Community Action to Promote Healthy Environments (CAPHE): Mobile Source Controls

STUART BATTERMAN*; AMY SCHULZ*; XXX**; AND KRISTINA RICE* ON BEHALF OF COMMUNITY ACTION TO PROMOTE HEALTHY ENVIRONMENTS

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Partner Organizations & Partnerships

Air Quality in Detroit

Historically, Detroit has faced a number of air quality

- Industrial legacy, multiple large emission sources, many of which are “grandfathered”
- Large exposed population
- Adverse health outcomes associated with air pollutants
- Vulnerable communities with disproportionate exposures

Opportunity to improve air quality and reduce health inequities

Photo 1: Incinerator, Detroit Renewable Power, Detroiters Working for Environmental Justice, 1-4-16
Photo 2: Truck Traffic, Detroit, Hannah Gordon, 6-18-15

CAPHE's Overarching Goals

- To develop a multilevel, integrated & scientifically-informed Public Health Action Plan designed to reduce adverse effects of air pollution on health

- To promote implementation of components of the plan

CAPHE's Approach

- Aims to increase knowledge about factors influencing exposure to air pollution and health effects
- Translates findings into a public health action plan (PHAP)
- Implements innovative policy & practice solutions to reduce pollutant exposure & mitigate adverse health effects

CAPHE's Timeline

- 2013-2015: Created Scientific Foundation for PHAP
- 2015-2016: Public Health Action Planning
  - Created the CAPHE PHAP Resource Manual (see website)
  - Solicited input from PHAP about 10 key air pollution mitigation strategies
  - Refined recommendations based on input
  - **6 Meetings of broader interested groups/parties**
  - **Input on strategies, synergies and collaboration**
- Early 2017: Release Public Health Action Plan
- 2017-2018: Implementation

CAPHE Mitigation Strategies

- Buffers & Barriers
- Indoor Air Filters
- Point Source Controls
- Renewable Energy
- Compliance & Enforcement
- Air Quality Monitoring
- **Mobile Source Controls** (4 sets of recommendations):
  - **Clean Fuels, Diesel Engine Retrofits, Idling Controls, and Transportation Control Measures**

Today's discussion objectives

- Breakout into smaller group discussions
- Discuss draft strategies for **Mobile Source Controls**
- Identify synergies with current programs and projects
- Identify opportunities for collaboration

Types of mobile source controls

- Idling Controls
- Clean Fuels
- Retrofitting Diesel Engines
- Transportation Control Measures

Most mobile source controls apply to both:

- *On-road sources* (cars, trucks, buses) and
- *Non-road sources* (trains, ships, construction equipment, cranes, pumps, generators)

Who monitors mobile sources?

- EPA maintains the *National Emissions Inventory*, which calculates emissions based on the fleet mix and age, vehicle miles traveled, average road speeds, emission factors and other inputs from SEMCOG and others
- EPA sets *emission standards* (on exhaust, running, refueling emissions). No mandatory check in Michigan.
- MDEQ with EPA support operates "near-road" *monitoring sites* at Eliza Howell and Livonia; Allen Park is a similar site.
- MDEQ with EPA approval likely will develop a *State Implementation Plan* for ozone due to nonattainment with federal air quality standards.

Livonia Near Road monitoring site.
Source: MDEQ

Why are controls on mobile sources important?

Emissions: Considering point, mobile, and area sources combined, on-road emissions represent:

- >50% of CO and NOx emissions
- 27% of VOC emissions
- 15% of $PM_{2.5}$ emissions

Place matters: In Detroit, many of the on-road $PM_{2.5}$ emissions occur on freeways (43% of total), other principal arterials (31%), and the balance on smaller arterials, collectors and minor roads. Living near roads, especially roads with extensive truck traffic, increases exposure.

Trends are relatively flat, i.e., monitoring and emissions data show large decreases in point sources emissions, but not in mobile source emissions.

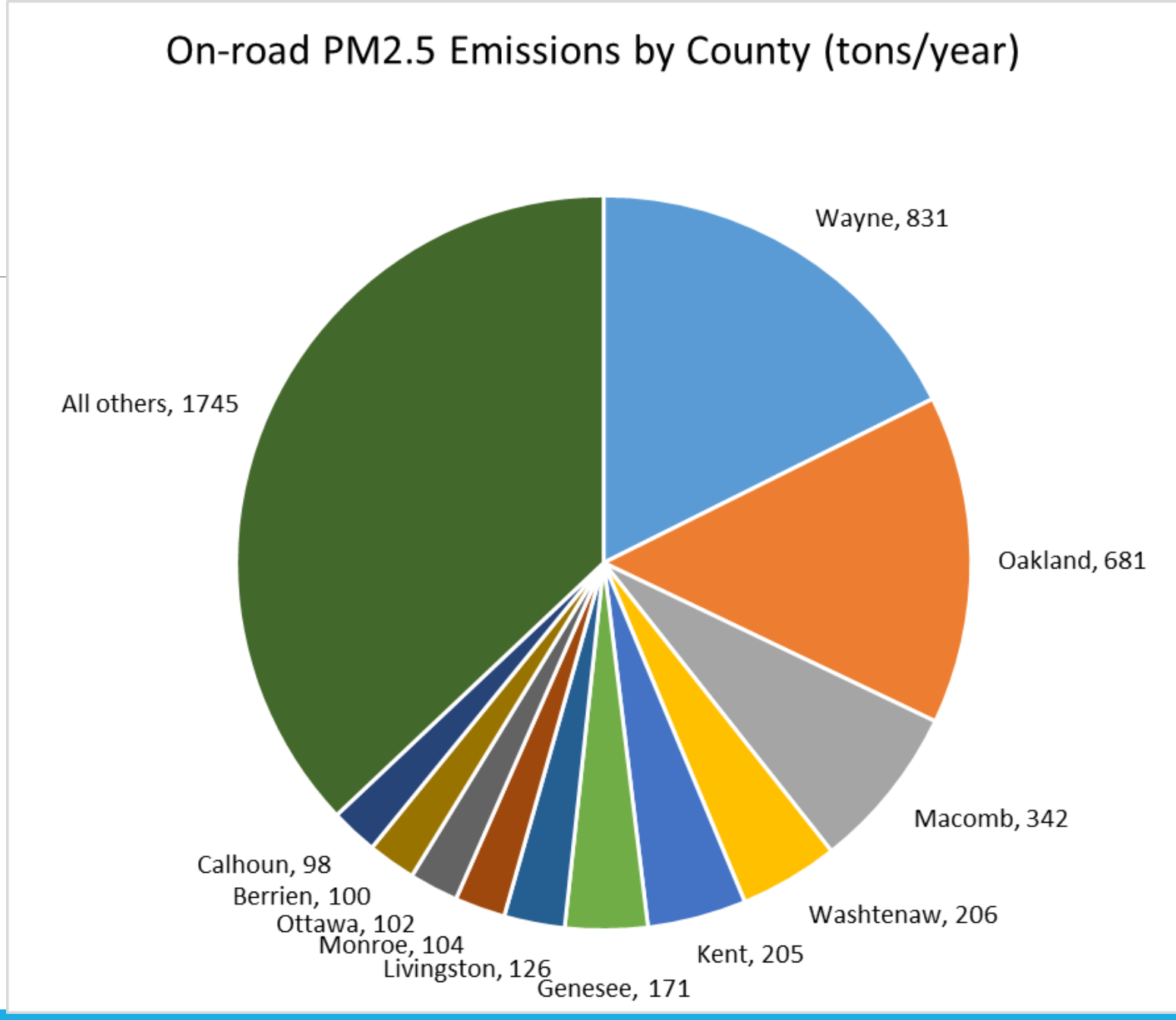
Why are controls on mobile sources important?

Table 5-9. On-road mobile source emission estimates by county. From NEI 2011. % of total emissions shows fraction of total emission in the NEI inventory for the 7-county area.

	Emissions (tons/year)								
Pollutant	Lenawee	Livingston	Macomb	Monroe	Oakland	Washtenaw	Wayne	Total	% of Total Emissions
PM2.5	109	150	458	128	875	259	1,098	3,077	14.6
PM10	164	279	839	239	1,615	481	2,035	5,651	8.3
SO2	9	21	64	18	124	37	156	430	0.4
CO	12,844	18,001	61,955	15,087	107,527	29,608	129,647	374,668	56.5
Nox	2,659	4,062	12,634	3,476	23,694	6,956	29,767	83,248	50.1
VOC	1,493	1,819	6,665	1,514	11,095	2,953	13,193	38,732	26.7

Wayne County has higher **on-road** emissions than any other county in Michigan.

For $PM_{2.5}$, this is 831 tons/year, 18% of state total (2121 tons/year), based on 2014 NEI.



Non-road emissions are also important, making up an average of 37% of all mobile source $PM_{2.5}$ emissions.

Diesel emissions make up about 57% of the total exhaust-related $PM_{2.5}$ emissions.

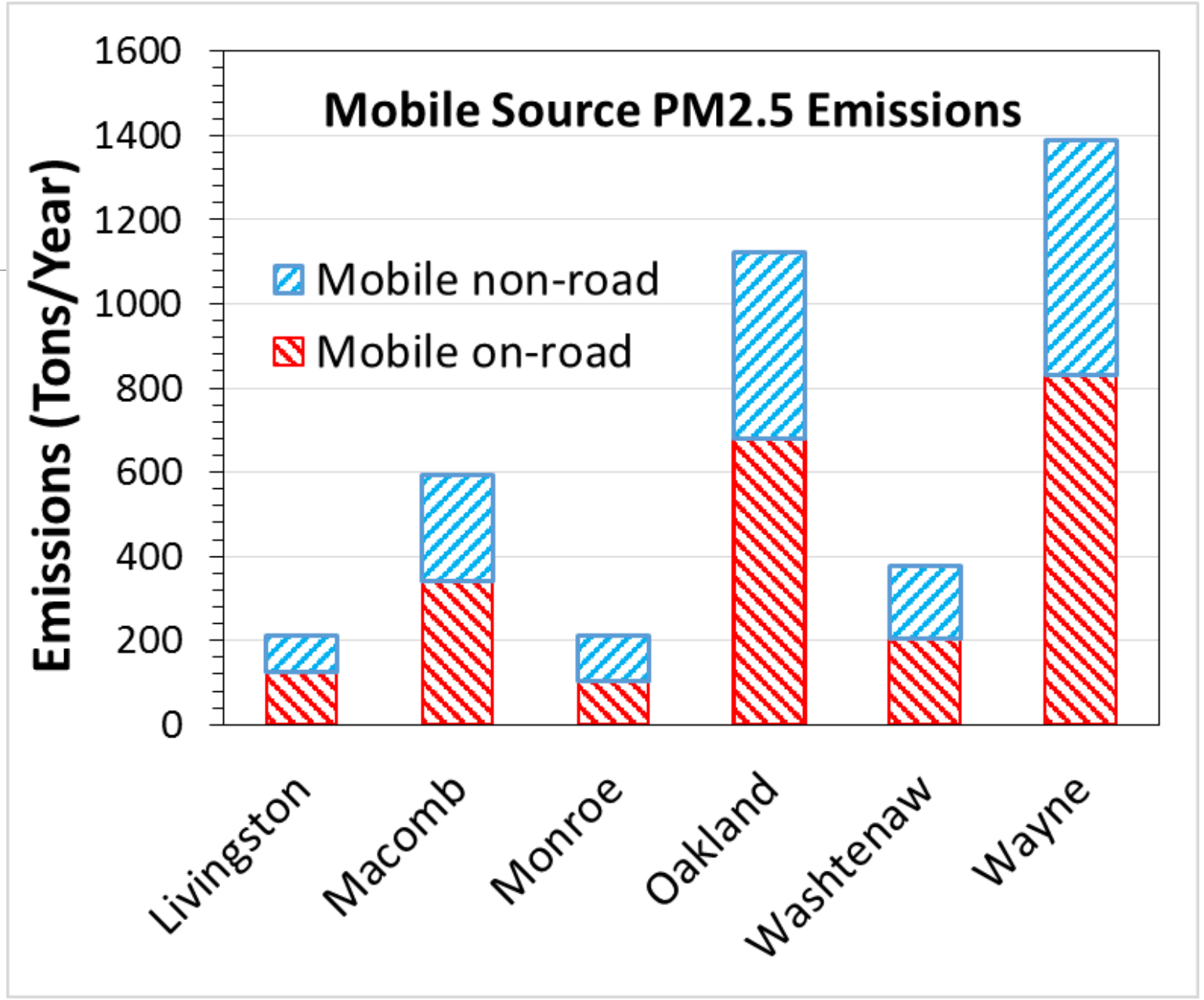
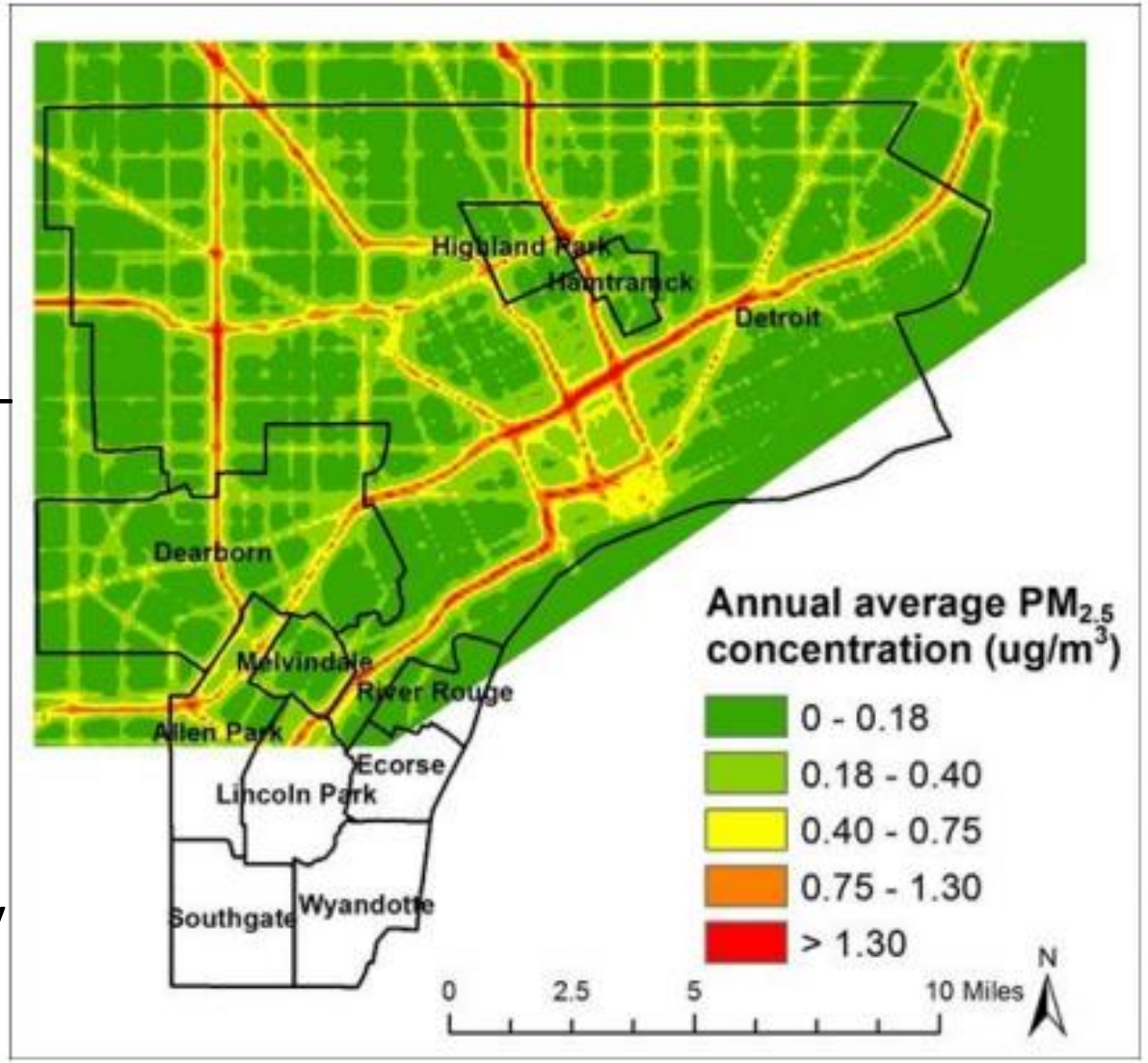


Figure 5-8. Annual $PM_{2.5}$ concentrations predicted in the Detroit area due to on-road mobile source exhaust emissions for the 25 m raster based on interpolating the 150 m receptor grid



On-road and diesel sources make up from 15-30% of $PM_{2.5}$ concentrations.

Mobile emissions of VOCs and NO_x emissions are key precursors of ozone.

Estimates of health impacts in Detroit from $PM_{2.5}$ from all sources and from mobile sources in Detroit

Table 5-13. Summary of health impacts (per year) associated with $PM_{2.5}$ exposures from all sources and exposure from exhaust emissions from mobile sources in Detroit.

Outcome (age group)	Impacts attributable to $PM_{2.5}$ exposures from all sources (per year)	Impacts attributable to $PM_{2.5}$ emissions from mobile sources (per year)
All-cause mortality (>29)	554	11
Infant mortality (0-1)	7	0
Asthma hospitalization (<65)	107	2
COPD hospitalization (>65)	21	0
CVD hospitalization (>65)	130	2
Pneumonia hospitalization (>65)	58	1
Non-fatal heart attack (18+)	25	1
Asthma ED visit (0-17)	374	11
Asthma exacerbation (as cough, 6-14)	224,799	4,311
Asthma exacerbation (as wheeze, 6-14)	18,003	423
Asthma exacerbation (as SOB, 6-14)	22,833	333
Minor restricted activity day (18-64)	365,937	7,238
Work loss day (18-64)	64,441	1,252
DALYs	10,367	209
Monetized impacts (million 2010$)	5,449	106

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Break out groups

- Idling Controls
- Clean Fuels
- Retrofitting
- Transportation Control Measures

Mobile Source Recommendations: Idling Controls

1) Increase awareness of existing anti-idling efforts through an education and outreach campaign.
2) Increase enforcement of the existing anti-idling ordinance.
3) Encourage and incentivize trucking, delivery, and bus companies and their drivers to minimize idling.

Applies to on-road and non-road vehicles and equipment

Mobile Source Recommendations: Clean Fuels

1) Increase use of the clean fuels best suited for Detroit and Michigan. This recommendation has three elements:
   a) Increase use of clean fuels in vehicles (e.g., cars, buses, trucks, ships), construction equipment, and industry (e.g., pumps, generators, cranes);
   b) Convert transit vehicles operated by DDOT, SMART, QLINE, and schools to clean fuels;
   c) Improve the electric vehicle and clean fuels infrastructure (e.g., installing charging stations, and CNG stations).

2) Increase local production of second generation clean fuels, particularly advanced biofuels and biodiesel from waste oil.

Mobile Source Recommendations: Types of clean fuels and trade-offs

Ethanol is the most widely used clean fuel, E10 and E15 (10 and 15% blends with gasoline), mostly made from corn. Cellulosic feedstocks preferred, not generally used, but research is being conducted to lower its costs and improve its energy efficiency.

Biodiesel is a commonly used (e.g., B20). Most is made from soybean oil, though other feedstocks (e.g., used cooking oil and animal fats) are used.

Hydrogen is used in fuel cells, but little infrastructure and high costs.

Propane is used in a range of vehicles, and existing gasoline-powered vehicles can be retrofitted to run on propane. Can be cheaper than gas.

Natural gas as compressed natural gas (CNG) and liquefied natural gas (LNG) is generally cleaner than gasoline or diesel alternatives and often cheaper. Source of gas is now fracking.

Electricity can power *hybrid electric vehicles* (Toyota Prius), *plug-in hybrid electric vehicles* (Chevrolet Volt) and *all-electric vehicles* (Nissan Leaf). Grid electricity must be clean.

Mobile Source Recommendations: Retrofitting

1) Expand diesel retrofit programs, and fleet and engine replacements

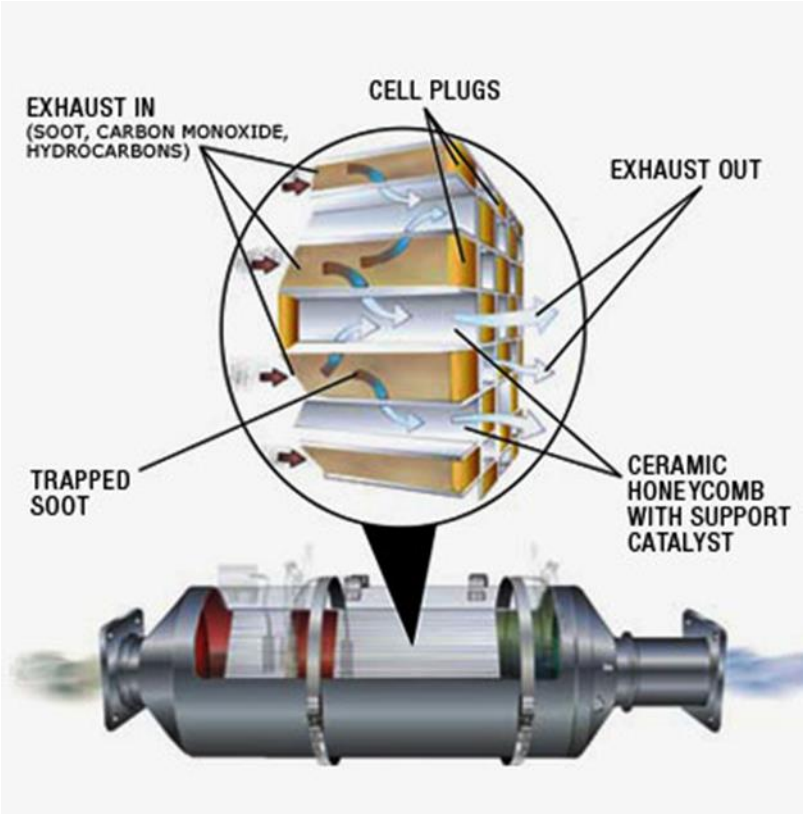


Figure 7.1-1: Diesel particulate filter (DPF) with catalyst. Exhaust flows through tiny pores that remove particles. Taken from: https://www.demanddetroit.com/parts-service/parts/emissions.aspx

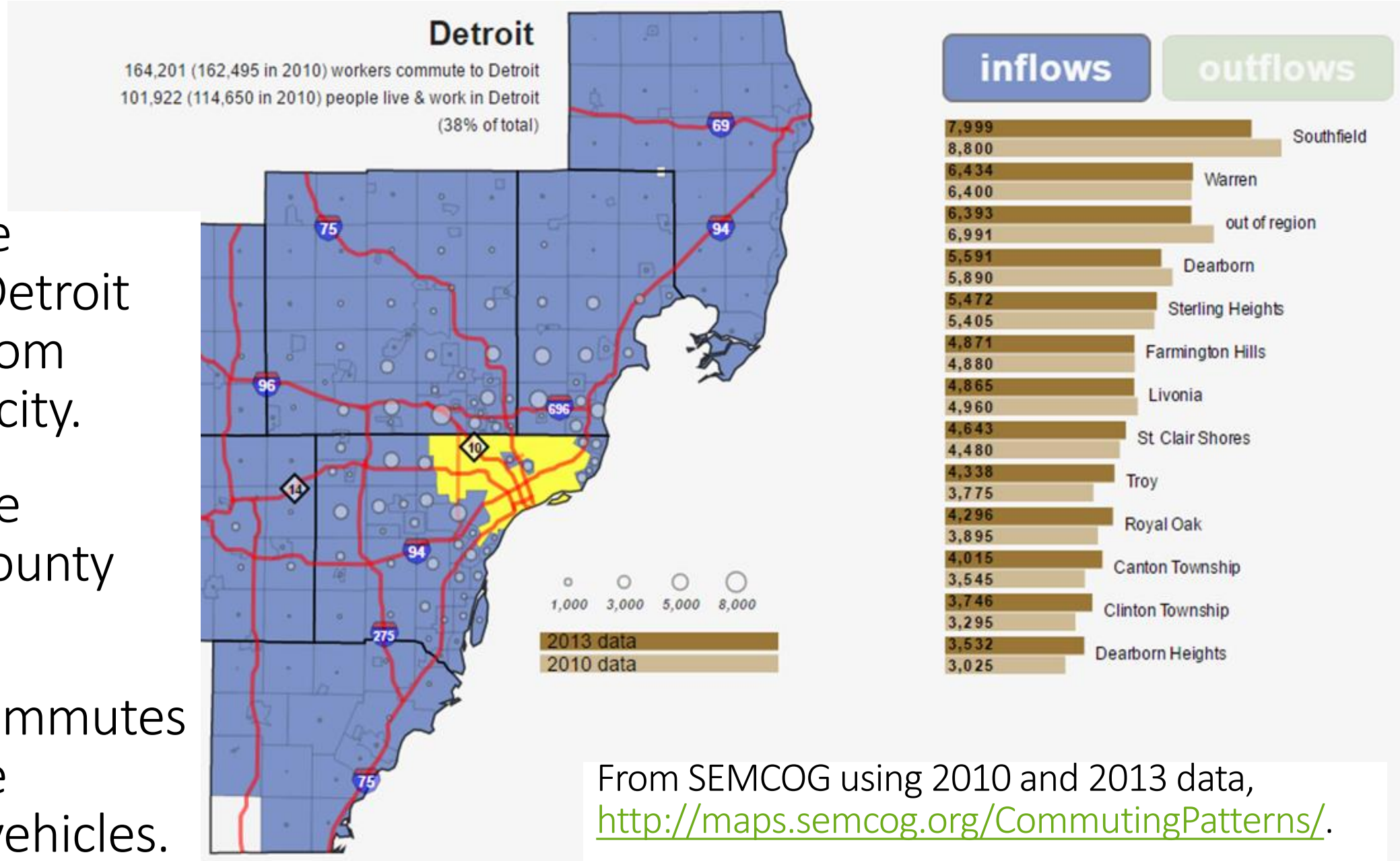
Mobile Source Recommendations: Transportation Control Measures (TCMs)

1) Increase public transit ridership by improving regional transit systems and incentivizing their use across southeast Michigan
2) Encourage higher vehicle occupancy, increase existing road capacity, and improve traffic flow
3) Encourage active transit (walking and cycling) and mixed-use ("20-minute") neighborhoods by improving planning and the built environment

Most people working in Detroit commute from outside the city.

Considerable county-to-county commuting.

Nearly all commutes are by single occupancy vehicles.



From SEMCOG using 2010 and 2013 data, http://maps.semcog.org/CommutingPatterns/.