Emission and Air Quality Trends Review

Florida

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, NOx, SO_2, 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

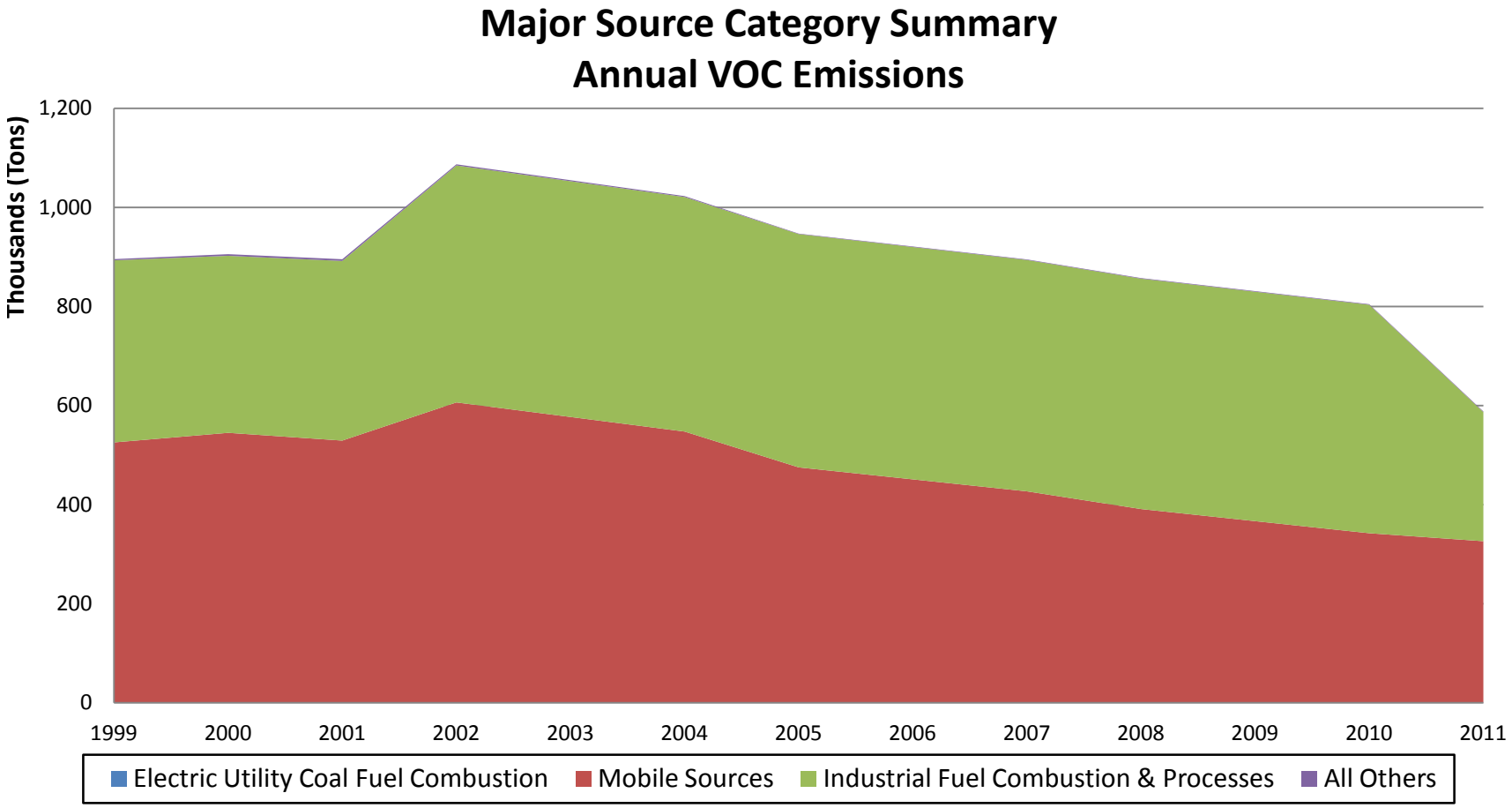
- Negative values indicate decrease in emissions, positive values indicate an increase

Florida Emission Trends (VOC)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	733	803	1,093	206	194	206	257	227	235	648
Mobile Sources	524,884	528,497	575,888	474,999	450,817	426,636	390,849	366,453	342,057	325,559
Industrial Fuel Combustion & Processes	367,658	362,629	475,912	471,016	469,058	467,100	465,138	463,183	461,224	260,713
All Others	2,340	3,461	2,059	904	1,081	1,068	1,162	1,189	1,158	1,285
Total	**895,615**	**895,390**	**1,054,953**	**947,125**	**921,151**	**895,010**	**857,406**	**831,052**	**804,674**	**588,205**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	9%	49%	-72%	-74%	-72%	-65%	-69%	-68%	-12%
Mobile Sources	0%	1%	10%	-10%	-14%	-19%	-26%	-30%	-35%	-38%
Industrial Fuel Combustion & Processes	0%	-1%	29%	28%	28%	27%	27%	26%	25%	-29%
All Others	0%	48%	-12%	-61%	-54%	-54%	-50%	-49%	-51%	-45%
Total	**0%**	**0%**	**18%**	**6%**	**3%**	**0%**	**-4%**	**-7%**	**-10%**	**-34%**

Florida Emission Trends (VOC)

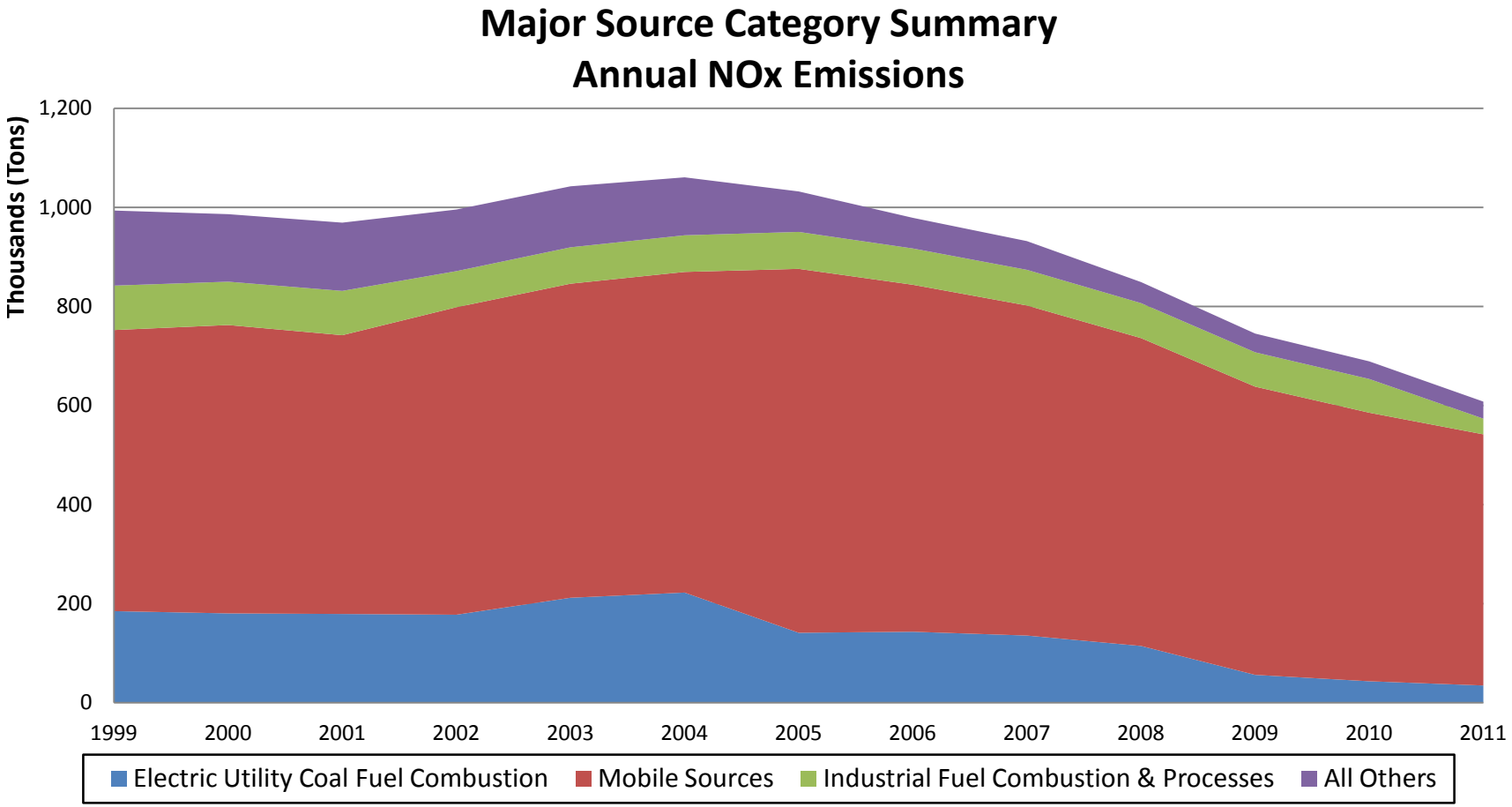


Florida Emission Trends (NOx)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	184,833	179,134	211,841	141,140	143,214	135,555	114,528	56,170	43,269	34,694
Mobile Sources	567,563	562,826	634,094	734,763	700,580	666,396	621,585	581,896	542,207	507,097
Industrial Fuel Combustion & Processes	89,691	89,416	73,469	74,585	73,281	71,981	70,609	69,367	68,074	31,711
All Others	151,529	137,808	123,132	81,689	61,844	57,967	42,475	37,795	35,568	34,354
Total	**993,615**	**969,184**	**1,042,536**	**1,032,177**	**978,919**	**931,899**	**849,198**	**745,228**	**689,118**	**607,856**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	-3%	15%	-24%	-23%	-27%	-38%	-70%	-77%	-81%
Mobile Sources	0%	-1%	12%	29%	23%	17%	10%	3%	-4%	-11%
Industrial Fuel Combustion & Processes	0%	0%	-18%	-17%	-18%	-20%	-21%	-23%	-24%	-65%
All Others	0%	-9%	-19%	-46%	-59%	-62%	-72%	-75%	-77%	-77%
Total	**0%**	**-2%**	**5%**	**4%**	**-1%**	**-6%**	**-15%**	**-25%**	**-31%**	**-39%**

Florida Emission Trends (NOx)

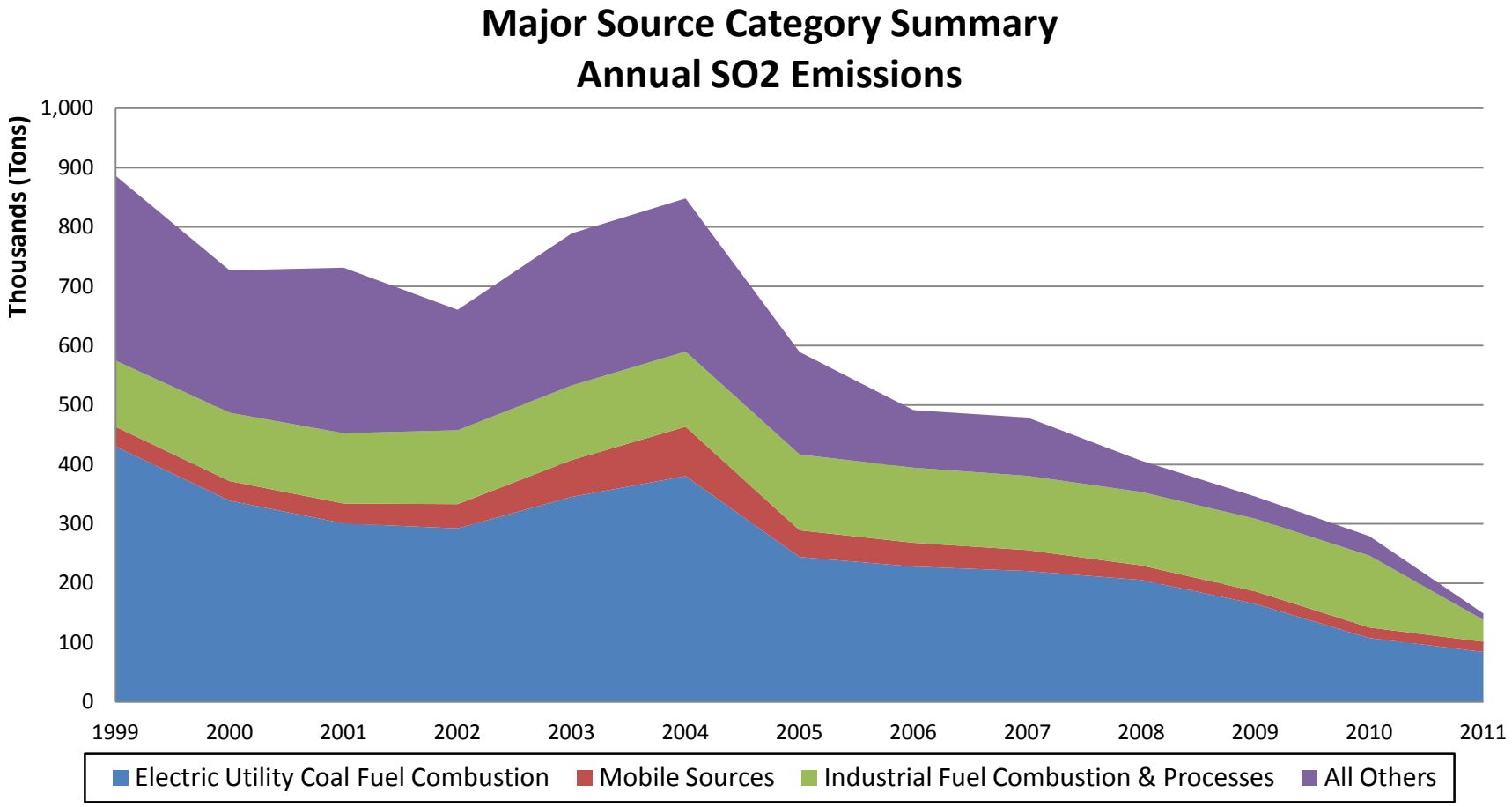


Florida Emission Trends (SO_2)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	430,053	300,720	345,319	244,132	228,034	220,534	205,384	165,038	107,580	84,252
Mobile Sources	33,319	33,486	61,985	44,916	40,059	35,202	24,458	21,123	17,788	16,984
Industrial Fuel Combustion & Processes	111,416	118,379	125,580	127,785	126,428	125,070	123,712	122,356	120,998	36,959
All Others	311,283	278,819	256,208	172,565	96,949	98,155	52,601	37,311	32,804	10,835
Total	**886,071**	**731,404**	**789,092**	**589,397**	**491,469**	**478,961**	**406,156**	**345,827**	**279,171**	**149,030**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	-30%	-20%	-43%	-47%	-49%	-52%	-62%	-75%	-80%
Mobile Sources	0%	1%	86%	35%	20%	6%	-27%	-37%	-47%	-49%
Industrial Fuel Combustion & Processes	0%	6%	13%	15%	13%	12%	11%	10%	9%	-67%
All Others	0%	-10%	-18%	-45%	-69%	-68%	-83%	-88%	-89%	-97%
Total	**0%**	**-17%**	**-11%**	**-33%**	**-45%**	**-46%**	**-54%**	**-61%**	**-68%**	**-83%**

Florida Emission Trends (SO_2)

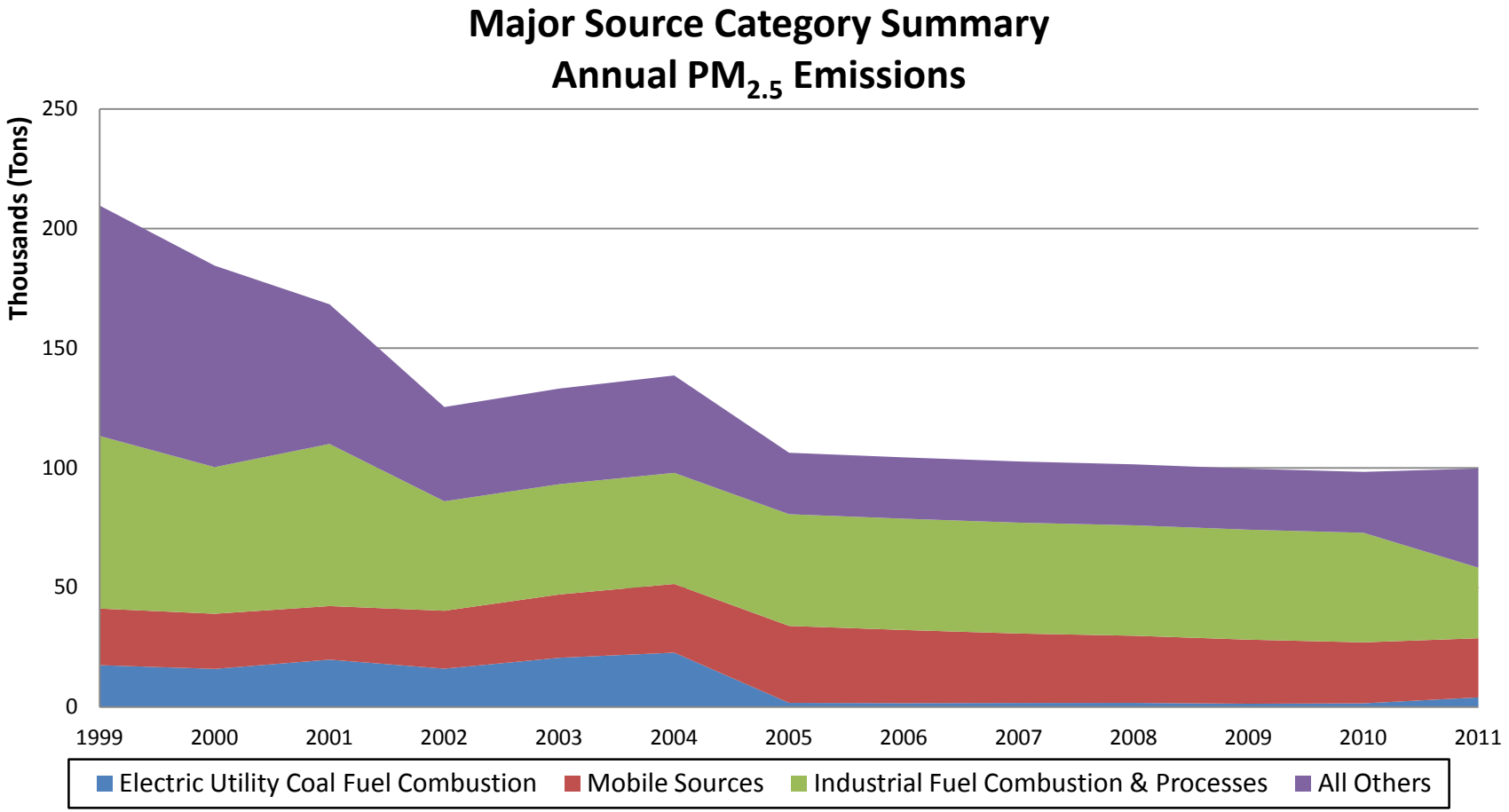


Florida Emission Trends ($PM_{2.5}$)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	17,498	19,809	20,594	1,743	1,619	1,705	1,733	1,376	1,540	4,028
Mobile Sources	23,666	22,403	26,466	32,169	30,602	29,035	28,077	26,792	25,508	24,733
Industrial Fuel Combustion & Processes	72,148	67,769	46,100	46,701	46,519	46,338	46,155	45,974	45,792	29,487
All Others	96,302	58,381	39,969	25,682	25,626	25,577	25,492	25,479	25,470	41,473
Total	**209,614**	**168,362**	**133,129**	**106,296**	**104,366**	**102,654**	**101,458**	**99,622**	**98,310**	**99,721**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	13%	18%	-90%	-91%	-90%	-90%	-92%	-91%	-77%
Mobile Sources	0%	-5%	12%	36%	29%	23%	19%	13%	8%	5%
Industrial Fuel Combustion & Processes	0%	-6%	-36%	-35%	-36%	-36%	-36%	-36%	-37%	-59%
All Others	0%	-39%	-58%	-73%	-73%	-73%	-74%	-74%	-74%	-57%
Total	**0%**	**-20%**	**-36%**	**-49%**	**-50%**	**-51%**	**-52%**	**-52%**	**-53%**	**-52%**

Florida Emission Trends ($PM_{2.5}$)



Emission Trends Summary

- All pollutants have decreased since 1999 in aggregate across Florida
- NOx and SO2 from Electric Utility Fuel Combustion sources show significant decrease over time as a result of Acid Rain Program, NOx 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/m^3
- $PM_{2.5}$ 24-Hour
  - Annual 98th percentile of daily averages averaged over three consecutive years
  - Current standard = 35 ug/m^3

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

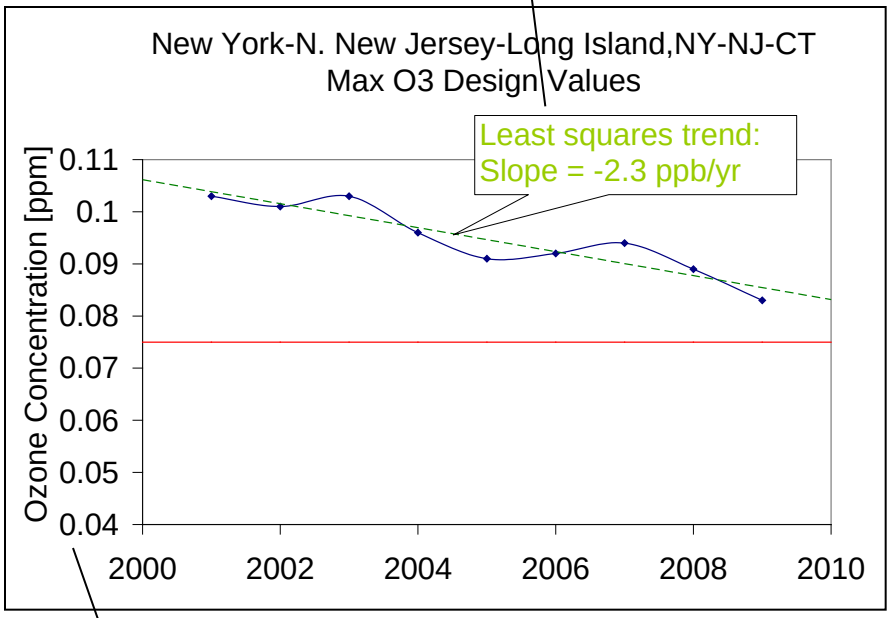
- O_3 design value (DV) for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculated using annual 4th highest daily max 8-hr averages and percent of valid observations, based on EPA data handling conventions
  - Data associated with exceptional events that 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

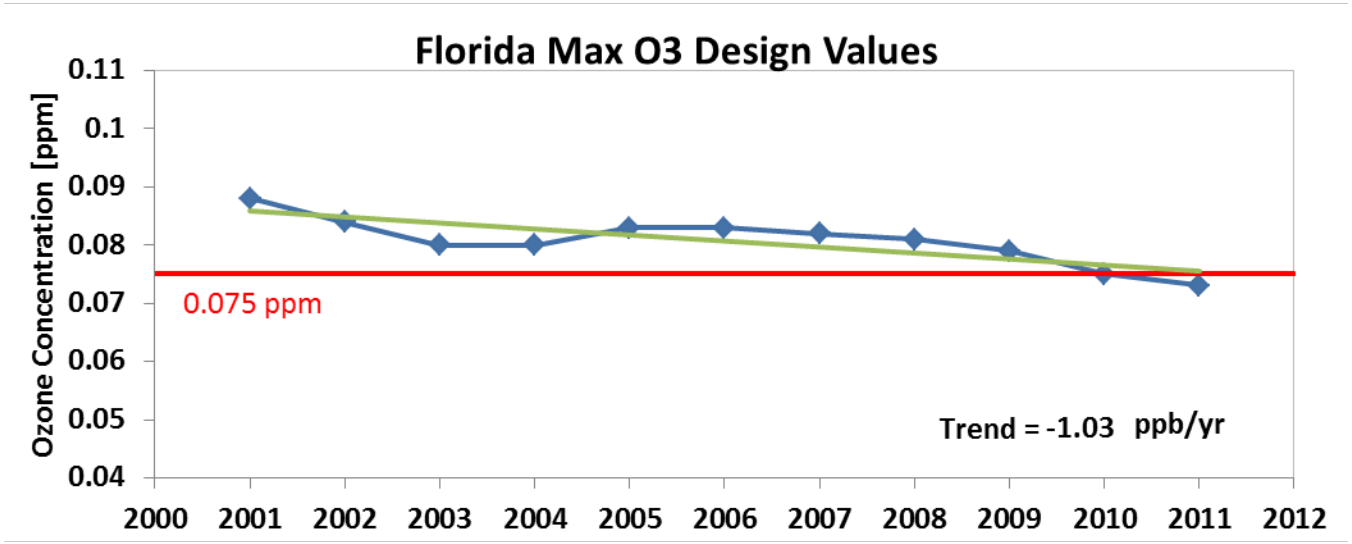
Trend in units of ppb/year

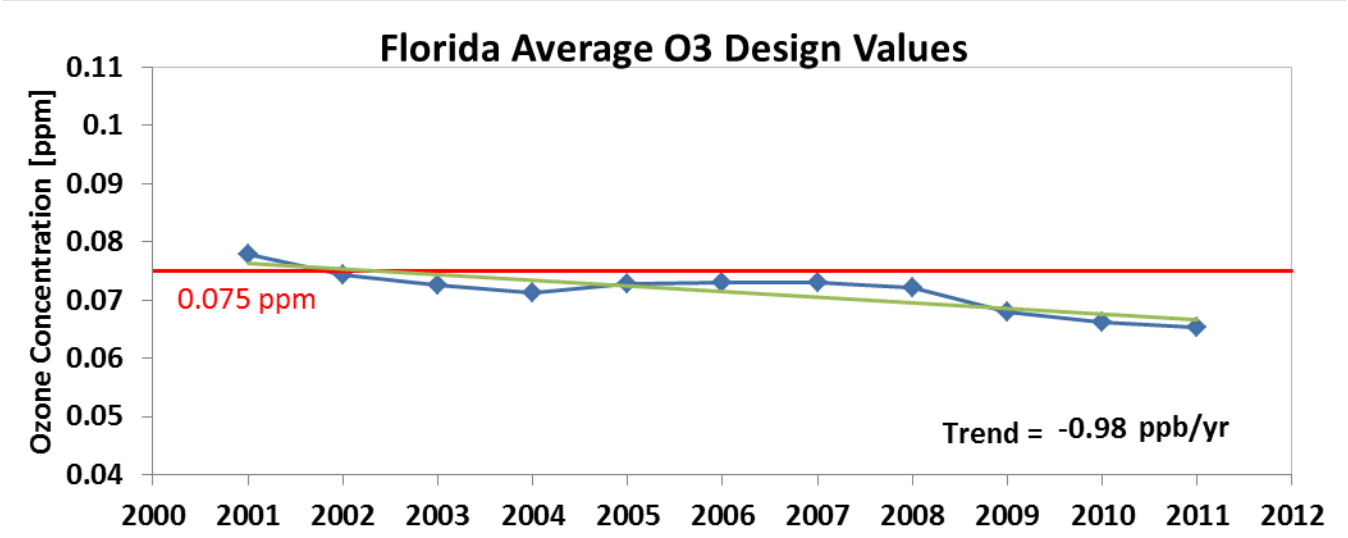


Scale in units of ppm

- 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 O_3 DVs and Trend





Ozone Trends by Site in Florida

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1200300024420101	Baker, FL	0.061	-1.26
1200500064420101	Bay, FL	0.069	-1.32
1200900074420101	Brevard, FL	0.064	-1.13
1200940014420101	Brevard, FL	0.063	-1.00
1201100314420101	Broward, FL	N/A	-0.25
1201120034420101	Broward, FL	0.058	-0.99
1201180024420101	Broward, FL	0.06	-1.01
1202300024420101	Columbia, FL	0.063	-1.10
1203100774420101	Duval, FL	0.066	-0.24
1203300044420101	Escambia, FL	0.07	-0.64
1203300184420101	Escambia, FL	0.073	-1.18

Note: Only monitoring sites meeting data completeness criteria listed

Ozone Trends by Site in Florida

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1205500034420101	Highlands, FL	0.064	-0.23
1205700814420101	Hillsborough, FL	0.073	-0.43
1205710354420101	Hillsborough, FL	0.069	-0.64
1205710654420101	Hillsborough, FL	0.072	-0.86
1205900044420101	Holmes, FL	0.062	-0.98
1206900024420101	Lake, FL	0.066	-1.45
1207120024420101	Lee, FL	0.063	-0.58
1207130024420101	Lee, FL	0.061	-0.97
1207300124420101	Leon, FL	0.062	-1.11
1207300134420101	Leon, FL	0.063	-0.67
1208130024420101	Manatee, FL	N/A	-1.96

Note: Only monitoring sites meeting data completeness criteria listed

Ozone Trends by Site in Florida

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1208140124420101	Manatee, FL	0.062	-2.29
1208300034420101	Marion, FL	0.064	-1.18
1208300044420101	Marion, FL	0.062	-1.45
1208600274420101	Miami-Dade, FL	0.065	-0.15
1208600294420101	Miami-Dade, FL	0.063	-0.34
1209500084420101	Orange, FL	0.071	-0.78
1209520024420101	Orange, FL	0.071	-0.96
1209720024420101	Osceola, FL	0.066	-0.70
1210100054420101	Pasco, FL	0.067	-0.56
1210120014420101	Pasco, FL	0.063	-1.52
1210300044420101	Pinellas, FL	0.066	-1.43

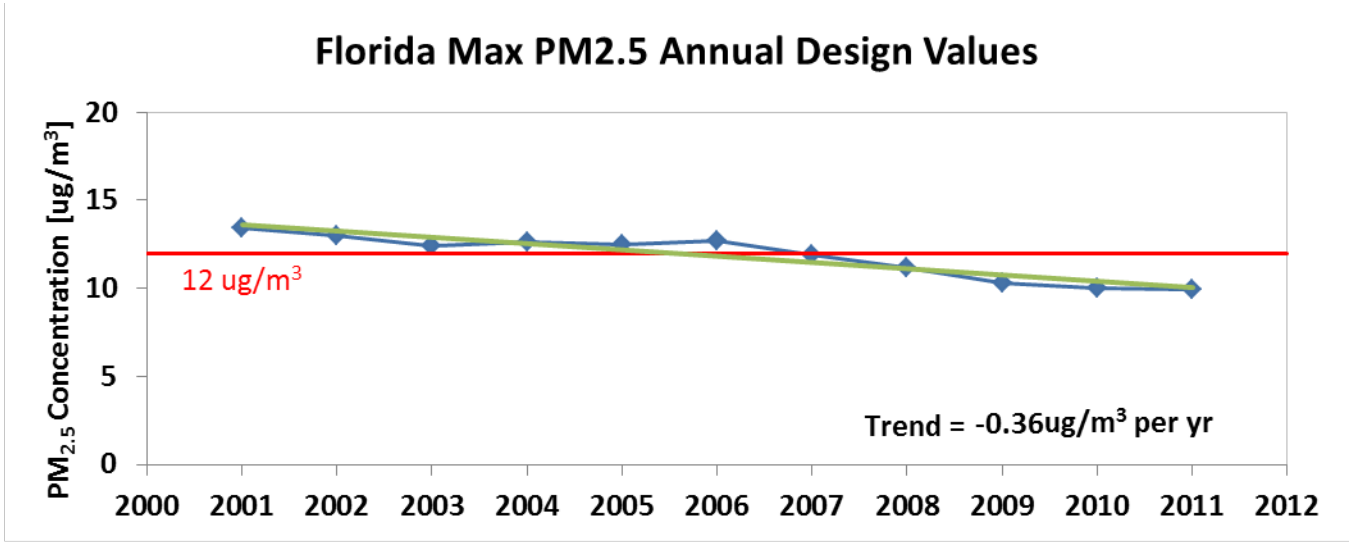
Note: Only monitoring sites meeting data completeness criteria listed

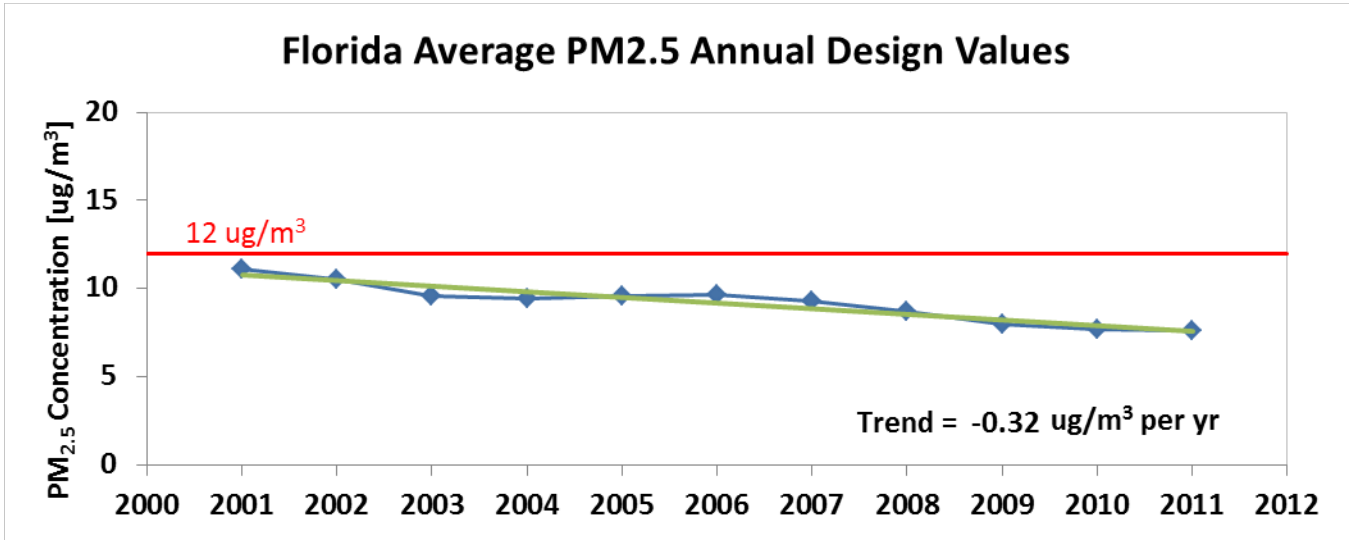
Ozone Trends by Site in Florida

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1210300184420101	Pinellas, FL	0.065	-1.00
1210350024420101	Pinellas, FL	0.063	-1.35
1210560054420101	Polk, FL	0.066	-1.05
1210560064420101	Polk, FL	0.068	-1.02
1211510054420101	Sarasota, FL	0.072	-1.12
1211510064420101	Sarasota, FL	0.068	-0.42
1211710024420101	Seminole, FL	0.066	-1.40
1212720014420101	Volusia, FL	0.059	-1.20
1212750024420101	Volusia, FL	0.063	-1.07
1212900014420101	Wakulla, FL	0.063	-1.42

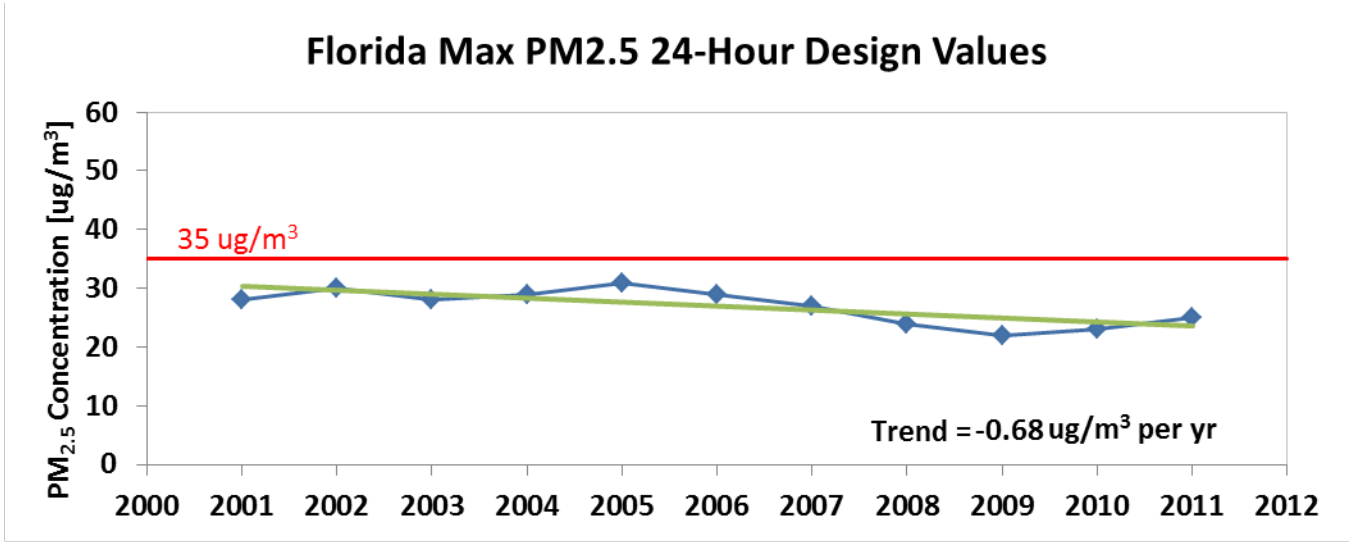
Note: Only monitoring sites meeting data completeness criteria listed

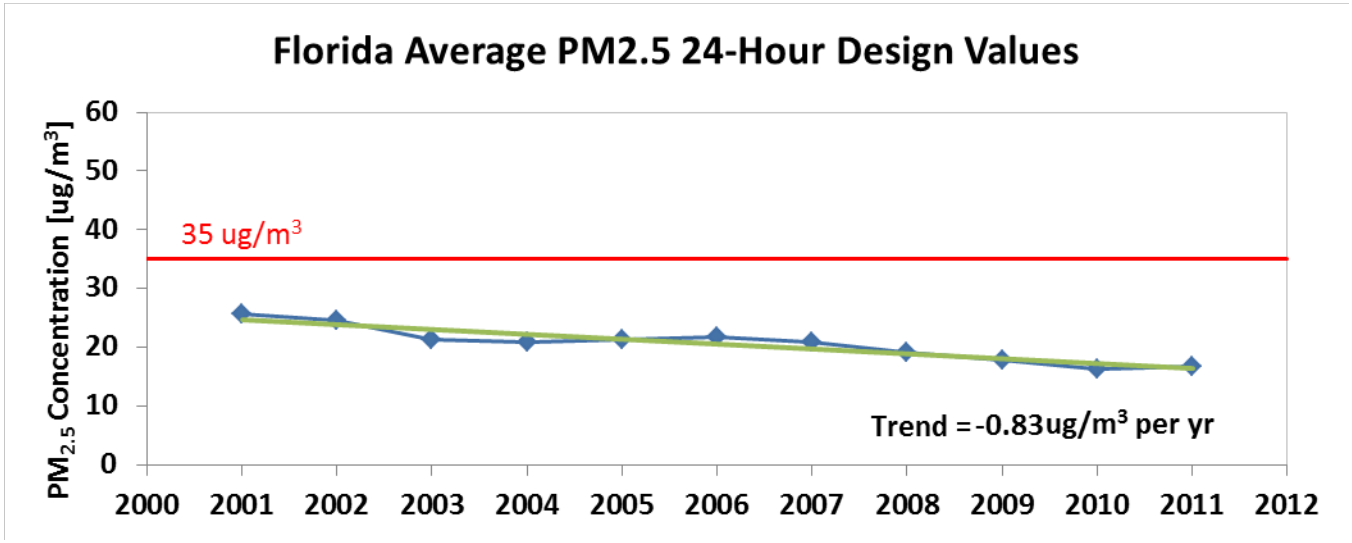
Max/Ave $PM_{2.5}$ Annual DVs and Trend





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





$PM_{2.5}$ Trends by Site in Florida

		2009-2011 DV [ug/m³]		Trend [ug/m³ per year]	
Monitoring Site	County	Annual	24-Hr	Annual DV	24-Hr DV
120010023	Alachua	7.7	20	-0.33	-0.79
120090007	Brevard	6.6	15	-0.18	-0.30
120111002	Broward	6.8	15	-0.18	-0.51
120170005	Citrus	7.3	16	-0.28	-1.01
120310098	Duval	8.3	22	-0.26	-0.60
120310099	Duval	8.4	N/A	-0.28	N/A
120330004	Escambia	9.0	20	-0.38	-0.82
120570030	Hillsborough	N/A	N/A	-0.40	-1.07
120710005	Lee	6.9	13	-0.24	-0.78
120730012	Leon	9.9	25	-0.36	-0.72
120861016	Miami-Dade	7.5	14	-0.27	-0.53

Note: Only monitoring sites meeting data completeness criteria listed

$PM_{2.5}$ Trends by Site in Florida

		2009-2011 DV [ug/m³]		Trend [ug/m³ per year]	
Monitoring Site	County	Annual	24-Hr	Annual DV	24-Hr DV
120866001	Miami-Dade	6.5	13	-0.21	-0.58
120951004	Orange	7.3	15	-0.41	-1.16
120952002	Orange	7.2	16	-0.39	-0.98
121030018	Pinellas	7.7	16	-0.38	-0.96
121056006	Polk	7.5	15	-0.37	-0.90
121111002	St. Lucie	N/A	N/A	-0.19	-0.33
121150013	Sarasota	6.8	15	-0.35	-1.16
121171002	Seminole	7.5	16	-0.26	-0.71

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O_3 and $PM_{2.5}$ design values have decreased since 1999 in Florida.

- There are no currently designated O_3 or $PM_{2.5}$ non-attainment areas in Florida.