

Emission and Air Quality Trends Review

Montana

May 2013

Project Objective

- ❑ To develop and present publicly available information on trends in emissions and ambient air quality in the U.S. since 1999 in easy to understand visual and tabular formats

Emission Trends

- Study Team collected and processed U.S. EPA emission inventories for years within the study period of interest (1999-2011)

- By pollutant and source category
 - electric generation fuel combustion
 - mobile sources
 - industrial fuel combustion & industrial processes
 - all other

Emissions Data Summary

- Data Obtained from EPA National Emission Inventory (NEI) and Trends Websites
 - EPA's Trends reports and emission comparisons include interpolations of all categories between key years (1999, 2002, 2005, 2008, 2011) at county-pollutant level
 - Represented Pollutants: VOC, NO_x, SO₂, and PM_{2.5}
- Project Improvement
 - The Study Team augmented above data with year specific CEM emissions (2002 through 2011)

Emission Changes

- ❑ The following slides also include the tonnage-based emissions change from 1999 to 2011 for each pollutant
- ❑ Negative values indicate decrease in emissions, positive values indicate an increase

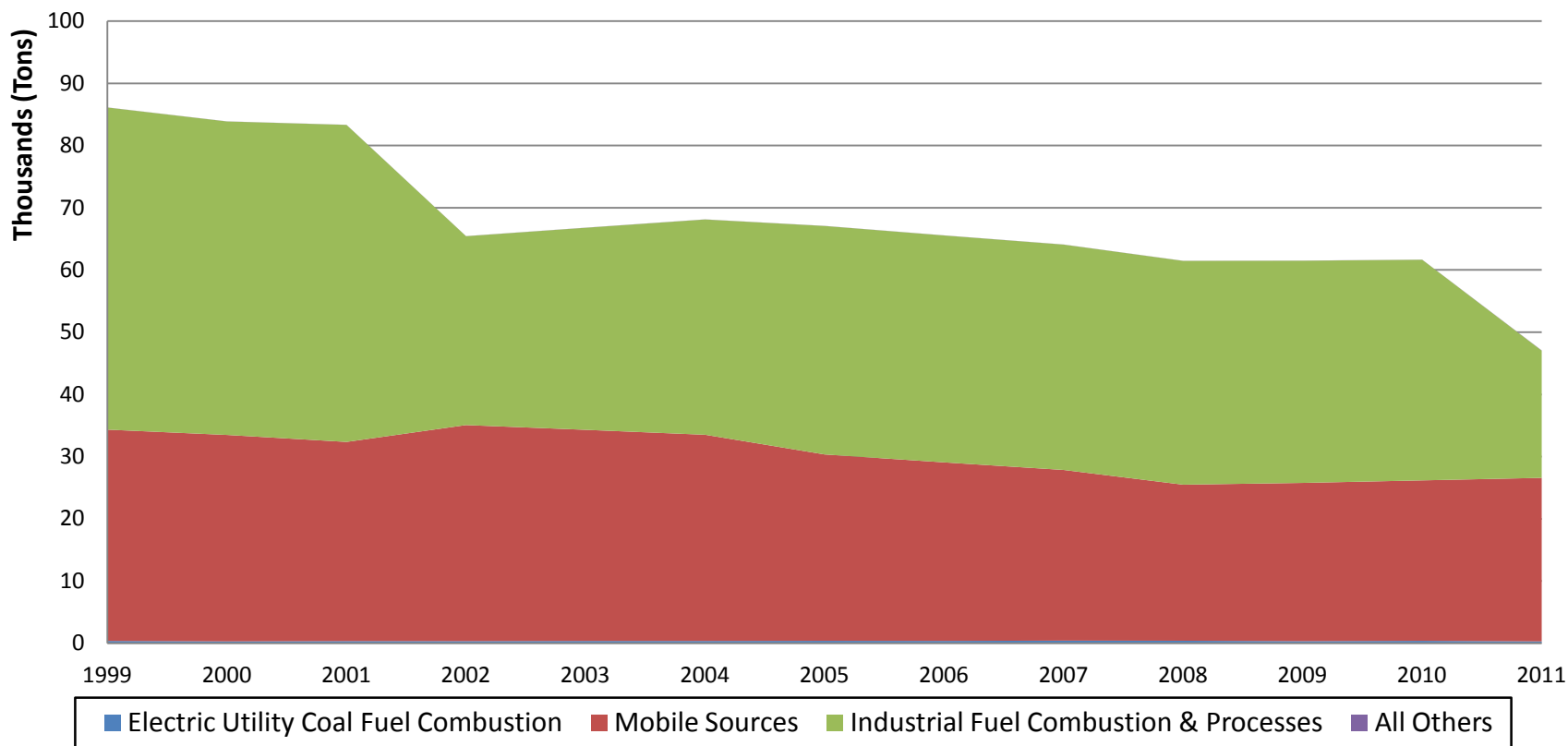
Montana Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	377	350	371	394	380	424	407	338	392	302
Mobile Sources	33,958	32,010	33,934	29,953	28,693	27,432	25,084	25,436	25,788	26,282
Industrial Fuel Combustion & Processes	51,774	50,954	32,476	36,722	36,470	36,219	35,967	35,715	35,464	20,453
All Others	15	16	17	17	17	17	17	17	17	36
Total	86,124	83,330	66,798	67,086	65,560	64,091	61,475	61,506	61,660	47,073

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-7%	-2%	5%	1%	12%	8%	-10%	4%	-20%
Mobile Sources	0%	-6%	0%	-12%	-16%	-19%	-26%	-25%	-24%	-23%
Industrial Fuel Combustion & Processes	0%	-2%	-37%	-29%	-30%	-30%	-31%	-31%	-32%	-60%
All Others	0%	5%	11%	11%	11%	11%	11%	11%	11%	136%
Total	0%	-3%	-22%	-22%	-24%	-26%	-29%	-29%	-28%	-45%

Montana Emission Trends (VOC)

**Major Source Category Summary
Annual VOC Emissions**



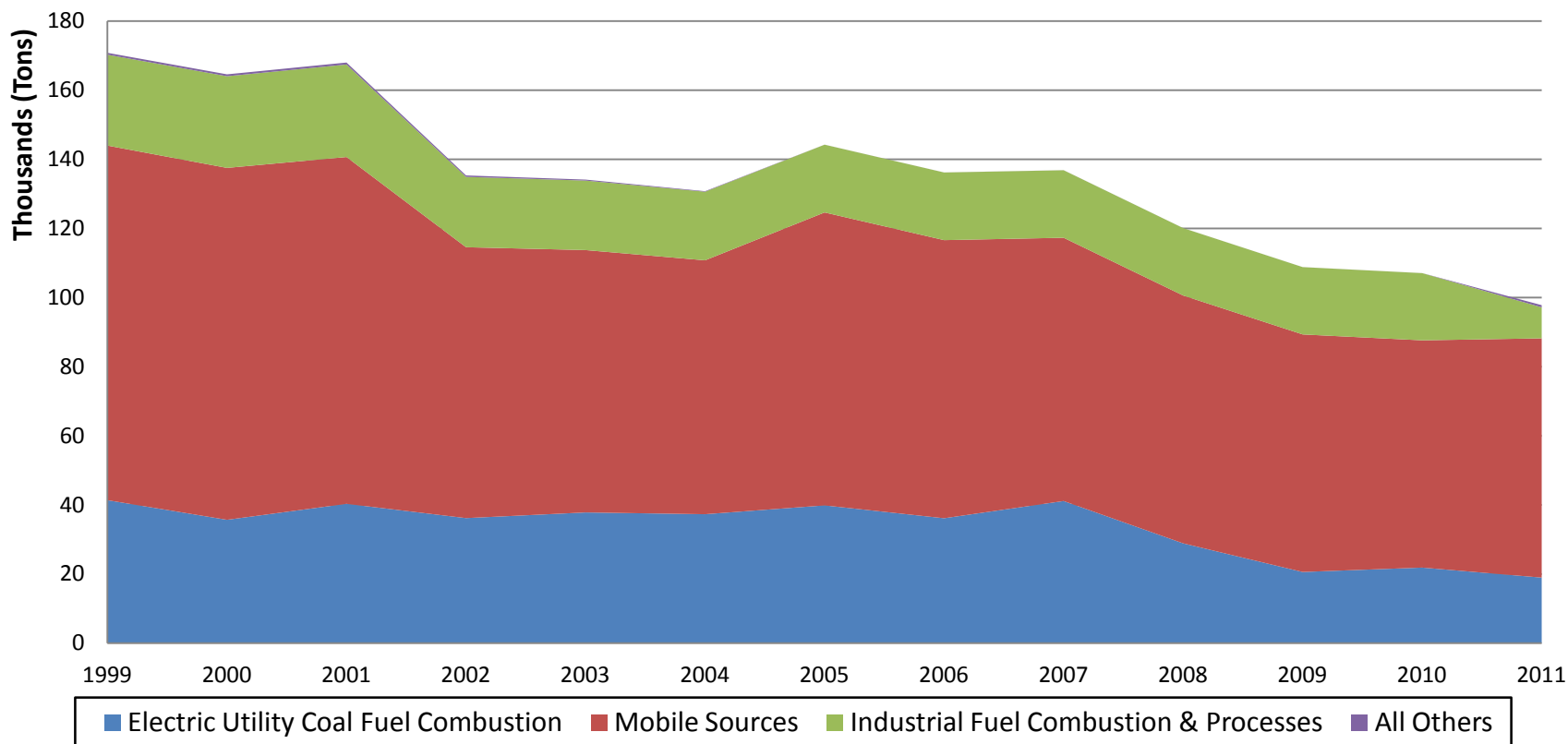
Montana Emission Trends (NO_x)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	41,359	40,308	37,816	39,857	36,140	41,121	28,876	20,590	21,860	18,965
Mobile Sources	102,609	100,350	75,919	84,766	80,471	76,176	71,715	68,738	65,760	69,233
Industrial Fuel Combustion & Processes	26,302	26,772	20,108	19,607	19,574	19,541	19,507	19,474	19,440	8,964
All Others	536	570	283	13	13	16	13	11	12	632
Total	170,807	168,000	134,126	144,243	136,199	136,853	120,111	108,812	107,073	97,793

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-3%	-9%	-4%	-13%	-1%	-30%	-50%	-47%	-54%
Mobile Sources	0%	-2%	-26%	-17%	-22%	-26%	-30%	-33%	-36%	-33%
Industrial Fuel Combustion & Processes	0%	2%	-24%	-25%	-26%	-26%	-26%	-26%	-26%	-66%
All Others	0%	6%	-47%	-98%	-98%	-97%	-98%	-98%	-98%	18%
Total	0%	-2%	-21%	-16%	-20%	-20%	-30%	-36%	-37%	-43%

Montana Emission Trends (NO_x)

**Major Source Category Summary
Annual NO_x Emissions**



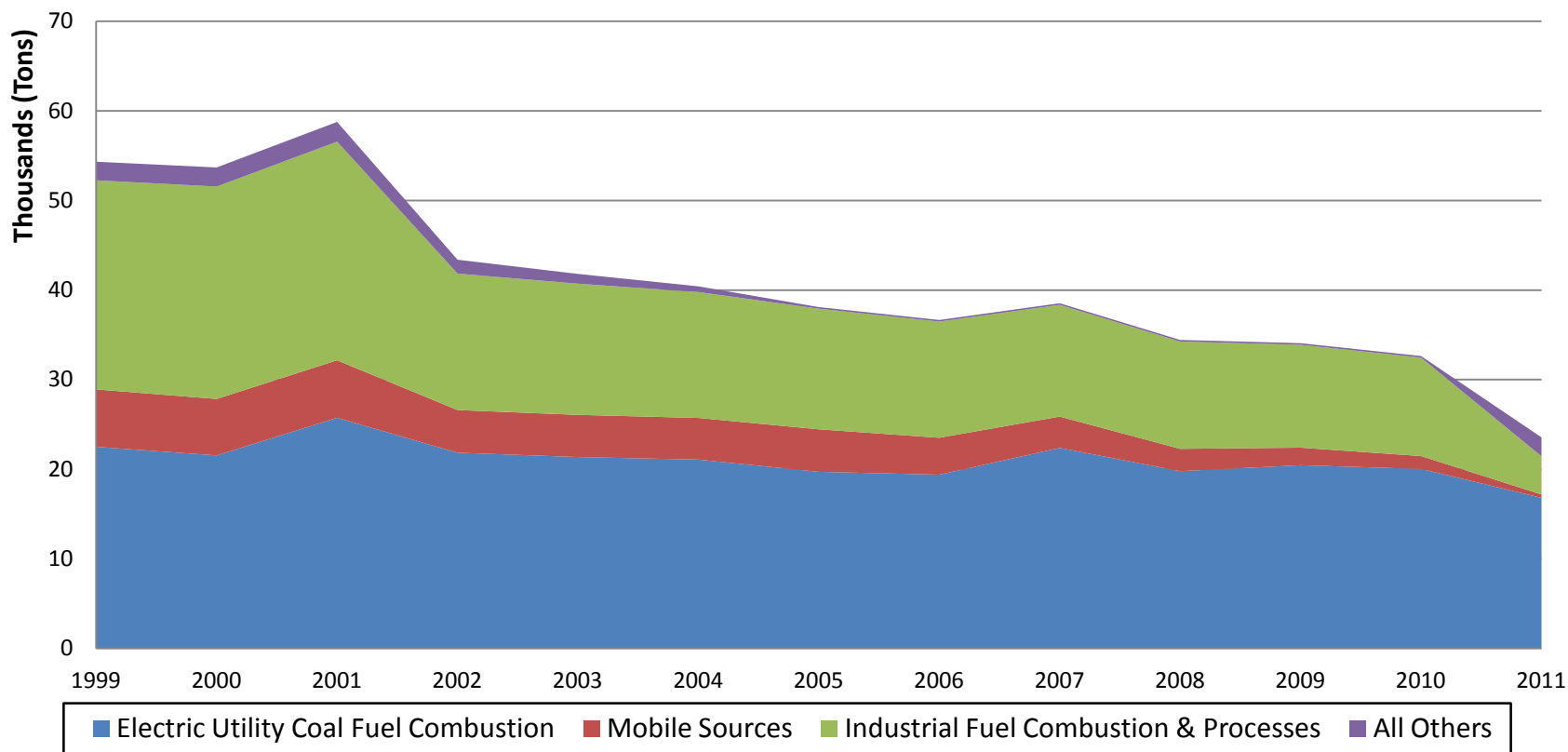
Montana Emission Trends (SO₂)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	22,501	25,742	21,362	19,715	19,394	22,380	19,789	20,449	20,036	16,811
Mobile Sources	6,408	6,416	4,705	4,743	4,120	3,498	2,487	1,962	1,436	372
Industrial Fuel Combustion & Processes	23,337	24,402	14,640	13,462	12,967	12,472	11,977	11,482	10,987	4,259
All Others	2,073	2,202	1,092	176	176	176	176	176	176	2,114
Total	54,320	58,763	41,800	38,095	36,658	38,526	34,429	34,068	32,635	23,556

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	14%	-5%	-12%	-14%	-1%	-12%	-9%	-11%	-25%
Mobile Sources	0%	0%	-27%	-26%	-36%	-45%	-61%	-69%	-78%	-94%
Industrial Fuel Combustion & Processes	0%	5%	-37%	-42%	-44%	-47%	-49%	-51%	-53%	-82%
All Others	0%	6%	-47%	-92%	-92%	-92%	-92%	-92%	-92%	2%
Total	0%	8%	-23%	-30%	-33%	-29%	-37%	-37%	-40%	-57%

Montana Emission Trends (SO₂)

**Major Source Category Summary
Annual SO₂ Emissions**



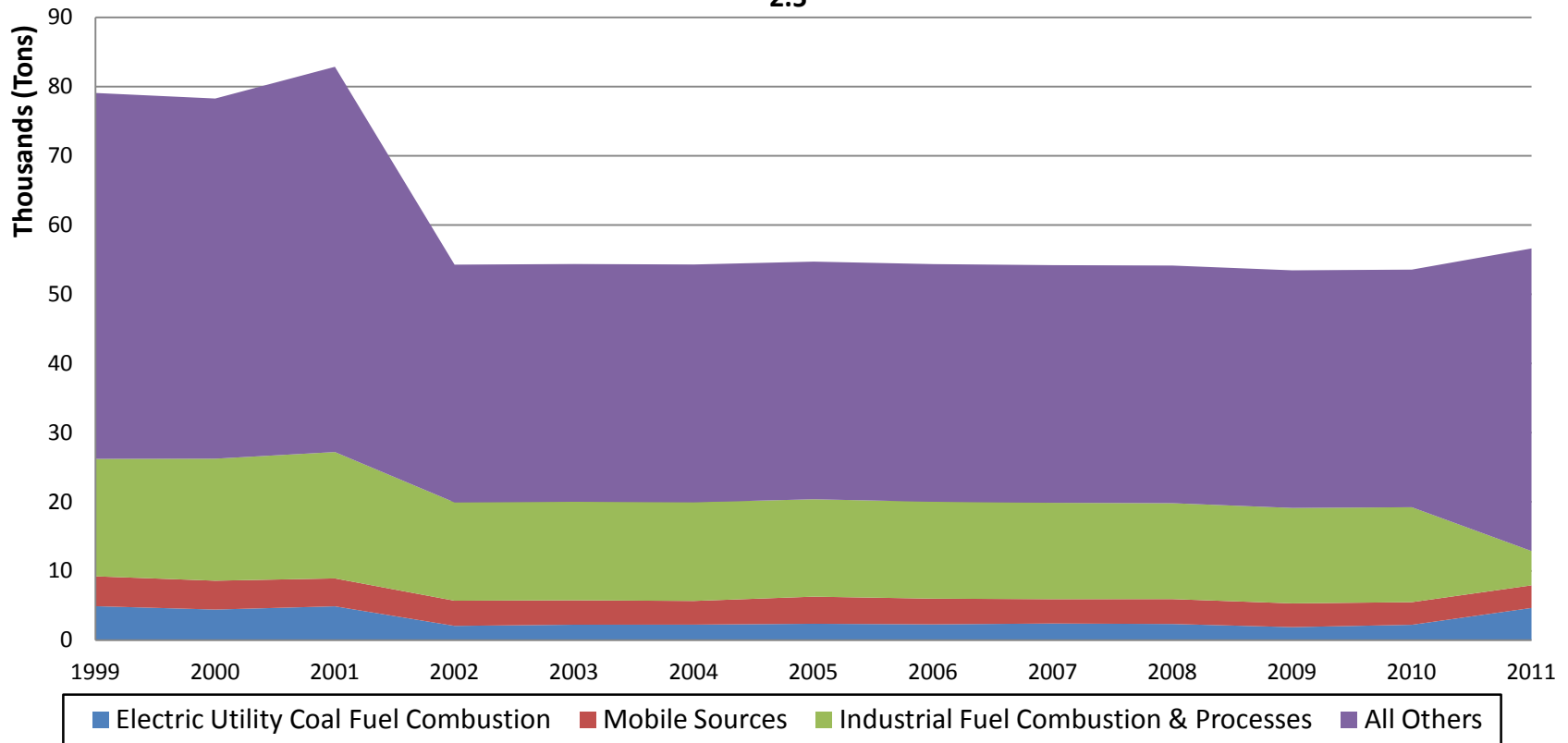
Montana Emission Trends (PM_{2.5})

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	4,909	4,893	2,234	2,371	2,285	2,409	2,337	1,883	2,222	4,657
Mobile Sources	4,319	4,031	3,531	3,917	3,715	3,512	3,598	3,435	3,271	3,265
Industrial Fuel Combustion & Processes	16,970	18,265	14,235	14,072	14,001	13,931	13,860	13,789	13,718	4,960
All Others	52,879	55,673	34,358	34,346	34,344	34,343	34,342	34,340	34,339	43,729
Total	79,077	82,861	54,357	54,705	54,345	54,195	54,136	53,447	53,550	56,610

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	0%	-54%	-52%	-53%	-51%	-52%	-62%	-55%	-5%
Mobile Sources	0%	-7%	-18%	-9%	-14%	-19%	-17%	-20%	-24%	-24%
Industrial Fuel Combustion & Processes	0%	8%	-16%	-17%	-17%	-18%	-18%	-19%	-19%	-71%
All Others	0%	5%	-35%	-35%	-35%	-35%	-35%	-35%	-35%	-17%
Total	0%	5%	-31%	-31%	-31%	-31%	-32%	-32%	-32%	-28%

Montana Emission Trends (PM_{2.5})

**Major Source Category Summary
Annual PM_{2.5} Emissions**



Emission Trends Summary

- ❑ All pollutants have decreased since 1999 in aggregate across Montana
- ❑ Onroad emission step increase seen between 2004 and 2005 is the result of EPA's method change and MOVES model integration for estimating onroad mobile source emissions

Air Quality Design Values

- Ozone
 - Annual 4th highest daily maximum 8-hour average averaged over three consecutive years
 - Current standard = 0.075 ppm
- PM_{2.5} Annual
 - Annual arithmetic mean of quarterly means averaged over three consecutive years
 - Current standard = 12 ug/m³
- PM_{2.5} 24-Hour
 - Annual 98th percentile of daily averages averaged over three consecutive years
 - Current standard = 35 ug/m³

State-Wide Design Value (DV) Trends

- Trends in state-wide maximum DV and average DV
 - Max DV: Maximum DVs over all valid trend monitoring sites in the state in each overlapping three year period
 - Average DV: Average of DVs over all valid trend monitoring sites in the state in each overlapping three year period
- Compute linear trend via least-squares regression

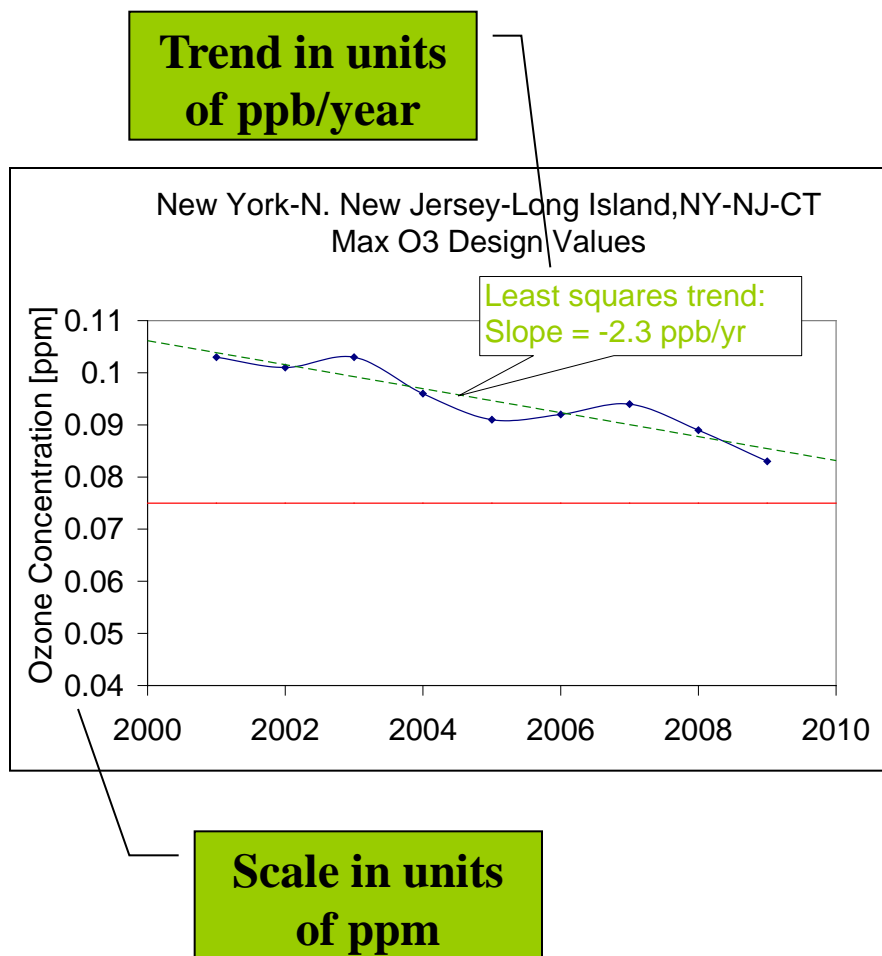
Data Handling Procedures

- O₃ design value (DV) for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculated using annual 4th highest daily max 8-hr averages and percent of valid observations, based on EPA data handling conventions
 - Data associated with exceptional events that have received EPA concurrence are omitted
 - Selection of trend sites require valid DV in 9 out of 11 three-year periods between 1999 and 2011
 - Identification of nonattainment areas is with respect to the 2008 8-hour standard only

Data Handling Procedures

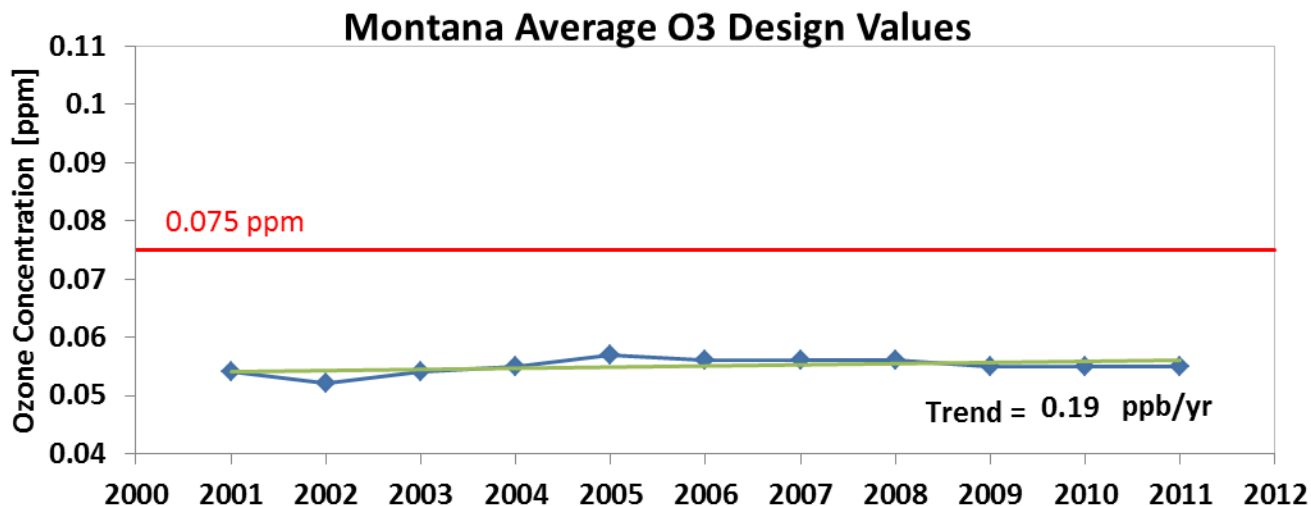
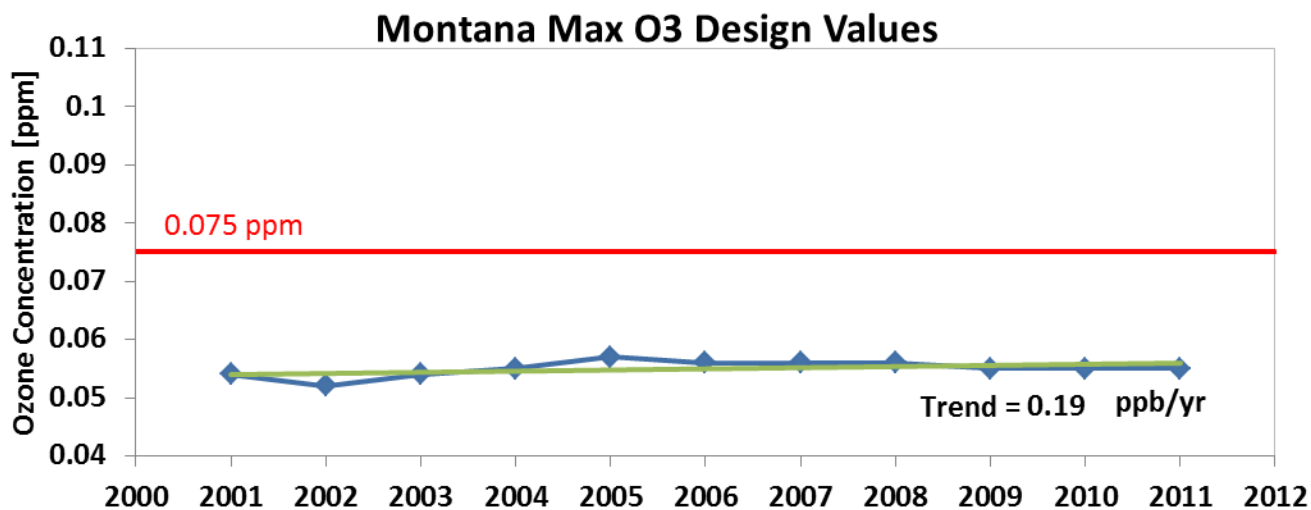
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculations based on EPA data handling conventions
 - Data extracted from monitors that have a non-regulatory monitoring type are omitted
 - Selection of trend sites require valid DV in 9 out of 11 three-year periods between 1999 and 2011

Trend Calculation



- Trends based on linear least squares fit to rolling three year design values (DVs)
- Negative trend indicates improving air quality
- DVs based on each 3-year period: 1999-2001, 2000-2002, ... 2009-2011
- Notes
 - On plots, DVs are for three year period ending in year shown (i.e., 2009-2011 DV plotted as 2011 value)
 - Ozone trend values expressed as ppb/year (1,000 ppb = 1 ppm); DVs are plotted as ppm

Max/Ave O₃ DVs and Trend



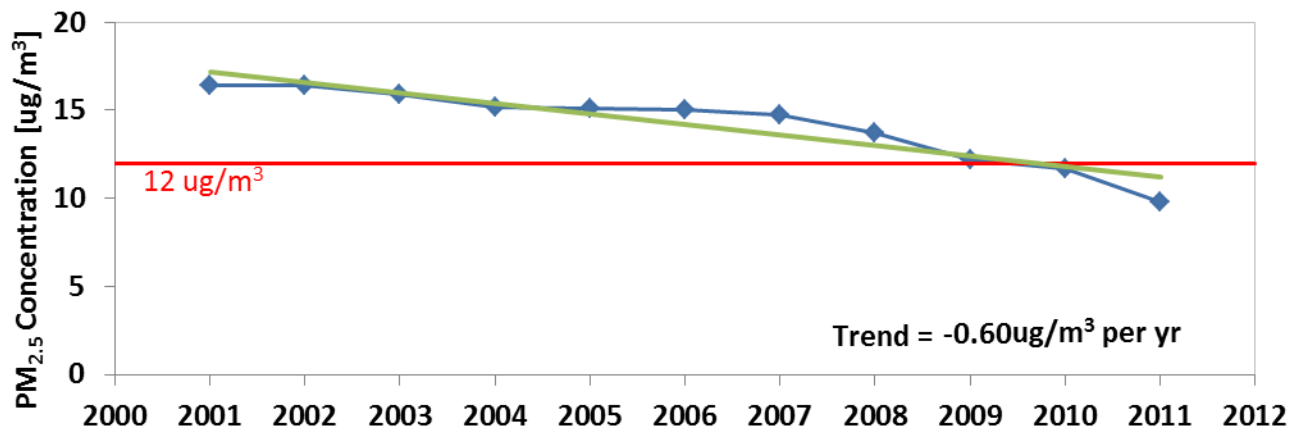
Ozone Trends by Site in Montana

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
3002980014420101	Flathead, MT	0.055	0.19

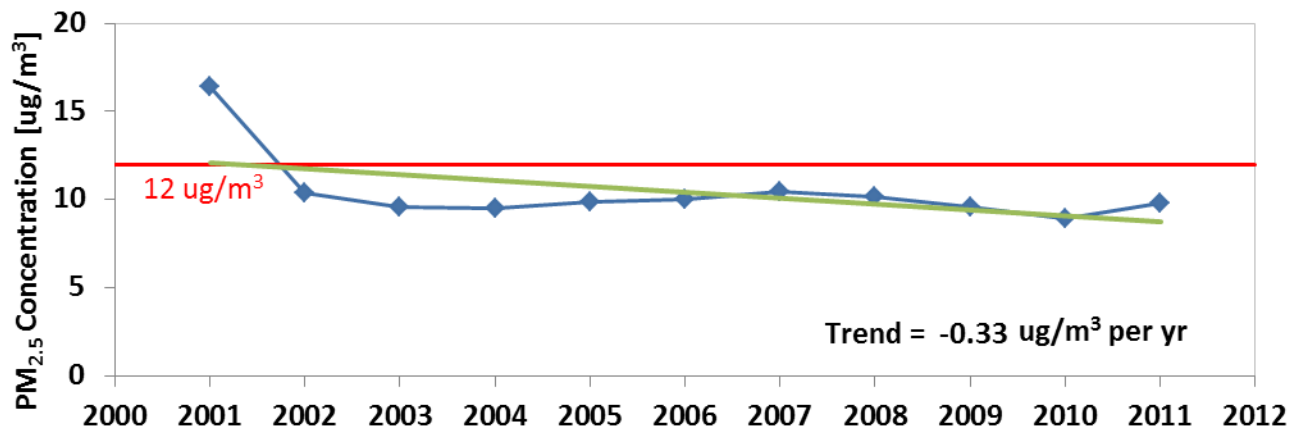
Note: Only monitoring sites meeting data completeness criteria listed

Max/Ave PM_{2.5} Annual DVs and Trend

Montana Max PM_{2.5} Annual Design Values

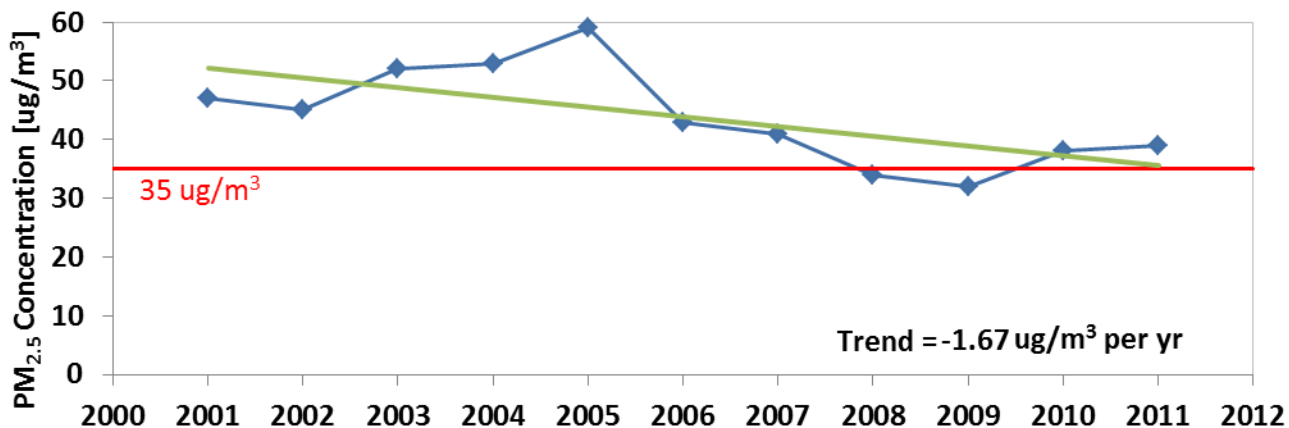


Montana Average PM_{2.5} Annual Design Values

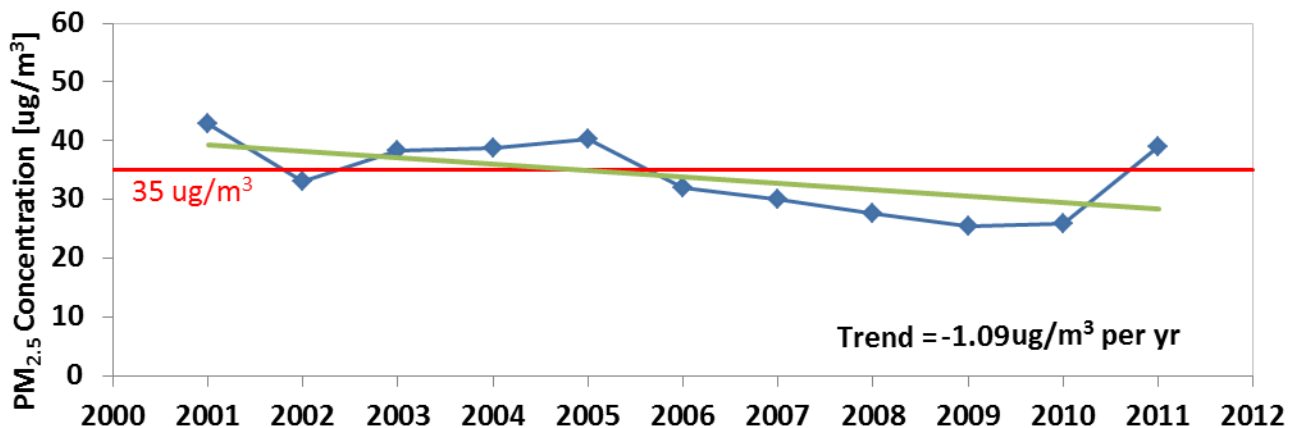


Max/Ave PM_{2.5} 24-Hour DVs and Trend

Montana Max PM_{2.5} 24-Hour Design Values



Montana Average PM_{2.5} 24-Hour Design Values



PM_{2.5} Trends by Site in Montana

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
300290047	Flathead	N/A	N/A	-0.01	-2.58
300530018	Lincoln	N/A	N/A	-0.51	-1.82
300630031	Missoula	N/A	N/A	N/A	-2.76
300890007	Sanders	N/A	N/A	0.04	-0.22
300930005	Silver Bow	9.8	39	0.31	-0.04

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O₃ design values have increased slightly since 1999 in Montana, based on one monitoring site that has complete data records (Flathead). Average annual and 24-hr PM_{2.5} design values have decreased since 1999 in Montana.
- There are no currently designated O₃ or 24-hour PM_{2.5} non-attainment areas in Montana. Annual PM_{2.5} design values have decreased since 1999 in Libby, MT, the only currently designated annual PM_{2.5} non-attainment area in Montana.