



PAT MCCRORY  
*Governor*

DONALD R. VAN DER VAART  
*Secretary*

## MEMORANDUM

TO: ENVIRONMENTAL REVIEW COMMISSION  
The Honorable Jimmy Dixon, Co-Chairman  
The Honorable Chuck McGrady, Co-Chairman  
The Honorable Trudy Wade, Co-Chairman

FROM: Mollie Young, Director of Legislative Affairs

SUBJECT: 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

DATE: April 1, 2016

Pursuant to Session Law 2013-413, section 26, “The Department of Environment and Natural Resources [now the Department of Environmental Quality] 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. 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.” The attached document satisfies this final reporting requirement.

If you have any questions or need additional information, please contact me by phone at 919-707-8618 or via email at [Mollie.Young@ncdenr.gov](mailto:Mollie.Young@ncdenr.gov).

cc: John Evans, Chief Deputy Secretary, DEQ  
Tom Reeder, Assistant Secretary for Environment, DEQ  
Sheila Holman, Director of Air Quality, DEQ

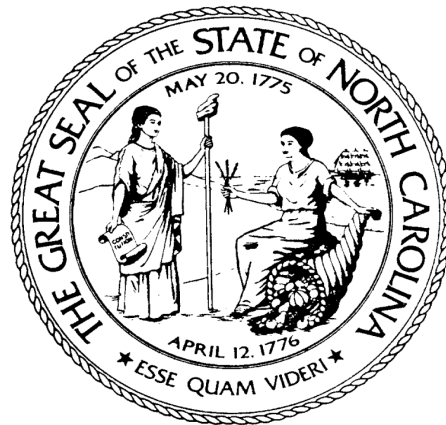


# **North Carolina Inspection and Maintenance Program**

**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 Environmental Quality**



**Final Report**

**April 1, 2016**

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

**Final Report**

**April 1, 2016**

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# **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**

## **Final Report to the Environmental Review Commission**

**April 1, 2016**

### **Executive Summary**

The 2013 session of the North Carolina General Assembly directed the Department of Environmental Quality (DEQ) (formerly the Department of Environment and Natural Resources) to study the continued need to conduct vehicle emissions inspections in all of the 48 counties covered under the program.<sup>1</sup>

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

*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. 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 final report, which is an update to the previous Interim Report dated April 1, 2015, describes the DEQ's study approach and its final findings. Collectively, the DEQ and the North Carolina Division of Motor Vehicles (DMV) recommend the following based on our technical evaluation of the emissions testing and maintenance program to determine (1) if the program is needed in all 48 counties to maintain compliance with the current and recently revised US Environmental Protection Agency's (EPA) 2015 ozone standard of 70 parts per billion (ppb), and (2) identify opportunities for optimizing the efficiency of the program:

Recommendation 1: Eliminate the following 31 counties from vehicle emissions inspections requirements, effective January 1, 2017: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Edgecombe, Franklin, Granville, Harnett, Haywood, Henderson, Lee, Lenoir, Moore, Nash, New Hanover, Onslow, Orange, Pitt, Robeson, Rockingham, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.

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<sup>1</sup> The 2015 Appropriations Act (H97) renamed the Department of Environment and Natural Resources (DENR) to the Department of Environmental Quality (DEQ).

Retain the vehicle emissions inspection program in the following 17 counties: Alamance, Buncombe, Cabarrus, Cumberland, Davidson, Durham, Forsyth, Gaston, Guilford, Iredell, Johnston, Lincoln, Mecklenburg, Randolph, Rowan, Union, and Wake.

Figure 1 provides a graphical summary of Recommendation 1.

Recommendation 2: The DEQ recommends retaining the vehicle emissions inspection program in 17 counties, and optimizing the efficiency of the program by implementing the following, effective January 1, 2019 (to allow time for the EPA to revoke the 2008 ozone standard):

- a. Change the vehicle emissions inspection frequency from annual to biennial; and
- b. Decrease the range of vehicle model years covered under the current program (i.e., 1996 through the current year) to the “latest 20 model years.” This change allows for coverage of the latest 20 vehicle model years such that vehicles that are more than 20 years old would transition out of the program. For example, under the current program, 1996 and newer model year vehicles would always be subject to emissions inspections; however, under a rolling 20-year program 1996 model year vehicles would be exempt from the program beginning January 2017.

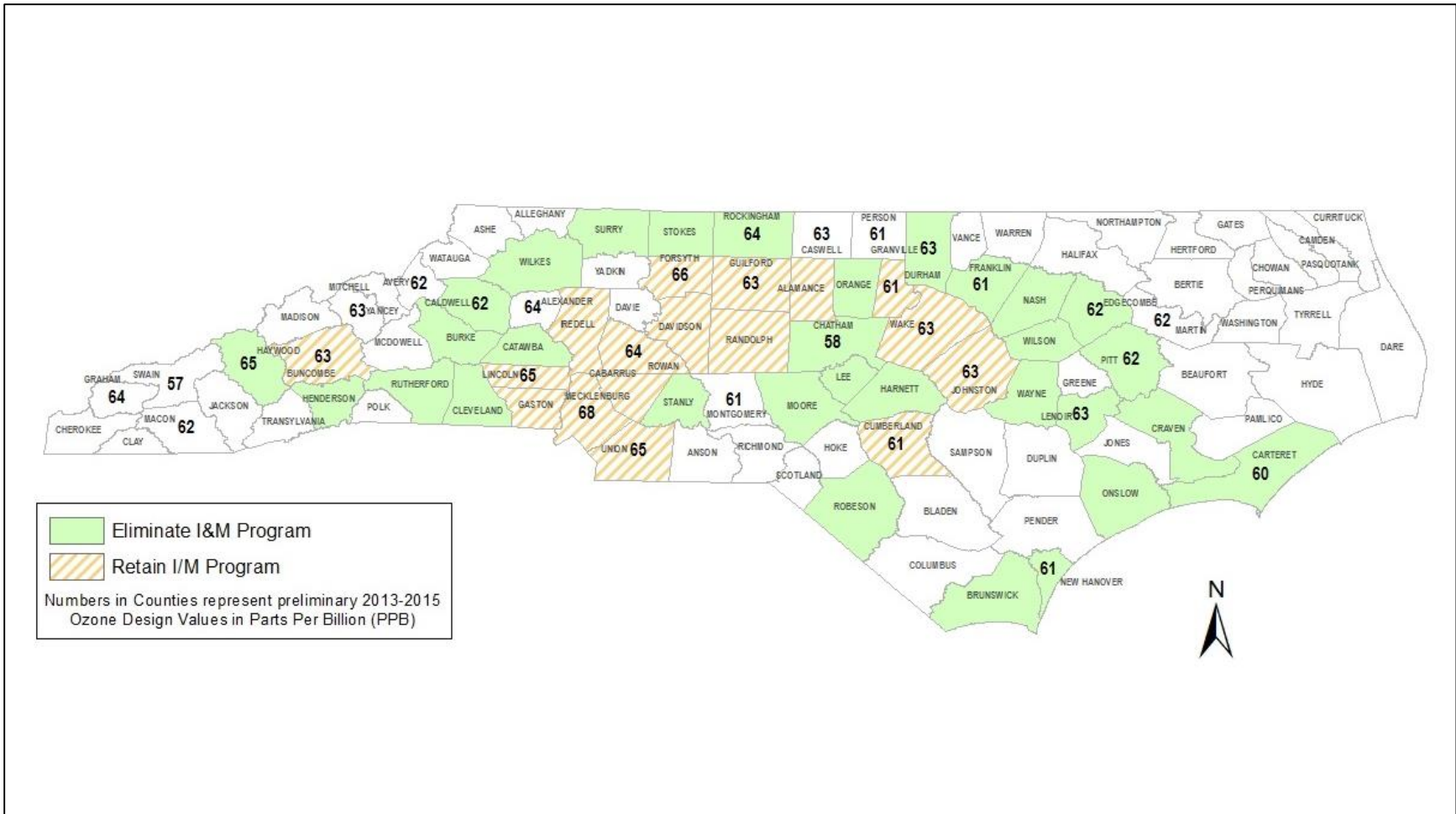
Recommendation 3: For the 17 counties remaining in the vehicle emissions inspection program, continue to evaluate the effectiveness of random survey inspections. This recommendation is based on the DEQ’s and DMV’s research of other potential opportunities to optimize program efficiencies in the future using remote survey inspections (remote sensing and remote On-Board Diagnostic II (OBD)). The two agencies conclude that remote sensing inspections are mostly used by states that continue to use the tail pipe test and would not improve the efficiency of North Carolina’s emissions inspection program. The DEQ and DMV conclude that remote OBD inspections are a new, emerging technology that should continue to be evaluated as the technology matures. While no state has fully implemented a remote OBD testing program, Oregon is starting a voluntary remote OBD testing program in early 2016. However, either method of remote testing would still require a safety/tamper inspection with North Carolina’s current program and would not improve the efficiency of the program if vehicle owners were still required to obtain a safety inspection. Also, citizens may be leery of the state potentially having continuous information on their vehicle or may think the state can track their vehicle location. The DEQ and DMV will continue to study methods for improving the efficiency of North Carolina’s emissions inspection program.

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 final 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 2013 through 2015 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 approach for quantifying air emissions for vehicles subject to the program and the potential emissions impacts associated with (1) removing each of the 48 counties from the emissions inspection program, and (2) optimizing the efficiency of the program. The approach for evaluating opportunities to optimize program efficiencies includes quantifying air emissions associated with changing from an annual to a biennial emissions inspection frequency and decreasing the range of model years that should be subject to emissions testing.

The results of the vehicle emissions analysis are presented and discussed in Section III of this report. Section IV presents DEQ'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.





**Figure 1. Recommendation 1 - Remove 31 counties from the emissions inspection program using 70 ppb as the ozone standard**

## 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 Statute (NCGS) §143-215.107 (a)(6)*, “Air quality standards and classifications.” The Environmental Management Commission has adopted rules for a basic inspection and maintenance (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 (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 Environmental Quality (DEQ) (formerly the Department of Environment and Natural Resources) provides technical support to DMV’s implementation of North Carolina’s I&M program.<sup>2</sup> In addition, the DEQ develops specifications for the program and certifies the emissions testing equipment used in the program. The DEQ also prepares revisions to the State Implementation Plan (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.<sup>3</sup> 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

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<sup>2</sup> The 2015 Appropriations Act (H97) renamed the Department of Environment and Natural Resources (DENR) to the Department of Environmental Quality (DEQ).

<sup>3</sup> Session Law 2000-134 (HB 1638) from the 1999 G.S. Session.

rise to a high of about 3.5 million inspections but then dip to a lower figure when all tailpipe testing ended on December 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.

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 DEQ 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 DEQ prepared and submitted to the EPA an amendment to the North Carolina I&M SIP and a non-interference demonstration under Section 110(l) of the federal Clean Air Act (CAA) to incorporate these changes to the emissions inspection program. The EPA approved the amendment on February 5, 2015.<sup>4</sup> In 2014, 5.267 million emissions inspections were performed which is about 5 percent higher than total emissions inspections (5.00 million) performed in 2013. However, in 2015, total vehicle inspections declined to about 4.820 million due to implementation of the exemption for the three newest model year vehicles with less than 70,000 miles, which started on April 1, 2015.

## 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 Statute. 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*.”

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<sup>4</sup> 80 FR 6455-6458 (Vol. 80, No. 24)

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

<b>County</b>	<b>Ozone NAAQS</b>	<b>Current Status</b>	<b>Total No. Vehicle Inspections in 2014</b>	<b>Total I&amp;M Vehicles (Model Years 1996-2012) as a Percentage of All Registered Vehicles</b>
Cabarrus <sup>1</sup>	1997 8-hour	Maintenance	123,208	81
	2008 8-hour	Maintenance		
Davidson <sup>2</sup>	1979 1-hour	Maintenance	96,646	77
Durham <sup>3</sup>	1979 1-hour	Maintenance	155,435	83
	1997 8-hour			
Forsyth <sup>3</sup>	1979 1-hour	Maintenance	236,423	81
Gaston <sup>1</sup>	1979 1-hour	Maintenance	136,172	79
	1997 8-hour	Maintenance		
	2008 8-hour	Maintenance		
Granville <sup>4</sup>	1979 1-hour	Maintenance	30,899	77
	1997 8-hour			
Guilford <sup>2</sup>	1979 1-hour	Maintenance	324,763	81
Iredell <sup>1,5</sup>	1997 8-hour	Maintenance	114,218	77
	2008 8-hour	Maintenance		
Lincoln <sup>1</sup>	1997 8-hour	Maintenance	49,034	77
	2008 8-hour	Maintenance		
Mecklenburg <sup>3</sup>	1979 1-hour	Maintenance	629,266	81
	1997 8-hour			
	2008 8-hour			
Rowan <sup>1</sup>	1997 8-hour	Maintenance	81,349	77
	2008 8-hour	Maintenance		
Union <sup>1</sup>	1997 8-hour	Maintenance	128,340	81
	2008 8-hour	Maintenance		
Wake <sup>3</sup>	1979 1-hour	Maintenance	679,869	83
	1997 8-hour			

<sup>1</sup> Although only part of this county is subject to a maintenance plan for the 2008 8-hour ozone NAAQS, the whole county is subject to the I&M program.

<sup>2</sup> County is also subject to a maintenance plan for particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers (PM<sub>2.5</sub>).

<sup>3</sup> County is now designated as attainment for CO.

<sup>4</sup> Although only part of this county is subject to a maintenance plan for the 1979 1-hour ozone NAAQS, the whole county is subject to the I&M program.

<sup>5</sup> Although only part of this county is subject to a maintenance plan 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**

<b>County</b>	<b>Ozone NAAQS</b>	<b>Current Status</b>	<b>Total No. Vehicle Inspections in 2014</b>	<b>Total I&amp;M Vehicles (Model Years 1996-2012) as a Percentage of All Registered Vehicles</b>
Alamance	-	-	93,702	78
Brunswick	-	-	67,518	82
Buncombe	-	-	157,786	79
Burke	-	-	49,196	75
Caldwell	-	-	47,768	74
Carteret	-	-	44,654	82
Catawba <sup>1</sup>	-	-	118,651	78
Chatham <sup>2</sup>	1997 8-hour	Maintenance	37,143	78
Cleveland	-	-	56,310	77
Craven	-	-	61,727	81
Cumberland	-	-	188,085	80
Edgecombe	1997 8-hour	Maintenance	25,431	78
Franklin	1997 8-hour	Maintenance	33,027	78
Harnett	-	-	61,717	79
Haywood	1997 8-hour	Maintenance	38,046	76
Henderson	-	-	73,189	79
Johnston	1997 8-hour	Maintenance	109,289	81
Lee	-	-	40,170	79
Lenoir	-	-	33,662	80
Moore	-	-	60,305	78
Nash	1997 8-hour	Maintenance	61,724	79
New Hanover	-	-	147,030	81
Onslow	-	-	100,188	81
Orange <sup>3</sup>	1997 8-hour	Maintenance	70,211	82
Pitt	-	-	99,605	82
Randolph	-	-	85,435	76
Robeson	-	-	72,749	78
Rockingham	-	-	54,017	74
Rutherford	-	-	37,576	76
Stanly	-	-	37,385	76
Stokes	-	-	27,393	73
Surry	-	-	49,649	76
Wayne	-	-	73,636	79
Wilkes	-	-	43,323	73
Wilson	-	-	51,145	80

<sup>1</sup> County is also subject to a maintenance plan for PM<sub>2.5</sub>.

<sup>2</sup> Although only part of this county is subject to a maintenance plan for the 1997 8-hour ozone NAAQS, the whole county is subject to the I&M program.

<sup>3</sup> 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 requires the EPA to establish NAAQS for the following criteria air pollutants: CO, lead, ozone, nitrogen dioxide (NO<sub>2</sub>), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and sulfur dioxide (SO<sub>2</sub>). The current air quality standards are displayed in Table 3. North Carolina adopts the NAAQS into its air quality rules as authorized under Article 21B of Chapter 143-215.107 of the General Statutes.

**Table 3. Current National Ambient Air Quality Standards**

Pollutant	Year Adopted by EPA	Primary / Secondary NAAQS	Averaging Time	Level*	Form
Ozone	2015	Primary and secondary	8-hour	70 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 <sup>3</sup>	Not to be exceeded
NO <sub>2</sub>	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 <sub>2.5</sub>	2012	Primary	Annual	12 µg/m <sup>3</sup>	Annual mean, averaged over 3 years
		Secondary		15 µg/m <sup>3</sup>	
		Primary and secondary	24-hour	35 µg/m <sup>3</sup>	98th percentile, averaged over 3 years
PM <sub>10</sub>	2012	Primary and secondary	24-hour	150 µg/m <sup>3</sup>	Not to be exceeded more than once per year on average over 3 years
SO <sub>2</sub>	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<sup>3</sup> = micrograms per cubic meter.

### 2. Recently Revised Ozone NAAQS and the Designation Process

The CAA requires the EPA to review, and revise if necessary, the NAAQS every five years. On October 1, 2015, the EPA completed its review of the 2008 ozone standard and promulgated its final decision to lower both the primary and secondary ground-level ozone standards from 75 to 70 parts per billion (ppb).<sup>5</sup> The form (fourth-highest daily maximum, averaged across three consecutive years) and averaging time (eight hours) of the new 2015 standard is the same as the

<sup>5</sup> 80 FR 65292-65468 (Vol. 80, No. 206), October 26, 2015.

2008 standard. The revised primary and secondary standards became effective on December 28, 2015.

Section 107(d) of the CAA addresses the designations process between the EPA and the states. Under Section 107(d), the Governor of a state is required to submit recommendations to the EPA for designating areas as attainment, nonattainment, or unclassifiable with the revised ozone NAAQS by October 1, 2016 (i.e., within one year after promulgation of the revised NAAQS). The EPA must complete the designation process by October 1, 2017 (i.e., within two years of promulgation of the revised NAAQS).<sup>6</sup> The EPA must notify the state at least 120 days prior to promulgating final designations and must provide the state an opportunity to comment on the final designations if the EPA's intends to modify a state's recommendation.

Because the form of the ozone standard relies on a 3-year average, the EPA recommends that states base their recommendations on the design value (DV) calculated using the three most recent years of quality assured monitoring data that is certified by the EPA.<sup>7</sup> For North Carolina, the EPA must certify quality assured monitoring data by May 1 for the ozone season ending October 30 of the previous year. For example, 2016 ozone season monitoring data will not be certified by the EPA until May 1, 2017.<sup>8</sup> Since states must submit their initial designation recommendations to the EPA by October 1, 2016, initial state recommendations will be based on 2013-2015 monitoring data. However, states may use preliminary 2016 monitoring data to inform their initial recommendation decisions. By October 1, 2017, the EPA intends to base its final designation decisions on EPA-certified monitoring data for the 2014-2016 ozone seasons, although early-certified 2017 data may also be used to make the final designations.

#### 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 DEQ prepared and submitted a 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 DEQ 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 DEQ 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

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<sup>6</sup> The EPA may take one additional year to make initial designation decisions if the EPA has insufficient information to make initial designation decisions within the two-year time frame.

<sup>7</sup> For the ozone NAAQS, the design value (DV) for a monitor is the average of the 4<sup>th</sup> highest ozone measurement for each year of a consecutive three-year period. If more than one monitor is used to characterize ambient ozone concentrations in the same county, the DV for the county is based on the monitor with the highest DV.

<sup>8</sup> For 2016, North Carolina's ozone monitoring season runs from April 1 through October 30. However, in addition to lowering the ozone standard, the EPA changed the ozone monitoring season to March 1 through October 30 for North Carolina starting in 2017 (see 80 FR 65467 (Vol. 80, No. 206), October 26, 2015).

remains in effect for 20 years after the EPA approves the plan. When a state seeks revisions to a maintenance plan, CAA 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 would be required 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.

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, in 2002 Kentucky adopted legislation to immediately end the emissions program for the Louisville, Kentucky area that 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<sub>2</sub>, CO, nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs). NO<sub>x</sub> refers to nitric oxide (NO) and NO<sub>2</sub>. Since NO<sub>x</sub> includes NO<sub>2</sub>, NO<sub>2</sub> does not need to be reviewed separately. The EPA does not require that the demonstration associated with removing the I&M program address SO<sub>2</sub>, lead, or PM<sub>2.5</sub> 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 NO<sub>x</sub> limited with respect to ozone formation. This means that there are significantly more biogenically induced VOC emissions in the atmosphere and that reductions in man-made VOC emissions will not result in reductions of ozone formation. Approximately 90 percent 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 NO<sub>x</sub> emissions.

## **II. Study Approach**

For each of the 48 counties with a vehicle emissions inspection program, the study approach involved an analysis of the available ambient air quality monitoring data for ozone and daily NO<sub>x</sub> and VOC emissions reductions associated with the program. The emissions data were used



in conjunction with ambient monitoring data and the new 2015 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 2015 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 70 ppb. A total of 22 of the 48 counties with a vehicle emissions inspection program have ozone monitors, and DVs are available for 2013 through 2015 for all 22 counties.

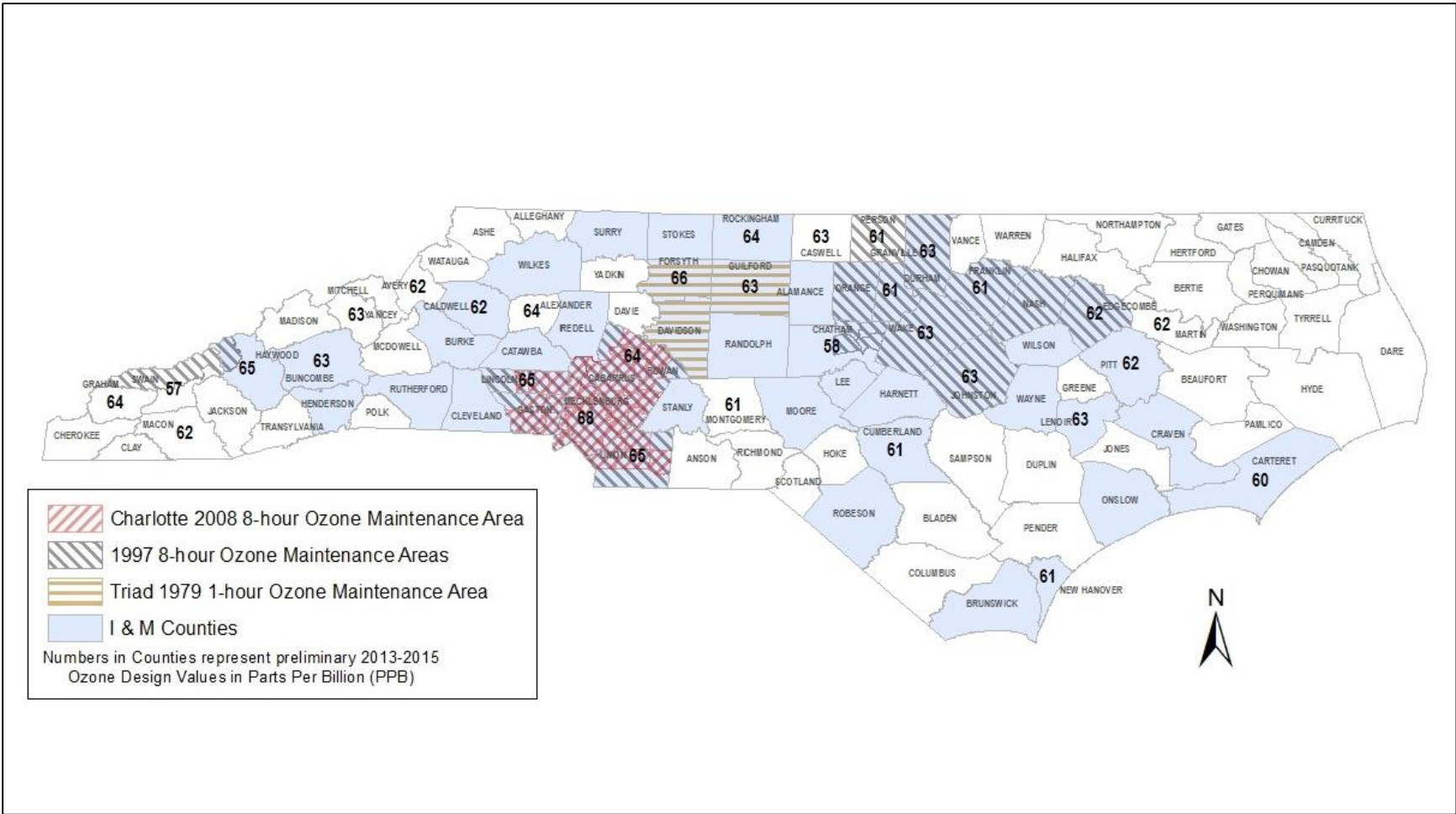
Figure 2 shows the 48 counties with an emissions inspection program, the 2013-2015 ozone DV for counties that have monitors, and counties that are covered by a maintenance plan for ozone. The figure also shows the boundaries for the Charlotte area that is covered by a maintenance plan for the 1997 and 2008 8-hour ozone standards.<sup>9</sup> At the end of the 2014 ozone season, the Charlotte area demonstrated attainment with the 2008 ozone standard based on 2012-2014 monitoring data. On April 16, 2015 the DEQ submitted a redesignation demonstration and maintenance plan to the EPA requesting that the EPA reclassify the Charlotte area from marginal nonattainment to attainment for the 2008 ozone standard. The EPA approved this request which was effective August 27, 2015.<sup>10</sup>

Based on the most recent ozone monitoring data (2013-2015), North Carolina does not have any areas violating the 2015 ozone standard or any of the other NAAQS. For the 48 counties with a vehicle emissions inspection program, ozone DVs for 2013-2015 range from a low of 58 ppb for Chatham County to a high of 68 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.

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<sup>9</sup> The Charlotte maintenance area for the 2008 8-hour standard includes all of Mecklenburg County and portions of Cabarrus, Gaston, Iredell, Lincoln, Rowan and Union Counties. For the 1997 8-hour standard, the Charlotte maintenance area includes all of Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan and Union Counties and a portion of Iredell County.

<sup>10</sup> 80 FR 44873-44882 (Vol. 80, No. 144), July 28, 2015.



**Figure 2. Ozone Design Values (2013-2015), I&M Counties and Ozone Attainment Status**

## 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 onroad mobile emissions were modeled for near-term and longer-term future years using the Motor Vehicle Emission Simulator (MOVES2014). 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:

- NO<sub>x</sub>, 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 percent
  - Waiver Rate: 5 percent
  - Inspection Frequency: Annual
  - Model years covered: 1996 to 2014
  - 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 percent
  - Waiver Rate: 5 percent
  - Inspection Frequency: Annual
  - Model years covered: 1996 to year modeled (2016 or 2018)
  - Exempted vehicles: 3 years (latest model years)
- For additional 2018 model runs designed to evaluate I/M program efficiency improvements, the following parameters were modeled (all other parameters unchanged):
  - Inspection Frequency: Biennial
  - Model years covered: 20 model years (1999 to 2018)

### III. Study Results

#### A. Elimination of Counties from the Emissions Inspection Program

##### 1. Summary of Results

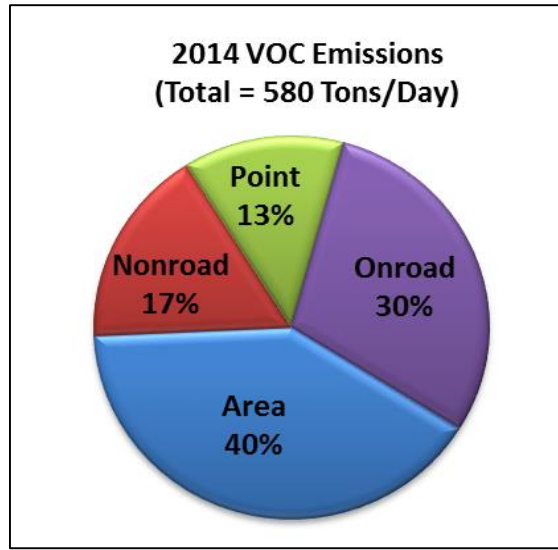
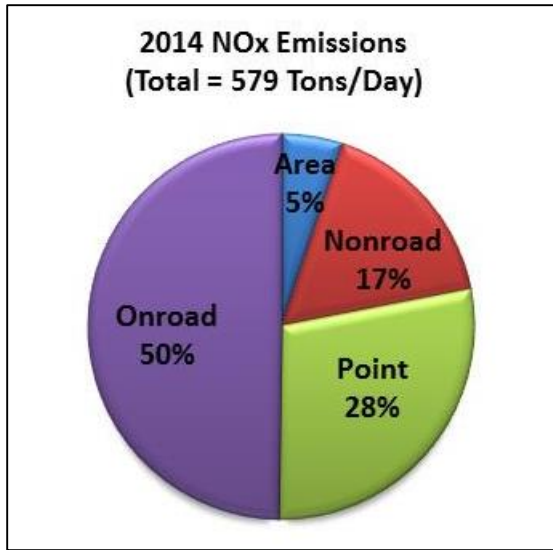
The mobile source daily emissions modeling results are presented in Table 4 for NO<sub>x</sub> emissions and Table 5 for VOC emissions. Both of these tables show emissions for each county and by their attainment status (i.e., counties in the same maintenance or nonattainment area grouped together). Both tables show the DV for each county with a monitor (based on the three-year average of 2013-2015 ozone monitoring data), total number of vehicle inspections for 2014, and total number of vehicles subject to the program for model years 1996-2012 as a percentage of all 2014 registered vehicles.<sup>11</sup> 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 NO<sub>x</sub> 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 3 shows the relative contribution of onroad and nonroad mobile and stationary point and area (nonpoint) sources to total daily NO<sub>x</sub> and VOC emissions for the 48 counties combined. In 2014, total NO<sub>x</sub> emissions were about 579 tons/day. Onroad mobile source emissions were about 50 percent (288 tons/day) of the total which means that vehicles are the single largest sector of NO<sub>x</sub> emissions. Total man-made VOC emissions for the 48 counties combined were about 580 tons/day; accounting for about 30 percent of statewide anthropogenic VOC emissions (172 tons/day).<sup>12</sup> Onroad mobile sources accounted for about 30 percent of statewide anthropogenic VOC emissions (172 tons/day). As previously discussed, approximately 90 percent of the VOC emissions come from biogenic or natural sources in North Carolina and mobile sources account for less than 10 percent of total biogenic and anthropogenic emissions combined.

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<sup>11</sup> Note that ozone monitoring data for 2015 will not be certified by the EPA until May 1, 2016. Although DEQ does not anticipate any changes to the 2015 ozone season monitoring data submitted to the EPA, it is regarded preliminary until certified by the EPA.

<sup>12</sup> It should be noted that biogenic VOC emissions account for 90 percent of total VOC emissions in North Carolina.



**Figure 3. Emissions Source Contribution to Total Man-Made Daily NO<sub>x</sub> and VOC Emissions in 2014**

**Table 4. Mobile Source NOx Emissions Results**

Ozone NAAQS Designation Status	County Grouping	County	2013-2015 Design Value (ppb)	Total Inspections 2014	Total I&M Vehicles (Model Years 1996-2012) 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)
Maintenance	Charlotte-Gastonia-Salisbury	Cabarrus		123,208	81%	9.56	67.3%	5.21	0.39	3.75	0.27
		Gaston		136,172	79%	25.93	31.0%	6.43	0.47	4.63	0.33
		Iredell		114,218	77%	15.96	51.2%	6.73	0.41	5.09	0.29
		Lincoln	65	49,034	77%	4.51	73.3%	2.70	0.18	1.98	0.13
		Mecklenburg	68	629,266	81%	52.65	48.3%	19.80	1.67	13.40	1.07
		Rowan	64	81,349	77%	11.95	52.9%	5.07	0.37	3.68	0.27
		Union	65	128,340	81%	10.43	59.5%	5.02	0.35	3.62	0.24
<b>Subtotal</b>				<b>1,261,587</b>		<b>130.99</b>		<b>50.97</b>	<b>3.85</b>	<b>36.15</b>	<b>2.60</b>
Maintenance	Triad	Davidson		96,646	77%	11.89	58.9%	5.65	0.40	4.12	0.29
		Forsyth	66	236,423	81%	16.29	61.5%	7.97	0.64	5.68	0.45
		Guilford	63	324,763	81%	25.26	57.9%	11.67	0.92	8.43	0.65
<b>Subtotal</b>				<b>657,832</b>		<b>53.43</b>		<b>25.29</b>	<b>1.96</b>	<b>18.22</b>	<b>1.39</b>
Maintenance	Triangle	Chatham	58	37,143	78%	11.45	27.4%	2.74	0.18	2.14	0.14
		Durham	61	155,435	83%	14.64	57.6%	6.72	0.57	4.69	0.38
		Franklin	61	33,027	78%	3.04	74.6%	1.81	0.13	1.33	0.09
		Granville	63	30,899	77%	4.71	73.5%	2.78	0.15	2.15	0.11
		Johnston	63	109,289	81%	12.59	79.6%	8.03	0.47	6.37	0.33
		Orange		70,211	82%	9.81	66.4%	5.28	0.30	4.07	0.21
		Wake	63	679,869	83%	40.48	55.7%	17.71	1.51	12.39	0.99
<b>Subtotal</b>				<b>1,115,873</b>		<b>96.73</b>		<b>45.07</b>	<b>3.30</b>	<b>33.14</b>	<b>2.25</b>
Maintenance	Rocky Mount	Edgecombe	62	25,431	78%	7.91	23.2%	1.44	0.11	1.01	0.08
		Nash		61,724	79%	7.34	74.4%	4.41	0.28	3.25	0.19
<b>Subtotal</b>				<b>87,155</b>		<b>15.25</b>		<b>5.85</b>	<b>0.39</b>	<b>4.27</b>	<b>0.27</b>
Maintenance	Great Smoky Mountains National Park	Haywood	65	38,046	76%	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	2013-2015 Design Value (ppb)	Total Inspections 2014	Total I&M Vehicles (Model Years 1996-2012) 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		93,702	78%	8.74	70.9%	5.04	0.36	3.69	0.26
		Brunswick		67,518	82%	11.85	36.3%	3.47	0.25	2.47	0.17
		Buncombe	63	157,786	79%	16.53	57.4%	7.65	0.57	5.54	0.40
		Burke		49,196	75%	5.62	78.9%	3.82	0.25	2.71	0.18
		Caldwell	62	47,768	74%	4.96	70.3%	2.99	0.20	2.13	0.15
		Carteret	60	44,654	82%	5.12	42.1%	1.69	0.14	1.18	0.09
		Catawba		118,651	78%	34.32	16.3%	4.52	0.34	3.28	0.24
		Cleveland		56,310	77%	7.03	76.1%	4.36	0.28	3.25	0.20
		Craven		61,727	81%	10.24	31.6%	2.68	0.20	1.80	0.13
		Cumberland	61	188,085	80%	13.66	69.8%	7.63	0.55	5.45	0.38
		Harnett		61,717	79%	5.17	77.4%	3.29	0.22	2.44	0.16
		Henderson		73,189	79%	5.95	68.8%	3.35	0.22	2.48	0.16
		Lee		40,170	79%	3.43	63.6%	1.78	0.13	1.29	0.09
		Lenoir	63	33,662	80%	3.70	62.1%	1.85	0.14	1.33	0.10
		Moore		60,305	78%	4.52	70.2%	2.63	0.19	1.93	0.14
		New Hanover	61	147,030	81%	21.96	20.5%	3.53	0.30	2.44	0.20
		Onslow		100,188	81%	8.03	61.6%	3.94	0.29	2.78	0.19
		Pitt	62	99,605	82%	7.22	61.0%	3.50	0.28	2.46	0.19
		Randolph		85,435	76%	8.51	76.4%	5.56	0.37	3.91	0.27
		Robeson		72,749	78%	11.33	62.6%	6.04	0.37	4.28	0.25
	Rockingham	64	54,017	74%	14.08	30.6%	3.52	0.24	2.60	0.18	
	Rutherford		37,576	76%	5.78	46.8%	2.21	0.15	1.64	0.11	
	Stanly		37,385	76%	4.18	65.6%	2.23	0.15	1.62	0.11	
	Stokes		27,393	73%	13.41	14.3%	1.66	0.11	1.20	0.08	
	Surry		49,649	76%	5.88	78.4%	3.99	0.24	2.84	0.17	
	Wayne		73,636	79%	13.64	28.5%	3.06	0.22	2.20	0.16	
	Wilkes		43,323	73%	4.87	69.6%	2.78	0.18	2.07	0.14	
	Wilson		51,145	80%	6.29	58.6%	3.10	0.20	2.17	0.13	
<b>Subtotal</b>				<b>2,033,571</b>		<b>266.00</b>		<b>101.86</b>	<b>7.15</b>	<b>73.21</b>	<b>5.03</b>
<b>Total</b>				<b>5,194,064</b>		<b>578.76</b>		<b>232.92</b>	<b>16.87</b>	<b>168.00</b>	<b>11.70</b>

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

**Table 5. Mobile Source VOC Emissions Results**

Ozone NAAQS Designation Status	County Grouping	County	2013-2015 Design Value (ppb)	Total Inspections 2014	Total I&M Vehicles (Model Years 1996-2012) 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)
Maintenance	Charlotte-Gastonia-Salisbury	Cabarrus		123,208	81%	10.11	39.0%	3.29	0.26	2.74	0.23
		Gaston		136,172	79%	12.76	38.2%	3.95	0.31	3.20	0.27
		Iredell		114,218	77%	12.03	36.6%	3.69	0.26	3.11	0.23
		Lincoln	65	49,034	77%	6.06	36.6%	1.83	0.13	1.51	0.12
		Mecklenburg	68	629,266	81%	51.24	27.9%	11.98	1.09	9.89	0.92
		Rowan	64	81,349	77%	13.78	28.7%	3.20	0.23	2.63	0.21
		Union	65	128,340	81%	12.92	30.8%	3.34	0.26	2.78	0.23
<b>Subtotal</b>				<b>1,261,587</b>		<b>118.89</b>		<b>31.29</b>	<b>2.55</b>	<b>25.86</b>	<b>2.21</b>
Maintenance	Triad	Davidson		96,646	77%	12.22	37.5%	3.74	0.28	3.05	0.25
		Forsyth	66	236,423	81%	21.86	29.5%	5.38	0.46	4.44	0.41
		Guilford	63	324,763	81%	37.52	23.8%	7.40	0.64	6.14	0.57
<b>Subtotal</b>				<b>657,832</b>		<b>71.60</b>		<b>16.52</b>	<b>1.38</b>	<b>13.63</b>	<b>1.23</b>
Maintenance	Triangle	Chatham	58	37,143	78%	6.30	28.9%	1.57	0.12	1.36	0.11
		Durham	61	155,435	83%	15.18	30.8%	3.92	0.35	3.24	0.31
		Franklin	61	33,027	78%	4.18	34.8%	1.20	0.09	1.01	0.08
		Granville	63	30,899	77%	5.96	28.9%	1.40	0.10	1.17	0.09
		Johnston	63	109,289	81%	12.20	36.3%	3.65	0.28	3.08	0.24
		Orange		70,211	82%	8.43	34.4%	2.41	0.18	2.01	0.16
		Wake	63	679,869	83%	45.57	29.5%	11.41	1.06	9.66	0.92
<b>Subtotal</b>				<b>1,115,873</b>		<b>97.83</b>		<b>25.57</b>	<b>2.17</b>	<b>21.52</b>	<b>1.90</b>
Maintenance	Rocky Mount	Edgecombe	62	25,431	78%	4.28	28.5%	0.98	0.08	0.78	0.07
		Nash		61,724	79%	7.09	38.1%	2.19	0.16	1.75	0.14
<b>Subtotal</b>				<b>87,155</b>		<b>11.37</b>		<b>3.17</b>	<b>0.24</b>	<b>2.53</b>	<b>0.21</b>
Maintenance	Great Smoky Mountains National Park	Haywood	65	38,046	76%	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	2013-2015 Design Value (ppb)	Total Inspections 2014	Total I&M Vehicles (Model Years 1996-2012) 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		93,702	78%	10.98	34.8%	3.16	0.24	2.60	0.22
		Brunswick		67,518	82%	9.60	24.6%	1.99	0.17	1.65	0.15
		Buncombe	63	157,786	79%	17.74	32.2%	4.73	0.37	3.92	0.33
		Burke		49,196	75%	7.48	35.9%	2.29	0.16	1.83	0.14
		Caldwell	62	47,768	74%	8.63	29.7%	2.14	0.15	1.73	0.13
		Carteret	60	44,654	82%	13.89	11.0%	1.25	0.11	1.02	0.09
		Catawba		118,651	78%	15.99	24.2%	3.17	0.25	2.61	0.22
		Cleveland		56,310	77%	7.03	43.9%	2.47	0.18	2.02	0.16
		Craven		61,727	81%	9.90	19.9%	1.66	0.13	1.32	0.11
		Cumberland	61	188,085	80%	17.64	32.5%	4.72	0.37	3.90	0.32
		Harnett		61,717	79%	6.48	37.5%	2.07	0.16	1.76	0.15
		Henderson		73,189	79%	10.09	25.0%	2.07	0.16	1.71	0.14
		Lee		40,170	79%	6.18	22.9%	1.18	0.09	0.98	0.08
		Lenoir	63	33,662	80%	5.01	29.9%	1.21	0.09	0.98	0.08
		Moore		60,305	78%	7.46	30.8%	1.93	0.14	1.62	0.13
		New Hanover	61	147,030	81%	12.28	25.7%	2.66	0.23	2.21	0.20
		Onslow		100,188	81%	9.71	30.0%	2.44	0.19	2.04	0.17
		Pitt	62	99,605	82%	10.05	28.1%	2.32	0.19	1.89	0.17
		Randolph		85,435	76%	11.61	35.6%	3.45	0.26	2.74	0.23
		Robeson		72,749	78%	9.26	37.7%	2.92	0.21	2.29	0.18
	Rockingham	64	54,017	74%	11.28	25.8%	2.37	0.17	1.94	0.15	
	Rutherford		37,576	76%	5.65	34.2%	1.57	0.11	1.30	0.10	
	Stanly		37,385	76%	5.95	30.6%	1.48	0.11	1.20	0.10	
	Stokes		27,393	73%	8.72	16.7%	1.22	0.09	0.99	0.08	
	Surry		49,649	76%	7.13	36.0%	2.17	0.15	1.75	0.13	
	Wayne		73,636	79%	9.78	26.7%	2.14	0.17	1.74	0.15	
	Wilkes		43,323	73%	6.77	33.5%	1.87	0.13	1.54	0.12	
	Wilson		51,145	80%	7.99	24.2%	1.63	0.13	1.29	0.11	
	<b>Subtotal</b>			<b>2,033,571</b>		<b>270.26</b>		<b>64.30</b>	<b>4.90</b>	<b>52.59</b>	<b>4.35</b>
	<b>Total</b>			<b>5,194,064</b>		<b>579.94</b>		<b>142.62</b>	<b>11.36</b>	<b>117.61</b>	<b>10.00</b>

\* 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 onroad vehicles in emissions inspection program counties are expected to decline by about 120 tons per day (42 percent) 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. A total of 12 of the most urbanized counties account for about 50 percent of the NOx emissions reduction benefit associated with the emissions inspection program in 2016 and 2018. 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.<sup>13</sup>

## 2. Conclusions

Using the emissions modeling results and observed ambient air quality monitoring data relative to the EPA’s revised ozone standard of 70 ppb as the criteria, the DEQ is recommending the following:

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<sup>13</sup> The federal Tier 3 program sets new vehicle emissions standards and lowers the sulfur content of gasoline (See U.S. EPA, <http://www.epa.gov/otaq/tier3.htm>). 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 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 (See U.S. EPA, <http://www.epa.gov/otaq/climate/regs-light-duty.htm>). All of these programs result in expected reductions in emissions from vehicles in the coming years.

Eliminate the following 31 counties from vehicle emissions inspections requirements, effective January 1, 2017: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Edgecombe, Franklin, Granville, Harnett, Haywood, Henderson, Lee, Lenoir, Moore, Nash, New Hanover, Onslow, Orange, Pitt, Robeson, Rockingham, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.

Retain the vehicle emissions inspection program in the following 17 counties: Alamance, Buncombe, Cabarrus, Cumberland, Davidson, Durham, Forsyth, Gaston, Guilford, Iredell, Johnston, Lincoln, Mecklenburg, Randolph, Rowan, Union, and Wake.

These conclusions reflect Option B of DEQ’s recommendations in the April 1, 2015 Interim Study Report. The DEQ considered the following combination of factors in developing its recommendation:

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 2017. 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 DEQ estimates that NOx emissions reductions due to the inspection program will be 0.25 tons per day or less in each of the 31 counties recommended for removal from the program. Table 7 provides a summary of the emissions impacts associated with removing the 31 counties from the emissions inspection program.

**Table 7. Summary of Onroad NOx and VOC Emissions Increases Associated With Removing 31 Counties from the Emissions Inspection Program**

	<b>NOx Emissions in 2018</b>	<b>VOC Emissions in 2018</b>
Total Onroad Emissions for 48 Counties in Current I&M Program (TPD)	168.00	117.61
Total Onroad Emissions after Removing 31 Counties from I&M Program (TPD)	172.70	121.61
Emissions Increases (TPD)	4.70	4.00
Emissions Increases (% of Total Onroad Emissions for 48 Counties)	2.80%	3.40%

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

2015, North Carolina does not have a single air quality monitor violating any air quality standard including the new 2015 8-hour ozone standard recently adopted by the EPA. 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 DEQ estimates that removal of 31 counties from the I&M program will not interfere with the state's ability to continue to attain and maintain all current air quality standards.

The new 2015 ozone standard is set at 70 ppb. The DEQ believes it is prudent to consider the new standard when making these recommendations. Based on current 2013-2015 ozone monitoring data, 11 of the 31 counties have monitors showing ozone DVs *at or below 65 ppb*. There has never been a need to site an ozone monitor in any of the remaining 20 counties based on EPA monitoring requirements.<sup>14</sup> With ozone DVs generally expected to decline over time, the DEQ believes that it is very unlikely that removal of the vehicle inspection program from these 31 counties would result in compliance issues with the new 70 ppb ozone standard.

It is important to note that two counties that meet both of the emissions increase and air quality criteria listed above were excluded from the recommendation for removal from the program. Those counties (Lincoln and Union) are currently in the Charlotte-Gastonia-Salisbury 2008 8-hour ozone maintenance area. The maintenance plan approved by the EPA includes the current control programs at the time that the area came into attainment. The DEQ believes it is prudent to revisit the status of those counties after October 1, 2018, which is the earliest potential date the 2008 ozone standard could be revoked.

## B. Optimization of Efficiency of Vehicle Emissions Inspection Program

For the 17 counties for which the DEQ recommends retaining the I&M program, the following subsections present the results of the emissions analysis associated with (1) changing the vehicle emissions inspection frequency from annual to biennial, and (2) decreasing the range of vehicle model years covered by the I&M program to cover the latest 20 model years.

### 1. Summary of Results

#### a. Change Vehicle Emissions Inspection Frequency from Annual to Biennial for 17 Counties

The change in NO<sub>x</sub> and VOC emissions associated with changing from an annual to a biennial program was modeled for calendar year 2018. For these model runs, the emissions testing frequency was adjusted from one year to two years for each of the 17 counties. All other model input parameters were unchanged. The modeling results presented in Tables 8 and 9 show that

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<sup>14</sup> The need for locating a monitor in a county is determined based on the monitoring objectives and general criteria listed in 40 CFR 58 Appendix D. These criteria include consideration of several factors including, but not limited to, the size of the geographic area and associated changes in population, emissions, meteorology, and air quality concerns; addition of a new or revisions to an existing NAAQS, and costs. The DEQ complies with these requirements on an on-going basis that are documented in its annual and 5-year monitoring network plans that undergo public review and comment and subsequent approval by the EPA.

switching to a biennial emissions testing program would result in only slight increases in summer day NOx and VOC emissions. For all 17 counties combined, total NOx emissions would increase by 0.300 tons per day (0.3 percent) and total VOC emissions would increase by 0.548 tons per day (0.8 percent).

**Table 8. NOx Emissions Increases from Switching to Biennial I&M Emissions Inspections**

County	Annual Inspection Frequency, 23 model years (1996 to 2018) (Current Program)	Biennial Inspection Frequency, 23 model years (1996 to 2018)		
	NOx Emissions (TPD)	NOx Emissions (TPD)	NOx Emissions Increase (TPD)	NOx Emissions Increase (Percent)
Cabarrus	3.745	3.756	0.011	0.3%
Gaston	4.631	4.642	0.011	0.2%
Iredell	5.089	5.100	0.011	0.2%
Lincoln	1.982	1.986	0.004	0.2%
Mecklenburg	13.402	13.460	0.058	0.4%
Rowan	3.679	3.688	0.009	0.2%
Union	3.624	3.634	0.010	0.3%
<b>Charlotte Area Subtotal</b>	<b>36.152</b>	<b>36.266</b>	<b>0.114</b>	<b>0.3%</b>
Davidson	4.119	4.128	0.009	0.2%
Forsyth	5.676	5.694	0.018	0.3%
Guilford	8.428	8.456	0.028	0.3%
<b>Triad Subtotal</b>	<b>18.223</b>	<b>18.278</b>	<b>0.055</b>	<b>0.3%</b>
Durham	4.694	4.712	0.018	0.4%
Johnston	6.368	6.380	0.012	0.2%
Wake	12.391	12.446	0.055	0.4%
<b>Triangle Subtotal</b>	<b>23.453</b>	<b>23.538</b>	<b>0.085</b>	<b>0.4%</b>
Alamance	3.693	3.701	0.008	0.2%
Buncombe	5.537	5.552	0.015	0.3%
Cumberland	5.449	5.465	0.016	0.3%
Randolph	3.915	3.922	0.007	0.2%
<b>Totals - All 17 Counties</b>	<b>96.422</b>	<b>96.722</b>	<b>0.300</b>	<b>0.3%</b>

**Table 9. VOC Emissions Increases from Switching to Biennial I&M Emissions Inspections**

County	Annual Inspection Frequency, 23 model years (1996 to 2018) (Current Program)	Biennial Inspection Frequency, 23 model years (1996 to 2018)		
	VOC Emissions (TPD)	VOC Emissions (TPD)	VOC Emissions Increase (TPD)	VOC Emissions Increase (Percent)
Cabarrus	2.739	2.759	0.020	0.7%
Gaston	3.202	3.223	0.021	0.7%
Iredell	3.111	3.129	0.018	0.6%
Lincoln	1.508	1.516	0.008	0.5%
Mecklenburg	9.895	9.991	0.096	1.0%
Rowan	2.628	2.643	0.015	0.6%
Union	2.780	2.801	0.021	0.8%
<b>Charlotte Area Subtotal</b>	<b>25.863</b>	<b>26.062</b>	<b>0.199</b>	<b>0.8%</b>
Davidson	3.048	3.066	0.018	0.6%
Forsyth	4.440	4.477	0.037	0.8%
Guilford	6.139	6.192	0.053	0.9%
<b>Triad Subtotal</b>	<b>13.627</b>	<b>13.735</b>	<b>0.108</b>	<b>0.8%</b>
Durham	3.237	3.267	0.030	0.9%
Johnston	3.079	3.098	0.019	0.6%
Wake	9.655	9.760	0.105	1.1%
<b>Triangle Subtotal</b>	<b>15.971</b>	<b>16.125</b>	<b>0.154</b>	<b>1.0%</b>
Alamance	2.598	2.614	0.016	0.6%
Buncombe	3.923	3.949	0.026	0.7%
Cumberland	3.904	3.934	0.030	0.8%
Randolph	2.743	2.758	0.015	0.5%
<b>Totals - All 17 Counties</b>	<b>68.629</b>	<b>69.177</b>	<b>0.548</b>	<b>0.8%</b>

b. Decrease Range of Vehicle Model Years Covered for 17 Counties

The change in NOx and VOC emissions associated with decreasing the number of vehicle model years subject to emissions inspections was also evaluated for the year 2018 for each of the 17 counties. For this analysis, county-level summer day NOx and VOC emissions based on the current I&M program requirements (1996 through 2018, annual inspection frequency) were compared to emissions modeled for an annual and a biennial emissions inspection frequency covering the 20 latest model years (1999 through 2018). All other model input parameters were unchanged.

Tables 10 and 11 compare the results of the current 23-year annual versus a 20-year annual and biennial emissions inspection frequency for NOx and VOC emissions, respectively. For an annual emissions testing program, total NOx emissions would increase by 1.829 tons per day (1.9 percent) and total VOC emissions would increase by 1.411 tons per day (2.1 percent) for all

17 counties combined. For a biennial emissions testing program, total NOx emissions would increase by 2.126 tons per day (2.2 percent) and total VOC emissions would increase by 1.949 tons per day (2.8 percent) for all 17 counties combined.

**Table 10. NOx Emissions Increases from Decreasing Vehicle Model Years Covered**

County	Annual Inspection Frequency, 23 model years (1996 to 2018) (Current Program)	Annual Inspection Frequency, 20 model years (1999 to 2018)			Biennial Inspection Frequency, 20 model years (1999 to 2018)		
	NOx Emissions (TPD)	NOx Emissions (TPD)	NOx Emissions Increase (TPD)	NOx Emissions Increase (Percent)	NOx Emissions (TPD)	NOx Emissions Increase (TPD)	NOx Emissions Increase (Percent)
Cabarrus	3.745	3.818	0.073	1.9%	3.829	0.084	2.2%
Gaston	4.631	4.724	0.093	2.0%	4.736	0.105	2.3%
Iredell	5.089	5.172	0.083	1.6%	5.182	0.093	1.8%
Lincoln	1.982	2.023	0.041	2.1%	2.027	0.045	2.3%
Mecklenburg	13.402	13.636	0.234	1.7%	13.692	0.290	2.2%
Rowan	3.679	3.762	0.083	2.3%	3.771	0.092	2.5%
Union	3.624	3.688	0.064	1.8%	3.698	0.074	2.0%
<b>Charlotte Area Subtotal</b>	<b>36.152</b>	<b>36.823</b>	<b>0.671</b>	<b>1.9%</b>	<b>36.935</b>	<b>0.783</b>	<b>2.2%</b>
Davidson	4.119	4.212	0.093	2.3%	4.221	0.102	2.5%
Forsyth	5.676	5.799	0.123	2.2%	5.817	0.141	2.5%
Guilford	8.428	8.604	0.176	2.1%	8.631	0.203	2.4%
<b>Triad Subtotal</b>	<b>18.223</b>	<b>18.615</b>	<b>0.392</b>	<b>2.2%</b>	<b>18.669</b>	<b>0.446</b>	<b>2.4%</b>
Durham	4.694	4.791	0.097	2.1%	4.808	0.114	2.4%
Johnston	6.368	6.453	0.085	1.3%	6.465	0.097	1.5%
Wake	12.391	12.594	0.203	1.6%	12.648	0.257	2.1%
<b>Triangle Subtotal</b>	<b>23.453</b>	<b>23.838</b>	<b>0.385</b>	<b>1.6%</b>	<b>23.921</b>	<b>0.468</b>	<b>2.0%</b>
Alamance	3.693	3.774	0.081	2.2%	3.783	0.090	2.4%
Buncombe	5.537	5.653	0.116	2.1%	5.667	0.130	2.4%
Cumberland	5.449	5.548	0.099	1.8%	5.565	0.116	2.1%
Randolph	3.915	4.000	0.085	2.2%	4.008	0.093	2.4%
<b>Totals - All 17 Counties</b>	<b>96.422</b>	<b>98.251</b>	<b>1.829</b>	<b>1.9%</b>	<b>98.548</b>	<b>2.126</b>	<b>2.2%</b>

**Table 11. VOC Emissions Increases from Decreasing Vehicle Model Years Covered**

County	Annual Inspection Frequency, 23 model years (1996 to 2018) (Current Program)	Annual Inspection Frequency, 20 model years (1999 to 2018)			Biennial Inspection Frequency, 20 model years (1999 to 2018)		
	VOC Emissions (TPD)	VOC Emissions (TPD)	VOC Emissions Increase (TPD)	VOC Emissions Increase (Percent)	VOC Emissions (TPD)	VOC Emissions Increase (TPD)	VOC Emissions Increase (Percent)
Cabarrus	2.739	2.796	0.057	2.1%	2.816	0.077	2.8%
Gaston	3.202	3.276	0.074	2.3%	3.297	0.095	3.0%
Iredell	3.111	3.174	0.063	2.0%	3.192	0.081	2.6%
Lincoln	1.508	1.542	0.034	2.3%	1.550	0.042	2.8%
Mecklenburg	9.895	10.065	0.170	1.7%	10.159	0.264	2.7%
Rowan	2.628	2.689	0.061	2.3%	2.703	0.075	2.9%
Union	2.780	2.834	0.054	1.9%	2.854	0.074	2.7%
<b>Charlotte Area Subtotal</b>	<b>25.863</b>	<b>26.376</b>	<b>0.513</b>	<b>2.0%</b>	<b>26.571</b>	<b>0.708</b>	<b>2.7%</b>
Davidson	3.048	3.124	0.076	2.5%	3.142	0.094	3.1%
Forsyth	4.440	4.539	0.099	2.2%	4.576	0.136	3.1%
Guilford	6.139	6.275	0.136	2.2%	6.326	0.187	3.0%
<b>Triad Totals</b>	<b>13.627</b>	<b>13.938</b>	<b>0.311</b>	<b>2.3%</b>	<b>14.044</b>	<b>0.417</b>	<b>3.1%</b>
Durham	3.237	3.305	0.068	2.1%	3.334	0.097	3.0%
Johnston	3.079	3.140	0.061	2.0%	3.159	0.080	2.6%
Wake	9.655	9.812	0.157	1.6%	9.915	0.260	2.7%
<b>Triangle Totals</b>	<b>15.971</b>	<b>16.257</b>	<b>0.286</b>	<b>1.8%</b>	<b>16.408</b>	<b>0.437</b>	<b>2.7%</b>
Alamance	2.598	2.661	0.063	2.4%	2.677	0.079	3.0%
Buncombe	3.923	4.012	0.089	2.3%	4.037	0.114	2.9%
Cumberland	3.904	3.982	0.078	2.0%	4.012	0.108	2.8%
Randolph	2.743	2.814	0.071	2.6%	2.829	0.086	3.1%
<b>Totals - All 17 Counties</b>	<b>68.629</b>	<b>70.040</b>	<b>1.411</b>	<b>2.1%</b>	<b>70.578</b>	<b>1.949</b>	<b>2.8%</b>

## 2. Conclusions

For the 17 counties recommended for continuation of the emissions inspection program, the DEQ recommends that the efficiency of the program be optimized by implementing the following, effective January 1, 2019 (to allow time for the EPA to revoke the 2008 ozone standard):

- Change the vehicle emissions inspection frequency from annual to biennial; and
- Decrease the range of vehicle model years covered under the current program (i.e., 1996 through the current year) to the “latest 20 model years.” This change allows for coverage of



the latest 20 vehicle model years such that vehicles that are more than 20 years old would transition out of the program. For example, under the current program 1996 and newer model year vehicles would always be subject to emissions inspections; however, under a rolling 20-year program 1996 model year vehicles would be exempt from the program beginning January 2017.

The DEQ considered the following combination of factors in developing these recommendations:

a. Emissions and Program Benefits are Low

As previously discussed, NO<sub>x</sub> emissions associated with onroad vehicles have been and will continue to decline over time due to fleet turnover (newer low-emitting vehicles are replacing older higher-emitting vehicles) and the phase-in of new federal fuel and engines standards (Tier 3) starting in 2017. The federal Tier 3 standards will result in significant emissions reductions from newer vehicles, thus lowering the potential benefits of an emissions inspection program. The incremental emissions increases associated with changing to a biennial emissions inspection frequency and reducing the coverage of the program to the latest 20 model years is low; therefore, the DEQ does not anticipate that these increases will result in an exceedance of the new ozone standard in any of the 17 counties.

b. Air Quality has Improved – No Violating Monitors

Based on current 2013-2015 ozone monitoring data, 15 of the 17 counties included in Recommendation 2 have ozone values at or below 65 ppb. Mecklenburg County's DV is 68 ppb and Forsyth County's DV is 66 ppb. With ozone values generally expected to decline over time, the DEQ believes that it is unlikely that the NO<sub>x</sub> emissions increases associated with this recommendation will cause an exceedance of the 70 ppb ozone standard in any of these 17 counties.

C. Combined Results for Removing 31 Counties from Emissions Inspection Program and Various Efficiency Options Evaluated for 17 Counties Remaining in Program

Table 12 shows the daily NO<sub>x</sub> and VOC emissions and emissions increases associated with removing 31 counties from the emissions inspection program and each of the program efficiency options evaluated relative to the current 48-county program. As previously discussed, removing 31 counties from the current program is estimated to increase statewide onroad mobile NO<sub>x</sub> emissions by 4.70 tons per day (2.8 percent). For the 17 remaining counties, the modeling results show that changing from an annual to a biennial inspection frequency results in a very small increase in total NO<sub>x</sub> emissions (i.e., 0.03 tons per day or 0.18 percent). Decreasing the vehicle model year coverage is estimated to increase NO<sub>x</sub> emissions by 1.83 tons per day (1.09 percent) under an annual inspection frequency and 2.13 tons per day (1.27 percent) under a biennial inspection frequency.

**Table 12. Summary of Onroad Ozone Season Day NO<sub>x</sub> and VOC Emissions Increases Associated with Various Efficiency Options**

	<b>Total Onroad Emissions (TPD)*</b>	<b>Emissions Increase (TPD)</b>	<b>Emissions Increase (% of Total)</b>	<b>Total Emissions Increase from Various Efficiency Options (TPD)</b>	<b>Total Emissions Increase from Various Efficiency Options (% of Total)</b>
<b>NO<sub>x</sub> Emissions in 2018</b>					
<b>Current I&amp;M Program for 48 Counties</b>	<b>168.00</b>				
<b>Remove 31 Counties from I&amp;M Program</b>	<b>172.70</b>	<b>4.70</b>	<b>2.80%</b>		
<b>Options to Improve Efficiency of I&amp;M Program for Remaining 17 Counties*</b>					
2a: Change vehicle emissions inspection frequency from annual to biennial, 23 model years covered (1996-2018)	173.00	0.30	0.18%	<b>5.00</b>	<b>2.98%</b>
2b: Decrease range of vehicle model years covered from 23 (1996-2018) to 20 (1999-2018), annual inspection frequency	174.53	1.83	1.09%	<b>6.53</b>	<b>3.89%</b>
2c: Change vehicle emissions inspection frequency from annual to biennial and decrease range of vehicle model years covered from 23 (1996-2018) to 20 (1999-2018)	174.83	2.13	1.27%	<b>6.83</b>	<b>4.07%</b>
<b>VOC Emissions in 2018</b>					
<b>Current I&amp;M Program for 48 Counties</b>	<b>117.61</b>				
<b>Remove 31 Counties from I&amp;M Program</b>	<b>121.61</b>	<b>4.00</b>	<b>3.40%</b>		
<b>Options to Improve Efficiency of I&amp;M Program for Remaining 17 Counties*</b>					
2a: Change vehicle emissions inspection frequency from annual to biennial, 23 model years covered (1996-2018)	122.16	0.55	0.47%	<b>4.55</b>	<b>3.87%</b>
2b: Decrease range of vehicle model years covered from 23 (1996-2018) to 20 (1999-2018), annual inspection frequency	123.02	1.41	1.20%	<b>5.41</b>	<b>4.60%</b>
2c: Change vehicle emissions inspection frequency from annual to biennial and decrease range of vehicle model years covered from 23 (1996-2018) to 20 (1999-2018)	123.56	1.95	1.66%	<b>5.95</b>	<b>5.06%</b>

\* For the Total Onroad Emissions column, the values for each of Options 2a, 2b, and 2c reflect cumulative totals relative to removing 31 counties from the emissions inspection program; the results for Options 2a, 2b, and 2c cannot be combined.

## D. Effectiveness of Random Survey Inspections

The DEQ and DMV researched potential opportunities to optimize program efficiencies using remote survey inspections. Two types of remote survey inspections were researched: remote sensing inspections and remote OBD inspections.

### 1. Remote Sensing Inspections

Remote sensing inspections are an automated method of measuring pollutant levels in a vehicle's exhaust while the vehicle is traveling down the road. Unlike most equipment used to measure vehicle emissions today, remote sensing devices (RSD) do not need to be physically connected to the vehicle. The concept of an efficient tool to monitor the vehicle fleet and identify excessive polluters is one way to complement traditional mobile source emission control programs. The system employs either an infrared adsorption principle or laser to measure tail pipe emissions and a still/scene camera to take a picture of the vehicle license plate. These systems operate by continuously projecting either a laser or a beam of infrared radiation across a roadway. As a vehicle passes through the laser or beam, the device measures the vehicle emissions. Currently there are only two companies that provide RSD services or equipment, Envirotest (a subsidiary of Opus Inspection) and Hager Environmental and Atmospheric Testing (HEAT).

The Envirotest system uses specially designed emissions analyzers that are placed roadside to measure specific vehicle emissions using low-intensity infrared and ultraviolet beams. Remote sensing devices collect emissions data as vehicles are driven in normal, everyday use without the need for the vehicle to stop or even slow down. As a vehicle passes through speed and acceleration detectors, an image of the license plate is taken to compare against the system registration database. The vehicle then passes through safe, low intensity infrared and ultraviolet beams of the analyzer. An eye-safe laser directs the beam across the road, where the beam is bounced off mirrors and directed back to the analyzer detection module. The light beam is broken up and the detector measures the levels of CO, carbon dioxide, hydrocarbons, NO<sub>x</sub> and particulate matter in the vehicle exhaust. The readings are then matched to the license plate and an official test record is recorded. This system is not recommended to be operated during rain, snow, high winds, or other adverse weather to ensure accurate, unbiased readings. The Envirotest system is a manned system and usually consists of a van housing a portable detection system that is placed at road level. The estimated cost of a complete system including the van is between \$150,000 and \$200,000, which does not include the staff hours required to operate the system. Remote sensing is also typically used in states that are required to implement enhanced I&M programs or still have tail pipe testing as part of their programs. Areas that use Envirotest equipment or services as part of their I&M program are Colorado, Maryland, Indiana, Ohio, and Tennessee in the United States, and British Columbia in Canada.

The HEAT system is a laser based system usually permanently mounted to a light pole near roadways. This system uses the same technology as active satellite remote sensing platforms using the principles known as Emissions Detection and Reporting (EDAR). This technology is an eye safe laser-based technology capable of remotely detecting and measuring infrared adsorption of vehicle exhaust gases. The EDAR technology is designed to collect data on CO, carbon dioxide, hydrocarbons, NO<sub>x</sub> and particulate matter as part of an unmanned system. The

EDAR laser-based technology is combined with still/scene camera technology and a license plate recognition camera, all of which allows for the capture of not only a 2-dimensional (2D) image of the vehicle as it passes below the EDAR unit, but also a 3-dimensional (3D) multi-spectral image of the entire exhaust plume and the identification of the subject vehicle. The 2D image allows for vehicle profiling (a method of ranking vehicles for the likelihood that they need emissions repairs, using statistics on the historic failure rate of vehicles of very similar design), a benefit previously unavailable to existing remote testing technology, and only now available using EDAR technology. HEAT runs/owns their equipment and the user pays for the data. The I&M program would be required to supply the sites, power and internet access. The readings would cost approximately \$0.01 per vehicle. A total of 5,194,064 vehicle emissions inspections were conducted in 2014; thus, for 2014 the cost of this service would be about \$51,940. The geographical size of North Carolina's program would make it difficult to place enough instruments on road ways to collect data on all five million plus vehicles that are subject to the program. In addition to the estimated cost of purchasing the data, the state would also endure costs for determining site locations, power and internet access at each site.

## 2. Remote On-Board Diagnostic II Inspections

Remote OBD uses wireless technology to continuously monitor the emission related component status of motor vehicles. Through continuous monitoring, vehicle conditions that can cause elevated emissions can be identified more frequently than through traditional periodic inspection. Newer vehicles have manufacturer systems built in the vehicle that also can query the vehicle emissions system, such as On-Star, Ford SYNC, Acura Connect, and Hyundai Bluelink.

North Carolina's current emissions inspection program uses a plug-in cable that transmits OBD data between a vehicle's on-board computer and DMV's computer at the inspection station. Remote OBD allows for the same data transmission, but without a cable connection. Instead, it takes advantage of existing telematics and wireless and/or cellular technology to remotely transmit a vehicle's data to DMV. This single snapshot of data is sent whenever the driver chooses, from wherever the vehicle is located at the time.

Remote OBD offers the opportunity for owners of OBD-equipped vehicles to avoid having to get a periodic, physical inspection of their motor vehicle, and yet still comply with the requirements for an OBD inspection. Greater emission reductions can be derived by continuously monitoring and repairing vehicles when they break instead of once every year or two. This system is best used with 2005 and newer model year vehicles because these vehicles have electronic Vehicle Identification Numbers (VIN) stored in the vehicle computer. Having the electronic VIN number helps the program to detect fraud when someone attempts to use a surrogate vehicle when their vehicle will not pass the OBD test otherwise, known as "Clean Scanning." Oregon is piloting their remote OBD testing program in privately owned and fleet vehicles on a voluntary basis in early 2016. California, Maryland and Nevada are also piloting a remote OBD program with private and/or fleet vehicles.

Opus Inspection and Verizon Telematics are two companies that have remote OBD systems that work with I&M program databases. Both Opus Inspection and Verizon Telematics are participants in Oregon's pilot program which is open to any vendor. In Oregon, Verizon

Telematics would be similar to a normal inspection station and would charge the market rate for an inspection including any state fees. The initial setup cost is approximately \$200,000 and then there would be revenue sharing between Verizon and the state. Vehicle owners in Oregon can either purchase a continuously connected device (examples include devices used by auto fleets to optimize driving routes and maintenance schedules, by usage based auto insurance programs and other applications), purchase a vehicle with a compatible telematics system, or borrow a shared device available at participating locations (auto dealers, repair shops, gasoline service stations, etc.).

Remote OBD systems are also a useful tool for fleet vehicles. Fleet managers can remotely track the maintenance of their vehicles and can be alerted immediately when there is a problem with a vehicle. For government vehicles, it could eliminate the need for staff to take time from their normal daily duties to take a vehicle in to be inspected.

### 3. Conclusions

The DEQ and DMV found that remote sensing inspections are mostly used by states that continue to use the tail pipe test and would not improve the efficiency of North Carolina's emissions inspection program. The DEQ and DMV conclude that remote OBD inspections are a new, emerging technology that should continue to be evaluated as the technology matures. While no state has fully implemented a remote OBD testing program, Oregon is starting a voluntary remote OBD testing program in early 2016. However, either method of remote testing would still require a safety/tamper inspection with North Carolina's current program and would not improve the efficiency of the program if vehicle owners were still required to obtain a safety inspection. Also, citizens may be leery of the state potentially having continuous information on their vehicle or may think the state can track their vehicle location. The DEQ and DMV will continue to study methods for improving the efficiency of North Carolina's emissions inspection program.

#### **IV. Final Recommendations**

Using the emissions modeling results and observed ambient air quality monitoring data relative to the EPA's revised ozone standard of 70 ppb as the criteria, the DEQ is recommending the following:

##### **A. Recommendation 1**

- Eliminate the following 31 counties from vehicle emissions inspections requirements, effective January 1, 2017: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Edgecombe, Franklin, Granville, Harnett, Haywood, Henderson, Lee, Lenoir, Moore, Nash, New Hanover, Onslow, Orange, Pitt, Robeson, Rockingham, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.
- Retain the vehicle emissions inspection program in the following 17 counties: Alamance, Buncombe, Cabarrus, Cumberland, Davidson, Durham, Forsyth, Gaston, Guilford, Iredell, Johnston, Lincoln, Mecklenburg, Randolph, Rowan, Union, and Wake.

##### **B. Recommendation 2**

The DEQ recommends retaining the vehicle emissions inspection program in 17 counties, and optimizing the efficiency of the program by implementing the following, effective January 1, 2019 (to allow time for the EPA to revoke the 2008 ozone standard):

- Change the vehicle emissions inspection frequency from annual to biennial; and
- Decrease the range of vehicle model years covered under the current program (i.e., 1996 through the current year) to the "latest 20 model years." This change allows for coverage of the latest 20 vehicle model years such that vehicles that are more than 20 years old would transition out of the program. For example, under the current program 1996 and newer model year vehicles would always be subject to emissions inspections; however, under a rolling 20-year program 1996 model year vehicles would be exempt from the program beginning January 2017.

##### **C. Recommendation 3**

For the 17 counties remaining in the vehicle emissions inspection program, the DAQ and DMV recommend to continue the evaluation of the effectiveness of random survey inspections. This recommendation is based on current review of potential opportunities to optimize program efficiencies using remote survey inspections (remote sensing and remote On-Board Diagnostic II (OBD)) for this report. The two agencies conclude that remote sensing inspections are mostly used by states that continue to use the tail pipe test and would not improve the efficiency of North Carolina's emissions inspection program. The DEQ and DMV conclude that remote OBD inspections are a new, emerging technology that should continue to be evaluated as the technology matures. While no state has fully implemented a remote OBD testing program, Oregon is starting a voluntary remote OBD testing program in early 2016. However, either method of remote testing would still require a safety/tamper inspection with North Carolina's

current program and would not improve the efficiency of the program if vehicle owners were still required obtain a safety inspection. Also, citizens may be leery of the state potentially having continuous information on their vehicle or may think the state can track their vehicle location. The DEQ and DMV will continue to study methods for improving the efficiency of North Carolina's emissions inspection program.

#### D. Basis for Recommendations

In developing Recommendations 1 and 2, the DEQ considered the following combination of factors:

##### 1. 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 2017. 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.

For Recommendation 1, by 2018, the DEQ estimates that NOx emissions reductions due to the inspection program will be 0.25 tons per day or less in each of the 31 counties recommended for removal from the program. For Recommendation 2, the incremental emissions increases associated with changing to a biennial emissions inspection frequency and reducing the coverage of the program to the latest 20 model years is low; therefore, the DEQ does not anticipate that these increases will contribute to an exceedance of the new ozone standard in any of the 17 counties.

The incremental and cumulative impacts associated with Recommendations 1 and 2 are provided in Table 13. Statewide, relative to the current 48-county program, NOx emissions from onroad mobile sources are estimated to increase by 6.83 tons per day (4.07 percent) and VOC emissions from onroad mobile sources are estimated to increase by 5.95 tons per day (5.06 percent).

##### 2. Air Quality has Improved – No Violating Monitors

Another important factor is current air quality. Significant improvements have been realized in North Carolina over the last decade in both ozone and fine particle concentrations. As of November 2015, North Carolina does not have a single air quality monitor violating any air quality standard including the new 2015 8-hour ozone standard of 70 ppb recently adopted by the EPA. 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 DEQ estimates that implementation of Recommendations 1 and 2 will not interfere with the state's ability to continue to attain and maintain all current air quality standards statewide.

**Table 13. Summary of Onroad Ozone Season Day NOx and VOC Emissions Increases Associated with Recommendations 1 & 2**

	<b>Total Onroad Emissions (TPD)*</b>	<b>Emissions Increase (TPD)</b>	<b>Emissions Increase (% of Total)</b>	<b>Total Emissions Increase from Rec. 1 and 2 (TPD)**</b>	<b>Total Emissions Increase from Rec. 1 and 2 (% of Total)**</b>
<b>NOx Emissions in 2018</b>					
Current I&M Program for 48 Counties	168.00				
Recommendation 1: Remove 31 Counties from I&M Program	172.70	4.70	2.80%		
Recommendation 2: Options to Improve Efficiency of I&M Program for Remaining 17 Counties**					
Change vehicle emissions inspection frequency from annual to biennial and decrease range of vehicle model years covered from 23 (1996-2018) to 20 (1999-2018)	174.83	2.13	1.27%	<b>6.83</b>	<b>4.07%</b>
<b>VOC Emissions in 2018</b>					
Current I&M Program for 48 Counties	117.61				
Recommendation 1: Remove 31 Counties from I&M Program	121.61	4.00	3.40%		
Recommendation 2: Options to Improve Efficiency of I&M Program for Remaining 17 Counties**					
Change vehicle emissions inspection frequency from annual to biennial and decrease range of vehicle model years covered from 23 (1996-2018) to 20 (1999-2018)	123.56	1.95	1.66%	<b>5.95</b>	<b>5.06%</b>

\* For the Total Onroad Emissions column, the values for each of the Recommendations 2a, 2b, and 2c reflect cumulative totals relative to Recommendation 1; the results for Recommendations 2a, 2b, and 2c cannot be combined.

\*\* Rec. = Recommendation.

For Recommendation 1, based on current 2013-2015 ozone monitoring data, 11 of the 31 counties affected have monitors showing ozone values *at or below 65 ppb*. There has never been a need to site an ozone monitor in any of the remaining 20 counties based on EPA monitoring requirements. With ozone values generally expected to decline over time, the DEQ believes that it is very unlikely that any of these 31 counties will be required to have a vehicle emissions inspection program due to attainment issues with the new 70 ppb ozone standard. It is important to note that two counties that meet both of the emissions increase and air quality criteria listed above were excluded from the recommendation for removal from the program. Those counties (Lincoln and Union) are currently in the Charlotte-Gastonia-Salisbury 2008 8-hour ozone maintenance area. The maintenance plan approved by the EPA includes the current control programs at the time that the area came into attainment. The DEQ believes it is prudent to revisit the status of those counties after October 1, 2018, which is the earliest potential date the 2008 ozone standard could be revoked.



Based on current 2013-2015 ozone monitoring data, 15 of the 17 counties included in Recommendation 2 have ozone values *at or below 65 ppb*. Mecklenburg County's DV is 68 ppb and Forsyth County's DV is 66 ppb. With ozone values generally expected to decline over time, the DEQ believes that it is very unlikely that the NOx emissions increases associated with this recommendation will cause an exceedance of the 70 ppb ozone standard in any of these 17 counties.

## Appendix A. Onroad Modeling Framework

For this study, county-level onroad mobile emissions were modeled for near-term and longer-term future years using the Motor Vehicle Emission Simulator (MOVES2014). 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:

- NO<sub>x</sub>, 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 DEQ 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 percent
  - Waiver Rate: 5 percent
  - Inspection Frequency: Annual
  - Model years covered: 1996 to 2014
  - 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 percent
  - Waiver Rate: 5 percent
  - Inspection Frequency: Annual
  - Model years covered: 1996 to year modeled (2016 or 2018)
  - Exempted vehicles: 3 years (latest model years)

- For additional 2018 model runs designed to evaluate I/M program efficiency improvements, the following parameters were modeled (all other parameters unchanged):
  - Inspection Frequency: Biennial
  - Model years covered: 20 model years (1999 to 2018)

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). Note that emissions modeling for this report was completed before the EPA approved North Carolina’s request to remove the summertime RVP limitation of 7.8 psi for Mecklenburg and Gaston Counties beginning in 2016. Although this change increases summertime NOx and VOC emissions slightly, the impact of this change is not significant enough to alter the DEQ’s final recommendation presented in this report.

## Appendix B. Acronyms and Abbreviations

Acronym / Abbreviation	Definition
$\mu\text{g}/\text{m}^3$	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
DEQ	North Carolina Department of Environmental Quality
DMV	North Carolina Division of Motor Vehicles
DV	Design value
EDAR	Emissions Detection and Reporting
EPA	U.S. Environmental Protection Agency
FR	Federal Register
HEAT	Hager Environmental and Atmospheric Testing
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
NCDOT	North Carolina Department of Transportation
$\text{NO}_2$	Nitrogen dioxide
$\text{NO}_x$	
OBD	On-Board Diagnostic
$\text{PM}_{10}$	Particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
$\text{PM}_{2.5}$	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
RSD	Remote Sensing Devices
RVP	Reid Vapor Pressure
SIP	State Implementation Plan
TDM	Transportation Demand Modeling
VIN	Vehicle Identification Number
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds