Final

Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)

Prepared by

North Carolina Department of Environmental Quality

Division of Air Quality

February 28, 2025

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Preface: Effective July 20, 2012, the U. S. Environmental Protection Agency (EPA) designated the Charlotte-Gastonia-Salisbury, North Carolina nonattainment area (referred to as the Charlotte area) as "marginal" nonattainment for the 2008 8-hour ozone National Ambient Air Quality Standard (NAAQS) based on certified monitoring data from 2009-2011 (77 FR 30088, May 21, 2012). The nonattainment area included all of Mecklenburg County and portions of Cabarrus, Gaston, Iredell, Lincoln, Rowan, and Union Counties. At that time, the design value for the Charlotte area was 0.079 parts per million (ppm) or just 0.004 ppm above the standard of 0.075 ppm. Subsequently, the Charlotte area attained the NAAQS and on April 16, 2015, the North Carolina Division of Air Quality (DAQ) submitted to EPA a request to redesignate the area from marginal nonattainment to attainment which was approved by EPA on July 28, 2015 (effective August 27, 2015) (80 FR 44873). The EPA requires that maintenance plans cover the 20-year period after an area is redesignated from nonattainment to attainment to fulfill the requirements of Section 175A(b) of the federal Clean Air Act, as amended. The initial plan, which was developed to cover the first 10 years of the maintenance period (August 27, 2015, through August 26, 2025) has maintained compliance with the 2008 8-hour ozone NAAQS. The DAQ prepared this submittal to EPA to cover the last 10 years of the maintenance period (August 27, 2025, through August 27, 2035).

EXECUTIVE SUMMARY

Introduction

Ozone is formed by a complex set of chemical reactions involving nitrogen oxides (NOx), volatile organic compounds (VOCs) and to a lesser extent carbon monoxide (CO). These gases are generated by electric utilities, combustion processes, certain industrial processes and even by natural sources such as trees. Tailpipe emissions from mobile sources (vehicles) are also significant sources of these pollutants. Emissions from smaller sources such as boat engines, lawn mowers, and construction equipment also contribute to the formation of ozone. Ozone formation is promoted by strong sunlight, warm temperatures and light winds and is hence a problem predominantly during the hot summer months.

The 2008 8-hour ozone National Ambient Air Quality Standard (NAAQS) is 0.075 parts per million (ppm). An exceedance of the 2008 8-hour ozone NAAQS occurs when a monitor measures ozone above 0.075 ppm on average for an 8-hour period. A violation of this NAAQS occurs when the average of the annual fourth highest daily maximum 8-hour ozone values over three consecutive years is greater than or equal to 0.076 ppm. This three-year average is termed the "design value" for the monitor. The design value for a maintenance area is the highest monitor design value in the area.

Charlotte-Gastonia-Salisbury Maintenance Area

Effective July 20, 2012, the U. S. Environmental Protection Agency (EPA) designated the Charlotte-Gastonia-Salisbury, North Carolina nonattainment area (referred to as the Charlotte area, see the hatched areas displayed in Figure 1) as "marginal" nonattainment for the 2008 8-hour ozone standard based on certified monitoring data from 2009-2011. The nonattainment area included all of Mecklenburg County and portions of Cabarrus, Gaston, Iredell, Lincoln, Rowan, and Union Counties. Table 1 identifies the townships in each county included in the Charlotte nonattainment area. At that time, the design value for the Charlotte area was 0.079 ppm. The official designation and classification was published in the Federal Register (FR) on May 21, 2012 and became effective on July 20, 2012.[1] Subsequently, the Charlotte area attained the NAAQS and on April 16, 2015, the North Carolina Division of Air Quality (DAQ) submitted to

[1] 77 FR 30088.

EPA a request to redesignate the area from marginal nonattainment to attainment which was approved by EPA on July 28, 2015 (effective August 27, 2015).[2]

The EPA requires that maintenance plans be developed to cover the 20-year period after an area is redesignated from nonattainment to attainment. The initial plan, which was developed to cover the first 10 years of the maintenance period from August 27, 2015, through August 26, 2025, has been effective in maintaining compliance with the 2008 ozone NAAQS. The DAQ prepared this submittal to cover the second 10 years of the maintenance period from August 27, 2025, through August 27, 2035.

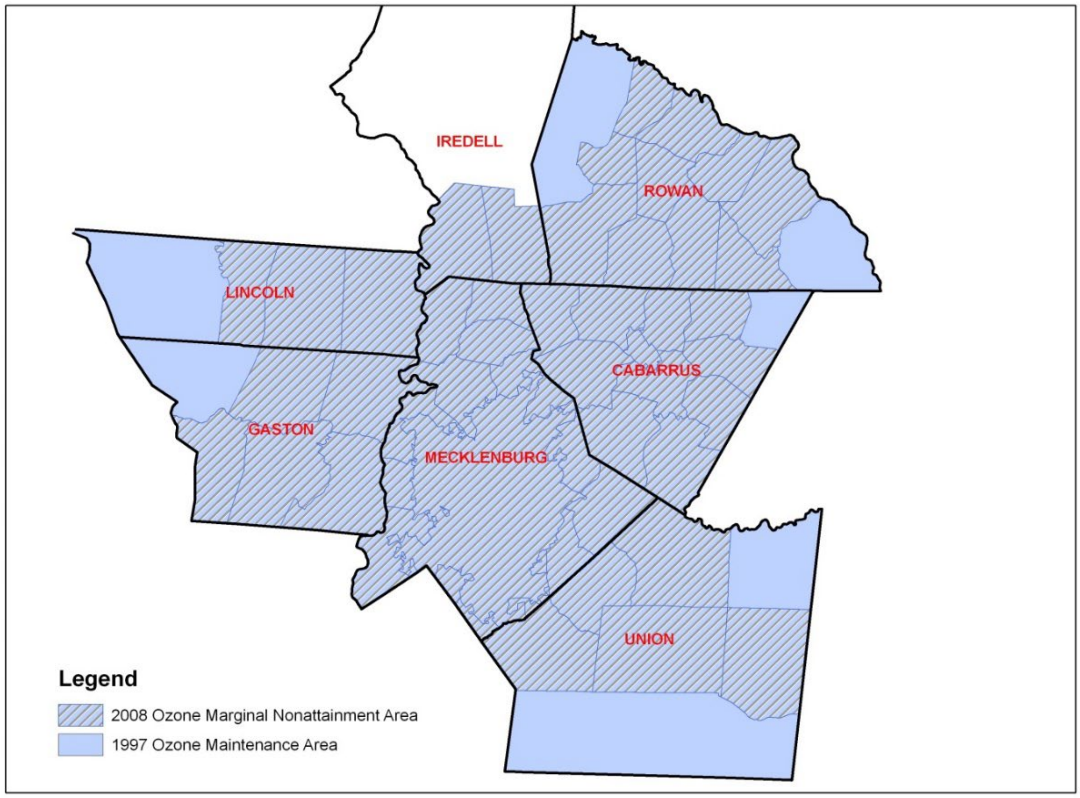

Figure 1 Charlotte Maintenance Area Boundary

[2] 80 FR 44873. The redesignation request also included a Clean Air Act Section 110(1) noninterference demonstration to support the gasoline Reid Vapor Pressure (RVP) standard relaxation in Gaston and Mecklenburg Counties which was approved by EPA on August 17, 2015 (80 FR 49164).

Table 1 Counties and Townships within the Charlotte Maintenance Area

Cabarrus County Townships					
Central Cabarrus	Concord*	Georgeville	Harrisburg	Kannapolis	Midland
Mount Pleasant	Odell	Poplar Tent	New Gilead	Rimertown	
Gaston County Townships					
Dallas	Crowders Mountain	Gastonia	Riverbend	South Point	
Iredell County Townships					
Coddle Creek	Davidson				
Lincoln County Townships					
Catawba Springs	Lincolnton	Ironton			
Mecklenburg County – All Townships					
Rowan County Townships					
Atwell	China Grove	Franklin	Gold Hill*	Litaker	Locke
Providence	Salisbury	Steele	Unity		
Union County Townships					
Goose Creek	Marshville	Monroe	Sandy Ridge	Vance	

*Note: Concord Township in Cabarrus County and Gold Hill Township in Rowan County were inadvertently left out of North Carolina's recommendation and EPA's final designations. In a letter dated January 28, 2014, the DAQ requested the EPA to add the missing townships in the state's 2008 marginal ozone nonattainment area definition.

Current Air Quality Standing

There are currently six ozone monitors located throughout the Charlotte area and one monitor located in York County, South Carolina, just outside of the area. The design value for the maintenance area is 0.069 ppm based on certified monitoring data from 2021-2023. A detailed discussion of air quality levels in the region is provided in Section 2.0.

Maintenance Plan Requirements

Attainment and demonstration of ongoing maintenance of the NAAQS has been achieved by implementing permanent and enforceable federal, state, and local control measures and voluntary actions to control ozone precursor emissions in and near the Charlotte maintenance area. This combination of state, federal, and local actions has resulted in cleaner air in the Charlotte area, and the anticipated future benefits from these programs are expected to result in continued maintenance of the 2008 8-hour ozone NAAQS in this region through the end of the 20-year maintenance period and beyond. A detailed discussion of the foundation control program and additional programs supporting maintenance of air quality levels in the region is provided in Section 3.0.

Emissions

A base year inventory for NOx and VOC emissions was developed for 2018 because it is one of the more recent years for which the Charlotte Area has clean air quality for the 2008 8-hour ozone NAAQS, it is consistent with the base year of the travel demand model runs for the Charlotte area, and it is the base year of the most recent emissions modeling platform at the time this maintenance plan demonstration was prepared. Also, the 2018 base year avoids the potential underrepresentation of emissions related to the consequences of the COVID-19 pandemic beginning in early 2020. The interim year 2026 was chosen because it is the final year of the first 10-year maintenance plan. The final year of the maintenance demonstration is 2035, since the Clean Air Act (CAA) Section 175A(b) requires that a state demonstrate maintenance with the NAAQS for 20 years after the effective date of the redesignation. The maintenance demonstration consists of a comparison between the 2018 baseline emissions inventory and the projected emissions inventories (for 2026 and 2035), which consider economic and population growth. The comparison shows that the total emissions in the interim year and the final year are estimated to be lower than in the base year, which demonstrates maintenance of the 2008 8-hour ozone standard. The reductions in emissions are due to the foundation control program. A detailed discussion of the foundation control program and additional programs supporting maintenance of air quality levels in the region is provided in Section 3.0.

Conclusion and Request for Approval of Maintenance Plan and Motor Vehicle Emission Budgets (MVEBs)

Based on the information provided in this second 10-year maintenance plan and criteria established in Section 107(d)(3)(E) of the CAA, North Carolina is requesting that EPA approve this maintenance plan for the Charlotte-Gastonia-Salisbury maintenance area. The ozone monitoring data demonstrate that the maintenance area has attained the 2008 8-hour ozone NAAQS and maintained the NAAQS every year after redesignation. The maintenance plan also demonstrates that the projected emissions inventories for 2035, the final year of the maintenance plan, as well as the interim year of 2026, are all less than the 2018 base year emissions inventory. In addition, the maintenance plan includes contingency measures to be evaluated for implementation in the event of an air quality violation or other indications of an impending violation. Therefore, maintenance of the 2008 8-hour ozone NAAQS will continue to be maintained through the end of the 20-year maintenance period of August 27, 2035.

In addition, as discussed in Section 4.0, the DAQ completed an Interagency Consultation (IAC) process with its federal, state, and local transportation partners to develop MVEBs to support transportation conformity planning analyses. In this submittal, the DAQ is requesting EPA approval of new MVEBs for 2018 and 2035, and removal of the MVEBs for 2014 and 2026

associated with the first 10-year maintenance plan. The DAQ is not requesting EPA to deem the new budgets for 2018 and 2035 adequate prior to it completing action on this submittal.

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Acronym	Definition
AADVMT	Average annual daily vehicle miles traveled
AEO	Annual Energy Outlook
AERR	Air Emission Reporting Rule
API	Application Programming Interface
ARRA	American Recovery and Reinvestment Act
ASOS	Automated Surface Observing System
AVFT	Alternate Vehicle Fuel and Technology
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CAMPD	Clean Air Markets Program Data
CDOT	Charlotte Department of Transportation
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
CMV	Commercial Marine Vehicles
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRMPO	Cabarrus-Rowan Metropolitan Planning Organization
CRTPO	Charlotte Regional Transportation Planning Organization
CSAPR	Cross State Air Pollution Rule
DAQ	North Carolina Division of Air Quality
DERA	Diesel Emissions Reduction Act
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
DPI	Department of Public Instruction
EGU	Electricity Generating Units
EIA	United States Energy Information Administration
EMP	Emissions Modeling Platform
EMT	Environmental Mitigation Trust
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standard
FR	Federal Register
GCLMPO	Gaston-Cleveland-Lincoln Metropolitan Planning Organization
GHG	Greenhouse Gas

Acronym	Definition
GIS	Geographic Information System
GMS	Grant Management System
GRADE	Grants to Replace Aging Diesel Engines
GVWR	Gross Vehicle Weight Rating
HAP	Hazardous Air Pollutant
HC	Hydrocarbons
HPMS	Highway Performance Monitoring System
HURCOP	Historically Under-Resourced County Outreach Program
I&M	Inspection and Maintenance
IAC	Interagency Consultation
ICI	Industrial and commercial/institutional
KCLT	Charlotte / Douglas International Airport
kg/day	Kilograms/Day
lbs	Pounds
LD	Light-duty
LFG	Landfill Gas
LPG	Liquified Petroleum Gas
MACT	Maximum Achievable Control Technology
MATS	Mercury Air Toxics Standards
MC	Motorcycles
MCAPCO	Mecklenburg County Air Pollution Control Ordinance
MCAQ	Mecklenburg County Air Quality
MDV	Medium-duty vehicle
MOA	Memorandum of Agreement
MOVES	Motor Vehicle Emissions Simulator
MPO	Metropolitan Planning Organization
MRM	Metrolina Regional Model
MRS	MOVES RunSpec
MTP	Metropolitan Transportation Plan
MVEB	Motor Vehicle Emission Budget
MW	Megawatts
NAAQS	National Ambient Air Quality Standard
NC	North Carolina
NCAA	North Carolina Air Awareness
NCAC	North Carolina Administrative Code
NCDEQ	North Carolina Department of Environmental Quality
NCDOT	North Carolina Department of Transportation
NCGS	North Carolina General Statue
NEI	National Emissions Inventory

Acronym	Definition
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NEVI	National Electric Vehicle Infrastructure
NHTSA	National Highway Traffic Safety Administration
NMOG	Non-methane Organic Gases
NOx	Nitrogen Oxides
NPS	National Parks Service
NSPS	New Source Performance Standard
OBD	Onboard Diagnostics
OSBM	North Carolina Office of State Budget and Management
PM	Particulate Matter
PM_{10}	Particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
ppm	Parts per million
psi	pounds per square inch
RICE	Reciprocating Internal Combustion Engines
RPO	Rural Planning Organization
RRRPO	Rocky River Rural Planning Organization
RVP	Reid Vapor Pressure
SAFE	Safer Affordable Fuel-Efficient Vehicle Rule
SCC	Source Classification Code
SCDES	South Carolina Department of Environmental Services
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
STIP	State Transportation Improvement Program
SUV	Sport Utility Vehicle
TDM	Travel Demand Model
TIP	Transportation Improvement Program
tpd	tons per summer day
TVA	Tennessee Valley Authority
U.S.	United States
VHT	Vehicle Hours Traveled
VIN	Vehicle Identification Number
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds
vPIC	NHTSA Product Information Catalog Vehicle Listing
VW	Volkswagen

1.0 INTRODUCTION

1.1 WHAT IS TROPOSPHERIC OZONE?

Ozone, a strong chemical oxidant, adversely impacts human health through effects on respiratory function and can also damage forests and crops. Ozone is not emitted directly by the electric utilities, industrial sources or motor vehicles but instead, is formed in the lower atmosphere, the troposphere, by a complex series of chemical reactions involving nitrogen oxides (NOx), resulting from the utilities, combustion processes and motor vehicles, and reactive volatile organic compounds (VOCs). VOCs include many industrial solvents, toluene, xylene and hexane as well as the various hydrocarbons (HC) that are evaporated from the gasoline used by motor vehicles or emitted through the tailpipe following combustion.

Ozone formation is promoted by strong sunlight, warm temperatures, and light winds. High concentrations tend to be a problem in the eastern United States during the hot summer months when these conditions frequently occur. Therefore, the U. S. Environmental Protection Agency (EPA) mandates seasonal monitoring of ambient ozone concentrations in North Carolina from March 1 through October 31 as specified in Title 40 of the Code of Federal Regulations (CFR).[3] The North Carolina Division of Air Quality (DAQ) has examined both the man-made and natural sources of VOC emissions and their contribution to ozone formation in North Carolina. Because of the generally warm and moist climate of North Carolina, vegetation abounds in many forms, and forested lands naturally cover much of the state. As a result, the biogenic sector, which cannot be controlled, is the most abundant source of VOCs in North Carolina accounting for approximately 80% of statewide VOC emissions.[4] The overwhelming abundance of biogenic VOCs makes the majority of North Carolina a NOx limited environment for the formation of ozone. This is supported by a study published in the Journal of Environmental Management that concludes that the sensitivity of ozone to anthropogenic VOC emissions in the Southeastern United States is 2-3 orders of magnitude smaller than the sensitivity of ozone to NOx emissions, primarily due to the abundance of biogenic VOC emissions in this region.[5] As a result, controlling anthropogenic VOC emissions in the Southeast is far less effective than controlling NOx emissions for purposes of reducing ozone levels.

[3] 40 CFR 58 App. D, 4.1(i) Table 3.
[4] Based on EPA's 2018v2 emissions modeling platform, biogenic VOC emissions were 80% of total statewide VOC emissions in 2018. Reference: "https://gaftp.epa.gov/Air/emismod/2018/v2/reports/2018gg_county_monthly_report_03aug2022_v0.csv" downloaded April 18, 2024, from EPA's FTP server at: https://gaftp.epa.gov/Air/emismod/2018/v2/reports/.
[5] Odman, M Talat et al., *Quantifying the sources of ozone, fine particulate matter, and regional haze in the Southeastern United States,* 90 Journal of Environmental Management 3155-3168 (2009).

1.2 CLEAN AIR ACT OF 1990

Since the 1977 amendments to the Clean Air Act (CAA), areas of the country that had not attained the ambient standard for a particular pollutant were formally designated as nonattainment for that pollutant. This formal designation concept was retained in the 1990 CAA Amendments. The CAA requires the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants that are considered harmful to public health and the environment. Primary and secondary NAAQS under Section 109 of the CAA are set forth in Title 40 of the CFR, Part 50. The NAAQS are subject to revision and additional primary and secondary standards may be promulgated as the EPA deems necessary to protect public health and welfare. The EPA has promulgated primary and secondary NAAQS for ground-level ozone, carbon monoxide (CO) (no secondary standard for CO), lead, nitrogen dioxide (NO_2), sulfur oxides (SO_2), and particulate matter (PM) with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) and 2.5 micrometers ($PM_{2.5}$). The EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally based criteria (science-based guidelines) for setting permissible levels. For each criteria air pollutant, a health-based or "primary" standard has been set to protect public health in general, and a welfare-based or "secondary" standard may be set to protect quality of life and the environment. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

1.3 AIR QUALITY HISTORY

1.3.1 1997 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)

The 1997 8-hour ozone NAAQS was set at 0.08 parts per million (ppm). An exceedance of the 1997 8-hour ozone NAAQS occurs when a monitor measures ozone at or above 0.085 ppm on average for an 8-hour period (0.084 ppm is considered to be in compliance with the 1997 ozone standard to three decimal places). A violation of this NAAQS occurs when the annual fourth highest daily maximum 8-hour ozone values, averaged over three consecutive years, is greater than or equal to 0.085 ppm. This three-year average is termed the "design value" for the monitor. For areas with more than one ozone monitor, the design value for the area is based on the monitor with the highest design value.

The area surrounding Charlotte-Gastonia-Rock Hill, North Carolina-South Carolina, called the Metrolina area (see Figure 1.1), was designated "moderate" nonattainment for the 1997 8-hour

ozone NAAQS on April 30, 2004.[6] The 1997 8-hour ozone NAAQS was set at 0.085 ppm. The Metrolina nonattainment area includes the North Carolina counties of Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan and Union; Coddle Creek and Davidson Townships in Iredell County, North Carolina; and the Rock Hill Metropolitan Planning Organization boundary in York County, South Carolina. On December 2, 2013, EPA approved North Carolina's redesignation demonstration and maintenance plan for the 1997 8-hour ozone NAAQS for the Charlotte-Gastonia-Rock Hill, North Carolina area which covered the period from January 2, 2014, through January 2, 2024.[7] On December 9, 2021, the DAQ submitted to EPA for review and approval a limited maintenance plan covering the second 10-year maintenance period from January 3, 2024, through January 2, 2034. The limited maintenance plan was approved by EPA on January 13, 2023, with an effective date of February 13, 2023.[8] The area qualified for a limited maintenance plan, which removes the requirement for establishing motor vehicle emissions budgets, because air quality levels for monitoring sites in the area are below 85% of the level of the standard and air quality levels have not been highly variable during preceding years.

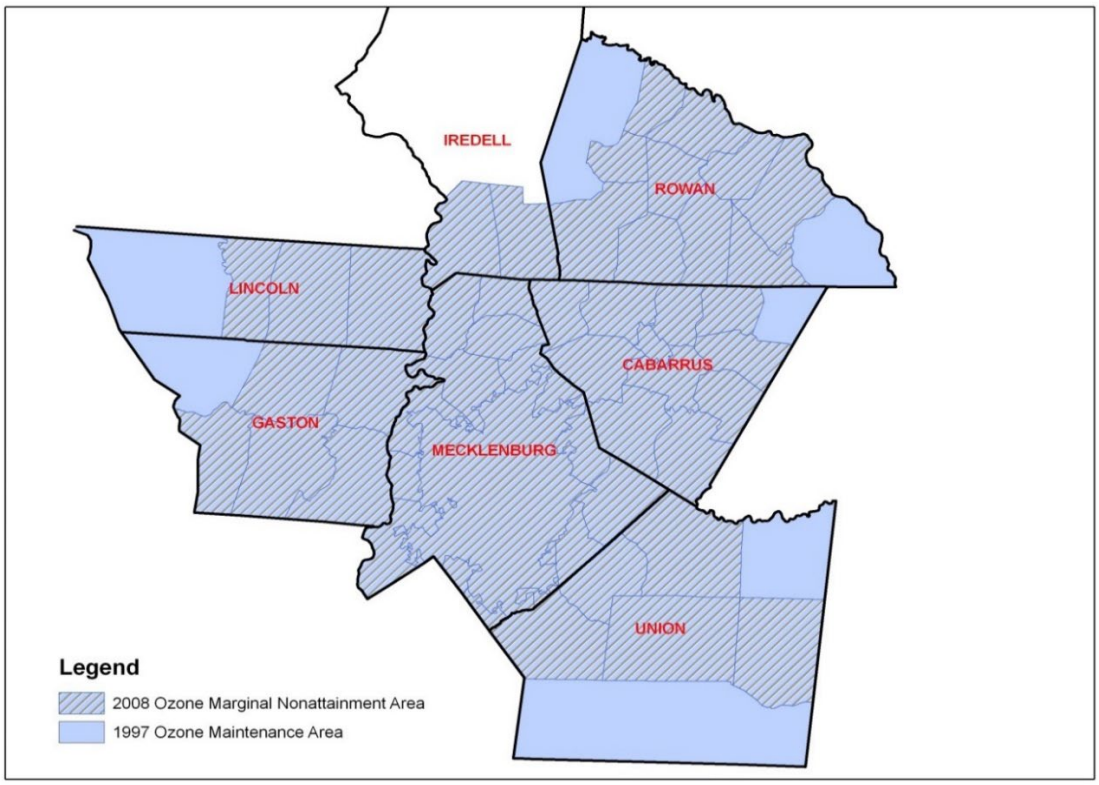

Figure 1.1 Charlotte Maintenance Area Boundary

[6] 69 FR 23858.
[7] 78 FR 72036.
[8] 88 FR 2245.

1.3.2 2008 8-Hour Ozone NAAQS

On March 12, 2008, the EPA revised the primary (health) and secondary (welfare) NAAQS for ozone to a level of 0.075 parts per million (ppm). An exceedance of the 2008 8-hour ozone NAAQS occurs when a monitor measures ozone above 0.075 ppm on average for an 8-hour period. A violation of this NAAQS occurs when the average of the annual fourth highest daily maximum 8-hour ozone values over three consecutive years is greater than or equal to 0.076 ppm. This three-year average is termed the "design value" for the monitor. The design value for a nonattainment area is the highest monitor's design value in the area.

On July 20, 2012, the EPA designated the Charlotte-Gastonia-Salisbury, North Carolina nonattainment area (referred to as the Charlotte area) as "marginal" nonattainment for the 2008 8-hour ozone standard based on certified monitoring data from 2009-2011. As shown in Figure 1.1, the nonattainment area includes all of Mecklenburg County and portions of Cabarrus, Gaston, Iredell, Lincoln, Rowan, and Union Counties. Table 1.1 identifies the townships in each county that are included in the Charlotte nonattainment area. At that time, the design value for the Charlotte area was 0.079 ppm. The official designation and classification was published in the Federal Register (FR) on May 21, 2012.[9] The designation became effective on July 20, 2012.

Table 1.1 Counties and Townships within the Charlotte Maintenance Area

Cabarrus County Townships					
Central Cabarrus	Concord*	Georgeville	Harrisburg	Kannapolis	Midland
Mount Pleasant	Odell	Poplar Tent	New Gilead	Rimertown	
Gaston County Townships					
Dallas	Crowders Mountain	Gastonia	Riverbend	South Point	
Iredell County Townships					
Coddle Creek	Davidson				
Lincoln County Townships					
Catawba Springs	Lincolnton	Ironton			
Mecklenburg County – All Townships					
Rowan County Townships					
Atwell	China Grove	Franklin	Gold Hill*	Litaker	Locke
Providence	Salisbury	Steele	Unity		
Union County Townships					
Goose Creek	Marshville	Monroe	Sandy Ridge	Vance	

*Note: Concord Township in Cabarrus County and Gold Hill Township in Rowan County were inadvertently left out of North Carolina's recommendation and EPA's final designations. In a letter dated January 28, 2014, the DAQ requested EPA to add the missing townships in the state's 2008 marginal ozone nonattainment area definition.

[9] 77 FR 30088.

On July 28, 2015, EPA published its final rule (80 FR 44873) in which it (1) determined that the Charlotte-Gastonia-Salisbury, North Carolina 2008 8-Hour Ozone Marginal Nonattainment Area (hereinafter referred to as the "Charlotte area" or "maintenance area") was attaining the 2008 8-hour ozone NAAQS, (2) redesignated the North Carolina portion of the Charlotte area to attainment for the 2008 8-hour ozone NAAQS, (3) approved and incorporated North Carolina's maintenance plan for maintaining attainment of the 2008 8-hour ozone standard for the North Carolina portion of the Charlotte area into the State Implementation Plan (SIP), and (4) determined that the 2014 and 2026 sub-area NOx and VOC motor vehicle emissions budgets (MVEBs) for 2026 for the North Carolina portion of the Charlotte area were adequate for the purposes of transportation conformity. The final rule became effective August 27, 2015.

On the same day, EPA also published its final rule (80 FR 44868) approving of North Carolina's CAA Section 110(l) noninterference demonstration for relaxing the Federal Reid vapor pressure (RVP) requirement from 7.8 pound per square inch (psi) to 9.0 psi applicable to gasoline introduced into commerce from June 1 to September 15 of each year in Mecklenburg and Gaston Counties. The EPA subsequently issued a direct final rule (80 FR 49164) on August 17, 2015, approving revisions to the rule (effective on October 16, 2015) to relax the summertime RVP requirement in the two counties.

Since 2015, three supplements have been submitted for this maintenance plan. Two supplements updated the 2026 MVEBs for NOx and VOC and one supplement revised the motor vehicle model year coverage of the emissions inspection and maintenance program (I&M) as required by North Carolina session law. The following provides a summary of the supplements to the first 10-year maintenance plan.

- Supplement I: In 2017, the North Carolina General Assembly enacted Session Law 2017-10, Senate Bill 131 (An Act to Provide Further Regulatory Relief to the Citizens of North Carolina) which revised the state's emissions I&M program. Section 3.5.(b) of the Act amended North Carolina General Statue (NCGS) §143-215.107A(c) §20-183.2(b) by changing the vehicle model year coverage from 1996 and newer vehicles to the most recent 20 model years (excluding the three most recent model year vehicles with less than 70,000 miles on the odometer). On July 25, 2018, the DAQ submitted a revision to the maintenance plan for the Charlotte area to update the emissions forecast and MVEBs for 2026 to account for the small increase in NOx and VOC emissions associated with the change in vehicle model year coverage as proposed by Section 3.5.(b) of the Act. The DAQ also submitted an accompanying I&M SIP revision, CAA Section 110(l) noninterference demonstration, and revisions to North Carolina's air quality rule 15A North Carolina Administrative Code

(NCAC) 02D .1002 (Applicability). On September 11, 2019, EPA published a final rule (84 FR 47889) approving the revisions (effective on October 11, 2019). In accordance with Section 3.5.(d) of the Act, on September 17, 2019, the Secretary of the Department of Environmental Quality submitted official certification to North Carolina's Revisor of Statutes that EPA published its final approval of the SIP revisions. The Section also required the changes to become effective on the first day of a month that is 60 days after the Secretary's official certification was submitted. As a result, the effective date for implementing the changes to the vehicle model year coverage was on December 1, 2019.

- Supplement II: On July 16, 2020, the DAQ submitted a supplement to revise the MVEBs for the Charlotte-Gastonia-Salisbury area by increasing the safety margin emissions allocated to the MVEBs of each of the three budget regions in the area. Historically, the DAQ has limited the allocation of NOx and VOC safety margin emissions to MVEBs so that less than 50% of the safety margin of each pollutant is allocated. In this submittal, North Carolina proposed to increase the amount of the total safety margin allocated to the 2026 MVEBs from 4.7% to 9.4% for NOx and from 18.7% to 37.4% for VOC. These revisions were proposed to accommodate recent changes to the travel demand model (TDM), to account for uncertainty in the mobile emissions model and unanticipated growth in the vehicle miles traveled (VMT) in the Charlotte area. At this time, the Charlotte-Gastonia-Salisbury area was attaining the 2008 and 2015 8-hour ozone NAAQS based on certified ambient monitoring data. Therefore, the DAQ concluded that the proposed revisions to the 2026 MVEBs would not interfere with any applicable requirement concerning the attainment and maintenance of the NAAQS. On August 25, 2021, EPA published a final rule (86 FR 47387) approving the North Carolina; Revision to Approved Motor Vehicle Emissions Budgets.

- Supplement III: Due to a requirement to use the Motor Vehicle Emissions Simulator (MOVES3) model, released January 7, 2021, in regional emissions analyses for transportation conformity determinations after January 9, 2023, the DAQ prepared a third supplement to provide MOVES3-compatible MVEBs for the three budget areas in the Charlotte-Gastonia-Salisbury, North Carolina 2008 8-Hour Marginal Nonattainment Area. Transportation conformity in the area ensures that federal transportation actions do not interfere with maintaining compliance with the 2008 8-hour ozone NAAQS. The current MVEBs were based on emissions results from the previous version of the MOVES model (MOVES2014b), and, therefore, did not reflect the higher NOx emissions from diesel vehicles operating at lower speeds that are estimated with MOVES3. Revised safety margin allocations agreed upon by the IAC process, totaled 21.4% for NOx and 49.7% for VOC, with a significant amount of safety margin held in reserve, which indicates NOx and VOC emissions will continue to decline through 2026. The Charlotte-Gastonia-Salisbury area

continues to attain the 2008 and 2015 8-hour ozone NAAQS based on certified ambient monitoring data; therefore, these revisions will not interfere with any applicable requirement concerning the attainment and maintenance of the 2008 8-hour Ozone NAAQS. On June 13, 2024, EPA published its final rule approving these revisions to the 2026 MVEBs based on MOVES3 modeling results. The effective date for this rule is July 15, 2024.

The 2023 session of the North Carolina General Assembly enacted Session Law 2023-134, House Bill 259 (2023-2024 Appropriations Bill) effective October 3, 2023. Section 12.7 of S.L. 2023-134 amended NCGS §143-215.107A(c) to remove 18 of the 19 counties from North Carolina's I&M program and changed the vehicle model year coverage for Mecklenburg County which is the only county retained in the program. As required by this legislation, on October 1, 2024, the North Carolina Department of Environmental Quality (NCDEQ) submitted a proposed SIP revision and CAA Section 110(l) noninterference demonstration requesting EPA approval to remove 19 counties from the I&M program including the six counties subject to this maintenance plan. After consultation with EPA, it was agreed that for the purpose of the North Carolina SIP, the DAQ would propose to remove Mecklenburg County from the I&M program SIP. The proposed changes will not be effective until approved by EPA and finalized by NCDEQ and the N.C. Division of Motor Vehicles (DMV).[10]

Based on a technical study of county-level emissions increases associated with the proposed I&M program change, and current ambient air quality data, the DAQ concluded that removing the 19 counties from the I&M SIP will not interfere with continued attainment or maintenance of any applicable NAAQS. Note that although the DAQ is requesting EPA approval to remove Mecklenburg County from the I&M SIP and from the 1997 and 2008 ozone maintenance plans for the Charlotte area, the I&M program will continue to be implemented in the Mecklenburg County as required in Section 12.7 of Session Law 2023-134.

[10] NCDEQ, State Implementation Plan (SIP) Revision and Clean Air Act Section 110(1) Noninterference Demonstration to Remove 19 Counties from North Carolina's Motor Vehicle Emissions Inspection and Maintenance (I&M) Program SIP, October 1, 2024, https://www.deq.nc.gov/about/divisions/air-quality/air-quality-planning/state-implementation-plans-sips/inspection-and-maintenance-program-sip.

2.0 AIR QUALITY

2.1 AIR QUALITY DATA TRENDS (2010 – 2023)

The DAQ and the Mecklenburg County Air Quality (MCAQ) local agency have collected ambient monitoring data for the Charlotte area since the late seventies. Figure 2.1 shows the location of the five regulatory ozone monitors throughout the Charlotte maintenance area. In addition, two additional ozone monitors are in York County, South Carolina (not shown in Figure 2.1). The DAQ operates three of the monitors in the Charlotte area, MCAQ operates two of the monitors in Mecklenburg County, the South Carolina Department of Environmental Services (SCDES) operates the York County Landfill monitor, and the Catawba Indian Nation operates the Catawba Indian Nation monitor. These monitors were, and will continue to be, installed and operated in accordance with 40 CFR 58.

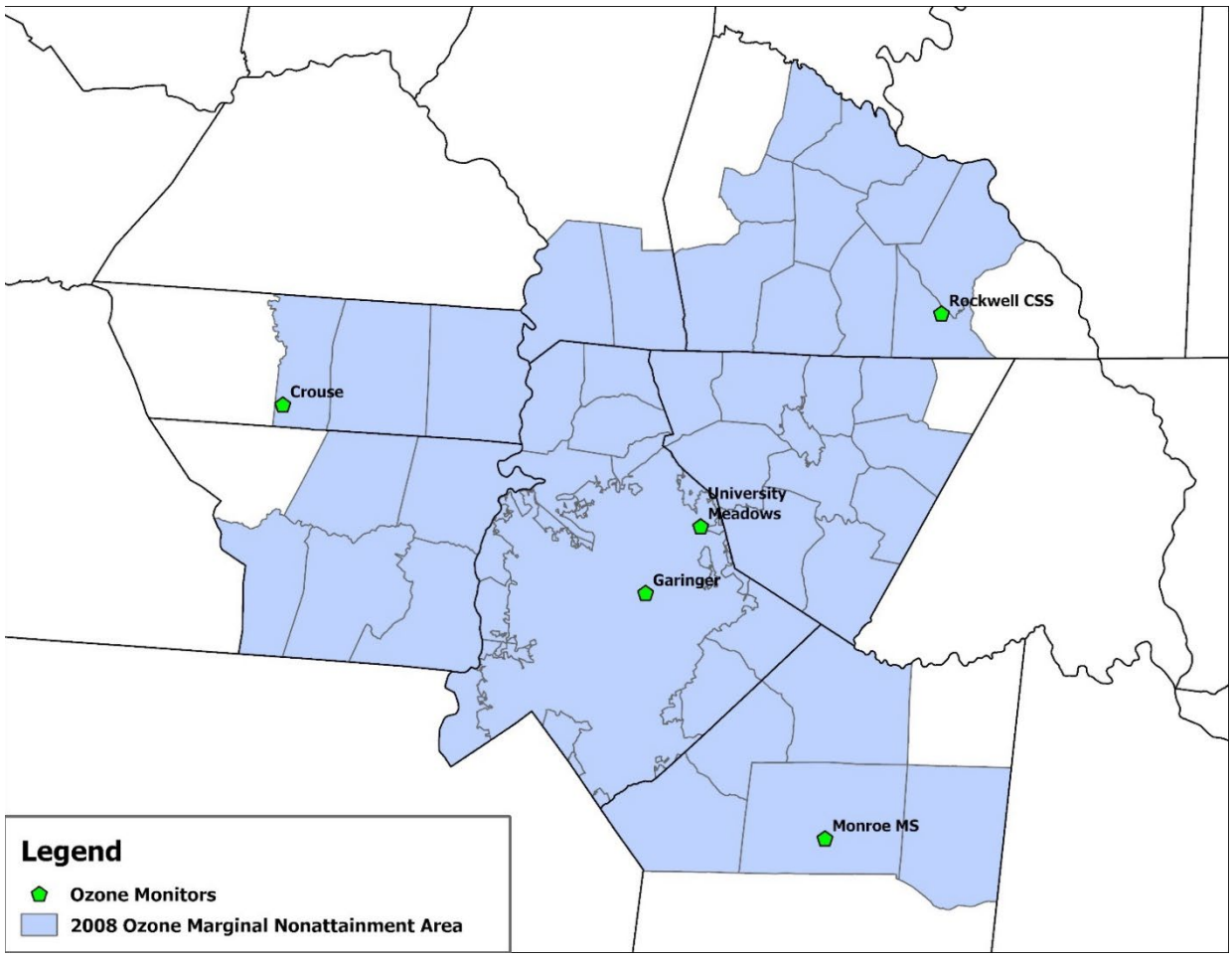

Figure 2.1 Ozone Monitor Locations in the Charlotte Maintenance Area

Table 2.1 shows the fourth highest 8-hour average ozone concentration at each of the monitors in the Charlotte region for 2010-2023. These data have been certified and were extracted from EPA's Air Quality System in May 2024.

Table 2.1 Charlotte Area's Historic 4th Highest 8-hour Ozone Values (2010-2023) Based on Certified Monitoring Data (ppm)

Monitor / AQS ID / County / State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Crouse ID #37-109-0004 Lincoln County, NC	0.072	0.077	0.076	0.064	0.064	0.068	0.069	0.064	0.063	0.065	0.054	0.066	0.064	0.066
Garinger ID #37-119-0041 Mecklenburg County, NC	0.082	0.088	0.080	0.067	0.065	0.073	0.070	0.066	0.070	0.074	0.059	0.067	0.068	0.073
University Meadows ID#37-119-0046[a] Mecklenburg County, NC				0.066	0.068	0.069	0.074	0.068	0.069	0.072	0.060	0.067	0.067	0.070
Rockwell ID #37-159-0021 Rowan County, NC	0.077	0.077	0.080	0.062	0.064	0.066	0.066	0.062	0.060	0.066	0.058	0.063	0.064	0.068
Monroe ID #37-179-0003 Union County, NC	0.071	0.073	0.075	0.062	0.067	0.067	0.070[b]	0.066[b]	0.070	0.070	0.051	0.066	0.067	0.068
York CMS ID # 45-091-0006[c] York County, SC	0.065	0.065	0.065	0.061	0.056	0.061	0.061							
York Landfill ID# 45-091-0008 York County, SC								0.065	---[d]	---[d]	0.053	0.063	0.061	0.069
Catawba Indian Nation ID #45-091-8801[e] York County, SC							0.066	0.058	0.066	0.068	0.054	0.065	0.062	0.067

[a] Monitor started in 2016 to replace County Line (ID# 37-119-1009); EPA approved combining data for the two sites to calculate a design value; value reported is a combined design value.
[b] Monitor did not meet 3-year completeness requirement of 90% for 2016 and 2017.
[c] The York CMS Monitoring Site was relocated to the York Landfill Monitoring Site in 2017. With the EPA's approval, the data is now reported under one AQS code – 45-091-0008.
[d] The EPA retroactively invalidated portions of the Department's ozone data collected in 2018 and 2019. The monitoring data collected during these years is not included within this document.
[e] The Catawba Indian Nation Monitoring Site is owned and operated by the Catawba Indian Nation (Tribal Code: 032).

Table 2.2 shows the three-year average design values calculated using the fourth highest 8-hour average ozone concentrations for each monitor. Overall, the design values remain well below the 2008 ozone NAAQS of 0.075 ppm and are expected to remain below the standard as more stringent federal standards that control NOx emissions are implemented in the light-, medium-, and heavy-duty vehicle fleet. The design values that include calendar year 2020 declined somewhat due to the impacts of the COVID-19 pandemic (during which vehicle miles traveled significantly declined because people stayed home) and subsequently are returning to pre-pandemic levels. In 2023, all monitors in the Charlotte maintenance area are in attainment of the 2008 8-hour ozone NAAQS. The 2021-2023 design value for Charlotte area is 0.069 ppm.

Table 2.2 Charlotte Area Historic Ozone Design Values for the 2008 8-Hour Ozone NAAQS (ppm)*

Monitor / AQS ID / County / State	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Crouse ID #37-109-0004 Lincoln County, NC	0.075	0.072	0.068	0.065	0.067	0.067	0.065	0.064	0.060	0.061	0.061	0.065
Garinger ID #37-119-0041 Mecklenburg County, NC	0.083	0.078	0.070	0.068	0.069	0.069	0.068	0.070	0.067	0.066	0.064	0.069
University Meadows ID#37-119-0046[a] Mecklenburg County, NC	0.083	0.078	0.073	0.067	0.070[a]	0.070[a]	0.070	0.069	0.067	0.066	0.064	0.068
Rockwell ID #37-159-0021 Rowan County, NC	0.078	0.073	0.068	0.064	0.065	0.064	0.062	0.062	0.061	0.062	0.061	0.065
Monroe ID #37-179-0003 Union County, NC	0.073	0.070	0.068	0.065	0.068	0.067	0.068[b]	0.068[b]	0.063	0.062	0.061	0.067
York CMS ID # 45-091-0006[c] York County, SC	0.065	0.063	0.060	0.059	0.059							
York Landfill ID# 45-091-0008 York County, SC						0.062	---[d]	---[d]	---[d]	---[d]	0.059	0.064
Catawba Indian Nation ID #45-091-8801[e] York County, SC							0.063	0.064	0.062	0.062	0.060	0.064

* Ozone design values calculated based on the methodology in 40 CFR Part 50.15, Appendix P for the 2008 primary 8-hour ozone NAAQS. Design values downloaded from EPA's AQS May 17, 2024, for North Carolina monitors and June 5 and 6, 2024 for South Carolina monitors.

[a] Monitor started in 2016 to replace County Line (ID# 37-119-1009); EPA approved combining data for the two sites to calculate a design value; value reported is a combined design value.

[b] Monitor did not meet 3-year completeness requirement of 90% for 2016 and 2017.

[c] The York CMS Monitoring Site was relocated to the York Landfill Monitoring Site in 2017. With the EPA's approval, the data is now reported under one AQS code – 45-091-0008.

[d] The EPA retroactively invalidated portions of the Department's ozone data collected in 2018 and 2019. The monitoring data collected during these years is not included within this document.

[e] The Catawba Indian Nation Monitoring Site is owned and operated by the Catawba Indian Nation (Tribal Code: 032). This monitoring site began operation in 2016 and did not have a valid design value until 2018.

2.2 PERMANENT AND ENFORCEABLE EMISSIONS REDUCTIONS

There are several state and federal measures and actions that North Carolina has adopted and implemented to ensure permanent and enforceable emissions reductions in the Charlotte maintenance area. The following provides a list of federal and state measures and actions included in the foundation control program for this maintenance plan. These federal and state actions are discussed in more detail in Section 3.2.

Federal Measures and Actions:

For mobile sources:

- Tier 2 and Tier 3 vehicle and fuel standards
- National program for greenhouse gas (GHG) emissions and fuel economy standards
- Heavy-duty gasoline and diesel highway vehicle standards
- Medium- and heavy-duty vehicle fuel consumption and GHG standards
- Large nonroad diesel engine standards
- Nonroad spark-ignition engine and recreational engine standards

For stationary sources:

- NOx SIP Call, Clean Air Interstate Rule (CAIR), and Cross State Air Pollution Rule (CSAPR) for electricity generating units (EGUs)
- Tennessee Valley Authority (TVA) Consent Decree
- Boiler and Reciprocating Internal Combustion Engine (RICE) National Emissions Standards for Hazardous Air Pollutants (NESHAP)
- Utility Mercury Air Toxics Standards (MATS) and New Source Performance Standards (NSPS)

State Measures and Actions:

For mobile sources:

- Light-Duty Gasoline Vehicle Emissions Inspection and Maintenance (I&M) On-board Diagnostics (OBDII) Program that began on July 1, 2002
- Transportation Conformity Memorandum of Agreements (MOAs)

For stationary sources:

- Clean Smokestacks Act
- Boiler 112(j) Permitting Program

In addition, the state of North Carolina has adopted state rules to implement and enforce federal and state air pollution control requirements to ensure that ozone precursor emissions reductions are permanent and enforceable in the North Carolina portion of the Charlotte area. The state

rules are codified at 15A NCAC Subchapter 2D (Air Pollution Control Requirements) and Subchapter 2Q (Air Quality Permit Procedures).[11] The MCAQ has also adopted rules reflecting the state and federal rules which are codified as Mecklenburg County Air Pollution Control Ordinance (MCAPCO) Article 1.0000 (Sections 1.5100-1.5700, Permitting Provisions for Air Pollution Sources; Rules and Operating Regulations) and MCAPCO Article 2.0000 (Sections 2.0100 - 2.2600, Air Pollution Control Regulations and Procedures).[12]

This combination of state, federal, and local actions has resulted in cleaner air in the Charlotte area, and the anticipated future benefits from these programs are expected to result in continued maintenance of the 2008 8-hour ozone NAAQS in this region.

As a result of state legislative actions, the vehicle I&M program is being phased out because of the declining benefits of the program as new, cleaner vehicles manufactured to comply with federal emissions and fuel standards that have been tightened over the years have replaced older vehicles. Section 3.2 provides a summary of these legislative actions. For seven counties in the Charlotte maintenance area, the NCDEQ submitted to EPA on October 1, 2024, a SIP revision and CAA Section 110(l) noninterference demonstration to remove all seven counties from the I&M program. This submittal was prepared as required by Session Law 2023-134, House Bill 259 (2023-2024 Appropriations Bill) adopted by the North Carolina General Assembly effective October 3, 2023. Section 12.7 of S.L. 2023-134 amended NCGS §143-215.107A(c) to remove 18 of the 19 counties from North Carolina's I&M program and changed the vehicle model year coverage for Mecklenburg County which is the only county retained in the program. After consultation with EPA staff, it was agreed that for the purpose of the North Carolina SIP, the NCDEQ would propose to remove Mecklenburg County from the I&M program SIP. Based on a technical study of county-level emissions increases associated with the proposed I&M program change, and current ambient air quality data, the DAQ concluded that removing the counties from North Carolina's I&M SIP will not interfere with continued attainment or maintenance of any applicable NAAQS.[13] For the seven counties in the Charlotte area, the NCDEQ also requested that EPA approve removal of the I&M program from the foundation control program in the maintenance plans for the 1997 and 2008 ozone NAAQS for the Charlotte area. The EPA

[11] North Carolina Air Quality Rules, https://www.deq.nc.gov/about/divisions/air-quality/air-quality-planning/air-quality-rules-regulations/rules#cnt.
[12] Mecklenburg County Air Pollution Control Ordinance (MCAPCO), https://airquality.mecknc.gov/regulated-industry/regulations.
[13] The EPA's MOVES4.0.1 model was used to perform the emissions analysis associated with removing counties from the I&M program. For vehicle model years 2027-2033, federal multi-pollutant emissions standards have been adopted for light-, medium-, and heavy-duty vehicles (89 FR 27842, 89 FR 29440) and these standards were not included in the MOVES4.0.1 model. The additional NOx and VOC emission reductions from implementation of these standards will help to support future emissions reductions and ongoing maintenance of the NAAQS.

would need to approve this request before approving removal of the I&M program from these two maintenance plans for the Charlotte area.

2.4 ADDITIONAL PROGRAMS SUPPORTING MAINTENANCE

This section identifies state and local programs that have been implemented in the Charlotte area to support maintenance of the NAAQS. Although these are important programs that help to ensure compliance with the NAAQS, they have not been relied upon as federally enforceable measures. These state and local programs are more fully described in Section 3.3.

State programs that have been implemented include:

- North Carolina Air Awareness (NCAA) Program
- Mobile Sources Emissions Reduction Grant Program
- Open Burning Rule
- Idle Reduction Regulation[14]
- Advance Program
- Volkswagen Mitigation Settlement
- Electric Vehicle Adoption

Local programs that have been implemented include:

- Open Burning Prohibition
- Grants to Replace Aging Diesel Engines (GRADE) Program
- Mobile Source Emissions Reduction Grants
- Breathing Room

2.5 EFFECT OF NOX CONTROL PROGRAMS ON OZONE LEVELS

The foundation control program for stationary and mobile sources for the Charlotte area has significantly reduced NOx emissions enabling the area to demonstrate attainment with the 2008 ozone NAAQS. As an example, EGUs historically have been a significant source of NOx emissions contributing to ozone formation during the summer months in the Charlotte area as well as statewide. A review of the NOx emissions in the EPA's Air Markets Program Data database shows a 122,000-ton reduction (84%) in NOx emissions from the reporting sources in North Carolina from 2002 through 2023. The trend in decreasing NOx emissions from these

[14] Rule 15A NCAC 02D .1010 (Heavy-Duty Vehicle Idling Restrictions) was repealed by North Carolina effective November 1, 2016.

facilities are attributable to a combination of state (e.g., Clean Smokestacks Act) and federal (e.g., NOx SIP Call and CSAPR) measures and market forces (switching from coal to renewable resources and natural gas). Table 2.3 presents the annual emissions for the North Carolina sources obtained from the EPA's Clean Air Markets Program Data database.

Table 2.3 NOx Emissions from NC EGUs in EPA's Air Markets Program Database

Year	Annual NOx Emissions from NC Sources (tons)
2002	145,706
2003	135,879
2004	124,079
2005	114,300
2006	108,584
2007	64,770
2008	61,669
2009	44,506
2010	57,305
2011	48,889
2012	51,057
2013	49,065
2014	44,288
2015	39,636
2016	34,287
2017	33,761
2018	34,674
2019	30,752
2020	22,927
2021	24,506
2022	25,415
2023	23,706

Table 2.4 shows trends in NOx emissions from 2002 through 2023 from North Carolina power plants in the Charlotte area, as well as the power plants located directly north and west of the Charlotte region that may impact the area. There are four facilities located within Gaston, Lincoln and Rowan Counties. The facility west of the Charlotte area is Duke Energy Carolinas, LLC (DEC) – Cliffside Steam Station (Cliffside, facility id 8100028), located in Cleveland County and the facility north of the Charlotte area is DEC – Marshall Steam Station (Marshall, facility id 1800073) located in Catawba County. These data are taken from the EPA Clean Air Markets Division's (CAMD) Air Markets Program Data and represent the second and third quarters of the year (April through September), the period during which ozone levels are the highest. The emissions from these facilities have significantly decreased since 2002, with over 15,206 tons (76%) of NOx reduction in 2023 compared to 2002. In addition, two coal-fired

power plants (DEC – Buck Combined Cycle Facility (facility id 8500004) and DEC – Riverbend Steam (facility id 3600040)) were retired in April 2013, which resulted in additional emissions reductions. The remaining two coal units at DEC - Allen Steam Station (GG Allen, facility id 3600039) will be retired by December 31, 2024.

Table 2.4 Ozone Season (April 1 through September 30) NOx Emissions for EGUs In and Near Charlotte Maintenance Area (tons/period)

Facility	County	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GG Allen*	Gaston	5,011	3,643	4,002	3,589	3,001	3,053	3,082	2,188	2,925	2,738	1,676
Riverbend*	Gaston	2,556	2,703	1,844	1,379	1,417	1,296	1,256	304	1,063	884	109
Lincoln*	Lincoln	44	20	50	20	52	81	33	6	40	46	10
Buck*	Rowan	1,084	1,468	1,089	1,286	1,262	870	832	197	783	477	196
Marshall	Catawba	9,283	9,101	8,243	7,558	6,370	7,253	7,151	4,481	4,861	5,443	5,128
Cliffside	Cleveland	1,944	2,149	1,738	1,782	1,540	1,311	1,173	561	357	469	267
Total	**-----**	**19,922**	**19,084**	**16,966**	**15,614**	**13,642**	**13,864**	**13,527**	**7,737**	**10,029**	**10,057**	**7,386**
Facility	**County**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
GG Allen*	Gaston	1,906	1,731	1,681	1,449	1,055	699	1,101	564	214	421	186
Riverbend*	Gaston	0	0	0	0	0	0	0	0	0	0	0
Lincoln*	Lincoln	22	13	16	10	3	9	11	6	44	22	12
Buck*	Rowan	61	67	75	72	74	82	66	55	63	80	55
Marshall	Catawba	4,777	3,879	5,157	4,757	5,020	4,732	5,153	3,355	4,142	3,105	3,486
Cliffside	Cleveland	673	744	717	714	961	1,050	1,518	1,108	1,085	1,021	978
Total	**-----**	**7,439**	**6,435**	**7,645**	**7,002**	**7,112**	**6,572**	**7,848**	**5,088**	**5,547**	**4,648**	**4,717**

* Facility is located within the Charlotte maintenance area boundary.

Air quality in North Carolina continues to improve as a result of federal, state, and local programs and regulations that have significantly reduced NOx emissions that are a key component to the ozone formation process. As NOx levels have continued to decrease, there have been far fewer ozone exceedance days compared to the early 2000s, as shown in Figure 2.2. At the turn of the millennium, North Carolina recorded 100 or more Code Orange days per year, with roughly a third of those days reaching Code Red, or *Unhealthy*, levels. After 2012, exceedance days became less frequent, with only a handful of Code Orange days per year, on average, and only one day reaching Code Red levels since 2013.

Along with the well-documented reduction in precursor pollutants, the meteorological patterns that accompany the highest ozone concentrations in North Carolina have also changed compared to a decade ago. Historically, prior to 2013, potential high-ozone days were easy to pick out from a meteorological pattern recognition standpoint. As seen on the left side of Figure 2.3, whenever an area of high pressure (at the surface and aloft) formed over the eastern United States (U.S.) during the summer months, some, or all, of the major metropolitan areas of the state were likely to experience a significant increase in daily ozone concentrations. The exact position and strength of the high pressure was not as important for ozone concentrations to increase when skies were sunny, and winds were light.

However, concurrent with the decline in ozone precursor emissions – especially NO_x – achieved in recent years, it has been observed that a different atmospheric pattern regime is now responsible for many of the highest-ozone days in North Carolina. Referred to as an "Omega block", this pattern is aptly named due to the way it is configured: an area of high pressure becomes surrounded by low pressure on both sides, resembling the Greek letter omega as depicted in Figure 2.4. Omega blocks are notorious for featuring prolonged periods of warm and dry weather due to the sinking air associated with high pressure. Additionally, the air masses underneath the high pressure often become trapped due to the inherent inward-rotating circulation pattern. This can lead to air mass stagnation and an increase in pollution, not only beneath the area of high pressure, but also downwind of the area between the high and the eastern-positioned low pressure system, where pollution can sometimes be funneled southward.

Since 2015, the five highest ozone days in North Carolina have all been accompanied by an Omega blocking atmospheric pattern. Additionally, the highest ozone day *within a single season* has also featured an Omega block in five of the past eight ozone seasons. The observed pattern shift, seen in Figure 2.4, during North Carolina's high-ozone days in recent years is likely a direct result of our improving air quality. Due to the reduction in daily precursor emissions, it now takes a much longer period of air mass stagnation before enough precursors can build up to produce significantly elevated levels of ozone across the state.

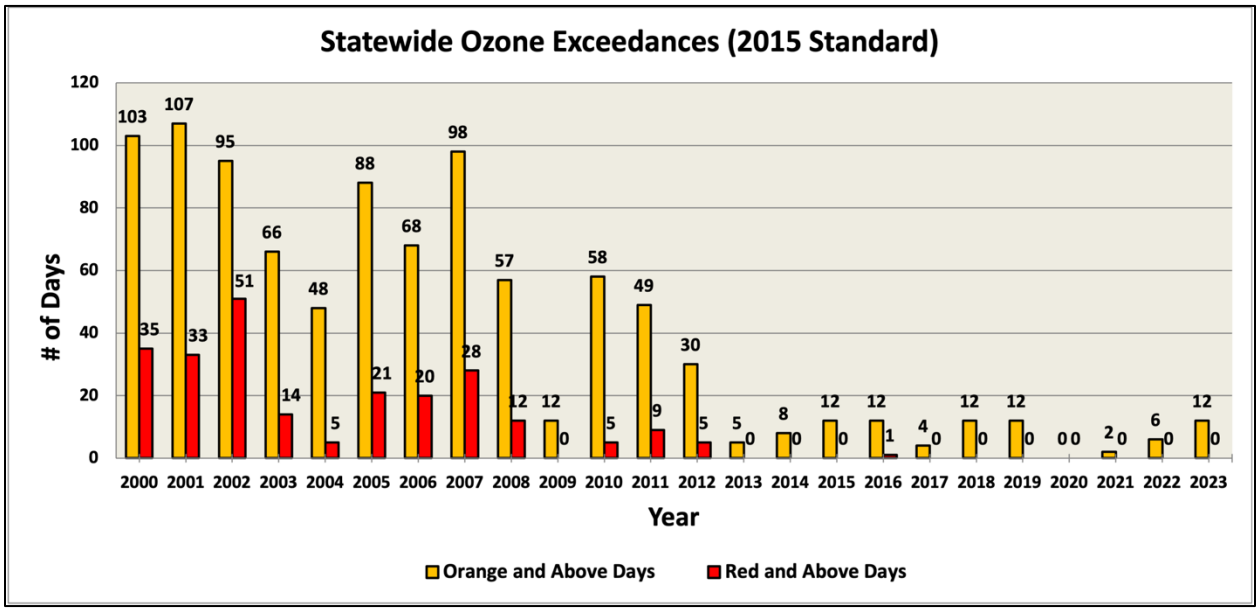

Figure 2.2 Annual Statewide Ozone Exceedance Days

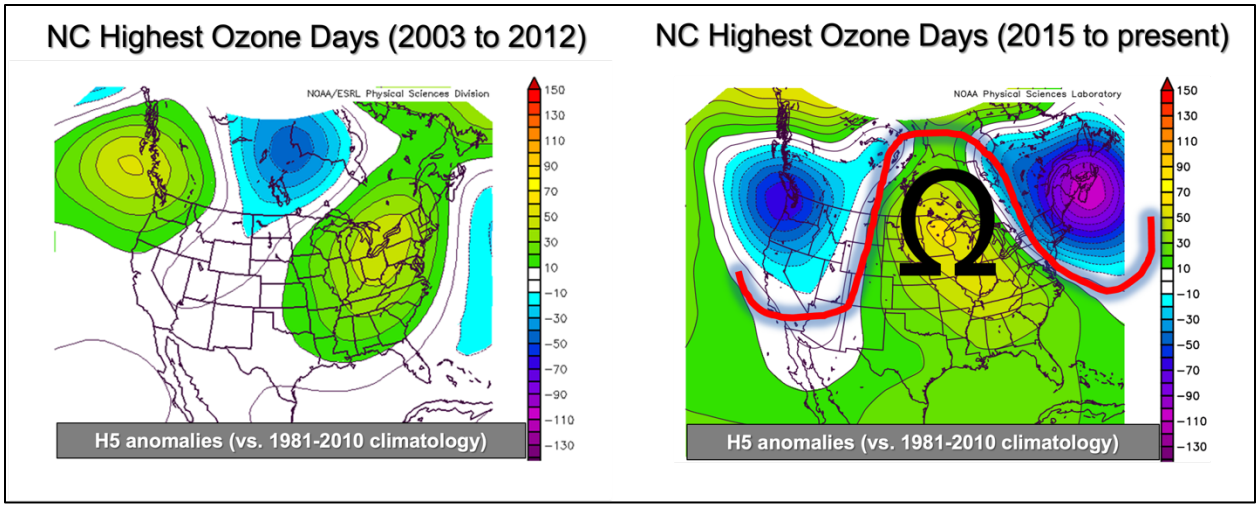

Figure 2.3 Upper-Level Atmospheric Pattern Comparison Between Historical Highest NC Ozone Days and Current Highest NC Ozone Days

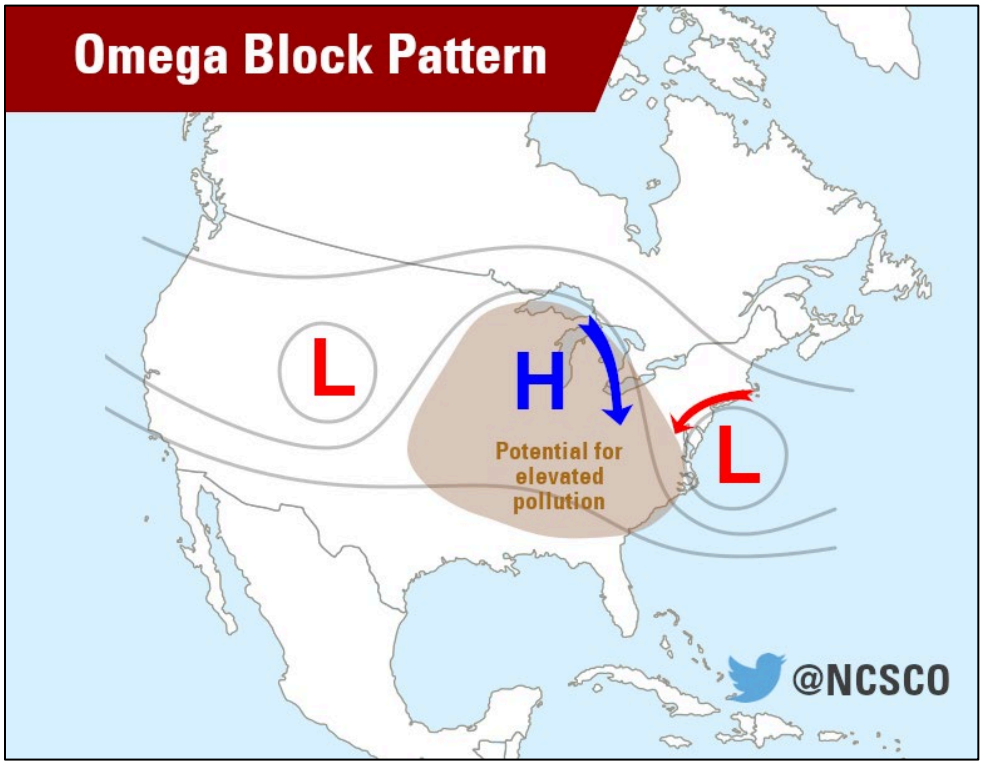

Figure 2.4 Omega Block Conceptual Illustration

3.0 MAINTENANCE PLAN

3.1 CONCEPT OF NORTH CAROLINA'S MAINTENANCE PLAN

The state's plan for maintaining compliance with the 2008 8-hour ozone NAAQS in the Charlotte-Gastonia-Salisbury maintenance area consists of three major parts: a foundation control program, a maintenance demonstration, and a contingency plan. The foundation control program, presented in Section 3.2, consists of the current federal and state control measures already in effect, as well as the future benefits of the federal actions. These programs will remain enforceable and ensure that maintenance of the 2008 8-hour ozone standard will continue. Sources are prohibited from reducing or removing emission controls (anti-backsliding) following the redesignation of the area unless such a change is first approved by the EPA as a revision to the North Carolina SIP that is consistent with Section 110(l) of the CAA. Section 3.3 presents additional state and local programs supporting maintenance that support public education and outreach programs; grant programs to replace diesel and gasoline vehicles with cleaner vehicles; and coordination with local, state, and federal transportation partners in the Charlotte maintenance area. These programs have served to support effective implementation of the foundation control programs.

The maintenance demonstration is presented in Section 3.4 which documents the methods and results for estimating NOx and VOC emissions for the 2018 (base year), 2026 (interim year), and 2035 (final year) for the maintenance plan. The final year of the maintenance demonstration is 2035, since the CAA 175A(b) requires that a state demonstrate maintenance with the NAAQS for 20 years after the effective date of the redesignation. The maintenance demonstration consists of a comparison between the 2018 baseline emissions inventory and the projected emissions inventories (for 2026 and 2035), which consider economic and population growth. The comparison shows that the total emissions in the interim year and the final year are estimated to be lower than in the base year, which demonstrates maintenance of the 2008 8-hour ozone standard. The reductions in emissions are due to the foundation control program outlined below.

Section 3.5 presents North Carolina’s contingency plan which involves tracking and triggering mechanisms to determine when contingency measures are needed and a process of implementing appropriate control measures. The primary trigger of the contingency plan will be a violation of the 2008 8-hour ozone NAAQS. The secondary trigger will be a monitored air quality pattern that suggests an actual 2008 8-hour ozone NAAQS violation may be imminent. The tertiary trigger will be activated when a monitor in a maintenance area has a 4th highest value of 0.076 ppm or greater.

On September 26, 2023, the SCDES submitted to EPA a SIP package for the second maintenance plan for the York County portion of the Charlotte maintenance area.[15]

3.2 FOUNDATION CONTROL PROGRAM

A key element of the maintenance plan is the foundation control program, which consists of the federal and state control measures and actions that ensure continued maintenance of the NAAQS. Table 3.1 displays each of these measures along with a list of additional supporting programs. The two right columns of the table identify the control programs included in the first 10-year maintenance plan (from August 27, 2015, through August 26, 2025) and this second 10-year maintenance plan (from August 27, 2025, through August 27, 2035).

The foundation control program includes federally and state enforceable control programs and actions that have been adopted by North Carolina. These programs will remain enforceable and ensure that maintenance of the 2008 8-hour ozone standard will continue. The state rules included in the foundation control program are approved into the Federally approved SIP (see Section 5.0). Sources in maintenance areas are prohibited from reducing the effectiveness or removing emission controls (anti-backsliding) unless such a change is first approved by EPA as a revision to the North Carolina SIP that is consistent with Section 110(l) of the CAA. The following provides a summary of each federal and state control measure and action included in the foundation control program for the Charlotte maintenance area. All of these programs are: (1) implemented or are in the process of being implemented; and (2) apply to emission sources in the maintenance areas or to sources that may contribute to the transport of ozone or ozone precursor emissions into these areas.

[15] South Carolina Department of Environmental , Revision to South Carolina Air Quality Implementation Plan Submittal SIP Package: Second Maintenance Plan for the York County portion of the Charlotte-Gastonia-Rock Hill, NC-SC 8-hour 2008 Ozone Maintenance Area, September 26, 2023, https://www.epa.gov/system/files/documents/2023-10/rfats-2008-ozone-sip-2nd-maintenance-plan-final-20230926.pdf.

Table 3.1 Summary of Foundation Control Program and Additional Programs Supporting Maintenance

Jurisdiction	Control Programs	Initial Implementation Year(s)	First 10-Year Maintenance Plan*	Second 10-Year Maintenance Plan**
Foundation Control Programs and Actions				
Federal	Tier 2 Vehicle and Fuel Standards	2004 - 2009	Yes	Yes
	Tier 3 Vehicle and Fuel Standards	2017 - 2025	Yes	Yes
	National Program for GHG Emissions and Fuel Economy Standards	2012-2016 (phase 1) and 2017-2025 (phase 2)	Yes	Yes
	Heavy-duty Gasoline and Diesel Highway Vehicles Standards	2002 - 2010	Yes	Yes
	Nonroad Spark-Ignition Engine and Recreational Engine Standards	2004 - 2012	Yes	Yes
	Large Nonroad Diesel Engines and Fuel Standards Rule	2008 - 2014	Yes	Yes
	Medium- and Heavy-duty Vehicle Fuel Consumption and Greenhouse Gas (GHG) Standards	2014 - 2018	Yes	Yes
	Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards	2023-2026	No	Yes
	Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards	2027	No	Yes
	Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles—Phase 3	2027-2032	No	Yes
	Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles	2027-2032	No	Yes
	NO_x SIP Call, Clean Air Interstate Rule (CAIR), and Cross State Air Pollution Rule (CSAPR)	2004 - 2007, 2009 - 2010, 2015 - 2017	Yes	Yes
	Utility Mercury Air Toxics Standards (MATS) and New Source Performance Standards (NSPS)	2012 - 2017	Yes	Yes
	Reciprocating Internal Combustion Engines (RICE) NESHAP	2013	Yes	Yes
	Consent Decree between EPA and Tennessee Valley Authority (TVA)	2018 - 2019	Yes	Yes

Jurisdiction	Control Programs	Initial Implementation Year(s)	First 10-Year Maintenance Plan*	Second 10-Year Maintenance Plan**
	Boiler National Emissions Standards for Hazardous Air Pollutants (NESHAP) / Maximum Achievable Control Technology (MACT)	2016 and 2019	Yes	Yes
State	Clean Smokestacks Act	2007 - 2013	Yes	Yes
	Boiler Section 112(j) Permitting Program	2016	Yes	Yes
	Transportation Conformity MOAs	2014/2021	Yes	Yes
	Clean Air Bill/Vehicle Emissions Inspection and Maintenance (I&M) Program	2003 -2006	Yes	No
Additional Supporting Programs				
State	North Carolina Air Awareness (NCAA) Program	1997	Yes	Yes
	Mobile Sources Emissions Reduction Grant Program	1995	Yes	Yes
	Open Burning Rule	1971	Yes	Yes
	Idle Reduction Regulation	2010	Yes	No
	Advance Program	2019	No	Yes
	Volkswagen Mitigation Settlement	2018	No	Yes
	Electric Vehicle Adoption	2018	No	Yes
Local	Mobile Source Emissions Reduction Grants	2011-2013	Yes	Yes
	Grants to Replace Aging Diesel Engines (GRADE) Program	2007	Yes	Yes
	Mecklenburg County Open Burning Prohibition	1967	Yes	Yes
	Breathing Room	2019	Yes	Yes

* The duration of the first 10-year maintenance plan is from August 27, 2015, through August 26, 2025.
** The duration of the second 10-year maintenance plan is from August 27, 2025, through August 27, 2035.

3.2.1 Summary of Federal Measures Included in Foundation Control Program

The federal measures in the foundation control program include:

- Tier 2 Vehicle and Fuel Standards: For new passenger cars and light light-duty trucks, the Tier 2 standards phase-in began in 2004, with full implementation in the 2007 model year. These standards required passenger vehicles in each manufacturer's fleet to meet an average standard of 0.07 grams of NO_x per mile by 2007. The Tier 2 standards also cover passenger vehicles over 8,500 pounds gross vehicle weight rating (i.e., larger pickup trucks and sport utility vehicles [SUVs]). For these vehicles, the standards were phased in beginning in 2008, with full compliance required by 2009. The Tier 2 standards require vehicles to be 77% to

95% cleaner. Fuel standards required that most refiners and importers meet a corporate average gasoline sulfur standard of 120 ppm and a cap of 300 ppm beginning in 2004. Additionally, in January 2006, the sulfur content of gasoline was required to be on average 30 ppm. Lower sulfur content gasoline assists in lowering NO_x emissions by increasing the efficiency of the catalytic converter. Most gasoline sold in North Carolina prior to January 2006 had a sulfur content of about 300 ppm. These emission reductions are federally enforceable.

- Tier 3 Vehicle and Fuel Standards: Federal Tier 3 vehicle standards require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and SUVs, to meet an average standard of 0.03 grams/per mile of NO_x. Heavy-duty passenger vehicles must meet average standards of 0.178 to 0.247 grams/per mile of NO_x depending on vehicle classification. Implementation began in 2017, with full compliance required by 2025. Compared to Tier 2, the Tier 3 tailpipe standards for light-duty vehicles are expected to reduce combined NO_x and non-methane organic gases (NMOG) by approximately 80%. Tier 3 vehicle standards also include evaporative standards using OBD that result in a 50% reduction in VOC emissions over Tier 2. The rule reduced the sulfur content of gasoline to 10 ppm in January 2017. Reduced sulfur content in gasoline also enables the controls on vehicles already in use to operate more effectively. These emission reductions are federally enforceable.

- National Program for GHG Emissions and Fuel Economy Standards: The EPA and the National Highway Traffic Safety Administration (NHTSA) jointly developed the federal GHG and fuel economy standards for light-duty cars and trucks in model years 2012-2016 (phase 1) and 2017-2025 (phase 2).[16] 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. Together, phases 1 and 2 of the final standards are projected to result in an average industry fleet-wide level of 163 grams/mile of carbon dioxide (CO_2) in model year 2025, which is equivalent to 54.5 miles per gallon if achieved exclusively through fuel economy improvements. The fuel economy standards will result in less fuel being consumed, and therefore less NOx emissions released. These emission reductions will be federally enforceable.

- Heavy-duty Gasoline and Diesel Highway Vehicle Standards: Implementation of these standards, designed to reduce NO_x and VOC emissions from heavy-duty gasoline and diesel highway vehicles, began with model year 2004 vehicles with full implementation occurring

[16] 75 FR 25324 (phase 1) and 77 FR 62624 (phase 2).

in 2010.[17] The program was estimated to reduce NO_x emissions by 95% and required that the sulfur content of fuel ultimately be reduced to 15 ppm. These emission reductions are federally enforceable.

- Nonroad Spark-ignition Engine and Recreational Engine Standards: Tier 1 of these standards was implemented in 2004, and Tier 2 began in 2007, with the final engine standards coming on-line in 2012. These engine standards apply to all new engines sold in the United States and all engines imported after these standards began and apply to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all-terrain-vehicles), and recreational marine diesel engines. These emission reductions are federally enforceable.

- Large Nonroad Diesel Engine Standards: EPA promulgated rules for new large nonroad diesel engines, such as those used in construction, agricultural and industrial equipment, to be phased in between 2008 and 2014. The EPA mandated reductions in sulfur content in nonroad diesel fuels, as follows: 500 ppm effective June 2007; and 15 ppm effective June 2010.[18] The combined engine and fuel requirements are estimated to reduce NO_x emissions by 90% and reduce the sulfur content in nonroad diesel fuel to 15 ppm. These emission reductions are federally enforceable.

- Medium- and Heavy-duty Vehicle Fuel Consumption and GHG Standards: In September 2011, EPA and NHTSA promulgated joint rules to reduce GHG emissions and improve fuel efficiency of combination tractor trucks, heavy-duty pickups and vans, and vocational trucks beginning with model year 2014 and applying to all model years by 2018. The decrease in fuel consumption is expected to result in a 7% to 20% decrease in NO_x emissions. These emission reductions are federally enforceable.

- Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards[19]: These standards, published December 30, 2021, set tighter CO_2 limits for light-duty (LD) vehicles and are expected to lead to more electric vehicles (EVs) in the future fleet. Compared to the Safer Affordable Fuel-Efficient (SAFE) Vehicles rule, the final rule significantly accelerates CO_2 reductions to between 5% and 10% each year from 2023 through 2026, with cumulative projected industry average CO_2 reductions of 28% over the

[17] As part of a consent decree related to high NO_x emissions from heavy-duty diesel engines during certain driving modes caused by an engine control strategy that U.S. EPA considered an illegal "emission defeat device," most engine manufacturers were required to comply with the 2004 emission standards by October 2002.
[18] The U.S. EPA also set the same diesel sulfur content requirements for locomotive and marine fuels.
[19] 86 FR 74434.

period. Manufacturers can meet the standards through advanced high-efficiency engine and transmission technology as well as hybrid (mild and strong), battery electric, and plug-in hybrid vehicles. Corresponding reductions of NOx, VOC, and other pollutant emissions are expected along with the GHG reductions.

- Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards.[20] These standards, published January 24, 2023, sets tighter emission standards for NOx and other pollutants from heavy-duty onroad vehicles starting in model year 2027. By 2045, the rule is projected to reduce the emissions of ozone precursors NOx and VOC by 45% and 23% respectively, along with reducing $PM_{2.5}$ emissions and CO emissions by 8% and 18% respectively. The rule also extends the useful life periods and the emissions-related warranty periods for heavy duty engines, promoting improved durability of pollution control systems.

- Greenhouse Gas Emissions Standards for Heavy-Duty Vehicles—Phase 3:[21] Published April 22, 2024, EPA's final rule includes new, stronger GHG standards that phase in over model years (MY) 2027 through 2032. The standards are technology-neutral and performance-based, allowing each manufacturer to choose what set of emissions control technologies is best suited to meet the standards and the needs of their customers. This means that the standards can be met with a diverse range of heavy-duty vehicle technologies, including advanced internal combustion engine vehicles, hybrid vehicles, plug-in hybrid electric vehicles, battery electric vehicles, and hydrogen fuel cell vehicles. For heavy-duty vocational vehicles such as delivery trucks, refuse haulers, and public utility trucks, the Phase 3 standards vary according to vehicle type and range up to 60% stronger than the previous Phase 2 standards for MY 2032. For tractors such as day cabs and sleeper cabs on tractor-trailer trucks, the Phase 3 standards vary according to vehicle type and range up to 40% stronger than the previous Phase 2 standards for MY 2032. Corresponding reductions of NOx, VOC, and other pollutant emissions are expected along with the GHG reductions, due to adoption of heavy-duty ZEVs in response to this rule.

- Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles:[22] This rule, published April 18, 2024, establishes standards that will significantly reduce emissions of GHG, hydrocarbons, NOx, and $PM_{2.5}$ from new passenger cars, light trucks, and larger pickups and vans, helping tackle the climate crisis and resulting in widespread reductions in air pollution. For light-duty vehicles (LDVs), the standards are

[20] 88 FR 4296.
[21] 89 FR 29440.
[22] 89 FR 27842.

projected to reduce CO_2 emissions in MY 2032 by nearly 50% relative to the existing MY 2026 standards. Similarly, medium-duty vehicle (MDV) CO_2 emissions in MY 2032 are expected to be reduced by 44% relative to the existing MY 2026 standards. The LDV and MDV standards for criteria pollutants and their precursors, including NOx, NMOG, and PM, will be phased in on individual schedules, with all standards fully phased in by MY 2033. By MY 2032, LDV NMOG and NOx standards will phase down to 50% of the Tier 3 standard for MY 2025, while MDV standards will be reduced to between 58% and 70% (based on vehicle class) of Tier 3 standards by MY 2033. New LDV and MDV standards for PM emissions will be phased in by MY 2030 and MY 2031 respectively, reducing PM emissions from gasoline vehicles by 95%. Mobile source air toxics emissions will also be reduced.

- NOx SIP Call, Clean Air Interstate Rule (CAIR) and Cross State Air Pollution Rule (CSAPR): EPA promulgated the NO_x SIP Call in October 1998 to reduce ozone transport and precursor emissions from upwind states contributing to ozone attainment and maintenance issues in downwind states. A central component of the NO_x SIP Call included the Budget Trading Program, which was a cap-and-trade system to reduce NO_x emissions from EGUs and large industrial boilers during the ozone season (May 1 through September 30). In May 2005, EPA promulgated CAIR to reduce NO_x and SO_2 emissions from EGUs. In so doing, CAIR incorporated the EGUs, and large boilers covered by the NO_x Budget Trading Program but did not incorporate budgets for other sectors covered by the NO_x Budget Trading Program (e.g., onroad and nonroad sources). On December 23, 2008, the United States Court of Appeals for the District of Columbia Circuit issued an opinion remanding the CAIR program to EPA without vacatur. Therefore, because of EPA's "anti-backsliding" rules, North Carolina remains subject to the NO_x SIP Call's ozone season EGU budgets.

  After the court challenges to CAIR, EPA issued CSAPR in July 2011. As amended, CSAPR required 28 states to limit their statewide emissions of SO_2 and/or NO_x in order to reduce or eliminate the states' contributions to $PM_{2.5}$ and/or ground-level ozone pollution in other states. The emissions limitations are defined in terms of maximum statewide "budgets" for emissions of annual SO_2, annual NO_x, and/or ozone-season NO_x by each state's large EGUs. The EPA excluded large industrial boilers from CSAPR, resulting in a group of "orphaned" industrial units that are still subject to the NO_x SIP call budget for these sources. North Carolina EGUs are subject to the Phase I and II annual NO_x and SO_2 budgets as of January 1, 2015, and January 1, 2017, respectively. However, it is important to note that North Carolina does not have an ozone season budget for EGUs under the CSAPR program. Although the state is not relying on CSAPR for ozone season reductions, CSAPR is a federally enforceable

program that has yielded residual NO_x and SO_2 emissions reduction benefits. Based on EPA's power sector programs progress report for 2018 (the base year of the inventory for this maintenance plan), CSAPR was estimated to reduce annual EGU SO_2 and NO_x emissions by 91% and 73% below 2005 levels, respectively.[23]

- Utility Mercury Air Toxics Standards (MATS) and New Source Performance Standards (NSPS): On February 16, 2012, EPA promulgated the National Emission Standards for Hazardous Air Pollutants (NESHAP) from Coal- and Oil-Fired Electric Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units.[24] The standard applies to EGUs burning fossil fuel and sets standards for certain hazardous air pollutant (HAP) emissions, many of which are acid gases. Control of these acid gases often have the co-benefit of reducing SO_2 emissions. Sources had until April 16, 2015, to comply with the rule unless granted a one-year extension for control installation or an additional extension for reliability reasons with all sources required to comply by April 2017. The EGUs in NC are permitted for mercury using the mercury emission standards in the MATS rule. However, they initially met and continue to meet these standards as a result of the Clean Smokestacks Act (CSA) that was enacted in 2002. The controls used to reduce NO_x and SO_2 emissions that are required to meet the CSA requirements, also reduce mercury emissions.[25]

- RICE NESHAP: The RICE NESHAP has provided emission reductions of NO_x, VOC, PM, and SO_2. RICE owners and operators were required to comply with the NESHAP by May 3, 2013. These emission reductions are federally enforceable.

- TVA Consent Decree: In January 2009 a federal court found that four TVA coal-fired generating stations were creating a public nuisance in North Carolina. The judge ordered that each unit of each facility install modern pollution controls for SO_2 and NOx and meet emission limits that are consistent with the continuous operation of such controls. The court ordered that TVA meet these limits on a staggered schedule ending in 2013. In July 2010 an appeals court reversed the decision.

[23] U. S. Environmental Protection Agency, "2018 Power Sector Programs - Progress Report", 2018, https://www3.epa.gov/airmarkets/progress/reports/pdfs/2018_full_report.pdf
[24] 77 FR 9304.
[25] Final Report of the Division of Air Quality to the Environmental Management Commission on the Control of Mercury Emissions from Coal-Fired Electric Steam Generating Units In accordance with 15A NCAC 02D .2509(b), July 1, 2012, https://deq.nc.gov/about/divisions/air-quality/air-quality-outreach/news/clean-air-legislation/clean-smokestacks-act.

In April 2011 North Carolina, TVA, and several other parties agreed to a comprehensive settlement of a variety of air pollution allegations. The detailed settlement would (1) subject SO_2 and NOx emissions at all of TVA's coal-fired facilities to system-wide caps that decline on an annual basis to permanent levels of 110,000 tons of SO_2 in 2019 and 52,000 tons of NOx in 2018; (2) require TVA to install modern pollution controls on or shutdown the majority of its coal-fired units; and (3) require TVA to pay North Carolina $11.2 million to fund mitigation projects in North Carolina. The settlement is being successfully implemented, including the provision of funds directly to North Carolina for approved projects.[26] These emission reductions are federally enforceable.

- Boiler NESHAP/Maximum Achievable Control Technology (MACT): Facilities with affected units were required to comply with the NESHAP by January 31, 2016, for all states except North Carolina which had a compliance date of May 20, 2019. Because of delays associated with EPA's promulgation of the boiler NESHAP, in 2009 North Carolina adopted and implemented equivalent emission limitations by permit under CAA Section 112(j). After EPA finalized the NESHAP, facilities subject to the Section 112(j) were required to revise their permits to comply with the Section 112(d) requirements by May 20, 2020. Some facilities in North Carolina complied with the NESHAP by converting affected units from burning coal to natural gas resulting in additional reductions in NO_x, SO_2, CO, and PM emissions. These emission reductions are federally enforceable.

3.2.2 Summary of State Measures Included in Foundation Control Program

- Clean Smokestacks Act: This state law required coal-fired power plants to reduce annual NO_x emissions by 77% by 2009, and to reduce annual SO_2 emissions by 49% by 2009 and 73% by 2013. This law set a NO_x emissions cap of 56,000 tons/year for 2009 and SO_2 emissions caps of 250,000 tons/year and 130,000 tons/year for 2009 and 2013, respectively. In 2013, the power plants subject to this law had combined NO_x emissions of 38,857 tons/year, well below the 56,000 tons/year cap. The emissions cap has been met in all subsequent years as well. With the requirement to meet annual emissions caps and disallowing the purchase of NO_x credits to meet the caps, the Clean Smokestacks Act reduces NO_x emissions beyond the requirements of the NO_x SIP Call. These emissions limits are enforceable at both the federal and state level.

- Boiler Section 112(j) Permitting Program: Because of delays associated with the EPA's promulgation of the boiler NESHAP, North Carolina adopted and implemented equivalent

[26] http://www.ncdoj.gov/getdoc/bdf66401-8137-4be2-bd20-57e89b570c1a/TVA-signed-consent-decree.aspx.

emission limitations by permit under Section 112(j) of the CAA.[27] These limitations apply to owners and operators of industrial, commercial and institutional boilers and process heaters burning natural gas, coal, oil or biomass beginning in 2013. These permit limitations reduced uncertainty for owners and operators of affected emission units while the EPA resolved legal challenges to the federal rule, reduced emissions from affected units three years earlier than the federal rule, and provided the time needed for owners and operators to transition to the federal rule requirements beginning in May 2019.[28] Although the rule establishes limits for reducing HAPs from boilers and process heaters, VOC emissions will also be controlled. In the Charlotte area, natural gas fired boilers are the only types of emission units affected by this rule. For natural gas fired boilers, VOC emissions are estimated to be reduced by 4%. The emission limits associated with this rule are state and federally enforceable.

- Transportation Conformity MOAs: Transportation conformity MOAs establish criteria and procedures related to interagency consultation, conflict resolution, public participation and enforceability of certain transportation related control measures and mitigation measures in the State of North Carolina and its SIP.

  Transportation conformity is required under section 176(c) of the CAA for nonattainment and maintenance areas to ensure that federally supported highway projects, transit projects, and other activities are consistent with (conform to) the purpose of the SIP, which is to eliminate or reduce the severity and number of violations of the NAAQS and to achieve expeditiously the attainment of such standards. In compliance with Section 176(c) of the CAA, the DAQ chose, through rulemaking as referenced in 15A NCAC 02D.2005, to develop Conformity MOAs to ensure that interagency consultation procedures for transportation conformity are followed.[29] The Conformity MOAs were submitted to the EPA on July 12, 2013. The EPA, through direct final rule action, approved a revision to the North Carolina SIP with the effective date of February 24, 2014.[30]

  In 2019, the DAQ, North Carolina Department of Transportation (NCDOT), Federal Highway Administration (FHWA), National Parks Service (NPS) and eleven Metropolitan Planning Organizations (MPO) began the process of revising the Conformity MOAs. On February 14, 2020, the DAQ formally requested that each MPO and the NPS conduct preliminary review of the revised MOAs. After discussions with all partners, an agreement

[27] 15A NCAC 02D .1109 - 112(j) Case-by-Case Maximum Achievable Control Technology.
[28] See U.S. EPA http://www.epa.gov/ttn/atw/boiler/boilerpg.html.
[29] http://www.ncair.org/rules/rules/D2005.pdf.
[30] 78 FR 73266-78272.

of the necessary revisions and the process for approval was finalized. On September 24, 2021, the DAQ submitted the final revised MOAs to EPA for incorporation into North Carolina's SIP. The conformity MOAs were approved by EPA on March 29, 2023 (88 FR 18423).

- Clean Air Bill/Vehicle Emissions Inspection and Maintenance (I&M) Program: The 1999 Clean Air Bill expanded the vehicle emissions I&M program in North Carolina from 9 counties to 48 counties from July 1, 2002, through January 1, 2006. Vehicles are tested using the OBDII, an improved method of testing, which ensures proper emission system operation for vehicles and light trucks during their lifetime by monitoring emission-related components and systems for malfunction and/or deterioration. An important aspect of OBDII is its ability to notify the driver of malfunction and/or deterioration by illuminating the "check engine light". If the vehicle is taken to a repair shop in a timely fashion, it can be properly repaired before any significant and prolonged emission increase occurs. The previously used tailpipe test (i.e., idle test) did not measure NOx emissions; it only tested for VOC and CO emissions. By utilizing the OBDII test method, the NOx emissions as well as other pollutants from motor vehicles are reduced. The effective dates for the counties in the North Carolina portion of the Charlotte maintenance area are July 1, 2002, for Cabarrus, Gaston, Mecklenburg and Union Counties; July 1, 2003, for Iredell and Rowan Counties; and January 1, 2004, for Lincoln County.

  The I&M program rule was submitted to the EPA for adoption into the SIP in August 2002 and was federally approved in October 2002. Therefore, these emission reductions are both state and federally enforceable.

  On February 5, 2015, the EPA approved a change to North Carolina's I&M rules triggered by a state law which exempted plug-in vehicles and the three newest model year vehicles with less than 70,000 miles on their odometers from emission inspection in all areas in North Carolina where I&M is required. [31] In North Carolina's Section 110(l) demonstration, the state showed that the change in the compliance rate from 95% to 96% more than compensates for the NOx and VOC emissions increase from exempting the newest model year vehicles with less than 70,000 miles. Based on recent modeling the DAQ completed using the EPA's Motor Vehicle Emission Simulator (MOVES2014) model, North Carolina's current I&M program with the three newest model year vehicle exemption is expected to yield annual I&M emission reduction benefits ranging from 5% to 8% for NOx and 6% to

[31] Approval and Promulgation of Implementation Plans; North Carolina; Inspection and Maintenance Program Updates, 80 FR, 6455.

8.5% for VOC. The EPA-approved change to the I&M rules was effective March 9, 2015. The emissions reductions are state and federally enforceable.

The 2017 session of the North Carolina General Assembly enacted Session Law 2017-10, Senate Bill 131 (An Act to Provide Further Regulatory Relief to the Citizens of North Carolina). Section 3.5.(a) of the Act amended NCGS §143-215.107A(c) to remove 26 of 48 counties from North Carolina's emissions I&M program. For the 22 counties remaining in the I&M program, Section 3.5.(b) of the Act also amended NCGS §20-183.2(b) by changing the vehicle model year coverage. Specifically, the Act requires the following changes to North Carolina's I&M program:

- Eliminate the following 26 counties from vehicle I&M requirements: Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Edgecombe, Granville, Harnett, Haywood, Henderson, Lenoir, Moore, Nash, Orange, Pitt, Robeson, Rutherford, Stanly, Stokes, Surry, Wayne, Wilkes, and Wilson.

  Retain the vehicle I&M program in the following 22 counties: Alamance, Buncombe, Cabarrus, Cumberland, Davidson, Durham, Forsyth, Franklin, Gaston, Guilford, Iredell, Johnston, Lee, Lincoln, Mecklenburg, New Hanover, Onslow, Randolph, Rockingham, Rowan, Union, and Wake.

- For the 22 counties remaining in the program, change the model year vehicle coverage to: (i) a vehicle with a model year within 20 years of the current year and older than the three most recent model years, or (ii) a vehicle with a model year within 20 years of the current year and has 70,000 miles or more on its odometer. Previously, the program applied to (i) a 1996 or later model year vehicle and older than the three most recent model years, or (ii) a 1996 or later model year vehicle and has 70,000 miles or more on its odometer.

On September 25, 2018, EPA approved removal of the 26 counties from the I&M program (83 FR 48383) which became effective on December 1, 2018. On September 11, 2019, EPA approved revisions to the vehicle model year coverage for the 22 counties that remain subject to the I&M program (84 FR 47889), which became effective on December 1, 2019.

The 2020 session of the North Carolina General Assembly enacted Session Law 2020-05, House Bill 85 (An Act to Remove Lee, Onslow, and Rockingham Counties from the Motor Vehicle Emissions Inspection Program). Section 1 of the Act amended NCGS §143-215.107A(c) to remove 3 of 22 counties from North Carolina's I&M program: Lee, Onslow, and Rockingham. On December 14, 2020, the DAQ submitted for EPA approval the final I&M SIP revision and CAA Section 110(l) noninterference demonstration to Remove Lee,

Onslow, and Rockingham Counties from the I&M program. On August 11, 2022, EPA approved the removal of these three counties from the I&M program (87 FR 49524). The letter of certification of EPA's final approval from the Secretary of NCDEQ was sent to the Revisor of Statutes on August 15, 2022. The effective implementation date for this revision was November 1, 2022.

The North Carolina General Assembly enacted Session Law 2023-134, House Bill 259 (2023-2024 Appropriations Bill) effective October 3, 2023. Section 12.7 of S.L. 2023-134 amended NCGS §143-215.107A(c) to remove 18 of the 19 counties from North Carolina's I&M program and changed the vehicle model year coverage for Mecklenburg County which is the only county retained in the program. After consultation with EPA staff, it was agreed that for the purpose of the North Carolina SIP, the NCDEQ would propose to remove Mecklenburg County from the I&M program SIP. On October 1, 2024, the NCDEQ submitted to EPA (after public notice) a SIP Revision and CAA Section 110(l) noninterference demonstration to remove the remaining 19 counties from North Carolina's I&M program SIP.[32] For the seven counties in the Charlotte area, the NCDEQ also requested that EPA approve removal of the I&M from the foundation control program in the maintenance plans for the 1997 and 2008 ozone NAAQS for the Charlotte area. The EPA would need to approve this request before approving removal of the I&M program from these two maintenance plans for the Charlotte area.

3.3 ADDITIONAL PROGRAMS SUPPORTING MAINTENANCE

This section provides a summary of state and local programs that have been implemented in the Charlotte area to maintain compliance with the NAAQS. Although these are important programs that help to ensure compliance with the NAAQS, they have not been relied upon as federally enforceable measures.

3.3.1 State Programs Supporting Maintenance

- North Carolina Air Awareness (NCAA) Program: The DAQ has found that the most effective outreach programs are performed by locally-based personnel working with the local community. The DAQ has contracted with Mecklenburg County Air Quality (MCAQ) to manage the Charlotte area NCAA program since 1997. Charlotte area NCAA has conducted educational outreach with the public, built strong working relationships with regional interest groups, and developed communication resources for business coalition members. Coalition

[32] State Implementation Plan (SIP) Revision and Clean Air Act Section 110(1) Noninterference Demonstration to Remove 19 Counties from North Carolina's Motor Vehicle Emissions Inspection and Maintenance (I&M) Program SIP, October 1, 2024, https://edocs.deq.nc.gov/AirQuality/DocView.aspx?id=513492&dbid=0&repo=AirQuality&cr=1.

activities are designed to communicate air quality information, including the forecast, and promote voluntary emission reduction programs. The business coalition includes partnerships with private businesses and civic organizations. These efforts are important for maintaining compliance with the NAAQS. Under MCAQ's management, Charlotte area NCAA has established itself as a leader in advocating for voluntary pollution reduction efforts throughout the state's only ozone maintenance region.

- Mobile Sources Emissions Reduction Grant Program: Since 1995, the DAQ has offered multiple forms of grant funding to help cover the costs associated with emission reduction projects. These projects include diesel engine replacements, diesel oxidation catalyst (DOC) retrofits, marine diesel repowers, replacing gasoline vehicles with electric vehicles and many more. One source of funding is the North Carolina Mobile Source Emissions Reduction Grants funded by gasoline tax receipts. The Mobile Source Emissions Reduction Grant program has awarded grants to several businesses, cities, counties and school districts that have ranged from the installation of DOCs or diesel particulate filters (DPFs) on their diesel equipment to non-diesel emission reduction projects like purchase of electric vehicles. The DAQ has also received federal funds from the Diesel Emission Reduction Activities (DERA) and the American Recovery and Reinvestment Act (ARRA) to fund diesel emission reducing projects. The DERA and ARRA funds that the DAQ has received have been used to retrofit, repower or replace existing diesel engines from onroad and nonroad mobile source vehicles/equipment. Even though these emission reductions are voluntary and not enforceable, they are still considered permanent reductions.

- Open Burning Rule: State Rule 15A NCAC 02D .1903 (Open Burning Without an Air Quality Permit) prohibits open burning of man-made materials throughout the state. Additionally, the rule prohibits nearly all types of open burning during Air Quality Action Days of Code Orange or higher in forecasted areas of the state. Ozone forecasts are issued for each of the maintenance areas from March 1 through October 31, therefore the areas in this maintenance plan are covered by this rule. The open burning rule reduces PM, SO_2, CO, NOx, and VOC emissions. This rule is state enforceable.

- Idle Reduction Regulation: State Rule 15A NCAC 02D .1010 (Heavy-Duty Vehicle Idling Restrictions) was adopted to reduce unnecessary idling of heavy-duty trucks on July 9, 2009, and the rule became effective on July 10, 2010. This rule generally intended to prevent any person who operates a heavy-duty vehicle to cause, let, permit, suffer or allow idling for a period of time in excess of 5 consecutive minutes in any 60-minute period. The rule was repealed by North Carolina effective November 1, 2016. Conversely, most public-school systems across the state that transport children in yellow buses have adopted idling

limitations to promote child health and safety as well as reducing fuel costs. These idling limitations are promoted by the Department of Public Instruction (DPI).[33,34]

- Advance Program: The DAQ joined the EPA Advance program in September 2017. The EPA Advance Program encourages collaborations between state, local, and community organizations to encourage emissions reductions in areas that are currently in attainment of the ozone and $PM_{2.5}$ NAAQS. The program provides a flexible framework for organizations who want closer involvement and support from the DAQ and EPA in achieving these emission reductions. In 2019, the DAQ developed a set of Advance Program plans that could be used to leverage Air Awareness Program projects in support of continued NAAQS maintenance.[35]

- Volkswagen Mitigation Settlement: In 2015, Volkswagen (VW) publicly admitted that it had secretly, and deliberately, installed defeat-device software designed to cheat emissions tests and deceive federal and state regulators in approximately 590,000 model year 2009 to 2016 motor vehicles containing 2.0- and 3.0-liter diesel engines. The United States Department of Justice filed a complaint against VW, alleging that the company had violated the CAA. In October 2016 and May 2017, the U.S. District Court, Northern District of California ("Court"), approved two partial settlements related to the affected 2.0- and 3.0-liter vehicles, respectively, totaling $14.9 billion ("the VW Mitigation Settlement").

  The VW Mitigation Settlement is being implemented through the First Partial Consent Decree and Second Partial Consent Decree. Under these consent decrees, VW has agreed to: (1) dedicate $10 billion to the recall of at least 85% of the affected 2.0- and 3.0-liter vehicles; (2) invest $2 billion in zero-emission vehicle infrastructure and promotion ("Zero Emission Vehicle Investment Plan"); and (3) establish a $2.9 billion Environmental Mitigation Trust (EMT) to mitigate the environmental effects of the excess NO_x emissions from the affected vehicles. The purpose of the EMT is to execute environmental mitigation projects that reduce emissions of NO_x. In accordance with the EMT goal, North Carolina will use the funds to achieve significant NO_x emissions reductions across the state by soliciting for projects from all eligible mitigation actions.

[33] Public Schools Of North Carolina, State Board Of Education, Department Of Public Instruction, Financial And Business Services, Division Of School Business, 2024-2025 Allotment Policy Manual, https://www.dpi.nc.gov/state-allotment-policy-manual-fy-202508-2024pdf/download?attachment.
[34] North Carolina School Bus Safety Web, Reduced Idling Materials, https://www.ncbussafety.org/idling.html.
[35] DAQ, "Ozone and Particulate Matter Advance Programs Path Forward," October 2019.

The NCDEQ targeted funding to achieve significant reductions of NOx emissions across the state. Funds were allocated through grants and rebates to eligible projects focusing on the most cost-effective projects, the quantity of NOx emission reductions, and other factors. The funding was split into two phases to give grantees time to complete projects in a timely manner. Phase 1 ran from 2018-2021 and Phase 2 runs from 2021-2025.

Since 2019, DAQ has reviewed funding applications and awarded grants and rebates for a variety of transportation projects. Specifically, in the Charlotte maintenance area, 78 vehicles were replaced, and 175 charging ports were installed resulting in 65.1 tons of lifetime NOx avoided for a cost of also $15 million.

Additionally, between November 8, 2017, and May 18, 2022, the VW team provided 28 in-person meetings and 28 virtual meetings to educate stakeholders about the VW Mitigation Settlement court case and the actions the actions resulting from the litigation which included DAQ's mitigation and outreach plans. During Phase 2 of the project, there were numerous webinars held geared towards project specific topics and the grant management system (GMS) to help potential grant applicants before they applied and to answer questions they had. In addition to these sessions, separate sessions were offered for the Historically Under-Resourced County Outreach Program (HURCOP). The meetings were held in various locations across the state and at different times. The DAQ's partners in the Charlottle maintenance area were instrumental in these outreach efforts and assisted with 8 meetings in the area.

- Electric Vehicle Adoption: North Carolina recognizes the importance of supporting EV adoption over recent years. For example, state agencies (NCDEQ and NCDOT) have made funding available for the installation of EV charging infrastructure across the state from a variety of federal and state funding sources beginning in 2019. The NCDEQ has awarded funding for 155 DC Fast charging ports at 78 sites and 839 Level 2 charging ports at 240 sites from the Volkswagen Mitigation Settlement program. Funds were made available for public access, multi-unit dwelling, workplace, and state agency projects.

  The NCDOT has awarded funding for the installation of EV charging infrastructure in nine initial locations using funds from the National Electric Vehicle Infrastructure (NEVI) program. This program specifically funds electric vehicle charging stations along designated alternative fuel corridors across the state. The NCDOT also has plans for more community-based charging projects with future NEVI funds.

3.3.2 Local Programs Supporting Maintenance

- Mobile Source Emissions Reduction Grants: In the Charlotte area, between 2011 and 2013, with funding from a settlement, a nonroad equipment repower was funded. This project resulted in significant fuel savings and reductions in NOx and $PM_{2.5}$ emissions.

- GRADE (Grant to Replace Aging Diesel Engines) Program: In 2007, MCAQ initiated an air pollution control program called GRADE designed to reduce NOx emissions in the Charlotte maintenance area. Funded by federal and state grants, and County tax money, the GRADE program provides businesses and organizations financial incentives to replace or repower heavy-duty nonroad equipment with newer, cleaner, less polluting engines. GRADE has funded cost-effective emission reduction projects operating in multiple segments of the economy including construction, landfills, freight transportation, and commercial aviation. As of July 31, 2024, GRADE projects have reduced over 1,300 tons of NOx in the Charlotte region.

- Open Burning Prohibitions: Mecklenburg County prohibits open burning of any kind year round except under extenuating circumstances with an approved burn permit. This prohibition is more stringent than the state's open burning rule and therefore enhances this control measure's overall benefit to the region. The open burning rule reduces emissions of NOx, VOC, CO, PM_{10} and $PM_{2.5}$. These emission reductions are enforced at the local level.

- Breathing Room: MCAQ and DAQ are partnering through EPA's Advance Program, known in the Charlotte region as "Breathing Room," to take proactive steps to reduce ozone-forming air pollution. On September 17, 2019, the Mecklenburg Board of County Commissions approved the Breathing Room Path Forward, after it was reviewed and endorsed by the County's Environmental Stewardship Committee and the Air Quality Commission. The Breathing Room Path Forward is a strategy to continue the positive trend of improving air quality in the Charlotte region by promoting new fleet electrification, clean energy, and transportation choice initiatives. These efforts help decrease the likelihood that our region will violate the health-based standard for ozone in the future.

3.4 EMISSIONS INVENTORIES

3.4.1 Theory of Approach

There are two basic approaches used to demonstrate continued maintenance. The first is the comparison of a projected emissions inventory with a baseline emissions inventory. The second approach involves complex analysis using gridded photochemical modeling. The approach used

by the DAQ is the comparison of emissions inventories for the base year 2018, an interim year 2026, and projection year 2035 representing the last year of the maintenance plan.

A base year inventory for NOx and VOC emissions was developed for 2018 because it is one of the more recent years for which the Charlotte Area has clean air quality for the 2008 8-hour ozone NAAQS, it is consistent with the base year of the TDM runs for the Charlotte area, and it is the base year of the most recent emissions modeling platform at the time this maintenance plan demonstration was prepared. In addition, the selection of 2018 as the base year avoids the potential underrepresentation of emissions the response to the COVID-19 pandemic may have caused beginning in early 2020. The interim year 2026 was chosen because it is the final year of the first 10-year maintenance plan. The final year of the maintenance demonstration is 2035, since the CAA 175A(b) requires that a state demonstrate maintenance with the NAAQS for 20 years after the effective date of the redesignation. The maintenance demonstration is made by comparing the 2018 baseline summer day emissions inventory to the 2026 and 2035 projected summer day emissions inventories which consider economic and population growth. The projected emissions remain below the baseline emissions demonstrating continued maintenance of the 2008 8-hour ozone standard. The use of average July day emission estimates to represent summer day emissions is consistent with the first 2008 ozone NAAQS maintenance plan developed for the Charlotte-Gastonia-Salisbury, NC nonattainment area and all related subsequent SIPs.

The emissions inventories are comprised of four major types of sources: point, nonpoint (area), onroad mobile and nonroad mobile. The projected summer day emission inventories have been estimated using projected rates of growth in population, traffic, economic activity and other parameters. Naturally occurring, or biogenic, emissions are not included in the emissions inventory comparison, as these emissions are outside the state's control.

The emissions inventories were prepared for the North Carolina portion of the maintenance area. On September 23, 2023, the SCDES (formerly South Carolina Department of Health and Environmental Control) submitted the second 10-year maintenance plan for the York County, South Carolina portion of the Charlotte-Gastonia-Rock Hill, NC-SC 8-hour 2008 Ozone Maintenance Area.[36]

[36] South Carolina 2008 8-Hour Ozone Second 10-Year Maintenance Plan, for the Portion of York County, South Carolina within the Rock Hill-Fort Mill Area Transportation Study Metropolitan Planning Organization, part of the Charlotte-Gastonia-Rock Hill, NC-SC 8-Hour Ozone Maintenance Area, prepared by South Carolina Department of Health and Environmental Control Bureau of Air Quality, September 26, 2023.

3.4.2 Emission Inventories

The base year and future year emissions include the emissions associated with all emission sources in Mecklenburg County and the portion of the other six counties that is included in the maintenance area. For point sources, the location coordinates for each facility were mapped using Geographic Information System (GIS) software to identify the facilities located within the maintenance area of each county. For the onroad mobile sector, emissions were modeled based on vehicle activity within the maintenance area of each county. For the nonroad mobile and nonpoint source sectors, total county emissions were multiplied by the population percentages for the townships within the maintenance area to calculate the emissions for the maintenance area for each county. Table 3.2 shows the population percentages that were used to determine emissions contributions for the maintenance area of each partial county (except for Mecklenburg County). The population percentages were obtained from TDM that the Charlotte Department of Transportation (CDOT) completed to develop VMT, and vehicle speed data used as inputs to the onroad model for the base year and each of the future year inventories.

Table 3.2 Population Percentages Used to Allocate Partial County Emissions

	Partial County Population			Full County Population			Population Percentage		
County	2018	2026	2035	2018	2026	2035	2018	2026	2035
Cabarrus	208,342	275,449	338,989	209,513	276,773	340,481	99.4	99.5	99.6
Gaston	202,174	219,379	233,086	219,196	236,554	250,685	92.2	92.7	93.0
Iredell	84,506	96,957	106,721	182,268	203,113	230,276	46.4	47.7	46.3
Lincoln	68,077	78,186	86,825	81,190	91,432	100,071	83.8	85.5	86.8
Rowan	136,390	147,503	158,921	145,397	157,114	169,182	93.8	93.9	93.9
Union	206,052	256,070	292,041	230,959	282,564	319,833	89.2	90.6	91.3

The 2018, 2026, and 2035 emissions for all sectors were developed to incorporate the most recent emissions data available. Table 3.3 identifies the references/data sources for the 2018 base year emissions inventory and 2026 and 2035 emissions forecast prepared for each sector.

Table 3.3 References/Data Sources for the Base Year Emissions Inventory and Revised Emissions Forecast

Sectors	Inventory Years	References / Data Sources*
Onroad and Nonroad	2018, 2026, 2035	MOVES modeling
Point EGU with a Continuous Emissions Monitoring System (CEMS)	2018	NOx: EPA's Clean Air Markets Program Data[37] VOC: Duke Energy Carolinas
	2026, 2035	Lincoln and Buck: Duke Energy Carolinas Rowan: ERTAC v22.0 AEO2023 Reference Case[38]
Point EGU without a CEMS	2018, 2035	EPA's 2018 version 2 Emissions Modeling Platform (2018 EMPv2)[39]
	2026	2022 North Carolina point source inventory
Point non-EGU (including Aircraft and Wild/Prescribed/Agriculture Fire)	2018, 2026, 2035	EPA's 2018 EMPv2 (2026 data are interpolated)
Nonpoint	2018, 2026, 2035	EPA's 2018 EMPv2 (2026 data are interpolated)

* Detailed documentation of the inventory methods is provided in Appendix A for onroad, Appendix B for nonroad, Appendix C for point, and Appendix D for nonpoint sectors.

The following provides a brief discussion on the four different man-made emission inventory source classifications: (1) stationary point, (2) stationary nonpoint (area), (3) onroad mobile, and (4) nonroad mobile.

Point Sources

Point sources are those stationary sources that require an air permit to operate. In general, these sources have a potential-to-emit more than five tons per year of a criteria air pollutant or its precursors from a single facility. The source emissions are tabulated from data collected by direct on-site measurements of emissions or mass balance calculations utilizing emission factors from the EPA's AP-42 or stack test results. There are usually several emission sources for each

[37] U.S. EPA, "Clean Air Markets Program Data Download," available from https://campd.epa.gov/data/custom-data-download, accessed June 2024.
[38] Email communication from Doris McLeod, Virginia Department of Environmental Quality, "Re: 2026 & 2035 month of July NOx and VOC emission forecast," to Ming Xie, DAQ, July 14 and July 17, 2024.
[39] U.S. Environmental Protection Agency, "2018v2 Emissions Modeling Platform," available from https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform, accessed April 2024.

facility. Emission data are collected for each point source at a facility and reported to the DAQ through its on-line system.

Airports are not required to have air quality permits for construction and operation (although they could have equipment such as a boiler or generator that requires a permit). They do have fixed and known locations and their emissions quantities can be comparable to industrial sources so, for purposes of the EPA's National Emissions Inventory (NEI), they are included in the point source inventory even though they are traditionally considered nonroad sources.

In addition, EPA includes wild and prescribed fires in the point source inventory because the extent of fire event activity is defined by geographic coordinates. The EPA also develops agricultural fire emissions estimates using crop residue burning activity, which is derived from the Hazard Mapping System satellite detects identifying fires on agricultural lands. Because EPA compiles emission estimates from the three fire subcategories using a common framework, the DAQ has chosen to report all fire emission estimates in the point source inventory.

Point EGU Sources

For EGUs with a CEMS, 2018 base year NOx emissions for July were obtained from the EPA's Clean Air Markets Division (CAMD) database for the G.G. Allen Steam Station in Gaston County, Lincoln County Combustion Turbine Station in Lincoln County, and Buck Steam Station and Plant Rowan in Rowan County. Total emissions for the month of July for each unit were divided by the number of days the unit operated in July to calculate average July day emissions. Base year 2018 summer day VOC emissions were calculated for each unit using annual emissions that Duke Energy Carolinas reported to the DAQ, divided by 365 days. Duke Energy Carolinas provided the DAQ with 2026 and 2035 July day NOx and VOC emissions forecasts for Lincoln Combustion Turbine Station and Buck Steam Station. For Plant Rowan County, the DAQ used Eastern Regional Technical Advisory Committee (ERTAC) model v22.0 AEO2023 reference case's July 2026 and July 2035 NOx emissions forecast to develop summer day NOx emissions.[40] The ERTAC forecast includes the number of days each unit is projected to operate in July; therefore, for each emission unit, July emissions for 2026 and 2035 were divided by the number of days the unit is projected to operate in each month to estimate average summer day NOx emissions. It is important to note that GG Allen will retire by the end 2024 and the ERTAC forecasts reflect this information. The DAQ calculated 2018 to 2026 and 2018

[40] Email communication from Doris McLeod, Virginia Department of Environmental Quality, "Re: 2026 & 2035 month of July NOx and VOC emission forecast," to Ming Xie, DAQ, July 14 and July 17, 2024.

to 2035 summer day NOx emission growth rates and applied the growth rates to 2018 VOC summer day emissions to estimate VOC emissions for 2026 and 2035.

The DAQ compiled annual NOx and VOC emissions from the 2022 North Carolina point source inventory for the list of relevant non-CEMS EGUs, and these emissions were divided by 365 to estimate typical summer day emissions. These values were used to estimate emissions in 2026. For 2018 and 2035, the DAQ compiled annual 2018 and 2032 VOC and NOx emissions from the 2018v2 EMP for the non-CEMS EGUs included in this plan. Given the proximity of 2032 to 2035 and the lack of emission projections for 2035, the 2032 projections are used to represent 2035 emissions. The 2018 and 2032 emissions were divided by 365 days to estimate typical summer day emissions.

Point Non-EGU Sources

For non-EGU point sources, aircraft, and wild/prescribed/agriculture fires, the 2018 inventory reflects county emissions from EPA's 2018v2 Emissions Modeling Platform (EMP) and mapping of the coordinates of these facilities to determine the proportion of county emissions in the maintenance area. The 2018v2 platform was created to support EPA's analysis of the impact of EPA's revised annual $PM_{2.5}$ NAAQS and utilized the most up-to-date modeling and data sources. The platform is considered to provide the most comprehensive and accurate inventories available at the time that this maintenance demonstration was prepared. The DAQ compiled July 2018 and July 2032 county-level emissions for the non-EGU point source categories and estimated typical summer day emissions by dividing the platform's July emissions by 31 days. The DAQ believes that dividing July emissions by the 31 days in the month provides a reasonable estimate of typical summer day emissions for these point sources. Given the proximity of 2032 to 2035 and the lack of emission projections for 2035, the 2032 projections are used to represent 2035 emissions.

Table 3.4 and Table 3.5 present a summary of the point source NOx and VOC emissions, respectively, on a tons per summer day basis. As shown in Table 3.4, point source NOx emissions decrease from 2018 to 2035 for all counties except Mecklenburg County. The increase in NOx emissions for Mecklenburg County is associated with the projected increase in air traffic at the Charlotte Douglas International Airport that EPA included in the 2018/2032v2 EMP.

Table 3.4 Point Source NOx Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	1.73	1.67	1.64
Gaston*	5.70	0.59	0.58
Iredell*	0.69	0.65	0.63
Lincoln*	0.62	0.94	0.26
Mecklenburg	6.23	7.90	9.01
Rowan*	3.78	3.98	3.73
Union*	0.70	0.70	0.69
Total	**19.45**	**16.43**	**16.54**

* Emissions for portion of county included in maintenance area.

Table 3.5 Point Source VOC Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	1.08	1.03	1.10
Gaston*	1.41	1.36	1.34
Iredell*	0.32	0.30	0.28
Lincoln*	0.64	0.65	0.64
Mecklenburg	2.52	3.06	3.47
Rowan*	2.51	2.58	2.62
Union*	1.85	1.83	1.81
Total	**10.33**	**10.81**	**11.26**

* Emissions for portion of county included in maintenance area.

Nonpoint Sources

Nonpoint sources are those stationary sources whose emissions are relatively small but due to the large number of these sources, their collective emissions could be significant (i.e., dry cleaners, service stations, etc.). In general, nonpoint source emissions are estimated by multiplying an emission factor by some known indicator of collective activity such as production, number of employees, or population. These types of emissions are estimated at the county level. The following summarizes the methods used to compile nonpoint source emissions data for this maintenance plan. The reader is referred to the nonpoint source emissions inventory documentation appendix for details. The nonpoint source emissions inventory is based on the EPA's 2018v2 EMP, which was previously described in the non-EGU point source section above. The 2018v2 EMP emission estimates for July were divided by 31 days to estimate typical summer day emissions. Given the proximity of 2032 to 2035 and the lack of emission projections for 2035, the 2018v2 EMP projections for 2032 are used to represent 2035 emissions. Emissions for 2026 were estimated by interpolating between the 2018 and 2032 emission

estimates provided in the 2018v2 EMP. Table 3.6 and Table 3.7 present summaries of the nonpoint source NOx and VOC emissions, respectively, on a tons per summer day basis.

Table 3.6 Nonpoint Source NOx Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	0.22	0.24	0.26
Gaston*	0.27	0.30	0.32
Iredell*	0.12	0.14	0.15
Lincoln*	0.08	0.09	0.10
Mecklenburg	1.37	1.53	1.65
Rowan*	0.19	0.21	0.22
Union*	0.25	0.29	0.31
Total	**2.50**	**2.80**	**3.01**

* Emissions for portion of county included in maintenance area.

Table 3.7 Nonpoint Source VOC Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	4.42	4.88	5.22
Gaston*	5.00	5.14	5.23
Iredell*	2.18	2.37	2.40
Lincoln*	1.70	1.85	1.97
Mecklenburg	26.10	28.76	30.75
Rowan*	3.72	3.82	3.89
Union*	5.69	6.34	6.81
Total	**48.81**	**53.16**	**56.27**

* Emissions for portion of county included in maintenance area.

Onroad Mobile Sources

Onroad mobile sources are vehicles licensed to operate on public roadways, including a wide range of vehicle types, from motorcycles and passenger cars to the largest buses and trucks. Onroad mobile source emissions inventories were developed using the latest version of the EPA MOVES model, MOVES4.0.1. The model requires input data which fully characterizes the onroad mobile source fleet and activity for each modeled area, including vehicle population by vehicle type, vehicle age distribution, fuel type distribution, VMT by road type and vehicle type, and speed distribution. Local county-level or partial county-level model input data were used where available. If county-level data were not available, state-level data or MOVES model default data were used, in that order of preference. Historical input data were used for modeling 2018 emissions, whereas 2026 and 2035 modeling inputs were developed by projecting the latest available data (e.g., 2023 vehicle population data) to the needed future years. The MOVES model incorporates the scheduled implementation of EPA engine standards and emissions

regulations in future years, as well as projections of future vehicle fuel type distribution, and the effects of these factors are included in the future year emissions estimates. For a detailed discussion on how the onroad mobile source emission inventory was developed, see Appendix A. Table 3.8 and Table 3.9 present a summary of the onroad mobile source NOx and VOC emissions, respectively, on a tons per summer day basis.

Table 3.8 Onroad Mobile Source NOx Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	5.62	2.98	1.33
Gaston*	6.72	3.11	1.07
Iredell*	3.20	1.53	0.59
Lincoln*	2.53	1.24	0.45
Mecklenburg	29.14	15.65	8.05
Rowan*	4.98	2.30	0.78
Union*	4.88	2.65	1.18
Total	**57.07**	**29.46**	**13.45**

* Emissions for portion of county included in maintenance area.

Table 3.9 Onroad Mobile Source VOC Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	3.12	2.27	1.81
Gaston*	3.64	2.22	1.39
Iredell*	1.72	1.10	0.71
Lincoln*	1.50	0.96	0.62
Mecklenburg	13.87	10.01	8.68
Rowan*	2.90	1.74	1.03
Union*	2.89	2.14	1.64
Total	**29.64**	**20.44**	**15.88**

* Emissions for portion of county included in maintenance area.

Nonroad Mobile Sources

The nonroad mobile source inventory contains emissions from mobile equipment and vehicles not licensed for use on public roadways.

Nonroad Equipment

Nonroad mobile source equipment covers a diverse set of items including lawn mowers, chain saws, tractors, all-terrain vehicles, forklifts, and construction equipment. Freight and passenger railroads and commercial marine vessels (CMV) are vehicle types included in the nonroad mobile source category. For this maintenance plan, the 2018, 2026, and 2035 emissions for nonroad equipment were calculated using EPA's MOVES4.0.1 model. Model runs were performed for each county and year of interest. The model runs were developed for a typical July weekday. Default data were used for the input files used in the MOVES4.0.1 Nonroad model. The MOVES RunSpec (MRS) file (wherein all modeling variables are set) was tailored to reflect North Carolina-specific information. The emissions were calculated and reported in tons per day for VOCs and NOx for each equipment sector and summed for each county. Partial county emissions were calculated by multiplying county total emissions by percent population of the partial county as displayed in Table 3.2. Further details on the equipment sectors and nonroad model runs are provided in Appendix D.

Nonroad Vehicles

The EPA's 2018v2 EMP reports two major types of nonroad vehicle emissions in North Carolina: CMV and railroad locomotives.[41] Only railroad locomotive emissions occur in the maintenance area. For the railroad locomotive source categories, year 2018 monthly emissions were obtained from the 2018v2 modeling platform file "2018gg_county_monthly_report_03aug2022_v0.csv."[42] Year 2032 monthly emissions for railroad locomotive sources were obtained from the 2018v2 modeling platform file "2032gg2_county_monthly_report_23oct2023_v1.csv."[3] Year 2032 emission projections were used as the best available representation of 2035 emissions.

The DAQ estimated July 2026 NOx and VOC emissions from the July 2018 and July 2032 emissions in the 2018v2 EMP. The 2026 values were calculated via interpolation between the 2018 and 2032 emissions. To develop average July day emissions, the DAQ divided the

[41] U.S. Environmental Protection Agency, "2018v2 Emissions Modeling Platform," available from https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform, accessed April 2024.
[42] U.S. Environmental Protection Agency, "Index of /Air/emismod/2018/v2/reports," monthly emissions data available for download from https://gaftp.epa.gov/Air/emismod/2018/v2/reports/, accessed June 2024.

estimated July emissions in each year by 31 days. The DAQ believes that dividing July emissions by 31 days provides a reasonable estimate of typical summer day railroad locomotive emissions. Table 3.10 and Table 3.11 present a summary of nonroad mobile source NOx and VOC emissions, respectively, on a tons per summer day basis.

Table 3.10 Nonroad Mobile Source NOx Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	1.08	0.77	0.77
Gaston*	0.94	0.75	0.85
Iredell*	0.55	0.40	0.40
Lincoln*	0.38	0.29	0.30
Mecklenburg	8.18	5.75	5.60
Rowan*	0.73	0.57	0.61
Union*	1.88	1.28	1.18
Total	**13.74**	**9.81**	**9.71**

* Emissions for portion of county included in maintenance area.

Table 3.11 Nonroad Mobile Source VOC Emissions (tons/summer day)

County	2018	2026	2035
Cabarrus*	1.16	1.18	1.27
Gaston*	1.05	1.04	1.14
Iredell*	0.43	0.40	0.41
Lincoln*	0.42	0.39	0.42
Mecklenburg	10.44	10.60	11.44
Rowan*	0.79	0.73	0.77
Union*	1.89	1.92	2.06
Total	**16.18**	**16.26**	**17.51**

* Emissions for portion of county included in maintenance area.

3.4.3 Summary of Emissions

The sum totals of the man-made emissions for the North Carolina portion of the Charlotte maintenance area are tabulated in Table 3.12 and Table 3.13.

Table 3.12 Total Man-Made NOx Emissions for the North Carolina Portion of the Charlotte Maintenance Area (tons/summer day)

County	2018	2026	2035
Cabarrus*	8.65	5.66	4.00
Gaston*	13.63	4.75	2.82
Iredell*	4.56	2.72	1.77
Lincoln*	3.61	2.56	1.11
Mecklenburg	44.92	30.83	24.31
Rowan*	9.68	7.06	5.34
Union*	7.71	4.92	3.36
Total	**92.76**	**58.50**	**42.71**

* Emissions for portion of county included in maintenance area.

Table 3.13 Total Man-Made VOC Emissions for the North Carolina Portion of the Charlotte Maintenance Area (tons/summer day)

County	2018	2026	2035
Cabarrus*	9.78	9.36	9.40
Gaston*	11.10	9.76	9.10
Iredell*	4.65	4.17	3.80
Lincoln*	4.26	3.85	3.65
Mecklenburg	52.93	52.43	54.34
Rowan*	9.92	8.87	8.31
Union*	12.32	12.23	12.32
Total	**104.96**	**100.67**	**100.92**

* Emissions for portion of county included in maintenance area.

3.4.4 Maintenance Demonstration

As discussed above, maintenance is demonstrated when the future year's total man-made emissions are less than the 2018 baseline emissions. Table 3.14 summarizes the NOx and VOC emissions for the North Carolina portion of the Charlotte maintenance area. The difference between the base year and the final year illustrates that the continued maintenance of the 2008 8-hour ozone NAAQS is expected.

Table 3.14 Maintenance Demonstration for North Carolina Portion of the Charlotte Maintenance Area

Year	NOx (tons/summer day)	VOC (tons/summer day)
2018	92.76	104.96
2026	58.50	100.67
2035	42.71	100.92
Difference from 2018 to 2035	**-50.05**	**-4.04**

The difference between the attainment level of emissions (2018) from all man-made sources and the projected level of emissions (2026 and 2035) from all man-made sources in the maintenance area is considered the "safety margin". The safety margin for the North Carolina portion of the maintenance area for each period is summarized in Table 3.15.

Table 3.15 Safety Margins for North Carolina Portion of the Charlotte Maintenance Area

Year	NOx (tons/summer day)	VOC (tons/summer day)
2018	N/A	N/A
2026	-34.26	-4.29
2035	-50.05	-4.04

3.5 CONTINGENCY PLAN

A contingency plan is required to promptly correct any violation of the ozone standard that occurs after approval of the maintenance plan. The contingency plan does not need to include control measures that have been fully adopted. However, the plan is considered to be an enforceable part of the SIP and should ensure that the contingency measures are expeditiously adopted once their need is triggered. The two main elements of the North Carolina contingency plan are tracking and triggering mechanisms to determine when control measures are needed, and a process for developing and adopting appropriate control measures.

There are three potential triggers for the contingency plan. The primary trigger of the plan will be a violation of the 2008 8-hour ozone NAAQS at any of the Charlotte area monitors. The secondary trigger will be a monitored air quality pattern that suggests an actual 2008 8-hour ozone NAAQS violation may be imminent. The tertiary trigger will be a monitored fourth highest exceedance of the NAAQS. Upon either the primary or secondary triggers being activated, the DAQ, working in consultation with the SCDES and the MCAQ local program, will

commence analyses to determine what additional measures, if any, will be necessary to attain or maintain the 2008 8-hour ozone standard. If activation of either the primary or secondary triggers occurs, this plan provides a regulatory adoption process for revising emission control strategies. Activation of the tertiary trigger will result in an analysis to understand the cause of the exceedance and to identify voluntary measures if needed.

3.5.1 Contingency Plan Triggers

The primary trigger of the contingency plan will be a violation of the 2008 8-hour ozone standard or when the three-year average of the 4th highest values is equal to or greater than 0.076 ppm at a monitor in the maintenance area. The trigger date will be 60 days from the date on which an ozone monitor in a maintenance area records a 4th highest value that, when averaged with the two previous ozone seasons' fourth highest values, results in a 3-year average equal to or greater than 0.076 ppm.

The secondary trigger will apply where no actual violation of the 2008 8-hour ozone standard has occurred, but where the state finds monitored ozone levels indicating that an actual ozone NAAQS violation may be imminent. A pattern will be deemed to exist when there are two consecutive ozone seasons in which the 4th highest values are 0.076 ppm or greater at a single monitor within the maintenance area. The trigger date will be 60 days from the date on which an ozone monitor in the maintenance area records a 4th highest value of 0.076 ppm or greater for which the previous season had a 4th highest value of 0.076 ppm or greater.

Similarly, the tertiary trigger will not be an actual violation of the 2008 8-hour ozone standard. This trigger will be a first alert as to a potential air quality problem on the horizon. The trigger will be activated when a monitor in a maintenance area has a 4th highest value of 0.076 ppm or greater, starting the first year after the maintenance plan has been approved. The trigger date will be 60 days from the date on which an ozone monitor in a maintenance area records a 4th highest value of 0.076 ppm or greater.

3.5.2 Actions Resulting from Trigger Activation

Once the primary or secondary trigger is activated, the Planning Section of the DAQ, in consultation with the SCDES and MCAQ, shall commence analyses including trajectory analyses of high ozone days, and an emissions inventory assessment to determine emission control measures that will be required for maintaining the 2008 8-hour ozone standard. The analysis will include an evaluation of any future federal, state, and local measures that will be implemented after the trigger is activated to determine their effectiveness for bringing the area into attainment and assure maintenance going forward. If deemed applicable, the DAQ will

submit to EPA an analysis supporting the conclusion that control measures will be adequate to reduce ozone concentrations to attain and maintain the 2008 8-hour ozone NAAQS. If additional state and local control measures are determined to be necessary, the DAQ will perform an analysis to determine the most effective measure(s) to bring the area back into attainment of and maintain compliance with the NAAQS. The analysis of state and local control measures will focus on NO_x controls because North Carolina is NO_x limited for ozone formation (see Section 1.1 of this maintenance plan).

The measures that will be considered for adoption upon a trigger of the contingency plan include: NO_x Reasonably Available Control Technology (RACT) on stationary sources with a potential to emit less than 100 tons per year in the North Carolina portion of the maintenance area, implementation of diesel retrofit programs, including incentives for performing retrofits, reinstatement of the emissions I&M program for onroad light-duty gasoline vehicles in the counties subject to the maintenance plan, and additional controls in upwind areas.

By May 1 of the year following the ozone season in which the primary or secondary trigger has been activated, North Carolina will complete sufficient analyses to begin adoption of necessary rules for ensuring attainment and maintenance of the 2008 8-hour ozone NAAQS. These rules would become effective by the following March 1 (the beginning of the ozone season) unless legislative review is required.

The DAQ commits to begin implementing as expeditiously as practicable, but no later than 24 months of the primary or secondary trigger, at least one control measure that is determined to be most appropriate for reducing NO_x emissions to attain and maintain the standard based on the analyses performed.

Once the tertiary trigger is activated, the Planning Section of the DAQ, in consultation with the SCDES and MCAQ, shall commence analyses including meteorological evaluation, trajectory analyses of high ozone days, and emissions inventory assessment to understand why a 4th highest exceedance of the standard has occurred. Once the analyses are completed, the DAQ will work with SCDES, MCAQ and the local air awareness program to develop an outreach plan identifying any additional voluntary measures that can be implemented. If the 4th highest exceedance occurs early in the season, the DAQ will work with entities identified in the outreach plan to determine if the measures can be implemented during the current season, otherwise, the DAQ will work with SCDES, MCAQ and the local air awareness coordinator to implement the plan for the following ozone season.

4.0 MOTOR VEHICLE EMISSIONS BUDGET FOR CONFORMITY

4.1 TRANSPORTATION CONFORMITY

The purpose of the transportation conformity process is to ensure that federal transportation actions occurring in nonattainment or maintenance areas do not interfere with achieving or maintaining compliance with any of the NAAQS. For the Charlotte-Gastonia-Salisbury, North Carolina 2008 8-Hour Ozone Marginal Maintenance Area, transportation conformity must be demonstrated for emissions of the ozone precursors NOx and VOC related to all federally funded roadway projects. Specifically, estimates of future emissions, including any increases related to completed roadway projects, must not exceed the MVEBs as defined in this maintenance plan. Roadway projects are defined in NC DOT State Transportation Improvement Program (STIP) plans and Metropolitan Transportation Plans (MTPs) from municipal or regional transportation planning organizations, which are issued periodically. A new transportation conformity determination is generally triggered by the release of a new STIP or MTP, or by changes to current plans, referred to as TIP updates.

The DAQ held three meetings with the Charlotte area interagency consultation partners, including the Charlotte Regional Transportation Planning Organization (CRTPO) - Rocky River Rural Planning Organization (RRRPO), Gaston-Cleveland-Lincoln Metropolitan Planning Organization (GCLMPO), and Cabarrus-Rowan Metropolitan Planning Organization (CRMPO), to determine what years to set MVEBs for the Charlotte maintenance plan. As required under 40 CFR 93.118, a maintenance plan must establish MVEBs for the last year of the maintenance plan (in this case, 2035). The IAC process also agreed to establish MVEBs for the maintenance plan base year of 2018.

4.2 SAFETY MARGIN

As stated in Section 3.4.4, a safety margin is the difference between the attainment level of emissions from all source categories (i.e., point, nonpoint, onroad and nonroad) and the projected future level of emissions from all source categories. The safety margins for the North Carolina portion of the Charlotte area are listed in Table 3.15. The state may choose to allocate some of the safety margin to the MVEBs, for transportation conformity purposes, so long as the total level of emissions from all source categories remains below the attainment level of emissions.

The DAQ has decided to allocate a portion of the safety margin for 2035 to the MVEBs to allow for unanticipated growth in VMT, changes and uncertainty in vehicle mix assumptions, and uncertainty associated with mobile modeling that will influence the future year emission estimations. The DAQ has developed and implemented a five-step approach for determining a

factor to use to calculate the amount of safety margin to apply to the MVEBs for 2035 (see the following Section 4.3 and Appendix A). The resulting percent increase to the MVEBs for the North Carolina counties in the Charlotte area are listed in the Table 4.1. Note that because the initial 2018 MVEB year is also the base year for the maintenance plan inventory, there is no safety margin and, therefore, no adjustments were made to the MVEBs for 2018.

Table 4.1 Percent Increase to Mobile Vehicle Emissions Budget

County	2035 NOx	2035 VOC
Cabarrus	191.64%	30.88%
Gaston	188.54%	25.91%
Iredell	188.89%	27.80%
Lincoln	188.67%	27.76%
Mecklenburg	183.69%	22.89%
Rowan	193.81%	32.98%
Union	186.58%	25.94%

4.3 MOTOR VEHICLE EMISSION BUDGETS

Although the emissions up to this point have been expressed in terms of tons/summer day, for conformity purposes the MVEBs are expressed in kilograms/summer day (kg/summer day). Note that, for this reason, kg/summer day was selected as the specified unit for all MOVES model outputs. MOVES output emissions values were rounded to the nearest kg/summer day and were divided by 907.1847 to convert them to units of tons/summer day. The resulting values in tons/summer day were rounded to two decimal places.

Table 4.2 shows the counties with their onroad mobile NOx and VOC emissions, respectively, expressed in tons/summer day (tpd) and the corresponding kg/summer day (kg/d) values for 2018, 2026, and 2035.

Table 4.2 Onroad Mobile Source NOx and VOC Summer Day Emissions in 2018, 2026, and 2035 for North Carolina Portion of the Charlotte Maintenance Area

County	2018 NOx		2018 VOC		2026 NOx		2026 VOC		2035 NOx		2035 VOC	
	tpd	kg/d	tpd	kg/d	tpd	kg/d	tpd	kg/d	tpd	kg/d	tpd	kg/d
Cabarrus*	5.62	5,094	3.12	2,829	2.98	2,708	2.27	2,060	1.33	1,208	1.81	1,642
Gaston*	6.72	6,096	3.64	3,302	3.11	2,823	2.22	2,010	1.07	969	1.39	1,262
Iredell*	3.20	2,901	1.72	1,561	1.53	1,391	1.10	997	0.59	531	0.71	644
Lincoln*	2.53	2,295	1.50	1,364	1.24	1,124	0.96	870	0.45	406	0.62	562
Mecklenburg	29.14	26,436	13.87	12,581	15.65	14,198	10.01	9,079	8.05	7,301	8.68	7,871
Rowan*	4.98	4,514	2.90	2,627	2.30	2,083	1.74	1,580	0.78	711	1.03	934
Union*	4.88	4,430	2.89	2,620	2.65	2,403	2.14	1,943	1.18	1,073	1.64	1,488
Total	**57.07**	**51,766**	**29.64**	**26,884**	**29.46**	**26,729**	**20.44**	**18,539**	**13.45**	**12,199**	**15.88**	**14,403**

* Emissions for portion of county included in maintenance area.

As part of the consultation process on developing MVEBs, the DAQ coordinated three IAC meetings with local, state, and federal transportation partners and the EPA's Region IV staff to establish the framework and process for developing MVEBs. Based on these meetings, the participants in the consultation process agreed to the following:

Emissions Inventory and Forecast

- Use 2018 as the base year for the emissions inventory and include emissions estimates for 2018, 2026, and 2035.
- Use the VMT, speed, and human population data from the latest version of the Metrolina Regional Model (MRM22v2.0) travel demand model for emissions modeling. The model is maintained and executed by the Charlotte DOT for transportation planning purposes. The data was used to develop inputs for modeling onroad mobile source emissions with the latest version of the EPA MOVES model (MOVES4.0.1).

Geographic Extent of MVEBs

- Prepare separate MVEBs based on the latest MPO jurisdictional boundaries such that MVEBs are established for the CRMPO (Cabarrus and Rowan Counties), for the CRTPO-RRRPO (Iredell, Mecklenburg and Union Counties), and for the GCLMPO (Gaston and Lincoln Counties). Although Cleveland County is included in the GCLMPO, it is not included in the Charlotte ozone maintenance area.

MVEB Years

- Develop MVEBs for 2018 (base year) and 2035 (required, since it is the last year of the maintenance period)
- Request that the current 2014 and 2026 MVEBs be rescinded upon approval of this second maintenance plan by EPA.

Adjustment to MVEBs

- Allocate safety margin to increase the MVEBs for each budget area using a process adapted from the safety margin allocations used for the first ten-year maintenance plan for the area. Upon review of the NOx and VOC emissions modeling results and the safety margin emissions available, DAQ management agreed to allocate 50% of the total NOx safety margin emissions and 100% of the total VOC safety margin emissions to the 2035 MVEBs. Allocation percentages for Steps 2 and 4 below were adjusted to meet these allocation targets. Allocation to individual budget areas followed the steps outlined below, with allocation percentages calculated by county and pollutant. Safety margin allocations were not applicable for the 2018 MVEBs, since 2018 is the base year for the maintenance plan.

  Step 1 - Percentage below the standard

  - All counties were allocated safety margin equivalent to 2% of their emissions for both the NOx and VOC MVEBs for 2035

  Step 2 - Account for unanticipated model input data changes

  - For NOx, all counties were allocated safety margin equivalent to 100% of their emissions for the 2035 MVEB.
  - For VOC, all counties were allocated safety margin equivalent to 10.9% of their emissions for the 2035 MVEB.

  Step 3 - Provide flexibility and account for rapid growth for counties that are determined to be medium to small contributors to the onroad mobile NOx and VOC emissions inventories

  - Counties with <8% of maintenance area onroad mobile source NOx emissions were allocated additional safety margin equivalent to 5% of their emissions for the 2035 MVEBs (Gaston, Iredell, Lincoln, and Rowan)
  - Counties with <8% of maintenance area onroad mobile source VOC emissions were allocated additional safety margin equivalent to 5% of their emissions for the 2035 MVEBs (Iredell, Lincoln, and Rowan)

- Counties with 8% to 25% of maintenance area onroad mobile source NOx emissions were allocated additional safety margin equivalent to 3% of their emissions for the 2035 MVEBs (Cabarrus and Union)
- Counties with 8% to 25% of maintenance area onroad mobile source VOC emissions were allocated additional safety margin equivalent to 3% of their emissions for the 2035 MVEBs (Cabarrus, Gaston, and Union)

Step 4 - Account for input uncertainty in final year of the maintenance plan to account for potential changes in VMT, vehicle mix and vehicle age distribution:

- For NOx, all counties were allocated safety margin equivalent to 81.68% of their emissions for the NOx MVEBs for 2035
- For VOC all counties were allocated safety margin equivalent to 10% of their emissions for the VOC MVEBs for 2035
- Cabarrus and Rowan Counties each were allocated additional safety margin equivalent to 5% of their emissions for both the 2035 NOx and VOC MVEBs to account for projected high growth rates in the CRMPO jurisdiction.

Step 5 - Ensure the sum of the safety margins applied to the MVEBs equals the allocation targets agreed to by DAQ management. For 2035, Steps 1-4 accounted for:

- 50.0% of the total NOx safety margin allocated
- 100.0% of the total VOC safety margin allocated

Tables 4.3 through 4.5 provide the NOx and VOC MVEBs in kg/summer day, for transportation conformity purposes, for 2018 and 2035. Upon the EPA's final approval for these sub-area MVEBs, they will become the applicable MVEBs for transportation conformity.

Table 4.3 Cabarrus-Rowan Metropolitan Planning Organization (CRMPO) MVEBs for 2018 and 2035 (kg/summer day)*

	2018		2035	
	NOx	**VOC**	**NOx**	**VOC**
Base Emissions	9,608	5,456	1,919	2,576
Safety Margin Allocated to MVEB	-	-	3,693	815
Conformity MVEB	**9,608**	**5,456**	**5,612**	**3,391**

* Includes the portion of Cabarrus and Rowan Counties in the maintenance area.

Table 4.4 Gaston-Cleveland-Lincoln Metropolitan Planning Organization (GCLMPO) MVEBs for 2018 and 2035 (kg/summer day)*

	2018		2035	
	NOx	**VOC**	**NOx**	**VOC**
Base Emissions	8,391	4,667	1,375	1,824
Safety Margin Allocated to MVEB	-	-	2,593	483
Conformity MVEB	**8,391**	**4,667**	**3,968**	**2,307**

* Includes the portion of Gaston and Lincoln Counties in the maintenance area. Although Cleveland County is included in the MPO it is not included in the Charlotte ozone maintenance area.

Table 4.5 Charlotte Regional Transportation Planning Organization (CRTPO) - Rocky River Rural Planning Organization (RRRPO) MVEBs for 2018 and 2035 (kg/summer day)*

	2018		2035	
	NOx	**VOC**	**NOx**	**VOC**
Base Emissions	33,767	16,762	8,905	10,003
Safety Margin Allocated to MVEB	-	-	16,416	2,367
Conformity MVEB	**33,767**	**16,762**	**25,321**	**12,370**

* Includes all of Mecklenburg County and the portion of Iredell and Union Counties in the maintenance area.

Remaining Safety Margins

This total safety margin emissions allocations to the 2035 MVEBs totaled 22,702 kg/summer day (25.02 tons/summer day) of NOx and 3,665 kg/summer day (4.04 tons/summer day) of VOC. The remaining safety margins for each projected year are listed in Table 4.6.

Table 4.6 Remaining Safety Margins for the North Carolina Portion of the Charlotte Maintenance Area (tons/summer day)

Year	NOx	VOC
2018	N/A*	N/A
2026	-34.26	-4.29
2035	-25.03	-0.00

* N/A = not applicable.

5.0 STATE IMPLEMENTATION PLAN APPROVAL

5.1 INTRODUCTION

For an area to be redesignated and have an approved maintenance plan, the SIP must include evidence of compliance with the rules relied on to show maintenance of the standard. This section provides the evidence of compliance with such rules for the Charlotte-Gastonia-Salisbury 2008 8-hour ozone nonattainment area.

5.2 EVIDENCE OF COMPLIANCE

Two counties in the Charlotte area (Gaston and Mecklenburg Counties) were designated as moderate nonattainment for 1-hour ozone effective January 1992. Since a redesignation demonstration and maintenance plan was submitted for this area prior to November 15, 1992, the CAA requirements for moderate areas were not required with the exception of the I&M program. An I&M program was established in the Charlotte area as prescribed by the 1990 CAA. Therefore, North Carolina has a fully approved SIP for this area.

For the 1997 8-hour ozone standard, the DAQ submitted to the EPA for approval the Metrolina Attainment Demonstration SIP on June 15, 2007, and a Supplement to the Attainment Demonstration SIP on April 5, 2010. The North Carolina portion of the Metrolina nonattainment area includes the counties of Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan and Union and Coddle Creek and Davidson Townships in Iredell County. The Reasonable Further Progress SIP was submitted to the EPA for approval on June 15, 2007, and a Revised Reasonable Further Progress SIP was submitted on November 30, 2009. The EPA approved the Revised Reasonable Further Progress SIP on October 12, 2012.[43] On November 2, 2011, the DAQ submitted to the EPA a Redesignation Demonstration and Maintenance Plan for 1997 8-hour Ozone standard; and submitted a supplement to this SIP on March 28, 2013. The EPA approved the redesignation request and maintenance plan on December 2, 2013.[44] Subsequently, On December 9, 2021, the DAQ submitted to EPA for review and approval a limited maintenance plan covering the second 10-year maintenance period from January 3, 2024**,** through January 2, 2034. The limited maintenance plan was approved by EPA on January 13, 2023**,** with an effective date of February 13, 2023.[45] The area qualified for a limited maintenance plan, which removes the requirement for establishing motor vehicle emissions budgets, because air quality levels for monitoring sites

[43] 77 FR 62159-62166.
[44] 78 FR 72036-72040.
[45] 88 FR 2245.

in the area are below 85% of the level of the standard and air quality levels have not been highly variable during preceding years.

For the 2008 8-hour ozone standard for the Charlotte nonattainment area, the DAQ submitted to the EPA for approval the Base Year (2011) Emissions Inventory and Emissions Statements SIP on July 7, 2014, to fulfill the requirements of Sections 182(a)(1) and 182(a)(3)(B) of the CAA.[46]

Additionally, the following rules regulating emissions of VOCs and/or NOx in the Charlotte nonattainment area counties have been approved, or have been submitted with a request to be approved, as part of the SIP:

15A NCAC 2D .0958, Work Practices for Sources of Volatile Organic Compounds,
15A NCAC 2D .0530, Prevention of Significant Deterioration,
15A NCAC 2D .0925, Petroleum Liquid Storage in Fixed Roof Tanks,
15A NCAC 2D .0926, Bulk Gasoline Plants,
15A NCAC 2D .0927, Bulk Gasoline Terminals,
15A NCAC 2D .0928, Gasoline Service Stations Stage I,
15A NCAC 2D .0932, Gasoline Cargo Tanks and Vapor Collection Systems,
15A NCAC 2D .0933 Petroleum Liquid Storage in External Floating Roof Tanks
15A NCAC 02D .0948, VOC Emissions from Transfer Operations,
15A NCAC 02D .0949, Storage of Miscellaneous Volatile Organic Compounds,
15A NCAC 2D .1000, Motor Vehicle Emission Control Standard,
15A NCAC 2D .1200, Control of Emissions from Incinerators,
15A NCAC 2D .1409(b), Stationary Internal Combustion Engines,
15A NCAC 2D .1418 - .1423, NOx SIP rules,
15A NCAC 2D .1700, Municipal Solid Waste Landfills,
15A NCAC 2D .1900, Open Burning,
15A NCAC 2D .2000, Transportation Conformity, and
15A NCAC 2D .2400 Clean Air Interstate Rules

Rules 15A NCAC 2D .0925, .0926, .0927, .0928, .0932, .0933, .0948, .0949, and .0958 have been approved as part of the SIP and are applicable across the state regardless of the size of the source.

Section 15A NCAC 2D .1200 regulates the controls and emissions from incinerators. Part of this rule has been submitted as part of the SIP, while .1205, .1206 and .1210 are part of the CAA Section 111(d) plans.

[46] http://ncair.org/planning/metrolina/metrolina_area_sip_plans.shtml.

Section 15A NCAC 2D .2000 relates to transportation conformity projects. Although these rules do not require reduction in emissions, they do ensure that federal actions do not hinder attainment or maintenance of the NAAQS.

North Carolina has adopted an open burning rule, 15A NCAC 2D .1900 that prohibits open burning of vegetative material during Air Quality Action Days of Code Orange or higher in forecasted areas of the state. Ozone forecasts are issued for the Charlotte area from March 1st through October 31st; therefore, this area is covered by this rule.

Section 15A NCAC 2D .2400 regulated nitrogen oxide emissions from electric generating units with a nameplate capacity of 25 megawatts or more producing electricity for sale. Section 15A NCAC 2D .2400 also covered industrial boilers that are covered under the NOx SIP rules. However, North Carolina did not rely on the emission reductions from CAIR for maintenance of the 2008 8-hour ozone standard. The CAIR expired effective February 1, 2016, pursuant to NCGS 150B-21.3A (Periodic Review and Expiration of Existing Rules). Effective May 1, 2022, North Carolina adopted rule 15A NCAC 02D .1425 (NOx SIP Call Budget) establishing ozone season budgets for EGUs and non-EGUs subject to the NOx SIP Call and requiring annual reporting of ozone season emissions to the DAQ. The DAQ will submit to EPA for approval a CAA Section 110(l) noninterference demonstration to request removal of CAIR from and adoption of 15A NCAC 02D .1425 into the North Carolina SIP.

Another important set of rules that control VOC emissions in these counties is Section 15A NCAC 2D .1100, Control of Toxic Air Pollutants. These rules, however, have not been submitted to the EPA to be approved as part of the SIP.

There are two other rules that control VOC emissions in the maintenance area. They are 15A NCAC 2D .0524, New Source Performance Standards, and 2D.1110, National Emission Standards for Hazardous Air Pollutants. Also, rule 2D.1111, Maximum Achievable Control Technology applies to control of emissions of VOCs. They are not part of the SIP, but the EPA has delegated the state enforcement authority for standards that have been adopted by the state. (The standards adopted by the state are state-enforceable regardless of the EPA delegation.)

Section 15A NCAC 2D .1000 also regulates emissions from motor vehicles in the North Carolina counties in and around the Charlotte maintenance area and requires the use of the OBDII system, which provides an indication of NOx emissions as well as other pollutants. Although currently included in the North Carolina SIP, the vehicle I&M program is being phased out because of the declining benefits of the program as new, cleaner vehicles manufactured to comply with federal emissions and fuel standards that have been tightened over the years have

replaced older vehicles. As discussed in Section 2.2, the NCDEQ submitted to EPA on October 1, 2024, a SIP revision and CAA Section 110(l) noninterference demonstration to remove all seven counties from the I&M program. This submittal was prepared as required by Session Law 2023-134, House Bill 259 (2023-2024 Appropriations Bill) adopted by the North Carolina General Assembly effective October 3, 2023. The EPA would need to approve this request before approving removal of the I&M program from these two maintenance plans for the Charlotte area.

6.0 STATE COMPLIANCE WITH CLEAN AIR ACT REQUIREMENTS

Section 175(A)(b) of the CAA states: "8 years after redesignation of any area as an attainment area under section 7407(d) of this title, the State shall submit to the Administrator an additional revision of the applicable State implementation plan for maintaining the national primary ambient air quality standard for 10 years after the expiration of the 10-year period referred to in subsection (a) of this section." The DAQ's first maintenance plan for the Charlotte-Gastonia-Salisbury Maintenance Area is set to cover through August 2025. This additional SIP revision will ensure the continued maintenance of the 2008 ozone NAAQS in the Maintenance Area through August 2035.

The contingency provisions contained in this second 10-year maintenance plan, as outlined in Section 3.5, Contingency Plan, assure that the DAQ will promptly correct any violation of the NAAQS in the Maintenance Area through the final year of 2035, as required by Section 175(A)(d) of the CAA. The DAQ will evaluate future federal, state, and local NOx and VOC control measures, including those identified in Section 3.5.2, to implement to determine their effectiveness for bringing the area back into attainment and assure maintenance going forward. If needed, the DAQ will proceed with rulemaking to implement the most effective measure(s) for controlling ozone levels and submit the final rule to EPA for adoption into the North Carolina SIP.

Monitoring is one of the requirements of CAA Section 110. The DAQ commits to continue operating the current ozone monitors in the North Carolina portion of the Charlotte 2008 8-hour ozone nonattainment area, providing sufficient funding is available for continued operation. The current Annual Network Plan and 5-Year Network Assessment for 2020 to 2025 can be found on the DAQ webpage, https://www.deq.nc.gov/about/divisions/air-quality/air-quality-monitoring/annual-network-plan. Known potential monitor shutdowns or relocations are noted in these documents and will only be made with the approval of EPA. No plans are underway that will affect the integrity of the ambient monitoring network in place. The current monitors are operated consistent with 40 CFR Part 58 and no changes will be made that are inconsistent with 40 CFR Part 58.

7.0 SUMMARY AND CONCLUSION RELATED TO THIS REVISION TO THE MAINTENANCE PLAN

The most recent three years (2021-2023) of certified ozone monitoring data for the Charlotte maintenance area demonstrate continuing compliance with the 2008 8-hour ozone NAAQS. Since the 1990's, there have been many major emissions control programs implemented in North Carolina that have led to significant actual, enforceable emissions reductions that have significantly improved the air quality in the maintenance area. In addition, the maintenance plan demonstrates that the projected total emissions for the final year of the maintenance plan (2035) and the interim year (2026) are less than the 2018 base year total emissions. This second 10-year maintenance plan demonstrates that maintenance of the 2008 8-hour ozone NAAQS has been achieved for the Charlotte area and will continue through the second 10-year period.

This maintenance plan has been prepared to meet the requirements of the 1990 CAA Amendments.

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Final

Appendix A

Onroad Mobile Source

Emissions Inventory Documentation

Second Ten-Year Maintenance Plan for the Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)

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1.0 INTRODUCTION AND SCOPE

This appendix documents the development of emissions inventories and motor vehicle emissions budgets (MVEBs) for the second ten-year maintenance plan for the Charlotte-Gastonia-Salisbury 2008 8-hour ozone marginal nonattainment area (hereinafter referred to as the "Charlotte area"). To compile the inventories, estimates of summer day emissions of the ozone precursor pollutants oxides of nitrogen (NOx) and volatile organic compounds (VOC) from onroad mobile sources were modeled for the seven full and partial counties in the Charlotte area for each of three specific years. The onroad mobile source inventories include emissions from all motor vehicles that are licensed to use public roads. Onroad mobile sources include passenger vehicles, motorcycles, and various classes of trucks and buses categorized according to vehicle weight and drive cycle characteristics. The NOx and VOC MVEBs for each of three budget areas within the Charlotte area were then developed based on the emissions inventories.

2.0 OVERALL METHODOLOGY

2.1 INTERAGENCY CONSULTATION

Interagency consultation meetings with all involved transportation partners, coordinated by the North Carolina Division of Air Quality (DAQ), were held to develop the emissions inventory development project plan and schedule. The primary transportation partners involved in the Charlotte area redesignation interagency consultation process included the North Carolina Department of Transportation (NCDOT), EPA, the Federal Highway Administration (FHWA), the Charlotte Regional Transportation Planning Organization (CRTPO), the Cabarrus-Rowan Metropolitan Planning Organization (CRMPO), the Gaston-Cleveland-Lincoln Metropolitan Planning Organization (GCLMPO), the Rocky River Rural Planning Organization (RRRPO), and the Charlotte Department of Transportation (CDOT). CDOT agreed to provide vehicle miles traveled (VMT), average speed, and human population data for the Charlotte area counties, generated from travel demand modeling (TDM) using the latest version of the Metrolina Regional Model. All planning organizations coordinated with CDOT to ensure that all planned transportation projects were accurately represented in the TDM modeling. The NCDOT also provided vehicle registration data and vehicle mix data for all Charlotte area counties.

2.2 EMISSIONS INVENTORY YEARS

Onroad mobile source emissions inventories were developed for 2018 (the maintenance plan base year), 2026 (an interim year representing the last year of the first ten-year maintenance plan), and 2035 (the final year of the second maintenance plan). MVEBs were developed for 2018 and 2035. Each inventory represents the estimated emissions for a typical summer day, specifically a July weekday.

2.3 MOTOR VEHICLE EMISSIONS BUDGET AREAS

MVEBs were developed for three subareas consistent with the jurisdictional boundaries of the metropolitan planning organizations and the rural planning organizations (MPOs/RPOs) as

shown in the Table A-1. These budget area boundaries are unchanged from the first ten-year maintenance plan.

Table A-1. Motor Vehicle Emissions Budget Area Boundaries

MPO/RPO	County Areas Included
CRTPO/RRRPO	Iredell*, Mecklenburg, Union*
GCLMPO	Gaston*, Lincoln*
CRMPO	Cabarrus*, Rowan*

* Includes only the maintenance area portions of the county.

3.0 EMISSIONS INVENTORY DEVELOPMENT

The EPA MOtor Vehicle Emissions Simulator (MOVES) model was used to develop inventories of NOx and VOC emissions from onroad mobile sources for each county and year. Model input data was compiled from multiple sources and aggregated and formatted as required for the model. The appropriate MOVES modeling parameters were also selected based on EPA guidance for inventory development. To model partial counties, county-level input data such as source type population was scaled to partial county levels based on the fraction of total county human population within the partial county area. This allowed modeling of partial counties using the "County Scale" Domain/Scale setting. A full list of the MOVES modeling parameter selections used is shown in Table A-2.

Table A-2. MOVES Modeling Parameters

MOVES Model Version	MOVES4.0.1
Pollutants	NOx, VOC
Modeled Spatial Domains	Whole county – Mecklenburg County Partial counties, including only the area within the Charlotte maintenance area – Cabarrus, Gaston, Iredell, Lincoln, Rowan, and Union Counties
Temporal Emissions Time Period – Ozone Season Day	Typical summer weekday (July weekday)
MOVES Domain/Scale	County Scale
MOVES Calculation Type	Inventory mode
Vehicle Types	All onroad vehicles
Road Types	All road types
Inspection and Maintenance Program Applicability	2018 – All counties as per the North Carolina Inspection and Maintenance SIP, effective for July 2018 2026, 2035 – No emissions I&M

3.1 EMISSIONS MODELING APPROACH

Mobile source emissions were estimated by the methodologies suggested in the following U.S. Environmental Protection Agency (EPA) guidance documents: *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations* (EPA-454-B-17-002, May 2017); *MOVES4 Policy Guidance: Use of MOVES for State Implementation Plan Development, Transportation Conformity, General Conformity and Other Purposes* (August 2023, EPA-420-B-23-009); and *MOVES4 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity* (August 2023, EPA-420-B-23-011).

The EPA guidance requires the use of the latest approved mobile source emissions model. The North Carolina Division of Air Quality (DAQ) used MOVES4.0.1, which was the latest available version of the model at the time the modeling was performed. The guidance also recommends using local input data in lieu of the MOVES4.0.1 default data to represent local vehicle fleet and emissions characteristics more accurately. The DAQ used local data wherever possible as described in Section 3.2.

3.2 MOVES INPUT DATA

All input data for MOVES modeling was first compiled into county-level MariaDB databases which include separate tables for each type of input data needed. Output data from MOVES modeling runs were also created as MariaDB databases. Due to their size and complexity, the MOVES input and output database files are provided electronically.

3.2.1 VMT DATA

County-level and partial county-level VMT input data were developed based on the latest TDM completed by CDOT. CDOT provided daily VMT results from the MRM22v2.0 version of the Metrolina Regional Model (MRM), dated December 19, 2022. The MRM22v2.0 results included VMT and average speed by roadway functional class and by the four daily travel periods shown in Table A-3.

Table A-3. Metrolina Regional Model Travel Periods

Travel Period	Start Time	Duration
AM Peak	6:00 AM – 9:00AM	3 hours
Midday	9:00 AM – 3:00PM	6 hours
PM Peak	3:00 PM - 6:00 PM	3 hours
Night	6:00 PM - 6:00 AM	12 hours

3.2.2 VEHICLE ACTIVITY BY ROAD TYPE

Vehicle activity by functional classification (road type) data are used to calculate the distribution of vehicle miles traveled (VMT) by vehicle type and by road type. The NCDOT compiles these data annually on a statewide basis, based on traffic survey and Highway Performance Management System (HPMS) data collected throughout the year. Table A-4 shows the vehicle activity summary by functional classification for 2022, the latest year available. The data are provided as the fractional distribution of VMT by vehicle type on each of 12 Federal Highway Administration (FHWA) road types. Table A-5 shows the data aggregated by HPMS functional system group and HPMS vehicle class group. Data from Table A-4 were used to develop factors for allocating VMT to the appropriate road types and HPMS vehicle types. The allocation factors were then applied to the county-level TDM VMT data to create MOVES VMT input files.

3.2.3 ONROAD SPEEDS

Emissions modeling using MOVES requires vehicle speed input data formatted as fractions of vehicle hours traveled (VHT) in each of sixteen speed ranges, called “speed bins”, for each combination of clock hour/day type (weekday or weekend day), vehicle type, and road type. Speed Bin 1 represents speeds from 0 to 2.5 miles per hour (mph), and Speed Bin 16 represents speeds of 72.5 mph and greater. Speed Bins 2 through 15 each represent 5 mph speed ranges between 2.5 mph and 72.5 mph. The fractions for each combination of vehicle type, road type, and hour/day type sum to one. The DAQ used spreadsheet-based data converters developed by the EPA to process the TDM speed data into the required format.

Table A-4. North Carolina Vehicle Activity Summary by Functional Classification - 2022

FC Code	Functional Classification	Samples	MC	Cars	2A4T	Bus	2ASU	3ASU	4ASU	4AST	5AST	6AST	5AMT	6AMT	7AMT
1	Rural Principal Arterial – Interstate	62	0.0039	0.6876	0.1500	0.0058	0.0216	0.0061	0.0001	0.0111	0.1085	0.0013	0.0026	0.0012	0.0001
2	Rural Principal Arterial – Other	459	0.0040	0.6682	0.2292	0.0071	0.0283	0.0074	0.0012	0.0124	0.0392	0.0018	0.0007	0.0003	0.0003
6	Rural Minor Arterial	513	0.0043	0.6710	0.2474	0.0062	0.0275	0.0063	0.0011	0.0094	0.0254	0.0012	0.0000	0.0000	0.0002
7	Rural Major Collector	750	0.0058	0.6431	0.2680	0.0068	0.0287	0.0072	0.0010	0.0097	0.0284	0.0011	0.0000	0.0000	0.0001
8	Rural Minor Collector	25	0.0155	0.6270	0.2758	0.0063	0.0295	0.0075	0.0004	0.0070	0.0285	0.0018	0.0000	0.0000	0.0008
9	Rural Local System	41	0.0089	0.6651	0.2318	0.0147	0.0469	0.0113	0.0011	0.0082	0.0107	0.0011	0.0000	0.0000	0.0002
11	Urban Principal Arterial – Interstate	127	0.0043	0.7490	0.1553	0.0048	0.0180	0.0057	0.0000	0.0049	0.0559	0.0006	0.0010	0.0004	0.0000
12	Urban Principal Arterial - Other Freeways or Expressways	125	0.0053	0.7256	0.1945	0.0054	0.0205	0.0064	0.0007	0.0078	0.0319	0.0010	0.0005	0.0002	0.0001
14	Urban Principal Arterial - Other	640	0.0048	0.7545	0.1874	0.0058	0.0211	0.0058	0.0009	0.0054	0.0124	0.0014	0.0002	0.0001	0.0003
16	Urban Minor Arterial	380	0.0047	0.7438	0.2047	0.0048	0.0211	0.0054	0.0009	0.0048	0.0085	0.0009	0.0001	0.0001	0.0002
17	Urban Collector	76	0.0040	0.7401	0.2080	0.0048	0.0225	0.0059	0.0005	0.0049	0.0084	0.0008	0.0000	0.0000	0.0002
19	Urban Local System	22	0.0087	0.7325	0.1872	0.0168	0.0313	0.0083	0.0003	0.0049	0.0084	0.0010	0.0004	0.0001	0.0001

*MC - motorcycles
Cars – passenger cars
2A4T – trucks with two axles, 4 tires
Bus – intercity, transit, and school buses
2ASU – two-axle single unit trucks
2ASU – three-axle single unit trucks
4ASU – four-axle single unit trucks
4AST – four-axle single trailer truck
5AST – five-axle single trailer truck
6AST – six-axle single trailer truck
5MST – five-axle multi-trailer truck
6AMT – six-axle multi-trailer truck
7AMT – seven-axle multi-trailer truck

Table A-5. 2022 HPMS Travel Activity by Vehicle Type by HPMS Functional System Group and HPMS Vehicle Class Group

FS Group	Functional System*	MC	Cars	2A4T	Buses	SU Trucks*	CU Trucks*
1	Rural Interstate	0.39%	68.77%	15.00%	0.58%	2.78%	12.48%
2	Rural Other Arterial	0.42%	66.97%	23.88%	0.67%	3.58%	4.48%
3	Rural Other	0.63%	64.37%	26.64%	0.72%	3.81%	3.83%
4	Urban Interstate	0.43%	74.90%	15.53%	0.48%	2.37%	6.29%
5	Urban Other Arterial	0.48%	74.79%	19.39%	0.54%	2.76%	2.04%
6	Urban Other	0.50%	73.85%	20.33%	0.75%	3.13%	1.44%

* Other Arterial includes Rural FC 2 & 6, Urban FC 14 & 16
Other includes Rural FC 7, 8, & 9, Urban FC 17 & 19
SU Trucks includes 2ASU, 3ASU, and 4ASU
CU Trucks includes 4AST, 5AST, 6AST, 5AMT, 6AMT, and 7AMT

3.2.4 SOURCE TYPE POPULATION

Source type (i.e., vehicle type) population data are used within MOVES to calculate off-network emissions, which include exhaust emissions from vehicle starts and evaporative emissions from parked vehicles. Off-network emissions are based on both the number and type of vehicles in the modeling domain. MOVES source type population input data consists of the number of each of 13 types of vehicles within the modeling domain. Descriptions of the categories, which are subsets of the six HPMS vehicle classes, are shown in Table A-6. The DAQ developed source type population input tables from 2023 statewide registration data obtained from the North Carolina Department of Transportation (NCDOT). The data included vehicle model year, make, body style, vehicle identification number (VIN), fuel type, county where registered, and other identifying information as described in the NCDOT *Title and Registration Manual* (15th Edition, Revised January 2023). Additional information for individual vehicles was obtained by decoding VINs using the vPIC Application Programming Interface (API) provided by the National Highway Traffic Safety Administration (NHTSA).[1] Each vehicle was assigned a MOVES source type ID value based on its registration and VIN decoding data, and a vehicle age ID based on its model year. To calculate partial county source type population, the county-level data were scaled down to the partial county area based on the fraction of total county human population within the partial county area. Total and partial county human population data were provided by CDOT.

[1] NHTSA Product Information Catalog Vehicle Listing (vPIC) Application Programming Interface (API), https://vpic.nhtsa.dot.gov/api/

Table A-6. MOVES Source Types and HPMS Vehicle Types

Source Type ID	Source Types used in MOVES	HPMS Vtype ID	HPMS Vehicle Class
11	Motorcycle	10	Motorcycles
21	Passenger Car	25	Light Duty Vehicles
31	Passenger Truck	25	Light Duty Vehicles
32	Light Commercial Truck	25	Light Duty Vehicles
41	Intercity Bus	40	Buses
42	Transit Bus	40	Buses
43	School Bus	40	Buses
51	Refuse Truck	50	Single Unit Trucks
52	Single Unit Short-haul Truck	50	Single Unit Trucks
53	Single Unit Long-haul Truck	50	Single Unit Trucks
54	Motor Home	50	Single Unit Trucks
61	Combination Short-haul Truck	60	Combination Trucks
62	Combination Long-haul Truck	60	Combination Trucks

3.2.5 SOURCE TYPE AGE DISTRIBUTION

The 2023 county-level source type age distribution input files were then generated from the source type population data based on the source type ID and age ID values. Age distributions were then projected to appropriate future modeling year using the Age Distribution Projection Tool for MOVES4, provided by USEPA.

3.2.6 VEHICLE/EQUIPMENT: ONROAD VEHICLE EQUIPMENT

As per EPA guidance for state implementation plans and regional conformity analyses (see Section 3.1), the DAQ selected the appropriate fuel and vehicle type combinations that reflect the full range of vehicles that will operate in each county. All valid diesel, gasoline, CNG, ethanol, and electric vehicle and fuel combinations were selected.

3.2.7 ROAD TYPE

The MOVES model defines five different road types to categorize the roadways used in a particular MOVES modeling run. The five road types are:

- Off-Network (road type 1) – all locations where the predominant activities are vehicle starts, parking and idling (parking lots, truck stops, rest areas, freight or bus terminals).
- Rural Restricted Access (2) – rural highways that can only be accessed by an on-ramp.
- Rural Unrestricted Access (3) – all other rural roads (arterials, connectors, and local streets).
- Urban Restricted Access (4) – urban highways or freeways that can only be accessed by an on-ramp.
- Urban Unrestricted Access (5) – all other urban roads (arterials, connectors, and local streets).

The DAQ included all five road types in each modeling run as per EPA guidance. Including the Off-Network Road type was necessary to account for emissions from vehicle starts, extended idle activity, and VOC emissions from evaporative processes.

3.2.8 POLLUTANTS AND PROCESSES

Onroad mobile source emissions of NOx and VOC for a typical summer day, specifically a July weekday, were modeled for each year. The modeling results included emissions from all vehicular processes that generate NOx or VOC, such as running exhaust, start exhaust, and evaporative processes.

3.2.9 FUEL SUPPLY, FORMULATION, AND USAGE DATA

MOVES default fuel supply and fuel formulation data are categorized by fuel region ID – counties with the same fuel region ID have the same fuel supply and formulation for a given year. The state of North Carolina is covered by a single fuel region ID (100000000) for all counties. The default fuel supply and fuel formulations for fuel region ID 100000000 were used for all model runs. The MOVES default AVFT (fuel Type/vehicle technology) data and MOVES default county-specific fuel usage fractions were also used.

3.2.10 TEMPERATURE AND RELATIVE HUMIDITY DATA

Local temperature and humidity data are required inputs for the MOVES model. The 2023 average monthly 24-hour temperature and humidity profiles, based on data from the Automated Surface Observing System (ASOS) station KCLT at Charlotte / Douglas International Airport were used to best represent the meteorological conditions for each Charlote area county. The data were provided by the State Climate Office of North Carolina (http://www.nc-climate.ncsu.edu) and are included in each MOVES input database.

3.2.11 VEHICLE INSPECTION AND MAINTENANCE PROGRAM PARAMETERS

In 2002, North Carolina implemented a new vehicle emissions I&M program based on vehicle onboard diagnostics (OBDII), covering light-duty gasoline vehicles with a gross vehicle weight rating (GVWR) of less than 8,501 pounds. The program was initially implemented in 9 counties and was expanded to include a total of 48 counties between July 2002 and January 2006. Program coverage was subsequently reduced to 22 counties, and then to 19 counties, and is planned to be reduced to one county (Mecklenburg) by around 2026. Based on consultation with EPA, it was decided to omit I&M from emissions for all Charlotte area counties after 2018, due to the complexity of modeling an I&M program in a single county within the maintenance area.

All 2018 MOVES modeling runs were executed with the appropriate I&M program parameters to properly account for the emissions reductions resulting from implementation of the program. Within the MOVES model, the magnitude of the reductions is scaled by the I&M compliance factor parameters, which are calculated based on I&M program compliance rates and waiver rates. Also, the MOVES model allows for the exemption of specified model years of vehicles from the I&M program coverage. This is typically applied to the newest vehicles in the fleet. Table A-7 lists the applicable I&M program parameters used for all 2018 MOVES modeling runs.

Table A-7. Inspection and Maintenance Program Parameters

I&M Parameter	Parameter Value
Model Years Covered	20 latest model years
Compliance Rate	96%
Waiver Rate	5%
Number of Latest Model Years Exempted	3

4.0 EMISSIONS INVENTORIES AND MVEBS

4.1 ESTIMATED EMISSIONS FROM ONROAD MOBILE SOURCES

Tables A-8 and A-9 summarize the onroad mobile source NO_x and VOC emissions modeling results for the Charlotte area.

Table A-8. Onroad Mobile Source NOx Emissions by County

County	2018	2026	2035	2018	2026	2035
	kg/day			tons/day		
Cabarrus*	5,094	2,708	1,208	5.62	2.98	1.33
Gaston*	6,096	2,823	969	6.72	3.11	1.07
Iredell*	2,901	1,391	531	3.20	1.53	0.59
Lincoln*	2,295	1,124	406	2.53	1.24	0.45
Mecklenburg	26,436	14,198	7,301	29.14	15.65	8.05
Rowan*	4,514	2,083	711	4.98	2.30	0.78
Union*	4,430	2,403	1,073	4.88	2.65	1.18
Area Total	**51,766**	**26,729**	**12,199**	**57.07**	**29.46**	**13.45**

*Emissions are for the portion of the county in the maintenance area

Table A-9. Onroad Mobile Source VOC Emissions by County

County	2018	2026	2035	2018	2026	2035
	kg/day			tons/day		
Cabarrus*	2,829	2,060	1,642	3.12	2.27	1.81
Gaston*	3,302	2,010	1,262	3.64	2.22	1.39
Iredell*	1,561	997	644	1.72	1.10	0.71
Lincoln*	1,364	870	562	1.50	0.96	0.62
Mecklenburg	12,581	9,079	7,871	13.87	10.01	8.68
Rowan*	2,627	1,580	934	2.90	1.74	1.03
Union*	2,620	1,943	1,488	2.89	2.14	1.64
Area Total	**26,884**	**18,539**	**14,403**	**29.64**	**20.44**	**15.88**

*Emissions are for the portion of the county in the maintenance area.

4.2 MOTOR VEHICLE EMISSIONS BUDGETS FOR CONFORMITY

Transportation Conformity

The purpose of the transportation conformity process is to ensure that federal transportation actions occurring in nonattainment or maintenance areas do not interfere with achieving or maintaining compliance with any of the NAAQS. For the Charlotte-Gastonia-Salisbury, North Carolina 2008 8-Hour Ozone Marginal Maintenance Area, transportation conformity must be demonstrated for emissions of the ozone precursors NOx and VOC related to all federally funded roadway projects. Specifically, estimates of future emissions, including any increases related to completed roadway projects, must not exceed the MVEBs as defined in this maintenance plan.

Safety Margin

A safety margin is the difference between the attainment level of emissions from all source categories (i.e., point, area, nonroad mobile and onroad mobile) and the projected level of emissions from all source categories. The State may choose to allocate some of the safety margin to the MVEBs, for transportation conformity purposes, so long as the total level of emissions from all source categories remains below the attainment level of emissions for 2018. DAQ management agreed to allocate 50% of the total NOx safety margin emissions and 100% of the total VOC safety margin emissions to the 2035 MVEBs to allow for unanticipated growth in VMT, changes to vehicle mix assumptions and model uncertainty that will influence the emission estimations. The DAQ has developed and implemented a five-step approach for determining the amount of safety margin to apply to the MVEBs.

Step 1 - Percentage below the standard

- All counties were allocated safety margin equivalent to 2% of their emissions for both the NOx and VOC MVEBs for 2035

Step 2 - Account for unanticipated model input data changes

- For NOx, all counties were allocated safety margin equivalent to 100% of their emissions for the 2035 MVEB.
- For VOC, all counties were allocated safety margin equivalent to 10.9% of their emissions for the 2035 MVEB.

Step 3 - Provide flexibility and account for rapid growth for counties that are determined to be medium to small contributors to the onroad mobile NOx and VOC emissions inventories

- Counties with <8% of maintenance area onroad mobile source NOx emissions were allocated additional safety margin equivalent to 5% of their emissions for the 2035 MVEBs (Gaston, Iredell, Lincoln, and Rowan)
- Counties with <8% of maintenance area onroad mobile source VOC emissions were allocated additional safety margin equivalent to 5% of their emissions for the 2035 MVEBs (Iredell, Lincoln, and Rowan)
- Counties with 8% to 25% of maintenance area onroad mobile source NOx emissions were allocated additional safety margin equivalent to 3% of their emissions for the 2035 MVEBs (Cabarrus and Union)

- Counties with 8% to 25% of maintenance area onroad mobile source VOC emissions were allocated additional safety margin equivalent to 3% of their emissions for the 2035 MVEBs (Cabarrus, Gaston, and Union)

Step 4 - Account for input uncertainty in final year of the maintenance plan to account for potential changes in VMT, vehicle mix and vehicle age distribution:

- For NOx, all counties were allocated safety margin equivalent to 81.68% of their emissions for the NOx MVEBs for 2035
- For VOC all counties were allocated safety margin equivalent to 10% of their emissions for the VOC MVEBs for 2035
- Cabarrus and Rowan Counties each were allocated additional safety margin equivalent to 5% of their emissions for both the 2035 NOx and VOC MVEBs to account for projected high growth rates in the CRMPO jurisdiction.

Step 5 - Ensure the sum of the safety margins applied to the MVEBs equals the allocation targets agreed to by DAQ management. For 2035, Steps 1-4 accounted for:

- 50.0% of the total NOx safety margin allocated
- 100.0% of the total VOC safety margin allocated

Table A-10 summarizes the percent increase to the MVEB for purposes of transportation conformity for each county in the Charlotte area.

Table A-10. Percent Increase to Mobile Vehicle Emissions Budgets

County	2035 NOx	2035 VOC
Cabarrus	192%	31%
Gaston	189%	26%
Iredell	189%	28%
Lincoln	189%	28%
Mecklenburg	184%	23%
Rowan	194%	33%
Union	187%	26%

Motor Vehicle Emissions Budgets

The DAQ established 2018 and 2035 MVEBs for transportation conformity purposes based on the jurisdictional boundaries of the MPOs and/or RPOs within the Charlotte maintenance area. Tables A-11 through A-13 list the NOx and VOC MVEBs. Upon EPA's approval of the maintenance plan, these MVEBs will become the applicable MVEBs for each budget area.

Table A-11. Cabarrus-Rowan MPO MVEB*

	2018		2035	
	NOx (kg/day)	VOC (kg/day)	NOx (kg/day)	VOC (kg/day)
Base Emissions	9,608	5,456	1,919	2,576
Safety Margin Allocated to MVEB	-	-	3,693	815
Conformity MVEB	**9,608**	**5,456**	**5,612**	**3,391**

*Includes the portions of Cabarrus and Rowan Counties in the maintenance area.

Table A-12. Gaston-Cleveland-Lincoln MPO MVEB*

	2018		2035	
	NOx (kg/day)	VOC (kg/day)	NOx (kg/day)	VOC (kg/day)
Base Emissions	8,391	4,667	1,375	1,824
Safety Margin Allocated to MVEB	-	-	2,593	483
Conformity MVEB	**8,391**	**4,667**	**3,968**	**2,307**

* Includes the portions of Gaston and Lincoln Counties in the maintenance area.

Table A-13. Charlotte Regional TPO – Rocky River RPO MVEB*

	2018		2035	
	NOx (kg/day)	VOC (kg/day)	NOx (kg/day)	VOC (kg/day)
Base Emissions	33,767	16,762	8,905	10,003
Safety Margin Allocated to MVEB	-	-	16,416	2,367
Conformity MVEB	**33,767**	**16,762**	**25,321**	**12,370**

*Includes all of Mecklenburg County and the portions of Iredell and Union Counties in the maintenance area.

5.0 QUALITY ASSURANCE MEASURES

The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan, were applied to ensure the data meet specific data indicator goals and objectives. All raw data used to generate MOVES model inputs, such as speed and VMT values, were checked for reasonableness against historical data from the same data category and geographic area (county or state). All manual data entries were checked by a second party. All automated calculations and data processing operations performed by spreadsheet macros and database queries were validated by comparison to hand calculated results. All MOVES input file development and quality assurance activities were logged in a project design spreadsheet.

6.0 MOVES MODELING DATA FILES

Due to their size, format, and complexity, all MOVES data files were provided in electronic format. Three types of files are included:

- MOVES run specification (RunSpec) files – flat text files named in the format <ProjectName>_onroad_c<FIPS>y<YYYY>_<VMT>_<I&M>.mrs
- MOVES input databases – compressed archives of MOVES MariaDB input databases with file names in the format <ProjectName>_onroad_c<FIPS>y<YYYY>_<I&M>_cdb.zip
- MOVES output databases – compressed archives of MOVES MariaDB output databases with file names in the format < <ProjectName>_onroad_c<FIPS>y<YYYY>_<VMT>_<I&M>_out.zip

The file name < ProjectName>_onroad_c<FIPS>y<YYYY>_<I&M> describes the project, county, year modeled, VMT data source, and I&M parameters used for the MOVES model run as follows:

- <ProjectName> – name used internally to identify the MOVES modeling project.
- onroad – used to differentiate MOVES onroad and nonroad data files.
- <FIPS> - the 5-digit state-county Federal Information Processing Standard (FIPS) number for the county modeled.
- <YYYY> – calendar year modeled.
- <VMT> – indicates the source of VMT data (HPMS for Highway Performance Monitoring System, TDM for travel demand modeling).
- <I&M> – the I&M compliance rate, waiver rate, and number of latest model years exempted, or if no I&M program is modeled.

For example, "metrolina2ndmp_onroad_c37025y2018_tdm_9653_20my" specifies a MOVES onroad model run within the project labelled "metrolina2ndmp" for Cabarrus County, NC (FIPS 37025) and CY 2018, with TDM VMT data, with 96% I&M compliance rate, 5% waiver rate, and the 3 latest model year vehicles exempted from I&M requirements, and with I&M coverage of the 20 latest model year vehicles. Similarly, a file with the name "metrolina2ndmp_onroad_c37119y2035_TDM_NOIM" specifies a model run for Mecklenburg County, NC (FIPS 37119) for 2035 with TDM-based VMT data and with no I&M requirements. Table A-14 lists the files provided.

The CDOT TDM VMT and speed data and human population data files are also provided electronically, along with a copy of the email message documenting transmission of the data to DAQ.

Table A-14. MOVES Modeling Files Provided

County	Modeling Scenario	File Type	File Name
Cabarrus	2018	Run Spec File	metrolina2ndmp_onroad_c37025y2018_TDM_9653_20MY.mrs
		MOVES Input	metrolina2ndmp_onroad_c37025y2018_TDM_9653_20MY_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37025y2018_TDM_9653_20MY_out.zip
Cabarrus	2026	Run Spec File	metrolina2ndmp_onroad_c37025y2026_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37025y2026_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37025y2026_TDM_NOIM_out.zip
Cabarrus	2035	Run Spec File	metrolina2ndmp_onroad_c37025y2035_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37025y2035_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37025y2035_TDM_NOIM_out.zip
Gaston	2018	Run Spec File	metrolina2ndmp_onroad_c37071y2018_TDM_9653_20MY.mrs
		MOVES Input	metrolina2ndmp_onroad_c37071y2018_TDM_9653_20MY_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37071y2018_TDM_9653_20MY_out.zip
Gaston	2026	Run Spec File	metrolina2ndmp_onroad_c37071y2026_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37071y2026_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37071y2026_TDM_NOIM_out.zip
Gaston	2035	Run Spec File	metrolina2ndmp_onroad_c37071y2035_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37071y2035_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37071y2035_TDM_NOIM_out.zip
Iredell	2018	Run Spec File	metrolina2ndmp_onroad_c37097y2018_TDM_9653_20MY.mrs
		MOVES Input	metrolina2ndmp_onroad_c37097y2018_TDM_9653_20MY_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37097y2018_TDM_9653_20MY_out.zip
Iredell	2026	Run Spec File	metrolina2ndmp_onroad_c37097y2026_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37097y2026_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37097y2026_TDM_NOIM_out.zip
Iredell	2035	Run Spec File	metrolina2ndmp_onroad_c37097y2035_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37097y2035_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37097y2035_TDM_NOIM_out.zip
Lincoln	2018	Run Spec File	metrolina2ndmp_onroad_c37109y2018_TDM_9653_20MY.mrs
		MOVES Input	metrolina2ndmp_onroad_c37109y2018_TDM_9653_20MY_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37109y2018_TDM_9653_20MY_out.zip
Lincoln	2026	Run Spec File	metrolina2ndmp_onroad_c37109y2026_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37109y2026_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37109y2026_TDM_NOIM_out.zip
Lincoln	2035	Run Spec File	metrolina2ndmp_onroad_c37109y2035_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37109y2035_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37109y2035_TDM_NOIM_out.zip
Mecklenburg	2018	Run Spec File	metrolina2ndmp_onroad_c37119y2018_TDM_9653_20MY.mrs
		MOVES Input	metrolina2ndmp_onroad_c37119y2018_TDM_9653_20MY_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37119y2018_TDM_9653_20MY_out.zip
Mecklenburg	2026	Run Spec File	metrolina2ndmp_onroad_c37119y2026_TDM_NOIM.mrs

County	Modeling Scenario	File Type	File Name
		MOVES Input	metrolina2ndmp_onroad_c37119y2026_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37119y2026_TDM_NOIM_out.zip
Mecklenburg	2035	Run Spec File	metrolina2ndmp_onroad_c37119y2035_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37119y2035_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37119y2035_TDM_NOIM_out.zip
Rowan	2018	Run Spec File	metrolina2ndmp_onroad_c37159y2018_TDM_9653_20MY.mrs
		MOVES Input	metrolina2ndmp_onroad_c37159y2018_TDM_9653_20MY_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37159y2018_TDM_9653_20MY_out.zip
Rowan	2026	Run Spec File	metrolina2ndmp_onroad_c37159y2026_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37159y2026_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37159y2026_TDM_NOIM_out.zip
Rowan	2035	Run Spec File	metrolina2ndmp_onroad_c37159y2035_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37159y2035_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37159y2035_TDM_NOIM_out.zip
Union	2018	Run Spec File	metrolina2ndmp_onroad_c37179y2018_TDM_9653_20MY.mrs
		MOVES Input	metrolina2ndmp_onroad_c37179y2018_TDM_9653_20MY_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37179y2018_TDM_9653_20MY_out.zip
Union	2026	Run Spec File	metrolina2ndmp_onroad_c37179y2026_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37179y2026_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37179y2026_TDM_NOIM_out.zip
Union	2035	Run Spec File	metrolina2ndmp_onroad_c37179y2035_TDM_NOIM.mrs
		MOVES Input	metrolina2ndmp_onroad_c37179y2035_TDM_NOIM_cdb.zip
		MOVES Output	metrolina2ndmp_onroad_c37179y2035_TDM_NOIM_out.zip
All Counties	All Years	TDM Data	MRM22v2.0_2050MTP_VMT & Speeds_221219.xlsx
		Human Population Data	Human Population_MRM22v2.0.xlsx
		Transmittal email	Email_from_Anna_Gallup_CDOT_20221219_MRM22v2.0_Data.pdf

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Final

Appendix B

Nonroad Mobile Source Emissions Inventory Documentation

Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)

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1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop ozone season day emission estimates for nitrogen oxides (NOx) and volatile organic compounds (VOC) associated with nonroad mobile sources in year 2018, 2026, and 2035. The nonroad mobile source inventory contains emissions from mobile vehicles and equipment not licensed for use on public roadways. Nonroad mobile source equipment covers a diverse set of items including lawn mowers, chain saws, tractors, all-terrain vehicles, forklifts, and construction equipment. Freight and passenger railroads and commercial marine vessels (CMV) are the types of vehicles included in the nonroad mobile source category. Aircraft emissions, traditionally a nonroad category, are reported as point sources (see Appendix C) in keeping with the United States Environmental Protection Agency (EPA)'s practice for the National Emissions Inventory (NEI) where they are reported as part of the emission sources at the airport facility.

2.0 SUMMARY OF EMISSIONS

For 2018, Table B-1 displays total nonroad mobile source typical summer day NOx and VOC emissions by county. Note that "0.000" indicates that emissions are less than this value while "-" indicates that the source category does not exist in the county.

Table B-1. Nonroad Mobile Source NOx and VOC Emissions for 2018 (tons/summer day)

	Nonroad Model Categories		Freight and Passenger Railways		Class 1 & 2 Commercial Marine Vessels		Class 3 Commercial Marine Vessels		Totals	
County	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**
Cabarrus*	1.081	1.163	0.458	0.020	-	-	-	-	1.539	1.183
Gaston*	0.937	1.048	0.345	0.015	-	-	-	-	1.282	1.063
Iredell*	0.554	0.432	0.055	0.002	-	-	-	-	0.609	0.434
Lincoln*	0.378	0.416	0.031	0.001	-	-	-	-	0.409	0.417
Mecklenburg	8.177	10.444	0.710	0.031	-	-	-	-	8.887	10.475
Rowan*	0.732	0.792	0.732	0.032	-	-	-	-	1.464	0.824
Union*	1.875	1.886	0.385	0.017	-	-	-	-	2.260	1.903
Totals	**13.734**	**16.181**	**2.717**	**0.119**	-	-	-	-	**16.451**	**16.300**

* Emissions for portion of county included in maintenance area.

For 2026, Table B-2 displays total nonroad mobile source typical summer day NOx and VOC emissions by county. Note that "0.000" indicates that emissions are less than this value while "-" indicates that the source category does not exist in the county.

Table B-2. Nonroad Mobile Source NOx and VOC Emissions for 2026 (tons/summer day)

	Nonroad Model Categories		Freight and Passenger Railways		Class 1 & 2 Commercial Marine Vessels		Class 3 Commercial Marine Vessels		Totals	
County	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**
Cabarrus*	0.769	1.179	0.392	0.016	-	-	-	-	1.161	1.195
Gaston*	0.750	1.044	0.292	0.012	-	-	-	-	1.042	1.056
Iredell*	0.402	0.400	0.047	0.002	-	-	-	-	0.449	0.402
Lincoln*	0.286	0.393	0.025	0.001	-	-	-	-	0.311	0.394
Mecklenburg	5.753	10.599	0.597	0.025	-	-	-	-	6.350	10.624
Rowan*	0.568	0.725	0.612	0.025	-	-	-	-	1.180	0.750
Union*	1.279	1.920	0.317	0.013	-	-	-	-	1.596	1.933
Totals	**9.807**	**16.260**	**2.282**	**0.093**	-	-	-	-	**12.089**	**16.353**

* Emissions for portion of county included in maintenance area.

For 2035, Table B-3 displays total nonroad mobile source typical ozone season day NOx and VOC emissions by county. Note that "0.000" indicates that emissions are less than this value while "-" indicates that the source category does not exist in the county.

Table B-3. Nonroad Mobile Source NOx and VOC Emissions for 2035 (tons/summer day)

	Nonroad Model Categories		Freight and Passenger Railways		Class 1 & 2 Commercial Marine Vessels		Class 3 Commercial Marine Vessels		Totals	
County	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**
Cabarrus*	0.768	1.268	0.342	0.013	-	-	-	-	1.110	1.281
Gaston*	0.848	1.135	0.250	0.009	-	-	-	-	1.098	1.144
Iredell*	0.395	0.413	0.040	0.001	-	-	-	-	0.435	0.414
Lincoln*	0.300	0.420	0.021	0.001	-	-	-	-	0.321	0.421
Mecklenburg	5.604	11.437	0.512	0.020	-	-	-	-	6.116	11.457
Rowan*	0.614	0.770	0.521	0.020	-	-	-	-	1.135	0.790
Union*	1.175	2.057	0.264	0.009	-	-	-	-	1.439	2.066
Totals	**9.704**	**17.500**	**1.949**	**0.074**	-	-	-	-	**11.653**	**17.574**

* Emissions for portion of county included in maintenance area.

3.0 METHODOLOGY

The overall approach to preparing the nonroad mobile source emissions inventory was to use the most recent emissions data available for years 2018, 2026, and 2035. Separate methodologies were used to estimate emissions for nonroad equipment and nonroad vehicles. Because only portions of six of the seven counties are in the maintenance area (Mecklenburg County being the exception), it was necessary to apply adjustment factors to the available county-level emission estimates for all non-Mecklenburg counties to estimate maintenance area emissions. The North Carolina Division of Air Quality (DAQ) used the estimated proportion of human population in each county's maintenance area for these adjustment factors. County and maintenance area population estimates for 2018, 2026, and 2035 were obtained from the Charlotte Department of Transportation (CDOT)'s MRM22v2.0 version of the Metrolina Regional Model (MRM).

3.1 NONROAD EQUIPMENT

The EPA includes more than eighty different types of equipment in the MOtor Vehicle Emission Simulator (MOVES) where model version 4.0.1 was used to estimate nonroad equipment emissions.[1] The EPA groups the equipment types into the following categories:

Agricultural equipment	Lawn and garden equipment, commercial
Airport support equipment	Logging equipment
Commercial equipment	Oil field equipment
Construction and mining equipment	Pleasure craft
Industrial equipment	Railway maintenance equipment
Lawn and garden equipment, residential	Recreational equipment

The model estimates emissions for six different engine types: 2-stroke and 4-stroke spark ignition engines, diesel engines, liquid propane gas engines, and compressed natural gas engines.

Ozone season day emissions of NOx and VOC were estimated by running the nonroad mobile source module of MOVES4.0.1. Model runs were performed for each county and year of interest. The model runs were developed for a typical July weekday. Default data were used for the input files used in the MOVES4.01 Nonroad model. The MOVES RunSpec (MRS) file (wherein all modeling variables are set) was tailored to reflect North Carolina-specific information. For reporting purposes, the resulting emissions from the MOVES4.01 Nonroad model were totaled for each equipment category by county. The summary of NOx and VOC emissions by equipment category, expressed in tons per typical July weekday for years 2018, 2026, and 2035 are displayed in Tables B-4a thru B-6b.

Table B-4a. Nonroad Equipment: 2018 NOx Emissions (tons/summer day)

County	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	Totals
Cabarrus*	0.114	0.000	0.087	0.496	0.179	0.197	0.002	0.000	0.002	0.003	0.001	1.081
Gaston*	0.052	0.000	0.094	0.335	0.295	0.134	0.001	0.000	0.016	0.002	0.008	0.937
Iredell*	0.110	0.000	0.053	0.220	0.117	0.027	0.002	0.000	0.020	0.000	0.005	0.554
Lincoln*	0.083	0.000	0.029	0.112	0.088	0.044	0.001	0.000	0.016	0.001	0.004	0.378
Mecklenburg	0.029	0.147	1.170	4.234	0.807	1.701	0.002	0.001	0.051	0.003	0.032	8.177
Rowan*	0.195	0.000	0.055	0.146	0.228	0.059	0.005	0.000	0.027	0.003	0.014	0.732
Union*	0.418	0.000	0.113	0.791	0.209	0.332	0.001	0.000	0.005	0.001	0.005	1.875
Totals	**1.001**	**0.147**	**1.601**	**6.334**	**1.923**	**2.494**	**0.014**	**0.001**	**0.137**	**0.013**	**0.069**	**13.734**

* Emissions for portion of county included in maintenance area.

[1] U.S. Environmental Protection Agency, "MOVES and Other Mobile Source Emissions Models, Latest Version of MOtor Vehicle Emission Simulator (MOVES), MOVES4: Latest Version of Motor Vehicle Emission Simulator," available from https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves, accessed February 2024.

Table B-5b. Nonroad Equipment: 2018 VOC Emissions (tons/summer day)

County	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	Totals
Cabarrus*	0.012	0.000	0.113	0.084	0.031	0.909	0.002	0.000	0.007	0.001	0.004	1.163
Gaston*	0.005	0.000	0.119	0.057	0.053	0.674	0.001	0.000	0.061	0.000	0.078	1.048
Iredell*	0.011	0.000	0.066	0.037	0.021	0.151	0.002	0.000	0.077	0.000	0.067	0.432
Lincoln*	0.009	0.000	0.036	0.019	0.016	0.215	0.001	0.000	0.060	0.000	0.060	0.416
Mecklenburg	0.003	0.013	1.489	0.715	0.134	7.500	0.002	0.000	0.204	0.001	0.383	10.444
Rowan*	0.020	0.000	0.069	0.025	0.042	0.324	0.006	0.000	0.104	0.001	0.201	0.792
Union*	0.043	0.000	0.145	0.134	0.038	1.439	0.001	0.000	0.019	0.000	0.067	1.886
Totals	**0.103**	**0.013**	**2.037**	**1.071**	**0.335**	**11.212**	**0.015**	**0.000**	**0.532**	**0.003**	**0.860**	**16.181**

* Emissions for portion of county included in maintenance area.

Table B-5a. Nonroad Equipment: 2026 NOx Emissions (tons/summer day)

County	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	Totals
Cabarrus*	0.061	0.000	0.074	0.253	0.197	0.179	0.000	0.000	0.002	0.002	0.001	0.769
Gaston*	0.028	0.000	0.080	0.172	0.322	0.124	0.000	0.000	0.015	0.001	0.008	0.750
Iredell*	0.060	0.000	0.047	0.115	0.130	0.026	0.000	0.000	0.019	0.000	0.005	0.402
Lincoln*	0.045	0.000	0.025	0.058	0.098	0.041	0.000	0.000	0.015	0.000	0.004	0.286
Mecklenburg	0.015	0.063	0.996	2.156	0.897	1.544	0.000	0.000	0.048	0.002	0.032	5.753
Rowan*	0.104	0.000	0.047	0.074	0.246	0.055	0.001	0.000	0.025	0.002	0.014	0.568
Union*	0.227	0.000	0.098	0.409	0.230	0.305	0.000	0.000	0.004	0.001	0.005	1.279
Totals	**0.540**	**0.063**	**1.367**	**3.237**	**2.120**	**2.274**	**0.001**	**0.000**	**0.128**	**0.008**	**0.069**	**9.807**

* Emissions for portion of county included in maintenance area.

Table B-5b. Nonroad Equipment: 2026 VOC Emissions (tons/summer day)

County	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	Totals
Cabarrus*	0.006	0.000	0.129	0.055	0.035	0.944	0.002	0.000	0.004	0.000	0.004	1.179
Gaston*	0.003	0.000	0.137	0.037	0.061	0.699	0.001	0.000	0.034	0.000	0.072	1.044
Iredell*	0.006	0.000	0.078	0.025	0.025	0.159	0.002	0.000	0.044	0.000	0.061	0.400
Lincoln*	0.004	0.000	0.043	0.013	0.018	0.226	0.001	0.000	0.034	0.000	0.054	0.393
Mecklenburg	0.001	0.007	1.708	0.469	0.150	7.805	0.002	0.000	0.113	0.000	0.344	10.599
Rowan*	0.010	0.000	0.080	0.016	0.047	0.332	0.005	0.000	0.057	0.000	0.178	0.725
Union*	0.022	0.000	0.169	0.089	0.044	1.523	0.001	0.000	0.011	0.000	0.061	1.920
Totals	**0.052**	**0.007**	**2.344**	**0.704**	**0.380**	**11.688**	**0.014**	**0.000**	**0.297**	**0.000**	**0.774**	**16.260**

* Emissions for portion of county included in maintenance area.

Table B-6a. Nonroad Equipment: 2035 NOx Emissions (tons/summer day)

County	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	Totals
Cabarrus*	0.030	0.000	0.077	0.191	0.292	0.174	0.000	0.000	0.002	0.001	0.001	0.768
Gaston*	0.014	0.000	0.083	0.130	0.476	0.122	0.000	0.000	0.014	0.001	0.008	0.848
Iredell*	0.029	0.000	0.047	0.085	0.186	0.025	0.000	0.000	0.018	0.000	0.005	0.395
Lincoln*	0.023	0.000	0.027	0.045	0.146	0.041	0.000	0.000	0.014	0.000	0.004	0.300
Mecklenburg	0.008	0.040	1.029	1.629	1.326	1.493	0.000	0.000	0.046	0.001	0.032	5.604
Rowan*	0.052	0.000	0.049	0.056	0.363	0.054	0.001	0.000	0.024	0.001	0.014	0.614
Union*	0.113	0.000	0.102	0.312	0.341	0.297	0.000	0.000	0.004	0.000	0.006	1.175
Totals	**0.269**	**0.040**	**1.414**	**2.448**	**3.130**	**2.206**	**0.001**	**0.000**	**0.122**	**0.004**	**0.070**	**9.704**

* Emissions for portion of county included in maintenance area.

Table B-6b. Nonroad Equipment: 2035 VOC Emissions (tons/summer day)

County	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	Totals
Cabarrus*	0.003	0.000	0.163	0.047	0.052	0.994	0.002	0.000	0.003	0.000	0.004	1.268
Gaston*	0.001	0.000	0.173	0.032	0.090	0.738	0.001	0.000	0.026	0.000	0.074	1.135
Iredell*	0.003	0.000	0.095	0.021	0.036	0.163	0.002	0.000	0.032	0.000	0.061	0.413
Lincoln*	0.002	0.000	0.055	0.011	0.027	0.242	0.001	0.000	0.026	0.000	0.056	0.420
Mecklenburg	0.001	0.007	2.153	0.400	0.222	8.212	0.002	0.000	0.085	0.000	0.355	11.437
Rowan*	0.005	0.000	0.100	0.014	0.070	0.349	0.005	0.000	0.043	0.000	0.184	0.770
Union*	0.012	0.000	0.215	0.077	0.065	1.615	0.001	0.000	0.008	0.000	0.064	2.057
Totals	**0.027**	**0.007**	**2.954**	**0.602**	**0.562**	**12.313**	**0.014**	**0.000**	**0.223**	**0.000**	**0.798**	**17.500**

* Emissions for portion of county included in maintenance area.

3.2 NONROAD VEHICLES

Version 2 of the EPA's 2018 Emissions Modeling Platform (2018v2) reports two major types of nonroad vehicle emissions in North Carolina: CMV and railroad locomotives.[2] Table B-7 displays a list of the nonroad vehicle source categories for which the 2018v2 platform reports annual emissions in the state. Railroad line-haul locomotives are categorized by size (Class I, Class II/Class III) and by use for passenger service. Class I line-haul railroads are larger in size (consisting of Norfolk Southern Corporation and CSX Corporation in North Carolina) compared to Class II and Class III railroads, which serve more localized markets. Amtrak and the North Carolina Department of Transportation's Rail Division provide passenger service in the state.

Table B-7. Nonroad Vehicle Categories in 2018v2 Modeling Platform for North Carolina

SCC	SCC Description
2280002101	Marine Vessels, Commercial/Diesel/C1C2 Port emissions: Main Engine
2280002102	Marine Vessels, Commercial/Diesel/C1C2 Port emissions: Auxiliary Engine
2280002103	Marine Vessels, Commercial/Diesel/C3 Port emissions: Main Engine
2280002104	Marine Vessels, Commercial/Diesel/C3 Port emissions: Auxiliary Engine
2280002201	Marine Vessels, Commercial/Diesel/C1C2 Underway emissions: Main Engine
2280002202	Marine Vessels, Commercial/Diesel/C1C2 Underway emissions: Auxiliary Engine
2280002203	Marine Vessels, Commercial/Diesel/C3 Underway emissions: Main Engine
2280002204	Marine Vessels, Commercial/Diesel/C3 Underway emissions: Auxiliary Engine
2285002006	Railroad Equipment /Diesel /Line Haul Locomotives: Class I Operations
2285002007	Railroad Equipment /Diesel /Line Haul Locomotives: Class II / III Operations
2285002008	Railroad Equipment /Diesel /Line Haul Locomotives: Passenger Trains (Amtrak)

For the CMV and railroad locomotive source categories, year 2018 monthly emissions were obtained from the 2018v2 modeling platform file "2018gg_county_monthly_report_03aug2022_v0.csv."[3] Year 2032 monthly emissions for CMV and railroad locomotive sources were obtained from the 2018v2 modeling platform file "2032gg2_county_monthly_report_23oct2023_v1.csv."[3] Year 2032 emission projections are used as the best available representation of 2035 emissions. It is important to note that there are no CMV emissions in the maintenance area.

The DAQ estimated July 2026 NOx and VOC emissions from the July 2018 and July 2032 emissions in the 2018v2 modeling platform. The 2026 values were calculated via interpolation between the 2018 and 2032 emissions. To develop average July day emissions, the DAQ divided the estimated July emissions in each year by 31 days. The DAQ believes that dividing July emissions by 31 days provides a reasonable estimate of typical summer day railroad locomotive emissions.

[2] U.S. Environmental Protection Agency, "2018v2 Emissions Modeling Platform," available from https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform, accessed April 2024.
[3] U.S. Environmental Protection Agency, "Index of /Air/emismod/2018/v2/reports," monthly emissions data available for download from https://gaftp.epa.gov/Air/emismod/2018/v2/reports/, accessed June 2024.

4.0 QUALITY ASSURANCE MEASURES

For the nonroad model runs, the MOVES RunSpecs (MRS) files (files that display the inputs used in a model run) and calculations were reviewed by a DAQ staff person who did not perform the actual runs. The file size for the output table for each county model run was consistent in size and viewed in HeidiSQL individually to ensure the emissionQuant field was properly filled. Additionally, the error table for each individual model run was checked in HeidiSQL to be sure no errors occurred. The model results were then evaluated by comparing one county to another to see if the results were reasonable (accounting for known differences between counties). This county-to-county comparison included the application of the county population percentages representing the portion of the county included in the maintenance area.

Because the 2018v2 modeling platform emissions were used by EPA in support of modeling for analysis of the impact of EPA's revised particulate matter National Ambient Air Quality Standards (NAAQS), nonroad vehicle emissions underwent extensive quality assurance review prior to this use. The detailed quality assurance and quality control procedures and measures, outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan, were applied to ensure the data meets data quality indicator acceptance criteria.

5.0 MOVES4.0.1 NONROAD MRS FILES

Due to their size, format, and complexity, all MOVES data files were provided in electronic format. Two types of files are included:

- MOVES run specification (RunSpec) files – flat text files named in the format <ProjectName_nonroad_cFIPSyYYYY>.mrs
- MOVES output databases – compressed archives of MOVES MariaDB output databases with file names in the format < ProjectName_nonroad_cFIPSyYYYY>_out.

The file name < ProjectName_nonroad_cFIPSyYYYY> describes the county, year modeled, and nonroad selection used for the MOVES model run as follows:

- ProjectName – internal name used to identify the MOVES modeling project
- Nonroad – indicated the MOVES model selection
- FIPS – the 5-digit state-county Federal Information Processing Standard (FIPS) number for the county modeled
- YYYY – calendar year modeled

For example, "2ndCharMainPlan_nonroad_c37119y2018" specifies MOVES model run within the project labelled "2ndCharMainPlan" for Mecklenburg County, NC (FIPS 37119) for CY 2018. There is one MRS file for each county and one corresponding output file as seen in Table B-7 below.

Table B-8. Nonroad Vehicle Modeling Platform Files for North Carolina

Run#	County	MRS file	Output File
1	Cabarrus	2ndCharMainPlan_nonroad_c37025y2018.mrs	2ndCharMainPlan_nonroad_c37025y2018_out
2	Gaston	2ndCharMainPlan_nonroad_c37071y2018.mrs	2ndCharMainPlan_nonroad_c37071y2018_out
3	Iredell	2ndCharMainPlan_nonroad_c37097y2018.mrs	2ndCharMainPlan_nonroad_c37097y2018_out
4	Lincoln	2ndCharMainPlan_nonroad_c37109y2018.mrs	2ndCharMainPlan_nonroad_c37109y2018_out
5	Mecklenburg	2ndCharMainPlan_nonroad_c37119y2018.mrs	2ndCharMainPlan_nonroad_c37119y2018_out
6	Rowan	2ndCharMainPlan_nonroad_c37159y2018.mrs	2ndCharMainPlan_nonroad_c37159y2018_out
7	Union	2ndCharMainPlan_nonroad_c37179y2018.mrs	2ndCharMainPlan_nonroad_c37179y2018_out
8	Cabarrus	2ndCharMainPlan_nonroad_c37025y2026.mrs	2ndCharMainPlan_nonroad_c37025y2026_out
9	Gaston	2ndCharMainPlan_nonroad_c37071y2026.mrs	2ndCharMainPlan_nonroad_c37071y2026_out
10	Iredell	2ndCharMainPlan_nonroad_c37097y2026.mrs	2ndCharMainPlan_nonroad_c37097y2026_out
11	Lincoln	2ndCharMainPlan_nonroad_c37109y2026.mrs	2ndCharMainPlan_nonroad_c37109y2026_out
12	Mecklenburg	2ndCharMainPlan_nonroad_c37119y2026.mrs	2ndCharMainPlan_nonroad_c37119y2026_out
13	Rowan	2ndCharMainPlan_nonroad_c37159y2026.mrs	2ndCharMainPlan_nonroad_c37159y2026_out
14	Union	2ndCharMainPlan_nonroad_c37179y2026.mrs	2ndCharMainPlan_nonroad_c37179y2026_out
15	Cabarrus	2ndCharMainPlan_nonroad_c37025y2035.mrs	2ndCharMainPlan_nonroad_c37025y2035_out
16	Gaston	2ndCharMainPlan_nonroad_c37071y2035.mrs	2ndCharMainPlan_nonroad_c37071y2035_out
17	Iredell	2ndCharMainPlan_nonroad_c37097y2035.mrs	2ndCharMainPlan_nonroad_c37097y2035_out
18	Lincoln	2ndCharMainPlan_nonroad_c37109y2035.mrs	2ndCharMainPlan_nonroad_c37109y2035_out
19	Mecklenburg	2ndCharMainPlan_nonroad_c37119y2035.mrs	2ndCharMainPlan_nonroad_c37119y2035_out
20	Rowan	2ndCharMainPlan_nonroad_c37159y2035.mrs	2ndCharMainPlan_nonroad_c37159y2035_out
21	Union	2ndCharMainPlan_nonroad_c37179y2035.mrs	2ndCharMainPlan_nonroad_c37179y2035_out

Final

Appendix C

Point Source
Emissions Inventory Documentation

Second Ten-Year Maintenance Plan
for
The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)

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1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop typical ozone season day emissions for point sources for 2018, 2026, and 2035. The point source inventory consists of emissions from individual facilities (point sources), airports, and wild, prescribed and agriculture fires.

Industrial or commercial facilities have equipment that emits air pollutants at levels classified as point sources by air quality regulatory programs and are generally required to have permits issued by the North Carolina Division of Air Quality (DAQ) and the local program located in Mecklenburg County. A subcategory of these permitted sources are combustion sources such as boilers and turbines that generate electricity for sale on the electric grid. Emissions for these electricity generating units (EGUs) are developed separately from the other point sources due to differences in how they operate compared to industrial and commercial sources. In the following discussion, these two categories of point sources are referred to as "EGU" and "Non-EGU Point."

Airports are not required to have air quality permits for construction and aircraft operations (although they could have equipment such as a boiler or generator that requires a permit). They do have fixed and known locations, and their emissions quantities can be comparable to industrial sources so the United States Environmental Protection Agency (EPA)'s includes these emissions in the point source inventory even though they are traditionally considered nonroad mobile sources.

In addition, EPA includes wild and prescribed fires in the point source inventory because the extent of fire-event activity is defined by geographic coordinates. The EPA also develops agricultural fire emissions estimates using crop residue burning activity, which is derived from the Hazard Mapping System satellite detects identifying fires on agricultural lands. Because EPA compiles emission estimates from the three fire subcategories using a common framework, the DAQ has chosen to report all fire emission estimates in this point source inventory appendix.

2.0 SUMMARY OF EMISSIONS

Tables C-1, C-2, and C-3 show point source typical summer day nitrogen oxide (NOx) and volatile organic compound (VOC) emissions in the 2008 ozone National Ambient Air Quality Standards (NAAQS) maintenance area by county for 2018, 2026, and 2035 (note that only Mecklenburg County is entirely within the maintenance area). The following section discusses the approach for developing typical summer day emissions for the point source sector.

Table C-1. Point Source NOx and VOC Emissions in 2018 (tons/summer day)

	Electricity Generating Units (EGUs)		Non-EGU Point		Aircraft		Wild, Prescribed, and Agriculture Fires		Totals	
County	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**
Cabarrus*	0.165	0.098	1.512	0.955	0.050	0.032	0.000	0.000	1.727	1.085
Gaston*	5.104	0.034	0.589	1.366	0.008	0.012	0.000	0.000	5.701	1.412
Iredell*	0.000	0.000	0.684	0.320	0.001	0.003	0.000	0.000	0.686	0.324
Lincoln*	0.466	0.005	0.121	0.416	0.018	0.015	0.018	0.206	0.623	0.642
Mecklenburg	0.001	0.002	0.987	0.609	5.246	1.905	0.000	0.000	6.234	2.515
Rowan*	1.625	0.107	2.081	2.204	0.067	0.039	0.012	0.160	3.785	2.511
Union*	0.000	0.000	0.640	1.435	0.026	0.027	0.036	0.391	0.702	1.854
Totals	**7.360**	**0.245**	**6.615**	**7.307**	**5.416**	**2.033**	**0.065**	**0.758**	**19.456**	**10.343**

*Emissions for portion of county included in nonattainment area.

Table C-2. Point Source NOx and VOC Emissions in 2026 (tons/summer day)

	Electricity Generating Units (EGUs)		Non-EGU Point		Aircraft		Wild, Prescribed, and Agriculture Fires		Totals	
County	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**
Cabarrus*	0.159	0.019	1.451	0.975	0.059	0.037	0.000	0.000	1.668	1.032
Gaston*	0.000	0.000	0.578	1.346	0.008	0.012	0.000	0.000	0.585	1.358
Iredell*	0.000	0.000	0.653	0.293	0.001	0.003	0.000	0.000	0.655	0.297
Lincoln*	0.783	0.017	0.121	0.415	0.018	0.015	0.018	0.206	0.939	0.653
Mecklenburg	0.077	0.006	1.008	0.655	6.813	2.402	0.000	0.000	7.898	3.063
Rowan*	1.785	0.098	2.125	2.288	0.059	0.035	0.012	0.160	3.980	2.581
Union*	0.005	0.002	0.634	1.412	0.026	0.027	0.036	0.391	0.701	1.833
Totals	**2.809**	**0.142**	**6.569**	**7.386**	**6.984**	**2.531**	**0.065**	**0.758**	**16.427**	**10.817**

*Emissions for portion of county included in nonattainment area.

Table C-3. Point Source NOx and VOC Emissions in 2035 (tons/summer day)

	Electricity Generating Units (EGUs)		Non-EGU Point		Aircraft		Wild, Prescribed, and Agriculture Fires		Totals	
County	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**
Cabarrus*	0.169	0.068	1.405	0.990	0.065	0.041	0.000	0.000	1.639	1.100
Gaston*	0.000	0.000	0.569	1.331	0.008	0.012	0.000	0.000	0.577	1.343
Iredell*	0.000	0.000	0.630	0.273	0.001	0.003	0.000	0.000	0.631	0.277
Lincoln*	0.100	0.002	0.120	0.415	0.018	0.015	0.018	0.206	0.256	0.637
Mecklenburg	0.000	0.000	1.024	0.691	7.989	2.774	0.000	0.000	9.013	3.465
Rowan*	1.510	0.081	2.158	2.351	0.053	0.032	0.012	0.160	3.732	2.625
Union*	0.000	0.000	0.630	1.395	0.026	0.027	0.036	0.391	0.691	1.813
Totals	**1.779**	**0.152**	**6.535**	**7.446**	**8.161**	**2.904**	**0.065**	**0.758**	**16.539**	**11.260**

*Emissions for portion of county included in nonattainment area.

3.0 METHODOLOGY

The section discusses the methodologies applied to develop the emissions inventory for the EGU, non-EGU point, airports, and wild, prescribed, and agriculture fires source categories.

3.1 ELECTRICITY GENERATING UNITS

The following two subsections describe the development of emission estimates for (a) EGUs with a continuous emissions monitoring system (CEMS) and (b) EGUs without a CEMS.

3.1.1 Electricity Generating Units with a Continuous Emissions Monitoring System

As shown in Table C-4, four EGUs with CEMS are located in the 2008 8-hour ozone NAAQS maintenance area portions of Gaston County (37071), Lincoln County (37109), and Rowan County (37159). For this inventory, EGUs are defined as units with a generating capacity greater than or equal to 25 megawatts (MW) and report hourly NOx emissions to EPA's Clean Air Markets Program Data (CAMPD). Table C-4 identifies the EGUs with CEMS in the maintenance area. The methods for estimating 2018, 2026, and 2035 emissions for these sources are discussed below.

Table C-4. EGUs with a Continuous Emissions Monitoring System

County (FIPS)	Facility	Boiler ID	Type
Gaston (37071)	GG Allen	1-5	Coal
Lincoln (37109)	Duke Energy Corporation LCTS	1-17	Combustion Turbine
Rowan (37159)	Duke Energy Carolinas, LLC - Buck Combined Cycle Facility	11C,12C	Combined Cycle
	Plant Rowan County	1-3	Combustion Turbine
		4,5	Combined Cycle

For EGUs, 2018 NOx daily emissions for July were obtained from the EPA's CAMPD database for the GG Allen Steam Station in Gaston County, Lincoln County Combustion Turbine Station in Lincoln County, and Buck Steam Station and Plant Rowan County in Rowan County.[1] Total emissions for the month of July for each unit were divided by the number of days the unit operated in July to calculate average July day emissions. The number of days that each unit operated was identified by summing the number of days for which daily emissions were reported in July for each unit in the CAMPD download. These emissions were used to represent summer day emissions in this maintenance plan. This approach is consistent with the first 2008 ozone NAAQS maintenance plan developed for the Charlotte-Gastonia-Salisbury, NC nonattainment area and all related subsequent SIPs. Table C-5 presents details on the summer day NOx emissions calculations.

[1] U.S. EPA, "Clean Air Markets Program Data Download," available from https://campd.epa.gov/data/custom-data-download, accessed June 2024.

Table C-5. EGU 2018 Average Summer Day NOx Emissions Calculations

Facility Name	Unit ID	CAMPD 2018 July NOx Emissions (Tons)	Operating Days	2018 Avg. July Day NOx Emissions (Tons)
Buck	11C	7.037	31	0.227
	12C	6.957	31	0.224
GG Allen	1	0.000	0	0.000
	2	0.000	0	0.000
	3	0.000	0	0.000
	4	0.000	0	0.000
	5	51.035	10	5.104
Lincoln Combustion Turbine	1	0.229	2	0.115
	2	0.197	2	0.099
	3	0.000	0	0.000
	4	0.044	2	0.022
	5	0.099	2	0.050
	6	0.103	2	0.052
	7	0.042	2	0.021
	8	0.218	2	0.109
	9	0.000	0	0.000
	10	0.000	0	0.000
	11	0.000	0	0.000
	12	0.000	0	0.000
	13	0.000	0	0.000
	14	0.000	0	0.000
	15	0.000	0	0.000
	16	0.000	0	0.000
	17	New Unit (not operated in 2018)		
Plant Rowan County	1	3.385	15	0.226
	2	7.668	28	0.274
	3	6.619	26	0.255
	4	6.507	31	0.210
	5	6.509	31	0.210
			Total	**7.195**

On March 7, 2023, Duke Energy Carolinas provided the DAQ with 2026 and 2035 July day NOx and VOC emissions forecasts for Lincoln Combustion Turbine Station and Buck Steam Station. For Plant Rowan County, the DAQ used ERTAC v22.0 AEO2023 reference case's July 2026 and July 2035 NOx emissions forecast to develop summer day NOx emissions.[2] The ERTAC forecast includes the number of days each unit is projected to operate in July; therefore, for each emission unit, July emissions for 2026 and 2035 were divided by the number of days the unit is projected to operate in each month to estimate average summer day NOx emissions. See Table C-6 for details on the 2026 and 2035 summer day NOx emissions calculations. It is important to note that GG Allen will retire by the end 2024 and the ERTAC forecasts reflect this information.

[2] Email communication from Doris McLeod, Virginia Department of Environmental Quality, "Re: 2026 & 2035 month of July NOx and VOC emission forecast," to Ming Xie, DAQ, July 14 and July 17, 2024.

Table C-6. EGU 2026 and 2035 NOx Emissions Provided by Duke Energy and ERTAC

Facility Name	Unit ID	2026 Avg. July Day NOx Emissions (Tons)	2035 Avg. July Day NOx Emissions (Tons)
Buck	11C	0.221	0.169
	12C	0.221	0.169
GG Allen	Retired		
Lincoln Combustion Turbine	1	0.055	0.002
	2	0.001	0.002
	3	0.014	0.002
	4	0.000	0.002
	5	0.000	0.002
	6	0.000	0.002
	7	0.003	0.002
	8	0.000	0.002
	9	0.059	0.000
	10	0.000	0.000
	11	0.111	0.000
	12	0.000	0.000
	13	0.000	0.000
	14	0.000	0.000
	15	0.098	0.000
	16	0.000	0.000
	17	0.442	0.086
Plant Rowan County	1	0.315	0.323
	2	0.301	0.317
	3	0.312	0.325
	4	0.210	0.104
	5	0.205	0.101

Average summer day 2018 VOC emissions were calculated using annual VOC emissions as reported by Duke Energy Carolinas, divided by 365. This approach of estimating daily emissions by dividing emissions for the most detailed time-period available (e.g., monthly emissions preferred over annual) by the number of days in that period was consistently used throughout this plan. These calculations are displayed in Table C-7. The DAQ calculated 2018 to 2026 and 2018 to 2035 summer day NOx emission growth rates and applied these growth rates to 2018 VOC summer day emissions to estimate VOC emissions for 2026 and 2035.

Table C-7. EGU 2018 Average Summer Day VOC Emissions Calculations

Facility Name	Unit ID	2018 Actual Annual VOC Emissions (Tons)	Days Used to Estimate Average Summer Day Emissions	2018 Estimated Summer Day VOC Emissions (Tons)
Buck	11C,12C	9.700	365	0.027
GG Allen	1,2,5	7.775	365	0.021
	3,4	4.655	365	0.013
Lincoln Combustion Turbine	1-16	1.790	365	0.005
	17	New Unit (not operated in 2018)		

Facility Name	Unit ID	2018 Actual Annual VOC Emissions (Tons)	Days Used to Estimate Average Summer Day Emissions	2018 Estimated Summer Day VOC Emissions (Tons)
Plant Rowan County	1	1.186	365	0.003
	2	1.506	365	0.004
	3	1.506	365	0.004
	4	12.506	365	0.034
	5	12.606	365	0.035
			Total	**0.146**

3.1.2 Electricity Generating Units without a Continuous Emissions Monitoring System

For EGUs without a CEMS, the DAQ compiled historical emissions for 2018 and forecast year emissions for 2026 and 2035. To identify EGU facilities to include in this plan, the DAQ reviewed EGU records in EPA's 2018v2 Emissions Modeling Platform (EMP) for all relevant counties.[3] A different set of EGUs appear in the 2018v2 EMP's 2018 emissions file and 2032 emissions file. While the 2018 emissions represent actual data, the 2032 emissions reflect EGU sector projections from an EPA run of the Integrated Planning Model. A comprehensive list of EGUs from both the 2018 and 2032 files was developed, and then compared to the EPA's 2022 North Carolina point source inventory to identify the list of EGUs known to be currently operating. Next, the DAQ geographically plotted this list of EGUs to identify which are located in the 2008 ozone NAAQS maintenance area. This analysis determined that one of the operating non-CEMS EGUs in the counties of interest (Iredell County Landfill Gas [LFG] Facility) is located outside of the maintenance area. Therefore, this facility was excluded from this plan.

The DAQ compiled annual NOx and VOC emissions from the 2022 North Carolina point source inventory for the list of relevant non-CEMS EGUs (sub-annual emissions were not available for these sources), and these emissions were divided by 365 to estimate typical summer day emissions. These values were used to estimate likely emissions in 2026. The EGUs operating in 2022 and their emissions are displayed in Table C-8.

Table C-8. 2022 Non-CEMS EGU Emissions (tons/summer day)

Facility Name*	County	Facility ID	2022 Emissions			
			Annual		Summer Day	
			NOx	VOC	NOx	VOC
Concord Energy, LLC	Cabarrus	16601511	57.35	6.77	0.145	0.018
GRS CMS	Cabarrus	7959111	0.58	0.05	0.002	0.0001
Orbit Energy Charlotte	Mecklenburg	18882111	28.12	2.16	0.077	0.006
NC Municipal Power Agency No.1-Monroe	Union	16600711	1.92	0.57	0.005	0.002
		Total	**87.97**	**9.55**	**0.241**	**0.027**

*Excludes the EGU in Iredell County (Iredell County LFG Facility) which is outside the maintenance area.

[3] U.S. Environmental Protection Agency, "2018v2 Emissions Modeling Platform," available from https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform, accessed April 2024.

For 2018 and 2035, the DAQ compiled annual 2018 and 2032 VOC and NOx emissions from the 2018v2 EMP for the non-CEMS EGUs listed in Table C-8. Given the proximity of 2032 to 2035 and the lack of emission projections for 2035, the 2032 projections are used to represent 2035 emissions. The 2018 and 2032 emissions were divided by 365 days to estimate typical summer day emissions to ensure consistency with the approach used to estimate summer day emissions in 2022. Table C-9 displays the 2018 and 2035 summer day emission estimates for non-CEMS EGUs.

Table C-9. 2018 and 2035 Non-CEMS EGU Emissions (tons/summer day)

Facility Name	County	Facility ID	2018		2035	
			NOx	VOC	NOx	VOC
Concord Energy, LLC	Cabarrus	16601511	0.147	0.113	0.018	0.045
GRS CMS	Cabarrus	7959111	0.020	0.059	0.080	0.024
Orbit Energy Charlotte	Mecklenburg	18882111	0.001	0.000	0.002	0.000
NC Municipal Power Agency No.1-Monroe	Union	16600711	0.000	0.000	0.000	0.000
		Total	**0.169**	**0.069**	**0.112**	**0.085**

*Excludes the EGU in Iredell County (Iredell County LFG Facility) which is outside the maintenance area.

3.2 NON-EGU POINT SOURCES, AIRPORTS, AND FIRES (WILDFIRES, PRESCRIBED FIRES AND AGRICULTURE FIRES)

The overall approach to estimating emissions for these non-EGU point source categories reflects county emissions from EPA's 2018v2 EMP and mapping of the coordinates of these facilities to determine the proportion of county emissions in the maintenance area. The 2018v2 platform was created to support EPA's analysis of the impact of EPA's revised particulate matter NAAQS and utilized the most up-to-date modeling and data sources.[4] Year 2018 monthly emissions for these non-EGU point sources were obtained from the 2018v2 modeling platform file "2018gg_county_monthly_report_03aug2022_v0.csv."[5] Year 2032 monthly emissions for these sources were obtained from the 2018v2 modeling platform file "2032gg2_county_monthly_report_23oct2023_v1.csv."[5] The platform is considered to provide the most comprehensive and accurate inventories available at the time that this noninterference demonstration was prepared. Because of the difficulty with predicting wild, prescribed, and agriculture fires activity in the future, EPA held 2018 emissions constant to represent 2032 emissions in the 2018v2 modeling platform inventory. For other categories, EPA applied emissions growth, control, and facility/unit closure information to 2018 base year emissions to project emissions in 2032. The DAQ compiled July 2018 and July 2032 county-level emissions for the non-EGU point source categories and estimated typical summer day emissions by dividing the platform's July emissions by 31 days. The DAQ believes that dividing July

[4] Details on the methods used to develop this platform are described in "2018v2 Emissions Modeling Platform Technical Support Document," available from https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform-technical-support-document.

[5] U.S. Environmental Protection Agency, "Index of /Air/emismod/2018/v2/reports," monthly emissions data available for download from https://gaftp.epa.gov/Air/emismod/2018/v2/reports/, accessed June 2024.

emissions by the 31 days in the month provides a reasonable estimate of typical summer day emissions for these point sources.

To identify non-EGU point source emissions in the 2008 ozone NAAQS maintenance area, the DAQ plotted the coordinates for the facilities in the 2018v2 EMP to identify the proportion of NOx and VOC emissions in the townships that comprise the ozone maintenance area. Because of the effort involved in adapting this approach to the Prescribed Fire/Wildfire/Agricultural Fire sector, the DAQ used acres burned data to allocate county-level Prescribed Fire/Wildfire/Agricultural Fire NOx and VOC emissions to the maintenance area. Table C-10 displays the proportion of county-level emissions that were allocated to the 2008 ozone NAAQS maintenance area (note that Mecklenburg County is excluded from the table because the entire county is in the maintenance area).

Table C-10. Percentage of Emissions in 2008 NAAQS Ozone Maintenance Area

	Non-EGU Point		Aircraft		Fire Acreage
County	**NOx**	**VOC**	**NOx**	**VOC**	**Burned**
Cabarrus	100.0%	100.0%	100.0%	100.0%	75.5%
Gaston	97.0%	89.9%	100.0%	100.0%	23.7%
Iredell	40.1%	20.4%	16.0%	23.4%	0.6%
Lincoln	100.0%	100.0%	100.0%	99.9%	50.4%
Rowan	98.2%	69.1%	97.0%	95.2%	28.6%
Union	100.0%	100.0%	96.6%	97.2%	52.8%

By way of example, the following provides the steps followed to estimate 2018 Aircraft emissions in the maintenance area of Cabarrus County.

Step 1. July 2018 NOx emissions for all Cabarrus County Aircraft records were compiled from the aforementioned 2018v2 platform file (0.2975 tons).
Step 2. Cabarrus County Aircraft NOx emissions from Step 1 were allocated to the maintenance area based on the proportion of total county Aircraft NOx emissions identified as located in the maintenance area portion of county (16%) = 0.0476 tons).
Step 3. Typical summer day emissions were calculated by dividing July maintenance area emissions from Step 2 by 31 days = 0.0015 tons/summer day).

4.0 QUALITY ASSURANCE MEASURES

Because the 2018v2 modeling platform emissions were used by EPA in support of modeling of the impact of EPA's revised particulate matter NAAQS, these emissions underwent extensive quality assurance prior to this use. The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan, were applied to ensure the data meets data quality indicator acceptance criteria.

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Final

Appendix D

Nonpoint (Area) Source Emissions Inventory Documentation

Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)

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1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop the nonpoint (area) source emissions inventory for 2018, 2026, and 2035. Nonpoint sources represent a collection of many small, stationary sources of air pollution emissions within a specified geographical area that individually emit less than the minimum emission levels prescribed for point sources. Because these sources are too small and/or too numerous to be surveyed and characterized individually, all nonpoint source activities are collectively estimated. The county is the geographic area for which emissions from nonpoint sources are compiled, primarily because counties are the smallest areas for which data used for estimating emissions are readily available.

2.0 SUMMARY OF EMISSIONS

Tables D-1 through D-3 show total nonpoint source nitrogen oxide (NOx) and volatile organic compound (VOC) emissions for 2018, 2026, and 2035 by county and nonpoint source subsector for the 2008 ozone NAAQS maintenance area (note that only Mecklenburg County is entirely within the maintenance area). The following section discusses the approach for developing typical summer day emissions for the nonpoint source sector.

3.0 METHODOLOGY

The nonpoint source emissions inventory is based on use of the 2018 historical and 2032 projected emissions in the United States Environmental Protection Agency (EPA)'s 2018v2 Emissions Modeling Platform.[1] The 2018v2 modeling platform has undergone extensive reviews and, for this reason, is considered the most comprehensive and accurate emissions data available at the time that the inventory for this noninterference demonstration was prepared. Table D-4 displays the list of nonpoint source categories with NOx and/or VOC emissions in the 2018v2 modeling platform for one or more of the counties affected by this demonstration.

Year 2018 monthly emissions for nonpoint sources were obtained from the 2018v2 modeling platform file "2018gg_county_monthly_report_03aug2022_v0.csv."[2] Year 2032 monthly emissions for nonpoint sources were obtained from the 2018v2 modeling platform file "2032gg2_county_monthly_report_23oct2023_v1.csv."[2] The North Carolina Division of Air Quality (DAQ) estimated July 2026 NOx and VOC emissions by interpolating between the July 2018 and July 2032 emissions in the 2018v2 modeling platform. Year 2032 emission projections are used as the best available representation of 2035 emissions. To develop typical summer day emissions, the DAQ divided the July emissions estimated in each year by 31 days. The DAQ believes that average July day nonpoint source emissions provide a reasonable estimate of typical summer day nonpoint source emissions. This approach is consistent with the first 2008 ozone NAAQS maintenance plan developed for the Charlotte-Gastonia-Salisbury, NC nonattainment area and all related subsequent SIPs.

[1] U.S. Environmental Protection Agency, "2018v2 Emissions Modeling Platform," available from https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform, accessed April 2024.
[2] U.S. Environmental Protection Agency, "Index of /Air/emismod/2018/v2/reports," monthly emissions data available for download from https://gaftp.epa.gov/Air/emismod/2018/v2/reports/, accessed June 2024.

Table D-1. Nonpoint (Area) Source NOx and VOC Emissions in 2018 (tons/summer day)

County	Residential Wood Combustion		Solvents		Livestock		All Other Nonpoint Categories		Totals	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Cabarrus*	0.017	0.129	-	3.242	-	0.141	0.204	0.909	0.221	4.421
Gaston*	0.016	0.120	-	3.333	-	0.072	0.253	1.478	0.269	5.002
Iredell*	0.007	0.052	-	1.469	-	0.250	0.117	0.408	0.124	2.179
Lincoln*	0.006	0.049	-	1.279	-	0.152	0.075	0.223	0.082	1.702
Mecklenburg	0.064	0.464	-	20.489	-	0.036	1.306	5.116	1.370	26.104
Rowan*	0.011	0.081	-	2.861	-	0.136	0.176	0.642	0.186	3.719
Union*	0.019	0.141	-	3.353	-	1.257	0.235	0.936	0.254	5.688
Totals	**0.139**	**1.035**	**0.000**	**36.026**	**0.000**	**2.044**	**2.366**	**9.710**	**2.505**	**48.815**

* Emissions for portion of county included in maintenance area.

Table D-2. Nonpoint (Area) Source NOx and VOC Emissions in 2026 (tons/summer day)

County	Residential Wood Combustion		Solvents		Livestock		All Other Nonpoint Categories		Totals	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Cabarrus*	0.018	0.134	-	3.730	-	0.149	0.227	0.863	0.245	4.876
Gaston*	0.017	0.126	-	3.535	-	0.077	0.284	1.399	0.301	5.137
Iredell*	0.007	0.056	-	1.656	-	0.267	0.134	0.395	0.142	2.374
Lincoln*	0.007	0.052	-	1.427	-	0.162	0.085	0.213	0.091	1.854
Mecklenburg	0.067	0.486	-	23.468	-	0.038	1.463	4.768	1.529	28.759
Rowan*	0.011	0.084	-	3.000	-	0.142	0.195	0.593	0.206	3.819
Union*	0.020	0.149	-	3.945	-	1.362	0.268	0.879	0.288	6.335
Totals	**0.146**	**1.087**	**0.000**	**40.763**	**0.000**	**2.196**	**2.656**	**9.110**	**2.802**	**53.155**

* Emissions for portion of county included in maintenance area.

Table D-3. Nonpoint (Area) Source NOx and VOC Emissions in 2035 (tons/summer day)

County	Residential Wood Combustion		Solvents		Livestock		All Other Nonpoint Categories		Totals	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Cabarrus*	0.018	0.139	-	4.096	-	0.155	0.244	0.828	0.262	5.217
Gaston*	0.017	0.130	-	3.683	-	0.080	0.307	1.338	0.324	5.231
Iredell*	0.007	0.056	-	1.713	-	0.265	0.141	0.366	0.148	2.400
Lincoln*	0.007	0.054	-	1.541	-	0.170	0.092	0.206	0.099	1.971
Mecklenburg	0.069	0.502	-	25.703	-	0.039	1.580	4.507	1.649	30.750
Rowan*	0.011	0.087	-	3.104	-	0.146	0.209	0.557	0.221	3.894
Union*	0.021	0.155	-	4.383	-	1.436	0.292	0.831	0.313	6.805
Totals	**0.151**	**1.123**	**0.000**	**44.223**	**0.000**	**2.292**	**2.865**	**8.632**	**3.016**	**56.269**

* Emissions for portion of county included in maintenance area.

Table D-4. Nonpoint (Area) Source NOx and/or VOC Emissions Categories

SCC*	SCC Description	Pollutant	
		NOx	VOC
2102006000	Stationary Source Fuel Combustion; Industrial; Natural Gas; Total: Boilers and IC Engines	√	√
2102011000	Stationary Source Fuel Combustion; Industrial; Kerosene; Total: All Boiler Types	√	√
2103006000	Stationary Source Fuel Combustion; Commercial/Institutional; Natural Gas; Total: Boilers and IC Engines	√	√
2103007000	Stationary Source Fuel Combustion; Commercial/Institutional; Liquified Petroleum Gas (LPG); Total: All Combustor Types	√	√
2103011000	Stationary Source Fuel Combustion; Commercial/Institutional; Kerosene; Total: All Combustor Types	√	√
2104004000	Stationary Source Fuel Combustion; Residential; Distillate Oil; Total: All Combustor Types	√	√
2104006000	Stationary Source Fuel Combustion; Residential; Natural Gas; Total: All Combustor Types	√	√
2104007000	Stationary Source Fuel Combustion; Residential; Liquified Petroleum Gas (LPG); Total: All Combustor Types	√	√
2104008100	Stationary Source Fuel Combustion; Residential; Wood; Fireplace: general	√	√
2104008210	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; non-EPA certified	√	√
2104008220	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; non-catalytic	√	√
2104008230	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; catalytic	√	√

SCC*	SCC Description	Pollutant	
		NOx	VOC
2104008310	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, non-EPA certified	√	√
2104008320	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, EPA certified, non-catalytic	√	√
2104008330	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, EPA certified, catalytic	√	√
2104008400	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: pellet-fired, general (freestanding or FP insert)	√	√
2104008510	Stationary Source Fuel Combustion; Residential; Wood; Furnace: Indoor, cordwood-fired, non-EPA certified	√	√
2104008610	Stationary Source Fuel Combustion; Residential; Wood; Hydronic heater: outdoor	√	√
2104008700	Stationary Source Fuel Combustion; Residential; Wood; Outdoor wood burning device, NEC (fire-pits, chimeas, etc.)	√	√
2104009000	Stationary Source Fuel Combustion; Residential; Firelog; Total: All Combustor Types	√	√
2104011000	Stationary Source Fuel Combustion; Residential; Kerosene; Total: All Heater Types	√	√
2302002100	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Charbroiling; Conveyorized Charbroiling		√
2302002200	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Charbroiling; Under-fired Charbroiling		√
2302003000	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Frying; Deep Fat Frying		√
2302003100	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Frying; Flat Griddle Frying		√
2302003200	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Frying; Clamshell Griddle Frying		√
2401001000	Solvent Utilization; Surface Coating; Architectural Coatings; Total: All Solvent Types		√
2401005000	Solvent Utilization; Surface Coating; Auto Refinishing: SIC 7532; Total: All Solvent Types		√
2401008000	Solvent Utilization; Surface Coating; Traffic Markings; Solvent Utilization; Surface Coating;		√
2401015000	Solvent Utilization; Surface Coating; Factory Finished Wood: SIC 2426 thru 242; Total: All Solvent Types		√
2401020000	Solvent Utilization; Surface Coating; Wood Furniture: SIC 25; Total: All Solvent Types		√
2401025000	Solvent Utilization; Surface Coating; Metal Furniture: SIC 25; Total: All Solvent Types		√
2401040000	Solvent Utilization; Surface Coating; Metal Cans: SIC 341; Total: All Solvent Types		√
2401065000	Solvent Utilization; Surface Coating; Electronic and Other Electrical: SIC 36 - 363; Total: All Solvent Types		√
2401070000	Solvent Utilization; Surface Coating; Motor Vehicles: SIC 371		√
2401075000	Solvent Utilization; Surface Coating; Aircraft: SIC 372; Total: All Solvent Types		√
2401100000	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings; Total: All Solvent Types		√
2401200000	Solvent Utilization; Surface Coating; Other Special Purpose Coatings; Total: All Solvent Types		√

SCC*	SCC Description	Pollutant	
		NOx	VOC
2415000000	Solvent Utilization; Degreasing; All Processes/All Industries; Total: All Solvent Types		√
2420000000	Solvent Utilization; Dry Cleaning; All Processes; Total: All Solvent Types		√
2425000000	Solvent Utilization; Graphic Arts; All Processes; Total: All Solvent Types		√
2460030999	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; Lighter Fluid, Fire Starter, Other Fuels; Total: All Volatile Chemical Product Types		√
2460100000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Personal Care Products; Total: All Solvent Types		√
2460200000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Household Products; Total: All Solvent Types		√
2460400000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Automotive Aftermarket Products; Total: All Solvent Types		√
2460500000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Coatings and Related Products; Total: All Solvent Types		√
2460600000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Adhesives and Sealants; Total: All Solvent Types		√
2460800000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All FIFRA Related Products; Total: All Solvent Types		√
2460900000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; Miscellaneous Products (Not Otherwise Covered); Total: All Solvent Types		√
2461022000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Emulsified Asphalt; Total: All Solvent Types		√
2461850000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Pesticide Application: Agricultural; All Processes		√
2501011011	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Permeation		√
2501011012	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Evaporation (includes Diurnal losses)		√
2501011013	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Spillage During Transport		√
2501011014	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refilling at the Pump - Vapor Displacement		√
2501012011	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Permeation		√
2501012012	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Evaporation (includes Diurnal losses)		√
2501012015	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refilling at the Pump - Spillage		√
2501050120	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Terminals: All Evaporative Losses; Gasoline		√

SCC*	SCC Description	Pollutant	
		NOx	VOC
2501055120	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Plants: All Evaporative Losses; Gasoline		√
2501060053	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Balanced Submerged Filling		√
2501080050	Storage and Transport; Petroleum and Petroleum Product Storage; Airports: Aviation Gasoline; Stage 1: Total		√
2501080100	Storage and Transport; Petroleum and Petroleum Product Storage; Airports: Aviation Gasoline; Stage 2: Total		√
2505030120	Storage and Transport; Petroleum and Petroleum Product Transport; Truck; Gasoline		√
2505040120	Storage and Transport; Petroleum and Petroleum Product Transport; Pipeline; Gasoline		√
2610000100	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Leaf Species Unspecified	√	√
2610000500	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)	√	√
2610030000	Waste Disposal, Treatment, and Recovery; Open Burning; Residential; Household Waste (use 26-10-000-xxx for Yard Wastes)	√	√
2805002000	Miscellaneous Area Sources; Agriculture Production - Livestock; Beef cattle production composite; Not Elsewhere Classified		√
2805009100	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry production - broilers; Confinement		√
2805018000	Miscellaneous Area Sources; Agriculture Production - Livestock; Dairy cattle composite; Not Elsewhere Classified		√
2805045000	Miscellaneous Area Sources; Agriculture Production - Livestock; Goats Waste Emissions; Not Elsewhere Classified		√
2805035000	Miscellaneous Area Sources; Agriculture Production - Livestock; Horses and Ponies Waste Emissions; Not Elsewhere Classified		√
2805007100	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry production - layers with dry manure management systems; Confinement		√
2805040000	Miscellaneous Area Sources; Agriculture Production - Livestock; Sheep and Lambs Waste Emissions; Total		√
2805025000	Miscellaneous Area Sources; Agriculture Production - Livestock; Swine production composite; Not Elsewhere Classified (see also 28-05-039, -047, -053)		√
2805010100	Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry production - turkeys; Confinement		√
2810025000	Miscellaneous Area Sources; Other Combustion; Charcoal Grilling - Residential (see 23-02-002-xxx for Commercial); Total	√	√
2810060100	Miscellaneous Area Sources; Other Combustion; Cremation; Humans	√	√
2810060200	Miscellaneous Area Sources; Other Combustion; Cremation; Animals	√	√

*Source Classification Code

Only portions of six of the seven counties are in the 2008 ozone NAAQS maintenance area (Mecklenburg County being the exception). Therefore, the DAQ applied adjustments to the county emission estimates for all counties except Mecklenburg to estimate maintenance area emissions. The DAQ used the estimated proportion of human population in each county's maintenance area for these adjustment factors. County and maintenance area human population estimates for 2018, 2026, and 2035 were obtained from the Charlotte Department of Transportation's MRM22v2.0 version of the Metrolina Regional Model (MRM).

4.0 QUALITY ASSURANCE MEASURES

Because the 2018v2 modeling platform emissions were used by EPA in support of modeling for their analysis of the impact of EPA's revised particulate matter NAAQS, these emissions underwent extensive quality assurance prior to this use. The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan, were applied to ensure the data meets data quality indicator acceptance criteria.

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Final

Appendix E

Public Notice, Comments Received and Responses

Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)

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1.0 INTRODUCTION AND SUMMARY OF PUBLIC COMMENT PERIOD

On November 20th, 2024, the North Carolina Division of Air Quality (DAQ) issued a public notice announcement (see Attachment 1 to this appendix), in accordance with 40 CFR § 51.102, indicating that the pre-hearing draft of the *Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)* was available for public comment and posted on the DAQ website for review. The documents were also made available for in-person review during normal business hours at the DAQ Central Office in Raleigh and the DAQ Regional Office in Mooresville. The public comment period was open from Wednesday, November 20th, 2024, through Friday, December 20th, 2024. Public comments were accepted if received via postal mail, email, or voicemail.

The public notice announcement indicated that anyone may request a public hearing during the comment period, and, if requested, the DAQ would issue a separate notice to announce the hearing including the date, time, location, and other details. The DAQ did not receive a request for a public hearing.

In addition to posting on the DAQ's website, the public notice announcement was sent to a number of email distribution lists managed by DAQ, which include numerous stakeholders from industry and environmental groups. The DAQ has found that sending the public notice announcements to these groups is more effective than publishing the notices in a few local newspapers and is consistent with the requirements described in the April 6th, 2011, memorandum, "Regional Consistency for the Administrative Requirements of the State Implementation Plan Submittals and the Use of Letter Notices."

The DAQ received comments only from EPA. No comments were received from members of the public.

2.0 DAQ RESPONSES TO EPA COMMENTS

The following shows EPA's comments followed by the DAQ's response to the comments. The EPA's comments generally requested that the DAQ clarify how ozone season day emissions were calculated. In its response to comments, the DAQ identifies where it made revisions to the narrative or appendices to address the comments in this final submittal to EPA. Overall, the comments did not require revisions to baseline or projection year emissions, motor vehicle emissions budgets, or safety margins.

2.1 Comment 1: Partial County Emissions

Please provide a more thorough explanation and calculations for the population percentages used to allocate partial county emissions in Table 3.2. Additionally, provide the source and link from which the population data was obtained. It states they were obtained from the travel demand

model (TDM) that the Charlotte Department of Transportation (CDOT) completed, but there is no additional information.

Response:
The CDOT provided TDM (vehicle miles travelled and speeds) and human population data directly to the DAQ as email attachments on December 19, 2022. The TDM data, from model version MRM22v2.0, were initially used in the transportation conformity determination for the 2024-2033 Adopted Transportation Improvement Program (TIP) for the Charlotte Regional Transportation Planning Organization. Additional information about the TDM, known as the Metrolina Regional Model, can be found here: https://crtpo.org/resources/metrolina-regional-model/.

The CDOT also provided human population data for each analysis year, covering the full area of each county as well as the partial county areas within the maintenance area. As appropriate, the partial county fractions of human population were used to scale full county emissions data and MOVES4 model input data down to the maintenance area within each county.

Table 3.2 of the narrative has been revised to add the human population data for each county. The TDM data files are documented in Appendix A.

2.2 Comment 2: July Day NOx Emissions for Electric Generating Units (EGUs)

Please provide a reasoning for only using July Nox EGU emissions to calculate tons/summer day in Table C-5. How did NC DEQ determine that this was the most accurate representation of daily emissions in the summer? Looking at Clean Air Markets Program Data (CAMPD), GG Allen and Lincoln EGUs have more units operating in June and August than July, for example, which may indicate that only using July Nox emissions are not the most accurate representation of summer day emissions.

Response:
North Carolina adopted the July weekday to represent the typical summer/ozone season day for all sectors collectively (not individually) to be consistent with the first 2008 ozone NAAQS maintenance plan developed for the Charlotte-Gastonia-Salisbury, NC nonattainment area and all related subsequent SIPs (all of which have been approved by EPA). Estimated July day emissions were selected as representative of typical summer/ozone season day emissions in the *Charlotte-Gastonia-Salisbury, NC 2008 8-hour Ozone Marginal Nonattainment Area Redesignation Demonstration and Maintenance Plan* submitted in April16, 2015 and all **five** subsequent submissions related to the 2008 Ozone NAAQS for the Charlotte area. This methodology is consistent with EPA's final rule provided in *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements, (80 FR 12264, March 6, 2015)* (https://www.federalregister.gov/documents/2015/03/06/2015-04012/implementation-of-the-2008-national-ambient-air-quality-standards-for-ozone-state-implementation). This final rule states: "Ozone season day emissions means an average day's emissions for a typical ozone season work weekday as defined in CAA section 51.1100(cc). The state will select, subject to EPA approval, the particular month(s) in the ozone season and the

day(s) in the work week to be represented. The selection of days should be coordinated with the conditions assumed in the development of RFP plans and/or emissions budgets for transportation conformity to allow comparability of daily emissions estimates. The days should represent the conditions that contribute to high ozone that led to a nonattainment designation."

For consistency with the *Clean Air Act Section 110(l) Noninterference Demonstration to Remove 19 Counties from North Carolina's Motor Vehicle Emissions Inspection and Maintenance (I&M) Program* submitted as a final document on October 1, 2024, North Carolina has used the July day to represent a "typical summer/ozone season day".

The DAQ reviewed the monitoring data for the six regulatory ozone monitors operated in the maintenance area from 2017 through 2024. As shown in the following table, the highest maximum daily 8-hour ozone concentration varied by monitor and month for a given year ranging from May through October over the 8-year period. The frequency of the months in which the highest maximum daily 8-hour ozone concentration occurred over this 8-year period are as follows in descending order: July (13), June (9), August (6), September (5), May (4), April (2), and October (1). Therefore, these data show that the highest maximum daily 8-hour ozone concentration occurred most frequently in the month of July over the 8-year period. For this reason, the DAQ continues to believe using July day emissions is appropriate to represent "typical summer/ozone season day" for the Charlotte maintenance area.

Maximum Daily 8-Hour Ozone Concentration Measured by Monitor during the Ozone Season in the Charlotte Maintenance Area for 2017 through 2024

Monitor / AQS ID / County	2017		2018		2019		2020		2021		2022		2023		2024	
	PPB	Day	PPB	Day	PPB	Day	PPB	Day	PPB	Day	PPB	Day	PPB	Day	PPB	Day
Crouse ID #37-109-0004 Lincoln	68	May 16	67	April 21	69	Sept. 9	61	July 15	67	Aug. 24	73	June 6	69	June 3	64	June 13
Garinger ID #37-119-0041 Mecklenburg	73	May 16	72	May 13	79	Sept. 9	66	July 13	73	July 30	75	June 21	85	July 18	81	Aug. 27
University Meadows ID#37-119-0046 Mecklenburg	75	July 21	73	Aug. 27	81	Sept. 11	67	Aug. 10	74	July 30	76	July 22	84	July 18	88	Aug. 27
Rockwell ID #37-159-0021 Rowan	64	July 25	62	July 9	70	Sept. 17	61	July 17	66	June 18	66	June 21	73	July 18	69	Aug. 27
Monroe ID #37-179-0003 Union	75	Sept. 28	77	July 11	72	Oct. 3	54	April 4	71	May 24	70	June 20	71	June 17	69	June 24

PPB = parts per billion.

The comment also suggests that using July NOx emissions for two EGU facilities (i.e., GG Allen and Lincoln) are not the most accurate representation of summer day emissions because the two facilities had more units operating in June and August than in July. The DAQ disagrees with the comment based on its review of the data for these two facilities along with the data for the other two EGUs (Buck and Plant Rowan) located in the maintenance area that report data to CAMPD. Although 2018 NOx emissions are higher in June and August than in July for GG Allen and Lincoln, the NOx emissions are slightly higher in July than in June or August for Buck and Plant Rowan. Overall, in July 2018 EGU emissions represent less than 8% of total anthropogenic NOx emissions for all sources in 2018. As shown in the table, in 2018 the highest daily ozone concentration in the maintenance area occurred in July. Thus, it is unlikely that June or August would better represent the most favorable ozone formation conditions in the maintenance area because two facilities had higher emissions in June or August rather than July. In addition to emissions, meteorological conditions must be considered when selecting a month to represent favorable ozone formation in the maintenance area. Therefore, the DAQ believes it is best to rely on observed ozone concentration patterns for determining a representative month for ozone formation as previously discussed. Also, as noted in Appendix C, the GG Allen facility was permanently closed December 31, 2024, and this closure was accounted for in the 2026 and 2035 projection year inventories.

Based on this information, the DAQ did not make any revisions to the narrative or Appendices A through D to address this comment.

2.3 Comment 3: Calculations for Operating Days

Please provide the calculations for the operating days in table C-5 and an explanation of how they were determined. Additionally, for emissions in 2026 and 2035, please provide an explanation about the assumption to divide the July emissions by 31 days.

Response:
The DAQ added the following sentence on page 4 of Appendix C to provide further clarification of how operating days were identified: "The number of days that each unit operated were identified by summing the number of days for which daily emissions were reported in July for each unit in the CAMPD download." If there are emissions for each day in July, then there were 31 days that the unit operated.

North Carolina did not divide emissions in 2026 and 2035 by 31 days, but rather by the projected number of operating days. As noted on page 5 of Appendix C immediately preceding Table C-6, the appendix states: "The ERTAC forecast includes the number of days each unit is projected to operate in July; therefore, for each emission unit, July emissions for 2026 and 2035 were divided by the number of days the unit is projected to operate in each month to estimate average summer day NOx emissions." The DAQ did not make any revisions to the narrative or Appendices to address this comment.

2.4 Comment 4: Calculation of Summer Day VOC Emissions

Please provide an explanation for using 365 days for calculating the 2018 VOC emissions in Table C-7 and how this accurately represents the summer day emissions. This is based on the assumption that the facilities are operating 100% of the year which isn't accurate based on operating time from CAMPD. Similarly, please provide an explanation for using 365 days for calculating 2022 summer day emissions in table C-8 and C-9.

Response:
North Carolina did not have any sub-annual VOC emissions data for 2018 for these facilities. As noted in the text immediately preceding Table C-7, "Average summer day 2018 VOC emissions were calculated using annual VOC emissions as reported by Duke Energy Carolinas, divided by 365. This approach of estimating daily emissions by dividing emissions for the most detailed time-period available (e.g., monthly emissions preferred over annual) by the number of days in that period was consistently used throughout this plan." Therefore, in keeping with the approach used for other sectors, the emission estimates for the historical period that is available (annual 2018 emissions in this case) was divided by the number of the days in that period (365) to estimate average summer day (2018) emissions. This approach is consistent with the other sectors typical summer/ozone season day 2018 emissions, some of which have July 2018 emissions available, which are divided by 31 days.

Consistent with the discussion above, the 2022 emissions displayed in Table C-8 were calculated by dividing annual emissions by 365 days because sub-annual emissions were not available for this year. The Table C-9 summer day emissions for 2018 and 2035 were calculated using the same estimation approach (annual emissions divided by 365 days) to ensure consistency with the Table C-8 summer day values.

The revision that DAQ made to Appendix C in response to this comment was to add the sentence "This approach of estimating daily emissions by dividing emissions for the most detailed time-period available (e.g., monthly emissions preferred over annual) by the number of days in that period was consistently used throughout this plan" to identify how this approach is consistently applied across all sectors.

2.5 Comment 5: Point Source Emissions Methods

Please provide which modeling file was used and example calculations for Appendix C, Section 3.2. The EPA was not able to replicate the calculations with the information provided. Also, include justification for selecting July and dividing emissions by 31 days.

Response:
Please refer to the response to Comment #2 for justification of the approach used to estimate summer day emissions in Appendix C, Section 3.2. The 2018v2 platform is available at https://gaftp.epa.gov/Air/emismod/2018/v2/. July 2018 emissions were obtained from the "2018gg_county_monthly_report_03aug2022_v0.csv." file and July 2032 emissions were

obtained from the "2032gg2_county_monthly_report_23oct2023_v1.csv." file. The references to these files have been added to page 8 of Appendix C in response to EPA's comment.

The calculations used to develop the point source emission values are too detailed for EPA to replicate in order to match the summary values provided in the maintenance plan. However, the approach for 2018 Aircraft emissions is summarized for Cabarrus County below and was added to page 9 of the Appendix in response to EPA's comment.

- Step 1. July 2018 NOx emissions for all Cabarrus County Aircraft records were compiled from the aforementioned 2018v2 platform file (0.2975 tons).
- Step 2. Apportion Cabarrus County Aircraft NOx emissions from Step 1 to maintenance area based on the proportion of total county Aircraft NOx emissions identified as located in the maintenance area portion of county (16%) = 0.0476 tons).
- Step 3. Calculate typical summer day emissions by dividing July maintenance area emissions from Step 2 by 31 days = 0.0015 tons/summer day).

2.6 Comment 6: Calculation of Summer Day Nonpoint Source Emissions

Provide justification for calculating summer day nonpoint emissions using only the month of July and dividing it by 31 days.

Response:
Refer to the response to Comment #2 for justification of the approach used to estimate summer day nonpoint emissions.

3.0 ATTACHMENT 1 – PUBLIC NOTICE ANNOUNCEMENT

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
PUBLIC NOTICE

PURPOSE: The North Carolina Department of Environmental Quality (DEQ), Division of Air Quality (DAQ), hereby gives notice regarding its pre-hearing draft of the *Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)*.

The U.S. Environmental Protection Agency (EPA) designated the Charlotte-Gastonia-Salisbury, North Carolina area attainment of the 2008 8-hour ozone NAAQS effective August 27, 2015 (80 FR 44873). This maintenance plan covers the last 10 years of the 20-year maintenance period, from August 27, 2025, to August 27, 2035, to fulfill the requirements of Section 175A(b) of the federal Clean Air Act (CAA), as amended. Based on the information provided in this second 10-year maintenance plan and criteria established in Section 107(d)(3)(E) of the CAA, North Carolina proposes to request that EPA approve this maintenance plan for the Charlotte-Gastonia-Salisbury maintenance area. The ozone monitoring data demonstrate that the maintenance area has attained the 2008 8-hour ozone NAAQS and maintained the NAAQS every year after redesignation. The maintenance plan also demonstrates that the projected emissions inventories for 2035, the final year of the maintenance plan, as well as the interim year of 2026, are all less than the 2018 base year emissions inventory. In addition, the maintenance plan includes contingency measures to be evaluated for implementation in the event of an air quality violation or other indications of an impending violation. Therefore, maintenance of the 2008 8-hour ozone NAAQS will continue to be maintained through the end of the 20-year maintenance period of August 27, 2035.

In addition, the DAQ completed an Interagency Consultation process with its federal, state, and local transportation partners to develop motor vehicle emission budgets (MVEBs) for oxides of nitrogen and volatile organic compounds to support transportation conformity planning analyses. In this submittal, the DAQ proposes to request EPA approval of new MVEBs for 2018 and 2035, and removal of the MVEBs for 2014 and 2026 associated with the first 10-year maintenance plan. The DAQ is not requesting EPA to deem the new budgets for 2018 and 2035 adequate prior to it completing action on this submittal. The DAQ intends to submit a final version of this pre-hearing draft for incorporation into North Carolina's State Implementation Plan through EPAs State Planning Electronic Collaboration System (SPeCS) web-based system after considering relevant public comments.

COMMENT PROCEDURES: Any person wishing to comment may submit a written statement for inclusion in the record of proceedings regarding the pre-hearing draft of the *Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)*. Written comments should be submitted electronically to daq.publiccomments@deq.nc.gov or postmarked no later than Friday, December 20, 2024. (Please type "Charlotte Maintenance Plan" in the subject line)

REQUESTS FOR A PUBLIC HEARING: Requests for a public hearing must be in writing and include a statement supporting the need for such a hearing, an indication of your interest in the subject, and a brief summary of the information intended to be offered. A public hearing will be scheduled if requested. A separate notice will be announced for the hearing including the date, time, location, and other details.

INFORMATION: Copies of the pre-hearing draft of the *Second Ten-Year Maintenance Plan for The Charlotte-Gastonia-Salisbury, North Carolina Maintenance Area for the 2008 8-Hour Ozone National Ambient Air Quality Standard (NAAQS)* may be downloaded from the DAQ website at https://www.deq.nc.gov/about/divisions/air-quality/air-quality-planning/state-implementation-plans-sips/charlottegastoniasalisbury-nc-2008-8-hour-ozone-area.

Alternatively, comments or requests for a public hearing can be mailed to:

Tammy Manning
NC Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699-1641
919-707-8717 Phone
daq.publiccomments@deq.nc.gov
(Please type "Charlotte Maintenance Plan" in the subject line)

Copies of the proposals may also be reviewed at the DAQ's Mooresville Regional Office, (704) 235-2100.

Date: 11-20-2024

Michael A. Abraczinskas, DAQ Director

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