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

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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… NOx + VOC + sunlight = ozone

- NOx
  - precursor pollutant of concern in NC

- Majority of VOCs come from natural sources

- On-road mobile sources contribute significantly to the total NOx emissions in NC
**VOC emissions**

**Typical Summer Weekday**

**VOC Emissions in NC**

- **85%** Biogenic
- **7%** Area
- **4%** Mobile
- **2%** Point
- **2%** Nonroad

Source: NCDAQ, 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

NC Statewide NOx Emissions

Source: NCDAQ, 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)
2009 Metrolina Nonattainment Area NOx Emissions
237 tons/day
Typical Summer Weekday

Includes: Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Union Counties in NC and York County, SC

2009 NC Statewide NOx Emissions
1271 tons/day
Typical Summer Weekday

Source: NCDAQ, 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 Smokesacks Act (point sources), Federal Tier 2 (on-road mobile sources) and the expanded NC Inspection and Maintenance Program (on-road mobile sources)
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.

Source: NCDAQ, Association of Southeastern Integrated Planning and the Visibility Improvement State and Tribal Association of the Southeast, Version BaseF4
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 NOx 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

- CA LEV-II estimates for 2010, 2020 and 2030

Methods: USEPA Technical Guidance on the Use of MOBILE 6.2 for Emission Inventory Preparation, August 2004
North Carolina Onroad Mobile NOx Emissions
Typical Summer Day

- Tier 2
- LEV II
North Carolina Onroad Mobile VOC Emissions
Typical Summer Day

- Tier 2
- LEV II
North Carolina Daily Vehicle Miles Traveled

- 200,000,000
- 220,000,000
- 240,000,000
- 260,000,000
- 280,000,000
- 300,000,000
- 320,000,000
- 340,000,000
- 360,000,000
- 380,000,000
- 400,000,000

- 2004
- 2010
- 2020
- 2030

miles/day

VMT
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

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<thead>
<tr>
<th></th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
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</thead>
<tbody>
<tr>
<td>NOx</td>
<td>0.1%</td>
<td>4%</td>
<td>10%</td>
</tr>
<tr>
<td>VOC</td>
<td>0.1%</td>
<td>3%</td>
<td>6%</td>
</tr>
</tbody>
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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.
Future year (2009) NOx emissions from on-road mobile sources were reduced by 10% in the following counties:

- Mecklenburg
- Union
- Gaston
- Lincoln
- Iredell
- Cabarrus
- Rowan

The 10% NOx reduction in 2009 is equivalent to ~10 tons/day in this region
Air Quality Modeling

- 10 tons/day on-road mobile NOx 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 NOx ~ 100 tons/day (w/ Tier 2)
2020 on-road mobile NOx ~ 25 tons/day (w/ Tier 2)

If…
• 10% = 10 tons/day NOx in 2009 = 1 ppb max benefit

Then..
• 4 % = 1 ton/day NOx 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

Sources: North Carolina Department of Transportation and California Air Resources Board
Light Duty Gasoline Vehicles
Percent by Age

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

Sources: North Carolina Department of Transportation and California Air Resources Board
Methods: USEPA Technical Guidance on the Use of MOBILE 6.2 for Emission Inventory Preparation, August 2004
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

Source: NCDAQ, Washington State Department of Ecology-Air Quality Program
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

Source: NCDAQ, Washington State Department of Ecology-Air Quality Program
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
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Questions/Comments

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