

Emission and Air Quality Trends Review

Georgia

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

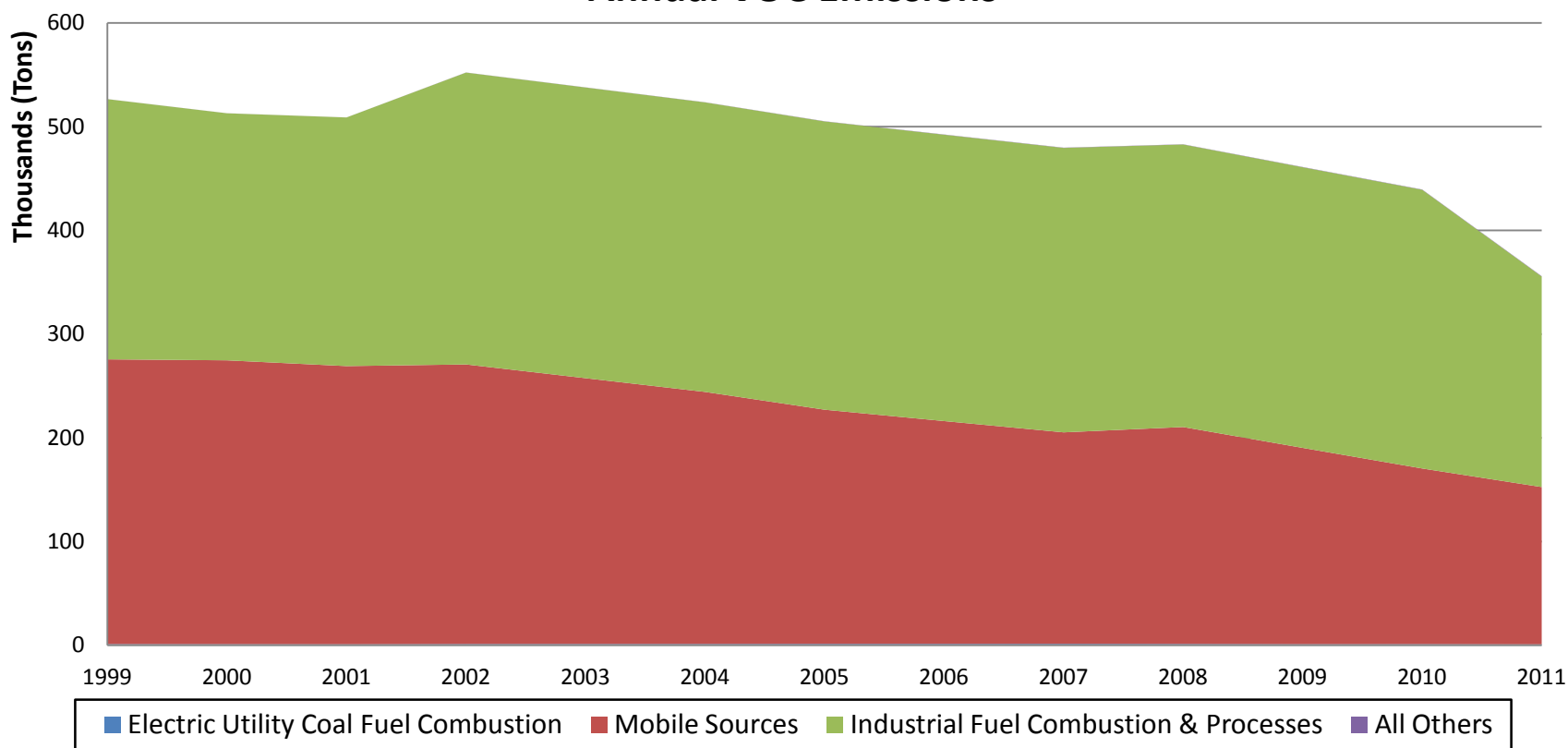
Georgia Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	1,093	939	1,160	1,268	1,265	1,328	1,193	1,004	1,048	870
Mobile Sources	274,536	268,199	256,321	225,835	214,874	203,913	209,204	189,287	169,371	151,653
Industrial Fuel Combustion & Processes	250,879	239,705	280,269	277,945	276,107	274,269	272,431	270,593	268,756	203,015
All Others	59	36	125	177	205	223	195	232	253	324
Total	526,567	508,880	537,874	505,224	492,451	479,733	483,023	461,117	439,427	355,863

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%	6%	16%	16%	22%	9%	-8%	-4%	-20%
Mobile Sources	0%	-2%	-7%	-18%	-22%	-26%	-24%	-31%	-38%	-45%
Industrial Fuel Combustion & Processes	0%	-4%	12%	11%	10%	9%	9%	8%	7%	-19%
All Others	0%	-39%	111%	198%	246%	275%	228%	290%	325%	446%
Total	0%	-3%	2%	-4%	-6%	-9%	-8%	-12%	-17%	-32%

Georgia Emission Trends (VOC)

**Major Source Category Summary
Annual VOC Emissions**



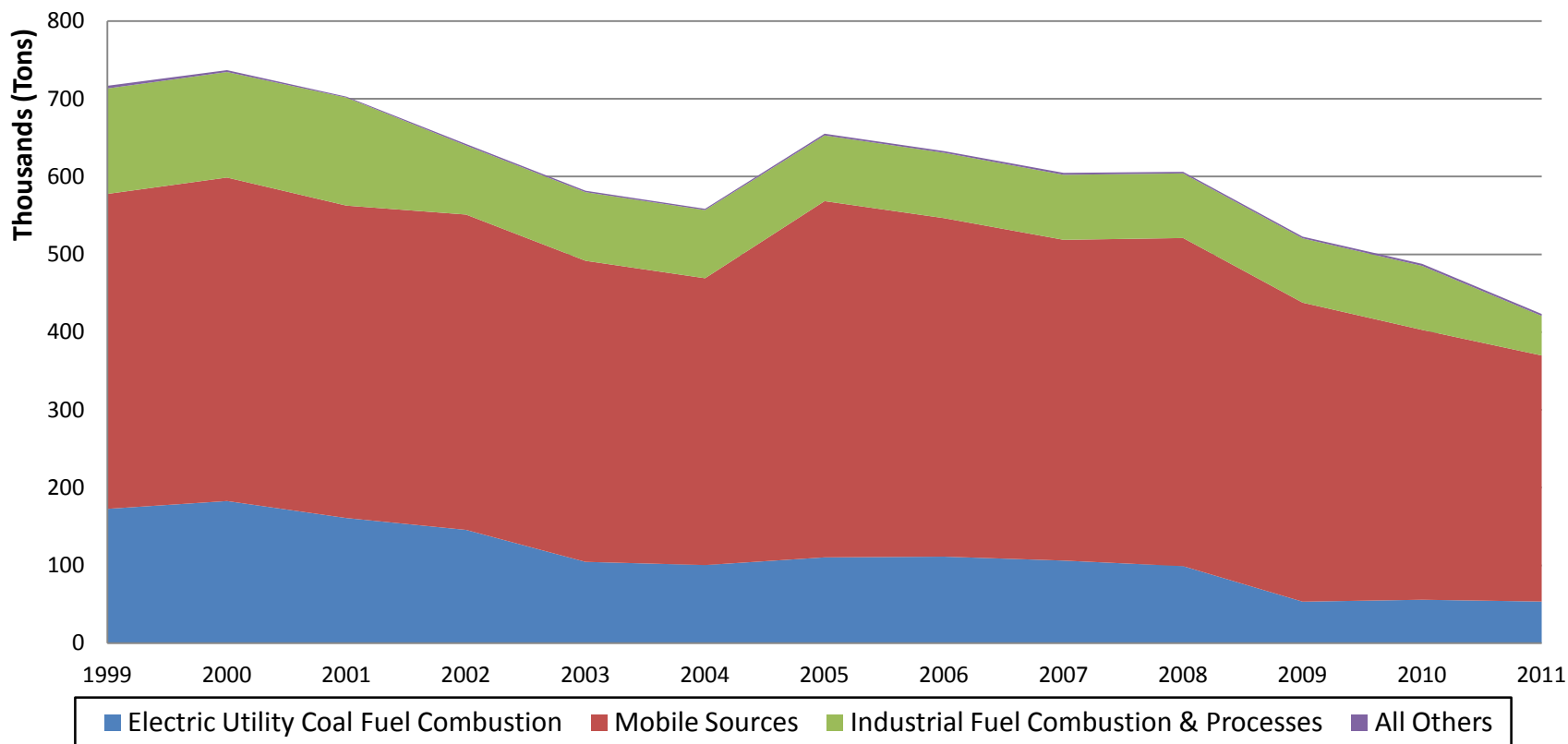
Georgia Emission Trends (NO_x)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	172,708	160,878	104,500	110,302	111,218	106,156	98,999	53,337	55,784	53,492
Mobile Sources	405,012	401,782	387,191	458,134	435,329	412,525	421,968	384,511	347,055	316,436
Industrial Fuel Combustion & Processes	135,611	138,908	88,224	84,453	84,017	83,581	83,145	82,709	82,273	50,852
All Others	3,462	1,178	1,877	2,249	2,182	2,510	2,008	2,203	2,653	2,545
Total	716,793	702,746	581,792	655,138	632,747	604,773	606,120	522,760	487,765	423,325

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%	-39%	-36%	-36%	-39%	-43%	-69%	-68%	-69%
Mobile Sources	0%	-1%	-4%	13%	7%	2%	4%	-5%	-14%	-22%
Industrial Fuel Combustion & Processes	0%	2%	-35%	-38%	-38%	-38%	-39%	-39%	-39%	-63%
All Others	0%	-66%	-46%	-35%	-37%	-27%	-42%	-36%	-23%	-26%
Total	0%	-2%	-19%	-9%	-12%	-16%	-15%	-27%	-32%	-41%

Georgia Emission Trends (NO_x)

**Major Source Category Summary
Annual NO_x Emissions**



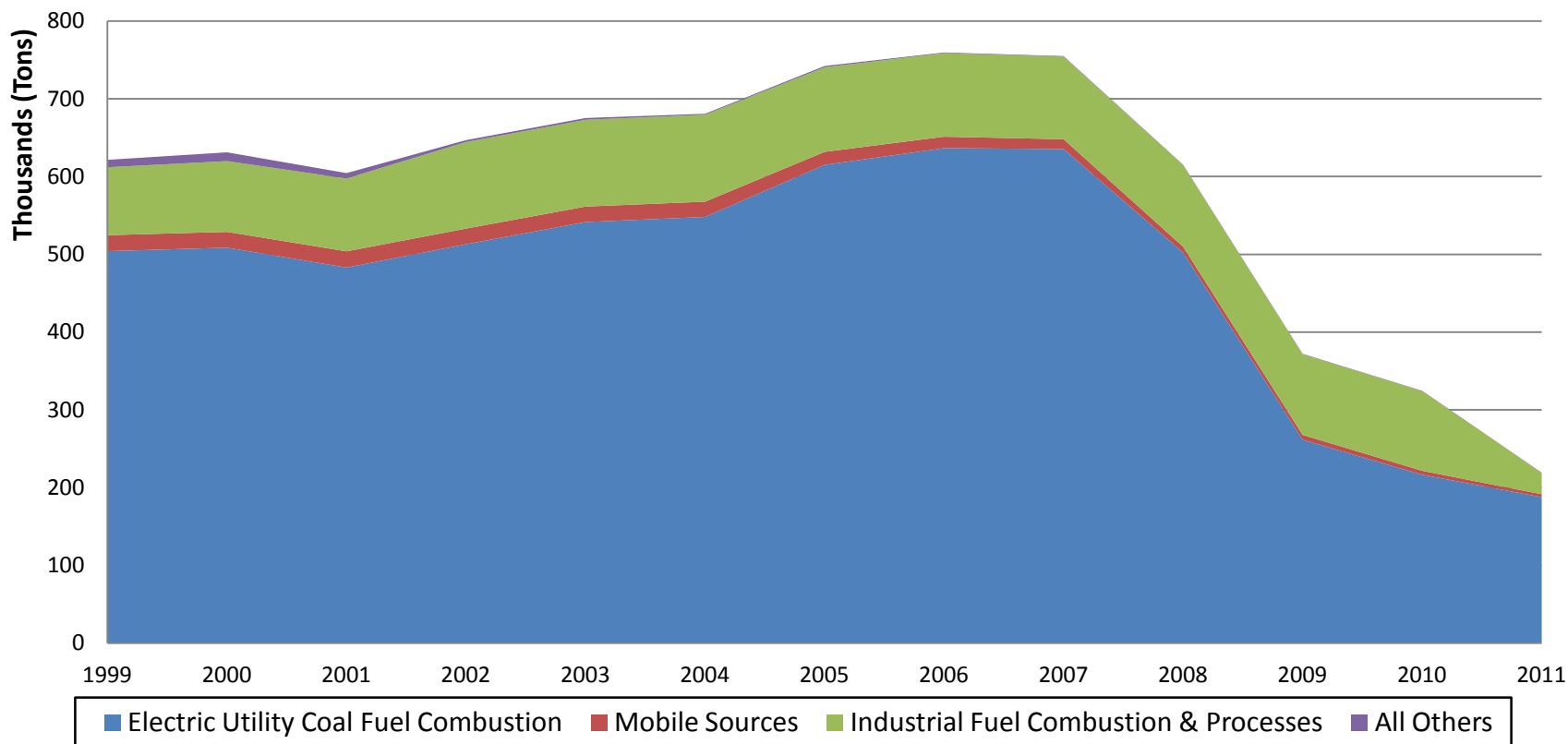
Georgia Emission Trends (SO₂)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	504,113	483,057	541,553	615,056	636,583	635,358	502,261	261,525	216,579	187,739
Mobile Sources	20,521	20,810	19,902	16,755	14,726	12,696	7,497	6,275	5,053	3,762
Industrial Fuel Combustion & Processes	87,372	93,700	111,574	108,752	107,508	106,264	105,020	103,776	102,532	27,573
All Others	9,507	6,902	2,288	1,672	824	688	496	514	461	269
Total	621,513	604,468	675,317	742,235	759,640	755,006	615,274	372,090	324,625	219,343

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-4%	7%	22%	26%	26%	0%	-48%	-57%	-63%
Mobile Sources	0%	1%	-3%	-18%	-28%	-38%	-63%	-69%	-75%	-82%
Industrial Fuel Combustion & Processes	0%	7%	28%	24%	23%	22%	20%	19%	17%	-68%
All Others	0%	-27%	-76%	-82%	-91%	-93%	-95%	-95%	-95%	-97%
Total	0%	-3%	9%	19%	22%	21%	-1%	-40%	-48%	-65%

Georgia Emission Trends (SO₂)

**Major Source Category Summary
Annual SO₂ Emissions**



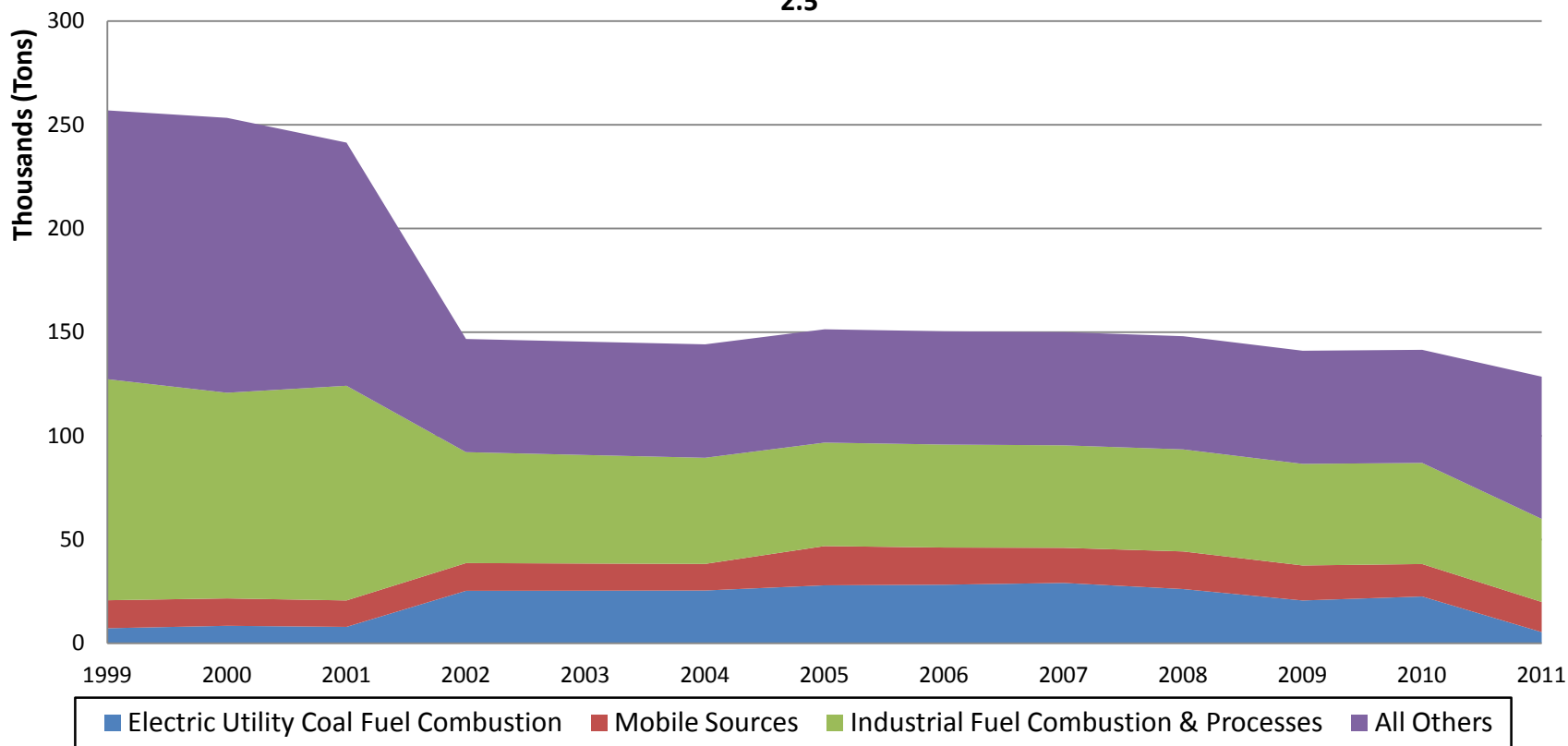
Georgia Emission Trends (PM_{2.5})

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	7,249	7,906	25,354	27,941	28,226	29,087	26,140	20,625	22,554	5,378
Mobile Sources	13,487	12,739	13,089	18,919	17,922	16,926	18,133	16,891	15,648	14,533
Industrial Fuel Combustion & Processes	106,583	103,513	52,331	49,883	49,656	49,429	49,202	48,975	48,748	40,039
All Others	129,613	117,237	54,644	54,636	54,617	54,597	54,574	54,556	54,537	68,588
Total	256,932	241,396	145,419	151,379	150,421	150,040	148,049	141,048	141,487	128,539

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	9%	250%	285%	289%	301%	261%	185%	211%	-26%
Mobile Sources	0%	-6%	-3%	40%	33%	25%	34%	25%	16%	8%
Industrial Fuel Combustion & Processes	0%	-3%	-51%	-53%	-53%	-54%	-54%	-54%	-54%	-62%
All Others	0%	-10%	-58%	-58%	-58%	-58%	-58%	-58%	-58%	-47%
Total	0%	-6%	-43%	-41%	-41%	-42%	-42%	-45%	-45%	-50%

Georgia 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 Georgia
- ❑ 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

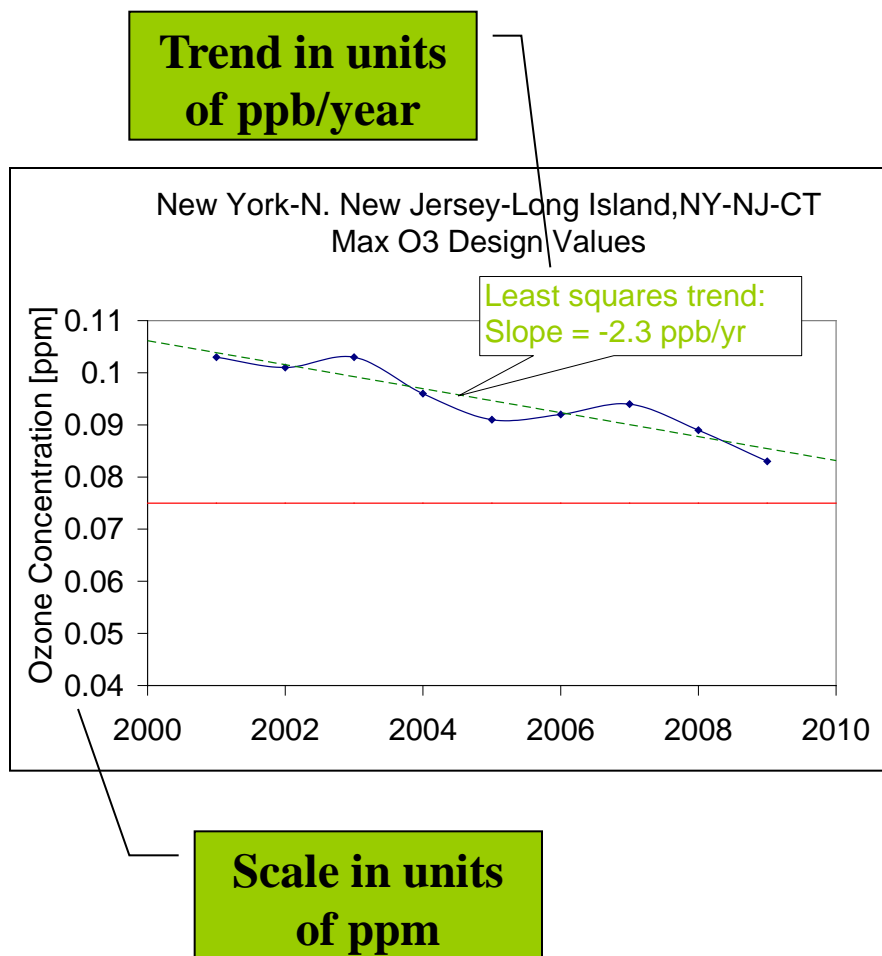
Data Handling Procedures

- 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

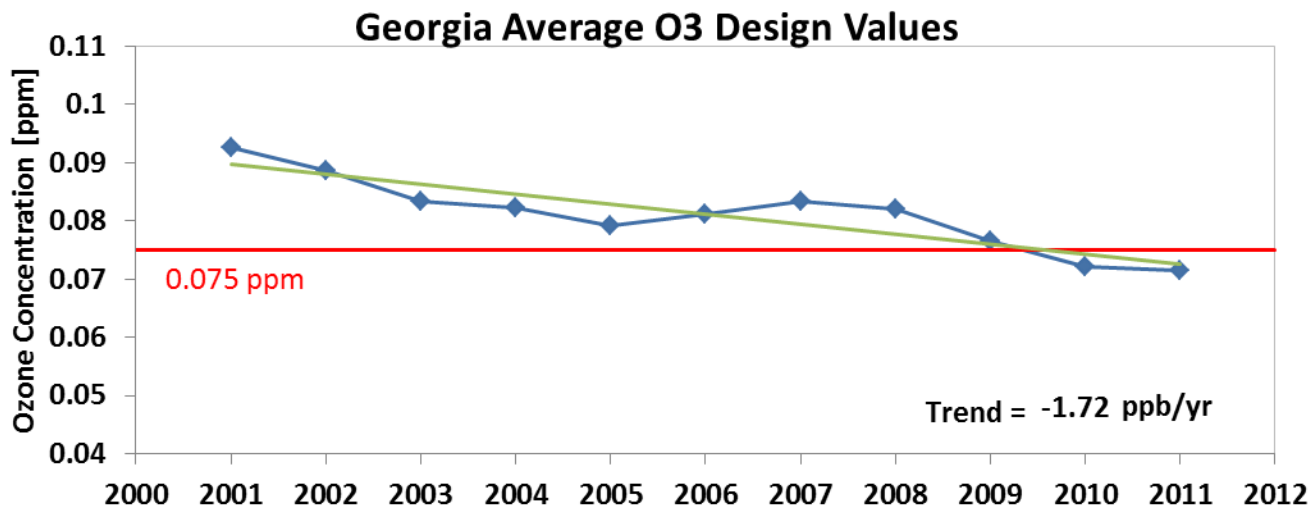
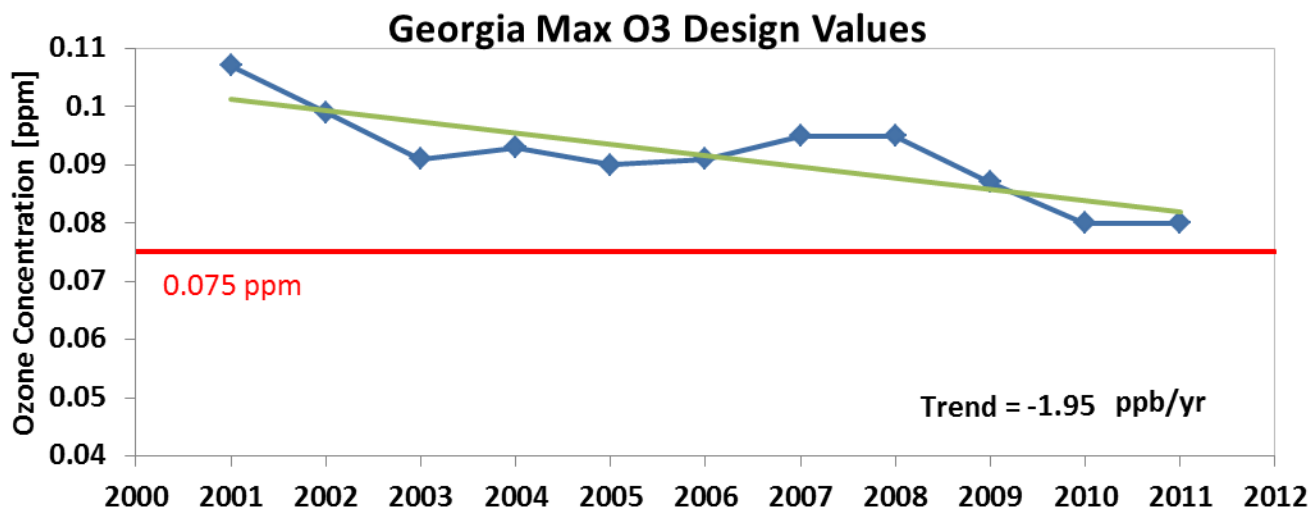
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculations based on EPA data handling conventions
 - Data extracted from monitors that have a non-regulatory monitoring type are omitted
 - Selection of trend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

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1302100124420101	Bibb, GA	0.073	-2.28
1305100214420101	Chatham, GA	0.064	-0.88
1306700034420101	Cobb, GA	0.078	-1.82
1307700024420101	Coweta, GA	0.067	-2.48
1308500014420102	Dawson, GA	0.068	-1.27
1308900024420101	De Kalb, GA	0.077	-1.51
1309700044420101	Douglas, GA	0.074	-2.09
1312100554420101	Fulton, GA	0.08	-2.05
1312700064420101	Glynn, GA	0.061	-1.29

Note: Only monitoring sites meeting data completeness criteria listed

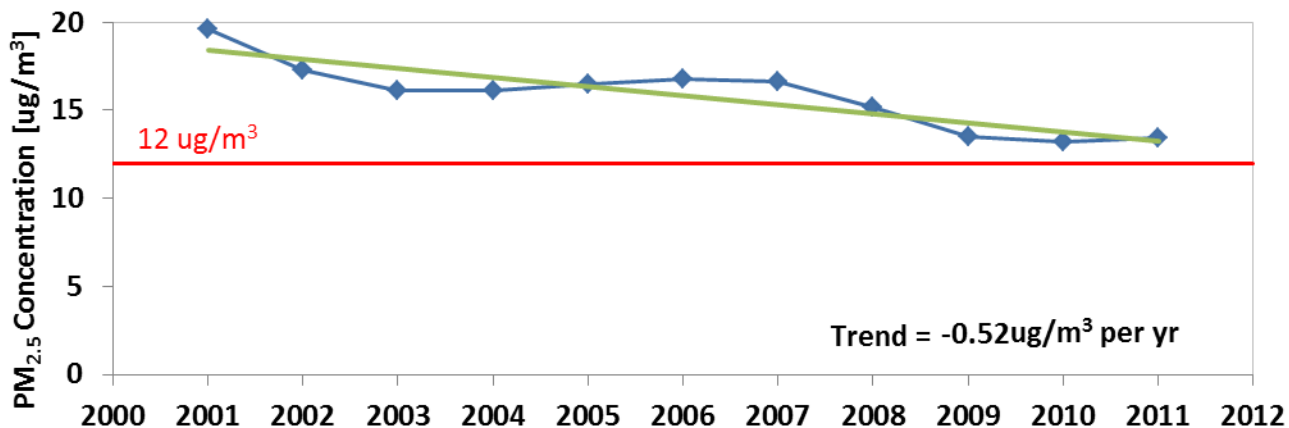
Ozone Trends by Site in Georgia

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1313500024420101	Gwinnett, GA	0.075	-1.52
1315100024420101	Henry, GA	0.078	-1.86
1321300034420101	Murray, GA	0.071	-1.59
1321500084420101	Muscogee, GA	0.067	-0.97
1322300034420101	Paulding, GA	0.071	-2.15
1324500914420101	Richmond, GA	0.069	-1.73
1324700014420101	Rockdale, GA	0.075	-1.85
1326110014420102	Sumter, GA	0.065	-1.62

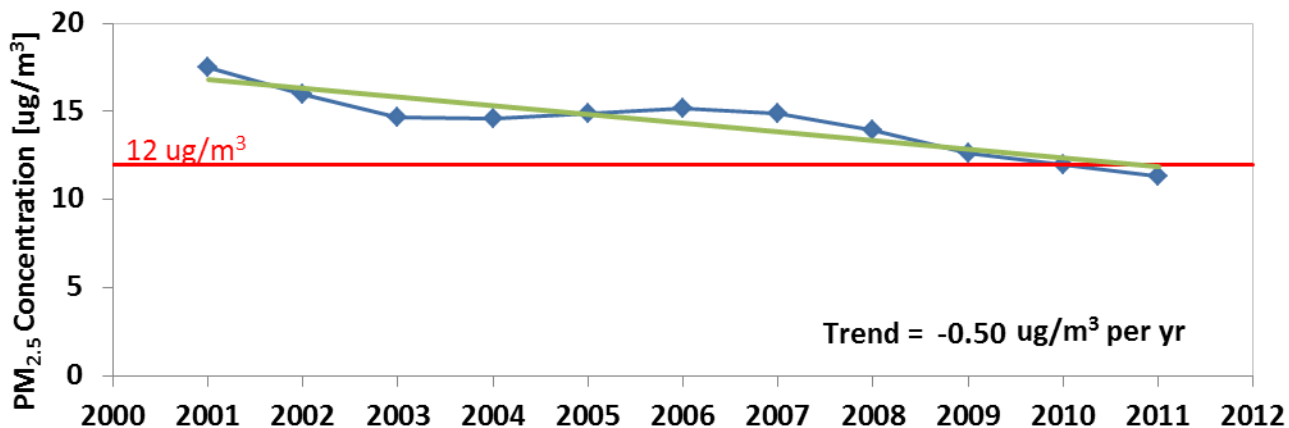
Note: Only monitoring sites meeting data completeness criteria listed

Max/Ave PM_{2.5} Annual DVs and Trend

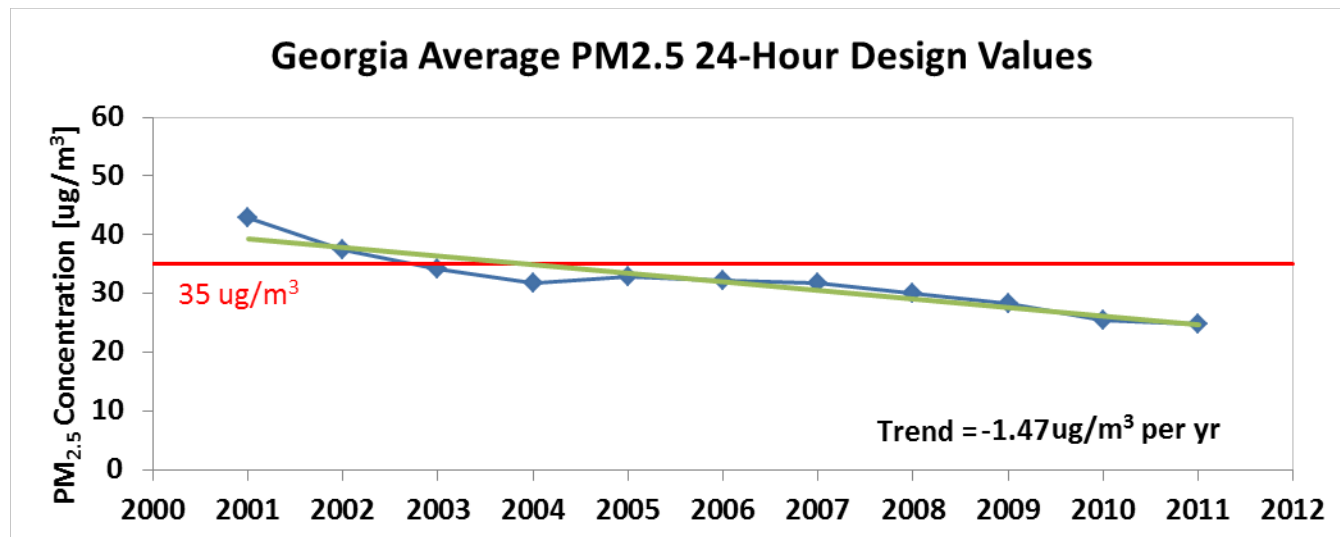
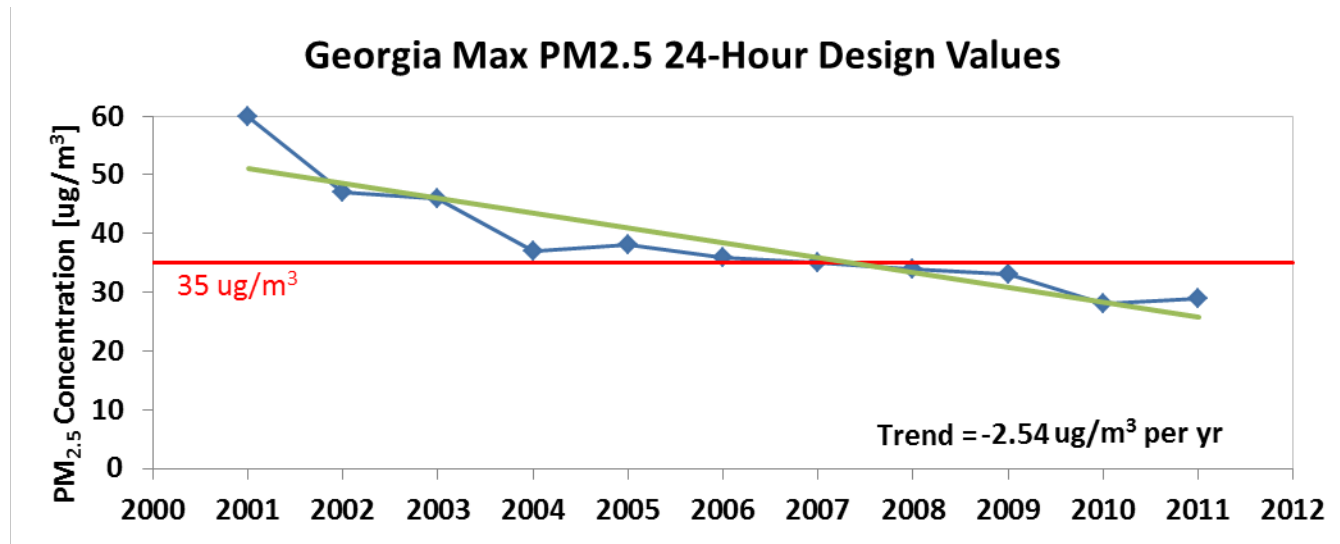
Georgia Max PM_{2.5} Annual Design Values



Georgia Average PM_{2.5} Annual Design Values



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



PM_{2.5} Trends by Site in Georgia

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
130210007	Bibb	13.4	N/A	-0.37	N/A
130210012	Bibb	11.0	24	-0.40	-0.89
130510017	Chatham	10.7	29	-0.49	-0.84
130630091	Clayton	N/A	N/A	-0.53	-2.12
130670003	Cobb	N/A	N/A	-0.52	-1.48
130890002	DeKalb	11.9	24	-0.55	-1.57
130892001	DeKalb	N/A	N/A	-0.63	-1.82
130950007	Dougherty	N/A	N/A	-0.32	-0.12
131150003	Floyd	N/A	N/A	-0.47	N/A
131350002	Gwinnett	N/A	N/A	-0.50	-1.93

Note: Only monitoring sites meeting data completeness criteria listed

PM_{2.5} Trends by Site in Georgia

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
131390003	Hall	10.7	23	-0.61	-1.16
131530001	Houston	N/A	24	N/A	-1.21
131850003	Lowndes	10.4	N/A	-0.27	N/A
132150001	Muscogee	N/A	N/A	-0.27	-0.68
132150011	Muscogee	N/A	N/A	-0.47	-1.82
132230003	Paulding	N/A	N/A	-0.46	-2.42
132450091	Richmond	N/A	N/A	-0.32	-1.02
133030001	Washington	N/A	N/A	-0.39	-2.57
133190001	Wilkinson	N/A	N/A	N/A	-1.09

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 Georgia
- O₃ and PM_{2.5} design values have decreased since 1999 in all currently designated O₃ and PM_{2.5} non-attainment areas in Georgia