



# 2009 Mobile Source Emissions Inventory, Mecklenburg County, NC

Prepared by: Megan Green, Air Quality Specialist

May 4, 2011

The annual Mobile Source Emissions Inventory for Mecklenburg County, NC has been completed for calendar year 2009, according to the procedures set forth in the Mecklenburg County Air Quality Mobile Source Inventory Procedures Guidance document.

## Summary

- Total mobile source NO<sub>x</sub> emissions decreased in 2009.
- The majority of mobile source air pollution is generated by the on-road sector.
- Citizens drove nearly 8 billion miles in Mecklenburg County in 2009
- Despite VMT growth, on-road NO<sub>x</sub> emissions are decreasing.
- There were over 400,000 pieces of nonroad equipment used in Mecklenburg County in 2009.
- Construction equipment remains the largest nonroad source of NO<sub>x</sub> emissions.

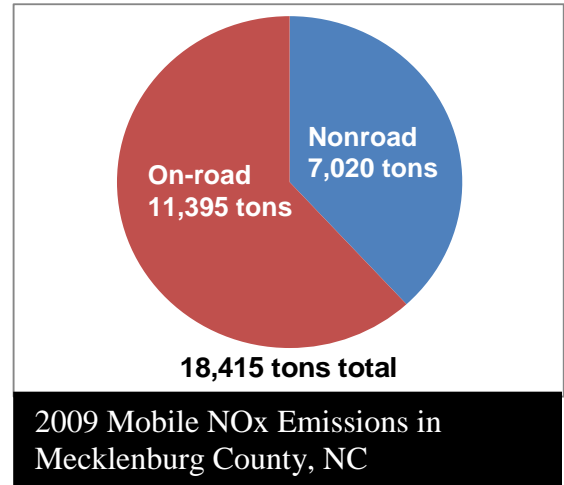


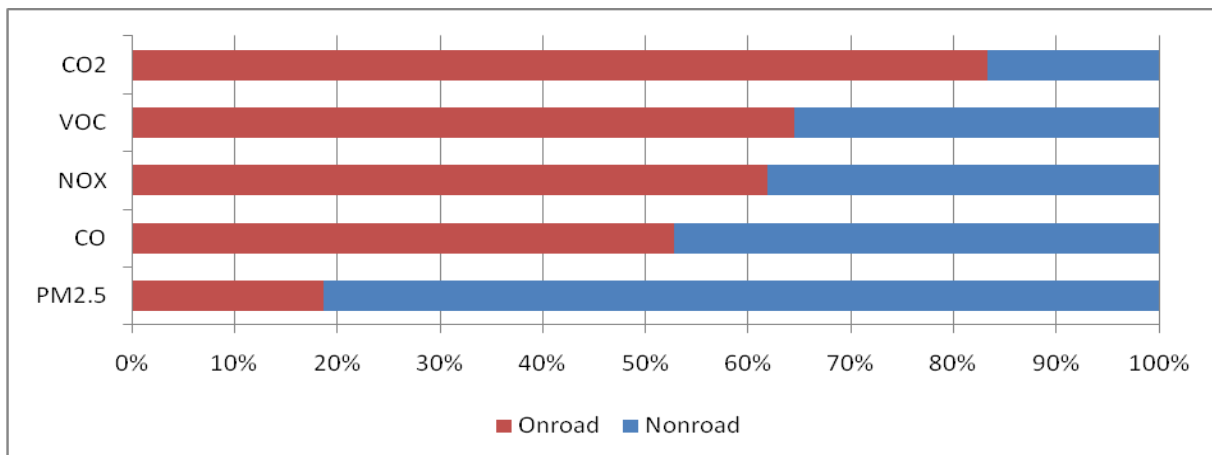
Table 1 below shows 2009 on-road and nonroad emissions from mobile sources in Mecklenburg County, NC. The majority of mobile source air pollution was generated by on-road vehicles, such as cars and trucks, including:

- 62% of nitrogen oxides (NO<sub>x</sub>),
- 53% of carbon monoxide (CO),
- 84% of carbon dioxide (CO<sub>2</sub>), and
- 64% of volatile organic compounds (VOC) emissions,

Most particulate matter (PM<sub>2.5</sub>) emissions (81%) were produced by nonroad mobile sources, examples of which are listed in Appendix A.

**Table 1: 2009 On-road vs. Nonroad Emissions**

	CO <sub>2</sub>		VOC		NO <sub>x</sub>		CO		PM <sub>2.5</sub>	
	tons	%	tons	%	tons	%	tons	%	tons	%
On-road	5,566,924	83%	9,017	64%	11,395	62%	112,091	53%	130	19%
Nonroad	1,120,742	17%	4,965	36%	7,020	38%	100,445	47%	566	81%
Total	6,687,666		13,982		18,415		212,537		696	

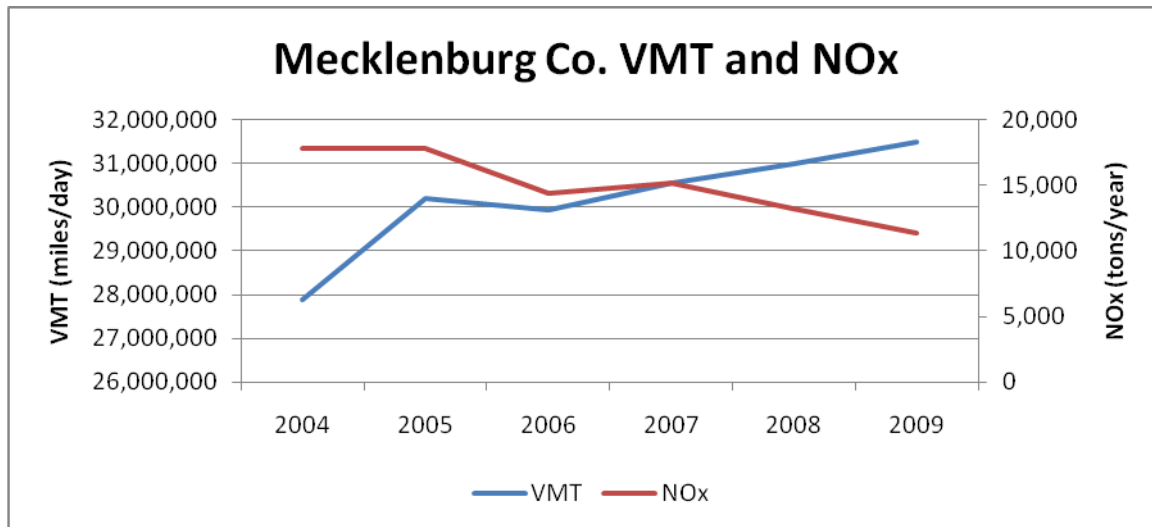


## 2009 On-road Emissions

Table 2 shows 2009 on-road mobile source emissions and the change in emissions from the 2008 inventory. In 2009, emissions from on-road sources decreased across the board. While vehicle miles traveled (VMT) continues to grow in Mecklenburg County, on-road NOx emissions have decreased over time, falling almost 14% in 2009. Inputs for the on-road emissions model, MOBILE 6.2, were revised in 2009 to include information about local speeds, making the model more refined than in 2008. These refinements also contribute to the apparent decrease in on-road emissions for all air pollutants.

**Table 2: 2009 On-Road Emissions, Change**

Pollutant	2009 emissions (tons/year)	2008-2009 Change
NOx	11,395	-13.8%
CO	112,091	-4.4%
PM2.5	130	-22.9%
VOC	9,017	-3.1%
CO2	5,566,924	0.0%
Daily VMT	31,500,373 (miles)	1.6%



## 2009 Nonroad Emissions

Table 3 shows the contribution of each nonroad mobile source category to total nonroad mobile source emissions, by pollutant.

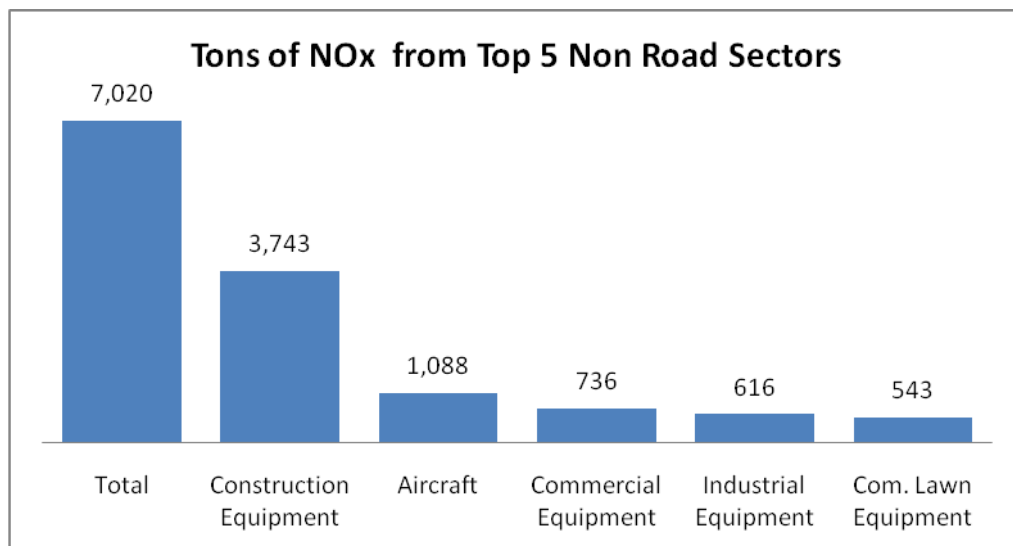
- Construction equipment continues to produce significant amounts of air pollution including over half of nonroad NO<sub>x</sub>, PM<sub>2.5</sub> and CO<sub>2</sub> emissions.
- Commercial lawn and garden equipment and other commercial equipment produce the majority of nonroad CO and VOC emissions.

The following factors affected the nonroad emissions totals reported in the inventory:

- EPA's current nonroad emissions model, NONROAD 2008, uses a base-grow projection model to estimate equipment populations, which are then used to estimate emissions. This method for estimating population lacks the ability to account for the effects of short to medium term economic fluctuations like those experienced during the time period of this inventory.
- Model inputs for three nonroad categories (airport equipment, commercial equipment, and commercial landscape equipment) were refined per state guidance in 2009. As a result, emissions of almost every air pollutant doubled from these nonroad sectors, contributing to over-all increases in nonroad inventory estimates. The exception is for NO<sub>x</sub> emissions, which decreased in the nonroad sectors, despite the model refinements.

**Table 3: 2009 Nonroad Emissions by Category**

	NO <sub>x</sub>		CO		PM <sub>2.5</sub>		VOC		CO <sub>2</sub>	
	tons	% of total	tons	% of total	tons	% of total	tons	% of total	tons	% of total
Construction Equipment	3,743	53.3%	5,624	5.6%	316	55.8%	541	10.9%	439,834	39.2%
Aircraft	1,088	15.5%	1,521	1.5%	16	2.7%	194	3.9%	334,687	29.9%
Commercial Equipment	736	10.5%	28,977	28.8%	56	9.9%	918	18.5%	106,613	9.5%
Industrial Equipment	616	8.8%	2,648	2.6%	24	4.3%	128	2.6%	72,317	6.5%
Lawn Equipment (Com)	543	7.7%	47,505	47.3%	117	20.7%	1,891	38.1%	115,188	10.3%
Airport Equipment	162	2.3%	165	0.2%	11	1.9%	15	0.3%	19,118	1.7%
Lawn Equipment (Res)	83	1.2%	11,181	11.1%	12	2.0%	728	14.7%	22,079	2.0%
Recreational Equipment	20	0.3%	2,496	2.5%	12	2.1%	418	8.4%	6,992	0.6%
Pleasure Craft	17	0.2%	299	0.3%	2	0.3%	129	2.6%	2,433	0.2%
Agricultural Equipment	10	0.1%	10	0.0%	1	0.2%	1	0.0%	1,012	0.1%
Logging Equipment	2	0.0%	15	0.0%	0	0.0%	1	0.0%	355	0.0%
Railroad Equipment	1	0.0%	4	0.0%	0	0.0%	0	0.0%	114	0.0%
Total	7,020		100,445		566		4,965		1,120,742	



## Six-Year Comparison of Mobile Source Emissions

Table 4 compares mobile source inventories from 2004 through 2009. Factors such as the types of vehicles/equipment, their age of vehicles and the number of miles being driven or hours operated, all affect total emissions each year.

- As on-road and off road vehicles age and are taken out of service, they are being replaced with newer vehicles built with more rigorous emissions control technology.
- The overall increase in CO emissions is primarily due to model refinements recommended in 2009 by NCDAQ.

**Table 4: Annual Emissions Comparison**

Air Pollution (tons/year)		2004	2005	2006	2007*	2008*	2009	2008-2009 Change
NO <sub>x</sub>	On-road	17,815	17,817	14,398	15,198	13,223	11,395	-13.8%
	Nonroad	5,930	6,003	7,266	7,413	7,245	7,020	-3.1%
	Total	23,745	23,820	21,664	21,979	20,468	18,415	-10.0%
CO	On-road	135,936	140,180	114,161	133,034	117,285	112,091	-4.4%
	Nonroad	98,852	101,305	91,835	95,839	86,338	100,445	16.3%
	Total	234,788	241,485	205,996	224,220	203,623	212,537	4.4%
PM <sub>2.5</sub>	On-road	304	236	175	202	169	130	-22.9%
	Nonroad	489	481	601	598	536	566	5.6%
	Total	793	717	776	791	705	696	-1.2%
VOC	On-road	10,011	10,816	9,087	10,871	9,311	9,017	-3.1%
	Nonroad	5,281	4,860	5,165	5,061	4,643	4,965	6.9%
	Total	15,292	15,676	14,252	14,120	13,953	13,982	0.2%
CO <sub>2</sub>	On-road				5,487,090	5,564,735	5,566,924	0.0%
	Nonroad				1,081,155	1,085,620	1,120,742	3.2%
	Total				6,568,244	6,650,355	6,687,666	0.6%

\* 2007 and 2008 on-road emission factors are calculated using national speed defaults rather than local speed data.

## Appendix A: Mobile Source Sector Descriptions

**On-road Vehicles:** Cars, trucks, buses and other motor vehicles that travel on public roads

**Nonroad Vehicles/Equipment:** Vehicles or equipment designed to travel or operate on unpaved roads, trails, beaches, or rough terrain rather than on public roads. Nonroad equipment includes:

**Agricultural Equipment:** 2-wheel tractors, agricultural tractors, combines, balers, agricultural mowers, sprayers, tillers, swathers, irrigation sets

**Aircraft:** Commercial, private and cargo airplanes

**Airport Equipment:** Fuel trucks, catering trucks, baggage carriers and generators

**Commercial Equipment:** Generators pumps, air compressors, gas compressors, welders, pressure washers

**Construction Equipment:** Pavers, rollers, scrapers, excavators, concrete/industrial saws, cement & mortar mixers, cranes, graders, off-highway trucks, tractors, loaders, backhoes

**Industrial Equipment:** Aerial lifts, forklifts, sweepers/scrubbers, other general industrial equipment, other material handling equipment, refrigeration, terminal tractors

**Lawn and Garden Equipment:** Commercial and residential lawnmowers, rotary tillers, chain saws, trimmers/edgers/brush cutters, leafblowers/vacuums, snowblowers, rear engine riding mowers, front mowers, shredders, lawn & garden tractors, chippers/stump grinders, commercial turf equipment

**Pleasure Craft:** Boats, and personal watercraft

**Railroad Equipment:** Railway maintenance equipment

**Recreational Equipment:** Snowmobiles, ATV/off-road motorcycles, golf carts

## Appendix B: Mobile Source Inventory Procedures

### On-road Mobile Inventory:

#### Model used:

- MOBILE6.2

#### Source of Input data:

- North Carolina Division of Air Quality
  - Motor vehicle age distribution
  - MOBILE6.2 input file(s)
  - I/M fraction
- Charlotte Department of Transportation
  - Average speed
  - Vehicle miles traveled

Using MOBILE6.2, local emission factors are generated for all vehicle classifications by roadway type. These emission factors are multiplied by the number of miles traveled on each type of roadway to calculate total air pollution generated by on-road vehicles.

### Nonroad Mobile Inventory:

#### Models used:

- NONROAD2008
- EDMS5.1.2

#### Source of Input Data:

- North Carolina Division of Air Quality
  - Local nonroad parameters
- Bureau of Transportation Statistics
  - Flight data, aircraft counts

Using local air quality parameters, nonroad emissions are calculated by NONROAD2008. Those totals are added to pollution generated from aircraft take-offs and landings, as calculated by EDMS5.1.2. The sum of these two model outputs is total nonroad air pollution.