



# **Emissions and Air Quality Analysis of the CA LEV-II Vehicle Emissions Standards in North Carolina**

**16<sup>th</sup> Annual International  
Emissions Inventory Conference**

**Wednesday, May 16, 2007**

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North Carolina Division of Air Quality**



# Outline

- **Air Quality in North Carolina**
- **Review of Vehicle Standards**
- **CA LEV-II Project**
- **CA LEV-II vs. Federal Tier 2**
  - **NOx and VOC emissions benefits**
  - **Projected impacts on ambient air quality**
- **Fleet Averaging**
  - **Comparison of CA and NC fleets**
- **Resources**
- **Options/Next Steps**



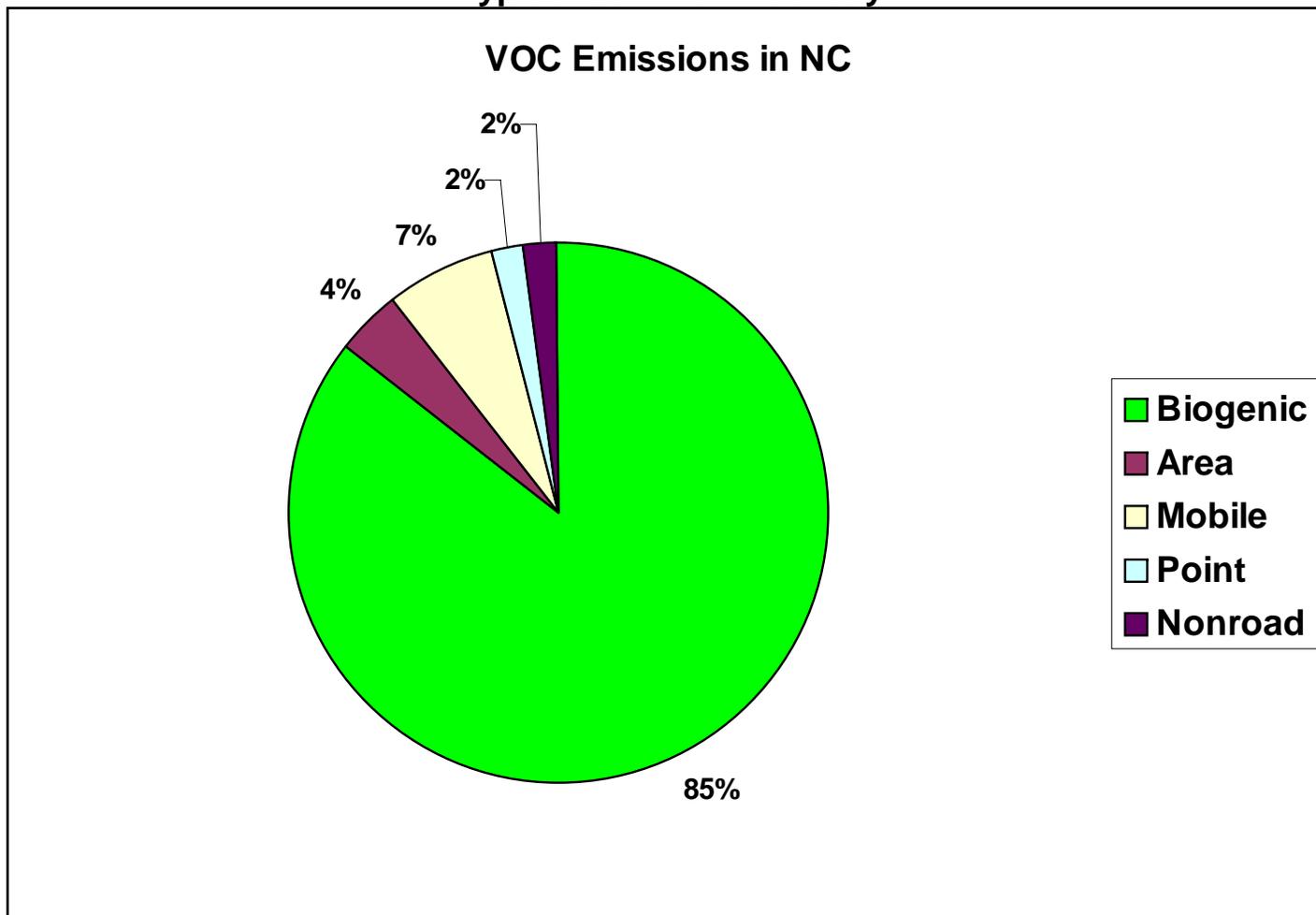
# **Air Quality - Ozone**

- **All areas of NC are attaining the 8-hr ozone standard except the Charlotte area**
- **Recall...  $\text{NO}_x + \text{VOC} + \text{sunlight} = \text{ozone}$**
- **$\text{NO}_x$** 
  - precursor pollutant of concern in NC
- **Majority of VOCs come from natural sources**
- **On-road mobile sources contribute significantly to the total  $\text{NO}_x$  emissions in NC**



## VOC emissions

Typical Summer Weekday

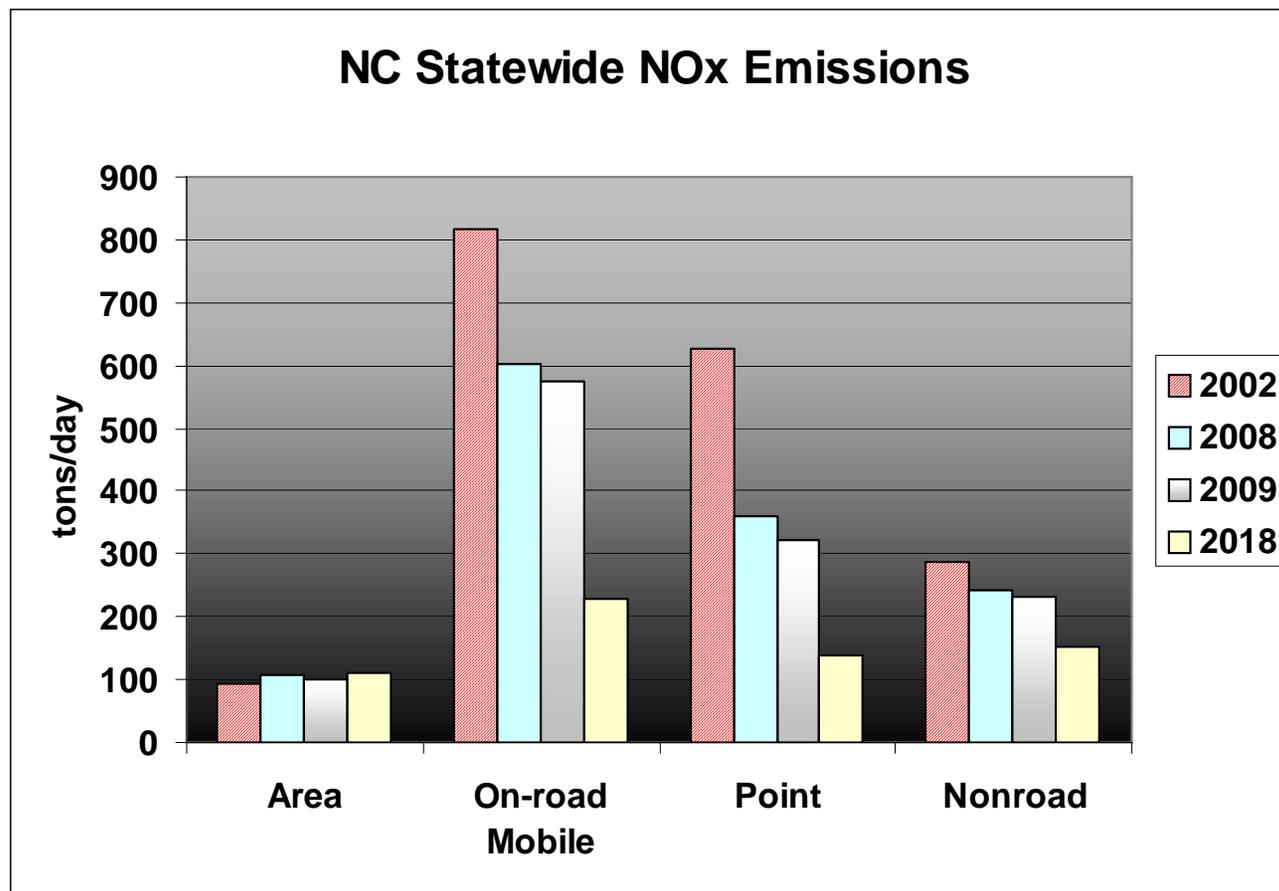


Source: NCDQA, Association of Southeastern Integrated Planning and the Visibility Improvement State and Tribal Association of the Southeast, Version BaseF4. 2009 estimates include all controls scheduled to be in place in 2009, including, but not limited to the NC Clean Smokestacks Act (point sources), Federal Tier 2 (on-road mobile sources) and the expanded NC Inspection and Maintenance Program (on-road mobile sources)



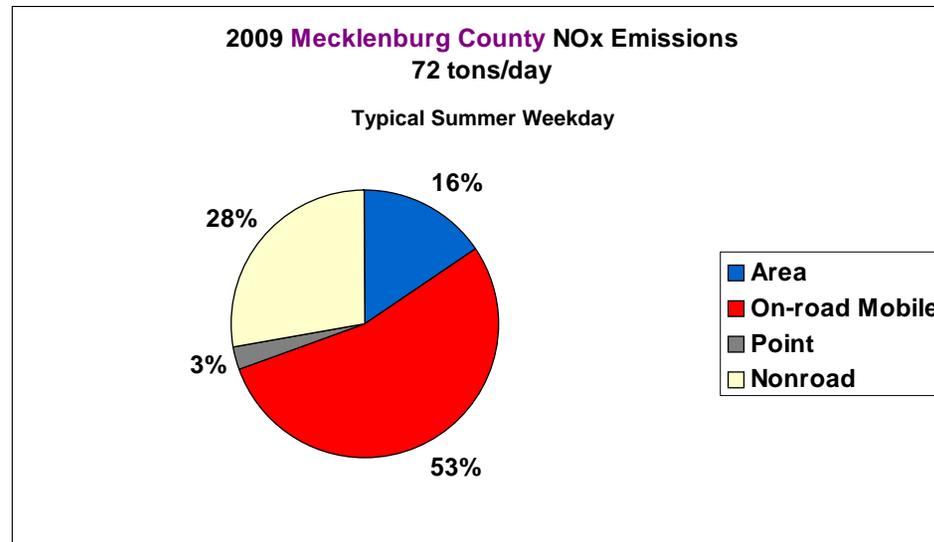
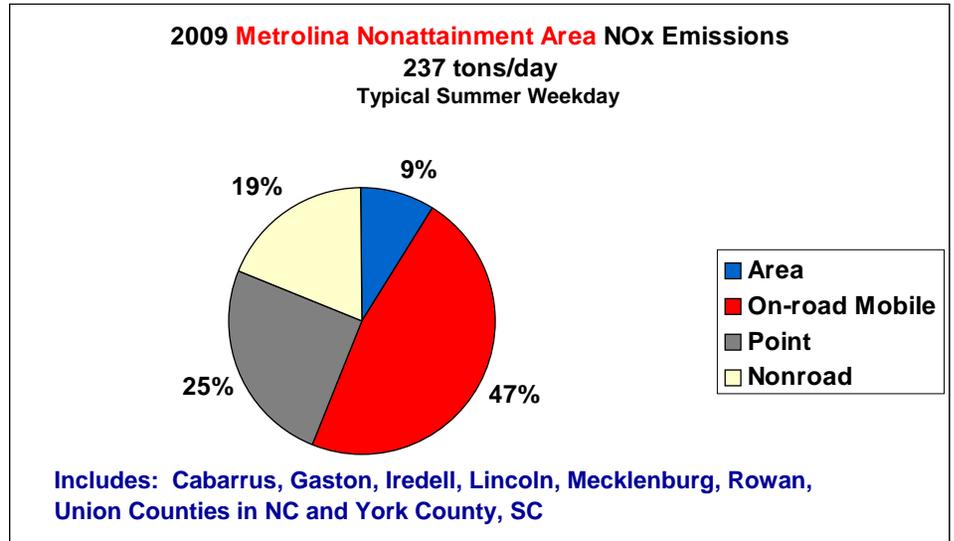
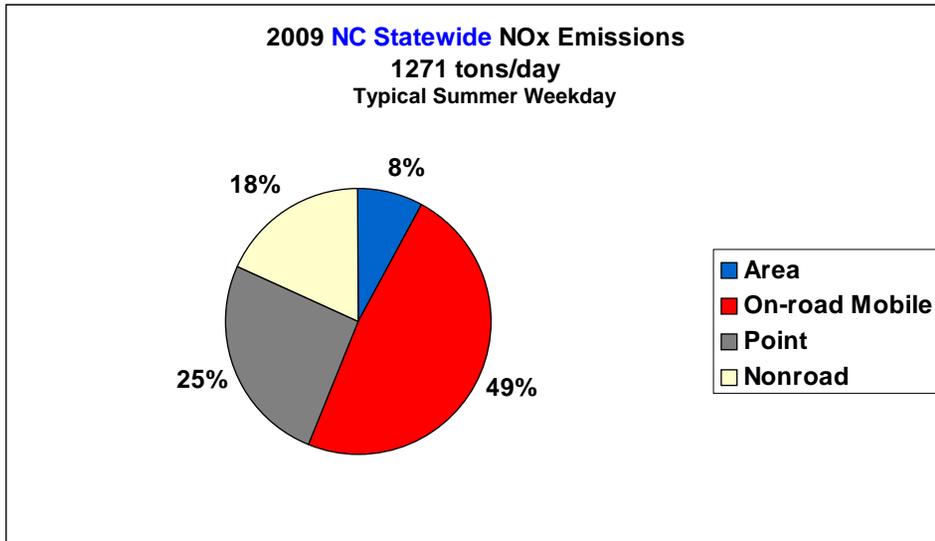
## NOx emissions

Typical Summer Weekday



Source: NCDQA, Association of Southeastern Integrated Planning and the Visibility Improvement State and Tribal Association of the Southeast, Version BaseF4. 2009 estimates include all controls scheduled to be in place in 2009, including, but not limited to the NC Clean Smokestacks Act (point sources), Federal Tier 2 (on-road mobile sources) and the expanded NC Inspection and Maintenance Program (on-road mobile sources)

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Source: NCDAQ, Association of Southeastern Integrated Planning and the Visibility Improvement State and Tribal Association of the Southeast, Version BaseF4  
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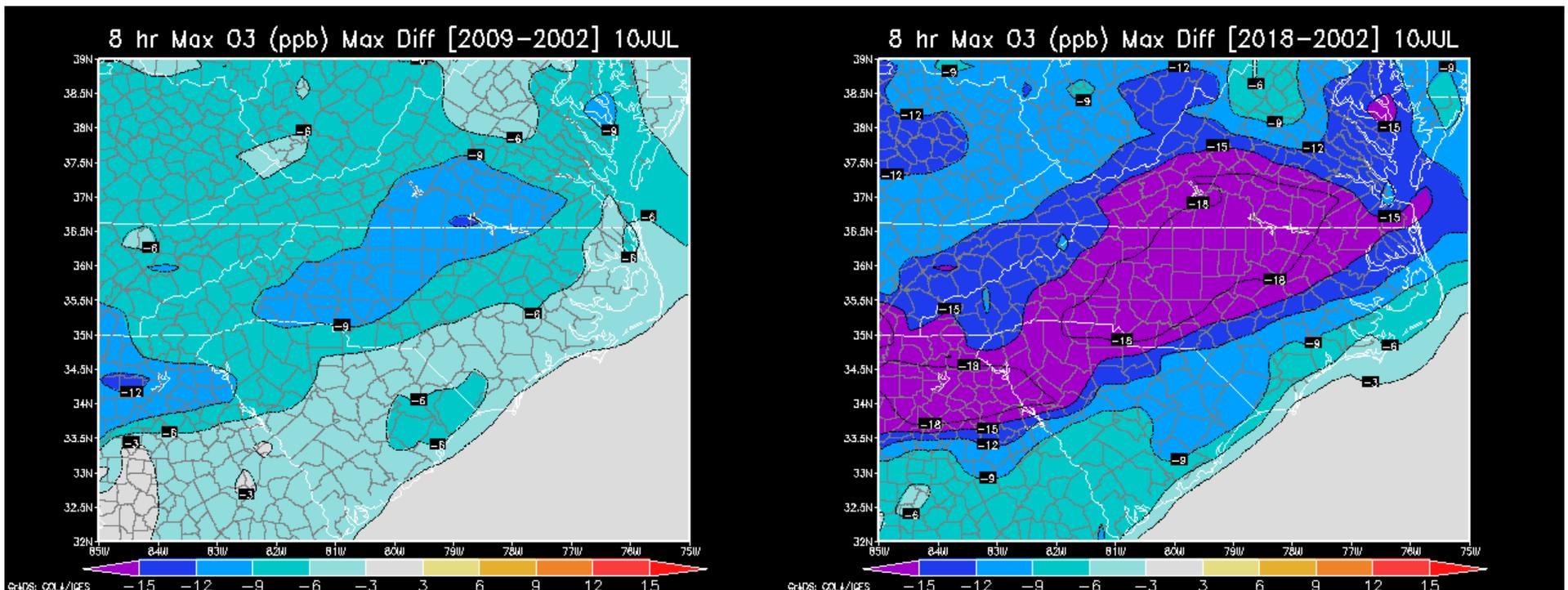
## Predicted Future Air Quality Current Federal and State Rules

Example of expected ozone reductions  
between 2002 and 2009

Example of expected ozone reductions  
between 2002 and 2018

Scales are the same on both maps.

Purple indicates 8-hour ozone reductions greater than 15 ppb.





## Vehicle Emissions Standards in the US

- **Federal – Currently “Tier 2”**
  - Adopted in 1999
  - Phased in 2004-2010
  - Fleet Average Requirement for NOx
  - Covers all States
  - Federal Clean Air Act (CAA) Section 209(a) “preempts” states from establishing separate standards
- **California – Currently “CA LEV-II”**
  - CAA Section 209(b) exempts California from the Sec 209(a) preemption
  - However, CA must obtain a waiver from USEPA for state standards to be effective
    - CA standards must be equal to or more stringent than the Federal standards
  - Fleet Average Requirement for VOC



# Objective of this Analysis

- **Estimate the NO<sub>x</sub> and VOC emissions benefits of adopting California Vehicle Emission Standards (CA LEV-II) in NC**
- **Apply knowledge from recent 8-hour ozone modeling studies to estimate the impacts of adopting CA LEV-II**
- **Compare the NC and CA vehicle fleet and age distributions to assess the need for “fleet averaging”**
- **Estimate State staffing resources needed if NC adopts CA LEV-II**



## **CA LEV-II vs. Federal Tier 2**

- **CA LEV-II program starts with model year 2010 vehicles**
- **CA LEV-II emissions estimates include:**
  - **Fleet averaging enforcement**
  - **Zero Emitting Vehicle (ZEV) component**
  - **Phase-in percentages by exhaust certification bin**
    - **Provided by USEPA in MOBILE6.2 ready format**
      - **Represents the California Air Resources Board (CARB) phase-in schedule**
      - **It represents an estimate of the mix of vehicles that manufacturers will distribute to meet the fleet average standard**



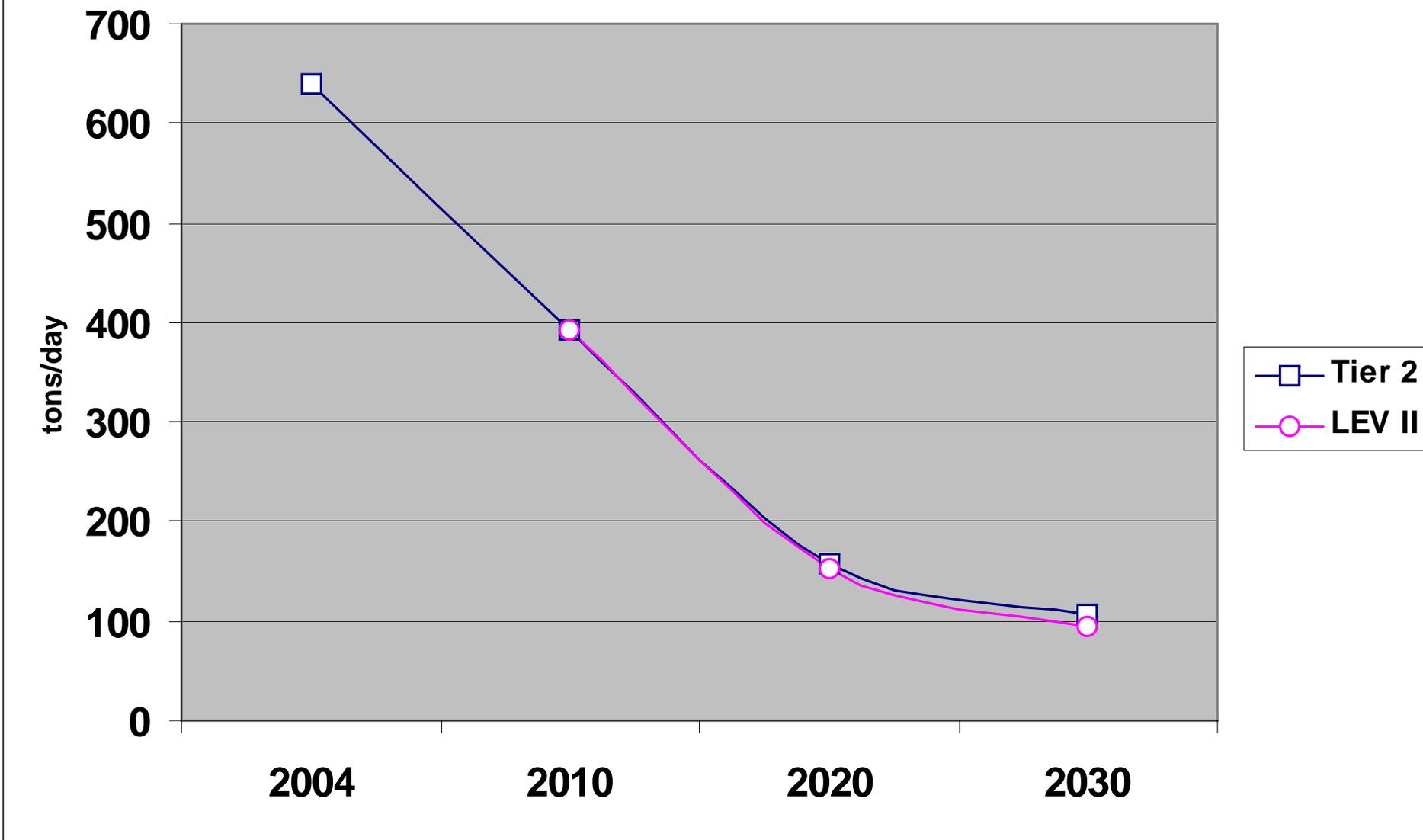
# CA LEV-II vs. Federal Tier 2

Emission estimates were developed using:

- USEPA motor vehicle emissions model (MOBILE6.2)
- USEPA mobile modeling guidance
- NC specific input data including:
  - Vehicle mix, vehicle age distribution, vehicle miles traveled (VMT), speeds, Inspection/Maintenance Programs (I/M), fuels, temperatures
- Federal Tier 2 estimates for 2004, 2010, 2020 and 2030
- CA LEV-II estimates for 2010, 2020 and 2030

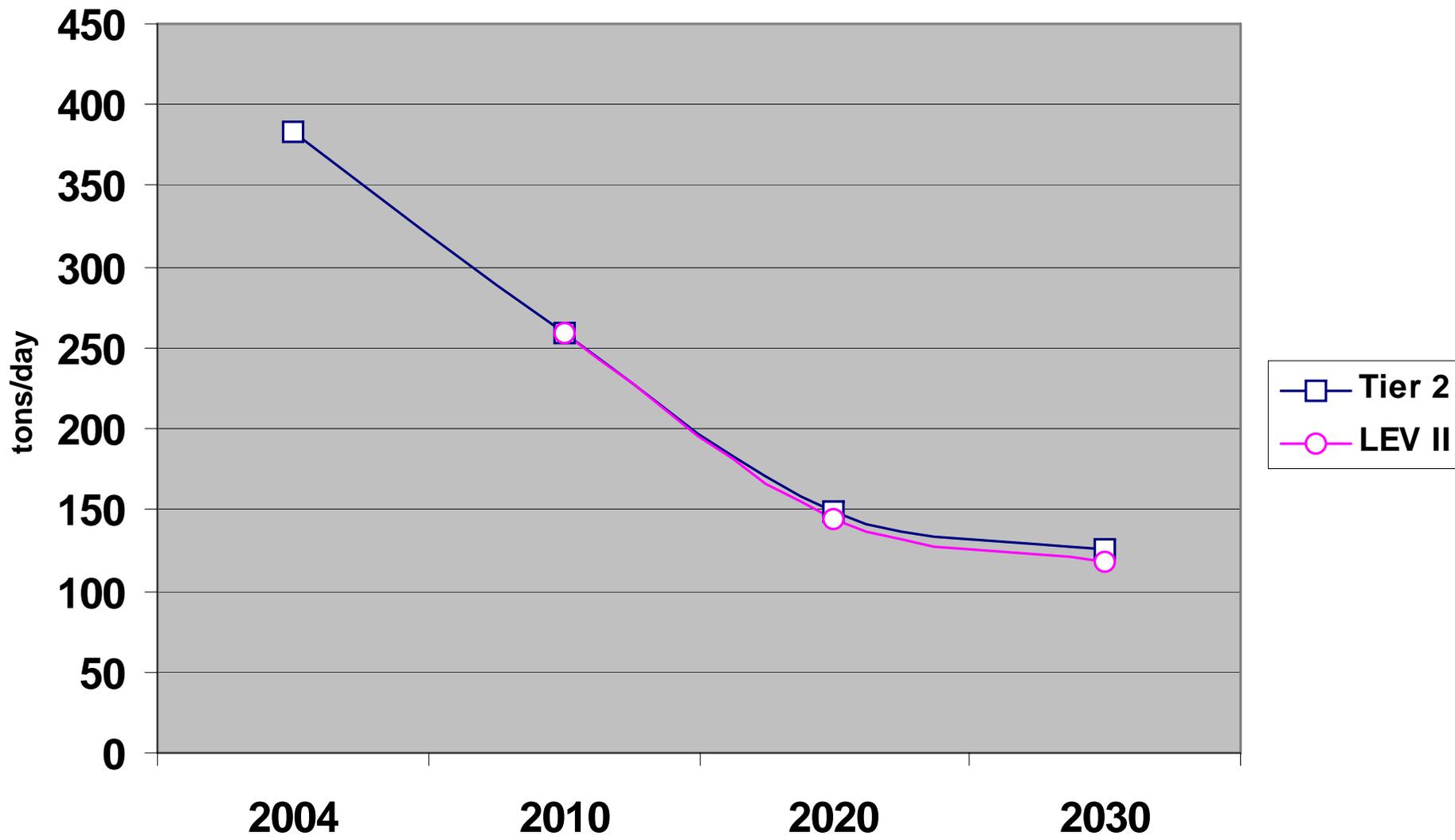


## North Carolina Onroad Mobile NO<sub>x</sub> Emissions Typical Summer Day



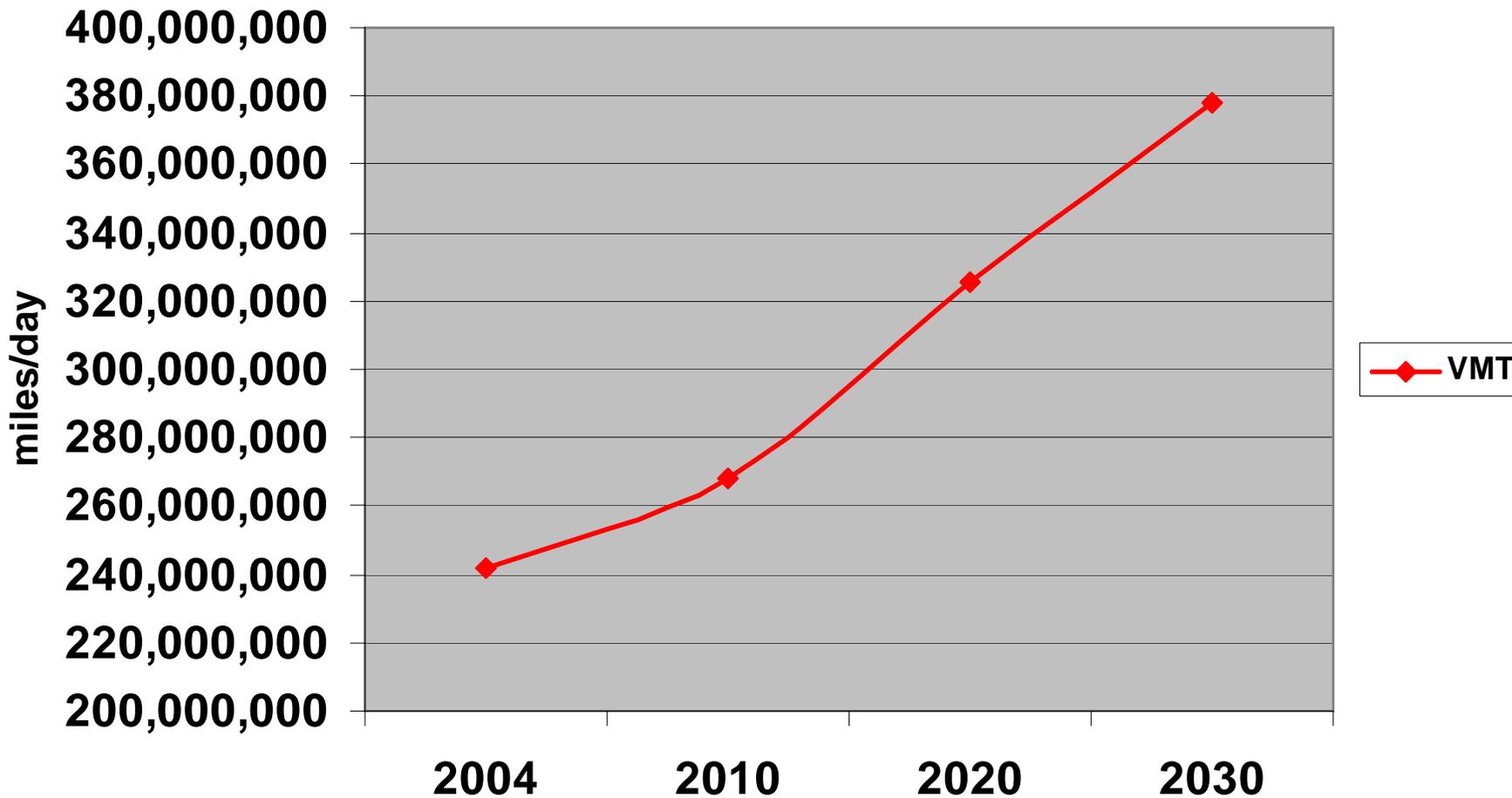


## North Carolina Onroad Mobile VOC Emissions Typical Summer Day





### North Carolina Daily Vehicle Miles Traveled





# CA LEV-II vs. Federal Tier 2

## Emissions Reductions Summary

- On-road mobile sources only
- CA LEV-II Program in NC starting with model year 2010

	<u>2010</u>	<u>2020</u>	<u>2030</u>
<b>NOx</b>	<b>0.1%</b>	<b>4%</b>	<b>10%</b>
<b>VOC</b>	<b>0.1%</b>	<b>3%</b>	<b>6%</b>



# **Air Quality Modeling**

- **During NCDAQ's current SIP modeling...  
Air Quality modeling sensitivities were performed by NCDAQ to assess the impacts of *additional* future year NOx emissions reductions from on-road mobile sources**



# Air Quality Modeling

**Future year (2009) NO<sub>x</sub> emissions from on-road mobile sources were reduced by 10% in the following counties:**

**Mecklenburg**

**Union**

**Gaston**

**Lincoln**

**Iredell**

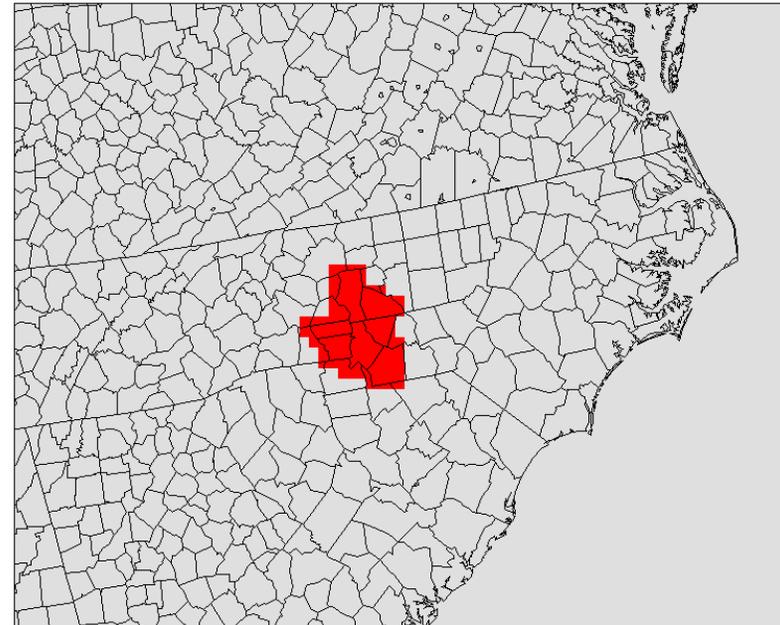
**Cabarrus**

**Rowan**

**The 10% NO<sub>x</sub> reduction in 2009 is equivalent to ~10 tons/day in this region**

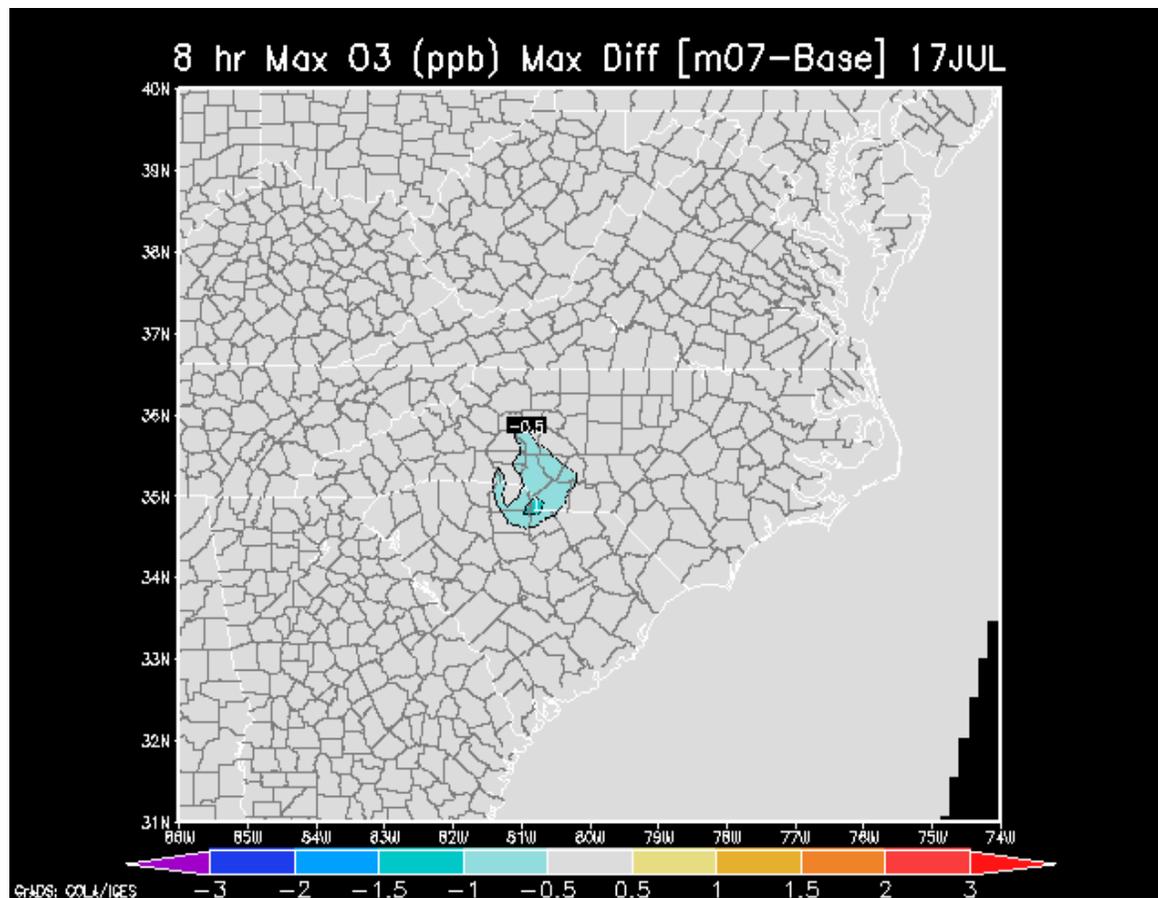
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## Air Quality Modeling



- 10 tons/day on-road mobile NO<sub>x</sub> reduction across the Metrolina area resulted in lowering 8-hour ozone concentrations by 0.1 to 1.0 ppb in 2009
- Only 1 of the 7 modeled days resulted in changes as high as 1.0 ppb (shown)
- Only 2 of the 7 modeled days resulted in changes as high as 0.5 ppb



# Air Quality Modeling

**For the Metrolina area...**

**2009 on-road mobile NO<sub>x</sub> ~ 100 tons/day (w/ Tier 2)**

**2020 on-road mobile NO<sub>x</sub> ~ 25 tons/day (w/ Tier 2)**

**If...**

- 10% = 10 tons/day NO<sub>x</sub> in 2009 = 1 ppb max benefit**

**Then..**

- 4 % = 1 ton/day NO<sub>x</sub> in 2020 = 0.1 ppb max benefit**



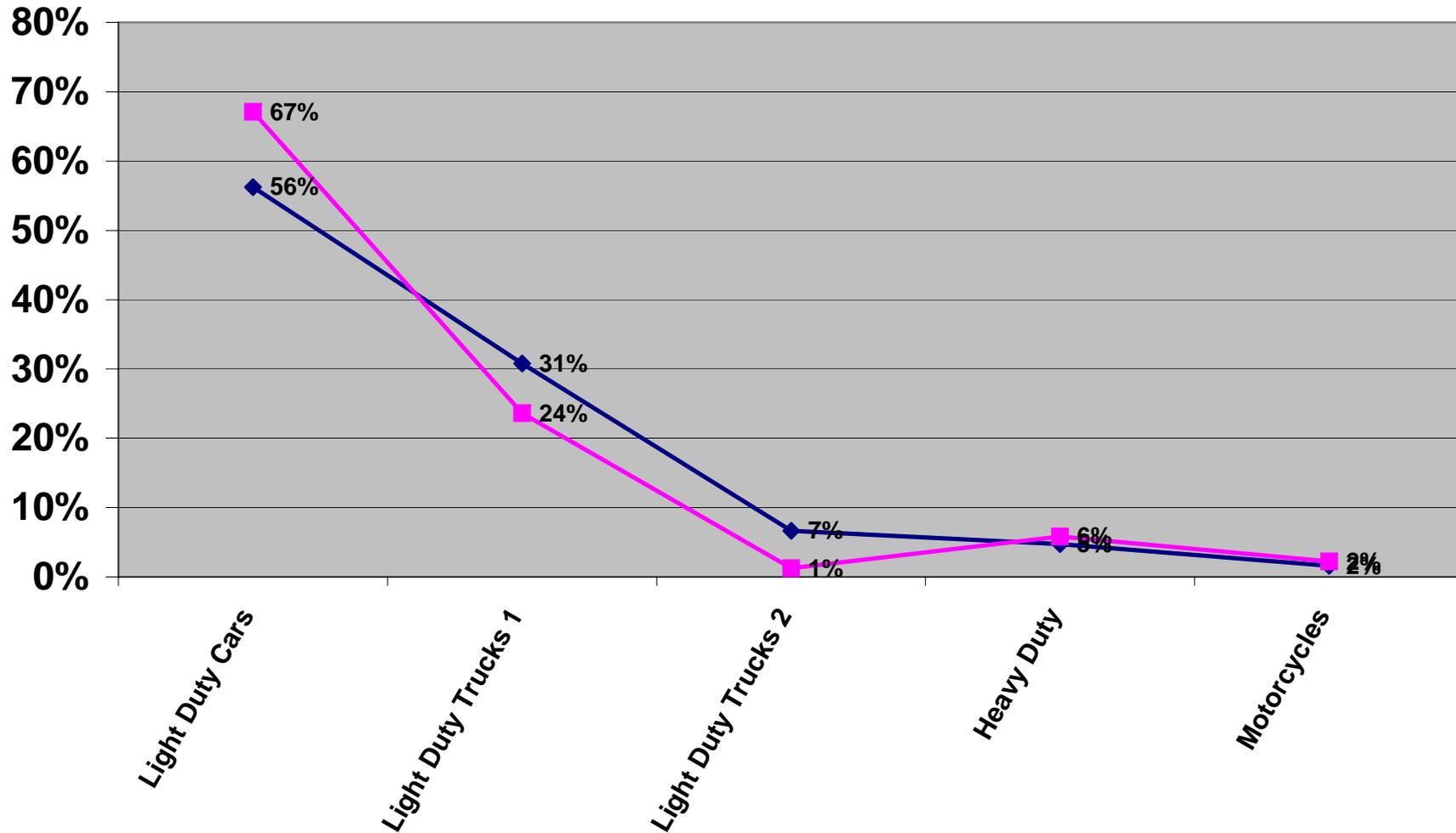
# **Fleet Characteristics**

- **Comparison of the NC and CA vehicle fleets**
  - **Composition**
  - **Age distributions**
- **Assess the value of “fleet averaging” enforcement**

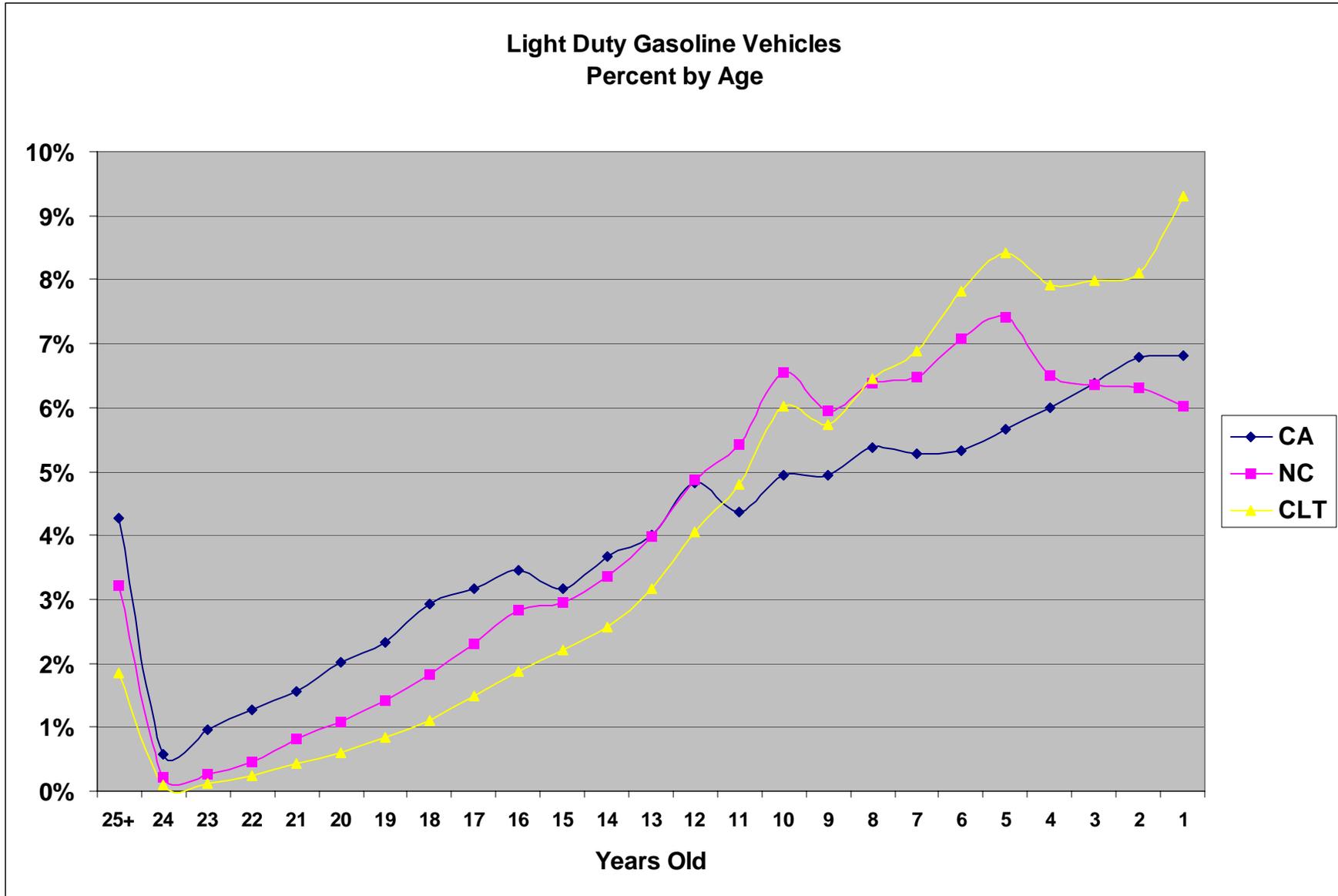


### Fleet Mix Composition of Fleet per Vehicle Type

◆ CA Fleet Mix  
■ NC Fleet Mix



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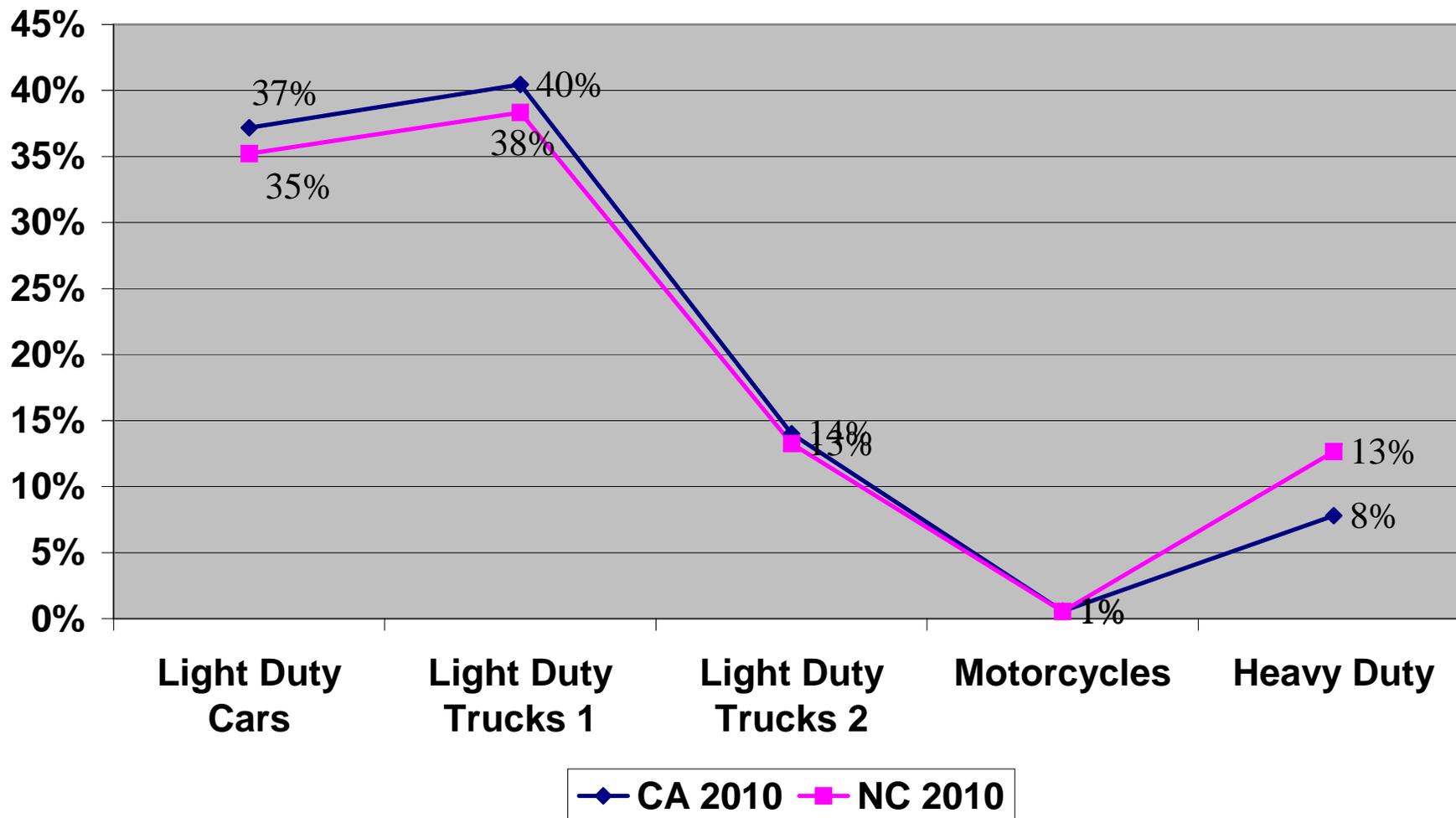


Sources: North Carolina Department of Transportation and California Air Resources Board

Note: CLT includes Gaston and Mecklenburg Counties



## VMT Mix Percent of VMT per Vehicle Type





## Staff Resources

- **DAQ and DMV**
  - **DMV: Primary point of enforcement**
  - **DAQ: Audits, monitor performance of program, public outreach and troubleshoot registration issues**
  
- **Fleet average enforcement**
  - ***Potential* State staffing requirements with fleet average enforcement**
    - **Washington, 1.5 full time employees (FTEs)**
    - **New York, 2-3 people (not full time)**
    - **Massachusetts, 2-3 people (not full time)**
  - **Potential duties of DAQ Employees**
    - **Enforce compliance of fleet average requirement**
    - **Work with manufacturers / dealers and public on vehicle model availability issues**



# **Staff Resource Impacts**

- **Existing Tasks:**
  - **Transportation conformity, SIP modeling and emissions inventories would require more time and resources due to more complicated mobile sources emissions estimation techniques**
  - **This would also impact Local Air Quality Agencies, Metropolitan Planning Organizations and Rural Planning Organizations involved in the transportation conformity process**



# Summary

- **CA LEV-II benefits relative to Federal Tier II in future years in NC:**
  - **NOx emissions would be reduced by 0.1%, 4% and 10% in 2010, 2020 and 2030, respectively**
  - **VOC emissions would be reduced by 0.1%, 3% and 6% in 2010, 2020 and 2030, respectively**
  - **Air Quality benefits: Less than 0.1 ppb ozone reduction in 2020**



## **Summary - continued**

- **Air Quality**: Ozone concentrations would change *less than* 0.1 ppb in 2020
- **Vehicle fleet age**: NC currently has a newer fleet of light duty vehicles (passenger cars) than California
- **Vehicle population**: NC has a greater number of light duty vehicles (passenger cars) and fewer light duty trucks (including SUVs) than California
- **Implementation Resources**: Other States suggest 1-2 employees needed for enforcement of fleet average requirements
- **Implications for ongoing DAQ activities**: More complicated emission estimation techniques would lengthen NCDAQ timelines for transportation conformity, SIP modeling and emission inventories



## Contributors

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# Questions/Comments

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