

# ON-ROAD VEHICLE EMISSION INVENTORIES

## OVERVIEW

The WRAP Mobile Sources Forum (MSF) funded a project to develop a mobile source emission inventory with regionally consistent methods. This emission inventory was used in a complete comprehensive emission inventory for Regional Haze Modeling efforts in the Western Region of the U.S. State and local air quality planning agencies were surveyed to provide up-to-date estimates of vehicle activity, fuel composition, and modeling inputs. The regulatory mobile source emissions models used contain all federally promulgated on-road vehicle controls, and local control programs were incorporated via modeling inputs. On-road vehicle emissions are an important contributor to regional emissions, especially for NOx and PM. Despite large increases in vehicle activity from 2002 to 2018, most on-road emissions decrease because of fleet turnover to newer vehicles that meet more stringent federal standards.

## SIP DEVELOPERS AND POLICY MAKERS

Inventory is a regionally consistent inventory (consistent approach and methods)

Includes all "on the books" federal and state controls – significant reductions in per/vehicle emissions

Inventories can be used in local, state, regional applications

Surveyed state/local agencies to get up to date modeling inputs

## STATE AND LOCAL EMISSION INVENTORY DEVELOPERS

New MOBILE6 modeling tools are available -- key is defining/refining/getting accurate/complete/representative modeling inputs and VMT data

## BACKGROUND

WRAP mobile sources emission inventory (MSEI) originally completed in 2003, then EPA released significant update to MOBILE6 model used to estimate on-road emissions, and Tier 4 nonroad equipment regulations were promulgated. This project updated the original on-road emissions estimates.

Emission inventory scope:

Pollutants: NOx, SO2, VOC, CO, PM10, PM2.5, NH3

On-road vehicles (by vehicle class and fuel type)

Geographic resolution: WRAP states and tribes, county level

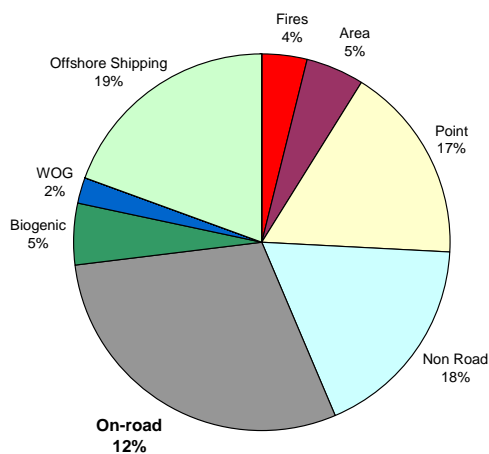
Temporal resolution: 2002 base year, 2008/2013/2018 future years, seasonal

## Western States Total On-Road Emissions and Vehicle Miles Traveled

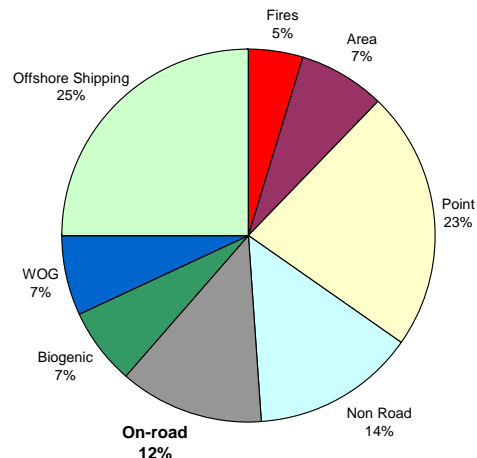
	VOC	NOx	CO	PM10 *	PM2.5 *	SO2	NH3	VMT
<b>2002</b>	1,009,103	1,607,593	12,210,686	42,172	31,460	30,688	51,889	303,440,405,008
<b>2018</b>	403,757	523,067	5,787,395	36,628	23,789	5,988	72,001	418,495,015,107
<b>% Change</b>	-60%	-67%	-53%	-13%	-24%	-80%	39%	38%

\* PM emissions include exhaust, brake wear, and tire wear emissions.

WRAP Total NOx Emissions Plan02b



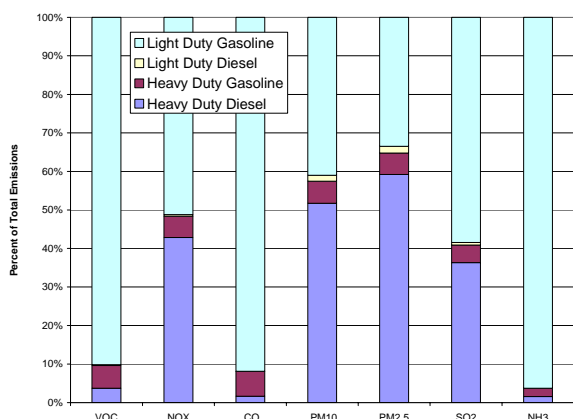
WRAP Total NOx Emissions Base 18b



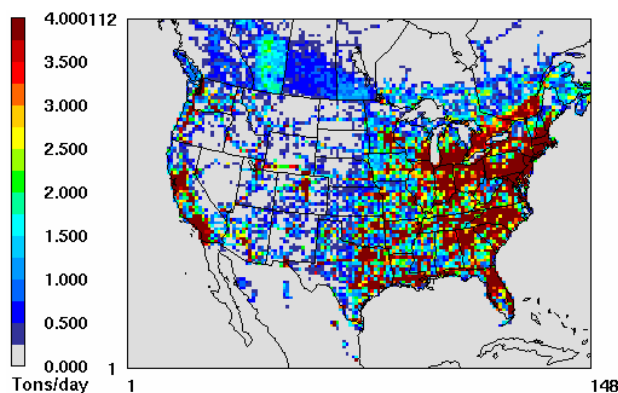
## METHODS

- General approach: emissions = g/mile emission factor \* VMT, by vehicle class and roadway type for each county
- Surveyed state and local agencies for base and future years MOBILE6 inputs, base year VMT, and VMT growth rates
  - Set default model inputs and VMT from what EPA used for NEI2002, CERR submittals to EPA, Sierra Research analysis of fuel survey data, VMT growth rates from previous WRAP MSEI project
  - Detailed spreadsheets were posted to web
  - Responses were received from all state agencies and key local agencies
- MOBILE6 model used (except for CA) to generate g/mi emission factors for each vehicle class, roadway type, county
  - Estimates vehicle exhaust and evaporative emissions
  - Incorporates all “on the books” controls
    - Tier 1 light-duty vehicle standards (begins MY 1996)
    - National Low Emission Vehicle (NLEV) standards (begins MY 2001)
    - Tier 2 light-duty vehicle standards (begins MY 2005), with low sulfur gasoline beginning summer 2004
    - Heavy-duty vehicle standards (begins MY 2004)
    - Heavy-duty vehicle standards (begins MY 2007), with low sulfur diesel beginning with summer 2006
  - Models state/local control programs
    - Fuels regulations
    - Inspection and Maintenance programs
- California on-road emissions
  - California ARB has developed CA-specific EMFAC model
  - EMFAC includes, for all CA counties, both VMT and g/mile emission factors (by vehicle class, but not by roadway type), so model estimates emissions
  - ARB was working on significant model revision during this project, and provided updated emissions from internal working version

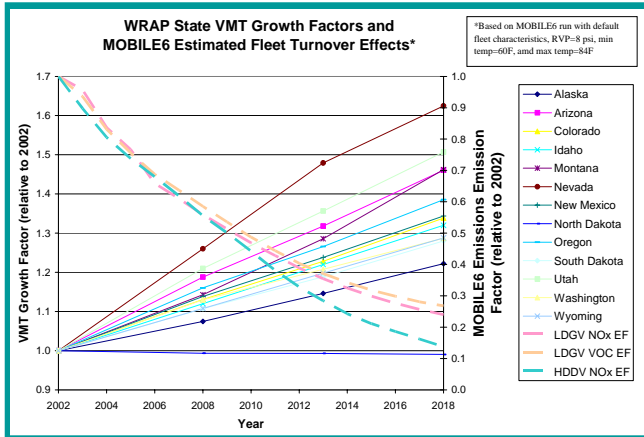
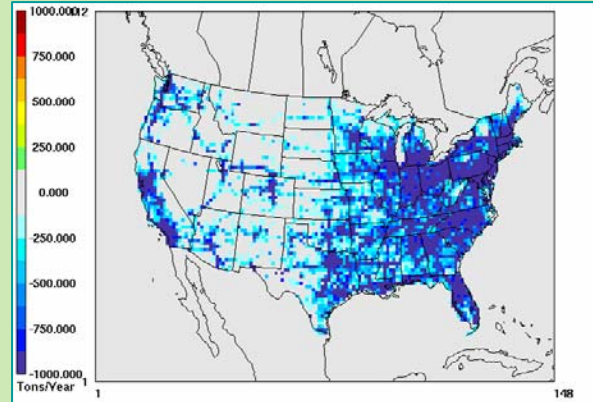
**2002 Western states average annual on-road emissions  
(% by vehicle class and fuel type).**



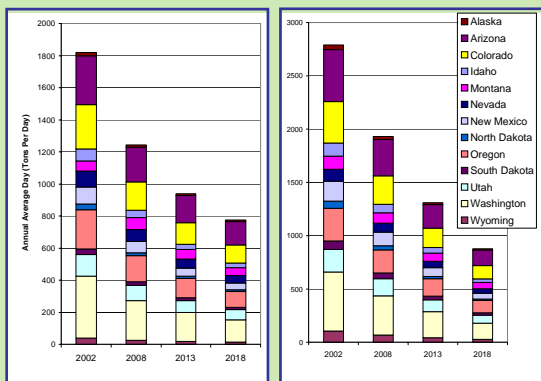
**Spatial distribution of all RPO on-road NO emissions,  
2002 July weekday.**



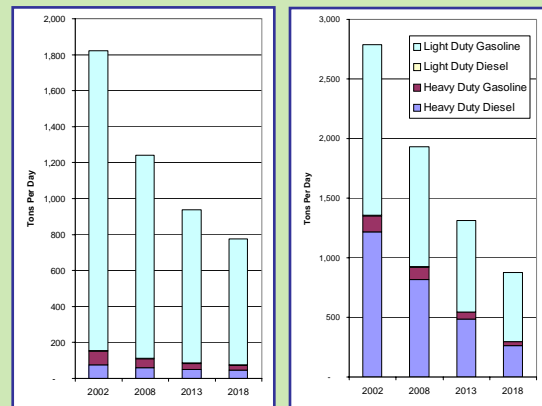
**Spatial distribution of all RPO on-road NO emissions, change in annual emissions from 2002 to 2018.**



**WRAP States Average Annual On-Road VOC and NOx Emissions by State (excludes CA)**



**WRAP States Average Annual On-Road VOC and NOx Emissions by Class (excludes CA)**



**Emissions summary files available on project web site:**

- Excel files with detailed emissions by county and vehicle class for each state, 2002 and 2018
- Excel files with plots and data tables of emissions by state for each year SMOKE IDA files, 2002 and 2018

<http://www.wrapair.org/forums/ef/UMSI/index.html>

#### OTHER RELEVANT POINTS AND ISSUES

- CARB released a new version of EMFAC in November 2006; significant changes from previous version

- EPA NMIM model, under development when the project was underway, is now complete and available for generating state and county on-road and off-road emission inventories.

<http://www.epa.gov/otaq/nmim.htm>

- EPA is working on next generation on-road emissions model, MOVES, release date unknown. MOVES development web page:

<http://www.epa.gov/otaq/ngm.htm>

- Link-level emissions can also be estimated using transportation modeling data with the CONCEPT Motor Vehicle emissions model.

(<http://www.conceptmodel.org>)

#### RESEARCH INFORMATION NEEDS

- No matter what modeling tool is used, key is to obtain as accurate estimates as possible of modeling inputs and VMT (both base year and growth factors)

- PM10 and PM2.5 emission factors are dated; EPA is updating them for MOVES but not for MOBILE6

#### CONTACT INFORMATION

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Project web page: <http://www.wrapair.org/forums/ef/UMSI/index.html>

#### RECOMMENDATIONS FOR FUTURE WORK

- For state/local agencies planning to update on-road emission inventories in the future, the use of NMIM is recommended.
- Key in developing on-road inventories with NMIM is to review and update the NMIM county data base with the most up-to-date MOBILE6 inputs and VMT estimates.