
Assessing Near Roadway Emissions Impact and Hot-spot Modeling

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MARAMA Transportation & Air Quality Workshop*

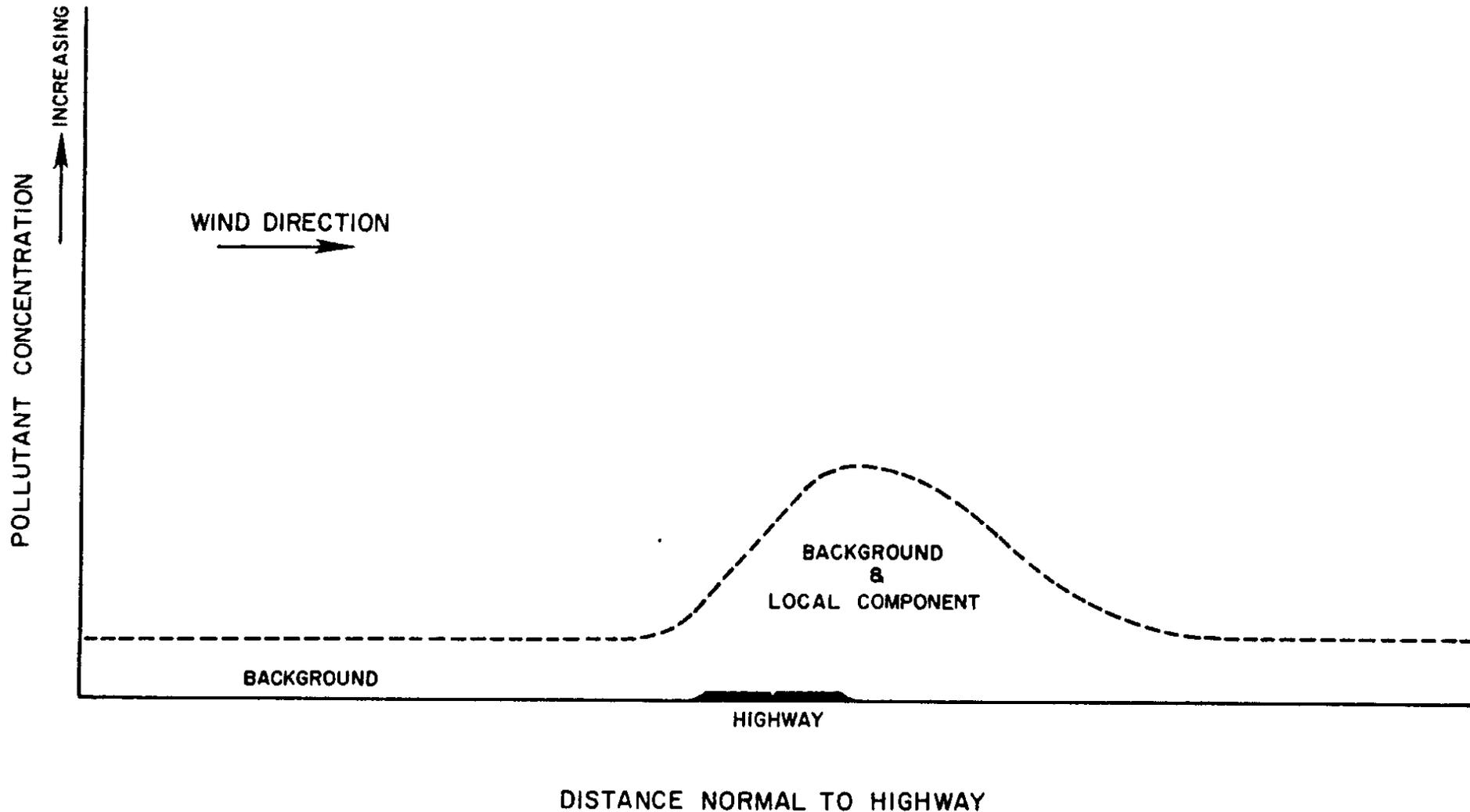
February 27, 2013

Presentation Overview

- Near roadway public health concerns
- Regulatory and voluntary programs
- EPA's modeling guidance, training, tools, and technical assistance

Public Health Concerns

Near-road Air Quality Impacts



Why are we concerned?

- Public health concerns have been raised regarding population exposures to traffic emissions near large roadways
 - » Adverse health effects for people living, working, and going to school near large roadways, including
 - Asthma
 - Cardiovascular effects
 - Birth and developmental effects
 - Premature mortality
 - » Often highly elevated pollutant concentrations measured
 - » Potentially large population exposed
 - EPA estimates >45 million people in the US live within 100 meters of a major road or transportation facility (from American Housing Survey)
 - Approximately 2 million school children attend classes within 200 meters of a large highway
 - On average, Americans spend >1 hour per day traveling

Why are we concerned?

- Strong international consensus on elevated health risks for near-road populations
 - » Numerous reviews summarized findings of hundreds of studies conducted mainly in the last decade, concluding that exposures to traffic emissions near roads are a “public health concern.”
 - Health Effects Institute (HEI)
 - Centers for Disease Control (CDC)
 - World Health Organization (WHO)
 - Academic journal review articles
 - » Several public health and medical organizations have made prominent statements regarding these elevated risks
 - CDC
 - American Academy of Pediatrics
 - American College of Cardiology
 - American Public Health Association

Programs

EPA Involvement in Near-road Programs

- Regulatory
 - » Monitoring Requirements
 - » Transportation Conformity
 - » NEPA

- Voluntary
 - » School Siting Guidelines

- Research
 - » Mitigation Measures

Background: Near-road Monitoring

- EPA has established near-road monitoring requirements in recent revisions to the NO₂, CO, and PM_{2.5} NAAQS
- For the first time, near-road air quality will be subject to the NAAQS for attainment/nonattainment designations

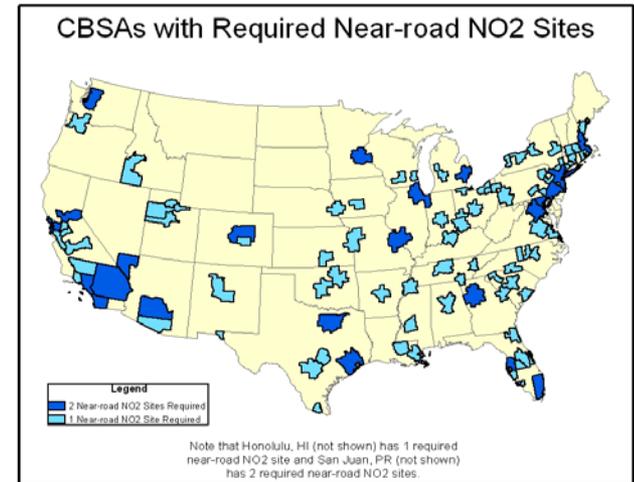
Pollutant	Averaging Time	Level	Form of Standard
Nitrogen Dioxide (NO ₂)	1-Hour	100 ppb	98 th percentile, averaged over 3 years
	Annual	53 ppb	Annual mean
Carbon Monoxide (CO)	1-Hour	35 ppm	Not to be exceeded more than once per year
	8-Hour	9 ppm	Not to be exceeded more than once per year
Particulate Matter (PM _{2.5})	24-Hour	35 µg/m ³	98 th percentile, averaged over 3 years
	Annual	12.0 µg/m ³	Annual mean, averaged over 3 years

U.S. Near-road Monitoring Requirements

- Near-road monitoring requirements:
 - » One NO₂ monitor in each urban area with >500,000 population
 - » Second near-road NO₂ monitor in each urban area with >2.5 million or a road(s) with >250,000 AADT
 - » One near-road CO and PM_{2.5} monitor collocated with NO₂ in each urban area with >1,000,000

- Monitoring to begin in 2014 and phased in over several years

- Near-road Pilot Study and Technical Assistance Document (TAD) developed by EPA found at: www.epa.gov/ttnamti1/nearroad.html



Multi-pollutant Considerations

- EPA encourages state/local agencies to conduct multi-pollutant monitoring at the near-road sites to inform research, including exposure and health studies
 - » Recommendations include:
 - PM number measurements
 - Black Carbon (or elemental carbon)
 - MSATs (e.g. BTEX, aldehydes)
 - Nitrogen Oxide (NO)
 - PM₁₀ mass
 - EC/OC
 - Carbon Dioxide (CO₂)
 - Ozone
 - Speciated PM (organics, metals including Pb)

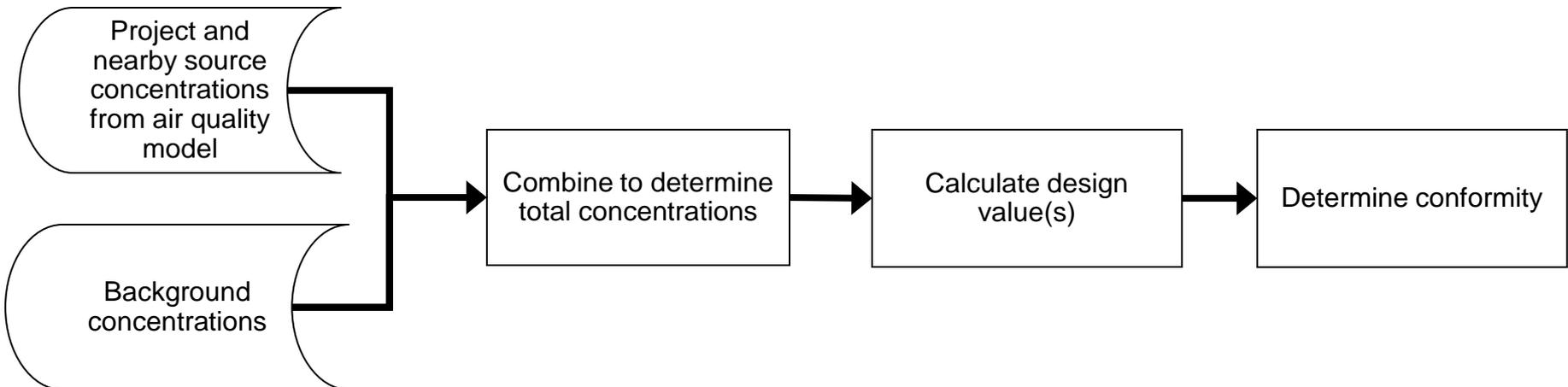
Recent PM_{2.5} NAAQS Changes

- EPA recently published revisions to the PM_{2.5} NAAQS and monitoring requirements that included:
 - » Revised primary annual PM_{2.5} NAAQS to 12.0 µg³
 - » Retained existing standards:
 - Secondary annual PM_{2.5} NAAQS of 15.0 µg³
 - Primary and secondary 24-hour PM_{2.5} NAAQS of 35 µg³
 - Primary and secondary 24-hour PM₁₀ NAAQS of 150 µg³
 - » Updated existing PM_{2.5} monitoring regulations, including possible relocations of small number of monitors to measure PM_{2.5} near heavily traveled roads in areas with populations of 1 million or more
 - Any monitor relocations will be phased over two years and not require additional monitors
 - » Designations and implementation rule in future
 - » See www.epa.gov/airquality/particlepollution/actions.html#dec12

Transportation Conformity

Hot-spot Analysis

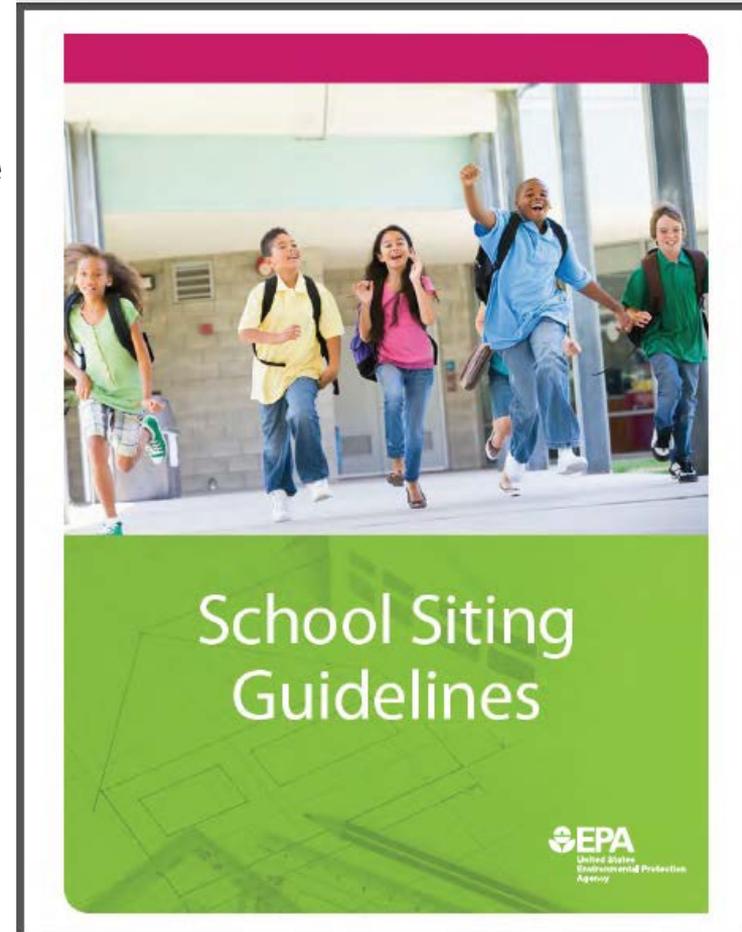
- Certain projects in PM_{2.5}, PM₁₀, and CO nonattainment and maintenance areas are required to undergo a hot-spot analysis
 - » Ensure a project does not cause new NAAQS violations, worsen existing violations, or delay timely attainment
 - » In PM areas, required only for new projects with significant increases in diesel vehicles



- Analysis and program promotes public health protection through early consideration of transportation projects that affect local-scale air quality (*more details later in presentation*)

School Siting Guidelines

- Recommendations for evaluating environmental and health issues of potential new school locations
- Near-road exposures a prominent issue
 - » Consider health concerns from elevated pollutant exposures from road, rail, port, airport emissions
 - » Evaluate exposure concerns with benefits of active commuting (walking, biking, etc.)
 - » Reference to California law (500' buffer) and other state guidance
 - » Mitigation options to consider
 - Indoor air treatment
 - Site layout
 - Buffers
 - Barriers
- See www.epa.gov/schools/siting/



EPA Research: Roadside Vegetation

- May provide a future option to mitigate air quality impacts of individual projects
- Roadside vegetation may already be present, and is often seen as a positive for other purposes
- Additional research is necessary in order to quantify air quality impacts (not yet available for official purposes)



- See www.epa.gov/nrmrl/appcd/nearroadway/

EPA Guidance, Training, Tools, and Technical Assistance

MOVES CO Project-level Guidance

- ❑ In December 2010, EPA released *Using MOVES in Project-Level Carbon Monoxide Analyses*
 - » See www.epa.gov/otaq/stateresources/transconf/policy/420b10041.pdf
- ❑ Guidance describes how to use MOVES to estimate CO emissions for:
 - » Intersections
 - » Highways
 - » Parking lots
 - » Transit projects
- ❑ Can be used for screening and refined analyses
- ❑ Updates emissions modeling portion of EPA's *1992 Guideline for Intersection Modeling*

EPA PM Hot-spot Guidance

- In December 2010, EPA also released PM hot-spot modeling guidance
 - » Developed through Agency-wide effort and stakeholder involvement
- Provides **first-of-its-kind** method for estimating air quality impacts of specific transportation projects
 - » Emissions from EPA's MOVES model
 - Input to AQ dispersion model
 - » Estimate a project's impact on air quality concentrations
- **Guidance can be used for other purposes:** NEPA, EJ reviews of projects, ports, research efforts

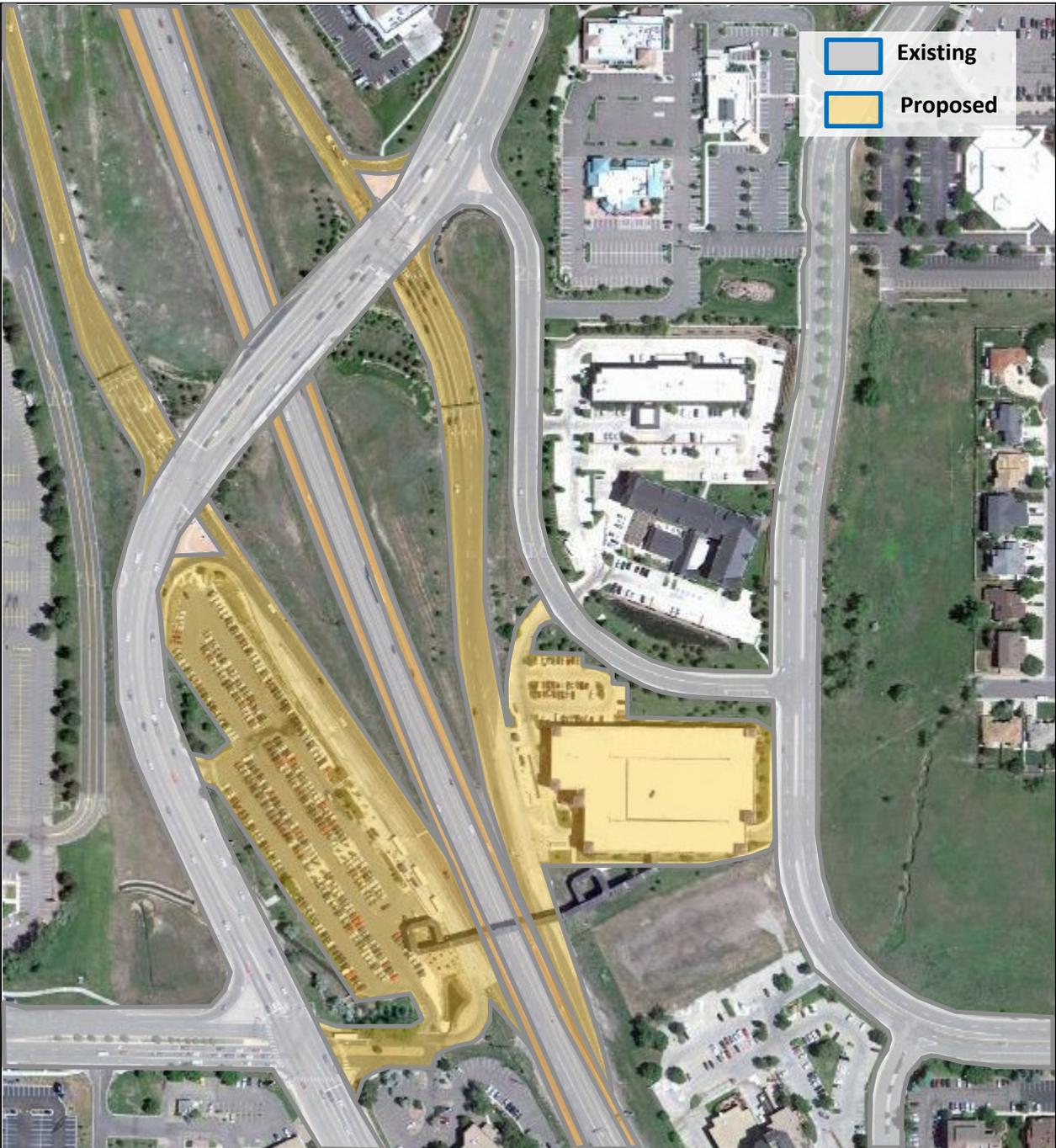


Timing

- On December 20, 2010, EPA also established a 2-year conformity grace period before MOVES required in PM and CO hot-spot analyses
- Beginning December 20, 2012, new PM hot-spot analyses must be **quantitative**
 - Previously, these analyses have been **qualitative**
- During the 2-year grace period, we have worked with DOT, EPA Regions, and stakeholders to prepare for conformity transition
 - Deadline also applies to use of MOVES in NEPA



Example of Project Needing PM Hot-spot Analysis



Relevant Models

Emissions model:

- MOVES – EPA’s official model for estimating on-road motor vehicle emissions

Air Quality models:

Type of Project	Recommended Model
Highway and intersection projects	AERMOD, CAL3QHCR
Transit, freight, and other terminal projects	AERMOD
Projects that involve both highway/intersections and terminals, and/or nearby sources	AERMOD

Model Updates

- MOVES2010b
 - » Correction to database recently released (*More on next slide*)

- AERMOD/AERMET – update released in December 2012
 - » AERMOD version dated 12345
 - » AERMET version dated 12345

- CAL3QHCR – update released in December 2012
 - » CAL3QHCR version dated 12355

- Only **approved** versions of models can be used for official purposes

Correction to MOVES2010b Database

- ❑ MOVES2010b was originally released April 2012
- ❑ Recently discovered error in MOVES2010b database
 - » Underestimates vapor venting component of evap emissions beginning in calendar year 2021
 - » Impact is small initially but grows over time
 - Less than 0.5% of total VOC emissions in 2021
 - Up to almost 6.5% of total VOC emissions in 2040
- ❑ EPA recently released a corrected MOVES2010b database
 - » New installation suite replaces 4/10/2012 database with corrected 10/30/2012 database
- ❑ Users should switch to new database as soon as possible, but if significant work has already been done with the 4/10/2012 database, that work can be completed

Ongoing and Future EPA Work

- Update EPA's PM Hot-spot Guidance to reflect:
 - » New PM NAAQS monitoring regulations
 - » EMFAC2011 (California only)

- Conduct EPA-FHWA PM Hot-spot Training
 - » 10 trainings already completed for 250+ attendees

- Continue to consult with DOT in development of categorical hot-spot conformity findings

- Provide technical assistance on state and local project-level analyses

- Partner with TRB/DOT on PM Hot-spot Template to streamline state and local hot-spot documentation

EPA PM Hot-spot Tools

- Emission Rate Post-processing Tool (now in MOVES2010b)
 - » Automates the summing of aggregate MOVES emissions for PM and CO project-level analyses (e.g., PM grams/hour or grams/mile)

- 24-hour PM_{2.5} NAAQS Design Value Tool
 - » Automates a computationally intensive process for this NAAQS
 - » Design value calculations for other PM NAAQS are less complicated and can be done using a spreadsheet

- MOVES2AERMOD
 - » Automates process of incorporating MOVES output into AERMOD input file

- Email patulski.meg@epa.gov if you have ideas for other PM hot-spot tools

New EPA Project-level Website

- Organized to cover all EPA project-level resources:
 - » PM Hot-spot Analyses: Guidance
 - » CO Hot-spot Analyses: Guidance
 - » Emission Models and Methods
 - » Air Quality (Dispersion) Models
 - » Tools for Completing Project-level Analyses
 - » Training and Other Resources
 - » Frequently Asked Questions
 - » Contact Information

- www.epa.gov/otaq/stateresources/transconf/projectlevel-hotspot.htm

More Information

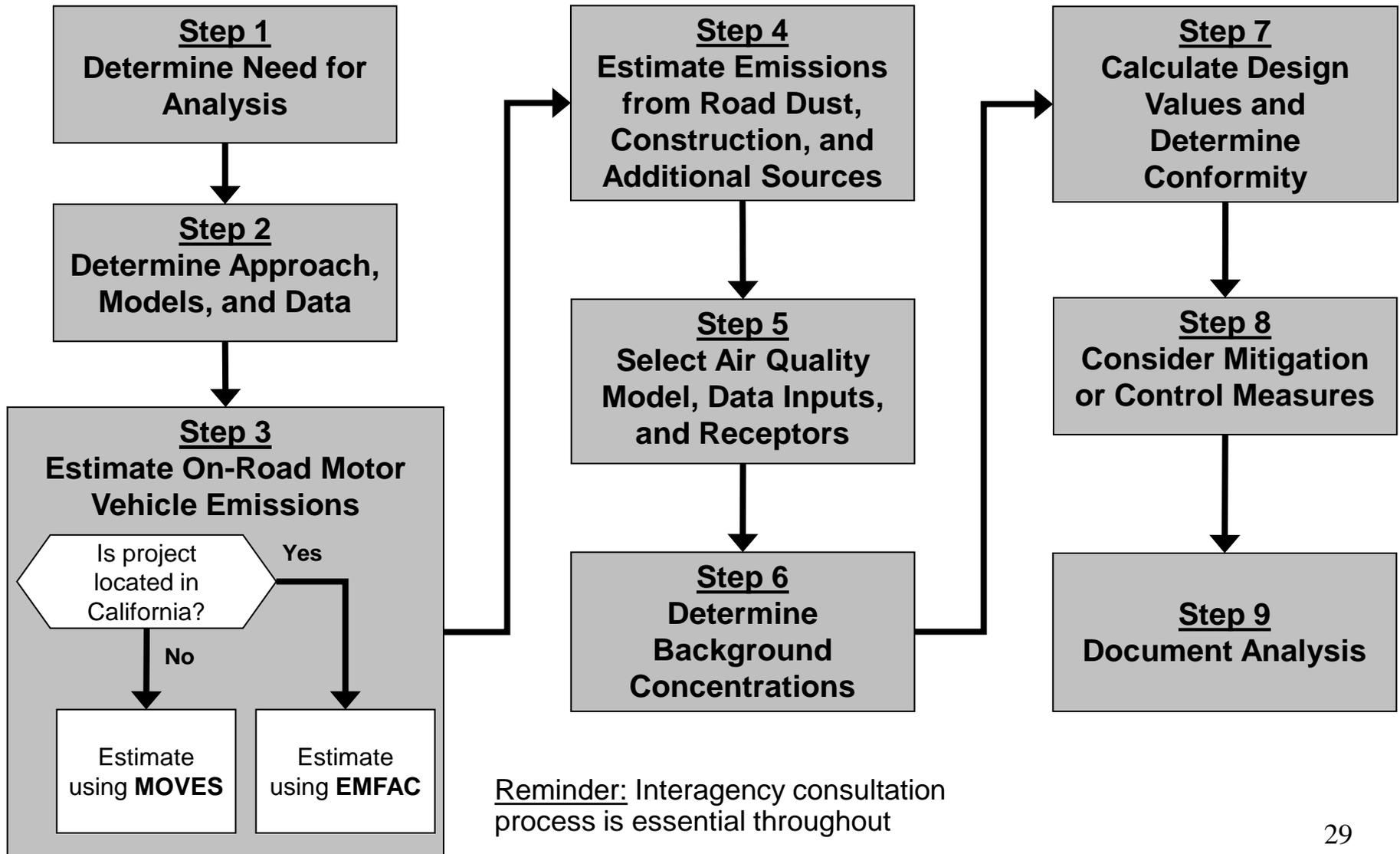
- See EPA's MOVES website for:
 - » Software, technical documentation, tools, and other helpful background materials
 - » www.epa.gov/otaq/models/moves/

- See EPA's SCRAM website for:
 - » Downloading AERMOD and CAL3QHCR
 - » <http://www.epa.gov/scram001/>

- Questions?
 - » General questions on MOVES
 - mobile@epa.gov
 - » Technical questions about hot-spot modeling
 - conformity-hotspot@epa.gov

Appendix

Completing a PM Hot-spot Analysis

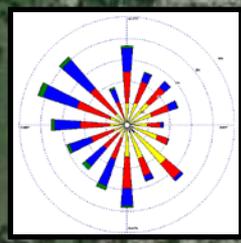


Other PM Hot-spot Requirements

- Estimate the **total emissions burden** of direct PM emissions from project and background
- Examine the **project area** (“area substantially affected by the project”)
- Analyze the year(s) during when:
 - » Peak emissions **from project** are expected, and
 - » New or worsened violation would most likely occur due to cumulative impacts **of project and background concentrations**
- Use the latest planning assumptions and emissions model
- Only include mitigation and control measures with sufficient commitments
- Be consistent with other EPA regulations for AQ modeling and NAAQS calculations

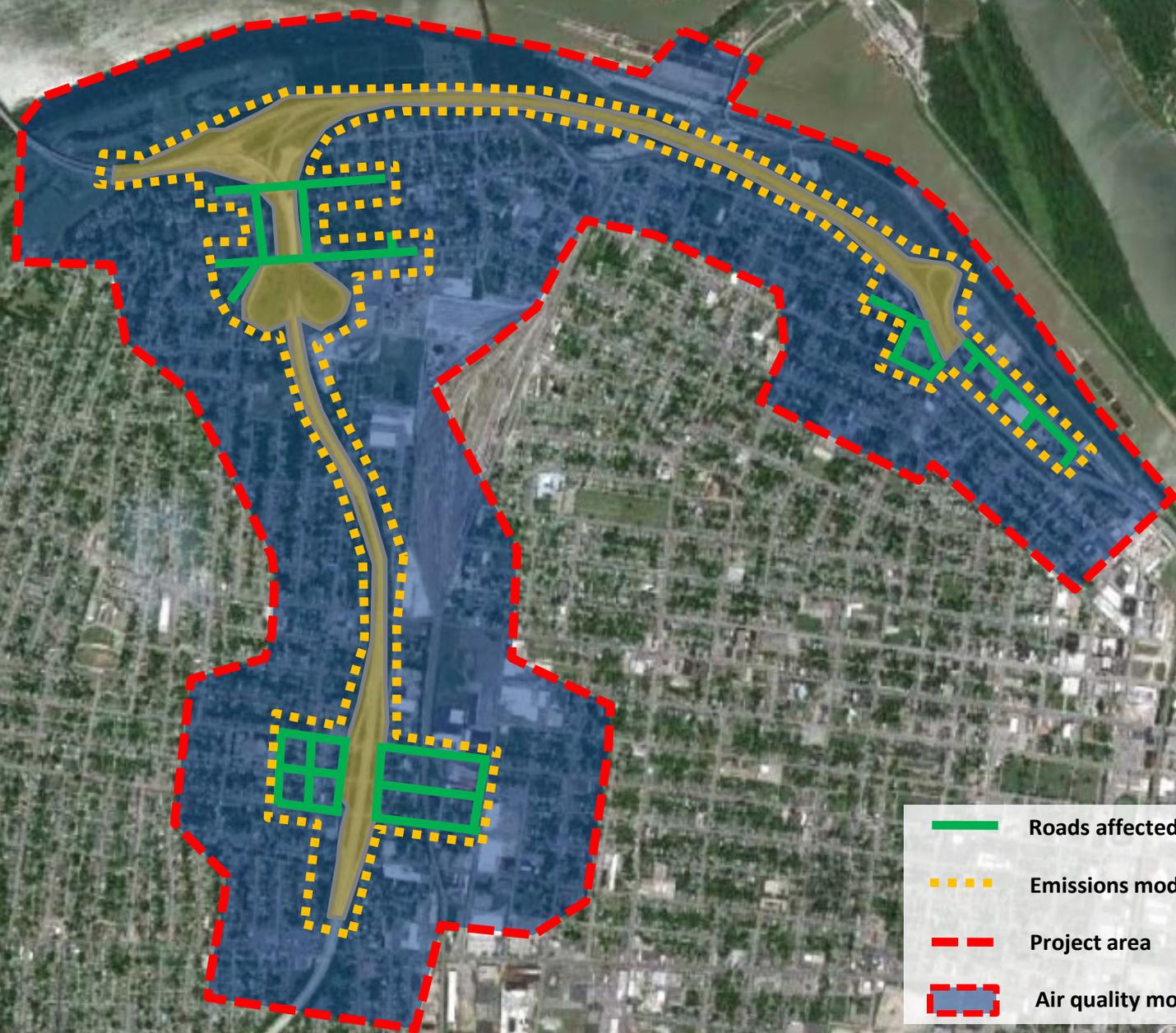
Example of Project Area

Hypothetical situation



1/2 mile

500 m



-  Roads affected by project
-  Emissions modeling
-  Project area
-  Air quality modeling