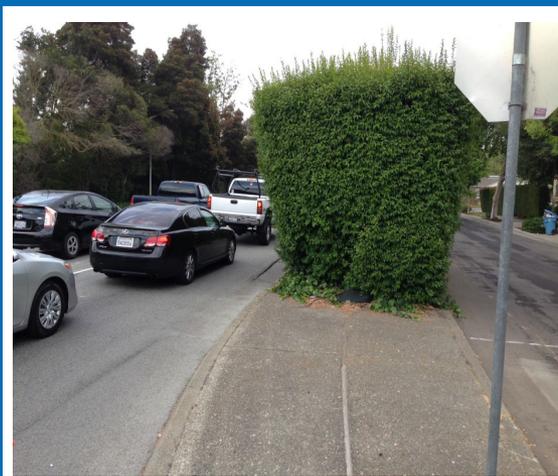


# Mobile and sensor measurements to assess community impacts and mitigation strategies for transportation sources

*NAAMC Annual Conference*

*August 24, 2022*



# Overview

- Introduction
  - Overall Research Approach
  - Implementation Process
- Research Programs
  - Resources and Capabilities
  - Example Projects
  - Example Results
- Example Resources and Guides

# Introduction

- Transportation sources significantly impact air quality, climate, and human health in urban and rural areas
- Combining multiple ambient measurement techniques can provide useful insights on traffic-related emissions, air quality, exposures, and health effects
- This research also addresses broader scientific questions and community planning issues, including:
  - What are the magnitude and extent of emissions impacts from transportation vehicles and facilities?
  - What mitigation can reduce/eliminate public health concerns related to traffic emission exposures?
  - How can we design more sustainable transportation systems?
  - How can we promote more healthy, livable communities?

# Near-Road Health Concerns

Health outcomes associated with traffic-related air pollution

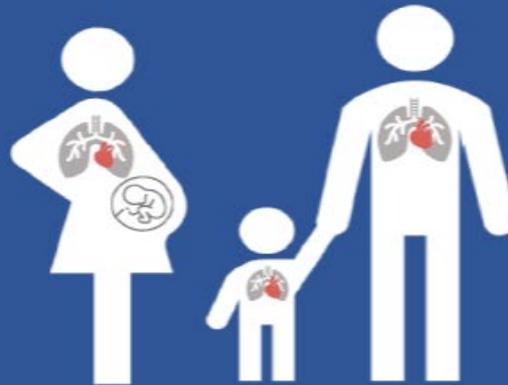


**Birth outcomes:**

- Term low birth weight ●
- Small for gestational age ●

**In Children:**

- Asthma onset ●
- Acute lower respiratory infections ●
- Asthma ever ●
- Active asthma ●



**In Adults:**

- All-cause mortality
- Circulatory mortality
- Ischemic heart disease mortality
- Lung cancer mortality
- Asthma onset
- Respiratory mortality
- Ischemic heart disease events
- Diabetes



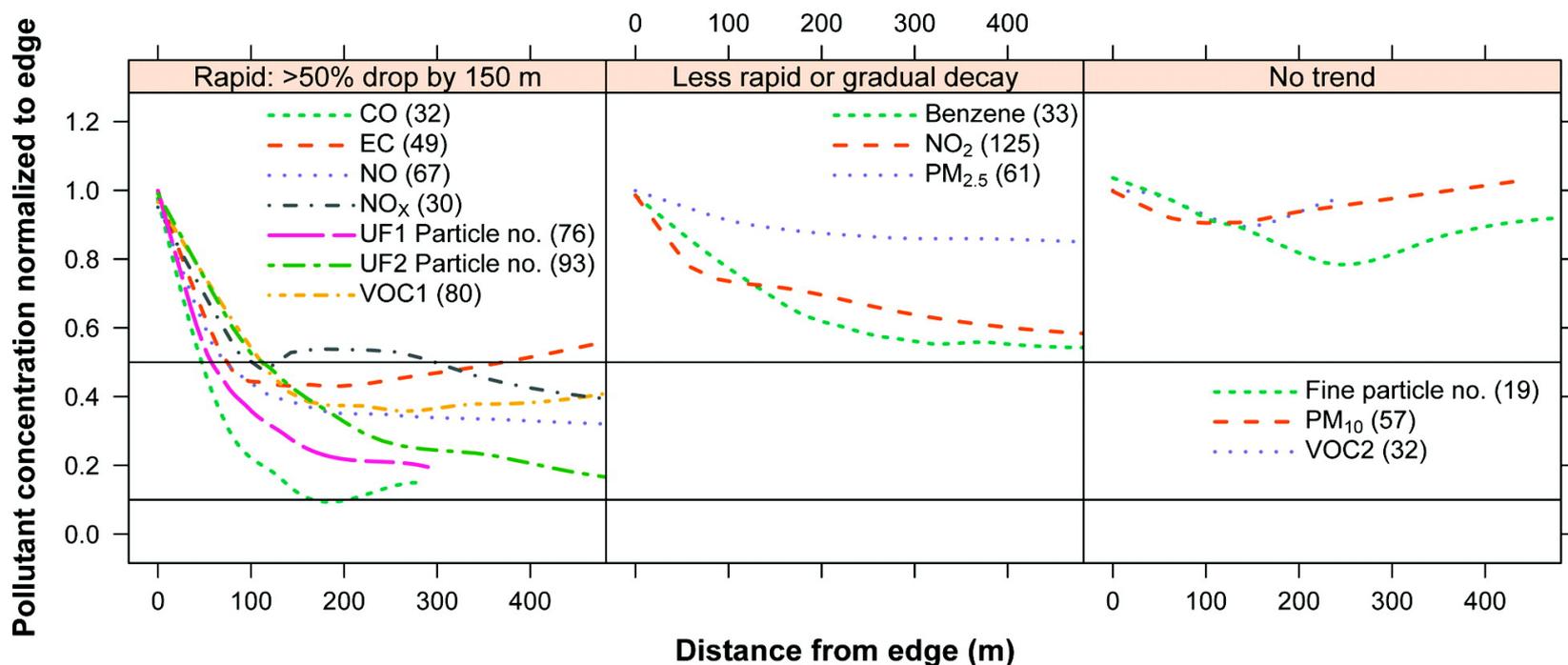
Overall confidence in the evidence for an association with long-term exposure to traffic-related air pollution:

- high
- moderate to high
- moderate

**People living, working and going to school near highways and large transportation facilities face increased health risks**

# Health Concerns from Transport

Air pollution and exposures are often highly elevated near large transportation sources, especially within first 200-300 meters

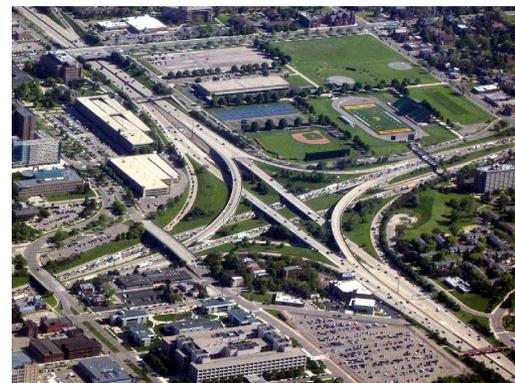


# Health Concerns from Transport

**Large portion of global population is exposed to traffic emissions near roads.**

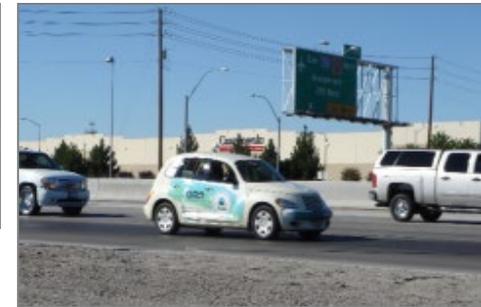
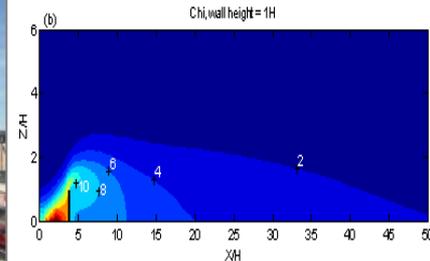
## **In the U.S.:**

- Over 50 million people estimated to live within 100 meters of a large highway or other transport facility (e.g., airport, rail yard)
- Almost 17,000 schools in the U.S. are estimated to be within 250 meters of a heavily-traveled road



# Air Quality and Exposure

- Field measurements of traffic, meteorology and air quality
  - Fixed samplers
  - Mobile monitoring
  - Reference and sensor instruments
- Wind tunnel assessments
  - General road configurations
  - Simulations of field sites
- Modeling assessments
  - Computational Fluid Dynamics (CFD)
  - Research dispersion model (R-LINE)
  - EPA regulatory emissions (MOVES) and dispersion (AERMOD) models
  - EPA mapping software (e.g., EnviroAtlas)



# Fixed Measurements

## Priority Fixed Measurements

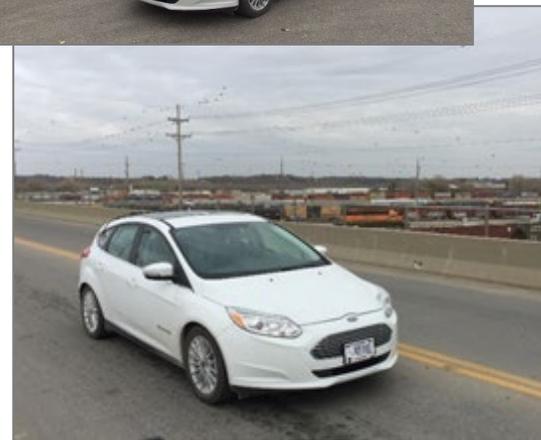
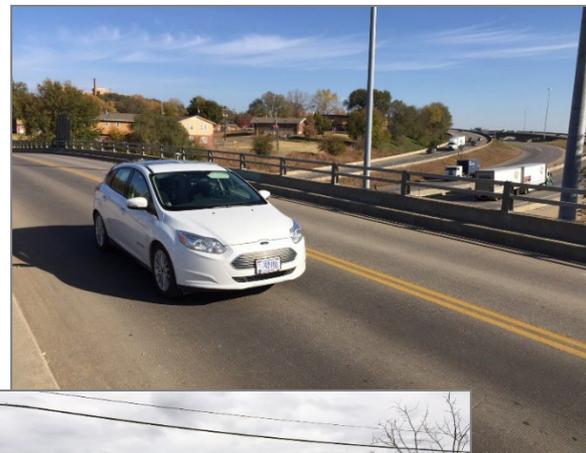
- Particulate Matter (PM<sub>2.5</sub>)
- Ultrafine Particles (UFP)
- Black Carbon (BC)
- Oxides of Nitrogen (NO/NO<sub>2</sub>)
- Carbon Monoxide (CO)
- Carbon Dioxide (CO<sub>2</sub>)
- Met Data
  - Barometric Pressure
  - Relative Humidity
  - Temperature
  - Wind Speed
  - Wind Direction



# Mobile Measurements

## Priority Mobile Measurements

- Particulate Matter (PM<sub>2.5</sub>)
- Ultrafine Particles (UFP)
- Black Carbon (BC)
- Nitrogen Dioxide (NO<sub>2</sub>)
- Carbon Dioxide (CO<sub>2</sub>)
- GPS
- Video
- Met Data (remote)
  - Wind Speed
  - Wind Direction

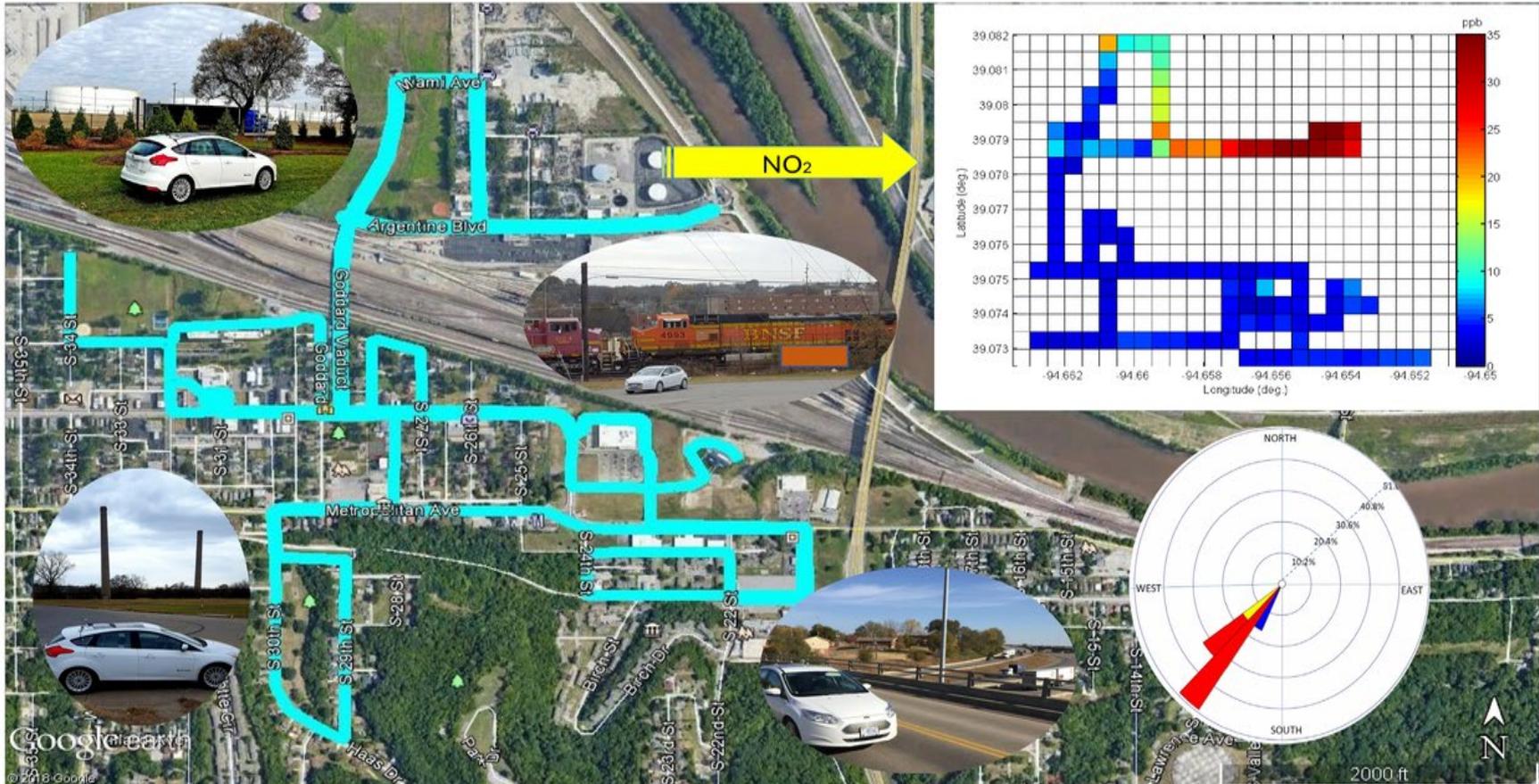


# Recent Projects

- Characterize air quality and exposures **near major transportation facilities**
  - Highways
  - Railyards
  - Ports
- Investigate associations among near-road **air quality and adverse health effects**
- Determine the effectiveness of **mitigation** strategies
  - Emission standards
  - Reduced vehicle activity
  - Roadway and Urban Design (including sound walls and roadside vegetation)



# Source Impacts on Community Air Quality

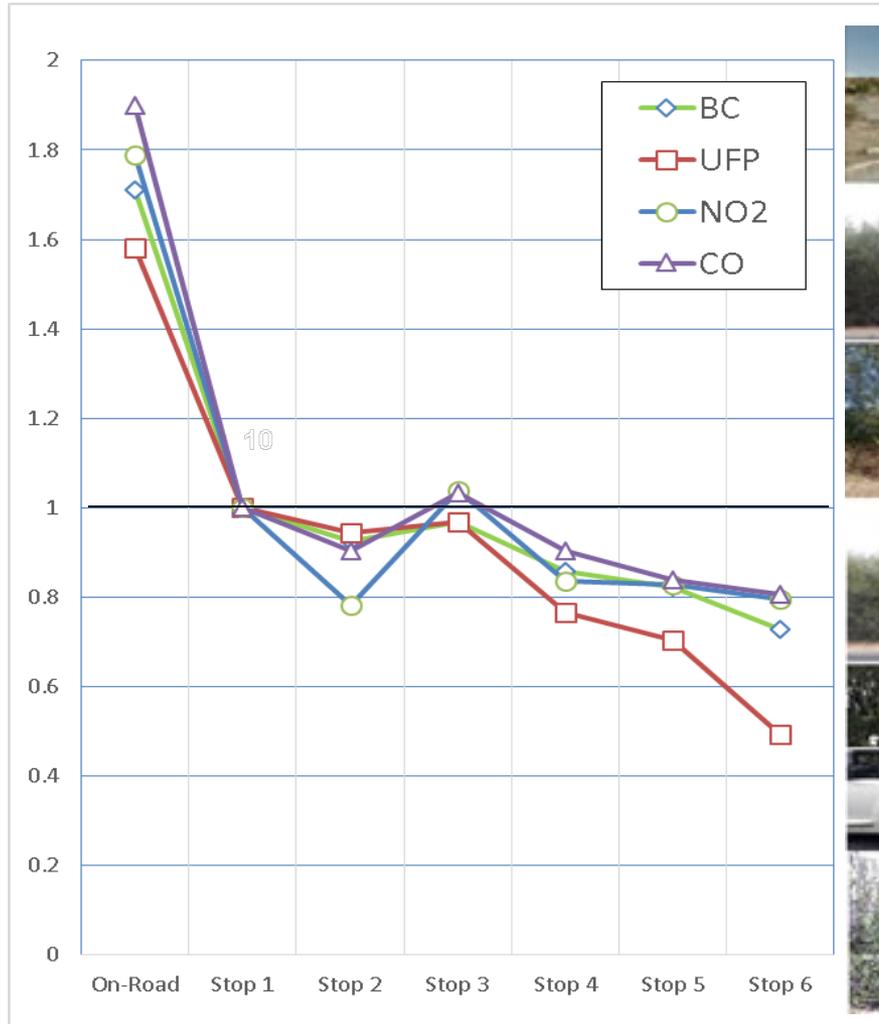


Mobile monitoring used to identify impacts from railyard, highways, and industrial sources

# Roadside Vegetation Effects

## Plant conditions affect downwind pollution

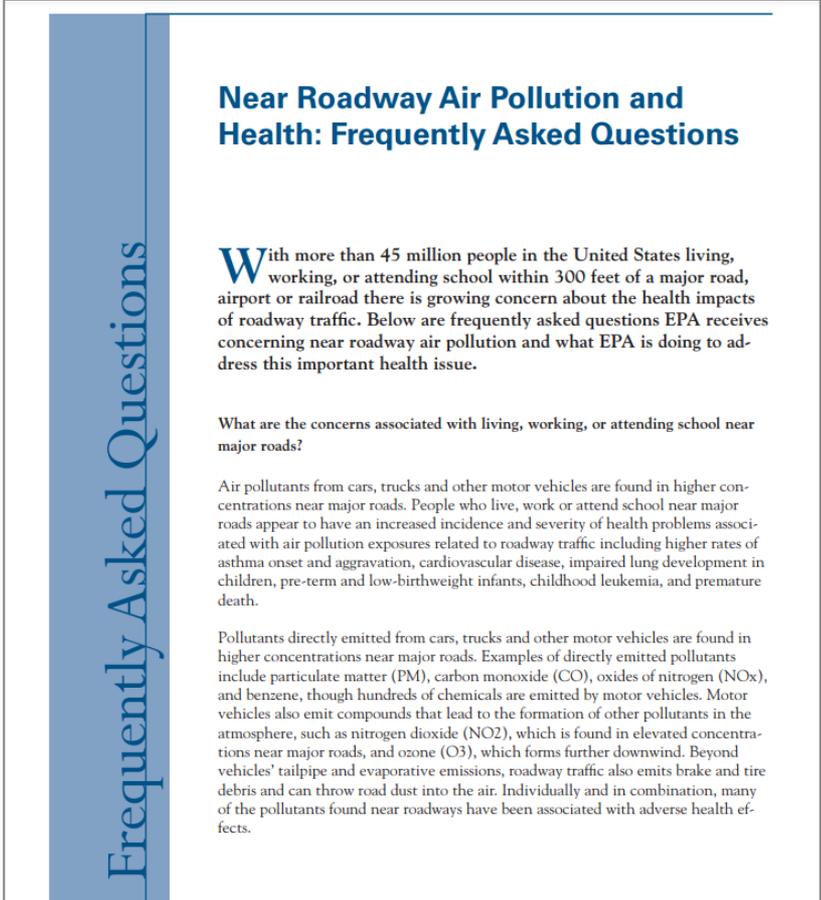
- Thick, tall and full coverage reduced pollution
- Gaps and porous vegetation led to higher levels



# Resources and Guides

# Near-Road Q&A Web Page

- EPA Office of Transportation and Air Quality maintains a Q&A document on near-road issues related to:
  - Emissions
  - Air Quality
  - Exposure
  - Adverse Health Effects
- In the form of “Frequently Asked Questions”
- Links to research and outreach materials
- Discuss roadside features



**Near Roadway Air Pollution and Health: Frequently Asked Questions**

**Frequently Asked Questions**

With more than 45 million people in the United States living, working, or attending school within 300 feet of a major road, airport or railroad there is growing concern about the health impacts of roadway traffic. Below are frequently asked questions EPA receives concerning near roadway air pollution and what EPA is doing to address this important health issue.

What are the concerns associated with living, working, or attending school near major roads?

Air pollutants from cars, trucks and other motor vehicles are found in higher concentrations near major roads. People who live, work or attend school near major roads appear to have an increased incidence and severity of health problems associated with air pollution exposures related to roadway traffic including higher rates of asthma onset and aggravation, cardiovascular disease, impaired lung development in children, pre-term and low-birthweight infants, childhood leukemia, and premature death.

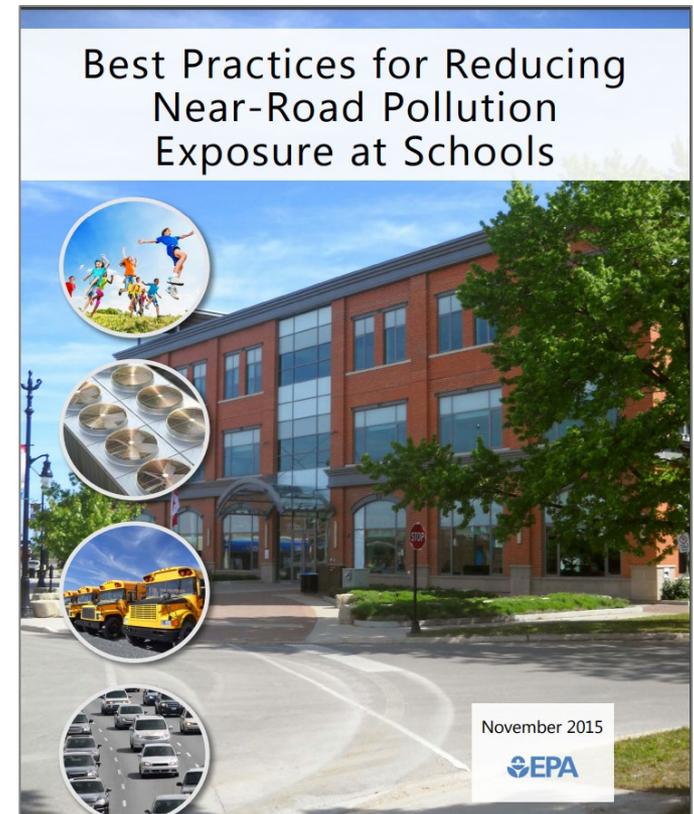
Pollutants directly emitted from cars, trucks and other motor vehicles are found in higher concentrations near major roads. Examples of directly emitted pollutants include particulate matter (PM), carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>), and benzene, though hundreds of chemicals are emitted by motor vehicles. Motor vehicles also emit compounds that lead to the formation of other pollutants in the atmosphere, such as nitrogen dioxide (NO<sub>2</sub>), which is found in elevated concentrations near major roads, and ozone (O<sub>3</sub>), which forms further downwind. Beyond vehicles' tailpipe and evaporative emissions, roadway traffic also emits brake and tire debris and can throw road dust into the air. Individually and in combination, many of the pollutants found near roadways have been associated with adverse health effects.

 United States  
Environmental Protection  
Agency

Office of Transportation and Air Quality  
EPA-420-F-14-044  
August 2014

# Best Practices for Reducing Near-Road Pollution Exposure at School

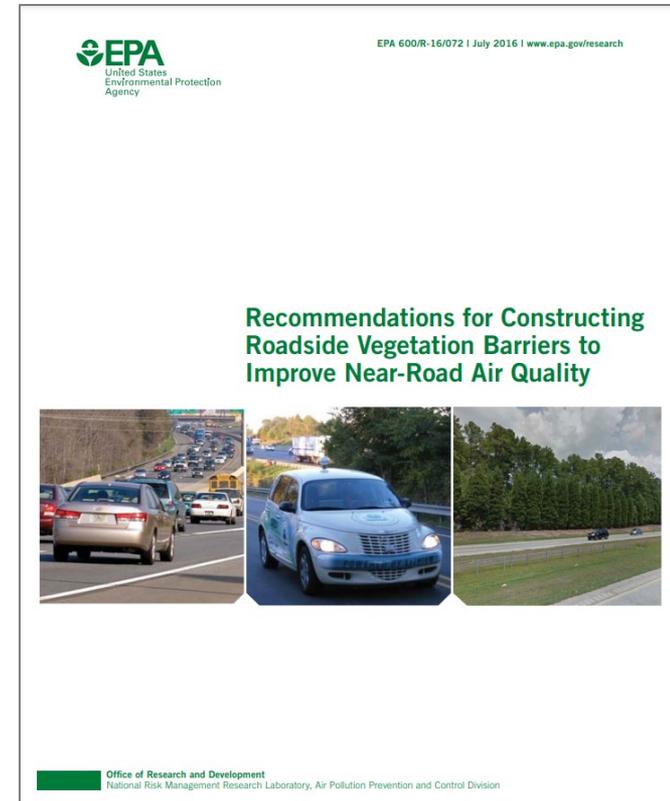
- Developed to provide practical solutions to mitigate traffic-related pollution based on issues in the School Siting Guidance
- Document for schools and parents
- Types of solutions provided:
  - Building design and operation strategies
    - Ventilation, filtration, and indoor air
    - Building occupant behavior
  - Site-related strategies
    - Transportation policies
      - Anti-idling and idle reduction policies
      - Upgrade bus fleets
      - Encourage active transport
    - Site location and design
    - Roadside barriers
      - Noise barriers
      - Vegetation



<https://www.epa.gov/schools/best-practices-reducing-near-road-pollution-exposure-schools>

# Recommendations for the Design of Roadside Features

- EPA has developed recommendations for designing and planting roadside vegetation
  - Development for implementing pilot studies in Oakland and Detroit
  - Includes vegetation alone and vegetation in combination with solid barriers
  - Maximize the potential for near-road air pollution reduction
  - Avoid unintended consequences such as increased downwind pollution concentrations due to gaps in the vegetation
- EPA is planning to develop a similar set of recommendations for solid barriers in cooperation with FHWA



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