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.

6.11 OREGON

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. Oregon has 12 mandatory Federal CIAs, and the State of Oregon additionally tracks progress at the Columbia River Gorge National Scenic Area. These CIAs and the IMPROVE monitors used to represent the CIAs and the scenic area are illustrated in Figure 6.11-1 and listed in Table 6.11-1, 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 the best days, the 5-year average deciview metric decreased at all except the CORI1 and KALM1 sites. Note that the CORI1 site does not represent a Federal CIA, but the state of Oregon tracks regional haze progress at this site.
  - Increases on best days at both sites were small (0.3 dv at CORI1 and 0.1 dv at KALM1). At the CORI1 site, higher deciview values were due to increases in ammonium nitrate, soil, coarse mass and sea salt. At the KALM1 site, the only aerosol species that increased on the best days was sea salt.
- For the worst days, the 5-year average deciview metric decreased at most sites, but increased at the CRLA1, KALM1 and THSI1 sites.
- The largest increases in 5-year averages at the KALM1 and CRLA1 sites were due to particulate organic mass and ammonium sulfate.
  - For particulate organic mass, several wildland fire events during the summer months affected measurements at the sites for the current 5-year period. The largest events occurred at the KALM1 site in August 2008, and at the CRLA1 site in July 2007.
  - For ammonium sulfate, increases in 5-year averages were consistent with slightly increasing ammonium sulfate trends for the southwest Oregon and nearby northeast California sites. Emissions inventories showed decreases in state-wide SO_2 for all categories, but off-shore emissions that may affect these sites are not explicitly represented here.
- At the THSI1 site, coarse mass was the largest species contributor to increases in the 5-year average deciview metric. A slightly increasing annual average trend in coarse mass was also measured at the site, and emissions inventories showed increases in

fugitive and road dust sources for coarse mass, partially offset by decreases in point and area sources.

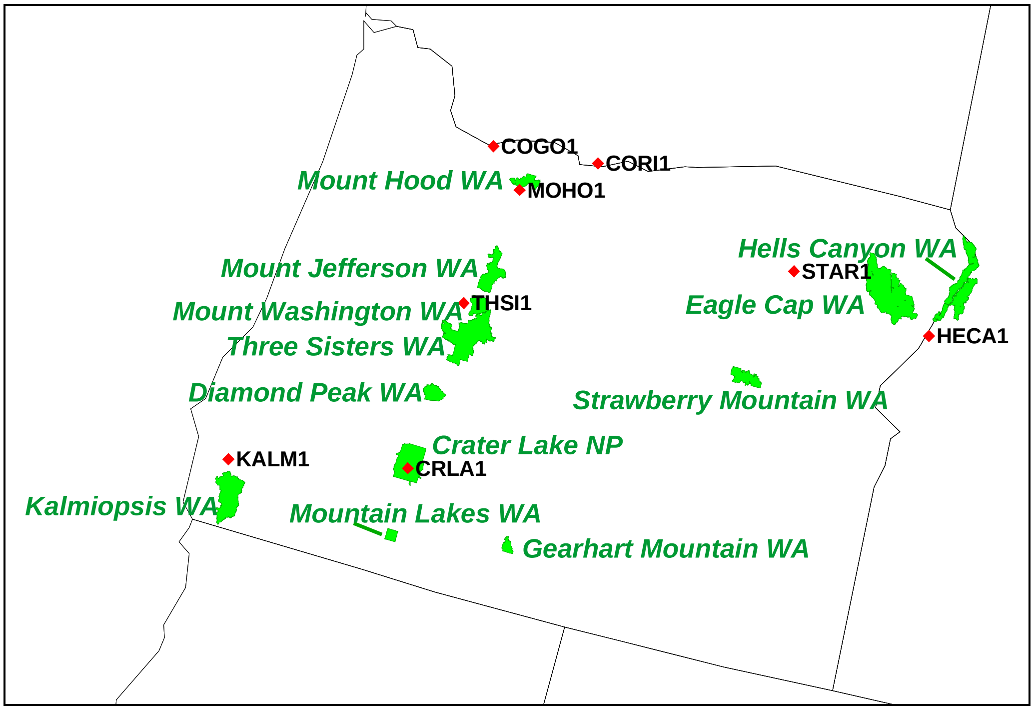

Figure 6.11-1. Map Depicting Federal CIAs and Representative IMPROVE Monitors in Oregon.

Table 6.11-1
Oregon CIAs and Representative IMPROVE Monitors

Class I Area	Representative IMPROVE Site	Latitude	Longitude	Elevation (m)
Crater Lake NP Diamond Peak WA Gearhart Mountain WA Mountain Lakes WA	CRLA1	42.90	-122.14	1996
Hells Canyon WA	HECA1	44.97	-116.84	655
Kalmiopsis WA	KALM1	42.55	-124.06	80
Mount Hood WA	MOHO1	45.29	-121.78	1531
Eagle Cap WA Strawberry Mountain WA	STAR1	45.22	-118.51	1259
Three Sisters WA Mount Washington WA Mount Jefferson WA	THSI1	44.29	-122.04	885
Columbia River Gorge*	CORI1	45.66	-121.00	178
	COGO1	45.57	-122.21	230

*Not a Federal CIA

6.11.1 Monitoring Data

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

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}).

6.11.1.1 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.[105] 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 6.11-2 and 6.11-3 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 Oregon. Figure 6.11-2 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 Oregon sites were particulate organic mass, ammonium nitrate and ammonium sulfate.
- The highest aerosol extinction (22.9 dv) was measured at the CORI1 site, where ammonium nitrate was the largest contributor to aerosol extinction, followed by ammonium sulfate. The lowest aerosol extinction (13.7 dv) was measured at the MOHO1 site.

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. Average extinction (including Rayleigh) ranged from 1.6 dv (CRLA1) to 9.9 dv (CORI1).
- For all sites except KALM1, ammonium sulfate was the largest non-Rayleigh contributor to the aerosol species of extinction
- At the KALM1 site, particulate organic mass was the largest contributor to aerosol extinction, followed by ammonium sulfate.

[105] 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 6.11-2
Oregon 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
CRLA1	13.8	21% (2)	4% (5)	**58% (1)**	9% (3)	2% (6)	5% (4)	0% (7)
COGO1	20.8	30% (2)	**33% (1)**	21% (3)	7% (4)	1% (7)	6% (5)	2% (6)
CORI1	22.9	24% (2)	**46% (1)**	14% (3)	5% (5)	2% (6)	8% (4)	1% (7)
HECA1	18.1	11% (3)	22% (2)	**52% (1)**	9% (4)	1% (6)	5% (5)	0% (7)
KALM1	16.4	26% (2)	7% (5)	**45% (1)**	8% (4)	1% (7)	5% (6)	8% (3)
MOHO1	13.7	31% (2)	13% (3)	**38% (1)**	7% (4)	2% (7)	7% (5)	2% (6)
STAR1	16.2	17% (3)	23% (2)	**43% (1)**	8% (4)	2% (6)	7% (5)	0% (7)
THSI1	16.2	25% (2)	5% (5)	**40% (1)**	8% (4)	3% (6)	18% (3)	1% (7)

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

Table 6.11-3
Oregon 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
CRLA1	1.6	**42% (1)**	8% (5)	15% (3)	17% (2)	3% (7)	7% (6)	8% (4)
COGO1	9.2	**29% (1)**	16% (3)	25% (2)	11% (4)	1% (7)	8% (6)	10% (5)
CORI1	9.9	**27% (1)**	16% (4)	18% (2)	10% (5)	4% (7)	18% (3)	7% (6)
HECA1	4.8	**36% (1)**	12% (3)	28% (2)	8% (5)	3% (6)	10% (4)	3% (7)
KALM1	6.4	26% (2)	5% (6)	**37% (1)**	11% (4)	1% (7)	8% (5)	12% (3)
MOHO1	1.7	**50% (1)**	13% (3)	9% (4)	5% (6)	2% (7)	6% (5)	15% (2)
STAR1	3.6	**43% (1)**	13% (3)	20% (2)	7% (6)	2% (7)	8% (4)	7% (5)
THSI1	3.0	**48% (1)**	9% (4)	18% (2)	7% (5)	1% (7)	7% (6)	11% (3)

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

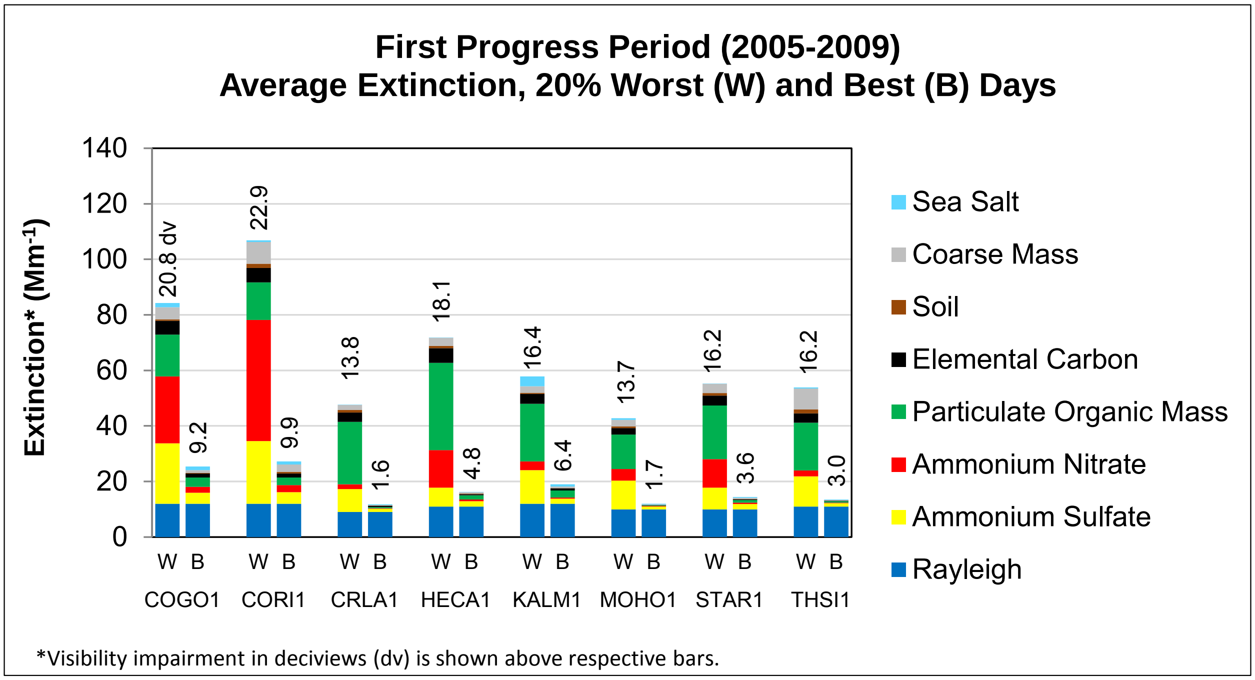

Figure 6.11-2. Average Extinction for Current Progress Period (2005-2009) for the Worst (Most Impaired) and Best (Least Impaired) Days Measured at Oregon Class I Area IMPROVE Sites.

6.11.1.2 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 6.11-4 presents the differences between the 2000-2004 baseline period average extinction and the 2005-2009 progress period average for each site in Oregon for the 20% most impaired days, and Table 6.11-5 presents similar data for the least impaired days. Averages that increased are depicted in red text and averages that decreased in blue.

Figure 6.11-3 presents the 5-year average extinction for the baseline and current progress period averages for the worst days and Figure 6.11-4 presents the differences in averages by aerosol species, with increases represented above the zero line and decreases below the zero line. Figures 6.11-5 and 6.11-6 present similar plots for the best days.

For the 20% most impaired days, the 5-year average RHR deciview metric increased between the 2000-2004 and 2005-2009 periods at the CRLA1, KALM1, and THSI1 sites and decreased at the COGO1, CORI1, HECA1, MOHO1, and STAR1 sites. Notable differences for individual species averages were as follows:

- Ammonium nitrate decreased at all sites except KALM1, where the 5-year average remained the same. The largest decreases were measured at the CORI1 and HECA1 sites.
- At the CRLA1 and KALM1 sites, where the average deciview value increased, ammonium sulfate and particulate organic mass contributed to the largest increases in extinction.
- At the THSI1 site, coarse mass and soil were the largest aerosol species contributors to the increase in the deciview average at the site.

For the 20% least impaired days, the 5-year average deciview metric decreased at all sites except CORI1 and KALM1. Notable differences for individual species averages on the 20% least impaired days were as follows:

- The increase in 5-year average deciviews at the CORI1 site was due to increases in soil, coarse mass, sea salt and ammonium sulfate.
- The increase at the KALM1 site was due to increases in ammonium sulfate and sea salt.

Table 6.11-4
Oregon 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
COGO1	23.1	20.8	-2.3	-3.4	-9.5	-10.2	-1.0	-0.1	+0.2	+0.7
CORI1	24.7	22.9	-1.8	-0.7	-20.6	-5.3	-0.5	+0.9	+3.5	+0.4
CRLA1	13.7	13.8	+0.1	+0.9	-0.9	+1.1	-1.0	0.0	-0.5	+0.1
HECA1	18.6	18.1	-0.5	-1.6	-15.0	+15.8	+2.2	+0.2	+1.0	+0.1
KALM1	15.5	16.4	+0.9	+1.7	0.0	+6.2	+1.0	0.0	+0.2	+0.7
MOHO1	14.9	13.7	-1.2	-1.0	-1.3	-2.1	-0.5	-0.1	-0.2	+0.6
STAR1	18.6	16.2	-2.4	0.0	-5.5	-4.8	-0.6	-0.3	-1.5	0.0
THSI1	15.3	16.2	+0.9	-1.0	-0.5	0.0	+0.1	+0.8	+4.9	+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 6.11-5
Oregon 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**
COGO1	9.3	9.2	**-0.1**	**-0.2**	**-0.4**	0.0	**-0.1**	0.0	**+0.1**	**+0.3**
CORI1	9.6	9.9	**+0.3**	**-0.3**	**+0.2**	0.0	0.0	**+0.3**	**+0.3**	**+0.3**
CRLA1	1.7	1.6	**-0.1**	**+0.2**	0.0	**-0.2**	**-0.2**	0.0	0.0	**+0.1**
HECA1	5.5	4.8	**-0.7**	0.0	**-0.2**	**-0.5**	**-0.1**	**-0.1**	**-0.3**	**+0.1**
KALM1	6.3	6.4	**+0.1**	**+0.3**	0.0	**-0.1**	**-0.1**	0.0	0.0	**+0.2**
MOHO1	2.2	1.7	**-0.5**	**-0.2**	**-0.2**	**-0.1**	**-0.1**	0.0	0.0	0.0
STAR1	4.5	3.6	**-0.9**	**-0.1**	**-0.1**	**-0.8**	**-0.2**	0.0	**-0.2**	**+0.1**
THSI1	3.0	3.0	0.0	**+0.1**	**-0.1**	0.0	0.0	0.0	0.0	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.

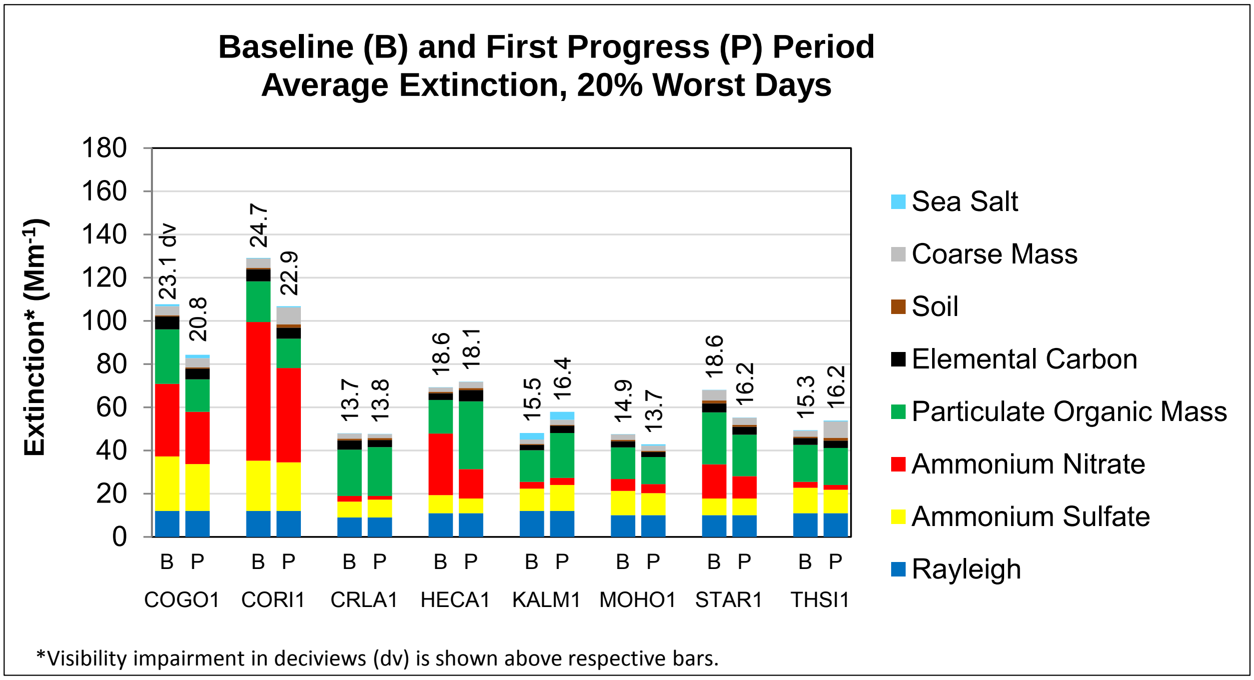

Figure 6.11-3. Average Extinction for Baseline and Progress Period Extinction for Worst (Most Impaired) Days Measured at Oregon Class I Area IMPROVE Sites.

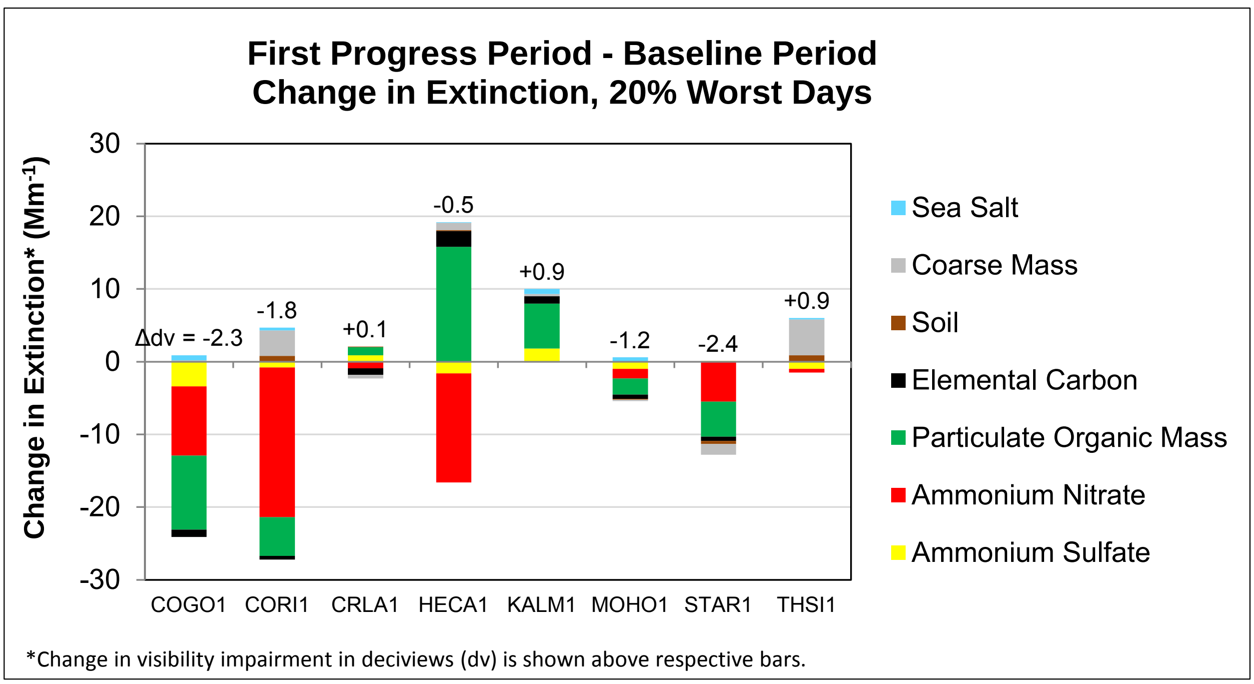

Figure 6.11-4. Difference between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Worst (Most Impaired) Days Measured at Oregon Class I Area IMPROVE Sites.

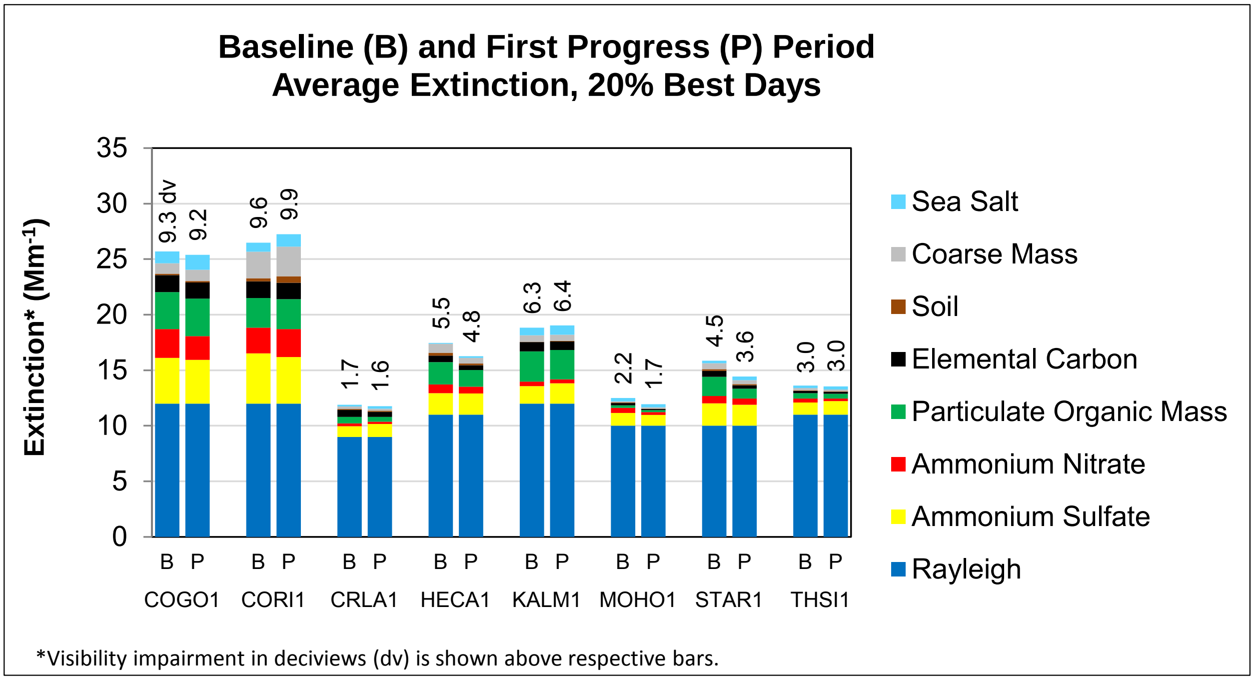

Figure 6.11-5. Average Extinction for Baseline and Progress Period Extinction for Best (Least Impaired) Days Measured at Oregon Class I Area IMPROVE Sites.

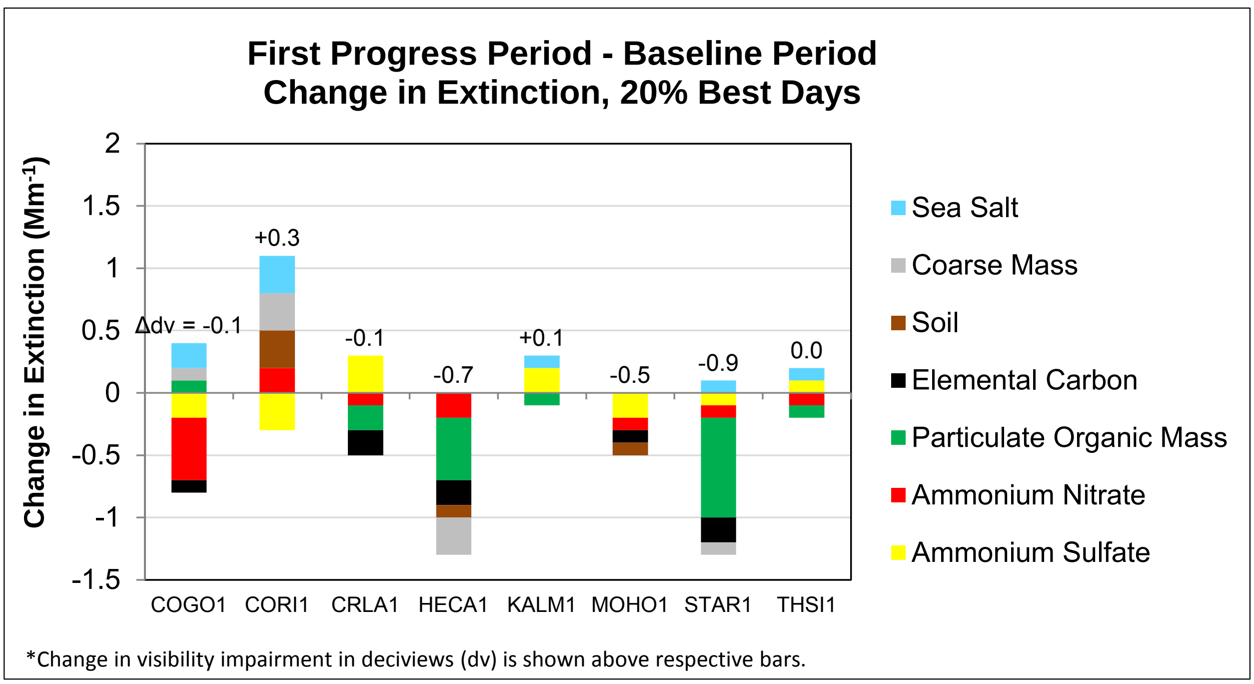

Figure 6.11-6. Difference between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Best (Least Impaired) Days Measured at Oregon Class I Area IMPROVE Sites.

6.11.1.3 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 Oregon are summarized in Table 6.11-6, and regional trends were presented earlier in Section 4.1.1.[106] 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.[107] 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 K. Additionally, this 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 Oregon are as follows:

- Ammonium nitrate showed decreasing annual average trends for the worst days at all Oregon sites, with the largest decreases measured at the HECA1, STAR1, CORI1, and COGO1 sites.
- Large particulate organic mass events occurred at all sites, generally between August and September. Monthly and daily charts in Appendix K indicate that the largest events occurred in August 2005 at KALM1, August and September 2006 at CRLA1,

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[106] 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)
[107] 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.

HECA1, MOHO1, and STAR1, July 2007 at HECA1 and July through September 2008 at CRLA1 and MOHO1.

- The increase in the deciview metric between the baseline period and the progress on the worst days at the THSI1 site was mostly due to coarse mass. Daily extinction plots in Appendix K indicate that this was due an anomalous increase in coarse mass measured between July and September of 2009 at the site.

Table 6.11-6
Oregon 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
COGO1	20% Best	--	-0.1	--	0.0	0.0	0.0	--
	20% Worst	-0.3	-2.6	-2.1	-0.4	--	--	--
	All Days	-0.4	-0.8	-0.4	-0.2	--	-0.1	--
CORI1	20% Best	--	--	--	--	--	--	--
	20% Worst	--	-4.3	-1.1	--	--	--	--
	All Days	-0.2	-0.9	-0.6	-0.1	0.1	--	--
CRLA1	20% Best	--	--	0.0	0.0	--	--	0.0
	20% Worst	0.3	--	--	-0.2	--	--	0.0
	All Days	--	-0.1	--	-0.1	--	0.0	0.0
HECA1	20% Best	--	--	-0.1	0.0	0.0	-0.1	--
	20% Worst	-0.4	-3.7	1.6	--	--	0.3	--
	All Days	--	-0.8	--	--	--	--	--
KALM1	20% Best	--	--	--	--	--	0.0	0.0
	20% Worst	0.4	--	--	--	--	--	--
	All Days	0.1	-0.1	--	-0.1	--	--	0.1
MOHO1	20% Best	-0.1	0.0	0.0	0.0	--	--	0.0
	20% Worst	--	-0.3	--	--	--	--	0.0
	All Days	-0.1	-0.1	--	-0.1	--	--	--
STAR1	20% Best	--	--	-0.2	-0.1	0.0	0.0	--
	20% Worst	--	-1.8	-1.5	-0.3	--	--	--
	All Days	--	-0.4	-0.6	-0.2	--	-0.1	--
THSI1	20% Best	--	0.0	--	0.0	0.0	--	--
	20% Worst	-0.3	-0.1	--	--	0.0	0.4	0.0
	All Days	-0.1	-0.1	--	0.0	0.0	0.1	--

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

6.11.2 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 6.11-7 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 6.11-7
Oregon
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 associated 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.
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 reported by the IMPROVE Network as the difference between PM_{10} and $PM_{2.5}$ mass measurements. Coarse mass is not separated by species in the same way that $PM_{2.5}$ is speciated, but these measurements are generally associated with crustal components. Similar to crustal $PM_{2.5}$, natural windblown dust is often the largest contributor to PMC.

6.11.2.1 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 6.11-8 and Figure 6.11-7 present the differences between the 2002 and 2008 sulfur dioxide (SO_2) inventories by source category. Tables 6.11-9 and Figure 6.11-8 present data for oxides of nitrogen (NO_X), and subsequent tables and figures (Tables 6.11-10 through 6.11-15 and Figures 6.11-9 through 6.11-14) 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.

- Largest differences for point source inventories were decreases in SO_2, NO_X, VOCs, fine soil, and coarse mass.
- Area source inventories showed decreases in all parameters except NO_X. 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_2 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 slight 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 most parameters, especially POAs, VOCs, and EC, natural fire emission inventory estimates decreased, and anthropogenic fire estimates 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 increased for 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 6.11-8
Oregon
Sulfur Dioxide Emissions by Category

Source Category	Sulfur Dioxide Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	18,493	15,918	-2,575
Area	9,932	1,528	-8,404
On-Road Mobile	3,446	654	-2,792
Off-Road Mobile	6,535	431	-6,104
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	1,586	1,403	-182
Total Anthropogenic	**39,992**	**19,934**	**-20,058 (-50%)**
Natural Sources			
Natural Fire	7,328	1,207	-6,121
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**7,328**	**1,207**	**-6,121 (-84%)**
All Sources			
Total Emissions	**47,320**	**21,140**	**-26,180 (-55%)**

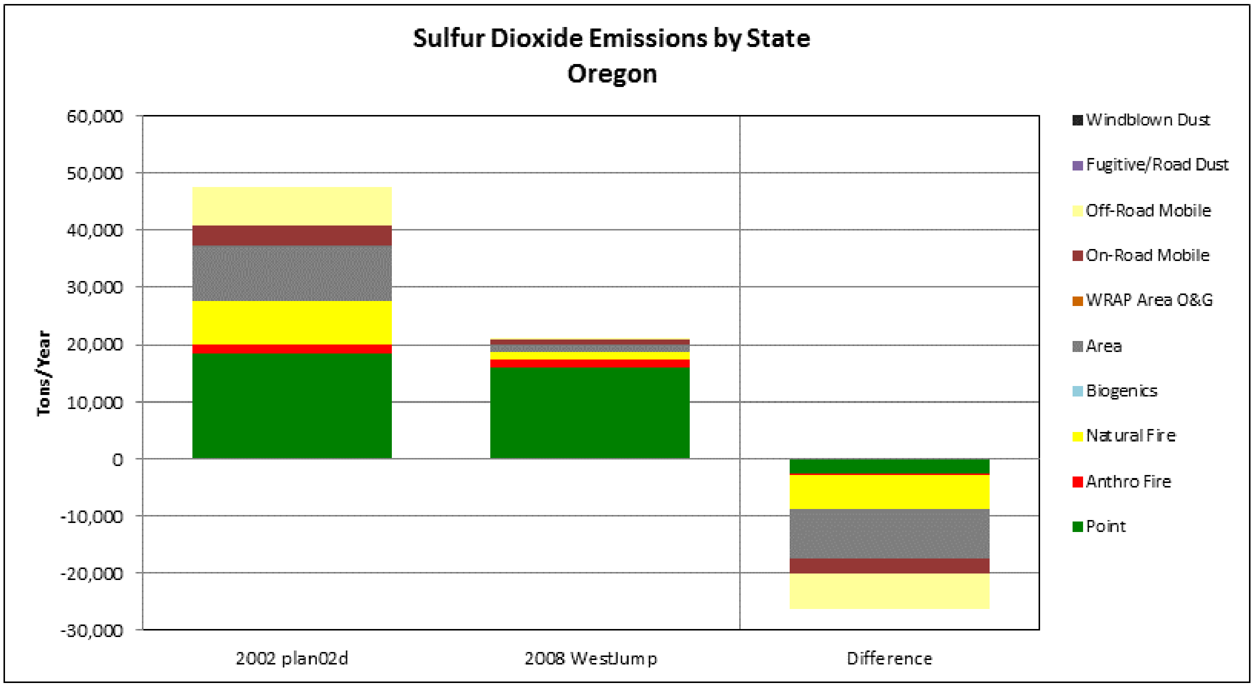

Figure 6.11-7. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Sulfur Dioxide by Source Category for Oregon.

Table 6.11-9
Oregon
Oxides of Nitrogen Emissions by Category

Source Category	Oxides of Nitrogen Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	26,160	23,548	-2,612
Area	14,740	24,121	9,381
On-Road Mobile	111,646	98,399	-13,247
Off-Road Mobile	53,896	23,463	-30,434
Area Oil and Gas	85	0	-85
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	6,292	9,923	3,630
Total Anthropogenic	**212,819**	**179,453**	**-33,366 (-16%)**
Natural Sources			
Natural Fire	27,397	8,521	-18,876
Biogenic	16,527	5,560	-10,967
Wind Blown Dust	0	0	0
Total Natural	**43,924**	**14,081**	**-29,843 (-68%)**
All Sources			
Total Emissions	**256,744**	**193,534**	**-63,209 (-25%)**

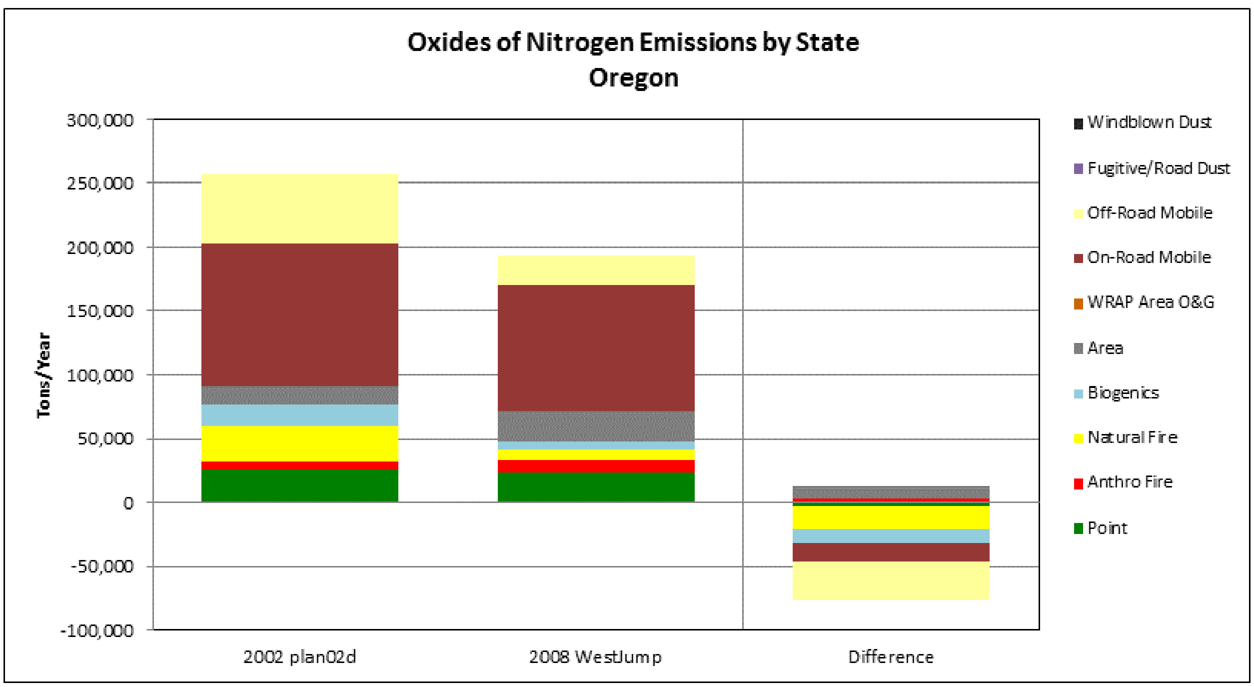

Figure 6.11-8. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Oxides of Nitrogen by Source Category for Oregon.

Table 6.11-10
Oregon
Ammonia Emissions by Category

Source Category	Ammonia Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	919	255	-664
Area	45,591	43,814	-1,777
On-Road Mobile	3,263	1,668	-1,594
Off-Road Mobile	39	27	-12
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	1,211	6,900	5,690
Total Anthropogenic	**51,022**	**52,665**	**1,643 (3%)**
Natural Sources			
Natural Fire	6,132	5,907	-225
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**6,132**	**5,907**	**-225 (-4%)**
All Sources			
Total Emissions	**57,154**	**58,571**	**1,418 (2%)**

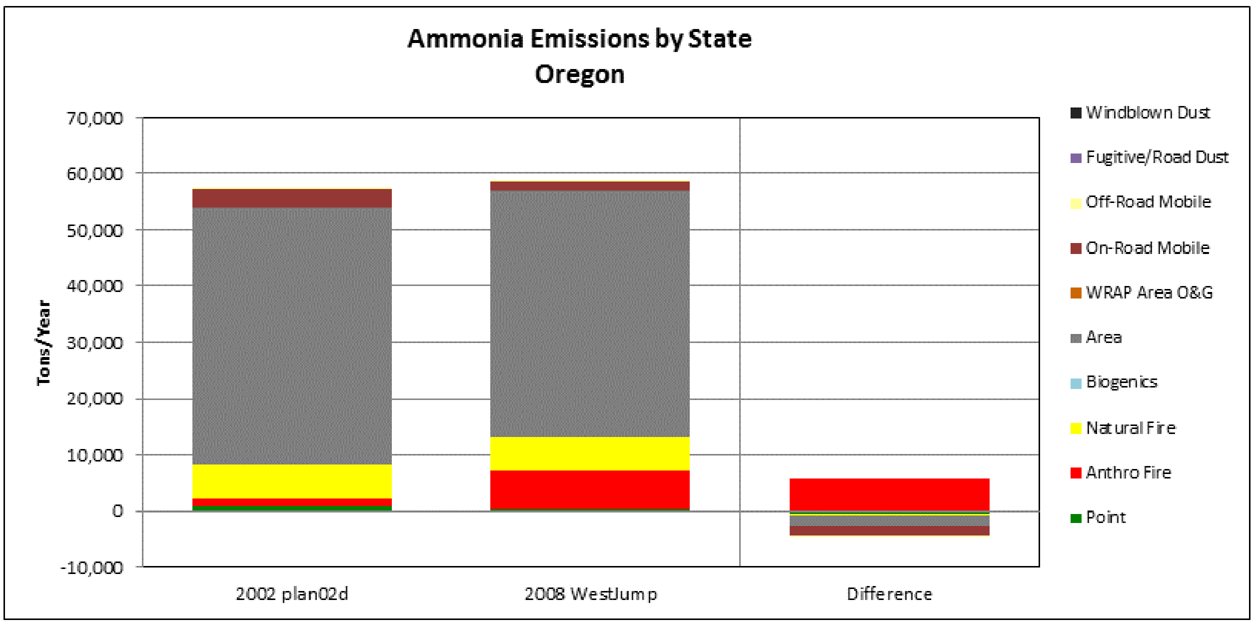

Figure 6.11-9. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Ammonia by Source Category for Oregon.

Table 6.11-11
Oregon
Volatile Organic Compound Emissions by Category

Source Category	Volatile Organic Compound Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point	28,762	8,554	-20,208
Area	245,649	63,741	-181,908
On-Road Mobile	88,784	39,649	-49,135
Off-Road Mobile	39,516	33,308	-6,208
Area Oil and Gas	34	0	-34
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	9,939	9,639	-300
Total Anthropogenic	**412,685**	**154,891**	**-257,793 (-62%)**
Natural Sources			
Natural Fire	60,336	9,023	-51,314
Biogenic	1,148,266	339,630	-808,636
Wind Blown Dust	0	0	0
Total Natural	**1,208,602**	**348,653**	**-859,950 (-71%)**
All Sources			
Total Emissions	**1,621,287**	**503,544**	**-1,117,743 (-69%)**

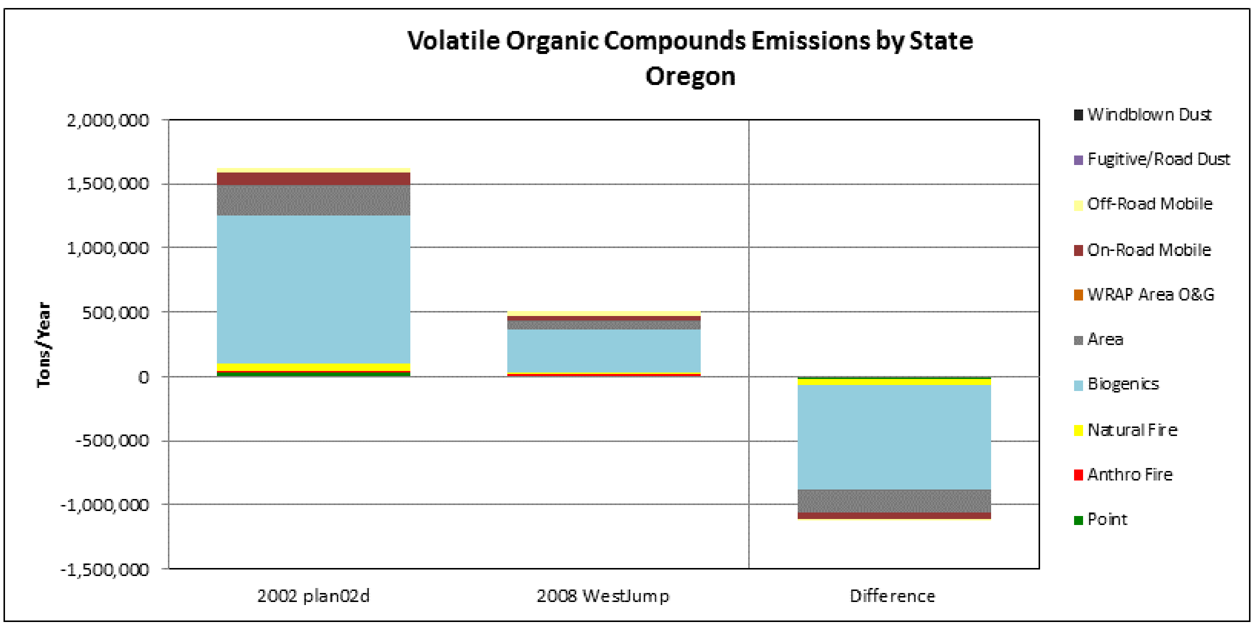

Figure 6.11-10. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Volatile Organic Compounds by Source Category for Oregon.

Table 6.11-12
Oregon
Primary Organic Aerosol Emissions by Category

Source Category	Primary Organic Aerosol Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	1,445	88	-1,358
Area	22,281	10,459	-11,822
On-Road Mobile	1,009	2,314	1,305
Off-Road Mobile	1,323	1,005	-318
Area Oil and Gas	0	0	0
Fugitive and Road Dust	298	617	319
Anthropogenic Fire	10,937	19,073	8,136
Total Anthropogenic	**37,293**	**33,555**	**-3,738 (-10%)**
Natural Sources			
Natural Fire	81,047	17,462	-63,585
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**81,047**	**17,462**	**-63,585 (-78%)**
All Sources			
Total Emissions	**118,340**	**51,017**	**-67,323 (-57%)**

*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/).

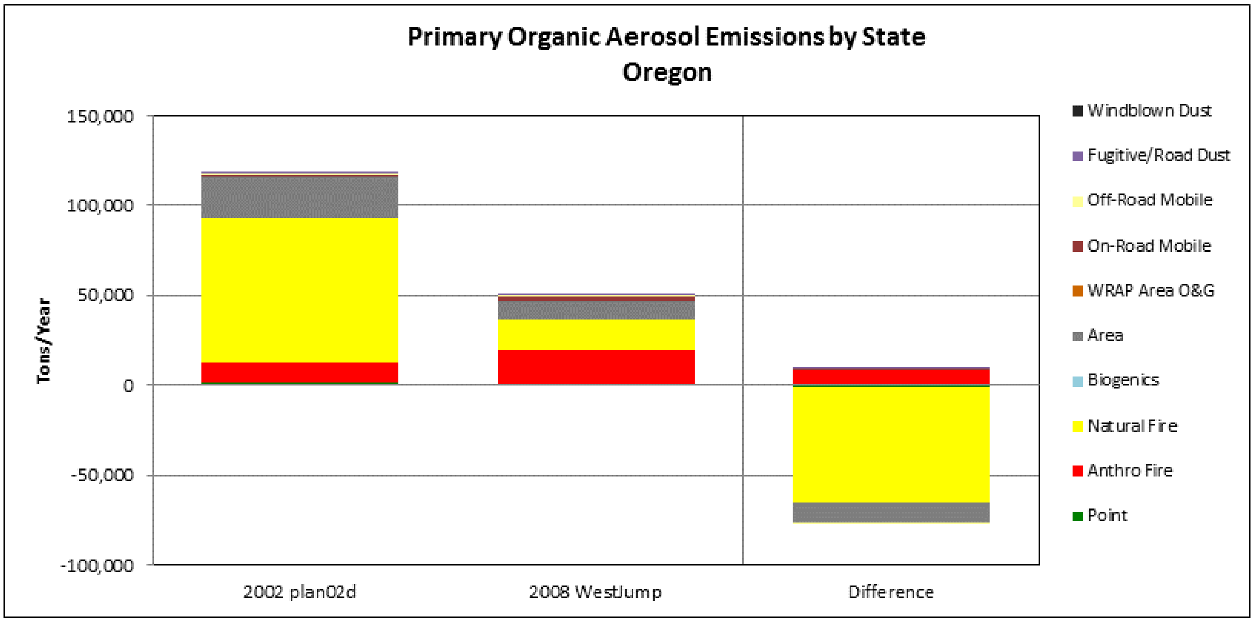

Figure 6.11-11. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Primary Organic Aerosol by Source Category for Oregon.

Table 6.11-13
Oregon
Elemental Carbon Emissions by Category

Source Category	Elemental Carbon Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	45	103	59
Area	4,121	1,533	-2,588
On-Road Mobile	1,166	4,041	2,876
Off-Road Mobile	3,038	1,199	-1,839
Area Oil and Gas	0	0	0
Fugitive and Road Dust	21	21	0
Anthropogenic Fire	1,935	2,872	938
Total Anthropogenic	**10,325**	**9,769**	**-556 (-5%)**
Natural Sources			
Natural Fire	16,403	2,448	-13,955
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**16,403**	**2,448**	**-13,955 (-85%)**
All Sources			
Total Emissions	**26,728**	**12,218**	**-14,510 (-54%)**

*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/).

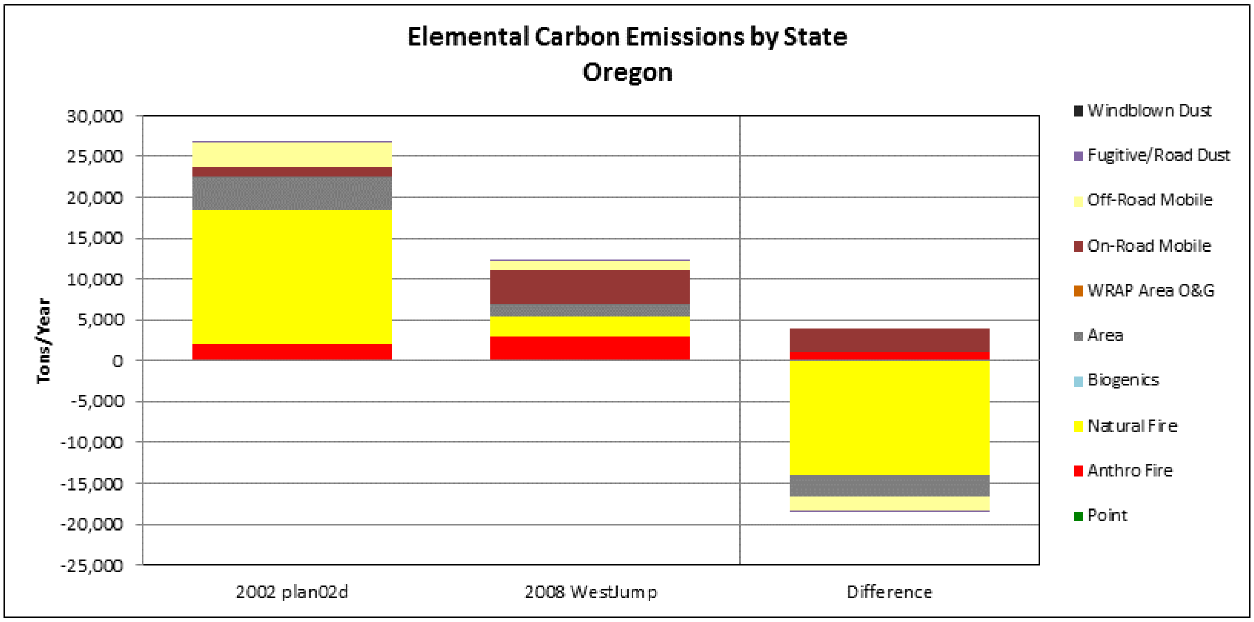

Figure 6.11-12. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Elemental Carbon by Source Category for Oregon.

Table 6.11-14
Oregon
Fine Soil Emissions by Category

Source Category	Fine Soil Emissions (tons/year)		
	2002 (Plan02d)	**2008 (WestJump2008)**	**Difference (Percent Change)**
Anthropogenic Sources			
Point*	5,728	430	-5,298
Area	15,295	5,038	-10,256
On-Road Mobile	606	394	-212
Off-Road Mobile	0	70	70
Area Oil and Gas	0	0	0
Fugitive and Road Dust	5,022	9,364	4,342
Anthropogenic Fire	1,483	6,972	5,490
Total Anthropogenic	**28,133**	**22,269**	**-5,864 (-21%)**
Natural Sources			
Natural Fire	6,090	6,396	305
Biogenic	0	0	0
Wind Blown Dust	11,586	8,499	-3,087
Total Natural	**17,676**	**14,894**	**-2,782 (-16%)**
All Sources			
Total Emissions	**45,809**	**37,163**	**-8,645 (-19%)**

*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/).

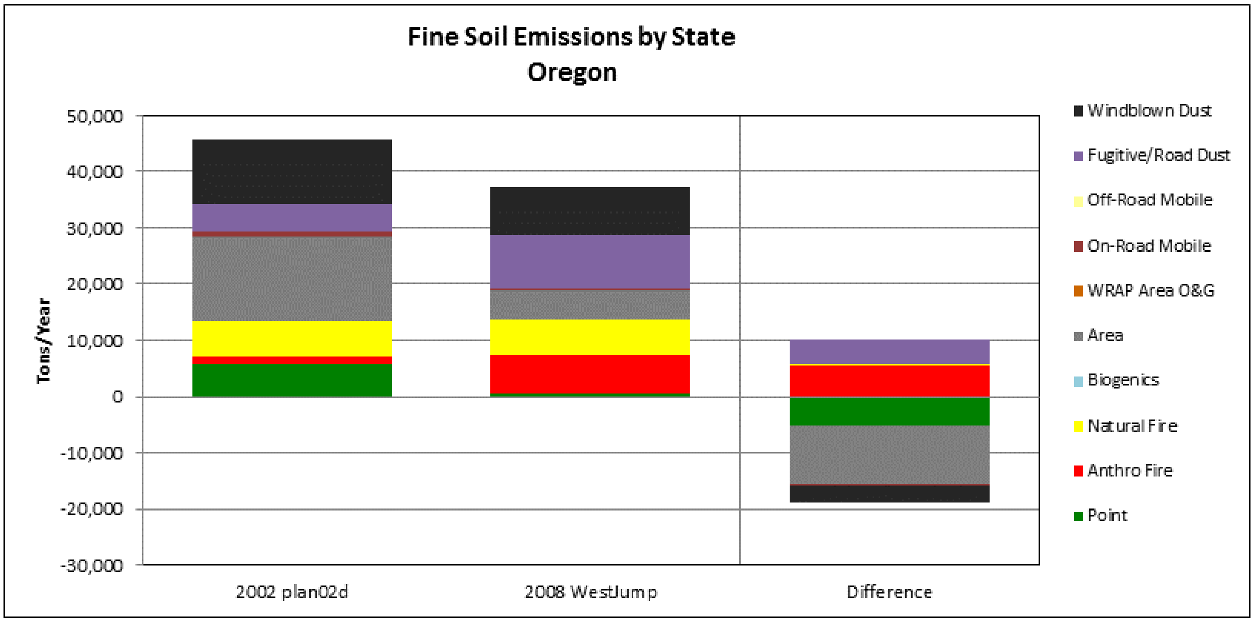

Figure 6.11-13. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Fine Soil by Source Category for Oregon.

Table 6.11-15
Oregon
Coarse Mass Emissions by Category

Source Category	Coarse Mass Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	10,211	2,067	-8,145
Area	3,546	597	-2,949
On-Road Mobile	618	4,295	3,677
Off-Road Mobile	0	116	116
Area Oil and Gas	0	0	0
Fugitive and Road Dust	33,999	63,599	29,600
Anthropogenic Fire	1,282	3,648	2,365
Total Anthropogenic	**49,657**	**74,321**	**24,664 (50%)**
Natural Sources			
Natural Fire	17,036	3,326	-13,709
Biogenic	0	0	0
Wind Blown Dust	104,272	76,489	-27,783
Total Natural	**121,307**	**79,815**	**-41,492 (-34%)**
All Sources			
Total Emissions	**170,964**	**154,136**	**-16,828 (-10%)**

*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/).

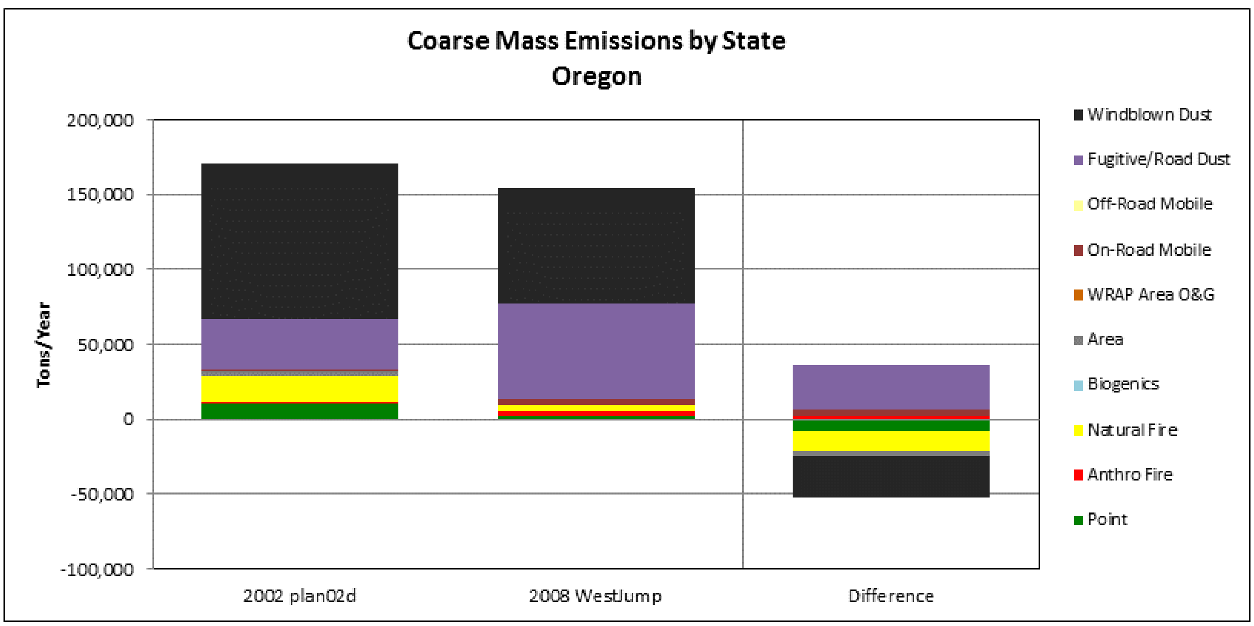

Figure 6.11-14. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Coarse Mass by Source Category for Oregon.

6.11.2.2 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 Oregon 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 6.11-17 presents a sum of annual NO_X and SO_2 emissions as reported for Oregon 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 several periods of increases and decreases for both SO_2 and NO_X.

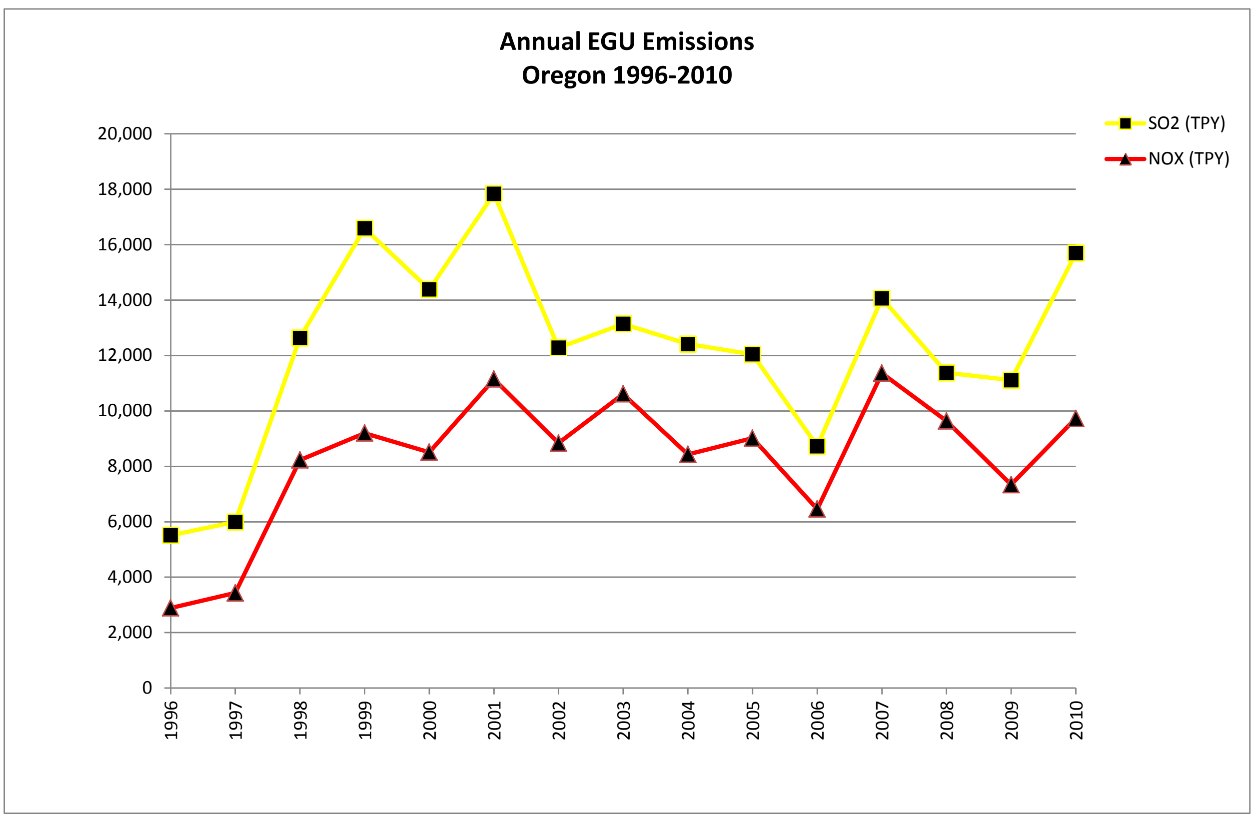

Figure 6.11-8. Sum of EGU Emissions of SO_2 and NO_X reported between 1996 and 2010 for Oregon.