6.0 STATE AND CLASS I AREA SUMMARIES

As described in Section 2.0, each state is required to submit progress reports at interim points between submittals of Regional Haze Rule (RHR) State Implementation Plans (SIPs), which assess progress towards visibility improvement goals in each state's mandatory Federal Class I areas (CIAs). Data summaries for each CIA in each Western Regional Air Partnership (WRAP) state, which address Regional Haze Rule (RHR) requirements for visibility measurements and emissions inventories are provided in this section. These summaries are intended to provide individual states with the technical information they need to determine if current RHR implementation plan elements and strategies are sufficient to meet all established reasonable progress goals, as defined in their respective initial RHR implementation plans.

6.12 SOUTH DAKOTA

The goal of the RHR is to ensure that visibility on the 20% most impaired, or worst, days continues to improve at each Federal Class I area (CIA), and that visibility on the 20% least impaired, or best, days does not get worse, as measured at representative Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring sites. South Dakota has 4 mandatory Federal CIAs, which are depicted in Figure 6.12-1 and listed in Table 6.12-1, along with the associated IMPROVE monitor locations.

This section addresses differences between the 2000-2004 baseline and 2005-2009 period, for both monitored data and emission inventory estimates. Monitored data are presented for the 20% most impaired, or worst, days and for the 20% least impaired, or best, days, as per Regional Haze Rule (RHR) requirements. Annual average trend statistics for the 2000-2009 10-year period are also presented here to support assessments of changes in each monitored species that contributes to visibility impairment. Some of the highlights regarding these comparisons are listed below, and more detailed state specific information is provided in monitoring and emissions sub-sections that follow.

- For both the best and worst days, the 5-year average deciview metric decreased at both the BADL1 and WICA1 sites.
- The largest decreases in 5-year averages for the worst days were measured for ammonium nitrate and elemental carbon at both sites, and coarse mass at the BADL1 site.
- No increasing annual average trends were measured at either site, and statistically significant decreasing trends were measured for several parameters, including ammonium nitrate at the WICA1 site, and elemental carbon and coarse mass at the BADL1 site.
- Decreases in measurements were consistent with emissions inventory comparisons, which showed a decrease in mobile source NO_X and EC emissions, and decreasing NO_X emissions on an annual basis from EGU point sources.

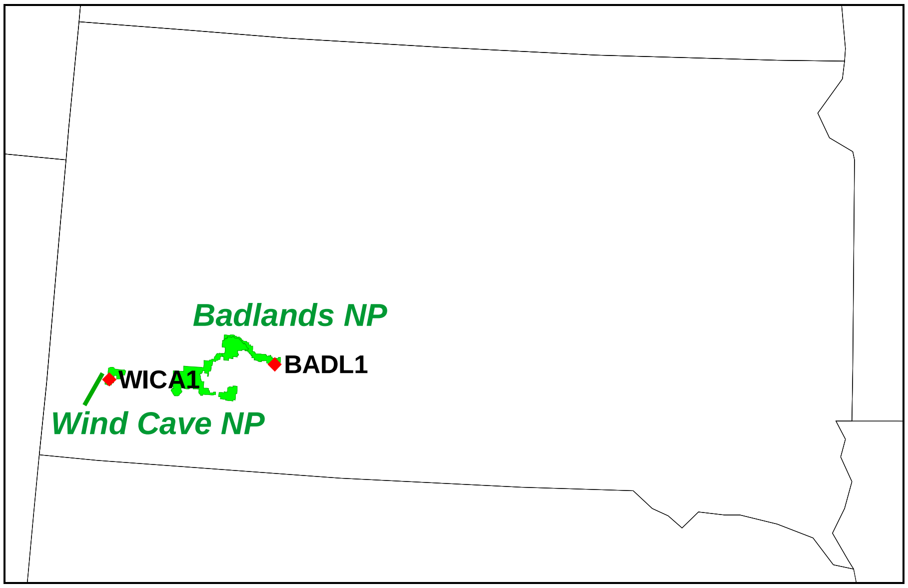

Figure 6.12-1. Map Depicting Federal CIAs and Representative IMPROVE Monitors in South Dakota.

Table 6.12-1
South Dakota CIAs and Representative IMPROVE Monitors

Class I Area	Representative IMPROVE Site	Latitude	Longitude	Elevation (m)
Badlands NP	BADL1	43.74	-101.94	736
Wind Cave NP	WICA1	43.56	-103.48	1296

6.12.1 Monitoring Data

This section addresses RHR regulatory requirements for monitored data as measured by IMPROVE monitors representing Federal CIAs in South Dakota. These summaries are supported by regional data presented in Section 4.0 and by more detailed site specific tables and charts in Appendix L.

As described in Section 3.1, regional haze progress in Federal CIAs is tracked using calculations based on speciated aerosol mass as collected by IMPROVE monitors. The RHR calls for tracking haze in units of deciviews (dv), where the deciview metric was designed to be linearly associated with human perception of visibility. In a pristine atmosphere, the deciview metric is near zero, and a one deciview change is approximately equivalent to a 10% change in cumulative species extinction. To better understand visibility conditions, summaries here include both the deciview metric, and the apportionment of haze into extinction due to the various measured species in units of inverse megameters (Mm^{-1}).

6.12.1.1 Current Conditions

This section addresses the regulatory question, ***what are the current visibility conditions for the most impaired and least impaired days (40 CFR 51.308 (g)(3)(i))?*** RHR guidance specifies that 5-year averages be calculated over successive 5-year periods, i.e. 2000-2004, 2005-2009, 2010-2014, etc.[1] Current visibility conditions are represented here as the most recent successive 5-year average period available, or the 2005-2009 period average, although the most recent IMPROVE monitoring data currently available includes 2010 data.

Tables 6.12-2 and 6.12-3 present the calculated deciview values for current conditions at each site, along with the percent contribution to extinction from each aerosol species for the 20% most impaired, or worst, and 20% least impaired, or best, days for each of the Federal CIA IMPROVE monitors in South Dakota. Figure 6.12-2 presents 5-year average extinction for the current progress period for both the 20% most impaired and 20% least impaired days. Note that the percentages in the tables consider only the aerosol species which contribute to extinction, while the charts also show Rayleigh, or scattering due to background gases in the atmosphere.

Specific observations for the current visibility conditions on the 20% most impaired days are as follows:

- The largest contributors to aerosol extinction at the South Dakota sites were ammonium sulfate and particulate organic mass.

Specific observations for the current visibility conditions on the 20% least impaired days are as follows:

- The aerosol contribution to total extinction on the best days was less than Rayleigh, or the background scattering that would occur in clear air.
- The largest contributor to the non-Rayleigh aerosol species of extinction was ammonium sulfate.

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[1] EPA's September 2003 *Guidance for Tracking Progress Under the Regional Haze Rule* specifies that progress is tracked against the 2000-2004 baseline period using corresponding averages over successive 5-year periods, i.e. 2005-2009, 2010-2014, etc. (See page 4-2 in the Guidance document.)

Table 6.12-2
South Dakota Class I Area IMPROVE Sites
Current Visibility Conditions
2005-2009 Progress Period, 20% Most Impaired Days

Site	Deciviews (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BADL1	16.6	**44% (1)**	12% (3)	24% (2)	4% (5)	2% (6)	12% (4)	1% (7)
WICA1	15.5	**34% (1)**	15% (3)	33% (2)	6% (5)	2% (6)	9% (4)	1% (7)

*Highest aerosol species contribution per site is highlighted in bold.

Table 6.12-3
South Dakota Class I Area IMPROVE Sites
Current Visibility Conditions
2005-2009 Progress Period, 20% Least Impaired Days

Site	Deciviews (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BADL1	6.8	**39% (1)**	13% (4)	24% (2)	6% (5)	4% (6)	14% (3)	0% (7)
WICA1	4.6	**42% (1)**	11% (4)	20% (2)	9% (5)	4% (6)	14% (3)	0% (7)

*Highest aerosol species contribution per site is highlighted in bold.

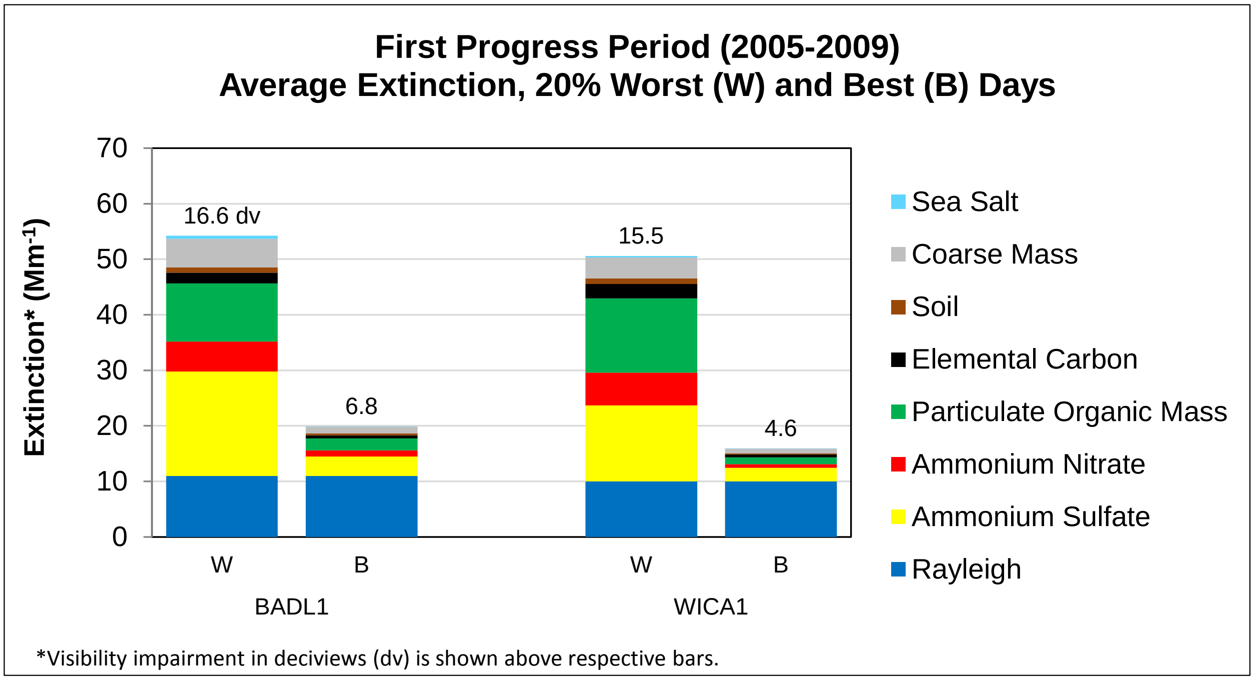

Figure 6.12-2. Average Extinction for Current Progress Period (2005-2009) for the Worst (Most Impaired) and Best (Least Impaired) Days Measured at South Dakota Class I Area IMPROVE Sites.

6.12.1.2 Differences between Current and Baseline Conditions

This section addresses the regulatory question, ***what is the difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions (40 CFR 51.308 (g)(3)(ii))?*** Included here are comparisons between the 5-year average baseline conditions (2000-2004) and current progress period extinction (2005-2009).

Table 6.12-4 presents the differences between the 2000-2004 baseline period average extinction and the 2005-2009 progress period average for each site in South Dakota for the 20% most impaired days, and Table 6.12-5 presents similar data for the least impaired days. Averages that increased are depicted in red text and averages that decreased in blue.

Figure 6.12-3 presents the 5-year average extinction for the baseline and current progress period averages for the worst days and Figure 6.12-4 presents the differences in averages by aerosol species, with increases represented above the zero line and decreases below the zero line. Figures 6.12-5 and 6.12-6 present similar plots for the best days.

For the 20% most impaired days, the 5-year average deciview metric decreased between the 2000-2004 and 2005-2009 periods at both South Dakota sites. Notable differences for individual species averages were as follows:

- Ammonium nitrate and elemental carbon decreased at both sites.

- All species except sea salt decreased at the BADL1 site, with the largest decreases measured in particulate organic mass, coarse mass and elemental carbon.
- The large decreases in ammonium nitrate at the WICA1 site was offset by small increases in ammonium sulfate, particulate organic mass, soil and coarse mass.

For the 20% least impaired days, the 5-year average deciview metric decreased at both South Dakota sites. Notable differences for individual species averages on the 20% least impaired days were as follows:

- At the BADL1 site, increases in ammonium sulfate and particulate organic mass were offset by decreases in ammonium nitrate, elemental carbon and coarse mass.
- No increases were measured for the best days at the WICA1 site.

Table 6.12-4
South Dakota Class I Area IMPROVE Sites
Difference in Aerosol Extinction by Species
2000-2004 Baseline Period to 2005-2009 Progress Period
20% Most Impaired Days

Site	Deciview (dv)			Change in Extinction by Species (Mm^{-1})*						
	2000-04 Baseline Period	2005-09 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
BADL1	17.1	16.6	**-0.5**	0.0	**-0.5**	**-1.3**	**-0.7**	0.0	**-0.8**	**+0.4**
WICA1	15.8	15.5	**-0.3**	**+0.5**	**-1.1**	**+0.1**	**-0.3**	**+0.2**	**+0.2**	**+0.2**

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction and values in blue indicate decreases.

Table 6.12-5
South Dakota Class I Area IMPROVE Sites
Difference in Aerosol Extinction by Species
2000-2004 Baseline Period to 2005-2009 Progress Period
20% Least Impaired Days

Site	Deciview (dv)			Change in Extinction by Species (Mm^{-1})*						
	2000-04 Baseline Period	2005-09 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
BADL1	6.9	6.8	**-0.1**	**+0.1**	**-0.1**	**+0.3**	**-0.2**	0.0	**-0.3**	0.0
WICA1	5.1	4.6	**-0.5**	**-0.1**	**-0.2**	**-0.2**	**-0.2**	0.0	**-0.2**	0.0

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction and values in blue indicate decreases.

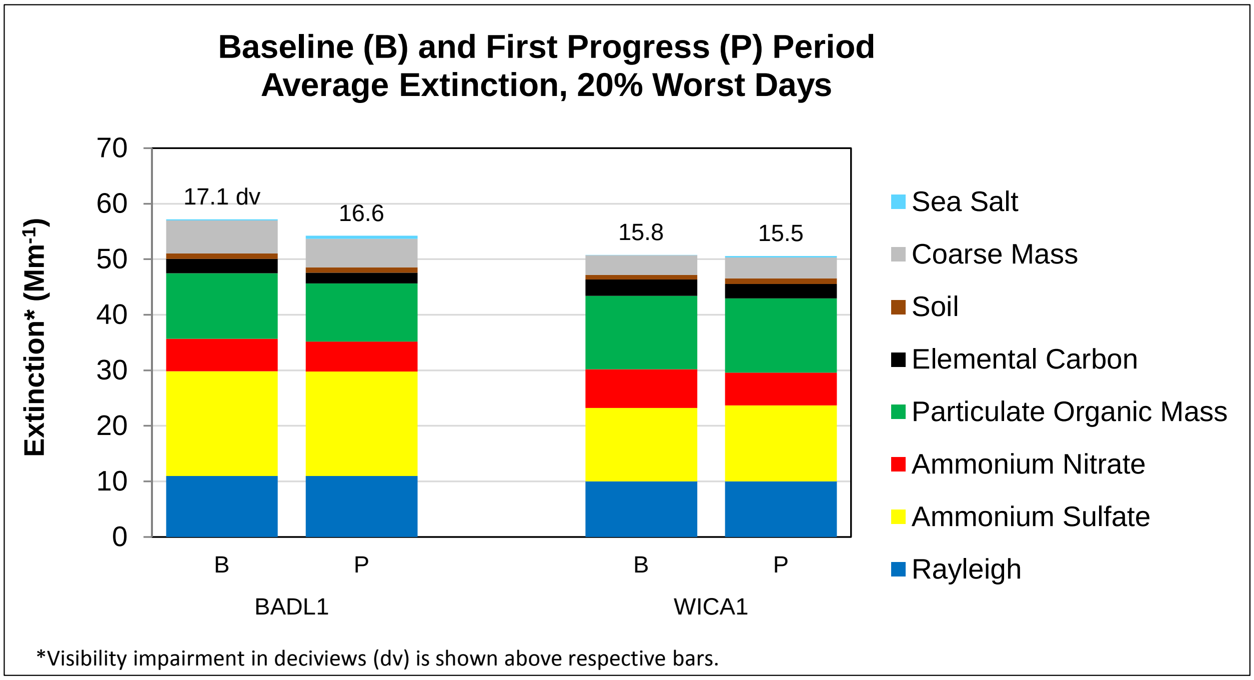

Figure 6.12-3. Average Extinction for Baseline and Progress Period Extinction for Worst (Most Impaired) Days Measured at South Dakota Class I Area IMPROVE Sites.

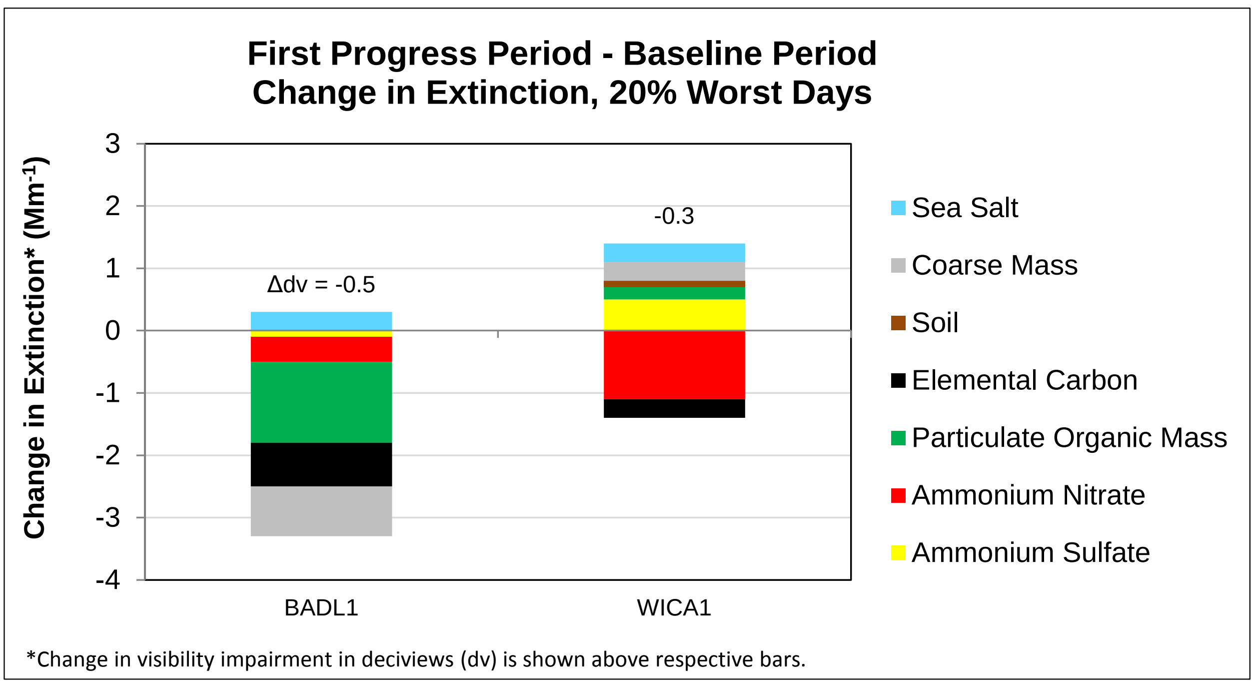

Figure 6.12-4. Difference between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Worst (Most Impaired) Days Measured at South Dakota Class I Area IMPROVE Sites.

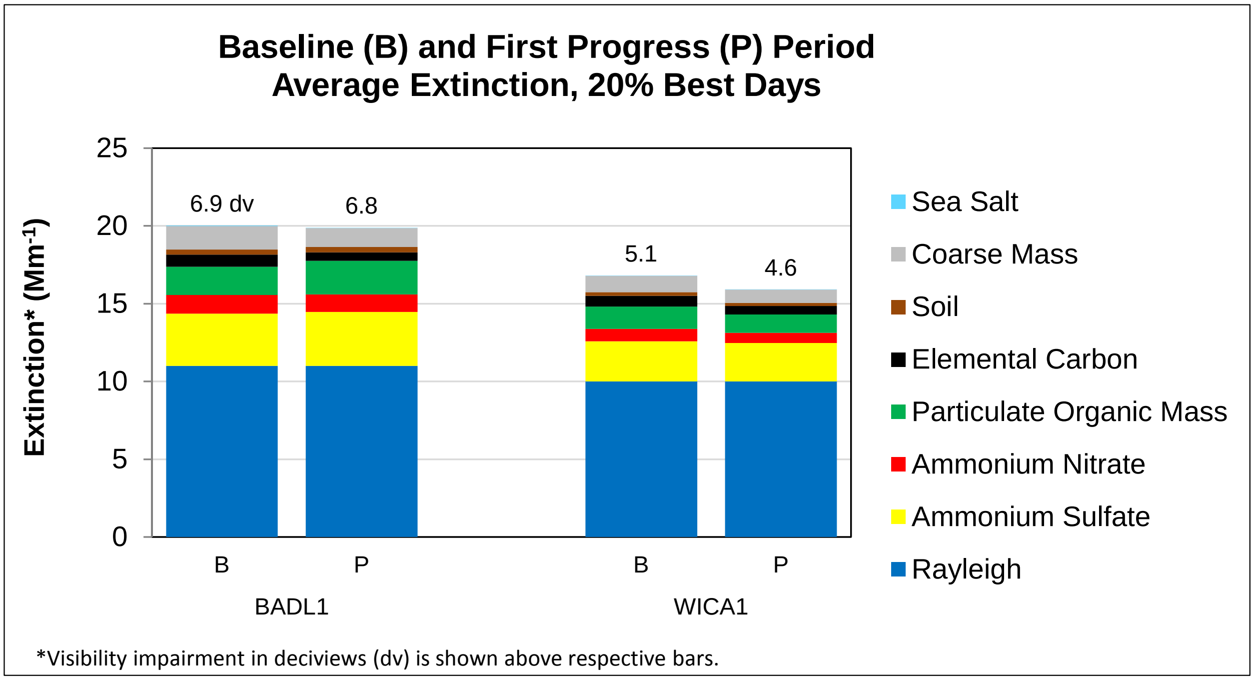

Figure 6.12-5. Average Extinction for Baseline and Progress Period Extinction for Best (Least Impaired) Days Measured at South Dakota Class I Area IMPROVE Sites.

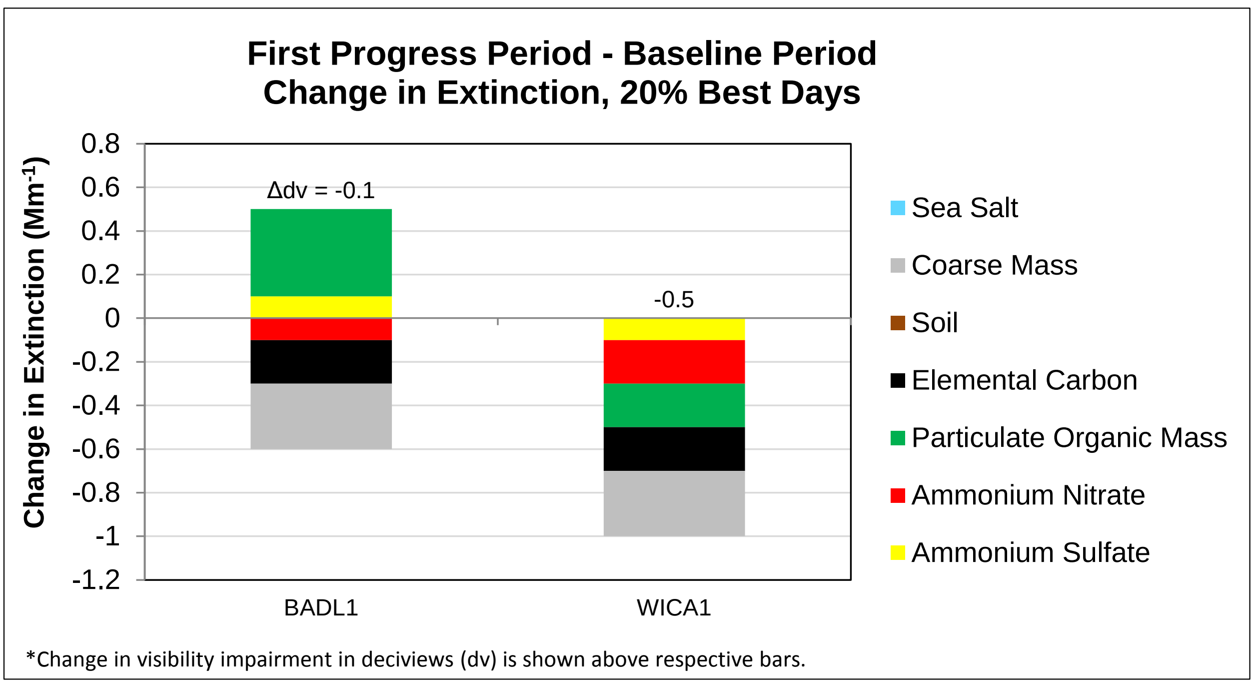

Figure 6.12-6. Difference between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Best (Least Impaired) Days Measured at South Dakota Class I Area IMPROVE Sites.

6.12.1.3 Changes in Visibility Impairment

This section addresses the regulatory question, ***what is the change in visibility impairment for the most impaired and least impaired days over the past 5 years (40 CFR 51.308 (g)(3)(iii))?*** Included here are changes in visibility impairment as characterized by annual average trend statistics, and some general observations regarding local and regional events and outliers on a daily and annual basis that affected the current 5-year progress period. The regulatory requirement asks for a description of changes over the past 5-year period, but trend analysis is better suited to longer periods of time, so trends for the entire 10-year planning period are presented here.

Trend statistics for the years 2000-2009 for each species at each site in South Dakota are summarized in Table 6.12-6, and regional trends were presented earlier in Section 4.1.1.[2] Only trends for aerosol species trends with p-value statistics less than 0.15 (85% confidence level) are presented in the table here, with increasing slopes in red and decreasing slopes in blue.[3] In some cases, trends may show decreasing tendencies while the difference between the 5-year averages do not (or vice versa), as discussed in Section 3.1.2.2. In these cases, the 5-year average for the best and worst days is the important metric for RHR regulatory purposes, but trend statistics may be of value to understand and address visibility impairment issues for planning purposes.

For each site, a more comprehensive list of all trends for all species, including the associated p-values, is provided in Appendix L. Additionally, the appendix includes plots depicting 5-year, annual, monthly and daily average extinction for each site. These plots are intended to provide a fairly comprehensive compilation of reference information for individual states to investigate local and regional events and outliers that may have influenced changes in visibility impairment as tracked using the 5-year deciview metrics. Note that similar summary products are also available from the WRAP TSS website (http://vista.cira.colostate.edu/tss/). Some general observations regarding changes in visibility impairment at sites in South Dakota are as follows:

- The largest changes in 5-year averages for particulate organic mass were measured at the BADL1 site. Average particulate organic mass measurements at both sites were influenced by large events in August 2000, August 2003 and July 2008.
- Decreasing trends were measured for elemental carbon and coarse mass at the BADL1 site, and a decreasing trend in ammonium nitrate was measured at the at the WICA1 site.

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[2] Annual trends were calculated for the years 2000-2009, with a trend defined as the slope derived using Theil statistics. Trends derived from Theil statistics are useful in analyzing changes in air quality data because these statistics can show the overall tendency of measurements over long periods of time, while minimizing the effects of year-to-year fluctuations which are common in air quality data. Theil statistics are also used in EPA's National Air EPA's National Air Quality Trends Reports (http://www.epa.gov/airtrends/) and the IMPROVE program trend reports (http://vista.cira.colostate.edu/improve/Publications/improve_reports.htm)

[3] The significance of the trend is represented with p-values calculated using Mann-Kendall trend statistics. Determining a significance level helps to distinguish random variability in data from a real tendency to increase or decrease over time, where lower p-values indicate higher confidence levels in the computed slopes.

Table 6.12-6
South Dakota Class I Area IMPROVE Sites
Change in Aerosol Extinction by Species
2000-2009 Annual Average Trends

Site	Group	Annual Trend* (Mm^{-1}/year)						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BADL1	20% Best	--	--	0.0	0.0	--	0.0	--
	20% Worst	--	--	--	**-0.2**	--	--	--
	All Days	--	0.0	--	**-0.1**	--	**-0.1**	--
WICA1	20% Best	**-0.1**	0.0	0.0	0.0	--	0.0	--
	20% Worst	--	**-0.2**	--	**-0.1**	0.0	--	0.0
	All Days	--	**-0.1**	--	--	0.0	--	0.0

*(--) Indicates statistically insignificant trend (<85% confidence level). Annual averages and complete trend statistics for all significance levels are included for each site in Appendix L.

6.12.2 Emissions Data

Included here are summaries depicting differences between two emission inventory years that are used to represent the 5-year baseline and current progress periods. The baseline period is represented using a 2002 inventory developed by the WRAP for use in the initial WRAP state SIPs, and the progress period is represented by a 2008 inventory which leverages recent WRAP inventory work for modeling efforts, as referenced in Section 3.2.1. For reference, Table 6.12-7 lists the major emitted pollutants inventoried, the related aerosol species, some of the major sources for each pollutant, and some notes regarding implications of these pollutants. Differences between these baseline and progress period inventories, and a separate summary of annual emissions from electrical generating units (EGUs), are presented in this section.

Table 6.12-7
South Dakota
Pollutants, Aerosol Species, and Major Sources

Emitted Pollutant	Related Aerosol	Major Sources	Notes
Sulfur Dioxide (SO_2)	Ammonium Sulfate	Point Sources; On- and Off-Road Mobile Sources	SO_2 emissions are generally associated with anthropogenic sources such as coal-burning power plants, other industrial sources such and refineries and cement plants, and both on- and off-road diesel engines.
Oxides of Nitrogen (NO_X)	Ammonium Nitrate	On- and Off-Road Mobile Sources; Point Sources; Area Sources	NO_X emissions are generally associated with anthropogenic sources. Common sources include virtually all combustion activities, especially those involving cars, trucks, power plants, and other industrial processes.
Ammonia (NH_3)	Ammonium Sulfate and Ammonium Nitrate	Area Sources; On-Road Mobile Sources	Gaseous NH_3 has implications in particle formation because it can form particulate ammonium. Ammonium is not directly measured by the IMPROVE program, but affects formation potential of ammonium sulfate and ammonium nitrate. All measured nitrate and sulfate is assumed to be fully neutralized with ammonium for IMPROVE reporting purposes.
Volatile Organic Compounds (VOCs)	Particulate Organic Mass (POM)	Biogenic Emissions; Vehicle Emissions; Area Sources	VOCs are gaseous emissions of carbon compounds, which are often converted to POM through chemical reactions in the atmosphere. Estimates for biogenic emissions of VOCs have undergone significant updates since 2002, so changes reported here are more reflective of methodology changes than actual changes in emissions (see Section 3.2.1).
Primary Organic Aerosol (POA)	POM	Wildfires; Area Sources	POA represents organic aerosols that are emitted directly as particles, as opposed to gases. Wildfires in the west generally dominate POA emissions, and large wildfire events are generally sporadic and highly variable from year-to-year. As referenced in Section 3.2.1, emissions summaries here compare an average of 2000-2004 wildland fire emission with 2008 emissions.
Elemental Carbon (EC)	EC	Wildfires; On- and Off-Road Mobile Sources	Large EC events are often associated with large POM events during wildfires. Other sources include both on- and off-road diesel engines.
Fine Soil	Soil	Windblown Dust; Fugitive Dust; Road Dust; Area Sources	Fine soil is reported here as the crustal or soil components of $PM_{2.5}$.
Coarse Mass (PMC)	Coarse Mass	Windblown Dust; Fugitive Dust	Coarse mass is measured by the IMPROVE Network as the difference between PM_{10} and $PM_{2.5}$. Coarse mass is not separated by species in the same way that $PM_{2.5}$ is speciated, but measurements are often associated with crustal components. Similar to crustal $PM_{2.5}$, natural windblown dust is often the largest contributors to PMC.

6.12.2.1 Changes in Emissions

This section addresses the regulatory question, ***what is the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State (40 CFR 51.308 (g)(4))?*** For these summaries, emissions during the baseline years are represented using a 2002 inventory, which was developed with support from the WRAP for use in the original RHR SIP strategy development (termed plan02d). Differences between inventories are represented as the difference between the 2002 inventory, and a 2008 inventory which leverages recent inventory development work performed by the WRAP for the WestJumpAQMS and DEASCO$_3$ modeling projects (termed WestJump2008). Note that the comparisons of differences between inventories does not necessarily reflect a change in emissions, as a number of methodology changes and enhancements have occurred between development of the individual inventories, as referenced in Section 3.2.1. Inventories for all major visibility impairing pollutants are presented for major source categories, and categorized as either anthropogenic or natural emissions. State-wide inventories totals and differences are presented here, and inventory totals on a county level basis are available on the WRAP Technical Support System website (http://vista.cira.colostate.edu/tss/).

Table 6.12-8 and Figure 6.12-7 present the differences between the 2002 and 2008 sulfur dioxide (SO_2) inventories by source category. Tables 6.12-9 and Figure 6.12-8 present data for oxides of nitrogen (NO_X), and subsequent tables and figures (Tables 6.12-10 through 6.12-15 and Figures 6.12-9 through 6.12-14) present data for ammonia (NH_3), volatile organic compounds (VOCs), primary organic aerosol (POA), elemental carbon (EC), fine soil, and coarse mass. General observations regarding emissions inventory comparisons are listed below.

- The largest difference for point source inventories was a decrease in reported NO_X.
- Area source inventories showed decreases in SO_2 and VOCs and increases in NO_X and NH_3. These changes may be due to a combination of population changes and differences in methodologies used to estimate these emissions, as referenced in Section 3.2.1. One methodology change was the reclassification of some off-road mobile sources (such as some types of marine vessels and locomotives) into the area source category in 2008, which may have contributed to increases in area source inventory totals, but decreases in off-road mobile totals.
- On-road mobile source inventory comparisons showed decreases in most parameters, especially NO_X and VOCs, with slight increases in POA, EC, and coarse mass. Reductions in NO_X and VOC are likely influenced by federal and state emissions standards that have already been implemented. The increases in POA, EC, and coarse mass occurred in all of the WRAP states for on-road mobile inventories, regardless of reductions in NO_X and VOCs, indicating that these increases were likely due use of different on-road models, as referenced in Section 3.2.1.
- Off-road mobile source inventories showed decreases in NO_X, SO_2, and VOCs, and increases in fine soil and coarse mass, which was consistent with most contiguous WRAP states. These differences were likely due to a combination of actual changes in source contributions and methodology differences, as referenced in Section 3.2.1. As noted previously, one major methodology difference was the reclassification of

some off-road mobile sources (such as some types of marine vessels and locomotives) into the area source category in 2008, which may have contributed to decreases in the off-road inventory totals, but increases in area source totals.

- For all parameters, especially POAs, VOCs, and EC, natural fire emission inventory estimates decreased, and anthropogenic fire inventories increased. Note that these differences are not necessarily reflective of changes in monitored data, as the baseline period is represented by an average of 2000-2004 fire emissions, and the progress period is represented only by the fires that occurred in 2008, as referenced in Section 3.2.1.
- Comparisons between VOC inventories showed large decreases in biogenic emissions, which was consistent with other contiguous WRAP states. Estimates for biogenic emissions of VOCs have undergone significant updates since 2002, so changes reported here are more reflective of methodology changes than actual changes in emissions, as referenced in Section 3.2.1.
- Fine soil and coarse mass decreased for the windblown dust inventory comparisons and the combined fugitive/road dust inventories. Large variability in changes in windblown dust was observed for the contiguous WRAP states, which was likely due in large part to enhancements in dust inventory methodology, as referenced in Section 3.2.1, rather than changes in actual emissions.

Table 6.12-8
South Dakota
Sulfur Dioxide Emissions by Category

Source Category	Sulfur Dioxide Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	14,024	14,727	703
Area	1,071	339	-732
On-Road Mobile	873	179	-693
Off-Road Mobile	5,733	484	-5,249
Area Oil and Gas	6	0	-6
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	5	53	48
Total Anthropogenic	**21,712**	**15,784**	**-5,928 (-27%)**
Natural Sources			
Natural Fire	362	117	-245
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**362**	**117**	**-245 (-68%)**
All Sources			
Total Emissions	**22,074**	**15,901**	**-6,174 (-28%)**

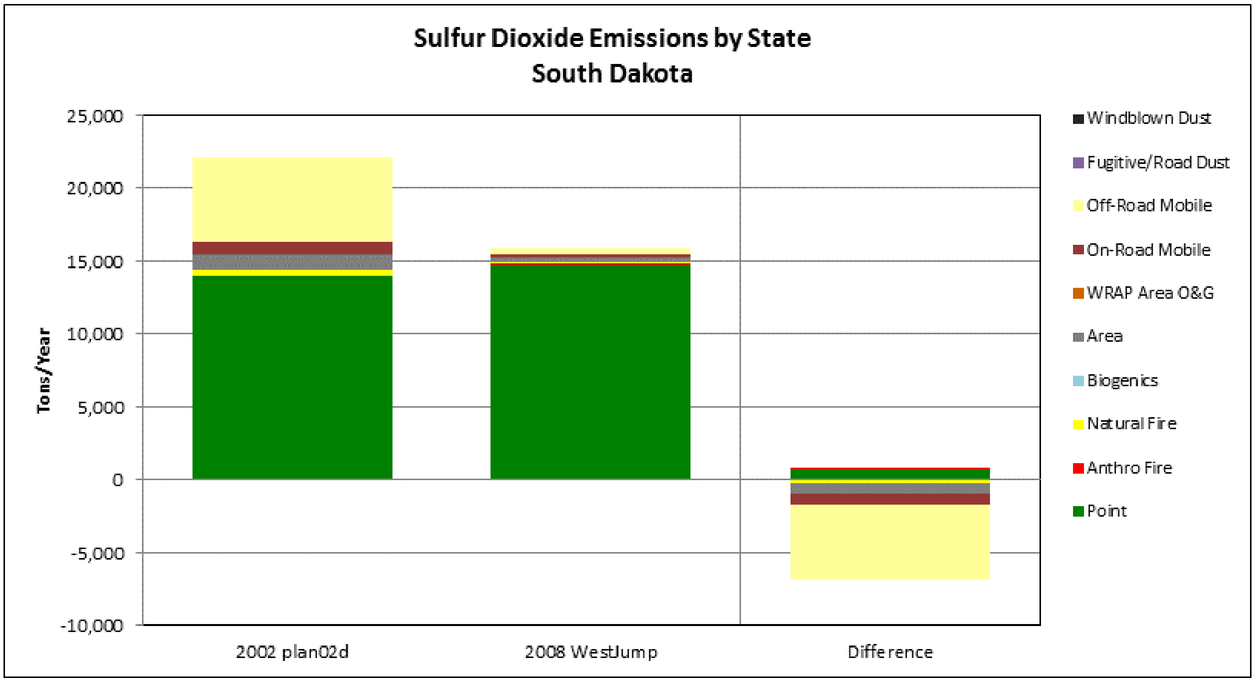

Figure 6.12-7. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Sulfur Dioxide by Source Category for South Dakota.

Table 6.12-9
South Dakota
Oxides of Nitrogen Emissions by Category

Source Category	Oxides of Nitrogen Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	20,698	16,384	-4,314
Area	2,897	5,904	3,007
On-Road Mobile	29,224	26,865	-2,359
Off-Road Mobile	39,039	24,699	-14,339
Area Oil and Gas	361	0	-361
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	40	378	338
Total Anthropogenic	**92,258**	**74,230**	**-18,028 (-20%)**
Natural Sources			
Natural Fire	1,658	827	-831
Biogenic	52,852	14,758	-38,094
Wind Blown Dust			
Total Natural	**54,511**	**15,586**	**-38,925 (-71%)**
All Sources			
Total Emissions	**146,769**	**89,815**	**-56,953 (-39%)**

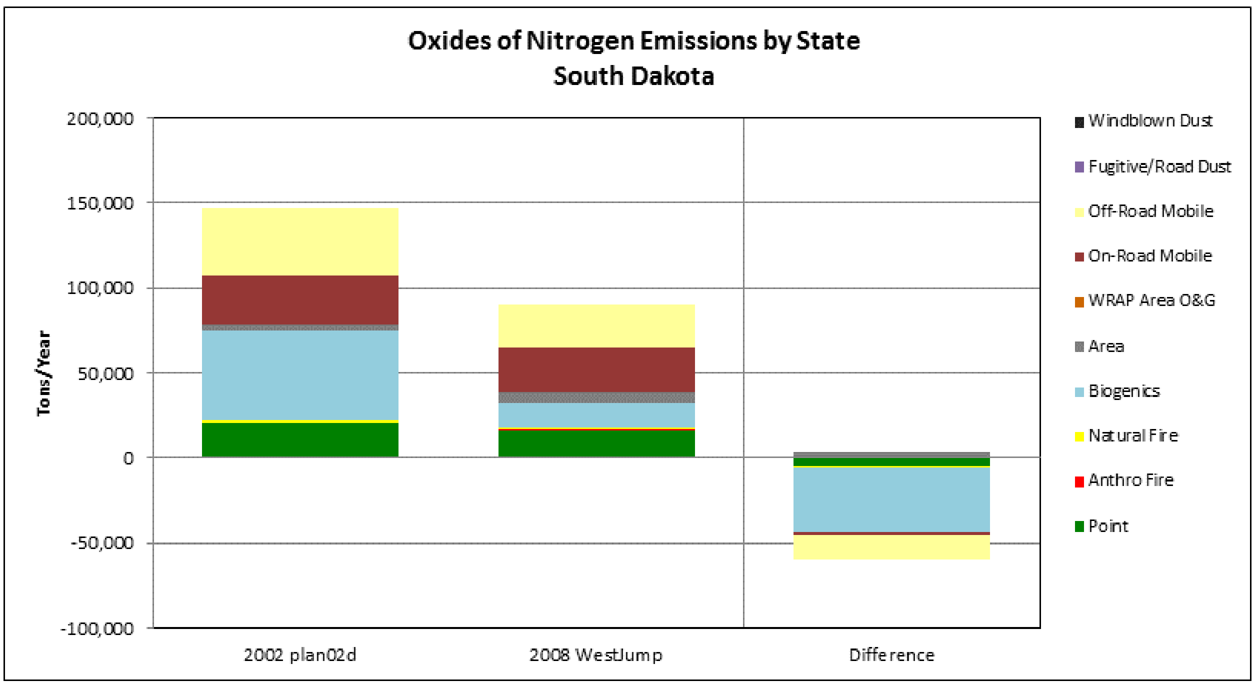

Figure 6.12-8. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Oxides of Nitrogen by Source Category for South Dakota.

Table 6.12-10
South Dakota
Ammonia Emissions by Category

Source Category	Ammonia Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	100	263	163
Area	118,877	131,616	12,739
On-Road Mobile	842	386	-456
Off-Road Mobile	25	21	-4
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	20	264	243
Total Anthropogenic	**119,864**	**132,549**	**12,685 (11%)**
Natural Sources			
Natural Fire	542	577	35
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**542**	**577**	**35 (6%)**
All Sources			
Total Emissions	**120,406**	**133,126**	**12,720 (11%)**

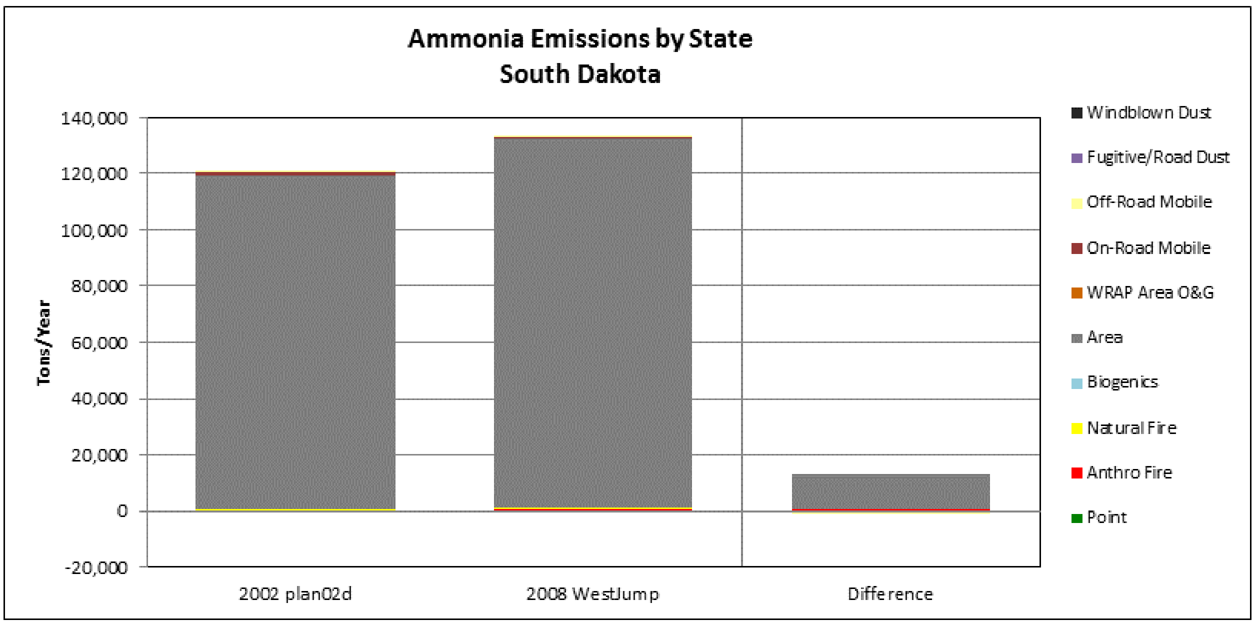

Figure 6.12-9. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Ammonia by Source Category for South Dakota.

Table 6.12-11
South Dakota
Volatile Organic Compound Emissions by Category

Source Category	Volatile Organic Compound Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	2,542	2,550	7
Area	40,551	27,164	-13,387
On-Road Mobile	13,741	11,521	-2,219
Off-Road Mobile	12,764	10,827	-1,937
Area Oil and Gas	288	0	-288
Fugitive and Road Dust			
Anthropogenic Fire	95	443	348
Total Anthropogenic	**69,981**	**52,506**	**-17,476 (-25%)**
Natural Sources			
Natural Fire	3,758	726	-3,032
Biogenic	445,241	151,342	-293,900
Wind Blown Dust	0	0	0
Total Natural	**448,999**	**152,067**	**-296,932 (-66%)**
All Sources			
Total Emissions	**518,981**	**204,573**	**-314,407 (-61%)**

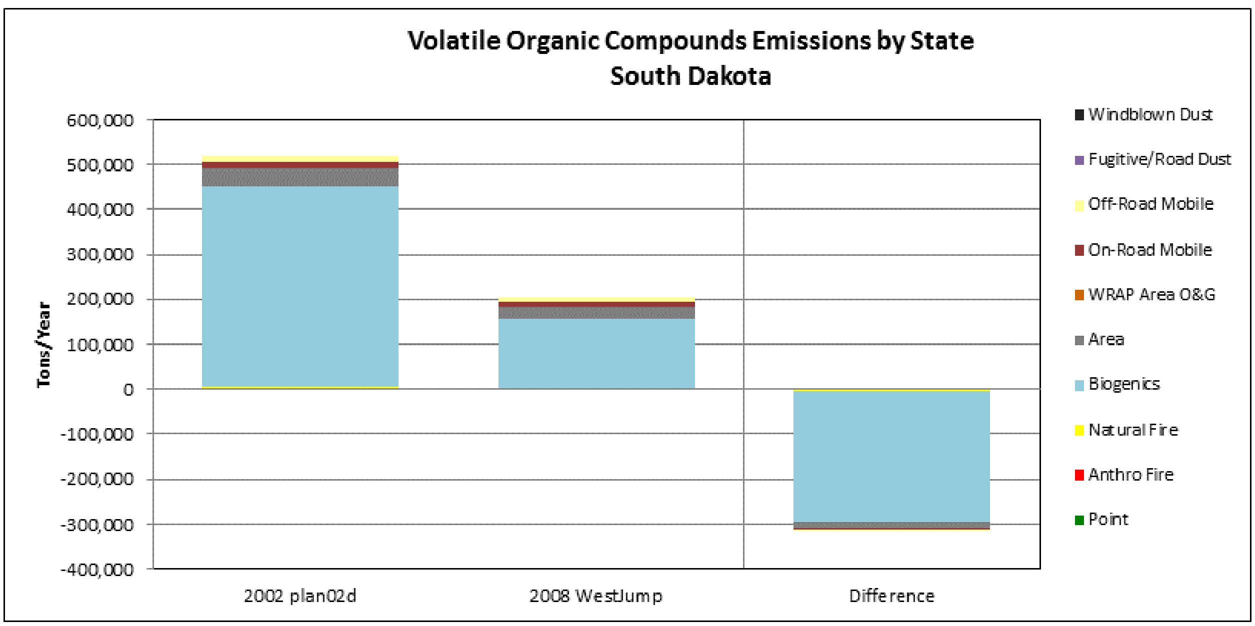

Figure 6.12-10. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Volatile Organic Compounds by Source Category for South Dakota.

Table 6.12-12
South Dakota
Primary Organic Aerosol Emissions by Category

Source Category	**Primary Organic Aerosol Emissions (tons/year)**		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	10	7	-2
Area	1,792	1,103	-689
On-Road Mobile	278	695	416
Off-Road Mobile	942	607	-335
Area Oil and Gas	0	0	0
Fugitive and Road Dust	1,571	1,167	-404
Anthropogenic Fire	91	659	569
Total Anthropogenic	**4,683**	**4,237**	**-446 (-10%)**
Natural Sources			
Natural Fire	4,483	1,743	-2,741
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**4,483**	**1,743**	**-2,741 (-61%)**
All Sources			
Total Emissions	**9,166**	**5,980**	**-3,186 (-35%)**

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

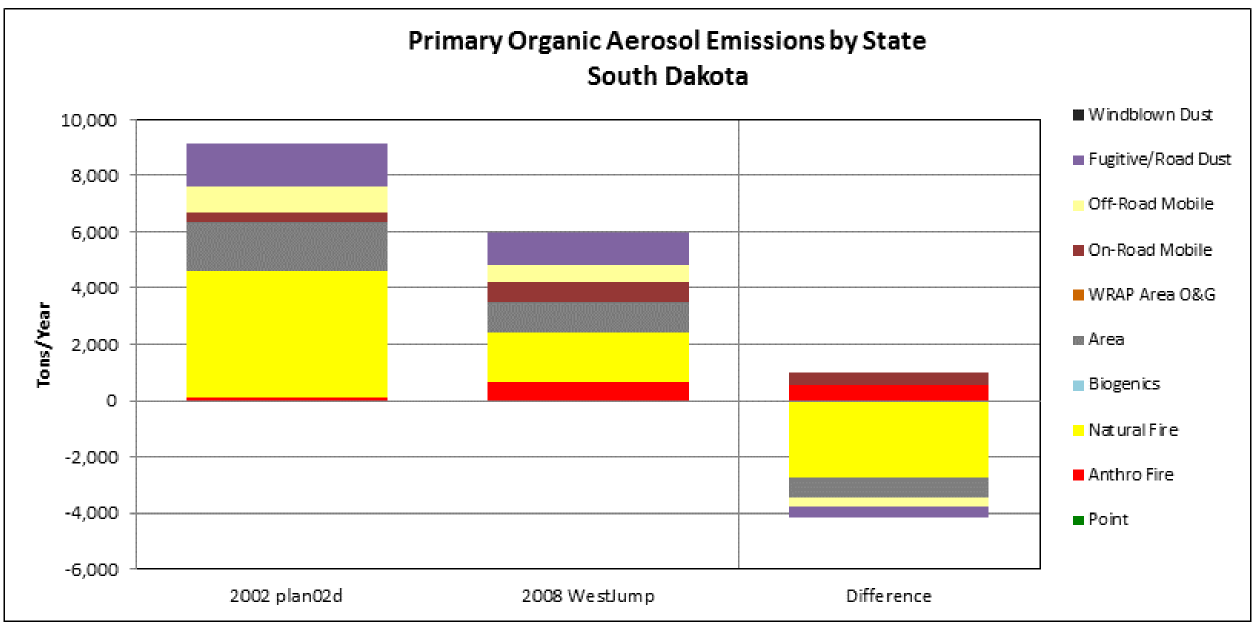

Figure 6.12-11. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Primary Organic Aerosol by Source Category for South Dakota.

Table 6.12-13
South Dakota
Elemental Carbon Emissions by Category

Source Category	Elemental Carbon Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	0	4	4
Area	306	236	-70
On-Road Mobile	339	1,183	844
Off-Road Mobile	3,234	1,637	-1,597
Area Oil and Gas	0	0	0
Fugitive and Road Dust	108	20	-88
Anthropogenic Fire	5	212	206
Total Anthropogenic	**3,992**	**3,292**	**-700 (-18%)**
Natural Sources			
Natural Fire	712	237	-475
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**712**	**237**	**-475 (-67%)**
All Sources			
Total Emissions	**4,703**	**3,529**	**-1,175 (-25%)**

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

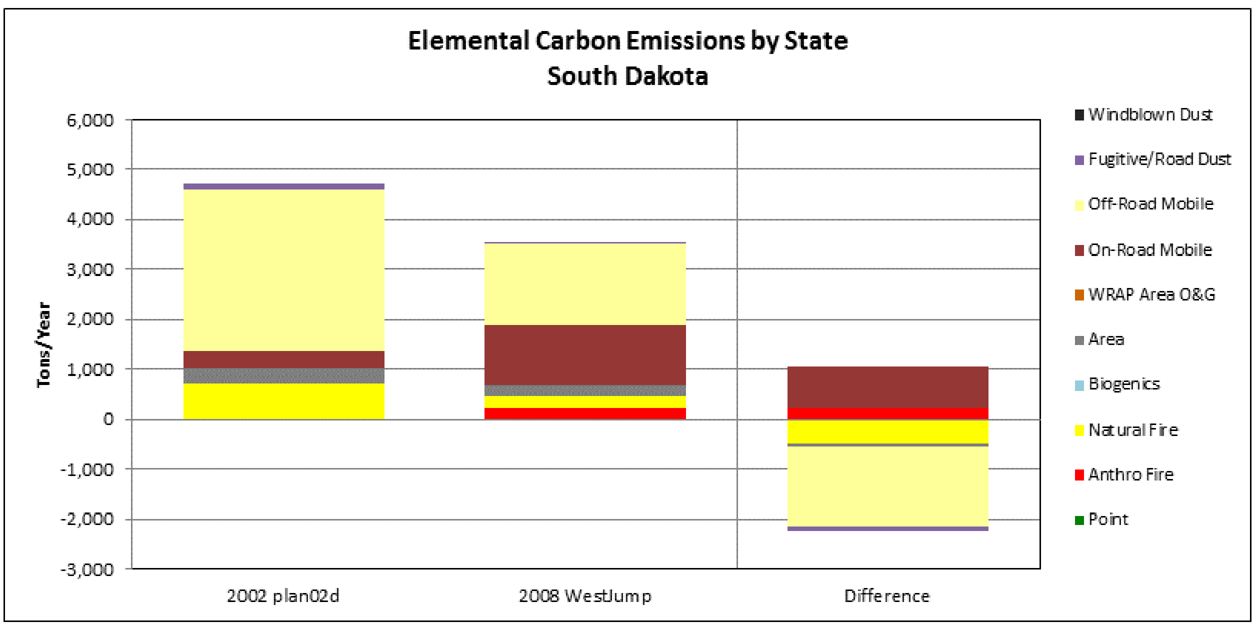

Figure 6.12-12. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Elemental Carbon by Source Category for South Dakota.

Table 6.12-14
South Dakota
Fine Soil Emissions by Category

Source Category	Fine Soil Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	216	188	-28
Area	1,804	589	-1,215
On-Road Mobile	180	104	-76
Off-Road Mobile	0	41	41
Area Oil and Gas	0	0	0
Fugitive and Road Dust	29,281	25,217	-4,064
Anthropogenic Fire	38	249	212
Total Anthropogenic	**31,519**	**26,389**	**-5,129 (-16%)**
Natural Sources			
Natural Fire	801	635	-167
Biogenic	0	0	0
Wind Blown Dust	50,274	34,242	-16,033
Total Natural	**51,076**	**34,876**	**-16,199 (-32%)**
All Sources			
Total Emissions	**82,594**	**61,266**	**-21,329 (-26%)**

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

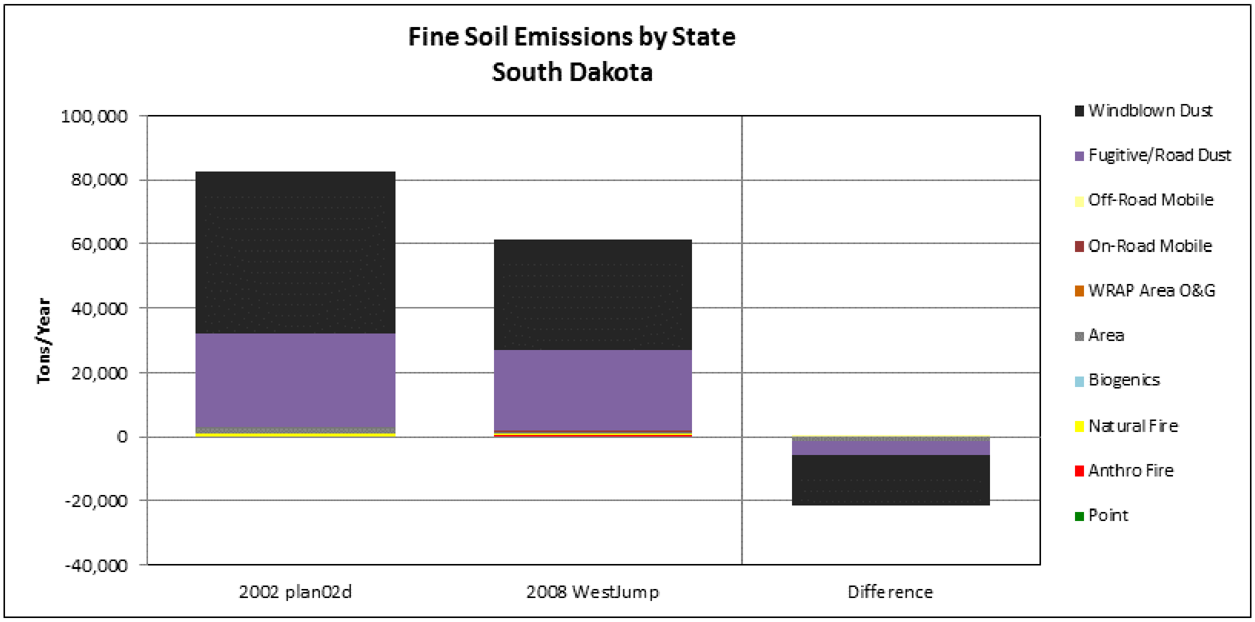

Figure 6.12-13. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Fine Soil by Source Category for South Dakota.

Table 6.12-15
South Dakota
Coarse Mass Emissions by Category

Source Category	Coarse Mass Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	727	25	-702
Area	156	126	-30
On-Road Mobile	169	1,229	1,060
Off-Road Mobile	0	82	82
Area Oil and Gas	0	0	0
Fugitive and Road Dust	161,078	123,701	-37,377
Anthropogenic Fire	6	126	120
Total Anthropogenic	**162,137**	**125,290**	**-36,847 (-23%)**
Natural Sources			
Natural Fire	748	334	-414
Biogenic	0	0	0
Wind Blown Dust	452,470	308,176	-144,294
Total Natural	**453,218**	**308,510**	**-144,708 (-32%)**
All Sources			
Total Emissions	**615,355**	**433,800**	**-181,555 (-30%)**

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

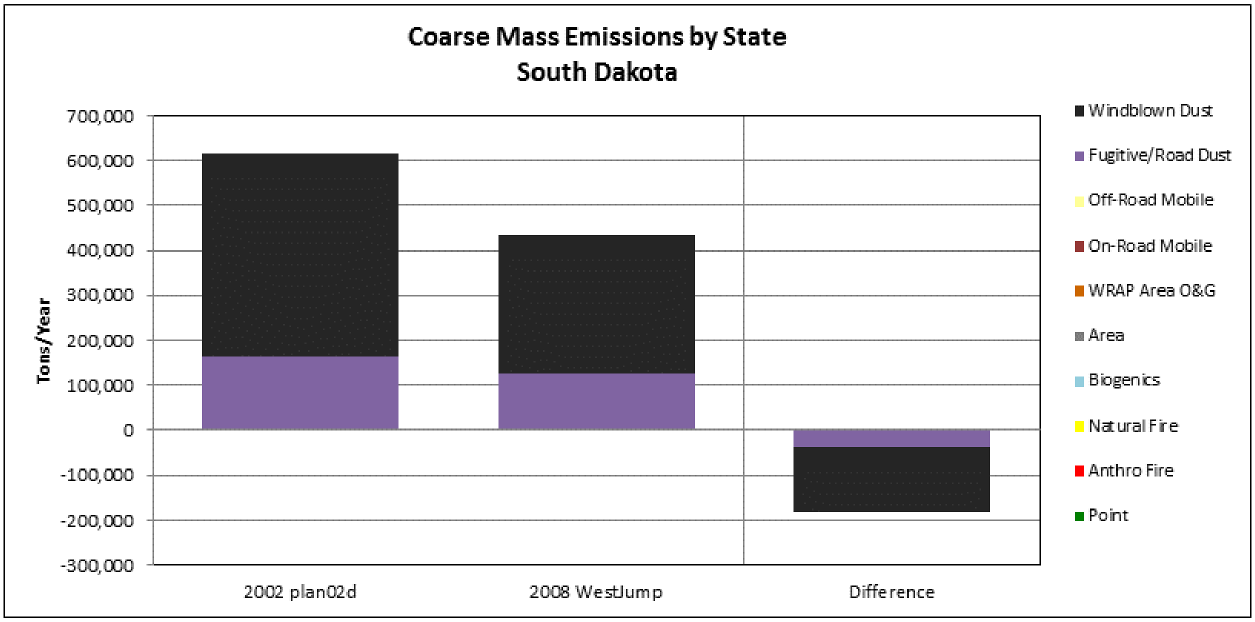

Figure 6.12-14. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Coarse Mass by Source Category for South Dakota.

6.12.2.2 EGU Summary

As described in previous sections, differences between the baseline and progress period inventories presented here do not necessarily represent changes in actual emissions because numerous updates in inventory methodologies have occurred between the development of the separate inventories. Also, the 2002 baseline and 2008 progress period inventories represent only annual snapshots of emissions estimates, which may not be representative of entire 5-year monitoring periods compared. To better account for year-to-year changes in emissions, annual emission totals for South Dakota electrical generating units (EGU) are presented here. EGU emissions are some of the more consistently reported emissions, as tracked in EPA's Air Markets Program Database for permitted Title V facilities in the state (http://ampd.epa.gov/ampd/). RHR implementation plans are required to pay specific attention to certain major stationary sources, including EGUs, built between 1962 and 1977.

Figure 6.12-17 presents a sum of annual NO_X and SO_2 emissions as reported for South Dakota EGU sources between 1996 and 2010. While these types of facilities are targeted for controls in state regional haze SIPs, it should be noted that many of the controls planned for EGUs in the WRAP states had not taken place yet in 2010, while other controls separate from the RHR may have been implemented. The chart shows periods of decline for both SO_2 and NO_X through 2007, followed by slight increases in 2008.

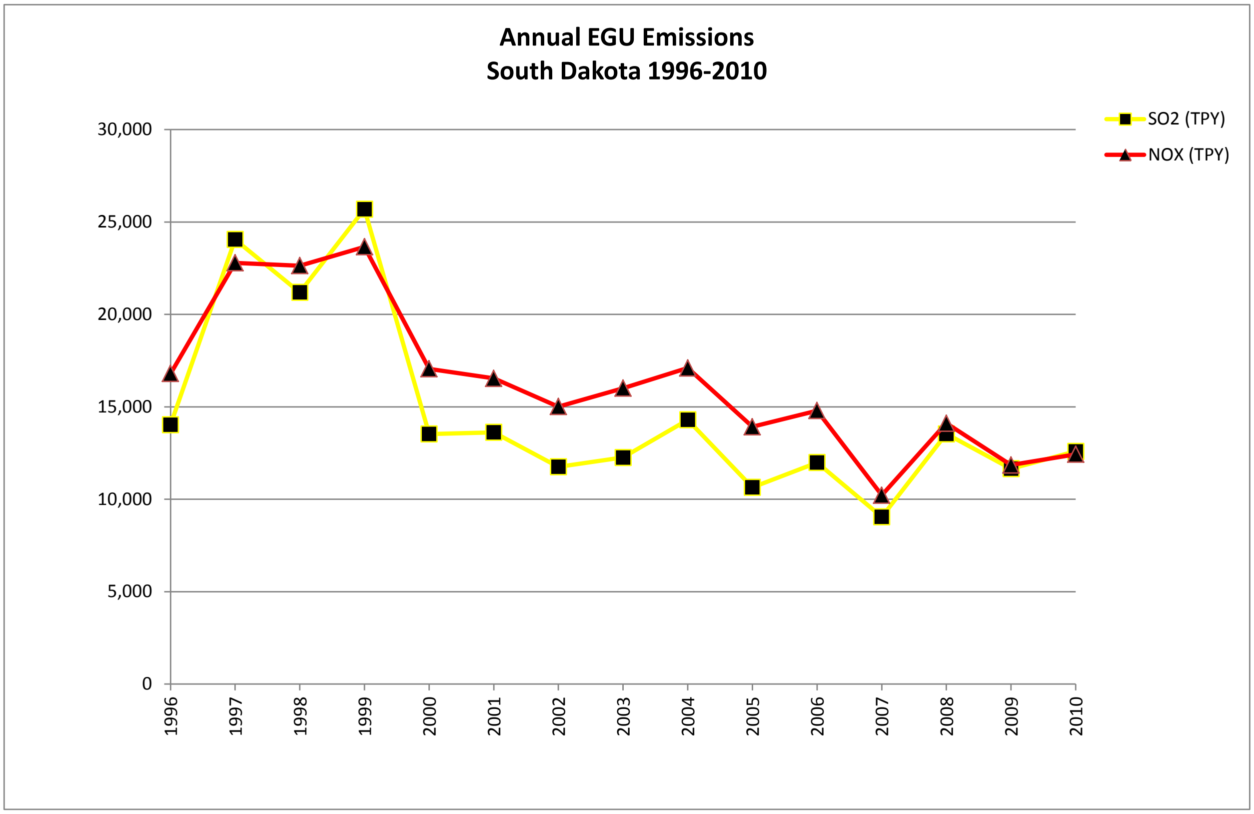

Figure 6.12-17. Sum of EGU Emissions of SO_2 and NO_X reported between 1996 and 2010 for South Dakota.