Air Monitoring & Modeling in Denver

Environmental Quality Division
City & County of Denver
Denver dept. of Public Health & Environment
Nov 2019

DENVER PUBLIC HEALTH & ENVIRONMENT

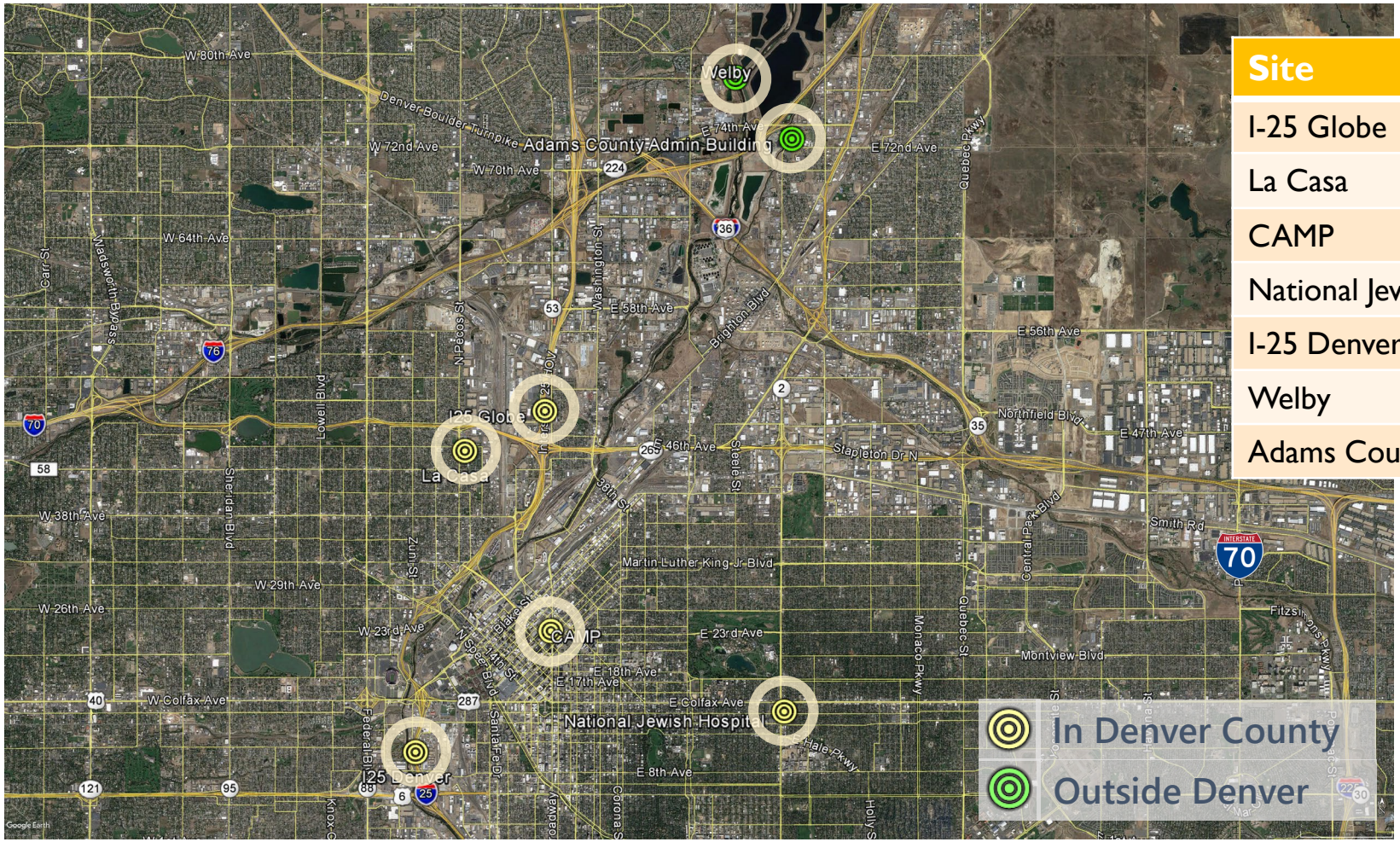
ACCREDITED HEALTH DEPARTMENT · PUBLIC HEALTH ACCREDITATION BOARD · PHAB Advancing public health performance

Overview

- Denver air monitoring locations
- Special projects and grants
- Emissions forecast
- Long term air monitoring trends
- Love My Air Denver

State Monitoring (CDPHE)

EPA funded



Site	Pollutant
I-25 Globe	NO, NO_2, PM_{10}, $PM_{2.5}$
La Casa	CO, NO, NO_2, NO_Y, O_3, PM_{10}, $PM_{2.5}$
CAMP	CO, NO, NO_2, O_3, PM_{10}, $PM_{2.5}$
National Jewish Hospital	$PM_{2.5}$
I-25 Denver	CO, NO, NO_2, PM_{10}, $PM_{2.5}$
Welby	CO, NO, NO_2, O_3, PM_{10}
Adams County Admin	PM Coarse, PM_{10}, $PM_{2.5}$

Goal: Monitoring of criteria air pollutants in the local community. These monitors are used to determine compliance with health based standards.

DENVER PUBLIC HEALTH & ENVIRONMENT

Swansea Air Monitoring Station (SAMS)

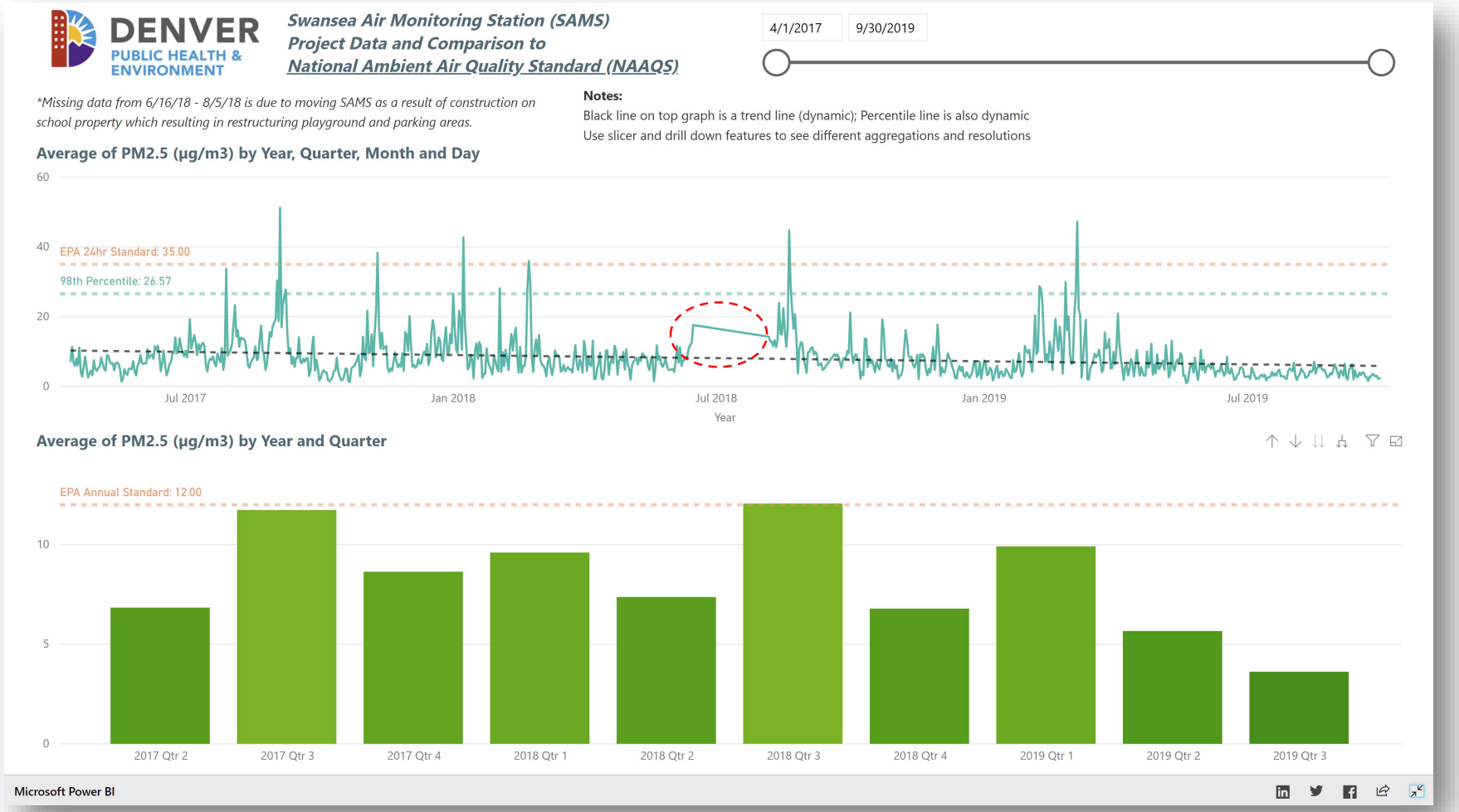
FHWA/CDOT Grant

- Goal: Develop a better understanding of ongoing cumulative air quality impacts associated with major highway construction
- Measured Pollutants:
  - CO, NOx, $PM_{2.5}$, PM_{10}, Black Carbon, VOC's
  - Frequency: Hourly for criteria pollutants
- Collaborators:
  - DDPHE
  - Colorado Department of Transportation
  - Colorado Department of Public Health and Environment
- Schedule:
  - Start: April 1, 2017
  - End: 1 year after end of construction

DENVER PUBLIC HEALTH & ENVIRONMENT

ACCREDITED HEALTH DEPARTMENT · PUBLIC HEALTH ACCREDITATION BOARD · PHAB Advancing public health performance

SAMS Data Summary (fine particulate)



- Expected seasonal variations
- Values below NAAQS
- High 24 hr values align with region wide events and not isolated to Swansea
- High PM episodes are usually in the winter.
- Low wildfire season in 2019 is evident.
- Jul 2018 site was shut down and moved during school construction

https://app.powerbigov.us/view?r=eyJrIjoiNmE0NWU4OTctZTRhMS00OGJkLWJlY2EtYTcwYTdmYTllYzEwIiwidCI6IjM5Yzg3YWIzLTY2MTItNDJjMC05NjIwLWE2OTZkMTJkZjgwMyJ9

Near Highway Air Toxics Gradient Study

EPA Grant

- Goal: Determine gradients of air toxics concentrations from highway emissions
- Measured Pollutants:
  - CO, NO_2, $PM_{2.5}$, Black Carbon, VOC's, Air Toxics (formaldehyde, acetaldehyde, acrolein, benzene, 1,3-butadiene)
  - Frequency: Hourly to 24-hr averages
- Collaborators:
  - DDPHE
  - Colorado Department of Public Health and Environment
- Schedule:
  - Three 4-6 week intensive Fall 2017 – Fall 2018
  - Continuous monitoring at SAMS throughout

DENVER PUBLIC HEALTH & ENVIRONMENT

Near Highway Air Toxics Gradient Findings

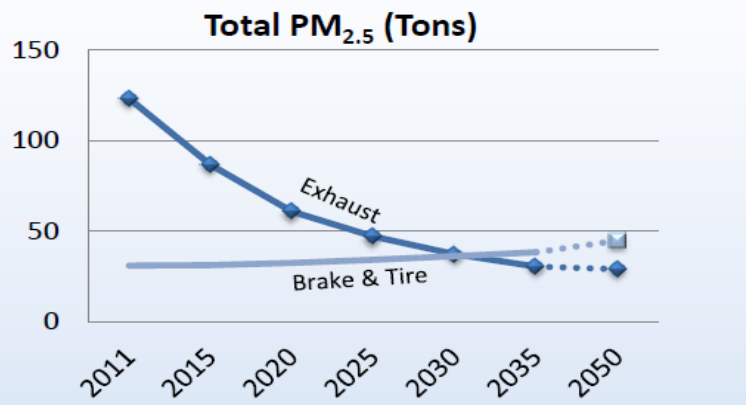
- Air pollutant concentrations 30-40% above local background levels when downwind of highway (within 500 feet).
- Over all wind directions, the concentrations were ~10-15% higher over the course of about four months of measurements.
- Similar findings in other cities/studies, though Denver gradients were not as sharp

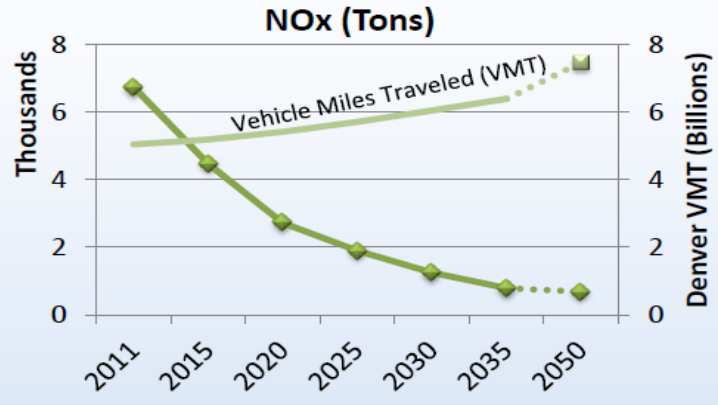
DDPHE Air Emissions Modeling Project

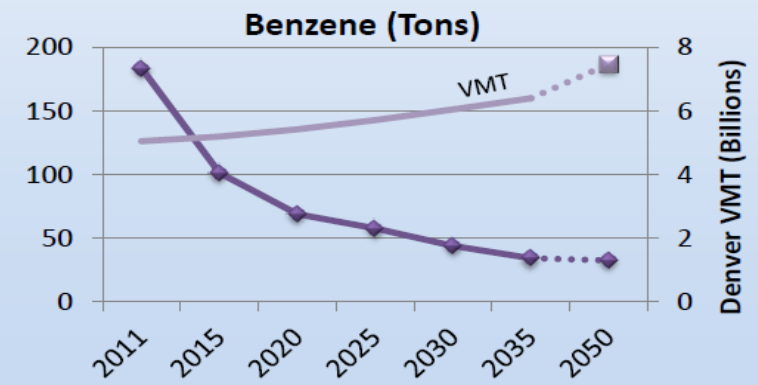
DDPHE Driven Effort

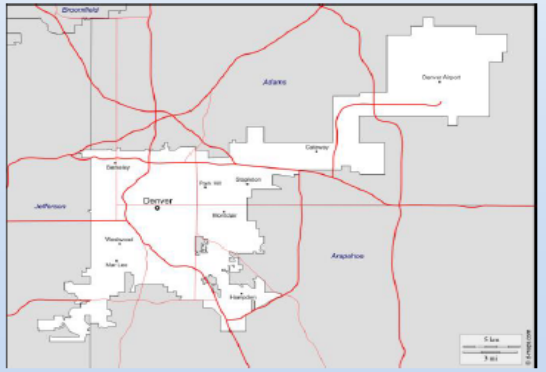
- Goal: Forecast future changes in air pollutants due to increased traffic
- Modeled Pollutants:
  - CO, NO_2, $PM_{2.5}$, Black Carbon, Benzene
  - Denver County (summer day): 2011, 2015, 2020, 2025, 2030, 2035, 2050
  - Forecast future pollutant loads
- Schedule:
  - Last updated in 2019
  - With ongoing further refinement for entire Denver region

Denver County Annual Emissions









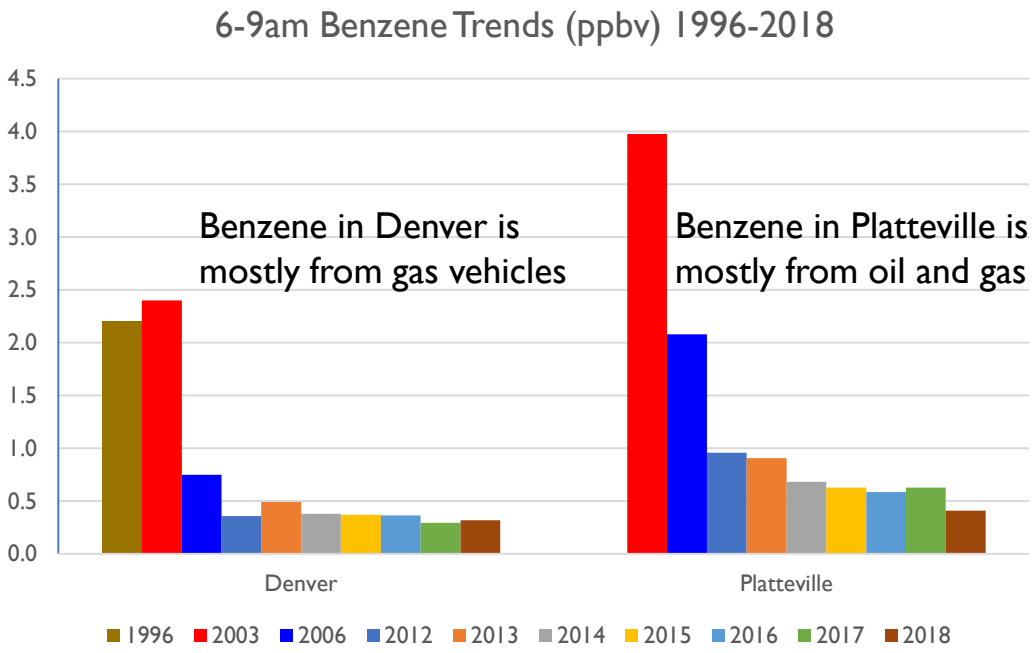
DENVER PUBLIC HEALTH & ENVIRONMENT

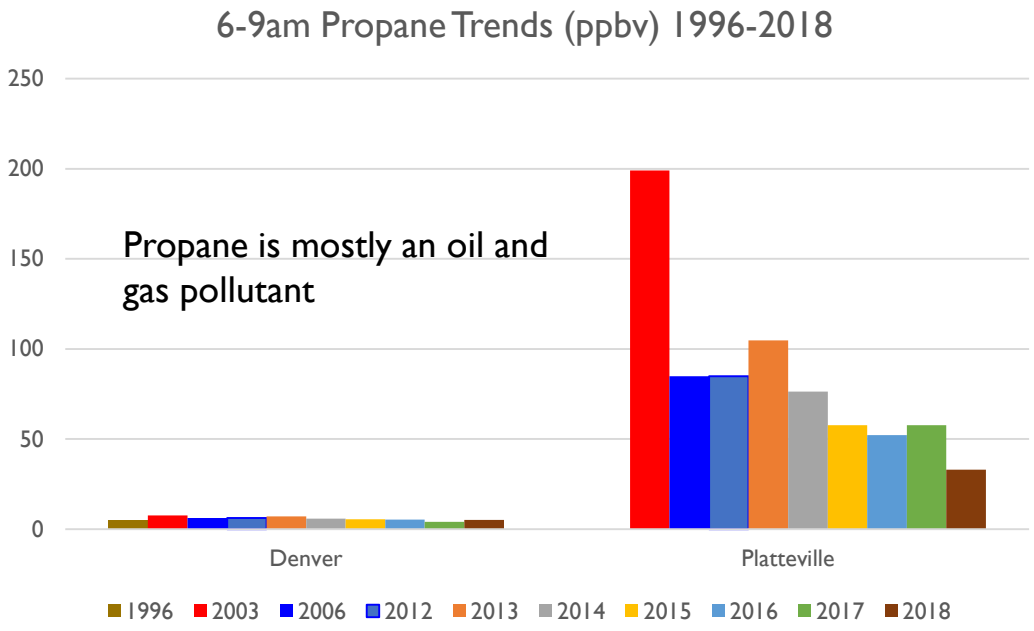
ACCREDITED HEALTH DEPARTMENT · PHAB · PUBLIC HEALTH ACCREDITATION BOARD

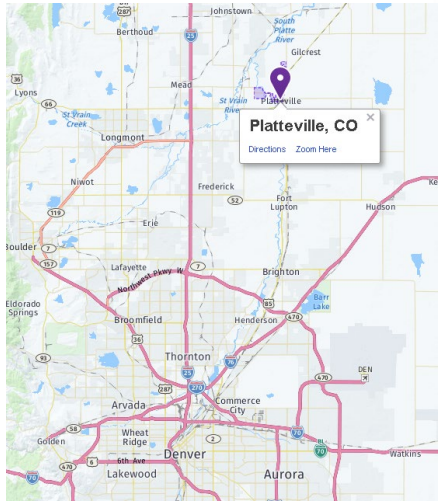
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Approved/Recommended Models by the US EPA for Transportation and Conformity

Do Modeled/Forecast Trends Match Reality?

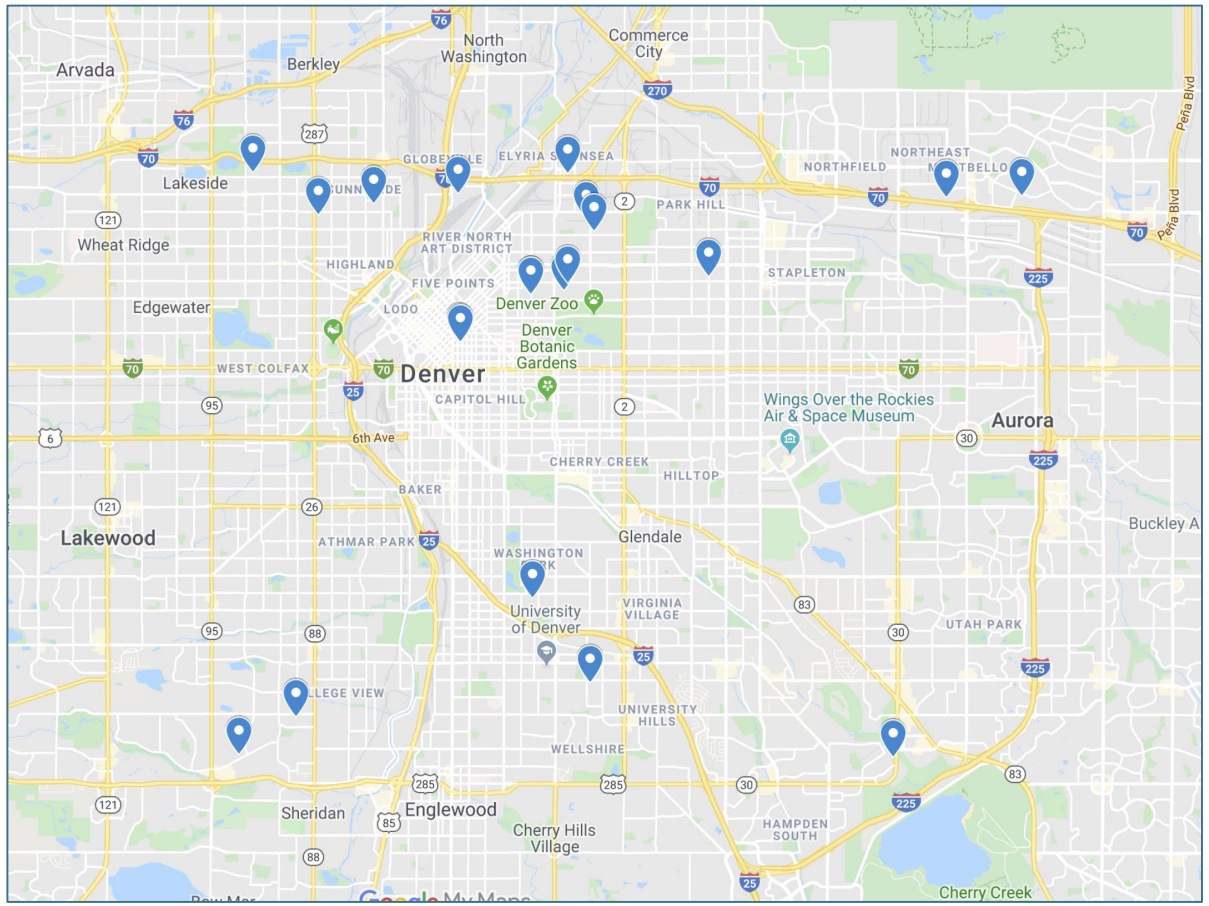






Love My Air

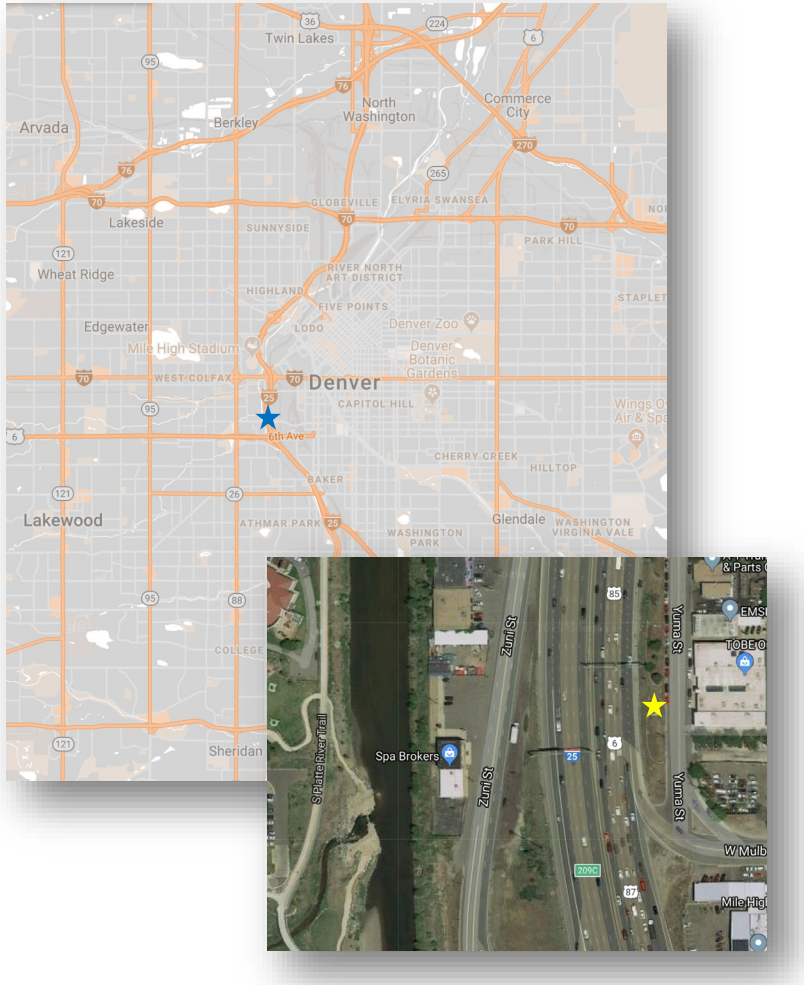
Bloomberg Mayors Challenge Grant

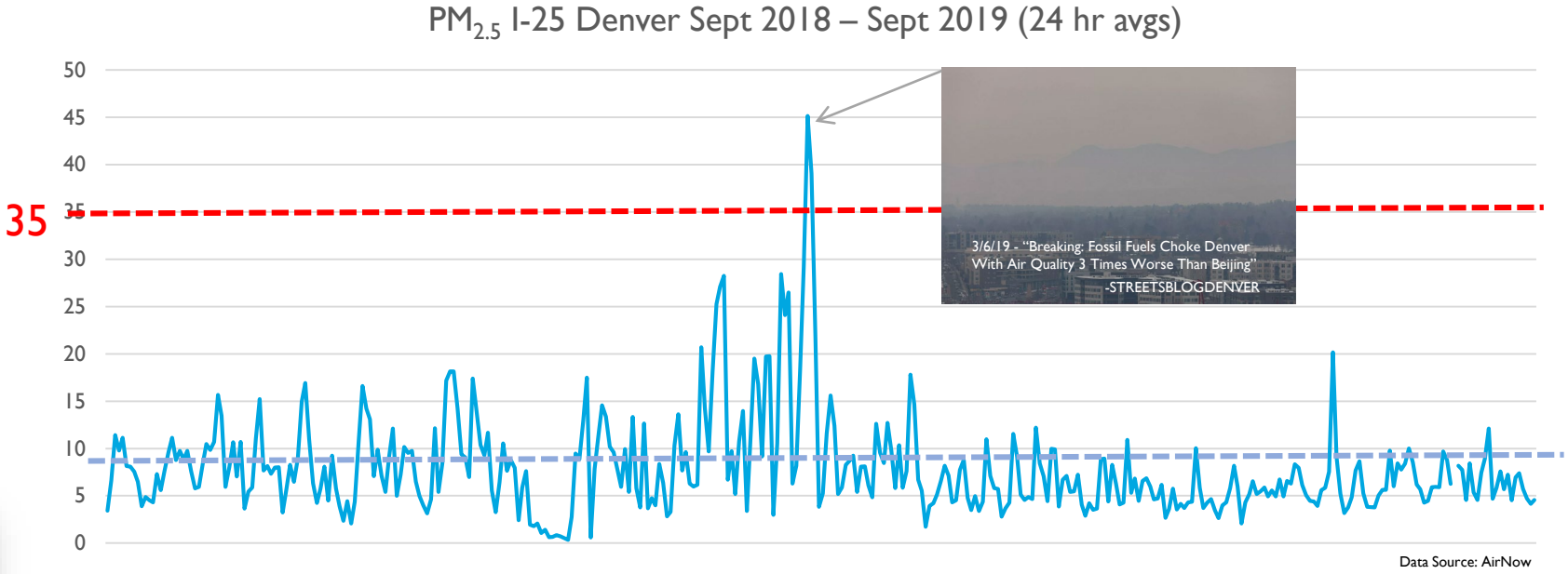


- Goal: Reduce long term health and economic impacts of air pollution on Denver's youth
- Measured Pollutants:
  - $PM_{2.5}$
- Collaborators:
  - Denver Public Schools, regional, state, and federal air agencies, university researchers, local advocacy groups
- Status:
  - Currently 10 schools with 12 more for 2019-20 school year
  - Interventions, programming, and curriculum in final stages of implementation

DENVER PUBLIC HEALTH & ENVIRONMENT

What kinds of patterns can we expect



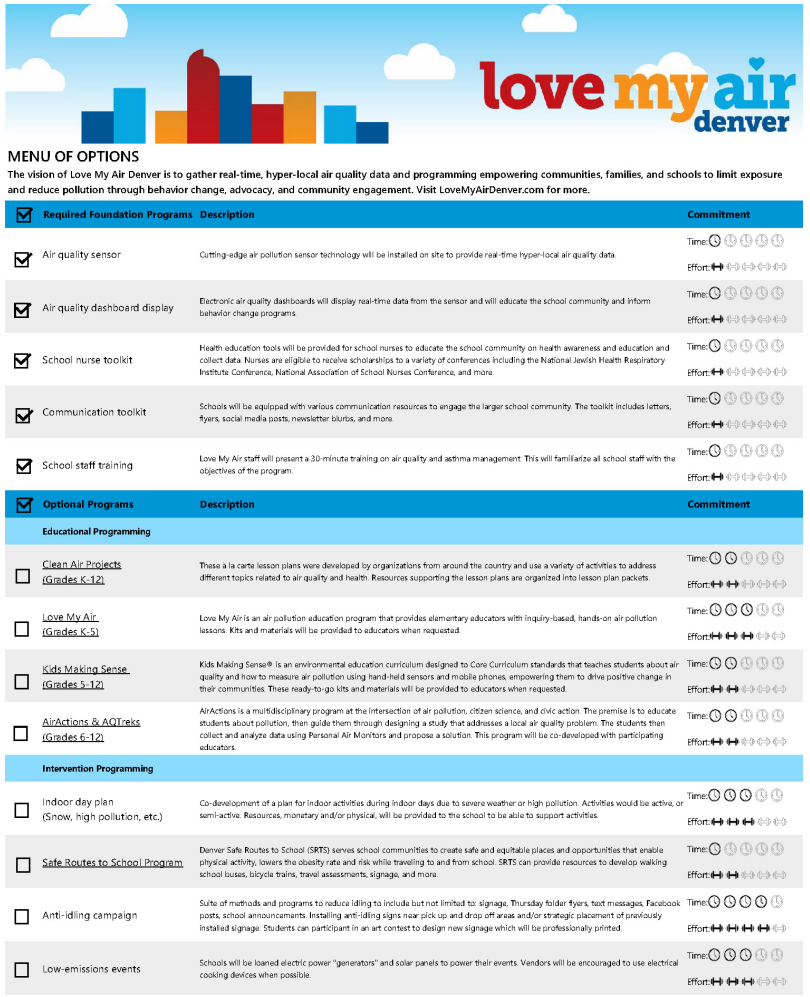


2012 78 FR 3085 15-Jan-13	Primary	PM2.5	Annual	12.0 µg/m3	Annual arithmetic mean, averaged over 3 years 2, 7
2012 78 FR 3085 15-Jan-13	Secondary	PM2.5	Annual	15.0 µg/m3	Annual arithmetic mean, averaged over 3 years 2, 7
2012 78 FR 3085 15-Jan-13	Primary and Secondary	PM2.5	24 hour	35 µg/m3	98th percentile, averaged over 3 years 6

8.1 – 12 month avg

Love My Air - Menu of Options

- Customized programming
- Developed with teachers & nurses
- Behavior-change programs
- Air quality in STEM curriculum



love my air denver

MENU OF OPTIONS

The vision of Love My Air Denver is to gather real-time, hyper-local air quality data and programming empowering communities, families, and schools to limit exposure and reduce pollution through behavior change, advocacy, and community engagement. Visit LoveMyAirDenver.com for more.

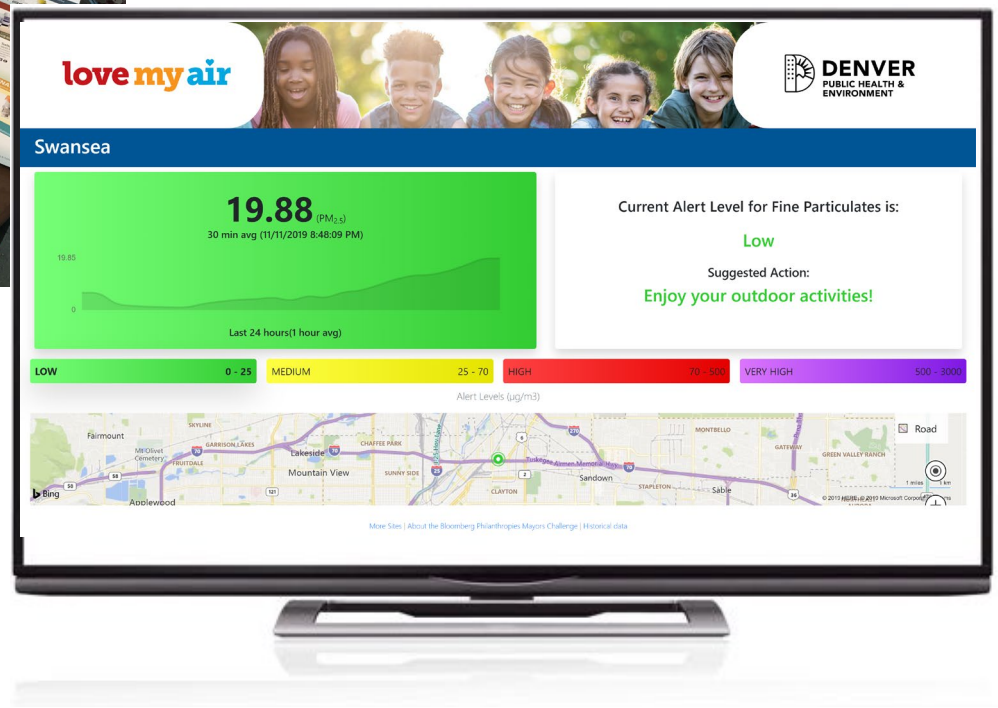
☑ Required Foundation Programs	Description	Commitment
☑ Air quality sensor	Cutting-edge air pollution sensor technology will be installed on site to provide real-time hyper-local air quality data.	Time: Effort:
☑ Air quality dashboard display	Electronic air quality dashboards will display real-time data from the sensor and will educate the school community and inform behavior change programs.	Time: Effort:
☑ School nurse toolkit	Health education tools will be provided for school nurses to educate the school community on health awareness and education and collect data. Nurses are eligible to receive scholarships to a variety of conferences including the National Jewish Health Respiratory Institute Conference, National Association of School Nurses Conference, and more.	Time: Effort:
☑ Communication toolkit	Schools will be equipped with various communication resources to engage the larger school community. The toolkit includes letters, flyers, social media posts, newsletter blurbs, and more.	Time: Effort:
☑ School staff training	Love My Air staff will present a 30-minute training on air quality and asthma management. This will familiarize all school staff with the objectives of the program.	Time: Effort:
☑ **Optional Programs**	**Description**	**Commitment**
Educational Programming		
☐ Clean Air Projects (Grades K-12)	These à la carte lesson plans were developed by organizations from around the country and use a variety of activities to address different topics related to air quality and health. Resources supporting the lesson plans are organized into lesson plan packets.	Time: Effort:
☐ Love My Air (Grades K-5)	Love My Air is an air pollution education program that provides elementary educators with inquiry-based, hands-on air pollution lessons. Kits and materials will be provided to educators when requested.	Time: Effort:
☐ Kids Making Sense (Grades 5-12)	Kids Making Sense® is an environmental education curriculum designed to Core Curriculum standards that teaches students about air quality and how to measure air pollution using hand-held sensors and mobile phones, empowering them to drive positive change in their communities. These ready-to-go kits and materials will be provided to educators when requested.	Time: Effort:
☐ AirActions & AQTreks (Grades 6-12)	AirActions is a multidisciplinary program at the intersection of air pollution, citizen science, and civic action. The premise is to educate students about pollution, then guide them through designing a study that addresses a local air quality problem. The students then collect and analyze data using Personal Air Monitors and propose a solution. This program will be co-developed with participating educators.	Time: Effort:
Intervention Programming		
☐ Indoor day plan (Snow, high pollution, etc.)	Co-development of a plan for indoor activities during indoor days due to severe weather or high pollution. Activities would be active, or semi-active. Resources, monetary and/or physical, will be provided to the school to be able to support activities.	Time: Effort:
☐ Safe Routes to School Program	Denver Safe Routes to School (SRTS) serves school communities to create safe and equitable places and opportunities that enable physical activity, lowers the obesity rate and risk while traveling to and from school. SRTS can provide resources to develop walking school buses, bicycle trains, travel assessments, signage, and more.	Time: Effort:
☐ Anti-idling campaign	Suite of methods and programs to reduce idling to include but not limited to: signage, Thursday folder flyers, text messages, Facebook posts, school announcements. Installing anti-idling signs near pick up and drop off areas and/or strategic placement of previously installed signage. Students can participant in an art contest to design new signage which will be professionally printed.	Time: Effort:
☐ Low-emissions events	Schools will be loaned electric power "generators" and solar panels to power their events. Vendors will be encouraged to use electrical cooking devices when possible.	Time: Effort:

DENVER PUBLIC HEALTH & ENVIRONMENT

ACCREDITED HEALTH DEPARTMENT · PUBLIC HEALTH ACCREDITATION BOARD · PHAB Advancing public health performance

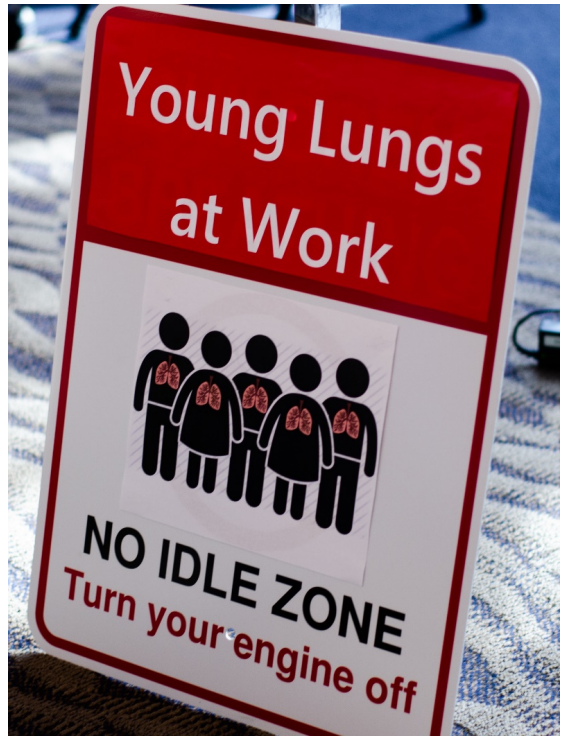
Foundational Programming

- AQ Sensor
- Dashboard
- Staff Training
- Engagement Toolkit
- Nurse Asthma Training and Toolkit



Intervention Programming

- Indoor Day Activity Plan
- Safe Routes to School Program
- Anti-Idling Campaigns and Signage
- Low Emissions Events



Innovative community engagement

- Sensor artwork
- Custom anti-idling signage
- Engaging program identity
- Storytelling
  - Pictures
  - Videos
  - Newsletters

Summary

- DDPHE has been a national leader to understand and reduce air pollution
- Over $2M dollars in grants
- Balance of federal, state, and local policies; active in all areas
- Love My Air Denver is focused on fine particulate matter at schools; asthma focus
- DDPHE is a leader when it comes to new low cost air sensors; consulting with other local govts