Nebraska Department of Environmental Quality
State Implementation Plan
For
Regional Haze
And
Best Available Retrofit Technology (BART)

Nebraska
DEQ

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1 Executive Summary

In amendments to the Clean Air Act (CAA) in 1977, Congress set a national goal to restore national parks and wilderness areas to pristine conditions by preventing any future, and remedying any existing man-made visibility impairment. In 1999, the U.S. Environmental Protection Agency (EPA) finalized the federal Regional Haze Rule, which aims to fulfill the goals set forth in the CAA by the year 2064. The Regional Haze Rule addresses the combined effects of several pollution sources over large geographic areas. It was therefore necessary to use a regional planning approach.

EPA designated five regional planning organizations (RPOs); the Central Regional Air Planning Association (CENRAP) was designated as the RPO representing the central portion of the United States. Since its inception, the State of Nebraska has been actively involved in CENRAP. The Nebraska Regional Haze Plan incorporates data analyses, modeling results, and technical support documents prepared for CENRAP members by various contractors. In addition, CENRAP has served as a platform for consultation between states, tribes, federal land managers (FLMs), and stakeholders.

The federal Regional Haze Rule requires states to submit revisions to their State Implementation Plans by December 17, 2007. The Regional Haze Rule applies to all states that contribute to visibility impairment, even those states that do not have Class I areas.

States are required by 40 CFR 51.308 to set reasonable progress goals for achieving natural visibility conditions, develop a long-term emissions reduction strategy, and maintain a monitoring network and emissions inventory to support regional haze programs. In addition, Section 51.308(e) outlines the requirements for applying Best Available Retrofit Technology (BART) to certain older emission sources that were not previously regulated by the CAA.

In July of 2005, EPA published a revised final rule, including Appendix Y to 40 CFR Part 51 "Guidelines for BART Determinations under the Regional Haze Rule." Nebraska followed these guidelines in its selection of sources that are subject to BART requirements. We further followed these rules when making determinations on control technology requirements. Appendix Y of the guidelines outlines a presumptive emission rate or percent of control for SO_2 and NO_x, for certain types of facilities, unless the state can demonstrate, based on careful consideration of the statutory five factors. The five factors are: cost effectiveness, energy and non-air environmental impacts, existing controls at source, remaining useful life of source, and the degree of visibility improvement which may be reasonably anticipated from the technology. Nebraska has three subject-to-BART emission units at two facilities. One facility, OPPD Nebraska City was not subject to presumptive levels of control; however, NDEQ used the statutory factors as a guide for making the BART determination. For the other facility which has two BART units, NPPD Gerald Gentleman Station, due to unique non-air environmental impacts and cost effectiveness and relative degree of visibility improvement, NDEQ determined presumptive levels of sulfate control were not appropriate and that presumptive levels of nitrate control were appropriate. The BART requirements are outlined in Chapter 10 of this document.

In addition to requiring BART controls at subject facilities, the state also evaluated whether other sources need to be addressed at this time to reach reasonable progress goals. This analysis is referred to as the statutory factor analysis, or four-factor analysis.

Nebraska has no mandatory Class I areas, but in an effort to support the planning process, Nebraska worked through CENRAP to coordinate regional efforts to reduce visibility at Class I areas within the CENRAP states. For areas outside the region, Nebraska consulted with other states that may have required reductions to improve visibility from emissions from Nebraska sources. Nebraska will continue to participate and cooperate in regional efforts to reduce visibility impairment at Class I areas outside its borders by maintaining an IMPROVE visibility monitoring network and emissions inventory, and providing periodic progress reports and SIP revisions as required by the Regional Haze Rule.

2 Background and Overview of the Federal Regional Haze Regulation

2.1 General Background / History of Federal Regional Haze Rule

In amendments to the Clean Air Act (CAA) in 1977, Congress added Section 169 (42 U.S.C. 7491) setting forth the following national visibility goal of restoring pristine conditions in certain national parks and wilderness areas, which it named Class I 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 is a result from specific sources, such as a power plant smoke stack, 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 progress. In 1993, the National Academy of Sciences concluded: *"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 (Commission) to make recommendations to the U.S. Environmental Protection Agency (EPA) for the region affecting the visibility of the Grand Canyon National Park. Following four years of research and policy development the Commission submitted its report to EPA in June of 1996. This report, as well as the many research reports prepared by the Commission, contributed invaluable information to EPA in its development of the federal Regional Haze Rule.

EPA's Final Regional Haze Rule was adopted July 1, 1999, and went into effect on August 30, 1999. The Regional Haze Rule aims at achieving national visibility goals by 2064. This rulemaking addressed the combined visibility effects of various pollution sources over a wide geographic region. This wide-reaching pollution net meant that many states, even those without Class I Areas, would be required to participate in haze reduction efforts. EPA designated five regional planning organizations (RPOs) to assist with the coordination and cooperation needed to address the visibility issue. The Central Regional Air Planning Association (CENRAP) was designated as the RPO to represent those states that make up the midsection of the contiguous United States.

On May 24, 2002 the US Court of Appeals, DC 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 Best Available Retrofit Technology (BART) provisions of the rule, and denied industry's challenge to the haze rule goals of natural visibility and no degradation

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

requirements. EPA adopted revisions to the Regional Haze rule pursuant to the remand. To facilitate the review of this State Implementation Plan (SIP) by the Environmental Protection Agency (EPA), Federal Land Managers (FLM), stakeholders and the public, a guide is provided to identify where the Section 308 Requirements may be found in this document. (See Appendix 2.1)

Appendix 2.1 Section 308 Requirements Crosswalk

3 General Planning Provisions

Pursuant to the requirements of 51.308(a) and (b), Nebraska submits this SIP submission as adopted to meet the requirements of EPA's Regional Haze rules that were adopted to comply with requirements set forth in the Clean Air Act. Elements of this Plan address the Core Requirements pursuant to 40 CFR 51.308(d) and the Best Available Retrofit Technology (BART) components of 40 CFR 50.308(e). In addition, this SIP addresses Regional Planning, State/Tribe and Federal Land Manager coordination, and contains a commitment to provide Plan revisions and adequacy determinations.

Nebraska has adopted this SIP in accordance with Title 115 the Nebraska Administrative Procedures Act and 40 CFR 51.100 - 105. The Nebraska Department of Environmental Quality (NDEQ) provided public notice of the opportunity to comment on the SIP on December 6, 2010. NDEQ provided notice of public hearing on December 6, 2010. NDEQ held a public hearing regarding the SIP on January 21, 2011. All public comments on this proposed SIP, inclusive of those made by the Federal Land Manager (FLM), affected States, and Tribes were addressed and are summarized in Appendix 3.1. A complete copy of the public proceedings, including the affidavit of publication and the hearing transcript may be found in Appendix 3.2.

A copy of this report is available at the NDEQ Offices, 1200 N Street Suite 400; Lincoln, NE 68509-8922 and on-line at www.ndeq.state.ne.us. A notice of this report's availability for review and comment was submitted to the Omaha World Herald for general state-wide publication on or before December 6, 2010, and on the Department's website. In addition, Nebraska specifically made the States of Colorado, South Dakota, Missouri, Minnesota, and Oklahoma aware of its availability.

Appendix 3.1 Public Comments & Responsiveness Summary
Appendix 3.2 Affidavit of Publication

4 Regional Planning

In 1999, EPA and affected States/Tribes agreed to create five Regional Planning Organizations (RPOs) to facilitate interstate coordination on Regional Haze SIP/TIPs. The State of Nebraska is a member of the Central Regional Air Planning Association (CENRAP) RPO. Members of CENRAP are in the geographical areas listed in Table 4.1. Figure 4.1 shows a map of all five regional planning organizations.

Table 4.1 CENRAP Geographical Area*

Arkansas	Iowa
Kansas	Louisiana
Minnesota	Missouri
Nebraska	Oklahoma
Texas	

*Includes both state and tribal areas

Figure 4.1 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 9 States and 3 Tribes from each EPA Region 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 Policy Oversight Group (POG) facilitates communication with Federal Land Managers, stakeholders, the public, and with 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, including stakeholders and the public. Ad hoc workgroups may be formed by the POG to address specific issues. Ultimately, policy decisions are made by the CENRAP POG. However, SIP decisions are left to the individual State.

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 SIP utilizes and refers to data analysis, modeling results and other technical support documents prepared for CENRAP members by contractors and provided through the CENRAP website or file transfer protocol (FTP) site.

By coordinating with CENRAP and other RPOs as well as through direct consultation with other states, Nebraska has worked to ensure that its long term strategy and BART determinations provide sufficient reductions to mitigate impacts of sources from Nebraska on affected Class I areas.

5 State/Tribe and Federal Land Manager Coordination

40 CFR Section 51.308(i) require coordination between States and the Federal Land Managers (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 SIP. NDEQ provided FLMs an early opportunity to comment on the draft BART permits for NPPD and OPPD prior to finalization of the SIP. Nebraska 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).

The State of Nebraska provided FLMs an opportunity for consultation, in person and at least 60 days prior to holding any public hearing on the essential elements of the control strategies of the implementation plan or plan revision.

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 reasonable progress goals
- Recommendations on the development and implementation of strategies to address visibility impairment.

Nebraska sent the draft Best Available Retrofit Technology permits to the FLMs in mid-2008 and again prior to public notice. The FLM comments on the BART permits were addressed. No public hearings were requested on the BART permits. For the proposed Regional Haze SIP hearing, Nebraska notified all interested parties, including the FLMs, affected and nearby states, and Tribes on November 16, 2010, via email. Copies of all appendices were made available upon request via CD. This proposed SIP and appendices were also made available on our website.

Comments received from the Federal Land Managers on the proposed SIP were addressed. Copies of the letters received from the FLMs are attached. A summary of responses to their comments are included in Appendix 3.1 and in the BART response to comments found in Appendix 10.8 to this plan.

Nebraska will continue to coordinate and consult with the Federal Land Managers 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. The FLMs must be consulted in the following instances:

- Development and review of implementation plan revisions
- Review of 5-year progress reports
- Development and implementation of other programs that may contribute to impairment of visibility in Class I areas.

6 Assessment of Baseline and Current Conditions and Estimate of Natural Conditions in Class I Areas

The goal of the Regional Haze Rule is to restore natural visibility conditions to the 156 Class I areas identified in the 1977 Clean Air Act Amendments. Section 51.301(q) defines natural conditions: "Natural conditions include naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration." Regional Haze SIPs must contain measures that make "reasonable progress" toward this goal by reducing anthropogenic emissions that cause haze. Nebraska does not have any Class I areas.

This chapter is provided as background information to support the technical analyses presented throughout this document.

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, and
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 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 IMPROVE monitoring data for 2000 through 2004 and can be thought of as "current" visibility conditions for this initial planning period. The comparison of initial baseline conditions to natural visibility conditions indicates the amount of improvement necessary to attain natural visibility by 2064.

Each state must estimate natural visibility levels for Class I areas within its borders in consultation with federal land managers and other states [40 CFR 51.308(d)(2)]. "Current conditions" are assessed every five years as part of the SIP review where actual progress in reducing visibility impairment is compared to the reductions committed to in the SIP. EPA's *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Program* (2) 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 (3). 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, LA) with seven Class I areas, and "West" (NE, KS, OK, TX) with three Class I areas. In the two equations, only sulfate and organic carbon have different values, but the calculated deciview difference is significant.

In the guidance, EPA also provides that states may use a "refined approach" to estimate the values that characterize the natural visibility conditions of the Class I areas. The purpose of such a refinement would be to provide more accurate estimates with changes to the extinction algorithm that may include the concentration values, factors to calculate extinction from a measured particulate species and particle size, the extinction coefficients for certain compounds,

geographical variation (by altitude) of a fixed value, and the addition of visibility pollutants. States can choose between the default and refined equations. One equation is used to calculate baseline and current conditions of visibility due to haze-causing pollutants and, with natural concentrations of the same pollutants; the same equation is used to calculate natural visibility.

The old (default) algorithm:

b_{ext} = 3 □ *f (RH)* □ *[Sulfate]*

+ 3 □ *f (RH)* □ *[Nitrate]*

+ 4 □ *[Organic Carbon]*

+ 10 □ *[Elemental Carbon]*

+ 1 □ *[Fine Soil]*

+ 0.6 □ *[Coarse Mass]*
+ 10

The new (refined) algorithm:
(Differences from the default are in bold)

b_{ext} = **2.2 □ fs (RH) □ [Small Sulfate] + 4.8 □ fL(RH) □ [Large Sulfate]**

+ 2.4 □ fs (RH) □ [Small Nitrate] + 5.1 □ fL(RH) □ [Large Nitrate]

+ 2.8 □ fs (RH) □ [Small Organic Carbon] + 6.1 □ fL(RH) □ [Large Organic Carbon]

+ 10 □ [Elemental Carbon]

+ 1 □ [Fine Soil]

+ 1.7 □ fss(RH) □ [Sea Salt]

+ 0.6 □ [Coarse Mass]
+ Rayleigh Scattering (Site Specific)
+ 0.33 □ [NO_2 (ppb)]

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 [40 CFR 51.308(d)(2)]. Nebraska consulted with other CENRAP states as those states assessed baseline and natural visibility conditions in their respective Class I areas.

7 Monitoring Strategy

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. The monitoring strategy relies, in large part, upon participation in the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. The IMPROVE website is located at http://vista.cira.colostate.edu/improve/ .

7.1 Current Monitoring Strategy

7.1.1 Measuring Visibility Data

Shortly after creation of the Central Regional Air Planning Association (CENRAP), the organization's 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 entire 9 state CENRAP region. Between 2000 and 2003, five more IMPROVE sites and 15 IMPROVE Protocol sites (i.e., sites not managed by IMPROVE directly, but by individual government or tribal organizations) were established in the CENRAP region.

In conjunction with CENRAP and EPA Region 7, Nebraska installed one IMPROVE protocol sampler at Nebraska National Forest County near Halsey, NE in the central part of the State, and another at Crescent Lake National Wild Life Refuge in the Panhandle of the state. A third IMPROVE Protocol sampler in Nebraska is operated independently in Thurston County, by the Omaha Tribe of Nebraska.

7.1.1.1 Nebraska National Forest

The IMPROVE Protocol site at Nebraska National Forest near Halsey, NE is located in the Sandhills of central Nebraska. The 90,000 acre forest area was first established in 1902 by Charles Bessey, a University of Nebraska Botanist, and is known to be the world's largest man-made forest. In addition to forest land, the area is characterized by rolling sand dunes covered with native grasses. The area is known for wildlife, including white tailed and mule deer, antelope, turkey, sharp-tailed grouse and the greater prairie chicken.

The primary purposes of the site are to evaluate regional haze and the contributions that may impact Federal Class I areas in National Parks and Wilderness Areas. The Nebraska National Forest site is regional in scale and the purpose is designed to understand background and transport of pollution into and out of the state. The monitor measures on a continuous basis for fine particulate matter ($PM_{2.5}$) and speciates the particles to understand the composition.

Figure 7.1 Nebraska National Forest IMPROVE Protocol Site

County:	Thomas County (pop. 851)
Latitude:	41.8888
Longitude:	-100.3387
Elevation:	883m above MSL
Region:	Central Great Plains
Dates:	7/2002 – Present

7.1.1.2 Crescent Lake Wild Life National Refuge

The site at Crescent Lake Wild Life National Refuge in the panhandle of Nebraska serves as another background and transport site for evaluating background levels in rural Nebraska as well as understanding regional transport patterns. Like the Nebraska National Forest site, the monitor measures on a continuous basis for fine particulate matter ($PM_{2.5}$) and speciates the particles to understand the composition.

This isolated refuge consists of 45,818 acres of rolling sandhills, the largest continuous sand dune area in America. The grass covered dunes were created from the windblown sands of an ancient sea.

The twenty-one lakes and numerous ponds are supported by an aquifer lying below the hills. The grasslands range from the densely vegetated meadows to the sparsely covered areas and support a wide variety of wildlife.

Figure 7.2 Crescent Lake Wild Life National Refuge IMPROVE Protocol Site

County:	Garden County (pop. 2460)
Latitude:	41.7627
Longitude:	-102.4336
Elevation:	1207m above MSL
Region:	Central Great Plains
Dates:	7/2002 - Present

7.1.1.3 Omaha Tribe

The Omaha Tribe also operated an IMPROVE Protocol sampler in Thurston County in northeast Nebraska. The monitor operated on a continuous basis and measured the same constituents as the other two monitors. For a period of time the Omaha Tribe also operated a nephelometer.

Figure 7.3 Omaha Tribe IMROVE Protocol Monitor

County:	Thurston County (pop. 6936)
Latitude:	42.1487
Longitude:	-96.4318
Elevation:	429m above MSL
Sponsor:	TRIBE
Region:	Central Great Plains
Dates:	8/2003 - uknown

7.1.2 Characterizing Visibility Data

The State of Nebraska does not have any mandatory Class I Federal areas. In accordance with 40 CFR 51.308(d)(4)(iii), Nebraska, along with other states that do not have Class I areas, must establish procedures by which monitoring data and other information are used in determining the contribution of emissions from within the state to regional haze visibility impairment at affected mandatory Class I areas in other states. The procedures Nebraska used were established through the work completed by contractors retained by CENRAP, and are only briefly described here.

IMPROVE monitoring data for the 2000-2004 period was used to define baseline, natural, and 2018 conditions for each of the Class I areas. PM_{10} was speciated into six components (sulfate, particulate nitrate, organic carbon, elemental carbon, soil, and coarse mass) which were used to develop relative response factors (RRFs) between current and predicted concentrations for each component. The RRFs were multiplied by current baseline values to estimate future concentrations. The visibility improvements for 2018 were then calculated using the original or new IMPROVE equation. Additional information about these analyses can be found in Chapter 4 of the Technical Support Document (TSD) prepared by ENVIRON and the Causes of Haze Assessment work performed by Sonoma Technology for CENRAP (Appendix 9.1 and Appendix 10.10).

Nebraska also relied upon source apportionment modeling (CAMx PSAT) in determining the State's contribution to other Class I areas. This type of modeling provides the best available estimate of the potential visibility impacts Nebraska may have on various surrounding Class I areas in 2018. Source apportionment modeling for the CENRAP region is outlined in Chapter 11 of this document.

7.1.3 Data Validation and Reporting

The filter samples from all IMPROVE modules from the three IMPROVE-protocol sites in Nebraska are sent for analysis to the University of California in Davis (UC-D), and the resultant data are subjected to preliminary review and quality assurance/quality control (QA/QC) procedures.

After validation, data from the three IMPROVE-protocol sites in Nebraska are sent by UC-D for posting to the IMPROVE website and the Visibility Information Exchange Web System (VIEWS) website [http://vista.cira.colostate.edu/views/].

7.2 Special Monitoring Studies

CENRAP, in cooperation with member states and tribes, studied the impacts of ammonia on visibility impairment in the CENRAP region. Preliminary monitoring studies and monitoring data analysis suggest that ammonia could contribute to visibility impairment in the CENRAP geographical area. CENRAP conducted studies to provide more information on ammonia emission inventories. Given the extent of estimated ammonia emissions from natural and man-made sources such as fertilizer application, CENRAP determined that there was enough excess ammonia in the air such that it would not be feasible to control fine particle formation by controlling ammonia emissions. Rather, control of the other chemicals that combine with ammonia, such as nitrates or sulfates, is more conducive to reducing fine particle formation and consequent visibility impairment.

During two measurement periods in 2002 (August 24–October 23 and November 18–December 31), an intensive study was conducted to characterize ambient fine particulate matter ($PM_{2.5}$) at the Sac and Fox Nation IMPROVE Protocol site in Reserve, Kansas. The sampling station was configured in the same manner as the St. Louis, Missouri Supersite. Selected semi-continuous monitors remained in operation during the six-week interim period. This special study was funded by CENRAP and EPA Region 7. Daily 24-hour mass reconstructions demonstrated the episodic nature and seasonal variations of sulfate (summer/fall) and nitrate (fall/winter). Ion balances for 24-hour sampling periods were consistent with conditions favorable for formation of ammonium nitrate. A sulfate transport episode was captured as well as elevated local ammonia levels possibly associated with seasonal application of anhydrous ammonia to corn and soybean fields.

From November 1, 2003 through June 28, 2006, the Sac and Fox Nation also operated a passive ammonia monitoring station for a CENRAP ammonia monitoring project. Denuder-based gas phase ammonia, nitric acid, and sulfur dioxide were monitored at the Reserve, Kansas site and six other sites within the CENRAP region. Twenty-four hour samples were collected on a one in-six day schedule. The denuder-based samples were analyzed by the Illinois State Water Survey Laboratory. IMPROVE Protocol samplers were in operation at all but one of the CENRAP ammonia study sites. This special ammonia study was conducted to collect data for evaluation of the role of ammonia in regional haze formation in the CENRAP region.

7.3 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 federal 103 grant funding. Data from the IMPROVE Protocol sites in Nebraska will be used to characterize and model conditions within the State of Nebraska. Data from IMPROVE monitors will be used to compare visibility conditions in Nebraska to regional haze visibility impairment at Class I areas affected by emissions from Nebraska to satisfy requirements of 40 CFR 51.308(d)(4)(i). The State of Nebraska will evaluate the monitoring network periodically, including an evaluation of changes in technology and the need for new monitors. With continuation of adequate funding, the network will be reconfigured as necessary to enable assessment of reasonable progress toward goals for each of mandatory Class I area potentially affected by emissions from within the State of Nebraska. This assessment will be done as part of the monitoring network assessment required by federal regulation 40 CFR Part 58.

8 Emissions Inventory

Nebraska is required by 40 CFR 51.308(d)(4)(v) to provide a statewide emissions inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area(s). Nebraska worked with CENRAP on the compilation of a statewide inventory using EPA guidance on inventorying all sources of anthropogenic and biogenic emissions. Nebraska's emissions inventory for 2002 may be found in Appendix 8.1.

8.1 2002 Emissions Inventory Summary

As specified in the applicable EPA guidance, the pollutants inventoried for Nebraska include volatile organic compounds (VOCs), nitrogen oxides (NO_x), fine particulates ($PM_{2.5}$), coarse particulates (PM_{10}), ammonia (NH_3), and sulfur dioxide (SO_2). An inventory was developed for the baseline year 2002; a summary of those inventory results is presented in Tables 8.1 and 8.2.

Table 8.1 2002 Nebraska Emissions Summary, by Pollutant and Source Category

Source Category	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
	Tons per Year				
Point [2]	7,274	58,619	73,487	13,105	4,638
Area [3]	66,769	15,023	7,748	447,703	83,852
On-Road [4]	43,113	61,850	1,822	1,277	930
Non-Road [5]	24,882	119,568	11,011	7,491	6,785
Fires [6] **(Ag & Prescribed)**	3,204	679	268	5,057	3,956
Nebraska Total	**145,242**	**255,739**	**94,336**	**474,633**	**100,161**

Table 8.2 2002 Nebraska Ammonia (NH_3) Emissions Summary, by Source Category [7]

Source Category	NH_3 (TPY)
Livestock	96,983
Fertilizer Application	64,443
Biogenics (Soil)	7,829
Point	800
On-Road	1,521
Non-Road	320
Miscellaneous	7,912
Nebraska Total	**179,808**

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[2] Point Source Information taken from Table 2c Summary of Point Source Emissions by State and Pollutant *Pechan, Refinement of CENRAP's 2002 Emissions Inventories (August 31, 2005)*

[3] Area Source Information taken from Table 2b Summary of Area Source Emissions by State and Pollutant *Pechan, Refinement of CENRAP's 2002 Emissions Inventories (August 31, 2005)*

[4] On Road Information taken from Table 2e Summary of On Road Source Emissions by State and Pollutant *Pechan, Refinement of CENRAP's 2002 Emissions Inventories (August 31, 2005)*

[5] Non Road Information taken from Table 2d Summary of Non Road Source Emissions by State and Pollutant *Pechan, Refinement of CENRAP's 2002 Emissions Inventories (August 31, 2005)*

[6] Fire information taken from Table 2-1 and Table 2-2 of *Research and Development of Planned Burning and Emission Inventories for the Central States Regional Air Planning Association (July 2004)*

[7] Ammonia information taken from Table B-1 Appendix B of *Research and Development of Ammonia Emission Inventories for the Central States Regional Air Planning Association (October 2003)*

Methodologies for the 2002 emissions inventory are documented in the Appendix 8.3. Nebraska, along with the other members of CENRAP agencies submits emission inventory information to EPA for purposes of building the National Emissions Inventory Report. This information formed the basis for the CENRAP 2002 emissions inventory. Sonoma Technology supplemented the National Emissions Inventory (NEI) data with area (non-point) source inventories specifically developed for CENRAP. These inventories addressed agricultural and prescribed burning, on-road and non-road mobile sources, agricultural and livestock dust, and agricultural ammonia. Information on fires was obtained from the *Research and Development of Planned Burning and Emission Inventories for the Central States Regional Air Planning Association (July 2004)* found in Appendix 8.3.

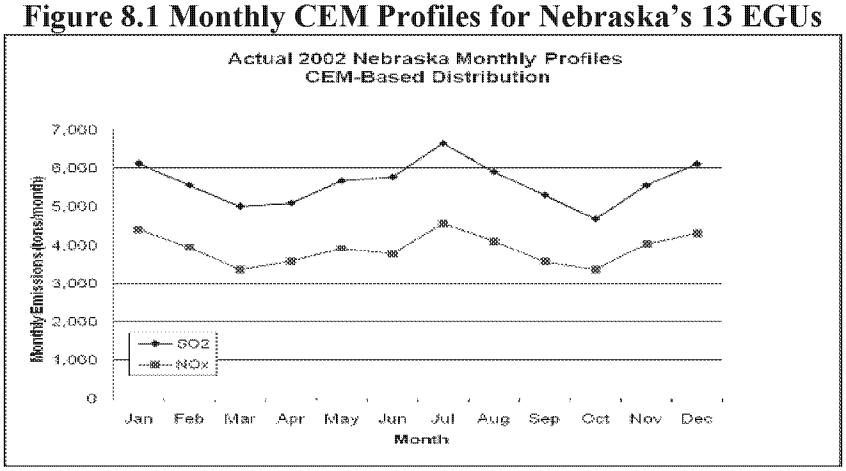
8.1.1 Point Source Emissions

NDEQ conducts an annual emissions inventory of all Class I major sources. Synthetic minor sources are required to submit emissions inventories at least once every three years or as otherwise specified in their permit in accordance with Title 129 Chapter 6. This cycling of synthetic minor sources is to ensure a complete inventory once at least every three years. NDEQ followed internal quality assurance procedures and submitted the data to EPA for the 2002 national emissions inventory. Following submission to the national emissions inventory, CENRAP provided additional quality assurance and revision opportunities for data improvement. E.H. Pechan & Associates, (Pechan) through a contract with CENRAP, obtained the Nebraska point-source inventory and worked with NDEQ and the Nebraska local agencies to make corrections and to fill gaps where necessary.

8.1.1.1 Electric Generating Units

The majority of visibility-impairing point source emissions in Nebraska currently come from the electric utility sector. This sector represented 92% of the reported point source SO_2 emissions and 82% of the point source NO_X emissions for the 2002 inventory year. Nebraska's utility system is structured in a manner where power is provided to businesses and citizens through public (municipal or rural) utility districts. The largest units are found in the eastern part of Nebraska and in the panhandle of the state. Mid-size units servicing moderate sized communities are located throughout the state. In 2002, the continuous emission monitors (CEMs) from the 13 units reporting to the EPA Clean Air Markets Division averaged between 5,000-6,000 tons of SO_2 per month and about 4,000 tons of NO_X per month.

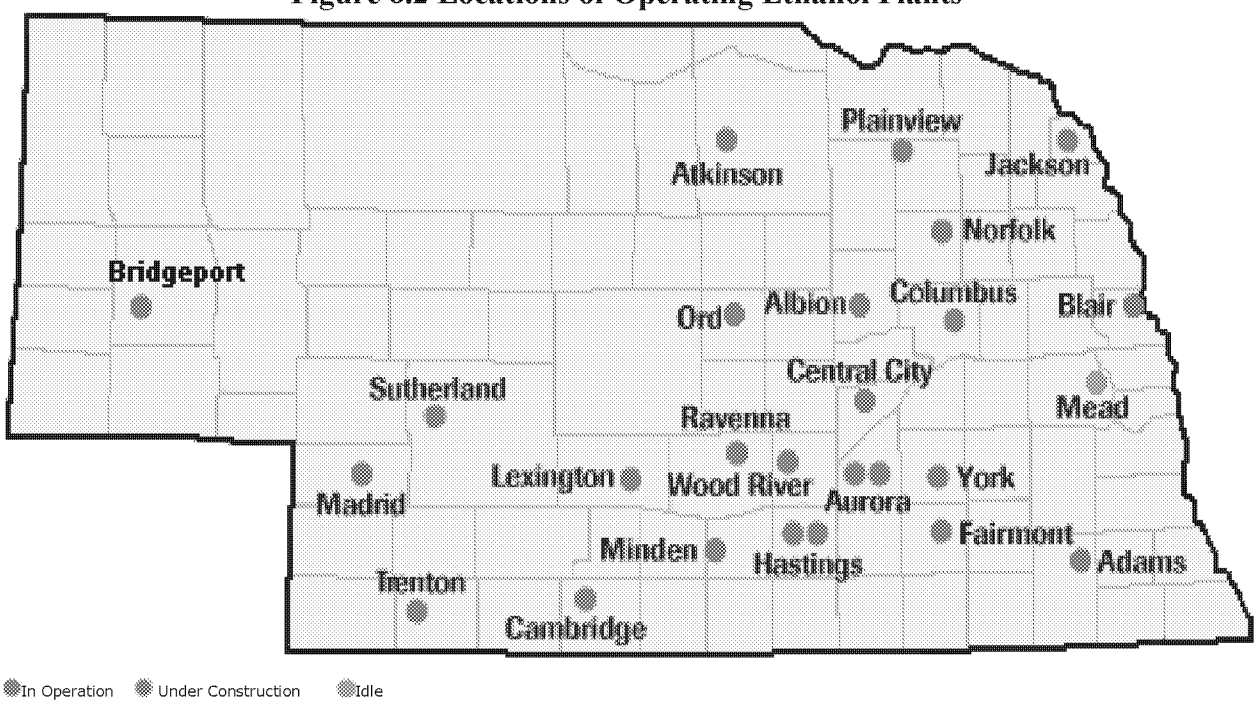
Figure 8.1 Monthly CEM Profiles for Nebraska's 13 EGUs



8.1.1.2 Fuel Ethanol Manufacturing Facilities

In 2002, there were six ethanol plants in operation in Nebraska. From 2002-2008 , due to a number of factors, production capacity expanded to where 24 plants are currently operating, with a production capacity of over 2 billion gallons per year.[8] A map of the locations is shown in Figure 8.2.[9] Since 2008, expansion of the fuel ethanol industry in Nebraska has slowed dramatically. The actual emission rate of NO_x for these plants is relatively low compared to EGUs. The majority of ethanol plants are fueled with natural gas and report NO_x emissions well below 100 tons per year. Four plants have the capability to be fueled by coal. The largest coal fired ethanol plant reported NO_x emissions around 200 tons per year. One facility is partially fueled by landfill gas. One plant that is currently idle has the capacity to be fueled by methane that is generated from waste collected from a co-located feedlot. Many are exploring alternatives fuel scenarios to maximize efficiency of operations. Nebraska does not anticipate visibility impacts due to the operation of additional facilities as those facilities will likely be subject to the Prevention of Significant Deterioration (PSD) program.

Figure 8.2 Locations of Operating Ethanol Plants



8.1.2 Area Source Emissions

EPA treats each class of stationary area sources collectively by county. Neither EPA nor NDEQ can feasibly collect specific information from each area source emission point; therefore EPA provides estimates over larger regions based upon factors such as population. Residential heating is an example of a stationary area source. The area-source inventory for 2002 builds on EPA-provided estimates for area-source emissions. It includes emissions estimates that NDEQ and CENRAP prepared and data from the national emissions inventory to fill gaps.

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[8] From Nebraska Ethanol Board http://www.ne-ethanol.org/industry/ethplants.htm.
[9] From Nebraska Ethanol Board http://www.ne-ethanol.org/industry/ethplants.htm.

Sonoma Technology prepared the following reports which are referenced in the Technical Support Document (Appendix 9.1) for CENRAP and found in Appendix 8.3:

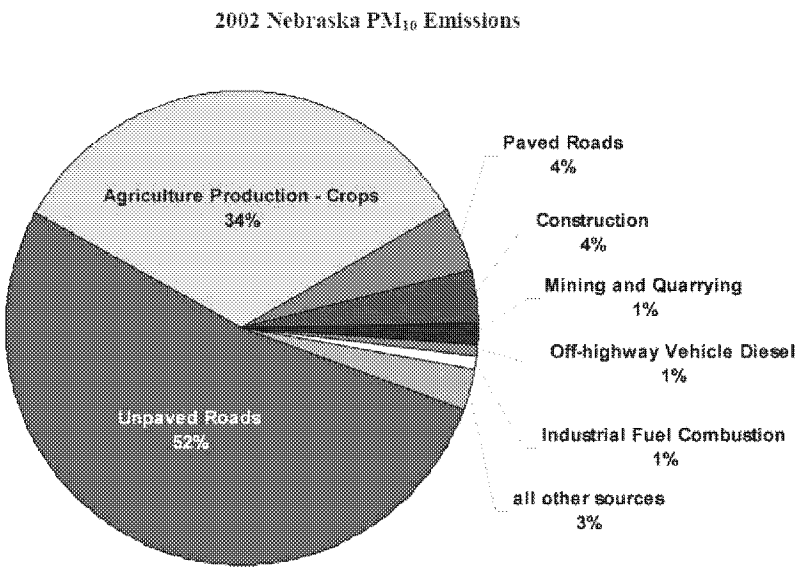
- *Research and Development of Planned Burning Emission Inventories for the Central States Regional Air Planning Association (July 30, 2004),*
- *Emission Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States (October 28, 2004),* and
- *Research and Development of Ammonia Emission Inventories for the Central States Regional Air Planning Association (October 30, 2003).*

The Sonoma reports were used to inform the bases of the prescribed burning, agricultural dust, and ammonia emissions inventories for CENRAP.

Under contract with CENRAP, Pechan consolidated the area-source inventories from these various inventory sources, conducted additional quality assurance, and worked with states to revise this consolidated inventory. Two documents referenced in Appendix 9.1 describe the work of Pechan in detail: *The Consolidation of Emissions Inventories (April 28, 2005)* and *Refinement of CENRAP's 2002 Emissions Inventories (August 31, 2005*), both may also be found in Appendix 8.3. University of California at Riverside (UCR), under contract with CENRAP, removed selected sources from the consolidated area inventories to process them as separate subcategories. UCR created these subcategories to allow specialized processing within the Sparse Matrix Operator Kernel Emissions (SMOKE) model in anticipation of particulate source apportionment within the Comprehensive Air Quality Model with extensions (CAMx).

Area sources account for the majority of the Nebraska PM_{10} emission inventory at 94%. As Figure 8.3 shows, unpaved roads comprise 52% of the PM_{10} emissions, 34% come from crop production.[10] These values are based on the 2002 National Emissions Inventory.

Figure 8.3 Compositions of PM_{10} Emissions



[10] Nebraska Air Quality Report 2005-2006.

Area sources account for approximately 46% of the total anthropogenic VOCs emitted in the state of Nebraska. The top VOC area source sectors include: solvent utilization, storage and transport, residential fuel combustion, and waste disposal and recycling.

Area Source NO_X and SO_2 emissions are relatively small portions of the overall NO_X and SO_2 emissions from the state. Less than 6% of the total NO_X emissions and approximately 8% of the total SO_2 emissions come from area sources. The top sectors include residential, industrial, commercial/institutional combustion, and storage and transport.

8.1.3 On-road Source Emissions

CENRAP developed the on-road mobile source emissions inventory for 2002 with contractor support. For all counties in Nebraska and elsewhere throughout the CENRAP region, Sonoma Technology provided vehicle miles traveled data for all months of 2002 and MOBILE6 input files only for the months of January and July 2002, using the methods and data described in the report *Emissions Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States* (October 28, 2004), referenced in Appendix 8.3. CENRAP contractors then prepared MOBILE6 input files for the remaining months of 2002 and processed the mobile emissions using the MOBILE6 model within the SMOKE framework. The two sets of results from the SMOKE process were then merged together to obtain an on-road mobile source emissions file for the entire CENRAP region.

8.1.4 Non-road Source Emissions

The non-road source emissions category includes aircraft operations, marine vessels, recreational boats, railroad locomotives, and a broad category of other equipment ranging from large construction equipment to lawn equipment. Calculation methods for emissions from non-road engine sources are based on information about equipment population, engine horsepower, load factor, emission factor, and annual usage.

Sonoma Technology, under contract to CENRAP, used the NONROAD model to prepare and develop broad emissions estimates for the non-road mobile source 2002 emission inventory. Sonoma Technology documented the methods and data used to generate the 2002 emissions inventory in the report *Emissions Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States (October 28, 2004)* referenced in Appendix 8.3.

Pechan consolidated the estimates of Sonoma Technology with those of EPA to generate the full non-road emissions inventory. In the process of consolidating the emissions estimates, Pechan assured quality of the data and worked with NDEQ to make necessary corrections before creating SMOKE model formatted files. The local air agency, Lancaster County Health Department (LLHD) provided its own non-road inventory for Source Classification Code (SCC) 2260000000 (Off-highway Vehicle Gasoline, 2-Stroke: 2-Stroke Gasoline except Rail and Marine: All). Pechan removed inventories for SCCs starting with 226 in Lancaster County to correct double-counting of emissions. This adjustment was made by Pechan for Base02b modeling. Pechan made specific corrections to the fuel oxygenate content used in the NONROAD model. Two documents referenced in Appendix 8.3 describe Pechan's work: *The Consolidation of Emissions Inventories (April 28, 2005)* and *Refinement of CENRAP's 2002 Emissions Inventories (August 31, 2005)*.

Of all non-road categories, non-road diesel engines made up the majority of the SO_2 and NO_x emissions for the nonroad sector. Non-road sources are the second highest source of SO_2 emissions in Nebraska, yet comprise only about 11.6% of the total SO_2 inventory. However, non-road NO_x emissions are 47% of the statewide total for non-biogenic sources and are the largest sector for this pollutant, at more than double the total from all point sources combined.

8.1.5 Biogenic Source Emissions

EPA calculates biogenic emissions based on land use data that characterize types of vegetation as county-total or grid-cell values.

NDEQ's biogenic source emissions were estimated through the use of CENRAP's contractor who ran the Biogenic Emissions Inventory System 3 (BEIS3) model within the SMOKE framework to generate a biogenic emissions inventory. The BEIS3 system derives estimates of biogenic gas-phase emissions from land-use information, emissions factors for different plant species, and hourly meteorological data on a coordinate grid. The technical support document found in 9.1 describes the development of the biogenic emissions inventory.

Nebraska's Biogenic Emissions are found in Table 8.3:

Table 8.3 Nebraska 2002 Biogenic Emissions Inventory

Source Category	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$	NH_3
	Tons per Year					
Biogenic	533,705	39,446	0	0	0	7,829

8.2 2005 Emissions Inventory and Periodic Updates

States are required by 40 CFR 51.308(d)(4)(v) to include in their SIPs a commitment to update their statewide emissions inventories periodically. Nebraska's Emissions Inventory for 2005 is the most recent state-wide emissions inventory available. This inventory is available on EPA's website at **http://www.epa.gov/ttn/chief/eiinformation.html**.

Nebraska tracks air emissions over time as required by current EPA regulations and the Air Emissions Reporting Rule (AERR). This federal rule, proposed in December 2005 and finalized in December 2008, consolidates the current emission inventory reporting requirements, and will require that emissions be reported every three years from the following source categories in all parts of the State, excluding sources located on tribal lands:

- Point
- Area
- On-road mobile
- Nonroad mobile

In addition, all visibility-impairing pollutants are required to be included for the reportable categories listed above. These pollutants will include NO_x, SO_2, PM_{10}, $PM_{2.5}$, VOCs, and NH_3. The rule requires that starting in 2009, emissions reports will be due 12 months after the end of the year. The rule can be found at: http://www.epa.gov/ttn/chief/aerr/.

Nebraska intends to follow the reporting requirements of the AERR where funding and staffing allow. We commit to updating its point source emissions inventory annually and to analyze sectors identified in the regional haze planning process that need improvement on a periodic basis.

In the past, due to available resources, Nebraska chose to utilize the EPA-generated nonpoint, on-road, and nonroad inventories when available. It is anticipated that practice will continue unless an error is noted in the EPA generated inventory that requires correction or there is another reason for NDEQ to generate the information. Nebraska will work with EPA to correct any errors in the aforementioned inventories.

8.3 2018 Predicted Emissions Inventory

The 2002 emissions were grown to year 2018, primarily using the Economic Growth Analysis System (EGAS6), MOBILE 6.2 vehicle emission modeling software, and the Integrated Planning Model (IPM) version 2.93 for electric generating units (EGUs). Again, this work was done through CENRAP contractor support. Table 8.4 is a summary of those inventory results. The complete 2018 emissions inventory is submitted as Appendix 8.2. The 2018 emissions for most source categories were based on projections of the 2002 inventory assuming growth and "on the books" control. The 2018 emissions for Electrical Generating Units (EGUs) were based on simulations of the IPM that took into the account the effects of the Clean Air Interstate Rule (CAIR) on emissions from EGUs in CAIR states using an IPM realization of a CAIR cap-and-trade program.

At the time modeling was conducted, Best Available Retrofit Technology (BART) decisions had not been made. Regardless, reductions anticipated from BART controls for electric generating units (EGU) in Oklahoma, Arkansas, Kansas, and Nebraska were included in projections of 2018 emissions before the BART decisions were complete. These anticipated reductions were based on actual operating conditions and estimated control efficiencies from utilities.

Newly permitted coal-fired utilities were also included in 2018 projections. Therefore, two newly permitted units in Nebraska have been factored into the projections. The permitted allowable emissions were included into the projections. Conservatively, none of new units the IPM model projected to be installed, but not currently planned or permitted, were removed from the simulation. This is likely to project higher than needed allowable emissions, because the majority of the additional power that is projected to be needed is already factored in with the cleaner, newly permitted facilities. It is expected that with the new, cleaner units coming online, older units will be relied upon less.

To correct the 2018 projections to account for the BART decisions, Table 8.5 has been updated. NDEQ also noted that other states in the MANE-VU region used a 2018 projection of 73,629 tons SO_2 per year. That value was obtained from IPM v 2.1.9.

Some source categories were held constant between 2002 and 2018 because either stagnant growth was deemed appropriate or insufficient data was available to adequately project future growth or controls. These categories include: biogenic VOC and NO_x emissions, windblown dust, and emissions from fires.

Table 8.4 Actual SO_2 Emissions from EGUs (Tons per Year)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Gerald Gentleman Station	31,297	32,152	31,089	32,035	28,171	31,135	28,815	31,362	31,931	29,741	
Whelan Energy Center	2,008	2,007	2,152	2,352	2,563	2,330	2,207	2,229	2,001	2,301	
Lon D Wright Power Plant	1,088	978	1,017	1,183	1,332	1,401	1,708	1,958	1,250	1,206	
Nebraska City Station	16,205	12,820	15,052	15,593	17,550	14,994	14,173	17,498	19,074	14,296	
North Omaha Station	11,799	11,509	11,730	16,125	16,705	14,315	14,749	15,012	13,159	10,515	
Platte	2,436	2,250	2,194	2,158	2,476	2,637	2,641	3,086	2,679	2,365	
Sheldon	5,410	5,624	4,478	4,768	4,878	4,403	4,627	4,552	5,395	3,758	
	70,243	**67,340**	**67,712**	**74,214**	**73,675**	**71,215**	**68,920**	**75,697**	**75,489**	**64,182**	**70,869**

The average SO_2 emissions for the last 10 years from the coal fired power plants have been 70,869 tons per year. Emissions have been within 7-10 % of that tonnage since 2001, with the low being in 2010. According to the US Census the population in Nebraska grew 6.7% from 2000 – 2010. Assuming that the population grows another 6.7% from 2010 to 2018, and that there is a commensurate growth in EGU emissions, it is reasonable to anticipate the EGU point source SO_2 contribution to be 75,617 tons per year in 2018. If EGU emissions contribute 92% overall, SO_2 point source emissions would be anticipated to be 82,193 tons per year in 2018.

Table 8.5 2018 Nebraska Projected Emissions Summary, by Pollutant and Source Category

Source Category	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
	Tons per Year				
Point	13,344	56,190	82,193	18,654	8,596
Area	78,417	17,737	9,793	303,578	56,193
On-Road	18,862	19,702	236	432	432
Non-Road	14,611	50,972	226	3,269	2,974
Fires	3,204	679	268	5,057	3,956
Biogenic	533,705	39,446	0	0	0
Totals	**660,868**	**185,040**	**92,716**	**335,012**	**76,610**

Methodologies used to develop the non-SO_2 2018 emissions inventory are documented in the CENRAP Technical Support Document found in Appendix 9.1.

Table 8.6 presents percent changes in the inventory between 2002 and 2018.

Table 8.6 2018 Percent Changes in Nebraska Emissions 2002 to 2018, By Pollutant and Source Category

VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Tons per Year				
83%	-4%	12%	42%	85%
17%	18%	26%	-32%	-33%
-56%	-68%	-87%	-66%	-54%
-41%	-57%	-98%	-56%	-56%
0%	0%	0%	0%	0%
0%	0%	N/A	N/A	N/A
-12%	-43%	-1.7%	-30%	-28%

8.3.1 Discussion of 2018 Predicted Emissions Inventory

8.3.1.1 Volatile Organic Compounds

Although VOC emissions from area and point sources are projected to grow by 2018, the on-road and non-road sectors are expected to decrease due to fleet turnover and improvement in efficiency of engines. Therefore, overall VOCs are expected to decrease state-wide by 12% by 2018. Furthermore, as evidenced in the zero-out modeling done by ENVIRON and UCR for CENRAP to measure the impact of VOCs from BART-eligible facilities to Class I areas, VOC is not anticipated to be a large contributor to visibility impairment from point sources in the Class I areas surrounding Nebraska. When VOCs were zeroed out, the maximum improvement was less than 0.25 Δdv at any Class I area. Nebraska's VOC emissions inventory is the smallest of all 9 states in the CENRAP region in both 2002 and 2018, so it follows that Nebraska's VOCs would likely have less impact than other states. Therefore, VOCs were not considered for reductions.

8.3.1.2 Nitrogen Oxides

For the point source sector, reductions in NO_X by 2018 were predicted, primarily through BART controls. Even with the projected growth predicted by the models for 2018, NDEQ expects that the point source sector will achieve at least an overall reduction of 4% for NO_X emissions. However, it is anticipated that the NO_X reductions achieved in practice may be more than what is predicted through the model. Table 8.7 details the NO_X reductions anticipated from installation of BART controls at the three BART subject units in Nebraska.

Table 8.7 Potential NO_x Emission Reductions in BART-Subject Units

Subject to Bart Unit	Baseline Emissions (BART assumption)	2002 Actual Emissions[11] (CENRAP baseline)	Permitted BART Emissions	Maximum Expected Reduction	Max Percent Reduction	Reduction from CENRAP baseline	Percent Reduction
	Tons per Year of NO_x						
OPPD Nebraska City #1	17,020	8,132	6,827	10,193	59.9%	1,305	16.0%
NPPD Gerald Gentleman Station #1 & 2	30,243	21,878	15,287	14,956	49.5%	6,591	30.1%
Total	47,263	30,010	22,114	25,149	53.2%	7,896	26.3%

The baseline emissions (BART assumption) were established using the maximum 24-hr emissions over a three year period (2001-2003), assuming continuous maximum operation to establish the maximum potential emissions. The units were then assumed to be able to meet at least BART presumptive levels for NO_x which are 0.23 lb/MMBtu. The CENRAP baseline is based on actual emissions from emission year 2002.

These three units represent 51.1% of the total actual NO_x emissions from 2002 (30,010 tons of 58,619 tons) for the entire point source sector. Reducing emissions from this sector by over 25% represents a significant reduction in the overall emissions for the point source sector.

NO_x makes up a relatively small proportion of the non-biogenic (less than 6%) 2002 area source emissions inventory for Nebraska, at 15,023 tons/yr. By 2018, area source NO_x emissions are projected to increase by 18% respectively. Despite the increase, the area source contribution is about 9.6% of the overall NO_x inventory in 2018.

Models predict reductions for NO_x from the combined on-road and non-road sector of about 61% between 2002 and 2018. These reductions are anticipated due to vehicle turnover and full implementation of current federal regulations, including the federal emission standards for light-duty vehicles and light-duty trucks and the Tier 2 Program. Reductions are also attributed to the use of newer equipment subject to more stringent emissions requirements, including the Clean Air Nonroad Diesel Rule, locomotive emission standards, the Large-Spark Ignition and Recreational Vehicle Rule, and Emissions Standards for New Nonroad Small Spark-Ignition Engines, Equipment, and Vessels. These rules are discussed in more detail in Chapter 11.

[11] As reported and used in the CENRAP emissions inventory. This value was used for the modeling into the 2018 projections.

8.3.1.3 Sulfur Dioxide

For the point source sector, the IPM procedure predicts reductions in SO_2 by 2018. Reductions were presumed primarily from the installation of BART controls. However, as discussed in Chapter 10, additional controls for SO_2 were not required by NDEQ during the BART determination. Despite the lack of additional controls on the BART subject sources, and assuming utility SO_2 emissions were to remain constant, SO_2 would still be reduced overall by 1.7% due to the other sector categories. As discussed later, these reductions are presumed to result from the use of lower sulfur fuels for on-road and non-road equipment. Additionally, it is expected that due to other federal measures, SO_2 emissions are expected to be reduced.

SO_2 makes up a relatively small proportion of the Nebraska's 2002 area emissions inventory at 7,748 tons/yr. By 2018, area source SO_2 emissions are projected to increase by 26%. The major contributing source categories for SO_2 are associated with fuel combustion and storage and transport. However, in reality, due to the lack of availability of higher sulfur fuels, the distillate and residual oil combustion in the area source sector are likely to remain unchanged or decrease between 2002 and 2018. Therefore, NDEQ believes the 2018 projections for area source emissions are overstated. At worst, if the 2018 projections are correct, the nonpoint emissions for SO_2 are still only about 15% of the total SO_2 inventory.

Models predict significant reductions for SO_2 from the combined on-road and non-road sectors of about 96% between 2002 and 2018. These reductions are anticipated due to vehicle turnover and full implementation of current federal regulations, including the federal emission standards for light-duty vehicles and light-duty trucks and the Tier 2 Program. This large reduction is also due to the requirement to use low sulfur diesel fuel by 2010. Nebraska also participates in the Diesel Emissions Reduction Act program which provides financial incentives to reduce emissions from diesel engines. These rules are discussed in more detail in Chapter 11.

The models did not take into account the Clean Air Transport Rule which is currently proposed by EPA. Nebraska is named under the rule and expects that when the final rule comes out, if SO_2 emissions are deemed to be a significant contributor to downwind ozone or PM2.5 nonattainment, reductions will be required.

8.3.1.4 Particulate Matter

Area sources account for the majority of the Nebraska PM. As shown earlier in Figure 8.3, unpaved roads comprise 52% of the PM_{10} emissions, whereas 34% come from crop production.[12] These values are based on the 2002 National Emissions Inventory. Since CENRAP held windblown dust from nonagricultural land-use categories and fire emissions constant from 2002 to 2018, reductions in the PM were most likely from other sectors such as the implementation of area MACT standards and reduction in dust from crops through alternative land practices. While the point source sector is predicted to increase, the overall contribution of point source PM emissions to the total inventory is relatively low. The on-road and non-road sector reductions are anticipated due to fleet turnover and full implementation of current federal regulations, including the federal emission standards for light-duty vehicles and light-duty trucks and the Tier 2 Program. The low sulfur fuel requirements are expected to result in reduced PM levels as well.

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[12] Nebraska Air Quality Report 2005-2006.

Nebraska also participates in the Diesel Emissions Reduction Act program which provides financial incentives to reduce diesel particulates emissions from engines.

For BART, all units subject to BART were determined to be adequately controlled through either an electrostatic precipitator (ESP) or through baghouses. Furthermore, BART subject facilities provided information supporting a conclusion that, as currently controlled, PM had a small impact on visibility. OPPD NCS Unit #1 greatest impact was 0.933 dV at Hercules Glades (MO), of which only 0.32% could be attributed to PM, or 0.00299 ΔdV. For NPPD Units #1 and #2, the greatest impact was in the Badlands (SD). Their total impact was predicted to be 3.121 dV, but only 0.69% of that could be attributed to PM for a 0.0215 ΔdV potential contribution. Therefore, eliminating all PM from these BART subject sources would have an insignificant impact on visibility improvement.

8.3.1.5 Ammonia

Livestock production and fertilizer application contribute collectively about 90% of the ammonia emissions in Nebraska. These sources mostly lie beyond the currently active regulatory purview of the air quality program at NDEQ. Furthermore, EPA currently does not consider ammonia for regulation as a precursor of $PM_{2.5}$, but does allow states to make case by case decisions. With regard to this, NDEQ has followed the lead of EPA. But most significantly, because NO_x and SO_2 are considered limiting pollutants with regard to $PM_{2.5}$ formation and the significant uncertainties in the ammonia inventories as well as in assessing the effect of ammonia emissions reductions on visibility, Nebraska does not consider ammonia among visibility-impairing pollutants. For these reasons, the 2018 projections are not included here, but may be found in the Appendix 8.2.

Appendix 8.1 2002 Emissions Inventory
Appendix 8.2 2018 Emissions Inventory
Appendix 8.3 Consolidation of Emissions Inventories (April 28, 2005),
Refinement of CENRAP's 2002 Emissions Inventories (August 31, 2005),
Research and Development of Planned Burning and Emission Inventories for the Central States Regional Air Planning Association (July 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)

9 Modeling Assessment

40 CFR Part 51, Appendix W provides modeling guidelines for conducting regional-scale modeling for particulate matter and visibility. The U.S. EPA recommends the use of one of the three following models to simulate pollutants impairing visibility: CMAQ, CAMx, and REMSAD. CENRAP contractors performed regional modeling using CMAQ and CAMx.

Community Multi-scale Air Quality (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 re-gridding as the plumes expand.

The Comprehensive Air quality Model with extensions (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 sub grid-scale Plume-in-Grid module to treat the early dispersion and chemistry of point source NO_x plumes, and a fast chemistry solver.

Particulate Matter (PM) Modeling: CAMx Mechanism 4 (M4) provides "1-atmosphere" modeling for fine and coarse PM and ozone. Aqueous phase chemistry is modeled using the RADM mechanism. Inorganic sulfate/nitrate/ammonium chemistry is modeled with ISORROPIA. Secondary organic aerosols are modeled using a semi-volatile scheme called SOAP. Wet and dry deposition processes are included for gasses and particles. Gridded deposition information is output along with the concentrations.

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

9.1 Modeling Protocol

CENRAP's contractor, Environ, prepared a modeling protocol to serve as a road map for performing the CENRAP emissions and air quality modeling and to communicate the modeling plans to the CENRAP participants. The Modeling Protocol was prepared in accordance with the EPA guidance available at the time. This Modeling Protocol can be found on the CENRAP modeling Website at:
http://pah.cert.ucr.edu/aqm/cenrap/docs/CENRAP_Draft2.0_Modeling_Protocol_120804.pdf

9.2 Quality Assurance Project Plan

The CENRAP contractor prepared a Quality Assurance Project Plan (QAPP) for the CENRAP emissions and air quality modeling study that described the quality management functions performed by the modeling team. The QAPP was prepared and was based on the national consensus standards for quality assurance and followed EPA's guidelines for quality assurance project plans for modeling and took into account recommendations from the North American Research Strategy for Tropospheric Ozone (NARSTO) Quality Handbook for modeling projects.

The EPA and NARSTO guidance documents were developed specifically for modeling projects, which have different quality assurance concerns than environmental monitoring data collection projects. The work performed in this project involves modeling at the basic research level and for regulatory/planning applications. In order to use model outputs for these purposes, it must be established that each model is scientifically sound, robust, and defensible. This is accomplished by following a project planning process that incorporates the following elements:

- A systematic planning process including identification of assessments and related performance criteria;
- Peer reviewed theory and equations;
- A carefully designed life-cycle development process that minimizes errors;
- Documentation of any changes from original plans;
- Clear documentation of assumptions, theory, and parameterization that is detailed enough so others can understand the model output;
- Input data and parameters that are accurate and appropriate for the analysis; and
- Output data that can be used to help inform decision makers.

The CENRAP QAPP can be found at:
http://pah.cert.ucr.edu/aqm/cenrap/docs/CENRAP_QAPP_Nov_24_2004.pdf.

A key component of the CENRAP emissions and air quality modeling QAPP was the graphical display of model inputs and outputs and multiple peer-review of each step of the modeling process. This was accomplished through use of the CENRAP modeling website where modelers posted displays of work products (e.g., emissions plots, model outputs, etc.) for review by the CENRAP modeling team, modeling workgroup and others. This website can be found at:
http://pah.cert.ucr.edu/aqm/cenrap/index.shtml.

9.3 Model Inputs

9.3.1 Year Selection

For regional haze, the full 2002 modeling year was chosen as the episode period to evaluate. The 2002 calendar year, which lies in the middle of the 2000-2004 baseline period in the regional haze rule, was selected for the following reasons:

- Based on available information, 2002 appears to be a fairly typical year in terms of meteorology for the 5-year baseline period of 2000-2004;
- 2003 and 2004 appeared to be colder and wetter than typical in the eastern US;
- The enhanced IMPROVE and IMPROVE Protocol and Supersites PM monitoring data were fully operational by 2002. Much less IMPROVE monitoring data was available during 2000-2001, especially in the CENRAP region;
- IMPROVE data for 2003 and 2004 were not yet available at the time that the CENRAP modeling was initiated; and
- 2002 was being used by the other RPOs.

9.3.2 Domain

As one of the five national regional planning organizations (RPOs), CENRAP chose to use the unified grid domain developed by all of the other RPOs. This domain covers all RPO areas and was chosen to enable sharing of data and results between RPOs in a consistent manner. The grid consists of 36km grid cells and is 148 x 112 in size. Sensitivity simulations were also performed for episodes on a 12 km modeling domain covering the central states, however the results were very similar to the 36 km results so CENRAP elected to proceed with the 2002 annual modeling using the 36 km domain for computational efficiency.

9.3.3 Emissions Inputs

Generating the source inventory for modeling is intertwined with the creation of the pollutant inventory. Each emission source and the type of pollutants it emits must be specifically identified. For dispersion modeling, each source must be classified as a point source, area source, mobile source (on-road and off-road), and biogenic sources. The CENRAP Technical Support Document (TSD) provides the methodologies for this process and is found at Appendix 9.1. Emission inventory information can be found in Chapter 8.

9.3.4 Meteorological Input Preparation

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) non-hydrostatic 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 TSD in Appendix 9.1 refers to the methodologies and process used to collectively support the MM5 system for CENRAP.

9.4 Model Performance Evaluation

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

- Interagency Monitoring of PROtected Visual Environments (IMPROVE)
- Clean Air Status and Trends Network (CAST Net)
- Speciated Trends Network (STN)
- Aerometric Information Retrieval Systems (AIRS)
- South Eastern Aerosol Research and Characterization (SEARCH)

Environ evaluated the CMAQ and CAMx models 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). Details on the final 2002 Base F

36 km CMAQ base case modeling performance evaluations are provided in the TSD. Due to resource constraints and the similarity between 2002 Base F and 2002 Base G, the model evaluation was not re-conducted for Base G. In general, the model performance of the CMAQ and CAMx models for sulfate (SO4) and elemental carbon (EC) was good. Model performance for nitrate (NO3) was variable, with a summer underestimation and winter overestimation bias. Performance for organic mass carbon (OMC) was also variable, with the inclusion of the enhancement in CMAQ Version 4.5 greatly improving the CMAQ summer OMC model performance (Morris et al., 2006c). Model performance for Soil and coarse mass (CM) was generally poor. Environ concluded that the poor performance for Soil and CM was due, in part, to IMPROVE measured values for local fugitive dust sources that are not captured in the model's emission inputs and the 36 km grid resolution which is not conducive to modeling localized events.

The CENRAP TSD contains a detailed model performance, including performance evaluations at each Class I area in CENRAP. (Appendix 9.1)

Appendix 9.1 CENRAP Technical Support Document
Appendix 9.2 CENRAP Modeling Protocol

10 Best Available Retrofit Technology (BART)

The U.S. 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. The State of Nebraska is to require that those older sources that contribute to visibility impairment in a mandatory Class I area to install Best Available Retrofit Technology (BART) unless an alternative level of control is warranted. On July 6, 2005, U.S. EPA published a revised final rule, including Appendix Y to 40 CFR part 51 "Guidelines for BART Determinations Under the Regional Haze Rule" that provides guidance to states on determining which of these older sources may need to install BART and how to determine BART.

The rule states that in the case of any fossil-fuel fired power generation plant (EGU) having a total generating capacity in excess of 750 megawatts, the BART determination must be made pursuant to the guidelines in Appendix Y. Appendix Y of the guidelines outlines a presumptive emission rate or percent of control for SO_2 and NO_x, dependent of the fuel type (i.e. coal, oil) and unit type (i.e. dry-bottom wall fired, tangentially fired). These presumptive emission rates should be determined as BART for an EGU having a total generating capacity of 750 megawatt or greater unless the state can demonstrate, based on careful consideration of the statutory five factors. The five factors are: cost effectiveness, energy and non-air environmental impacts, existing controls at source, remaining useful life of source, and the degree of visibility improvement which may be reasonably anticipated from the technology.

10.1 Identification of BART – Eligible Sources in Nebraska

The BART-eligible sources were identified using the methodology in the Guidelines for BART Determinations under the Regional Haze Rules or "Guidelines". [40 CFR Part 51, Appendix Y.] For an emission unit source to be identified as BART-eligible, Nebraska 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}.

NDEQ utilized its Integrated Information System (IIS) database to identify potential BART-eligible units and major facilities with emission units in one or more of the BART categories. Only those facilities with emission units in one or more of the 26 source categories below are eligible for BART, regardless of emissions potential.

26 BART Source Categories

(1) Fossil-fuel fired steam electric plants of more than 250 million British thermal units (BTU) per hour heat input,
(2) Coal cleaning plants (thermal dryers),
(3) Kraft pulp mills,
(4) Portland cement plants,
(5) Primary zinc smelters,
(6) Iron and steel mill plants,
(7) Primary aluminum ore reduction plants,
(8) Primary copper smelters,
(9) Municipal incinerators capable of charging more than 250 tons of refuse per day,
(10) Hydrofluoric, sulfuric, and nitric acid plants,
(11) Petroleum refineries,
(12) Lime plants,
(13) Phosphate rock processing plants,
(14) Coke oven batteries,
(15) Sulfur recovery plants,
(16) Carbon black plants (furnace process),
(17) Primary lead smelters,
(18) Fuel conversion plants,
(19) Sintering plants,
(20) Secondary metal production facilities,
(21) Chemical process plants,
(22) Fossil-fuel boilers of more than 250 million BTUs per hour heat input,
(23) Petroleum storage and transfer facilities with a capacity exceeding 300,000 barrels,
(24) Taconite ore processing facilities,
(25) Glass fiber processing plants, and
(26) Charcoal production facilities.

A survey of facilities was conducted to solicit information concerning potential emissions, age of units, and other relevant factors. The information was compared to known records and the list was narrowed to the one found in Table 10.1.

The facilities with BART-eligible units in the State of Nebraska are shown in Table 10.1. More detailed information regarding each facility's BART-eligible units may be found in Appendix 10.2.

Table 10.1 Facilities with BART-eligible Units in Nebraska

Facility Name	City Location	Facility ID	SIC Code
Beatrice Nitrogen Plant	Beatrice	3106700001	2873
Ash Grove Cement	Louisville	3102500002	3241
Don Henry Power Center	Hastings	3100100061	4911
NPPD Gerald Gentlemen Station	Sutherland	3111100019	4911
Lon D. Wright Power Plant	Fremont	3105300001	4911
CW Burdick Generating Station	Grand Island	3107900001	4911
North Denver Station	Hastings	3100100040	4911
OPPD Nebraska City	Nebraska City	3113100036	4911
NPPD Sheldon Station	Hallam	311090005	4911
OPPD North Omaha Station	Omaha	310550002	4911

The Guidelines recommend addressing these visibility-impairing pollutants: sulfur dioxide (SO_2), nitrogen oxides (NO_X), and Particulate Matter. Nebraska 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 suggests. Consistent with the Guidelines, Nebraska did not evaluate emissions of Volatile Organic Compounds (VOCs) and ammonia in BART determinations because:

- The majority of VOC emissions in Nebraska are biogenic, rather than anthropogenic, in nature. Table 8.2 shows that biogenic VOC emissions are 533,705 tpy. Comparatively, anthropogenic VOCs as shown in Table 8.1 are 145,242, or just 21.4% of the total.
- The largest areas of anthropogenic VOC emissions in Nebraska exist in the eastern part of the state, in particular the largest metropolitan area of Omaha where VOC emission control is being undertaken as part of an innovative Community Based Planning process where the community is taking proactive steps to control emissions of VOC and NO_x to mitigate ozone levels. The program is called Clean Air Performance Agreement.
- As explained in section 8.3.1.5 above, because NO_x and SO_2 are considered limiting pollutants with regard to $PM_{2.5}$ formation and the significant uncertainties in the ammonia inventories as well as in assessing the effect of ammonia emissions reductions on visibility, NDEQ does not consider ammonia among visibility-impairing pollutants.
- NDEQ did not identify additional sources with greater than 250 tpy ammonia that required a subsequent BART analysis.

10.2 Determination of Units Subject to BART

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

Nebraska chose the first option and with one exception, required the owner/operator of each BART-eligible source to conduct the dispersion modeling using the CALPUFF model. NDEQ conducted modeling for one source (Lon D. Wright). NDEQ reviewed source-specific analyses conducted by the sources to determine which ones cause or contribute to visibility impairment. The CALPUFF modeling protocol used for determining which facilities are subject to BART is included in Appendix 10.3. In accordance with the Guidelines, a contribution threshold of 0.5 deciviews, based on the 98th percentile of daily modeled visibility impact over an annual period, was used for determining which sources were subject to BART. The Guidelines provide States the discretion to set a lower deciview threshold than 0.5 deciviews if "the location of a large number of BART-eligible sources within the State and in proximity to a Class I area justifies this approach." The 0.5 deciview threshold was selected because it is consistent with the guidelines, the nearest Class I area from any BART-eligible source is over 300 km away, stretching the reliability of the model, and Nebraska did not have any significant clusters of BART-eligible sources.

During the time that NDEQ was reviewing the modeling provided by sources, NDEQ requested the assistance of an EPA Region 7 modeler. Although, Appendix Y states that CALPUFF is "the best regulatory modeling application currently available for predicting a single source's contribution to visibility impairment and is currently the only EPA-approved model for use in estimating single source pollutant concentrations resulting from the long-range transport of primary pollutants", the person providing assistance utilized a different model (CAMx) to compare the results provided by one of the facilities, OPPD-North Omaha Station, and included additional Class I areas in the analysis. The CAMx results were not comparable to the CALPUFF results; however, the conclusions were the same.

Table 10.2 summaries the conclusions for each of the BART-eligible units. In order for the NDEQ to consider the source to be contributing to visibility impairment, and thus subject to BART, the 98th percentile change in deciview (dV) must have been equal to or greater than 0.5 dV for the source. Table 10.3 details the facilities with BART-eligible units found to be subject to BART by the State of Nebraska. Appendix 10.4 contains copies of the letters sent to sources deemed to be not BART-subject. Appendix 10.5 contains more detailed results of the modeling analyses for each BART-eligible source.

Table 10.2 BART-Eligible CALPUFF Modeling Conclusions

Facility Name	Modeling Conclusion
Beatrice Nitrogen Plant (Koch Nitrogen)	Visibility impacts < 0.5 dV. Not BART-subject.
Ash Grove Cement	Visibility impacts < 0.5 dV. Not BART-subject.
Don Henry Power Center	Visibility impacts < 0.5 dV. Not BART-subject.
NPPD Gerald Gentlemen Station	Visibility impacts > 0.5 dV. BART-subject. See Table 10.3
Lon D. Wright Power Plant	Visibility impacts < 0.5 dV. Not BART-subject.
CW Burdick Generating Station	Visibility impacts < 0.5 dV. Not BART-subject.
North Denver Station	Visibility impacts < 0.5 dV. Not BART-subject.
OPPD Nebraska City	Visibility impacts > 0.5 dV. BART-subject. See Table 10.3
NPPD Sheldon Station	Visibility impacts < 0.5 dV. Not BART-subject.
OPPD North Omaha Station	Visibility impacts < 0.5 dV. Not BART-subject.

Table 10.3 Facilities with Units Subject to BART in the Nebraska

Facility Name	Emission Units Subject to BART	Pollutants Evaluated in BART Determination	98th Percentile Contribution (dV)	Class I area & Year of Impact
OPPD Nebraska City	Unit #1	PM, NO_x, SO_2	0.933	Hercules Glades, MO (2001)
			0.556	Hercules Glades, MO (2002)
			0.686	Wichita Mtns, OK (2003)
NPPD Gerald Gentleman Station	Units #1 & #2	PM, NO_x, SO_2	2.845	Badlands, SD (2001)
			2.828	Badlands, SD (2002)
			3.121	Badlands, SD (2003)

10.3 Determination of BART Requirements for Subject-to-BART Sources

As part of the BART determination, NDEQ considered EPA's BART Guidelines (Appendix Y to 40 CFR Part 51) for those sources that were required to complete a five factor BART analysis. NDEQ also considered the State's authority to implement the regional haze rule under Title 129 Chapter 43 (Appendix 10.9).

One of the more important decisions in the BART Guidelines relates to EGUs and facilities that met the presumptive threshold. NDEQ expected these presumptive levels of control to be cost effective in most cases. If a facility proposed controls or emission limits less stringent than these presumptive levels, justification incorporating the statutory factors was required.

BART determinations for the three subject-to-BART units in Nebraska were carried out by third-party contractors on behalf of the sources' two owners and submitted to the State for evaluation. All three of the BART units are EGUs, but only two are located at a 750 MW facility (NPPD) and are considered by the state to be "presumptive" units.

The third unit, located at OPPD – Nebraska City Unit #2 (NCS), is not considered by the state to be a presumptive BART unit.

A summary of the BART determinations for the BART-subject sources in Nebraska is shown in Table 10.4 for each visibility impairing pollutant. BART is the emission limit for each pollutant based on the degree of reduction achievable through the application of the best system of continuous emission reduction, taking into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any

pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. BART-subject sources provide an estimated emission reduction from the 2002 baseline year of 25,137 tons per year of nitrogen oxides.

Table 10.4 BART Determinations for BART-subject units in Nebraska

Facility Name	BART subject Unit	Pollutant	Standard/Determination
OPPD Nebraska City	Unit #1	PM	Existing controls and requirements. Electrostatic precipitator is subject to an existing permit limit of 0.1 lb/MMBtu.
		NO_x	Install Low NO_x Burners with over fired air. Meet presumptive level of 0.23 lb/MMBtu.
		SO_2	No additional controls. Source currently uses low sulfur coal.
NPPD Gerald Gentleman Station	Units #1 & #2	PM	Existing controls and requirements. Baghouses subject to an existing permit limit of 0.1 lb/MMBtu.
		NO_x	Install Low NO_x Burners with over fired air. Meet presumptive level of 0.23 lb/MMBtu.
		SO_2	No additional controls. Continue to use low sulfur coal.

10.4 BART Determination Process

The BART determination process is comprised of the following basic steps:

Step 1: Identify all retrofit control technologies:
All control technologies for similar processes, as well as Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) technologies must be considered. Control technologies should include pollution prevention, use of add-on controls, and combinations of the two. The owner/operator is not expected to purchase or construct a process or control device that has not already been demonstrated in practice.

Step 2: Eliminate technically infeasible options:
Technologies demonstrated to be technically infeasible based on physical, chemical, and engineering principles are excluded from further consideration. Physical modifications needed to resolve technical obstacles do not, by themselves, provide justification to eliminate a technology.

Step 3: Rank remaining technologies by control effectiveness:
Technically feasible control technologies are ranked in the order of highest expected emission reduction to lowest expected emission reduction. The ranking also includes expected emission rate, control effectiveness, energy impacts, environmental impacts (including toxic and hazardous air emissions), economic impacts, and visibility impacts.
Step 4: Evaluate most effective controls (non-air quality impacts) and document results:
The technology ranking is evaluated and case-by-case consideration is given to costs of compliance, energy impacts, non-air quality and other environmental impacts, and remaining useful life of the unit. NDEQ used an incremental cost effectiveness threshold of $5,000 per ton.
Step 5: Evaluate Visibility Impacts:
Modeling analyses are performed on the pre- and post-control emissions to determine actual impact on visibility. The NDEQ has evaluated visibility improvement balanced with the cost of compliance in determining the best, most appropriate option for BART as allowed under Appendix Y. This was done through a cost per deciview of visibility improvement factor, which is similar to the cost per ton of pollutant removed from the atmosphere that is used in the BACT process.

The Regional Haze Rules provide that States may conduct the analysis in the order they choose and that they may weigh each factor as they deem appropriate.

There were a few factors that informed Nebraska's decision as to how to evaluate visibility improvement. First, the purpose of this program is to drive visibility improvement; therefore, any control technology would need to have a benefit on visibility improvement in order to warrant further evaluation. Nebraska does not have Class I areas. The closest Class I areas are located in the states of Missouri, South Dakota, Oklahoma, and Colorado. For the two BART-subject sources, the nearest Class I areas are over 300 km away. The CALPUFF model has limited reliability at distances beyond 200 km, therefore, NDEQ took into account, the magnitude and frequency of predicted improvement, whether additional control provided significant, measureable average benefit (>0.5 dV) at the closest Class I areas and whether such control would improve this average level of visibility for less than $40,000,000 per deciview and $400,000 per day of improvement. NDEQ used the cost per deciview and cost per day of improvement as indices of the frequency of improvement as well as the cost effectiveness.

The NDEQ also weighed the non-air quality impacts very carefully, in particular whether the amount of visibility improvement would result in other environmental issues. For example, if there was information indicating that investing in controls for haze purposes would result in another significant environmental (non-air quality) burden, such as impacts to water or land, NDEQ weighed that information heavily against the level of visibility benefit. NDEQ believed it was important to weigh all of these factors carefully because of the distance to Class I areas, the limited number of BART sources and the limitations of the model.

10.5 Summary of BART Determination- OPPD

10.5.1 Nebraska City Station Unit #1 – Not a Presumptive Unit

Prior to embarking on a BART determination, NDEQ first needed to determine whether the OPPD NCS Unit #1 should be included as a presumptive unit.

On July 6, 2005, the US EPA issued guidelines on conducting a BART determination, which are contained in Appendix Y of 40 CFR Part 51. States must follow these guidelines in making BART determinations on a source-by-source basis for 750 megawatt (MW) and larger power plants but are not required to use the guidelines when making BART determinations for other types of BART sources, including those with a total plant capacity less than 750 MW.

When an early draft of the BART proposal was shared with the Federal Land Managers, a question was raised as to the status of the total plant capacity at NCS. At issue was whether NCS Unit 2 should now be considered part of the total plant capacity at NCS for purposes of determining BART applicability. Since the CAA and the BART regulations did not speak to the specific issue of a source becoming a 750 MW facility after the BART rules were promulgated, the NDEQ raised the question with the US EPA and received a response on November 10, 2008. The response read "we believe that it is a reasonable interpretation to assume that if the plant is greater than 750 megawatts at the time the BART determination is made by the state (i.e. at the time the state places the BART determination on public notice) then any unit at the plant greater then [sic] 200 megawatts is subject to presumptive BART." US EPA Region 7's response did not address whether it is sufficient to have commenced or begun actual construction on Unit 2, or whether Unit 2 must be operational. The NDEQ's conclusion is that the plant's commercial operational capacity must be 750 MW or more. Since Unit 2 was not yet commercially operational at the time of the BART determination, NDEQ determined that NCS, for purposes of BART had a plant capacity of less than 750 MW. Therefore, it is not mandatory for NDEQ to follow 40 CFR 51 Appendix Y for federal purposes.

To further substantiate NDEQ's conclusion, NDEQ conducted a careful review of the June 2005 "Regulatory Impact Analysis for the Final Clean Air Visibility Rule or the Guidelines for Best Available Retrofit Technology (BART) Determinations under the Regional Haze Regulations" (RIA), the Federal Register July 2005 final preamble, and the rule. NDEQ believes that these documents provide clarification as to how the US EPA intended for states to aggregate multiple units at a power plant in order to determine whether the 750 MW threshold is crossed.

First, in the preamble to the July 6, 2005, Regional Haze/BART rule, on page 39112, middle column, EPA states:

> *"Finally, the approach to identifying a "BART-eligible source" in the guidelines is based on the definitions in the regional haze rule of the relevant terms. For 750 MW power plants, States are required to apply the definitions as set forth in the guidelines; for other sources, States may adopt a different approach to the task of identifying BART eligible sources, so long as that approach is consistent with the ACT and the implementing regulations. In other words,* ***while the guidelines adopt an approach for large power plants which involves the aggregation of all emission units put into place between 1962 and 1977 (emphasis added)****, States have the flexibility to consider other reasonable approaches to the question of identifying BART-eligible sources for other source categories."*

Therefore, NDEQ determined that individual EGUs that were put into place between 1962 and 1977 be aggregated for purposes of determining whether a power plant meets the 750 MW capacity threshold for applying presumptive-level BART.

Further support of the NDEQ determination is found in Appendix B of the RIA includes a memo from Perrin Quarles Associates, Inc (PQA) dated July 19, 2004. The memo provides a summary of the analysis PQA conducted for EPA to develop supporting materials for the Regional Haze/BART rule. The memo states that ***"Based on EPA guidance, the original analysis also assumed that BART-eligible units are only those that are located at a plant where the total capacity of all units within the BART timeframe exceeds 750MW."*** Attached to the memo are two tables which include NCS #1 with the listed capacity at around 616 MW. The first table also lists much smaller units located in Nebraska that were potentially put into place during the BART timeframe (1962 – 1977). The second table includes NCS #1 as a potentially BART-subject source, but no-where does the table indicate that the sources on the table are subject to the presumptive levels in the guidelines. The reasonable conclusion NDEQ draws from the inclusion of NCS #1 in the second table is that NCS #1 could potentially have a contribution to a Class I area above the 0.5 deciview threshold on more than one day, triggering the need for further analysis and the potential need for BART to be applied to one or more visibility impairing pollutants.

Therefore, NDEQ concluded that EPA's record supported a decision that OPPD Nebraska City Station is not a presumptive BART source.

Nevertheless, given the size of the unit at OPPD, NDEQ concluded it was still appropriate to evaluate the necessity of BART controls at NCS Unit #1, and used the five-factor analysis as a guideline.

The BART analysis conducted for OPPD NCS is included in Appendix 10.6. Appendix 10.7 contains any additional supporting information that was provided by the OPPD.

BART for each subject-to-BART source was determined by the State using the methodology in the Guidelines. These BART emission standards summarized above have been included in BART permits for each source and are in Appendix 10.8. Included in Appendix 10.8 is the State's rationale, including its evaluation of the full five-factor analysis for the BART determinations, and responses to comments received during the public processing of each of the BART permits.

10.5.2 BART Determination Summary for PM

Prior to evaluating BART, NDEQ evaluated whether PM control would be necessary for purposes of visibility improvement.

The baseline case model indicated that the direct particulate emissions were generally responsible for well under 1% of the total predicted change in deciview impact from NCS. In fact, PM only accounted for 0.32% of the greatest deciview impairment Unit 1 estimated for (0.933 in 2001 at Hercules Glades in Missouri). This would indicate that the predicted deciview impact is from a pollutant or pollutants other than PM. The results confirmed that the direct particulate matter emissions from NCS do not significantly contribute to visibility impairment.

NDEQ concluded that based on the fact that NCS Unit 1 appears to be currently adequately controlled by an electrostatic precipitator (ESP), is subject to an emissions limitation of 0.1

lb/MMBtu (Title V OP), and the modeling results revealed that direct particulate emissions do not significantly contribute to visibility impairment in Class I areas, BART for PM is existing controls and requirements.

10.5.3 BART Determination Summary for SO_2

For a full summary of the SO2 control technologies evaluated and eliminated during the BART process, please see Appendices 10.6 – 10.8.

Scrubber technology is a technically feasible SO_2 retrofit technology that could be implemented on Nebraska City Station (NCS) Unit 1. NDEQ evaluated the effectiveness of this technology at the 0.15 lb/MMBtu and at 0.1 lb/MMBtu levels for SO_2. Table 10.5 provides a summary of the cost effectiveness at 0.10 lb/MMBtu.

Table 10.5 SO_2 Controls (0.10 lb/MMBtu level)

	2001 (Hercules Glades)	2003 (Wichita Mtns)	Average
Baseline	0.933	0.686	
98th Percentile Impact	0.493	0.311	
dV improvement	0.440	0.375	0.0.408
Baseline Days	14	10	12
Days over 0.5 dV	7	6	7
Total Days improved	7	4	5
Cost per dV	$78,909,091	$92,586,667	$85,747,879
Cost per ton			$1,636
Cost per ton per dV	$3,718	$4,362	$4,040
Cost per day of Improvement	$4,960,000	$8,680,000	$6,820,000

As stated in Chapter 8 of the Regulatory Impact Analysis (RIA) the US EPA prepared for the Regional Haze rule, high cost control measures that have only minimal effect on visibility improvement can be avoided. Using scrubbing technology would be expected to result in the number of days where NCS's impact contributed to more than 0.5 dV to decrease from 14 days to 7 days during the worst meteorological year for Hercules Glades and from 10 days to 6 days for Wichita Mountains. The BART guidelines do not provide a level to which individual sources must reduce their visibility impact, leaving it up to the state's judgment. As further discussed and substantiated in Chapter 11, the PSAT apportionment modeling and the Causes of Haze study show that SO_2 emissions contributing to visibility in the Class I areas in Missouri are coming from the Ohio River Valley area.

Areas of influence and apportionment of Nebraska's SO_2 emissions were evaluated in the August 31, 2005, Causes of Haze Study conducted by Sonoma Technology, Inc. This study may be found on CENRAP's website (www.cenrap.org). Sonoma concluded that because the emission impact potentials (EIPs) of potentially BART-eligible sources are relatively small, the enforcement of BART requirements will produce limited improvement in visibility conditions and require the need for additional emission reduction strategies. Emission impact potentials relate the probability of transport of SO_2 and NO_x pollution from an area such as a state to a Class I area and the scale of emissions in that given area (State). In Figures 4-8 and 4-9 of the

study, Nebraska BART sources have an insignificant EIP, specifically for the Hercules Glades Class I area.

Therefore, due to the costs for the amount of visibility improvement being high, meaning that the amount of visibility improvement would be small compared to the amount of investment, the lack of certainty of contribution of sulfate from Nebraska sources, given the distance, and the lack of Missouri needing controls from Nebraska at this time, NDEQ concluded NCS did not require additional SO_2 controls.

10.5.4 BART Determination Summary for NO_x

For a full summary of the NOx control technologies evaluated and eliminated during the BART process, please see Appendices 10.6 – 10.8.

Low NO_x burner with over-fire air (LNB/OFA) technology is a feasible NO_x retrofit technology that could be implemented on NCS Unit 1. The cost effectiveness of this control technology is $135.55 per ton NO_x removed ($1,380,000 / 10,181 tons NO_x removed). The lowest incremental visibility impairment improvement cost is $4,600,000 per year per change in deciview at Hercules Glades in Missouri. The NDEQ determined that at a minimum, LNB/OFA would be required for BART. Using LNB/OFA technology would be expected to result in the number of days where NCS's impact contributing to more than 0.5 dV to decrease from 14 days to 9 days during the worst meteorological year for Hercules Glades and from 10 days to 9 days for Wichita Mountains in Oklahoma.

The incremental costs of adding select catalytic reduction (SCR) to the LNB/OFA system would be $8,583 per ton of NO_x. NDEQ estimated that the incremental visibility impairment improvement cost of approximately ranged $82,479,167 - $1,799,545,455 for a SCR+LNB/OFA system. The incremental visibility improvement of adding SCR to the LNB/OFA system ranged 0.022 – 0.48 dV with an average of 0.17 dV.

Table 10.6 Low NO_x Burner with Over-Fired Air Evaluation – OPPD NCS 1

	2001 (Hercules Glades)	2003 (Wichita Mtns)	Average
Baseline	0.933	0.686	
98th Percentile Impact	0.633	0.531	
dV improvement	0.300	0.155	0.228 dV
Baseline Days	14	10	12
Days over 0.5 dV	9	9	9
Days improved	5	1	3
Cost per dV	$4,600,000	$8,903,226	$6,751,613
Cost per ton			$136
Cost per day of improvement	$276,000	$1,380,000	$828,000

Table 10.7 Low NOx Burner with Over-Fired Air Evaluation with SCR – OPPD NCS 1

	2001 (Hercules Glades)	2003 (Wichita Mtns)	Average
Baseline	0.933	0.686	
98th Percentile Impact	0.453	0.447	
Incremental dV improvement over LNB/OFA	0.180	0.084	0.132 dV
Total dV improvement	0.480	0.239	0.360 dV
Baseline Days	14	10	12
Days over 0.5 dV	7	6	6
Incremental days improved over LNB/OFA	2	3	
Total Days improved	7	4	6
Cost per dV	$82,479,167	$165,648,536	$124,063,851
Incremental Cost per dV	$212,277,778	$454,880,952	$333,579,365
Cost per ton			$2,706
Incremental cost per ton			$8,583
Cost per day improvement	$5,655,714	$9,897,500	$6,598,333
Incremental cost per total days improvement	$5,458,571	$9,552,500	$6,368,333

As stated in Chapter 8 of the RIA EPA prepared for the Regional Haze rule, high cost control measures that have only minimal effect on visibility improvement can be avoided. Adding SCR to LNB/OFA technology would be expected to result in the number of days where NCS's impact contributed to more than 0.5 dV to decrease to 6 days during the worst meteorological year for Hercules Glades and to 7 days for Wichita Mountains. As indicated in the Causes of Haze assessment for Glades (see http://www.coha.dri.edu/doc/conceptualmodels/ConceptualModel-HEGL1.pdf), sulfates comprise more than 50% of the components contributing to light extinction. Nitrates make up an average of 13.5%, of which Nebraska contributes less than 4.4%. Using incremental cost effectiveness per ton of $5,000, the addition of SCR was deemed not cost effective. For the above reasons, LNB/OFA control was deemed appropriate for OPPD NCS. Therefore BART for OPPD NCS Unit 1 was determined to be the installation of LNB/OFA with an emission limitation of 0.23 lb NO_X /MMBtu.

For more details on the BART determination for OPPD, see Appendices 10.6 – 10.8

10.6 Summary of BART Determination- NPPD

10.6.1 BART Determination Summary for PM

Prior to evaluating BART, NDEQ evaluated whether PM control would be necessary for purposes of visibility improvement.

The baseline case model results indicated that the direct particulate emissions were generally responsible for less than 1% of the total predicted change in deciview impact from NPPD GGS

Units 1 and 2 at any Class I areas. These results demonstrate that the direct particulate matter emissions from GGS Units 1 and 2 do not significantly contribute to visibility impairment. Furthermore, GGS Units 1 and 2 are controlled by the baghouses, the best technology available for PM. NDEQ concluded that based on the fact that GGS Units 1 and 2 are currently controlled by the best technology available for direct PM emissions, and are subject to an emissions limitation of 0.1 lb/MMBtu (Title V OP), and the modeling results revealed that direct particulate emissions do not significantly contribute to visibility impairment in Class I areas, BART for PM is existing controls and requirements.

10.6.2 BART Determination Summary for NO_x

For a full summary of the NOx control technologies evaluated and eliminated during the BART process, please see Appendices 10.6 – 10.8.

LNB/OFA technology is a feasible NO_x retrofit technology that could be implemented on GGS Units 1 and 2. The total annualized cost associated with the installation of LNB/OFA is $2,960,000. The average cost effectiveness of this control technology is $198 per ton NO_x removed ($2,960,000 / 14,956 tons NOx removed).

Utilizing SCR technology is also feasible, however in order to install SCR, LNB/OFA must also be utilized. The incremental cost effectiveness (incremental cost SCR) is $5,445 per ton NO_x removed, over 25 times the amount of LNB/OFA alone. The average incremental improvement in visibility for the addition of SCR to LNB/OFA is less than 0.5 dV and improvement would be seen on an average of 7.3 days per year. Refer to Tables 10.8 & 10.9 for a comparison of the control options and the effectiveness.

Table 10.8 Low NO_x Burner with Over-Fired Air Evaluation - NPPD

	2001 Badlands	2002 Badlands	2003 Badlands	Average
Baseline	2.845	2.828	3.121	
98th Percentile Impact	2.224	2.162	2.419	
dV improvement	0.621	0.666	0.702	0.663
Baseline Days	54	55	60	56
Days over 0.5 dV	49	52	54	51
Days improved	5	3	6	5
Cost per dV	$4,766,506	$4,444,444	$4,216,524	$4,464,555
Cost per ton				$198
Cost per day of improvement	$953,301	1481481	$702,754	$592,000

The total annualized cost associated with the installation of LNB/OFA and SCR is $57,251,000. The cost effectiveness of LNB/OFA and SCR is $2,297 per ton NOx removed ($57,251,000 / 24,926 tons NOx removed). The incremental cost effectiveness calculation compares the costs and performance level of a control option to those of the next most stringent option. The incremental cost analysis of installing LNB/OFA and SCR as opposed to LNB/OFA alone is $5,445 ([$57,251,000 - $2,960,000] / [24,926 – 14,956]).

Table 10.9 Low NO_x Burner with Over-Fired Air Evaluation with SCR - NPPD

	2001 Badlands	2002 Badlands	2003 Badlands	Average
Baseline	2.845	2.828	3.121	
98th Percentile Impact	1.732	1.728	1.879	
Incremental dV improvement over LNB/OFA	0.492	0.434	0.540	0.489
Total dV improvement	1.113	1.10	1.242	1.118
Baseline Days	54	55	60	56
Days over 0.5 dV	44	41	48	44
Incremental days improved over LNB/OFA	5	11	6	7
Total Days improved	10	14	12	12
Cost per dV	$51,438,454	$52,046,363	$46,095,813	$51,208,408
Incremental Cost per dV	$110,347,560	$125,094,470	$100,538,889	$111,024,540
Cost per ton				$2,297
Incremental cost per ton				$5,445
Cost per day of Improvement	$5,725,100	$4,089,357	$4,770,917	$4,770,917
Incremental Cost per total days improvement	$5,429,100	$3,877,929	$4,524,250	$4,524,250

NDEQ determined that the incremental cost for the addition of SCR is excessive (>$5,000 per ton) and that LNB/OFA would be required for BART.

For more details on the BART determination for NPPD, see Appendices 10.6 – 10.8.

10.6.3 BART Determination Summary for SO_2

The BART Determination for SO_2 for NPPD was different from OPPD in that impacts to water were raised during NDEQ's review that required consideration. Appendix Y to Part 51 – Guidelines for BART Determinations under the Regional Haze Rule provides guidance on evaluation of the "costs of compliance" and "non-air quality environmental impacts." One of the factors is taking into consideration the extent of the short term environmental gains at the expense of long term environmental losses and the extent to which there may be an irreversible or irretrievable commitment of resources. The water demands of scrubber systems (wet or dry) relate to a commitment of scarce water resources, costs of compliance, and non-air quality environmental impacts. NDEQ conducted further analysis into the available water resources in Nebraska and discussed the impact with the agencies and persons responsible for the management of water quantity in the state. NDEQ solicited the assistance of the State Department of Natural Resources, the Twin Platte's Natural Resource's District Manager, and the Nebraska Association of Natural Resource Districts in its review as well as answering initial questions raised by EPA Region VII.

The BART Determination Process is summarized here, more details may be found in Appendices 10.6 - 10.8. The information on the DSI evaluation may be found in Appendix 10.13.

Upon completion of Steps 1 – 2 of the BART Determination Process, scrubbing technology was identified as a technically feasible SO_2 retrofit technology for NPPD Gerald Gentleman Station (GGS) Units 1 and 2.

Prior to taking into account the other environmental effects, the average cost effectiveness of using scrubbing control technology is approximately $2,500 – $2,700 per ton SO_2 for both units, combined. NDEQ believes this cost per ton removed seems reasonable. However, as discussed further below, NDEQ has determined that additional SO_2 controls are not reasonable, due, in part to the excessive cost effectiveness in terms of cost per benefit in terms of visibility improvement.

10.6.3.1 Unique Water Impacts in the Twin Platte Basin

Surface water and groundwater are both used for irrigation for purposes of crop production in the state. Irrigated crops have higher yields and irrigated lands are of higher value than non-irrigated cropland. (Lamphear October 2005) (See Appendix 10.7.) Water resources are also critical to conservation of endangered and threatened species and their habitats. The State of Nebraska has several unique laws in place to not only protect, but also increase, stabilize and allocate its water resources.

In 2004, the Nebraska Legislature enacted LB 962, which went into effect in July 2004. This law required the Department of Natural Resources (DNR) to identify geographic areas where surface water and ground water are hydrologically connected. This innovative law requires the integrated management of water resources through the identification of river basins where water resources were already fully-appropriated and other areas where the basins were over-appropriated.

A basin is considered fully-appropriated if the current uses of hydrologically connected surface water and groundwater in a basin cause, or will cause in the reasonably foreseeable future, (a) the surface water to be insufficient to sustain over the long term the beneficial purposes for which the existing surface water appropriations were granted, (b) the stream flow to be insufficient to sustain over the long term the beneficial uses from wells constructed in aquifers dependent on recharge from the basin's river or stream, or (c) reduction in stream flow sufficient to cause Nebraska to be in noncompliance with an interstate compact or decree, formal state contract, or state or federal laws. Therefore, in fully-appropriated and over-appropriated basins, a plan for future water use must be established.

The statutory definition of an over-appropriated basin is very precise and relates to conditions at a single point in time, July 16, 2004. Areas that were designated as over-appropriated were required to develop an integrated management plan to reduce water use to the 1997 level of use within the next 10 years. In over-appropriated areas, the water demand already exceeds the current availability of water and the law requires steps be taken to mitigate the situation. An over-appropriated area is causing depletion to occur not only in the immediate area, but potentially downstream as well. For both fully and over-appropriated areas, moratoriums are presently in place on the construction of new large capacity water wells (greater than 50 gallons per minute) and surface water rights.

Once a basin has been designated as fully or over-appropriated, each local Natural Resource District (NRD) must work in conjunction with the State NDNR to develop an Integrated Management Plan (IMP) to either make certain the basin does not become over-appropriated or to find ways to recharge or augment the water resources in a manner such that the basin is no longer over-appropriated. The 23 local NRDs are distinctive to Nebraska and have been in existence since 1972. They are charged with water shed management and are equipped to best respond to the local needs of their district.

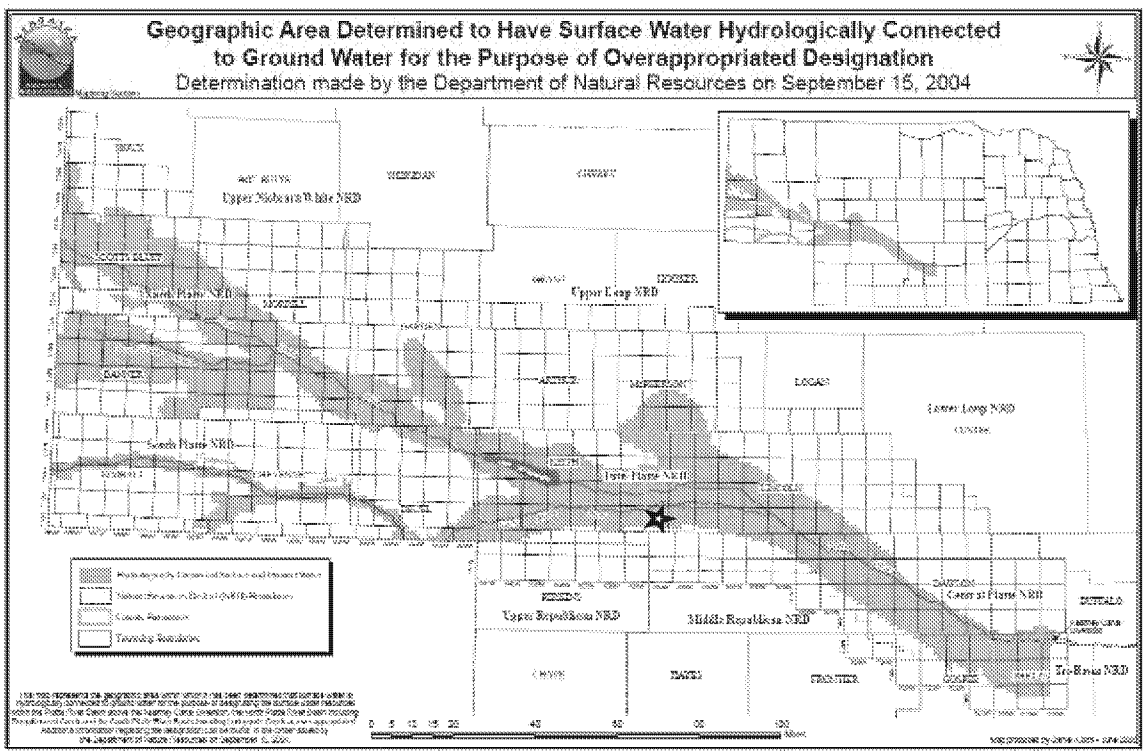
The concept of developing an integrated management plan for watershed management is analogous to the air quality state implementation planning process for non-attainment or attainment areas. While the development of the basin IMP may take three to five years, recharging the system to a sustainable level is expected to take many more years.

GGS is located in a semi-arid region of Nebraska in a portion of the Twin Platte NRD that has been designated by the Department of Natural Resources Director as over-appropriated. Below are maps detailing the relationship between the surface water and ground water in the area, the areas that have been identified as being fully-appropriated or over-appropriated, and the areas within the Twin Platte NRD that are currently under a moratorium prohibiting the construction of new water wells greater than 50 gallons per minute or increasing irrigated acres (effective June 18, 2007).

As previously noted, the NDNR and the local NRDs involved are required to jointly develop and implement an integrated management plan within three to five years of a fully or over-appropriated designation. An Integrated Management Plan (IMP) for the Twin Platte NRD has been approved and took effect September 15, 2009 (Appendix 10.11). The purpose of the IMP is to manage all hydrologically connected groundwater and surface water for the purpose of sustaining a balance between demand and availability so that the economic viability, social and environmental health, safety, and welfare of the basin can be achieved and maintained for both the near and long-term.

The Twin Platte NRD estimates that in order to return to 1997 levels, the NRD will need to return 7,700 acre-feet of already difficult to find offset water to the river that is hydrologically connected within the region and another 33,750 -67,450 acre-feet in order to return to fully appropriated status.

Figure 1: Areas with Hydrologically Connected Surface Water to Ground Water



Approximate Location of GGS- ☆

Figure 2: Over Appropriated Surface Water of Nebraska

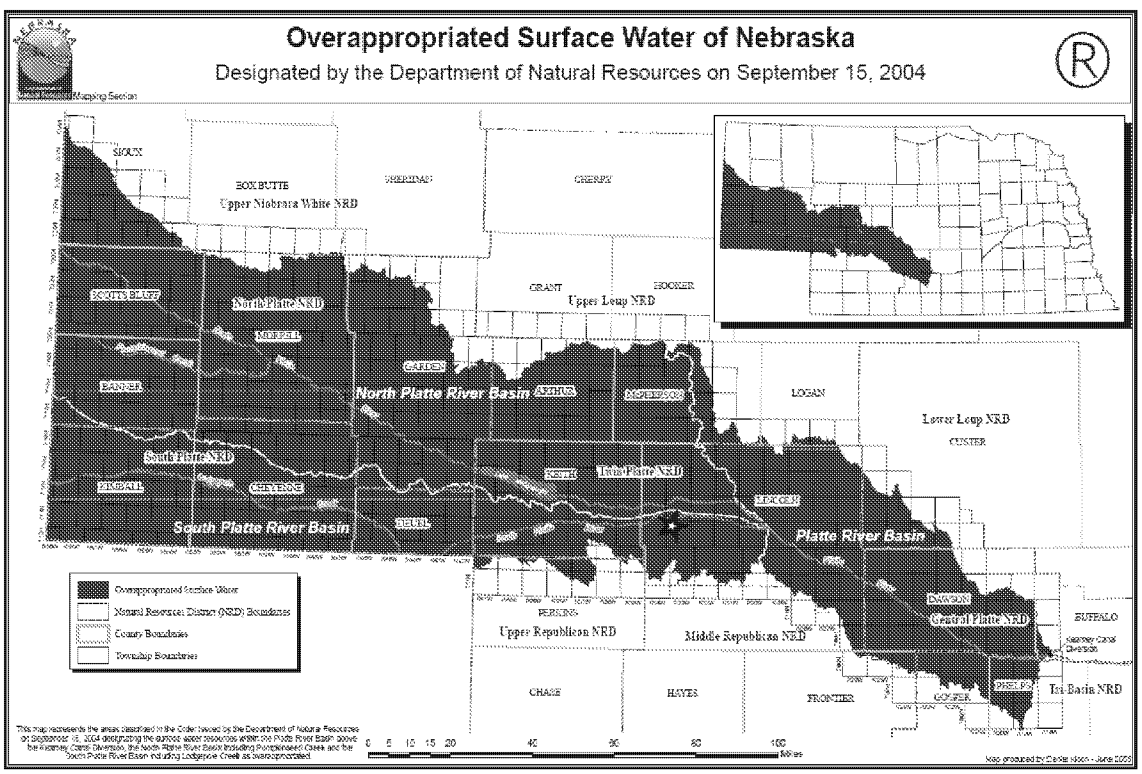
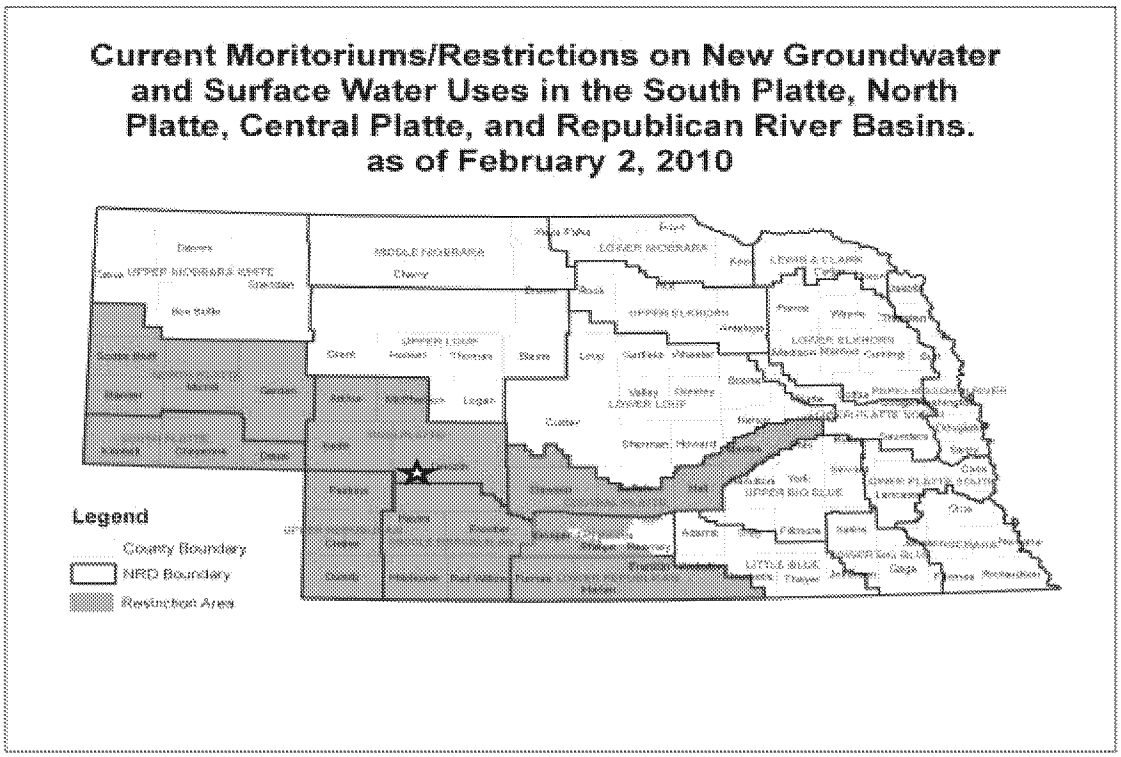
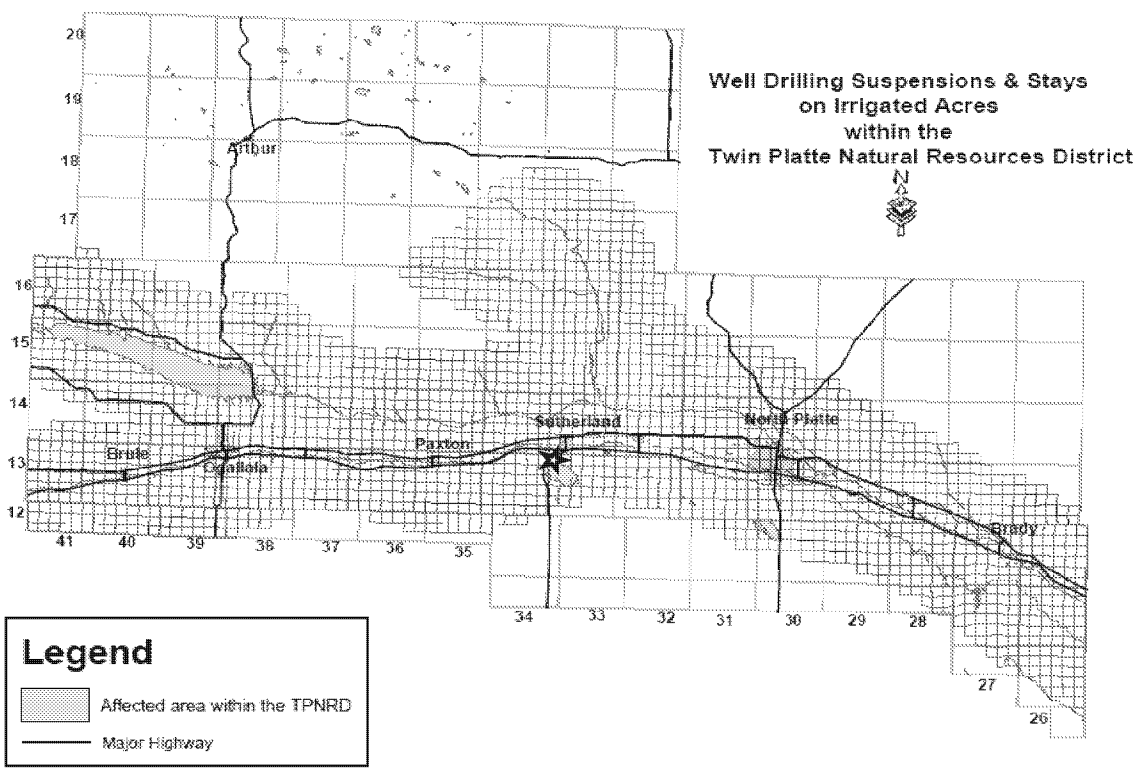


Figure 3: Current Moratoriums on New Water Uses



Approximate Location of GGS-☆

Figure 4: Well Drilling Suspensions and Stays on Irrigation within Twin Platte NRD



NDEQ searched for information on the water demands of dry scrubbers to determine whether the estimates provided by NPPD were reasonable. Actual water usage information for comparable operating existing facilities that had been retrofitted was difficult to locate, but information on proposed units was found, and is summarized in Table 10.10 below:

Table 10.10 Scrubber Water Usage
Gallons Per Minute/Megawatt (GPM/MW)

Facility Name	State	MW	GPM/MW (dry)	GPM/MW (wet)
Round Up	Montana	780	0.743	1.03
Dave Johnston (existing)	Wyoming	360	0.689	0.917
Noborne	Missouri	680	0.912	1.22
Dry Fork	Montana	590	0.578	0.723
Dry Fork	Texas	920	0.707	0.891
Paradise (existing)	Kentucky	1150	1.47	1.92
NPPD	Nebraska	1365	1.47	1.76
Average			0.938	1.21

NPPD projected water usage at 1.47 GPM/MW of generation for dry scrubbing and 1.76 GPM/MW for wet scrubbing. While, it would appear that the water usage estimates submitted by NPPD are higher than the average, NPPD stated during a meeting with NDEQ that their estimates were for total water consumption for the project, not just for the scrubbers. Information relating to water quality, additives, pH, and other parameters, were not available to the NDEQ for analysis. Quality of water available to a source could have an impact on the efficiency of the device, how it is designed and ultimately how much water must be used to achieve the desired level of control. Although on the high side, the water values provided by NPPD are within the range of other facilities currently in operation, particularly the one of a similar size in Kentucky as noted in the table above.

Based on the information available, NDEQ concluded that NPPD's water consumption estimates for wet and dry scrubbers were not unreasonable. To be conservative in its analysis, NDEQ used both the average and NPPD's values for analyzing NPPD's water demands against water availability in Nebraska.

Table 10.11 Potential Scrubber water requirements for NPPD - GGS

	GPM/MW (dry)	GPM/MW (wet)	MW	GPM (dry)	GPM (wet)	Acre-Feet per Year (dry)	Acre-Feet per Year (wet)
NPPD	1.47	1.76	1365	2007	2402	3238	3877
Average	0.938	1.21	1365	1280	1652	2065	2666

1 million gallons = 3.07 acre-feet
525,600 minutes per year

10.6.3.2 Platte River Recovery and Implementation Program

As is evident with the over-appropriated status designation, the demand for beneficial uses of water in the area where GGS is located is considerable. In 1997, the Governors of Nebraska, Colorado, and Wyoming, and the U.S. Secretary of the Interior signed a cooperative agreement outlining a proposed basin-wide recovery implementation program for endangered species in the Central and Lower Platte river basins. In 2007, the Department of Interior, Colorado, Wyoming and Nebraska entered into an agreement called the Platte River Recovery and Implementation Program (PRRIP) to restore shortages to U.S. Fish and Wildlife Service (USFWS) target flows in the Platte River, thereby protecting endangered and/or threatened species whose habitat is the Platte River. These agreements were the result of settlement negotiations in the Grayrocks Dam litigation and the FERC relicensing of Lake McConaughy. The threatened and endangered species identified for protection include the piping plover, pallid sturgeon, least tern, and whooping crane. Substantial offsets to current water use are required in order to meet the PRRIP needs as well as the required IMP reductions. While the total potential water needs for both the PRRIP and IMP may not necessarily be mutually exclusive, they are substantial over the near and long term.

The requirements of the PRRIP are in addition to the requirements of LB962. The PRRIP is also set up to restore the shortages to USFWS target flows in an incremental fashion. During the first increment, the goal is to restore between 130,000 and 150,000 acre-feet per year. Of this, 80,000 acre-feet per year has already been obtained through project commitments from the three states, for a remaining requirement of 50,000 to 70,000 acre-feet per year. For more information about the PRRIP see http://platteriverprogram.org/default.aspx. Should the requirements of the PRRIP not be met, Lake McConaughy's FERC license would be reopened.

The outstanding existing commitments and obligations of both LB962 and the PRRIP are estimated below:

1ST Increment of PRRIP		
3 State Projects	80,000AF	
Remainder	50,000 – 70,000AF	
Return to 1997 Levels (LB962)	26,200 AF	(Current Estimate- Basin)
Twin Platte NRD only 7,700 AF		
Potential 2ND Increment – PRRIP	137,500 AF	(Current Estimate)
Return to "Fully Appropriated – LB 962	114,750 – 229,500 AF	(Current Estimates-Basin)
Twin Platte NRD only 33,750- 67,450 AF		
Potential 3rd Increment – PRRIP	137,500 AF	(Current Estimate)
TOTALS	**545,950 – 680,700 AF**	

The expected demands of scrubbing at the NPPD GGS facility is 2,000 to 3,900 acre-feet per year, or 26% - 51% of Twin Platte's estimate for their requirements for meeting initial obligations under LB962, and 7.6 – 29% for the entire basin's initial obligations to return to 1997

levels. The NDNR has informed the NDEQ that this additional demand represents a significant amount of the overall initial increment required for the basin, and that placing this additional demand on the basin jeopardizes Nebraska's ability to meet commitments made to other states and the federal government, as well as the requirements of State Law relating to over-appropriated basins described above.

10.6.3.3 Acquisition of Allocations and Offsets (Costs of Water)
In order for NPPD to obtain sufficient water for the scrubbers, it would need to acquire water from somewhere or someone else. There are two options for this: 1) transport the water from a location that has a suitable water supply, or 2) purchase existing water rights owned by someone else and retire the wells to ensure the offset is permanent.

Costs of Transporting Water
A study conducted by the State of Nebraska Water Management Board, the Report on Water Rights Transfer Study (1988), found that since water rights were not traded routinely in a market situation, there was no demand curve for determining a cost schedule. The report concluded that economics in these situations will rely on willingness or ability to pay and the least cost alternatives. For industries, water is relatively hard to transfer compared to other inputs because transfers of water for industrial purposes are subject to additional statutory requirements, so typically a site is chosen where there is an adequate supply of water. Several other factors impact the costs of transferring water: well construction, pipeline construction, pumping plants, land, energy, operation and maintenance. Pipeline costs are the most significant fixed cost. Energy is the largest cost of operation.

A study conducted by the High Plains Study Council, "A Summary of Results of the Ogallala Aquifer Regional Study, With Recommendations to the Secretary of Commerce and Congress" (1982), evaluated the potential for transferring water within the High Plains area. Four routes were evaluated, including one that started at Fort Randall, South Dakota, moved southwesterly across Nebraska, nearing the Sutherland, Nebraska area, to storage near Bonny Reservoir in Eastern Colorado. In 1977 dollars the average costs for this project were:

Table 10.12 Summary of Costs to Transfer Water

Water Studied for Transfer	Route Length	Elevation Change	# Pumping Stations	Total Energy Requirements (Million KWHr/yr)	Total Construction Costs (1977 $)	Average Annual Cost ($/acre-ft)
1.91 – 3.4 million acre-ft	813 miles	0 ft	18	6,600 – 14,300	5.4 – 8.9 billion	291

The acre-ft involved in the above study is significantly larger than that which would be required for NPPD. Looking at the construction costs alone, the costs equate to $ 6.6 – 10.9 million per mile in 1977 dollars ($5.4-8.9 billion/813 miles). Converting to 2007 dollars would increase the costs to $16.46-27.1 billion/813 miles, or $20.2 – 33.3 million/mile. Sutherland, NE is approximately 300 miles from Fort Randall, SD. Using the above study as a guide, it would cost NPPD, and thus the citizens of Nebraska, nearly $6 billion to construct a water pipeline (2007 dollars) from Fort Randall, SD. If water could be found closer, in an area that was not fully or

over appropriated, where a moratorium does not currently exist, the closest area would be approximately 50 miles from NPPD, making it just over $1 billion to transport water. Annualizing costs at a rate of 7% over 20 years resulted in the costs associated with water transport to be estimated at $94,392,925 – $566,357,554.

The costs to transport water increased the annualized cost associated with FGD at GGS from $108,450,000 to $202,842,925 - $674,807,554. The cost per ton for this control technology is $4,702 – $15,643 per ton SO_2 removed ($202,842,925 - $674,807,554/ 43,138 tons SO_2 removed) based on an emissions rate of 0.10 lb/MMBtu. The mean (average) cost per ton removal rate would be $10,172 per ton. The NDEQ determined that the costs to transport water were costs prohibitive for NPPD as a BART SO_2 measure.

Costs of Obtaining Water Rights and Retiring Wells

There are two sources of water in the state: surface water and groundwater.

Surface water is subject to prior appropriation and governed by water rights under the jurisdiction of the NDNR which are prioritized by the legal concept of "first in time, first in right." (Neb. Rev. Stat. §46-203 through 46-205) See Appendix 10.12. Therefore, were NPPD to find a surface water right that was available, retiring that right would only mean that the next existing priority in line would receive that water. NPPD could not obtain a new water right given that the basin in which it is located or near are all fully-appropriated or over-appropriated. Even if a new surface water appropriation could be obtained, NPPD would be the newest and lowest priority water right in the chain. Therefore, surface water rights are not considered to be available to NPPD for purchase or transfer.

Groundwater is managed by the regional Natural Resources Districts, which are political subdivisions created by statute. Historically, groundwater has not been subject to an appropriation system similar to that applied to surface water. The owner of the overlying land could use groundwater for reasonable uses subject to the correlative rights of other landowners. Groundwater in and of itself is publicly owned in the State of Nebraska. Consequently, the value of groundwater to a landowner is often inextricably linked to the value of the land itself, i.e. irrigated cropland versus non-irrigated cropland.

Management of groundwater use is becoming increasingly integrated with surface water after the passage of LB 962 discussed above. Due to the moratorium on new wells described above, NPPD would have to find existing groundwater wells, such as irrigation wells and retire those wells, before NPPD could drill a new groundwater well.

The cost of retiring a groundwater well will vary depending upon the situation largely based on the existence of a willing seller. For agricultural uses of water, the decision to retire a well would be made only when/if the irrigator felt it would be more advantageous to sell than continue to irrigate—the seller could convert to dry land agriculture but could not resume irrigation after the well has been retired. If the irrigator were willing to forego the use of this resource, the price for that water right would presumably have to be sufficient to compensate for decreased net returns over a period of years and a decrease in overall land value from irrigated to non-irrigated. Decreased land value impacts a variety of other entities, including taxing authorities, which have not been evaluated here. The long-term economic value of irrigation

water to a farmer is based on the expected return over a number of years discounted into present values, i.e. the opportunity cost. Furthermore, offset credits would be dependent upon how the retired well is hydrologically connected to the river, therefore, not all irrigation wells would necessarily given the same offset credit.

Figure 10.5 is an aerial view of GGS station and the surrounding area. The circles are pivot-irrigation, clearly showing the irrigated cropland in the area surrounding GGS. The star identifies the location of the NPPD GGS station. The black numbers in each box represent the Section within the Township and Range. The green numbers represent the percent stream depletion factors (SDF) for that section. This SDF value represents how wells in that section are hydrologically connected to the river. The higher the value, the more connected the well is to the river. Wells that would be retired with higher SDFs would receive more offset credit than those with lower SDF values. The Twin Platte NRD provided NDEQ with example offset calculations for NPPD near their GGS station. The calculations are found in Table 10.13 and coincide with Figure 10.5:

Table 10.13 Offset Water Calculations

Section	Township	Range	Stream Depletion Factor (SDF) %	Offset H2O Calculation to South Platte River IF 100 Acres of Irrigated Corn w/i Section no longer irrigated Acre-Feet
35	14	34	81	37.03
2	13	34	96	39.37
11	13	34	74	25.39
14	13	34	59	20.57
23	13	34	48	16.66
26	13	34	39	13.62
35	13	34	33	11.59
3	12	34	28	9.88
10	12	34	15	5.33

NDEQ estimated that NPPD would need up to 3877 acre-feet per year to scrub SO_2. In order to determine how much irrigated land NPPD would need to acquire and retire sufficient offsets, NDEQ used the information provided by the Twin Platte NRD. NDEQ visually estimated the amount of irrigated land based upon pivot coverage. NDEQ assumed all irrigated land was corn. Given that a section has 640 acres, the estimates in Table 10.14 were derived.

Table 10.14 Estimates Acres and Acre-Feet

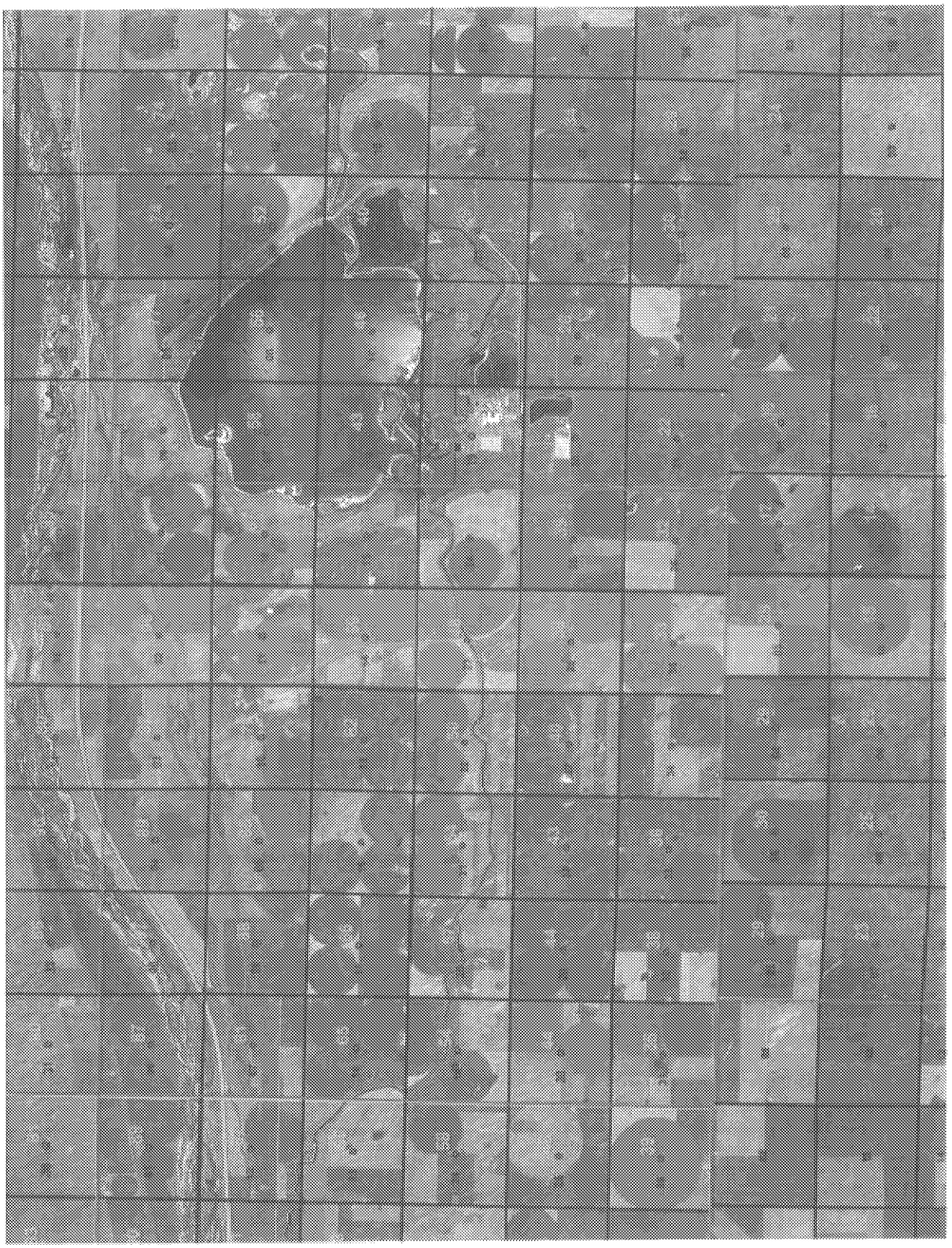
Section	Township	Stream Depletion Factor (SDF) %	Offset H2O Calculation to South Platte River IF 100 Acres of Irrigated Corn w/i Section no longer irrigated Acre-Feet	Estimated Irrigated Acres	Estimated Offset Acre-Feet
35	14	81	37.03	320	119
2	13	96	39.37	160	63
11	13	74	25.39	480	122
14	13	59	20.57	320	66
23	13	48	16.66	384	64
26	13	39	13.62	480	65
35	13	33	11.59	480	56
3	12	28	9.88	480	47
10	12	15	5.33	384	20
			Total	**3488**	**622**

NPPD would require more than 6 times more acre-feet to offset their need. This would mean over 21,500 acres of irrigated crop land. This is about 6 times more acreage than was originally estimated in the NPPD fact sheet because stream depletion factors were not factored in.

Center pivot irrigated crop land sells for a higher price than non-irrigated crop land. In the Lincoln County area, prices went up 3.5% over last year. The average price as of February 2010 was $2,475 per acre, not including the value of the pivot (http://www.agecon.unl.edu/Cornhuskereconomics/3-10-10.pdf). However, in 2008, according to newspaper reports, 30 square miles of a Lincoln County irrigated farm near North Platte sold for about $3,000 per acre. In 2009, Lincoln County irrigated farmland sold for about $3,200 - $3,500 per acre. Also, according to a prospective buyer in the area, when an offer of $2,500 per acre was made for irrigated land, the offer was not accepted. Given the amount of land that would be needed to be acquired and the fact that prices went up 3.5% in 2009, it is expected that if NPPD were in demand for irrigated land, the price per acre would be driven up. Furthermore, price for the irrigated land would likely be influenced by the fact that several farmers would no longer being able to farm their land. For this reason, NDEQ assumed NPPD would require approximately 22,000 acres of land at $4,000 per acre. NDEQ determined the cost of irrigated land for purposes of offsets is estimated to be $88,000,000. Any offsets would be calculated and subject to approval from the local NRD through issuance of a variance.

The annualized costs to install scrubber alone are $108,450,000. The annualized costs of obtaining the water offsets at 7% over 20 years is $8,306,590, increasing the total annualized cost with the installation of scrubbers at GGS to $116,756,590. Over 14% of the costs would be for obtaining water.

Figure 10.5 Aerial View of GGS & Surrounding Area



10.6.3.4 Economic Impacts from Irrigated Agriculture

Agriculture is the mainstay of Nebraska's economy. Irrigated cropland has a significant direct economic impact to the state, as well as indirect and consumptive effects within the state. Whenever irrigated cropland is taken out of service, it is appropriate to evaluate that impact to the state. Lincoln County was ranked in the top five counties for agriculture sales in 2007. Nebraska's leading commodities accounting for 98% of the state's total cash receipts are: cattle, corn, soybeans, hogs, wheat, chicken eggs, dairy products, hay, dry beans, and sorghum.

Nebraska has been first in red meat production, cattle slaughter, great northern beans production, irrigated land and popcorn production. Nebraska is ranked third in corn and grain sorghum production.

In 2008, net farm income was just over $4 billion and cash receipts from all crops just under $9 billion. The 2008 farm marketing cash receipts contributed $17 billion to Nebraska's economy and 5% of the United States total. When cropland is permanently taken out of production or irrigated cropland is converted to dry land farming, wealth is being removed from the state. The effect of this is direct on the farmer, the employees, and their families, but there is also an indirect effect that trickles out from reductions in crop income. Reduced crops in an agricultural state result in fewer grains for livestock and for export out of the state. This reduction impacts more people and their jobs, including grain elevators and slaughter houses. According to the USDA, for every $1 in agricultural exports another $1.40 is generated in transportation, financing, warehousing and production. It follows that for every $1 reduced in agricultural exports, another $1.40 is reduced in those areas as well. Nebraska's $5.9 billion in agricultural exports translate into $8.3 billion in additional economic activity. When the foundational industries to our economic structure begin to weaken, the service sectors start to suffer as well.

NPPD GGS Station is located in Lincoln County. Within Lincoln County, there are 322,916 irrigated acres of farmland. Should NPPD take 22,000 acres of irrigated farmland out of service that would be 6.8% of the total irrigated cropland in service as of the 2007 USDA Census. (http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Nebraska/index.asp).

According to http://www.fedstats.gov/qf/states/31/31111.html, the current unemployment rate is lower in Lincoln County than in the rest of Nebraska; however, the percentage of people living in poverty is greater in Lincoln County. Were NPPD to be required to take about 6.8% of irrigated acres out of service, there could be an adverse ripple effect to the economy of Lincoln County. As indicated above, agriculture is the primary economic industry for Lincoln County. Irrigated land corn yields are about 74% higher than dry land farming. The approximate yield for 22,000 acres of irrigated corn cropland is 4,081,000 bushels. For dry land farming, the approximate yield for 22,000 acres is 2,347,400 bushels. While the corn market has experienced great volatility the last couple years, the average price in 2007 was $4.20 per bushel nationally, and $4.14 per bushel in Nebraska. Table 10.15 details the economic differences as a result of reduced corn yield at various price points since 2004. http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1050 .

Table 10.15 Differences Value of Yields

Year	Average Price per Bushel of Corn in Nebraska	Estimated Value Irrigated Yield (4,081,000 bushels)	Estimated Value Dry land Yield (2,347,400 bushels)	Difference
2004	$ 2.02	$ 8,243,620	$ 4,741,748	$ (3,501,872)
2005	$ 1.92	$ 7,835,520	$ 4,507,008	$ (3,328,512)
2006	$ 3.00	$12,243,000	$ 7,042,200	$ (5,200,800)
2007	$ 4.14	$16,895,340	$ 9,718,236	$ (7,177,104)
2008	$ 4.05	$16,528,050	$ 9,506,970	$ (7,021,080)
2009	$ 3.70	$ 15,099,700	$ 8,685,380	$ (6,414,320)

According to the USDA (http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/Nebraska/cp31111.pdf), the value of grains, oilseeds, dry beans and dry peas in Lincoln County totaled $185,812,000. The loss of the 1,733,600 bushels of corn yield would have equated to loss of 3.9% of the total value in grain, oilseeds, dry beans, and dry peas in Lincoln County for 2007 had the 22,000 acres been converted to dry land farm land.

To illustrate an example: Livestock producers rely on grains from nearby farmers to supply feed. Reduced yields mean livestock producers must pay more to find feed trucked in from further away. Reduced yields could also affect the corn markets. Increased costs to livestock producers reduce their margins which could drive up prices to the meat packing facilities, which in turn could cause the prices of meat to increase in grocery stores. The farmer, livestock producer, meat packing facility, and grocery store owner all are operating with tight budgets and profit margins; therefore, when there is an upset to the market system, they make resource adjustments, find efficiencies, and may ask employees to do more work with less people. The ripple economic impacts to the livestock producer, the meat packing facility, grocer, and the general consumer are difficult to quantify. The ripple effects from the potential loss of jobs are impossible to predict. Usually businesses know how to manage through temporary, short-term fluctuations, however, in this case, the change is permanent, and therefore any affects as a result, permanent. Furthermore, as public power district, NPPD does not pay property taxes, resulting in lost tax revenue to Nebraska. Losses in tax revenue impact the local and state government services such as the NRD, the school district, the rural fire department, and the county health department. However, for purposes of the cost effectiveness analysis, only the loss of revenue (2007 figures) was added to the annualized costs, which increased the total annualized costs to $123,933,694. Approximately 5.7% of the costs are associated with the loss of crop value. Overall, the impact as a result due to water-related issues increased the annualized costs from $108,450,000 to $123,933,694, a 14.3% increase. The NDEQ concluded this is a significant economic impact.

10.6.3.5 Visibility Impacts

Air dispersion modeling using CALPUFF was conducted to determine the impact on visibility from GGS Units 1 and 2 at several Class I areas. The highest impacts were observed at Badlands in South Dakota. The second highest were in Wind Cave in South Dakota, which is just west of the Badlands. Badlands is the Class I area closest to GGS at approximately 300 km.

Improvements seen at the Badlands are expected to be seen at Wind Cave as well. Appendix Y to Part 51 – Guidelines for BART Determinations under the Regional Haze Rule provides under STEP 5: Determining Visibility Impacts: "*If the highest modeled effects are observed at the nearest Class I area, you may choose not to analyze the other Class I areas any further...*" Given the direction provided by Appendix Y and the uncertainties of the model beyond 200km, NDEQ concluded that the analysis of the Badlands was appropriate.

The total baseline impact from NPPD GGS is shown in Table 2 of the May 11, 2010 NPPD BART Permit Fact Sheet. The number of days above 0.5 dV for the 7 Class I areas analyzed ranged from 10 – 60 days. The area with the greatest impact was Badlands in all 3 years analyzed. Additional benefits analyses beyond the Badlands are unwarranted because controls on the GGS Units 1 and 2 will not likely exhibit greater visibility improvement than what is predicted in the Badlands. However, given the comment received by the federal land managers and the relative proximity of Wind Cave National Park, NDEQ assumed similar benefits would be expected there. Furthermore, model accuracy is highly uncertain at distances greater than 200 km. Table 10.16 shows the modeled visibility effectiveness of SO_2 control options, based on the estimated impacts at the Badlands. Included in the analysis is an evaluation of putting the control cost into perspective as they relate to visibility impairment.

Table 10.16: Visibility Effectiveness (SO_2 Controls)

		2001	2002	2003	Average
Control Option	**Class I Area with Greatest Impact from GGS**	**Badlands**	**Badlands**	**Badlands**	
Baseline (no SO_2 Control)	SO_2 Modeled Emission Rate (lb/MMBtu)	0.749	0.749	0.749	
	Modeled 98th Percentile Value (dV)	2.845	2.828	3.121	2.931
	Number of Days Exceeding 0.5 dV	54	55	60	56
FGD Control Added (0.10 lb/MMBtu)	Modeled 98th Percentile Value (dV)	1.790	2.026	2.443	2.086
	Visibility Impairment Improvement (ΔdV)	1.055	0.802	0.678	0.845
	Number of Days Exceeding 0.5 dV	33	33	36	34
	Days of Improvement	21	22	24	22
	Impairment Improvement Cost ($/yr/ΔdV)	$117,472,696	$154,530,791	$182,793,059	$146,667,093
	Cost per Day of Improvement	$5,901,604	$5,633,350	$5,163,904	$5,633,350

If we assume similar benefits are achieved at Wind Cave National Park, and consider the benefits as cumulative:

Average impairment improvement cost = $73,333,547 $/yr/ΔdV
Cost per Day of Improvement = $2,816,675

The cost per day of improvement index is an indicator of the frequency of impact (and benefit) a source has on a Class I area. The impairment improvement cost is an indicator of how much benefit is derived from the investment in the control. Nebraska used a $40,000,000/yr/ΔdV and $500,000 per day as thresholds for determining what would be considered reasonable investment for visibility improvement. In conclusion, as indicated in the discussion above, the water resources within the river basin in which GGS is located and in surrounding river basins are scarce. A moratorium has been placed on new consumptive uses of water. Offsets of existing uses are difficult to find and economically prohibitive given the distances and infrastructure needed to transport water from a reliable supply location. The unusual and unique circumstances related to the scarce water resources in this region of the state and the State of Nebraska's commitments to other states and the federal government under the PRRIP when compared to the limited visibility improvement that might result from the additional control justifies not requiring GGS to install scrubbing technology as a BART control measure for SO_2.

10.6.4 Dry Sorbent Injection (DSI) Evaluation

On December 14, 2010, the federal land managers commented on Nebraska's proposed Regional Haze (RH) State Implementation Plan (SIP), while it was on public notice, concerning the extent to which dry sorbent injection (DSI) should be considered as a sulfur dioxide (SO2) control option for Nebraska Public Power District's (NPPD's) Gerald Gentleman Station (GGS) Units 1 and 2.

NDEQ had eliminated scrubbing as BART as document in Sections 10.6.3 above, but had failed to evaluate DSI, a control option uses very little water. The NDEQ cited the water requirements of Wet Flue Gas Desulfurization (FGD) and Dry FGD as one contributing factors for eliminating them as BART for GGS Units 1 and 2.

The purpose of the following sections is to supplement the analyses on the other SO_2 controls previously analyzed.

10.6.4.1 Updated BART Analysis for SO2

The objective of this analysis is to complete a five-factor analysis for DSI, as it pertains to SO_2 removal. The five basic steps for BART analysis are:

Step 1- Identify all available retrofit control technologies
Step 2- Eliminate technically infeasible options
Step 3- Evaluate control effectiveness of remaining control technologies
Step 4- Evaluate impacts and document the results
Step 5- Evaluate visibility impacts

10.6.4.2 Technical Feasibility

DSI

DSI involves the injection of a sorbent into the ductwork upstream of the unit's particulate control system. The sorbent for SO_2 removal is typically either mineral trona (sodium sesquicarbonate) or refined sodium bicarbonate. This BART analysis only considers trona as the

sorbent since it has a wider active flue gas temperature range and is less expensive than refined sodium bicarbonate.[13]

10.6.4.3 Eliminate technically infeasible options
Utilities have installed DSI on several smaller boilers (88 megawatts (MW) to 200 MW) since 2006. Midwest Generation, LLC recently conducted pilot scale testing at their Powerton and Joliet facilities on boilers ranging in size from 700 MW to 900 MW that demonstrated the technology is transferable to larger boilers.

In addition, the Illinois Environmental Protection Agency[14] and the Oregon Department of Environmental Quality[15] are requiring DSI on large utility boilers in their states in order to satisfy BART requirements. However, NPPD continues to refute the claim that DSI is a proven technology for coal-fired power plants with the size of the GGS Units 1 and 2.[16]

10.6.4.4 Evaluate control effectiveness
Since DSI is considered a feasible technology, its effectiveness was measured by the amount of SO_2 removed based on a comparison of the controlled emission rate of 0.15 pounds per million British thermal units (lb/MMBtu) to the uncontrolled baseline emission rate of 0.749 lb/MMBtu. The 0.15 lb/MMBtu is the presumptive BART limit in 40 CFR Appendix Y for electrical generation units above 200 megawatts (MW) at plants greater than 750 MW. NPPD used the baseline emission rate of 0.749 lb/MMBtu in the original BART analysis, which is based on the maximum actual 24-hr SO_2 emissions over a three-year baseline period (2001-2003).

10.6.4.5 Evaluate impacts and document the results
In order to be consistent with the last BART analysis for GGS, the NDEQ has considered DSI's cost of compliance, energy impacts, non-air quality environmental impacts, and the remaining useful life of the units.

10.6.4.6 Cost of Compliance
NPPD's analysis was conducted by Sargent & Lundy, LLC. They also provided the supplemental information for the previous BART analysis. Sargent & Lundy is a full-service firm, providing consulting, design, procurement, construction management, and turnkey services. As such, the analysis provided is considered to include vendor quotes as allowed by Appendix Y and supplements guidance contained the Environmental Protection Agency's (EPA's) Office of Air Quality Planning and Standards' Control Cost Manual.

The cost associated with DSI installation include, but are not limited to: storage silos for the trona, construction of rail upgrades to allow for the receiving of trona, and expanding the ash storage system due to increased quantity of solid waste generated by the facility. Detailed information can be found in the supporting materials provided by NPPD. The table below

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[13] Information provided by Solvay Chemicals, Inc.
[14] Faggert, Pamela F. of Dominion Resources Services, Inc., Concerning the Memorandum of Understanding on SO_2 and NO_x Reductions Reflective of BART for Kincaid Units 1 and 2, to James R. Ross of the Illinois Environmental Protection Agency, February 3, 2009.
[15] Addendum to the Oregon DEQ BART Report for the Boardman Power Plant, November 30, 2010.
[16] Information can be found in NPPD's letter dated April 29, 2011 to the NDEQ.

provides a cost comparison of DSI versus the control technology analyzed in the previous BART Permit. Costs were adjusted to 2016 because that is the likely time when installation would occur.

Table 10.17: Comparison Costs for SO_2 Controls Adjusted to 2016 Dollars

Cost Element	Dry FGD[17]	Wet FGD[17]	DSI
Total Capital Cost	$1,057,068,000	$1,109,003,000	$208,330,000
Annualized Capital Cost	$86,166,000	$90,422,000	$17,500,000
Annualized O&M Cost	$30,697,000	$26,368,000	$64,458,000
Total Annualized Cost	$116,863,000	$116,790,000	$81,958,000
Annual Tons SO_2 Removed	39,815	39,815	39,815
Cost Per Ton Removed	$2,935	$2,933	$2,058

The total annualized cost associated with the installation of DSI at GGS is $81,958,000. The average cost effectiveness of this control technology is $2,058 per ton SO_2 removed ($81,958,000 / 39,815 tons SO_2 removed) based on an emissions rate of 0.15 lb/MMBtu. This is assuming a very high removal rate at nearly 80%. The cost per ton removal estimated for GGS is similar to the values provided in the DSI BART analysis by the Illinois Environmental Protection Agency[14] and the Oregon Department of Environmental Quality.[15] However, the capital costs are higher when compared to other BART determinations requiring DSI. Even though Illinois and Oregon have required the use of DSI on comparable size boilers, there are many uncertainties involved with the installation of this control equipment since it is a relatively new technology for boilers the size of GGS Units 1 and 2. In addition, the majority of the dollars per ton of SO_2 removed result from high ongoing operating cost due to the use of a sorbent.

10.6.4.7 Energy Impacts

If DSI was employed, 0.6% (7.6 MW)[16] of the units' generating capacity would be utilized to operate the control equipment. Seven and six-tenths megawatts is equivalent to the power utilized by approximately 7,600 homes. The original BART analysis reported a power usage rate 36 MW and 26 MW for Wet FGD and Dry FGD, respectively.

The energy costs were included in the BART analysis cost above.

10.6.4.8 Other (Non-Air Quality) Environmental Impacts

Disposal of Solid Waste

Non-air quality environmental impacts associated with the installation of DSI include disposal of solid waste generated from the spent trona and fly ash. The cost to dispose of the waste was included in the cost analysis. The fly ash will be intermixed with trona which will cause it to be unsuitable for third party use requiring it to be land-filled.[13] From 2004 to 2008, NPPD sold an average of approximately 107,000 tons of fly ash from GGS.[188] The revenue lost from fly-ash sales was not included in the cost analysis.[18]

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[17] Appendix A of NPPD's letter dated March 15, 2011 to the NDEQ. Does not account for the costs of water with dry or wet scrubbing.

[18] GGS's Landfill Permit, pp. 2-3, September 2009.

The use of DSI would require GGS to landfill approximately 400,000 tons of waste per year[16] which is four times more than GGS currently landfills.[18] Therefore, the life of their current landfill would be vastly shortened, requiring additional landfill capabilities much sooner than previously anticipated.

The NDEQ is also concerned with the possibility that the land-filled waste may have a hazardous waste classification. The EPA is still pending their determination on the classification of fly ash as a solid waste or hazardous waste. Also, a study by the Department of Energy found arsenic and methylene chloride in the ash when DSI was used; however, it is not currently known if the levels of arsenic and methylene chloride discovered would classify the ash as hazardous waste. This was an issue raised by the National Park Service in their comments on Martin Drake.

Disposal of Liquid
The DSI application does not use water to improve the mass transfer of SO_2 as is the case with Dry and Wet FGD technologies. However, some water is used in DSI application to wash the trona mills as part of required daily maintenance. The trona mills are filled with water to dissolve the deposits of sodium that accumulate on the mill internals. Based on information provided by NPPD[18] and a scaling factor, GGS will averages less than 5 gallons per minute on an annual basis to wash the trona mill. The resulting liquid waste is high in sodium and, therefore, must be disposed of properly.

10.6.4.9 Remaining Useful Life
The useful remaining life of GGS Units 1 and 2 is greater than 20 years under the current NPPD energy resource plan. Therefore, the remaining useful life has no impact on the annualized estimated control technology cost at this time.

10.6.4.10 Visibility Impacts
Air dispersion modeling using CALPUFF was conducted to determine the impact on visibility from GGS Units 1 and 2 at the Badlands in South Dakota. The highest impacts were observed at the Badlands in the original BART analysis and it is the closest to GGS, at distance of approximately 300 km. 40 CFR Part 51 Appendix Y says that if the highest modeled effects are at the nearest Class I area, states may choose not to analyze the other Class I areas any further. The CALPUFF results of the deciview improvement using DSI are compared to GGS's previous BART analysis in the table below.

Table 10.18: Visibility Effectiveness

Control Option	Class I Area with Greatest Impact from GGS	2001 Badlands	2002 Badlands	2003 Badlands	Average
Baseline (no SO_2 Control)	SO_2 Modeled Emission Rate (lb/MMBtu)	0.749	0.749	0.749	
	Modeled 98th Percentile Value (dV)	2.845	2.828	3.121	2.931
	# of Days Exceeding 0.5 dV	54	55	60	56
FGD Control Added (0.10 lb/MMBtu)[1]	Modeled 98th Percentile Value (dV)	1.79	2.02	2.44	2.08
	Visibility Impairment Improvement (ΔdV)	1.055	0.802	0.678	0.845
	# of Days Exceeding 0.5 dV	33	33	36	34
	Impairment Improvement Cost ($/yr/ΔdV)[2]	$117,472,696	$154,530,791	$182,793,059	$146,667,093
	Cost per Day of Improvement[3]	$5,901,604	$5,633,350	$5,163,904	$5,633,350
Dry Sorbent Injection (0.15 lb/MMBtu)[4]	Modeled 98th Percentile Value (dV)	1.755	2.147	2.31	2.07
	Visibility Impairment Improvement (ΔdV)	1.09	0.681	0.811	0.861
	# of Days Exceeding 0.5 dV	35	37	39	37
	Impairment Improvement Cost ($/yr/ΔdV)[2]	$75,190,826	$120,349,486	$101,057,953	$95,189,314
	Cost per Day of Improvement[3]	$4,313,579	$4,553,222	$3,902,762	$4,256,521

[1] Results from GGS's previous BART analysis
[2] Total annualized cost / Incremental visibility impairment improvement
[3] Incremental Cost per day = Total annualized cost/no. of days improvement (<0.5 dV)
[4] Provided in NPPD's letter to the NDEQ dated April 29, 2011.

The results for DSI and FGD (both at 0.15 lb/MMBtu) had different deciview impacts because the use of FGD results in a substantial drop in stack temperature and velocity, compared to when DSI is used.

If we assume similar benefits are achieved at Wind Cave National Park, and consider the benefits as cumulative:

Average impairment improvement cost = $47,594,657$/yr/ΔdV
Cost per Day of Improvement = $2,156,789

The cost per day of improvement index is an indicator of the frequency of impact (and benefit) a source has on a Class I area. The impairment improvement cost is an indicator of how much benefit is derived from the investment in the control. Nebraska used a $40,000,000/yr/ΔdV and $500,000 per day as thresholds for determining what would be considered reasonable for visibility improvement. EPA Region 7 provided NDEQ with a table comparing the dollars per deciview ($/dV) impact of several BART SO_2 determinations by other states in their comments on the NDEQ's proposed SIP. The NDEQ has confirmed that EPA Region 7 used the visibility improvement at a single class one area in order to compare the $/dV improvement. The table, with DSI incorporated as BART for GGS Units 1 and 2 can be found below.

Table 10.19: SO_2 BART Cost Comparisons to other Facilities [1]

Operating Company	State	Facility	Proposed Control	Reductions (tons/year)	Capital Cost ($1000)	Annual Cost ($1000)	$/ton	Δdv	$/dv[2]
PGE [3]	OR	Boardman	LSD/FF	11,988	$247,300	$36,600	$3,053	1.04	$35,192,308
Colorado Springs Utility [4]	CO	Martin Drake	LSD/FF	3,610	$44,166	$8,216	$2,276	0.2	$4,192,276
PacifiCorp [5]	WY	Dave Johnston	Dry FGD/FF	11,589	$169,500	$21,419	$1,848	1.39	$16,703,531
PacifiCorp [6]	WY	Dave Johnston	Dry FGD/FF	5,657	$222,776	$26,833	$4,743	1.15	$25,421,181
PacifiCorp [7]	WY	Naughton	Wet FGD	7,657	$89,400	$13,068	$1,707	1.03	$13,947,954
PacifiCorp [8]	WY	Naughton	Wet FGD	9,934	$117,440	$16,889	$1,700	1.14	$15,889,802
Basin Electric Power [9,13]	ND	Leland Olds	FGD	32,949	$107,220	$19,310	$586	1.75	$11,065,903
Great River Energy [10,13]	ND	Stanton	LSD/FF	8,438	$79,514	$11,200	$1,330	0.77	$14,533,679
Minnkota Power [11,13]	ND	Milton R. Young	FGD	20,443	$111,776	$22,584	$1,105	1.46	$15,426,230
Otter Tail Power [12]	SD	Big Stone Generation	SD/FF	16,120	$141,300	$23,750	$1,462	0.16	$51,350,763
Nebraska Public Power District	NE	Gerald Gentleman	DSI/FF	39,815	$208,330	$64,458	$2,058	0.86	$95,189,314
Omaha Public Power District[14]	NE	Nebraska City Station	FGD	21,223	$201,660	$34,720	$1,636	0.49	$79,450,801

[1] The costs were based on EPA Region 7's letter dated January 21, 2011.
[2] All were confirmed to use a single Class I Area in their $/dv comparison
[3] Table 23 on page D-26 of "Appendix D: Supplement BART information for Boardman Power Plant BART Report", June 19, 2009
[4] Page 79 of "Colorado Visibility and Regional Haze State Implementation Plan for 12 Mandatory Class I Federal Areas", January 7, 2011
[5] Tables 16 and 17 on page 22 and Table 28 on page 39 of "BART Application Analysis (AP-6041) for Dave Johnston Power Plant", May 28, 2009
[6] Tables 18 and 19 on pages 22 and 23 and Table 29 on page 40 of "BART Application Analysis (AP-6041) for Dave Johnston Power Plant", May 28, 2009
[7] Tables 19 and 20 on page 26 of "BART Application Analysis (AP-6042) for Naughton Power Plant", May 28, 2009
[8] Tables 21 and 22 on pages 26 and 27 of "BART Application Analysis (AP-6042) for Naughton Power Plant", May 28, 2009
[9] Pages 6 and 8 of "BART Determination for Leland Olds Station Units 1 and 2" in Appendix B of Department BART Determination.
[10] Page 5 of "BART Determination for Stanton Station Unit 1" in Appendix B of Department BART Determination.
[11] Page 6 of "BART Determination for Milton R. Young Station Units 1 and 2" in Appendix B of Department BART Determination.
[12] Table 3-8 on page 18 and Table 6-7 on page 87 of "South Dakota's Regional Haze State Implementation Plan"
[13] Primarily use Dakota Lignite Coal.
[14] Omaha Public Power District BART determination was not to install control equipment for SO_2 due to the high cost for the little benefit

10.6.4.11 SO_2 BART Determination for GGS

DSI technology is a technically feasible SO_2 retrofit technology that could be implemented on GGS Units 1 and 2. Not considering all outstanding issues, the average cost effectiveness of using DSI control technology is approximately $2,000 per ton of SO_2 removed; this cost per ton removed is reasonable. However, when comparing the dV improvement that would be gained and compared to the $/dV improvement to those provided by EPA Region 7, GGS Units 1 and 2 are substantially higher than any other facility included in Table 19. Furthermore, visibility benefit gained does not outweigh the added burden of the added waste that would be generated through the control of SO_2. Even though one facility has a $/dV impact higher than that of the threshold NDEQ used, the rules allow for states to use different approaches and threshold. A distinguishing factor between Nebraska and South Dakota is that Nebraska does not contain any Class I areas.

NDEQ does reserve the ability to revisit additional SO_2 controls at NPPD GGS in the future for purposes of "reasonable further progress". However, at this time the NDEQ has determined that it is inappropriate to require the installation of DSI at GGS Units 1 and 2 due to the excessive cost per benefit in terms of visibility improvement (i.e. $/yr/dV) and the significant solid waste impact, and the uncertainty with regard to whether the waste would be considered a hazardous waste.

Appendix 10.1 Detailed Information on BART Eligible Units
Appendix 10.2 Information about Identification of BART Eligible Units
Appendix 10.3 CALPUFF Modeling Protocols
Appendix 10.4 Letters sent to non-BART subject Sources
Appendix 10.5 Modeling Results
Appendix 10.6 BART analysis submitted by BART subject Sources
Appendix 10.7 Additional supporting information
Appendix 10.8 BART permit determinations and supporting information
Appendix 10.9 Title 129 Chapter 43- Visibility Protection
Appendix 10.10 Causes of Haze Study, Sonoma
Appendix 10.11 Twin Platte NRD Integrated Management Plan
Appendix 10.12 Nebraska Statutes
Appendix 10.13 Supplemental BART information related to DSI Analysis

11 Reasonable Further Progress/Long Term Strategy

The Regional Haze Rule calls for each state to "address regional haze in each mandatory Class I Federal area located within the state and in each mandatory Class I Federal area located outside the state which may be affected by emissions from within the state" [40 CFR 51.308(d)]. Although there are no Class I areas located within Nebraska, the State is still required to address regional haze by mitigating the emissions that may be significantly be impacting a mandatory Class I area. As part of the CENRAP regional planning process, regional modeling was performed to show the impact on several surrounding Class I areas from Nebraska emissions. The impact from Nebraska emissions is discussed further below.

Despite the minimal impact from Nebraska, the State still anticipated the surrounding states would request that we consult with them to address the requirements to meet reasonable progress at their Class I areas. As discussed in the consultation section, because of the minimal impact the State of Nebraska was not asked by any state, beyond the BART determinations, for any additional specific reductions from any State during their consultation process. The consultation process is described in Chapter 11.4.

11.1 Determining Visibility Impact

Nebraska is required by 40 CFR 51.308(d)(3)(iii) to document the technical basis for the State's apportionment of emission reductions necessary to meet reasonable progress goals in each Class I area affected by the State's emissions. In order to address the issue of source attribution and apportionment of regional haze for its member states, CENRAP contracted with ENVIRON to carry out PM Source Apportionment Technology (PSAT) modeling, a well known "probing tool" for the CAMx photochemical model. ENVIRON delivered its results in the form of a customized Microsoft Access database query tool, hereinafter the PSAT tool, which allows users to select among various inputs to produce charts and tables. The PSAT information is available through the CENRAP website http://www.cenrap.org/html/projects.php and on the University of California Riverside website at http://pah.cert.ucr.edu/aqm/cenrap/camx.shtml.

Visibility impact can be represented in terms of absolute light extinction (Bext),inverse megameters (Mm-1), and percent total light extinction. Visibility impact can be further evaluated in terms of the percent contribution by pollutant species. The relationship between deciviews (dv) and inverse megameters (Mm^{-1}) is described in detail by Malm, (1999). The following equation defines the Haze Index (HI):

$$HI = 10 \ln(b_{ext}/10)$$

Thus, one deciview is approximately equal to 11.05 Mm^{-1} and a change of one dv represents a change of approximately ten percent in b_{ext}, "which is a small but perceptible scenic change under many circumstances".

Figures 11.1-11.13 are taken from Appendix E of the Cenrap Technical Support Document and the PSAT modeling tool which show the ranked results by source category contributions to the average 2018 extinction (Mm-1) for the worst 20% visibility days.

Figure 11.1 Caney Creek Wilderness Area, AR (CACR)

CENRAP PSAT Projected W20% 2018 BEXT at Site CACR1 [Total=80.33]

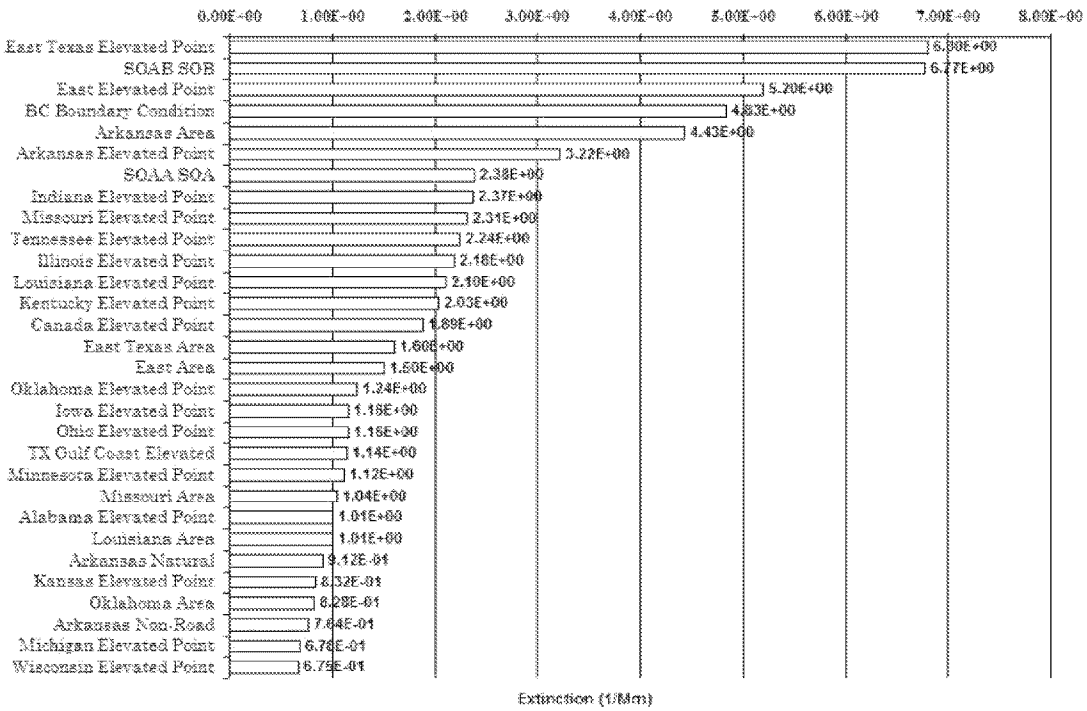


Figure 11.2 Upper Buffalo Wilderness Area, AR (UPBU)

CENRAP PSAT Projected W20% 2018 BEXT at Site UPBU1 [Total=81.54]

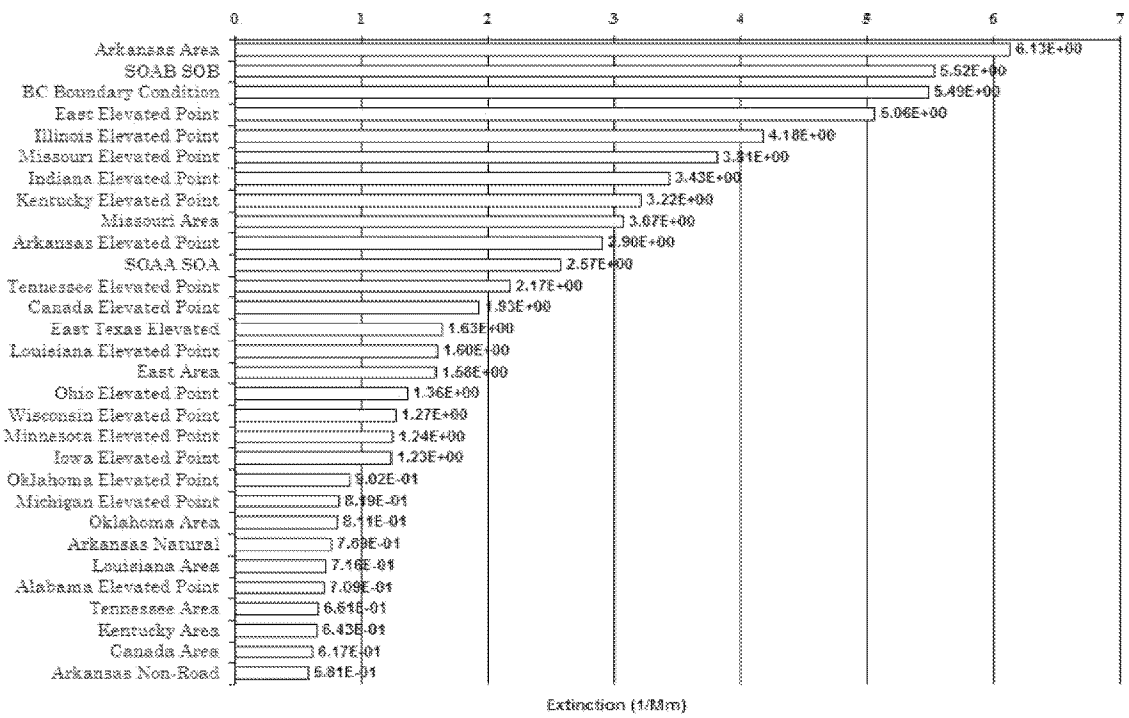


Figure 11.3 Breton Island Wilderness Area, LA (BRET)

CENRAP PSAT Projected W20% 2018 BEXT at Site BRET1 [Total=101.05]

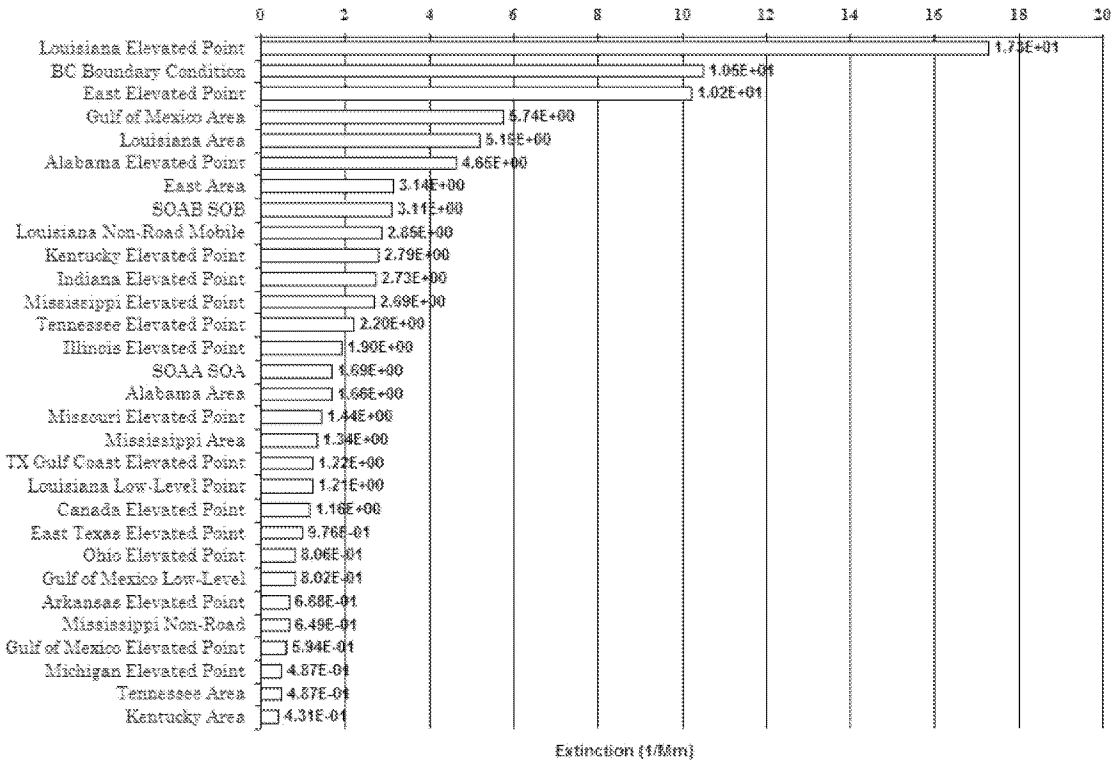


Figure 11.4 Boundary Waters Canoe Area Wilderness Area, MN (BOWA)

CENRAP PSAT Projected W20% 2018 BEXT at Site BOWA1 [Total=54.21]

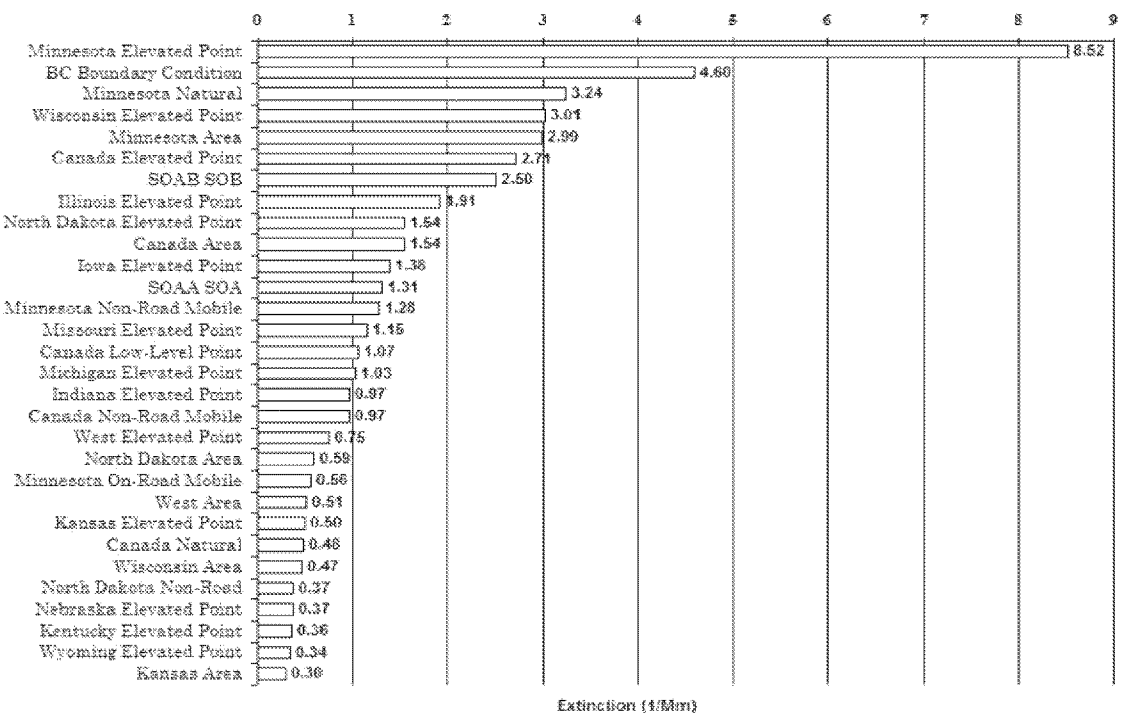


Figure 11.5 Voyagers National Park, MN (VOYA)

CENRAP PSAT Projected W20% 2018 BEXT at Site VOYA2 [Total=49.34]

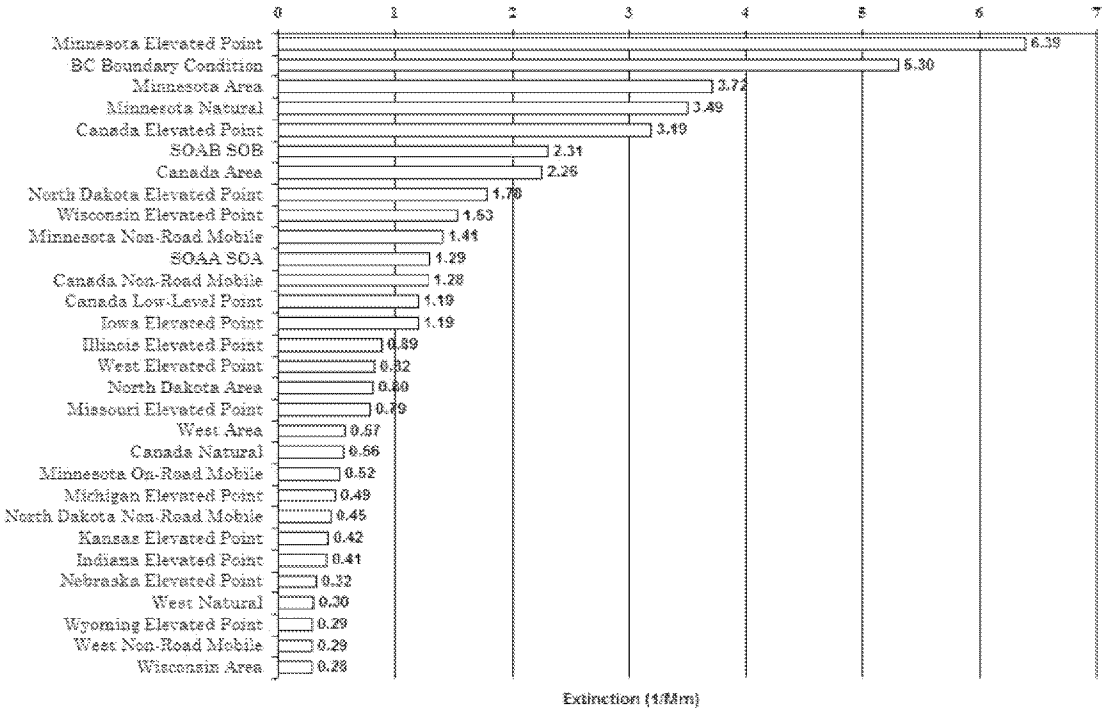


Figure 11.6 Hercules-Glades Wilderness Area, MO (HEGL)

CENRAP PSAT Projected W20% 2018 BEXT at Site HEGL1 [Total=85.93]

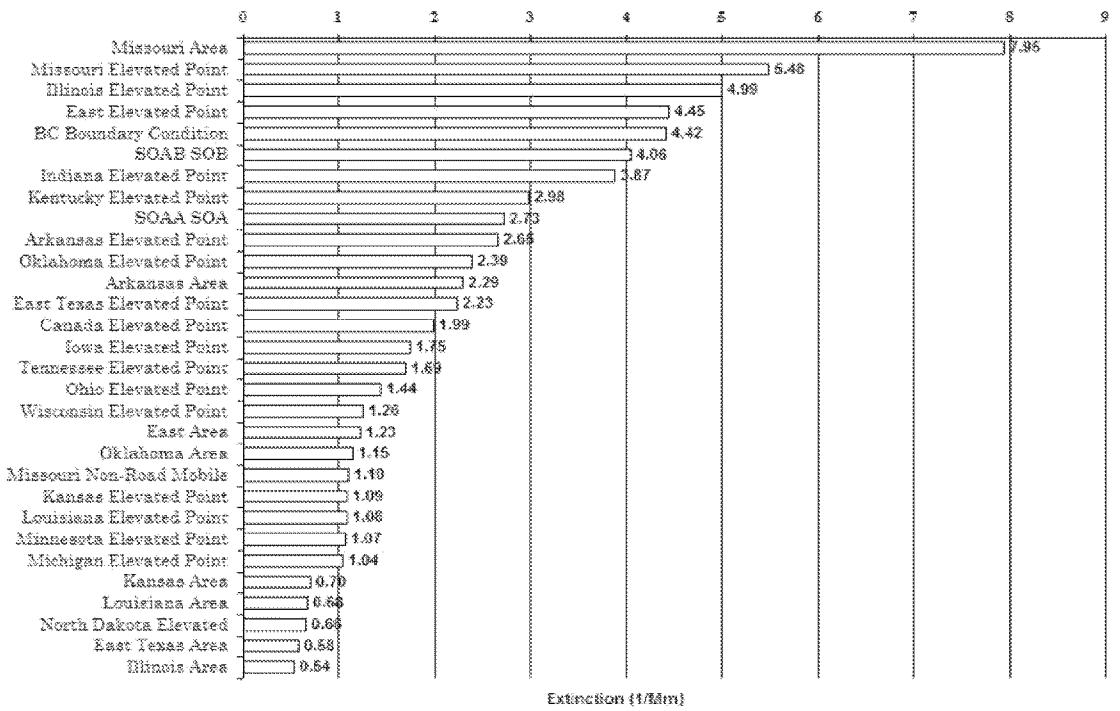


Figure 11.7 Mingo Wilderness Area, MO (MING)

CENRAP PSAT Projected W20% 2018 BEXT at Site MING1 [Total=96.32]

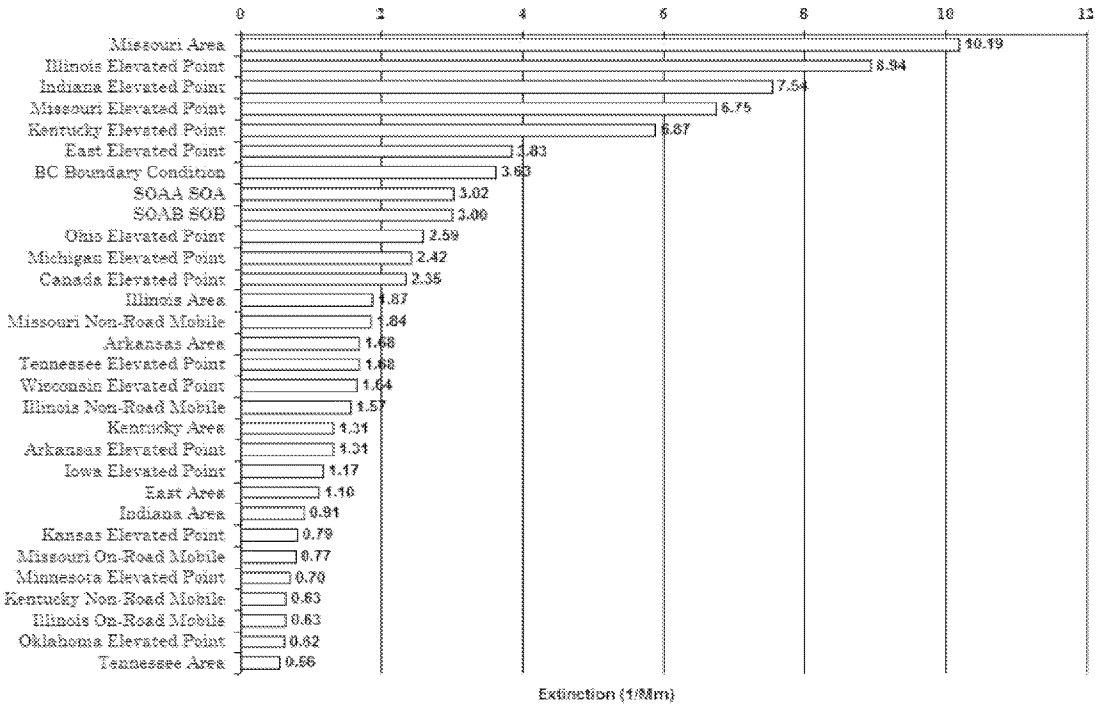


Figure 11.8 Wichita Mountains Wilderness Area, OK (WIMO)

CENRAP PSAT Projected W20% 2018 BEXT at Site WIMO1 [Total=72.01]

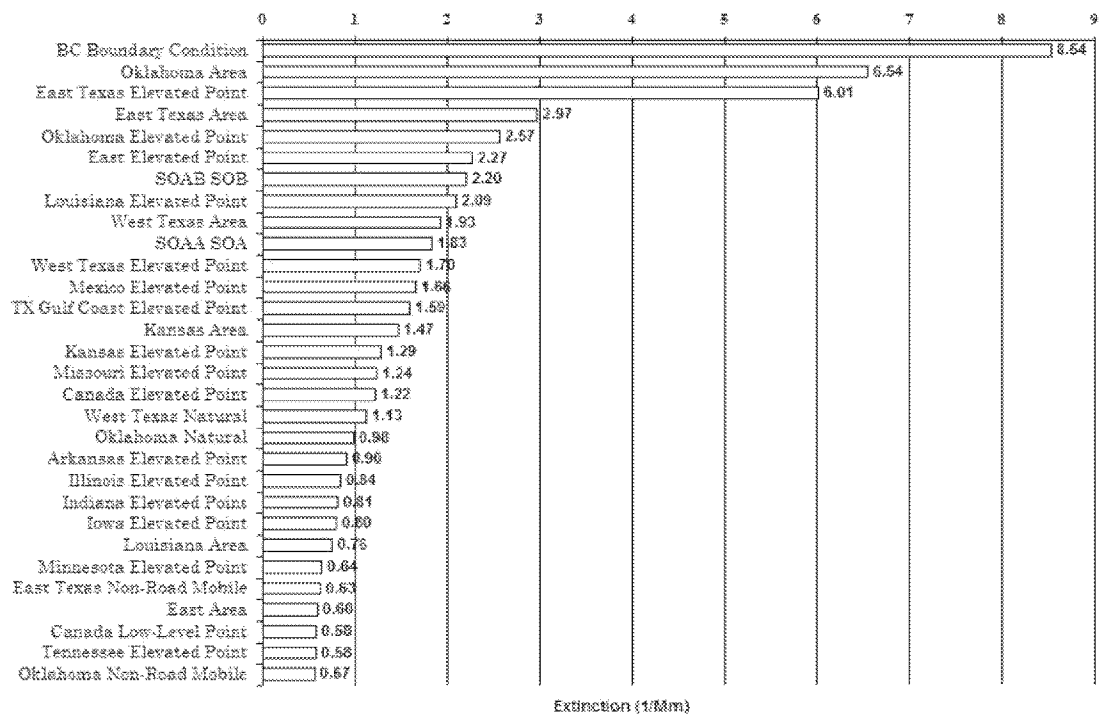


Figure 11.9 Big Bend National Park (BIBE), TX

CENRAP PSAT Projected W20% 2018 BEXT at Site BIBE1 [Total=43.27]

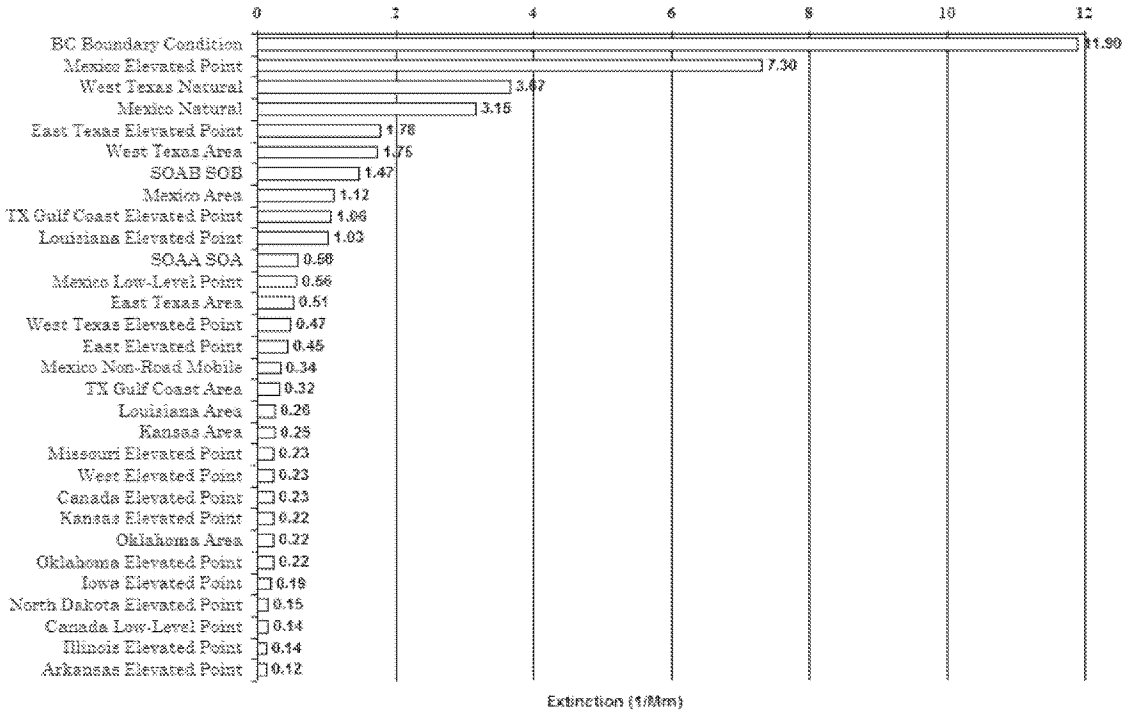


Figure 11.10 Guadalupe Mountains National Park (GUMO), TX

CENRAP PSAT Projected W20% 2018 BEXT at Site GUMO1 [Total=45.15]

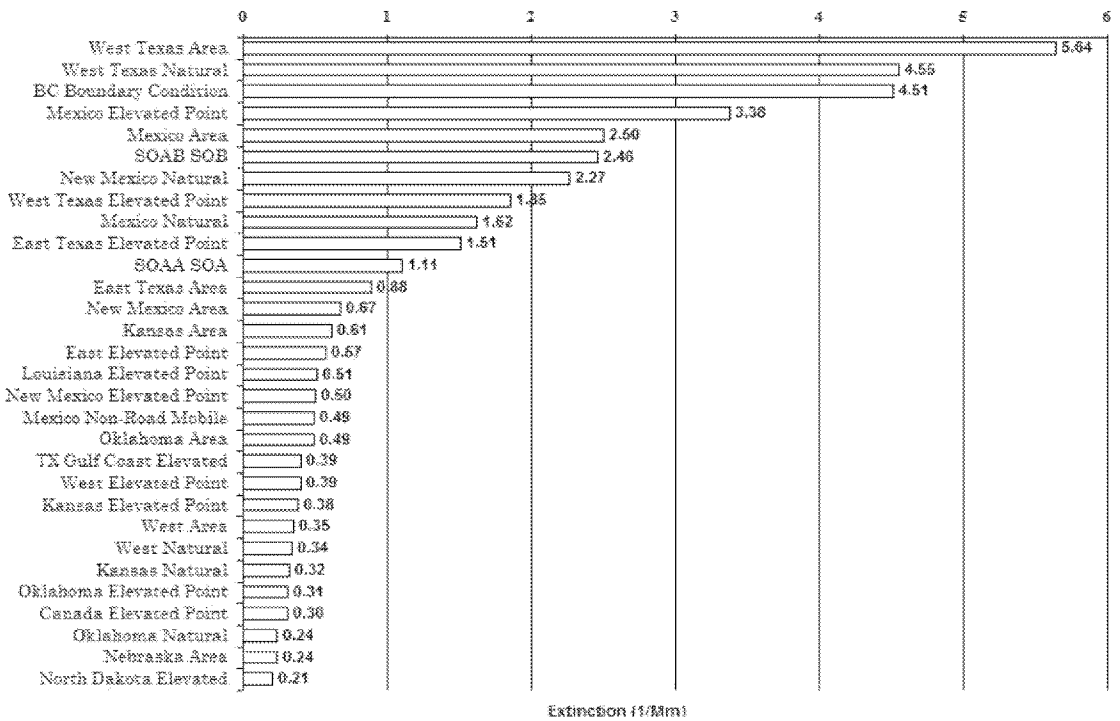


Figure 11.11 Badlands National Park (BADL), SD

CENRAP PSAT Projected W20% 2018 BEXT at Site BADL1 [Total=41.2,Rayleigh=11,SS=0.19]

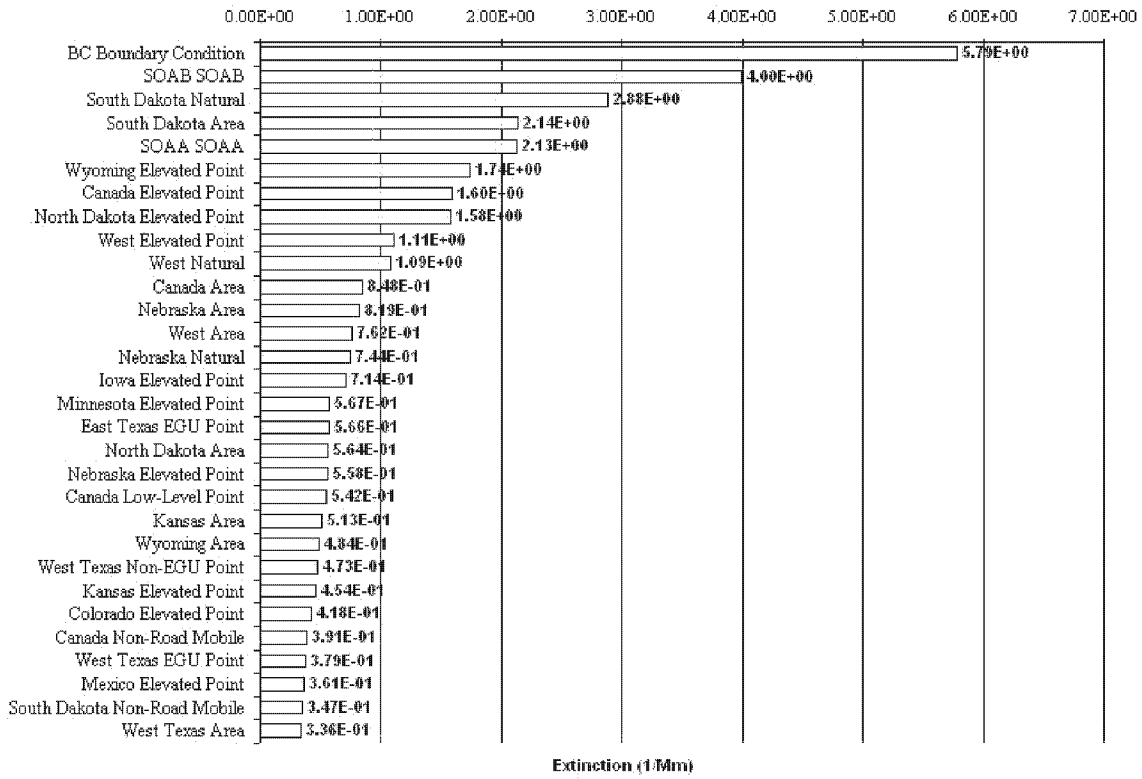


Figure 11.12 Wind Cave National Park (WICA), SD

CENRAP PSAT Projected W20% 2018 BEXT at Site WICA1 [Total=37.16,Rayleigh=10,SS=0.03]

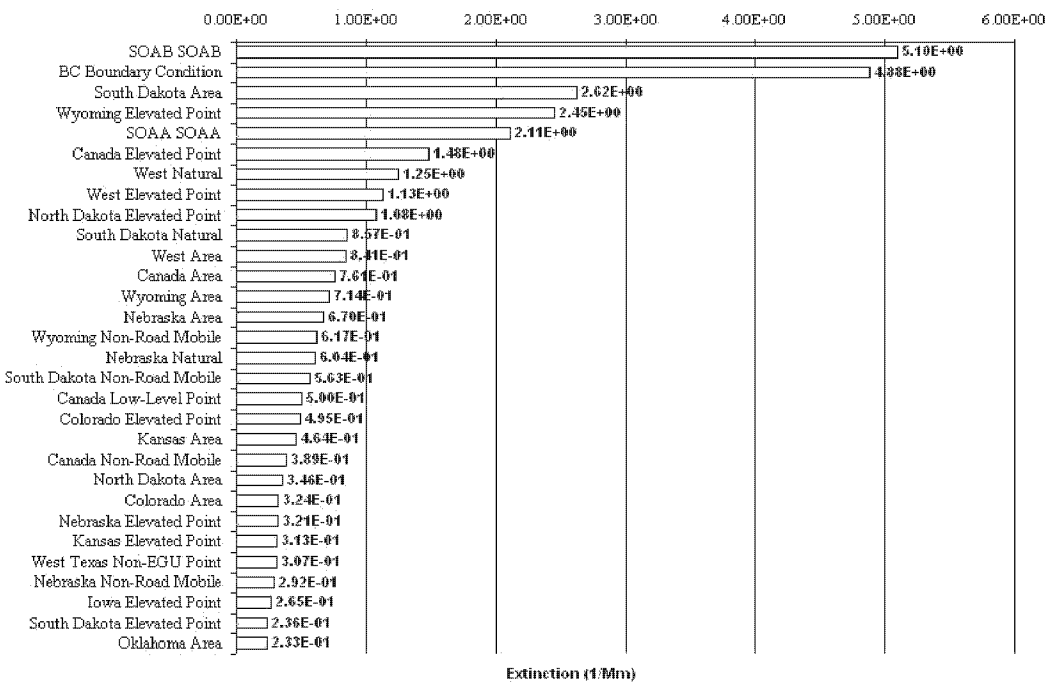


Figure 11.13 Rocky Mountain National Park (ROMO), CO

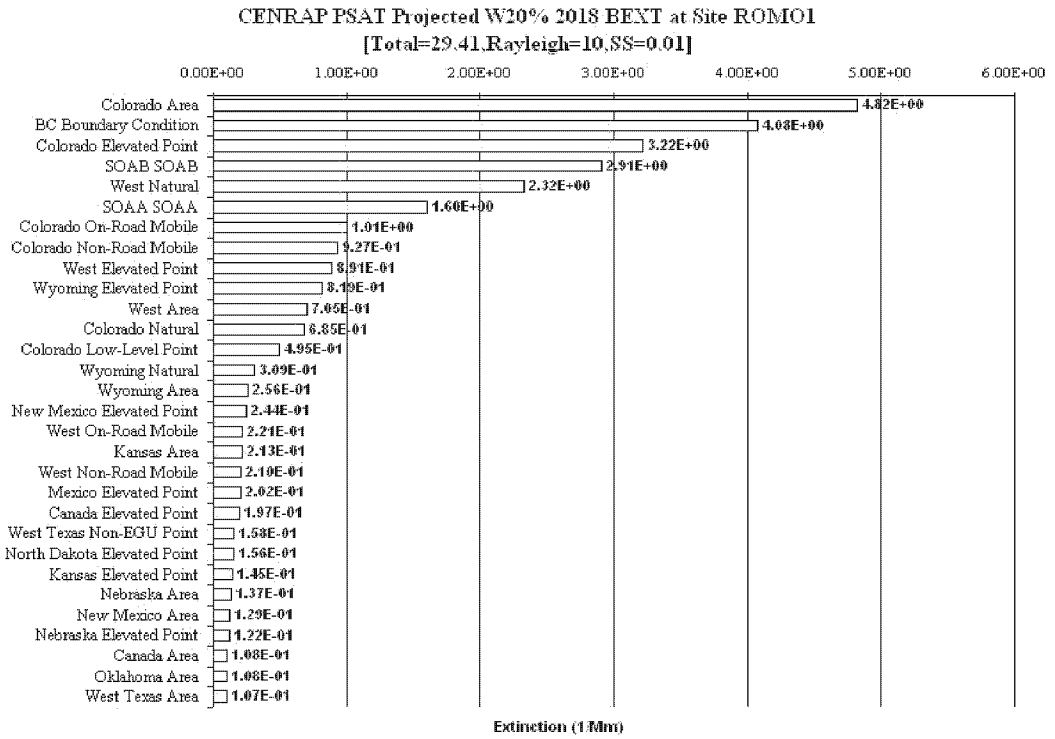
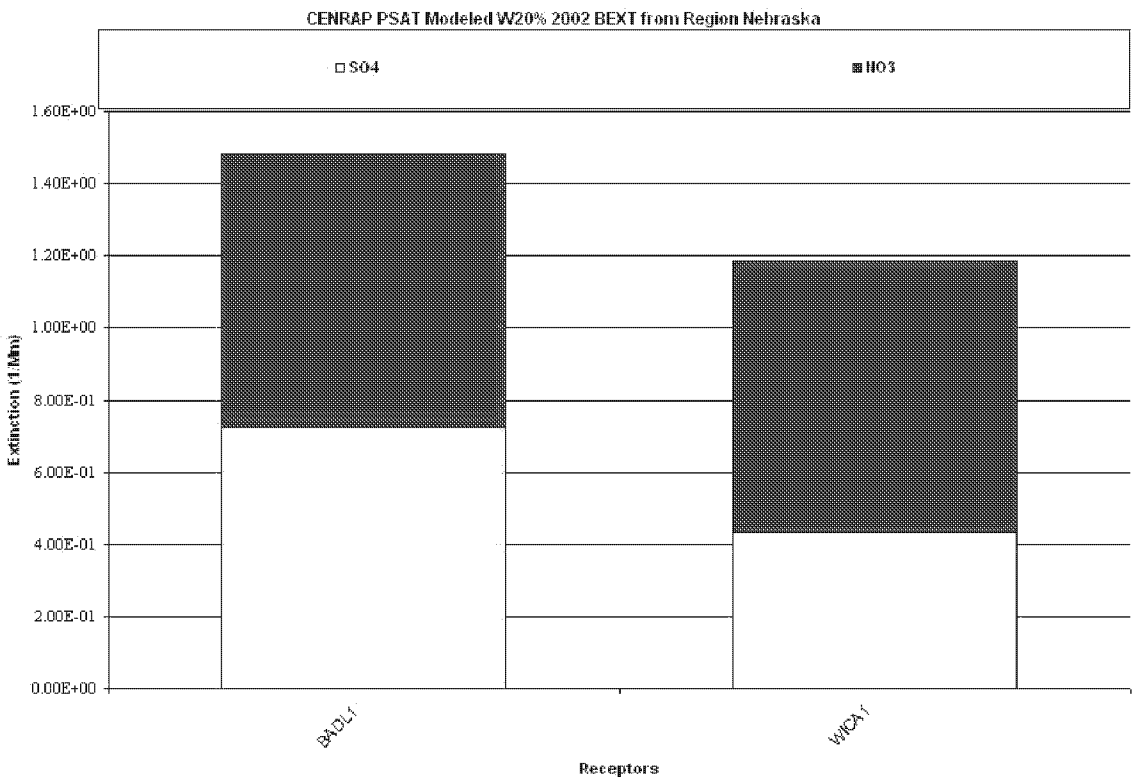


Figure 11.14 Modeled W20% 2002 Extinction from Nebraska (SO4 & NO3)



The nearest Class I areas to OPPD NCS is Hercules Glades, located in Missouri. Hercules Glades is just approximately 580km from OPPD NCS. OPPD NCS is located in the southeastern corner of the state. Using the PSAT tool, previously discussed, the source apportionment of light extinction causing pollutants can be determined.

Figure 11.15 shows that at Hercules Glades the most significant pollutant to light extinction is sulfates from elevated point sources.

Figure 11.15 Worst 20% visibility days at Hercules Glade (HEGL), MO Future Year 2018

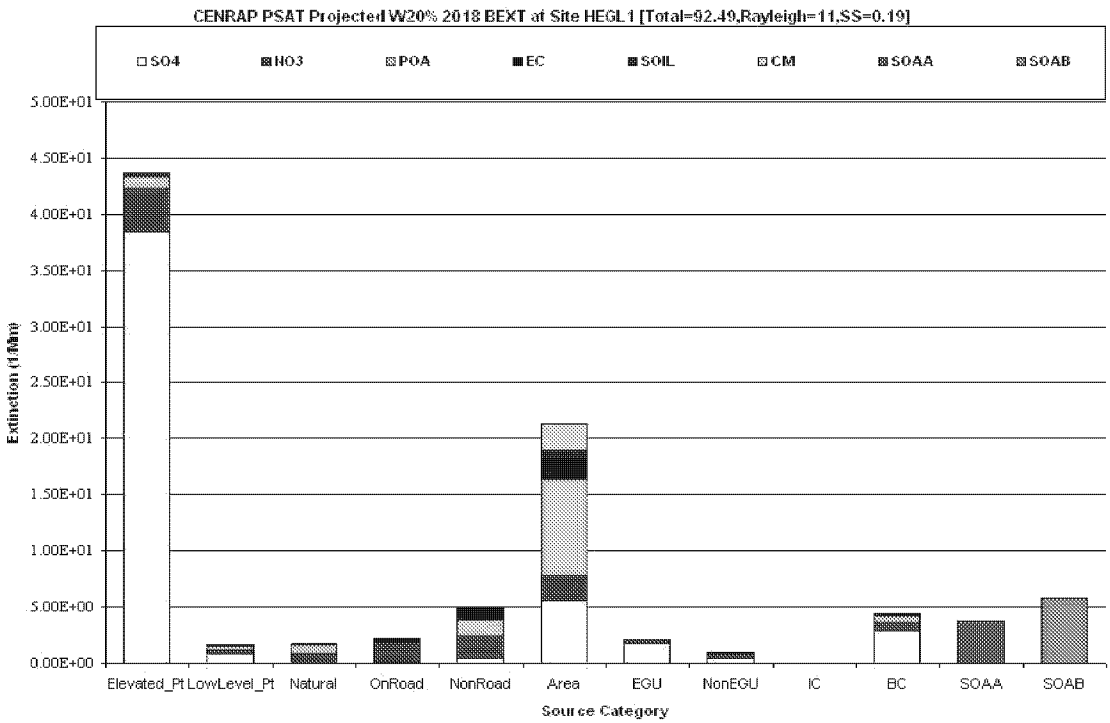


Figure 11.16 Source Category contributions to the average 2018 SO4 extinction (Mm-1) for the Worst 20% visibility days at Hercules Glade (HEGL), MO.

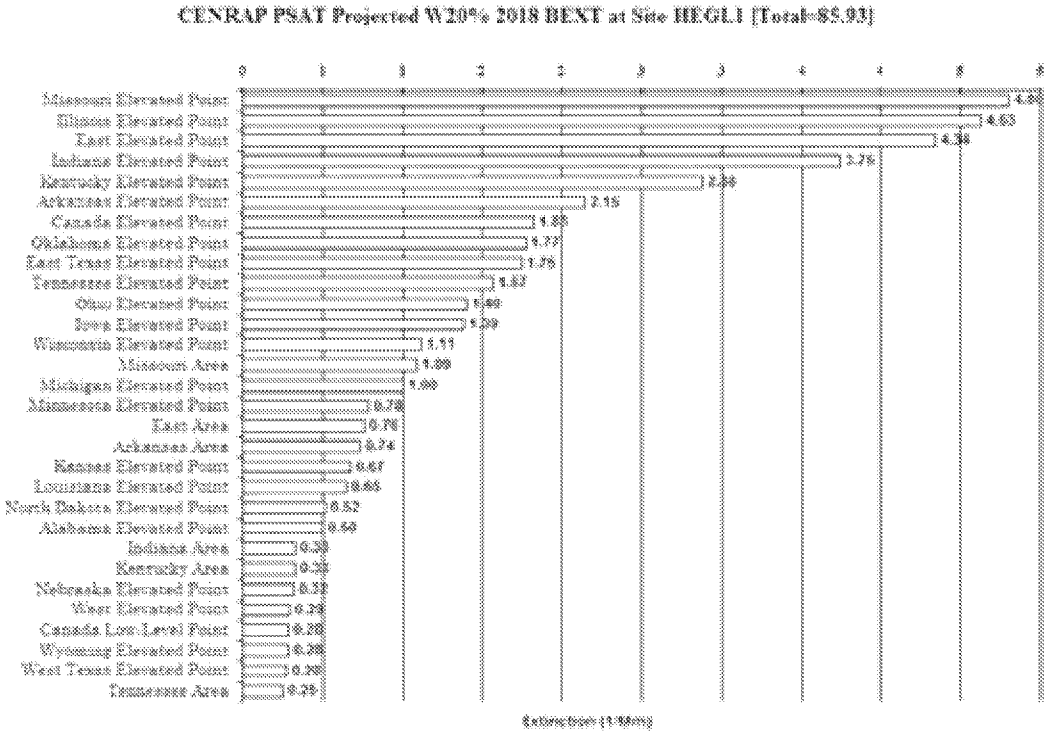


Figure 11.17 Source Category Contributions to the Average 2018 NO3 extinction (Mm-1) for the Worst 20% visibility days at Hercules Glade (HEGL), MO

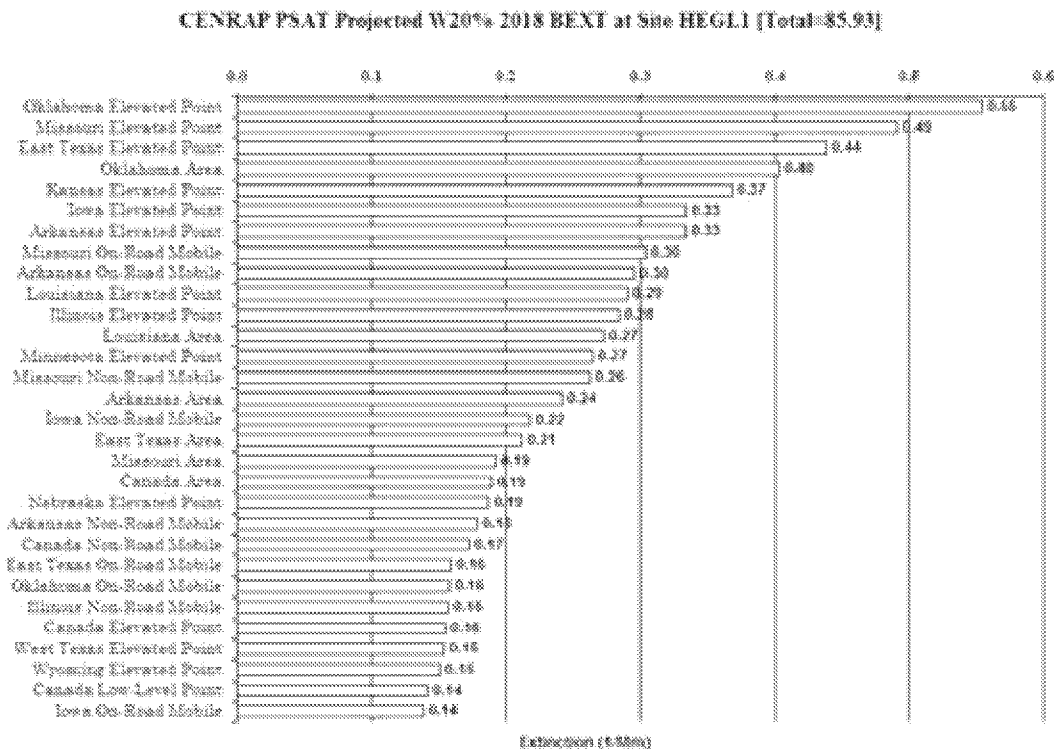
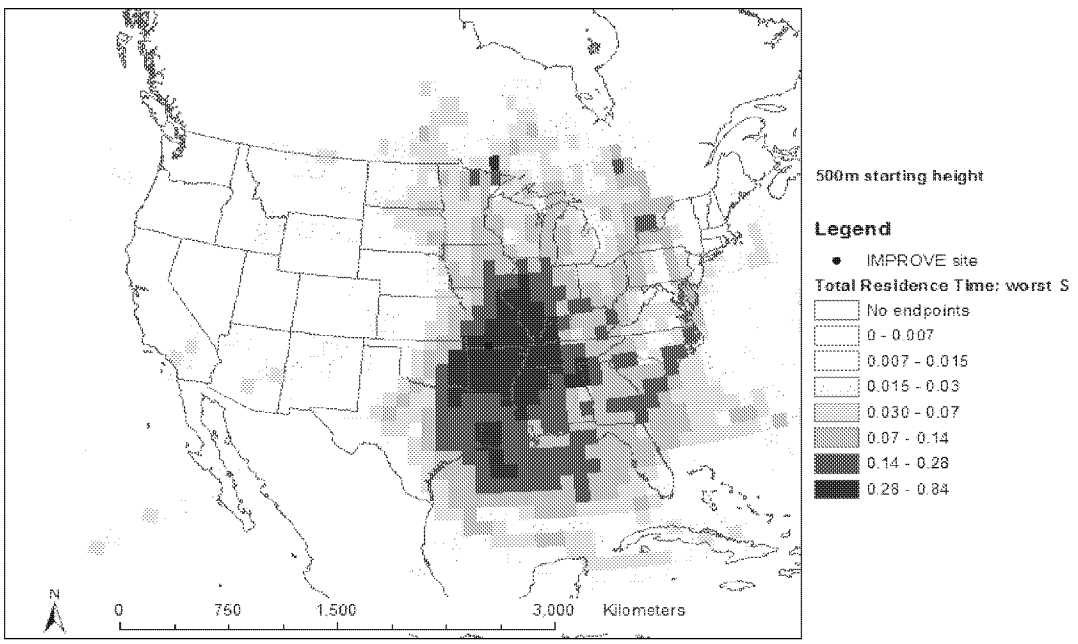


Figure 11.18: Worst 20% Sulfate Residence time from 500m



Finally, according to the analysis conducted by Sonoma for CENRAP in the Causes of Haze Assessment (Appendix 10.10), sulfates are coming from the east, south and south east of Hercules Glades, which further substantiates that reducing sulfates on Nebraska sources will have insignificant impact on visibility improvement in the Hercules Glades Class I area.

Of the 13 Class I areas, Nebraska did not show in the top 30 source category contributors of extinction on the worst 20% projected in 2018 for 7 of the Class I areas. Nebraska did not show up in the top 10 for any of the Class I areas. The extinction Nebraska contributed most to was the Class I areas in South Dakota, the Badlands National Park and Wind Cave National Park, approximately 300km away from NPPD GGS. Nitrates comprised a slightly larger percentage than sulfates at these parks in the baseline year 2002, as shown in Figure 11.14. Therefore, it would seem that mitigating nitrates, as has been done in the BART permits is appropriate.

The Federal Land Managers commented during the comment period of the proposed SIP that since the SO2 emissions were not being reduced from the EGUs (essentially elevated point sources) that the conclusions from the graphs above would be flawed. That said, using the revised 2018 emission inventory for SO2 and comparing it to the inventory for that of the neighboring Region 7 states:

Table 11.1

State	2018 Predicted SO2 Emissions (TPY)
Nebraska	92,716 (previous 62,878)
Iowa	198,264
Kansas	97,070
Missouri	280,887

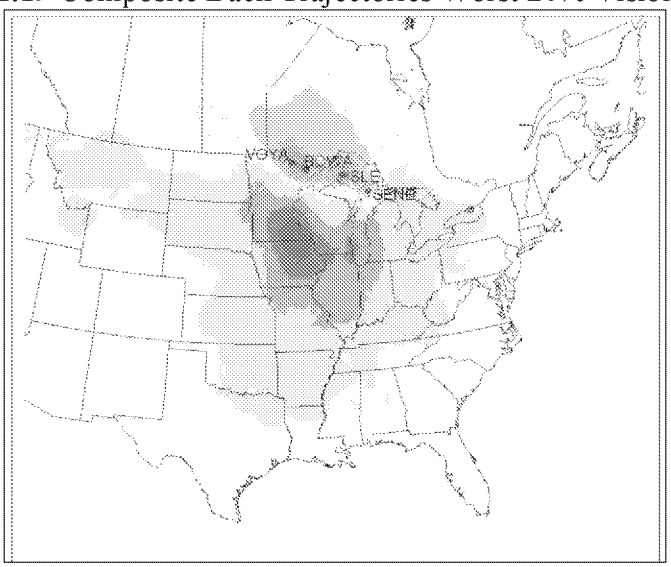
It would be expected that the predicted impacts would be greater in 2018 than previously predicted. However, even for the Badlands, where Nebraska's impact was the greatest, it is highly unlikely that Nebraska would reach the impact level that elevated Iowa point sources have on the Badlands, considering that the SO2 emissions from Iowa are expected to contribute 151,354 tons per year compared to 82,193 (approximately 55%) in Nebraska. The impact on Wind Cave, SD would likely be higher than previously predicted. Previous models expected elevated point sources to be #24 out of 30 as far as priority. An increase in SO2 emissions would increase this ranking, but is not expected to raise it to the top 10. For the other areas, 8 do not have Nebraska elevated point sources on the top 30 list. It is unlikely that would change. If it were, the most would be commensurate with where Kansas elevated point sources are, which is typically in the bottom 10. For the areas in Minnesota, Missouri, and Oklahoma, Nebraska elevated point sources may have a potential impact slightly higher than that predicted previously.

11.2 State Consultation Process

11.2.1 Minnesota (Northern Midwest)

As identified in the document Reasonable Progress for Class I Areas in the Northern Midwest – Factor Analysis (Appendix 11.1), the Lake Michigan Air Directors Consortium (LADCO) identified the following states contributing to Class I area visibility impairment in the LADCO region: Michigan, Minnesota, and Wisconsin, as well as surrounding states, such as the Dakotas, Iowa, Missouri, Illinois, and Indiana. Figure 11.19 presents the results of composite back trajectories for light extinction on the 20% worst visibility days. The darkest orange areas are where the air is most likely to come from on poor air quality days, and the darkest green areas are where the air is least likely to come from on poor air quality days. As can be seen, poor visibility days are generally associated with transport from regions located to the south of these class I areas. While Nebraska is in the lightest shade of orange, indicating some impact on poor visibility days, after further evaluation by Minnesota and consultation through the regional planning process, no additional emissions reductions from these Nebraska sources were required to meet Class I area visibility improvement goals at this point in time.

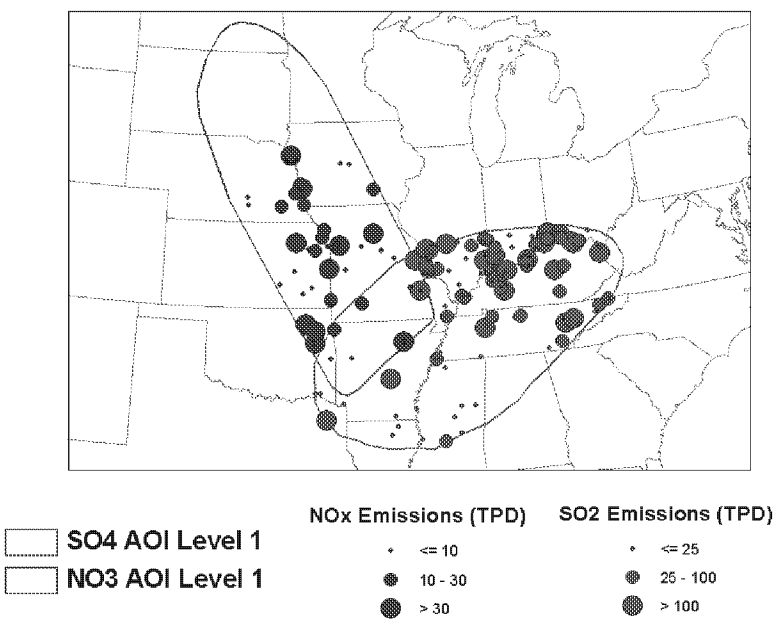
Figure 11.19 Composite Back Trajectories Worst 20% Visibility Days



11.2.2 Central States (Missouri, Arkansas)

As identified in the document Central Class I Areas Consultation Plan (Appendix 11.2), CENRAP identified early on in its process that Nebraska was in its area of influence for nitrogen oxides. Figure 11.20 presents the AOIs for NO_x and SO4.

Figure 11.20 Initial AOI's for Central Class I Areas



The central states determined whether a state was a contributor based on a combined analysis of four approaches, i.e., PMF/Trajectories, Area of Influence (AOI), PSAT, and Q/D. If a state was

found to be a major contributor in at least 3 of the 4 approaches, the central states concluded it was appropriate to include that state as a major contributor.

To be included as a contributor under the PMF/Trajectories (positive matrix factorization) approach, depended on the level of probability that an air mass originated from the state during the days of high contribution by sulfate or nitrate sources where the emission impact potential was significant. A state with a high potential of emission impact would be considered a significant contributor.

States were included in the AOI listing if they were part of the level 1 group as determined by Alpine Geophysics. This AOI was based primarily on residence time of air masses, along with evaluation of source emissions of, in this case, nitrate and sulfate.

PSAT analysis was determined based on the 2018 Modeled sulfate and nitrate contribution to average extinction for the 20% worst days. Any state with the contribution of 2.0 deciview or higher was identified as a candidate.

Lastly, Q/D was determined by dividing total SO_2 and NO_2 precursor emissions for the state by distance from a state geographic centroid. If totals were less than 200, the state was not indicated as a significant contributor under Q/D.

Nebraska was found to only be a contributor based upon the AOI and therefore it did not meet the criteria of meeting at least 3 of the 4 methodologies. Nebraska was excluded as a major contributing state to visibility impairment in Class I areas in Missouri and Arkansas. (See Appendix 11.2). Figure 11.21 below shows the results of each analysis. Red indicates the state has been identified as being a contributor based upon that analytical methodology.

Figure 11.21 States Contributing to Hercules Glade Class I Area

Sulfate

Q/D*	PMF/ Trajectories	AOI	PSAT	Average
MN	MN	MN	MN	MN
SD	SD	SD	SD	SD
WI	WI	WI	WI	WI
IA	IA	IA	IA	IA
NE	NE	NE	NE	NE
KS	KS	KS	KS	KS
MO	MO	MO	MO	MO
IL	IL	IL	IL	IL
IN	IN	IN	IN	IN
OH	OH	OH	OH	OH
MI	MI	MI	MI	MI
KY	KY	KY	KY	KY
TN	TN	TN	TN	TN
AR	AR	AR	AR	AR
OK	OK	OK	OK	OK
TX	TX	TX	TX	TX
LA	LA	LA	LA	LA
MS	MS	MS	MS	MS
AL	AL	AL	AL	AL

*Informational

State in Red/Bold = Major Contributing States

Nitrate

Q/D*	PMF/ Trajectories	AOI	PSAT	Average
MN	MN	MN	MN	MN
SD	SD	SD	SD	SD
WI	WI	WI	WI	WI
IA	IA	IA	IA	IA
NE	NE	NE	NE	NE
KS	KS	KS	KS	KS
MO	MO	MO	MO	MO
IL	IL	IL	IL	IL
IN	IN	IN	IN	IN
OH	OH	OH	OH	OH
MI	MI	MI	MI	MI
KY	KY	KY	KY	KY
TN	TN	TN	TN	TN
AR	AR	AR	AR	AR
OK	OK	OK	OK	OK
TX	TX	TX	TX	TX
LA	LA	LA	LA	LA
MS	MS	MS	MS	MS
AL	AL	AL	AL	AL

*Informational

State in Red/Bold = Major Contributing States

11.2.3 Wichita Mountains (Oklahoma)

As identified in the document titled Oklahoma's Wichita Mountains Wilderness Area Regional Haze Planning (Appendix 11.3), Oklahoma identified early on in its process that Nebraska was in its area of influence for nitrogen oxides. Figures 11.22 & 11.23 present the AOIs for the Wichita Mountains.

Figure 11.22 AOI for Wichita Mountains – Nitrogen Oxides

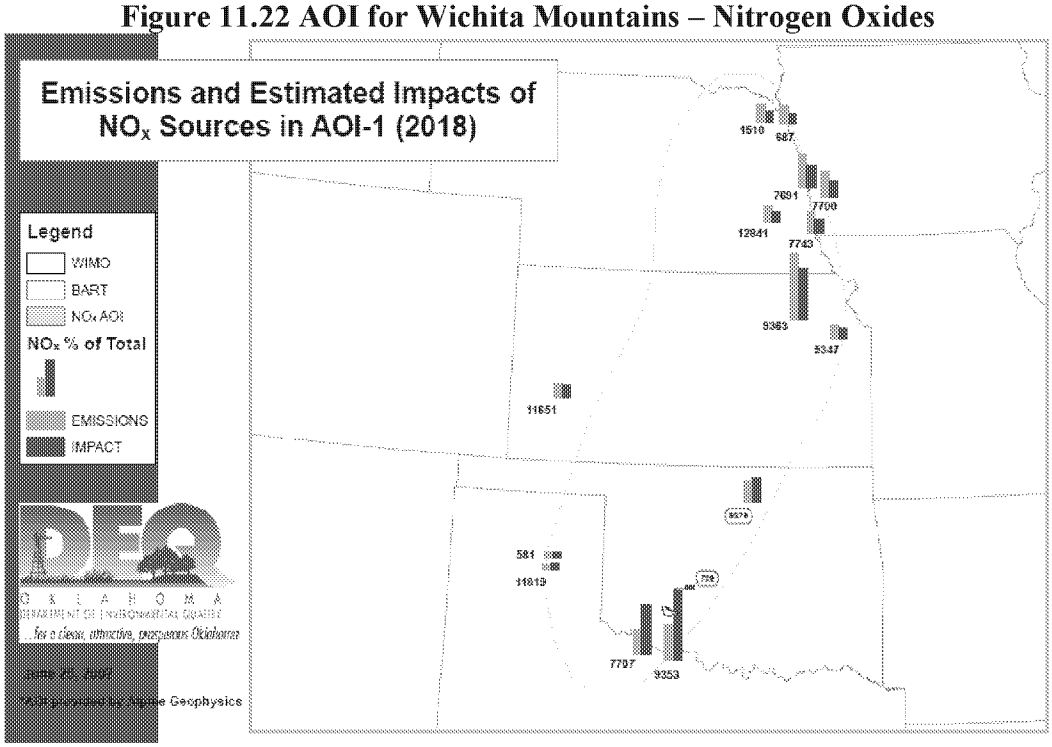
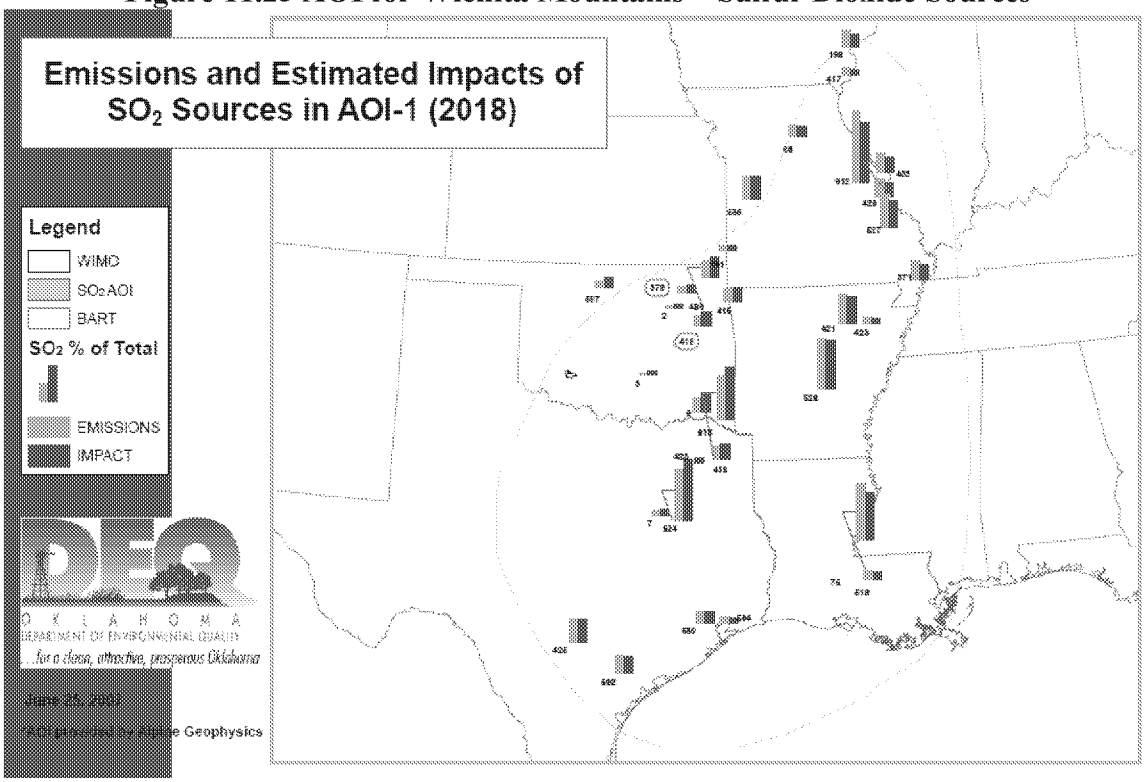


Figure 11.23 AOI for Wichita Mountains – Sulfur Dioxide Sources



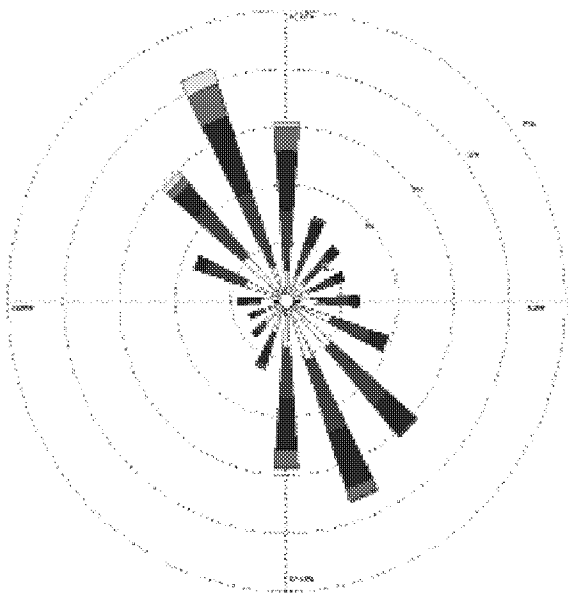
Nebraska was initially invited to participate in the Oklahoma consultation process. Only BART controls for NO_X on the NPPD and OPPD were ultimately identified as requiring control. Nebraska provided copies of the draft BART permits packages to the State of Oklahoma while on public notice. Oklahoma did not provide any comment, nor did the State request additional controls for the initial planning period.

11.2.4 Badlands National Park and Wind Cave National Park (South Dakota)

Nebraska is part of the CENRAP region. South Dakota is part of the WRAP region. Information on emission inventories and modeling was shared between the two regional planning organizations to assist in the planning process and in the consultation process.

As identified above, Nebraska's contribution to visibility impairment is limited. To examine Nebraska's potential impact closer, during the BART review, reviewed the Causes of Haze Study carefully. We noted that the wind patterns (wind roses) for the Badlands indicate a high frequency of flow from the north-northwest year round, with an additional high frequency component of southeasterly flow during the warm months (June – August). Nebraska's primary sources emitting visibility impairing pollutants would be south of the Class I areas in South Dakota. Figure 11.24 is a wind rose from August 2002 showing an equal distribution from the north-northwest and south-southeast.

Figure 11.24 August 2002 Wind Rose for Rapid City (Station #24090- Rapid City, SD Regional Airport)



Nebraska consulted directly with the State of South Dakota several times through phone and email correspondence. Nebraska provided copies of the draft BART package for NPPD Gerald Gentleman Station because of the potential the units have on visibility impairment in Class I areas in South Dakota. Nebraska wanted to make sure South Dakota had an opportunity to comment on our plans to control emissions the Gerald Gentlemen Power Plant. As noted in their proposed SIP (http://denr.sd.gov/des/aq/publicnotices/RegionalHazeSIPDraft.pdf), South Dakota included Nebraska's BART plans in their SIP submittal.

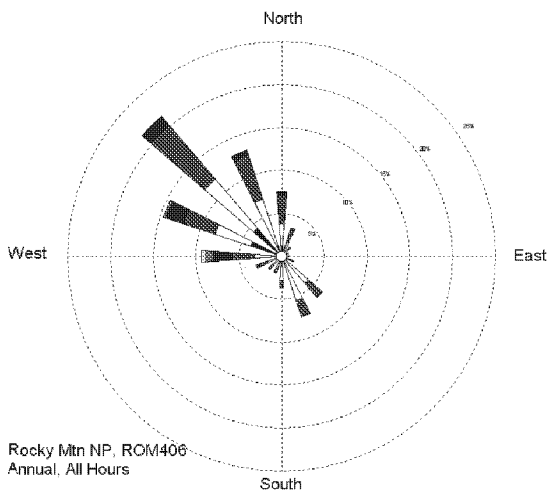
11.2.5 Rocky Mountain National Park (Colorado)

Nebraska is part of the CENRAP region. Colorado is part of the WRAP region. Information on emission inventories and modeling was shared between the two regional planning organizations to assist in the planning process and in the consultation process. Additionally, during the BART permit development process, Nebraska provided copies of the draft BART package for NPPD Gerald Gentleman Station because of the potential the units have on visibility impairment in Class I areas in Colorado. Nebraska wanted to make sure Colorado had an opportunity to comment on our plans to control emissions the Gerald Gentlemen Power Plant. The State of Colorado provided comments on the BART permit, as well as on the proposed SIP.

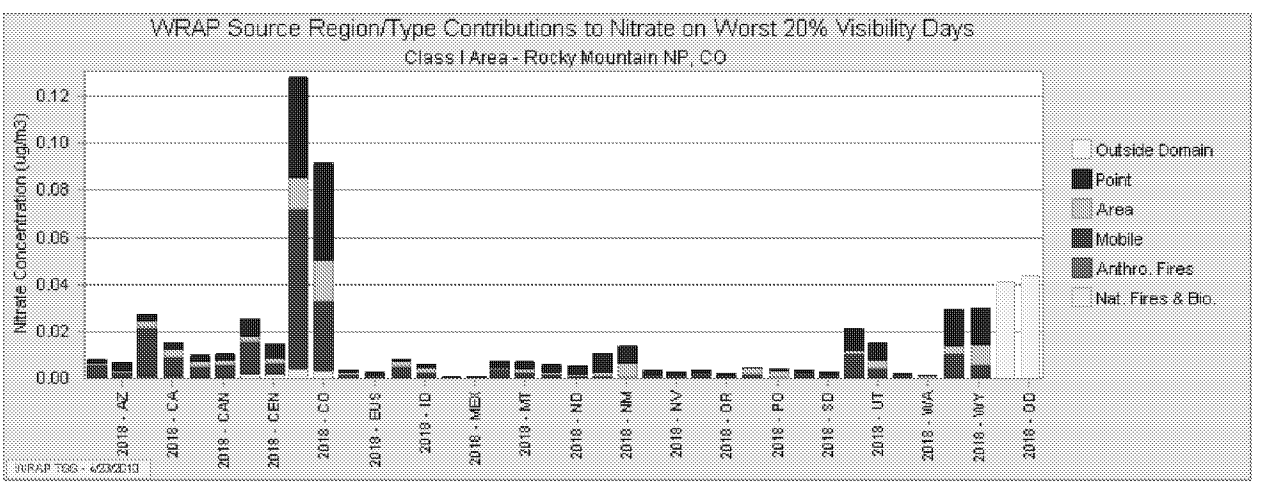
The CDPHE expressed concern over their ability to meet visibility improvement goals for Rocky Mountain National Park. They pointed NDEQ to a website where baseline, modeling projections and source apportionment information could be found. The CDPHE noted that the modeling conducted shows the Central Regional Air Partnership (CENRAP) states predicted to be contributing 7.2% of sulfates in 2018 on the 20% worst days. They conclude because of proximity to Colorado, that since Nebraska is one of nine CENRAP states, and that GGS is among the largest sources of sulfur dioxide (SO2) in the CENRAP region, it is reasonable to

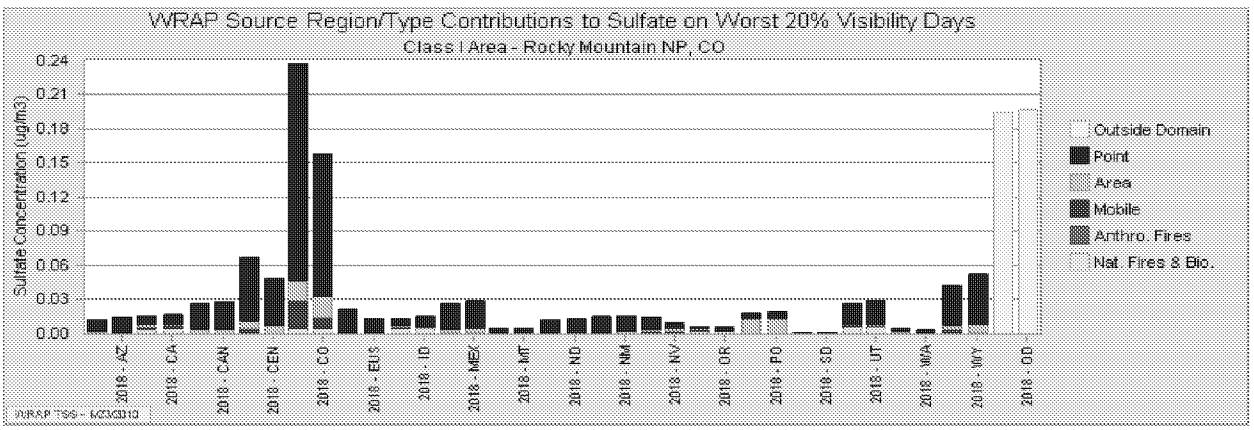
attribute some portion of the CENRAP contribution to GGS. Therefore, CDPHE requests that NDEQ reconsider SO2 controls at GGS under the Regional Haze rule.

NDEQ reviewed the website information provided by CDPHE. There, NDEQ found a "Causes of Haze Assessment" (COHA) that maybe found at http://www.coha.dri.edu/ as well as information on contribution for Rocky Mountain National Park, CO. The COHA included information regarding meteorological conditions. Below is an annualized wind rose for the Rocky Mountain National Park using the data collected from the station at the Class I area. As NDEQ expected, the patterns indicate the wind rarely comes from the east or northeast, directions that would have indicated a potential for impacts from sources in the state of Nebraska.



The contribution assessment did not distinguish Nebraska from the other eight CENRAP states. CENRAP includes Minnesota, Iowa, Kansas, Missouri, Oklahoma, Arkansas, Louisiana, and Texas. Overall, CENRAP's contribution was significantly smaller than that of Colorado as shown in the graphs below. Taking into consideration the wind patterns it is most likely that contributions from the CENRAP region are not from Nebraska, but are from sources in states located southeast of Rocky Mountain National Park.





11.3 Long Term Strategy

11.3.1 Federal Measures

11.3.1.1 Clean Air Interstate Rule/ Clean Air Transport Rule

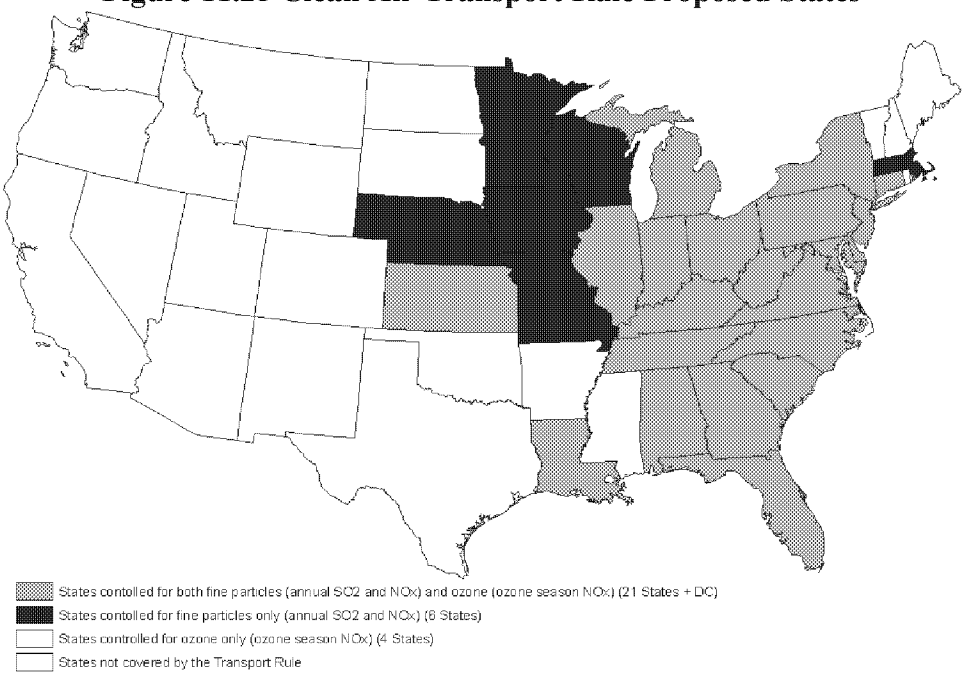
At the onset of the regional haze consultation process, many states relied heavily on the Clean Air Interstate Rule (CAIR), a rule that was to address the interstate transport of air pollution to downwind states. CAIR covered 28 eastern states plus the District of Columbia, and would have reduced SO2 emissions by an estimated 5.4 million tons and NO_x emissions by an estimated 2 million tons by 2015. Affected states had the choice of either meeting the state's emission budget by requiring power plants to participate in a cap and trade system, or by means of a measure of the state's choosing.

Although Nebraska was not included in the final CAIR rulemaking, the rule was a major component in the underlying assumptions used to determine source apportionment because of the reductions expected in neighboring states with Class I areas.

In July 2008, the D.C. District Court of Appeals vacated the CAIR rule in its entirety. On September 24, 2008 EPA filed a petition for rehearing or for a remand of the case without vacatur. On December 23, 2008, the D.C. District Court of Appeals remanded the case to EPA without vacatur so that EPA could remedy CAIR's flaws as were discussed in their July ruling.

On July 6, 2010, EPA announced a proposed rule to replace CAIR, the Clean Air Transport Rule. In this proposed rulemaking, Nebraska was a named state for purposes of $PM_{2.5}$, and if finalized as proposed, would be required to control annual SO_2 and NO_x emissions from power plants. It is expected that this rule will still include Nebraska when finalized.

Figure 11.25 Clean Air Transport Rule Proposed States



Emissions reductions are to begin to take effect in 2012. EPA estimates that by 2014, the rule would reduce power plant SO_2 emissions by 71 percent over 2005 levels and NO_x emissions by 52 percent. Certainly, should Nebraska be included in the final rule and be required to reduce emissions of SO_2 and NO_x, the impact on visibility is expected to be positive. A 71% reduction in SO2 emissions and 52% in NOx over 2005 levels would mean Nebraska EGU emissions would be: 52,309 tons of SO2 and 26,659 tons of NOx.

Nebraska will continue to engage with states in the CENRAP region and will participate in future consultation processes as necessary to address reasonable progress goals at Class I areas.

11.3.1.2 Mobile Source Related Emissions and Standards

Mobile sources, both on-road and non-road, comprise a significant portion of Nebraska's emissions inventory. In 2002, non-road sources were the second largest emitter of SO_2 in the state. On-road and non-road sources make up over 60% of Nebraska's total NO_x emissions. Reducing emissions from these mobile sources could have a positive impact on visibility impacts from Nebraska sources. Over the last several years, EPA has promulgated mobile source rules that are under implementation.

11.3.1.3 Tier 2 Vehicle and Gasoline Sulfur Program

In December 1999, the U.S. Environmental Protection Agency (EPA) is announced two significant mobile source rulemakings. The first was tailpipe emissions standards for all passenger vehicles, including sport utility vehicles (SUVs), minivans, vans and pick-up trucks. This regulation marked the first time that SUVs and other light-duty trucks were to be subject to the same national pollution standards as cars. The second rule that was announced at the same time was for lower sulfur standards in gasoline. The lower sulfur standards were put in place to ensure the effectiveness of low emission-control technologies in vehicles and reduce harmful air

pollution. These new standards require passenger vehicles to be 77 to 95 percent cleaner than those on the previously on the road and reduce the sulfur content of gasoline by up to 90 percent.

The phase-in of new standards began with model year (MY) 2004, and was completed in MY 2007 for cars and light-duty trucks, and in 2008 for medium-duty vehicles. By 2007, the emission limit for NO_X was 0.07 grams per mile (g/mi). The sulfur levels in gasoline were capped at 300 parts per million (ppm) and limited to an average of 120 ppm in 2004, and by 2006 the cap was lowered to 80 ppm with a limit on average sulfur levels of 30 ppm.

11.3.1.4 Locomotives and Marine Engines

Like on-road vehicles, EPA addressed marine engines in two ways, through their fuels and through their emission limits. In May 2004, as part of the Clean Air Nonroad Diesel Rule, EPA finalized new requirements for nonroad diesel fuel that decrease the allowable levels of sulfur in fuel used in marine vessels by 99 percent. These fuel improvements, which began to take effect in 2007, are creating significant environmental and public health benefits by reducing PM from new and existing engines. In March 2008, EPA finalized a three part program that will dramatically reduce emissions from marine diesel engines below 30 liters per cylinder displacement. These include marine propulsion engines used on vessels from recreational and small fishing boats to towboats, tugboats and marine auxiliary. The rule is expected to cut PM emissions from these engines by as much as 90 percent and NO_X emissions by as much as 80 percent when fully implemented. Also in March 2008, EPA finalized a three part program that dramatically reduces emissions from diesel locomotives of all types -- line-haul, switch, and passenger rail. Just as with the marine engines, the rule will cut PM emissions from these engines by as much as 90 percent and NO_X emissions by as much as 80 percent when fully implemented.

11.3.1.5 Small Engines (Personal Watercraft; Lawn and Garden Equipment)

EPA has established a new emission control program to reduce VOC and NO_X emissions from small spark-ignition engines by about 35 percent. The new regulations put in place a set of more stringent exhaust standards and establish new evaporative emission standards for the fuel tanks and fuel lines used in this equipment. The rules apply starting in the 2011 model year for Class II engines (above 225 cc) and in the 2012 model year for Class I engines (less than 225 cc, used in non-handheld applications).

11.3.1.6 NESHAP MACT Standards

National Emission Standards for Hazardous Air Pollutants (NESHAP) have been promulgated by EPA and incorporated into Title 129-Nebraska Air Quality Regulations in recent years that will not only achieve reductions in hazardous air pollutants (HAPs), but will also reduce visibility impairing pollutants such as SO_2, NO_X, and PM. Some of the most notable NESHAPS include:

- Commercial, Industrial & Institutional Boilers & Process Heaters - Subpart DDDDD
- Industrial, Commercial, & Institutional Boilers - Area Sources - Subpart JJJJJJ
- Reciprocating Internal Combustion Engines - Subpart ZZZZ
- Stationary Combustion Turbines - Subpart YYYY

EPA has also proposed a NESHAP for Coal- and Oil-Fired Electric Utility Steam Generating Units- Subpart UUUUU. This rule, when finalized, is expected to reduce emissions from power plants and have resulting benefits on visibility impairment.

Nebraska has units subject to each of these standards, and the State has or intends to incorporate these rules into Title 129 as they are updated by EPA.

11.3.2 Visibility Requirements under the New Source Review and Prevention of Significant Deterioration Program

The New Source Review Program is broken down into two parts: nonattainment new source review and prevention of significant deterioration (PSD) program. In Nebraska, since the whole state is currently in attainment with the National Ambient Air Quality Standards, the provisions of the PSD program apply. The visibility provisions of PSD are found under section 40 CFR 52.21(o) which requires owners or operators of new major sources or modifications to provide an analysis of visibility impairment as part of the prevention of significant deterioration process. Section 40 CFR 52.21(p) requires notification and consultation with federal land managers (FLMs) of Class I areas which may be affected. Section 40 CFR 52.21(o) requirements have been incorporated into Title 129-Nebraska Air Quality Regulations at Chapter 19 Section 022 "Additional impact analysis." Notification and consultation requirements under 40CFR 52.21(p) have been incorporated by reference into Title 129 at Chapter 19 Section 001.

11.3.3 Measures to Mitigate the Impacts of Construction Activities

Nebraska is required by 40 CFR 51.308(d)(3)(v)(B) to consider measures to mitigate the impacts of construction activities. When EPA first promulgated the Regional Haze Rule in 1999, emissions related to construction activities such as windblown dust and nonroad diesel engines were a major concern. This was especially a problem in rapidly growing metropolitan areas such as Los Angeles and Phoenix. Construction activities are directly related to population growth. Nebraska has not experienced rapid growth and is not forecasted to in the future. Figure 11.26 comes from the 2009 Ambient Monitoring Network Plan. It shows the top ten counties population and their respective growth over the last few years.

Figure 11.26 Population Growth in Nebraska

Figure C-3: Top Ten Nebraska Counties by Population and Growth Rates

Top Ten Counties by Population*			Top Ten Counties by Growth Rate**		
County	Population	Growth	County	Growth	Population
Douglas (Omaha MSA)	502,032	0.8 %	Sarpy (Omaha MSA)	3.3%	150,467
Lancaster (Lincoln MSA)	278,728	1.0 %	Lancaster (Lincoln MSA)	1.7%	278,728
Sarpy (Omaha MSA)	150,467	2.0 %	Douglas (Omaha MSA)	1.4%	502,032
Hall (Grand Island)	56,401	0.8 %	Hall (Grand Island MiSA)	1.3%	56,401
Buffalo (Kearney)	45,354	0.7 %	Platte (Columbus MiSA)	1.3%	32,072
Scotts Bluff (Scottsbluff)	36,554	0.2 %	Buffalo (Kearney MiSA)	1.2%	45,354
Dodge (Fremont)	35,872	0.0 %	Dixon (Sioux City MiSA)	1.2%	6,293
Lincoln (North Platte)	35,582	0.4 %	Wheeler	0.7%	807
Madison (Norfolk)	34,020	-0.9 %	Washington (Omaha MSA)	0.7%	19,812
Adams (Hastings)	33,238	0.4 %	Lincoln (North Platte MiSA)	0.7%	35,582

* Population estimates are for July 1st, 2008. They were obtained from the US Census Bureau's Population Estimate Program on or about April 1st 2009.

** The Average Annual Growth Rate over the last 5 years (July 1, 2004 through July 1, 2008). The growth rates were calculated from data obtained from the US Census Bureau's Population Estimate Program.

Population growth is projected to remain at a steady pace and construction activities are not expected to cause a significant impact to visibility.

11.3.3.1 Water Regulations on Construction Activities

Construction projects in Nebraska that disturb one acre or more are required to obtain a general permit for storm water discharges under the National Pollutant Discharge Elimination System (NPDES). The permitting program was implemented to protect the waters of the State from sediment and other contaminants, and may also reduce the amount of particulate matter emissions from these activities. The NPDES permits require permitted entities to develop storm water pollution prevention plan containing best management practices to control erosion and runoff. Many of the best management practices employed to prevent erosion and runoff are also effective at preventing windblown dust.

11.3.3.2 Fugitive Dust Regulations

Nebraska Title 129- Chapter 32 – Dust; Duty to Prevent Escape (Appendix 11.4) of includes a provision applicable to construction activities in section 002. This section requires the use of reasonable measures such as paving, cleaning, application of water, planting and maintenance of ground cover, and/or application of dust-free surfactants to be taken to prevent dust from becoming airborne such that it remains visible beyond the property boundary.

11.3.4 Agricultural and Forestry Smoke Management

Nebraska is required by 40 CFR 51.308(d)(3)(v)(E) to consider smoke management techniques for the purposes of agricultural and forestry management in developing reasonable progress goals.

As evidenced in the emissions inventory in Chapter 8, Nebraska's emissions from fires is insignificant.

Nebraska Title 129- Chapter 30 – Open Fires (Appendix 11.5) is a ban on burning with some exceptions. Exceptions are limited in scope and most exceptions require permits from the NDEQ and the local fire authority. For purposes of agricultural burning, such burning is allowed under the following circumstances:

- Must be in an agricultural setting
- No nuisance or traffic hazard can be created
- Only includes trees or vegetation indigenous to the property
- Burning is recommended for disposal because of the hazardous nature of the materials. Such materials can only be those that have been used on the property.

For purposes of forestry or land management, such burning is allowed under section 002.06 provided it is conducted by the Nebraska Game and Parks Commission, the US Forest Service, the University of Nebraska, or other entities determined to be acceptable by the Department.

The University of Nebraska Extension service provides information on how to properly do a prescribed burn. These resources are available through their website at: http://www.ianrpubs.unl.edu. Because of the minimal impacts from burning, Nebraska has not further developed a smoke management plan. Existing measures seem to be working to manage smoke from prescribed fires. However, NDEQ will continue to evaluate the need for additional measures during the periodic SIP reviews.

11.3.5 Enforceability of Emission Limitations and Control Measures

Nebraska is required by 40 CFR 51.308(d)(3)(v)(F) to ensure that emission limitations and control measures used to meet reasonable progress goals are enforceable. Nebraska has ensured that all emission limitations and control measures are enforceable by including adopting the appropriate rules into Title 129. Additionally, the other measures needed include the BART limits. These BART permits contain the applicable emission limits and compliance schedules, which will be federally enforceable upon EPA's approval of this SIP. The emissions limits and compliance verification requirements are already incorporated into an enforceable construction permit and will be incorporated into each facility's Title V operating permit when the appropriate operating permits are reopened or renewed.

11.3.6 Source Retirement and Replacement Schedules

At this time, Nebraska has not identified any source retirement or replacement obligations.

11.3.7 Anticipated Net Effect on Visibility Resulting from Projected Changes to Emissions

Nebraska is required by 40 CFR 51.308(d)(3)(v)(G) to address the net effect on visibility resulting from changes projected in point, area, and mobile source emissions by 2018. The 2002 to 2018 projected visibility improvement at the Class I areas selected for analysis and discussed previously will, for the State of Nebraska, result chiefly from the implementation of NO_X controls on the 3 electric generating units (EGUs) at 2 facilities subject to BART. Additional improvements are expected from the other federal measures that are currently under

implementation described earlier in Chapter 11. NDEQ expects additional federal measures to be forthcoming which will have additional visibility improvement.

These projected visibility improvements as a result of implementation of this plan are shown in Table 11.1, based on the ENVIRON PSAT tool, and shown in terms of light extinction. About 36 to 40% improvement is expected in the South Dakota Class I areas.

Table 11.2 Net Improvement in Light Extinction

Class I Area	2002 Extinction (Mm^{-1})	2018 Extinction (Mm^{-1})	Net Improvement (Mm^{-1})
Badlands National Park	2.356	1.495	0.861
Caney Creek Wilderness Area	0.772	0.485	0.287
Great Sand Dunes Wilderness Area	0.183	0.115	0.068
Hercules-Glades Wilderness Area	1.249	0.860	0.389
Mingo Wilderness Area	1.093	0.731	0.362
Rocky Mountain National Park	0.254	0.158	0.096
Upper Buffalo Wilderness Area	0.353	0.226	0.127
Voyagers National Park	0.931	0.699	0.232
Wichita Mountains Wilderness Area	1.831	1.129	0.732
Wind Cave National Park	0.668	0.505	0.163

11.4 Reasonable Further Progress Conclusion

In summary, during this first planning period, Nebraska has not been asked by any other state to reduce emissions beyond those under BART during the consultation processes. Given that Nebraska was identified as a potential contributor, or a lower-tier contributor, in some Class I areas, additional emission reductions from Nebraska sources may be the subject of consultation discussions in the future. However, the implementation of federal measures such as the Clean Air Transport Rule, National Emission Standards for Hazardous Air Pollutants for various source categories, the lower standards for sulfur on motor vehicles, and other such measures are expected to have a significant effect on visibility improvement.

At this time, consistent with the RPG guidance, given the emissions reductions that we anticipate to result from BART and the implementation of other federal CAA programs, and the resultant improvement in light extinction, we find that there are no additional measures necessary to achieve reasonable progress in the first planning period for Nebraska.

Appendix 11.1 Northern Midwest – Factor Analysis (LADCO)
Appendix 11.2 Central Class I Areas Consultation Plan
Appendix 11.3 Oklahoma's Wichita Mountains Wilderness Area Regional Haze Planning
Appendix 11.4 Nebraska Title 129- Chapter 32 – Dust; Duty to Prevent Escape
Appendix 11.5 Nebraska Title 129- Chapter 30 – Open Fires

12 Plan Revisions and Progress Reports

Nebraska is required by 40 CFR 51.308(f) 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 40 CFR 51.308(f) of the federal rule for regional haze, Nebraska commits to revising and submitting this regional haze implementation plan by July 31, 2018 and every ten years thereafter.

In addition, 40 CFR 51.308(g) requires periodic reports evaluating progress towards the reasonable progress goals established for each mandatory Class I area. In accordance with the requirements listed in 40 CFR 51.308(g) of the federal rule for regional haze, Nebraska commits to submitting a report on reasonable progress to EPA every five years following the initial submittal of the SIP. The report will be in the form of a SIP revision. The reasonable progress report will evaluate the progress made towards the reasonable progress goal for each mandatory Class I area located outside Nebraska, which may be affected by emissions from within Nebraska. All requirements listed in 40 CFR 51.308(g) shall be addressed in the SIP revision for reasonable progress. The first five-year progress report will be completed by December 31, 2016. Using the findings of this first report, Nebraska will determine whether the adequacy of the plan is sufficient and will take appropriate action. Nebraska intends to consult and coordinate with other states, the FLMs, and EPA as required and appropriate.

The 2014 National Emissions Inventory will likely be the most current available inventory at that time and will be used as part of the progress report. However, given the need to consult with other states, an earlier inventory may be required to be used. It is expected that Nebraska will also have access to a later point source inventory and continuous emissions monitoring systems (CEMS) data for EGUs. Where this more up-to-date information is available, it may be used to supplement the National Emissions Inventory.

Nebraska will use the latest available inventory for the five-year progress report, and compare that with the projected 2018 inventories. The status of BART controls will be addressed individually in that review. For the remaining sectors, EGAS growth rates will be used, where applicable, and projected growth will be compared with actual emissions. If this comparison indicates overall emissions are growing at a rate significantly (i.e., more than 10%) higher, on an individual species basis than previously projected, Nebraska will evaluate the need to reassess the visibility impacts on potentially affected Class I areas through consultation with the appropriate federal land manager (FLM) and EPA. If additional controls are required, this could potentially include a SIP revision to address the visibility goal for the affected Class I area(s).