North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

March 30, 2015

MEMORANDUM

TO: ENVIRONMENTAL REVIEW COMMISSION
The Honorable Mike Hager, Co-Chair
The Honorable Brent Jackson, Co-Chair

FROM: Matt Dockham, Director of Legislative Affairs

SUBJECT: North Carolina Inspection and Maintenance Program Interim Report

DATE: March 30, 2015

Pursuant to S.L. 2013-413, section 26, the Department of Environment and Natural Resources shall conduct a study to examine whether all of the counties covered under the emissions testing and maintenance program pursuant to G.S. 143-215.107A are needed to meet and maintain the current and proposed federal ozone standards in North Carolina. Please consider the attached as the formal submission this report.

If you have any questions or need additional information, please contact me by phone at (919) 707-8618 or via e-mail at matthew.dockham@ncdenr.gov.

cc: Tom Reeder, Assistant Secretary for Environment, NCDENR
Sheila Holman, Director of Air Quality, NCDENR

North Carolina Inspection and Maintenance Program

Study to Examine Whether All the Counties Covered Under the Emissions Testing and Maintenance Program are Needed to Meet and Maintain the Current and Proposed Federal Ozone Standards in North Carolina

A Report to the Environmental Review Commission

Submitted by the North Carolina Department of Environment and Natural Resources

Interim Report

April 1, 2015

North Carolina Inspection and Maintenance Program

Study to Examine Whether All the Counties Covered Under Emissions Testing and Maintenance Program are Needed to Meet and Maintain the Current and Proposed Federal Ozone Standards in North Carolina

A Report to the Environmental Review Commission

Submitted by the North Carolina Department of Environment and Natural Resources

This report is submitted pursuant to the requirement of Section 26 of Session Law 2013-413, House Bill 74 enacted August 23, 2013.

Signed: 

Donald R. van der Vaart, Secretary
Department of Environment and Natural Resources

Interim Report

April 1, 2015

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Interim Report to the Environmental Review Commission

April 1, 2015

Executive Summary

The 2013 session of the North Carolina General Assembly directed the Department of Environment and Natural Resources (DENR) to study the continued need to conduct vehicle emissions inspections in all of the 48 counties covered under the program.

Specifically, Section 26 of Session Law 2013-413 states the following:

Section 26 The Department of Environment and Natural Resources to conduct a study to examine whether all of the counties covered under the emissions testing and maintenance program pursuant to G.S. 143 215.107A are needed to meet and maintain the current and proposed federal ozone standards in North Carolina. The Department shall report its interim findings to the Environmental Review Commission on or before April 1, 2015, and shall submit its final report, including any findings and legislative recommendations, to the Environmental Review Commission on or before April 1, 2016.

This report describes DENR's study approach and its interim findings. Collectively, DENR and the North Carolina Division of Motor Vehicles (DMV) recommend the following:

> Option A - using 65 ppb as the potential ozone standard: Eliminate the following 27 counties from vehicle emissions inspection requirements, effective January 1, 2016: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Edgecombe, Franklin, Harnett, Haywood, Henderson, Lee, Lenoir, Moore, Nash, New Hanover, Onslow, Robeson, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.
>
> If EPA finalizes a new ozone standard at 70 ppb, then the current data would support a recommendation of removing the 27 counties named above, plus 4 additional counties (Rockingham, Orange, Granville and Pitt), that have current ozone values *at or below 70 ppb*.
>
> Option B - using 70 ppb as the potential ozone standard: Eliminate the following 31 counties from vehicle emissions inspections requirements, effective January 1, 2016: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven,

Edgecombe, Franklin, Granville, Harnett, Haywood, Henderson, Lee, Lenoir, Moore, Nash, New Hanover, Orange, Onslow, Pitt, Robeson, Rockingham, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.

Addtionally, DENR and DMV recommend an additional report to the Environmental Review Commission by April 1, 2016, with recommendations on whether additional counties should be removed from the vehicle emissions inspection program considering the final 2015 EPA ozone standard, the latest ambient air quality monitoring data and the latest mobile source emissions estimates. Also, DENR shall study other opportunities to optimize efficiencies, including, but not limited to: the range of model years that should be subject to emissions testing to meet and maintain the current federal ozone standards; a biennial emissions inspection frequency; and the effectiveness of random survey inspections. Finally, if this reporting recommendation is put into session law, then, the reporting requirements in Section 26 of Session Law 2013-413 can be repealed.

Figures 1 and 2 provide a graphical summaries of the options presented.

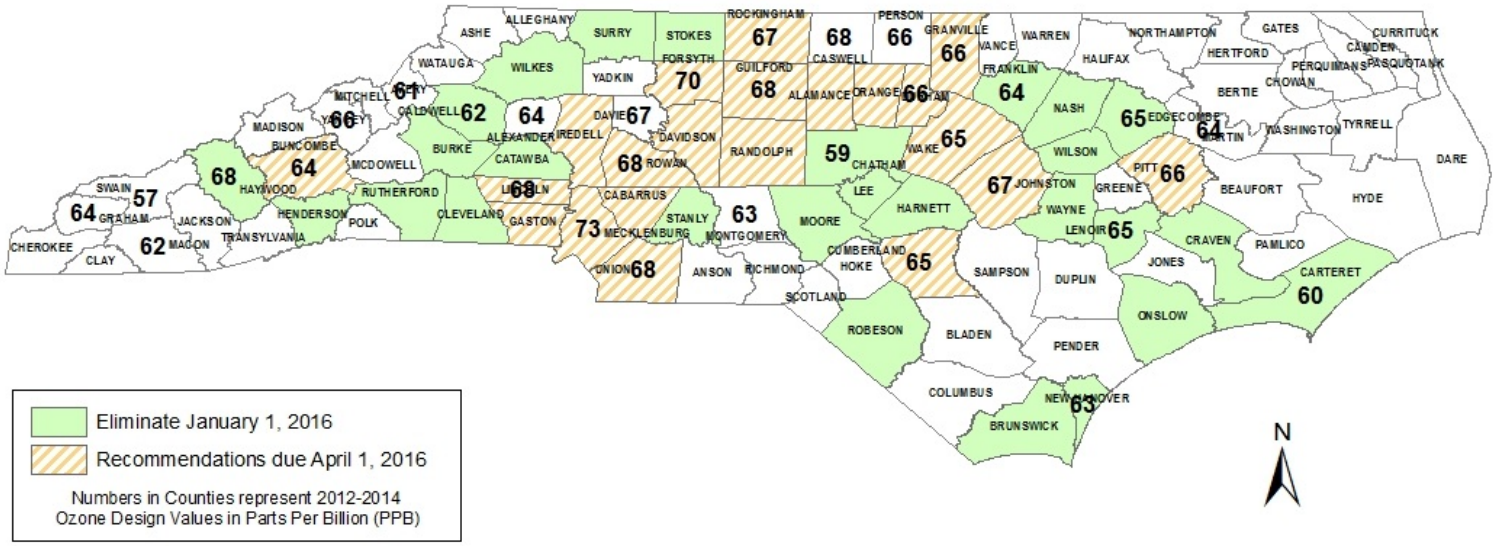

Figure 1. Option A - Remove 27 counties from the emissions inspection program using 65 ppb as the potential ozone standard.

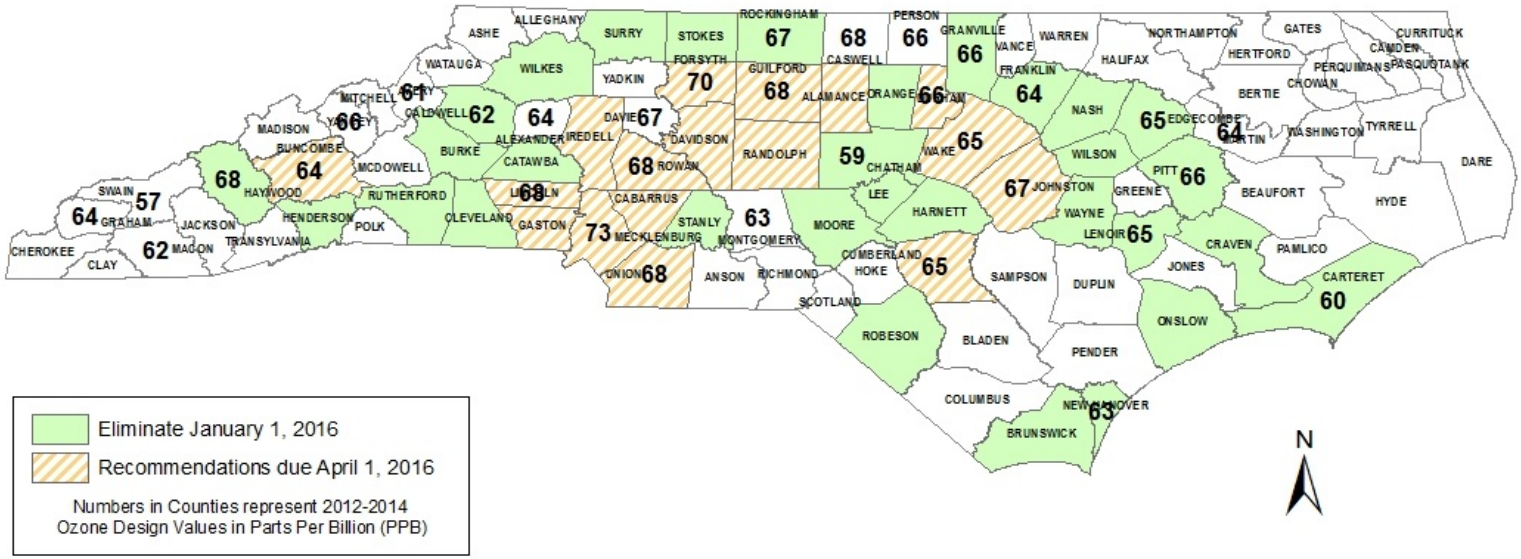

Figure 2. Option B – Remove 31 counties from the emissions inspection program using 70 ppb as the potential ozone standard.

Section I of this report provides a brief background on the emissions inspection program and its applicability to the 48 counties subject to the program, an overview of the current National Ambient Air Quality Standards (NAAQS) and the EPA's proposed revisions to the ozone NAAQS, and State Implementation Plan (SIP) requirements for demonstrating compliance with the NAAQS.

Section II presents the study approach that includes a summary of North Carolina's most recent ozone monitoring data available for 2012 through 2014 for 22 counties subject to the emissions inspection program. The remaining 26 counties subject to the emissions inspection program do not contain ozone monitors. Section II also presents an analysis approach for quantifying air emissions associated with vehicles subject to the program and the potential emissions impacts associated with removing each of the 48 counties from the emissions inspection program.

The results of the vehicle emissions analysis are presented and discussed in Section III of this report. Section IV presents DENR's recommendations and explains the basis for the recommendations. Appendix A to this report summarizes key aspects of the onroad modeling framework and Appendix B provides a list of acronyms and abbreviations used in this report.

I. Introduction

A. Vehicle Emissions Inspection Program Background

The Environmental Management Commission has the authority to adopt "a program for testing emissions from motor vehicles and to adopt motor vehicle emission standards," *North Carolina General Statue (NCGS) §143-215.107 (a)(6), "Air quality standards and classification*s." The Environmental Management Commission has adopted rules for a basic I/M program under 15A North Carolina Administrative Code (*NCAC) Subchapter 2D, Section .1000 "Motor Vehicle Emissions Control Standards,"* that are federally enforceable by the U.S. Environmental Protection Agency's (EPA) under the Code of Federal Regulations (CFR) 40 CFR Part 51. The I/M program is implemented by the Commissioner of the DMV through the use of licensed safety/emission inspection stations, *NCGS Article 3 – Motor Vehicle Act of 1937 §20-128.2 (a),"Motor vehicle emission standards."*

The North Carolina Division of Motor Vehicles (DMV), License and Theft Bureau, has operational responsibility for the I/M program, and has created rules for implementing and monitoring the program under 19A NCAC 03D .0500. The Division of Air Quality (DAQ) in the Department of Environment and Natural Resources (DENR) provides technical support to DMV's implementation of North Carolina's I/M program. In addition, the DENR develops specifications for the program and certifies the emissions testing equipment used in the program. The DENR also prepares revisions to the SIP based on changes made by the North Carolina General Assembly and the Environmental Management Commission. In the past, implementation of this program has been an integral part of North Carolina's SIP(s) to support attainment and maintenance of the NAAQS for ozone and carbon monoxide (CO).

The North Carolina I/M program began in 1982 in Mecklenburg County. From 1986 through 1991, the program was expanded to include eight additional counties, based on a "tailpipe" emissions test. In 1999, the North Carolina General Assembly passed legislation to require an On-Board Diagnostic II (OBD) I/M program in not only the counties required to have an I/M program under 40 CFR 51.350(a), but also in other counties in the State that may need the additional emission reductions to achieve the 1997 8-hour ozone standard. Starting in October 2002, the original nine counties converted from tailpipe testing to the new OBD emissions testing for all model year 1996 and newer light-duty gasoline vehicles and continued tailpipe testing of model year 1995 and older vehicles. The program was expanded from nine counties starting July 1, 2003 to a total of 48 counties on January 1, 2006. At the time of full implementation of the OBD program, inspection stations were performing the OBD emissions test on model year 1996 and newer vehicles, and tailpipe testing for model year 1995 and older vehicles was discontinued.

In 2002, North Carolina inspection stations performed over 2.5 million vehicle emission inspections. As the new I/M counties were added, the number of inspections was expected to rise to a high of about 3.5 million inspections but then dip to a lower figure when all tailpipe testing ended on Dec 31, 2005. The actual number of OBD inspections has varied from 3.6 to about 5.4 million since 2006, due to a program change to align registration and inspection dates

in 2008 and higher than expected fleet turnover and population growth. In 2013, 5.38 million emissions inspections were performed.

On November 1, 2008, the State ended the use of paper stickers and began the process of aligning vehicle inspection expiration and registration renewal dates by using electronic inspection authorizations. Session Law 2011-95 enacted by the North Carolina General Assembly exempted plug-in electric vehicles from the emissions inspection requirement.

In 2012, the North Carolina General Assembly enacted Session Law 2012-199 which required DENR and DMV to change the emissions inspection program to exempt the three newest model year vehicles with less than 70,000 miles, and secure EPA approval. The DENR prepared and submitted to the EPA an amendment to the North Carolina I/M SIP under the federal Clean Air Act (CAA) to incorporate these changes to the emissions inspection program. The EPA approved the amendment on February 5, 2015.[1]

B. Counties Subject to the I/M Program

Table 1 lists the North Carolina counties required to have an I/M program as described in *40 CFR 51.350(a)*, due to being designated nonattainment for the 1979 1-hour ozone, and 1997 8-hour ozone NAAQS.

In 1999, the North Carolina General Assembly passed legislation to require an OBD I/M program in not only the counties required to have an I/M program under *40 CFR 51.350(a)*, but also in other counties in the State that may need the additional emission reductions to achieve the 1997 8-hour ozone standard. The *NCGS §143-215.107A(c), "Motor vehicle emissions testing and maintenance program,"* specifies the counties that are required to have OBD I/M. The State regulations *at 15A NCAC Subchapter 2D, Section .1000, "Motor Vehicle Emission Control Standards,"* references the General Statue. Table 2 lists the additional counties that are required to have an I/M program per *NCGS §143-215.107A(c), "Motor vehicle emissions testing and maintenance program."*

[1] 80 FR 6455-6458 (Vol. 80, No. 24)

Table 1. Counties Subject to I/M Program Based on Previous Nonattainment Designations

County	Ozone NAAQS	Current Status	Total No. Vehicle Inspections in 2013	Total I/M Vehicles (Model Years 1996-2011) as a Percentage of All Registered Vehicles
Cabarrus[1]	1997 8-hour	Maintenance	121,383	71
	2008 8-hour	Marginal-Nonattainment		
Davidson[2]	1979 1-hour	Maintenance	106,689	67
Durham[3]	1979 1-hour	Maintenance	166,122	75
	1997 8-hour			
Forsyth[3]	1979 1-hour	Maintenance	241,364	73
Gaston[1]	1979 1-hour	Maintenance	140,761	72
	1997 8-hour			
	2008 8-hour	Marginal-Nonattainment		
Granville[4]	1979 1-hour	Maintenance	33,086	70
	1997 8-hour			
Guilford[2]	1979 1-hour	Maintenance	334,492	72
Iredell[1,5]	1997 8-hour	Maintenance	111,934	67
	2008 8-hour	Marginal-Nonattainment		
Lincoln[1]	1997 8-hour	Maintenance	52,507	69
	2008 8-hour	Marginal-Nonattainment		
Mecklenburg[3]	1979 1-hour	Maintenance	634,474	72
	1997 8-hour			
	2008 8-hour	Marginal-Nonattainment		
Rowan[1]	1997 8-hour	Maintenance	87,414	69
	2008 8-hour	Marginal-Nonattainment		
Union[1]	1997 8-hour	Maintenance	130,996	71
	2008 8-hour	Marginal-Nonattainment		
Wake[3]	1979 1-hour	Maintenance	686,949	73
	1997 8-hour			

[1] Although only part of this county was designated marginal nonattainment for the 2008 8-hour ozone NAAQS, the whole county is subject to the I/M program.

[2] County is also subject to a maintenance plan for particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$).

[3] County is also subject to a limited maintenance plan for CO.

[4] Although only part of this county was designated moderate nonattainment for the 1979 1-hour ozone NAAQS, the whole county is subject to the I/M program.

[5] Although only part of this county was designated moderate nonattainment for the 1997 8-hour ozone NAAQS, the whole county is subject to the I/M program.

Table 2. Additional Counties Subject to I/M Program Based on 1999 Clean Air Bill

County	Ozone NAAQS	Current Status	Total No. Vehicle Inspections in 2013	Total I/M Vehicles (Model Years 1996-2011) as a Percentage of All Registered Vehicles
Alamance	-	-	98,472	70
Brunswick	-	-	73,255	72
Buncombe	-	-	160,657	71
Burke	-	-	53,749	67
Caldwell	-	-	53,120	67
Carteret	-	-	47,727	73
Catawba[1]	-	-	125,162	69
Chatham[2]	1997 8-hour	Maintenance	41,107	69
Cleveland	-	-	60,429	70
Craven	-	-	65,841	73
Cumberland	-	-	194,558	71
Edgecombe	1997 8-hour	Maintenance	28,772	71
Franklin	1997 8-hour	Maintenance	36,206	70
Harnett	-	-	65,696	70
Haywood	1997 8-hour	Maintenance	38,553	67
Henderson	-	-	75,498	71
Johnston	1997 8-hour	Maintenance	117,534	73
Lee	-	-	41,471	71
Lenoir	-	-	36,729	71
Moore	-	-	61,687	65
Nash	1997 8-hour	Maintenance	65,722	70
New Hanover	-	-	145,204	73
Onslow	-	-	99,576	71
Orange[3]	1997 8-hour	Maintenance	77,092	73
Pitt	-	-	102,603	73
Randolph	-	-	91,635	68
Robeson	-	-	77,384	71
Rockingham	-	-	59,002	67
Rutherford	-	-	40,974	68
Stanly	-	-	39,690	68
Stokes	-	-	29,313	66
Surry	-	-	51,768	64
Wayne	-	-	76,866	71
Wilkes	-	-	45,886	65
Wilson	-	-	53,820	71

[1] County is also subject to a maintenance plan for $PM_{2.5}$.

[2] Although only part of this county was designated moderate nonattainment for the 1997 8-hour ozone NAAQS, the whole county is subject to the I/M program.

[3] Although Orange County was one of the original nine counties subject to the I/M program prior to the 1999 Clean Air Bill, it is included in this table instead of Table 1 because it was not designated nonattainment with the ozone or CO NAAQS.

C. Air Quality Standards and Implementation Requirements

1. Current National Ambient Air Quality Standards (NAAQS)

The federal CAA as amended established NAAQS for the following criteria air pollutants: CO, lead, ozone, nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), and sulfur dioxide (SO_2). North Carolina has adopted the existing NAAQS under Article 21B of Chapter 143-215.107 of the General Statutes. The air quality standards are displayed in Table 3.

Table 3. Current National Ambient Air Quality Standards

Pollutant	Year Adopted by EPA	Primary / Secondary NAAQS	Averaging Time	Level*	Form
Ozone	2008	Primary and secondary	8-hour	75 ppb	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
CO	2011	Primary	1-hour 8-hour	35 ppm 9 ppm	Not to be exceeded more than once per year
Lead	2008	Primary and secondary	Rolling 3 month average	0.15 µg/m^3	Not to be exceeded
NO_2	2010	Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	Annual	53 ppb	Annual Mean
$PM_{2.5}$	2012	Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
		Secondary		15 µg/m^3	
		Primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
PM_{10}	2012	Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
SO_2	2010	Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

* ppm = parts per million, ppb = parts per billion, µg/m^3 = micrograms per cubic meter.

2. Scheduled Revisions to the Ozone NAAQS

The CAA requires the EPA to review, and revise if necessary, the NAAQS every five years. On December 17, 2014, the EPA proposed to revise both the primary ozone standard, to protect public health, and the secondary standard, to protect the public welfare.[2] Both standards would be 8-hour standards set within a range of 65 to 70 parts per billion (ppb). The EPA is also requesting public comment on levels for the health standard as low as 60 ppb as well as keeping

[2] 79 FR 75234-75411 (Vol. 79, No. 242)

the existing standard. The EPA is under a court order to finalize its decision on the revised NAAQS by October 1, 2015.

D. Implementation of the NAAQS

Section 110(a)(1) of the CAA requires that each state adopt and submit to the EPA for approval a plan which provides for implementation, maintenance and enforcement of primary standards for all areas within the state. For areas previously designated as nonattainment with a NAAQS (see Tables 1 and 2), the DENR prepared and submitted a State Implementation Plan (SIP) to the EPA that demonstrated how each area would attain the NAAQS by adopting and implementing a combination of permanent and enforceable federal, state, and local control measures. Once each area reached attainment with the NAAQS, the DENR submitted to the EPA a SIP demonstrating that attainment had been reached (based on air quality monitoring data), and requested that the EPA redesignate the area as attainment pursuant to Section 107(d)(3)(D) and (E) of the CAA. As a part of the redesignation request, the DENR also prepared and submitted a maintenance plan pursuant to Section 175A of the CAA to demonstrate how each area will maintain compliance with each of the NAAQS for at least 10 years after the redesignation. The maintenance plan remains in effect for 20 years after the EPA approves the plan, and must contain three fundamental elements to demonstrate continuous compliance with the NAAQS:

- A foundation control program that contains all of the necessary federal, state and local control measures to maintain compliance;
- A demonstration which shows projected decreases in emissions from all sectors (e.g., point, mobile, area, non-road) from the duration of the plan; and
- A contingency plan which details actions that the state will take should the design value (DV) of any monitor within the maintenance area violate the NAAQS.

When a state seeks revisions to a maintenance plan, Section 110(l) requires a non-interference demonstration to remove control strategies or make other changes. Section 110(l) states:

> "Each revision to an implementation plan submitted by a State under this chapter shall be adopted by such State after reasonable notice and public hearing. The Administrator shall not approve a revision of a plan if the revision would interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in section 171 of this title), or any other applicable requirement of this Act."

If the vehicle emissions inspection program was removed from a county, North Carolina needs to submit to the EPA for approval a demonstration that any emissions increases associated with removing the emissions inspection program would not hinder any area from attaining and/or maintaining compliance with all of the NAAQS. For counties that are in attainment with all of the NAAQS, the non-interference demonstration would rely on ambient air quality monitoring data and emissions data to show that removing the emissions inspection program will not interfere with continued attainment of the NAAQS. For areas that are currently designated as not attaining the NAAQS (i.e., the Charlotte-Gastonia-Salisbury 2008 8-hour ozone nonattainment area), North Carolina would have to revise the SIP to include compensating or equivalent

emissions reductions to offset increased emissions due to removal of the emissions inspection program.

Failure to have a revised SIP approved by the EPA before eliminating or modifying an I/M program could result in the state being sued for non-compliance with the CAA. For example, Kentucky legislation immediately ending the emissions program for the Louisville, Kentucky area prompted a lawsuit by the Kentucky Resource Council since the appropriate SIP revisions demonstrating compliance with Section 110(l) of the CAA had not been submitted to the EPA. The lawsuit resulted in a court order reinstating the emissions inspection program until the Section 110(l) demonstration had been submitted to and approved by the EPA.

The pollutants that need to be reviewed are NO_2, CO, nitrogen oxides (NOx) and volatile organic compounds (VOCs). NOx refers to nitric oxide (NO) and NO_2. Since NOx includes NO_2, NO_2 does not need to be reviewed separately. The EPA does not require that the demonstration associated with removing the I/M program address SO_2, lead, or $PM_{2.5}$ because vehicle emissions have little or no impact on ambient concentrations of those pollutants.

It is also important to note that North Carolina is considered NOx limited with respect to ozone formation. This means that there are significantly more VOC emissions in the atmosphere and that reductions in man-made VOC emissions will not result in reductions of ozone formation. Approximately 90% of the VOC emissions come from biogenic or natural sources in North Carolina, which cannot be controlled; therefore, control measures requiring small VOC emitting sources to reduce man-made VOC emissions will not result in a reduction in ozone formation. The best method to achieve reductions in ozone in North Carolina is to reduce NOx emissions.

II. Study Approach

For each of the 48 counties with a vehicle emissions inspection program, the study approach involved an analysis of daily NOx and VOC emissions reductions associated with the program and the available ambient air quality monitoring data for ozone. The emissions data were used in conjunction with ambient monitoring data and the current/proposed ozone NAAQS to provide a basis for recommending counties to be removed from the emissions inspection program.

A. Ambient Air Quality Data

Attainment of the 2008 ozone NAAQS is demonstrated by monitoring ambient air ozone concentrations in areas required to be monitored by the EPA (typically in and near large metropolitan areas). A monitoring location is considered in attainment if its DV is less than or equal to the current ozone NAAQS of 75 ppb.[3] A total of 22 of the 48 counties with a vehicle emissions inspection program have ozone monitors, and DVs are available for 2012 through 2014 for all 22 counties.

Figure 3 shows the 48 counties with an emissions inspection program, the 2012 through 2014 ozone DV for counties that have monitors, and counties that are covered by a maintenance plan for ozone. The figure also shows the boundaries for the Charlotte area that is covered by a

[3] An ozone design value is the average of the 4th highest ozone measurements for each year of a three year period.

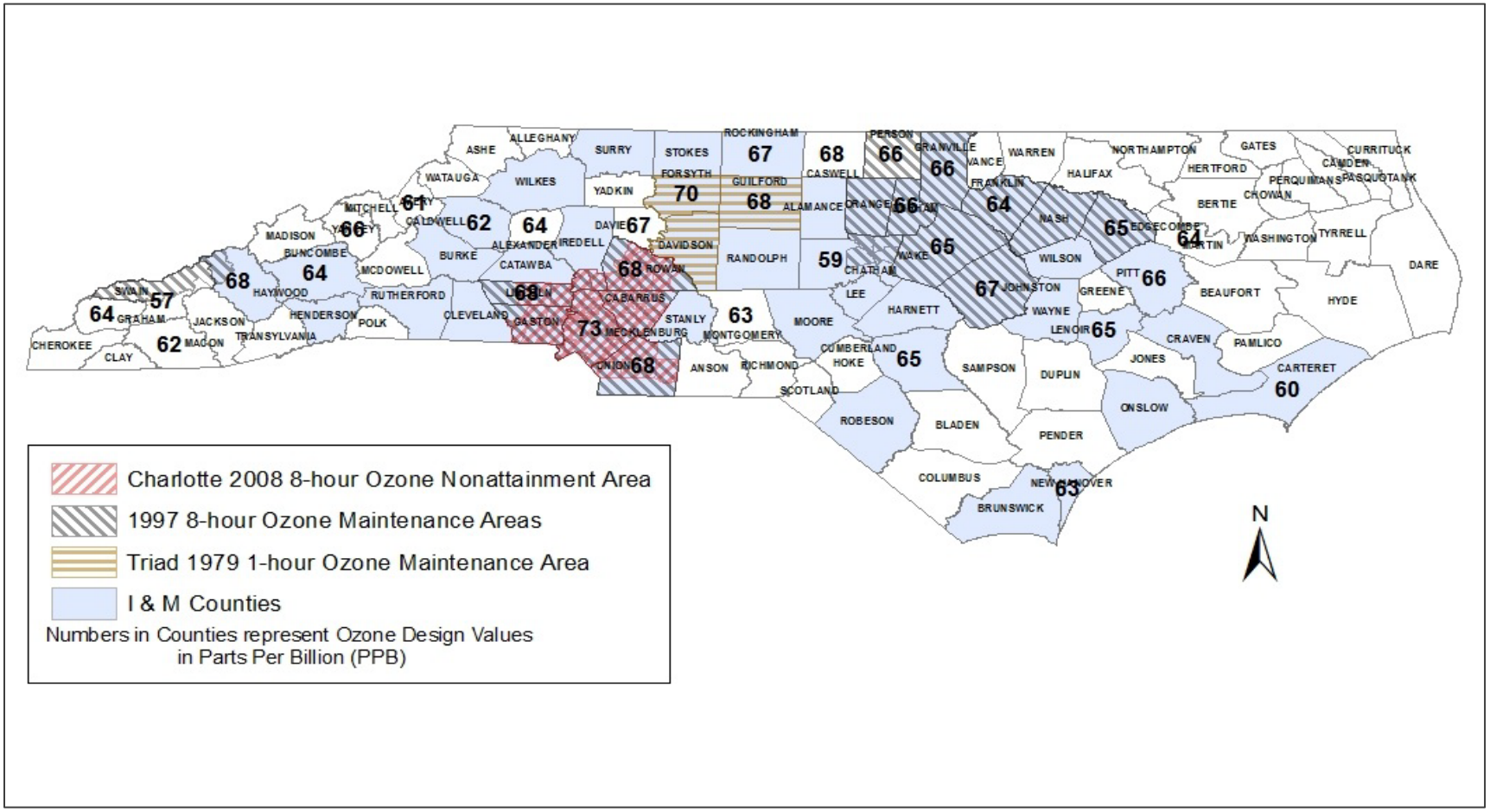

Figure 3. Ozone Design Values (2012-2014), I/M Counties and Ozone Attainment Status

maintenance plan for the 1997 8-hour ozone standard and is classified as nonattainment with the 2008 8-hour ozone standard. At the end of the 2014 ozone season, the Charlotte nonattainment area demonstrated attainment with the 2008 ozone standard based on the most recent three years of monitoring data. The DENR is in the process of submitting a redesignation request and maintenance plan to request the EPA to reclassify the Charlotte area as attainment with the 2008 ozone standard.

Based on the most recent ozone monitoring data (2012 through 2014), North Carolina does not have any areas violating the 2008 ozone standard or any of the other NAAQS. For the 48 counties with a vehicle emissions inspection program, ozone DVs for 2012-2014 range from a low of 59 ppb for Chatham County to a high of 73 ppb for Mecklenburg County. This is in sharp contrast to the ambient air quality data when the vehicle emissions inspection program was expanded to 48 counties. At that time, two-thirds of the state's ozone monitors were violating the federal ozone standard.

B. Vehicle Emissions Analysis

Air pollution emissions levels associated with vehicles subject to the I/M program are estimated using an EPA-approved emissions model. For this study, county-level on-road mobile emissions were modeled for near-term and longer-term future years using the Motor Vehicle Emission Simulator (MOVES2014); the EPA's latest version of the on-road emissions model. For each county in the emissions inspection program, modeling was performed to generate emissions data both with and without the program parameters in place to quantify emissions increases expected if the county is not subject to the program. The following summarizes key aspects of the onroad modeling framework; a detailed explanation is provided in Appendix A to this report.

Pollutants Modeled:

- NOx, VOC

Temporal Basis:

- MOVES2014 modeling runs were executed to model emissions for a typical summer workday (specifically a July weekday)

Inventory Base Year:

- 2014 modeled (with the emissions inspection program) as the base year of the study.

Inventory Projection Years:

- 2016 and 2018 were modeled (each with and without the emissions inspection program) as the future years for this study.

Emissions Inspection Program Parameters:

- For 2014, the following I/M parameters representative of North Carolina's I/M SIP for the 2014 operating year were modeled:
  - Compliance Rate: 95%
  - Waiver Rate: 5%
  - Exempted vehicles : 1 year (latest model year)

- For 2016 and 2018, the following I/M parameters were modeled to represent future years including the EPA approval of North Carolina's SIP revision to exempt the three newest model year vehicles with less than 70,000 miles:
  - Compliance Rate: 96%
  - Waiver Rate: 5%
  - Exempted vehicles : 3 years (latest model years)

Reid Vapor Pressure (RVP) Parameters for Summer Months:

- 9.0 pounds per square inch (psi) for all counties, except 7.8 psi for Mecklenburg and Gaston Counties for June 1 – September 15 of each year (2014, 2016, and 2018)

III. Study Results

The mobile source daily emissions modeling results are presented in Table 4 for NOx emissions and Table 5 for VOC emissions. Both of these tables show emissions for each county and by their attainment status (i.e., counties in the same maintenance or nonattainment area grouped together). Both tables show the DV for each county with a monitor, total number of vehicle inspections for 2013, and total number of vehicles subject to the program for model years 1996-2011 as a percentage of all registered vehicles. The tables also show the total emissions for all source categories in 2014, which includes onroad, stationary and nonroad emissions sources, and the percent contribution of onroad vehicles to total NOx and VOC emissions in 2014. Emissions are also presented for each county for 2016 and 2018 to show total emissions with the I/M program and the estimated emissions reductions associated with the I/M program. The following discussion summarizes the results presented in these two tables. The results from these two tables were used to formulate recommendations for counties to be removed from the emissions inspection program (see Section IV).

Figure 4 shows the relative contribution of onroad and nonroad mobile and stationary point and area (nonpoint) sources to total daily NOx and VOC emissions for the 48 counties combined. In 2014, total NOx emissions were about 579 tons/day. Onroad mobile source emissions were about 50% (288 tons/day) of the total which suggests that vehicles are a significant contributor to NOx emissions. Total man-made VOC emissions for the 48 counties combined were about 580 tons/day.[4] The relative contribution of onroad mobile sources to total man-made VOC emissions is considerably less than this sector's contribution to total NOx emissions. Onroad mobile sources accounted for about 30% (172 tons/day).

[4] It should be noted that biogenic VOC emissions account for 90% of total VOC emissions in North Carolina.

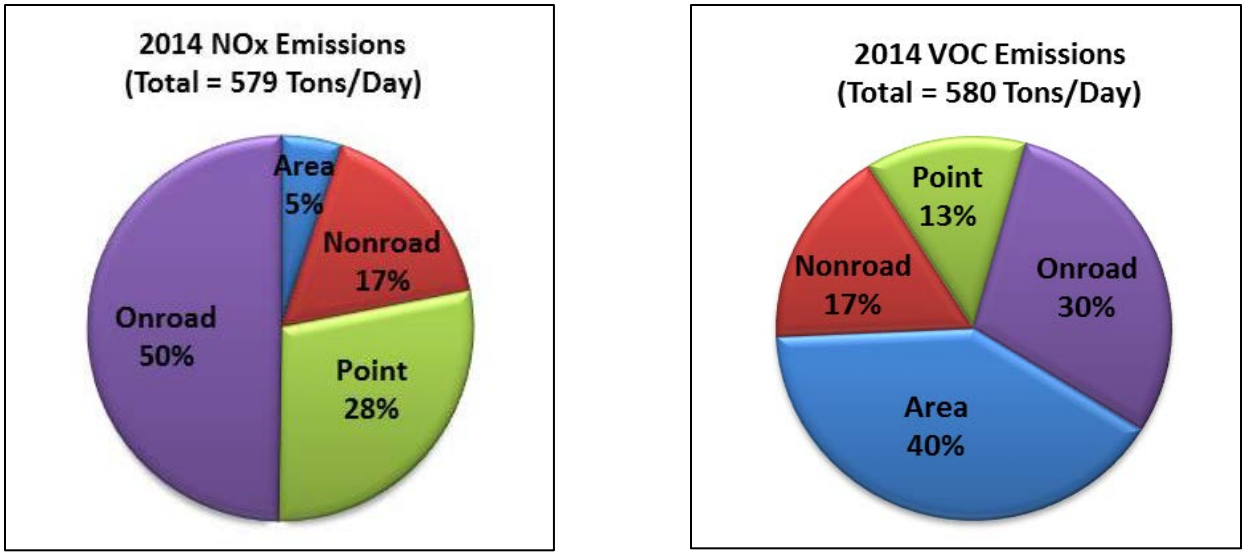

Figure 4. Emissions Source Contribution to Total Man-Made Daily NOx and VOC Emissions in 2014

Table 4. Mobile Source NOx Emissions Results

Ozone NAAQS Designation Status	County Grouping	County	2012-2014 Design Value (ppb)	Total Inspections 2013	Total I/M Vehicles (Model Years 1996-2011) as a Percentage of All Registered Vehicles	Total NOx Emissions for all Source Categories (TPD) (2014)	Percent of Onroad NOx to Total NOx Emissions for County (2014)	Total Onroad NOx Emissions with I/M (TPD) (2016)	I/M NOx Emission Reduction (TPD) (2016)	Total Onroad NOx Emissions with I/M (TPD) (2018)	I/M NOx Emission Reduction (TPD) (2018)
Marginal Nonattain-ment	Charlotte-Gastonia-Salisbury	Cabarrus		121,383	71%	9.56	67.3%	5.21	0.39	3.75	0.27
		Gaston		140,761	72%	25.93	31.0%	6.43	0.47	4.63	0.33
		Iredell		111,934	67%	15.96	51.2%	6.73	0.41	5.09	0.29
		Lincoln	68	52,507	69%	4.51	73.3%	2.70	0.18	1.98	0.13
		Mecklenburg	73	634,474	72%	52.65	48.3%	19.80	1.67	13.40	1.07
		Rowan	68	87,414	69%	11.95	52.9%	5.07	0.37	3.68	0.27
		Union	68	130,996	71%	10.43	59.5%	5.02	0.35	3.62	0.24
Subtotal				**1,279,469**		**130.99**		**50.97**	**3.85**	**36.15**	**2.60**
Maintenance	Triad	Davidson		106,689	67%	11.89	58.9%	5.65	0.40	4.12	0.29
		Forsyth	70	241,364	73%	16.29	61.5%	7.97	0.64	5.68	0.45
		Guilford	68	334,492	72%	25.26	57.9%	11.67	0.92	8.43	0.65
Subtotal				**682,545**		**53.43**		**25.29**	**1.96**	**18.22**	**1.39**
Maintenance	Triangle	Chatham	59	41,107	69%	11.45	27.4%	2.74	0.18	2.14	0.14
		Durham	66	166,122	75%	14.64	57.6%	6.72	0.57	4.69	0.38
		Franklin	64	36,206	70%	3.04	74.6%	1.81	0.13	1.33	0.09
		Granville	66	33,086	70%	4.71	73.5%	2.78	0.15	2.15	0.11
		Johnston	67	117,534	73%	12.59	79.6%	8.03	0.47	6.37	0.33
		Orange		77,092	73%	9.81	66.4%	5.28	0.30	4.07	0.21
		Wake	65	686,949	73%	40.48	55.7%	17.71	1.51	12.39	0.99
Subtotal				**1,158,096**		**96.73**		**45.07**	**3.30**	**33.14**	**2.25**
Maintenance	Rocky Mount	Edgecombe	65	28,772	71%	7.91	23.2%	1.44	0.11	1.01	0.08
		Nash		65,722	70%	7.34	74.4%	4.41	0.28	3.25	0.19
Subtotal				**94,494**		**15.25**		**5.85**	**0.39**	**4.27**	**0.27**
Maintenance	Great Smoky Mountains National Park	Haywood	68	38,553	67%	16.34	27.9%	3.88	0.22	3.04	0.16

Table 4. Mobile Source NOx Emissions Results

Ozone NAAQS Designation Status	County Grouping	County	2012-2014 Design Value (ppb)	Total Inspections 2013	Total I/M Vehicles (Model Years 1996-2011) as a Percentage of All Registered Vehicles	Total NOx Emissions for all Source Categories (TPD) (2014)	Percent of Onroad NOx to Total NOx Emissions for County (2014)	Total Onroad NOx Emissions with I/M (TPD) (2016)	I/M NOx Emission Reduction (TPD) (2016)	Total Onroad NOx Emissions with I/M (TPD) (2018)	I/M NOx Emission Reduction (TPD) (2018)
Attainment		Alamance		98,472	70%	8.74	70.9%	5.04	0.36	3.69	0.26
		Brunswick		73,255	72%	11.85	36.3%	3.47	0.25	2.47	0.17
		Buncombe	64	160,657	71%	16.53	57.4%	7.65	0.57	5.54	0.40
		Burke		53,749	67%	5.62	78.9%	3.82	0.25	2.71	0.18
		Caldwell	62	53,120	67%	4.96	70.3%	2.99	0.20	2.13	0.15
		Carteret	60	47,727	73%	5.12	42.1%	1.69	0.14	1.18	0.09
		Catawba		125,162	69%	34.32	16.3%	4.52	0.34	3.28	0.24
		Cleveland		60,429	70%	7.03	76.1%	4.36	0.28	3.25	0.20
		Craven		65,841	73%	10.24	31.6%	2.68	0.20	1.80	0.13
		Cumberland	65	194,558	71%	13.66	69.8%	7.63	0.55	5.45	0.38
		Harnett		65,696	70%	5.17	77.4%	3.29	0.22	2.44	0.16
		Henderson		75,498	71%	5.95	68.8%	3.35	0.22	2.48	0.16
		Lee		41,471	71%	3.43	63.6%	1.78	0.13	1.29	0.09
		Lenoir	65	36,729	71%	3.70	62.1%	1.85	0.14	1.33	0.10
		Moore		61,687	65%	4.52	70.2%	2.63	0.19	1.93	0.14
		New Hanover	63	145,204	73%	21.96	20.5%	3.53	0.30	2.44	0.20
		Onslow		99,576	71%	8.03	61.6%	3.94	0.29	2.78	0.19
		Pitt	66	102,603	73%	7.22	61.0%	3.50	0.28	2.46	0.19
		Randolph		91,635	68%	8.51	76.4%	5.56	0.37	3.91	0.27
		Robeson		77,384	71%	11.33	62.6%	6.04	0.37	4.28	0.25
		Rockingham	67	59,002	67%	14.08	30.6%	3.52	0.24	2.60	0.18
		Rutherford		40,974	68%	5.78	46.8%	2.21	0.15	1.64	0.11
		Stanly		39,690	68%	4.18	65.6%	2.23	0.15	1.62	0.11
		Stokes		29,313	66%	13.41	14.3%	1.66	0.11	1.20	0.08
		Surry		51,768	64%	5.88	78.4%	3.99	0.24	2.84	0.17
		Wayne		76,866	71%	13.64	28.5%	3.06	0.22	2.20	0.16
		Wilkes		45,886	65%	4.87	69.6%	2.78	0.18	2.07	0.14
		Wilson		53,820	71%	6.29	58.6%	3.10	0.20	2.17	0.13
Subtotal				**2,127,772**		**266.00**		**101.86**	**7.15**	**73.21**	**5.03**
Total				**5,380,929**		**578.76**		**232.92**	**16.87**	**168.03**	**11.70**

* ppb = parts per billion; TPD = tons per day.

Table 5. Mobile Source VOC Emissions Results

Ozone NAAQS Designation Status	County Grouping	County	2012-2014 Design Value (ppb)	Total Inspections 2013	Total I/M Vehicles (Model Years 1996-2011) as a Percentage of All Registered Vehicles	Total Man-Made VOC Emissions for all Source Categories (TPD) (2014)	Percent of Onroad VOC to Total Man-Made VOC Emissions for County (2014)	Total Onroad VOC Emissions with I/M (TPD) (2016)	I/M VOC Emission Reduction (TPD) (2016)	Total Onroad VOC Emissions with I/M (TPD) (2018)	I/M VOC Emission Reduction (TPD) (2018)
Marginal Nonattain-ment	Charlotte-Gastonia-Salisbury	Cabarrus		121,383	71%	10.11	39.0%	3.29	0.26	2.74	0.23
		Gaston		140,761	72%	12.76	38.2%	3.95	0.31	3.20	0.27
		Iredell		111,934	67%	12.03	36.6%	3.69	0.26	3.11	0.23
		Lincoln	68	52,507	69%	6.06	36.6%	1.83	0.13	1.51	0.12
		Mecklenburg	73	634,474	72%	51.24	27.9%	11.98	1.09	9.89	0.92
		Rowan	68	87,414	69%	13.78	28.7%	3.20	0.23	2.63	0.21
		Union	68	130,996	71%	12.92	30.8%	3.34	0.26	2.78	0.23
Subtotal				**1,279,469**		**118.89**		**31.29**	**2.55**	**25.86**	**2.21**
Maintenance	Triad	Davidson		106,689	67%	12.22	37.5%	3.74	0.28	3.05	0.25
		Forsyth	70	241,364	73%	21.86	29.5%	5.38	0.46	4.44	0.41
		Guilford	68	334,492	72%	37.52	23.8%	7.40	0.64	6.14	0.57
Subtotal				**682,545**		**71.60**		**16.52**	**1.38**	**13.63**	**1.23**
Maintenance	Triangle	Chatham	59	41,107	69%	6.30	28.9%	1.57	0.12	1.36	0.11
		Durham	66	166,122	75%	15.18	30.8%	3.92	0.35	3.24	0.31
		Franklin	64	36,206	70%	4.18	34.8%	1.20	0.09	1.01	0.08
		Granville	66	33,086	70%	5.96	28.9%	1.40	0.10	1.17	0.09
		Johnston	67	117,534	73%	12.20	36.3%	3.65	0.28	3.08	0.24
		Orange		77,092	73%	8.43	34.4%	2.41	0.18	2.01	0.16
		Wake	65	686,949	73%	45.57	29.5%	11.41	1.06	9.66	0.92
Subtotal				**1,158,096**		**97.83**		**25.57**	**2.17**	**21.52**	**1.90**
Maintenance	Rocky Mount	Edgecombe	65	28,772	71%	4.28	28.5%	0.98	0.08	0.78	0.07
		Nash		65,722	70%	7.09	38.1%	2.19	0.16	1.75	0.14
Subtotal				**94,494**		**11.37**		**3.17**	**0.24**	**2.53**	**0.21**
Maintenance	Great Smoky Mountains National Park	Haywood	68	38,553	67%	9.98	21.4%	1.78	0.12	1.49	0.11

Table 5. Mobile Source VOC Emissions Results

Ozone NAAQS Designation Status	County Grouping	County	2012-2014 Design Value (ppb)	Total Inspections 2013	Total I/M Vehicles (Model Years 1996-2011) as a Percentage of All Registered Vehicles	Total Man-Made VOC Emissions for all Source Categories (TPD) (2014)	Percent of Onroad VOC to Total Man-Made VOC Emissions for County (2014)	Total Onroad VOC Emissions with I/M (TPD) (2016)	I/M VOC Emission Reduction (TPD) (2016)	Total Onroad VOC Emissions with I/M (TPD) (2018)	I/M VOC Emission Reduction (TPD) (2018)
Attainment		Alamance		98,472	70%	10.98	34.8%	3.16	0.24	2.60	0.22
		Brunswick		73,255	72%	9.60	24.6%	1.99	0.17	1.65	0.15
		Buncombe	64	160,657	71%	17.74	32.2%	4.73	0.37	3.92	0.33
		Burke		53,749	67%	7.48	35.9%	2.29	0.16	1.83	0.14
		Caldwell	62	53,120	67%	8.63	29.7%	2.14	0.15	1.73	0.13
		Carteret	60	47,727	73%	13.89	11.0%	1.25	0.11	1.02	0.09
		Catawba		125,162	69%	15.99	24.2%	3.17	0.25	2.61	0.22
		Cleveland		60,429	70%	7.03	43.9%	2.47	0.18	2.02	0.16
		Craven		65,841	73%	9.90	19.9%	1.66	0.13	1.32	0.11
		Cumberland	65	194,558	71%	17.64	32.5%	4.72	0.37	3.90	0.32
		Harnett		65,696	70%	6.48	37.5%	2.07	0.16	1.76	0.15
		Henderson		75,498	71%	10.09	25.0%	2.07	0.16	1.71	0.14
		Lee		41,471	71%	6.18	22.9%	1.18	0.09	0.98	0.08
		Lenoir	65	36,729	71%	5.01	29.9%	1.21	0.09	0.98	0.08
		Moore		61,687	65%	7.46	30.8%	1.93	0.14	1.62	0.13
		New Hanover	63	145,204	73%	12.28	25.7%	2.66	0.23	2.21	0.20
		Onslow		99,576	71%	9.71	30.0%	2.44	0.19	2.04	0.17
		Pitt	66	102,603	73%	10.05	28.1%	2.32	0.19	1.89	0.17
		Randolph		91,635	68%	11.61	35.6%	3.45	0.26	2.74	0.23
		Robeson		77,384	71%	9.26	37.7%	2.92	0.21	2.29	0.18
		Rockingham	67	59,002	67%	11.28	25.8%	2.37	0.17	1.94	0.15
		Rutherford		40,974	68%	5.65	34.2%	1.57	0.11	1.30	0.10
		Stanly		39,690	68%	5.95	30.6%	1.48	0.11	1.20	0.10
		Stokes		29,313	66%	8.72	16.7%	1.22	0.09	0.99	0.08
		Surry		51,768	64%	7.13	36.0%	2.17	0.15	1.75	0.13
		Wayne		76,866	71%	9.78	26.7%	2.14	0.17	1.74	0.15
		Wilkes		45,886	65%	6.77	33.5%	1.87	0.13	1.54	0.12
		Wilson		53,820	71%	7.99	24.2%	1.63	0.13	1.29	0.11
Subtotal				**2,127,772**		**270.26**		**64.30**	**4.90**	**52.59**	**4.35**
Total				**5,380,929**		**579.94**		**142.62**	**11.36**	**117.61**	**10.00**

* ppb = parts per billion; TPD = tons per day.

For the 48 counties combined, Table 6 shows onroad NOx emissions for 2014 (with the emissions inspection program in place) and for 2016 and 2018 (each with and without the emissions inspection program in place). The emissions increase represents the emissions inspection program emissions reduction benefit for the 48 counties combined. From 2014 to 2018, NOx emissions from on-road vehicles in emissions inspection program counties are expected to decline by about 120 tons per day (42%) because of fleet turnover (newer and more fuel efficient vehicles replacing older less fuel efficient vehicles) and two federal programs that will be phased in beginning in 2017.

Table 6. Total Onroad NOx Emissions for 48 Counties (tons/day)

	2014	2016	2018
With Emissions Inspection Program	288	233	168
Without Emissions Inspection Program		250	180
Emissions Increase (Program Benefit)		17	12
Percent Increase		7%	7%

The benefit of the emissions inspection program in all 48 counties is estimated at about 17 tons/day of NOx in 2016 and declines to about 12 tons/day NOx in 2018. For individual counties, the NOx emissions reduction benefit associated with the emissions inspection program in 2016 varies from highs of 1.67 tons/day for Mecklenburg and 1.51 tons/day for Wake counties, to lows of 0.11 tons/day each for Edgecombe and Stokes counties. A total of 12 of the most urbanized counties account for about 50% of the NOx emissions reduction benefit associated with the emissions inspection program in 2016 and 2018. From 2016 to 2018, the emission reduction benefit declines by 36% and 35% for Mecklenburg and Wake Counties, respectively, and by 28% and 25% for Edgecombe and Stokes Counties, respectively. Thus, the benefits of the emissions inspection program vary widely depending on the county, and yields the highest emissions reductions in the more urbanized areas with high vehicle populations and vehicle miles traveled.

The benefit of the emissions inspection program declines from 2014 to 2018 because the baseline NOx emissions in 2018 are lower due to the effects of fleet turnover and implementation of the federal standards starting in 2017. Going forward, the baseline emissions are expected to continue to decline due to these programs, thus reducing the emissions reduction benefit of the emissions inspection program. The federal Tier 3 program sets new vehicle emissions standards and lowers the sulfur content of gasoline.[5] The reduced sulfur levels in gasoline will enable more stringent vehicle emissions standards by allowing vehicle catalytic converters to work more efficiently and by facilitating development of some lower-cost technologies to improve fuel economy. The vehicle standards will reduce both exhaust and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. The exhaust emissions standards include different phase-in schedules that vary by vehicle class but generally phase in between model years 2017 and 2025.

The EPA and the National Highway Traffic Safety Administration (NHTSA) jointly developed the federal greenhouse gas emissions (GHG) and fuel economy standards for light-duty cars and

[5] See U.S. EPA, http://www.epa.gov/otaq/tier3.htm.

trucks in model years 2012-2016 (phase 1) and 2017-2025 (phase 2). The EPA also aligned implementation of the Tier 3 program with the second phase of the EPA and NHTSA federal GHG and fuel economy standards program.[6]

IV. Recommendations

Using the observed ambient air quality monitoring data, emissions modeling results and EPA's proposed ozone standards as the criteria, the DENR is proposing a range of options after consulting with the DMV:

- Option A - using 65 ppb as the potential ozone standard: Eliminate the following 27 counties from vehicle emissions inspections requirements, effective January 1, 2016: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Edgecombe, Franklin, Harnett, Haywood, Henderson, Lee, Lenoir, Moore, Nash, New Hanover, Onslow, Robeson, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.

- Option B - using 70 ppb as the potential ozone standard: Eliminate the following 31 counties from vehicle emissions inspections requirements, effective January 1, 2016: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Edgecombe, Franklin, Granville, Harnett, Haywood, Henderson, Lee, Lenoir, Moore, Nash, New Hanover, Orange, Onslow, Pitt, Robeson, Rockingham, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.

Additionally, DENR and DMV recommend an additional report to the Environmental Review Commission by April 1, 2016, with recommendations on whether additional counties should be removed from the vehicle emissions inspection program considering the final 2015 EPA ozone standard, the latest ambient air quality monitoring data and the latest mobile source emissions estimates. Also, DENR shall study other opportunities to optimize efficiencies, including, but not limited to: the range of model years that should be subject to emissions testing to meet and maintain the current federal ozone standards; a biennial emissions inspection frequency; and the effectiveness of random survey inspections. Finally, if this reporting recommendation is put into session law, then, the reporting requirements in Section 26 of Session Law 2013-413 can be repealed.

In developing the recommendations, the DENR considered a combination of factors as described below.

A. Emissions and Program Benefits Decline Over Time

One important factor is the declining NOx emission reductions over time. As the fleet of gasoline vehicles subject to emissions inspections becomes cleaner (newer low-emitting vehicles are replacing older higher-emitting vehicles), and the emissions controls on the vehicles are more technologically advanced - thus lasting longer and less prone to malfunctions or failures – the emissions reductions due to the inspections diminishes over time. Additionally, cars will be getting even cleaner as new federal fuel and engines standards (Tier 3) are phased in starting in

[6] See U.S. EPA, http://www.epa.gov/otaq/climate/regs-light-duty.htm.

2018. Those federal Tier 3 standards will result in significant emissions reductions from these newer vehicles, thus lowering the potential benefits of an emissions inspection program. By 2018, the DENR estimates that NOx emissions reductions due to the inspection program will be 0.25 tons per day or less in each of the 27 counties (65 ppb option), or 31 counties (70 ppb option), recommended for removal from the program. The DENR estimates that statewide NOx emissions in 2018 would increase by less than 1% by removing these counties from the program.

B. Air Quality has Improved – No Violating Monitors

Another important factor is current air quality. Great improvements have been realized in North Carolina over the last decade in both ozone and fine particle concentrations. As of November 2014, North Carolina does not have a single air quality monitor violating any air quality standard. This is in sharp contrast to the air quality conditions when the vehicle emissions inspection program was expanded to 48 counties. At that time, two-thirds of the state's monitors were violating the federal ozone standard. The DENR estimates that removal of these counties will not interfere with the state's ability to continue to attain and maintain all current air quality standards.

C. Air Quality Standards may be Changing Soon

The EPA proposed changes to the primary and secondary ozone standards on November 26, 2014. The EPA will finalize any changes by October 1, 2015. The EPA's proposal considers a primary standard between 65-70 ppb. The EPA is also taking comments on retaining the current standard and on a standard as low as 60 ppb. The current standard is set at 75 ppb. The DENR believes it is prudent to consider these potential changes to the air quality standards when making these recommendations. Based on current data, all 27 counties included in the first option have ozone values *at or below 65 ppb*. With ozone values generally expected to decline over time, the DENR believes that it is very unlikely that any of these 27 counties will be required to have a vehicle emissions inspection program due to attainment issues with any new primary ozone standard. If EPA finalizes a new ozone standard at 70 ppb, then the current data would support a recommendation of removing the 27 counties, plus 4 additional counties (Rockingham, Orange, Granville and Pitt), that have current ozone values *at or below 70 ppb*.

It is important to note that a few counties that meet the criteria listed above were excluded from the recommendations for removal. Those counties (Lincoln and Union) are currently in the 2008 ozone nonattainment area that DENR is requesting be redesignated to maintenance. The redesignation and maintenance plan submitted to EPA includes the current control programs at the time that the area came into attainment. The DENR believes it is prudent to revisit the status of those counties after EPA redesignates those counties under the 2008 ozone standard.

Appendix A. Onroad Modeling Framework

For this study, county-level on-road mobile emissions were modeled for near-term and longer-term future years using the Motor Vehicle Emission Simulator (MOVES2014); the EPA's latest version of the on-road emissions model. This appendix provides details on the modeling framework and assumptions used to generate emissions data both with and without the emissions inspection program parameters in place to quantify emissions increases expected if the county is not subject to the program.

Pollutants Modeled:

- NOx, VOC

Temporal Basis:

- MOVES2014 modeling runs were executed to model emissions for a typical summer workday (specifically a July weekday) at the hourly time aggregation level

Inventory Base Year:

2014 was modeled (with the emissions inspection program) as the base year of the study for the following reasons:

- 2014 emissions modeling results provide a snapshot of current emissions
- 2014 is the base year for the next update to the EPA's National Emissions Inventory
- 2014 is the base year used in the redesignation request and maintenance plan for the Charlotte-Gastonia-Salisbury, NC 2008 8-hour ozone nonattainment area.

Inventory Projection Years:

2016 and 2018 were modeled (each with and without the emissions inspection program) as the future years for this study for the following reasons:

- 2016 was selected to support preparing a CAA Section 110(l) non-interference demonstration because the non-interference demonstration must be conducted for a year that is within plus or minus one year of when a county is removed from the program.
- 2018 was selected for the following reasons:
  - Modeled emissions for 2018 show some of the effects of the Federal Tier 3 Motor Vehicle Emissions and Fuel Standards, especially the gasoline sulfur standard which goes into effect on January 1, 2017
  - The EPA has developed a 2018 emissions modeling platform to support studies supporting their revision to the ozone standard as transport modeling. The DENR had developed input databases for the EPA's emissions modeling platform prior to initiating this study.
- Both 2016 and 2018 fall within the modeled years in the current North Carolina ozone maintenance plans for the areas shown in the following table.

Onroad Modeling Years for North Carolina Ozone Maintenance Areas

Area	Years modeled
Charlotte - Gastonia - Rock Hill	2010, 2013, 2016, 2019, 2022, 2025
Raleigh – Durham - Chapel Hill	2005, 2008, 2011, 2014, 2017
Greensboro - Winston-Salem – High Point	2007, 2011, 2018
Rocky Mount	2005, 2008, 2011, 2014, 2017
Great Smoky Mountains	2005, 2008, 2011, 2014, 2017, 2020

Data Sources for MOVES2014 Input Files:

- Vehicle Miles Traveled (VMT) and Speed Data – Latest available transportation demand modeling (TDM) and Highway Performance Monitoring System (HPMS) data. County-level VMT estimates for years 2014, 2016, and 2018 were derived by interpolation or extrapolation from the following datasets:
  - Triangle Area
    - Project: Triangle 2040 metropolitan transportation plan (MTP) TDM Modeling
    - Years – 2015, 2017, 2020, 2030, 2035, 2040
  - Metrolina Area
    - Project: Metrolina 2040 MTP TDM Modeling
    - Years: 2015, 2025, 2030, 2040
  - Triad Area
    - Project: Greensboro 2013 TIP Amendment TDM Modeling
    - Years: 2009, 2015, 2025, 2035
  - Hickory Area
    - Project: Hickory 2040 MTP TDM Modeling
    - Years: 2011, 2021, 2030, 2040
  - Rocky Mount Area
    - Project: 2017, 2020, 2030, 2040 TDM Modeling
  - HPMS Counties
    - 2012 NC HPMS Data
- Source Type Population and Source Type Age Distribution
  - 2013 county-level vehicle registration data by model year and vehicle type from North Carolina Department of Transportation (NCDOT) and DMV
- Meteorology
  - 2013 meteorology data from selected weather stations from NC Climate Center
- County human population and projections (for source type population projections)
  - Latest certified data from the North Carolina Office of State Budget and Management website (2013)

Emissions Inspection Program Parameters:

- For 2014, the following I/M parameters representative of North Carolina's I/M SIP for the 2014 operating year were modeled:
  - Compliance Rate: 95%
  - Waiver Rate: 5%
  - Exempted vehicles : 1 year (latest model year)

- For 2016 and 2018, the following I/M parameters were modeled to represent future years including the EPA approval of North Carolina's SIP revision to exempt the three newest model year vehicles with less than 70,000 miles:
  - Compliance Rate: 96%
  - Waiver Rate: 5%
  - Exempted vehicles : 3 years (latest model years)

Reid Vapor Pressure (RVP) Parameters for Summer Months:

- 9.0 pounds per square inch (psi) for all counties except use 7.8 psi for Mecklenburg and Gaston Counties for June 1 – September 15 of each year (2014, 2016, and 2018)

Appendix B. Acronyms and Abbreviations

Acronym / Abbreviation	Definition
$\mu g/m^3$	micrograms per cubic meter
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
DAQ	North Carolina Division of Air Quality
DENR	North Carolina Department of Environment and Natural Resources
DENR	North Carolina Department of Natural Resources
DMV	North Carolina Division of Motor Vehicles
DV	Design value
EPA	U.S. Environmental Protection Agency
FR	Federal Register
HPMS	Highway Performance Monitoring System
I/M	Inspection and Maintenance
MOVES	Motor Vehicle Emission Simulator
MTP	metropolitan transportation plan
NAAQS	National Ambient Air Quality Standard
NCAC	North Carolina Administrative Code
NO_2	Nitrogen dioxide
NOx	Nitrogen Oxides
OBD	On-Board Diagnostic
PM_{10}	Particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
ppb	Parts per billion
ppm	Parts per million
psi	pounds per square inch
RVP	Reid Vapor Pressure
SIP	State Implementation Plan
TDM	Transportation Demand Modeling
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds