

Emission and Air Quality Trends Review

Alabama

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

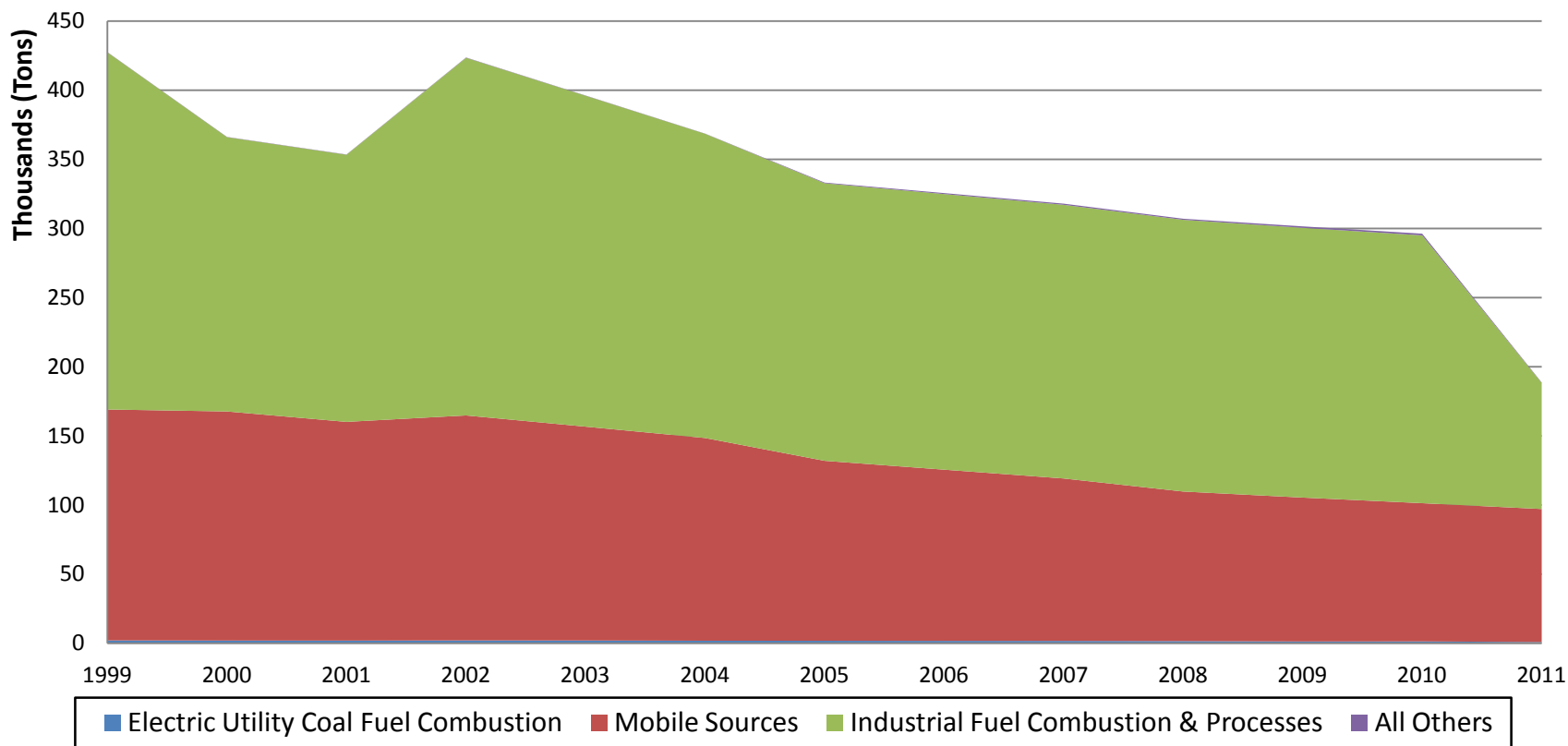
Alabama Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	2,058	1,921	1,991	1,799	1,741	1,709	1,562	1,285	1,345	858
Mobile Sources	167,024	158,211	154,679	130,162	123,819	117,475	108,190	104,079	99,968	96,242
Industrial Fuel Combustion & Processes	258,241	193,197	239,349	200,750	199,331	197,918	196,499	195,096	193,689	91,208
All Others	176	185	177	491	705	849	787	1,057	1,222	302
Total	427,500	353,514	396,195	333,203	325,596	317,951	307,039	301,517	296,224	188,610

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-7%	-3%	-13%	-15%	-17%	-24%	-38%	-35%	-58%
Mobile Sources	0%	-5%	-7%	-22%	-26%	-30%	-35%	-38%	-40%	-42%
Industrial Fuel Combustion & Processes	0%	-25%	-7%	-22%	-23%	-23%	-24%	-24%	-25%	-65%
All Others	0%	5%	0%	179%	299%	381%	346%	499%	593%	71%
Total	0%	-17%	-7%	-22%	-24%	-26%	-28%	-29%	-31%	-56%

Alabama Emission Trends (VOC)

**Major Source Category Summary
Annual VOC Emissions**



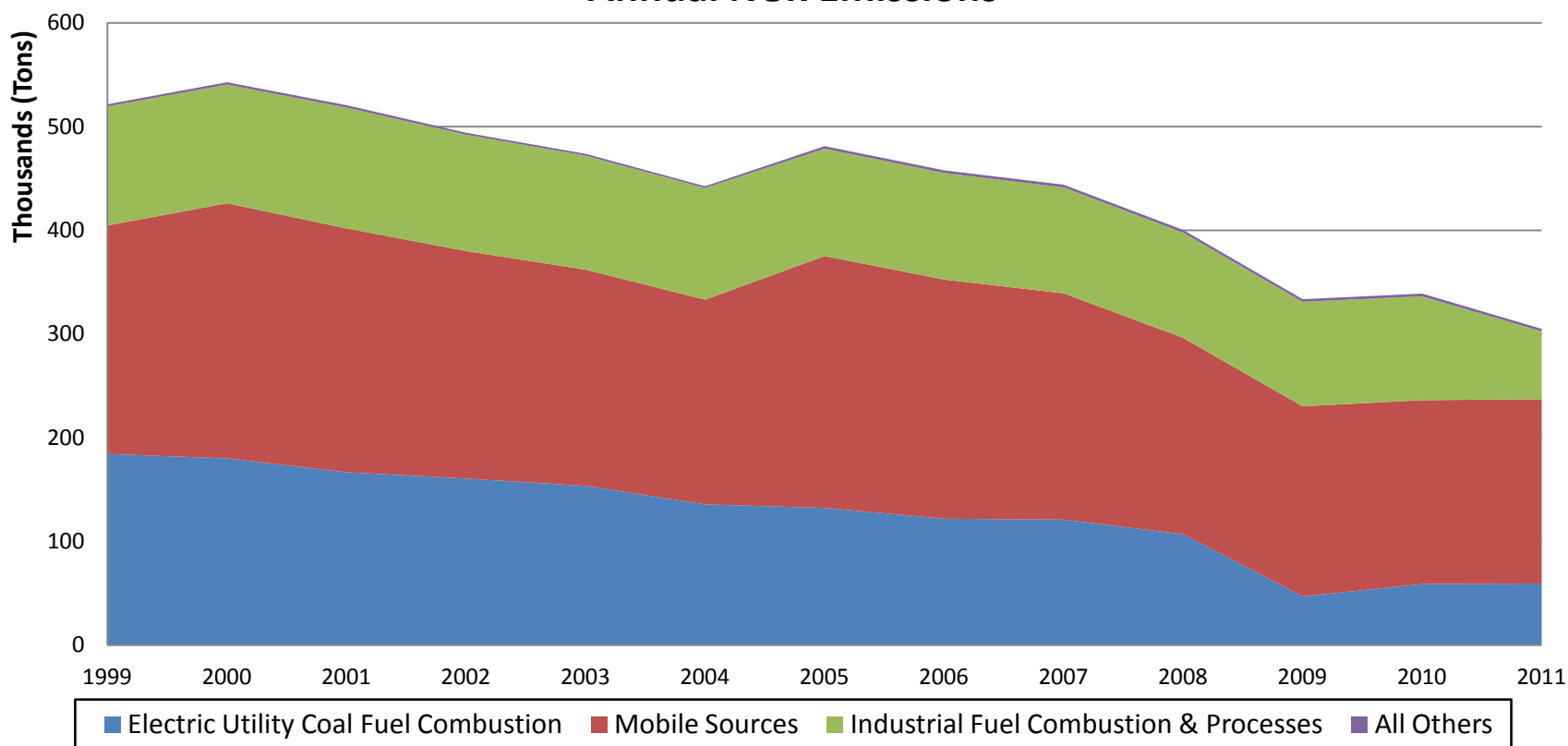
Alabama Emission Trends (NO_x)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	184,289	166,747	153,604	132,295	121,895	120,986	107,037	47,015	58,886	59,350
Mobile Sources	220,382	235,106	208,453	242,912	230,595	218,277	189,237	183,273	177,308	177,800
Industrial Fuel Combustion & Processes	114,786	116,511	109,924	103,507	102,806	102,128	101,478	100,814	100,166	65,440
All Others	2,098	2,317	1,820	2,485	2,552	2,611	2,611	2,479	2,614	2,400
Total	521,555	520,681	473,801	481,198	457,848	444,002	400,363	333,580	338,974	304,989

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-10%	-17%	-28%	-34%	-34%	-42%	-74%	-68%	-68%
Mobile Sources	0%	7%	-5%	10%	5%	-1%	-14%	-17%	-20%	-19%
Industrial Fuel Combustion & Processes	0%	2%	-4%	-10%	-10%	-11%	-12%	-12%	-13%	-43%
All Others	0%	10%	-13%	18%	22%	24%	24%	18%	25%	14%
Total	0%	0%	-9%	-8%	-12%	-15%	-23%	-36%	-35%	-42%

Alabama Emission Trends (NO_x)

**Major Source Category Summary
Annual NO_x Emissions**



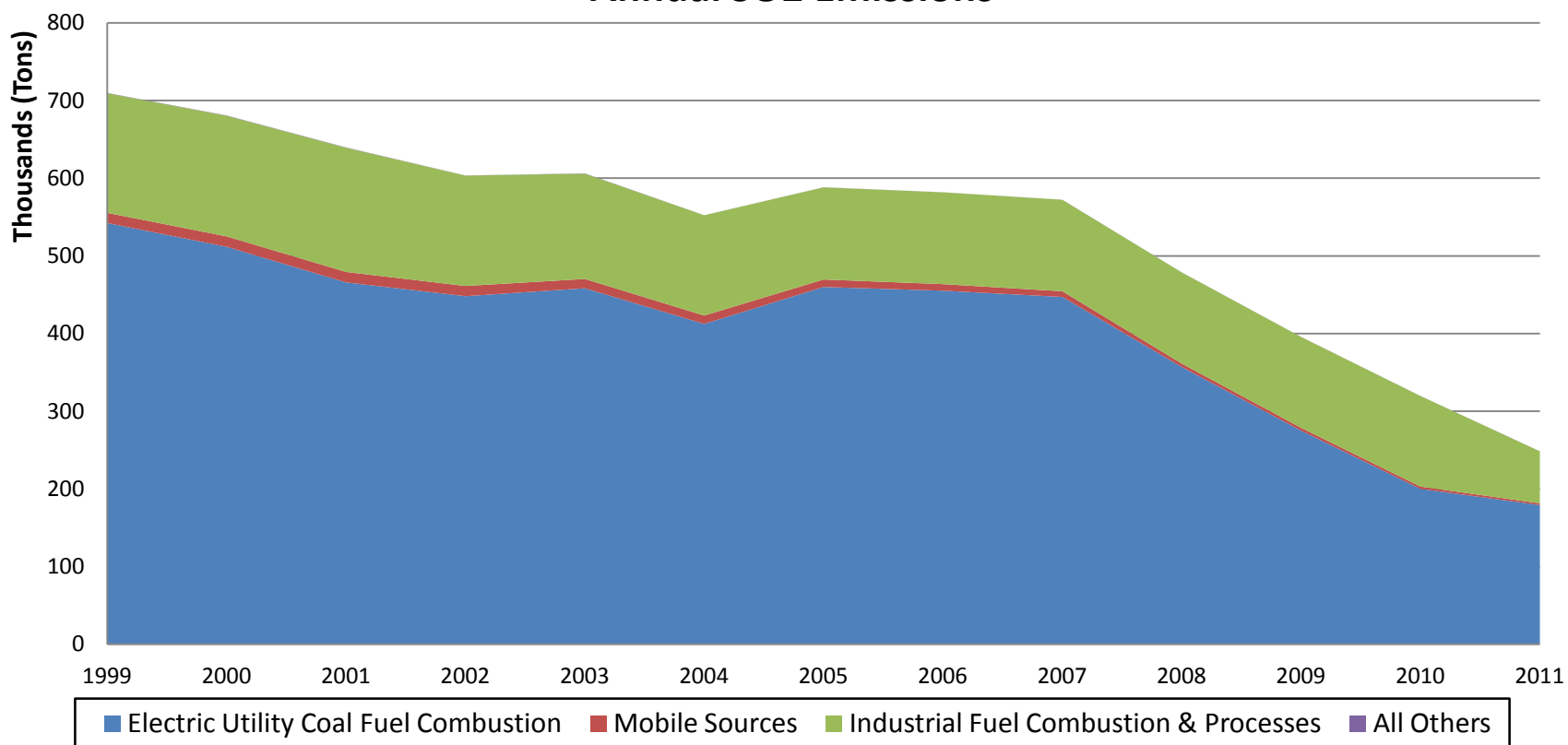
Alabama Emission Trends (SO₂)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	542,306	465,862	458,326	459,990	455,171	447,157	357,020	274,991	200,002	179,209
Mobile Sources	13,090	13,474	11,967	9,640	8,472	7,304	4,330	3,656	2,981	2,191
Industrial Fuel Combustion & Processes	154,026	159,905	135,606	118,614	118,201	117,790	117,379	116,972	116,565	66,969
All Others	352	369	341	149	88	96	106	112	120	118
Total	709,774	639,611	606,239	588,393	581,932	572,346	478,835	395,729	319,668	248,487

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%	-15%	-15%	-16%	-18%	-34%	-49%	-63%	-67%
Mobile Sources	0%	3%	-9%	-26%	-35%	-44%	-67%	-72%	-77%	-83%
Industrial Fuel Combustion & Processes	0%	4%	-12%	-23%	-23%	-24%	-24%	-24%	-24%	-57%
All Others	0%	5%	-3%	-58%	-75%	-73%	-70%	-68%	-66%	-66%
Total	0%	-10%	-15%	-17%	-18%	-19%	-33%	-44%	-55%	-65%

Alabama Emission Trends (SO₂)

**Major Source Category Summary
Annual SO₂ Emissions**



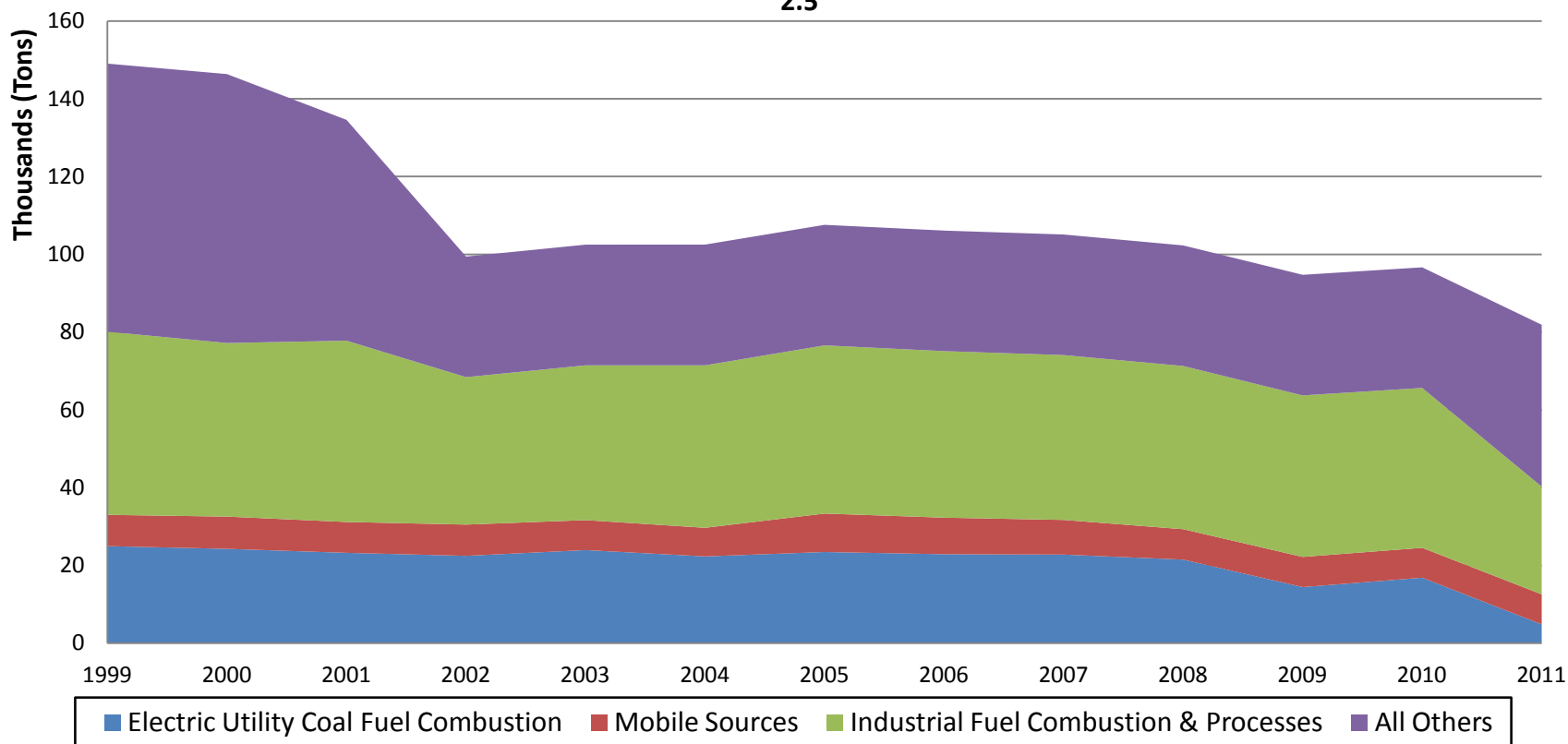
Alabama Emission Trends (PM_{2.5})

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	24,953	23,229	23,937	23,438	22,867	22,774	21,488	14,417	16,825	4,833
Mobile Sources	8,042	7,930	7,701	9,892	9,404	8,915	7,821	7,757	7,694	7,714
Industrial Fuel Combustion & Processes	47,107	46,637	39,817	43,261	42,832	42,403	41,975	41,547	41,118	27,700
All Others	68,955	56,796	31,037	31,002	31,005	31,009	31,012	31,015	31,019	41,637
Total	149,058	134,591	102,492	107,593	106,108	105,101	102,295	94,736	96,656	81,883

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%	-4%	-6%	-8%	-9%	-14%	-42%	-33%	-81%
Mobile Sources	0%	-1%	-4%	23%	17%	11%	-3%	-4%	-4%	-4%
Industrial Fuel Combustion & Processes	0%	-1%	-15%	-8%	-9%	-10%	-11%	-12%	-13%	-41%
All Others	0%	-18%	-55%	-55%	-55%	-55%	-55%	-55%	-55%	-40%
Total	0%	-10%	-31%	-28%	-29%	-29%	-31%	-36%	-35%	-45%

Alabama 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 Alabama
- ❑ NO_x and SO₂ from Electric Utility Fuel Combustion sources show significant decrease over time as a result of Acid Rain Program, NO_x Budget Trading Program and CAIR control implementation
- ❑ 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

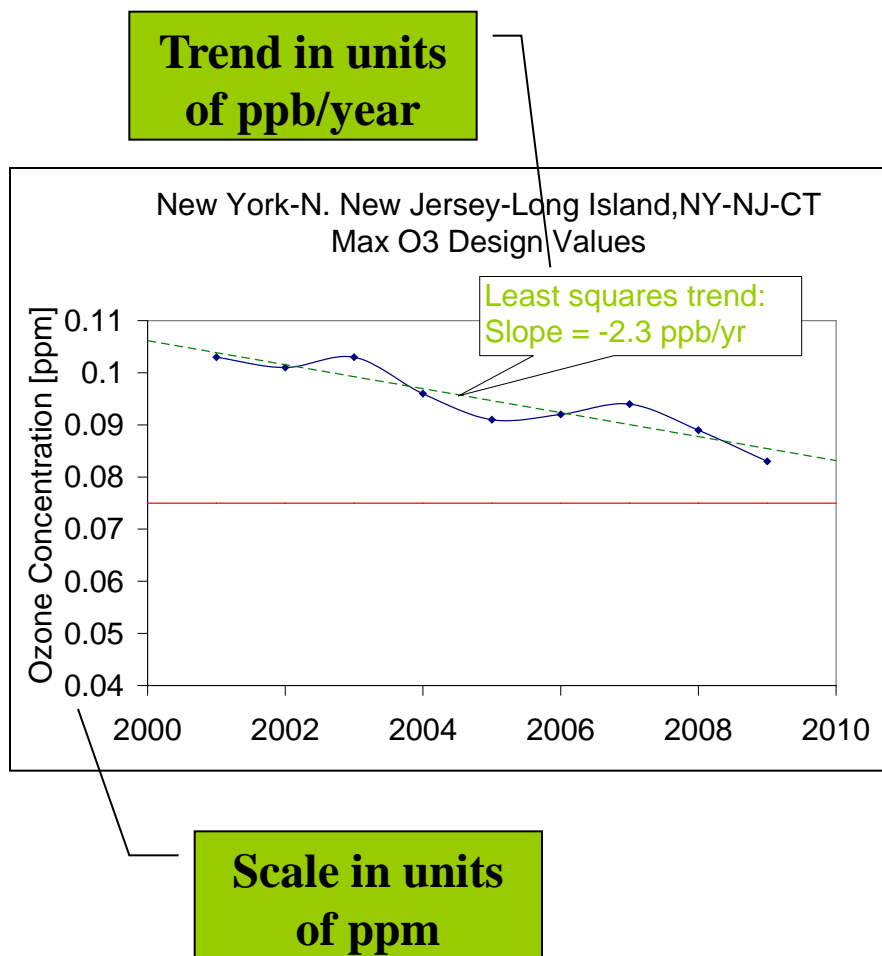
Data Handling Procedures

- 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

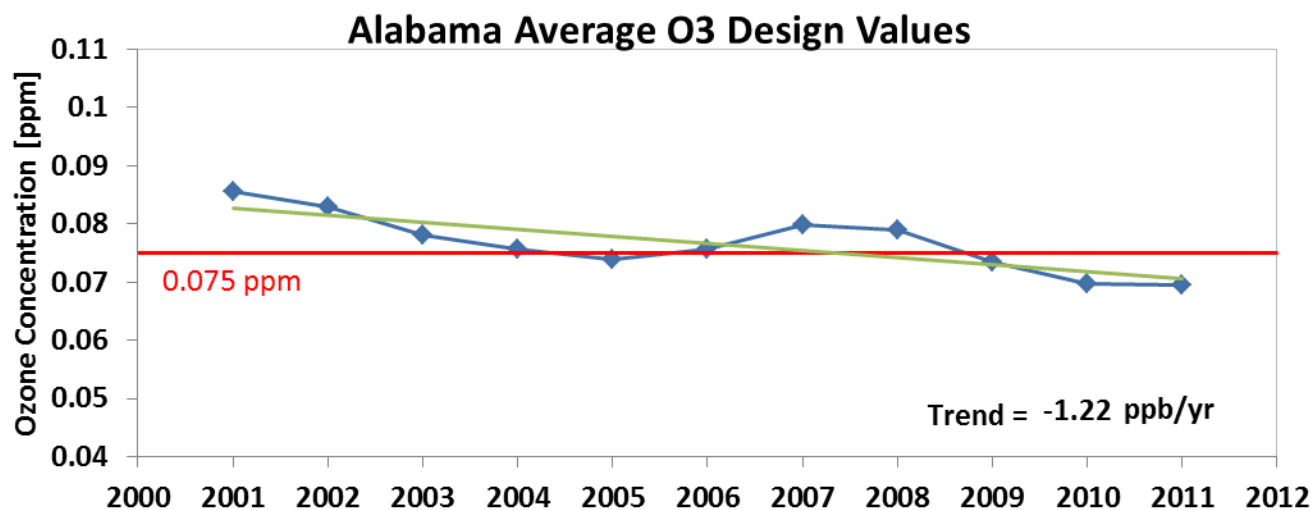
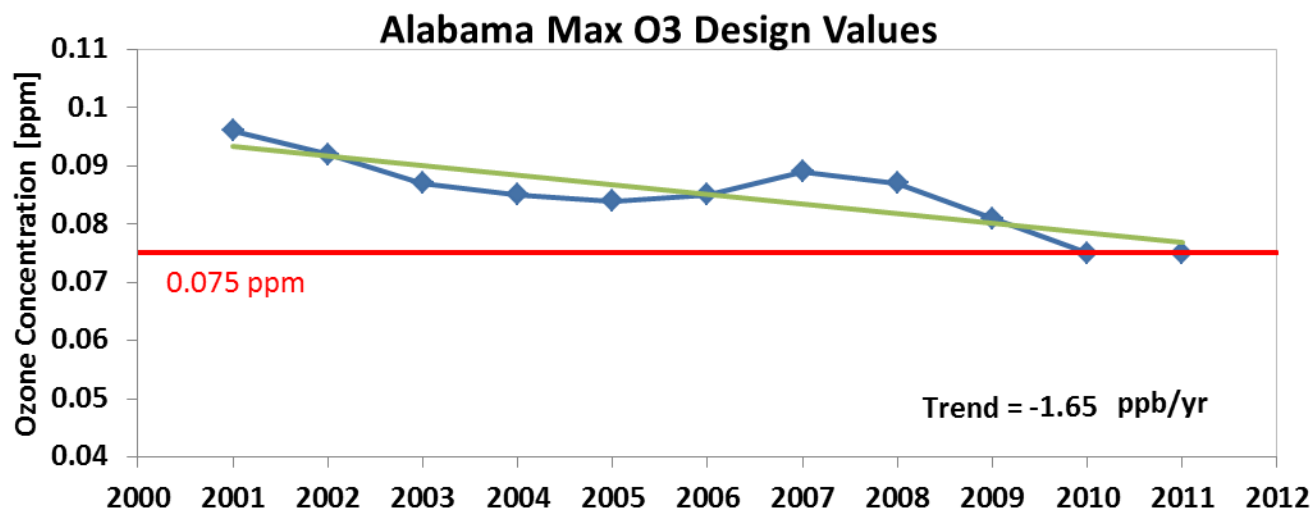
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculations based on EPA data handling conventions
 - Data extracted from monitors that have a non-regulatory monitoring type are omitted
 - Selection of trend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

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
0100300104420101	Baldwin, AL	0.072	-0.85
0105100014420101	Elmore, AL	0.067	-1.31
0107300234420101	Jefferson, AL	0.071	-0.30
0107310034420101	Jefferson, AL	0.07	-1.10
0107310054420101	Jefferson, AL	0.075	-0.95
0107310094420101	Jefferson, AL	0.07	-1.29
0107310104420101	Jefferson, AL	0.071	-0.18
0107320064420101	Jefferson, AL	0.075	-1.06
0107350024420101	Jefferson, AL	0.07	-1.21
0107350034420101	Jefferson, AL	0.07	-0.95

Note: Only monitoring sites meeting data completeness criteria listed

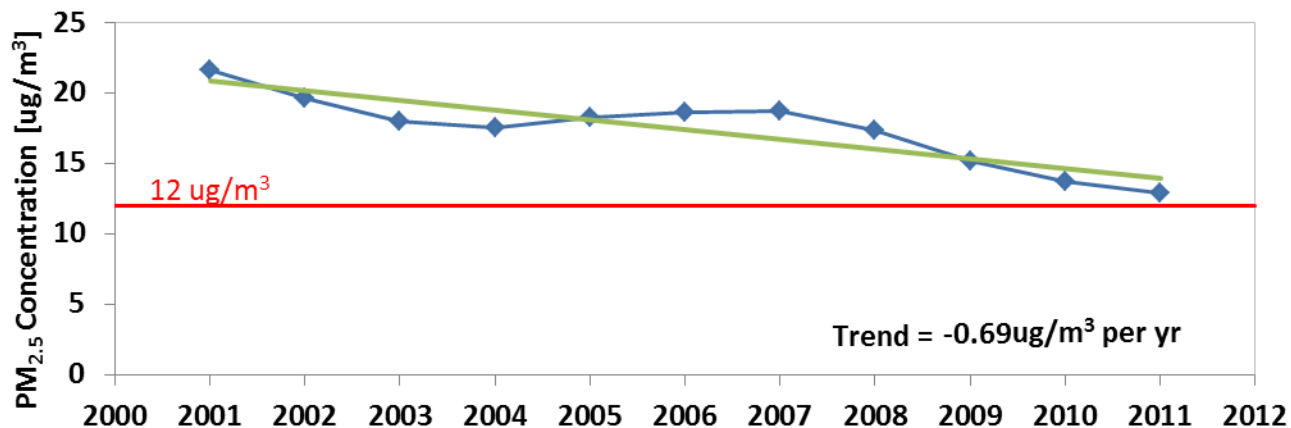
Ozone Trends by Site in Alabama

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
0107360024420101	Jefferson, AL	0.073	-0.58
0108900144420101	Madison, AL	0.069	-1.41
0109700034420101	Mobile, AL	0.07	-0.91
0109720054420101	Mobile, AL	0.073	-0.82
0110110024420101	Montgomery, AL	0.068	-1.18
0110300114420101	Morgan, AL	0.067	-1.94
0111700044420101	Shelby, AL	0.072	-1.84
0111900024420101	Sumter, AL	0.061	-1.52
0112500104420101	Tuscaloosa, AL	0.058	-2.00

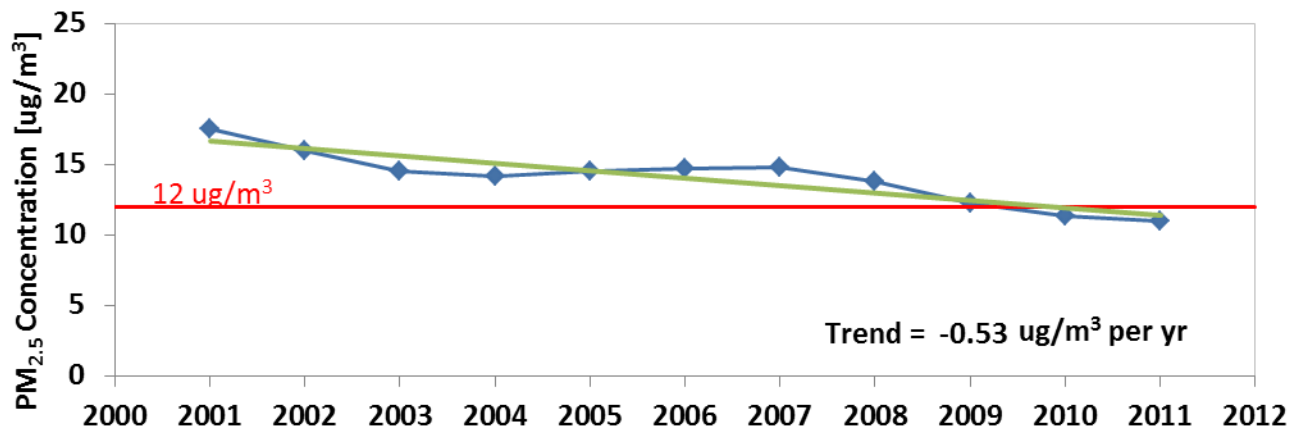
Note: Only monitoring sites meeting data completeness criteria listed

Max/Ave PM_{2.5} Annual DVs and Trend

Alabama Max PM_{2.5} Annual Design Values

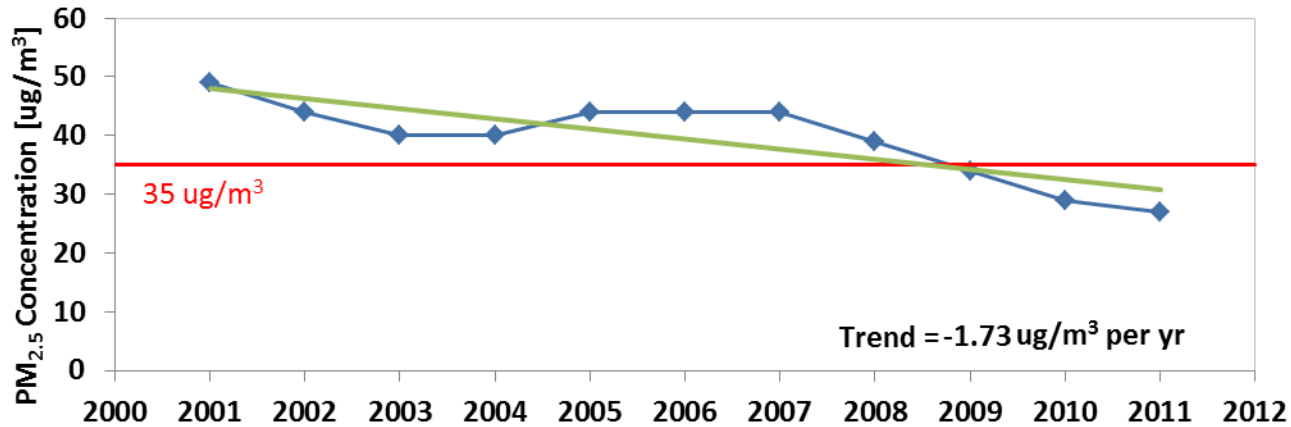


Alabama Average PM_{2.5} Annual Design Values

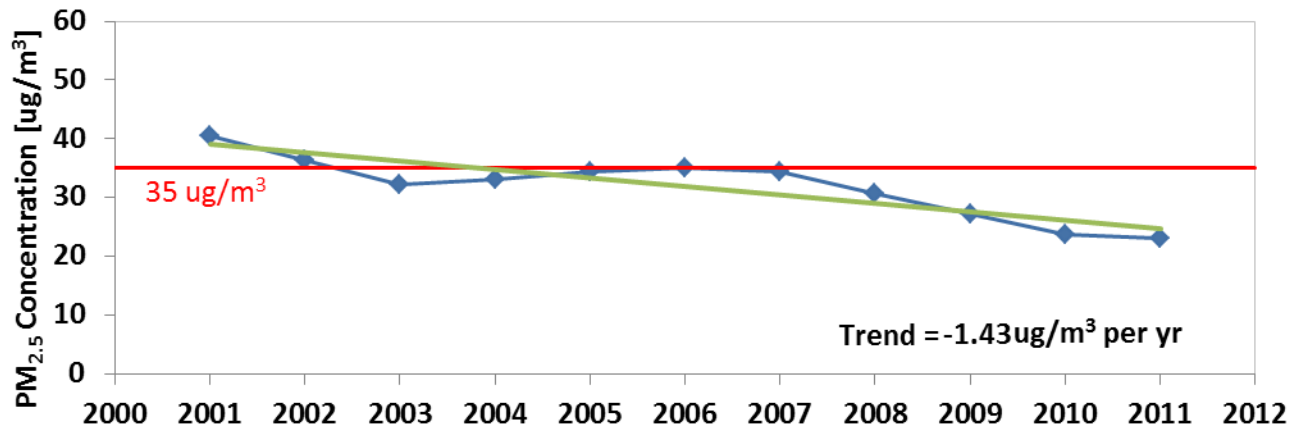


Max/Ave PM_{2.5} 24-Hour DVs and Trend

Alabama Max PM_{2.5} 24-Hour Design Values



Alabama Average PM_{2.5} 24-Hour Design Values



PM_{2.5} Trends by Site in Alabama

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
010270001	Clay	10.1	22	-0.47	-1.41
010331002	Colbert	10.0	20	-0.43	-1.18
010491003	DeKalb	10.8	22	-0.57	-1.60
010550010	Etowah	11.1	N/A	-0.56	N/A
010730023	Jefferson	12.9	27	-0.69	-1.73
010731005	Jefferson	11.3	23	-0.46	-1.46
010731009	Jefferson	10.0	22	-0.37	-1.22
010732003	Jefferson	12.0	26	-0.63	-1.63
010732006	Jefferson	11.1	23	-0.54	-1.38
010735002	Jefferson	10.6	22	-0.45	-1.04
010735003	Jefferson	10.4	22	-0.45	-1.23
010890014	Madison	11.0	22	-0.42	-1.13
011030011	Morgan	10.6	21	-0.57	-1.70
011130001	Russell	12.2	27	-0.55	-1.46

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O₃ and PM_{2.5} design values have decreased since 1999 in Alabama.
- There are no currently designated O₃ non-attainment areas in Alabama. Annual and 24-hour PM_{2.5} design values have decreased in Birmingham, AL, the only PM_{2.5} non-attainment area in Alabama.