Regional Haze

5-Year Periodic Review

State Implementation Plan

for

North Carolina Class I Areas

Prepared by

North Carolina Department of Environment and Natural Resources

Division of Air Quality

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Preface: This document contains summaries of the technical analyses that will be used by North Carolina's Division of Air Quality to support the regional haze 5-year periodic review state implementation plan pursuant to §§107(d)(3)(D) and (E) of the Clean Air Act, as amended.

Acknowledgement: This document is dedicated to our friend and colleague Laura Boothe, who worked on this report with the same spirit and commitment given to all of North Carolina's air quality plans. Laura's love for the environment and vision for improving and maintaining air quality for the citizens of North Carolina is a testament to us all. We will miss her, and carry on with the mission of meeting our state's air quality goals.

EXECUTIVE SUMMARY

Introduction

Regional haze is pollution that impairs visibility over a large region, including national parks, forests, and wilderness areas. Regional haze is caused by sources and activities emitting fine particles and their precursors, often transported over large regions. Particles affect visibility through the scattering and absorption of light. Reducing fine particles in the atmosphere is an effective method of improving visibility. In the southeast, the most important sources of haze-forming emissions are coal-fired power plants, industrial boilers and other combustion sources, but also include mobile source emissions, area sources, fires, and wind blown dust.

An easily understood measure of visibility is visual range. Visual range is the greatest distance, in kilometers or miles, at which a dark object can be viewed against the sky. However, the most useful measure of visibility impairment is light extinction, which affects the clarity and color of objects being viewed. The measure used by the regional haze rule is the deciview (dv), calculated directly from light extinction using a logarithmic scale.

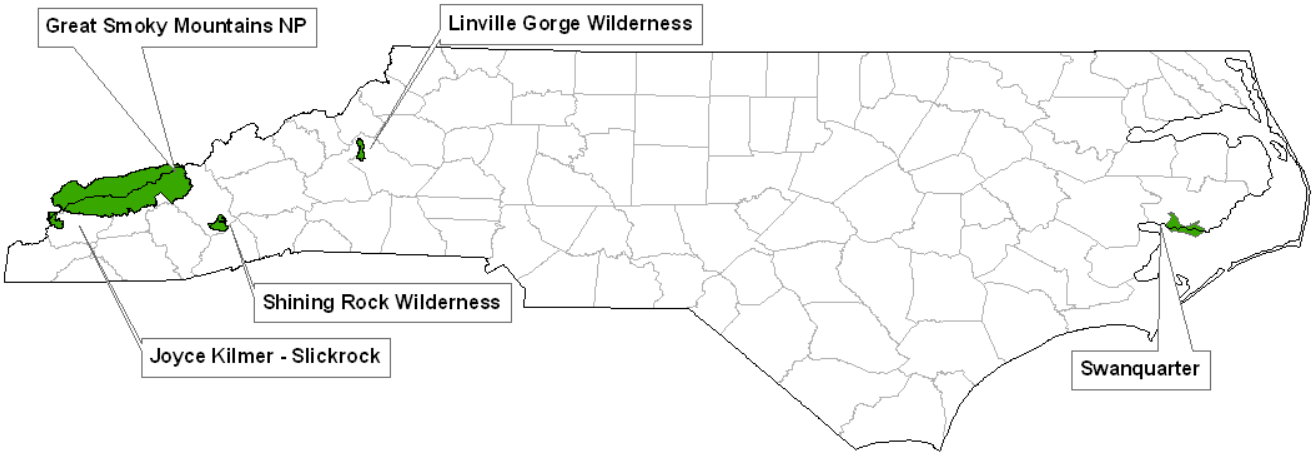
In Section 169A of the 1977 Amendments to the Clean Air Act (CAA), the U.S. Congress established a program for protecting visibility in 156 mandatory Federal "Class I" areas. Class I areas consist of national parks exceeding 6000 acres, wilderness areas and national memorial parks exceeding 5000 acres, and all international parks that were in existence on August 7, 1977. In the 1990 Amendments to the CAA, Congress added 169B and called on the U.S. Environmental Protection Agency (USEPA) to issue regional haze rules addressing regional haze impairment from manmade air pollution and establishing a comprehensive visibility protection program for Class I areas.

The USEPA promulgated the Regional haze Rule on July 1, 1999 (64 FR 35713). States are required to submit state implementation plans (SIPs) to the USEPA that set out each states' plan for complying with the regional haze rule. States must demonstrate reasonable progress toward meeting the national goal of a return to natural visibility conditions by 2064. The rule directs states to graphically show what would be a "uniform rate of progress", also known as the "glide path", toward natural conditions for each Class I area within the State and certain ones outside the State. The first regional haze SIPs were due December 17, 2007.

North Carolina's Class I areas

North Carolina has five Class I areas within its borders: Great Smoky Mountains National Park, Joyce Kilmer-Slickrock Wilderness Area, Linville Gorge Wilderness Area, Shining Rock Wilderness Area, and Swanquarter Wildlife Refuge. Both the Great Smoky Mountains National

Park and Joyce Kilmer-Slickrock Wilderness Area are located in both North Carolina and Tennessee. The figure below illustrates the location of these Class I areas.



Currently, the visibility on the worst days at the mountain sites is generally between 25 and 27 dv, and visibility at Swanquarter is about 24 dv. Natural background visibility on the worst days is between 11 and 12 dv.

State Implementation Plan Requirements for the 5-Year Periodic Review

States are required to submit state implementation plans (SIPs) to the United States Environmental Protection Agency (USEPA) five years after the initial regional haze SIP was submitted evaluating the progress towards the reasonable progress goals for each Class I area located within the state and located outside the state which may be affected by emissions from within the state. Since North Carolina's original regional haze SIP was submitted on December 17, 2007, the 5-year periodic review is due December 17, 2012.

The SIP must include 1) the status of implementation of control measures included in the original regional haze SIP, 2) a summary of emission reductions achieved through the implementation of control measures, 3) an assessment of visibility conditions, 4) an analysis of the changes in emission pollutants, 5) an assessment of significant changes in emissions that may have limited or impeded progress in improving visibility, 6) an assessment of whether the current SIP elements and strategies are sufficient to meet reasonable progress goals and 7) a review of the state's visibility monitoring strategy. This SIP revision addresses each requirement based on visibility improvements observed in the 2006-2010 period.

In the December 2007 Regional Haze Implementation Plan, the NCDAQ committed "to ongoing consultation with the FLMs throughout the implementation process, including annual discussion of the implementation process and the most recent IMPROVE monitoring data and VIEWS

data." The NCDAQ hosted a conference call with National Park Service and US Forest Service to discuss progress in western North Carolina. The NCDAQ plans to host a similar conference call with the Fish and Wildlife Service to discuss visibility improvements in eastern North Carolina.

Progress Towards Reasonable Progress Goals (40 CFR 51.308(g))

The control strategy in the original regional haze SIP continues to be implemented. Although the Clean Air Interstate Rule has been remanded back to the USEPA, it remains in effect until the USEPA promulgates another regulation to replace it. The North Carolina Clean Smokestacks Act (CSA) continues to be implemented and the coal-fired electric generating units subject to this Act emitted only 73,454 tons per year of sulfur dioxide (SO_2) and 39,292 tons per year of nitrogen oxide (NOx) in 2011, well below the Act's system caps and well below what was modeled in the original regional haze SIP.

The CSA was the primary State control strategy in the original regional haze SIP. The projected 2018 SO_2 emissions in the original plan from the sources subject to the CSA were 93,301 tons per year. The current 2018 projection of emissions from these sources are 18,420 tons per year, approximately 80% lower than the 2018 projected emissions in the original regional haze plan, due to both Duke Energy and Progress Energy deciding to convert some units to natural gas and shut down small uncontrolled coal units.

North Carolina's Class I areas have seen improvement on the 20% worst days and all but Swanquarter Wildlife Refuge has seen improvement on the 20% best days. At Swanquarter, a slight increase in the haze index was measured - less than 1 dv. This could be in part due to having incomplete data for 2008 in Swanquarter, which could affect the 5-year average. Additionally, there are electric generating units (EGU) located in the eastern part of the state that have yet to be retired, controlled or converted to natural gas as of the end of 2010. These facilities are scheduled to undergo operational changes between the 2012-2013 timeframe. The associated reduction in emissions at EGU sources and other improvements occurring at non-electric generating units indicate that improvement in the visibility on the 20% best days will occur by 2018. Indeed, early preview of 2011 data shows a significant improvement, with annual average being less than the baseline for the first time since 2002.

The baseline and current visibility conditions as well as the reasonable progress goals for 2018 for the 20% worst and 20% best days are displayed in the table below.

Class I Area	Baseline (2000-2004)	Current (2006-2010)	2018 Reasonable Progress Goal
20% Worst Days			
Great Smoky Mountain National Park	30.3	26.6	23.5
Joyce Kilmer-Slickrock	30.3	26.6	23.5
Linville Gorge	28.6	25.1	21.7
Shining Rock	28.5	25.8	21.9
Swanquarter	24.7	24.2	20.3
20% Best Days			
Great Smoky Mountain National Park	13.6	12.3	12.1
Joyce Kilmer-Slickrock	13.6	12.3	12.1
Linville Gorge	11.1	11	9.5
Shining Rock	8.2	7.25	6.9
Swanquarter	12.0	12.9[a]	10.9

[a] The average measurement for 2011 was 10.5 dv, resulting in the most recent 5-year average haze index of 12.1 dv.

Since the new projection for 2018 emissions from the electric generating units subject to the CSA are significantly lower than the projected 2018 emissions in the original regional haze SIP, the North Carolina Division of Air Quality believes the state is on track to meet the 2018 reasonable progress goals for the North Carolina Class I areas and will not impede a Class I area outside of North Carolina from meeting their goals.

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1.0 INTRODUCTION

1.1 What is regional haze?

Regional haze is pollution from disparate sources that impairs visibility over a large region, including national parks, forests, and wilderness areas (156 of which are termed mandatory Federal "Class I" areas). Regional haze is caused by sources and activities emitting fine particles and their precursors. Those emissions are often transported over large regions.

Particles affect visibility through the scattering and absorption of light, and fine particles – particles similar in size to the wavelength of light – are most efficient, per unit of mass, at reducing visibility. Fine particles may either be emitted directly or formed from emissions of precursors, the most important of which are sulfur dioxides (SO_2) and nitrogen oxides (NOx). Reducing fine particles in the atmosphere is generally considered to be an effective method of reducing regional haze, and thus improving visibility. Fine particles also adversely impact human health, especially respiratory and cardiovascular systems. The United States Environmental Protection Agency (USEPA) has set national ambient air quality standards for daily and annual levels of fine particles with diameter smaller than 2.5 micrometers (μm) ($PM_{2.5}$). In the southeast, the most important sources of $PM_{2.5}$ and its precursors are coal-fired power plants, industrial boilers and other combustion sources. Other significant contributors to $PM_{2.5}$ and visibility impairment include mobile source emissions, area sources, fires, and wind blown dust.

1.2 What are the requirements under the Clean Air Act for addressing regional haze?

In Section 169A of the 1977 Amendments to the Clean Air Act (CAA), Congress set forth a program for protecting visibility in Class I areas which call for the "prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution." Congress adopted the visibility provisions to protect visibility in these 156 national parks, forests and wilderness areas. On December 2, 1980, the USEPA promulgated regulations in the Federal Register (FR) to address visibility impairment (45 FR 80084). The 1980 regulations were developed to address visibility impairment that is "reasonably attributable" to a single source or small group of sources. These regulations represented the first phase in addressing visibility impairment and deferred action on regional haze that emanates from a variety of sources until monitoring, modeling and scientific knowledge about the relationships between pollutants and visibility impairment improved.

In the 1990 Amendments to the CAA, Congress added section 169B and called on the USEPA to issue regional haze rules. The regional haze rule that the USEPA promulgated on July 1, 1999 (64 FR 35713), revised the existing visibility regulations in order to integrate provisions

addressing regional haze impairment and establishing a comprehensive visibility protection program for Class I Federal areas. States are required to submit state implementation plans (SIPs) to the USEPA that set out each states' plan for complying with the regional haze rule, including consultation and coordination with other states and with Federal Land Managers (FLMs). The timing of SIP submittal is tied to the USEPA's promulgation of designations for the National Ambient Air Quality Standard (NAAQS) for fine particulate matter. States must submit a regional haze implementation plan to the USEPA within three years after the date of designation. The USEPA promulgated designation dates on December 17, 2004, therefore the first regional haze SIPs were due December 17, 2007.

The regional haze rule addressed the combined visibility effects of various pollution sources over a wide geographic region. This wide reaching pollution net meant that many states – even those without Class I areas – would be required to participate in haze reduction efforts. The USEPA designated five Regional Planning Organizations (RPOs) to assist with the coordination and cooperation needed to address the visibility issue for the first regional haze SIPs. The RPO that made up the southeastern portion of the contiguous United States is known as VISTAS (Visibility Improvement – State and Tribal Association of the Southeast), and includes the following states: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.

Figure 1-1. Geographical Areas of Regional Planning Organizations

1.3 Class I areas in North Carolina

North Carolina has five Class I areas within its borders: Great Smoky Mountains National Park, Joyce Kilmer-Slickrock Wilderness Area, Linville Gorge Wilderness Area, Shining Rock Wilderness Area, and Swanquarter Wildlife Refuge. The Great Smoky Mountains and Joyce Kilmer-Slickrock are located in both Tennessee and North Carolina. For the Great Smoky Mountains, both states are sharing the lead for setting goals and for Joyce Kilmer-Slickrock, North Carolina is the lead. The North Carolina Division of Air Quality (NCDAQ) in the North Carolina Department of Environment and Natural Resources is responsible for developing the Regional Haze Periodic Review SIP. This SIP compares the current visibility conditions at each of these Class I areas to the 2018 reasonable progress goals to determine if North Carolina is on track with reaching these goals. Although 2018 reasonable progress goals were established in the initial regional haze SIP submitted on December 17, 2007, the VISTAS modeling continued and additional controls were modeled in Tennessee and other Southeast states that changed the final modeled reasonable progress goals for the Class I areas that Tennessee and North Carolina share. Therefore, the NCDAQ will compare the current visibility conditions to the VISTAS's best and final modeling analysis and use the results to adopt the new reasonable progress goals for the shared Class I areas. Finally, this SIP will review the long-term strategy to determine if there have been any changes that need to be addressed.

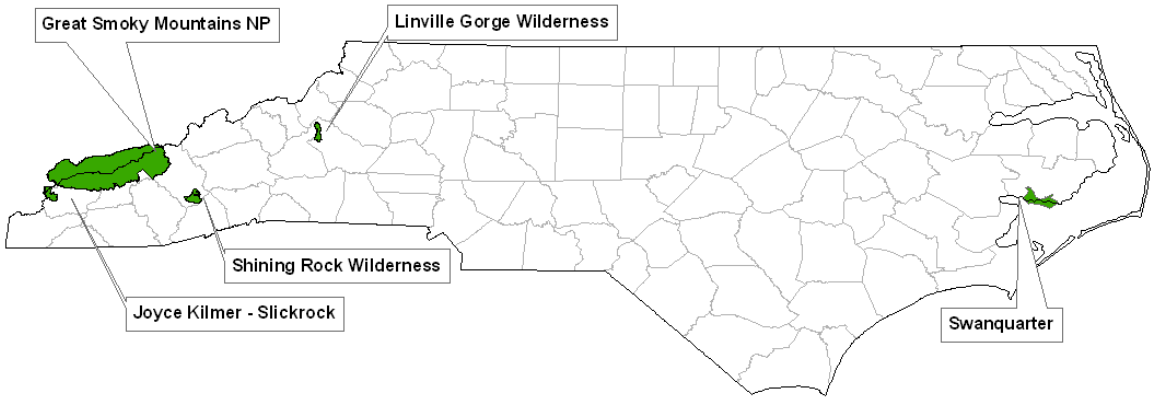

Figure 1-2. North Carolina's Class I areas

In developing the initial regional haze SIP, the NCDAQ also considered that emission sources outside of North Carolina may affect the visibility at these North Carolina Class I areas, and that emission sources within North Carolina may affect the visibility at Class I areas in neighboring states. Through VISTAS, the southeastern states worked together to assess state-by-state contributions to visibility impairment in specific Class I areas, including those in North Carolina and those affected by emissions from North Carolina. The sources identified in the initial regional haze SIP either impacting North Carolina's Class I areas or Class I areas outside North Carolina will be reviewed as part of this progress report.

1.4 General overview of regional haze SIP requirements

The regional haze rule is codified in the Code of Federal Regulations (CFR) at Title 40 CFR 51.308. At 40 CFR 51.308(d), the rule requires states to demonstrate reasonable progress toward meeting the national goal of a return to natural visibility conditions by 2064. As a guide for reasonable progress, the regional haze rule directs states to graphically show what would be a "uniform rate of progress" toward natural conditions for each mandatory Class I Federal area within the State and/or for each mandatory Class I Federal area located outside the State, which may be affected by emissions from sources within the State. States are to establish baseline visibility conditions for 2000-2004, natural background visibility conditions in 2064, and the rate of uniform progress between baseline and background conditions. The uniform rate of progress is also known as the "glidepath."

The regional haze rule then requires states to establish reasonable progress goals, expressed in deciviews, for visibility improvement at each affected Class I area covering each (approximately) 10-year period until 2064. The goals must provide for reasonable progress towards achieving natural visibility conditions, provide for improvement in visibility for the most impaired days over the period of the implementation plan, and ensure no degradation in visibility for the least impaired days over the same period (see 40 CFR 51.308(d)(1)).

In order to ensure that visibility goals are properly met and set, SIPs must include determinations, for each Class I area, of the baseline visibility conditions (expressed in deciviews) for the most impaired and least impaired days. The SIPs must also contain supporting documentation for all required analyses used to calculate the degree of visibility impairment under natural visibility conditions for the most impaired and least impaired days (see 40 CFR 51.308(d)(2)). In addition, states must include a monitoring strategy for measuring, characterizing, and reporting of regional haze visibility impairment that is representative of all mandatory Class I Federal areas within the state (see 40 CFR 51.308(d)(4)).

This first set of reasonable progress goals must be met through measures contained in the state's long-term strategy covering the period from the present until 2018. The long-term strategy includes enforceable emissions limitations, compliance schedules, and other measures as necessary to achieve the reasonable progress goals, including all controls required or expected under all federal and state regulations by 2009 and by 2018. During development of the long-term strategy, states are also required to consider specific factors such as the above mentioned ongoing control programs, measures to mitigate construction activities, source retirement and replacement schedules, smoke management techniques for agriculture and forestry, and enforceability of specific measures (see 40 CFR 51.308(d)(3)).

In addition, a specific component of each state's first long-term strategy is dictated by the specific best available retrofit technology (BART) requirements in 40 CFR 51.308(e) of the regional haze rule. The regional haze rule at 40 CFR 51.308(e) requires states to include a determination of BART for each BART-eligible source in the State that emits any air pollutant, which may reasonably be anticipated to cause or contribute to any impairment of visibility in any mandatory Class I Federal area. The Clean Air Act section 169A(b) defines BART-eligible sources as sources in 26 specific source categories, in operation within a 15-year period prior to enactment of the 1977 Clean Air Act Amendments. States must determine BART according to five factors set out in section 169A(g)(7) of the Clean Air Act. Emission limitations representing BART and schedules for compliance with BART for each source subject to BART must be included in the long-term strategy.

As required by 40 CFR §51.308(i), the regional haze SIP must include procedures for continuing consultation between the States and FLMs on the implementation of the visibility protection program, including development and review of implementation plan revisions and 5-year progress reports, and on the implementation of other programs having the potential to contribute to impairment of visibility in any mandatory Class I Federal area within the State. The three FLMs are the United States Department of Interior (USDI) Fish and Wildlife Service (FWS) and National Park Service (NPS) and the United States Department of Agriculture (USDA) Forest Service (FS).

The SIPs for the first review period were due December 17, 2007. These plans covered long-term strategies for visibility improvement between baseline conditions in 2000-2004 and 2018. States are required to evaluate progress toward reasonable progress goals every 5 years to assure that installed emissions controls are on track with emissions reduction forecasts in each SIP. The first interim review is due to the USEPA five years after the initial SIP was submitted, which for North Carolina is December 17, 2012. If emissions controls are not on track to meet SIP forecasts, then states would need to take action to assure emissions controls by 2018 will be consistent with the SIP or to revise the SIP to be consistent with the revised emissions forecast. This SIP is to address the first interim, or periodic, review.

1.5 Requirements for Periodic Reports

The requirements for the periodic reports are outlined in 40 CFR 51.308(g). Each state must submit a report to the USEPA every five years evaluating the progress towards the reasonable progress goal for each Class I area located within the state and in each Class I area located outside the state which may be affected by emissions from within the state. As stated earlier, NC's first periodic report is due on December 17, 2012. The progress report must be a formal SIP submittal and at a minimum, must contain the following elements:

(1) A description of the status of implementation of all measures included in the SIP for achieving reasonable progress goals for Class I areas both within and outside the state.

(2) A summary of the emission reductions achieved throughout the state through implementation of the measures described in (1) above.

(3) For each Class I area within the state, the state must assess the following visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of 5-year averages of these annual values

(i) The current visibility conditions for the most impaired and least impaired days;

(ii) The difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions;

(iii) The change in visibility impairment for the most impaired and least impaired days over the past 5 years;

(4) An analysis tracking the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities with the state. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.

(5) An assessment of any significant changes in anthropogenic emissions within or outside the state that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility.

(6) An assessment of whether the current SIP elements and strategies are sufficient to enable the state, or other states with Class I areas affected by emissions from the state, to meet all established reasonable progress goals.

(7) A review of the state's visibility monitoring strategy and any modifications to the strategy as necessary.

In the sections to follow, the NCDAQ will address the various progress report requirements as outlined above.

2.0 STATUS OF IMPLEMENTATION OF CONTROL MEASURES (40 CFR 51.308 (g)(1))

40 CFR 51.308(g)(1) requires *"a description of the status of implementation of all measures included in the implementation plan for achieving reasonable progress goals for Class I areas both within and outside the State."*

This section provides a description of the emission reduction measures that were included in the VISTAS regional haze best and final inventory and reasonable progress goal modeling effort. In instances where implementation of a measure did not occur in a timely manner, information is provided on the source category and its relative impact on the overall future year emissions inventories.

The sections below also contain information on emissions strategies that were not included in the best and final inventory and modeling effort. At the time of the best and final inventory development process, these measures were not fully documented or had not yet been published in final form, and therefore the benefits of these measures were not included in future year inventories. Emission reductions from these measures will help ensure that each Class I area meets or exceeds the visibility progress goal set in the regional haze SIP.

This section also includes a summary of the emission sources and status of controls installed that were identified in the area of influence for each Class I area in North Carolina in the initial regional haze SIP. Additionally, a summary of those emission sources and the status of controls installed that were identified to impact Class I areas outside of North Carolina is provided.

2.1 Emission Reduction Strategies Included in VISTAS Final Modeling

2.1.1 Federal Programs

The emission reductions associated with the federal programs that are described by the following paragraphs were included in the VISTAS future year emissions estimates. Descriptions contain qualitative assessments of emissions reductions associated with each program, and where possible, quantitative assessments. In cases where delays or modification have altered emissions reduction estimates such that the original estimates of emissions are no longer accurate, information is also provided on the effects of these alterations.

<u>2007 Heavy-Duty Highway Rule (40 CFR Part 86, Subpart P)</u>

In this regulation, the USEPA set a particulate matter (PM) emissions standard for new heavy-duty engines of 0.01 gram per brake horsepower-hour (g/bhp-hr), which took full effect for

diesel engines in the 2007 model year. This rule also included standards for nitrogen oxides (NOx) and non-methane hydrocarbons (NMHC) of 0.20 g/bhp-hr and 0.14 g/bhp-hr, respectively. These diesel engine NOx and NMHC standards were successfully phased in together between 2007 and 2010. The rule also required that sulfur in diesel fuel be reduced to facilitate the use of modern pollution-control technology on these trucks and buses. The USEPA required a 97 percent reduction in the sulfur content of highway diesel fuel -- from levels of 500 parts per million (ppm) (low sulfur diesel) to 15 ppm (ultra-low sulfur diesel). These requirements were successfully implemented on the timeline in the regulation.

Tier 2 Vehicle and Gasoline Sulfur Program (40 CFR Part 80 Subpart H; Part 85; Part 86)

The USEPA's Tier 2 fleet averaging program for on-road vehicles, modeled after the California low emitting vehicles (LEV) II standards, became effective in the 2005 model year. The Tier 2 program allows manufacturers to produce vehicles with emissions ranging from relatively dirty to very clean, but the mix of vehicles a manufacturer sells each year must have average NO_X emissions below a specified value. Mobile emissions continue to benefit from this program as motorists replace older, more polluting vehicles with cleaner vehicles.

Nonroad Mobile Diesel Emissions Program (40 CFR Part 89)

The USEPA adopted standards for emissions of NOx, hydrocarbons, and carbon monoxide (CO) from several groups of nonroad engines, including industrial spark-ignition engines and recreational nonroad vehicles. Industrial spark-ignition engines power commercial and industrial applications and include forklifts, electric generators, airport baggage transport vehicles, and a variety of farm and construction applications. Nonroad recreational vehicles include snowmobiles, off-highway motorcycles, and all-terrain vehicles. These rules were initially effective in 2004 and were fully phased in by 2012. Mobile emissions continue to benefit from this program as motorists replace older, more polluting vehicles with cleaner vehicles.

The nonroad diesel rule set standards that reduced emissions by more than 90 percent from nonroad diesel equipment and, beginning in 2007, the rule reduced fuel sulfur levels by 99 percent from previous levels. The reduction in fuel sulfur levels applied to most nonroad diesel fuel in 2010 and applied to fuel used in locomotives and marine vessels in 2012.

Maximum Achievable Control Technology Programs (40 CFR Part 63)

VISTAS applied controls to future year emissions estimates from various maximum achievable control technology (MACT) regulations for volatile organic compounds (VOC), SO_2, NOx, and PM on source categories where controls were installed on or after 2002. Control estimates are documented in the report entitled, "Control Packet Development and Data Sources", Alpine Geophysics, July 14, 2004. Table 2-1 describes the MACTs used as control strategies for the non-electric generating units point source emissions. The table notes the pollutants for which

controls were applied as well as the promulgation dates and the compliance dates for existing sources.

Table 2-1. MACT Source Categories with Compliance Dates on or after 2002

MACT Source Category	40CFR63 Subpart	Date Promulgated	Existing Source Compliance Date	Pollutants Affected
Hazardous Waste Combustion (Phase I)	Parts 63(EEE), 261 and 270	9/30/99	9/30/03	PM
Oil & Natural Gas Production	HH	6/17/99	6/17/02	VOC
Polymers and Resins III	OOO	1/20/00	1/20/03	VOC
Portland Cement Manufacturing	LLL	6/14/99	6/10/02	PM
Publicly Owned Treatment Works (POTW)	VVV	10/26/99	10/26/02	VOC
Secondary Aluminum Production	RRR	3/23/00	3/24/03	PM
Combustion Sources at Kraft, Soda, and Sulfite Pulp & Paper Mills (Pulp and Paper MACT II)	MM	1/12/01	1/12/04	VOC
Municipal Solid Waste Landfills	AAAA	1/16/03	1/16/04	VOC
Coke Ovens	L	10/27/93	Phased from 1995-2010	VOC
Coke Ovens: Pushing, Quenching, and Battery Stacks	CCCCC	4/14/03	4/14/06	VOC
Asphalt Roofing Manufacturing and Asphalt Processing (two source categories)	LLLLL	4/29/03	5/1/06	VOC
Metal Furniture (Surface Coating)	RRRR	5/23/03	5/23/06	VOC
Printing, Coating, and Dyeing of Fabrics	OOOO	5/29/03	5/29/06	VOC
Wood Building Products (Surface Coating)	QQQQ	5/28/03	5/28/06	VOC
Lime Manufacturing	AAAAA	1/5/04	1/5/07	PM, SO_2
Site Remediation TSDF	GGGGG	10/8/03	10/8/06	VOC
Iron & Steel Foundries	EEEEE	4/22/04	04/23/07	VOC
Taconite Iron Ore Processing	RRRRR	10/30/03	10/30/06	PM, SO_2

Table 2-1. MACT Source Categories with Compliance Dates on or after 2002

MACT Source Category	40CFR63 Subpart	Date Promulgated	Existing Source Compliance Date	Pollutants Affected
Miscellaneous Coating Manufacturing	HHHHH	12/11/03	12/11/06	VOC
Metal Can (Surface Coating)	KKKK	11/13/03	11/13/06	VOC
Plastic Parts and Products (Surface Coating)	PPPP	4/19/04	4/19/07	VOC
Miscellaneous Metal Parts and Products (Surface Coating)	MMMM	1/2/04	1/2/07	VOC
Industrial, Commercial, and Institutional Boilers and Process Heaters for Major Sources [c]	DDDDD	1/31/13	1/31/16	PM SO_2
Industrial, Commercial, and Institutional Boilers and Process Heaters for Area Sources	JJJJJJ	2/1/13	3/21/14	PM SO_2
Plywood and Composite Wood Products	DDDD	7/30/04	10/1/07	VOC
Reciprocating Internal Combustion Engines	ZZZZ	6/15/04	6/15/07	NO_X, VOC
Auto and Light-Duty Truck (Surface Coating)	IIII	4/26/04	4/26/07	VOC
Wet Formed Fiberglass Mat Production	HHHH	4/11/02	4/11/05	VOC
Metal Coil (Surface Coating)	SSSS	6/10/02	6/10/05	VOC
Paper and Other Web Coating (Surface Coating)	JJJJ	12/4/02	12/4/05	VOC
Petroleum Refineries	UUU	4/11/02	4/11/05	VOC
Miscellaneous Organic Chemical Production (MON)	FFFF	11/10/03	05/10/08	VOC

Use of the 2004 Industrial/Commercial/Institutional (ICI) Boiler MACT standard was problematic in that the U.S. Court of Appeals for the District of Columbia Circuit vacated and remanded that regulation to the USEPA on June 8, 2007. However, VISTAS chose to leave the emissions reductions associated with this regulation in place since the Clean Air Act required use of alternative control methodologies under Section 112(j) for uncontrolled source categories. The applied MACT control efficiencies were 4 percent for SO_2 and 40 percent for coarse

particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) to account for the co-benefit from installation of acid gas scrubbers and other control equipment to reduce hazardous air pollutants (HAPs).

To determine how the vacature of this regulation may have affected the VISTAS future year inventories, VISTAS created an analysis of inventory data to determine the level of SO_2, PM_{10}, and $PM_{2.5}$ reductions associated with the vacated regulation. Table 2-2 compares the level of emission reductions for VISTAS in 2009 and 2018 estimated to be derived from the vacated regulation to the total non-electric generating unit point source inventory for those years and to the total annual inventory for those years.

Table 2-2. ICI Boiler MACT Reductions Compared to the 2009 and 2018 VISTAS Inventory

Pollutant	ICI Boiler MACT Estimated Reductions in VISTAS States[(1)]		Non-EGU Inventories for VISTAS States[(2)]		Total Inventories for VISTAS States[(2)]	
	2009	2018	2009	2018	2009	2018
Primary PM_{10}, tpy	13,325	14,556	211,267	248,367	4,161,695	4,549,680
Primary $PM_{2.5,}$ tpy	10,892	11,919	157,615	185,490	1,124,150	1,195,487
SO_2, tpy	7,773	8,188	548,196	575,716	3,468,899	2,169,773

[(1)]ICI Boiler MACT reduction estimates taken from *VISTAS Boiler_MACT_20080611.xls*
[(2)]Data from Documentation of the Base G2 and Best & Final 2002 Base Year, 2009 and 2018 Emission Inventories for VISTAS-Revision 1, April 9, 2008 (Table 2.1-15, Table 2.1-19, Table 2.1-20, and Appendix A).

The USEPA finalized the revised ICI Boiler MACT on February 21, 2011. However, in March of 2011, the USEPA published a notice stating their intention to reconsider certain aspects of the boiler and commercial and industrial solid waste incinerator rules and subsequently proposed the relevant changes on December 2, 2011. In August 2012, the USEPA won a court order delaying until January 13, 2012, any further proceedings in litigation over the original March 2011 version of the rules. In the meantime, on February 2, 2012, EPA issued a "no action assurance" letter stating that it will not enforce compliance or reporting deadlines in the original March 2011 rules.

EPA re-promulgated the ICI Boiler MACT on January 31, 2013 with a compliance date three years later. However, in 2010 and 2011 the NCDAQ issued Clean Air Act Section 112(j) permits approved by EPA for nearly 100 affected Boiler MACT facilities covering approximately 1,000 boilers effective for up to eight years from issuance. The 112(j) permits will stay in effect until 2018/2019 when the affected facilities will need to comply with the

Boiler MACT standards revised in January 2013. The revised rule is expected to result in substantially greater emissions reductions of visibility-impairing pollutants than the vacated 2004 rule, providing further assurance that North Carolina will achieve its Reasonable Progress Goals. Based on a 7% share of the U.S. boiler population, the Boiler MACT rule is projected to reduce North Carolina emissions by more than 30,000 ton/yr for SO_2 and 1,000 ton/yr for $PM_{2.5}$ sustainably beyond 2015 (http://www.epa.gov/airquality/combustion/actions.html). These emissions reductions are considerably higher than those estimated in the VISTAS Inventory under the vacated ICI Boiler MACT.

Federal Consent Agreements

The VISTAS 2009 and 2018 emissions inventories took into account unit specific requirements from several federal consent orders applicable to source types other than electrical generation, as described below.

- Dupont (US District Court for the Southern District of Ohio): A 2007 agreement called for the James River plant, located in Virginia, to install dual absorption pollution control equipment by September 1, 2009, resulting in emission reductions of approximately 1,000 tons of SO_2 annually. The sulfuric acid plant emitted 1,145 tons of SO_2 in 2002. In 2009, the year in which controls were applied, the plant emitted 379 tons of SO_2, and in 2010 the plant emitted 42 tons of SO_2.

- Stone Container (US District Court, Eastern District of Virginia): A 2004 agreement called for the West Point Paper Mill, owned by Smurfit/Stone Container and located in West Point, Virginia, to control SO_2 emissions from the #8 Power Boiler with a wet scrubber. This device was installed and operational in October of 2007. Emissions of SO_2 from the facility during 2002 were 4,575 tons. Emissions of SO_2 from the facility during 2009, after installation of the scrubber, were 1,009 tons. Emissions of SO_2 in 2010 from the facility were 1,252 tons.

- Santee Cooper (US District Court, South Carolina Charleston Division): Santee Cooper operates four coal-fired power plants. The March 16, 2004 settlement encompassed ten units at four coal-fired power plants and two proposed new coal-fired units. Specifically, the settlement required Santee Cooper to install state-of-the-art air pollution controls on certain units and upgrade other existing air pollution controls. The controls will result in the removal of approximately 37,500 tons per year of SO_2 and 29,500 tons per year of NOx from existing coal-fired units. The settlement also required Santee Cooper to retire excess SO_2 emission allowances from its Acid Rain allocations and restrict trade of its NOx allowances. The power plants and their locations covered under this settlement that are in the area of influence of North Carolina Class I areas include the Cross Plant and

the Jefferies Plant. Santee Cooper retired the coal and oil-fired boilers at its Jefferies Plant at the end of 2012.

2.1.2 Electric Generating Units Control Strategies

Emissions from electric generating units (EGUs) have been regulated through a number of mechanisms, including Clean Air Interstate Rule (CAIR), Cross State Air Pollution Rule (CSAPR), State programs, and federal consent agreements. Reductions associated with many of these mechanisms were used to estimate the 2018 visibility improvements at the VISTAS Class I areas.

North Carolina Clean Smokestacks Act

In June of 2002, the North Carolina General Assembly enacted the Clean Smokestacks Act (CSA), which required significant actual emissions reductions from coal-fired power plants in North Carolina. These reductions were included as part of the VISTAS 2018 Best and Final modeling effort. Under the act, power plants were required to reduce their NOx emissions by 77% in 2009 and their SO_2 emission by 73% in 2013. Actions taken to date by facilities subject to these requirements comply with the provisions of the CSA, and compliance plans and schedules will allow these entities to achieve the emissions limitations set out by the Act. This program has been highly successful. In 2009, regulated entities emitted less than the 2013 system annual cap of 250, 000 tons of SO_2 and less than the 2009 system annual cap of 56,000 tons of NOx. In 2002, the sources subject to CSA emitted 459,643 tons of SO_2 and 142,770 tons of NOx. In 2011, these sources emitted only 73,454 tons of SO_2 and 39,284 tons of NOx, well below the Act's system caps.

Georgia Multi-Pollutant Control for Electric Utility Steam Generating Units

Georgia rule 391-3-1.02(2)(sss), enacted in 2007, requires flue-gas desulphurization (FGD) and selective catalytic reduction (SCR) controls on coal fired EGUs in Georgia. Reductions from this regulation were included as part of the VISTAS 2018 best and final modeling effort. These controls will reduce SO_2 emissions from the affected emissions units by at least 95 percent and will reduce NOx emissions by approximately 85 percent. Control implementation dates vary by EGU, starting on December 31, 2008.

Maryland Healthy Air Act

The Maryland Healthy Air Act (HAA) regulations became effective on July 16, 2007 and required reductions in NO_X, SO_2, and mercury emissions from large coal burning power plants in Maryland. Emission reductions from the HAA come in two phases. The first phase required reductions in the 2009/2010 timeframe, and compared to a 2002 emission baseline, reduced NO_X

emission by almost 70 percent and SO_2 emission by 80 percent. The second phase of emissions controls occurs in the 2012/2013 time frame. At full implementation, the HAA will reduce NO_X emissions by approximately 75 percent from 2002 levels and SO_2 emissions by approximately 85 percent from 2002 levels. Maryland is not a VISTAS participant. However, Maryland borders two VISTAS states, and Maryland facilities have calculated sulfate visibility impairment contributions to several VISTAS Class I areas. The first phase of the HAA was successfully implemented, and the second phase of the program is expected to be implemented in a timely manner. Reductions associated with this program were included as part of the VISTAS 2018 Best and Final modeling effort.

North Carolina NOx SIP Call

Phase I of the NOx SIP call applies to certain EGUs and large non-EGUs, including large industrial boilers and turbines, and cement kilns. Those states affected by the NOx SIP call in the VISTAS region developed rules for the control of NOx emissions that have been approved by the USEPA. The NOx SIP Call has resulted in a 68% reduction in summertime NOx emissions from large stationary combustion sources in North Carolina.

Clean Air Interstate Rule and Cross State Air Pollution Rule

On May 12, 2005, the USEPA promulgated CAIR, which required reductions in emissions of NOx and SO_2 from large fossil fuel fired EGUs. These emission reductions were included as part of the VISTAS 2018 best and final modeling effort. The U.S. Court of Appeals for the D.C. Circuit ruled on petitions for review of CAIR and CAIR Federal Implementation Plans, including their provisions establishing the CAIR NOx annual and ozone season and SO_2 trading programs. On July 11, 2008, the Court issued an opinion vacating and remanding these rules. However, parties to the litigation requested rehearing of aspects of the Court's decision, including the vacatur of the rules. On December 23, 2008, the Court remanded the rules to the USEPA without vacating them. The December 23, 2008 ruling left CAIR in place until the USEPA issues a new rule to replace CAIR in accordance with the July 11, 2008 decision.

On July 6, 2011, the USEPA finalized the Cross-state Air Pollution Rule (CSAPR). This rule replaces CAIR beginning 2012 and requires 27 states in the eastern half of the United States to reduce power plant emissions. The USEPA also issued a supplemental proposal for six states to make summer time NOx reductions. This supplemental proposal, when finalized, would bring the total number of states participating in the program to 28. CSAPR was estimated to reduce 2005 emissions from EGUs by 6,500,000 tons of SO_2 annually and 1,400,000 tons of NOx annually in the covered states. These estimates represent a 71 percent reduction in SO_2 and a 52 percent reduction in NOx from 2005 levels.

On December 30, 2011, the U.S. Court of Appeals for the D.C. Circuit issued a ruling to stay the CSAPR pending judicial review. The court heard oral arguments on April 13, 2012, and issued a decision on August 21, 2012, vacating the CSAPR. Further, the court remanded the case to EPA for action consistent with the decision. The court directed EPA to continue implementing CAIR while the agency works on a replacement rule. North Carolina's CAIR rules (15A NCAC 02D .2401) went into effect on July 1, 2006, replacing the NOx SIP Call program. Sources within the State are continuing to comply with CAIR.

Utility Federal Consent Orders

Federal consent agreements with major utilities contained remedies that imposed control requirements or other reductions in future year emissions. These requirements were taken into account in the VISTAS 2018 Best and Final Inventory.

- Under a settlement agreement, Tampa Electric installed permanent emissions control equipment by 2008 to meet stringent pollution limits; implemented a series of interim pollution-reduction measures to reduce emissions while the permanent controls were designed and installed; and retired pollution emission allowances that Tampa Electric or others could use, or sell to others, to emit additional NO_X, SO_2, and PM.

- In the VEPCO (Dominion Power) consent agreement, the utility agreed to spend $1.2 billion by 2013 to eliminate 237,000 tons of SO_2 and NO_X emissions each year from eight coal-fired EGUs in Virginia and West Virginia. Installation of these controls proceeded well ahead of schedule.

- The Gulf Power agreement required Gulf Power to upgrades to cut NO_X emission rates by 61 percent at its Crist generating plant by 2007.

- American Electric Power agreed to spend $4.6 billion dollars to eliminate 72,000 tons of NO_X emission annually by 2016 and 174,000 tons of SO_2 emissions annually by 2018 from sixteen plants located in Indiana, Kentucky, Ohio, Virginia, and West Virginia.

2.1.3 Non-Electric Generating Units Control Strategies

Two non-electric generating facilities in North Carolina were subject to BART: Blue Ridge Paper in Canton and PCS Phosphate in Aurora. Existing controls at both facilities were deemed to be BART in North Carolina's 2007 Regional Haze SIP.

2.2 Emission Control Measures Not Included in the VISTAS Final Modeling

Since development of the 2018 Best and Final inventory effort, a number of regulations and requirements have been promulgated that were not included in 2018 estimates. The sections below provide information on these requirements, and where possible, estimates of additional reductions are provided. These reductions provide extra assurances that the VISTAS Class I areas will meet their reasonable progress goals in a timely manner.

2.2.1 North American Emission Control Area

On March 26, 2010, the International Maritime Organization officially designated waters off North American coasts as an area in which stringent international emission standards will apply to ships. These standards will reduce air pollution from ships and deliver air quality benefits that extend hundreds of miles inland. In 2020, the USEPA expects emissions from ships operating in the designated area to be reduced by 320,000 tons for NO_X, 90,000 tons for $PM_{2.5}$, and 920,000 tons for SO_2, which is 23 percent, 74 percent, and 86 percent, respectively, below predicted levels in 2020 absent the Emissions Control Area designation.

Implementation of the Emission Control Area means that ships entering the designated area would need to use compliant fuel for the duration of their voyage that is within that area, including time in port as well as voyages whose routes pass through the area without calling on a port. The requirements for quality of fuel change over time. From the effective date in 2012 until 2015, fuel used by all vessels operating in designated areas cannot exceed 10,000 ppm sulfur content. Beginning in 2015, fuel used by vessels operating in these areas cannot exceed 1,000 ppm sulfur content, and beginning in 2016, NO_X after-treatment requirements become applicable.

2.2.2 Residual Risk Requirements

The Clean Air Act requires the USEPA to assess the risk remaining after application of final technology-based air toxics standards to any source category within 8 years of setting the technology based MACT standards. In the residual risk process, the USEPA must assess the remaining health risks from each source category to determine whether the MACT standards provide an ample margin of safety to protect public health and protect against adverse environmental effects. Final rules for this Clean Air Act requirement are expected for 28 source categories between 2011 and 2013. Additional requirements to reduce toxic air emissions under the residual risk assessment may also have co-benefits for the reduction of VOC and other criteria pollutant emissions between now and 2018.

2.2.3 Control Technique Guidelines

The federal Clean Air Act (§ 172(c)(1)) provides that SIPs for nonattainment areas must include reasonably available control techniques (RACT) for control of emissions that contribute to the formation of ozone air pollution. Section 182(b)(2) provides that for certain nonattainment areas, states must revise their SIPs to include RACT for sources of VOC emissions covered by a control techniques guidelines document (CTG). Section 183(e) then directs the USEPA to list for regulation those categories of products that account for at least 80 percent of the VOC emissions from commercial products in ozone nonattainment areas.

RACT controls for source categories controlled by a CTG are known as CTG RACTs. CTG RACTs have been issued for various printing, coating, and cleaning operations. In 2006, 2007, and 2008, the USEPA published CTGs as listed in Table 2-3. These regulations, which must be implemented in ozone nonattainment areas and the Ozone Transport Region within 1 year of becoming final, will reduce emissions of VOCs from areas in which they are required.

Table 2-3. CTGs Promulgated in 2006, 2007, and 2008

Category	EPA Document Number
Industrial Cleaning Solvents	EPA-453/R-06-001
Offset Lithographic Printing and Letterpress Printing	EPA-453/R-06-002
Flexible Package Printing	EPA-453/R-06-003
Flat Wood Paneling Coatings	EPA-453/R-06-004
Paper, Film, and Foil Coatings	EPA-453/R-07-003
Large Appliance Coatings	EPA-453/R-07-004
Metal Furniture Coating	EPA-453/R-07-005
Miscellaneous Metal and Plastic Parts Coatings	EPA-453/R-08-003
Fiberglass Boat Manufacturing Materials	EPA-453/R-08-004
Miscellaneous Industrial Adhesives	EPA-453/R-08-005
Automobile and Light-Duty Truck Assembly Coatings	EPA-453/R-08-006

2.2.4 New EGU Control Strategies

Two federal programs and one federal consent agreement will provide further reductions in SO_2 from the EGU source sector, either as a result of SO_2 requirements or as co-benefit from the

reduction of HAPs. These benefits were not considered in the development of the VISTAS Best and Final 2018 inventories. Any additional SO_2 emission reduction benefits achieved by the implementation of these requirements will help to ensure that all Class I areas in VISTAS meet their reasonable progress goals in a timely manner.

Mercury and Air Toxics Rule

On December 16, 2011, the USEPA finalized national CAA standards to reduce mercury and other toxic air pollution from coal and oil-fired power plants. The final rule established power plant emission standards for mercury, acid gases, and non-mercury metallic toxic pollutant that will prevent 90 percent of the mercury in coal burned in power plants from being emitted to the air; reduce by 88 percent the acid gas emissions from power plants; and cut power plant SO_2 emissions by 41 percent beyond the reductions expected from CSAPR. These reductions are expected in the 2016 time frame.

2010 SO_2 NAAQS

On June 2, 2010, the USEPA strengthened the primary NAAQS for SO_2 by revising the primary SO_2 standard to 75 parts per billion (ppb) averaged over one hour. This short term standard is significantly more stringent than the revoked standards of 140 ppb averaged over 24 hours and 30 ppb averaged annually. Under the new standard, facilities with significant emissions of SO_2, many of which are EGUs, may be required to demonstrate compliance with the standard no later than 2017.

Tennessee Valley Authority Federal Consent Agreement

In April of 2011, the USEPA announced a settlement with the Tennessee Valley Authority (TVA) to resolve alleged Clean Air Act violations at 11 of its coal fired plants in Alabama, Kentucky, and Tennessee. The settlement requires TVA to invest $3 billion to $5 billion on new and upgraded state-of-the-art pollution controls. Once fully implemented, the pollution controls and other required actions will address 92 percent of TVA's coal-fired power plant capacity, reducing emissions of NO_X by 69 percent and SO_2 by 67 percent from TVA's 2008 emissions levels.

2.3 Sources in Area of Influence and Status of Controls

As determined in the initial regional haze SIP, ammonium sulfate is the largest contributor to visibility impairment at the North Carolina Class I areas, and reduction of SO_2 emissions is the most effective means of reducing ammonium sulfate. The coal-fired EGUs were the largest contributors to SO_2 emissions and the focus in the initial regional haze SIP was on controlling these sources. Table 2-4 lists the coal-fired EGU sources owned by Duke Energy or Progress Energy in North Carolina, the SO_2 and NOx emission controls included in the initial regional

haze SIP and the status of those controls. As illustrated in Table 2-4, all of the coal-fired units will be controlled with a scrubber for SO_2 control, a selective catalytic reduction (SCR) unit or a selective non-catalytic reduction (SNCR) for NOx control, or retired by January 2015. This will result in significantly more SO_2 and NOx emission reductions than what was demonstrated in the initial regional haze SIP.

Table 2-4. North Carolina EGUs and Status of Controls

Facility	Emission Unit	Emission Controls Included in SIP	SIP Required Control Date: Scrubber/ SCR	Status of Controls*
Progress Energy - Asheville	1-2	Scrubbers and SCRs	2005 - 2007	Scrubbers and SCRs installed; throughout 2005 to 2007
Progress Energy - Mayo	1	Scrubber/ SCR	2007- 2009	Scrubber installed 2009; SCR installed 2007
Progress Energy - Roxboro	1-4	Scrubbers and SCRs	2001- 2008	Scrubbers and SCRs installed throughout 2001 to 2008
Duke Energy - Allen	1-5	Scrubbers and SNCRs	2003-2009	Scrubbers and SCRs installed throughout 2003 to 2009
Duke Energy - Belews Creek	1-2	Scrubbers/ SCRs	2003- 2008	Scrubbers and SCRs installed throughout 2003 to 2008
Duke Energy - Cliffside	1-4	None	None	Retired Oct 2011
	5	Scrubber/ SCR	2010/ 2002	Scrubber installed 2010; SCR installed 2002
	6	Scrubber/ SCR	2012/ 2012	Scrubber and SCR installed 2012
Duke Energy - Marshall	1-4	Scrubbers/SCR/ SNCRs	2006- 2008	Scrubbers, SCR, and SNCRs installed throughout 2006 to 2008
Progress Energy - Cape Fear	5-6	None	None	Retired Oct 2012
Progress Energy - H.F. Lee	1-3	None	None	Retired fall 2012
Progress Energy - L.V. Sutton	1-3	None	None	Retiring January 2014
Progress Energy - Weatherspoon	1-3	None	None	Retired fall 2011
Duke Energy - Buck	5-7	None	None	Retired mid 2011
	8-9	None	None	Retiring April 2013

Table 2-4. North Carolina EGUs and Status of Controls

Facility	Emission Unit	Emission Controls Included in SIP	SIP Required Control Date: Scrubber/ SCR	Status of Controls*
Duke Energy - Dan River	1-3	None	None	Retired April 2012
Duke Energy - Riverbend	7-10	None	None	Retiring April 2013

Table 2-5 displays the sources located in the area of influence for each of the North Carolina Class I areas, the SO_2 emission controls included in the initial regional haze SIP and the status of those controls. One coal-fired EGU in North Carolina was determined to be in the area of influence of the James River Face Class I area in Virginia (Table 2-6). This plant was retired in April 2012 and replaced with combustion turbines in August 2012.

Table 2-5. Source in Area Influence of North Carolina Class I Areas

State	Facility	Emission Unit	Class I Area Impacted	Emission Controls Included in SIP	SIP Required Control Date	Status of Controls*
Alabama	TVA – Widow Creek	008	JOKI	Scrubber	Operational in base year	Scrubber installed and operational
Georgia	Georgia Power – Yates	SG06, SG07	JOKI	Scrubbers	By 2018	Plan to retire by 2015
Georgia	Georgia Power – Scherer	SG01, SG02, SG03, SG04	JOKI	Scrubbers	By 2018	Unit 3 in place 7/2011 Units 1, 2, & 4 to be in place by 2015, 2014 & 2013
Georgia	Georgia Power - Bowen	SG03, SG04	JOKI	Scrubbers	By 2018	All in place and operational, last unit started 6/1/2010
North Carolina	Blue Ridge Paper	G-25, G-65, G-24, G-66, G-26, G-31, G-32	JOKI, LIGO, SHRO	None	N/A	No new controls installed recently, but 5 boilers subject to MACT requirements for PM and SO_2 controls by 2018
North Carolina	Duke Energy – Cliffside	3, 4, 5, 6	LIGO	Units 3 & 4 –None, Unit 5– Scrubber, Unit 6 -- Scrubbers and SCR	N/A 2010	Units 1-4 retired 2011; Unit 5 scrubber in operation 2010; Unit 6 in operation with scrubbers and SCR in 2012.
North Carolina	Duke Energy – Riverbend	7-10	LIGO	None	N/A	All coal-fired units to retire by April 2013
North Carolina	Duke Energy – Marshal	3, 4	LIGO	Scrubbers and SNCRs and SCR	#3 – 2007 #4 – 2008	Controls installed and operational by SIP date
North Carolina	Duke Energy – Buck	8, 9	LIGO	None	N/A	Units to retire April 2013
North Carolina	Ecusta	G-28, G-29	SHRO	None	N/A	Facility shutdown in 2008

Table 2-5. Source in Area Influence of North Carolina Class I Areas

State	Facility	Emission Unit	Class I Area Impacted	Emission Controls Included in SIP	SIP Required Control Date	Status of Controls*
North Carolina	Progress Energy – Asheville	1, 2	SHRO	Scrubbers	#1 – 2005 #2 – 2006	Controls installed and operational by SIP date
North Carolina	PCS Phosphate	3, 4, 5, 6	SWAN	None	N/A	Sulfuric acid plant Units 3-4 shutdown to allow startup of less emissive new Unit 7.
North Carolina	Plymouth Domtar (was Weyerhaeuser)	31, 32, 40	SWAN	None	N/A	Retired one boiler and others switched to natural gas, reducing 2,600 ton/yr SO_2 emissions from 2007-2011
North Carolina	Weyerhaeuser Vanceboro	1	SWAN	None	N/A	Retired one boiler and others switched to natural gas, reducing 850 ton/yr SO_2 emissions from 2007-2011
North Carolina	Progress Energy - Sutton	3	SWAN	None	2012	All coal units to retire in 2014, switching to natural gas
North Carolina	Progress Energy - Lee	2 ,3	SWAN	None	N/A	All coal units retired in fall 2012, switching to natural gas
North Carolina	Cogentrix Kenansville (Coastal Carolina Clean Power)	Gen1	SWAN	None	N/A	SO_2 emissions grew 90 ton/yr from 2007-2011 due to generation increase from burning wood for renewable energy credits
Tennessee	TVA Bull Run	001	GSMNP, JOKI, LIGO, SHRO	Wet Scrubber	By 2018	Install FGD or retire by 2018

Table 2-5. Source in Area Influence of North Carolina Class I Areas

State	Facility	Emission Unit	Class I Area Impacted	Emission Controls Included in SIP	SIP Required Control Date	Status of Controls*
Tennessee	Alcoa – South Plant (BART Source)	Primary Aluminum Smelting Operation	GSMNP, JOKI	Coke Sulfur content not to exceed 3%	2017	Permit condition in place to meet scheduled control date
Tennessee	A.E. Staley Manufacturing Company	005	GSMNP, JOKI	None	N/A	N/A
Tennessee	Eastman Chemical Company (BART Source)	Powerhouse B-253-1, Boilers 25-29	GSMNP, JOKI, LIGO, SHRO	Reduce SO_2 emissions by 92%	2017/ 2018	Permit condition place to meet scheduled control date. Alternative control of converting to natural gas given to 2018 if chosen.
Tennessee	Apac-Tn, Inc./Harrison Construction	002	GSMNP	None	N/A	N/A
Tennessee	U.S. DOE, Y-12 Plant	002	GSMNP, JOKI	None	N/A	N/A
Tennessee	Bowater Newsprint	10	GSMNP, JOKI	None	N/A	Entered into Consent Decree to lower allowable SO_2 emissions to 4,562 tons per year
Tennessee	Intertrade Holdings	001	JOKI	None	N/A	N/A

Table 2-5. Source in Area Influence of North Carolina Class I Areas

State	Facility	Emission Unit	Class I Area Impacted	Emission Controls Included in SIP	SIP Required Control Date	Status of Controls*
South Carolina	Duke Energy W.S. Lee	1, 2, 3	JOKI, SHRO	None	N/A	Retiring units by 10/2014
South Carolina	Santee Cooper – Jefferies	3, 4	SWAN	None	N/A	Retiring units by 2015
Virginia	American Electric Power – Clinch River	1, 2, 3	LIGO	Facility-wide cap	2015	Facility has met cap early and plans to gasify units 1 & 2 and retire unit 3 by 2015.
Virginia	International Paper	4	SWAN	Scrubber	By 2018	Boilers switched fuels from coal to wood and natural gas, subject to Boiler MACT standards by 2015

GSMNP = Great Smoky Mountains National Park
JOKI = Joyce Kilmer-Slickrock
LIGO = Linville Gorge
SHRO = Shining Rock
SWAN = Swanquarter

Table 2-6. North Carolina Source in Area Influence of Other States Class I Areas

Facility	Emission Unit	Class I Area Impacted	Emission Controls Included in SIP	SIP Required Control Date	Status of Controls*
Duke Energy – Dan River	3	JARI	None	N/A	Retired April 2012, switching to natural gas

JARI = James River Face in Virginia

3.0 SUMMARY OF EMISSION REDUCTIONS ACHIEVED (40 CFR 51.308(g)(2))

40 CFR 51.308(g)(2) requires *"a summary of the emissions reductions achieved throughout the state through implementation of the measures in paragraph (g)(1)."*

This section provides a summary of emissions reduced as a result of implementation measures described in Section 2. It specifically focuses on SO_2 emission reductions because ammonium sulfate has been determined to be the most important contributor to visibility impairment and fine particle mass on the 20% worst and 20% best visibility days at all the North Carolina Class I areas. Sulfate particles are formed in the atmosphere from SO_2 emissions. Additional discussion on pollutant contributions to visibility impairment is provided in Section 7.0.

3.1 EGU SO_2 Emission Reductions

Table 3-1 lists the electric generating units in North Carolina that were previously projected to have controls installed by 2018 in the original regional haze SIP and units that more recent plans by the utility company are expected to be retired by 2015 or sooner. This table provides typical year 2002 emissions and the Integrated Planning Model (IPM) predicted 2018 emissions used in the modeling for the original regional haze SIP, as well as the estimated tons reduced between 2002 and 2018. The actual 2011 emissions data for these sources was obtained from the USEPA's Clean Air Markets database. An estimate of the current projection for 2018 SO_2 emissions was developed using the projected 2013 emissions from the 2012 Clean Smokestacks Act implementation plan for those sources expected to be in operation in 2018.

As can be seen in Table 3-1, the current SO_2 emission reductions from 2002 to 2011 are higher than the estimated SO_2 tons reduced in the original regional haze SIP between 2002 and 2018. Additionally, the new projected 2018 SO_2 emissions are approximately 80% lower than the projected 2018 SO_2 emissions in the original regional haze SIP. Since the EGU sector represents over 50% of statewide SO_2 emissions from stationary sources, this is a clear sign that the Class I areas in North Carolina are on track to meet or exceed their reasonable progress goals.

Duke Energy and Progress Energy emitted a total of 370,000 ton/yr of SO_2 emissions from their coal-fired EGUs in North Carolina in 2007. Due largely to flue gas desulfurization (FGD) scrubbers installed on 19 of their largest EGUs with 10 Gigawatts (GW) capacity, they emitted a total of 73,000 ton/yr of SO_2 emissions in 2011. Their statewide SO_2 emissions dropped nearly 300,000 ton/yr representing an 80% reduction over the recent 5-year period. Future SO_2 emissions are expected to decline further from more natural gas use and continued retirement of their older, smaller, non-FGD controlled coal-fired EGUs with 3 GW capacity by 2015. In regards to NO_x emissions, both utilities emitted a total of 57,400 ton in 2007 and 39,300 ton in

2011 from their coal-fired EGUs in North Carolina. Their statewide NO_x emissions dropped over 18,000 ton/yr representing a 32% reduction over the recent 5-year period.

Table 3-1. Estimated SO_2 Emissions for North Carolina's Major Electric Generating Utility Sources (tons/year)

Company - Facility	Emission Unit	2002 VISTAS	2018 IPM	Estimated Tons Reduced in SIP	Actual Emissions (2011 CAMD)	Current Emission Reductions (2002-2011)	Current Estimate of 2018 Emissions	Current Estimate of 2018 Emission Reductions
Progress Energy - Asheville	1	8,489	576	7,913	1,039	7,450	401	8,088
	2	8,074	499	7,575	1,203	6,871	447	7,627
Progress Energy - Cape Fear	5	5,486	3,379	2,107	3,415	2,071	0	5,486
	6	6,101	4,300	1,801	4,688	1,413	0	6,101
Progress Energy - H.F. Lee	1	2,744	2,918	-174	1,545	1,199	0	2,744
	2	2,719	2,363	356	1,015	1,704	0	2,719
	3	9,218	6,976	2,242	7,047	2,171	0	9,218
Progress Energy - Mayo	1A	13,673	954	12,719	4,053	9,620	653	13,020
	1B	13,122	953	12,169	3,182	9,940	653	12,469
Progress Energy - Roxboro	1	15,596	999	14,597	1,650	13,946	543	15,053
	2	29,504	2,438	27,066	1,864	27,640	981	28,523
	3A	16,082	1,071	15,011	1,383	14,699	466	15,616
	3B	15,835	1,071	14,764	1,336	14,499	467	15,368
	4A	11,207	1,253	9,954	1,610	9,597	331	10,876
	4B	10,625	1,253	9,372	1,491	9,134	331	10,294
Progress Energy - L.V. Sutton	1	2,805	2,357	448	2,048	757	0	2,805
	2	3,470	3,711	-241	2,083	1,387	0	3,470
	3	14,902	1,037	13,865	8,850	6,052	0	14,902
Progress Energy –	1	1,927	912	1,015	226	1,701	0	1,927

Table 3-1. Estimated SO_2 Emissions for North Carolina's Major Electric Generating Utility Sources (tons/year)

Company - Facility	Emission Unit	2002 VISTAS	2018 IPM	Estimated Tons Reduced in SIP	Actual Emissions (2011 CAMD)	Current Emission Reductions (2002-2011)	Current Estimate of 2018 Emissions	Current Estimate of 2018 Emission Reductions
Weather-spoon	2	2,084	1,151	933	545	1,539	0	2,084
	3	3,009	2,756	253	1,143	1,866	0	3,009
Duke Energy - Allen	1	4,435	173	4,262	225	4,210	34	4,401
	2	4,986	216	4,770	202	4,784	27	4,959
	3	8,810	741	8,069	366	8,444	374	8,436
	4	9,623	728	8,895	400	9,223	454	9,169
	5	8,424	715	7,709	472	7,952	212	8,212
Duke Energy - Buck	5	572	1,104	-532	0	572	0	572
	6	537	1,064	-527	0	537	0	537
	7	746	610	136	0	746	0	746
	8	3,752	3,155	597	1,932	1,820	0	3,752
	9	4,042	4,001	41	1,907	2,135	0	4,042
Duke Energy - Cliffside	1	862	1,049	-187	0	862	0	862
	2	1,027	882	145	0	1,027	0	1,027
	3	1,487	1,962	-475	0	1,487	0	1,487
	4	1,299	2,014	-715	0	1,299	0	1,299
	5	25,124	1,952	23,172	308	24,816	760	24,364
	6	0	0	0	0	0	1,571	-1,571

Table 3-1. Estimated SO_2 Emissions for North Carolina's Major Electric Generating Utility Sources (tons/year)

Company - Facility	Emission Unit	2002 VISTAS	2018 IPM	Estimated Tons Reduced in SIP	Actual Emissions (2011 CAMD)	Current Emission Reductions (2002-2011)	Current Estimate of 2018 Emissions	Current Estimate of 2018 Emission Reductions
Duke Energy - Dan River	1	2,621	3,464	-843	438	2,183	0	2,621
	2	921	1,498	-577	440	481	0	921
	3	1,026	1,837	-811	1,069	-43	0	1,026
Duke Energy - Marshall	1	26,469	2,243	24,226	577	25,892	626	25,843
	2	25,869	2,208	23,661	681	25,188	730	25,139
	3	14,931	485	14,446	1,291	13,640	1,389	13,542
	4	15,042	470	14,572	1,305	13,737	1,710	13,332
Duke Energy - Riverbend	7	3,321	2,592	729	1,128	2,193	0	3,321
	8	3,435	1,511	1,924	1,204	2,231	0	3,435
	9	5,686	3,973	1,713	2,381	3,305	0	5,686
	10	5,677	3,973	1,704	2,406	3,271	0	5,677
Duke Energy - Belews Creek	1	39,667	2,536	37,131	1,676	37,991	2,474	37,193
	2	43,766	3,218	40,548	1,632	42,134	2,786	40,980
Totals		460,829	93,301	367,528	73,456	387,373	18,420	442,409

Table 3-2 presents information on 35 coal-fired EGU sources with planned retirements by 2015 located in eight nearby states that modeling has shown impacts visibility in North Carolina Class I areas. The information on retirements in Table 3-2 covers 115 boilers with 22,000 megawatts (MW) emitting more than 550,000 ton/yr of SO_2 in 2011. This is another sign indicating that the Class I areas in North Carolina are on track to meet or exceed their reasonable progress goals. The information was initially found from searches on the Internet and then confirmed by air quality agency staff in the respective states.

Table 3-2. Planned Coal-fired EGU Retirements by 2015 Near North Carolina

State	Facility	Company	Units	Capacity (MW)
South Carolina	Canadys	South Carolina Electric & Gas	3	420
	McMeekin		2	250
	Urquhart		1	100
	Grainger	Santee Cooper	2	166
	Jefferies		2	346
	Robinson	Progress Energy	1	177
	W.S. Lee	Duke Energy	3	370
Georgia	Harlee Branch	Georgia Power	4	1,746
	Yates		5	1,487
	Kraft		3	208
Tennessee	John Sevier	TVA	2	400
	Johnsonville		10	1,206
Virginia	Chesapeke	Dominion Virginia Power	4	638
	Clinch River	American Electric Power	3	714
	Glen Lyn		3	338
	Potomac River	GenOn	4	514
West Virginia	Albright	Monongahela Power	3	278
	Kammer	American Electric Power	2	713
	Phil Sporn		5	1,105
	Rivesville	First Energy	2	110
	Willow Island		2	213
Alabama	Gadsden	Alabama Power	2	138
	Widows Creek	TVA	6	846
Kentucky	Big Sandy	American Electric Power	2	1,097
	Cane Run	Louisville Gas & Electric	3	563
	Dale	East Kentucky Power	4	216
	Green River	Kentucky Utilities	2	189
	Robert Reid	Big Rivers Electric	1	96
	Shawnee	TVA	9	1,206
Ohio	Ashtabula	First Energy	1	256
	Bay Shore		4	499

State	Facility	Company	Units	Capacity (MW)
	Eastlake		4	1,257
	Lake Shore		1	256
	Muskingum River	American Electric Power	5	1,529
	Picway		1	106
	Richard Gorsuch	American Municipal Power	4	200
Total			**142**	**22,938**

3.2 Non-EGU SO_2 Emission Reductions

In the December 2007 Regional Haze SIP, the NCDAQ identified several non-EGU sources with greater than 1% contributions at Class I areas. All but two sources submitted exemption modeling demonstrations. The two sources (Blue Ridge Paper and PCS Phosphate) were unable to demonstrate a contribution of less than 0.5 dv within 300 kilometers from their BART eligible sources. The NCDAQ evaluated whether controls were reasonable and determined that BART is no additional controls at either facility. Since this time, new federal regulations have been implemented and the availability of cheaper, cleaner burning natural gas has prompted many non-EGU sources to reduce emissions of SO_2 and other air pollutants. The following is a description of the status and plans for SO_2 emission reductions at non-EGU facilities identified within area of influence. Table 3-3 summarizes emission comparisons.

Blue Ridge Paper Mill in Canton, NC (aka Evergreen Packaging)
Nearly 90 percent of the SO_2 emissions from the Canton Paper Mill are produced from five large, primarily coal-fired industrial boilers with a total of 2 billion Btu/hr heat input capacity for facility electricity and steam generation. Facility-wide annual SO_2 emissions have ranged from 8,200 to 8,800 tons in the past five years. The Boiler MACT emissions standards for coal-fired boilers are expected to reduce well over half of the nominal 8,500 tons SO_2 emissions at the Canton Mill by 2019. Available control options to meet the standards include retiring multiple boilers, using/upgrading existing scrubbers or installing new ones, and/or installing a natural gas-fired combustion turbine.

Weyerhaeuser Paper Mill in New Bern, NC
The majority of the SO_2 emissions from the Vanceboro Paper Mill were produced from four largely oil-fired industrial boilers for on-site electricity and steam generation. Facility-wide annual SO_2 emissions have already dropped from over 1,300 tons to 500 ton during the past five years from retiring boilers and fuel switching to natural gas for the remaining boilers and combustion units. The facility plans to continue burning natural gas in the future to meet the Boiler MACT emissions standards by 2019.

Paper Mill in Plymouth, NC, currently Domtar Paper Co. (formerly Weyerhaeuser)
The majority of the SO_2 emissions from the Plymouth Paper Mill were produced from four largely coal, wood, and oil-fired industrial boilers with a total of 2,700 million Btu/hr heat input capacity for facility electricity and steam generation in 2007. Facility-wide annual SO_2 emissions have already dropped from over 4,000 tons to less than 1,000 tons during the past five years from retiring boilers and fuel switching to natural gas and away from coal and oil for the remaining boilers and combustion units. The facility plans to burn natural gas and lignin in the future in order to meet the Boiler MACT emissions standards by 2019.

Cogeneration Facility in Kenansville, NC, currently Coastal Carolina Clean Power (formerly (Cogentrix)
The facility is an "area source" under Section 112 of CAA with two boilers subject to the Boiler NESHAPS Subpart JJJJJJ - Area Source requirements for GACT. The requirements include work practice standards and emission reduction measures, but not emission limits. The facility is not subject to NESHAPS Subpart UUUUU (Utility MACT) because each boiler has a potential electric output capacity of $\leq$ 25 MWe. The facility consists of a biomass-fueled cogeneration power plant selling electric power to the grid and steam to a nearby facility. It's annual SO_2 emissions grew from 20-30 tons 2007-2008 to 110 tons in recent years due to a rise in generation from burning biomass instead of coal for state and federal renewable energy credits. However, this rise is still well below the 1,834 tons applied in VISTAS 2018 modeling.

PCS Phosphate Co. in Aurora, NC
The facility produces various phosphate products by calcining and refining the mined rock, making sulfuric acid, and mixing both to produce phosphoric acid. Nearly 95% of their SO_2 emissions are released from sulfuric acid production, with the remainder coming from phosphoric acid production, calcining and solid fertilizer production. The facility replaced its oldest sulfuric acid production lines with a newer, more efficient technology for making sulfuric acid with a lower SO_2 emission factor. The newer production equipment is subject to the federal New Source Performance Standards for Sulfuric Acid Plants (40 CFR 60 Subpart H), resulting in SO_2 emissions dropping from 27 lb/ton of 100% sulfuric acid produced to 4 lb/ton of 100% of sulfuric acid produced. Facility wide annual SO2 emissions have ranged between 3,554 and 5,477 tons during the past five years.

Table 3-3. Estimated Facility-Wide SO_2 Emissions for North Carolina's Non EGU Sources (tons/year)

Company -Facility	2002 VISTAS	2018 VISTAS	Estimated Tons Reduced in SIP (2002-2018)	Actual Emissions (2011)	Current Emission Reductions (2002-2011)	Current Estimate of 2018 Emission Reductions (2011 – 2018)
Blue Ridge Paper	8,730	10,147	-1,417	8,512	218	1,635
PCS Phosphate	4,616	6,059	-1,443	5,395	779	664
Plymouth Domtar (was Weyerhaeuser)	3,339	3,865	-526	711	2,628	3,154
Weyerhaeuser Vanceboro	1,026	1,200	-174	506	520	694
Cogentrix Kenansville (Coastal Carolina Clean Power)	0.009	1,834	-1,834	107	-107	1,727
Totals	17,711	23,105	-5,394	15,231	4,038	7,874

4.0 ASSESSMENT OF VISIBILITY CONDITIONS (40 CFR51.308(g)(3))

4.1 Reasonable Progress Goals Updated

Although the North Carolina's regional haze SIP was submitted in December 2007, the VISTAS modeling continued with neighboring states including additional control measures. The VISTAS best and final modeling concluded in Spring 2008 and the modeled progress for 2018 changed for the North Carolina Class I areas. North Carolina is adopting the new reasonable progress goals for all Class I areas in the state in this mid-course review. Additionally, the baseline visibility for the 20% best days for Shining Rock in the original regional haze SIP reported the 2001-2005 visibility (7.7 deciviews) instead of the 2000-2004 baseline visibility (8.2 deciviews). This is corrected in the table below. Table 4-1 lists the reasonable progress goals that were stated in the original regional haze SIP.

Table 4-1. Reasonable Progress Goals in 2007 Regional Haze SIP (deciviews)

Class 1 Area	Baseline Visibility for 20% Worst Days	Reasonable Progress Goal 20% Worst Days	Baseline Visibility for 20% Best Days	Reasonable Progress Goal 20% Best Days
GSMNP	30.3	23.7	13.6	12.2
JOKI	30.3	23.7	13.6	12.2
LIGO	28.6	22.0	11.1	9.6
SHRO	28.5	22.1	8.2	6.9
SWAN	24.7	20.4	12.0	11.0

The new reasonable progress goals for North Carolina's Class I areas are listed in Table 4-2. The plots in Section 4.2 will include these new reasonable progress goals.

Table 4-2. New Reasonable Progress Goals for North Carolina Class I Areas

Class 1 Area	Reasonable Progress Goal 20% Worst Days	Reasonable Progress Goal 20% Best Days
GSMNP	23.5	12.1
JOKI	23.5	12.1
LIGO	21.7	9.5
SHRO	21.9	6.9
SWAN	20.3	10.9

4.2 Visibility Conditions

Section 51.308(g)(3) requires the state to assess the visibility conditions for the most impaired and least impaired days expressed in terms of the 5-year averages. The visibility conditions that must be reviewed include 1) the current visibility conditions, 2) the difference between current visibility conditions compared to the baseline, and 3) the change in visibility impairment for the most and least impaired days over the past 5 years.

Table 4-3 addresses the current visibility conditions and the difference between the current visibility and the baseline condition expressed in terms of the 5-year averages. The baseline conditions are for 2000 through 2004 and the current conditions are for 2006 through 2010. Joyce Kilmer-Slickrock Wilderness Area does not have a monitor in the wilderness area so the Great Smoky Mountains National Park visibility data is used for this Class I area.

Table 4-3. Current Visibility and Differences from the Baseline (deciviews)

Class I Area	Baseline (2000-2004)	Current (2006-2010)	Difference
20% Worst Days			
Great Smoky Mountain National Park	30.3	26.6	-3.7
Joyce Kilmer-Slickrock	30.3	26.6	-3.7
Linville Gorge	28.6	25.1	-3.5
Shining Rock	28.5	25.8	-2.7
Swanquarter	24.7	24.2	-0.5
20% Best Days			
Great Smoky Mountain National Park	13.6	12.3	-1.3
Joyce Kilmer-Slickrock	13.6	12.3	-1.3
Linville Gorge	11.1	11	-0.1
Shining Rock	8.2	7.25	-0.95
Swanquarter	12.0	12.9	0.9

The data shows that all Class I areas saw an improvement in visibility on the 20% worst days. All but Swanquarter Wildlife Refuge saw an improvement in visibility on the 20% best days during the 2006-2010 evaluation period. However, as discussed later, a continuous improvement in visibility has been measured throughout 2011 and is expected to continue in future years.

At Swanquarter, a slight increase was seen (less than 1 deciview) in the 20% best-day average between the more recent 2006-2010 period (12.9 dv) compared to the 2000-2004 baseline (12.0 dv). This could be due in part to having incomplete monitoring data available for year 2008 in Swanquarter, as the data did not meet completeness criteria set forth by the USEPA[1]. In 2008, data was missing consecutively between September 9 and October 27, and again between November 20 and December 29. Therefore, under the criteria set forth by the USEPA, too many consecutive observations were missing in 2008 and could not be counted in the rolling 5-year average. A 4-year average was used to calculate visibility between the 2006-2010 review period.

The NCDAQ investigated whether data substitution would change the 5 year average for the 20% best days by using the same data substitution methods that were used by Air Resource Specialists for the Swanquarter baseline data (i.e., for year 2005). The substitution did not change the conclusion; therefore, the NCDAQ is not attempting to report the analysis results. However, The NCDAQ believes that planned changes to operating status and emission controls on large sources within the Swanquarter area of influence provide sufficient evidence that by 2018, the 20% best days will be protected. This improvement is clearly evident when the 2011 measurements data are mapped. Figure 4-1 illustrates annual and 5-year running average visibility data. For 2011, the haziness index for 20% best days was much lower (10.5 dv), resulting in the 5-year average to decline to a level below the glide path. As explained earlier, and further discussed below, this improvement is related to the operational changes occurring at sources within the Swanquarter area of influence.

[1] "In order for a year of data from a site to be used to track progress in improving visibility, all four quarters of that year should be at least 50% complete, and overall, the year should be 75% complete. That is, complete data (including that filled in by substitution of averages), should be available for at least 50% of the sampling days in each quarter of the year and for 75% of all scheduled sampling days for the year. In addition, there should be no more than 10 missing sampling days in a row at any time during the calendar year. With a sampling schedule of every third day, this requirement means that a site should not be out of operation for any period of more than one consecutive month during the calendar year." (see USEPA (2003) "Guidance for Tracking Progress Under the Regional Haze Rule," http://www.epa.gov/ttn/oarpg/t1/memoranda/rh_tpurhr_gd.pdf, pp. 2-8).

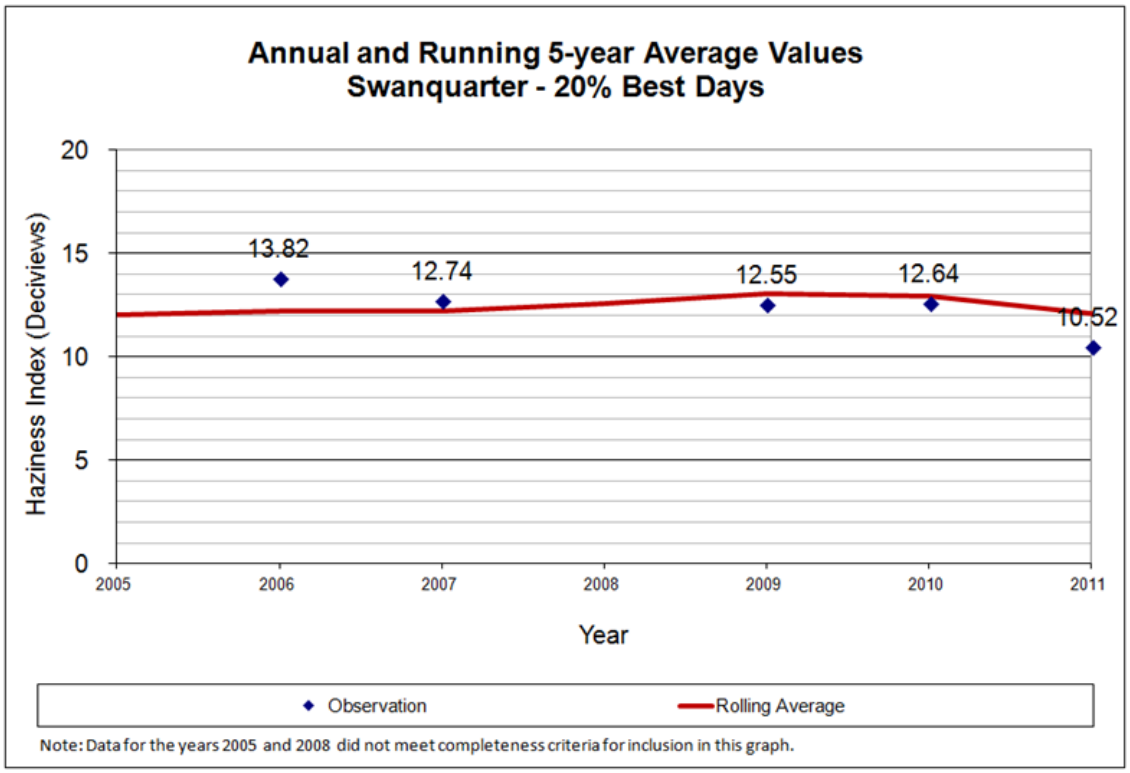

Figure 4-1. 2006-2011 visibility data for the 20% best days at Swanquarter Wildlife Refuge

Since the implementation of the NOx SIP Call and Clean Smokestacks Act, ammonium sulfate concentrations and aerosol concentrations have decreased significantly. Ammonium sulfate concentrations are strongly correlated to overall aerosol concentrations at Swanquarter. Lesser decreases were observed for both sulfates and overall aerosol concentrations for 20% best days in 2009 and 2010 (see Figures 4-2 and 4-3), but an early review of 2011 data showed a more noticeable decrease in both ammonium sulfate and overall aerosol concentrations, with both 20% worst days and 20% best days' annual average values the lowest ever observed at this site. It is expected that ammonium sulfate and overall aerosol concentrations will continue to decrease at Swanquarter in the future as remaining EGUs undergo operational changes. This trend is expected to continue as plants reduce or eliminate emissions in the coming years.

Coal-fired power plants in the eastern North Carolina and South Carolina are scheduled to be retired, converted to natural gas, or install emission controls (presented earlier in Tables 3-1 and 3-2). Specifically, the Santee Cooper Jefferies plant in South Carolina, which accounted for over 50% of 2002 SO_2 emissions within the area of influence at Swanquarter, retired its coal and oil-fired boilers at the end of 2012. The NCDAQ believes that the shutdown of this plant and the conversion of the Sutton Steam plant from coal to natural gas in January 2014 will reduce SO_2 emissions near the Swanquarter Class I area.

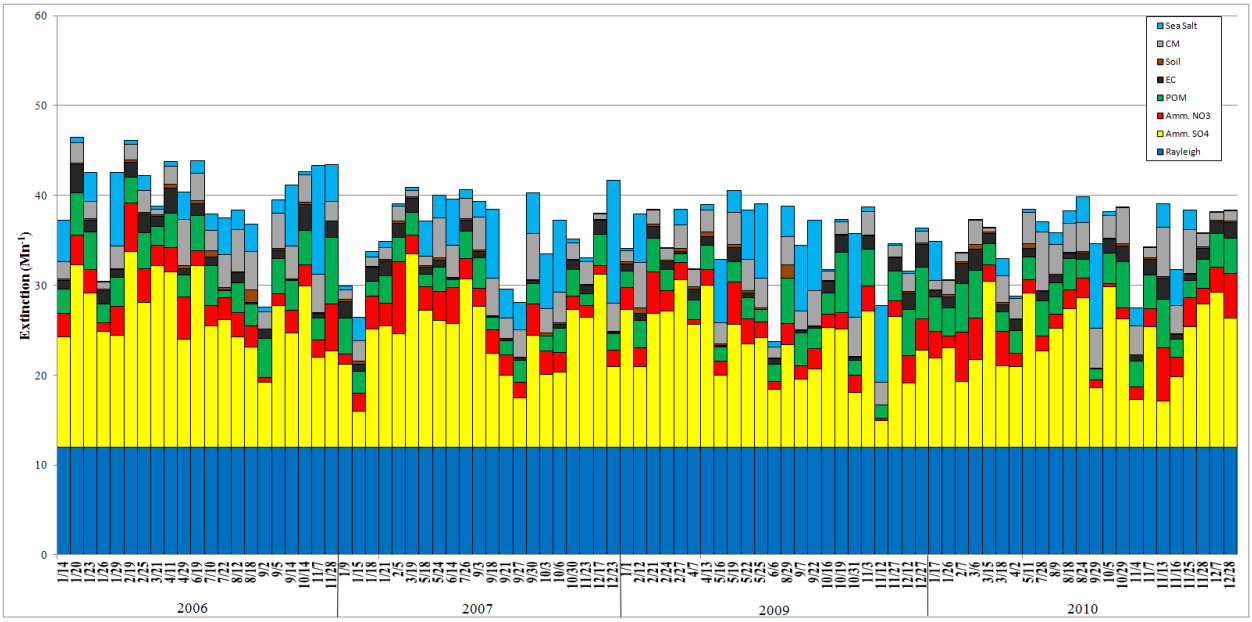

Figure 4-2. 2006-2010 reconstructed light extinction (using the new IMPROVE equation) for the 20% best days at Swanquarter Wildlife Refuge

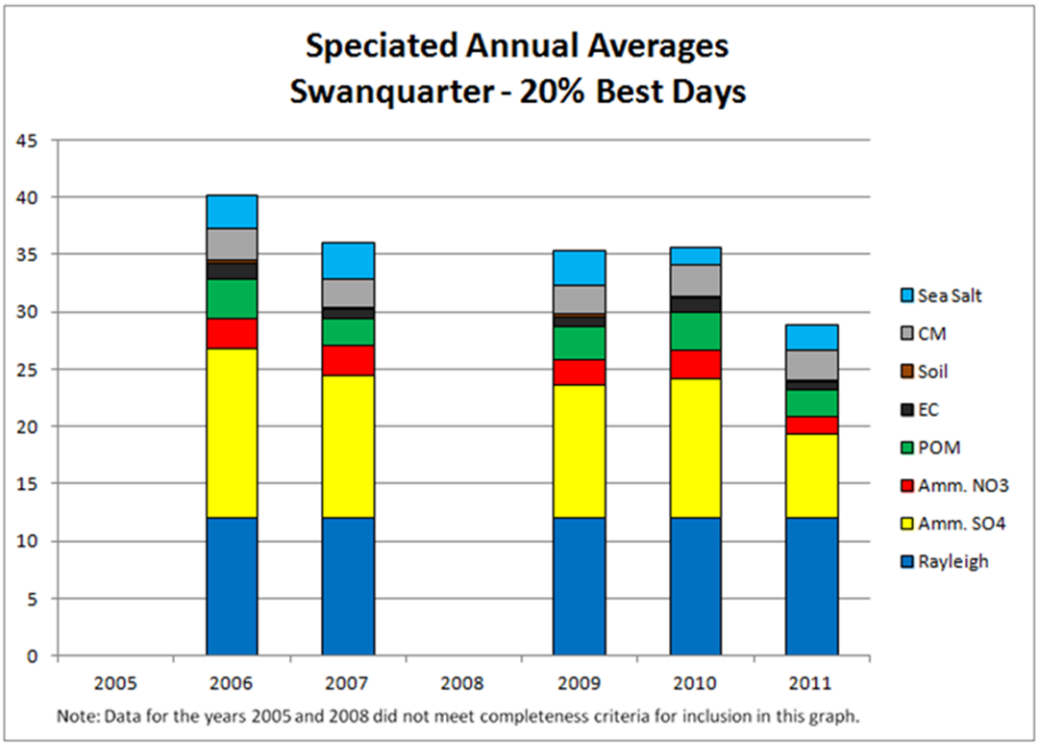

Figure 4-3. 2006-2011 Annual Averages for the 20% best days at Swanquarter Wildlife Refuge

Emission reductions will also be occurring from non-EGU facilities located in North Carolina. As discussed earlier in Section 3.2, Domtar Paper (formerly Weyerhaeuser), PCS Phosphate, and Cogentrix are undergoing operational changes that will further reduce SO_2 emissions affecting Swanquarter. Over the past five years, Domtar Paper has reduced annual SO_2 emissions by 3,000 tons from retiring coal, wood, and oil-fired boilers and fuel switching to natural gas. Additional plans call for conversion to cleaner burning fuels to comply with the Boiler MACT by 2019. PCS Phosphate has replaced its oldest sulfuric acid production lines with a newer, more efficient technology for making sulfuric acid. Nearly 95% of the plant's SO_2 emissions are released from sulfuric acid production. The replacement equipment is subject to the New Source Performance Standards, resulting in SO_2 emissions reductions of 23 lb/ton of 100% of sulfuric acid produced. The Cogenetrix plant experienced an SO_2 emissions growth by about 90 tons/year, but this growth was already accounted in the Base G2 2018 inventory at a level of 1,834 tons (see Table 3-3). Cogentrix is subject to the area source boiler GACT, which means that they will have to comply with work practice standards and emission reduction measures specified in the rule to achieve emission reductions.

One non-EGU facility, located in Virginia, was determined to be within the area of influence of Swanquarter Class I area with 2002 facility wide SO_2 emissions at 8,733 tons. In 2002, this facility, which is located in Franklin, Virginia (Isle of Wight County), was owned by International Paper and operated a large paper and paperboard products manufacturing facility that used the Kraft process. At that time, Boiler #7 was a large boiler in the power house operations that supplied steam and electricity to the paper-making process. The boiler burned coal as well as #6 fuel oil and wood waste, and it was the primary incineration point for noncondensable gases containing total reduced sulfur compounds. In 2002, Power Boiler #7 emitted approximately 3,720 tons of SO_2. The Base G2 2018 inventory estimated typical emissions of SO_2 to be 4,299 tons from this unit, and the G2 2018 inventory was used to calculate the sulfate visibility impairment metric from this unit on Swanquarter Wilderness Area. Using the G2 2018 inventory estimate, the calculated sulfate visibility impairment metric from this unit on Swanquarter Wilderness Area was approximately 1.5%

In 2005, the facility received a regulatory variance that allowed the Virginia Department of Environmental Quality (VDEQ) to cap the emissions of ten pollutants, including SO_2. The variance also waived the requirement for minor or major source permitting prior to the construction of new equipment or the modification of existing equipment that would normally require such permitting at the facility. The SO_2 cap for the plant in this site-specific regulation is 7,890 tpy and is included in the facility's current Title V permit. This cap was reflected in the Best and Final G4 2018 inventory, which contained facility-wide emissions of SO_2 equaling 7,890 tons for the plant. The Best and Final G4 effort took place after the calculated sulfate visibility impairment analysis was completed, and the Best and Final G4 effort contained estimated 2018 SO_2 emissions from Power Boiler #7 of 3,814 tons.

In April of 2010, the facility ceased operations and was idle until mid 2012. At that time the facility was repurposed for a number of ventures, including a fluff plant and a tissue manufacturing plant. The facility's current Title V permit reflects this repurposing and does not include Power Boilers #5, #6, or #7, or Recovery Boilers #4 and #5, as they are no longer operating. The facility is currently meeting on-site steam and power needs using the #6 Recovery Boiler and the #9 boiler/turbine, and duct burner system. These systems burn natural gas and black liquor. At this time, the facility is not using coal as a fuel source. The facility may begin may begin burning coal in the units if the owners so choose. However, to do so would require a significant amendment of the Title V permit to include these units. The state operating permit for this facility requires a control technology review for any new units operating at the site, which would include these boilers, and this requirement is also annotated in the Title V permit. Additionally, operation of these units as coal-fired units may require compliance with the Boiler MACT. Other than the requirements listed above, no other federally enforceable requirements currently exist affecting SO_2 emissions from Power Boiler #7.

In 2006, facility-wide annual SO_2 emissions for International Pulp Paper Pulp Mill in Franklin, Virginia, were 7,133 tons and later lowered to 5,000 and 1,400 tons in 2009 and 2010, respectively, due to fuel switching. Future emissions of SO_2 should decrease as compared to pre-2009 rates due to the increased use of biomass and the discontinuation of coal as a fuel source.

In conclusion, the various activities discussed above and summarized in Table 3-3 provide sufficient evidence that by 2018, the 20% best days will be protected in the Swanquarter Class I area.

The NCDAQ believes that improvement in the visibility on the 20% worst days will continue to occur at Swanquarter by 2018. For 20% worst days in 2006 and 2007, periods of high ammonium sulfate concentrations were observed during the summer months (see Figure 4-3). These high concentrations were correlated to periods of high concentrations of fine particulates (e.g., PM2.5) across the state of North Carolina. Since this time, control measures including measures passed in the Clean Smokestacks Act have gone into effect, and have significantly reduced haze-causing emissions within North Carolina along with concentrations of PM2.5. This is reflected in the lower ammonium sulfate values observed on the 20% worst days in 2009 and 2010 (Figure 4-3).

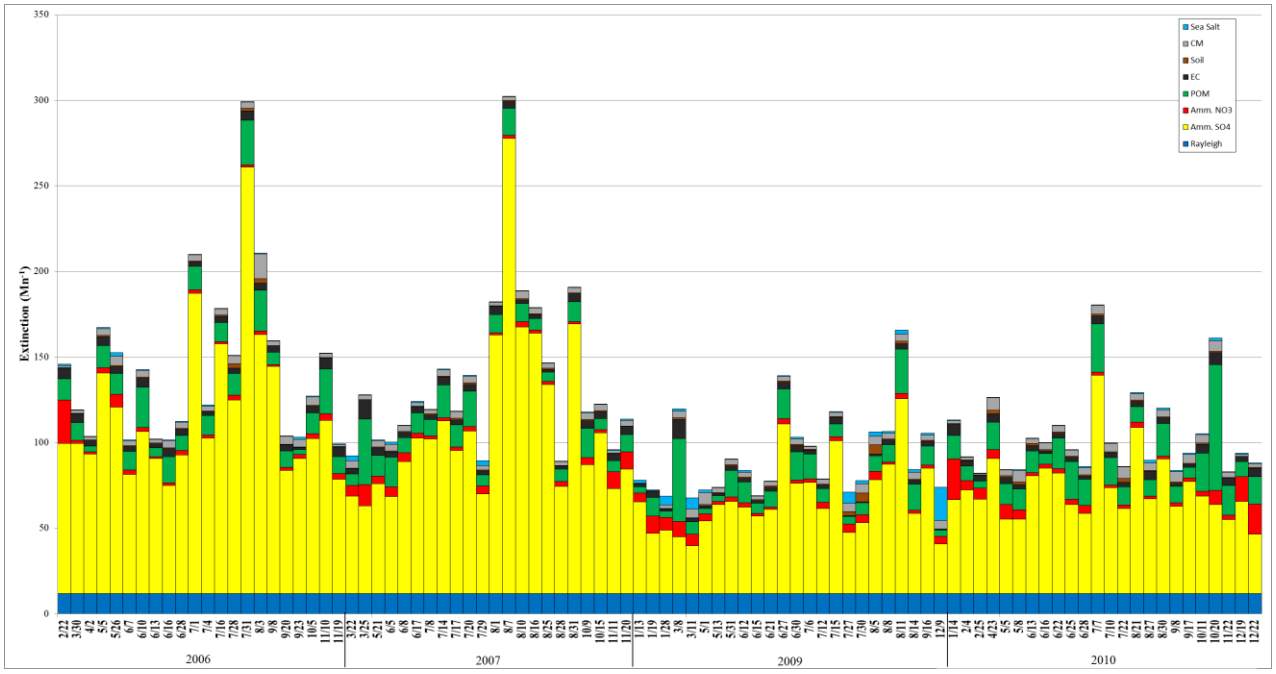

Figure 4-3. 2006-2010 reconstructed light extinction (using the new IMPROVE equation) for the 20% worst days at Swanquarter Wildlife Refuge

The annual 20% worst day average for 2011 was slightly higher than 2010. This increase can be attributed entirely to anomalously high POM values on 6 of the 22 daily readings in 2011 (see Table 4-4). On each of these days, smoke from one or more large wildfires burning in the area was blowing across the monitor (see Figure 4-4). In the absence of these fires, the annual average would have been far lower, and the rolling 5-year average would be very near to glidepath. Therefore, the NCDAQ believes that improvement in the visibility on the 20% worst days will continue to occur by 2018.

Table 4-4. Table of Large Wildfires in Eastern North Carolina in 2011

Fire Name	County	Dates Active	Acres Burned
Pains Bay	Dare	5/5/2011-8/8/2011	45,294
Juniper Road	Pender	6/19/2011-8/1/2011	31,140
Simmons Road	Bladen	6/20/2011-8/16/2011	4,538
Great Dismal Swamp	VA/NC State Line	8/4/2011-9/3/2011	6,377

Figure 4-4. Satellite image of wildfire smoke blowing across the Swanquarter area on July 4 2011. Source: MODIS Terra satellite (See URL: http://ge.ssec.wisc.edu/modis-today/index.php)

On April 30, 2010, the EPA finalized emission standards for new Category 3 marine diesel engines installed on U.S. vessels (75 FR 22896). The emission standards apply in two stages—near-term standards for newly built engines will apply beginning in 2011; long-term standards requiring an 80 percent reduction in NOX emissions will begin in 2016. The EPA also finalized a change to the diesel fuel program that will allow for the production and sale of 1,000 ppm sulfur fuel for use in Category 3 marine vessels. The new fuel requirements will generally forbid the production and sale of other fuels above 1,000 ppm sulfur for use in most U.S. waters, unless alternative devices, procedures, or compliance methods are used to achieve equivalent emissions reductions. According to the Regulatory Impact Analysis, this rule will provide additional visibility improvement of 0.68 dv and 1.10 dv by 2020 and 2030, compared to a base case without the rule.

4.3 Visibility Trends

Table 4-5 displays the change in visibility impairment for the most and least impaired days over the past 5 years in terms of the 5-year averages. For the 20% worst days, the overall trend is towards improvement in visibility, although from year to year there may be slight increases followed by decreases the following year. On the 20% best days, a similar trend towards improvement is seen.

Table 4-5. Visibility Change over the Past 5 years in terms of 5-year averages (deciviews)

	2006	2007	2008	2009	2010
20% Worst Days					
GSMNP	30.4	30.6	29.8	28.5	26.6
JOKI	30.4	30.6	29.8	28.5	26.6
LIGO	29.4	29.7	28.8	27.4	25.1
SHRO	28.8	28.5	27.5	26.6	25.8
SWAN	25.0	24.9	25.5	24.6	24.2
20% Best Days					
GSMNP	13.3	13.2	13.1	12.4	12.3
JOKI	13.3	13.2	13.1	12.4	12.3
LIGO	11.3	11.3	11.6	11.3	11.0
SHRO	7.4	7.6	7.6	7.3	7.2
SWAN	12.2	12.2	12.6	13.0	12.9

As discussed earlier, the Swanquarter Wildlife Refuge did not have an improved 5-year average visibility value in 2010 compared to 2006 (i.e., a lower deciview value). The 5-year averages between 2006 and 2010 shown in Table 4-5 used annual data between 2002 and 2010. However, visibility data at Swanquarter for the years 2005 and 2008 did not meet completeness criteria as prescribed by the USEPA, and therefore are not included in any rolling 5-year averages between 2005 and 2010. This can greatly impact the 5-year average especially for 2008 where only three years of data is used to calculate the average. The 2010 five-year average saw a slight improvement in visibility, and an early review of 2011 data shows a more pronounced improvement in visibility based on the 2011 five-year average for the 20% best days. The inadmissible data, combined with the fact that SO_2 controls and coal-fired unit retirements/conversions in eastern North Carolina commenced after the analysis period ended in 2010 as well as significant improvements observed in 2011 leads the NCDAQ to believe future years will see an improvement in visibility on the 20% best days.

The figures that follow displays the data listed in Tables 4-2, 4-3 and 4-5 , as well as the uniform rate of progress towards natural background for 20% worst and 20% best days for the Class I areas in North Carolina. The blue diamonds are the average 20% worst/best days observed annually, the lighter blue line with asterisks is the 5-year averages, the pink line is the uniform rate of progress and the light purple line with triangles is the modeled predictions used to establish the reasonable progress goals listed in Table 4-2.

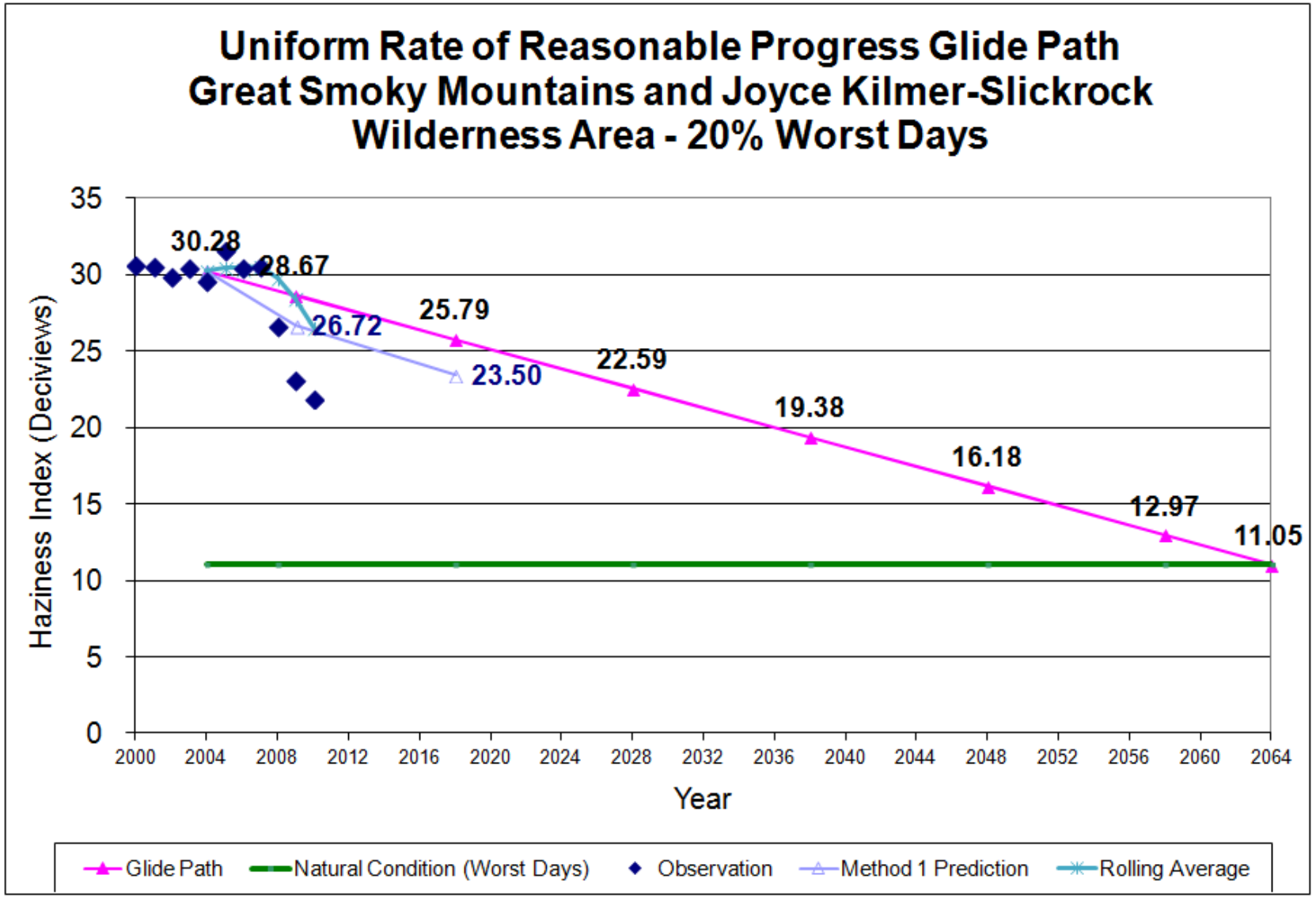

Figure 4-4.1. Visibility conditions at Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area for the most impaired days

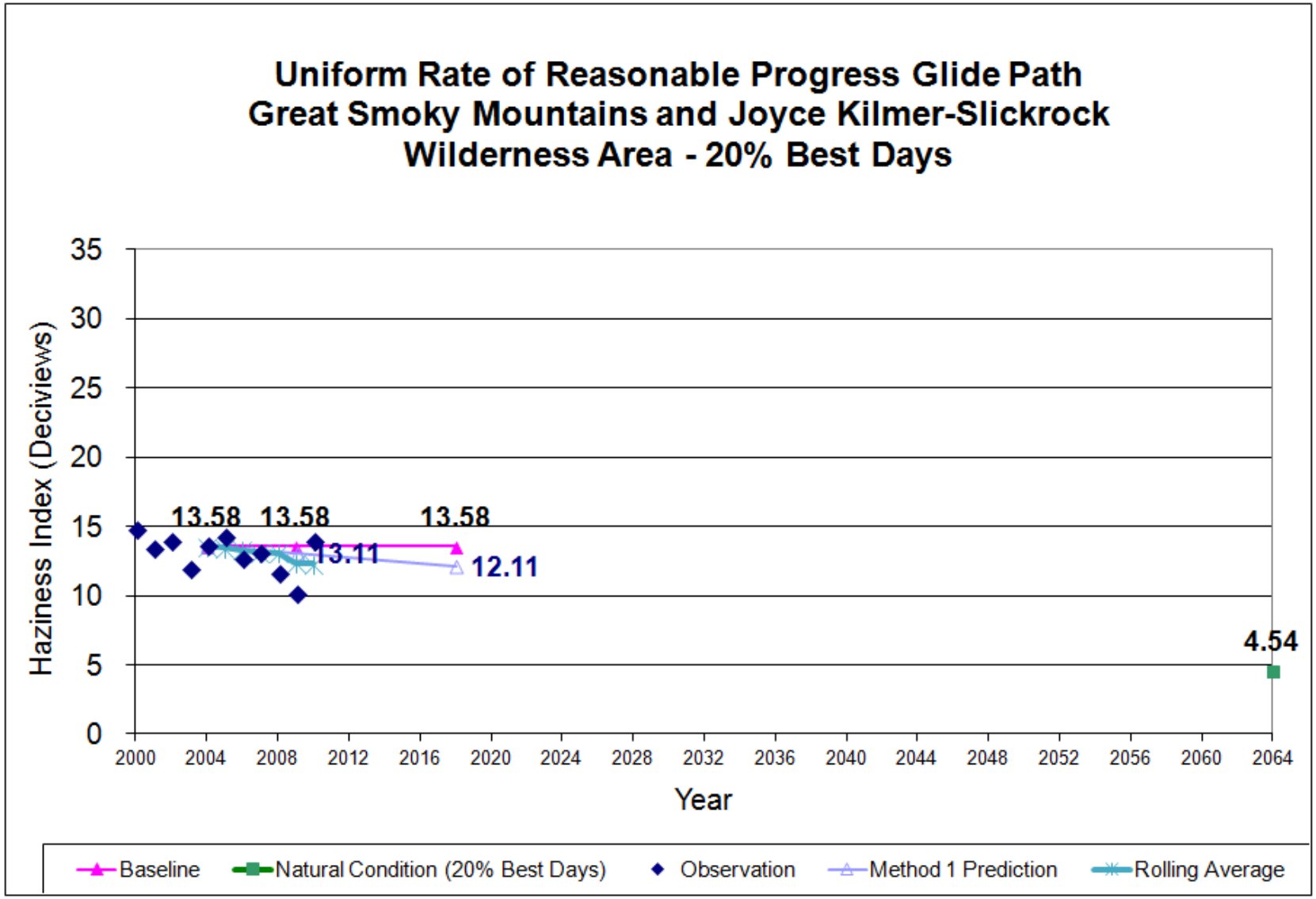

Figure 4-4.2. Visibility conditions at Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area for the least impaired days

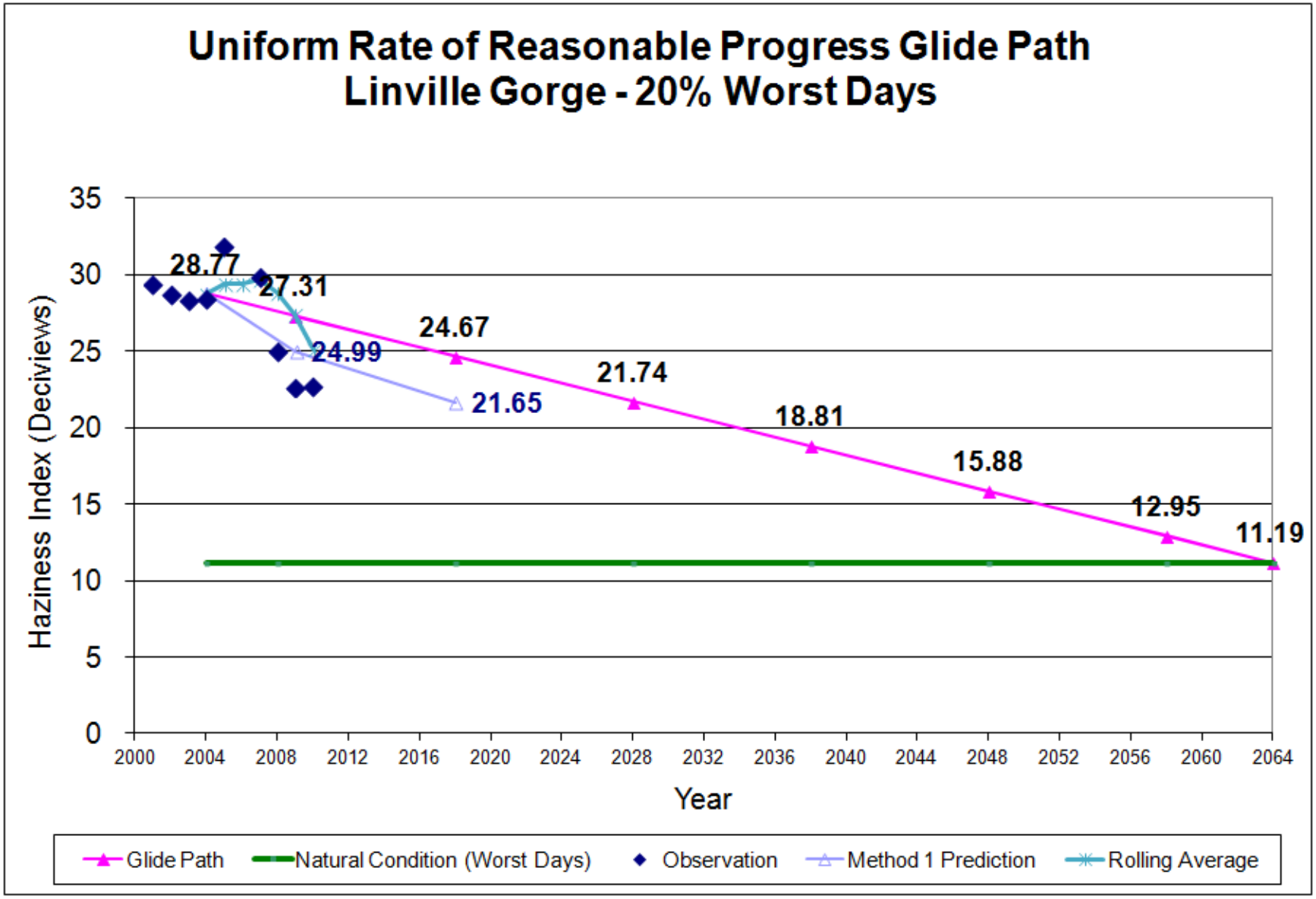

Figure 4-5.1. Visibility conditions at Linville Gorge for the most impaired days

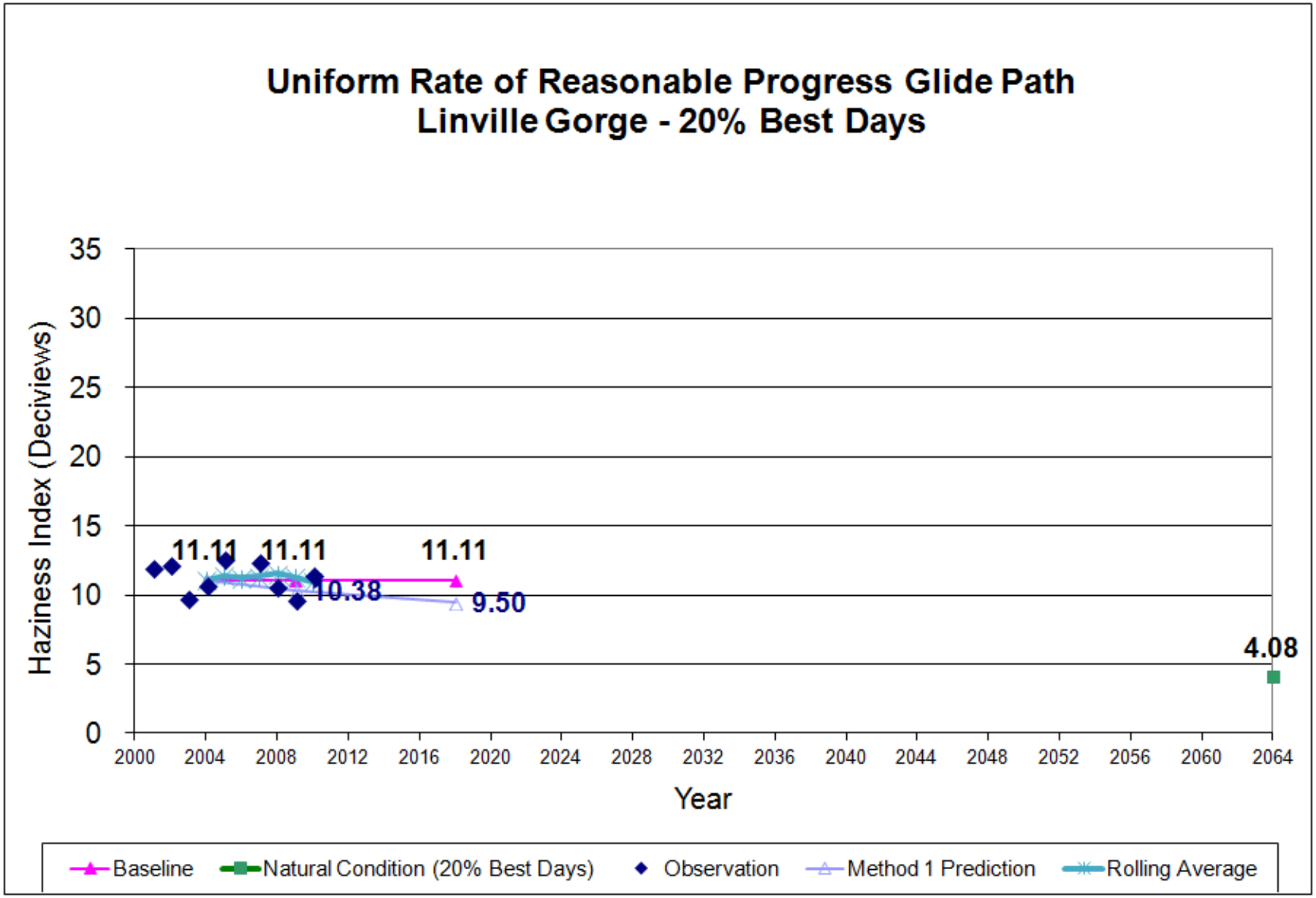

Figure 4-5.2. Visibility conditions at Linville Gorge for the least impaired days

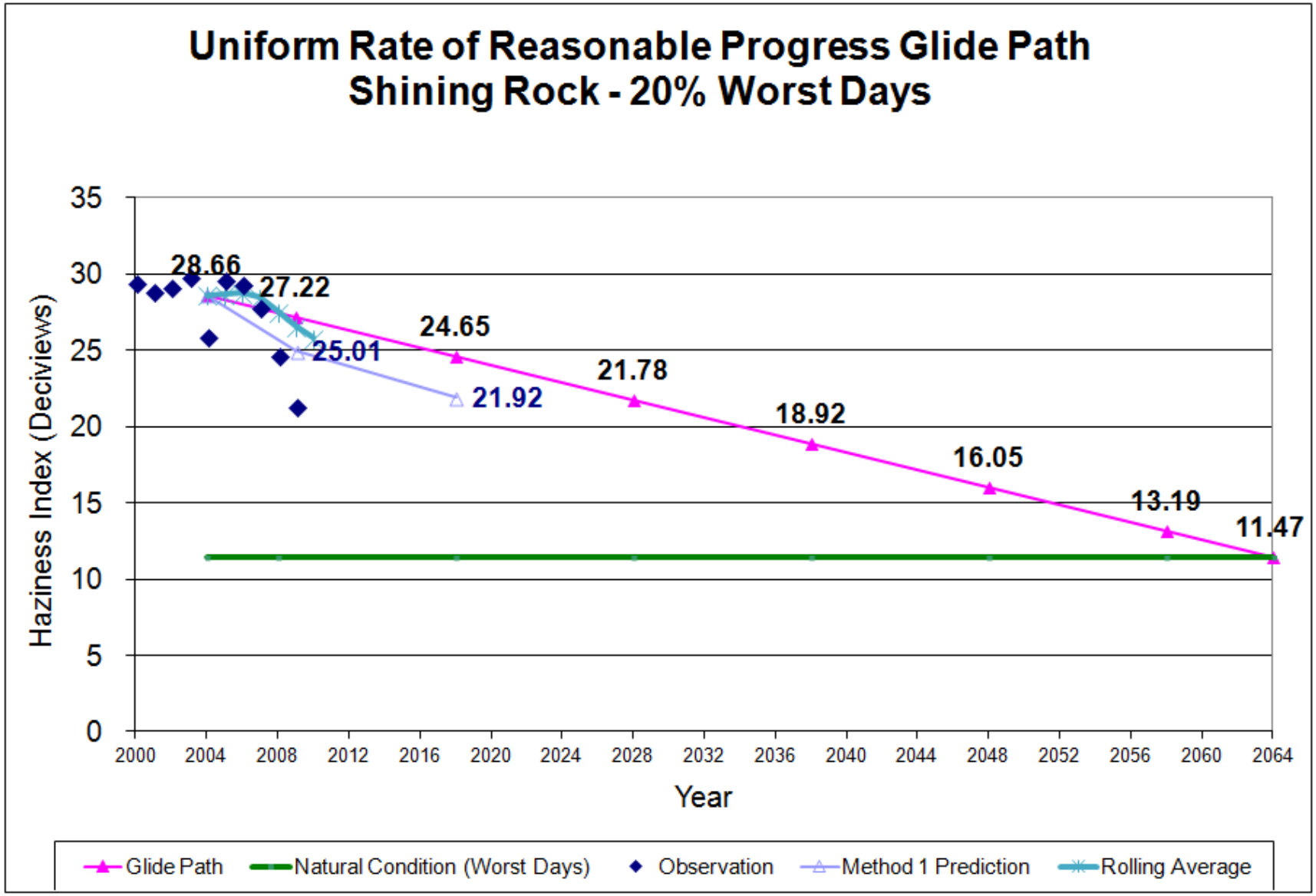

Figure 4-6.1. Visibility conditions at Shining Rock for the most impaired days

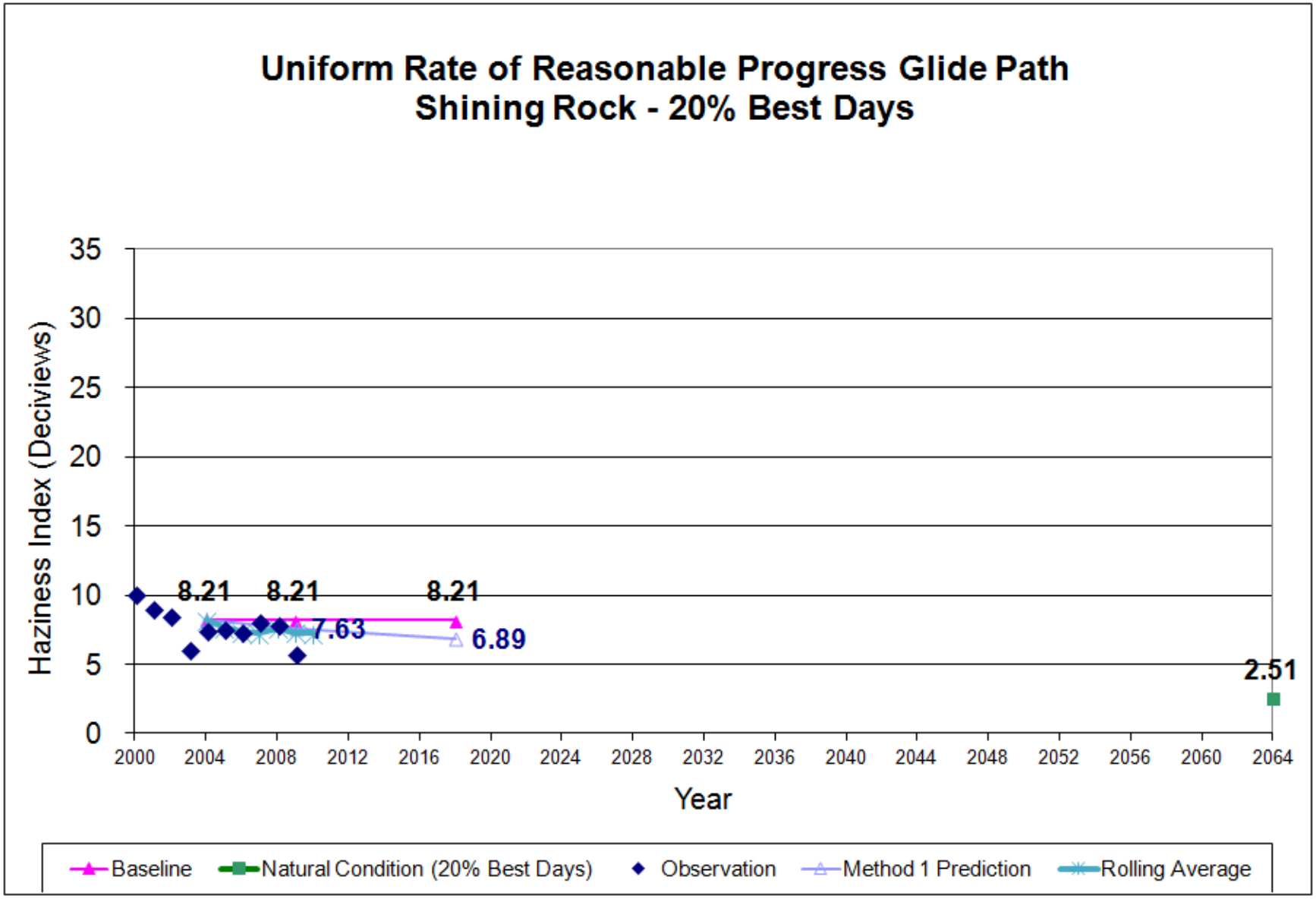

Figure 4-6.2. Visibility conditions at Shining Rock for the least impaired days

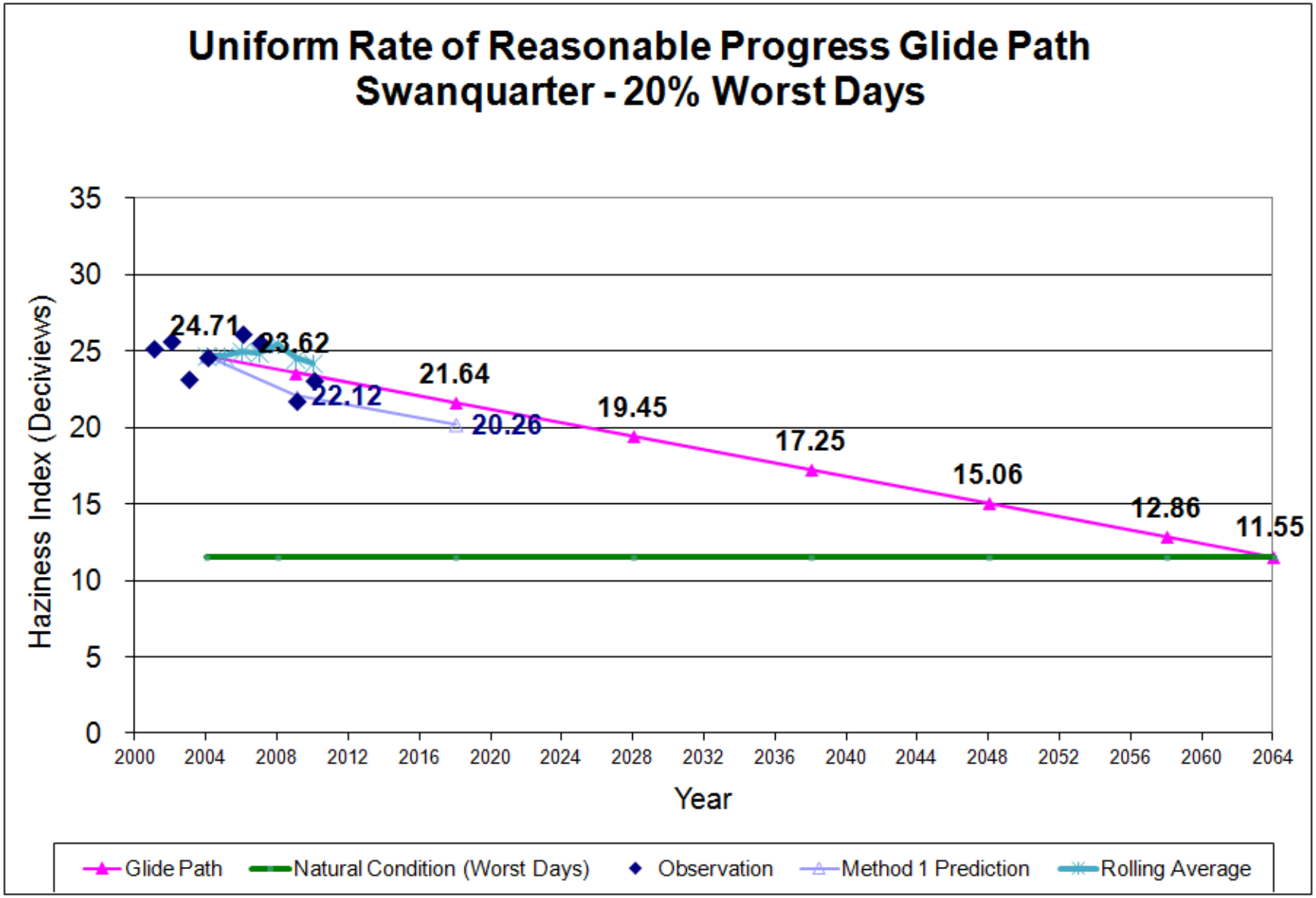

Figure 4-7.1. Visibility conditions at Swanquarter Wildlife Refuge for the most impaired days

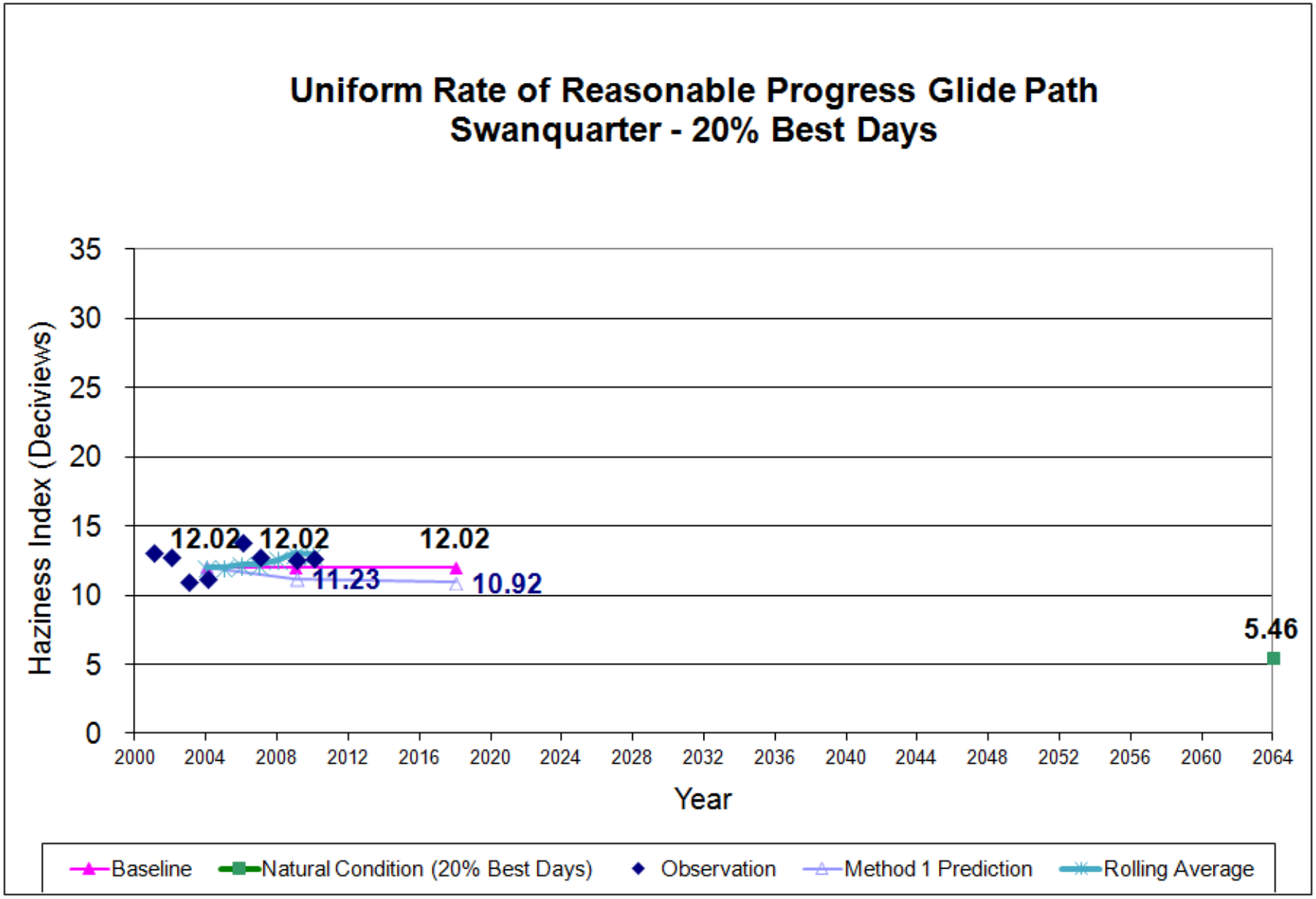

Figure 4-7.2. Visibility conditions at Swanquarter Wildlife Refuge for the least impaired days

5.0 ANALYSES OF EMISSIONS (40 CFR 51.308(g)(4))

40 CFR 51.308(g)(4) requires an analysis of the change over the past five years in emissions of pollutants contributing to visibility impairment from all sources and activities within the state.

There are five different emission inventory source classifications: stationary point and area sources, off-road and on-road mobile sources, and biogenic sources. Stationary point sources are those sources that emit greater than a specified tonnage per year, with data provided at the facility level. Electric generating utilities and industrial sources are the major categories for stationary point sources. Stationary area sources are those sources whose individual emissions are relatively small, but due to the large number of these sources, the collective emissions from the source category could be significant (i.e., dry cleaners, service stations, agricultural sources, prescribed fire emissions). These types of emissions are estimated on a countywide level. Off-road (or non-road) mobile sources are equipment that can move, but do not use the roadways (i.e., lawn mowers, construction equipment, railroad locomotives, aircraft). The emissions from these sources, like stationary area sources, are estimated on a countywide level. On-road mobile sources are automobiles, trucks, and motorcycles that use the roadway system. The emissions from these sources are estimated by vehicle type and road type and are summed to the countywide level. Biogenic sources are the natural sources like trees, crops, grasses and natural decay of plants. The biogenic emissions are not included in this mid-course review since they were held constant as part of the original regional haze SIP modeling and are not controllable emissions.

For the typical 2002 stationary point source emissions inventory, only those sources that reported emissions for 2002 to the NCDAQ were included in the emissions inventory. The Typical 2002 stationary point source emissions inventory was developed jointly with VISTAS States for emission projection purposes. For the typical year emissions, the electric generating units are adjusted to be for a typical year so that if sources were shut down or operating above or below normal, the emissions were to be normalized to a typical inventory year. This is necessary since the future year emissions represent a projected typical future year inventory. The 2009 point source emissions were estimated using the Integrated Planning Model (IPM) model for the electric generating units and economic growth factors for the remaining sources.

The 2002 area source emissions were estimated by taking an activity factor and multiplying by an emission factor. The 2009 area source emissions were projected using economic growth factors. The exception to this is the wildfire and prescribed fire emissions, in which typical year emissions were used for both 2002 and 2009. For the non-road mobile source inventory, all but the aircraft, locomotive and commercial marine emissions were estimated using the USEPA's NONROAD2005c model for both the typical 2002 and 2009 inventory years. The remaining non-road mobile sources were estimated the traditional way by taking an activity level and

multiplying it by an emission factor and these sources were projected to 2009 using economic growth factors. The on-road mobile source emissions were estimated using the USEPA's MOBILE6.2 mobile model for both the typical 2002 and projected 2009 inventory years.

The emissions that were in the original regional haze SIP for the typical year 2002 and the projected year 2009 are listed in Tables 5-1 and 5-2, respectively.

Table 5-1. Projected Typical 2002 Annual Emission Summary for North Carolina (tons)

Source Category	VOC	NOx	SO_2	$PM_{2.5}$
Point	61,484	196,731	522,093	26,953
Non-road Mobile	94,480	84,284	7,693	7,348
Area	250,044	41,517	5,815	83,520
On-road Mobile	263,766	327,329	12,420	4,623
Total Emissions	669,774	649,861	548,021	122,444

Table 5-2. Projected 2009 Annual Emission Summary for North Carolina (tons)

Source Category	VOC	NOx	SO_2	$PM_{2.5}$
Point	62,161	101,236	284,802	26,360
Non-road Mobile	74,056	70,997	1,892	5,760
Area	200,873	45,382	6,281	90,729
On-road Mobile	168,676	201,609	1,503	3,493
Total Emissions	505,766	419,224	294,478	126,342

Table 5-3 summarizes North Carolina specific emissions data using the EPA 2008 National Emissions Inventory (NEI). Selecting the actual 2008 emission inventory for comparison to the 2002 base year inventory, it can be seen from the tabulated emissions data, that the overall 2008 emissions are lower than the actual 2002 emissions inventory. The on-road mobile source emissions were estimated using the USEPA's mobile model MOVES2010a. The MOVES2010a model tends to estimate higher emissions than its previous counterpart MOBILE6 model, especially for NOx emissions. In a recent SIP revision, North Carolina documented MOVES model predictions for NOx can be 1.7 to 2.1 times higher than MOBILE6. Despite the change in methodology, a declining trend in all pollutants can be seen between 2002 and 2008 and actual 2008 emissions are below the predicted 2009 levels.

Table 5-3. Actual 2008 Annual Emission Summary for North Carolina (tons)

Source Category	VOC	NOx	SO_2	$PM_{2.5}$
Point	39,053	97,879	274,541	27,987
Non-road Mobile	72,754	52,469	980	4,924
Area	149,264	43,672	13,937	48,807
On-road Mobile	122,503	253,849	1,190	7,895
Total Emissions	383,573	447,869	290,648	89,613

For this SIP revision, NCDAQ also prepared an emission inventory for 2010 (see Table 5-4). Appendix B contains the complete documentation. The 2010 point source emissions were estimated by taking the emissions reported by sources for 2010 and adding the latest emissions for the small sources that only report emissions every 5 years. This is a different procedure than what was used in the original Regional Haze SIP which included only those sources that reported emissions in 2002 (small sources that did not report are estimated to contribute 1%, 7%, 1%, and 7% of total NOx, VOC, SO_2, and $PM_{2.5}$ emissions, respectively). The area source emissions were estimated by growing the existing 2007 emissions inventory to 2010. The non-road mobile source emissions were estimated using the USEPA's NONROAD2008 model for those sources covered by the model and growing the 2007 airport, locomotive and commercial marine emissions to 2010.

Table 5-4. 2010 Annual Emissions Summary for North Carolina (tons)

Source Category	VOC	NOx	SO_2	$PM_{2.5}$
Point	42,504	90,155	151,210	13,966
Non-road Mobile	66,773	65,353	2,829	5,455
Area	83,274	11,353	5,105	23,114
On-road Mobile	101,731	256,381	1,205	8,905
Total Emissions	294,281	423,242	160,350	51,441

The on-road mobile source emissions were estimated using the USEPA's mobile model MOVES2010a with the latest vehicle miles traveled (VMT) and speed data that was available. If 2010 speeds and VMT were not available for a particular county, interpolated or projected 2010 data was used. Both the non-road mobile and on-road mobile models have been updated to newer models for the 2010 estimated emissions. As a result of the change in EPA's methodology, the on-road mobile emissions shown in Table 5-3 are higher than those would be predicted using the older model. Consequently, the reduction in on-road emissions from 2002 to 2010 is lower.

As can be seen from the emissions data, the 2010 emissions are significantly lower than the typical 2002 emissions inventory. The VOC emissions are 52% or lower, the NOx emissions are 35% lower, the SO_2 emissions are 70% lower and the $PM_{2.5}$ emissions are 61% lower. The 2010 emissions are lower despite including additional stationary point sources and the use of the USEPA's mobile model MOVES, which predicts much higher NOx emissions than its predecessor MOBILE6.2.

When comparing the 2010 emissions with the projected 2009 emissions, all emissions are lower in 2010. The VOC emissions are 37% lower, the SO_2 emissions are 44% lower and the $PM_{2.5}$ emissions are 62% lower. The 2010 NOx emissions were essentially the same as the projected 2009 NOx emissions, and are primarily driven by the MOVES model over predictions compared to the MOBILE6 model.

6.0 CHANGES TO ANTROPOGENIC EMISSIONS (40 CFR 51.308(g)(5))

40 CFR 51.308(g)(5) requires "an assessment of any significant changes in anthropogenic emissions within or outside the state that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility."

Figure 6-1 displays the average light extinction for the 20% worst days over the 5-year period 2006 through 2010 for all Class I areas in the Southeast. This figure demonstrates that on the 20 percent worst days in the Class I areas in North Carolina, sulfates (SO_4) continue to be the major concern, which is formed from the SO_2 emissions. Since the stationary point sources are the largest contributor of SO_2 emissions, 98% of the SO_2 emissions in North Carolina, only the past 5 years of point source emissions are provided in Table 6-1.

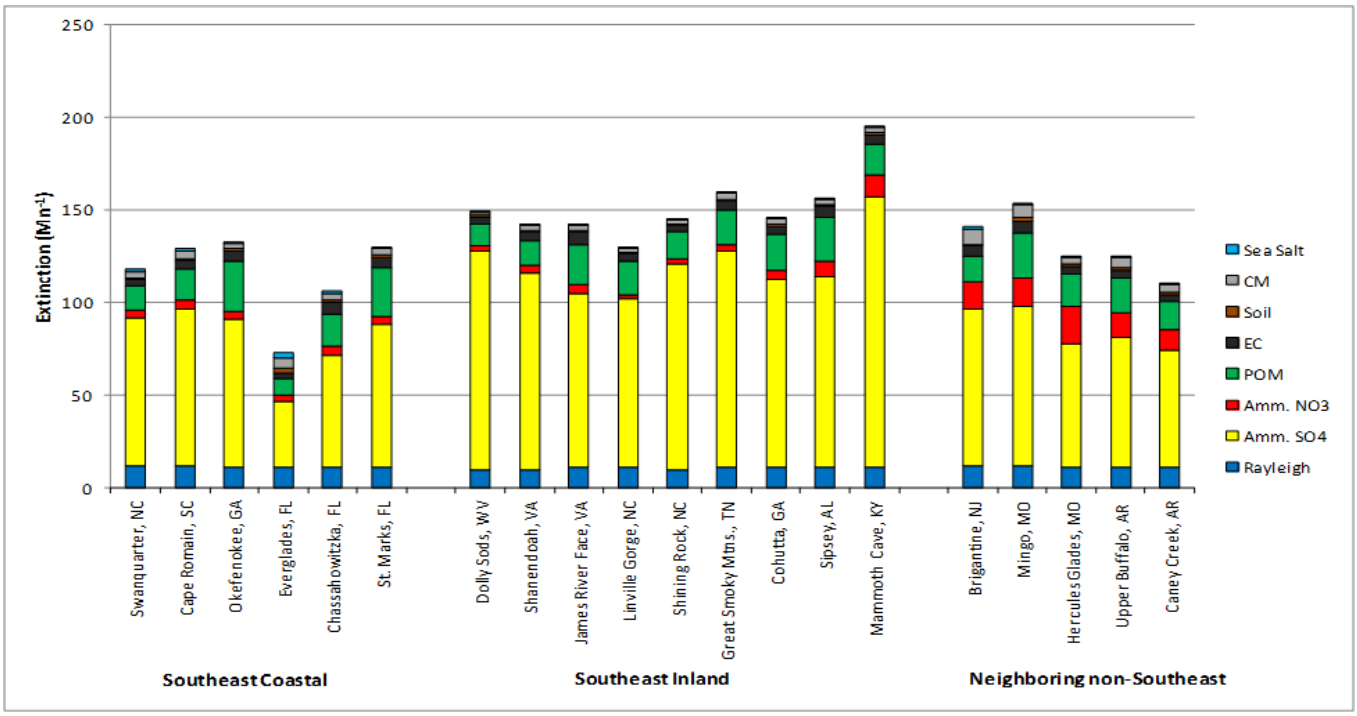

Figure 6-1. Average light extinction for the 20% worst days in 2006-2010 at Southeast and neighboring Class I areas using the IMPROVE equation

Table 6-1. Point Source Emissions Over Past 5 Years (tons)

Year	VOC	NOx	SO_2	$PM_{2.5}$
2006	62,359	148,707	520,116	26,403
2007	55,140	104,328	427,620	29,804
2008	39,053	97,879	274,541	27,987
2009	40,427	75,733	148,613	14,821
2010	41,358	90,322	151,707	14,072

There does not appear to be any anthropogenic emissions within North Carolina that would have limited or impeded progress in reducing pollutant emissions or improving visibility.

7.0 ASSESSMENT OF CURRENT SIP STRATEGY (40 CFR 51.308(g)(6))

40 CFR 51.308(g)(6) requires an assessment of whether the current SIP elements and strategies are sufficient to enable the state, or other Class I areas affected by emissions from the state, to meet all established reasonable progress goals.

Figure 7-1 displays the reconstructed extinction for the 20 percent worst days at the Great Smoky Mountains National Park during 2006 through 2010. Similar results are seen at the other Class I areas in North Carolina (Appendix A). This figure, along with Figure 7-1, demonstrate that on the 20 percent worst days in the Class I areas in North Carolina, sulfates continue to be the major concern, which are formed from the SO_2 emissions. As seen in Tables 5-3 and 6-1, stationary point sources are the greatest source of SO_2 emissions in North Carolina, with the electric generating units being the largest contributor.

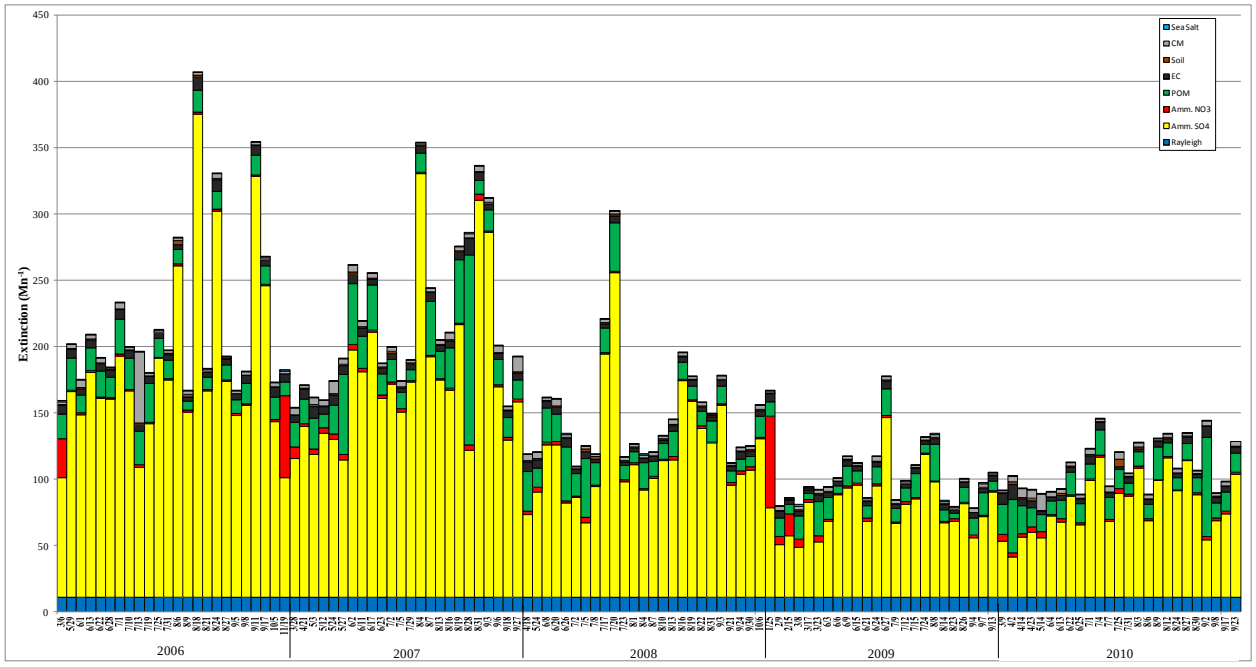

Figure 7-1. The 2006 – 2010 reconstructed extinction, using the IMPROVE equation, for the 20% worst days at Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, NC

Table 3-1 lists the electric generating units estimated 2018 emissions. The new projected 2018 emissions are significantly lower than the projected 2018 emissions in the original regional haze SIP. Additionally, the estimated 2010 emissions are lower than the 2009 modeled emissions from the original regional haze SIP for all pollutants except NOx, which can be attributed to different on-road mobile models.

The single coal-fired EGU in North Carolina which is in the area of influence of the James River Face Class I area in Virginia was retired in April 2012. The SO_2 emission reductions resulting from this retirement are expected to contribute to achieving the reasonable progress goals for the James River Face Class I area.

The NCDAQ believes the state is on track to meet the 2018 reasonable progress goals for the North Carolina Class I areas and will not impede a Class I area outside of North Carolina from meeting their goals. Please see the response provided in Section 4 – Assessment of Visibility Conditions (40 CFR 51.308(g)(3)).

8.0 ASSESSMENT OF CURRENT MONITORING STRATEGY (40 CFR 51.308(g)(7))

40 CFR 51.308(g)(7) of the Regional Haze Rule requires *"a review of the state's visibility monitoring and any modifications to the strategy as necessary."*

The primary monitoring network for regional haze, both nationwide and in North Carolina, is the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. Given that IMPROVE monitoring data from 2000-2004 serves as the baseline for the regional haze program, the future regional haze monitoring strategy must necessarily be based on, or directly comparable to, IMPROVE. The IMPROVE measurements provide the only long-term record available for tracking visibility improvement or degradation and therefore North Carolina intends to continue reliance on the IMPROVE network for complying with the regional haze monitoring requirement in the regional haze Rule.

There are currently 3 IMPROVE sites in North Carolina (2 at distinctly different locations in the mountains and one on the coast). In addition, as Table 8-1 shows, an IMPROVE site just across the border in Tennessee serves as the monitoring site for both the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area, both of which lie partly in Tennessee and partly in North Carolina. No modifications to the existing visibility monitoring strategy are necessary.

Table 8-1. North Carolina Class I Areas and Representative IMPROVE Monitors

Class I Area	IMPROVE Site Designation
Great Smoky Mountains National Park	GRSM1 (TN)
Joyce Kilmer-Slickrock Wilderness Area	GRSM1 (TN)
Linville Gorge Wilderness Area	LIGO1 (NC)
Shining Rock Wilderness Area	SHRO1 (NC)
Swanquarter Wildlife Refuge	SWAN1 (NC)

In addition to the IMPROVE measurements, some ongoing long-term limited monitoring supported by Federal Land Managers provides additional insight into progress toward regional haze goals. North Carolina benefits from the data from these measurements, but is not responsible for associated funding decisions to maintain these measurements into the future. Such measurements include:

- Web cameras operated by the National Park Service at Look Rock, Tennessee and Purchase Knob, North Carolina in Great Smoky Mountains National Park and by the United States Forest Service at Frying Pan Mountain in the Shining Rock Wilderness Area.
- An integrating nephelometer for continuously measuring light scattering, operated by the National Park Service at Look Rock, Tennessee.
- A Tapered Element Oscillating Microbalance (TEOM) for continuously measuring $PM_{2.5}$ mass concentration, operated by the National Park Service at Look Rock, Tennessee.

A continuous nitrate monitor continues to operate at the Millbrook site in Raleigh. Additionally, a second continuous nitrate monitor is in operation at the Rockwell monitoring site in Rowan County. The vendor no longer supports these monitors and it may be difficult to obtain the expendables for the monitors in the future. The NCDAQ plans to operate these monitors as long as funding and supplies allow. The NCDAQ began operating a continuous sulfate monitor at the Millbrook in August 2007. The continuous sulfate monitor for the Rockwell site has been purchased but will most likely not start operation until in January 2013. The NCDAQ was operating a 5400 R&P monitor for organic, total, and elemental carbon at the Millbrook site. However, the monitor has failed and no funding was available to replace this monitor. The NCDAQ is currently operating aethalometers at the Millbrook and Rockwell sites.

The NCDAQ will use the continuous speciation data from the sites discussed above to further the understanding of both $PM_{2.5}$ and visibility formation and trends in North Carolina. The NCDAQ will operate the units discussed above as long as funds allow.

In addition, the NCDAQ and the local air agencies in the State operate a fairly comprehensive $PM_{2.5}$ network of the filter based Federal reference method monitors, continuous mass monitors (TEOMs and Beta Attenuation Mass monitors), filter based speciated monitors and the continuous speciated monitors described above. A map of the various locations around the State is included in Figure 8-1. These $PM_{2.5}$ measurements help the NCDAQ characterize air pollution levels in areas across the state, and therefore aid in the analysis of visibility improvement in and near the Class I areas.

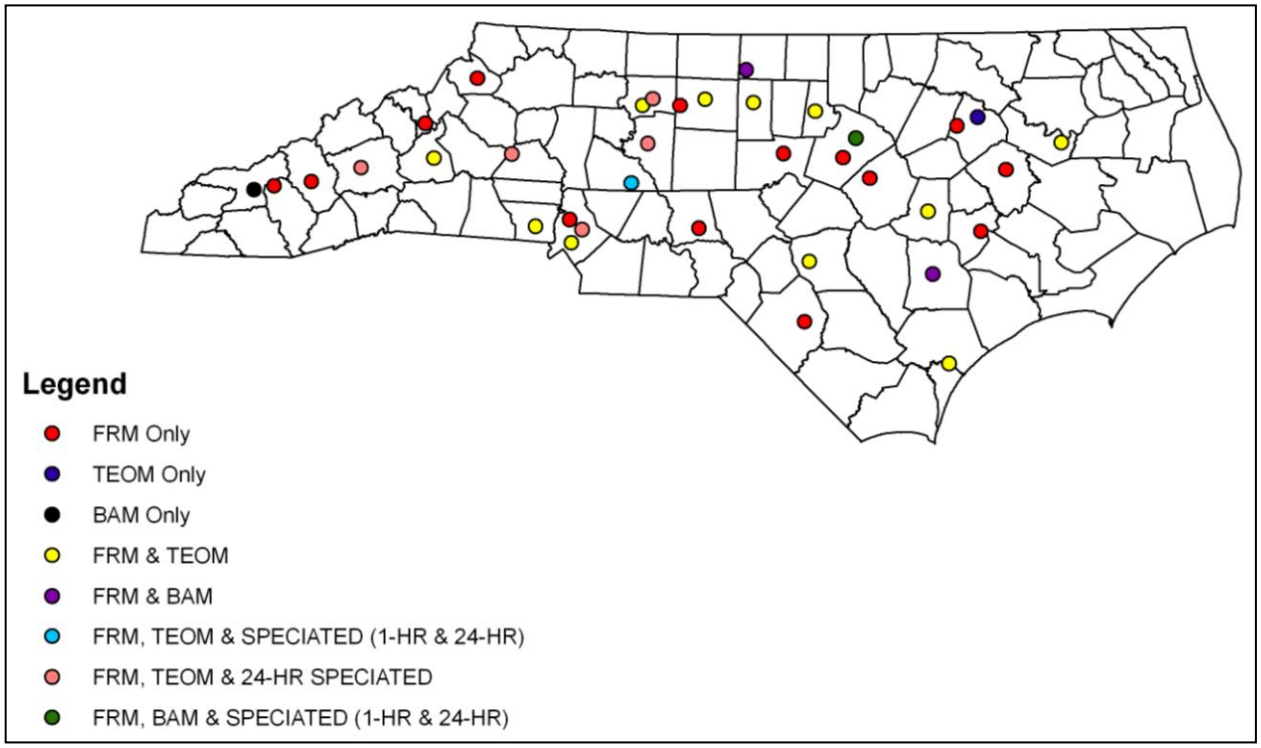

Figure 8-1. $PM_{2.5}$ Monitoring Network in North Carolina

The IMPROVE measurements are central to North Carolina's regional haze monitoring strategy, and it is difficult to visualize how the objectives listed above could be met without the monitoring provided by IMPROVE. Any reduction in the scope of the IMPROVE network in North Carolina would jeopardize the State's ability to demonstrate reasonable progress toward visibility improvement in some of its Class I areas. In particular, North Carolina's regional haze strategy relies on emission reductions that will result from the CAIR and the CSA, which occur on different time scales and will most likely not be spatially uniform. Monitoring at every Class I area is important to document the different air quality responses to the emissions reductions.

Since each of the current IMPROVE monitors in North Carolina represents a different airshed, reduction of the IMPROVE network by shutting down one of these monitoring sites impedes tracking progress at reducing haze at the affected Class I area. In the event this occurs, North Carolina, in consultation with the USEPA and relevant Federal Land Managers, will develop an alternative approach for meeting the tracking goal, perhaps by seeking contingency funding to carry out limited monitoring or by relying on data from nearby urban monitoring sites to demonstrate trends in speciated $PM_{2.5}$ mass.

Data produced by the IMPROVE monitoring network will be used nearly continuously for preparing the 5-year progress reports and the 10-year SIP revisions, each of which relies on analysis of the preceding five years of data. Consequently, the monitoring data from the IMPROVE sites needs to be readily accessible and to be kept up to date. Presumably, IMPROVE will continue to process information from its own measurements at about the same pace and with the same attention to quality as it has shown in the recent past. The VIEWS web site has been

maintained by VISTAS and the other Regional Planning Organizations to provide ready access to the IMPROVE data and data analysis tools. North Carolina is encouraging continued maintenance of VIEWS or a similar data management system to facilitate analysis of the IMPROVE data.

9.0 CONCLUSIONS

The NCDAQ has provided the information required under 40 CFR 51.308(g) in this 5-year periodic review. Based upon this information, and to address the requirements of 40 CFR 51.308(g)(7), the NCDAQ believes the state is on track to meet the 2018 reasonable progress goals for the North Carolina Class I areas and will not impede a Class I area outside of North Carolina from meeting their goals.