor air quality on health.

Ambassadors learned about the Rutgers project, actively participated in multiple sections of a Program Orientation, and shared their knowledge with others in the HACE communities.

Air Ambassadors served as important partners with Rutgers University to bring the RU-US EPA AirNow Flag Program to life at HACE.



Air Ambassador Pilot Program:
Participatory Program Design and
Place-Based Peer Education for
Community Engagement

Patrick Jones

Air Ambassador, Housing Authority of the City of Elizabeth

MaryAnn Sorensen Allacci, PhD,
Rutgers Center for Green Building &
Projects for Environmental Health, Knowledge, & Action, Inc.

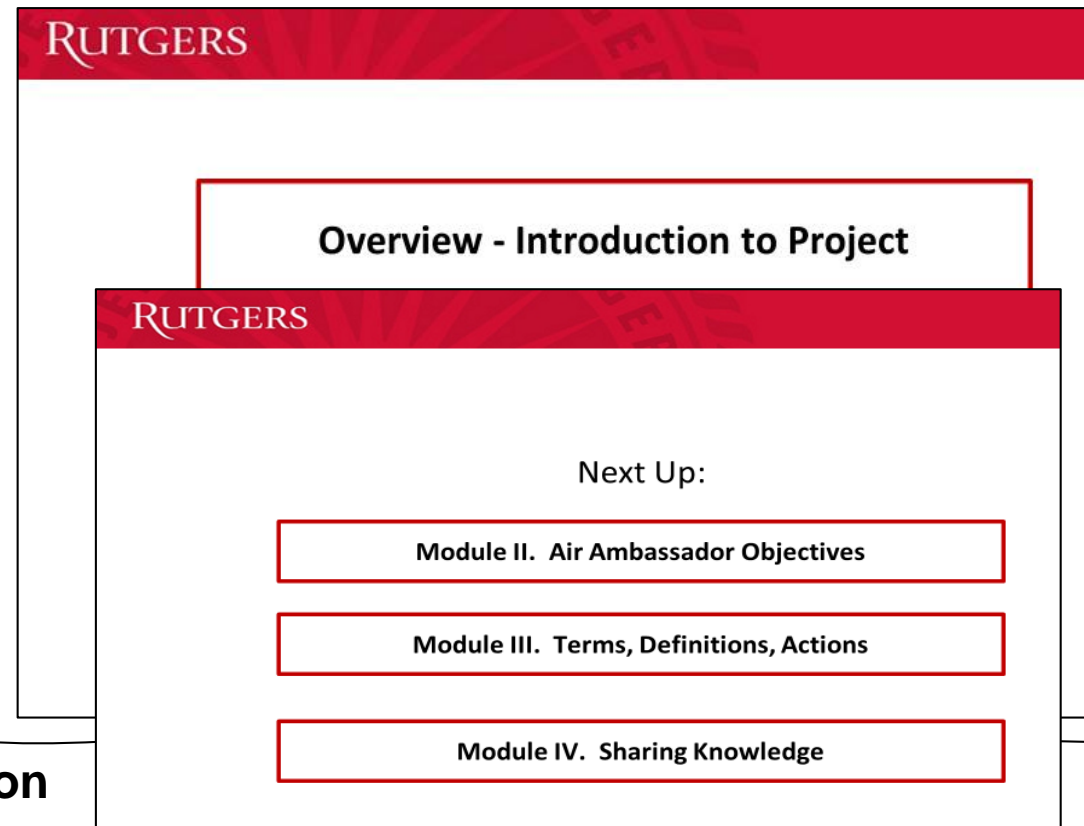
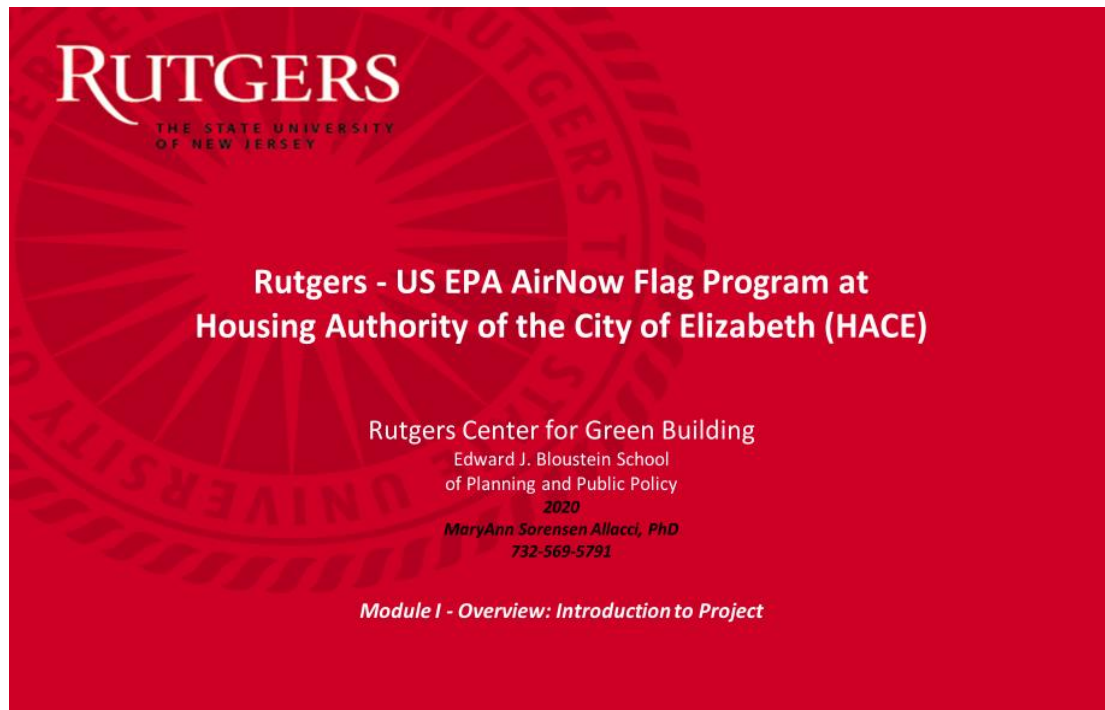
Air Ambassador Program Goals

- Recruit residents from 5 building complexes of the Housing Authority of the City of Elizabeth public housing to introduce the EPA *Air Now* Flag Program as *Air Ambassadors*
- *Air Ambassadors* recruited from 4 Senior / Handicapped Buildings who participated in design and decision-making about integrating the program into their buildings in a contextually relevant manner
- Incorporating the program and the use technical information in a low-tech context with covid precautions

The findings of the *Air Ambassador* program have Implications for

- Participant Design of Community-Based Programs, and
- Implications for Building Design to support building-wide resident programs

Place-Based Peer Education Modules









4 Module Intro for *Air Ambassadors*, with emphasis on

- **Self-Selection** hiring from each building complex
- **Participant-Centered communications** preferences
 - Individual & group phone conferences, texting, e- and snail-mail
- **Participatory design and Place-Based application** of program objectives in which *Ambassadors*:
 - Discussed similar & different approaches based on their knowledge of building and its residents

Initial flyers posted in buildings...






Heads Up!


Air Quality Index	Outdoor Activity Guidance
 green GOOD	Great day to be active outside!
 yellow MODERATE	Good day to be active outside!
 orange UNHEALTHY FOR SENSITIVE GROUPS	It's OK to be active outside, especially for short activities . For longer activities such as athletic practice, take more breaks and do less intense activities. Watch for symptoms and take action as needed.
 red UNHEALTHY	For all outdoor activities , take more breaks and do less intense activities. Consider moving longer or more intense activities indoors or rescheduling them to another day or time. Watch for symptoms and take action as needed.
 purple VERY UNHEALTHY	Move all activities indoors or reschedule them to another day.



Watch for flags going up in your neighborhood soon!

Fijense!

Índice de la calidad del aire	Pautas para las actividades al aire libre
 verde BUENO	¡Es un día excelente para realizar actividades al aire libre!
 amarillo MODERADO	¡Es un buen día para realizar actividades al aire libre! Los alumnos que son excepcionalmente sensibles a la contaminación atmosférica podrían presentar síntomas*.
 naranja INSALUBRE PARA GRUPOS SENSIBLES	Es aceptable realizar actividades al aire libre, en especial actividades breves como el recreo y la educación física. Para actividades más prolongadas como prácticas deportivas, descansar más a menudo y realizar actividades menos intensas. Prestar atención a la aparición de síntomas y tomar medidas según sea necesario*. Los alumnos asmáticos deben seguir sus planes de acción para el asma y tener a mano medicamentos de acción rápida.
 rojo INSALUBRE	Para todas las actividades al aire libre descansar más a menudo y realizar actividades menos intensas. Tener en cuenta la posibilidad de realizar las actividades más prolongadas o más intensas adentro o reprogramarlas a otro día o a otra hora. Prestar atención a la aparición de síntomas y tomar medidas según sea necesario*. Los alumnos asmáticos deben seguir sus planes de acción para el asma y tener a mano medicamentos de acción rápida.
 morado MUY INSALUBRE	Trasladar todas las actividades adentro o reprogramarlas a otro día.



Fijense en las banderas volando en su vecindario la próxima semana!

led to Ambassadors asking for more detail:

AIR QUALITY FLAG PROGRAM

How will air pollution affect my health and activity today?



green

GOOD

It's a great day to be active outside.



yellow

MODERATE

It's a good day to be active outside. Take it easier if you are unusually sensitive to air pollution.



orange

UNHEALTHY FOR SENSITIVE GROUPS

Older adults, children and teens, people with certain health conditions, and people who are active outdoors should take it easier.



red

UNHEALTHY

Everyone should take it easier.



purple

VERY UNHEALTHY

Sensitive groups, avoid outdoor exertion. Everyone else, avoid long or intense outdoor exertion.

Go for 150!

The CDC recommends 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity every week for adults.

Watch for symptoms.

Coughing or shortness of breath are signs to take it easier. Air pollution can also make asthma symptoms worse and trigger attacks.

Take it easier.

Take breaks. Be active for a shorter amount of time. Do less intense activities, like walking instead of running.

Plan ahead for ozone.

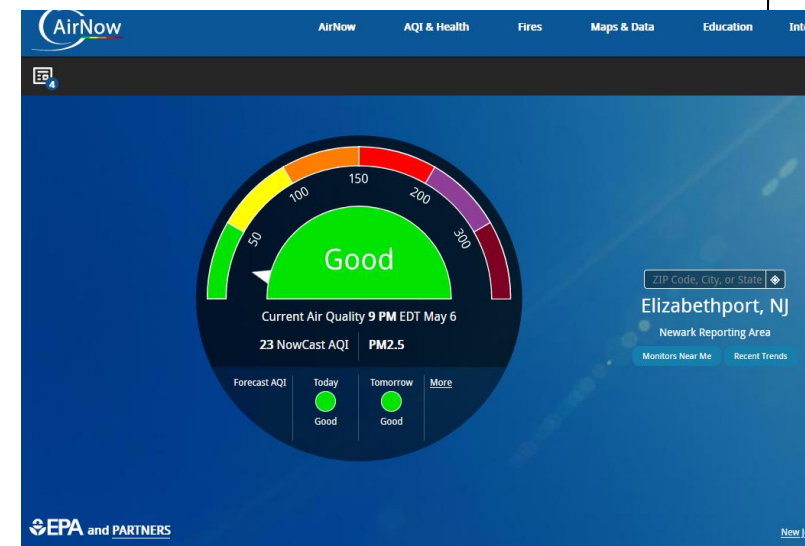
There is less ozone in the morning, so plan your intense outdoor activities early on high ozone days.

Programa de banderines sobre la calidad del aire

Índice de la calidad del aire	Pautas para las actividades al aire libre
verde BUENO	¡Es un día excelente para realizar actividades al aire libre!
amarillo MODERADO	¡Es un buen día para realizar actividades al aire libre! Los alumnos que son excepcionalmente sensibles a la contaminación atmosférica podrían presentar síntomas*.
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morado MUY INSALUBRE	Trasladar todas las actividades adentro o reprogramarlas a otro día.

Air Ambassador Activities

- Access the US EPA *Air Now* app or website 3 times / day – morning, midday, and afternoon - to check air quality readings for their zip code
- Raise and or change flag colors to correspond to the *Air Now* report & keep a log
- Post flyers at key points in the buildings and answer questions from other residents about the program
- Distribute end-game surveys for feedback by building residents
- Provide feedback on improvements to the project



Fitting the Program to the Context

Location of Flag Program was determined by building design and *Air Ambassador* **local knowledge** of building and resident activities

Some building designs are more amenable for social engagement ...



Initial location of flag at one building was moved closer to building entrance and more concentrated circulation

Common areas can support casual interactions & peer knowledge sharing



Exterior building shared-spaces design

Some buildings had more community oriented exterior design, particularly helpful for covid precautions, e.g.,

- Enhanced **sittability** (Whyte, 1982) with **social distancing**
- Good **sightlines** to see various aspects of the common area for **previewing, waiting, informal interaction**, and **safety** (Wekerle & Whitzman, 1995)
- Some **protection from the elements** and limited to seasonal comfort.



All buildings located in an urban context, but some exterior spaces are dominated by street, automobile, and parking design not well oriented to social engagement



Building Front views and Rear views



Locations of picnic table, flag, and entry to building, respectively

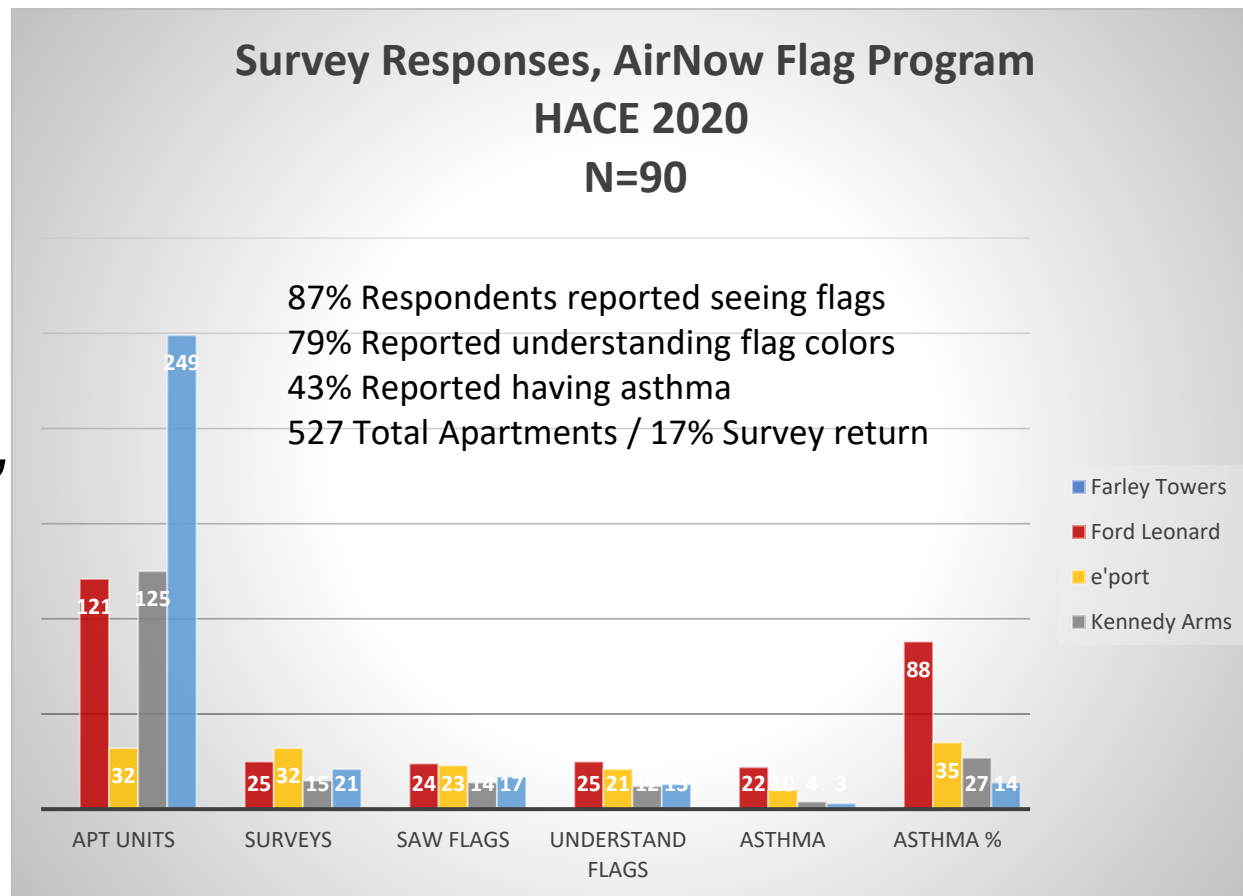
Feedback from Residents

Surveys - Cross-sectional, hard-copy, self-administered at the end of the EPA AirNow *AirAmbassador* project

Air Ambassadors – via regular telephone conferences, random comments, etc.

Multiple Choice Follow-up Survey & Descriptives

- Survey Objectives: Feedback on Residents' awareness & response – Air Quality Flag Program
- N=90 4 Buildings
- Spanish & English, 1-pager, distributed by *Air Ambassadors*, supported by local managers
- Anonymous by building, distributed to apt doors & also administered, returnable to receptacles in common areas



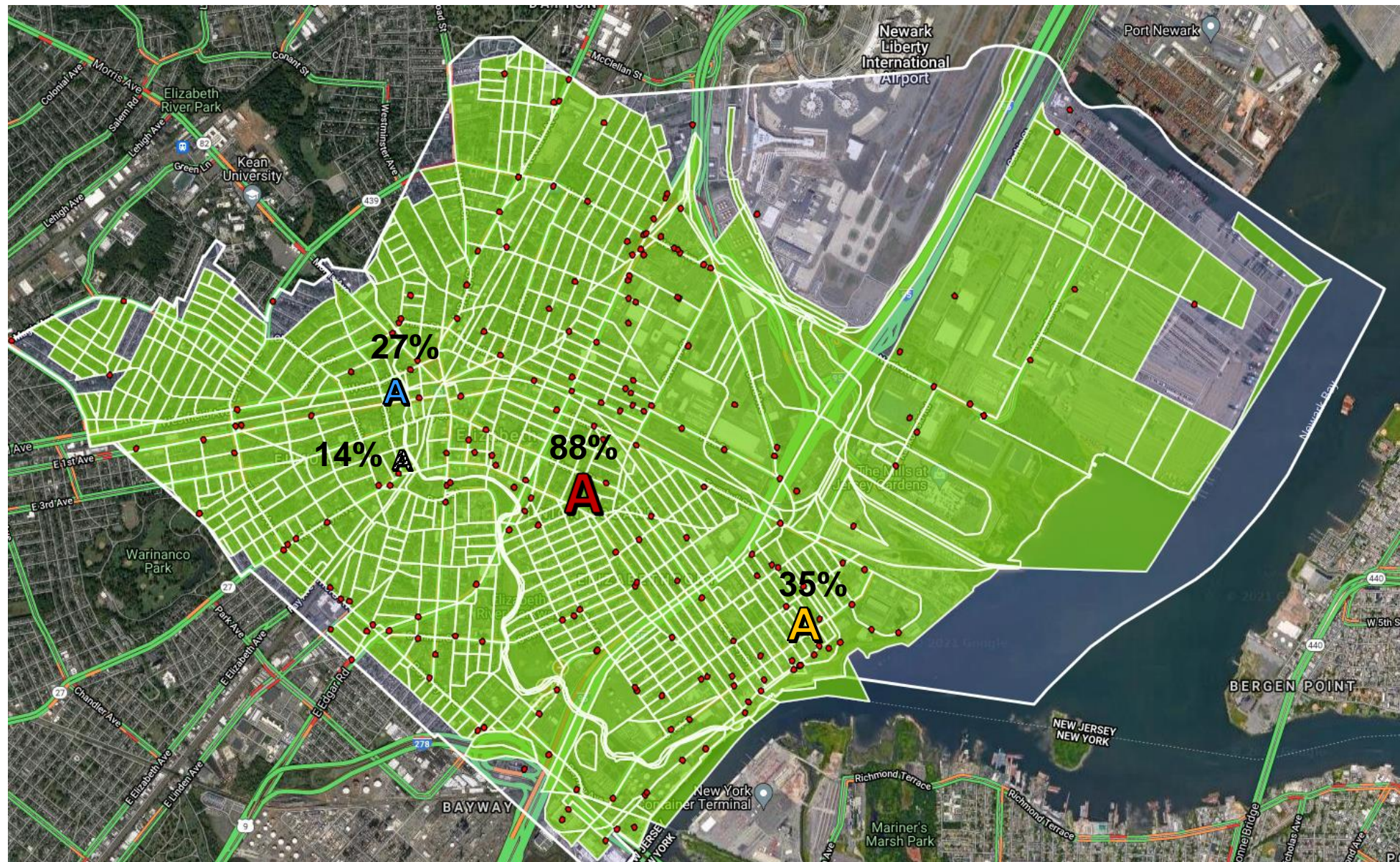
Self-Reported Asthma (survey data)

Map of Elizabeth, NJ showing Known Contaminated Sites & Traffic Volume layers. Graduated Symbols represent Asthma reported in surveys by general area of building location.

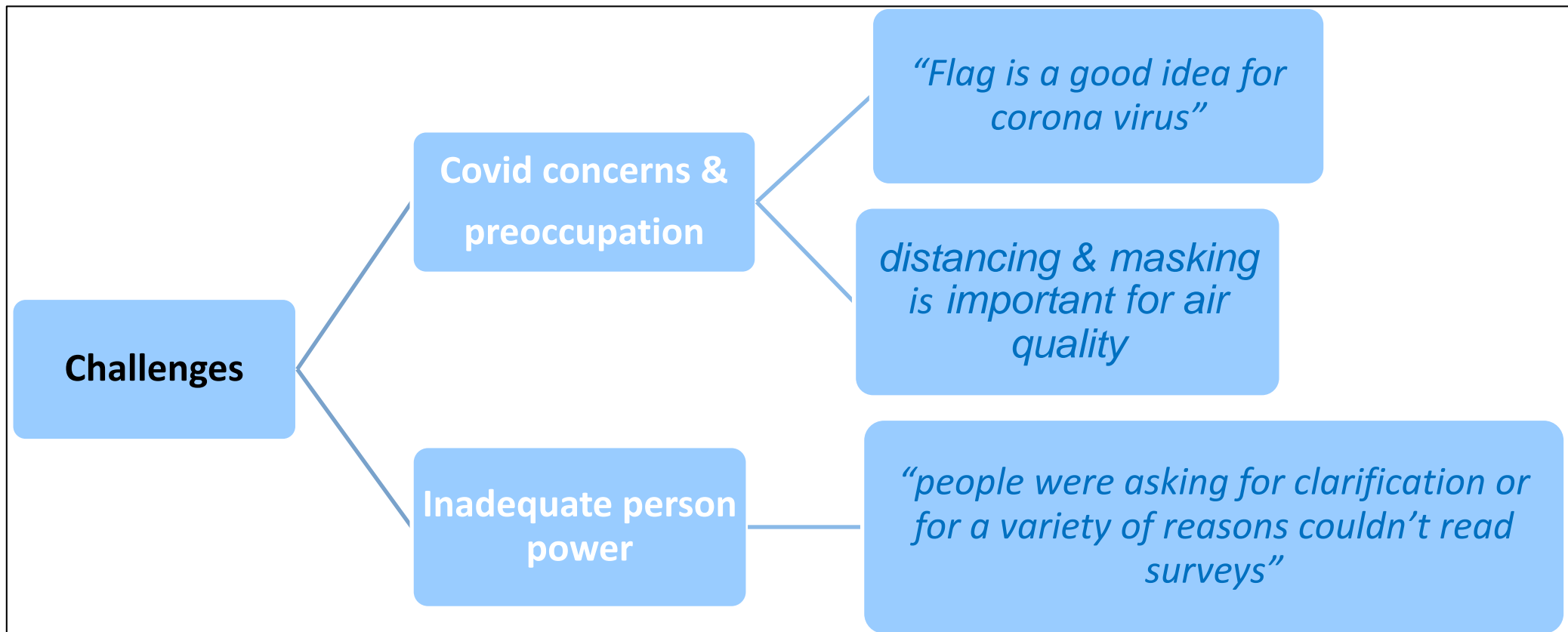
Survey

A n=25	121 apts
A n=29	32 apts
A n=15	125 apts
A n=21	249 apts

N=90



Multiple-Choice Follow-Up Surveys Challenges



Patrick Jones, *Air Ambassador*

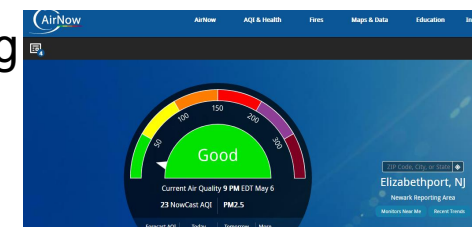
- ▶ What do you recall were some of the comments or questions from residents about the *AirNow* flag program?
- ▶ What stands out for you as something you learned from participating in this program? What were you surprised about?
- ▶ Do you think people in your building would like to see a similar program repeated?

Conclusion, Findings, Recommendations

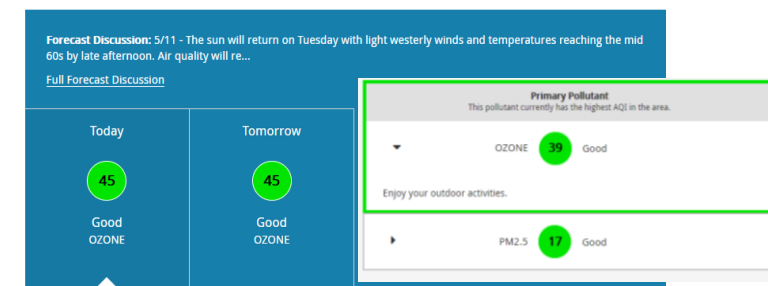
Success of *Air Ambassador* program depended on multiple components:

- “All-In”, start-to-finish collaboration between HACE Central Administration, local building management, and individual *Air Ambassadors*
- Consensus was required between air quality researchers and residents for selecting
 - Which EPA *AirNow* app data points to report
 - When to check *AirNow* postings
 - How to interpret data
- “Meeting Residents where they are”
 - *Ambassadors* had different tech literacies
 - Individual buildings have unique exterior layouts that influenced how program was implemented
 - Covid precautions were often foremost concerns, individual buildings required different approaches to communicating among residents
- Project provided **embedded value** for *Air Ambassadors* to connect across building complexes and discuss sources of pollution, share info on local community resources, brainstorm strategies for working with building residents

knowledge translation



Air Quality Forecast

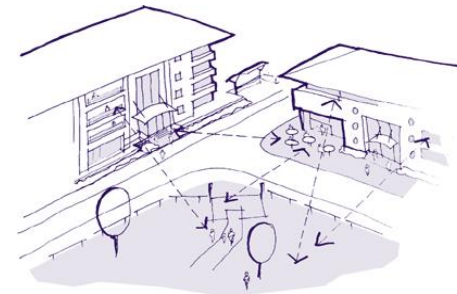


Recommendations for Future *Air Ambassador* Programming

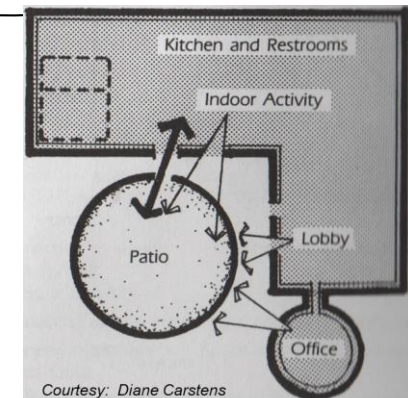
- Provide a Letter Contract for *AirAmb*s that clearly defines responsibilities
- *AirNow* App has a lag and some hiccups – offer suggestions what to do
- Individuals' daily schedules vary. Where there are more than 1 *Ambassador*, Discuss & Propose a specific time frame for Flag changes, documentation, etc.
- Introduce as Seasonal / Summertime program
- Offer more information for residents about the Flags:
 - Create take-away handouts for each person or apartment
 - Explain relevance of the Flag information to residents' existing medical conditions: “if you have trouble breathing, have COPD, asthma, etc.”
 - Surveys – offer food. Provide clipboards. Have a Program Representative explain the survey in a resident meeting when possible
 - Build in additional contact information for residents for more info

Implications for Building Design to Support Resident Engagement and Well-Being

- Interior spaces are often not equipped to support resident needs during extreme events, e.g., the pandemic, heat waves
- Exterior spaces which might be safer do not always provide for comfortable shared social spaces
- Planning, landscaping, and architectural design solutions can enhance exterior community engagement




Carstans, D. (1985). *Site Planning and Design for the Elderly*. NY: Vanstrand Reinhold



Courtesy: Diane Carstans

Additional Resources (rcgb.rutgers.edu)


RUTGERS
Edward J. Bloustein School
of Planning and Public Policy



Improving Air Quality in Your Home
Rutgers Center for Green Building
December 2018

Improving Air Quality: A Guide for Tenants

RUTGERS
Edward J. Bloustein School
of Planning and Public Policy



**Improving Air Quality:
A Guide for Property Owners**
Rutgers Center for Green Building
December 2018

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Improving Air Quality: A Guide for Owners

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QUESTIONS?

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Thank You!