

2014 Periodic Emissions Inventory Development

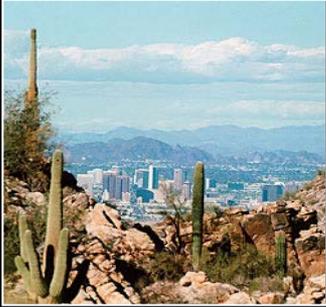


Air Quality Technical Advisory Committee Meeting
May 21, 2015

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PROGRAMS

2014 Periodic Emissions Inventory

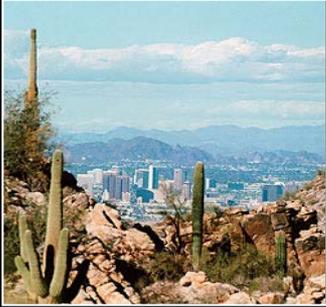
- 2014 calendar year periodic emissions inventories are currently being developed for Maricopa County and the nonattainment areas by MAG and the Maricopa County Air Quality Department
- Inventories for ozone precursors include annual and ozone season-day emissions of VOC, NO_x, and CO, while the PM-10 inventory includes annual and daily emissions of PM-10, PM-2.5, NO_x, SO_x, and NH₃
- County-level emissions for 2014 are required to be submitted to EPA's National Emissions Inventory (NEI)
- Nonattainment area emissions inventories are included and required in air quality plans for attaining and maintaining EPA air quality standards



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2014 Periodic Emissions Inventory

- **MAG develops emissions for:**
 - onroad mobile sources;
 - nonroad mobile sources (e.g., lawn and garden equipment, construction and mining equipment);
 - biogenic sources (e.g., vegetation); and
 - three area sources: windblown dust, dust from offroad recreational vehicles, and dust from unpaved parking lots
- **Maricopa County develops emissions for:**
 - point sources (e.g., power plants);
 - most area sources; and
 - one nonroad mobile source: locomotives
- **The Maricopa County Air Quality Department publishes the final periodic emissions inventories**



Onroad Mobile Source Emissions

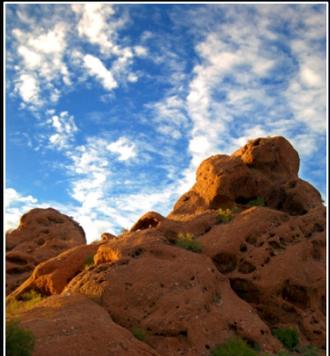
- EPA's Motor Vehicle Emission Simulator 2014 (MOVES2014) calculates onroad (roadways) and off-network (engine starting, parking and idling) vehicle emissions
- MOVES2014 inputs
 - Hourly meteorology data: temperature and humidity
 - Vehicle registration
 - Fuel inspection data: Reid Vapor Pressure (RVP), fuel sulfur %, oxygen %
 - Inspection and Maintenance (I/M) programs
 - Vehicle Miles Traveled (VMT) – derived from MAG TransCAD model outputs
 - Vehicle fleet speed – derived from MAG TransCAD model outputs



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Onroad Mobile Source Emissions

- TransCAD outputs provide ~120,000 link data for four time periods: AM Peak (6 AM–9 AM), Midday (9 AM–2 PM), PM Peak (2 PM–6 PM), Night Time (6 PM–6 AM)

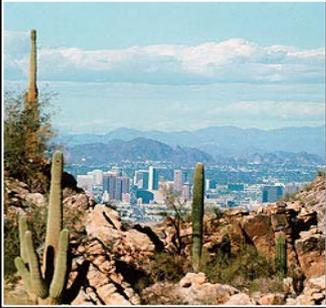


Line	Column	Type	Description
I +	ID	Integer	Link ID
	LENGTH	Float	Link length in mile
	DIR	Integer	Link direction; 0: two-way (AB and BA), 1: one-way (AB), and -1: one-way (BA)
	AB_LENGTH	Float	Link length for AB direction (in mile)
	BA_LENGTH	Float	Link length for BA direction (in mile)
	AB_TYPE	Integer	-
	BA_TYPE	Integer	-
	AB_LANES	Float	Number of lanes for AB direction
	BA_LANES	Float	Number of lanes for BA direction
	AB_VDF	Integer	Mixture of area (A) and facility (F); $(A * 100 + F)$ for AB direction
	BA_VDF	Integer	Mixture of area (A) and facility (F); $(A * 100 + F)$ for BA direction
	AB_TIME	Float	Average time (in minute) to pass a link during a given time period for AB direction
	BA_TIME	Float	Average time (in minute) to pass a link during a given time period for BA direction
	AB_LOV	Float	Traffic volume (low occupancy vehicle) passing a link during a given time period for AB direction
	BA_LOV	Float	Traffic volume (low occupancy vehicle) passing a link during a given time period for BA direction
	AB_HOV	Float	Traffic volume (high occupancy vehicle) passing a link during a given time period for AB direction
	BA_HOV	Float	Traffic volume (high occupancy vehicle) passing a link during a given time period for BA direction
	AB_HVY	Float	Traffic volume (heavy duty truck) passing a link during a given time period for AB direction
	BA_HVY	Float	Traffic volume (heavy duty truck) passing a link during a given time period for BA direction
	AB_MED	Float	Traffic volume (medium duty truck) passing a link during a given time period for AB direction
	BA_MED	Float	Traffic volume (medium duty truck) passing a link during a given time period for BA direction
	AB_LGT	Float	Traffic volume (light duty truck) passing a link during a given time period for AB direction
	BA_LGT	Float	Traffic volume (light duty truck) passing a link during a given time period for BA direction
	AB_FLOW	Float	Traffic volume (total) passing a link during a given time period for AB direction
	BA_FLOW	Float	Traffic volume (total) passing a link during a given time period for BA direction

Onroad Mobile Source Emissions

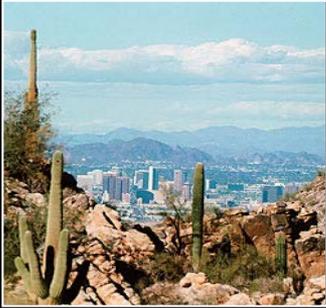
- **MOVESLINK2014**

- A state-of-the-art tool developed by MAG air quality modeling staff
- Using MOVES2014 emission factors, estimates onroad mobile source emissions for periodic emissions inventories, regional transportation conformity analyses and photochemical air quality modeling analyses
- Coded with Python programming language and Geographic Information System (GIS) technology
- Employs a bottom-up method: link-specific vehicle fleet emissions are calculated using link-specific VMT and speed data by road type, vehicle type and area type, that are subsequently summed to estimate county or sub-county level emissions
- Estimates hourly, gridded, and speciated emissions for photochemical air quality modeling analyses



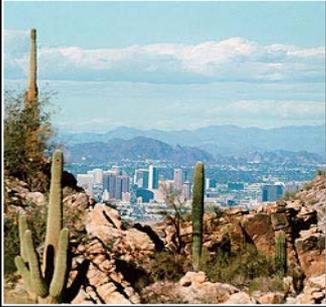
Nonroad Mobile Source Emissions

- **NONROAD2008a calculates emissions for the following sources**
 - Agricultural equipment
 - Construction, commercial, and mining equipment
 - Industrial equipment
 - Lawn and garden equipment
 - Pleasure craft and recreational equipment
 - Railway maintenance equipment
- **Nonroad emissions calculations are dependent upon**
 - Equipment types, fuel types, usage, deterioration rates, population, age, and power load factor
- **NONROAD2008a inputs: temperature, RVP, sulfur and oxygen content %**



Nonroad Mobile Source Airport Emissions

- Emissions Dispersion Modeling System (EDMS) 5.1 is used to develop airport emissions
- Aircraft, Auxiliary Power Unit (APU), and Ground Support Equipment (GSE) emissions are calculated for 15 airports:
 - Buckeye, Carefree, Chandler, Deer Valley, Falcon Field, Gila Bend, Glendale, Goodyear, Luke Air Force, Phoenix-Mesa Gateway, Phoenix Sky Harbor, Pleasant Valley, Scottsdale, Stellar Airpark, Wickenburg
- Emissions are calculated for four aircraft categories: Air Carrier (AC), Air Taxi (AT), General Aviation (GA), Military (ML)
- Inputs include number of aircraft operations or number of Landing and Takeoff (LTO) cycles, fleet mix data, and aircraft monthly/daily/hourly operation profiles
- Mixing height data are developed using AERMOD model based on Sky Harbor Airport surface and Tucson upper air meteorology data



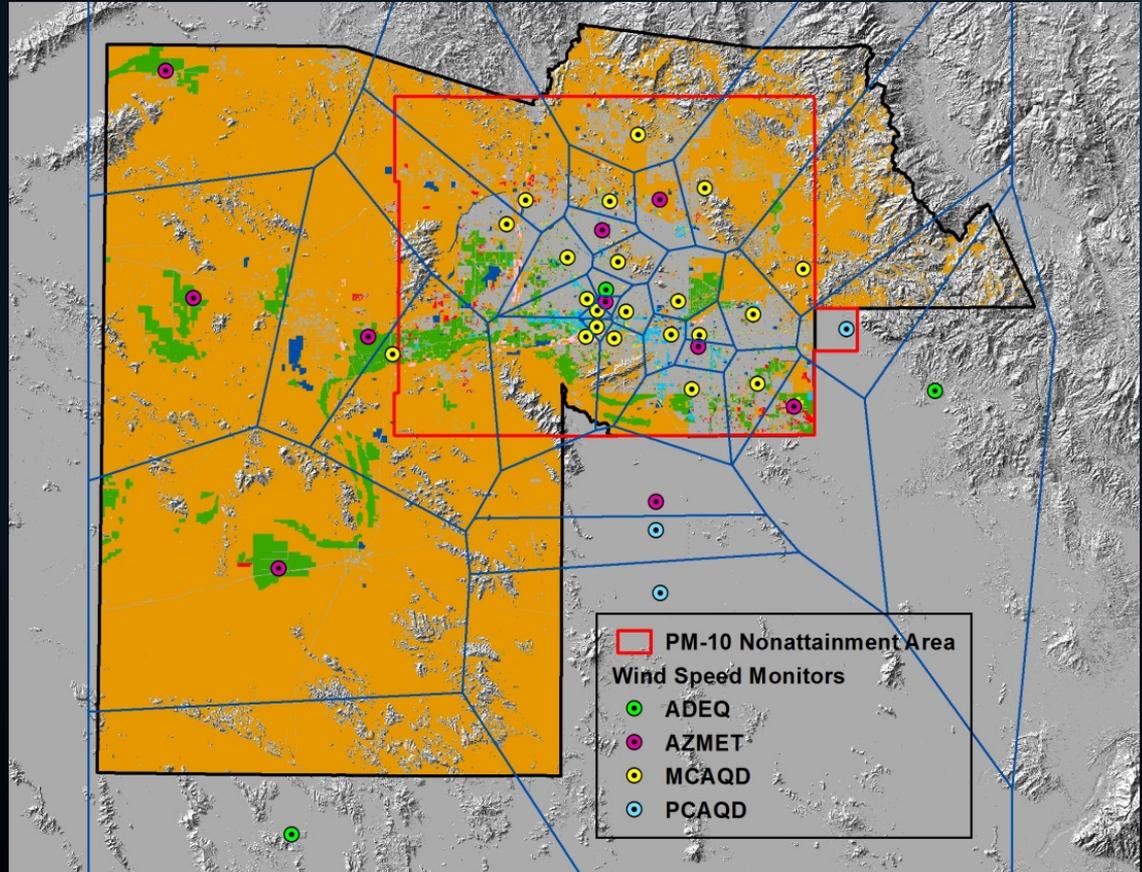
Biogenic Source Emissions

- Natural source emissions (e.g., lightning NO_x, volcanic eruption, vegetation emissions)
- Model of Emissions of Gases and Aerosols from Nature (MEGAN) 2.1 calculates vegetation VOC and soil microbial NO_x emissions
- **Inputs:**
 - Modeling domain information
 - Hourly Meteorological Data (temperature, solar radiation, humidity, etc.) – Weather Research and Forecasting (WRF) meteorological model outputs and/or monitor data
 - Vegetation emission factors
 - Leaf Area Index (LAI) or foliar density
 - Plant Functional Type (PFT) (e.g., needleleaf evergreen tree, broadleaf evergreen tree, broadleaf deciduous tree, shrub, grass, crop, etc.)



Windblown Dust

- Identify land uses capable of producing windblown dust
- Determine percentage of stable and disturbed land uses through Maricopa County inspection data
- Overlay all 2014 wind speeds above 12 mph onto land uses
- Multiply wind speed by land use acreage and wind tunnel emission factors to determine PM-10 emissions from each land use



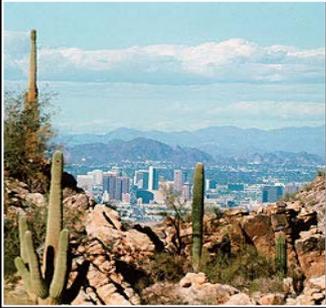
Windblown Dust

Standardize 2014 windblown dust PM-10 emissions to match the percentage of 2014 PM-10 concentrations associated with wind speeds of 12 mph or greater

Monitor	Sum of 5-Minute PM-10 Concentrations when 5-Minute Winds \geq 12 mph	Sum of all 5-Minute PM-10 Concentrations	Percent PM-10 Concentration Associated with 5-Minute Winds \geq 12 mph
Buckeye	321,551	4,675,879	6.88%
Central Phoenix	188,488	3,392,297	5.56%
Durango Complex	260,470	4,486,692	5.81%
Dysart	138,957	2,885,002	4.82%
Glendale	178,596	2,927,244	6.10%
Greenwood	146,975	4,691,387	3.13%
Higley	251,271	3,247,617	7.74%
Mesa	114,263	3,235,455	3.53%
South Phoenix	146,575	4,330,091	3.39%
South Scottsdale	121,395	3,330,811	3.64%
Tempe	59,346	3,082,562	1.93%
West 43rd Avenue	349,992	4,887,079	7.16%
West Chandler	239,913	3,170,092	7.57%
West Phoenix	167,712	4,132,270	4.06%
Zuni Hills	226,911	2,243,232	10.12%
All Monitors	2,912,415	54,717,710	5.32%

Dust From Offroad Recreational Vehicles

- EPA's NONROAD2008a model provides estimates of the number of offroad vehicles (e.g., ATVs and motorcycles) and annual mileage for offroad vehicles in Maricopa County
- Total vehicle miles traveled are multiplied by EPA emission factors for travel on unpaved roads to produce annual and daily PM-10 and PM-2.5 emissions for fugitive dust from offroad recreational vehicles
- Maricopa County-level emissions are allocated to the PM-10 nonattainment area using a spatial surrogate: the ratio of vacant and passive open space in the PM-10 nonattainment area to Maricopa County



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Dust From Unpaved Parking Lots

- GIS land use data and prior fugitive dust emissions studies are used to identify and estimate the total acreage of unpaved parking lots in Maricopa County and the PM-10 nonattainment area
- Estimates of the vehicle miles traveled on unpaved parking lots are developed assuming an average of 10 vehicles travel on each lot per day, over an average distance of 0.031 miles per day
- The total vehicle miles traveled are multiplied by EPA emission factors for travel on unpaved roads to produce annual and daily PM-10 and PM-2.5 emissions for fugitive dust from unpaved parking lots



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Schedule

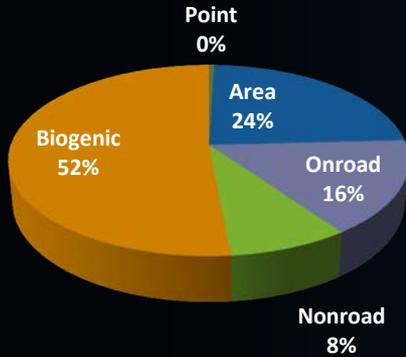
- **January 15, 2016 – County-level emissions submitted to EPA's National Emissions Inventory**
- **August 2016 – Final periodic emissions inventories published by Maricopa County Air Quality Department**



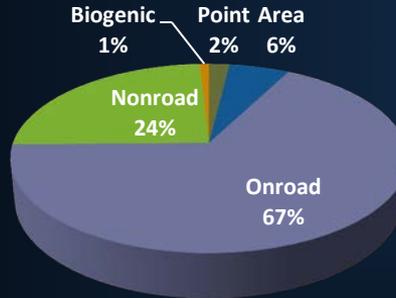
2011 Periodic Emissions Inventory

2011 Maricopa County Annual Emissions

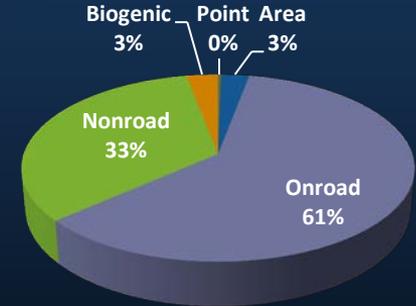
VOC (154,755 tons/yr)



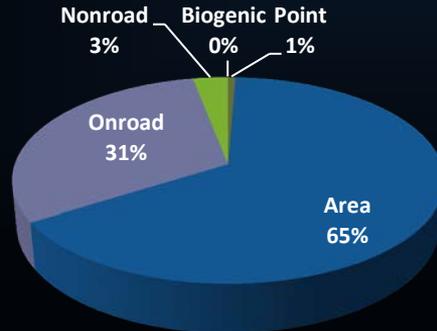
NOx (89,872 tons/yr)



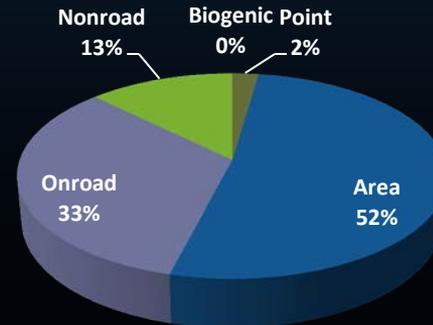
CO (387,934 tons/yr)



PM-10 (64,088 tons/yr)



PM-2.5 (14,757 tons/yr)





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