Overview of the Community Assessment of Freeway Exposure and Health Study in Boston, MA

Healthy Communities Task Force Meeting
June 8, 2015
Allison P. Patton, Ph.D.
Postdoctoral Fellow
Environmental and Occupational Health Sciences Institute
Rutgers University

Community Assessment of Freeway Exposure and Health (CAFEH)

- 5 related community-based participatory research (CBPR) air pollution studies.

- Community partners participate in all aspects of the science.

- Combine community and academic resources.

- Inform policymakers about air pollution and help to identify ways to reduce exposure.

CAFEH Funding

Santander Postgraduate Research Award

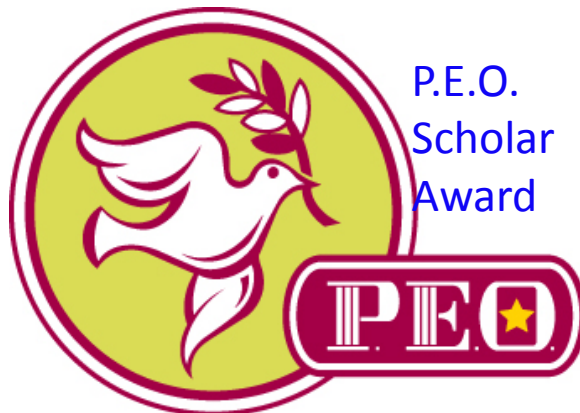**NIEHS** National Institute of Environmental Health Sciences

NIEHS ES015462

Tisch College Educating Active Citizens

Tufts Community Research Center

EPA STAR FP-91720301
EPA STAR FP-917349

NIH

National Heart, Lung, and Blood Institute

NHLBI CA148612

THE KRESGE FOUNDATION

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

HUD MALHH0194-09

P.E.O. Scholar Award

P.E.O.

NATIONAL LIBRARY OF MEDICINE

CAFEH Team

Steering committee

Doug Brugge, Co-chair (CAFEH Principal Investigator), Edna Carrasco (Committee for Boston Public Housing), Tina Wang (CAFEH Field Staff), John Durant (Tufts Department of Civil and Environmental Engineering), Kevin Lane (BU/Yale), Boalian Kuang /Lydia Lowe (Chinatown Progressive Association), Yuping Zeng/Michelle Liang (Chinatown Resident Association), Emmanuel Owusu (City of Somerville), Ellin Reisner, Co-chair (Somerville Transportation Equity Partnership), Wig Zamore (Somerville Transportation Equity Partnership), Emmanuel Owusu, Daniel Hauk, Dana LeWinter (City of Somerville)

Research Collaborators and Consultants

Christina Rioux (Tufts), David Arond, MD (Tufts) Mkaya Mwamburi, MD (Tufts), Bart Laws (Brown), Paul Ridker (Brigham and Women's Hospital), Jack Spengler (Harvard), Chuck Kolb (Aerodyne), Mark Woodin (Tufts), Jon Levy (BU), Madeleine Kangsen Scammell (BU), Cheri Lieberman, Ron Parambi (MGH), Rex Britter (MIT), Elena Naumova (Tufts), Tim McAuley

Staff

Don Meglio, Project Manager; Aaron Mardon/Deena Wang, Data Analyst

Field Staff

Helene Sroat, Mario Davila, Migdalia Tracy, Maria Crespo, Carmen Rodriguez, Kevin E. Stone, Consuelo J. Perez, Reva Levin, Marie Manis, Marjorie Alexandre, Christus Georges, Maximo Quevas, Kim-Lien Le, Stephanie Saintil, Robert Baptiste, Joseph Penella, Lisa Ng, Vladimir Albin Jr., Janet Vo, Quynh Dam, Lin Yian, Doreen Jenkins and Jozy Cantave

Nurses

Betsey Rodman, Marie Echevarria, Barbara Anderson, Catherine Murphy, Paula Dabenigno, Beverly Ashcroft, Maria Tamagna, Nida Tam, VNA of Eastern MA

Graduate Students/Post Docs

Christina Hemphill Fuller (Harvard/Georgia State), Allison Patton (Tufts/Rutgers), Jeff Trull (Tufts), Christine Ash (Tufts), Shengwei Zhu (Harvard), Erica Walker (Tufts/Harvard), Jess Perkins (Tufts), Luz Padro-Martinez (Tufts), Nira Hadar (Tufts), Elizabeth Baker (Harvard), Kyle Hoesterey (Tufts), David Weiss (Tufts), John Wu (Harvard), Matt Simon (Tufts), Laura Corlin (Tufts)
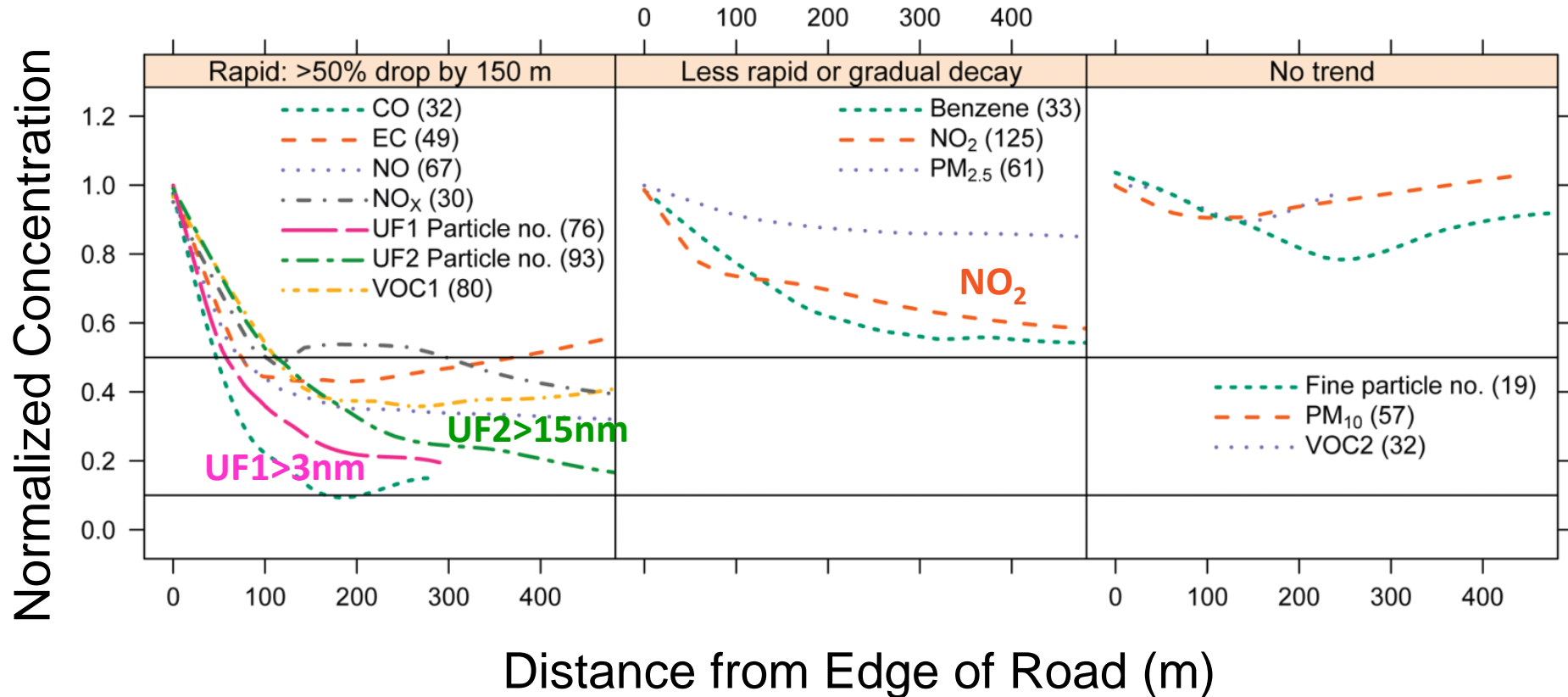
Student Interns

Yuki Ueda, Sarah Moy, Patricia Dao-Tran, Reed Morgan, Marie Delnord, Aliza Wasserman, Jessica Pogachar, Asi Somburu, Haley Schwartz, Ashley Tran, Sunetra Bane, Jessica Bocca, Heejin Choi, Brianna Cilley, Piers MacNaughton, Chad Milando, Eric Wilburn, Erika Brown, Sophia Burks, Lindsay Kephart, Dana Harada, Shu-Yeu Hou, Caitlin Collins, Jose Mira, Samantha Weaver, Maris Mann-Stadt, Marie Delnord, Aliza Wasserman, Heejin Choi, Ashley Tran, Sarah val Diez, Nina Grossman, Sophia Burks, Lindsay Kephart, Alex Bob, Andrea Stewart, Rachel Ganz, Jozy Contave, Christine Papastamelos, Oliver-John Bright, Yu Li, Andrew Shapero and Daniel Chen

CAFEH Projects

- Original CAFEH Study
- Clean Air Project
- Boston Puerto Rican Health Study
- Improving the Health of Near Highway Communities
- Visualizing Air Pollution

ORIGINAL CAFEH STUDY OF NEAR-HIGHWAY AIR POLLUTION

Near-highway air pollution

Normalized Concentration vs Distance from Edge of Road (m)

Rapid: >50% drop by 150 m	Less rapid or gradual decay	No trend
CO (32)	Benzene (33)	
EC (49)	NO₂ (125)	
NO (67)	PM₂.₅ (61)	
NOₓ (30)		
UF1 Particle no. (76)		Fine particle no. (19)
UF2 Particle no. (93)		PM₁₀ (57)
VOC1 (80)		VOC2 (32)

UF1>3nm   UF2>15nm   NO₂

Original CAFEH Study

Aim: Assess the association between exposure to highway air pollutants and cardiac health in communities near highways.
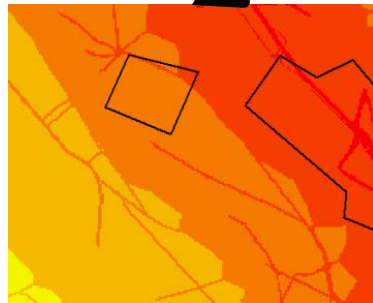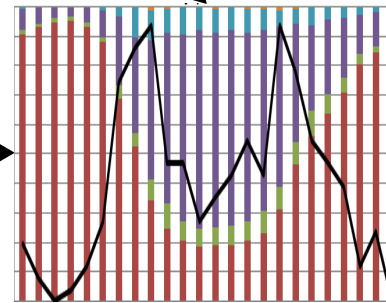

Mobile Monitoring on 162 days
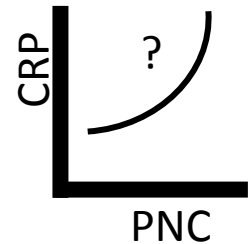
704 surveys

451 clinic visits

PNC Models

Ambient residential PNC

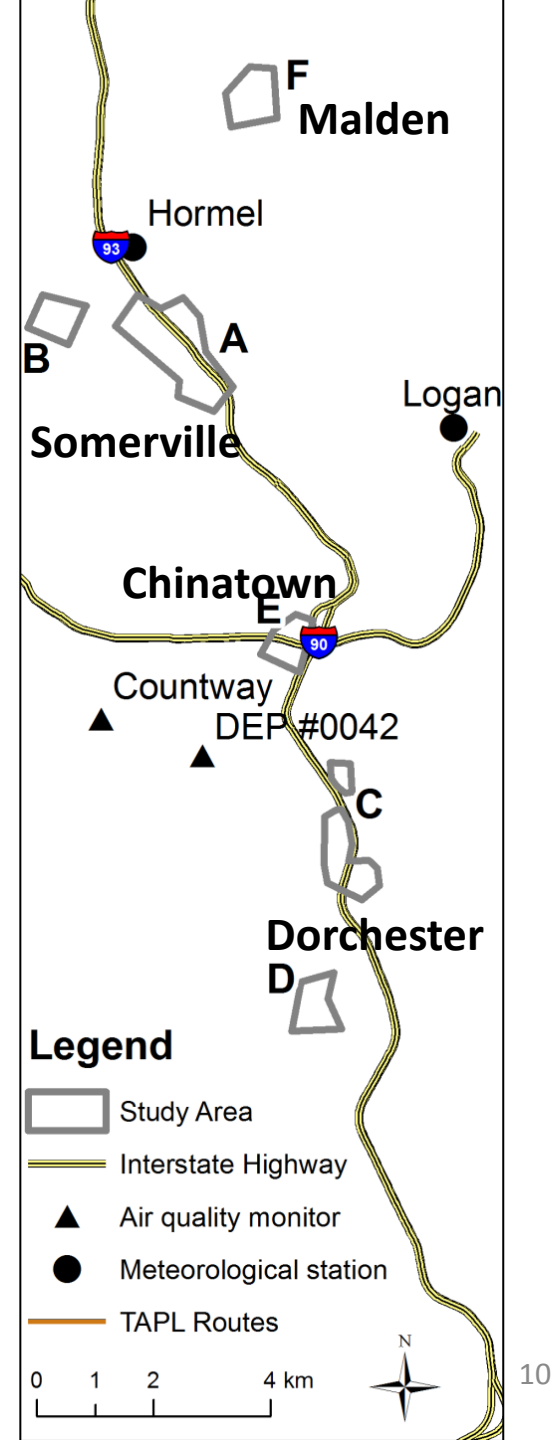Time-activity adjustment

Association?
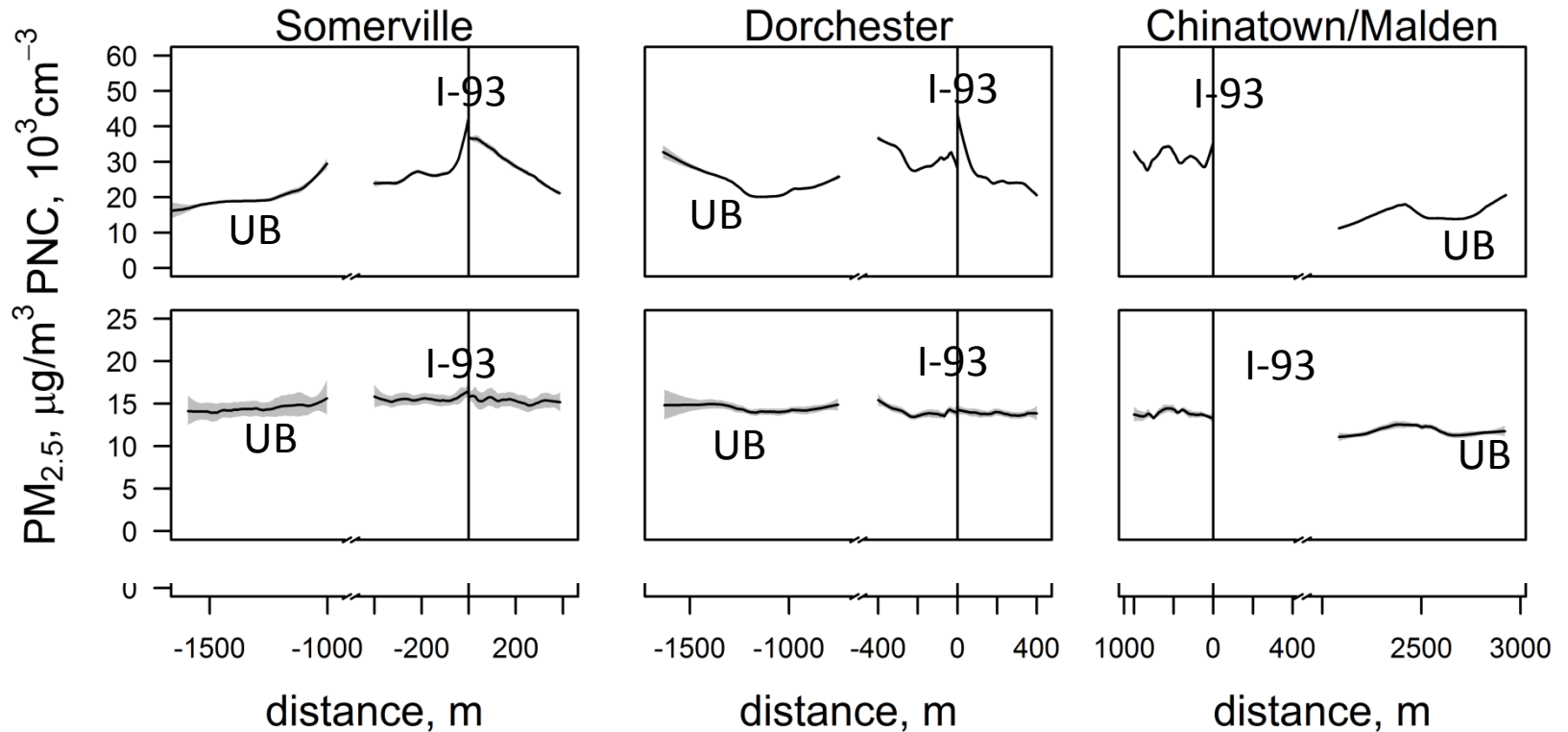
Mobile Monitoring

Alonso Nichols/Tufts University

- Near I-93: 150,000 vehicles per day.
- 2-6 hour shifts
- 35-47 days per area
- Focus on particle number concentration (PNC)

Elevated PNC but not PM$_{2.5}$ near I-93

Median (IQR)	PNC, 10^3 cm^{-3}			PM$_{2.5}$, µg/m^3		
	NH	UB	P(UB≥NH)	NH	UB	P(UB≥NH)
Somerville	30 (49)	18 (19)	<0.001	15 (23)	14 (17)	<0.001
Dorchester	27 (33)	19 (20)	<0.001	13 (8)	14 (7)	>0.999
Chinatown/Malden	26 (26)	14 (20)	<0.001	14 (9)	12 (9)	<0.001

Patton et al., *Atmos Environ*, 2014

Modeled Annual Average Ambient PNC

- Models included meteorological, traffic, and spatial parameters.

- Both space and time were important.

- PNC was generally
  - High in Somerville and Chinatown.
  - Intermediate in Dorchester.
  - Low in Malden.

Patton et al. *Environ Sci Technol*, 2015

PNC
10^3 particles/cm^3

50
45
40
35
30
25
20
15
10
5

N

0 0.5 1   2   3   4
km
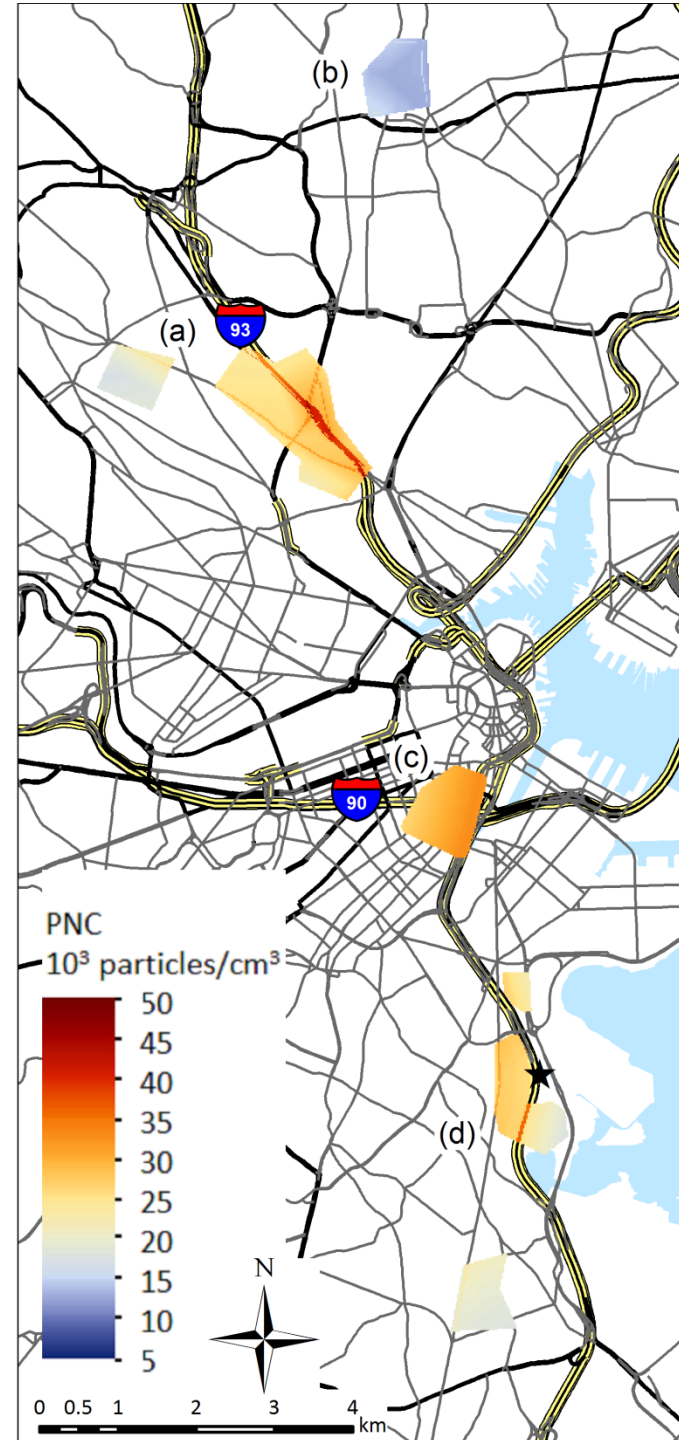
Relationship of LN hsCRP and PNC
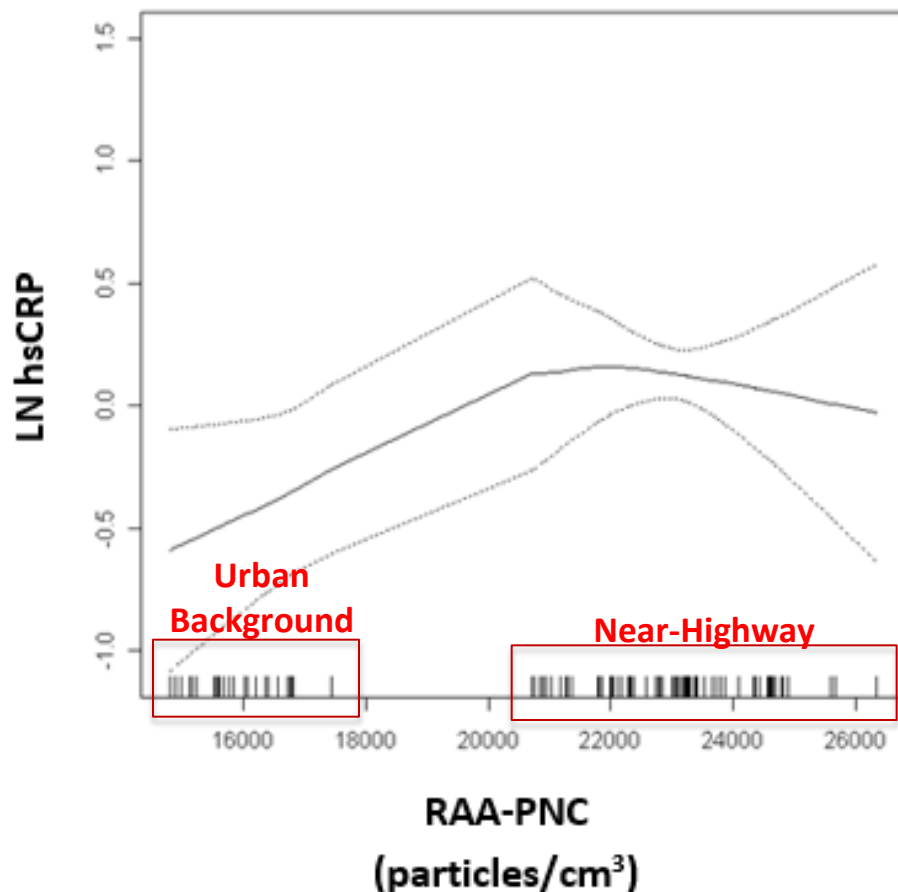
*Models adjusted for age, gender, smoking status and BMI.

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Summary

- Measured PNC and other traffic-related pollutants in near-highway neighborhoods.

- Developed ambient PNC models.

- Adjusted ambient PNC for time-activity.

- Measured association with CRP.

INTERVENTION STUDIES

CAFEH Intervention Studies

- Clean Air Project
  - Public Housing in Somerville, MA
  - Recruited specifically for this study

- Boston Puerto Rican Health Study
  - Puerto Ricans in Boston and Chelsea, MA
  - Selected from cohort who had already been followed for 5 years

Intervention Study Design

Randomize

Blood Draw

Sham Filtration → **Real Filtration**

3 weeks   Blood Draw   3 weeks   Blood Draw

Real Filtration → **Sham Filtration**
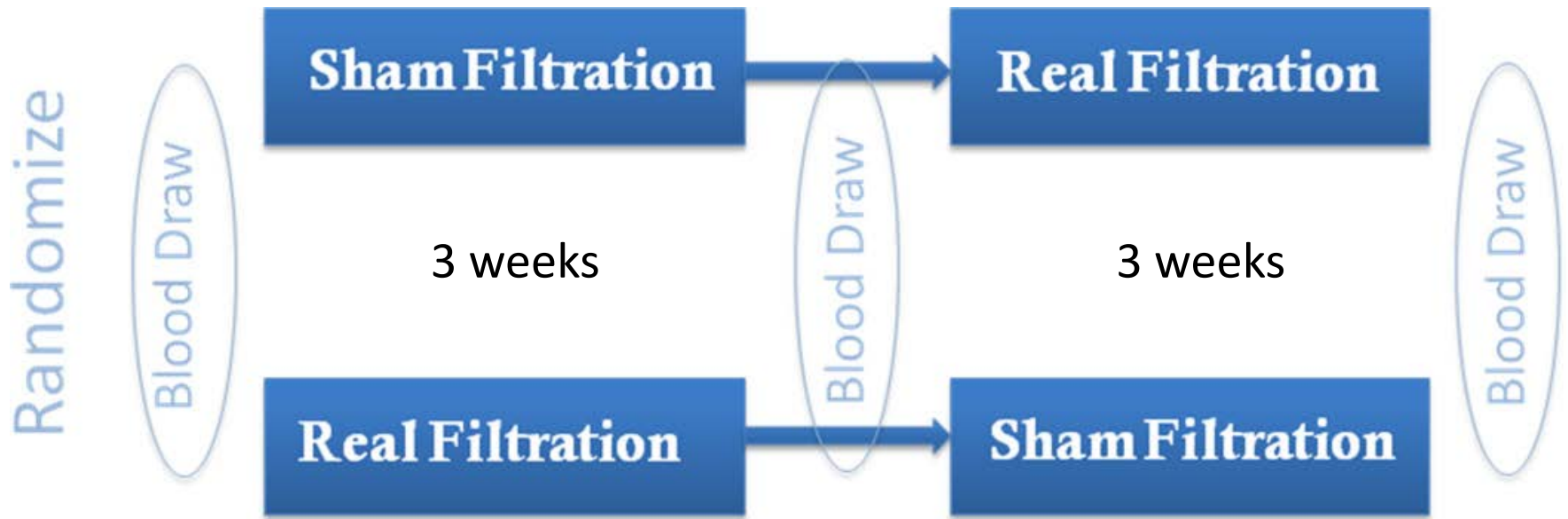
HEPA filter decreased particle numbers in some but not all homes.

Brugge *et al*, *Progress in Community Health Partnerships*, 2013

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IMPROVING HEALTH IN COMMUNITIES NEAR HIGHWAYS

Project Goal

- "enact positive changes at the community level and disseminate research results regionally, starting with the CAFEH study areas of Boston's Chinatown and communities in the City of Somerville."
  - Improving Health in Communities Near Highways: Design Solutions from a Charrette

General Methods to Reduce Exposure

- Generate less traffic-related air pollution.

- Move the pollution away from the people.

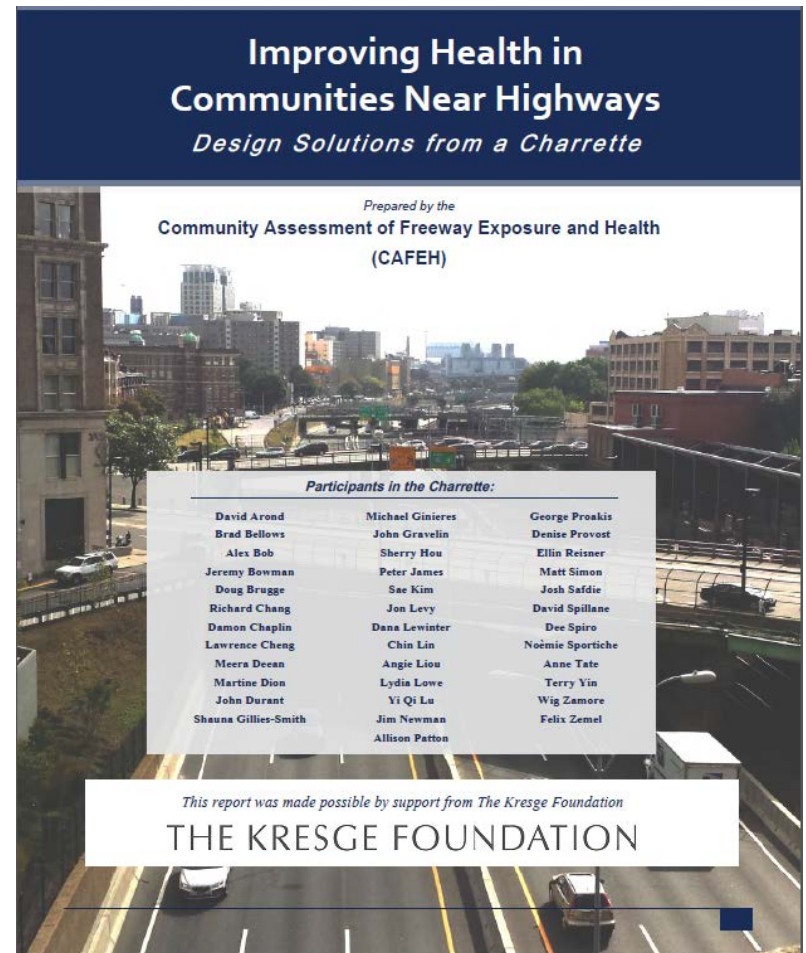- Prevent the pollution from getting where people are.

- We evaluated 11 specific proposed tactics.

Air Pollution Exposure Interventions

Location	Effectiveness		
	Good (>40%)	Moderate (0-40%)	Inconclusive
On-Site	• Filtration • Air intake location • Sound proofing	• Healthy placement of buildings and parking structures • Trees and Plantings	• Healthy vegetables
Off-Site	• Park locations • Land use buffers	• Built or vegetative barriers • Active travel locations • Decking over highways	

Brugge et al. *Environmental Justice,* in press.

Design Charette

- Introduced research results to the local design community

- Participants developed design solutions for two case study sites.

- ~35 attendees
  - Included designer, school headmaster

- Held on May 9-10, 2014.

Improving Health in
Communities Near Highways
Design Solutions from a Charrette

Prepared by the
**Community Assessment of Freeway Exposure and Health
(CAFEH)**

Participants in the Charrette:

David Arond	Michael Ginieres	George Proakis
Brad Bellows	John Gravelin	Denise Provost
Alex Bob	Sherry Hou	Ellin Reisner
Jeremy Bowman	Peter James	Matt Simon
Doug Brugge	Sae Kim	Josh Safdie
Richard Chang	Jon Levy	David Spillane
Damon Chaplin	Dana Lewinter	Dee Spiro
Lawrence Cheng	Chin Lin	Noèmie Sportiche
Meera Deean	Angie Liou	Anne Tate
Martine Dion	Lydia Lowe	Terry Yin
John Durant	Yi Qi Lu	Wig Zamore
Shauna Gillies-Smith	Jim Newman	Felix Zemel
	Allison Patton	

This report was made possible by support from The Kresge Foundation
THE KRESGE FOUNDATION

Case Study Sites

Somerville: Proposed Housing

Chinatown: Proposed High School

1/2 km

1/2 km

Example Somerville Design #1

Solid Band-Shell Sheltering Park

Credit: Giamportone Design.

Example Somerville Design #2

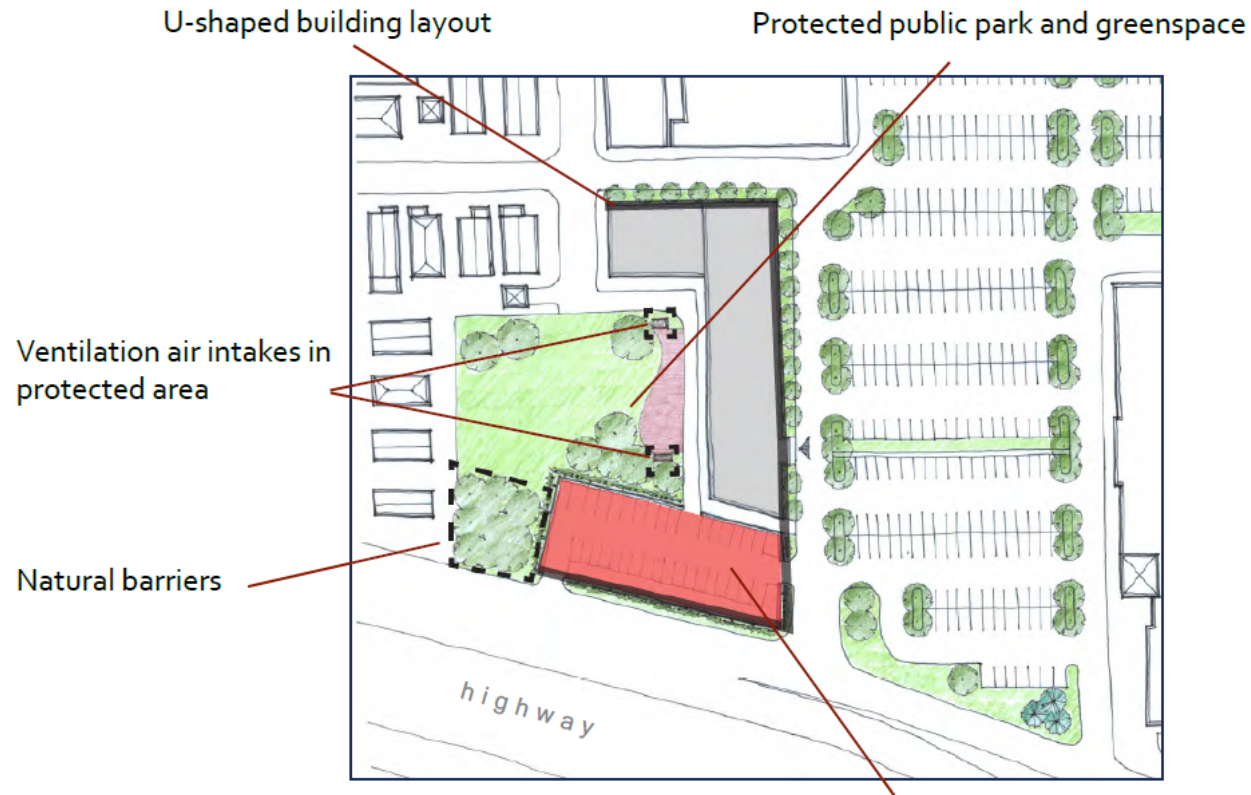U-shaped building layout

Protected public park and greenspace

Ventilation air intakes in protected area

Natural barriers

highway

Figure 45: This drawing shows how different tactics could work together to reduce exposure to near highway pollutants.
Credit: Giamportone Design, Linnean Solutions.

Multi-story parking garage as barrier toward highway (with exterior green wall)
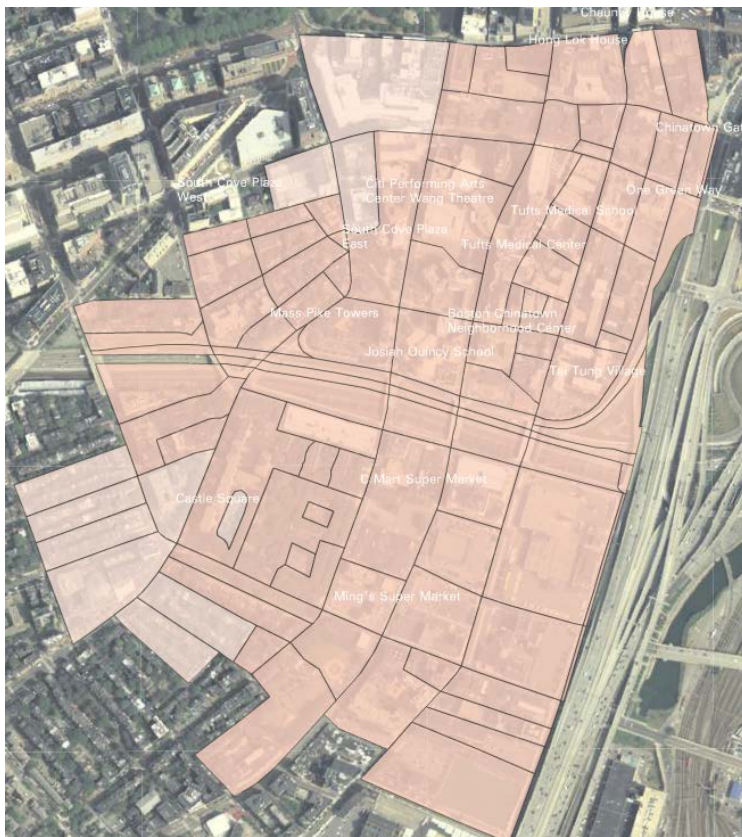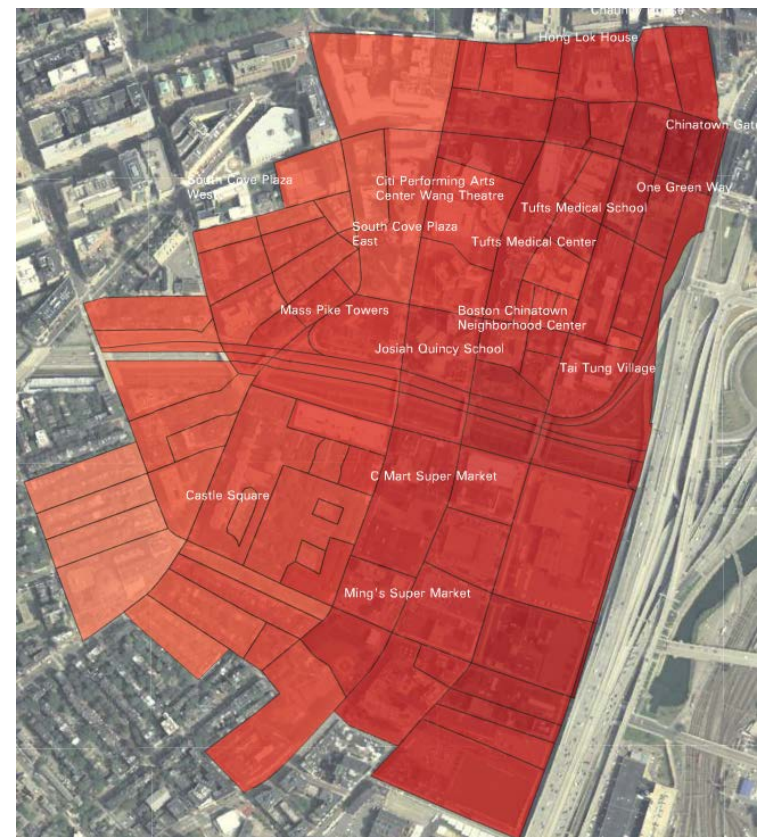
Example Chinatown Design

Filtered Air Intakes

Conditioned Atrium

Tight Exterior Envelope

Credit: Giamportone Design,
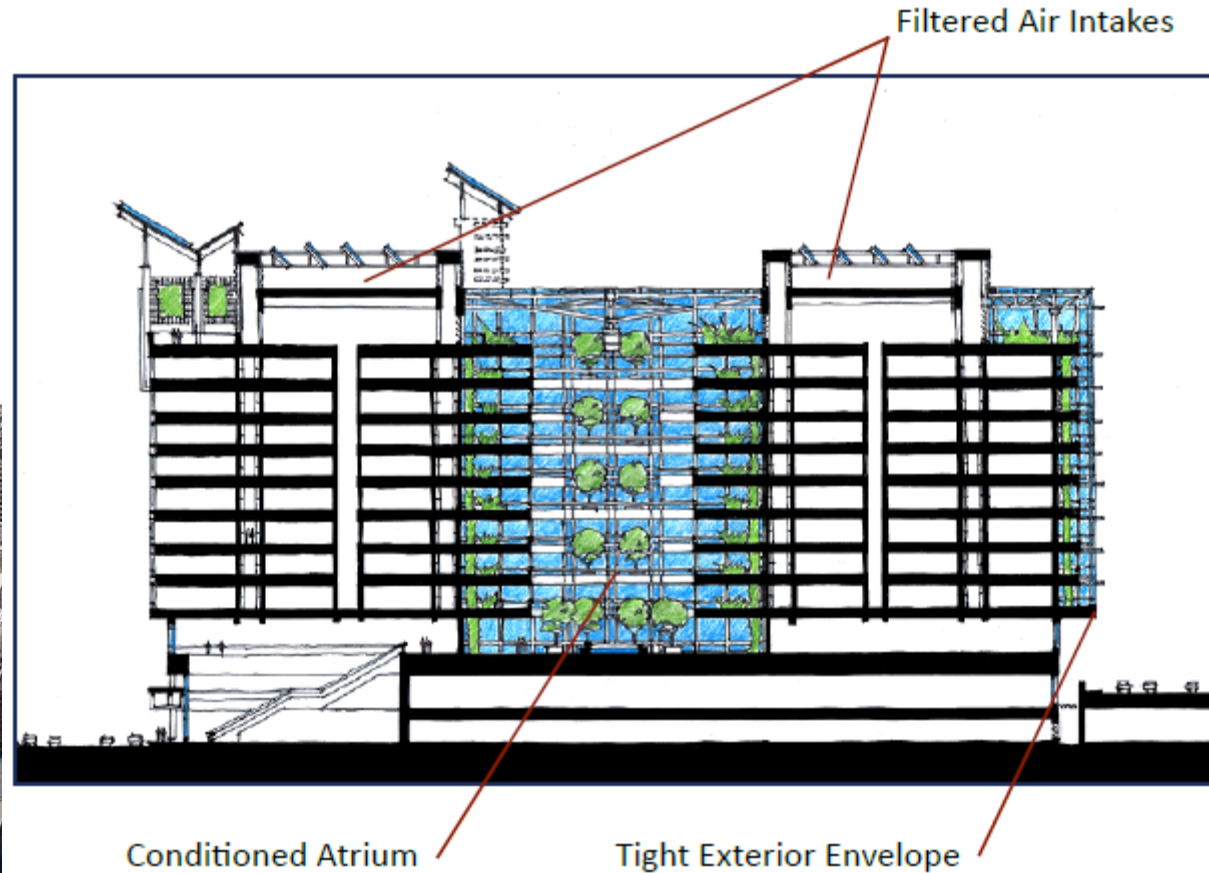
COMMUNICATION OF RESULTS

Visualizing Air Pollution to Promote Health Literacy

Best Case

Worst Case

Image from Kat Galkina

Research Group Website

Welcome to CAFEH!

CAFEH, the Community Assessment of Freeway Exposure and Health Study, serves as the larger umbrella for 5 related community-based participatory research (CBPR) air pollution studies. These projects have full participation of the community partners in all aspects of the science including: developing the proposal, leading the study, and collecting, analyzing and interpreting the data.

The CAFEH partnership combines community and academic resources to advance scientific understanding of the health risks of highway pollution. We hope our findings will inform policymakers about the risks of siting new housing, schools or playgrounds next to highways and help to identify measures to reduce exposures. **Please click on the links below to learn more about our constituent research projects:**

New report below!

Original CAFEH Study

Clean Air Project

Boston Puerto Rican Health Study

Improving the Health of Near Highway Communities

Visualizing Air Pollution

sites.tufts.edu/cafeh

Publications

Journal Articles

- English Factsheet
- Chinese Factsheet
- Spanish Factsheet
- French Factsheet
- Published Article is Open Access

Health Studies

🔵 Fuller CF, Williams PL, Mittleman MA, Patton AP, Spengler JD, Brugge D. **Response of biomarkers of inflammation and coagulation to short-term changes in central site, local and predicted particle number concentrations**. *Annals of Epidemiology*. 2015.

🔵 ⭐ Chung M, Wang DD, Rizzo AM, Gachette D, Delnord M, Parambi R, Kang C-M, Brugge D. **Association of PNC, BC, PM2.5 measured at a central monitoring site with blood pressure in a predominantly near highway population**. *International Journal of Environmental Research and Public Health*. 2015; 12(3): 2765-80.

Rioux CL, Tucker KL, Brugge D, Mwamburi M. **Medication type modifies inflammatory response to traffic exposure in a population with type 2 diabetes**. *Environmental Pollution*. 2015; 202: 58-65.

🔵 🔴 ⭐ Corlin L, Woodin M, Thanikachalam M, Lowe L, Brugge D. **Evidence of the healthy immigrant effect in older Chinese immigrants: a cross-sectional study.** *BioMed Central Public*

Conclusions

- Showed association between highway pollution and cardiovascular disease risk
- Ongoing intervention studies using HEPA filtration
- Working with community and designers to improve the health of near-highway communities
- Communicating results through classes and the project web site

Who We Are – Our Brands

Corporate Headquarters

Schuylkill Haven, Pennsylvania

Fast Facts

Founded 1938

2014 Stats

- Revenue $501 Million

- Loads Handled   956,000

- Tractors Operated   3,000

- Employees & Independent Contractors   4,250

- Operating Locations   170

Where We Operate

170 TERMINAL & OFFICE LOCATIONS

● CITIES

The EVANS
NETWORK OF COMPANIES

International Supply Chain Overview (Imports)

What is Drayage?

OCEAN CONTAINER

CHASSIS

+

DIESEL TRACTOR

+

MARINE PORT OPERATIONS

PORT AUTHORITIES

CARGO OWNERS

OCEAN CARRIERS

HOMELAND SECURITY

MAINTENANCE PROVIDERS

FREIGHT FORWARDERS

CHASSIS PROVIDERS

U. S. CUSTOMS

FEDERAL MARITIME COMMISSION

LABOR

CONTAINER YARDS & DEPOTS

EPA

NVOCC

DRAYAGE CARRIERS

MARINE TERMINAL OPERATORS

WAREHOUSING TRANSLOADING
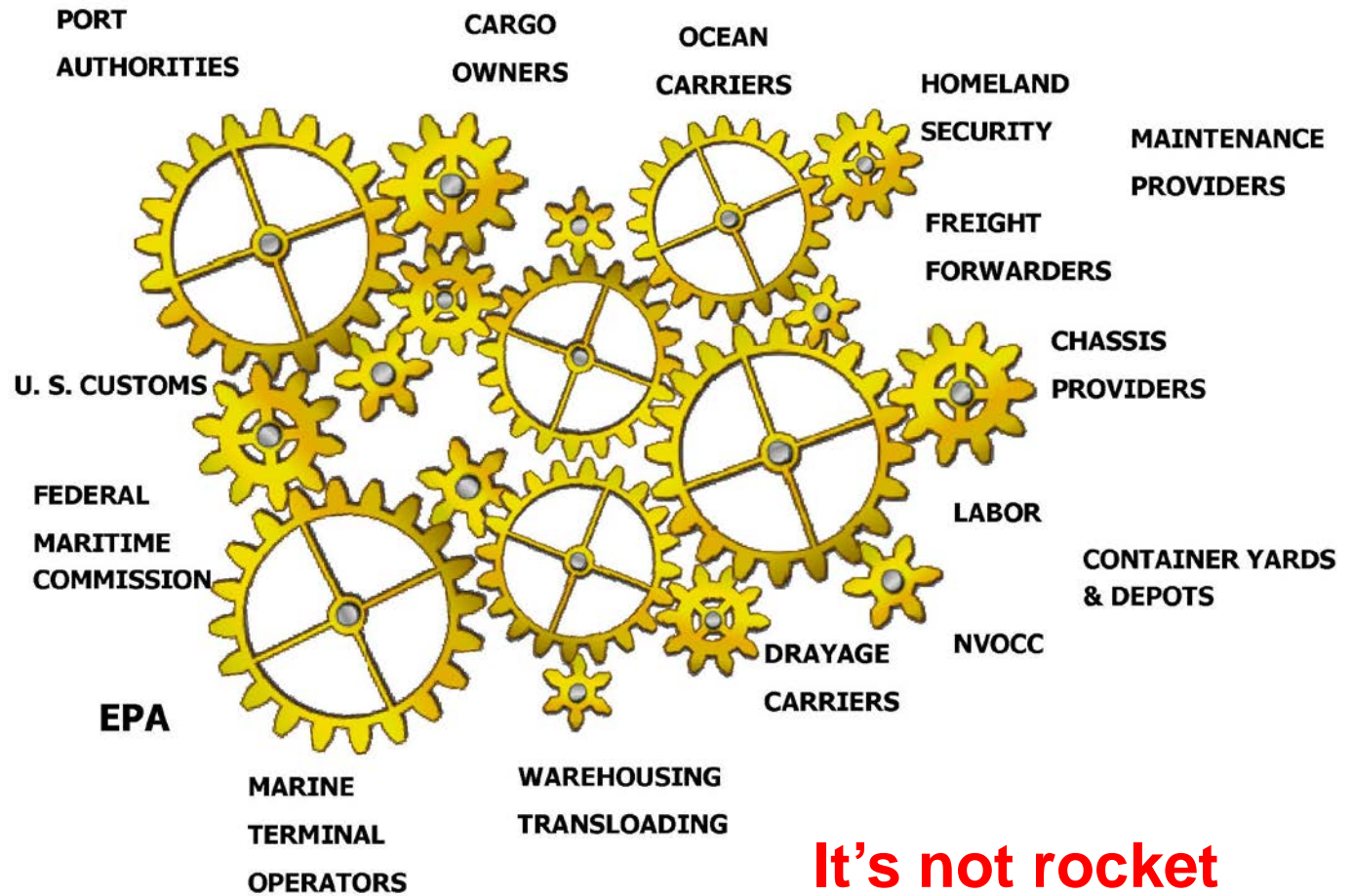
It's not rocket science but,…there are a lot of moving parts.

Port of Philadelphia

- Jobs (Direct & Indirect)   12,000

- Business Activity $2.7 billion

- Tax Revenue $290 million

Source: Philadelphia Regional Port Authority and South Jersey Port Corporation

We Support and Participate in:

- **Regional Organizations**

- **National Committees & Work Groups**
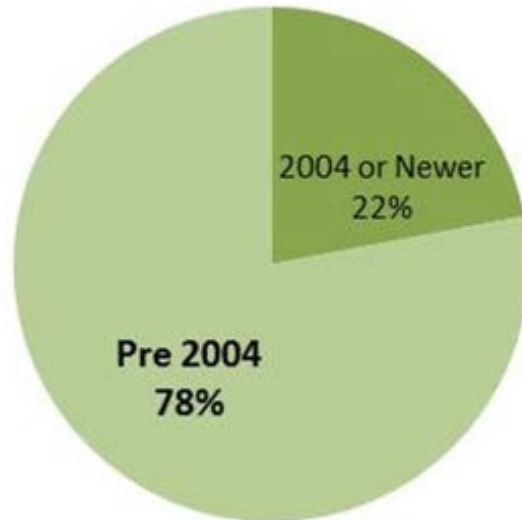
- **Public Events**

- **Public Testimony**

Working With Ports –
Examples of Public-Private Partnerships

Diesel Emission Retrofits
Drayage Truck Replacements

- **Baltimore, MD**
- **Charleston, SC**
- **Jacksonville, FL**
- **New York/New Jersey**
- **Norfolk, VA**
- **Philadelphia, PA**
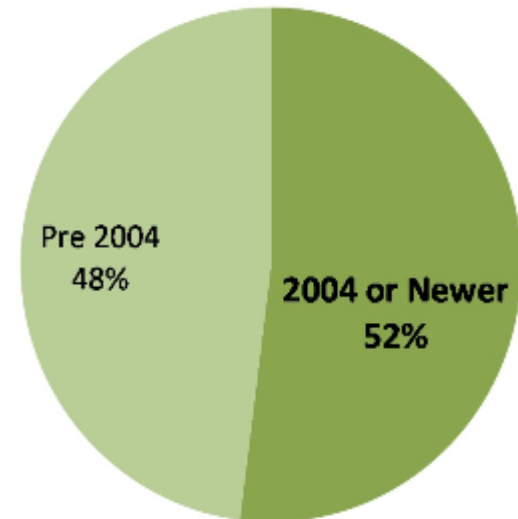- **Savannah, GA**
- **Wilmington, DE**
- **Wilmington, NC**

FLEET PROFILE

2012

2015

2007 & Newer = 41

2007 & Newer = 804

So, why be a good neighbor?

Evans Corporate Environmental Policy

"Our policy is to conduct business in socially responsible manner that protects the environment and the safety and health of our employees, customers, independent contractors and the community at large"

We advocate for voluntary programs to address the environmental needs of the community.
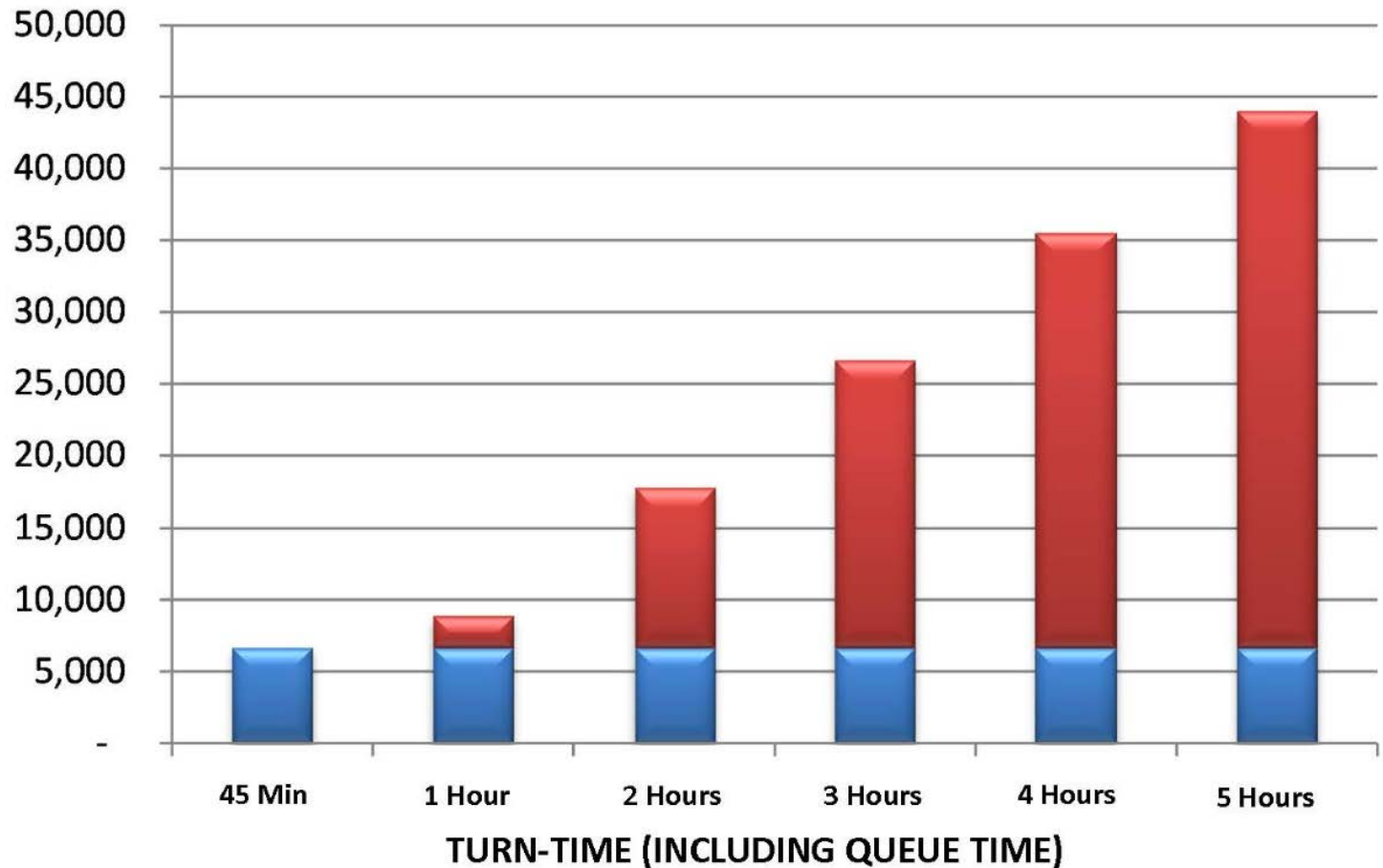
"If you are not at the table, you may be on the menu".

Hypothetical Marine Terminal
800,000 Container Transactions

CO$_2$ Carbon Dioxide (Tons) - From Truck Idling

TURN-TIME (INCLUDING QUEUE TIME)

45 Min | 1 Hour | 2 Hours | 3 Hours | 4 Hours | 5 Hours

Source Publication: EPA420-F-08-025 Idling Vehicle Emissions (Heavy Duty Diesel Trucks)
Grams Per Hour (g/hr) Converted to Tons

Hypothetical Marine Terminal
800,000 Container Transactions

Particulate Matter—PM$_{2.5}$ From Truck Idling
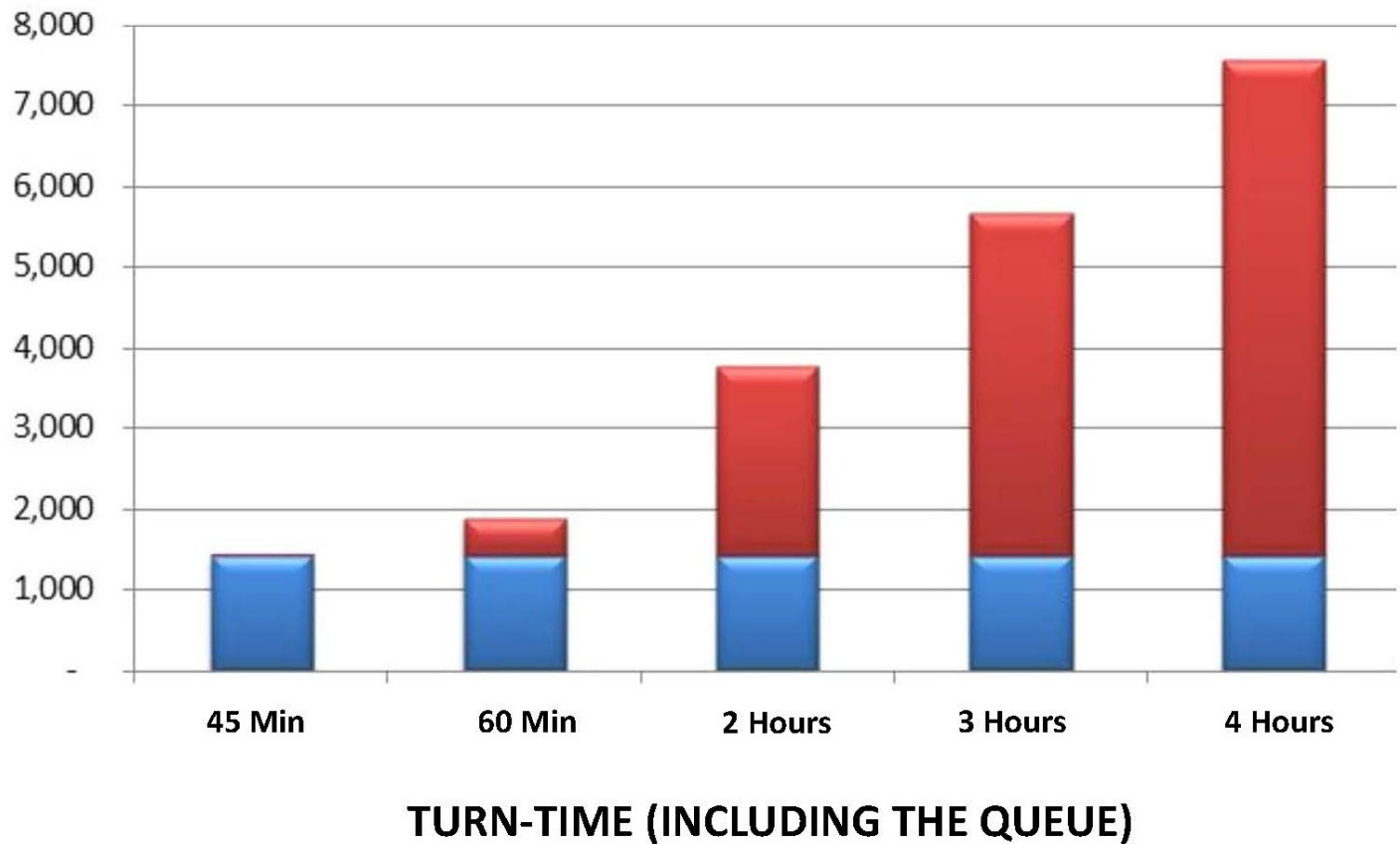
TURN-TIME (INCLUDING THE QUEUE)

Each Additional Hour of Idling Equals:

Pounds	Regulated Pollutant
17,760,000	CO_2 Carbon Dioxide
46,822	CO Carbon Monoxide
63,066	NO_X Nitrogen Oxides
1,887	$PM_{2.5}$ Fine Particulate Matter

Hypothetical Marine Terminal - 800,000 Container Transactions

**Source Publication: EPA420-F-08-025 Idling Vehicle Emissions (Heavy Duty Diesel Trucks)
Grams Per Hour (g/hr) Converted to Pounds**

Potential Improvements and Investments

- **Stakeholder Involvement**

- **Technology & Automation**

- **Process Improvements**

- **Facility & Equipment Upgrades**

- **Measurement & Reporting**

"If you don't measure it, you can't improve it"

- Peter Drucker

Final Thoughts

USAF Colonel Martha McSally

A10 Warthog

The first American woman to fly in combat

The first woman to command a USAF fighter squadron

Questions?

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gerry-coyle@evansdelivery.com

A Clean Air Strategy for the Port of New York and New Jersey

Delaware Valley Regional Planning Commission
Health Communities Task Force
June 8, 2015
William A. Nurthen

Port of New York and New Jersey

Port of New York and New Jersey

Third largest Port in US - 5.8 million TEU in 2014

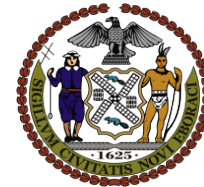Economic engine:
- 296,060 jobs
- $18.3B in wages
- $6.1B in taxes

Definition of Success = Sustainable Port =
- Regional Prosperity +
- Financial Return +
- Environment & Security

How to accommodate cargo growth –

with all the economic benefits that it brings

– while protecting and improving the environment, specifically air quality

Response: Develop A Clean Air Strategy for the Port of New York and New Jersey

Identify Emission Reduction Actions - All port sources

Incorporate feedback from:
- Port stakeholders
- Environment and Community Groups

Track Progress:
- Measurement, Verification and Reporting

Clean Air Strategy Purpose and Goals

Purpose:

- Reduce air pollutant impacts on human health and environment
- Reduce greenhouse gas emissions in advance of regulation
- Help bring region into attainment of air quality standards

Goals:

- Overall decrease in emissions despite any Port Growth
  - Annual 3 percent net decrease in criteria air pollutants
  - Annual 5 percent net decrease in greenhouse
    - Agency wide goal to reduce 2006 GHG emissions level by 80% by 2050

Highlights from the 2013 Clean Air Strategy Implementation Report

CAS implementation (Oct 2009 – Nov 2013):

- Eighty percent (27 of 34) of near-term/committed actions completed or underway

- 12 actions led by Port Authority with 4 Strategy Group partners and one community partner leading the remainder

Based on the latest Emissions Inventory at the time (2010):

- Average 17% decrease across criteria air pollutants associated with port operations, despite a 4.6% increase in cargo volume

- All maritime-related criteria air pollutants decreased at a rate greater than or equal to the 3% annual average reduction goal

- Annual 5% net decrease goal for GHGs was not met

Highlights of Major Actions Implemented To-Date in Each Sector

Ocean-Going Vessels (OGV)

- LSD Fuel Incentive Program
  - Provided incentives to 701 qualifying vessels (2010-2012)
- Clean Vessel Incentive Program
  - Provided $2.25M to 1192 qualifying vessel calls
- Installing Shore Power at Brooklyn Cruise Terminal

Trucks (HHDV)

- Truck Replacement Programs
  - Two programs: $28M & $6.2M; 429 old trucks replaced
  - Annual emissions reductions: 70% for NOx, 64% for PM
- Truck Phase Out Program
  - January 1, 2011 access denied to trucks with 1993 or older engines
  - January 1, 2017 must have 2007 or newer engine to gain access
- Truck Loan and Retrofit Program
  - Retrofitted 31 trucks with DPF and refinanced at 0% interest

Highlights of Major Actions Implemented To-Date in Each Sector

- ## Cargo Handling Equipment (CHE)

  - ### Fleet modernization

    - Replaced 46 pieces CHE with new units meeting latest engine standards

- ## Rail

  - ### Engine retrofits

    - 4 switching locomotives retrofitted to GenSet configuration
    - 3 included additional retrofits achieving reductions >99% for PM and >88% for NOx compared to pre-retrofit engines

- ## Harbor Craft (HC)

  - ### Engine retrofits and upgrades

    - 10 engines on BillyBey, Waterway, and Seastreak/Wall Street ferries and 16 engines on 6 private harbor craft upgraded from Tier 0 to Tier 2
    - Diesel oxidation catalysts (DOCs) installed on over 31 boats

2012 Emissions Inventory
Key Findings – Across All Sectors

Percent change from 2006 to 2012 – tons/year

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-22%	-34%	-33%	-7%	-13%	-56%	-11%

Percent change from 2006 to 2012 – tons/million TEU

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-28%	-39%	-38%	-14%	-20%	-60%	-18%

Average annual rate of decrease from 2006 to 2012 – tons/year

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-3.7%	-5.7%	-5.5%	-1.2%	-2.2%	-9.3%	-1.8%

Key Findings – Ocean-Going Vessels (OGV)
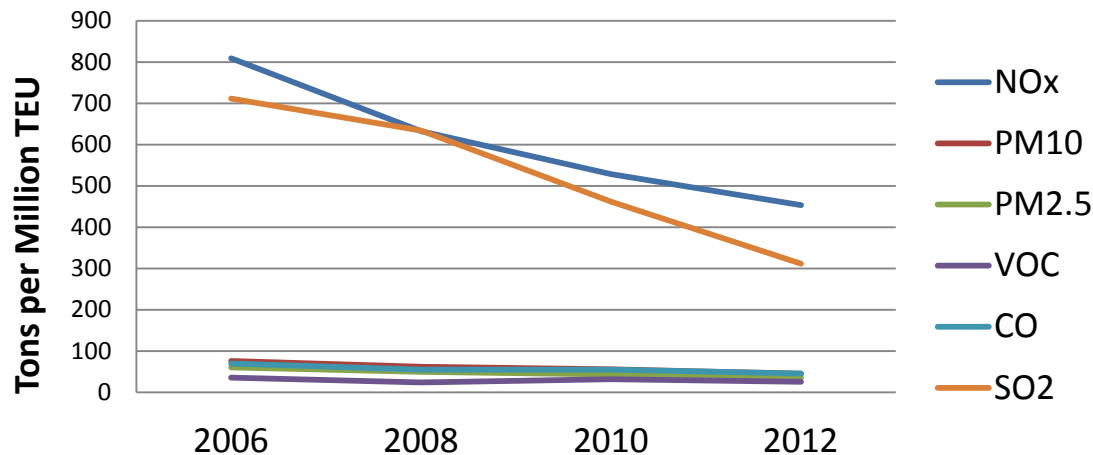
Vessel Calls:

- 2012 Container Ships: 2,033; 2010 Container Ships: 1,986

Percent change from 2006 to 2012 – tons/million TEU

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-44%	-41%	-41%	-28%	-34%	-56%	-40%

Ocean-Going Vessel Criteria Air Pollutant Emissions, 2006-2012
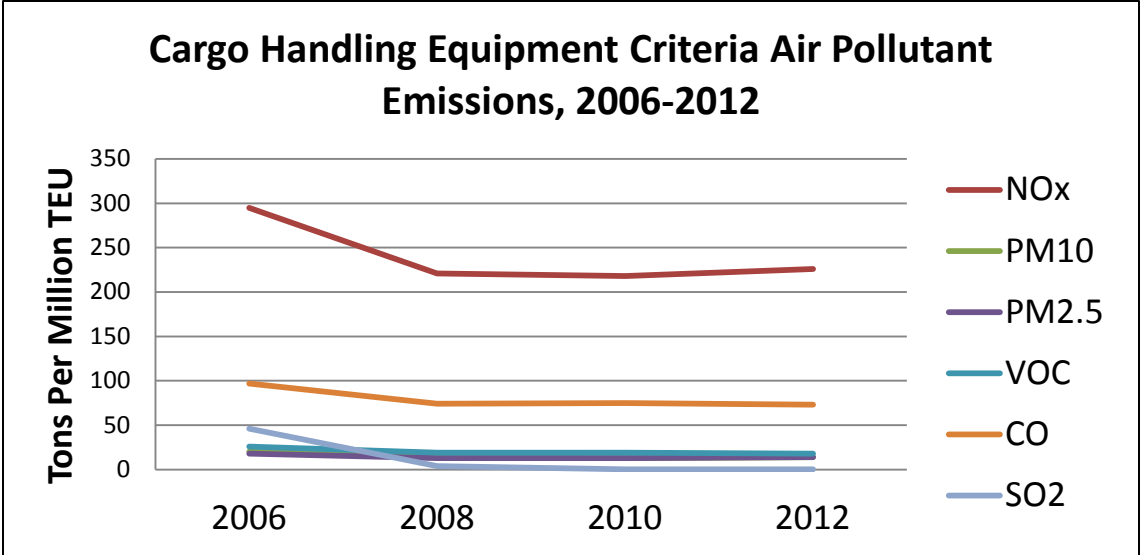
Key Findings – Cargo Handling Equipment (CHE)

Total Units:

- 2012:1 ,189; 2010: 1,052
- Terminal Tractors and Straddle Carriers: 63% of CHE and 69% of Emissions

Percent change from 2006 to 2012 - tons/million TEU

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-23%	-30%	-22%	-31%	-25%	-100%	-20%

Cargo Handling Equipment Criteria Air Pollutant Emissions, 2006-2012

Key Findings- Trucks (HDDV)

Vehicle Miles Traveled (VMT) and Idling Hours

		VMT	Idling Hrs
On Terminal	2012	4,696,337	1,970,936
	2010	4,025,715	3,483,603
		VMT	
On Road VMT	2012	124,718,000	
	2010	115,005,411	

Percent change from 2006 to 2012 - tons/million TEU

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-7%	-47%	-42%	23%	-14%	-92%	-3%

Key Findings- Trucks (HDDV)

Trucks Crtiteria Air Pollutant Emissions, 2006-2012
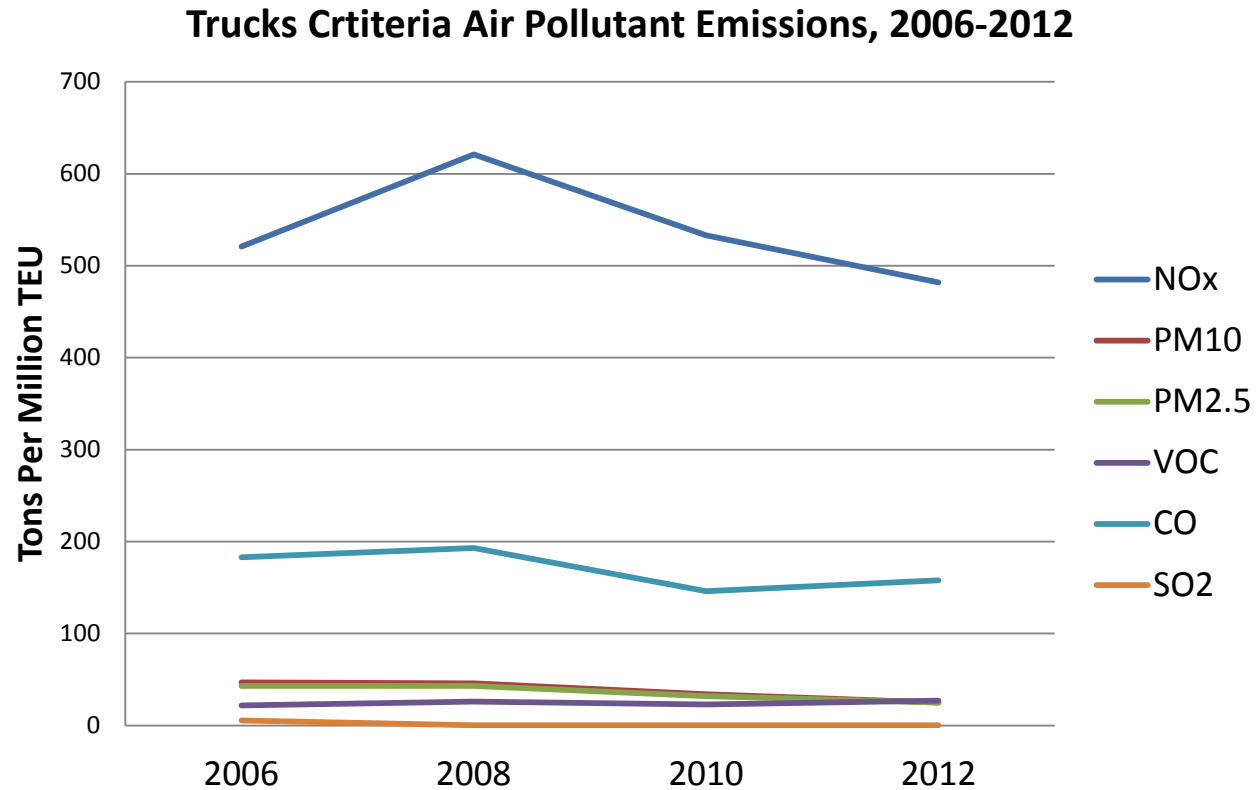
Key Findings – Trucks (HDDV)
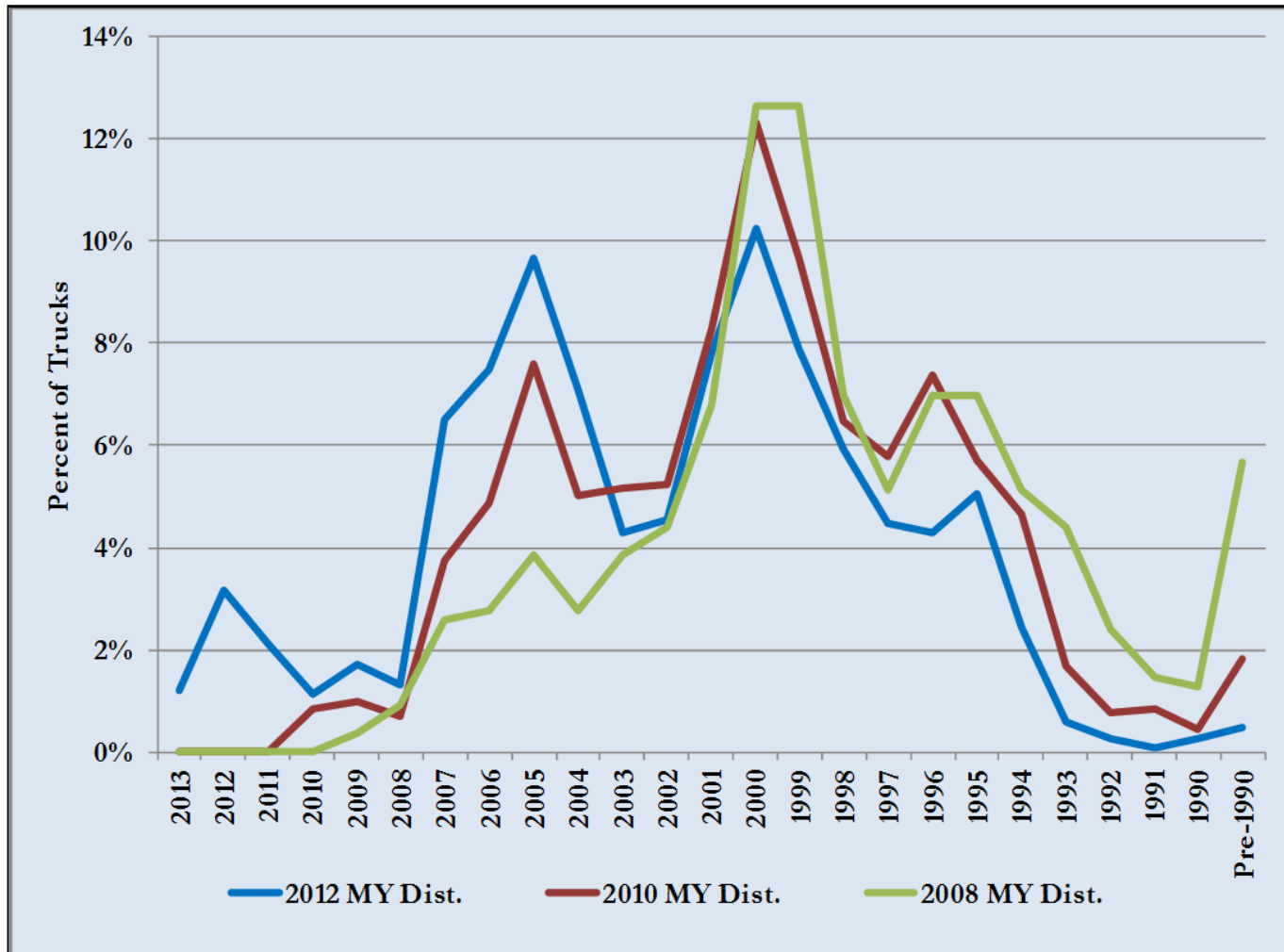
Key Findings – Rail

Containers Moved By Rail

- **2012:** 433,000 ; **2010**: 377,000

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-21%	-19%	-16%	-16%	-5%	-97%	6%

Rail Criteria Air Pollutant Emissions, 2006-2012
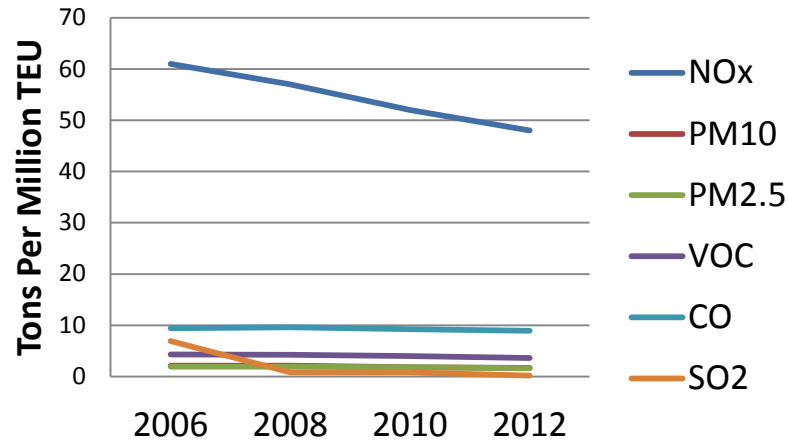
Key Findings – Harbor Craft (HC)

Tug Assists

- 2012: Total 11,448; 2010: Total 10,498

	NOx	PM10	PM2.5	VOC	CO	SO2	CO2 Eq
2006-12	-26%	-25%	-22%	-22%	-4%	-97%	-24%

Harbor Craft Criteria Air Pollutant Emissions, 2006-2012
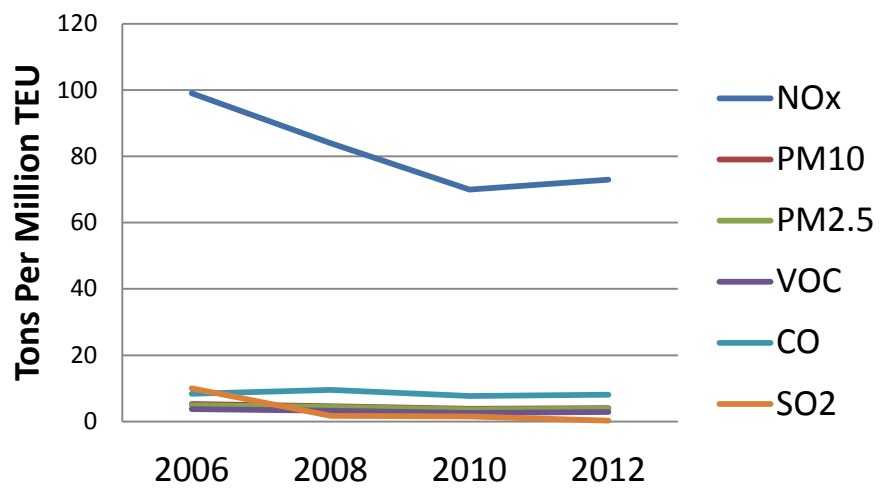
2014 Update Process

Round of stakeholder meetings in December 2012 to provide input on status and feasibility of outstanding committed and future 2009 CAS Actions

Strategy Group Meetings in Spring and Summer 2014

- Determined objectives, goals, scope, and process; reviewed 2009 outstanding actions and stakeholder input; reviewed draft 2012 Emissions Inventory findings; developed initial draft list of sector-based actions

- Round of stakeholder meetings August/September to discuss initial draft action list and gather input for additional actions

- Strategy Group meeting in September to discuss stakeholder input and develop final draft list of actions

- Public meeting in December to present/discuss final draft Strategy

  - Followed by Strategy Group meeting to finalize Strategy based on input received

- Published 2014 Clean Air Strategy Update in March 2015

Questions

CAS 2014 Update Draft Actions: Ocean-Going Vessels (OGV)

1. Implement a follow-on program to the Clean Vessel Incentive Program, which ends in 2015.

2. Research opportunities for reducing barriers to expansion of cold-ironing. If barriers can be overcome, create the infrastructure to support the use of cold ironing.

3. Implement pilot projects for promising new technologies, such as diesel particulate filters (DPFs), selective catalytic reduction (SCR), and scrubbers.

4. Examine the feasibility of and demand for a CNG/LNG refueling station for OGV and implement if feasible.

CAS 2014 Update Draft Actions: Cargo Handling Equipment (CHE)

1. **Develop a new CHE program, prioritizing yard tractors and straddle carriers, to incentivize faster than end-of-cycle turnover of equipment to the best-available technology (currently Tier 4).**

2. **Replace X% of the CHE fleet at all Port Authority leased terminals with alternative-powered (e.g., CNG, electric) equipment meeting the best available technology standards.**

3. **Support changing business practices and operating systems that will increase efficiency, such as use of rail-mounted gantry cranes and Truck Actions #1 and 2.**

4. **Install new engines with diesel particulate filters (DPFs) on remaining five operating diesel wharf cranes. These cranes may be retained for emergency purposes in the event of lost power.**

5. **Conduct a demonstration project, such as bringing alternative power to a terminal (i.e., a mobile fueling station), which will help overcome alternative fueling issues and increase demand.**
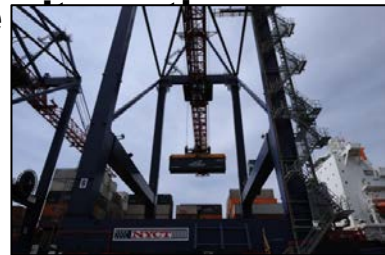
CAS 2014 Update Draft Actions: Trucks

1. **Support implementation of the Port Performance Task Force recommendation for a Chassis Management Improvement System.**

2. **Support the development of a Truck Management System recommended by the Port Performance Task Force for trucks serving the terminals in order to decrease truck congestion and peaking at terminal gates, as well as reducing truck on-terminal or turn time.**

3. **Develop strategies, including providing financial incentives to purchase alternative fuel vehicles, to replace the number of trucks necessary to comply with the 2017 phase out plan.**

4. **Examine the feasibility of and demand for a CNG/LNG refueling station for trucks and implement if feasible.**

5. **Conduct an on-terminal idling study that looks at a representative sample over the course of a year (accounting for seasonality, high/low cargo, etc.). Based on the results, develop and implement an idle reduction strategy and/or an incentive program for the use of on-board automatic shutdown devices.**

CAS 2014 Update Draft Actions: Rail

1. Upgrade to the best available technology an additional [#] switching locomotive engines that regularly service the port.

2. Support building line-haul trains directly on-port to decrease the use of switching locomotives (number or operating hours).

3. Pilot a compressed natural gas (CNG) mother-slug set.

4. Evaluate and implement using alternative powered lifting equipment at Kearney, CSX, and Norfolk Southern intermodal yards.

5. Support implementation of long-term operational changes to increase the amount of cargo leaving the port on rail versus truck, including Express rail expansion and increasing short-haul rail capabilities (e.g., development of an inland port).

CAS 2014 Update Draft Actions: Harbor Craft

1. Develop dockside electrification for harbor craft at Brooklyn Army Terminal Pier 4, Atlantic Basin (Brooklyn), and Homeport (Staten Island).

2. Repower/upgrade an additional [#] engines on private ferries, tugs, and other harbor craft, as an effort separate from the Harbor Deepening Project Air Offset Program.

3. Investigate and test post-combustion controls (diesel oxidation catalysts) and after-treatment technologies for tugs.

4. Implement a hybrid harbor craft pilot program.