4.0 WRAP REGIONAL SUMMARIES

As described in Section 2.0, each state is required to submit a report evaluating progress toward the reasonable progress goal, pursuant to Regional Haze Rule (RHR) 40 CFR 51.308(g). Because haze is a regional issue, summaries of monitoring and emissions data are presented here on a regional scale. These summaries are intended to support the individual State and Class I area data summaries which are presented in Section 6.0. Some general observations from these regional summaries are listed below, and described in more detail in the following sections.

- The 5-year deciview metric for the worst days decreased between the 2000-2004 baseline period and the 2005-2009 progress period at most sites, but increased at several sites. Particulate organic mass concentration was the largest contributing factor to increases in the 5-year deciview metric. The increases in particulate organic mass measurements were correlated with regions where large wildfire events occurred during the 2005-2009 progress period.
- The 5-year deciview metric for the best days decreased between the 2000-2004 baseline period and the 2005-2009 progress period did not get worse, and actually improved, at all but a few sites in Washington, Oregon, and Alaska, where small increases were measured.
- For ammonium nitrate, decreases in the 5-year average for the worst days, and decreasing annual trends, were measured at nearly all sites, with the largest decreases in northern Oregon and southern California. Emissions inventories indicate that oxides of nitrogen (NO_X) are mostly due to on-road mobile, off-road mobile, and point source emissions. Decreasing ammonium nitrate measurements were consistent with comparisons between baseline and progress period inventories, and tracking of annual averages electric generating units (EGU) emissions, which showed decreasing inventory totals for NO_X in most Western Regional Air Partnership (WRAP) states.
- A number of sites measured increases in 5-year average ammonium sulfate for the worst days, but most sites showed decreasing ammonium sulfate trends. For the 5-year average, most sites, including all sites in Utah, Colorado, Arizona, and New Mexico, were affected by anomalously high ammonium sulfate annual averages in 2005. Emissions inventories indicate that sulfur dioxide (SO_2) emissions in the western states are dominated by point sources, and comparisons between baseline and progress period inventories, and tracking of annual averages EGU emissions, show decreasing SO_2 emissions for most WRAP states.
- While most sites measured decreasing ammonium sulfate trends, increasing trends were measured in Alaska and Hawaii, at a few coastal sites in northwestern California and southwestern Oregon, and at a few sites along the Canadian border in northeastern Montana and northwestern North Dakota. Emissions inventories show that increases in Hawaii are largely due to volcanic emissions of SO_2. Increases at other WRAP sites do not appear to be reflected in the emissions inventory totals. The increases at the coastal sites may be affected by offshore emissions, which are not presented here on a state level. Increases along the Canadian border may be due to international emissions.

- For fine soil and coarse mass, measured concentrations were highest in the southern WRAP region. Soil and coarse mass extinction trends were variable and not statistically significant in most cases, but an area represented by several Interagency Monitoring of Protected Visual Environments (IMPROVE) sites in eastern Arizona and western New Mexico did show increasing coarse mass trends. Emission inventories indicated that natural windblown dust is the largest contributor to coarse mass measurements in this area, but significant changes in the development of the windblown dust inventories did not allow for definitive comparisons between 2002 and 2008 inventories for these emissions.

4.1 MONITORING DATA

The goal of the RHR is to ensure that visibility on the 20% most impaired, or worst, days continues to improve, and that visibility on the 20% least impaired, or best, days does not get worse, as measured in units of deciviews (dv) calculated from data measured at IMPROVE monitoring sites. For purposes here, progress is measured in 5-year average increments beginning with the 2000-2004 baseline average, and proceeding with each subsequent 5-year average (e.g. 2005-2009, 2010-2014, etc.).[50] This section addresses changes as measured between the baseline period and the most recent successive progress period available, or the 2005-2009 first progress period.

Figures 4.1-1 and 4.1-2 present the difference between the 2000-2004 average baseline period and the 2005-2009 first progress period in deciviews for the 20% worst and 20% best days, respectively, for Federal Class I area (CIA) IMPROVE sites in the WRAP region. The maps indicate that 5-year average extinction on the 20% worst days decreased at most sites, but showed some increases at several sites. The map for the 20% best days indicates that best days did not get worse, and actually improved, at all but a few sites in Washington, Oregon, and Alaska, where increases were small (~0.1 dv).

[50] 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).

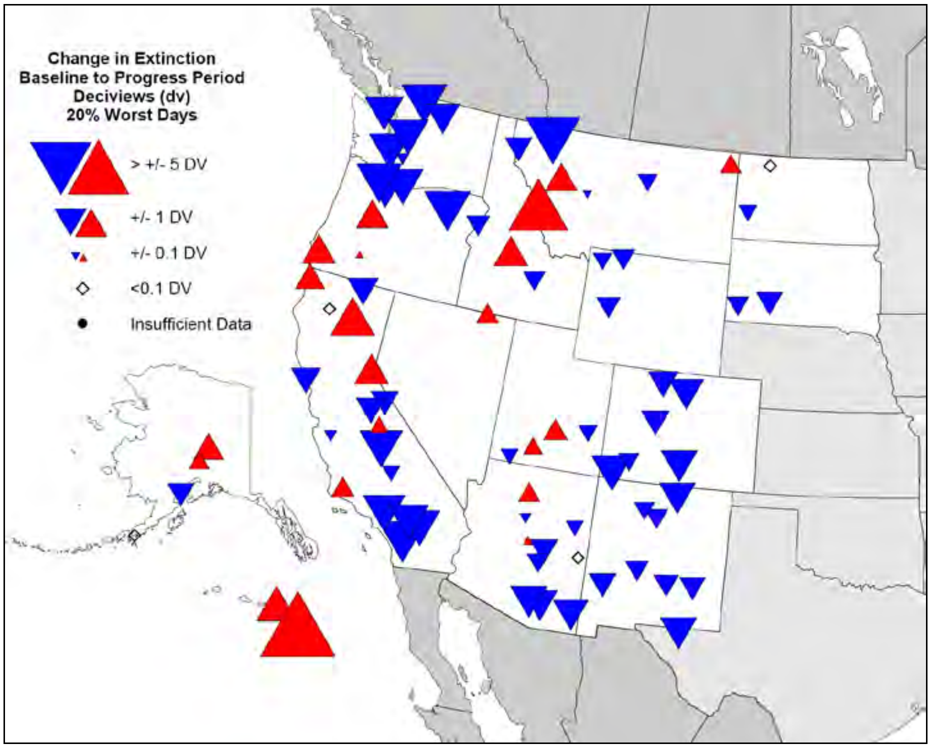

Figure 4.1-1. Change in Deciview Extinction between Baseline Period Average (2000-2004) and the First Progress Period Average (2005-2009) for the 20% Worst Visibility Days.

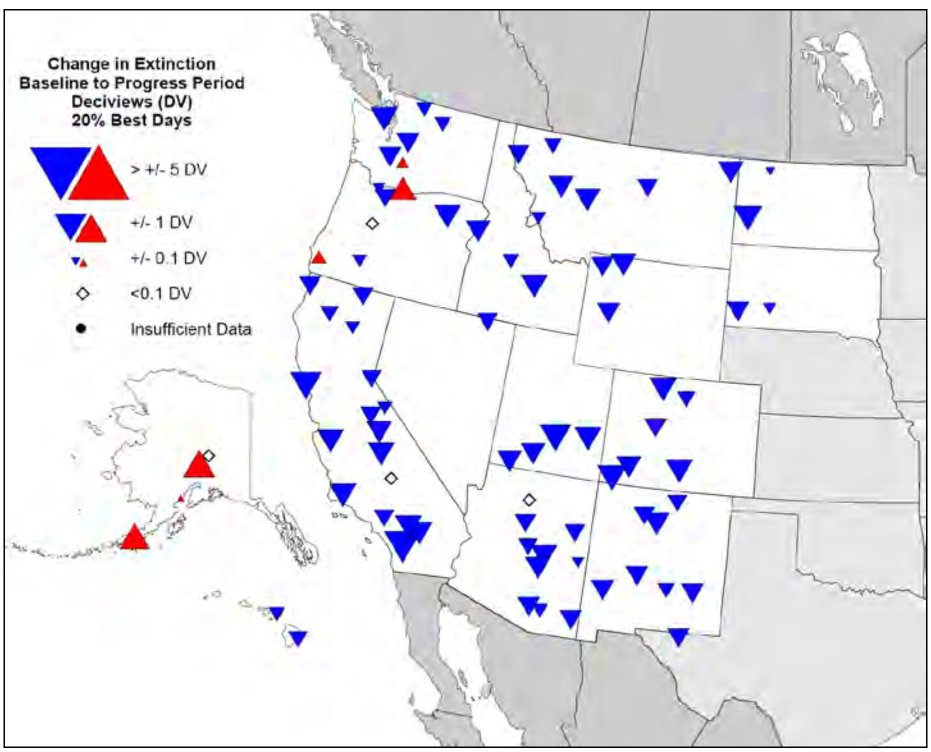

Figure 4.1-2. Change in Deciview Extinction between Baseline Period Average (2000-2004) and the First Progress Period Average (2005-2009) for the 20% Best Visibility Days.

The RHR haze index, as defined using deciview units, does not provide information regarding the relative contributions of specific pollutants to overall visibility impairment. As described in Section 3.1, calculation of visibility impairment is based on the cumulative impacts of several different species measured as measured at IMPROVE Network sites. Analyzing the behavior of each individual species has important implications for control measures, as some species originate from largely anthropogenic sources, while others may originate from a mixture of both anthropogenic and natural sources.

Figures 4.1-3 and 4.1-4 present regional maps of average aerosol extinction for the most impaired days during baseline period (2000-2004), and the first progress period average (2005-2009), respectively, for the IMPROVE monitors representing Federal CIAs in the WRAP region. The size of the pie chart is related to the magnitude of visibility impairment, and colors represent the relative contribution of the pollutants measured by the IMPROVE Network.

The maps indicate that particulate organic matter, which is often related to wildfire activity, is a large factor in visibility reduction in the west. Visibility impairment in western CIAs that are directly adjacent to more populated areas in the West is influenced more by ammonium nitrate, which is commonly associated with combustion activities, especially vehicles and industrial activities. Ammonium sulfate represents most of the visibility impairment at the Hawaii sites, and up to one third of the impairment in the contiguous United States. The largest contributor to ammonium sulfate concentrations in the contiguous United States and Alaska is generally industrial activities such as coal burning power plants, while natural volcanic activity contributes to the high measured ammonium sulfate at Hawaii sites.

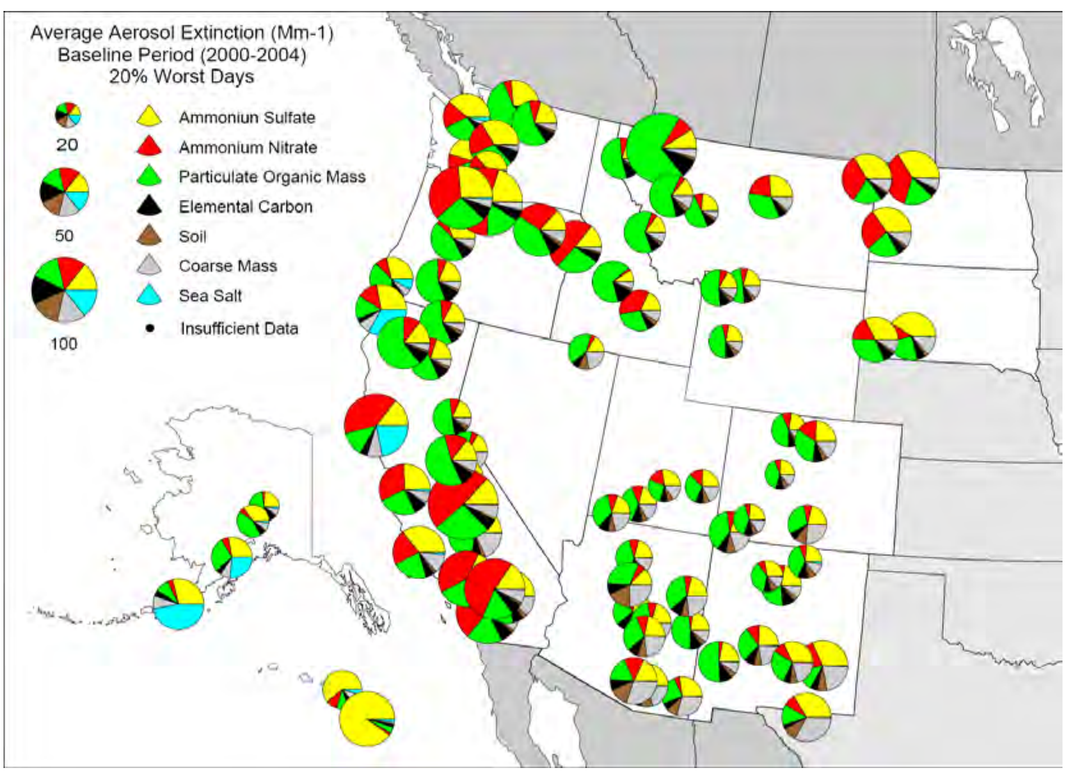

Figure 4.1-3. Regional Average of Aerosol Extinction by Pollutant for Baseline Period Average (2000-2004) for 20% Worst Days.

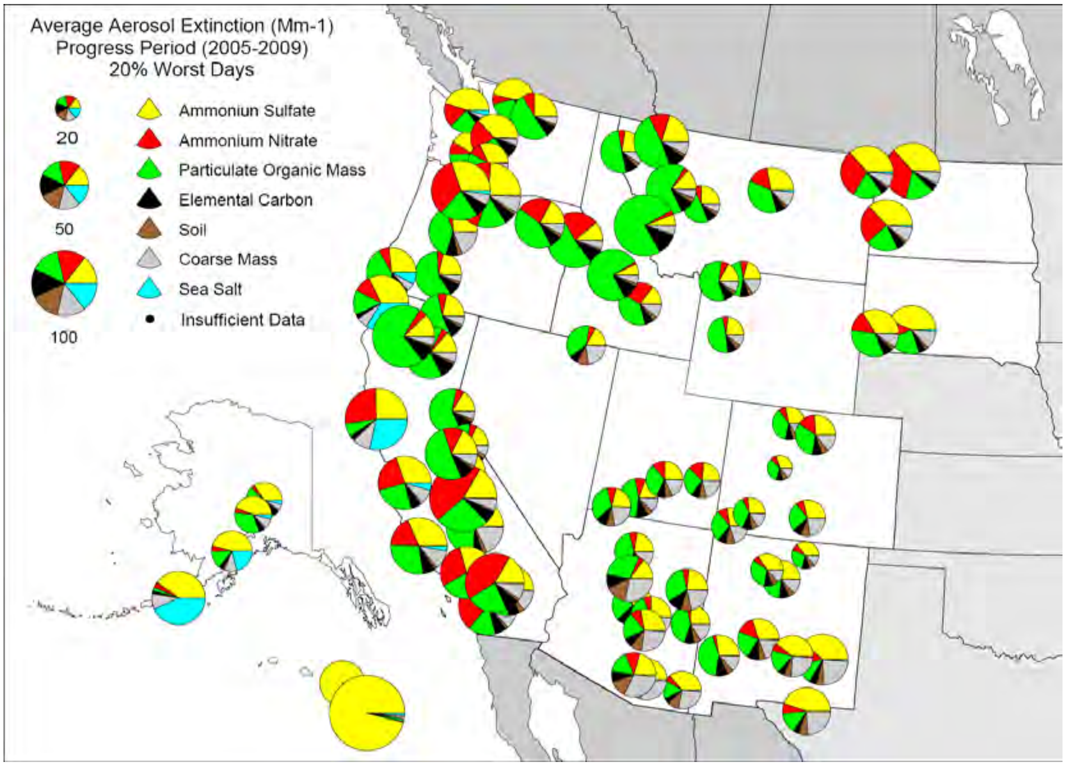

Figure 4.1-4. Regional Average of Aerosol Extinction by Pollutant for the First Progress Period Average (2005-2009) for 20% Worst Days.

The changes in deciview between the 2000-2004 baseline and 2005-2009 progress period averages, as depicted in Figure 4.1-1, is the combined effect of increases in some species and decreases in other species. To identify individual species behavior, the increasing and decreasing species are presented separately in Figures 4.1-5 and 4.1-6. Figure 4.1-5 presents the individual species of haze that have decreased between the 2000-2004 baseline period and the 2005-2009 progress period, where sites with corresponding decreases in deciview measurements are highlighted with blue circles. Figure 4.1-6 presents the individual species of haze that have increased, with corresponding deciview increases highlighted with purple circles.

As depicted in Figure 4.1-5, most of the decreases in deciviews averages values were associated with decreasing ammonium nitrate and particulate organic mass. Decreases in California, eastern Oregon, and Idaho were largely due to ammonium nitrate reductions, while decreases in northern Washington and Montana, Colorado, New Mexico, and Arizona were largely due to decreasing particulate organic mass. Some ammonium sulfate reductions were also measured in western Washington and northwestern Oregon. As depicted in Figure 4.1-6, most of the increases in deciview values were associated with increasing particulate organic mass in California, Idaho, Montana, and Utah. Ammonium sulfate increases also occurred in Alaska, Hawaii, and at a few of the sites in the contiguous states.

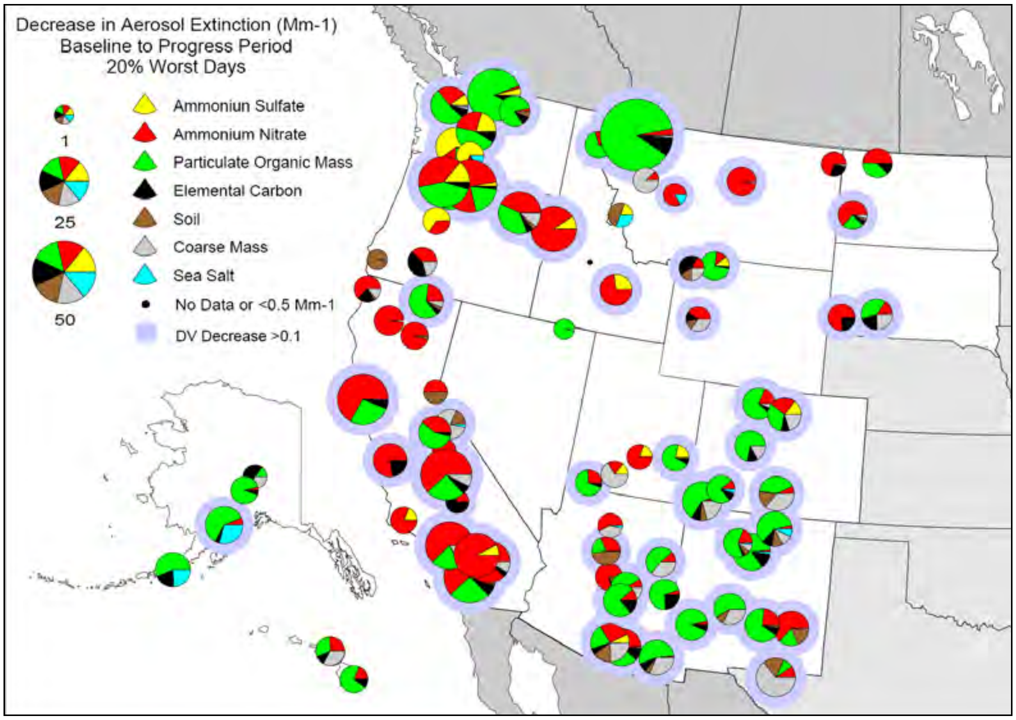

Figure 4.1-5. Magnitude of Aerosol Extinction Species That Have Decreased Between the Baseline Average (2000-2004) and the First Progress Period Average (2005-2009) for the 20% Worst Days.

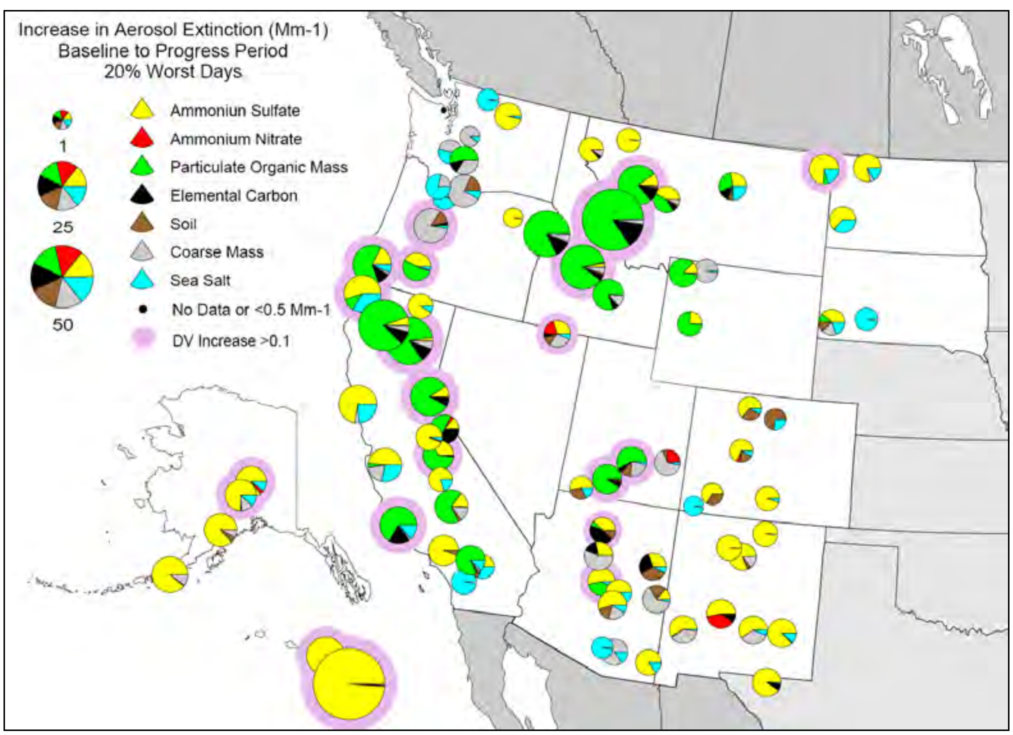

Figure 4.1-6. Magnitude of Aerosol Extinction Species That Have Increased Between the Baseline Average (2000-2004) and the First Progress Period Average (2005-2009) for the 20% Worst Days.

4.1.1 Annual Trends

In addition to looking at the 5-year averages deciview metric that is specified in regulatory text, it is useful to examine annual trends for each particle species. In the long term, annual trend 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.

Annual trends were calculated for the years 2000-2009, with a trend defined as the slope derived using Theil statistics, which is a nonparametric regression technique that is commonly applied to environmental data to determine statistically significant trends.[51] 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. Regional trends are presented here for aerosol species trends with p-value statistics less than 0.15 (85% confidence level). Trends for all significance levels at all sites are also included in state specific appendices provided with this report.

Figures 4.1-7 presents trends in ammonium sulfate measurements for the period 2000-2009 for the 20% most impaired or worst days at each IMPROVE Federal CIA site that had at least five years of complete data, and Figure 4.1-7 presents trends for all sampled days. Figures 4.1-9 through 4.1-20 present similar maps of ammonium nitrate, particulate organic mass, elemental carbon, soil, coarse mass, and sea salt trends. At the time this report was prepared, data were available through 2010,[52] but trends presented here include only data collected between 2000-2009 to better reflect the changes between the 2000-2004 baseline and 2005-2009 progress periods.

The RHR haze index specifically refers to the 20% most impaired and least impaired days, but trends are also presented here for the annual average of all sampled days. The 20% most impaired and least impaired days can represent different times of the year, especially when large events such as wildfires influence the worst day identification.[53] Because the annual average represents the entire year, these averages may better represent overall aerosol species trends than trends for just the 20% worst days. Consistency between worst day and all day trends adds confidence to the characterization of the trend, and differences may suggest a seasonality affect. Specific trend observations by species are listed below:

- Figures 4.1-7 and 4.1-8 indicate decreasing ammonium sulfate trends for most sites, but increasing trends were measured in Alaska and Hawaii, at a few coastal sites in northwestern California and southwestern Oregon, and at a few sites along the Canadian border in northeastern Montana and northwestern North Dakota.

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[51]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)

[52] The 2010 IMPROVE data were not included in trend analysis, but 2010 annual averages are included for reference in states specific appendices.

[53] Seasonality effects of the identification of worst days are discussed further in Section 3.1.2.1.

- Figures 4.1-9 and 4.1-10 indicate decreasing ammonium nitrate trends at nearly all sites. Slightly increasing trends were measured at the DENA1 site in Alaska.
- Figures 4.1-11 and 4.1-12 indicate that most particulate organic mass trends are either decreasing or insignificant.
- Figures 4.1-13 and 4.1-14 indicate that elemental carbon is also generally trending down.
- Figures 4.1-15 and 4.1-16 indicate that trends in soil are mostly insignificant.
- Figures 4.1-17 and 4.1-18 indicate that trends for coarse mass were mostly decreasing, but increasing trends were apparent for a region in eastern Arizona and western New Mexico.
- Figures 4.1-19 and 4.1-20 indicate that sea salt trends are mostly insignificant, with the largest significantly increasing trends measured on the pacific coast for the worst days.

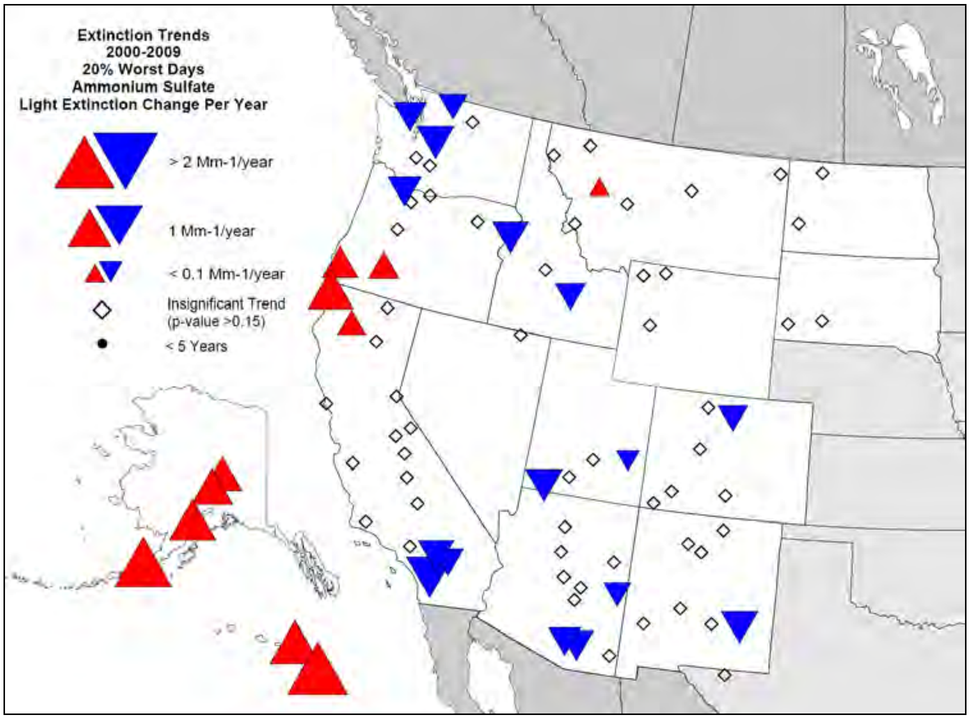

Figure 4.1-7. 10-Year Annual Average Ammonium Sulfate Extinction Trends for 20% Worst Days at CIA IMPROVE Sites in the WRAP Region.

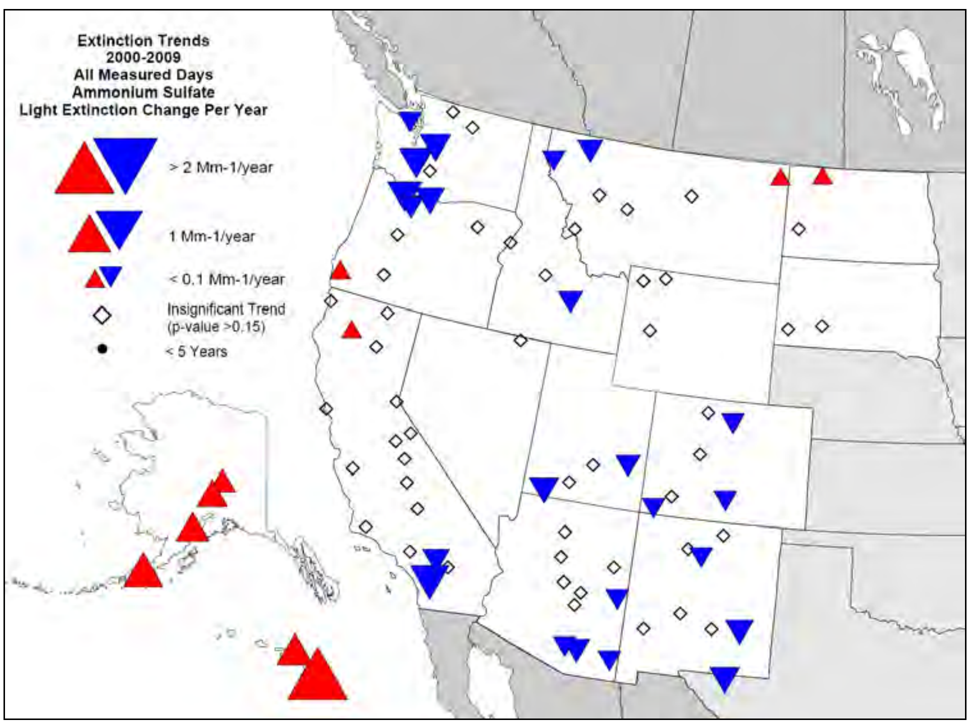

Figure 4.1-8. 10-Year Annual Average Ammonium Sulfate Extinction Trends for All Measured Days at CIA IMPROVE Sites in the WRAP Region.

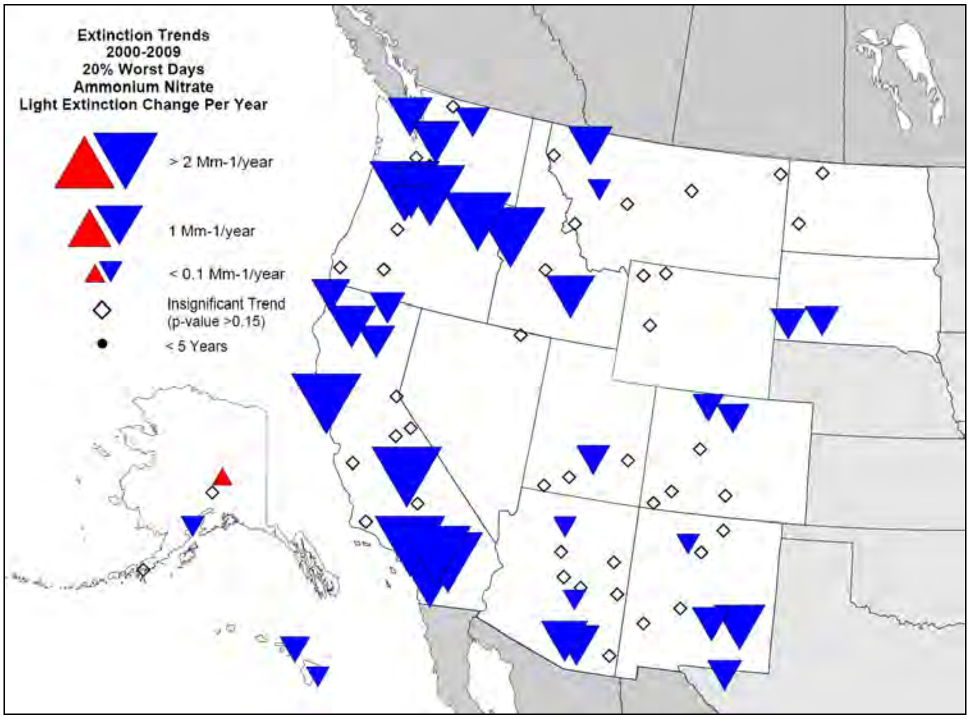

Figure 4.1-9. 10-Year Annual Average Ammonium Nitrate Extinction Trends for 20% Worst Days at CIA IMPROVE Sites in the WRAP Region.

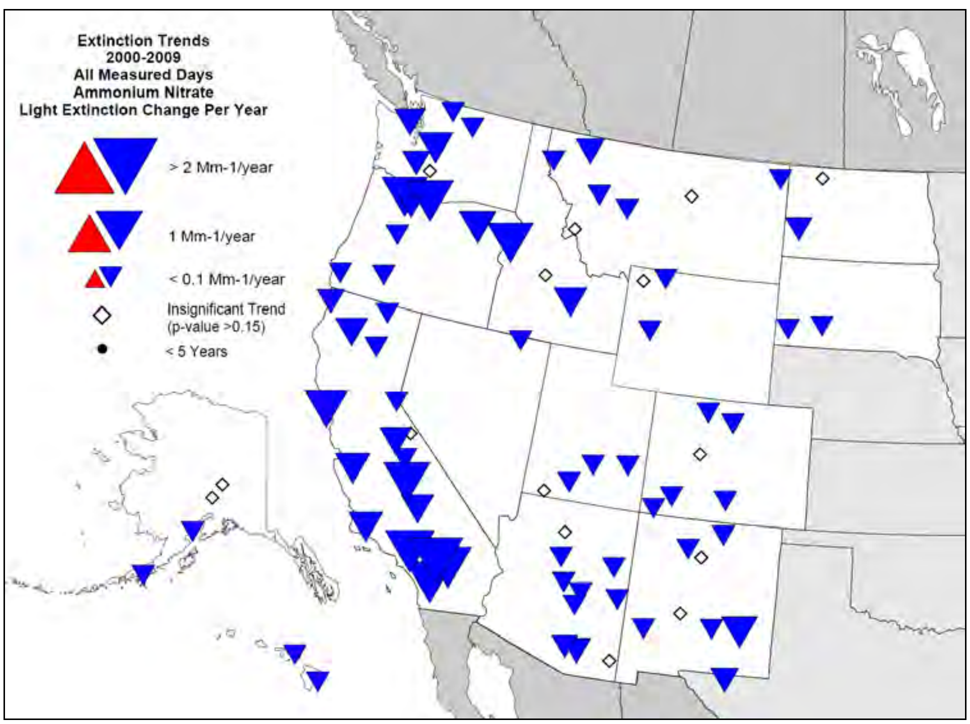

Figure 4.1-10. 10-Year Annual Average Ammonium Nitrate Extinction Trends for All Measured Days at CIA IMPROVE Sites in the WRAP Region.

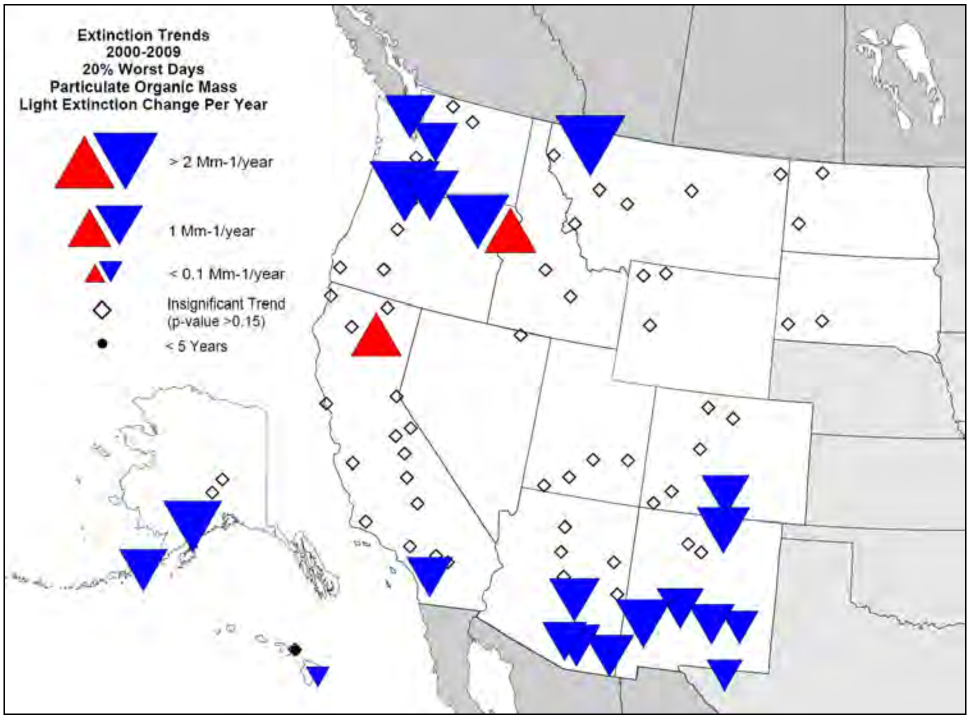

Figure 4.1-11. 10-Year Annual Average Particulate Organic Matter Extinction Trends for 20% Worst Days at CIA IMPROVE Sites in the WRAP Region.

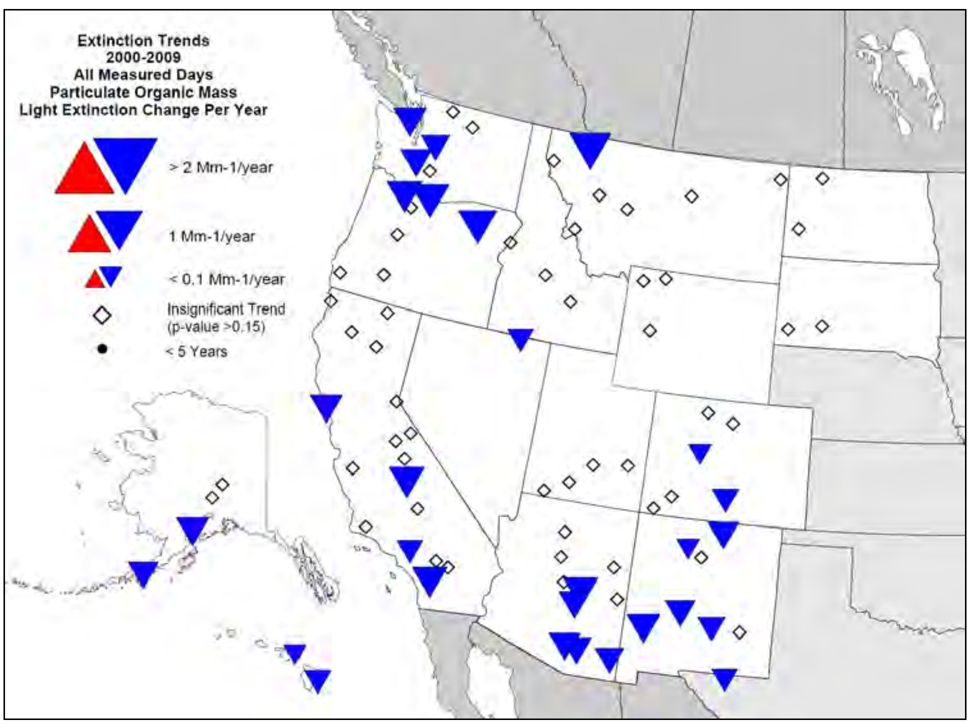

Figure 4.1-12. 10-Year Annual Average Particulate Organic Matter Extinction Trends for All Measured Days at CIA IMPROVE Sites in the WRAP Region.

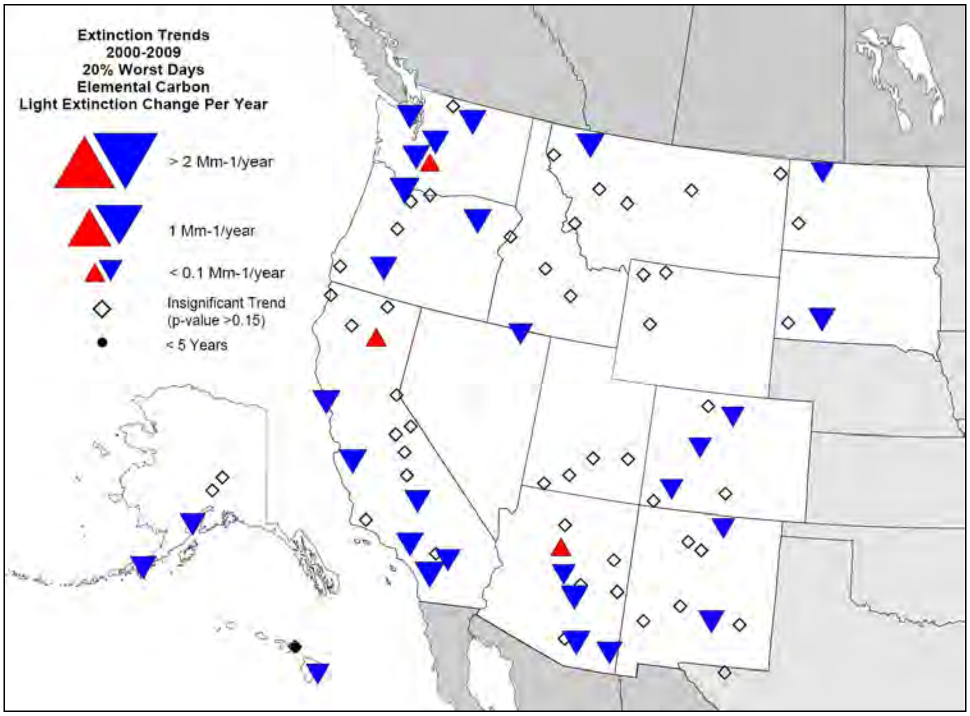

Figure 4.1-13. 10-Year Annual Average Light Absorbing Carbon Extinction Trends for 20% Worst Days at CIA IMPROVE Sites in the WRAP Region.

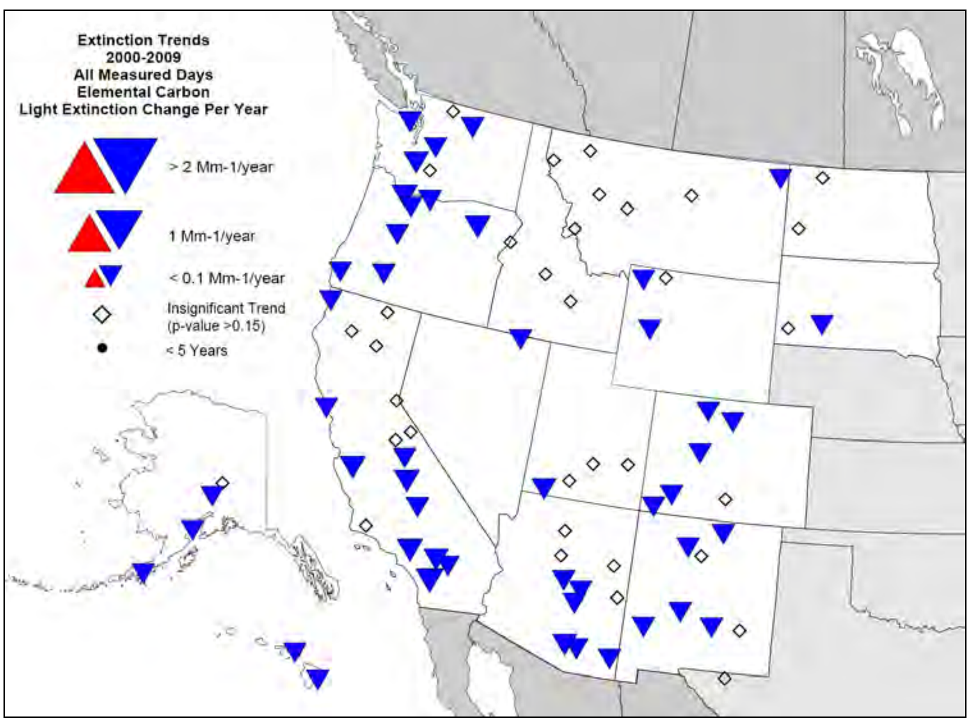

Figure 4.1-14. 10-Year Annual Average Light Absorbing Carbon Extinction Trends for All Measured Days at CIA IMPROVE Sites in the WRAP Region.

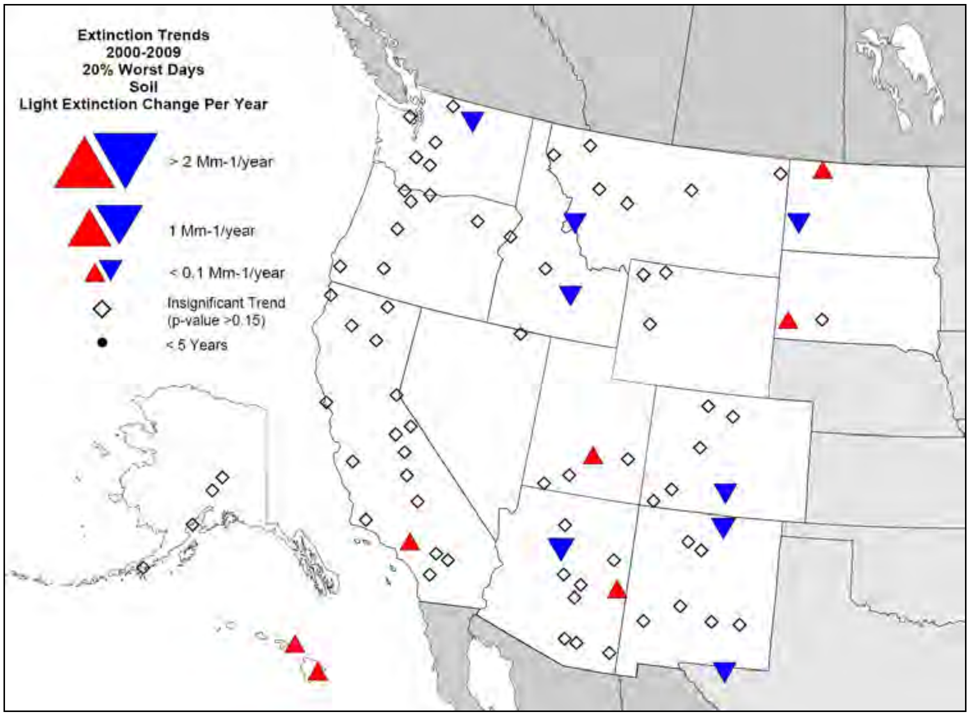

Figure 4.1-15. 10-Year Annual Average Soil Extinction Trends for 20% Worst Days at CIA IMPROVE Sites in the WRAP Region.

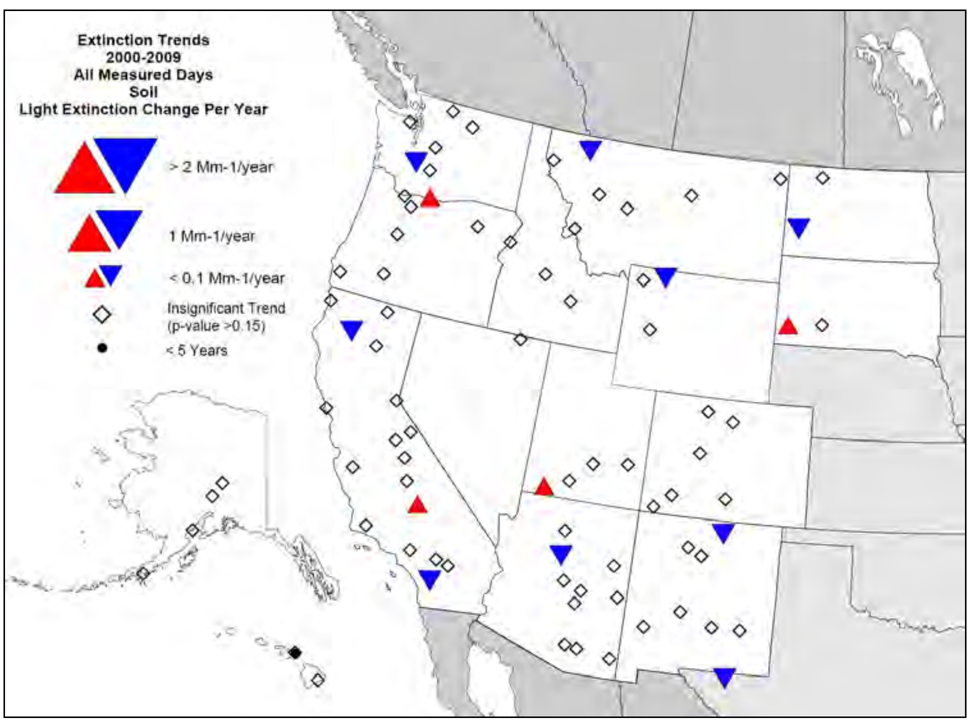

Figure 4.1-16. 10-Year Annual Average Soil Extinction Trends for All Measured Days at CIA IMPROVE Sites in the WRAP Region.

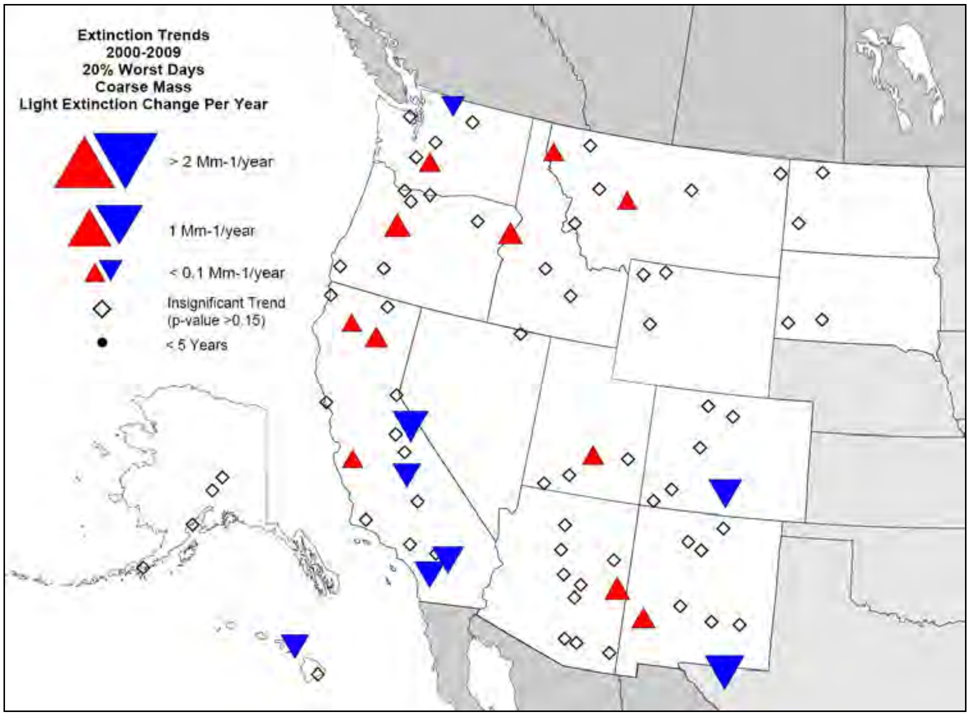

Figure 4.1-17. 10-Year Annual Average Coarse Mass Extinction Trends for 20% Worst Days at CIA IMPROVE Sites in the WRAP Region.

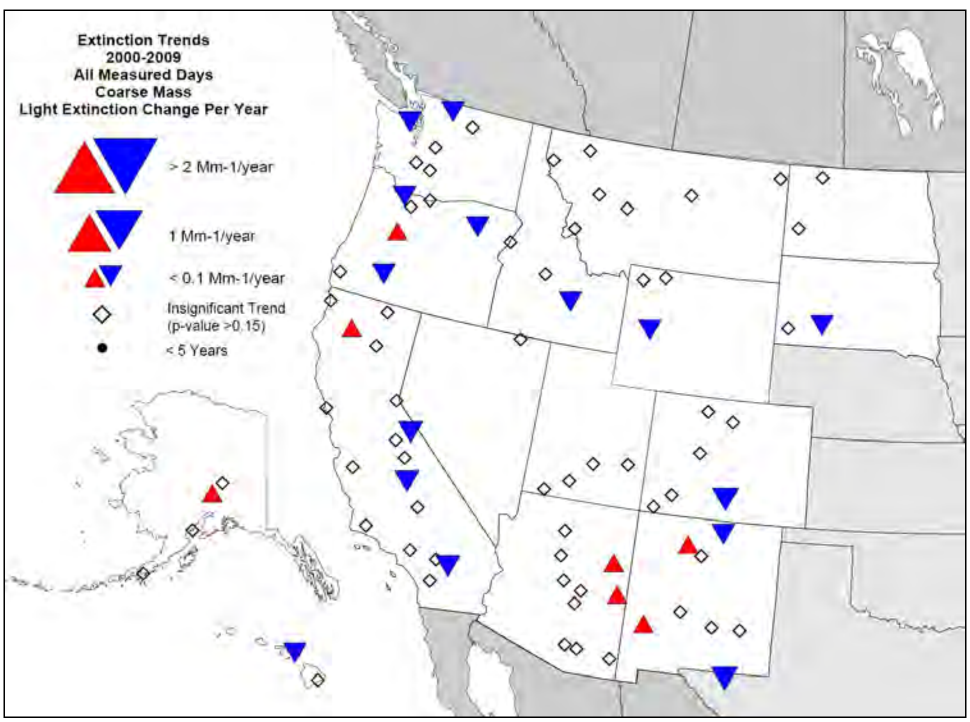

Figure 4.1-18. 10-Year Annual Average Coarse Mass Extinction Trends for All Measured Days at CIA IMPROVE Sites in the WRAP Region.

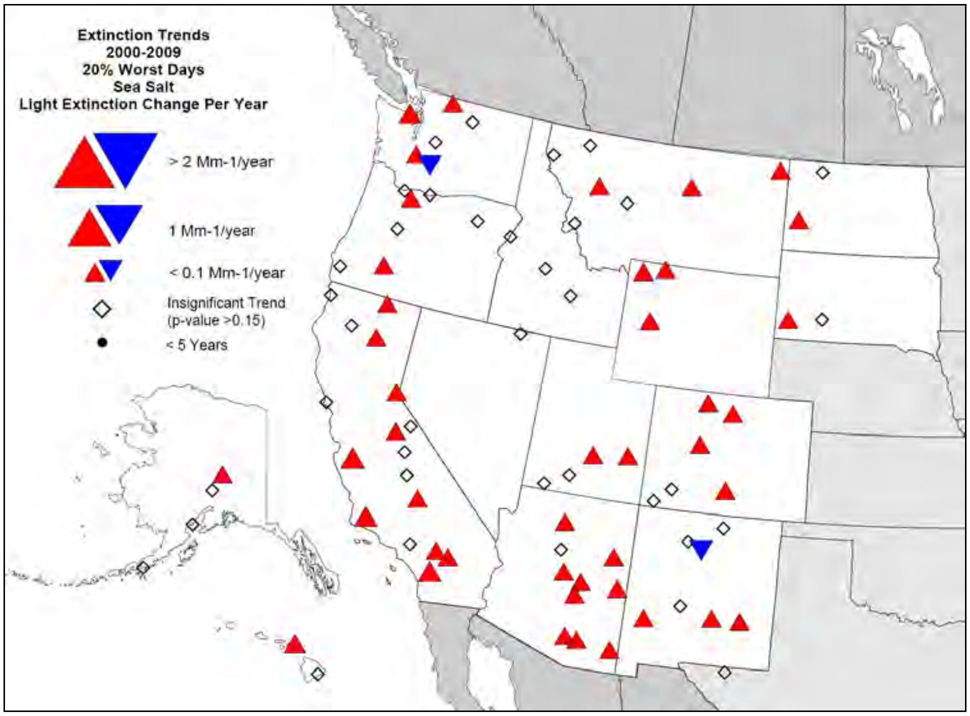

Figure 4.1-19. 10-Year Annual Average Sea Salt Extinction Trends for 20% Worst Days at CIA IMPROVE Sites in the WRAP Region.

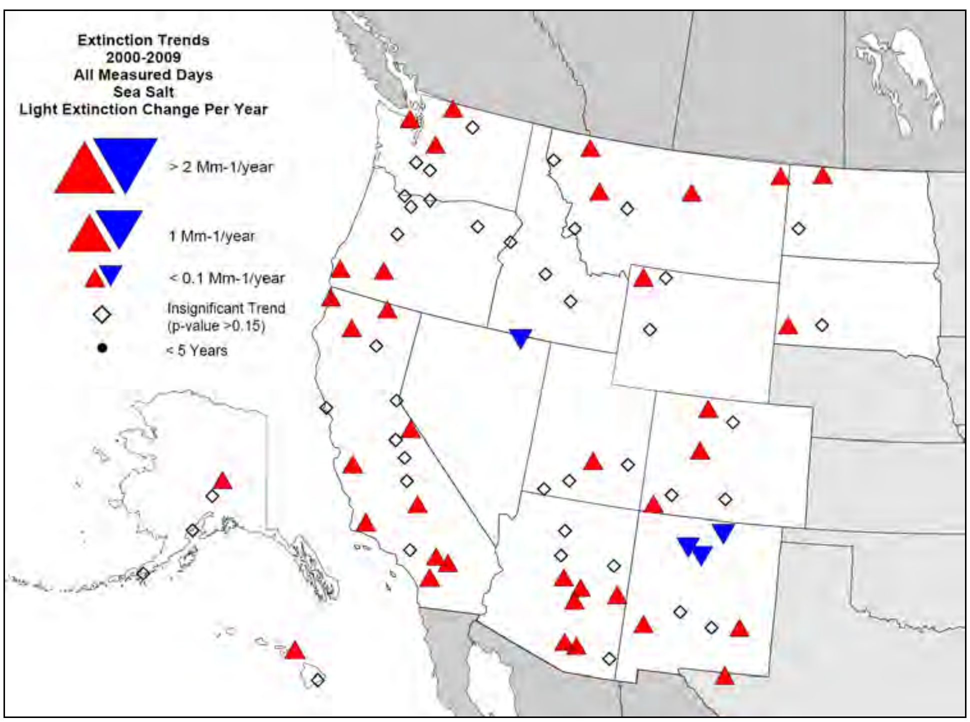

Figure 4.1-20. 10-Year Annual Average Sea Salt Extinction Trends for All Measured Days at CIA IMPROVE Sites in the WRAP Region.

4.1.2 Regional Events

The previous section presented aerosol trends, which are useful in analyzing changes in air quality data over long periods of time, but minimize the effects of large events that can affect the 5-year average metrics. Large regional episodic events can include windstorms which can transport dust from some of the desert regions in the WRAP, and even from intercontinental dust sources, as documented for several cases of Asian and African dust impacts on the United States. Other examples of large episodic regional events can include wildfires, which impact most of the western states, and volcanic emissions, which have large impacts in Hawaii. This section includes some examples showing the impact of large regional events on specific aerosol species as measured during the 2005-2009 progress period. Some effects of large events on the 5-year RHR haze indexes are discussed in for each WRAP state in Section 6.0.

Figure 4.1-21 presents an example of particulate organic mass measurements on August 4, 2007. High measurements spanned most of the state of Montana, and also some sites in Idaho, North Dakota, and Wyoming. Figure 4.1-22 presents a map from the WRAP Fire Emissions Tracking System (FETS) online tool,[54] showing fire detections between August 2 and 4, which indicates that there were a number of detections western Montana and Idaho. Largest fires in the area at the time included a fire in the Salish Mountains north of Hot Springs in Montana that began on July 31, and the Chippy Creek Fire which burned almost 100,000 acres in northwest Montana.

Figure 4.1-23 presents an example of particulate organic mass measurements on June 26, 2008, where high measurements spanned most of the state of California. Figure 4.1-24 presents a map from the WRAP FETS online tool showing fire detections on June 26, with numerous detections all along the Cascades, many of which were attributed to lightning strikes in the region.

Figures 4.1-25 and 4.1-26 present fine soil and coarse mass, respectively, as measured on May 15, 2005. For this event, high measurements spanned most of the west coast, which is consistent with what might be expected for international transport of dust from Asia. Further analysis of the chemical composition of the measured fine soil, including correlation with manganese (Mg) levels, would help elucidate whether this was an actual Asian Dust event. Figures 4.1-27 and 4.1-28 present fine soil and coarse mass as measured on June 29, 2008, representing a more typical dust event in the west, with high measurements spanning most of Arizona.

Figure 4.1-29 presents an abnormally high sea salt event that was measured on December 14, 2008 at several sites across the northern Great Plains, including sites in Montana, Wyoming, the Dakotas, and neighboring states as far south as Kansas. This event was discussed at the 2009 IMPROVE Steering Committee meeting, where it was noted that airmass characteristics and back-trajectories pointed to the Canadian arctic as the likely source of the material observed.[55]

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[54] The WRAP FETS is available online at http://www.wrapfets.org/.
[55] IMPROVE Steering committee meeting minutes are available at http://vista.cira.colostate.edu/improve/Activities/activities.htm.

Note that sea salt measurements are based on IMPROVE chloride measurements, which can also be associated with compounds not found in seawater. Figure 4.1-30 presents a more typical sea salt event, with higher measurements spanning the western coast.

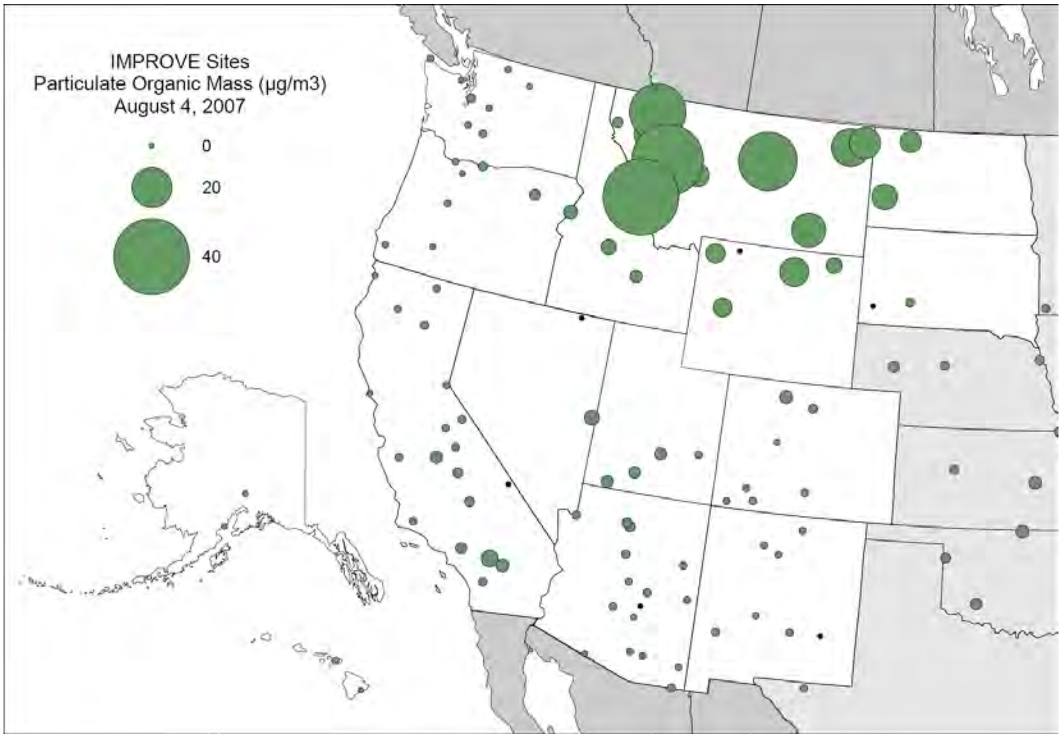

Figure 4.1-21. Particulate Organic Mass Event Measured on August 4, 2007, Affecting Most Montana IMPROVE Sites.

Figure 4.1-22. Map From the WRAP FETS Showing Fire Detections for the Period August 2 through August 4, 2007.

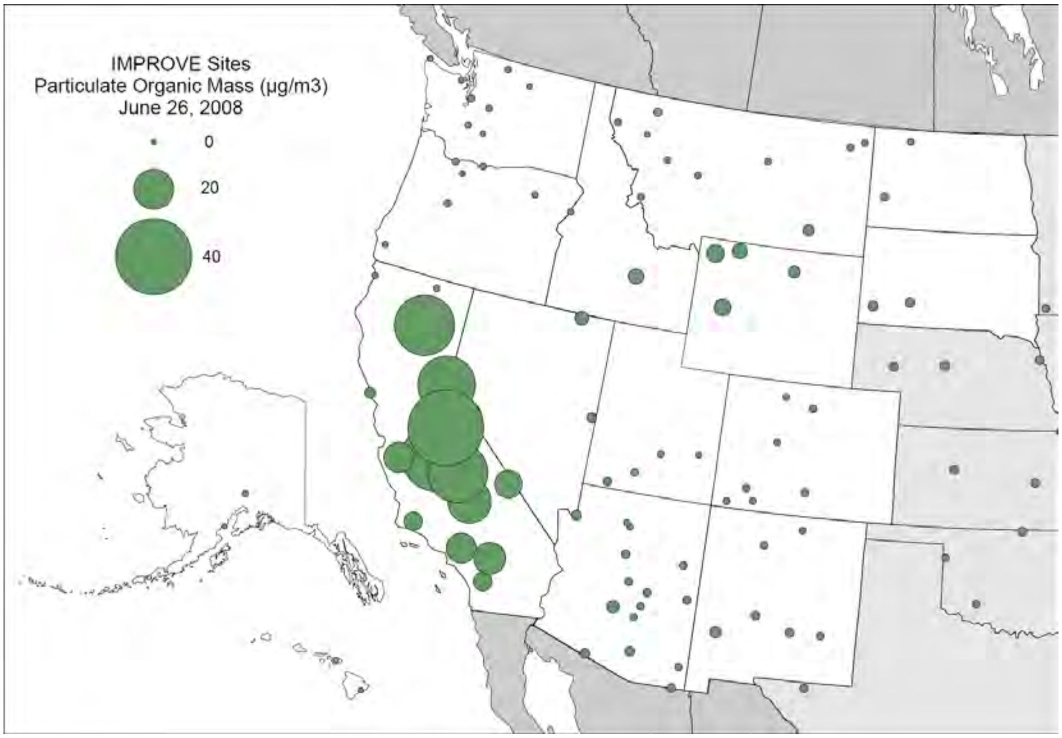

Figure 4.1-23. Particulate Organic Mass Event Measured on June 26, 2008, Affecting Most California IMPROVE Sites.

Figure 4.1-24. Map From the WRAP FETS Showing Fire Detections on June 26, 2007.

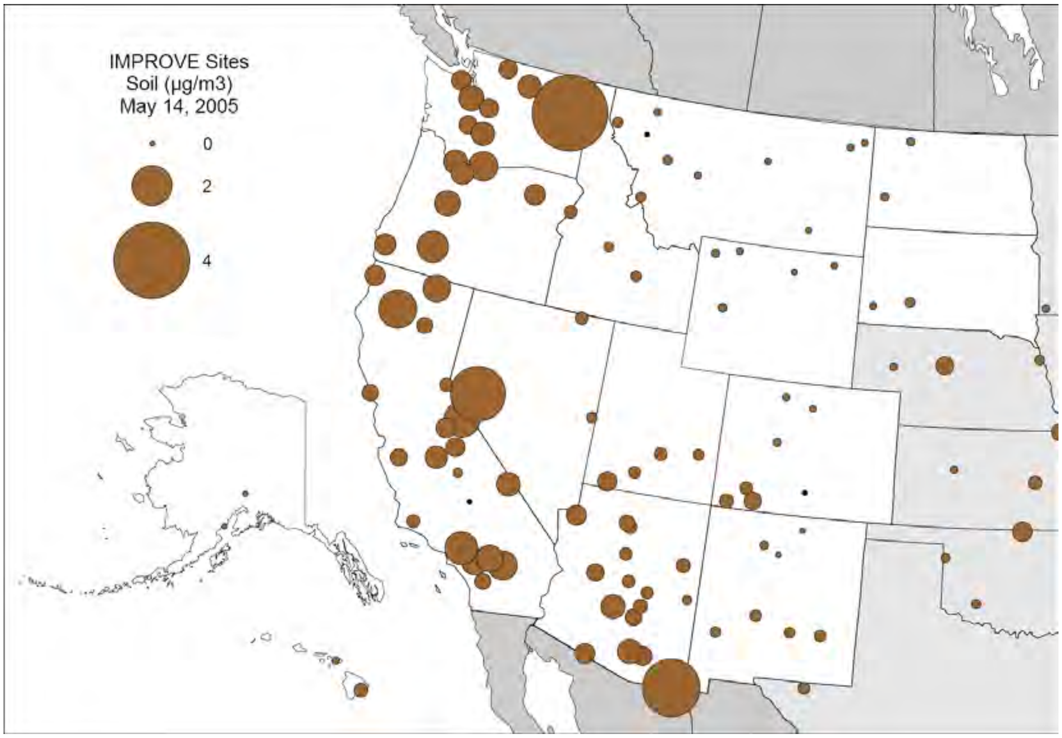

Figure 4.1-25. Soil Event Measured on March 14, 2005, Affecting Coastal IMPROVE Sites.

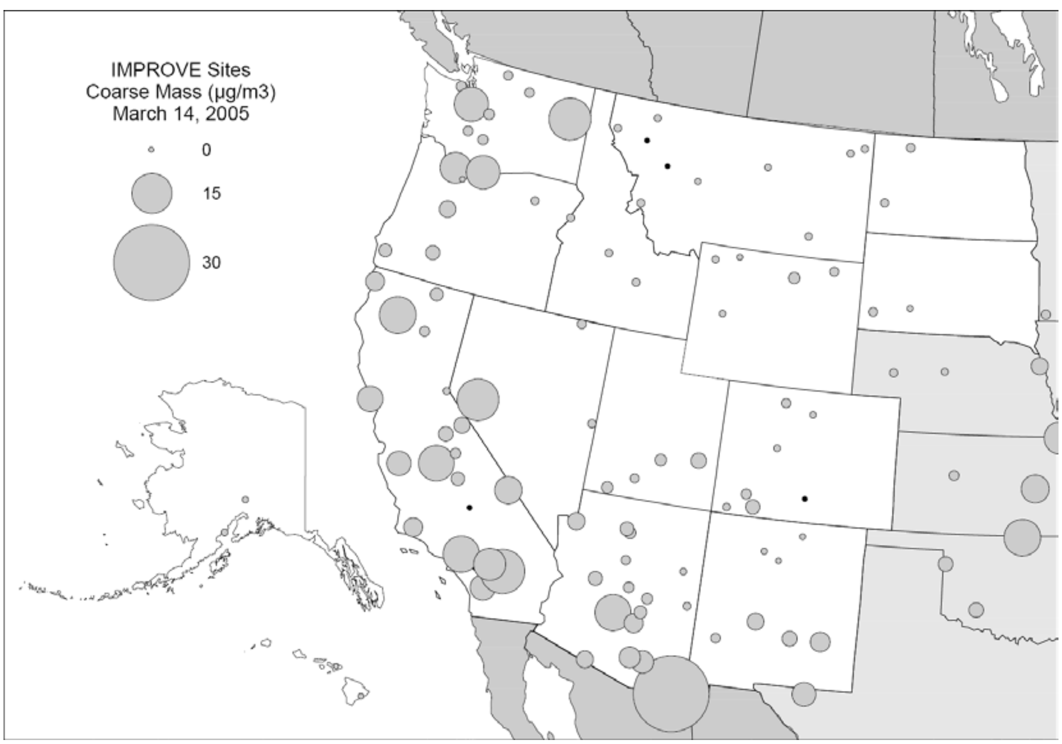

Figure 4.1-26. Coarse Mass Event Measured on March 14, 2005, Affecting Coastal IMPROVE Sites.

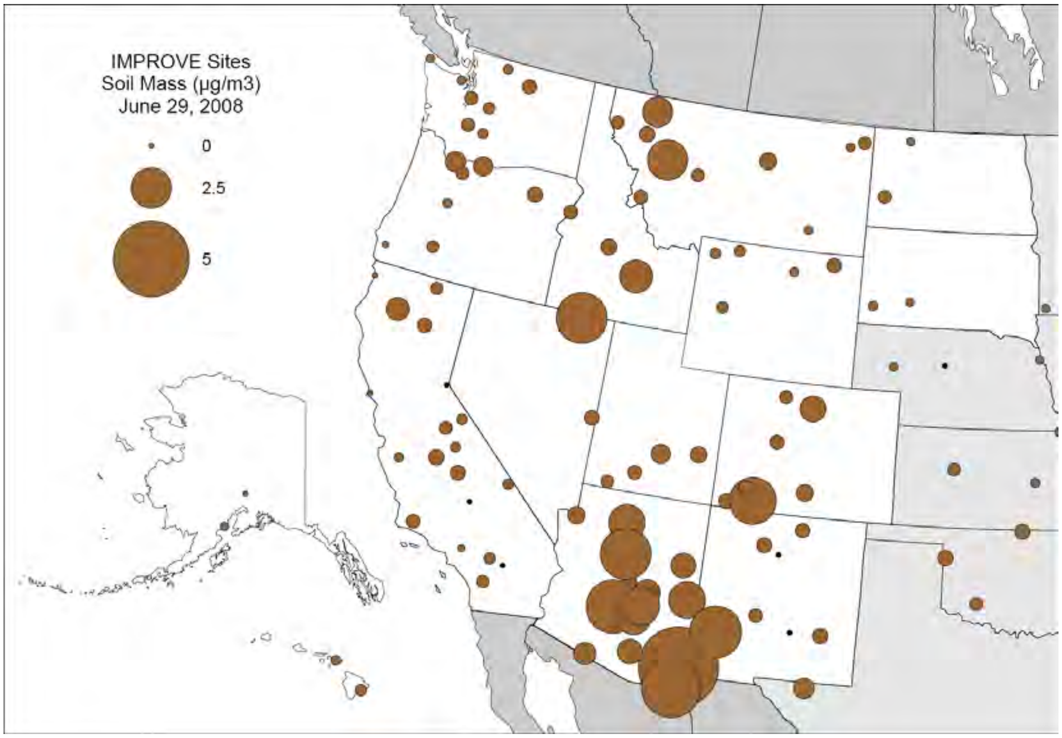

Figure 4.1-27. Soil Event Measured on June 29, 2008, Affecting Most Arizona IMPROVE Sites.

Figure 4.1-28. Coarse Mass Event Measured on June 29, 2008, Affecting Most Arizona IMPROVE Sites.

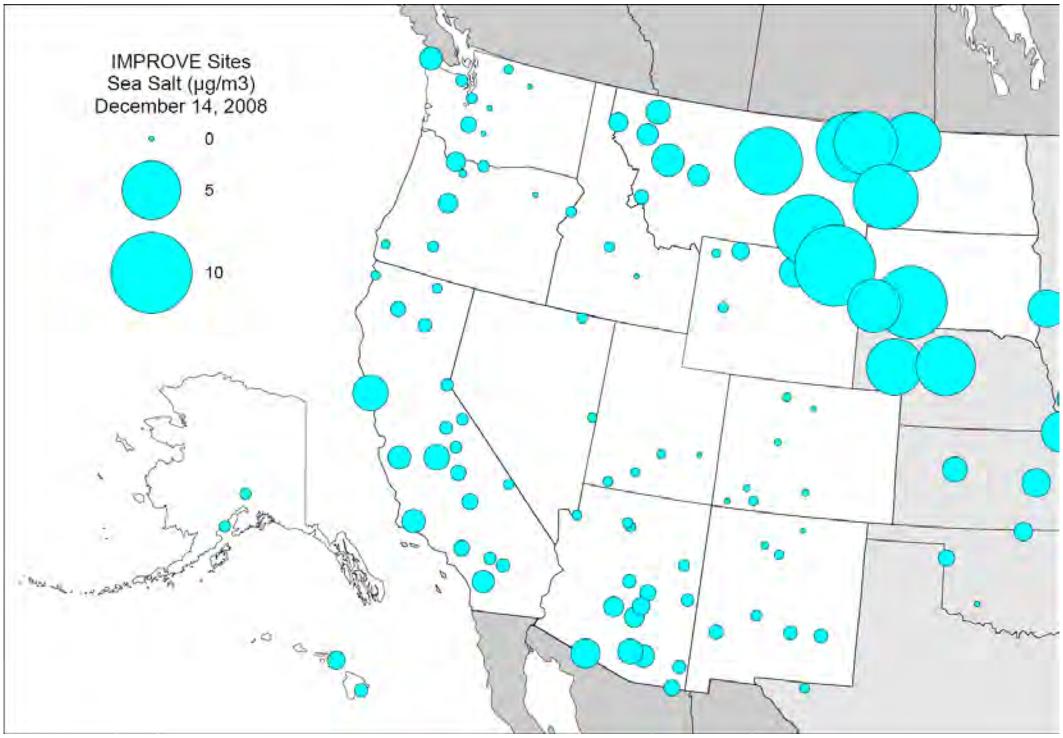

Figure 4.1-29 Sea Salt Event Measured on December 14, 2008, Affecting Inland IMPROVE Sites.

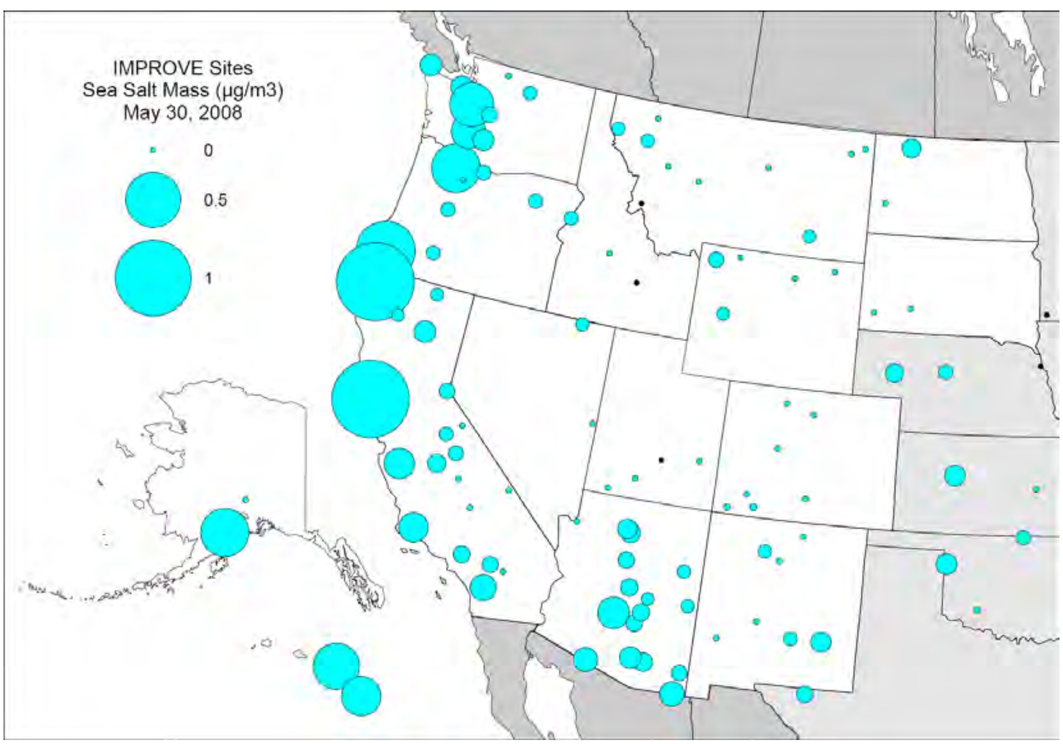

Figure 4.1-30. Sea Salt Event Measured on May 30, 2008, Affecting Coastal IMPROVE Sites.

4.2 EMISSIONS DATA

Included here are summaries depicting differences between an annual emission inventory representing the baseline period and an annual inventory representing the current progress period for the contiguous WRAP states.[56] For these summaries, emissions during the baseline years are represented using a 2002 inventory (termed plan02) which was developed with support from the WRAP for use in the original RHR SIP strategy development. Differences between inventories are represented as the difference between the 2002 inventory, and a 2008 inventory which leverages more recent inventory development work performed by the WRAP for the WestJumpAQMS and Deterministic and Empirical Assessment of Smoke's Contribution to Ozone (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.

Growth in population has implications for the planning needs of states. Population does not directly translate into increased emissions, but population growth can affect energy use, vehicle miles traveled (VMT), and other factors that affect the emissions of visibility related species. Figure 4.2-1 presents a map comparing 2002 and 2010 census populations by county for the WRAP states.[57] Population differences are not directly related to regulatory requirements, but are provided here as reference for state planning purposes. Note that the largest population increases were observed in southern California and southern Arizona, and the largest decreases were reported for Montana, North Dakota and South Dakota.

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[56] Emissions inventories used to represent Alaska and Hawaii were developed differently, so discussions for these states are not included here but are included in state specific summaries in Section 6.0.

[57] The US census is conducted every 10-years. Population data for the years 2000 and 2010 were obtained from http://www.census.gov/main/www/access.html.

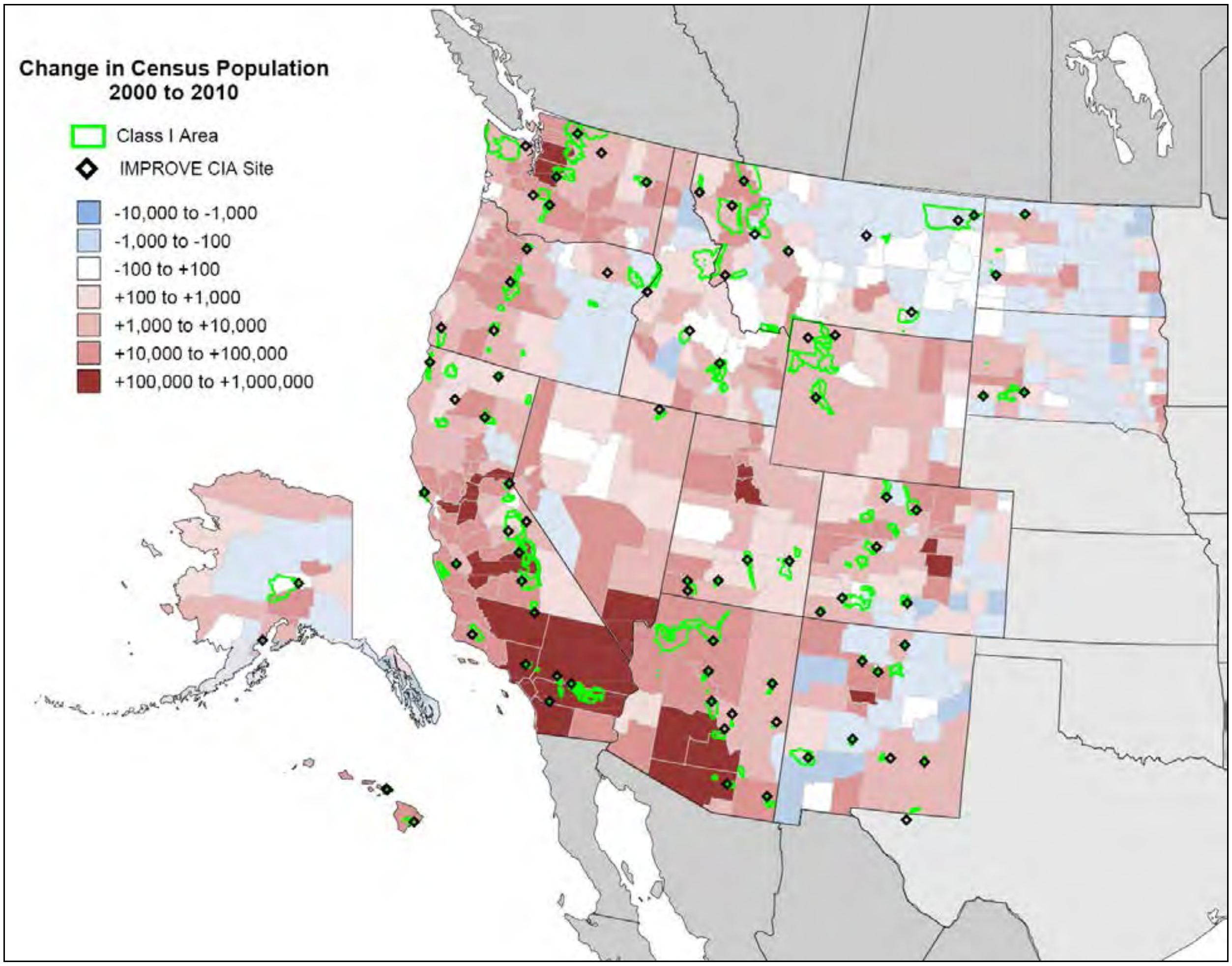

Figure 4.2-1. Difference Between 2000 and 2010 Census Population for the WRAP Region.

For regulatory purposes, State-wide inventories totals and differences for all major visibility impairing pollutants from both natural and anthropogenic source categories are presented here, and inventory totals from a county level basis are available on the WRAP Technical Support System website (http://vista.cira.colostate.edu/tss/).[58] Figure 4.2-2 presents both the 2002 and 2008 sulfur dioxide (SO_2) emission totals by source category for the contiguous and Figure 4.2-3 presents the differences for SO_2 for each category by state. Figures 4.2-4 and 4.2-5 present similar charts for oxides of nitrogen (NO_X), and subsequent figures (Figures 4.2-6 through 4.2-17) present ammonia, volatile organic compounds (VOCs), primary organic aerosol (POA), elemental carbon (EC), fine soil, and coarse particulate matter. These emissions inventory totals, including differences between inventories, are discussed for each State individually in Section 6.0. Some general regional observations are listed below.

- Inventories show that SO_2 emissions are largely due to point sources. These emissions saw decreases in most source categories for most states, with the largest decreases reported for point sources. Reductions are likely due to the implementation

[58] The WRAP TSS is described in Section 3.3.

of control strategies such as SO_2 scrubbers installed at point sources and required use of low sulfur diesel fuel.

- Inventories show that NO_X emissions are mainly due to on-road mobile, off-road mobile, and point sources. Inventories showed decreases in these categories for most states. Reductions may be to implementation of stricter emissions limits for NO_X related to combustion sources such as utility boilers and automobile engines.
- Inventories show that concentrations of VOCs are mainly due to biogenic emissions. Inventory totals comparing 2002 and 2008 emissions show large decreases in 2008, but this is likely due to enhancements in biogenic inventory methodology, as referenced in Section 3.2.1, rather than decreases of this magnitude in actual emissions.
- Inventories show that VOC, POA and EC emissions include large contributions from fire sources. Comparisons between fire inventories is not definitive as the current year inventory represent only the year 2008, as opposed to the entire 2005-2009 progress period represented in monitored data. In 2008, large fire events occurred in California, so fire emissions inventory totals increased in California, but decreased for other WRAP states.
- For fine soil and coarse mass, emissions inventories indicate that windblown and fugitive dust are the largest contributors to these haze species, with some contribution to fine soil from area and fire sources. Changes in fugitive dust and area source inventories were variable between states, and may be related to changes in population. Estimates for windblown dust inventory totals for most states in 2008 were lower than the baseline inventories, but significant methodology changes occurred with the development of the new WRAP windblown dust model, as referenced in Section 3.2.1, so differences reported here are not necessarily indicative of changes in actual source emissions between 2002 and 2008.

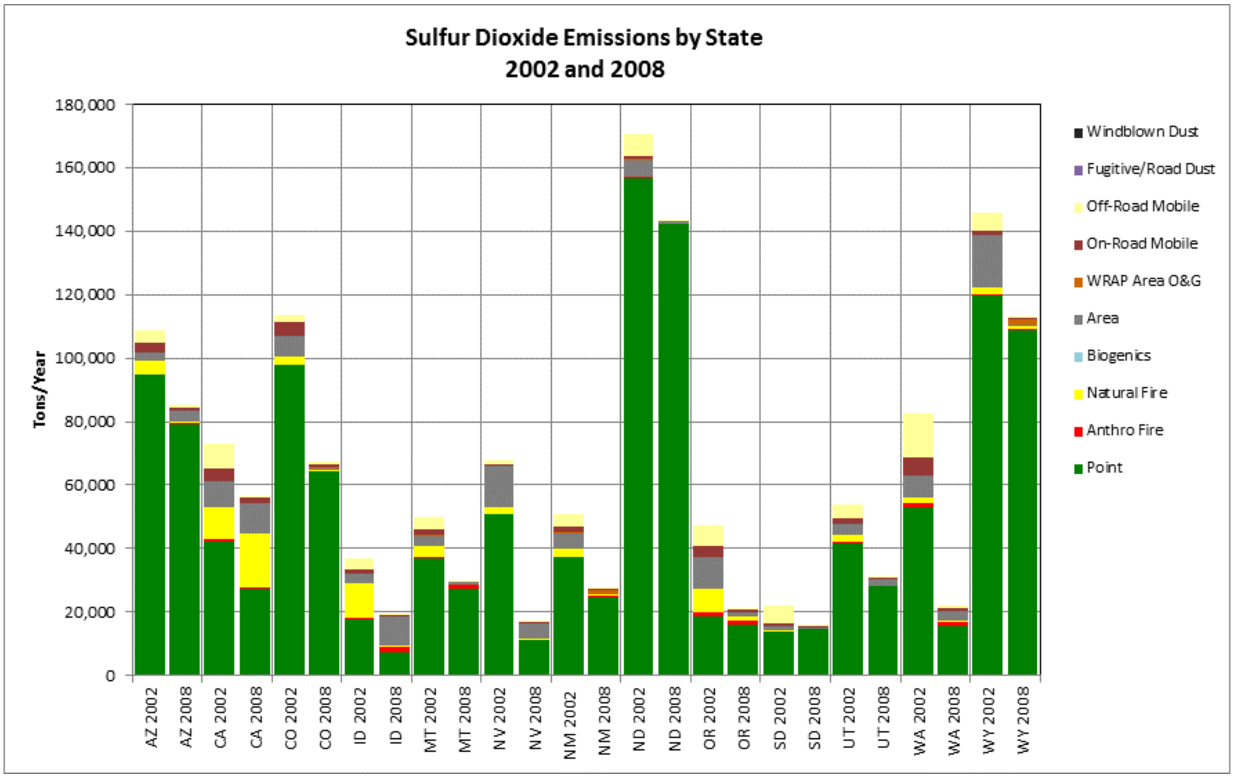

Figure 4.2-2. Comparison for 2002 and 2008 Sulfur Dioxide Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

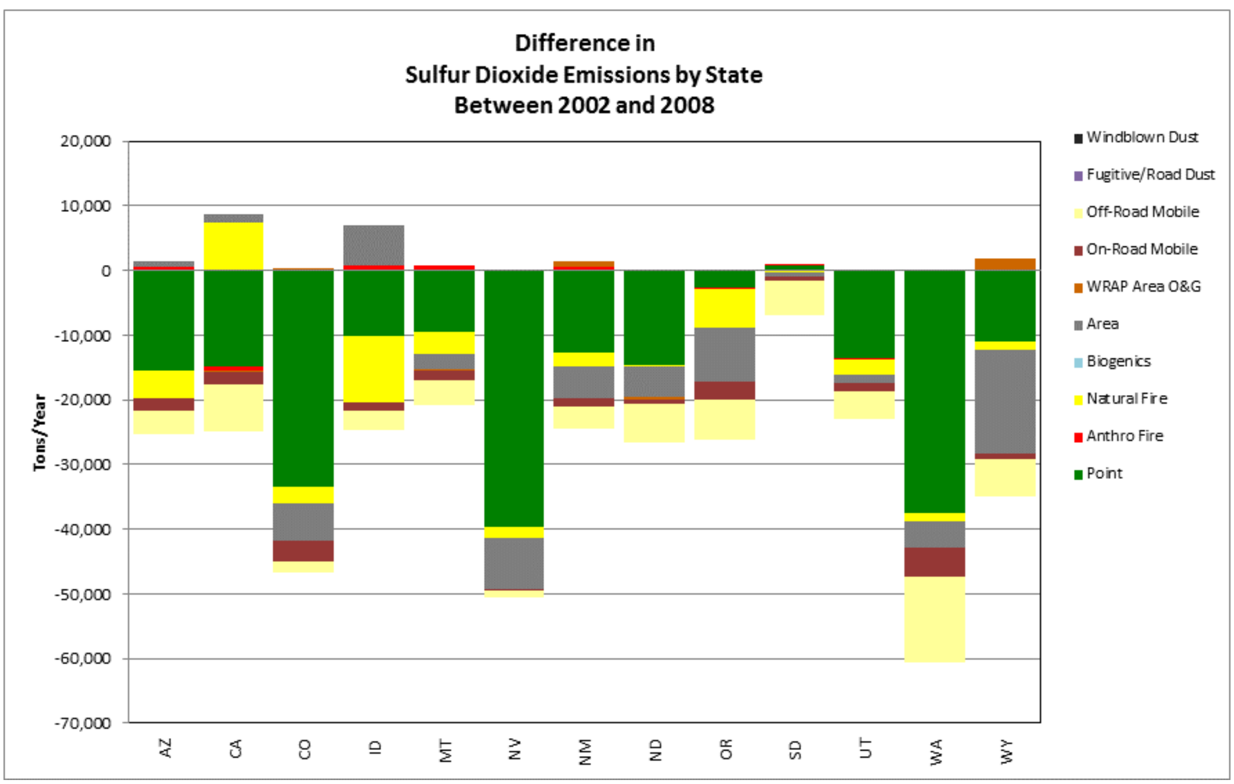

Figure 4.2-3. Differences between 2008 and 2002 Sulfur Dioxide Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

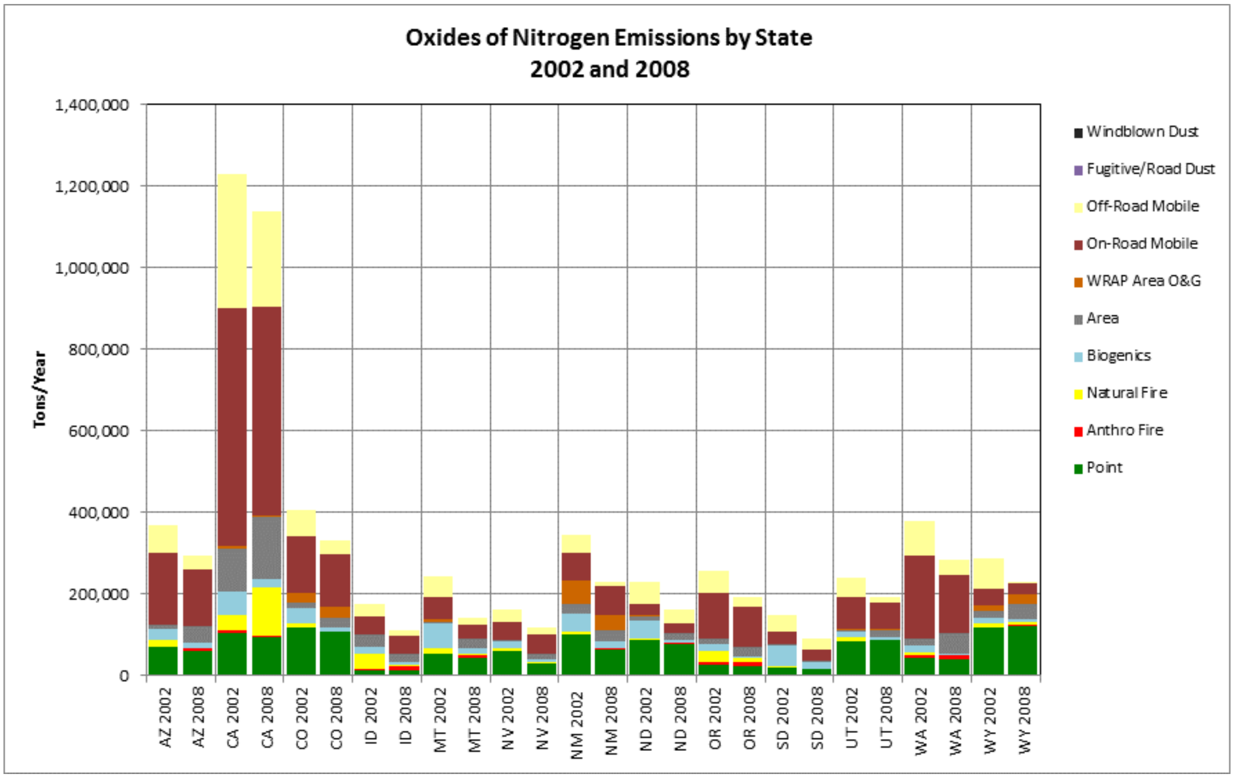

Figure 4.2-4. Comparison for 2002 and 2008 Oxides of Nitrogen Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

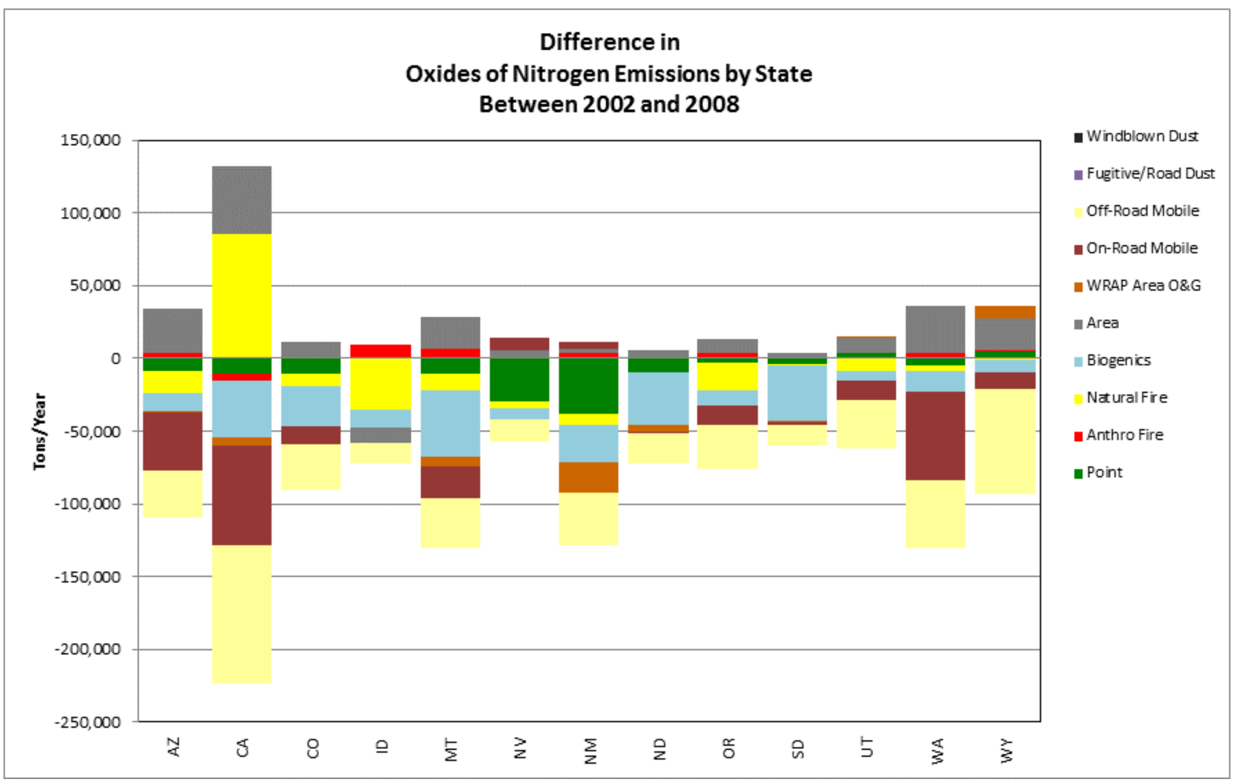

Figure 4.2-5. Differences between 2008 and 2002 Oxides of Nitrogen Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

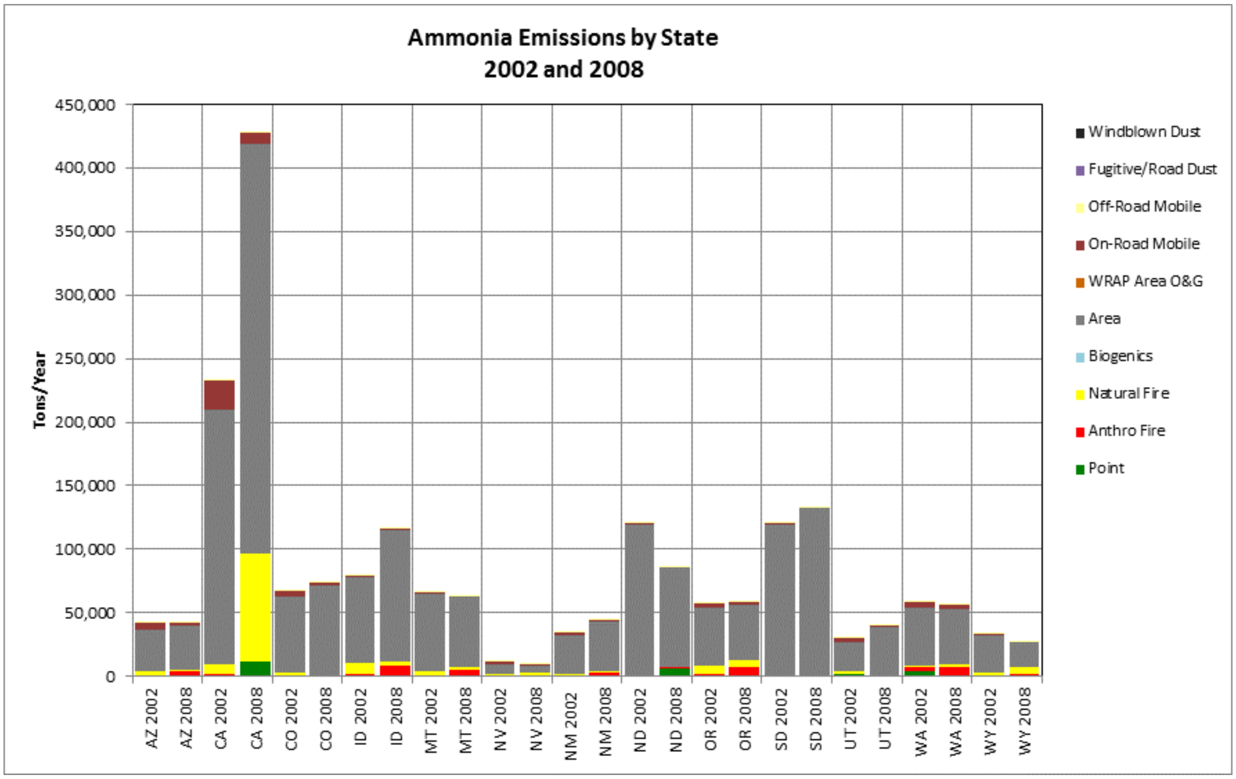

Figure 4.2-6. Comparison for 2002 and 2008 Ammonia Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

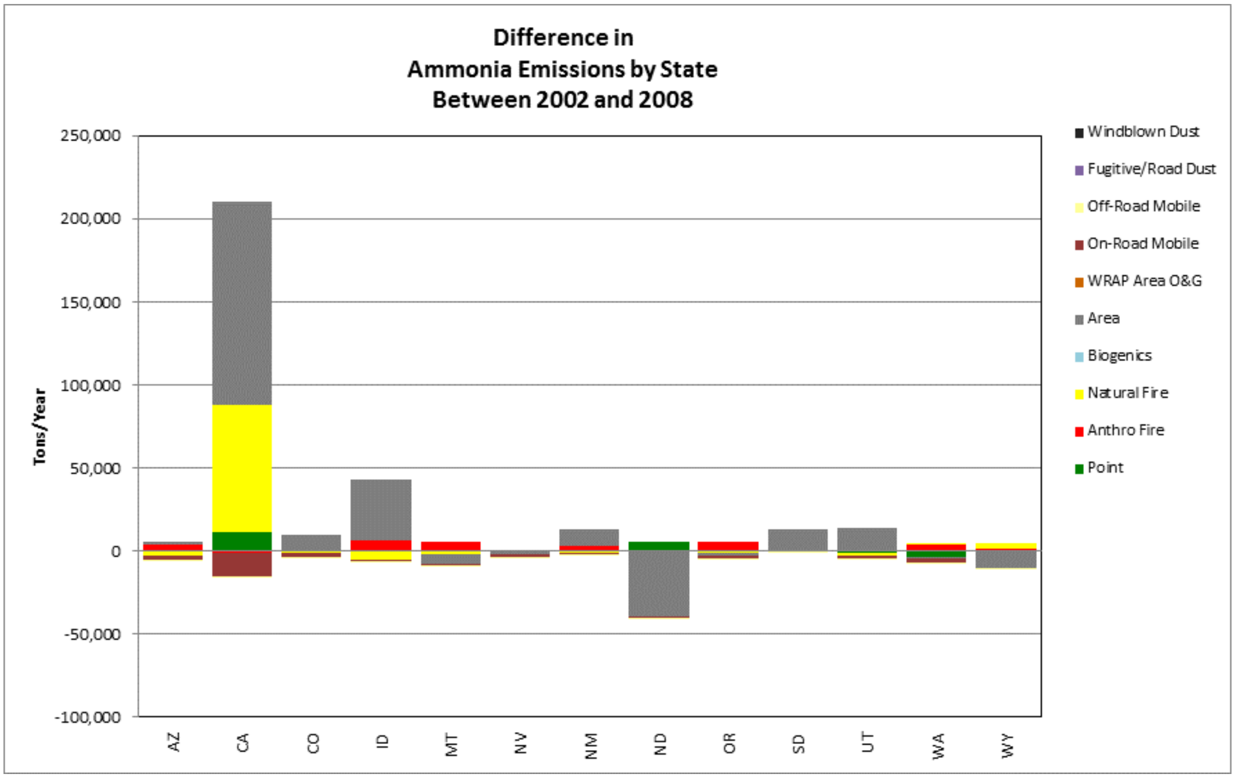

Figure 4.2-7. Differences between 2008 and 2002 Ammonia Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

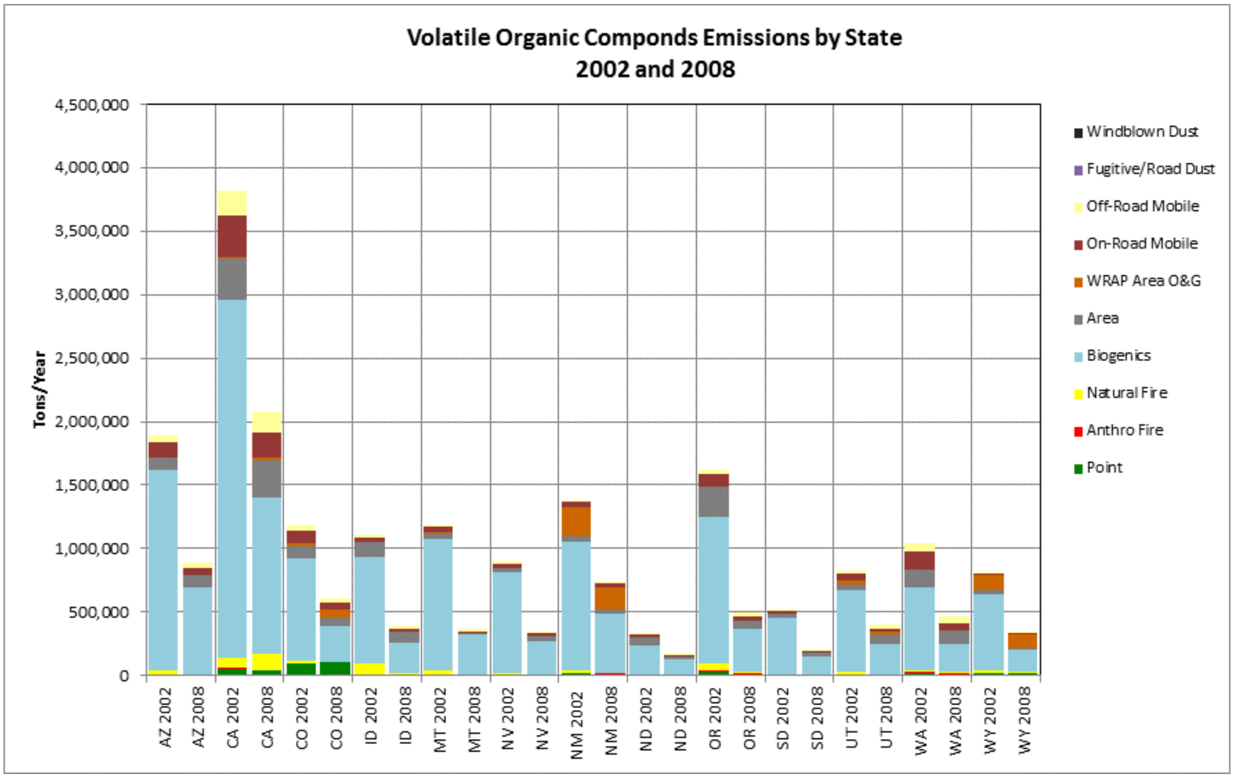

Figure 4.2-8. Comparison for 2002 and 2008 Volatile Organic Compound Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

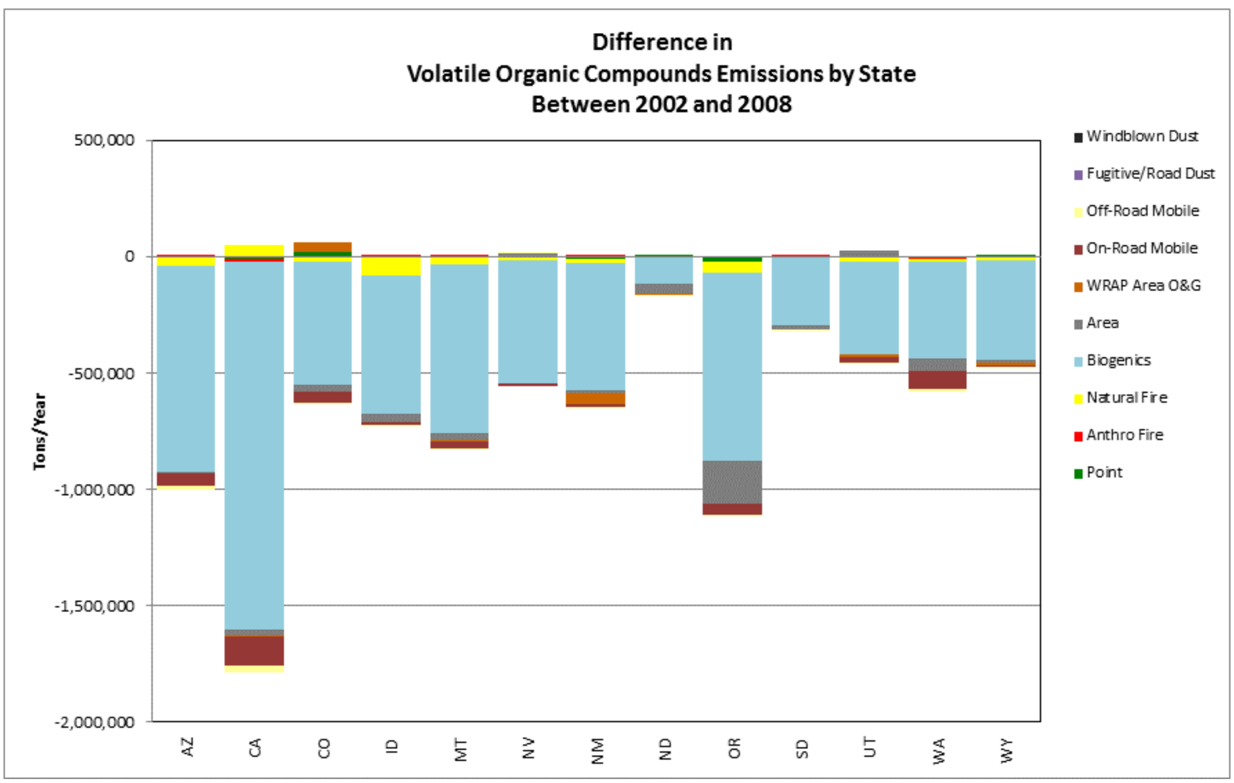

Figure 4.2-9. Differences between 2008 and 2002 Volatile Organic Compound Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

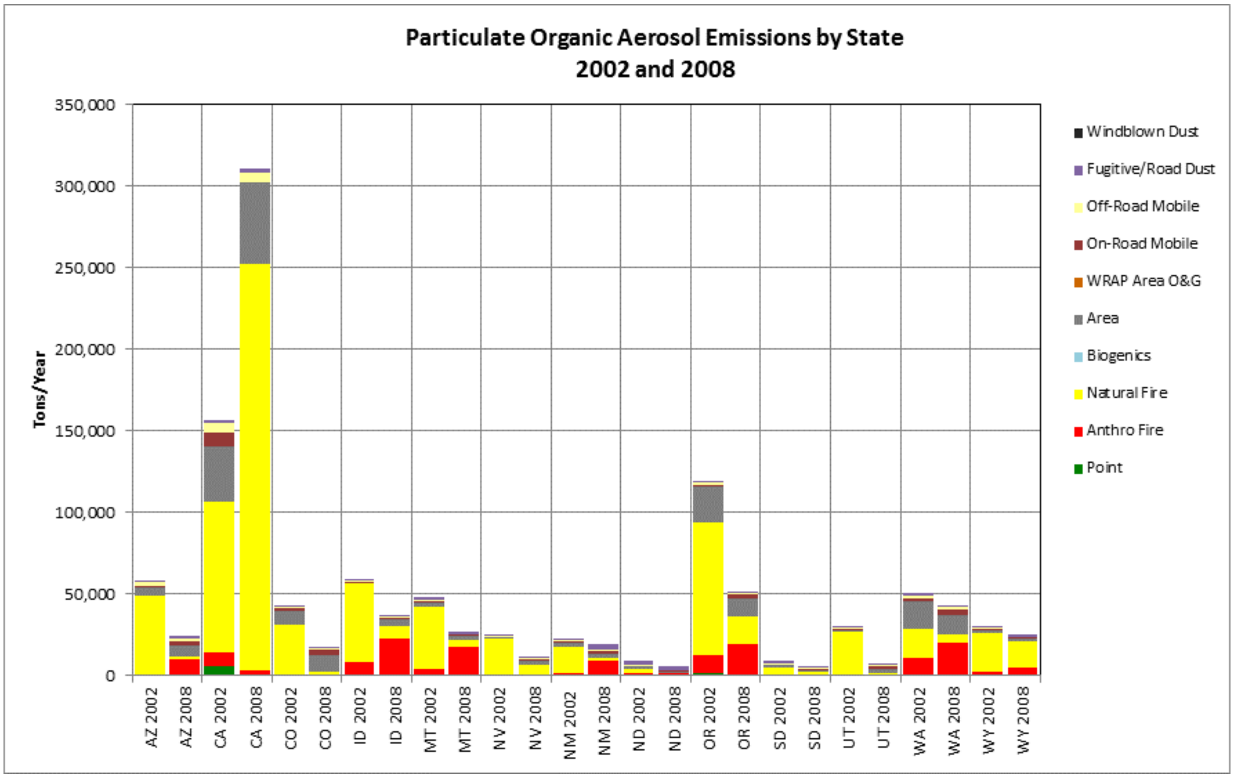

Figure 4.2-10. Comparison for 2002 and 2008 Particulate Organic Aerosol Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

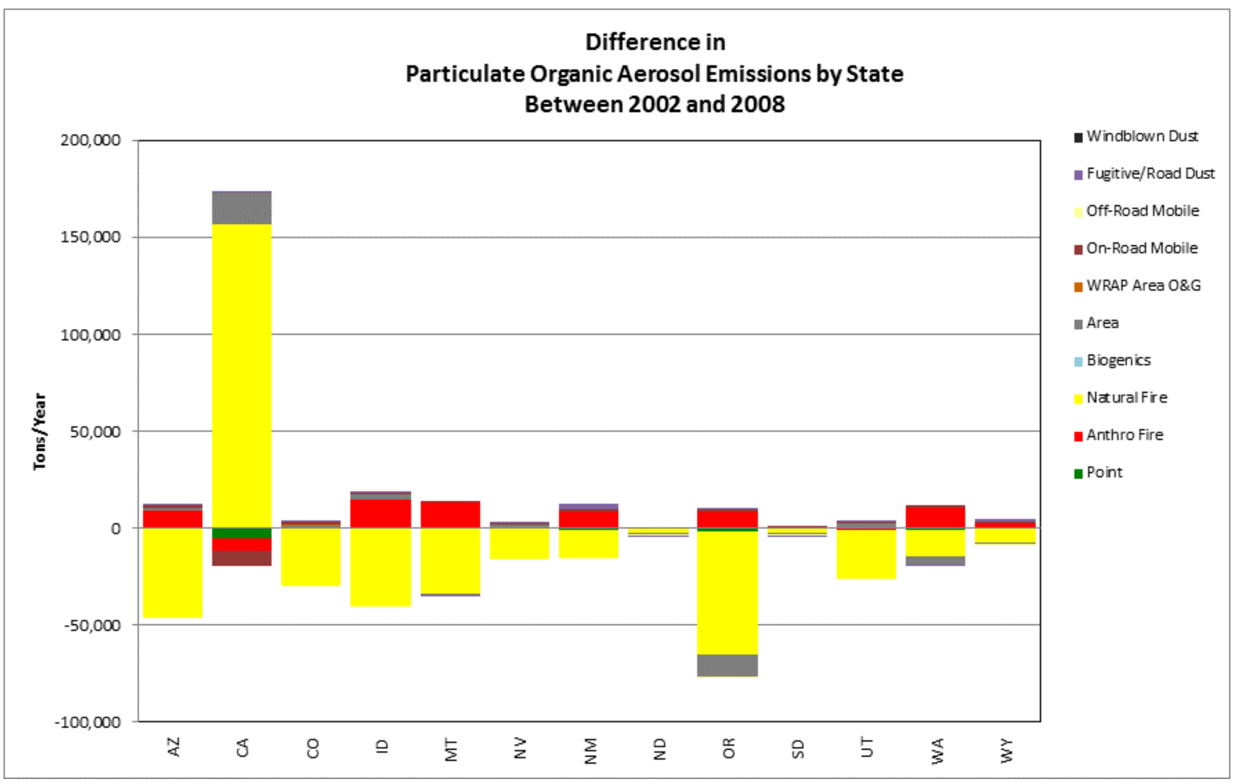

Figure 4.2-11. Differences between 2008 and 2002 Particulate Organic Aerosol Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

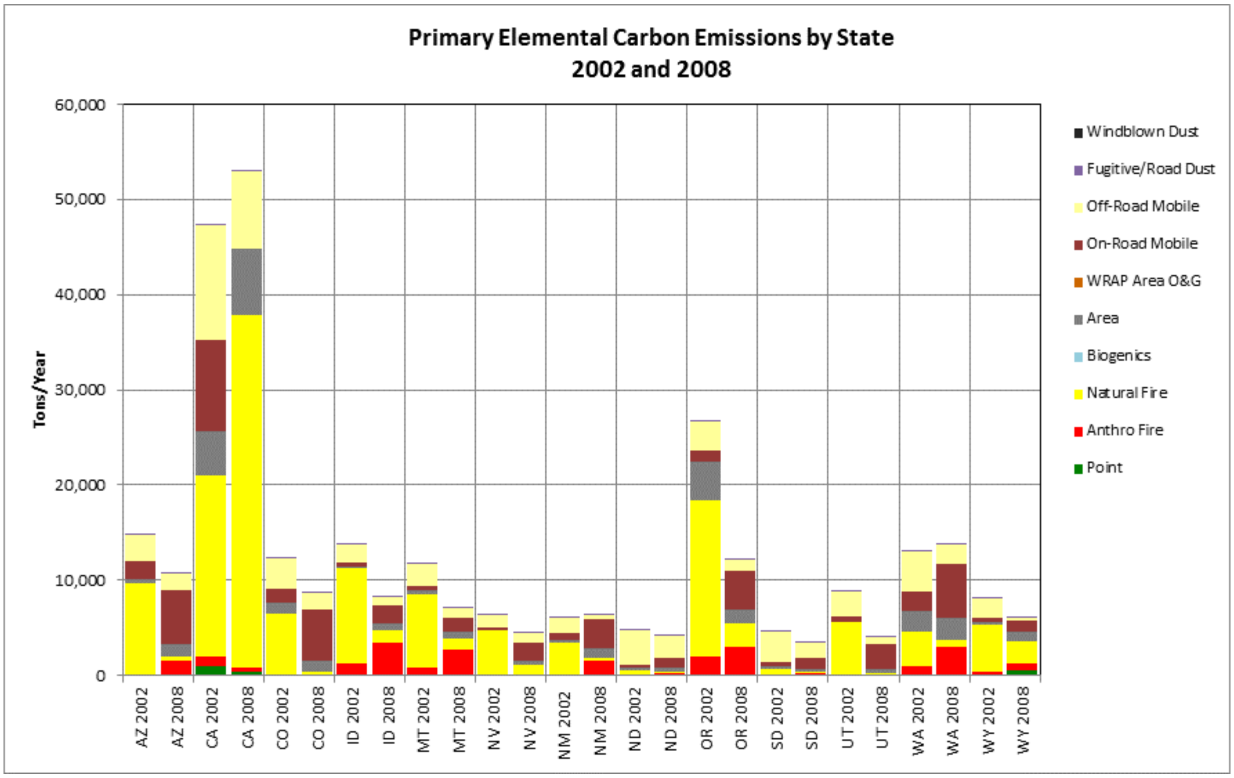

Figure 4.2-12. Comparison for 2002 and 2008 Elemental Carbon Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

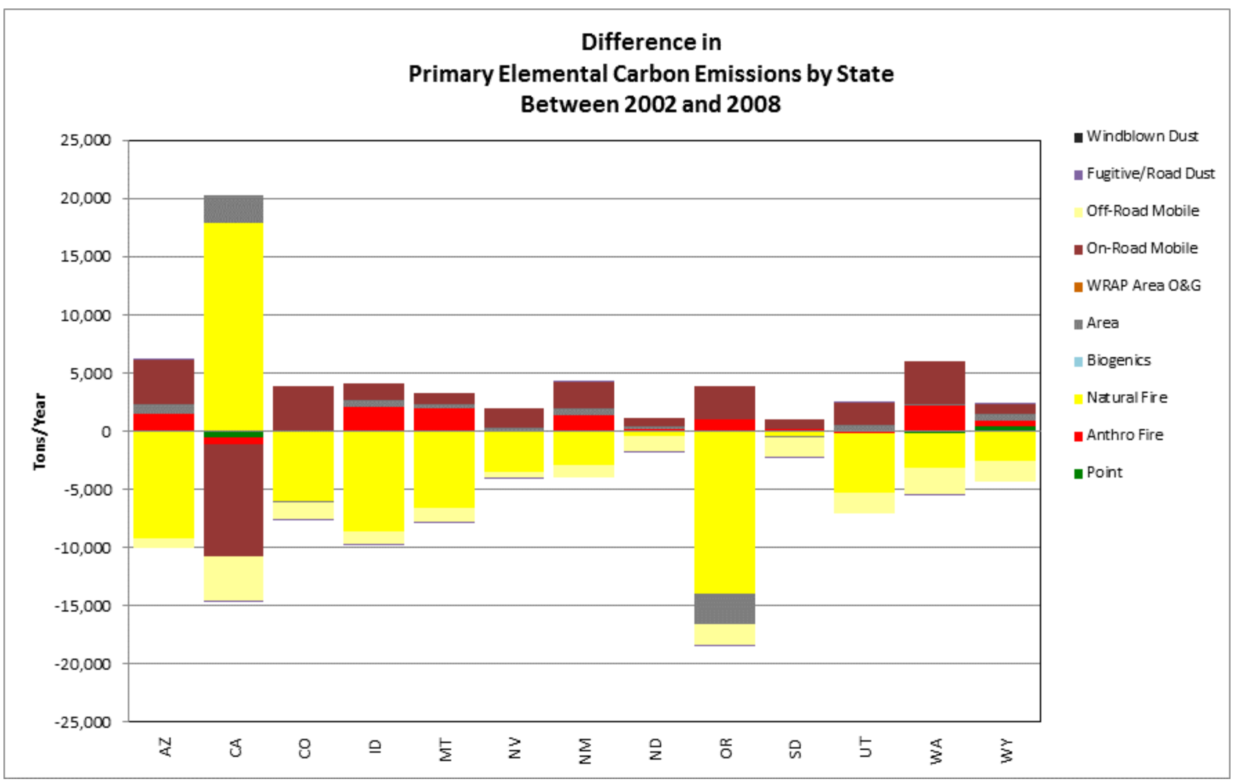

Figure 4.2-13. Differences between 2008 and 2002 Elemental Carbon Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

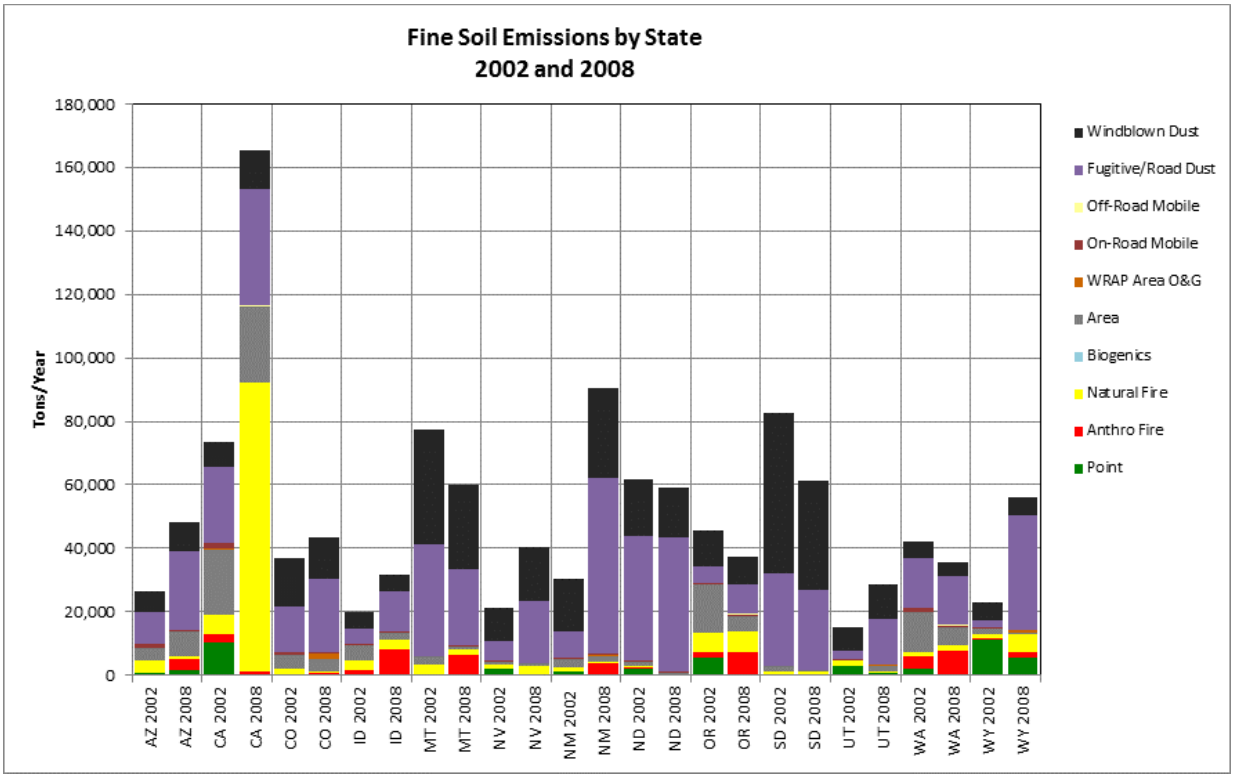

Figure 4.2-14. Comparison for 2002 and 2008 Fine Soil Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

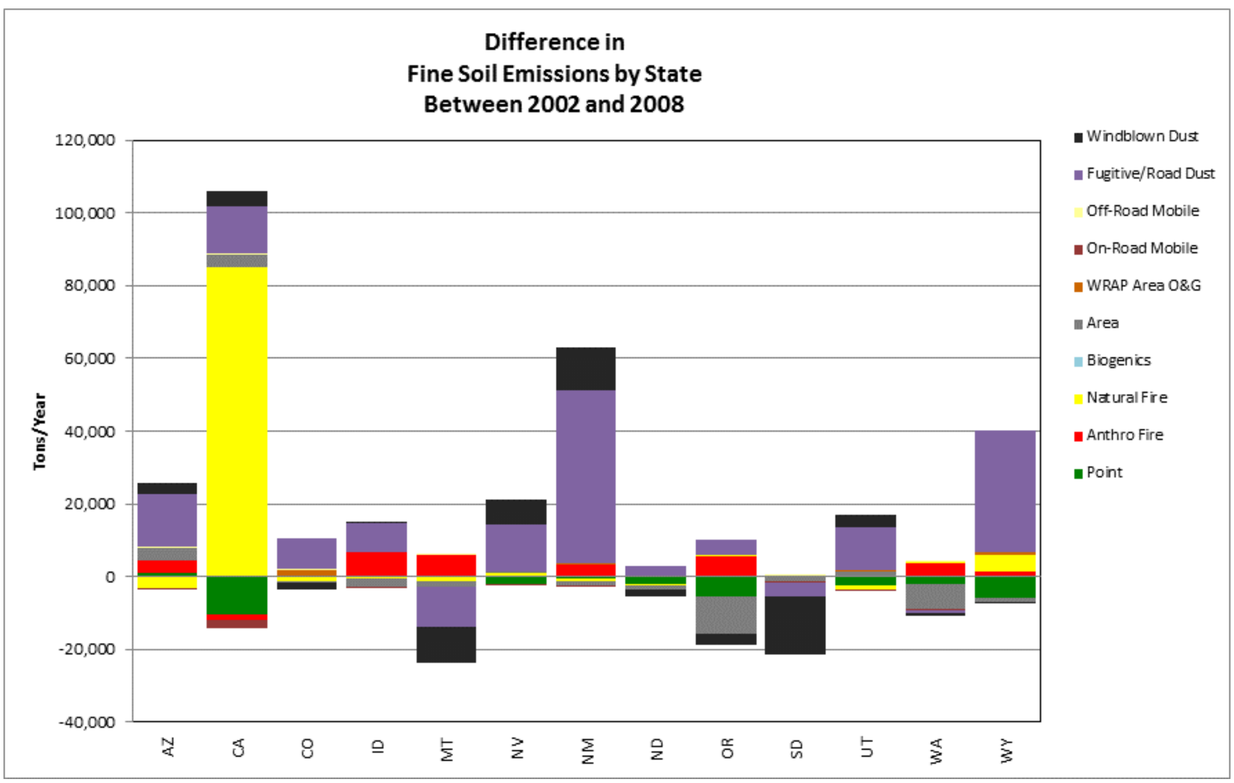

Figure 4.2-15. Differences between 2008 and 2002 Fine Soil Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

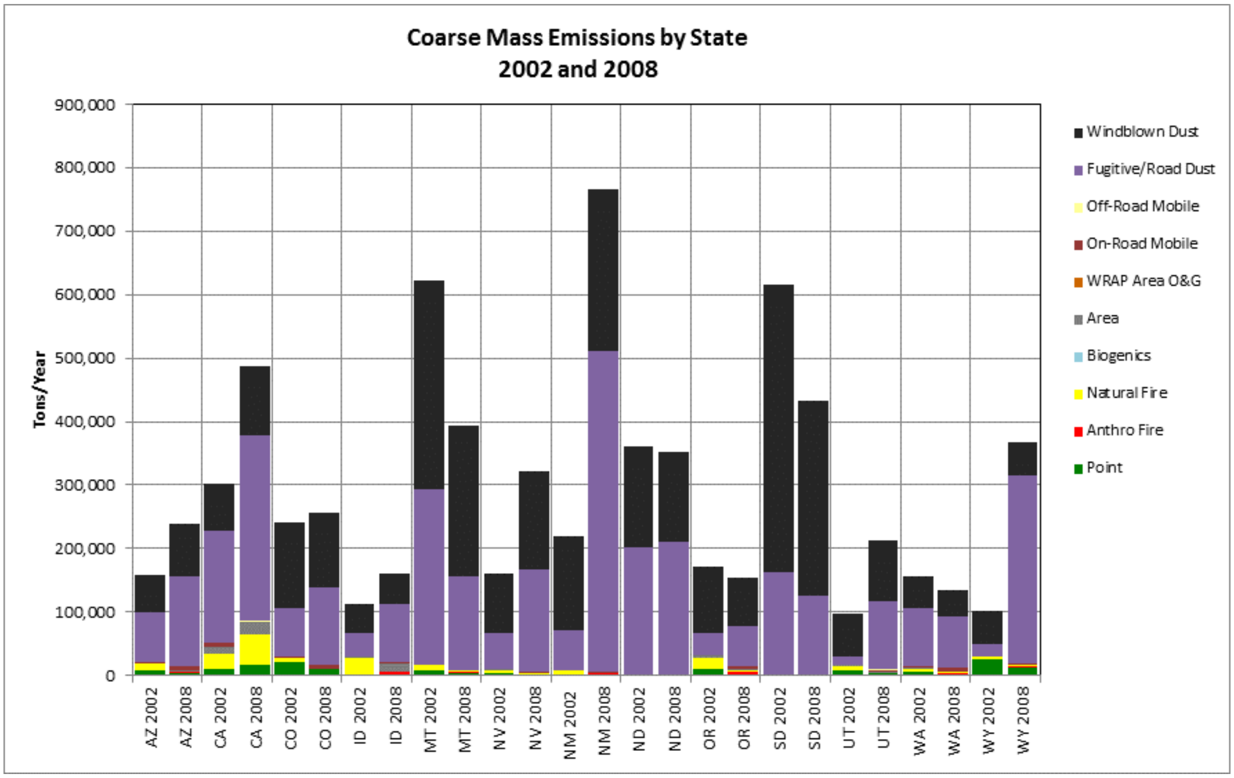

Figure 4.2-16. Comparison for 2002 and 2008 Coarse Mass Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

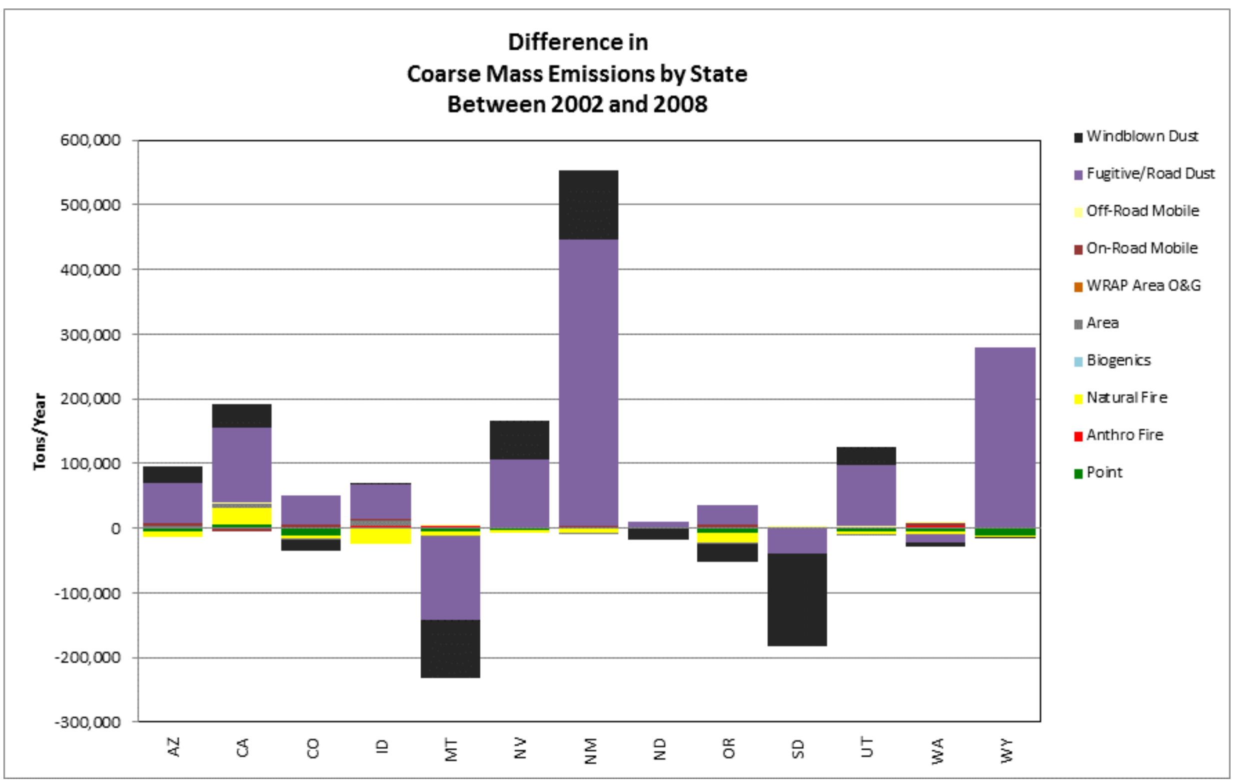

Figure 4.2-17. Differences between 2008 and 2002 Coarse Mass Emission Inventory Totals for the Contiguous WRAP States (2008 minus 2002).

4.2.1 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 as 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 electrical generating units (EGU) are presented here for the contiguous states, and for each state individually in Section 6.0. 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 4.2-18 presents a sum of annual NO_X and SO_2 emissions as reported for all EGU sources in the contiguous WRAP states 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 steady declines for both SO_2 and NO_X.

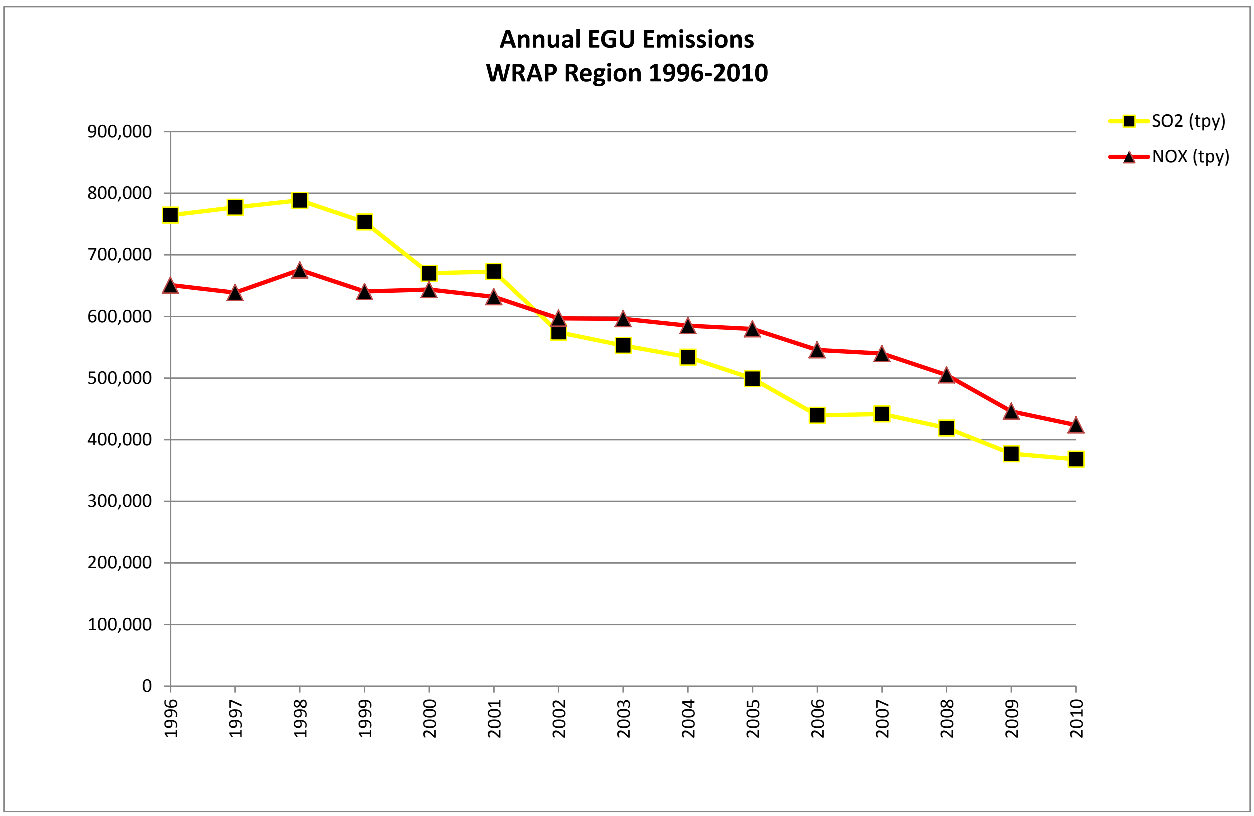

Figure 6.2-18. Sum of EGU Emissions of SO_2 and NOx Reported between 1996 and 2010 for the WRAP Region.