State of Missouri
Regional Haze Plan

Missouri Air Conservation Commission
Adopted: (Proposed for Revision June 25, 2009)

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EXECUTIVE SUMMARY

In 1977, Congress passed amendments to the Clean Air Act (CAA) with the goal of improving visibility in Class I federal areas, such as national parks and wilderness areas. Following the enactment of the 1977 CAA amendments, some measures were taken to address issues such as "plume blight" from specific pollution sources, but little was done to improve the regional haze issues in the Eastern United States. Congress passed additional amendments to the CAA in 1990 that authorized additional research and regular progress updates.

The U.S. Environmental Protection Agency (EPA) adopted the federal Regional Haze Rule on July 1, 1999. The Regional Haze Rule and the CAA require consultation between the states, tribes and the Federal Land Managers (FLMs) for managing Class I areas. Since regional haze often results from pollution emitted across broad regions, this multi-state planning effort will help in developing the most cost-effective controls for regional haze. This consultation process will provide a coordinated effort to achieve the federal visibility requirements and aid in developing regional strategies for meeting progress goals.

The Regional Haze Rule went into effect on August 30, 1999. The EPA selected five Regional Planning Organizations (RPOs) to aid in the coordination required to achieve the national visibility goals of Class I areas by 2064. One RPO, the Central Regional Air Planning Association (CENRAP), is comprised of nine states that make up the midsection of the contiguous United States, including Missouri. Missouri has two federal Class I areas (Hercules Glades and Mingo) within its borders and is in close proximity with two Class I areas in Arkansas (Caney Creek and Upper Buffalo).

Between 2000 and 2007, Missouri participated in the CENRAP workgroup process to develop technical analyses and control strategies for the Regional Haze Plan. Missouri determined the baseline visibility conditions for each Class I area using monitoring data collected from 2000 through 2004 and compared them to the natural background conditions. The technical analyses showed that both of the Class I areas in Missouri will meet the 2018 Reasonable Progress Goal (RPG). The analyses in this Regional Haze Plan demonstrate that the 2018 visibility goals for

Mingo and Hercules Glades will be largely achieved from EGU (Electric Generating Unit) emission reductions resulting from the federal Clean Air Interstate Rule (CAIR) program. Missouri long-term strategy also consists of other air pollution programs including Missouri NO_X State Implementation Plan (SIP) call, Tier 2 vehicle emission standards, other states' SIP controls, other states' Best Available Retrofit Technology (BART) controls, as well as other programs.

Missouri has satisfied the consultation requirement of the federal Regional Haze Rule through the consultation process that was used to develop this plan. The consultation process is documented in a consultation plan that was used to attain and share the technical information necessary in developing this Regional Haze Plan for the Central Class I areas. A copy of the consultation plan has been provided as an appendix to this plan. In addition, Missouri has consulted with and continues to consult with other states that have included Missouri in their consultation process to meet their Regional Haze Rule requirements.

A BART analysis was used to assure that the federal Regional Haze Rule requirements were met. This analysis included BART source development, screen-modeling analyses and refined modeling. As a result of the analysis and modeling, Missouri has identified one BART-eligible source in Missouri that must undergo a BART control evaluation to ensure it meets the Regional Haze Rule requirements.

The Missouri Department of Natural Resources (department) Air Pollution Control Program will submit this Regional Haze Plan to the EPA for inclusion in the Missouri SIP to meet the requirements of EPA's Regional Haze Rule. A public hearing was held for this plan on December 6, 2007, and the plan was adopted by the Missouri Air Conservation Commission (MACC) on February 7, 2008.

Missouri will continue to coordinate with other states, FLMs, EPA, CENRAP, and other RPOs to maintain/improve the visibility in Missouri's Class I areas. This coordination will include five-year progress reports and any necessary SIP revisions. If deemed necessary, there will be face to face consultation meetings.

1.0 BACKGROUND - FEDERAL REGIONAL HAZE REGULATION

1.1 FEDERAL REGIONAL HAZE RULE

In amendments to the CAA in 1977, Congress added Section 169 (42 U.S.C. 7491), setting forth the following national visibility goal of restoring pristine conditions in national parks and wilderness areas:

> *Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from man-made air pollution.*

Over the following years, modest steps were taken to address the visibility problems in Class I areas. The control measures taken mainly addressed plume blight from specific pollution sources and did little to address regional haze issues in the Eastern United States. Plume blight is the visual impairment of air quality that manifests itself as a coherent plume. This results from specific sources, such as a power plant smokestack, emitting pollutants into a stable atmosphere. The pollutants are then transported in some direction with little or no vertical mixing.

When the CAA was amended in 1990, Congress added Section 169B (42 U.S.C. 7492), authorizing further research and regular assessments of the progress made so far. In 1993, the National Academy of Sciences concluded that "current scientific knowledge is adequate and control technologies are available for taking regulatory action to improve and protect visibility."[1]

In addition to authorizing creation of visibility transport commissions and setting forth their duties, Section 169B(f) of the CAA specifically mandated creation of the Grand Canyon Visibility Transport Commission (GCVTC) to make recommendations to the EPA for the region affecting the visibility of the Grand Canyon National Park. Following four years of research and policy development, the GCVTC submitted its report to EPA in June 1996. This report, as well

1 National Research Council. *Protecting Visibility in National Parks and Wilderness Areas*. National Academy Press. Washington, DC: 1993.

as the many other research reports prepared by the GCVTC, contributed invaluable information to EPA in its development of the federal Regional Haze Rule.

EPA's Regional Haze Rule was adopted July 1, 1999, and went into effect on August 30, 1999. The Regional Haze Rule aimed at achieving national visibility goals by 2064. This rulemaking addressed the combined visibility effects of various pollution sources over a wide geographic region. This broad scope meant that many states – even those without Class I areas – would be required to participate in haze-reduction efforts. EPA designated five RPOs to assist with the coordination and cooperation needed to address the visibility issue. Those states that make up the midsection of the contiguous United States were designated as CENRAP.

On May 24, 2002, the U.S. Court of Appeals, D.C. District Court ruled on the challenge brought by the American Corn Growers Association against EPA's Regional Haze Rule of 1999. The Court remanded to EPA the BART provisions of the rule and denied the industry's challenge to the haze rule goals of natural visibility and no degradation. EPA has proposed revisions to the Regional Haze Rule pursuant to the remand. To facilitate the review of this SIP submittal by the EPA, FLMs, stakeholders, and the public; a guide is provided in 40 CFR 51.308, *Regional Haze Program Requirements* (Appendix A).

1.2 CLASS I AREAS

The State of Missouri has the following Class I areas within its borders:

Hercules Glades Wilderness Area

Situated in southwest Missouri, Taney County, Hercules Glades Wilderness Area (Hercules Glades) is managed by the United States Department of Agriculture (USDA) Forest Service as part of the Mark Twain National Forest. The area includes 12,315 acres located in some of the most rugged hills of the Missouri Ozarks. The closest urban area is the Springfield/Branson metropolitan statistical area, 40 miles to the west/northwest.

Mingo National Wildlife Refuge

The Mingo National Wildlife Refuge (Mingo) is managed by the U.S. Fish and Wildlife Service. The refuge is situated in southeast Missouri, along the Mississippi Flyway. Only a portion of the refuge is a Class I area (7,730 acres of a total 21,676 acres). Memphis to the south and St. Louis to the north are some of the largest urban areas nearby, although there are a few smaller population centers mostly to the east. Proximity to sources in the Ohio River Valley is a consideration.

In accordance with 40 CFR 51.308, Missouri has identified emissions sources within Missouri that have or may have impacts on the following Missouri Class I areas: Hercules Glades and Mingo. Emissions from Missouri may also contribute to visibility impairment in other states' Class I areas, such as the Caney Creek and Upper Buffalo Wilderness Areas in Arkansas (Upper Buffalo).

Improved visibility will lead to greater enjoyment of recreational opportunities at Hercules Glades and Mingo. The tourists drawn to the scenic beauty and recreational opportunities of each of these areas provide revenue to the respective regions. Missouri expects improved visibility of Hercules Glades and Mingo to provide not only enhanced scenic beauty, but also improved health benefits for people who are more susceptible to respiratory problems.

2.0 GENERAL PLANNING PROVISIONS

2.1 PLAN SUBMISSION

Pursuant to the requirements of 51.308(a) and (b), this Missouri Regional Haze Plan is being submitted for inclusion into the SIP as adopted to meet the requirements of EPA's Regional Haze Rule that was implemented to comply with requirements set forth in the CAA. Elements of this plan address the core requirements pursuant to 40 CFR 51.308(d) and the BART components of 40 CFR 50.308(e). In addition, this plan addresses regional planning; state/tribe and FLM coordination; and contains a commitment to provide plan revisions and adequacy determinations. Missouri has adopted this plan submittal in accordance with state laws and rules.

2.2 LEGAL AUTHORITY

The MACC is granted the legal authority to develop and implement regulations regarding air pollution under section 643.050 of the Revised Statues of Missouri.

2.3 PUBLIC HEARING NOTICE AND CERTIFICATION

The department's Air Pollution Control Program is required to announce a public hearing at least 30 days prior to holding such a hearing. Announcements were submitted to newspapers at least 30 days prior to the public hearing. The public hearing for this Regional Haze Plan occurred on December 6, 2007. Attached in Appendix B is the public hearing notice, along with certification of publication of the public notice for the Regional Haze Plan.

2.4 COMMENTS, RESPONSES, AND EXPLANATIONS OF CHANGE

Attached in Appendix C are the department's Air Pollution Control Program responses to comments received during the open public comment period for this region haze plan. The comment period was open until December 13, 2007, seven days after the Public Hearing that was held on December 6, 2007. The department's Air Pollution Control Program is required to respond to all comments received by either amending the plan or explaining the reasoning for not making an amendment.

2.5 MISSOURI AIR CONSERVATION COMMISSION ADOPTION CERTIFICATION

Attached in Appendix D is the MACC adoption certification to demonstrate the approval of the Regional Haze Plan by the Commission.

2.6 COMMITMENT TO REVISE PLAN

Consultation between the states and the FLMs will continue as the federal regional haze program progresses. The consultation will continue via participation in CENRAP, and if CENRAP is no longer operating, Missouri will lead the consultation with other states and FLMs for meeting Missouri's goals. This effort will include five-year progress reports and development and review of any plan revisions deemed necessary. It will also provide for consideration of any other programs that are implemented and have the potential to contribute to impairment of visibility in Class I areas.

3.0 REGIONAL PLANNING

In 1999, EPA and affected states/tribes agreed to create five RPOs to facilitate interstate coordination on regional haze plan submittals and Tribal Implementation Plans (TIPs). Figure 3.1 shows a map of all five RPOs. The State of Missouri is a member of the CENRAP RPO. Members of CENRAP include the following states: Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, Oklahoma, and Texas.

Figure 3.1: Geographical Areas of Regional Planning Organizations

The governing body of CENRAP is the Policy Oversight Group (POG). The POG is made up of 18 voting members representing the states and tribes within the CENRAP region and non-voting members representing local agencies, the EPA, the Fish and Wildlife Service, Forest Service and National Park Service. The POG facilitates communication with FLMs, stakeholders, the public, and CENRAP staff.

Since its inception, CENRAP has established an active committee structure to address both technical and non-technical issues related to regional haze. The work of CENRAP is accomplished through five standing workgroups: Monitoring; Emission Inventory; Modeling; Communications; and Implementation and Control Strategies. Participation in workgroups is open to all interested parties. Ad hoc workgroups may be formed by the POG to address specific issues. Ultimately, the CENRAP POG makes policy decisions.

CENRAP has adopted the approach that the Regional Haze Rule requires the "States to establish goals and emission reduction strategies for improving visibility in all 156 mandatory Class I parks and wilderness areas." The rule also encouraged states and tribes to work together in regional partnerships.

This plan utilizes data analysis, modeling results and other technical support documents prepared for CENRAP members. By coordinating with CENRAP and other RPOs, Missouri has worked to ensure that its long-term strategy provides sufficient reductions to mitigate impacts of sources from Missouri on affected Class I areas. Data analyses, modeling results and other technical support documents are provided to CENRAP members through either CENRAP's website or through a file transfer protocol (ftp) that allows users to copy files between their local system and CENRAP's system that they can reach on the CENRAP network.

4.0 PLAN COORDINATION AND CONSULTATION

4.1 Central Class I Areas Consultation

40 CFR 51.308(i) requires coordination between states/tribes and the FLMs. FLMs are an integral part of CENRAP's POG and the membership on standing committees. FLMs have contributed to the development of technical and non-technical work as a result of that participation. In addition, opportunities have been provided by CENRAP for FLMs to review and comment on each of the technical documents developed by CENRAP and included in this plan. Missouri has provided agency contacts to the FLMs as required. In development of this plan, the FLMs were consulted in accordance with the provisions of 51.308(i)(2).

Missouri provided FLMs an opportunity for consultation and an opportunity to hold a face to face meeting, if deemed necessary. All of the consultation for this plan was conducted by conference call with no need expressed for a face to face meeting and a draft of the plan was provided at least 60 days prior to holding the public hearing on the Regional Haze Plan.

During the consultation process, the FLMs were given the opportunity to address their:

- Assessment of the impairment of visibility in any Class I areas
- Recommendations on the development of RPGs
- Recommendations on the development and implementation of strategies to address visibility impairment.

According to 40 CFR 51.308(d)(3)(i), Missouri is required to consult with other states/tribes to develop coordinated emission strategies. This requirement applies both when emissions from the state are reasonably anticipated to contribute to visibility impairment in Class I areas outside the state and when emissions from other states/tribes are reasonably anticipated to contribute to visibility impairment in Class I areas within the state.

Missouri has consulted with other states/tribes in CENRAP, Visibility Improvement State and Tribal Association of the Southeast (VISTAS), the Midwest Regional Planning Organization (MRPO), FLMs and EPA Regions 5, 6 and 7 on development of coordinated strategies for

Central Class I areas, including Mingo, Hercules Glades, Upper Buffalo, and Caney Creek. Technical analyses, such as Area of Influence (AOI) and source apportionment, were developed as part of consultation planning to determine contributing states (Appendix E).

Missouri provided the Regional Haze Plan to the FLMs for review on August 23, 2007 and notified the FLMs that a public hearing would be held on this plan at a later date. The FLMs provided early comments on the draft plan and a conference call between Missouri, FLMs, and EPA Region 7 was conducted on September 25, 2007 to discuss the comments. Missouri considered all comments the FLMs provided on the early draft of the plan.

Regional modeling and other findings were used to develop RPGs for the Arkansas and Missouri Class I areas based on the existing and proposed controls through both state and federal requirements. It was also determined that these RPGs will meet the established URP goals by 2018. The consultation process determined which states significantly impacted the Arkansas and Missouri Class I areas.

Missouri is reasonably anticipated to contribute to the following Class I areas:

1) Mingo National Wildlife Refuge, Missouri
2) Hercules Glades Wilderness, Missouri
3) Upper Buffalo Wilderness Area, Arkansas
4) Caney Creek Wilderness Area, Arkansas

The state's coordination with FLMs on long-term strategy development is described in Chapter 11. The consultation was completed based on a determination that reasonable progress was achieved by contributing states.

4.2 Other State Consultations

The consultation processes for the Wichita Mountains (WIMO) Class I area in Oklahoma has recently been completed. Oklahoma Department of Environmental Quality has indicated their belief that Missouri sources impact WIMO. However, in response to the Oklahoma consultation letter, Missouri recommended that the rationale for determining contributing states deserves further examination. A more inclusive methodology for the Central Class I areas with four different metrics (Particulate Matter Source Apportionment Technology (PSAT), PMF, AOI, and emission rate divided by five times the distance - Q/d) was used in a combined manner with three out of four positive results required before concluding that a particular state is contributing. The distance between WIMO and western Missouri's Class I area is approximately 200-250 miles farther west. Because of this distance, it is counter-intuitive to assume that planned emission controls on Missouri sources would be significant enough. It seems likely that Missouri would not be included as significant based on this level/type of PSAT analysis, and emissions/source distance ratio.

It is also not clear that additional controls in Missouri would be reasonable to reduce the visibility in WIMO. Based on the PSAT analysis presented, over half the elevated point-source impacts to WIMO are due to sources in Oklahoma, Texas, and Louisiana and most of the area source impacts are due to Oklahoma and Texas sources. Point and area are the two largest emission sectors. Controls appear likely to be more efficient in those states, on a cost-per-ton basis, than additional controls in Missouri.

Consultation processes for the Minnesota Class I areas have also been conducted recently. The Minnesota Pollution Control Agency has indicated that it believes that Missouri impacts the Boundary Waters, but not Voyageurs.

Minnesota identifies Missouri as a contributing state based on LADCO 2002-2003 Trajectory analysis or LADCO 2018 PSAT modeling analysis at over a 5 percent total contribution to haze at either of their Class I areas. The criteria are met marginally at 5.2 percent for 2018 PSAT for the Boundary Waters area only.

Analysis conducted as part of the Causes of Haze II Study[2] shows emissions for the northern Class I area at Voyageurs National Park indicating the high impact of Minnesota sources, with

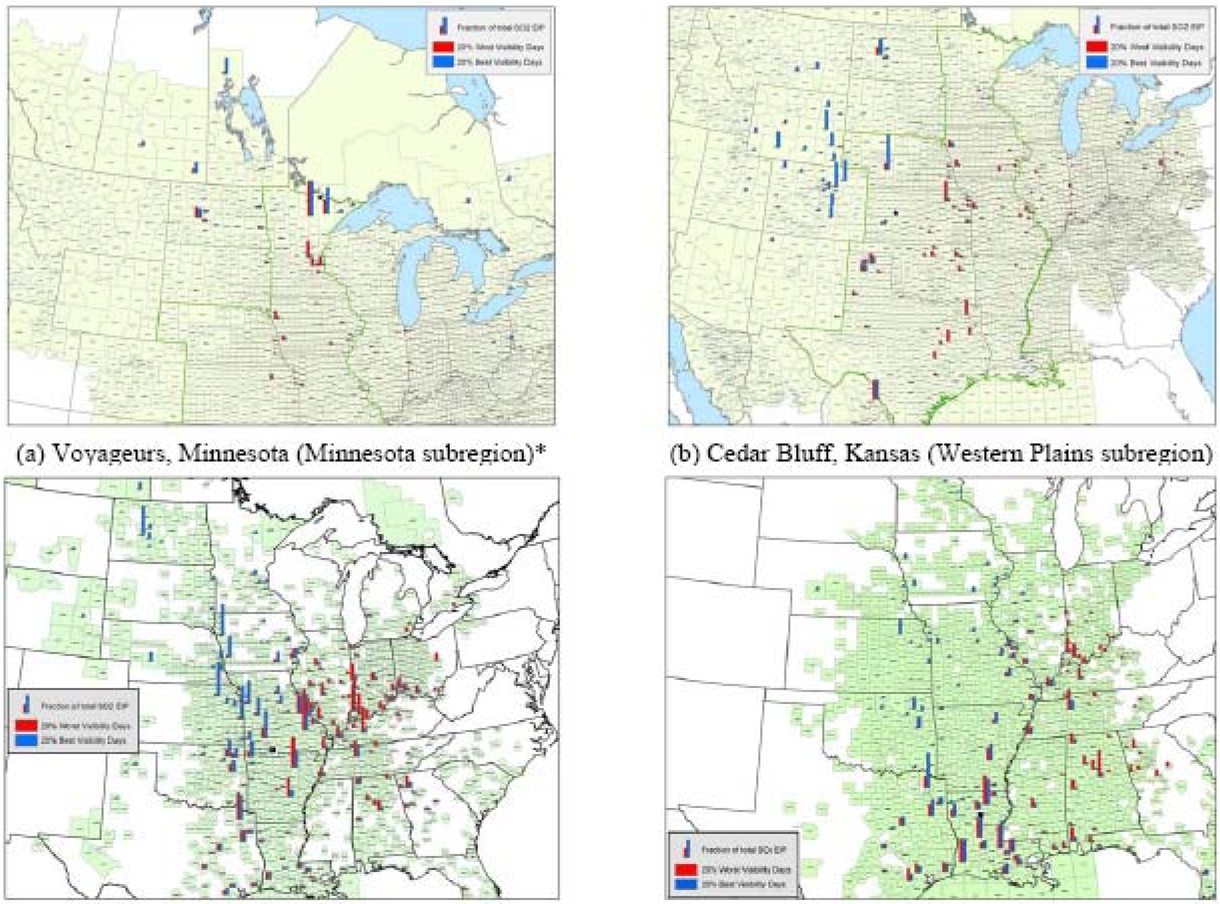
[2] Causes of Haze II, 2005; Sullivan, Hafner, Brown, MacDonald, Raffuse, Penfold, Roberts, Sonoma Technology

only small impact by out of state sources. Voyageurs and the Boundary Waters are very close in proximity, and the overall analysis was intended to apply regionally. The Emission Impact Potential mappings below underscore the impact of Minnesota sources on the area, and how controls on a relative few will provide much greater result than controls on sources outside Minnesota. Comparisons with Hercules Glades EIP show the difference in areas with significant external sources (Hercules) to areas with significant internal sources (Voyageurs, Boundary Waters). The conclusion reached in the Causes of Haze II is that for Voyageurs, and by geographic proximity, Boundary Waters, important emission source regions are internal (Minnesota and to a lesser extent North Dakota) on the 20 percent worst days. Area of Influence analysis for CENRAP states confirms that Level I Sulfate for both areas barely enters the northwest 20 miles of Missouri, not indicating strong source influence.

The most recent CENRAP PSAT analysis, as Figure 4.3, shows most Minnesota anthropogenic sources with very high impacts on Boundary Waters, slightly more than 15 inverse megameters for 2002. For 2018 modeling, it remains at almost 14 inverse megameters. Of other states, only Wisconsin elevated point impacts are larger than 2 inverse megameters, and Missouri impacts are 1.6. Based on the AOI and PSAT analyses, it is not reasonable to control the Missouri sources at the same level as Minnesota sources to achieve a very small impact at the Boundary Waters Class I area.

Since other states are still involved in their consultation process for their respective plans, Missouri will continue to participate in their consultation processes, as necessary.

Figure 4.1: Causes of Haze Study II, EIP sulfate mappings



(a) Voyageurs, Minnesota (Minnesota subregion)*

(b) Cedar Bluff, Kansas (Western Plains subregion)

(c) Hercules-Glades, Missouri (Upper Midwest subregion)

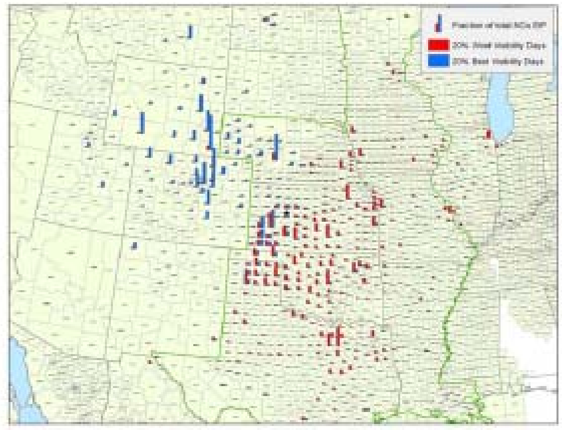
(d) Sikes, Louisiana (Southeastern Plains subregion)

* Note: Many trajectory hourly endpoints for the 20%-best days extended far northward into Canada and therefore dropped out of the analysis.

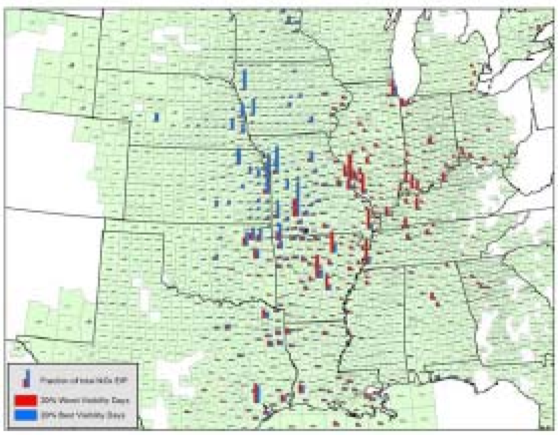
Figure 4-5. Geographic distributions of SO_2 EIP for the 20%-worst visibility days (red bars) and 20%-best visibility days (blue bars) observed at four representative sites.

Figure 4.2: Causes of Haze Study II, EIP nitrate mappings

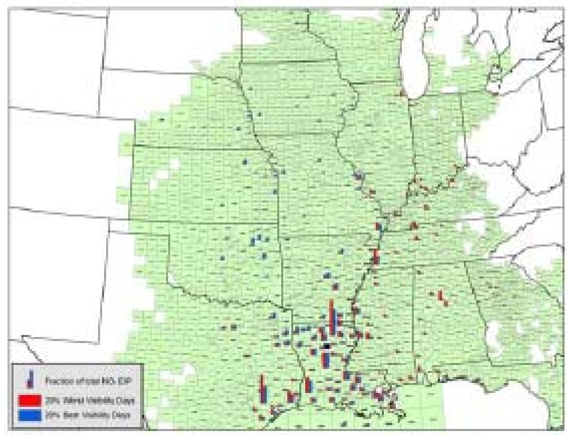
(a) Voyageurs, Minnesota (Minnesota subregion)*



(b) Cedar Bluff, Kansas (Western Plains subregion)



(c) Hercules-Glades, Missouri (Upper Midwest subregion)



(d) Sikes, Louisiana (Southeastern Plains subregion)

* Note: Many trajectory hourly endpoints for the 20%-best days extended far northward into Canada and therefore dropped out of the analysis.

Figure 4-6. Geographic distributions of NO_x EIP for the 20%-worst visibility days (red bars) and 20%-best visibility days (blue bars) observed at four representative sites.

Figure 4.3: PSAT Source Analysis for Missouri modeling demonstration (as part of CENRAP Analysis)

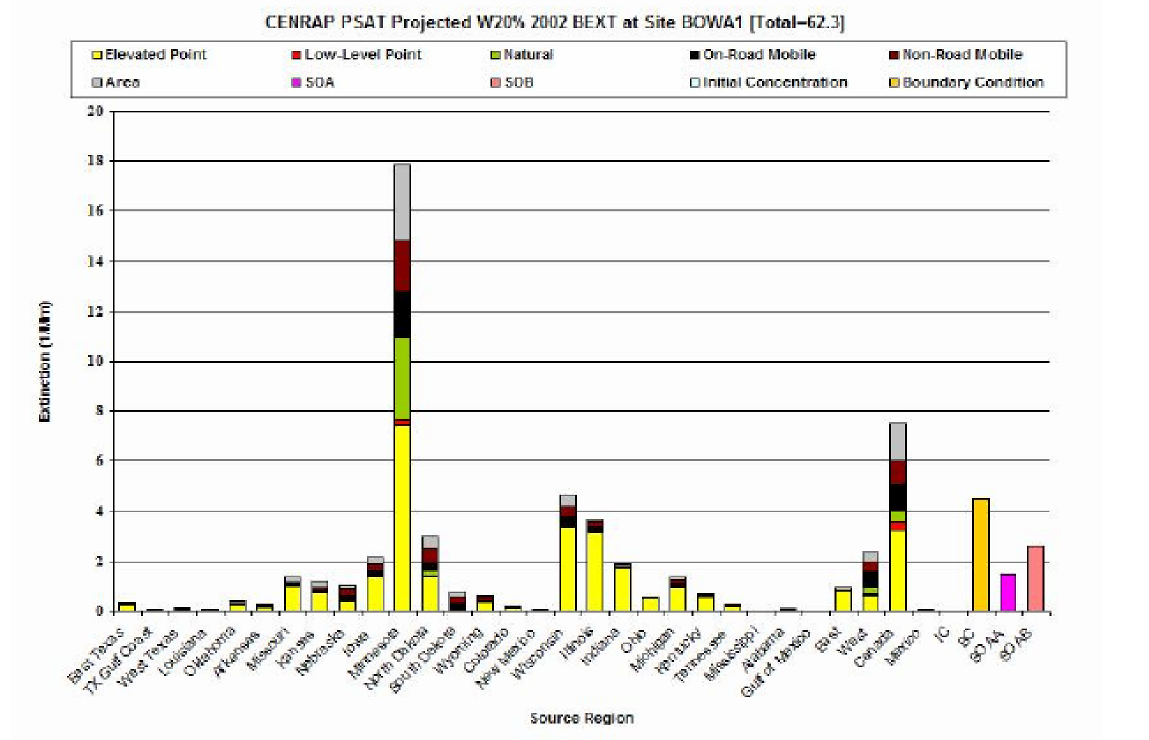


Figure E-4c. PSAT source region by source category contributions to the average 2000-2004 Baseline extinction (Mm^{-1}) for the Worst 20% visibility days at Boundary Waters (BOWA), Minnesota.

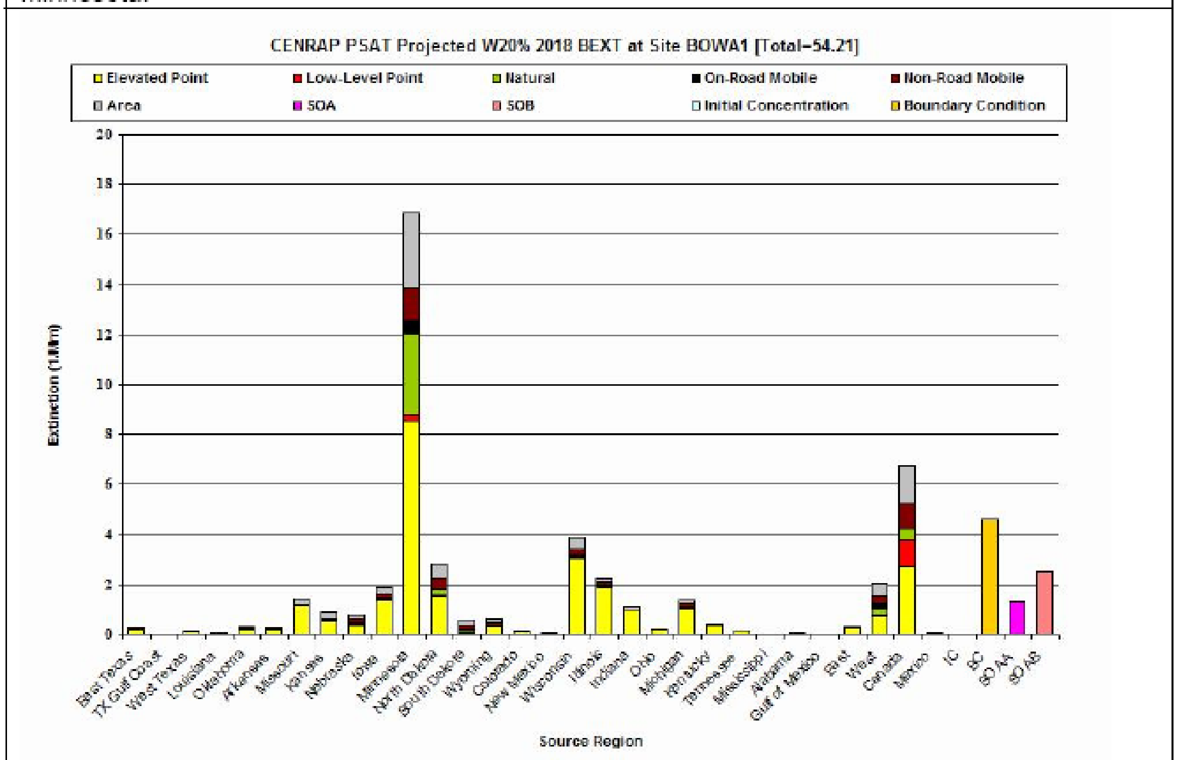


Figure E-4d. PSAT source region by source category contributions to the average 2018 extinction (Mm^{-1}) for the Worst 20% visibility days at Boundary Waters (BOWA), Minnesota.

5.0 ASSESSMENT OF BASELINE AND CURRENT CONDITIONS AND ESTIMATE OF NATURAL CONDITIONS

5.1 VISIBILITY REQUIREMENTS

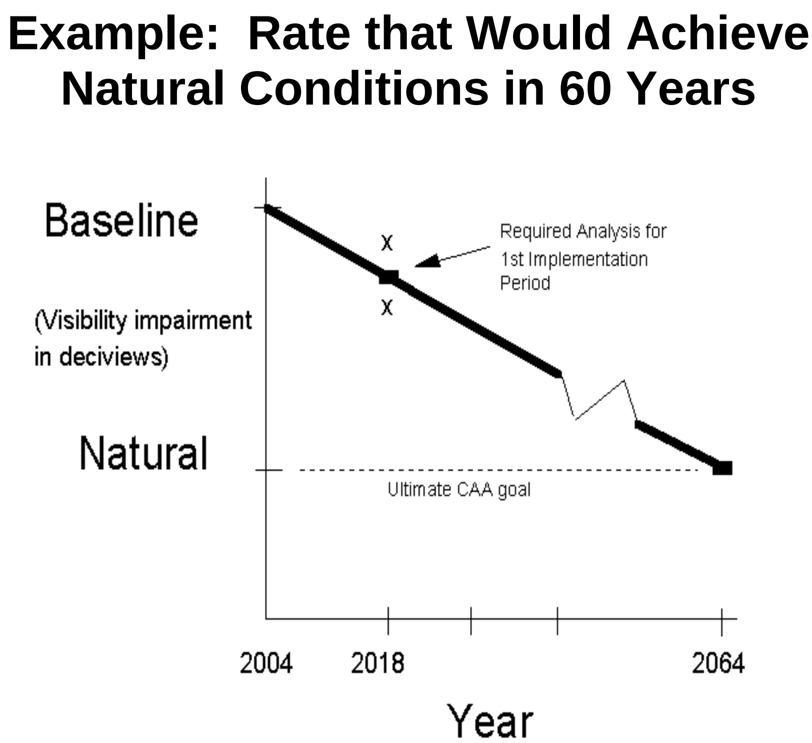
The goal of the Regional Haze Rule is to restore natural visibility conditions to the 156 Class I areas identified in the 1977 CAA Amendments. Sec. 51.301(q) defines natural conditions: "Natural conditions includes naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration." The regional haze plans must contain measures that make "reasonable progress" toward this goal by reducing anthropogenic emissions that cause haze. For each Class I area, there are three metrics of visibility that are part of the determination of reasonable progress:

1) baseline conditions
2) natural conditions
3) current conditions

Each of the three metrics includes the concentration data of the visibility pollutants as different terms in the light extinction algorithm, with respective extinction coefficients and relative humidity (RH) factors. Total light extinction when converted to deciviews (dv) is calculated for the average of the 20 percent best and 20 percent worst visibility days.

"Baseline" visibility is the starting point for the improvement of visibility conditions. It is the average of the Interagency Monitoring and PROtected Visual Environments (IMPROVE) monitoring data for 2000 through 2004 and can be thought of as "current" visibility conditions for this initial period. The comparison of initial baseline conditions to natural visibility conditions indicates the amount of improvement necessary to attain natural visibility by 2064. Natural visibility is determined by estimating the natural concentrations of visibility pollutants and then calculating total light extinction with the light extinction algorithm (Figure 5.1). Each state must estimate natural visibility levels for Class I areas within its borders in consultation with FLMs and other states (51.308(d)(2)). "Current conditions" are assessed every five years as part of the plan review where actual progress in reducing visibility impairment is compared to the reductions committed to in the plan (Appendix F, Chapter 4.0).

Figure 5.1: Determination of Natural Background



<u>Consultation regarding the visibility metrics</u>

Consultation among states is a requirement that is repeated in the Regional Haze Rule. As part of a "long-term strategy" for regional haze, a state whose emissions are "reasonably anticipated" to contribute to impairment in other states' Class I area(s) must consult with those states and also consult with any states whose emissions affect its own Class I area(s) (sec. 51.308(d)(3)).

A chief purpose of the RPO is to provide a means for states to confer on all aspects of the regional haze issue, including consultation on reasonable progress goals and long-term strategies, which are based on the current (baseline) and natural visibility determinations. This process is described in Chapter 3, *Regional Planning*. CENRAP has provided a forum for the member states and tribes to consult on the determination of baseline and natural visibility conditions in each of the Class I areas.

In addition, states in CENRAP have conferred with neighboring Class I area states outside CENRAP, both individually and by way of the states' RPO.

Sec. 51.308(i) requires Class I area states' coordination with FLMs that includes consultation on implementation, including the assessment of visibility impairment and recommendations regarding the reasonable progress goal and strategies for improvement.

Through participation in CENRAP and as a state, Missouri has completed this regulatory requirement. Details of actions taken to meet this requirement are found in the *Central Class I Areas Consultation Plan* (Appendix E).

5.2 BASELINE VISIBILITY CONDITIONS

During the five-year (2000-2004) baseline period, sites are required to have three valid years of data from which baseline conditions can be constructed. The Visibility Information Exchange Websystem (VIEWS) website (http://vista.cira.colostate.edu/views/) has posted particulate matter (PM)-species specific natural and baseline conditions based on the new IMPROVE algorithm. The new IMPROVE algorithm was developed by fitting reconstructed light extinction based on IMPROVE measured PM and nitrite (NO_2) concentrations with actual co-located measured light extinction (e.g., nephelometer measurements. The VIEWS document, *Revised IMPROVE Algorithm for Estimating Light Extinction from Particle Speciation Data*, posted under gray literature, explains the justification for the use of the new equation. Section II of this algorithm document, which provides more detail on the revised IMPROVE equation is included as Appendix G. The choice between use of the default or the refined equation for calculating the visibility metrics for each Class I area is made by the state in which the Class I area is located.[3] It is with these calculations that the state develops a RPG for each Class I area, in consultation with other states whose emissions affect visibility in that park or wilderness area (sec. 51.308(d)(1)(iv)).

Because it is based on more recent science which better exemplifies the observed light extinction values, Missouri, as well as other CENRAP states, has elected to perform their primary visibility

[3] According to sec. 51.308(d)(2), the state will make the determinations of baseline and natural visibility conditions.

projections using the new IMPROVE equation to calculate visibility metrics for the purpose of developing its reasonable progress goal (Appendix F, Section 4.2.1.1.3).

Using these PM-species specific natural conditions and the curved extinction glidepaths, we can evaluate how well visibility extinction achieves the 2018 Uniform Rate of Progress (URP) goal on a species-by-species basis in accordance with 40 CFR 51.308(d)(2).

The Mingo Class I area has an established baseline visibility of 13.76 dv for the cleanest 20 percent of the sample days and 28.02 dv for the 20 percent worst visibility days, as indicated in Table 5.1. This is based on sampling data collected at the Mingo IMPROVE monitoring site, which was established by the IMPROVE sampling staff at the University of California-Davis via their protocols. For Mingo, because of a clogged Module C Inlet, carbon data was not available from June 2000 to January 2002. The resolution was a substitution protocol developed by Warren White using organic mass hydrogen (OMH) to develop a surrogate for organic mass carbon (OMC). Data filling was used to obtain sufficient data so that three-years of valid data were available from which baseline conditions could be calculated. The data filled IMPROVE database were prepared and made available on the VIEWS website, where more information on the data filling procedures can be found (http://vista.cira.colostate.edu/views/).

The Hercules Glades Class I area has an established baseline visibility of 12.84 dv for the cleanest 20 percent of the sample days and 26.75 dv for the 20 percent worst visibility days. This is based on sampling data collected at the Hercules Glades IMPROVE monitoring site which was established by the IMPROVE sampling staff at the University of California-Davis via their protocols.

Table 5.1: Baseline Visibility Conditions for Missouri Class I Areas

Baseline Visibility Conditions 2000-2004		
Class 1 Area	**Average for 20% Worst Days (dv)**	**Average for 20% Best Days (dv)**
Mingo	28.02	13.76
Hercules Glades	26.75	12.84

5.3 NATURAL VISIBILITY CONDITIONS

EPA's "Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Program" (Sept 2003) provides states a "default" estimate of natural visibility. The default values of concentrations of visibility pollutants are based on a 1990 National Acid Precipitation Assessment Program report (Trijonis, J.C. 1990). In the guidance, the United States is divided into "East" and "West" along the western boundary of the states one tier west of the Mississippi River. This division divides the CENRAP states into "East" (MN, IA, MO, AR, and LA), with seven Class I areas, and "West" (NE, KS, OK, and TX), with three Class I areas. In the two equations, only sulfate (SO_4) and organic carbon have different values, but the calculated dv difference is significant (see Appendix F, Section 4.2 for further discussion of the default equation).

Using the New IMPROVE equation, Missouri has determined that natural visibility conditions for the Mingo Class I area is best represented by 12.40 dv for the 20 percent worst days (Table 5.2). The Hercules Glades Wilderness Class I area is best represented by 11.30 dv for the 20 percent worst days. Appendix F, Section 4.2.1.1.3 provides calculations, methodologies, and a discussion of the reasons for selection of the methodology and a demonstration of the appropriateness of these values for both Class I areas.

Table 5.2: Natural Background Conditions for the Class 1 Areas in Missouri

Class 1 area	20% Worst Days Goal (dv)	20% Best Days Goal
Mingo	12.40	No degradation
Hercules Glades	11.30	No degradation

6.0 MONITORING STRATEGY

6.1 MONITORING REQUIREMENTS

Section 51.308(d)(4) of the federal Regional Haze Rule requires a monitoring strategy for measuring, characterizing, and reporting regional haze visibility impairment that is representative of all mandatory Class I areas within the State of Missouri. The monitoring strategy relies upon participation in the IMPROVE network.

6.2 CURRENT MONITORING STRATEGY

Upon the creation of CENRAP, the newly formed Monitoring Workgroup identified large visibility data voids in Southern Arkansas, Iowa, Kansas, Southern Minnesota, Nebraska, and Oklahoma. Only five IMPROVE sites were located in the CENRAP region. Between 2000 and 2003, five more IMPROVE sites and 15 IMPROVE protocol sites were installed. In Missouri, IMPROVE Sites are located at Hercules Glades and Mingo (Figures 6.1 and 6.2). An IMPROVE protocol sampler is located at the site near El Dorado Springs (Figure 6.3). Missouri commits to meet the requirements under 40 CFR 51.308(d)(4)(iv) to report to EPA visibility data for each of Missouri's Class I areas annually.

The filter samples from the IMPROVE modules are sent for analysis to the Crocker Nuclear Laboratory of the University of California in Davis and the data is posted to the IMPROVE website and the VIEWS website.[4] Details regarding the monitors (location, date of installation, etc., and monitoring data) are found at the VIEWS website. This fulfills Missouri's reporting requirement of visibility data (electronic) under subsection (iv).

[4] The IMPROVE website can be found at: http://vista.cira.colostate.edu/improve/. The VIEWS website can be found at: http://vista.cira.colostate.edu/views/.

Figure 6.1: Hercules Glades IMPROVE Monitoring Station

Figure 6.2: Mingo IMPROVE Monitoring Station

Figure 6.3: El Dorado Springs IMPROVE Protocol Monitoring Station

6.3 FUTURE MONITORING STRATEGY

In order to assess progress in reducing visibility impairment in Class I areas, the existing IMPROVE and IMPROVE Protocol sites will be maintained contingent upon continued national funding to measure, characterize and report regional haze visibility impairment to satisfy requirements of subsection (i). If EPA elects to revise funding for this network, Missouri will evaluate the IMPROVE protocol site at El Dorado Springs. Any changes appropriate to continued monitoring of Regional Haze for the Missouri Class I areas will be evaluated during the Missouri five-year review. The five-year review will include the following aspects:

i. QA IMPROVE data from Mingo and Hercules Glades.
ii. Calculate current visibility conditions for most impaired and least impaired days.
iii. Calculate differences between current conditions and baseline conditions.
iv. Determine whether RPGs are being met.

Missouri will also evaluate technology changes and the need for new monitors as appropriate.

6.4 SPECIAL MONITORING STUDIES

Special monitoring in the CENRAP region for ammonia was conducted from November 1, 2003 through June 28, 2006. In all, approximately 7,200 individual ammonia and associated measurements were attempted in the course of this project. One of the primary outcomes of this sampling was the disclosure that high concentrations of ammonia are occurring in the northern and central CENRAP regions with a considerable regularity. It seems likely that these are due to the agricultural sources that have been documented as emitters of ammonia, including animal raising and fertilizer application.[5]

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[5] Caughey, Mike, David Gay, and Clyde Sweet. *CENRAP Project Report: Monitoring Ambient Ammonia and Related Compounds in the Midwest 2003-2006*. Illinois State Water Survey. (Champaign, IL): August 31, 2006. A copy of the report is available from David A. Gay, Associate Research Scientist, Illinois State Water Survey, University of Illinois, 217-244-0462.

7.0 EMISSIONS INVENTORY

7.1 2002 AND 2018 EMISSIONS INVENTORY SUMMARY

As specified in the EPA guidance document, *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations* (August 2005), the regional haze emissions inventory includes carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOCs), fine particulate ($PM_{2.5}$), coarse particulate (PM_{10}), and ammonia (NH_3). Missouri used the CENRAP Base G emissions inventory for both the baseline year of 2002 and future year of 2018. Tables 7.1 and 7.2 summarize the Missouri 2002 and 2018 inventories, respectively. Tables H.1-8 in Appendix H include the complete 2002 and 2018 emissions inventory for Missouri.

Table 7.1: 2002 Missouri Emissions Inventory Summary

Source Sector	NO_X (TPY*)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)	CO (TPY)	VOC (TPY)	NH_3 (TPY)
Point EGU**	145,437.9	272,128.1	4,093.2	2,523.2	11,357.0	1,796.4	19.2
Point NEGU***	36,143.8	97,117.0	15,092.2	7,045.3	107,756.3	38,473.6	6,233.9
Area	31,337.8	48,510.9	29,975.9	26,385.8	135,292.9	204,940.2	2,276.7
Offroad Mobile	99,305.6	9,350.5	13,063.5	11,985.3	754,272.8	141,183.3	73.9
Onroad Mobile	189,852.3	5,353.5	4,486.6	3,297.4	1,585,277.1	97,245.6	5,993.5
Fire	3,539.6	936.2	12,407.2	10,642.3	151,389.6	12,867.9	1,447.2
Ag and Soil Ammonia	0.0	0.0	0.0	0.0	0.0	0.0	152,904.1
Fugitive Dust	0.0	0.0	95,240.0	19,006.9	0.0	0.0	0.0
Road Dust	0.0	0.0	367,390.3	55,011.6	0.0	0.0	0.0
Biogenics	22,518.6	0.0	0.0	0.0	134,123.4	1,428,260.0	0.0
Totals	528,135.5	433,396.3	541,748.9	135,897.8	2,879,469.2	1,924,767.1	168,948.5

Table 7.2: 2018 Missouri Emissions Inventory Summary

Source Sector	NO_X (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)	CO (TPY)	VOC (TPY)	NH_3 (TPY)
Point EGU	84,619.8	289,330.1	18,958.2	17,036.6	15,752.7	2,080.5	874.4
Point NEGU	49,290.8	66,731.1	23,598.8	10,171.7	184,350.9	54,908.6	8,600.2
Area	35,212.8	49,726.1	29,193.0	25,528.5	120,114.9	265,737.4	4,411.8
Offroad Mobile	59,624.9	565.2	8,371.3	7,675.0	739,932.9	72,794.1	84.8
Onroad Mobile	50,860.9	797.4	1,415.5	1,415.5	895,481.6	39,672.3	8,316.0
Fire	3,539.6	936.2	12,407.2	10,642.3	151,389.6	12,867.9	1,447.2
Ag and Soil Ammonia	0.0	0.0	0.0	0.0	0.0	0.0	182,451.5
Fugitive Dust	0.0	0.0	106,045.3	21,147.2	0.0	0.0	0.0
Road Dust	0.0	0.0	313,576.4	46,957.9	0.0	0.0	0.0
Biogenics	22,518.6	0.0	0.0	0.0	134,123.4	1,428,260.0	0.0
TOTALS	305,667.4	408,086.1	513,565.8	140,574.6	2,241,146.0	1,876,320.7	206,185.9

* Tons Per Year
** Electric Generating Unit
*** Non-Electric Generating Unit

7.2 Overview of Emissions Inventory Development

7.2.1 Point Sources

The 2002 point source inventory is based on information reported by facilities on Emission Inventory Questionnaires (EIQs). The 2002 EIQ data collection process was conducted by the department's Air Pollution Control Program and the local air pollution agencies of St. Louis County and the City of St. Louis. As the coordinating agency for point source inventory development, the department's Air Pollution Control Program performed the overall quality-assurance procedures and submitted the data to EPA's 2002 National Emissions Inventory (NEI) to meet the requirements of the CERR.

Following submission of the Missouri point source inventory to the 2002 NEI, additional quality assurance, and revision of the data was completed through the CENRAP process. E. H. Pechan & Associates (Pechan), through a contract with CENRAP, obtained the Missouri point source inventory and worked with the department's Air Pollution Control Program to make corrections where needed. In particular, an error that resulted in the double counting of emissions from a number of emission units was corrected. The problem affected VOC emissions only. For example, for the Chrysler-North facility (291890231), emission unit number 20949, which emitted a total of 112 tons/year (about 0.3 tons/day) VOC in 2002, was associated with stack numbers 44387 and 44388. Instead of being proportioned between the two stacks, the total amount of 112 tons/year was linked to each stack, which doubled the emissions. In all, this problem resulted in overstating VOC emissions in the St. Louis nonattainment area by a total of 751 tons/year (roughly 2 tons/day). Other revisions included corrections to facility coordinates and stack parameters. Pechan also converted the point source inventory to the Sparse Matrix Operator Kernel Emissions/Inventory Data Analyzer (SMOKE/IDA) format. Pechan's work is described in detail in the two documents included in Appendix H: *The Consolidation of Emissions Inventories* (April 28, 2005) and *Refinement of CENRAP's 2002 Emissions Inventories* (August 31, 2005).

The 2018 point source emissions inventory was prepared by CENRAP. For non-EGUs, the 2002 emissions were projected to 2018 by applying growth and control factors using the SMOKE model. The growth and control factors were prepared by Pechan and are documented in the following report in Appendix H.4: *Development of Growth and Control Inputs for CENRAP 2018 Emissions Draft Technical Support Document* (May 2005). The control factors for non-EGU point sources account for Maximum Achievable Control Technology (MACT) standards and the NO_X SIP Call for industrial boilers. In addition, the newly permitted Holcim cement kiln in Ste. Genevieve County was added to the 2018 non-EGU point inventory.

The Integrated Planning Model (IPM) version 2.1.9 model output for 2018 was used for 2018 EGU point source emissions. The SMOKE IDA formatted version of the 2018 Integrated Planning Model (IPM) 2.1.9 file was prepared by Pechan for CENRAP. See the Pechan report, *Refinement of CENRAP's 2002 Emissions Inventories* (August 31, 2005), in Appendix H.3 for more information. The proprietary IPM model has been used by the EPA to simulate electrical power generation and electrical power distribution scenarios based upon "least-cost" assumptions for future years and, simultaneously, generate estimates of pollutant emissions associated with these scenarios. The IPM run was conducted by ICF under contract to the RPOs. This run corresponds with the "VISTASII_PC_1f" modeling run. This run specifically addressed the emission reductions to be realized through implementation of CAIR assuming all states participate in the EPA's trading program, Acid Rain Program (Title IV – Phases I and II), NO_X SIP Call, and state and local regulations, while incorporating unit-level updates provided by power company stakeholders.

The University of California-Riverside (UCR) ran the SMOKE model for 2018 point source emissions. The edited IPM file for EGUs was processed in SMOKE without adjustments. The growth and control factors for non-EGUs were applied using the SMOKE model. The technical support document in Appendix F describes UCR's work on the 2018 point source inventory.

7.2.2 Area Sources

The 2002 area source inventory includes emissions estimates prepared by the department's Air Pollution Control Program and CENRAP, with remaining gaps filled in with data from the NEI. Table H.9 in Appendix H.1 lists the source of the emissions estimates for each SCC in the base year area source inventory. For the categories developed by the department's Air Pollution

Control Program, the data and methods used are described in the document *Missouri Statewide Estimates for the 2002 National Emissions Inventory (NEI): Area Sources* (January 8, 2007) in Appendix H.5. The data and methods used to develop the prescribed burning, agricultural dust, and soil agricultural ammonia inventories for CENRAP can be found in the following reports prepared by Sonoma Technology in Appendix H: *Research and Development of Planned Burning Emission Inventories for the Central States Regional Air Planning Association* (July 30, 2004), *Emission Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States* (October 28, 2004), and *Research and Development of Ammonia Emission Inventories for the Central States Regional Air Planning Association* (October 30, 2003). Documentation of EPA's methods for the NEI may be found on EPA's Clearinghouse for Inventories and Emission Factors (CHIEF) website at http://www.epa.gov/ttn/chief/net/2002inventory.html.

In a contract with CENRAP, Pechan consolidated the area source data from the various sources, conducted additional quality assurance, and worked with the department's Air Pollution Control Program to make revisions where needed. In particular, corrections were made to a double-counting error of industrial surface coating VOC emissions. Pechan also converted the area source inventory to the SMOKE/IDA format. Pechan's work is described in detail in two documents included in Appendix H: *The Consolidation of Emissions Inventories* (April 28, 2005) and *Refinement of CENRAP's 2002 Emissions Inventories* (August 31, 2005).

To prepare the area inventories for modeling, UCR made several modifications to the IDA files by removing selected sources either to model them as separate source categories or to omit them from simulations completely. Fugitive and road dust sources were extracted from all stationary-area inventories and adjusted by transport factors following *Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses* (Pace 2005).

The 2018 area source emissions inventory was based on data provided by CENRAP states. Area source growth and control factors were prepared by Pechan and are documented in the following report in Appendix H.5: Development of Growth and Control Inputs for CENRAP 2018

Emissions Draft Technical Support Document (May 2005). The control factors reflect New Source Performance Standards (NSPS) for residential wood combustion and Stage II vapor recovery controls, including onboard vapor recovery.

UCR ran the SMOKE model for the 2018 area source emissions. The growth and control factors for area sources were applied within SMOKE. The technical support document in Appendix F describes UCR's work on the 2018 area source inventory. Windblown dust from non-agricultural land use categories and fire emissions were held constant from 2002 to 2018.

7.2.3 Offroad Mobile Sources

The 2002 offroad mobile source includes emissions estimates prepared by the department's Air Pollution Control Program and CENRAP, with remaining gaps filled in with EPA NEI data. Table H.10 in Appendix H.1 lists the source of the emissions estimates for each SCC in the base year offroad mobile inventory. The majority of the offroad mobile inventory was developed by Sonoma Technology under a contract with CENRAP. The methods and data used by Sonoma are described in the report *Emissions Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States* (October 28, 2004) in Appendix H.7. Information on the NONROAD model is at http://www.epa.gov/otaq/nonrdmdl.htm.

Pechan, under a contract with CENRAP, consolidated the offroad mobile source inventories from the various data sources, quality-assured the data, worked with the department's Air Pollution Control Program to make corrections where needed, and created SMOKE/IDA-formatted files. In particular, Pechan made corrections to the fuel oxygenate content used in the NONROAD model. Pechan's work is described in detail in the two documents included in Appendix H: *The Consolidation of Emissions Inventories* (April 28, 2005) and *Refinement of CENRAP's 2002 Emissions Inventories* (August 31, 2005).

The 2018 offroad mobile inventory was based on inputs from CENRAP states. Growth and control factors for locomotives, aircraft, and commercial marine vessels were prepared by Pechan. The control factors accounted for federal standards for commercial marine vessels and locomotives. For the remaining offroad mobile categories, Pechan ran the EPA's

NONROAD2004 model for 2018. EPA's NONROAD2004 model accounts for growth in equipment populations and incorporates the effects of most final federal standards, including the Tier 4 diesel engine standards and the exhaust emission standards for large spark-ignition engines, diesel marine, and land-based recreational engines. Pechan's methods are described in greater detail in the following report in Appendix H.4: Development of Growth and Control Inputs for CENRAP 2018 Emissions Draft Technical Support Document (May 2005).

UCR and applied the growth and control factors to non-NONROAD categories using the SMOKE model. In addition, UCR processed NONROAD-model categories in SMOKE without adjustments. The technical support document in Appendix F describes UCR's work on the 2018 offroad inventory

7.2.4 Onroad Mobile Sources

The department's Air Pollution Control Program and CENRAP, with contractor support, developed the 2002 and 2018 onroad mobile source emissions inventories. Sonoma Technology provided 2002 VMT data and MOBILE6 input files for all counties in the CENRAP region. MOBILE6 input files were provided only for the months of January and July for 2002. The methods and data used by Sonoma are described in the report Emissions Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States (October 28, 2004) in Appendix H.7. UCR prepared MOBILE6 input files for the remaining months of 2002 and processed the 2002 mobile emissions using the MOBILE6 model within the SMOKE framework.

Pechan prepared the VMT and MOBILE6 inputs for the 2018 onroad mobile source emissions inventory. The VMT growth factors and MOBILE6 input files were provided in SMOKE format. The MOBILE6 input files incorporated state/local control program information, including Reformulated Gasoline and the inspection and maintenance program in the St. Louis nonattainment area and low Reid vapor pressure (RVP) gasoline in the Kansas City maintenance area. For each county or group of counties modeled, two SMOKE-formatted MOBILE6 files were prepared: one representing July conditions and one representing January conditions. Pechan's methods are described in greater detail in the following report in Appendix H.4:

Development of Growth and Control Inputs for CENRAP 2018 Emissions Draft Technical Support Document (May 2005).

UCR prepared MOBILE6 input files for the remaining months of 2018 and processed the 2018 onroad mobile emissions by running the MOBILE6 model within the SMOKE framework. The SMOKE model applies the VMT growth factors. The MOBILE6 model accounts for federal motor vehicle controls, including light-duty motor vehicle engine standards and low-sulfur gasoline, and the federal heavy-duty diesel engine standards and low-sulfur diesel. The technical support document in Appendix F describes UCR's onroad mobile emissions inventory processing.

7.2.5 Biogenic Emissions

UCR generated biogenic emissions by running the BEIS3 model within the SMOKE framework. BEIS3 is a system integrated into SMOKE for deriving emissions estimates of biogenic gas-phase pollutants from land use information, emissions factors for different plant species, and hourly, gridded meteorology data. Biogenic emissions were held constant from 2002 to 2018. The technical support document in Appendix F describes the development of the biogenic emissions inventory.

7.3 PERIODIC UPDATES OF EMISSIONS INVENTORIES

Recognizing the importance of maintaining current, valid emissions information, the department's Air Pollution Control Program commits to periodically updating the Missouri statewide emissions inventories. The point source inventories will be updated on an annual basis, and the area, onroad mobile, and offroad mobile inventories will be updated every three years. The three-year updates will begin with the inventory for calendar year 2008, and follow with 2011, 2014, and so on, consistent with EPA's emissions inventory reporting requirements.

In addition to completing regular updates of Missouri's emissions inventory, the Air Pollution Control Program commits to periodically reviewing emissions information for other states and future-year emissions projections and making adjustments where needed. This effort will consist of reviewing and updating any technical data and assumptions regarding emissions growth rates, implementation of emissions controls, and geographic distribution of emissions. The periodic reviews will be coordinated with other states and consultation partners and will be conducted in conjunction with the five-year progress reports discussed in section 2.6.

8.0 MODELING ASSESSMENT

8.1 MODELING REQUIREMENTS

40 CFR 51, Appendix W provides modeling guidelines for conducting regional-scale modeling for particulate matter and visibility. The EPA recommends the use of one of the three following models to simulate pollutants impairing visibility: Community Multiscale Air Quality (CMAQ), Comprehensive Air quality Model with extensions (CAMx), and Regional Modeling System for Aerosols and Deposition (REMSAD). CENRAP contractors performed regional modeling using CMAQ and CAMx.

The CMAQ Model is an Eulerian model that simulates the atmospheric and surface processes affecting the transport, transformation and deposition of air pollutants and their precursors. An Eulerian model computes the numerical solution of partial differential equations of plumes on a fixed grid, while other models may lose accuracy or need regridding as the plumes expand.

CAMx is a computer modeling system for the integrated assessment of photochemical and particulate air pollution. CAMx incorporates all of the technical attributes demanded of state-of-the-art photochemical grid models, including two-way grid nesting, a subgrid-scale Plume-in-Grid module to treat the early dispersion and chemistry of point source NO_X plumes, and a fast chemistry solver.

In the July 1, 1999 publication of the Regional Haze Rule in the Federal Register, EPA defined the uses of regional modeling as follows:

- Analyses and determination of the extent of emissions reductions needed from individual states
- Analyses and determination of emissions needed to meet the progress goal for the Class I area
- Analyses to support conclusion that the Long-Term Strategy provides for reasonable progress
- Analyses to calculate the resulting degree of visibility improvement that would be achieved at each Class I area

- Analyses to compare visibility improvement between proposed control strategies

8.2 MODEL INPUTS

8.2.1 Selection of Episodes

The calendar year 2002 was selected for the base year for CENRAP regional haze annual modeling consistent with EPA guidance. The Technical Support Document provides additional information on the selection of 2002 as the base year for regional haze modeling and is found at Appendix F.

8.2.2 Selection of Modeling Domain

CENRAP conducted emissions and air quality modeling on the 36 km national RPO domain. This domain consists of a 148 by 112 array of 36 km by 36 km grid cells and covers the continental United States. The Technical Support Document provides additional information on the modeling domain and is found at Appendix F.

8.2.3 Emission Inventories

The emissions inventory includes VOC, NO_X, CO, SO_2, PM_{10}, $PM_{2.5}$, and NH_3 emissions from all anthropogenic and biogenic sources. The emissions inventory information submitted by state, tribal, and local agencies to the 2002 NEI formed the basis of the 2002 CENRAP emissions inventory. The NEI data was supplemented with non-point source emissions inventories developed for CENRAP by Sonoma Technology. These CENRAP-specific inventories addressed agricultural and prescribed burning, onroad and offroad mobile sources, agricultural tilling and livestock dust, and agricultural ammonia. In addition, Pechan assisted CENRAP by quality-assuring the emissions inventory and preparing day- and hour-specific emissions for EGUs based on Continuous Emissions Monitor (CEM) data for the model performance evaluation.

Emissions inputs for the air quality model were prepared using the SMOKE emissions modeling system. The CENRAP modeling emissions inventory consists of several distinct datasets: the 2002 base case for model performance evaluation, 2002 typical, 2018 base case, and the 2018 control strategy scenario. Its spatial extent is the RPO 36 km modeling domain, which covers the continental U.S. plus portions of Canada and Mexico. The inventory was refined through several rounds of CENRAP workgroup review and revision, beginning with the initial Base A version and culminating in the Base G inventory. The Technical Support Document provides the methodologies for the SMOKE emissions processing and is found at Appendix F. A summary of the development of the emissions inventory can be found in Chapter 7.

8.2.4 Meteorology

The Fifth-Generation NCAR / Penn State Mesoscale Model (MM5) is the latest in a series that developed from a mesoscale model used by Anthes at Penn State in the early 70's that was later documented by Anthes and Warner (1978). Since that time, it has undergone many changes designed to broaden its usage. These include (i) a multiple-nest capability, (ii) nonhydrostatic dynamics, which allows the model to be used at a few-kilometer scale, (iii) multitasking capability on shared- and distributed-memory machines, (iv) a four-dimensional data-assimilation capability, and (v) more physics options. The model (known as MM5) is supported by several auxiliary programs, which are referred to collectively as the MM5 modeling system. Since MM5 is a regional model, it requires an initial condition as well as a lateral boundary condition to run. To produce a lateral boundary condition for a model run, one needs gridded data to cover the entire time period that the model is integrated. The Technical Support Document provides the methodologies for this process and is found at Appendix F.

8.3 MODEL PERFORMANCE EVALUATION

Model evaluations compared concentrations of various pollutants simulated by CMAQ and CAMx with observations from:

- IMPROVE
- Clean Air Status and Trends Network (CASTNet)
- Speciated Trends Network (STN)
- Aerometric Information Retrieval Systems (AIRS)
- South Eastern Aerosol Research and Characterization (SEARCH)

The CMAQ and CAMx models were evaluated against ambient measurements of PM species, gas-phase species and wet deposition. Numerous iterations of CMAQ and CAMx 2002 base case simulations and model performance evaluations were conducted during the course of the CENRAP modeling study, most of which have been posted on the CENRAP modeling website (http://pah.cert.ucr.edu/aqm/cenrap/cmaq.shtml) and presented in previous reports and presentations for CENRAP. In general, the model performance of the CMAQ and CAMx models for SO_4 and elemental carbon (EC) was good. Model performance for nitrate (NO_3) was variable, with a summer underestimation and winter overestimation bias. Performance for OMC was also variable, with the inclusion of the Secondary Organic Aerosol Modules enhancement in CMAQ Version 4.5 greatly improving the CMAQ summer OMC model performance. Model performance for Soil and coarse mass was generally poor. Part of the poor performance for soil and coarse mass is believed to be due to measurement-model incommensurability whereby the IMPROVE measured values are due in part to local fugitive dust sources that are not captured in the model's emission inputs and 36 km grid resolution. Detailed information on the model performance evaluations is found in the Technical Support Document in Appendix F.

8.4 BASE G MODEL SIMULATIONS

8.4.1 2018 Base G visibility projections

The 2018 Base G modeling run reflects emissions growth and "on the books" controls, which are state and federal controls that will be implemented between the 2002 base year and the 2018 future year. The 2018 emissions for EGUs were based on simulations of the IPM that took into account the effects of the CAIR trading program. In addition, reductions anticipated from BART controls for EGUs in Oklahoma, Arkansas, Kansas, and Nebraska were included. Emissions for onroad and offroad mobile sources were based on activity growth and emissions factors from the EPA MOBILE6 and NONROAD models, respectively, which reflected emissions reductions from the Tier 2 and Tier 4 mobile source rules. Area sources and non-EGU point sources were grown to 2018 levels.

The two important regional haze metrics are the average visibility for the worst 20 percent and best 20 percent days from the 2000-2004 five-year baseline period. The results from the 2002 and 2018 CMAQ and CAMx simulations were used in a relative sense to scale observed PM concentrations from the 2000-2004 baseline to 2018 levels from which 2018 visibility estimates were obtained. The CENRAP 2018 visibility conditions were calculated following EPA default visibility projection procedures and are labeled "Method 1 Prediction" in Figures 8.1 and 8.2. The steps involved in the visibility calculations are described below:

1. For each Class I area and each monitored day, daily visibility based on IMPROVE data and the new IMPROVE equation was ranked for the five-year baseline period (2000-2004) to identify the worst 20 percent and best 20 percent visibility days for each year in the baseline period.
2. The CMAQ air quality model was used to simulate the base year (for CENRAP the 2002 annual period was simulated) and a future-year (2018). The resulting information was used to develop Class I area-specific relative reduction factors (RRFs) for each of the six components of light extinction in the IMPROVE equation (SO_4, NO_3, EC, OMC, Soil and CM).
3. The RRFs were multiplied by the measured 24-hour PM concentration for each day from the worst and best 20 percent days in each year from the five-year baseline period to obtain projected future-year 24-hour PM concentrations for the worst and best 20 percent days.
4. The future-year (2018) daily extinction was computed using the new IMPROVE equation and the projected PM concentrations for each of the worst and best 20 percent days in the five-year baseline from step 3.
5. For each of the worst and best 20 percent days within each year of the five-year baseline, the future-year daily extinction was converted to deciview. The daily deciview values were averaged within each of the five years separately to obtain five years (or as many years with valid data in the 2000-2004 baseline) of average deciview visibility for the worst and best 20 percent days.
6. The five years of deciview visibility were averaged to obtain the 2018 estimated visibility.

The 2018 visibility projections for the worst 20 percent days and best 20 percent days are compared against a 2018 point on the Uniform Rate of Progress (URP) glidepath or the "2018 URP point." The 2018 URP point is obtained by constructing a linear visibility glidepath in deciviews from the observed 2000-2004 Baseline for the worst 20 percent days to the 2064 Natural Conditions. The 2018 URP point is where the linear glidepath crosses the year 2018. Figures 8.1 and 8.2 present the 2018 visibility projections for Hercules Glades and Mingo. As seen in these figures, the 2018 visibility projections at both the Hercules Glades and Mingo Class I areas meet the 2018 point on the URP glidepath for the worst visibility days and exhibit no degradation on the best visibility days. For the worst 20 percent days, the 2018 projection for Hercules Glades is 23.06 dv, compared to the URP point of 23.14 dv. The 2018 projection for Mingo is 23.71 dv, as compared to the URP point of 24.37 dv.

Additional information on the CENRAP visibility projections based on the Base G modeling results is summarized in 4.4. of the Technical Support Document (TSD), which indicates that Appendix D of the TSD provides details for each Class I area in the CENRAP region using the new IMPROVE equation.

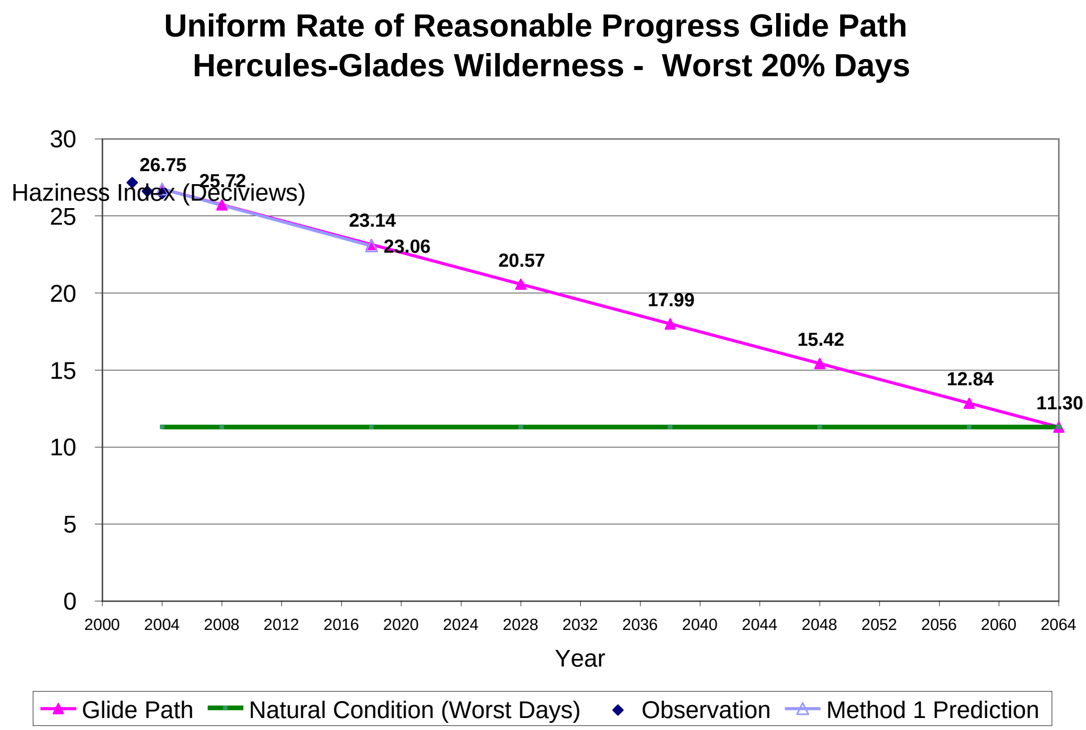

Figure 8.1a: 2018 Visibility Projections and 2018 URP Glidepaths in deciview for Hercules Glades, Missouri, and Worst 20% days using 2002/2018 Base G CMAQ 36 km modeling results.

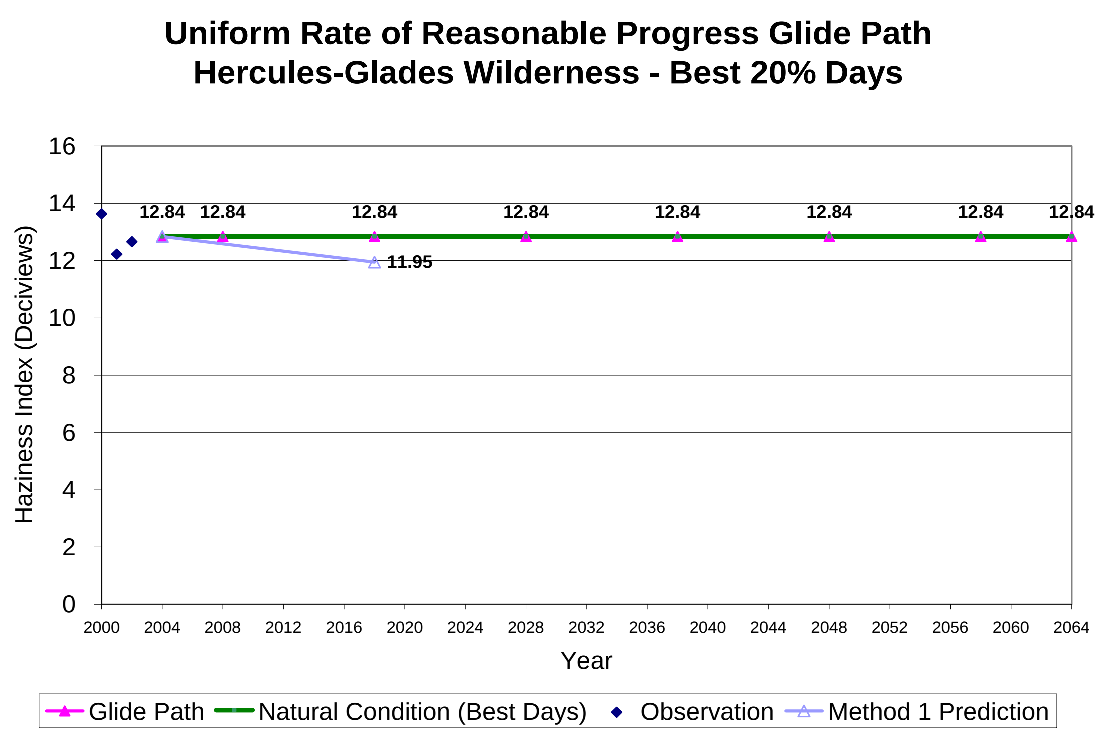

Figure 8.1b: 2018 Visibility Projections and 2018 URP Glidepaths in deciview for Hercules Glades, Missouri, and Best 20% days using 2002/2018 Base G CMAQ 36 km modeling results.

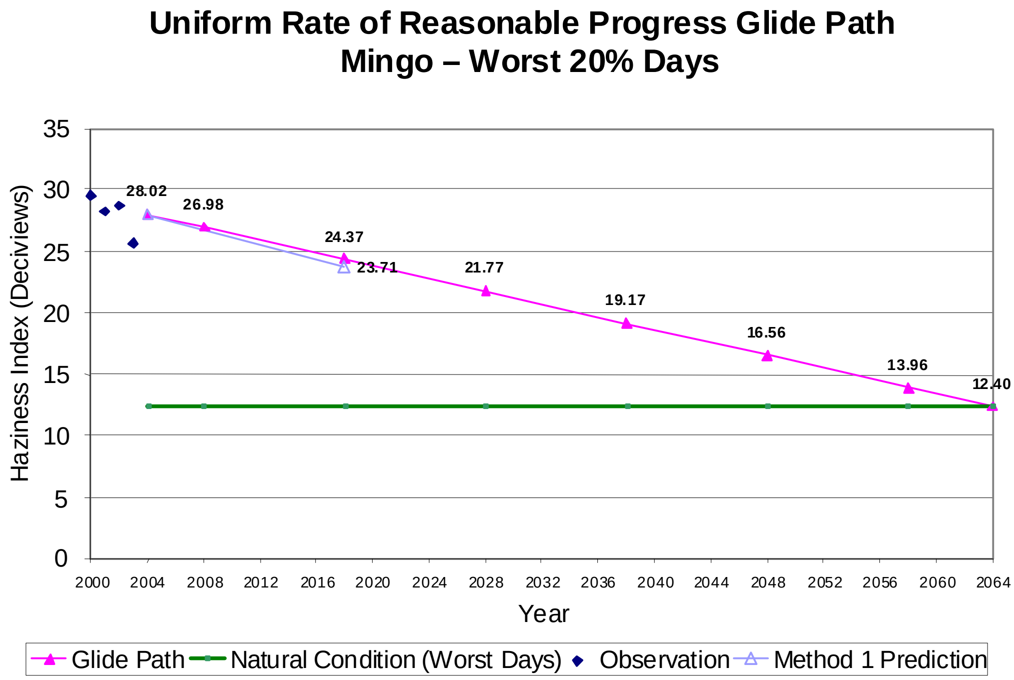

Figure 8.2a: 2018 Visibility Projections and 2018 URP Glidepaths in deciview for Mingo, Missouri, and Worst 20% days using 2002/2018 Base G CMAQ 36 km modeling results.

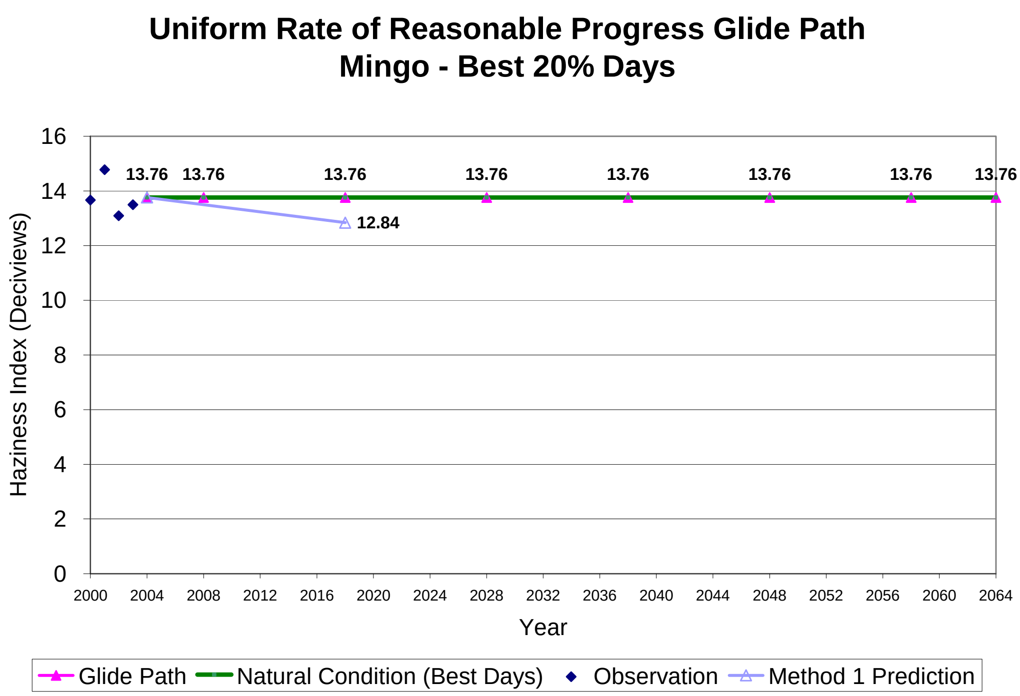

Figure 8.2b: 2018 Visibility Projections and 2018 URP Glidepaths in deciview for Mingo, Missouri, and Best 20% days using 2002/2018 Base G CMAQ 36 km modeling results.

8.4.2 Other RPO's visibility projections

The 2018 visibility projections for the two Missouri Class I areas are also available from the VISTAS and MRPO modeling. At Hercules Glades, the three RPOs' 2018 visibility projections are in close agreement with each other, estimated to achieve 102 percent, 101 percent and 96 percent of the 2018 URP point. The CENRAP and VISTAS 2018 visibility projections are also very close at Mingo, 118 percent and 114 percent, respectively. However, the MRPO 2018 visibility projections are approximately 15 percentage points lower than the CENRAP and VISTAS projections at Mingo. The reasons why the MRPO 2018 visibility projections are less optimistic than CENRAP and VISTAS are unclear. The discrepancy could be due to the use of different emissions inventories. CENRAP's Base G inventory included IPM 2.1.9 results for 2018 EGU emissions that had been quality-assured and edited by CENRAP and VISTAS states and stakeholders, while MRPO's latest modeling inventory used IPM 3.0 results that did not include edits from VISTAS or most of the CENRAP states. The department's Air Pollution Control Program concluded that CENRAP projections for Mingo and Hercules Glades should be more accurate due to a better emissions inventory for our states. Additional analysis including the IPM 3.0 results with states' review will be considered during the five-year review period.

9.0 BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

9.1 BART REQUIREMENTS

The EPA's 1999 Regional Haze Rule singles out certain older emission sources that have not been regulated under other provisions of the Clean Air Act for additional controls. Older sources that contribute to visibility impairment in Class I areas are required to implement BART or an emissions trading or other alternative program that will achieve greater reasonable progress than would be achieved through the installation and operation of BART. On July 6, 2005, EPA published a revised final rule, including Appendix Y to 40 CFR 51 "Guidelines for BART Determinations Under the Regional Haze Rule" that provides direction to states on determining which of these older sources may need to install BART and how to determine BART.

Based on comments received from EPA Region VII, sources originally not included in the BART air quality review were re-examined. Some additional sources were found to be BART eligible and were evaluated in the same fashion as the original sources. Upon completion of the BART air quality screen and draft refined modeling analyses; the State of Missouri has found one source that is subject to BART. This source (Holcim – Clarksville) has signed a consent agreement with emission limits that represent BART for the applicable source. This agreement with the department is included in this submittal as the enforceable mechanism for the necessary emission control requirements. No other sources were found to be subject to BART and, therefore, implementation of an emissions trading program, other emission controls or other alternative measure in place of BART are not necessary.

9.2 BART – ELIGIBLE SOURCES IN STATE OF MISSOURI

The facilities with BART-eligible units in the State of Missouri are shown in Table 9.1 (including the newly identified sources). A detailed description of each BART-eligible emission unit is included in Appendix I.

Table 9.1: Facilities with BART-eligible Units in the State of Missouri

BART Source Category Name	SIC Code	Facility ID	Facility Name	BART-Eligible Emission Units
Fossil-fuel fired steam electric plants of more than 250 MMBTU (1)*	4911	29-071-0003	Ameren – Labadie	Boiler 1 – B1, Boiler 2 – B2, Boiler 3 – B3, and Boiler 4 – B4
(1)*	4911	29-183-0001	Ameren – Sioux	Boiler 1 – B1 and Boiler 2 – B2
(1)*	4911	29-099-0016	Ameren – Rush Island	Boiler 1 – B1 and Boiler 2 – B2
(1)*	4911	29-095-0031	Aquila – Sibley	Boiler 3 – 5C
(1)*	4911	29-143-0004	Associated Electric – New Madrid	Boiler 1 – EP-01 and Boiler 2 – EP – 02
(1)*	4911	29-077-0039	City Utilities Springfield - Southwest	Boiler 1 – E09
(1)*	4911	29-077-0005	City Utilities Springfield – James River	Utility Boiler #4 – E07 and Utility Boiler #5 – E08
(1)*	4911	29-097-0001	Empire District Electric – Asbury	Boiler – 7
(1)*	4911	29-083-0001	Kansas City Power and Light – Montrose	Boiler Unit 3 – EP08
*(1)**	*4911*	*29-021-0004*	*Aquila – Lake Road*	*Boiler 6 – EP06*
*(1)**	*4911*	*29-175-0001*	*Associated Electric – Thomas Hill*	*Boiler 1 - EP-01 and Boiler 2 – EP-02*
(1)	4911	29-095-0021	Trigen – Kansas City	Boiler 1A
(1)	*4911*	*29-019-0002*	*City of Columbia Municipal Power Plant*	*Boiler #7 – EP02*
(1)	*4911*	*29-195-0010*	*Marshall Municipal Utilities*	*Coal-Fired Boiler - EP05*
(1)	*4911*	*29-095-0050*	*Independence Power and Light – Blue Valley*	*Boiler #3 – EP05*
Portland cement plants (4)	3241	29-099-0002	RC Cement	4-K-02 (Kiln)
(4)	*3241*	*29-173-0001*	*Continental Cement*	*KP01 (Kiln)*
(4)	*3241*	*29-163-0001*	*Holcim - Clarksville*	*Kiln – EP14 and a variety of supporting units*
Primary aluminum ore reduction plants (7)	3334	29-143-0008	Noranda Aluminum	Potlines 1 & 2 – EP-59,60,& 61, Carbon Bake 1 and 2 Stacks – EP 98 & 99, and a variety of supporting units**
Hydrofluoric, sulfuric, and nitric acid plants (10)	2873	29-163-0031	Dyno Nobel – Lomo Plant	Ammonia Oxidation Process – E01
Lime plants (12)	3274	29-186-0001	Mississippi Lime	Peerless Rotary Kilns 3,4,5&6 – EP-68-71
Primary lead smelters (17)	3339	29-099-0003	Doe Run – Herculaneum	Blast Furnace – EP059
(17)	3339	29-093-0008	Doe Run – Glover	Sinter Plant - EP-01 and Other Units at the facility
Secondary metal production facilities (20)	3341	29-087-0001	Exide Technologies	Main Stack – EP01
(20)	*3339*	*29-093-0009*	*Doe Run – Buick*	Main Stack – EP08
Chemical Process Plants (21)	*2879*	*29-127-0001*	*BASF Corporation*	*PR08 – HNO3 Storage Tank, PR53/54 Incinerators, TC01 Incinerator, UTIL07 – 2 Gas-fired boilers*
Fossil-fuel boilers >250 MMBTUs per hour (22)	4911	29-019-0004	University of Missouri – Columbia	Boiler 10

*BART-eligible EGU units included in the CAIR assumed to be BART for SO_2 and NO_X
** Other supporting units listed in facility summary later in this section
Italics means BART-eligible source identified after EPA comments

The BART-eligible sources were identified using the methodology in the Guidelines for BART Determinations under the Regional Haze Rules or "Guidelines" (40 CFR 51, Appendix Y). For an emission unit source to be identified as BART-eligible, the State of Missouri used these criteria from the Guidelines:

- One or more emissions units at the facility fit within one of the 26 categories listed in the Guidelines;
- The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and
- The limited potential emissions from all emission units identified in the previous two bullets emission units were greater than 250 tons or more per year of any of these visibility-impairing pollutants: SO_2, NO_X, and PM_{10}.

The Guidelines recommend addressing these visibility-impairing pollutants: SO_2, NO_X, and particulate matter. The State of Missouri addressed these three pollutants and used particulate matter less than 10 microns in diameter (PM_{10}) as an indicator for particulate matter to identify BART-eligible units, as the Guidelines suggest. Consistent with the Guidelines, the State of Missouri did not evaluate emissions of VOCs and ammonia in BART determinations for these reasons:

1) the majority of VOC emissions in Missouri are biogenic in nature and specifically the areas near Mingo and Hercules Glades are very rich in biogenic emissions (limited ability to reduce organic concentrations at the Class I areas),
2) the largest areas of anthropogenic VOC emissions in Missouri exist in the metropolitan areas (St. Louis and Kansas City) where VOC emission control has been undertaken to address ozone attainment issues (meaning large VOC sources have already been controlled),
3) the other category that would have substantial, uncontrolled VOC emissions is charcoal kilns, the department required existing charcoal kilns to install afterburners or shutdown noncompliant kilns as a result of 10 CSR 10-6.330,
4) the overall ammonia inventory is very uncertain and the amount of anthropogenic emissions at the sources that were BART-eligible was relatively small, and

5) No additional sources were identified that had greater than 250 tons per year ammonia and required a subsequent BART analysis.

The State of Missouri identified potentially BART-eligible source by reviewing the emission inventory database and extracting data for facilities within the 26 categories identified. A survey was conducted for the facilities within this group asking for large source identification and the timing of the installation and operation of those sources. The sources listed in Table 9.1 have been identified as sources that meet the criteria for inclusion as BART-eligible sources. Beyond the three primary visibility-impairing pollutants (SO_2, NO_X, and PM_{10}), the sources were also asked to identify ammonia and VOC emissions. The survey and resultant tabular response information are contained in Appendix J and Appendix I, respectively.

9.3 DETERMINATION OF SOURCES SUBJECT TO BART

Upon completion of the survey, the BART-eligible sources were divided into four distinct groups: (1) electric generating units participating in the CAIR trading program, (2) sources that have final new source review (construction) permits requiring a BART-eligible unit "shutdown" or no current operating permit at the facility, (3) sources that have gone through a subsequent construction permitting exercise for units that would have been BART-eligible based on original installation date, and (4) all other units that underwent a screen-modeling evaluation to determine the visibility impact on the applicable Class I area(s).

The first and fourth groups were evaluated initially using a screen-modeling technique for visibility impact. The first group (CAIR EGUs) was modeled collectively using all BART-eligible sources for only the PM impacts on the applicable Class I areas (NOTE: After EPA comment, two additional CAIR EGU facilities were discovered to be BART-eligible and additional analysis was performed). All the sources in the fourth group were modeled independently. The second group included some or all of the BART-eligible sources at four installations. River Cement, Doe Run – Glover, Continental Cement, and Mississippi Lime all had units that were part of a voluntary shutdown or being removed due a specific construction permit condition. To be clear, the Doe Run – Glover facility does not have a current operating permit for any of the BART-eligible units at the facility. The department sent a notice to the company on November 13, 2007, that detailed the termination of the operating permit for the BART eligible units after a thirty day period allowed for the company to provide additional information. This period expired on December 13, 2007, and the permit was closed out. Therefore, the pyro-process units at Glover can not restart without a new construction permit requiring a BACT evaluation for each. These BART-eligible units were not included in the modeling analyses and are shown in Table 9.2. During the public comment period, Mississippi Lime Company provided a comment that changed the units that were subject to the BART air quality screening evaluation. Mississippi Lime Company has provided a permit modification that includes the continued use of Peerless Rotary Kiln #4 (EP69) at the facility. The unit was originally subject to shutdown provisions in the applicable permit, but the updated information required a new evaluation of the facilities' BART-eligible units. The other unit in the shutdown provision (PRK #3 – EP68) has been dismantled.

Table 9.2: Units Removed from BART Consideration Due to Shutdown or Federal Permit Requiring Shutdown

Facility/Facility ID	Units	Reason for Removal from BART Consideration
Doe Run – Glover / 29-083-0008	Pyro-process units	No operating permit
RC Cement / 29-099-0002	4-K-02	Permit #122005-005
Mississippi Lime / 29-186-0001	EP68	Permit #122002-007
Continental Cement / 29-173-0001	KP01	Permit #072007-008

The third category illustrates a source that has undergone a major source permitting exercise for the units that would have been BART-eligible based on installation date. Doe Run – Buick underwent a Prevention of Significant Deterioration (PSD) review for Permit #0989-003 and a subsequent review for Permit #012005-008. Each review found that the blast furnace units had installed Best Available Control Technology (BACT). Therefore, this source has been found to meet the BART requirements based on the construction permit BACT review for the applicable units.

Under the Guidelines, the State has these options regarding its BART-eligible sources: a) make BART determinations for all sources or b) consider exempting some sources from BART because they do not cause or contribute to visibility impairment in a Class I area. The State of

Missouri has chosen option b. If a state chooses option b, then the Guidelines suggest three sub-options for determining that certain sources need not be subject to BART:

(1) Individual source attribution approach (dispersion modeling).

(2) Use of model plants to exempt sources with common characteristics.

(3) Cumulative modeling to show that no sources in a state are subject to BART.

The State of Missouri has chosen sub-options 1 and 3 above to notify sources that would be required to conduct refined analyses based on the results of the screening analyses discussed previously. The goal was to determine if these sources cause or contribute to visibility impairment using the CALPUFF model. As discussed previously, the CAIR-affected electric generating units were collectively modeled for PM emissions only due to the presumptive BART determination for NO_X and SO_2 emissions from these sources. The results of this evaluation are included in Table 9.3. Examples of CALPUFF/CALPOST modeling input files used for determining which facilities are subject to BART are included in Appendix K. The CALPOST files included are not universal for all the facilities modeled. The Noranda facility utilized speciation of the PM emissions to include both a coarse fraction and a fine fraction. In addition, the remaining facilities included the PM_{10} emissions component as fine particulate matter (PMF) in the CALPOST analyses, but were sometimes called PM_{10} or PMF depending on the individual screening analysis.

The State of Missouri utilized two different methods for evaluation of visibility impacts: (1) Method 2 – modeled relative humidity factors are calculated for each hour/day of the modeling period and (2) Method 6 – an average relative humidity factor is applied for each Class 1 area being evaluated. Based on the analyses, it was determined that Method 2 provides more conservative results for visibility calculation. Since only Method 6 was required by the BART rulemaking, the use of Method 2 gives added confidence to the findings regarding sources that did not trigger refined modeling. Some or all of the following Class 1 areas were evaluated based on source location: Mingo, Hercules Glades, Upper Buffalo, and Mammoth Cave (Kentucky). The screening evaluation criterion was a maximum deciview impact of greater than 0.5 deciview to require a refined screening analysis. Six sources were identified during the source-specific screening analyses and these sources were notified to provide refined CALPUFF modeling analyses and/or the department conducted the refined screening analyses. In accordance with the guidelines, a contribution threshold of 0.5 deciview (98th percentile) was used for determining which sources were subject to BART using the refined modeling approach.

The results of the individual screening analyses for each source are included in Table 9.3.

Table 9.3: CALPUFF/CALPOST Screening Results

Facility	Class I Area	Maximum Method 2 Impact	Maximum Method 6 Impact	Year
CAIR EGUs	Hercules Glades	0.400	0.363	2001
CAIR EGUs	Hercules Glades	0.197	0.185	2002
CAIR EGUs	Hercules Glades	0.204	0.242	2003
CAIR EGUs	Mingo	0.078	0.088	2001
CAIR EGUs	Mingo	0.056	0.060	2002
CAIR EGUs	Mingo	0.060	0.068	2003
CAIR EGUs	Upper Buffalo	0.134	0.127	2001
CAIR EGUs	Upper Buffalo	0.147	0.151	2002
CAIR EGUs	Upper Buffalo	0.094	0.093	2003
Exide	Hercules Glades	0.019	0.010	2001
Exide	Hercules Glades	0.055	0.024	2002
Exide	Hercules Glades	0.032	0.021	2003
Exide	Upper Buffalo	0.034	0.018	2001
Exide	Upper Buffalo	0.056	0.025	2002
Exide	Upper Buffalo	0.035	0.022	2003
Trigen - KC	Hercules Glades	0.393	0.189	2001
Trigen - KC	Hercules Glades	0.200	0.092	2002
Trigen - KC	Hercules Glades	0.142	0.056	2003
Trigen - KC	Upper Buffalo	0.321	0.146	2001
Trigen - KC	Upper Buffalo	0.138	0.061	2002
Trigen - KC	Upper Buffalo	0.129	0.071	2003
Dyno Nobel	Mingo	0.185	0.081	2001
Dyno Nobel	Mingo	0.206	0.093	2002
Dyno Nobel	Mingo	0.118	0.049	2003
Mississippi Lime	Mingo	0.271	0.172	2001
Mississippi Lime	Mingo	0.302	0.263	2002
Mississippi Lime	Mingo	0.194	0.099	2003
Mississippi Lime (Rev)	*Mingo*	*0.385*	*0.246*	*2001*
Mississippi Lime (Rev)	*Mingo*	*0.434*	*0.367*	*2002*
Mississippi Lime (Rev)	*Mingo*	*0.288*	*0.136*	*2003*
Doe Run - Herc	Mingo	0.399	0.356	2001
Doe Run - Herc	Mingo	0.487	0.228	2002
Doe Run - Herc	Mingo	0.231	0.211	2003
Noranda	Mingo	**1.118**	**0.663**	2001
Noranda	Mingo	**1.555**	**0.893**	2002
Noranda	Mingo	**1.816**	**1.080**	2003
Noranda	Hercules Glades	**0.512**	0.411	2001
Noranda	Hercules Glades	**1.098**	**0.534**	2002
Noranda	Hercules Glades	**0.617**	**0.520**	2003
Noranda	Upper Buffalo	0.499	0.425	2001

Noranda	Upper Buffalo	**0.841**	**0.648**	2002
Noranda	Upper Buffalo	**0.853**	**0.533**	2003
Noranda	Mammoth Cave	**0.634**	0.352	2001
Noranda	Mammoth Cave	**1.197**	**0.654**	2002
Noranda	Mammoth Cave	**0.547**	0.265	2003
UMC*	Mingo	**1.042**	**0.617**	2001
UMC	Mingo	**2.857**	**1.618**	2002
UMC	Mingo	**1.012**	**0.512**	2003
UMC	Hercules Glades	**0.996**	**0.601**	2001
UMC	Hercules Glades	**1.882**	**0.867**	2002
UMC	Hercules Glades	**0.917**	**0.593**	2003
UMC	Upper Buffalo	**1.152**	**0.518**	2001
UMC	Upper Buffalo	**1.614**	**0.819**	2002
UMC	Upper Buffalo	**0.867**	0.470	2003
Independence P&L	*Mingo*	***1.282***	***1.131***	*2001*
Independence P&L	*Mingo*	***1.071***	***0.701***	*2002*
Independence P&L	*Mingo*	***1.116***	***0.629***	*2003*
Independence P&L	*Hercules Glade*	***3.332***	***1.972***	*2001*
Independence P&L	*Hercules Glade*	***3.016***	***1.500***	*2002*
Independence P&L	*Hercules Glade*	***0.728***	*0.358*	*2003*
Independence P&L	*Upper Buffalo*	***2.418***	***1.136***	*2001*
Independence P&L	*Upper Buffalo*	***1.960***	***0.909***	*2002*
Independence P&L	*Upper Buffalo*	***0.589***	***0.683***	*2003*
Marshall	*Mingo*	*0.362*	*0.430*	*2001*
Marshall	*Mingo*	***1.717***	***0.994***	*2002*
Marshall	*Mingo*	***0.758***	*0.378*	*2003*
Marshall	*Hercules Glade*	***1.966***	*0.453*	*2001*
Marshall	*Hercules Glade*	***1.377***	***0.523***	*2002*
Marshall	*Hercules Glade*	***0.71***	*0.420*	*2003*
Marshall	*Upper Buffalo*	***0.825***	***0.505***	*2001*
Marshall	*Upper Buffalo*	***0.827***	*0.381*	*2002*
Marshall	*Upper Buffalo*	***0.823***	***0.519***	*2003*
Columbia	*Mingo*	*0.492*	*0.250*	*2001*
Columbia	*Mingo*	***1.462***	***0.808***	*2002*
Columbia	*Mingo*	***0.754***	*0.244*	*2003*
Columbia	*Hercules Glade*	*0.398*	*0.236*	*2001*
Columbia	*Hercules Glade*	***0.877***	*0.391*	*2002*
Columbia	*Hercules Glade*	*0.386*	*0.238*	*2003*
Columbia	*Upper Buffalo*	***0.517***	*0.194*	*2001*
Columbia	*Upper Buffalo*	***0.679***	*0.345*	*2002*
Columbia	*Upper Buffalo*	*0.385*	*0.184*	*2003*
Holcim - Clarksville	*Mingo*	***5.960***	***3.078***	*2001*
Holcim - Clarksville	*Mingo*	***3.351***	***2.084***	*2002*
Holcim - Clarksville	*Mingo*	***2.502***	***1.357***	*2003*
Holcim - Clarksville	*Hercules Glade*	***3.111***	***1.420***	*2001*
Holcim - Clarksville	*Hercules Glade*	***3.919***	***2.530***	*2002*
Holcim - Clarksville	*Hercules Glade*	***1.966***	***1.084***	*2003*
Holcim - Clarksville	*Upper Buffalo*	***2.705***	***1.248***	*2001*
Holcim - Clarksville	*Upper Buffalo*	***4.391***	***2.469***	*2002*
Holcim - Clarksville	*Upper Buffalo*	***1.839***	***1.072***	*2003*

BOLD denotes deciview impact over the 0.5 threshold
Italics denotes sources that were included as a result of a public comment
* University of Missouri – Columbia

The additional analysis on the two CAIR EGU facilities (Associated Electric – Thomas Hill and Aquila – Lake Road) mentioned above did not illustrate any discernable visibility difference (all CALPOST values are less than or equal to 0.001). Therefore, results were not presented in Table 9.3. Emissions from BART eligible units at BASF Corporation were not included in the screening analysis, but were included in the refined screening analysis detailed below.

In addition to the maximum impact metric shown above in the screening analyses, the State of Missouri evaluated the number of days with visibility impacts over the contribute (0.5 deciview) and cause (1.0 deciview) thresholds to decide which Class I area would be necessary for refined analyses. The results shown in Table 9.4 illustrate the number of days over the threshold for each source/Class I area combination. Again, these results were utilized to identify which Class I areas were more likely to be impacted and would need further refined analyses.

Table 9.4: Number of Days over the 0.5 Deciview Threshold

Facility	Class I Area	Method 2 Days	Method 6 Days	Year
Noranda	Hercules Glades	1	0	2001
Noranda	Hercules Glades	4	1	2002
Noranda	Hercules Glades	1	1	2003
Noranda	Mingo	**9**	3	2001
Noranda	Mingo	**8**	4	2002
Noranda	Mingo	**10**	6	2003
Noranda	Upper Buffalo	0	0	2001
Noranda	Upper Buffalo	5	1	2002
Noranda	Upper Buffalo	3	1	2003
Noranda	Mammoth Cave	1	0	2001
Noranda	Mammoth Cave	4	2	2002
Noranda	Mammoth Cave	1	0	2003
UMC	Hercules Glades	**8**	2	2001
UMC	Hercules Glades	**8**	1	2002
UMC	Hercules Glades	7	2	2003
UMC	Mingo	5	2	2001
UMC	Mingo	6	3	2002
UMC	Mingo	**8**	1	2003
UMC	Upper Buffalo	2	1	2001
UMC	Upper Buffalo	**10**	3	2002
UMC	Upper Buffalo	6	0	2003
Independence P&L	Mingo	2	1	2001
Independence P&L	Mingo	6	1	2002
Independence P&L	Mingo	4	2	2003
Independence P&L	Hercules Glade	5	5	2001
Independence P&L	Hercules Glade	5	3	2002
Independence P&L	Hercules Glade	2	0	2003
Independence P&L	Upper Buffalo	**8**	4	2001
Independence P&L	Upper Buffalo	6	1	2002

Independence P&L	Upper Buffalo	4	1	2003
Marshall	Mingo	0	0	2001
Marshall	Mingo	3	2	2002
Marshall	Mingo	2	0	2003
Marshall	Hercules Glade	4	1	2001
Marshall	Hercules Glade	7	2	2002
Marshall	Hercules Glade	4	0	2003
Marshall	Upper Buffalo	3	1	2001
Marshall	Upper Buffalo	4	0	2002
Marshall	Upper Buffalo	6	1	2003
Columbia	Mingo	0	0	2001
Columbia	Mingo	2	1	2002
Columbia	Mingo	1	0	2003
Columbia	Hercules Glade	0	0	2001
Columbia	Hercules Glade	2	0	2002
Columbia	Hercules Glade	0	0	2003
Columbia	Upper Buffalo	1	0	2001
Columbia	Upper Buffalo	2	0	2002
Columbia	Upper Buffalo	0	0	2003
Holcim - Clarksville	Mingo	**27**	**29**	2001
Holcim - Clarksville	Mingo	**28**	**26**	2002
Holcim - Clarksville	Mingo	**40**	**25**	2003
Holcim - Clarksville	Hercules Glade	5	7	2001
Holcim - Clarksville	Hercules Glade	**18**	**14**	2002
Holcim - Clarksville	Hercules Glade	**19**	**16**	2003
Holcim - Clarksville	Upper Buffalo	7	4	2001
Holcim - Clarksville	Upper Buffalo	**14**	**9**	2002
Holcim - Clarksville	Upper Buffalo	**14**	**9**	2003

Based on the screening analyses, the State of Missouri required Noranda to submit refined modeling for Mingo, and the University of Missouri-Columbia (UMC) to submit refined analysis for Mingo, Hercules Glades, and Upper Buffalo. The fundamental difference between both sets of refined analyses and the previous screening evaluation was the use of meteorological observations in the development of the CALMET files used in the CALPUFF evaluations. The emission rates were consistent between the screening analyses and the refined analyses, as were the meteorological years for the evaluation (2001-2003). In order to develop the new refined meteorological dataset, both companies chose different grid parameters for the evaluation. The grid structure is contained in Table 9.5 for both analyses. It should be noted that the UMC CALMET analyses were utilized for all the other refined modeling conducted by the department based on the revision to the BART-eligible source list detailed above. This means that the same meteorological dataset was utilized for refined modeling of: BASF Corporation, Independence Power and Light – Blue Valley, Columbia Municipal Power Plant, Marshall Municipal, BASF

Corporation, and Holcim - Clarksville.   Each of these BART-eligible sources were evaluated for Mingo, Hercules Glade, and Upper Buffalo Class I areas.

Table 9.5: Grid Structure for Refined Terrain, Land Use, and CALMET Analyses

Variable	RLAT0	RLON0	RLAT1	RLAT2	XREFKM	YREFKM	NX	NY	DGRIDKM
Noranda	36.0874	90.8491	36	40	0	0	83	80	2.0
UMC	37	92	30	45	-258	-330	87	111	6.0

The choices of the domain are appropriate for these evaluations of the relevant Class I areas. Please note that based on previous guidance from the FLMs on new source review evaluations, the domain for each analysis extends at least 50 km beyond the source(s) and Class I area(s) in each direction. The very fine grid spacing for Noranda is due to the proximity of the source to the Mingo National Wildlife Refuge (~60 km). The list of terrain and land use files used in the analyses for each project is included in Appendix L.

In addition to the grid structure change, meteorological observations were also utilized to refine the MM5 data used in the screening analyses. The lists of specific stations used along with relevant locational information for each station and upper air, surface, and precipitation data are included in Appendix L.

Based on the review process and discussions with the facilities during the screening analysis, the source parameter, emissions, and many other CALPUFF/CALPOST issues were addressed to allow for the use of the screening files as a basis for the development of the refined analysis. Nonetheless, the issues noted are presented below for clarification purposes.

9.3.1 University of Missouri-Columbia

The review for the BART-eligible unit at UMC (Boiler 10) included the verification of the CALPUFF concentration results along with a slightly different methodology for calculation of the visibility impacts at the relevant Class I areas. The methodology utilized by the contractor in this case included the use of speciation for the PM_{10} emissions from the boiler and the POSTUTIL program for the CALPUFF results. The speciation profile was obtained from the National Park Service web site at www2.nature.nps.gov/air/Permits/ect/ectCoalFiredBoiler.cfm from the Pulverized Coal – Dry Bottom Boiler with fabric filter (baghouse) control spreadsheet.

The department used the PM_{10} emission rate from the boiler and converted the concentrations directly to PMF for calculation of the visibility change at the relevant Class I areas. Each set of results is presented below in Table 9.6, 9.7, and 9.8.

Table 9.6: UMC Refined Analysis Results (Boiler PM Speciation Profile)

Facility	Class I Area	Maximum Method 6 Impact	8th Highest (98%) M6 Impact	Days over 0.5 Deciview Threshold	Year
UMC	Mingo	0.291	0.144	0	2001
UMC	Mingo	1.389	0.188	2	2002
UMC	Mingo	0.582	0.323	2	2003
UMC	Hercules Glades	0.709	0.310	2	2001
UMC	Hercules Glades	0.542	0.195	1	2002
UMC	Hercules Glades	0.591	0.271	2	2003
UMC	Upper Buffalo	0.466	0.232	0	2001
UMC	Upper Buffalo	0.714	0.210	1	2002
UMC	Upper Buffalo	0.406	0.226	0	2003

Table 9.7: UMC Refined Analysis Results (PM_{10}=PMF) Method 2

Facility	Class I Area	Maximum Method 2 Impact	8th Highest (98%) M2 Impact	Days over 0.5 Deciview Threshold	Year
UMC	Mingo	0.304	0.193	0	2001
UMC	Mingo	2.757	0.236	2	2002
UMC	Mingo	0.641	0.376	2	2003
UMC	Hercules Glades	0.804	0.377	3	2001
UMC	Hercules Glades	0.524	0.228	1	2002
UMC	Hercules Glades	0.647	0.413	5	2003
UMC	Upper Buffalo	0.855	0.248	2	2001
UMC	Upper Buffalo	0.941	0.227	3	2002
UMC	Upper Buffalo	0.549	0.339	1	2003

Table 9.8: UMC Refined Analysis Results (PM_{10}=PMF) Method 6

Facility	Class I Area	Maximum Method 6 Impact	8th Highest (98%) M6 Impact	Days over 0.5 Deciview Threshold	Year
UMC	Mingo	0.290	0.144	0	2001
UMC	Mingo	1.389	0.188	2	2002
UMC	Mingo	0.581	0.323	2	2003
UMC	Hercules Glades	0.708	0.310	2	2001
UMC	Hercules Glades	0.542	0.195	1	2002
UMC	Hercules Glades	0.591	0.270	2	2003
UMC	Upper Buffalo	0.465	0.232	0	2001
UMC	Upper Buffalo	0.714	0.210	1	2002
UMC	Upper Buffalo	0.405	0.226	0	2003

The results clearly demonstrate that Boiler 10 at the University of Missouri – Columbia does not exceed the 98th percentile visibility impact threshold of 0.5 deciview for CALPOST Method 2 methodology which is more conservative than the required Method 6 methodology. When comparing Table 9.6 and 9.8, it is apparent that the use of the PM_{10} speciation profile by the source did not impact the visibility change. This is due to the fact that SO_2 emissions from this boiler contribute over 90 percent of the visibility impact at all the relevant Class I areas evaluated when the impacts are above 0.5 deciview. Further, the SO_2 emissions calculation from this source was based on a potential maximum emission rate (maximum hourly design rate * emission factor).

9.3.2 Noranda

The Noranda evaluation is one of the BART analysis conducted by the State of Missouri with emission rates that do not represent the maximum allowable rates for all pollutants. In fact, most of the sources from Noranda are represented by the maximum allowable rates. However, there are five sources that had maximum 24-hour actual SO_2 emissions calculated: (1) EP-59, Monitor – Potline 1; (2) EP-60, Monitor – Potline 2; (3) EP-61, Stack – Potline 1&2; (4) EP-98, Carbon Bake Furnace 1; and (5) EP-99, Carbon Bake Furnace 2. For the first three sources, the methodology for calculating the emissions was as follows:

1) Obtain the maximum combined daily aluminum tapped for Lines 1 & 2 from 2000-2005 with the knowledge that tapped aluminum does not necessarily reflect production in the plant due to day-to-day carryover of aluminum in certain situations,
2) Obtain the maximum coke sulfur content,
3) Calculate the maximum ratio of tons anode consumed to tons aluminum, and
4) Multiply the maximum daily tapped aluminum (December 24, 2004) by the maximum ratio of tons anode/tons aluminum (0.413), the maximum coke sulfur content (2.82 percent), and the molecular weight ratio of SO_2 to S in the process (1.998).

The resultant calculation follows:

Line 1 468,725 tons aluminum/day * 0.413 * 0.0282 * 1.998 = 10,907.2 lb SO_2/day
Line 2 600,400 tons aluminum/day * 0.413 * 0.0282 * 1.998 = 13,971.3 lb SO_2/day

These emissions were then distributed to the stack and roof monitors using a previous permit relationship (95 percent stack vs. 5 percent monitor) for each line. The final modeled emission rate for these three sources was:

Monitor – Potline 1 => 10,907.2 lb SO_2/day * 0.05 = 545.4 lb SO_2/day
Monitor – Potline 2 => 13,971.3 lb SO_2/day * 0.05 = 698.6 lb SO_2/day
Stack for Potline 1&2 => 24,878.5 lb SO_2/day * 0.95 = 23,634.5 lb SO_2/day

It should be noted that the NO_X emission rates for these sources also used the same maximum tapping rates for this calculation.

The carbon bake furnace emissions were calculated using the monthly amount of pitch received along with the maximum sulfur content of the pitch in any month during the 5-year period. This information was evaluated for January 2000 – December 2005. The maximum product of the amount and the pitch S content was September 2005 (2,230 tons pitch received). The maximum sulfur content in the pitch was observed in November 2005 (0.72 percent S). The calculation of emissions from all three furnaces is as follows:

2,230 tons pitch/month * (0.0072 ton S/ ton pitch) * 1.998 ton SO_2/ton S =
31.634 ton SO_2/month

Then, the aluminum production at the three potline/furnace combinations for September 2005 was documented and a production ratio was calculated for each set. This ratio was then multiplied for potlines 1 and 2 by the total maximum SO_2 emissions/month. The daily "maximum" was evaluated using the maximum monthly emissions divided by 30 days/month. The calculation of emissions is as follows:

14,068,215 September 2005 production Line 1
13,844,190 Production Line 2
15,045,080 Production Line 3

Percent Line 1 Production = 32.75%

Percent Line 2 Production = 32.23%

Percent Line 3 Production = 35.02%

Line 1 Emissions = 31.634 ton SO_2/month * 0.3275 / 30 day/month = 0.3453 ton SO_2/day = 690.68 lb SO_2/day

Line 2 Emissions = 31.634 ton SO_2/month * 0.3223 / 30 day/month = 0.3399 ton SO_2/day = 679.71 lb SO_2/day

All these emissions were utilized in both the screening and the refined meteorological evaluations for Noranda's impacts and can be found in Appendix M.

One issue was identified with respect to the refined analyses completed by Noranda's contractor. In CALMET, the location of the surface, upper air, and precipitation stations is required to allow the model to develop the appropriate 3-D meteorological fields for input into CALPUFF. During the review, it was discovered that the location of the precipitation stations utilized in the Noranda project were based on incorrect latitude and longitude data procured from another source. Therefore, at this time, the results presented in Tables 9.9 and 9.10 reflect the previous Noranda submittal and the corrected submittal. As can be seen by direct comparison of the results, both sets are nearly identical and reflect that Noranda's BART-eligible sources do not cause or contribute to a visibility problem at Mingo.

Table 9.9: Noranda Refined Analysis Results (Original Submittal)

Facility	Class I Area	Max M2 Impact	98% M2 Impact	Days > 0.5 (M2)	Max M6 Impact	98% M6 Impact	Days >0.5 (M6)	Year
Noranda	Mingo	0.770	0.340	3	0.654	0.373	2	2001
Noranda	Mingo	0.812	0.427	3	0.653	0.416	3	2002
Noranda	Mingo	0.804	0.444	5	0.745	0.406	4	2003

Table 9.10: Noranda Refined Analysis Results (Revised CALMET)

Facility	Class I Area	Max M2 Impact	98% M2 Impact	Days > 0.5 (M2)	Max M6 Impact	98% M6 Impact	Days >0.5 (M6)	Year
Noranda	Mingo	0.769	0.340	2	0.660	0.373	2	2001
Noranda	Mingo	0.775	0.412	3	0.653	0.416	3	2002
Noranda	Mingo	0.799	0.447	5	0.745	0.435	4	2003

The results clearly demonstrate that the sources at Noranda do not exceed the 98th percentile visibility impact threshold of 0.5 deciview even if the more conservative CALPOST Method2 methodology is used.

9.3.3 Independence Power and Light – Blue Valley

The emission rates used for the BART-eligible unit (Boiler #3) at Independence Power and Light were generated by using the maximum boiler heat input (540 MMBTU/hr) and the minimum heat content for the coal used over the last five years (10,100 BTU/lb in 2004). This produced a maximum hourly design rate of 26.73 tons coal / hour. This design rate was multiplied by the highest annual emission factor for the last five years for each pollutant of interest: SO_2 – 115.14 lb SO_2/ton coal, 9.70 lb NO_X /ton coal, and 35.88 lb PM_{10}/ton coal (pre-control). For PM_{10}, the uncontrolled emissions were multiplied by (1-Control Efficiency%/100) to reflect the operation of an electrostatic precipitator. The resultant emissions were:

SO_2 -- 26.73 tons coal/hour * 115.14 lb SO_2/ ton coal * 24 hours/day = 73,684.6 lb SO_2/day
NO_X – 26.73 tons coal/hour * 9.7 lb NO_X /ton coal * 24 hours/day = 6,222.7 lb NO_X /day
PM_{10} – 26.73 tons coal/hour * 35.88 lb PM_{10}/ton coal * (1-95.5/100) * 24 hours/day = 1035.80 lb PM_{10}/day

As previously mentioned, the refined meteorological dataset for this analysis was originated by the University of Missouri – Columbia. The results of the refined analysis for Mingo, Hercules, and Upper Buffalo are presented in Table 9.11 including the 8th highest (98 percentile) values. Also, as with the department's analysis of the University of Missouri – Columbia's boiler, the same PM_{10} direct conversion to PMF calculation methodology was utilized to determine visibility impacts in CALPOST.

Table 9.11: Independence Power and Light Refined Analysis Results

Facility	Class I Area	Max M2 Impact	98% M2 Impact	Days > 0.5 (M2)	Max M6 Impact	98% M6 Impact	Days >0.5 (M6)	Year
Ind. P&L	Mingo	0.724	0.288	2	0.513	0.226	1	2001
Ind. P&L	Mingo	1.990	0.346	6	1.415	0.289	3	2002
Ind. P&L	Mingo	0.912	0.295	3	0.487	0.233	0	2003
Ind. P&L	Hercules	1.726	0.328	3	0.890	0.327	2	2001
Ind. P&L	Hercules	1.031	0.283	3	0.506	0.301	1	2002

Ind. P&L	Hercules	0.939	0.345	3	0.501	0.217	1	2003
Ind. P&L	Upper Buffalo	1.097	0.333	5	0.737	0.286	2	2001
Ind. P&L	Upper Buffalo	0.465	0.292	0	0.449	0.277	0	2002
Ind. P&L	Upper Buffalo	0.453	0.263	0	0.455	0.299	0	2003

The results demonstrate that the source at Independence Power and Light does not exceed the 98th percentile visibility impact threshold of 0.5 deciview even if the more conservative CALPOST Method2 methodology is used.

9.3.4 Marshall Municipal Utilities

The emission rates used for the BART-eligible unit (Coal-fired Boiler – EP05) at Marshall were generated by using the maximum boiler heat input (235 MMBTU/hr) and the minimum heat content for the coal used over the last five years (10,653 BTU/lb in 2005). This produced a maximum hourly design rate of 11.03 tons coal / hour. This design rate was multiplied by the highest annual emission factor for the last five years for each pollutant of interest: SO_2 – 134.90 lb SO_2/ton coal, 22 lb NO_X/ton coal, and 19.92 lb PM_{10}/ton coal (pre-control). For PM_{10}, the uncontrolled emissions were multiplied by (1-Control Efficiency%/100) to reflect the operation of an electrostatic precipitator. The resultant emissions were:

SO_2 -- 11.03 tons coal/hour * 134.90 lb SO_2/ ton coal * 24 hours/day = <u>35,709.9 lb SO_2/day</u>
NO_X – 11.03 tons coal/hour * 22 lb NO_X/ton coal * 24 hours/day = <u>5,823.7 lb NO_X/day</u>
PM_{10} – 11.03 tons coal/hour * 19.92 lb PM_{10}/ton coal * (1-87.5/100) * 24 hours/day =
<u>659.07 lb PM_{10}/day</u>

As previously mentioned, the refined meteorological dataset for this analysis was originated by the University of Missouri – Columbia. The results of the refined analysis for Mingo, Hercules, and Upper Buffalo are presented in Table 9.12 including the 8th highest (98 percentile) values. Also, as with the department's analysis of the University of Missouri – Columbia's boiler, the same PM_{10} direct conversion to PMF calculation methodology was utilized to determine visibility impacts in CALPOST.

Table 9.12: Marshall Municipal Utilities Refined Analysis Results

Facility	Class I Area	Max M2 Impact	98% M2 Impact	Days > 0.5	Max M6 Impact	98% M6 Impact	Days >0.5	Year

				(M2)			(M6)	
Marshall	Mingo	0.371	0.133	0	0.355	0.104	0	2001
Marshall	Mingo	1.487	0.143	2	0.698	0.143	2	2002
Marshall	Mingo	0.429	0.160	0	0.436	0.143	0	2003
Marshall	Hercules	1.074	0.263	6	0.453	0.235	0	2001
Marshall	Hercules	0.99	0.210	2	0.523	0.173	1	2002
Marshall	Hercules	0.495	0.432	0	0.420	0.211	0	2003
Marshall	Upper Buffalo	0.400	0.184	0	0.416	0.159	0	2001
Marshall	Upper Buffalo	0.474	0.187	0	0.341	0.175	0	2002
Marshall	Upper Buffalo	0.747	0.395	2	0.442	0.236	0	2003

The results demonstrate that the source at Marshall Municipal Utilities does not exceed the 98th percentile visibility impact threshold of 0.5 deciview even if the more conservative CALPOST Method2 methodology is used.

9.3.5 Columbia Municipal Power Plant

The emission rates used for the BART-eligible unit (Boiler #7– EP02) at Columbia were generated by using the maximum boiler heat input (371 MMBTU/hr) and the minimum heat content for the coal used over the last five years (13,304 BTU/lb in 2004). This produced a maximum hourly design rate of 13.94 tons coal / hour. This design rate was multiplied by the highest annual emission factor for the last five years for each pollutant of interest: SO_2 – 47.42 lb SO_2/ton coal, 14.74 lb NO_X/ton coal, and 13.2 lb PM_{10}/ton coal (pre-control). For PM_{10}, the uncontrolled emissions were multiplied by (1-Control Efficiency%/100) to reflect the operation of a cyclone/baghouse combination. The resultant emissions were:

SO_2 -- 13.94 tons coal/hour * 47.42 lb SO_2/ ton coal * 24 hours/day = <u>15,868.5 lb SO_2/day</u>
NO_X – 13.94 tons coal/hour * 14.74 lb NO_X/ton coal * 24 hours/day = <u>4,932.5 lb NO_X/day</u>
PM_{10} – 13.94 tons coal/hour * 13.2 lb PM_{10}/ton coal * (1-99.75/100) * 24 hours/day =
<u>11.04 lb PM_{10}/day</u>

As previously mentioned, the refined meteorological dataset for this analysis was originated by the University of Missouri – Columbia. The results of the refined analysis for Mingo, Hercules, and Upper Buffalo are presented in Table 9.13 including the 8th-highest (98 percentile) values. The same PM_{10} direct conversion to PMF calculation methodology was utilized to determine visibility impacts in CALPOST as with the other boilers reviewed.

Table 9.13: Columbia Municipal Utilities Refined Analysis Results

Facility	Class I Area	Max M2 Impact	98% M2 Impact	Days > 0.5 (M2)	Max M6 Impact	98% M6 Impact	Days >0.5 (M6)	Year
Columbia	Mingo	0.137	0.090	0	0.200	0.074	0	2001
Columbia	Mingo	1.337	0.102	1	0.645	0.095	1	2002
Columbia	Mingo	0.265	0.166	0	0.244	0.152	0	2003
Columbia	Hercules	0.467	0.183	0	0.411	0.130	0	2001
Columbia	Hercules	0.255	0.137	0	0.196	0.102	0	2002
Columbia	Hercules	0.343	0.171	0	0.232	0.119	0	2003
Columbia	Upper Buffalo	0.465	0.098	0	0.241	0.094	0	2001
Columbia	Upper Buffalo	0.401	0.090	0	0.301	0.091	0	2002
Columbia	Upper Buffalo	0.211	0.147	0	0.152	0.100	0	2003

The results demonstrate that the source at Columbia Municipal Power Plant does not exceed the 98th percentile visibility impact threshold of 0.5 deciview even if the more conservative CALPOST Method2 methodology is used.

9.3.6 BASF Corporation – Palmyra

The emission rates used for the BART-eligible units (124,000 Gallon Nitric Acid Tank – PR08, D Incinerator – TC01, A Incinerator – PR53, B Incinerator – PR54, and 2 Natural Gas Fired Boilers – UTIL07) at BASF were generated by utilizing the potential throughput for each unit and the maximum emission factor over the last five years. The remaining units at this facility were installed outside the BART timeframe or did not emit one of the visibility impairing pollutants. Unit PR08 has NO_X emissions from two components: working loss and breathing loss. The working loss throughput was calculated by assessing the maximum amount of acid moved through the tank in the last five years (2,130,000 gallons in 2005) and dividing by the number of hours acid was "worked" in the tank (5544 hours – 24 hours, 7 days, 33 weeks). This results in 384.1 gallons/hour. The emission factor is 0.16 lb NO_X /1000 gallons. The resultant emission calculation is:

NO_X – 0.3841 1000 gal acid/hour * 0.16 lb NO_X/1000 gallon * 24 hours/day =
<u>1.5 lb NO_X/day</u>

The breathing loss was calculated using the tank capacity multiplied by the appropriate emission factor.

NO_X – 124 1000 gal capacity * 1.94 lb NO_X/1000 gallons / 365 days/year =
0.66 lb NO_X/day

The emissions from the D Incinerator (TC01) utilized the maximum hourly design rate of material (7.75 tons/hour) and the maximum emission factor for the last five years for each pollutant – all were 2005. The emissions calculations are below:

SO_2 -- 7.75 tons/hour * 3.841 lb SO_2/ ton * 24 hours/day = 714.4 lb SO_2/day
NO_X – 7.75 tons/hour * 1.662 lb NO_X/ton * 24 hours/day = 309.1 lb NO_X/day
PM_{10} – 7.75 tons/hour * 1.923 lb PM_{10}/ton * 24 hours/day = 357.7 lb PM_{10}/day

The emissions from the A Incinerator (PR53) utilized the maximum hourly design rate of material (25 tons/hour) and the maximum emission factor for the last five years for each applicable pollutant – both were 2006. The emissions calculations are below:

NO_X – 25 tons/hour * 8.90 lb NO_X/ton * 24 hours/day = 5,340.0 lb NO_X/day
PM_{10} – 25 tons/hour * 1.35 lb PM_{10}/ton * 24 hours/day = 810.0 lb PM_{10}/day

The emissions from the B Incinerator (PR54) utilized the maximum hourly design rate of material (25 tons/hour) and the maximum emission factor for the last five years for each applicable pollutant – NO_X – 2004 and PM_{10} - 2005. The emissions calculations are below:

NO_X – 25 tons/hour * 3.99 lb NO_X/ton * 24 hours/day = 2,394.0 lb NO_X/day
PM_{10} – 25 tons/hour * 0.588 lb PM_{10}/ton * 24 hours/day = 352.5 lb PM_{10}/day

The emissions from the two natural gas-fired boilers (UTIL07) utilized the maximum heat input of the two boilers (232.5 MMBTU/hour) along with a heat content of 1,050 MMBTU/MMCF for natural gas to arrive at 0.2214 MMCF/hour. The emission factor (140 lb NOx / MMCF) was obtained from EPA's AP-42 guidance document. The emissions calculations are below:

NO_X – 0.2214 MMCF/hour * 140 lb NO_X/MMCF * 24 hours/day = 743.9 lb NO_X/day

As previously mentioned, the refined meteorological dataset for this analysis was originated by the University of Missouri – Columbia. The results of the refined analysis for Mingo, Hercules, and Upper Buffalo are presented in Table 9.14 including the 8^{th}-highest (98 percentile) values. The same PM_{10} direct conversion to PMF calculation methodology was utilized to determine visibility impacts in CALPOST as with the other boilers reviewed.

Table 9.14: BASF Corporation Refined Analysis Results

Facility	Class I Area	Max M2 Impact	98% M2 Impact	Days > 0.5 (M2)	Max M6 Impact	98% M6 Impact	Days >0.5 (M6)	Year
BASF	Mingo	0.152	0.062	0	0.100	0.065	0	2001
BASF	Mingo	0.260	0.059	0	0.153	0.050	0	2002
BASF	Mingo	0.088	0.040	0	0.080	0.038	0	2003
BASF	Hercules	0.210	0.032	0	0.121	0.022	0	2001
BASF	Hercules	0.097	0.020	0	0.081	0.018	0	2002
BASF	Hercules	0.170	0.043	0	0.082	0.030	0	2003
BASF	Upper Buffalo	0.198	0.024	0	0.119	0.012	0	2001
BASF	Upper Buffalo	0.059	0.022	0	0.059	0.018	0	2002
BASF	Upper Buffalo	0.155	0.028	0	0.075	0.020	0	2003

The results demonstrate that the BART-eligible sources at BASF Corporation - Palmyra Plant do not exceed the maximum visibility impact threshold of 0.5 deciview even if the more conservative CALPOST Method2 methodology is used.

9.3.7 Holcim – Clarksville

Prior to the February 2008 regional haze state implementation plan submittal, there were two different modeling analyses conducted for Holcim – Clarksville. The first evaluation utilized SO_2 and NO_X emissions from the calculation documented below (tons clinker per hour X lb pollutant / ton clinker). The other analysis utilized a maximum 24-hour actual emission rate for SO_2 and NO_X from 2004-07 based on Holcim's continuous emission monitoring system.

The emission rates used in the first analysis for the largest BART-eligible units at Holcim – Clarksville (EP14 – Main Stack) were generated by using the maximum clinker throughput for the kiln (175 tons/hour) and the maximum emission factors over the last five years. The highest annual emission factor for the last five years for each pollutant of interest is: SO_2 – 22.97 lb

SO_2/ton clinker, 13.89 lb NO_X/ton clinker, and 0.22 lb PM_{10}/ton clinker. The resultant emissions were:

SO_2 -- 175 tons clinker/hour * 22.97 lb SO_2/ ton clinker * 24 hours/day = 96,474.0 lb SO_2/day
NO_X – 175 tons clinker/hour * 13.89 lb NO_X /ton clinker * 24 hours/day = 58,338.0 lb NO_X /day
PM_{10} – 175 tons clinker/hour * 0.22 lb PM_{10}/ton coal * 24 hours/day = 924.0 lb PM_{10}/day

The remaining emission points (mostly handling of materials) were only PM_{10} emissions and were calculated based on maximum hourly design rate and emission factor for the particular operation. These emission points are further documented in Appendix I.

As previously mentioned, the refined meteorological dataset for this analysis was originated by the University of Missouri – Columbia. The results of the refined analysis for Mingo, Hercules, and Upper Buffalo are presented in Table 9.15 including the 8th-highest (98 percentile) values. The same PM_{10} direct conversion to PMF calculation methodology was utilized to determine visibility impacts in CALPOST as with the other boilers reviewed.

Table 9.15: Holcim - Clarksville Refined Analysis Results

Facility	Class I Area	Max M2 Impact	98% M2 Impact	Days > 0.5 (M2)	Max M6 Impact	98% M6 Impact	Days >0.5 (M6)	Year
Holcim	Mingo	1.975	**1.214**	26	1.378	**0.924**	23	2001
Holcim	Mingo	3.135	**1.088**	24	1.784	**0.834**	19	2002
Holcim	Mingo	1.861	**1.042**	18	1.719	**0.734**	15	2003
Holcim	Hercules	1.607	**0.650**	8	1.274	0.480	7	2001
Holcim	Hercules	2.699	**0.667**	11	1.758	**0.799**	10	2002
Holcim	Hercules	1.847	**0.804**	16	1.147	**0.626**	13	2003
Holcim	Upper Buffalo	1.543	0.389	7	1.101	0.382	5	2001
Holcim	Upper Buffalo	2.847	**0.557**	10	1.955	0.465	7	2002
Holcim	Upper Buffalo	1.502	**0.776**	15	1.309	**0.580**	12	2003

The refined modeling impacts from Holcim – Clarksville exceed the 0.5 deciview threshold for all three Class 1 areas for both the Method2 and the Method6 CALPOST methodology. Therefore, the department contacted Holcim to pursue control of SO_2 and NO_X for BART. The PM_{10} impact on visibility is less than 1 percent and does not constitute enough impact to pursue control. Holcim initially responded (prior to the February 2008 submittal) that they were in the process of retrofitting the kiln under permit #082007-019 that requires them to install a mid-kiln firing system for NO_X control. As a point of reference, the department determined that mid-kiln firing was equivalent to a 30 percent reduction from 1990 cement kiln NO_X emissions based on EPA information provided during the development of the NO_X SIP call.

After the February 2008 SIP submittal, Holcim provided additional information detailing the maximum 24-hour SO_2 and NO_X emissions using continuous emission monitoring (CEM) data. Holcim installed the CEM data in 2004, began collection of hourly emission data, and has maintained the necessary quality assurance measures to ensure accuracy of this data. The use of maximum 24-hour emission rates is the preferred methodology for determination of visibility impacts from BART sources (if available). The department utilized the maximum 24-hour emission rates provided by Holcim with the necessary filling of missing hourly data. The PM_{10} emission rates used in the new analysis were identical to the previous screening and refined modeling analyses. The resultant emissions obtained from the CEM data were:

SO_2 – 4,900.95 lb SO_2/hr = 117,622.7 lb SO_2/day on 12/2/2004
NO_X – 3049.39 lb NO_X/hr = 73,185.3 lb NO_X /day on 11/24/2007

These emissions were modeled using the refined analysis method described above. The Method 6 results are presented in Table 9.15.

Table 9.15: Holcim - Clarksville Post-Submittal Refined Analysis Results

Facility	Class I Area	Max M6 Impact	98% M6 Impact (8th high)	Days >0.5 (M6)	Year
Holcim	Mingo	1.685	**1.124**	26	2001
Holcim	Mingo	2.183	**1.018**	25	2002
Holcim	Mingo	2.063	**0.894**	23	2003
Holcim	Hercules	1.534	**0.595**	9	2001
Holcim	Hercules	2.129	**0.968**	11	2002
Holcim	Hercules	1.391	**0.769**	18	2003
Holcim	Upper Buffalo	1.331	0.465	7	2001
Holcim	Upper Buffalo	2.364	**0.572**	9	2002
Holcim	Upper Buffalo	1.577	**0.716**	17	2003

Based on confirmation of the visibility impacts over the 0.5 deciview impact, Holcim provided a BART proposal in late April 2008 that included inherent scrubbing (no additional control) for SO_2 and existing low NO_X burners and cement kiln dust insufflation along with the mid-kiln firing of tires at 12 percent fuel rate for NO_X control. The mid-kiln firing of tires was estimated by Holcim to provide a 20 percent reduction from existing NO_X emission levels. This submittal is included as part of Appendix N.

Based on the review of the Holcim submittal, the department requested additional SO_2 control information regarding scrubber problems with opacity and installation cost, cost evaluation of "local" fuels (specifically, switching from current petroleum coke at 6 percent sulfur to medium sulfur coal), and detailed information regarding sulfur balance of the kiln inputs from fuel and other raw materials and outputs as sulfur in product, solid waste streams, and stack exhaust gases (SO_2). The department was specifically interested in a partial control of the exhaust stream with a scrubber that would include a by-pass for part of the stream to help eliminate the opacity associated with reduced temperature after SO_2 scrubbing.

Holcim provided revised submittals in June and July 2008 (Appendix O and Appendix P, respectively) that addressed the partial stream scrubbing question for the kiln and provided sufficient information for the ultimate finding of emissions that would satisfy BART for the kiln operation at Clarksville. Holcim proposed a 20 percent reduction of NO_X and a 23 percent reduction of SO_2 from their maximum 24-hour emission rates modeled. The proposal also requested this limit be expressed as a 30-day rolling average. Based on a comprehensive review of these submittals along with visibility modeling of the impacts from this source, the department concluded that the mid-kiln firing of tires (using 12 percent total heat input substitution) and a switch from petroleum coke as the primary kiln fuel to 3 percent sulfur coal (along with the tire-derived fuel for NO_X control) would constitute BART for this source. However, the department did not agree with the emission limits proposed by Holcim. Specifically, the department did not agree to the use of the percentage reduction from the maximum 24-hour emission rate when using a thirty day rolling average.

The SO_2 finding was based primarily on the economic evaluation of several different control scenarios for the kiln including both wet and dry scrubbing of the kiln exhaust gas. The department found the overall net cost per ton of cement produced (~$15-20/ton) was excessive and would have seriously compromised the Clarksville kiln's ability to compete in the cement production market. The fuel switch provided a significant amount of emission reductions at a cost of approximately $3/ton cement produced. The overall cost per ton SO_2 reduced was calculated as $1,148/ton removed. The NO_X finding was based on information provided by Cinar (kiln design contractor for Holcim) regarding NO_X emission rates when burning tire-derived fuel and the department's serious concern over the use of selective non-catalytic reduction on the world's largest long wet cement kiln. The increased certainty of the mid-kiln firing of tires, along with the use of low- NO_X burners and cement kiln dust insufflation, provide a firm basis for the finding of NO_X BART at Clarksville. In addition, this reduction of emissions was to have very little additional cost for the plant due to the planned installation of the mid-kiln firing project. The department findings result in a 20 percent reduction of NO_X and a 27 percent reduction of SO_2 from the maximum 30-day average emissions using the CEM data. As provided in the presumptive BART finding for utilities, the emission limits are expressed as 30-day rolling averages of 42,287 pounds NO_X/day and 58,787 pounds SO_2/day. The calculation of these averages will include all hours when the kiln is not operating and those emissions for both pollutants will be entered as zero pounds. Detailed SO_2 cost spreadsheets along with calculations of emission reductions are included in Appendix Q.

Refined visibility modeling was conducted with the BART limits prescribed by the department using the previous refined modeling analysis as a baseline to determine the extent of visibility improvement for each of the three impacted Class I areas. The results are provided in Table 9.16.

Table 9.16: Holcim - Clarksville BART Limit Refined Analysis Results

Facility	Class I Area	Max M6 Impact	98% M6 Impact (8th high)	Days >0.5 (M6)	Year
Holcim	Mingo	0.963	**0.598**	13	2001
Holcim	Mingo	1.254	**0.532**	8	2002
Holcim	Mingo	1.094	0.471	7	2003
Holcim	Hercules	0.800	0.331	3	2001
Holcim	Hercules	1.163	0.499	7	2002
Holcim	Hercules	0.734	0.412	4	2003
Holcim	Upper Buffalo	0.697	0.236	4	2001
Holcim	Upper Buffalo	1.293	0.300	3	2002
Holcim	Upper Buffalo	0.825	0.370	3	2003

These results demonstrate less than the 0.5 deciview threshold for the 98th percentile visibility impact at the Hercules Glade and Upper Buffalo Wilderness Areas. Further, great improvement at the more proximate Mingo National Wildlife Refuge was also demonstrated. The highest 98th percentile impact was in 2001 and this impact was reduced 47 percent from the original refined modeling estimate.

The BART finding was provided to Holcim on August 18, 2008, along with the rationale for the finding and a draft consent agreement drafted by the department to codify the emission requirements for Holcim – Clarksville (also included in Appendix R). Subsequent comments provided by both Holcim and EPA Region VII necessitated some changes to the draft. In December 2008, Holcim informed the department of its intention to stop production at the Clarksville facility after the 1st quarter of 2009. A mutual decision was made to finalize the agreement in the event that Holcim would need to restart the Clarksville kiln operation in the near future. However, at this point, there has been no indication that the kiln will be operated further. The final consent agreement was signed by the department on April 14, 2009, and is included in Appendix S for inclusion in the regional haze State Implementation Plan.

As discussed previously, the EPA has found that, as a whole, the CAIR cap-and-trade program improves visibility more than implementing BART in states affected by CAIR. The state of Missouri has opted to participate in the CAIR program under part 96 AAA-EEE and, therefore, the CAIR EGU sources are not required to install, operate, and maintain BART for SO_2 or NO_X.

In summary, the State of Missouri has identified one BART-eligible source in Missouri that entered into a consent agreement with the department to limit emissions of SO_2 and NO_X. This agreement is the mechanism for enforcement of the BART requirements for this source. All other sources were examined and the findings were as follows:

1) sources were not operating or have a federally-enforceable construction permit to shutdown the applicable units,
2) sources were Clean Air Interstate Rule units (EGUs) that were determined to have installed BART based on their CAIR status,

3) one source was found to have been issued two subsequent Prevention of Significant Deterioration permits with a BACT finding, or
4) units were eliminated based on less than the threshold (0.5 deciview) impact from a screening analysis (maximum impact) or a refined analysis for four facilities (98 percent impact).

10.0 REASONABLE PROGRESS GOALS

10.1 Reasonable Progress Goal Requirements

40 CFR 51.308(d)(1) requires Missouri to establish RPGs for each Class I area within the state (in dv) that provide for reasonable progress towards achieving natural visibility. In addition, EPA released guidance on June 1, 2007 to use in setting RPGs (Appendix T). The goals must provide improvement in visibility for the most impaired days, and ensure no degradation in visibility for the least impaired days over the plan period. The state must also provide an assessment of the number of years it would take to attain natural visibility conditions if improvement continues at the rate represented by the RPG.

The EPA guidance referenced above describes the RPG development process as follows:

> *RPGs should be initially developed considering available control measures as evaluated using the statutory factors. Based on emission reductions anticipated from the resulting control strategy for all visibility impairing pollutants, the state should ensure that the RPGs define visibility conditions at, or better than, conditions based on the uniform rate of progress. If a state finds that its initial RPG will not result in visibility improvement equal to or better than the uniform rate of progress, then the state should reconsider available control measures, and additional measures should be evaluated as appropriate. The RPGs should then be revised based upon a more stringent suite of controls.*

The "statutory factors" that the state must consider are identified in 40 CFR 51.308(d)(i)(A) as:

a) The costs of compliance,
b) The time necessary for compliance,
c) The energy and non-air quality environmental impacts of compliance, and
d) The remaining useful life of existing sources that contribute to visibility impairment.

The state must demonstrate how these factors were taken into consideration in selecting the goal for its mandatory Class I areas.

10.2 MISSOURI REASONABLE PROGRESS GOAL

The URP named in the EPA guidance (described as uniform rate of improvement in 40 CFR 51.308(d)(1)(i)(B)) is essentially a line between current or baseline conditions on the worst days and natural background in 2064. Reference Figures 8.1a and 8.1.b. for Uniform Rate of Progress and modeled goals. Table 10.1 provides a Uniform Rate of Progress and Reasonable Progress for Class I areas in Missouri taken from those figures. Missouri has determined that the modeled rate of visibility improvement by 2018 shown in Table 10.1 is reasonable and hereby adopts it as the RPG for the listed Class I areas.

Table 10.1: Uniform Rate of Progress and Reasonable Progress Goals for Class I Areas in Missouri

Class I Area	2000/2004 Baseline Conditions (dv)	2018 URP Point (dv)	2018 Modeled Predictions (dv)	2064 Natural Background Conditions (dv)	Deciview Improvement Needed by 2018 assuming RPG	Progress Annually to 2018 assuming RPG (dv)
Mingo	28.02	24.37	23.71	12.40	4.31	0.308
Hercules Glades	26.75	23.14	23.06	11.30	3.69	0. 264

Missouri's approach, included in the EPA guidance document, is to "back out" the measures necessary to achieve the reasonable progress goals. In this process, modeling has been used to estimate the visibility impacts of a specific percentage reduction in visibility impairing pollutants. The resulting visibility conditions have been compared to the goals. Using this process, we have identified a percentage reduction in visibility impairing pollutants that will provide progress necessary to achieve the rate of progress goals.

In determining reasonable progress, CAA §169A(g)(1) requires states to take into consideration four factors, however, flexibility in consideration of factors may be used. The EPA guidance indicates that

> *…the factors could be used to select which sources or activities should or should not be regulated, or they could be used to determine the level or stringency of control, if any, for selected sources or activities, or some combination of both.*

The factors may be considered both individually and/or in combination. As noted in section 4.1, given the significant emissions reductions that we anticipate to result from BART, the CAIR, and the implementation of other CAA programs, these reductions may be all that is necessary to achieve reasonable progress in the first planning period for some States. Also, as noted in section 4.2, it is not necessary for you to reassess the reasonable progress factors for sources subject to BART for which you have already completed a BART analysis.

The analyses in this Regional Haze Plan demonstrate that the 2018 visibility goals for Mingo and Hercules Glades have been largely achieved through EGU emission reductions. These reductions will be energy and environmental neutral, but are clearly most effective in improving haze levels. In addition, controls under CAIR are effective for a considerable lifetime of the operating units. A discussion in the CAIR rule highlighted below (70 FR 25197) addresses their analysis of reasonable progress factors of cost and time necessary for compliance.

From past experience in examining multi-pollutant emissions trading programs for SO2 and NOX, EPA recognized that the air pollution control retrofits that result from a program to achieve highly cost-effective reductions are quite significant and can not be immediately installed. Such retrofits require a large pool of specialized labor resources, in particular, boilermakers, the availability of which will be a major limiting factor in the amount and timing of reductions.

Also, EPA recognized that the regulated industry will need to secure large amounts of capital to meet the control requirements while managing an already large debt load, and is facing other large capital requirements to improve the transmission system. Furthermore, allowing pollution control retrofits to be installed over time enables the industry to take advantage of planned outages at power plants (unplanned outages can lead to lost revenue) and to enable project management to learn from early installations how to deal with some of the engineering challenges that will exist, especially for the smaller units that often present space limitations.

Based on these and other considerations, EPA determined in the NPR that the earliest reasonable deadline for compliance with the final highly cost-effective control levels for reducing emissions was 2015 (taking into consideration the existing bank of title IV SO2 allowances). First, the Agency confirmed that the levels of SO2 and NOX emissions it believed were reasonable to set as annual emissions caps for 2015 lead to highly cost-effective controls for the CAIR region.

Once EPA determined the 2015 emissions reductions levels, the Agency determined a proposed first (interim) phase control level that would commence January 1, 2010, the earliest the Agency believed initial pollution controls could be fully operational (in today's final action, the first NOX control phase commences in 2009 instead of in 2010, as explained in detail in section IV.C). The first phase would be the initial step on the slope of emissions reductions (the glide-path) leading to the final (second) control phase to commence in 2015. The EPA determined the first phase based on the feasibility of installing the necessary emission control retrofits, as described in section IV.C.

Although EPA's primary cost-effectiveness determination is for the 2015 emissions reductions levels, the Agency also evaluated the cost effectiveness of the first phase control levels to ensure that they were also highly cost effective. Throughout this preamble section, EPA reports both the 2015 and 2010 (and 2009 for NOX) cost-effectiveness results, although the first phase levels were determined based on feasibility rather than cost effectiveness. The 2015 emissions reductions include the 2010 (and 2009 for NOX) emissions reductions as a subset of the more stringent requirements that EPA is imposing in the second phase.

CENRAP, assisted by Alpine Geophysics, conducted additional four factor analysis. The analysis provided recommendations on additional controls which were not adopted. See Appendix Q of the TSD for information on the CENRAP four factor analysis.

In determining the Reasonable Progress Goals, four factor analyses have been conducted by EPA, CENRAP and other RPOs. Chapter 11, the Long-Term Strategy Plan, identifies the control measures necessary to achieve the Reasonable Progress Goals. The BART analysis for Missouri is equivalent to the four factor analysis.

To ensure that the emissions from new stationary sources and major modifications will be consistent with making reasonable progress toward the national visibility goal, Missouri has a requirement to do a visibility impairment evaluation as part of the major construction permitting process.

10.3 CONSULTATION

In determining a reasonable progress rate for each Class I area discussed above, Missouri has consulted with FLMs and the other states/tribes, which (are) reasonably anticipated to cause or contribute to visibility impairment in each of these Class I areas. A description of the consultation process is provided in Appendix E, *United States Central Class I Areas Consultation Plan*, Missouri Department of Natural Resources, 2007. In addition, the minutes from those meetings are in Appendix U)

10.4 REPORTING

Progress will be reported to the EPA every five years in accordance with 51.308 (g).

11.0 LONG-TERM STRATEGY TO REACH REASONABLE PROGRESS GOALS

11.1 LONG-TERM STRATEGY REQUIREMENTS

40 CFR 51.308(d)(3) requires Missouri to submit a long-term strategy that addresses regional haze visibility impairment for each mandatory Class I federal area within and outside the state, which may be affected by emissions from within the state. The long-term strategy must include enforceable emissions limitations, compliance schedules and other measures necessary to achieve the RPGs established by states/tribes where the Class I areas are located. This chapter describes how Missouri meets the long-term strategy requirements.

11.2 CONSULTATION

Missouri will continue to coordinate and consult with the consultation stakeholders during the development of future progress reports and plan revisions, as well as during the implementation of programs having the potential to contribute to visibility impairment in the mandatory Class I areas. Face to face meetings will be held if deemed necessary. Otherwise, consultation will be in the form of conference calls and/or letter or email correspondence. The Central Class I areas consultation will be initiated through the Central Class I areas contacts listed in the consultation plan (Appendix E).

Missouri also participated in the consultation processes for Arkansas, Oklahoma and Minnesota; and will continue to participate in other consultation processes in response to any other states that request our participation.

11.3 SHARE OF EMISSION REDUCTIONS

40 CFR 51.308(d)(3)(ii) requires Missouri to demonstrate that its implementation plan includes all measures necessary to obtain its fair share of emission reductions needed to meet RPGs.

Missouri relied on technical analyses developed by CENRAP and additional weight of evidence analysis developed as part of consultation planning to determine contributing states (Appendix E). Nine states, including Missouri, Arkansas, Kentucky, Illinois, Indiana, Ohio, Oklahoma, Tennessee and Texas, were identified as contributing to visibility in Mingo and/or Hercules Glades Class I areas. The modeling demonstration has shown that the emission reductions from these contributing states are sufficient to achieve RPGs in Missouri's Class I areas.

Current visibility is estimated from monitored components of $PM_{2.5}$ and coarse mass. Models are used in a relative sense to estimate how current concentrations respond to emission reduction measures. Data analysis is used to identify source categories and regions. Current concentrations of particulate matter components are adjusted by the relative modeled response to estimate concentrations at the end the first implementation period in 2018. Future visibility is estimated from estimated component concentrations of $PM_{2.5}$ and PM_{10} at the end of the first implementation period. The difference between present visibility and future estimated visibility is compared with the RPGs to determine if the goal is met. The CENRAP technical analyses on visibility conditions and RPGs projections can be found in Appendix F. All applicable measures reflected in the modeling demonstration and weight of evidence analysis have been incorporated in the state's long-term strategy. Section 11.4 provides information on these control measures.

11.4 LONG-TERM STRATEGY COMPONENTS

40 CFR 51.308(d)(3)(v) requires Missouri to consider several factors in developing its long-term strategy. These are discussed below.

11.4.1 Ongoing air pollution control programs – "on the books" controls

40 CFR 51.308(d)(3)(v)(A) requires states to consider emission reductions from ongoing pollution control programs. The NO_X and SO_2 emissions reductions resulting from these ongoing programs will help improve air quality throughout the state of Missouri.

Missouri used the following "on the books" control programs in the modeling demonstration to meet the RPG requirements. The substantial improvements in visibility impairment at the Mingo site for the worst 20 percent days from 2002 (141 Mm_{-1}) to 2018 (96 Mm_{-1}) is primarily due to reductions in SO_4 (35 Mm-1 improvement) from elevated point sources (Figures E-7a through E-7d of the TSD). Elevated point sources also contribute over half to the total extinction for the worst 20 percent days at Hercules Glades in 2002 (Figures E-6a and E-6b of the TSD). Going from 2002 to 2018 the contributions due to elevated point sources (essentially CAIR and NOx SIP call), on-road mobile and non-road mobile are reduced substantially, over 25 Mm-1.

11.4.1.1 Clean Air Interstate Rule (CAIR)

On March 10, 2005, EPA signed the CAIR, following three years modeling study and cost analysis on SO_2 and NO_X controls (equivalent to a four factor analysis).

As required by CAIR, Missouri developed draft rules through the workgroup process.

The rules were presented for public hearing at the December 7, 2006 MACC Meeting and they were adopted at the February 1, 2007, MACC Meeting. The rules establish a cap and trade system for NO_X and SO_2 emissions, and Missouri sources will be included in the national program. The state rules are 10 CSR 10-6.362 Clean Air Interstate Rule Annual NO_X Trading Program and 10 CSR 10-6.366 Clean Air Interstate Rule SO_X Trading Program. The state rules include schedules for compliance, sources affected by the rule and emissions limitations.

Table 11.1 summarizes the NO_X emissions cap for each unit for each calendar year between 2009-2014 and 2015 and beyond. Table 11.2 summarizes the SO_2 emissions cap for each unit for each calendar year between 2010-2014 and 2015 and beyond. These rules can be found in Appendix V.

Table 11.1: CAIR NO_X Emissions Allocation (tons/yr)

County	Plant	Facility Name	Unit ID	2009 - 2014	2015 and beyond
097	0001	EMPIRE - ASBURY	1	1,097	914
095	0022	KCPL - HAWTHORN	5A	3,294	2,743
095	0022	KCPL - HAWTHORN	6	31	26
095	0022	KCPL - HAWTHORN	7	18	15
095	0022	KCPL - HAWTHORN	8	16	13
095	0022	KCPL - HAWTHORN	9	69	58
083	0001	KCPL - MONTROSE	1	911	759
083	0001	KCPL - MONTROSE	2	947	788
083	0001	KCPL - MONTROSE	3	942	784
095	0023	KCPL - NORTHEAST	11	3	2
095	0023	KCPL - NORTHEAST	12	2	2
095	0023	KCPL - NORTHEAST	13	7	6
095	0023	KCPL - NORTHEAST	14	5	5
095	0023	KCPL - NORTHEAST	15	4	4
095	0023	KCPL - NORTHEAST	16	3	2
095	0023	KCPL - NORTHEAST	17	6	5
095	0023	KCPL - NORTHEAST	18	4	3
051	0049	AMEREN - FAIRGROUNDS		2	2
037	0003	AQUILA - RALPH GREEN	3	9	8
095	0031	AQUILA - SIBLEY	1	306	255
095	0031	AQUILA - SIBLEY	2	305	254
095	0031	AQUILA - SIBLEY	3	1,977	1,646
031	0090	AMEREN VIADUCT		-	-
021	0004	AQUILA - LAKE ROAD	6	542	452
021	0004	AQUILA - LAKE ROAD	5	5	4
189	0023	AMEREN - HOWARD BEND		1	1
071	0003	AMEREN - LABADIE	1	2,913	2,425
071	0003	AMEREN - LABADIE	2	2,998	2,496
071	0003	AMEREN - LABADIE	3	3,329	2,772
071	0003	AMEREN - LABADIE	4	2,984	2,484
189	0010	AMEREN - MERAMEC	1	730	607
189	0010	AMEREN - MERAMEC	2	676	562
189	0010	AMEREN - MERAMEC	3	1,171	975
189	0010	AMEREN - MERAMEC	4	1,778	1,480
189	0010	AMEREN - MERAMEC	GT1	2	2
189	0010	AMEREN - MERAMEC	GT2	3	2
183	0001	AMEREN - SIOUX	1	2,318	1,930
183	0001	AMEREN - SIOUX	2	2,282	1,900
117	0002	CHILLICOTHE		2	2
019	0002	COLUMBIA	6	41	34
019	0002	COLUMBIA	7	44	36
019	0002	COLUMBIA	8	1	-
095	0050	BLUE VALLEY POWER	3	161	134
095	0050	BLUE VALLEY POWER	GT1	-	-
077	0005	CU - JAMES RIVER	GT1	15	12
077	0005	CU - JAMES RIVER	GT2	9	8
077	0005	CU - JAMES RIVER	3	293	244

077	0005	CU - JAMES RIVER	4	360	300
077	0005	CU - JAMES RIVER	5	614	511
143	0004	AECI - NEW MADRID	1	2,747	2,287
143	0004	AECI - NEW MADRID	2	3,035	2,527
175	0001	AECI - THOMAS HILL	MB1	1,126	938
175	0001	AECI - THOMAS HILL	MB2	1,663	1,385
175	0001	AECI - THOMAS HILL	MB3	4,046	3,369
151	0002	CENTRAL ELECTRIC - CHAMOIS	2	315	263
165	0007	KCPL - IATAN	1	3,990	3,322
095	0139	AQUILA - GREENWOOD ENERGY CENTER	1	12	10
095	0139	AQUILA - GREENWOOD ENERGY CENTER	2	12	10
095	0139	AQUILA - GREENWOOD ENERGY CENTER	3	14	12
095	0139	AQUILA - GREENWOOD ENERGY CENTER	4	15	12
099	0016	AMEREN - RUSH ISLAND	1	2,882	2,399
099	0016	AMEREN - RUSH ISLAND	2	2,748	2,287
077	0039	SOUTHWEST	1	1,339	1,115
077	0039	SOUTHWEST	CT1A	3	2
077	0039	SOUTHWEST	CT1B	3	2
077	0039	SOUTHWEST	CT2A	3	2
077	0039	SOUTHWEST	CT2B	3	2
097	0062	EMPIRE – ENERGY CENTER	3A	2	2
097	0062	EMPIRE – ENERGY CENTER	3B	2	2
097	0062	EMPIRE – ENERGY CENTER	4A	2	2
097	0062	EMPIRE – ENERGY CENTER	4B	2	2
097	0062	EMPIRE – ENERGY CENTER 1	1	21	18
097	0062	EMPIRE – ENERGY CENTER 2	2	19	16
007	0012	AMEREN – MEXICO		2	2
175	0010	AMEREN - MOBERLY		2	1
051	0008	AMEREN - MOREAU		2	2
201	0017	SIKESTON	1	1,556	1,295
097	0104	EMPIRE - STATE LINE	1	78	65
097	0104	EMPIRE - STATE LINE	2-1	122	101
097	0104	EMPIRE - STATE LINE	2-2	153	127
069	0066	ST. FRANCIS POWER PL	1	92	77
069	0066	ST. FRANCIS POWER PL	2	70	58
207	0064	ESSEX POWER PLANT	1	11	9
147	0032	NODAWAY POWER PLANT	1	11	9
147	0032	NODAWAY POWER PLANT	2	11	9
101	0051	HOLDEN POWER PLANT	1	2	2
101	0051	HOLDEN POWER PLANT	2	4	3
101	0051	HOLDEN POWER PLANT	3	2	2
077	0164	CU - MCCARTNEY	MGS1A	1	1
077	0164	CU - MCCARTNEY	MGS1B	1	1
077	0164	CU - MCCARTNEY	MGS2A	1	1
077	0164	CU - MCCARTNEY	MGS2B	1	1
163	0047	AMEREN - PENO CREEK	CT1A	2	1
163	0047	AMEREN - PENO CREEK	CT1B	2	1
163	0047	AMEREN - PENO CREEK	CT2A	2	1
163	0047	AMEREN - PENO CREEK	CT2B	2	1
163	0047	AMEREN - PENO CREEK	CT3A	2	1

163	0047	AMEREN - PENO CREEK	CT3B	2	1
163	0047	AMEREN - PENO CREEK	CT4A	1	1
163	0047	AMEREN - PENO CREEK	CT4B	1	1
107	0038	HIGGINSVILLE		3	3
037	0056	MEP PLEASANT HILL	CT-1	99	82
037	0056	MEP PLEASANT HILL	CT-2	91	76
007	0053	AMEREN - AUDRAIN	CT1	1	1
007	0053	AMEREN - AUDRAIN	CT2	1	-
007	0053	AMEREN - AUDRAIN	CT3	1	-
007	0053	AMEREN - AUDRAIN	CT4	1	-
007	0053	AMEREN - AUDRAIN	CT5	1	1
007	0053	AMEREN - AUDRAIN	CT6	-	-
007	0053	AMEREN - AUDRAIN	CT7	-	-
007	0053	AMEREN - AUDRAIN	CT8	-	-
019	0105	COLUMBIA ENERGY CTR	CT01	1	1
019	0105	COLUMBIA ENERGY CTR	CT02	1	1
019	0105	COLUMBIA ENERGY CTR	CT03	1	-
019	0105	COLUMBIA ENERGY CTR	CT04	-	-
		EE/RE set aside		300	300
		TOTAL		59,871	49,892

Table 11.2: CAIR SO_2 Emissions Allocation (tons/yr)

County	Plant	Facility Name	Unit ID	2010 Acid Rain Allowances	2010- 2014 (tons/yr)	2015/after
097	0001	EMPIRE - ASBURY	1	6,986	3,493	2,445
095	0050	BLUE VALLEY	3	4,678	2,339	1,637
151	0002	CENTRAL ELECTRIC - CHAMOIS	2	5,466	2,733	1,913
019	0002	COLUMBIA	7	3,639	1,820	1,274
019	0002	COLUMBIA	6	905	453	317
019	0002	COLUMBIA	8	125	63	44
095	0022	KCPL - HAWTHORN	5	12,309	6,155	4,308
165	0007	KCPL - IATAN	1	16,236	8,118	5,683
077	0005	CU - JAMES RIVER	5	2,136	1,068	748
077	0005	CU - JAMES RIVER	4	1,253	627	439
077	0005	CU - JAMES RIVER	3	681	341	238
077	0005	CU - JAMES RIVER	**GT2	605	303	212
071	0003	AMEREN - LABADIE	1	17,583	8,792	6,154
071	0003	AMEREN - LABADIE	3	17,516	8,758	6,131
071	0003	AMEREN - LABADIE	2	16,391	8,196	5,737
071	0003	AMEREN - LABADIE	4	15,611	7,806	5,464
021	0004	AQUILA - LAKE ROAD	6	606	303	212
189	0010	AMEREN - MERAMEC	4	2,554	1,277	894
189	0010	AMEREN - MERAMEC	3	2,362	1,181	827
189	0010	AMEREN - MERAMEC	2	1,105	553	387
189	0010	AMEREN - MERAMEC	1	1,029	515	360
083	0001	KCPL - MONTROSE	3	4,356	2,178	1,525
083	0001	KCPL – MONTROSE	2	3,541	1,771	1,239
083	0001	KCPL – MONTROSE	1	3,194	1,597	1,118
143	0004	AECI – NEW MADRID	2	14,033	7,017	4,912

143	0004	AECI – NEW MADRID	1	12,198	6,099	4,269
099	0016	AMEREN - RUSH ISLAND	2	15,518	7,759	5,431
099	0016	AMEREN - RUSH ISLAND	1	13,900	6,950	4,865
095	0031	AQUILA – SIBLEY	3	7,648	3,824	2,677
095	0031	AQUILA – SIBLEY	2	639	320	224
095	0031	AQUILA – SIBLEY	1	520	260	182
201	0017	SIKESTON	1	6,802	3,401	2,381
183	0001	AMEREN – SIOUX	1	10,842	5,421	3,795
183	0001	AMEREN – SIOUX	2	9,507	4,754	3,327
077	0039	CU – SOUTHWEST	1	4,127	2,064	1,444
175	0001	AECI - THOMAS HILL	MB3	18,288	9,144	6,401
175	0001	AECI - THOMAS HILL	MB2	7,444	3,722	2,605
175	0001	AECI - THOMAS HILL	MB1	4,429	2,215	1,550
		TOTAL		266,762	133,381	93,367

* 0.5 multiplier for CAIR allowances between 2010-2014

** 0.35 multiplier for CAIR allowances 2015 and after

The long-term strategy also includes any CAIR controls that are being undertaken in other impacting states that were identified during the Central Class I areas consultation process.

11.4.1.2 BART

Twenty-six potential BART sources have been identified. Twenty-five have been dropped through the screening and refined analyses. The remaining source (Holcim – Clarksville) is currently evaluating the retrofit control options and will provide justification that no controls are necessary or propose a BART control option for approval by the state of Missouri. No other sources were found to be subject to BART and, therefore, implementation of an emissions trading program, other emission controls or other alternative measure in place of BART are not necessary. Detailed analyses can be found in Chapter 9 of the SIP.

Missouri will include BART controls proposed by the eight other impacting states in its long-term strategy. Arkansas, Oklahoma and Texas have already had their BART rules proposed. Missouri is working with these states to document the emissions reduction and control measures required from their sources. Since not all of the BART determinations are completed for other states, the five-year review will be the mechanism used to adjust the Reasonable Progress Goal based on the other states' final BART determinations.

11.4.1.3 Other federal ongoing air pollution control programs

Tier 2

Tier 2 standards are federal emission standards for passenger cars, light trucks and larger passenger vehicles. The program is designed to focus on reducing the emissions most responsible for the ozone and PM impact from these vehicles – NO_X and non-methane organic gases, consisting primarily of hydrocarbons and contributing to VOCs. The Tier 2 standards will reduce new vehicle NO_X levels to an average of 0.07 grams per mile. For new passenger cars and light duty trucks, these standards were phased in starting in 2004, and the standards were fully phased in by 2007. For heavy trucks and similar vehicles, the Tier 2 standards will be phased in beginning in 2008, with full compliance in 2009.

During the phase-in period from 2004-2007, all passenger cars and light trucks not certified to the primary Tier 2 standards had to meet an interim average standard of 0.30 g/mi NO_X. During the period 2004-2008, heavy trucks and similar vehicles not certified to the final Tier 2 standards will phase in to an interim program with an average standard of 0.20 g/mi NO_X, with those not covered by the phase-in meeting a per-vehicle standard (i.e., an emissions “cap”) of 0.60 g/mi NO_X trucks and 0.09 g/mi for similar vehicles.

Tier 4

EPA's Clean Air Nonroad Diesel Rule (Tier 4) requires stringent pollution controls on diesel engines used in industries such as construction, agriculture and mining, and it will slash sulfur content of diesel fuel. This rule is the latest in a series of actions that are designed to reduce emissions from nearly every type of diesel vehicle and equipment. This nonroad diesel program combines cleaner engine technologies with cleaner fuel – similar to the on-highway diesel program. The standards will cut emissions from nonroad diesel engines by over 90 percent. Nonroad diesel equipment, as described in this rule, currently accounts for 47 percent of diesel PM and 25 percent of NO_X from mobile sources nationwide.

Sulfur levels will also be reduced in nonroad diesel fuel by 99 percent from current levels (from approximately 3,000 parts per million (ppm) now to 15 ppm in 2010). The lower sulfur fuel will also reduce PM from engines in existing nonroad equipment. It makes it possible for engine manufacturers to use advanced clean technologies, similar to catalytic technologies used in passenger cars. The new engine standards take effect, based on engine horsepower, starting in 2008.

11.4.1.4 NO_X SIP Call

The NO_X SIP call was designed to assist downwind ozone areas in attaining the one-hour and 8-hour ozone NAAQS by providing upwind NO_X emission control. This rulemaking was developed through the EPA's interpretation of the Ozone Transport Assessment Group recommendations and subsequent modeling and cost analysis of NO_X controls to reduce ozone transport. The final NO_X SIP call was published in the *Federal Register* on October 27, 1998.

Missouri's initial rule in response to the NO_X SIP Call, 10 CSR 10-6.*350 Emission Limitations and Emissions Trading of Oxides of Nitrogen*, was adopted by the MACC on April 24, 2003. The rule established an emission limitation of 0.25 lbs NO_X /MMBtu heat input for electric generating units in the eastern one-third of the state and a lower limit of 0.18 lb/MMBtu heat input for Labadie, Rush Island, and Meramec power plants. EGUs in the western two-third of the state were limited to an emission rate of 0.35 lbs NO_X /MMBtu of heat input. Cyclone boilers (Sibley and Asbury power plants) that burn tire-derived fuels are allowed to meet 0.68 lbs NO_X /MMBtu heat input. The compliance date was May 1, 2004.

On April 21, 2004, the EPA finalized the second phase of NO_X SIP call. Phase II of the SIP call excluded the portion known as the "coarse grid" (the western 2/3 of Missouri) from the NO_X SIP Call, defined the area of the eastern 1/3 of Missouri to include the same counties as established in 10 CSR 10-6.350, with the one exception of not including Phelps County, and revised the cap for NO_X emissions from the previous statewide budget of 114,532 tons of NO_X per ozone season to a partial state budget of 61,406 tons of NO_X per ozone season in the eastern 1/3 of Missouri. The budget assumed control levels of 0.15 lbs/MMBtu for electric generating units, 82 percent emissions reductions for large natural gas-fired stationary internal combustion engines, 90 percent emissions reductions for diesel and dual fuel stationary internal combustion engines, 60 percent emissions reductions for non-utility boilers and turbines, and 30 percent emissions reductions for cement manufacturing plants. Small cogeneration units were excluded from the

NO_X SIP Call. Small cogeneration units are units that supply one-third or less of their potential electrical output capacity, or 25 megawatts or less, to any utility power distribution system for sale.

The department's Air Pollution Control Program developed 10 CSR 10-6.360 *Control of NO_X Emissions from Electric Generating Units and Non-Electric Generating Boilers*, 10 CSR 10-6.*380 Control of NO_X Emissions from Portland Cement Kilns*, and 10 CSR 10-6.*390 Control of NO_X Emission from Large Stationary Internal Combustion Engines*. This set of three rules constitutes Missouri's response to EPA's NO_X SIP Call. These rules were presented at public hearing on April 28, 2005 and were adopted at the May 26, 2005 MACC meeting. The state rules include schedules for compliance, sources affected by the rule and emissions limitations. Table 11.3 summarizes the NO_X allowances for each unit during the ozone season.

Table 11.3: NO_X SIP Call Emissions Allocation (tons/ozone season)

County	Plant	Facility Name	Unit ID	NO_X Allocation
031	0090	AMEREN – VIADUCT	Combustion Turbine 1	4
071	0003	AMEREN – LABADIE	Boiler 1	1146
071	0003	AMEREN – LABADIE	Boiler 2	1263
071	0003	AMEREN – LABADIE	Boiler 3	1449
071	0003	AMEREN – LABADIE	Boiler 4	1339
099	0016	AMEREN - RUSH ISLAND	Boiler 1	1405
099	0016	AMEREN - RUSH ISLAND	Boiler 2	1395
143	0004	AECI - NEW MADRID	Boiler 1	1126
143	0004	AECI - NEW MADRID	Boiler 2	1182
183	0001	AMEREN – SIOUX	Boiler 1	809
183	0001	AMEREN – SIOUX	Boiler 2	726
189	0010	AMEREN – MERAMEC	Boiler 1	114
189	0010	AMEREN – MERAMEC	Boiler 2	88
189	0010	AMEREN – MERAMEC	Boiler 3	152
189	0010	AMEREN – MERAMEC	Boiler 4	280
189	0010	AMEREN – MERAMEC	Unit 5	5
189	0023	AMEREN – HOWARD BEND	Combustion Turbine 1	3
201	0017	CITY OF SIKESTON	Boiler 1	780
		Energy Efficiency Set-Aside		134
		TOTAL EGU Tons per Ozone Season NO_X		13400
510	0003	ANHEUSER BUSCH	Boiler 6	14
510	0038	TRIGEN ASHLEY STREET	Boiler 5	9
510	0038	TRIGEN ASHLEY STREET	Boiler 6	36
		TOTAL Non-EGU Tons per Ozone Season NO_X		59

11.4.2 Additional controls beyond CAIR

Ongoing air pollution control programs, as described in Section 11.4.1, are sufficient to meet the 2018 Uniform Rate of Progress for the Mingo and Hercules Glades Class 1 areas. These ongoing programs such as CAIR, BACT, or BART have been demonstrated to be very cost-effective in reducing the visibility in Missouri's Class I areas.

Additional controls not included in the modeling demonstration in the plan may be considered during the five-year review. A number of control strategies include SO_2/NO_X Reasonably Available Control Technology (RACT) in the St Louis $PM_{2.5}$ plan, Illinois Multi-Pollutant Strategy, regional SO_2 and NO_X control strategy proposed by Alpine Geophysics (Alpine) for CENRAP.

11.4.2.1 SO_2 and NO_X RACT in St Louis

Missouri is in the process of preparing an implementation plan to address the St. Louis $PM_{2.5}$ nonattainment problem. In addition to the development of an attainment demonstration, the $PM_{2.5}$ implementation rule requires states to develop all RACT and Reasonably Achievable Control Measures (RACM). All non-EGU SO_2 and NO_X sources were identified in the St. Louis $PM_{2.5}$ nonattainment area that had actual emissions exceeding 25 tons per year. These include large boilers, stationary internal combustion engines, two glass melting furnaces, a biosolids incinerator, a cement kiln and a lead smelter. The emission reductions associated with these sources will be determined and included in the $PM_{2.5}$ plan.

11.4.2.2 Illinois Multi-Pollutant Regulation

In 2006, a multi-pollutant standard (MPS) rule was approved by the Illinois Pollution Control Board and the Joint Committee on Administrative Rules. This multi-pollutant rule will result in measurable reduction in mercury, SO_2, and NO_X emissions. The rule targets the three largest coal-fired power plant companies in Illinois: Midwest Generation, Ameren and Dynegy. These three companies represent 88 percent of Illinois' 17,007 Megawatts of electric generating capacity from coal-fired plants. By implementation of this rule, the Illinois Environmental Protection Agency estimates the total emissions reduction from all three power companies is

233,600 tons per year of SO_2 and 61,434 tons per year of NO_X. This is a drastic improvement compared to emissions reduction achieved by the CAIR.

11.4.2.3 Regional Controls proposed by Alpine Geophysics (Alpine)

In February 2006, Alpine was contracted by CENRAP to assist in developing control strategies for CENRAP Class I areas. Based on the available cost information and the Area of Influence (AOI) analyses, Alpine proposed a methodology for constructing control strategy for both EGUs and non-EGUs. Control technologies for different industrial source categories were identified. Regional "CAIR-like" EGU controls, and sub-regional (AOI region) – Industrial, Commercial, and Institutional boilers and natural gas compressors controls – were recommended by Alpine. The final report from Alpine can be found in Appendix W.

11.4.3 Measures to mitigate the impacts of construction activities

40 CFR 51.308(d)(3)(v)(B) requires Missouri to consider measures to mitigate the impacts of construction activities. Under the ozone NAAQS, Missouri, as a state in nonattainment of the ozone standard, is required to consider construction emissions as part of the general conformity rule (only VOCs and NO_X emissions are reviewed). Missouri meets this commitment through rule 10 CSR 10-6.300 *Conformity of General Federal Actions to State Implementation Plans*, which can be found in Appendix V.

11.4.4 Source retirement and replacement schedules

40 CFR 51.308(d)(3)(v)(D) requires Missouri to consider source retirement and replacement schedules in developing RPGs. Retirement and replacement will be managed in conformance with existing SIP/TIP requirements pertaining to PSD and New Source Review (NSR).

11.4.5 Smoke Management Plan

40 CFR 51.308(d)(3)(v)(E) requires Missouri to consider smoke management techniques for the purposes of agricultural and forestry management in developing RPGs.

The purpose of the Smoke Management Plan (SMP) adopted by Missouri is to identify the responsibilities of the Missouri Department of Natural Resources, FLMs, and state land managers to coordinate procedures that mitigate the impacts of prescribed fire and wildland fire used for resource benefits on public health, safety and visibility. This plan is designed to meet the policies of the EPA's *Interim Air Quality Policy on Wildland and Prescribed Fires* (April 1998) and addresses smoke management through various procedures and requirements in place at various agencies throughout the state.

The department does not intend to submit the SMP for inclusion in the Missouri SIP, but a copy of the Missouri SMP is provided in Appendix X for reference. A letter certifying that the SMP meets the basic requirements will be provided to EPA.

The purpose of a SMP is to mitigate the nuisance and public safety hazards (e.g., on roadways and at airports) posed by smoke intrusions into populated areas; to prevent deterioration of air quality and NAAQS violations; and to address visibility impacts in mandatory federal Class I areas. Some strong indications that an area needs a SMP are: (1) citizens increasingly complain of smoke intrusions; (2) the trend of monitored air quality values is increasing (approaching the daily or annual NAAQS for $PM_{2.5}$ or PM_{10}) because of significant contributions from fires managed for resource benefits; (3) fires cause or significantly contribute to monitored air quality that is already greater than 85 percent of the daily or annual NAAQS for $PM_{2.5}$ or PM_{10}; or (4) fires in the area significantly contribute to visibility impairment in mandatory federal Class I areas. None of these four indicators currently shows a problem in Missouri. However, the Missouri SMP should provide additional protection to the federal Class I areas.

11.4.6 Enforceability of Emission Limitations and Control Measures

40 CFR 51.308(d)(3)(v)(F) requires Missouri to ensure that emission limitations and control measures used to meet RPGs are enforceable.

Missouri has ensured that all emission limitations and control measures used to meet RPGs are enforceable by Missouri law through section 643 of the Revised Statutes of Missouri. In addition, rules developed for CAIR and the NO_X SIP call have placed emission limits on both EGU and non-EGU units. These rules can be found in Appendix V.

11.4.7 Anticipated net effect on visibility resulting from projected changes to emissions

40 CFR 51.308(d)(3)(v)(G) requires Missouri to address the net effect on visibility resulting from changes projected in point, area and mobile source emissions by 2018.

The emission inventory for Missouri projects changes to point, area and mobile source inventories by the end of the first implementation period resulting from population growth; industrial, energy and natural resources development; land management; and air pollution control. A summary of these changes is given in Tables 7.1 and 7.2 for each of the pollutants addressed in the regional haze plan inventory.

The net effect on visibility in Missouri Class I areas resulting from these emission differences is discussed in the CENRAP Technical Support Document (Appendix F).

11.5 FIVE-YEAR REVIEW

For the 2013 five-year review process, Missouri intends to conduct a five factor analysis (four factors plus visibility impact) to address reasonable progress goals set for Mingo and Hercules Glades Class 1 areas.

12.0 COMPREHENSIVE PERIODIC PLAN REVISIONS

40 CFR 51.308(f) requires a state/tribe to revise its regional haze implementation plan and submit a plan revision to EPA by July 31, 2018 and every ten years thereafter. In accordance with the requirements listed in section 51.308(f) of the federal Regional Haze Rule, Missouri commits to revising and submitting this regional haze implementation plan by July 31, 2018 and every ten years thereafter.

The Missouri Department of Natural Resources Air Pollution Control Program is responsible for developing and submitting the required SIP revisions and periodic reports. The plan has been developed and will be maintained in electronic (computer) format as well as in paper copy.

In addition, 40 CFR 51.308(g) requires periodic reports evaluating progress towards the RPGs established for each mandatory Class I area. In accordance with the requirements listed in Section 51.308(g) of the federal rule for regional haze, Missouri commits to submitting a report on reasonable progress to EPA every five years following the initial submittal of the plan. The reasonable progress report will evaluate the progress made towards the RPG for each mandatory Class I area located within Missouri and in each mandatory Class I area located outside Missouri that may be affected by emissions from within Missouri**.** The report will be in the form of a SIP revision.

To establish the criteria in evaluating progress, all requirements listed in 40 CFR 51.308(g) shall be addressed in the plan revision for reasonable progress. These criteria are as follows:

1) Assessment of visibility conditions and changes for each federal Class I area in Missouri;

2) Implementation status of control measures included in plan and a summary of emissions reductions achieved from measures;

3) Analysis of emission reductions by pollutant, identified by source or activity;

4) Assessment of any significant changes in anthropogenic emissions;

5) Assessment of whether current plan is sufficient to meet RPGs; and

6) Review of Missouri's visibility monitoring strategy and any necessary strategy modifications

Figure 12.1 shows a flow chart for 5-year review criteria and actions to be taken if the criteria cannot be met.

All of the required documents (status, summaries, assessments, analysis and reviews will be done by the Missouri Department of Natural Resources Air Pollution Control Program.

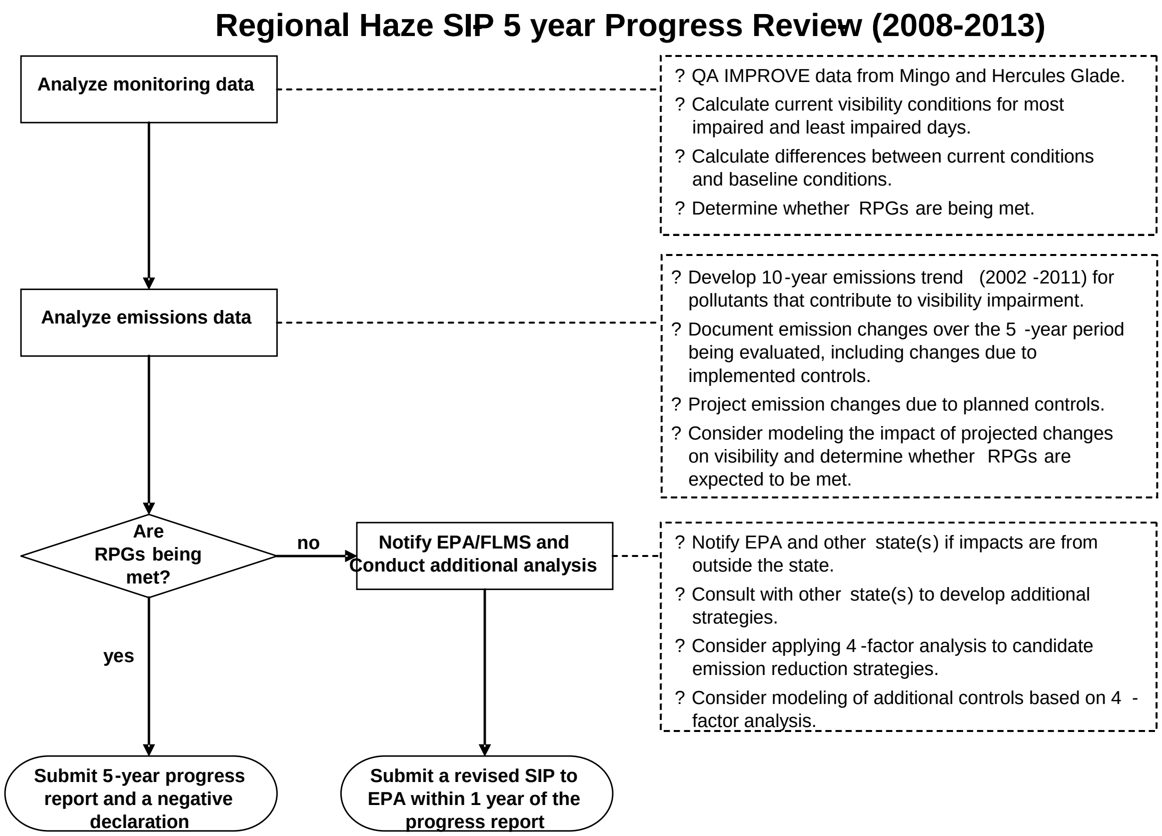

Figure 12.1: 5-Year Progress Review Criteria and Actions

13.0 DETERMINATION OF THE ADEQUACY OF THE EXISTING PLAN

Using the modeling and monitoring as described in this plan, a determination has been made that the plan will continue to meet the goal of showing progress towards reducing visibility. Using the consultation process described in this plan, Missouri's visibility goals have been adequately addressed. In addition, through participation in other states' consultation processes, Missouri's contribution to other states visibility goals is being adequately addressed.

The findings of the five-year progress report as described in Section 12.0 will determine which action is appropriate and necessary. Depending on the findings of the five-year progress report, Missouri commits to taking one of the actions listed in 40 CFR 51.308(h):

1) If Missouri determines that the existing plan requires no further substantive revision in order to achieve established goals, the state will provide the EPA with a negative declaration that further revision of the plan is not needed at this time.
2) If Missouri determines that the existing plan may be inadequate to ensure reasonable progress due to emissions from other states that participated in the regional planning process, Missouri will provide notification to the EPA and the other states that participated in regional planning. Missouri will collaborate with the other states through the regional planning process to address the plan's deficiencies.
3) Where Missouri determines that the current plan may be inadequate to ensure reasonable progress due to emissions from another country, the state shall provide notification, along with available information, to the EPA.
4) Where Missouri determines that the existing plan is inadequate to ensure reasonable progress due to emissions within the state, Missouri shall revise its plan to address the plan's deficiencies within one year.

Modeling and monitoring information will be used and the consultation process described in the plan will be followed in carrying out the scheduled incremental administrative and technical actions required in the plan. Any resulting plan revisions could include a revision to goals, contingency measures, the monitoring strategy, and any other parts of the plan as deemed necessary.

14.0 REFERENCE INFORMATION

14.1 LIST OF REFERENCES

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14.2 LIST OF ACRONYMS AND ABBREVIATIONS

AIRS	Aerometric Information Retrieval System
Alpine	Alpine Geophysics
AOI	Area of Influence
BACT	Best Available Control Technology
BART	Best Available Retrofit Technology
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMx	Comprehensive Air quality Model with Extensions
CASTNet	Clean Air Status and Trends Network
CEM	Continuous Emissions Monitor
CENRAP	Central Regional Air Planning Association
CFR	Code of Federal Regulations
CHIEF	Clearinghouse for Inventories and Emission Factors
CMAQ	Community Multiscale Air Quality
CO	Carbon Monoxide
department	Missouri Department of Natural Resources
dv	deciviews
EC	elemental carbon
EGU	Electric Generating Unit
EIQ	Emission Inventory Questionnaire
EPA	United States Environmental Protection Agency
FLM	Federal Land Manager
ftp	file transfer protocol
GCVTC	Grand Canyon Visibility Transport Commission
IDA	Inventory Data Analyzer
IMPROVE	Interagency Monitoring of PROtected Visual Environments
IPM	Integrated Planning Model
MACC	Missouri Air Conservation Commission
MACT	Maximum Achievable Control Technology
MM5	Fifth-Generation NCAR / Penn State Mesoscale Model
MPS	Multi-Pollutant Standard
MRPO	Midwest Regional Planning Organization
NAAQS	National Ambient Air Quality Standard
NCAR	National Center for Atmospheric Research
NEI	National Emissions Inventory
NH_3	Ammonia
NO_x	Nitrogen Oxides
NO_2	Nitrite
NO_3	Nitrate
NSPS	New Source Performance Standards
NSR	New Source Review
OMC	Organic Mass Carbon
OMH	Organic Mass Hydrogen
PM	Particulate Matter

Pechan	E. H. Pechan & Associates
PMF	Fine Particulate Matter
POG	Policy Oversight Group
ppm	parts per million
PSAT	Particulate Matter Source Apportionment Technology
PSD	Prevention of Significant Deterioration
RACM	Reasonably Achievable Control Measures
RACT	Reasonably Available Control Technology
REMSAD	Regional Modeling System for Aerosols and Deposition
RH	Relative Humidity
RPG	Reasonable Progress Goals
RPO	Regional Planning Organizations
RVP	Reid Vapor Pressure
SEARCH	South Eastern Aerosol Research and Characterization
SIC	Standard Industrial Code
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernel
SMP	Smoke Management Program
SO_4	Sulfate
SO_2	Sulfur Dioxide
STN	Speciated Trends Network
TIP	Tribal Implementation Plan
TPY	Tons Per Year
UCR	University of California-Riverside
UMC	University of Missouri-Columbia
URP	Uniform Rate of Progress
USDA	United States Department of Agriculture
VIEWS	Visibility Information Exchange Websystem
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VOC	Volatile Organic Compound
WIMO	Wichita Mountains Class I Area

14.3 List of Appendices

Appendix A	Regional Haze Program Requirements, 40 CFR 51.308
Appendix B	December 6, 2007 Public Hearing Notice and Certification of Publication of the Notice
Appendix C	Comments and Responses on Plan
Appendix D	MACC Adoption Certification
Appendix E	Central Class I Areas Consultation Plan
Appendix F	CENRAP Technical Support Document
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Appendix I	BART-Eligible Emission Point Information
Appendix J	BART Survey and Supplemental Information
Appendix K	CALPUFF/CALPOST Modeling Files
Appendix L	Refined Meteorological and Land Use Data Sources
Appendix M	Screen-Modeling Analyses
Appendix N	Holcim-Clarksville BART Analysis – April 24, 2008
Appendix O	Holcim-Clarksville BART Analysis – June 12, 2008
Appendix P	Holcim-Clarksville BART Analysis – July 24, 2008
Appendix Q	Holcim-Clarksville SO_2 Control Cost Evaluation
Appendix R	Holcim-Clarksville BART Draft Consent Agreement – August 18, 2008
Appendix S	Holcim-Clarksville BART Final Consent Agreement – April 19, 2009
Appendix T	Guidance for Setting Reasonable Progress Goals under the Regional Haze Program
Appendix U	Consultation Meeting Minutes
Appendix V	Applicable State Rules
Appendix W	CENRAP Regional Haze Control Strategy Analysis Plan
Appendix X	Missouri Smoke Management Plan