Emission and Air Quality Trends Review

New York

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

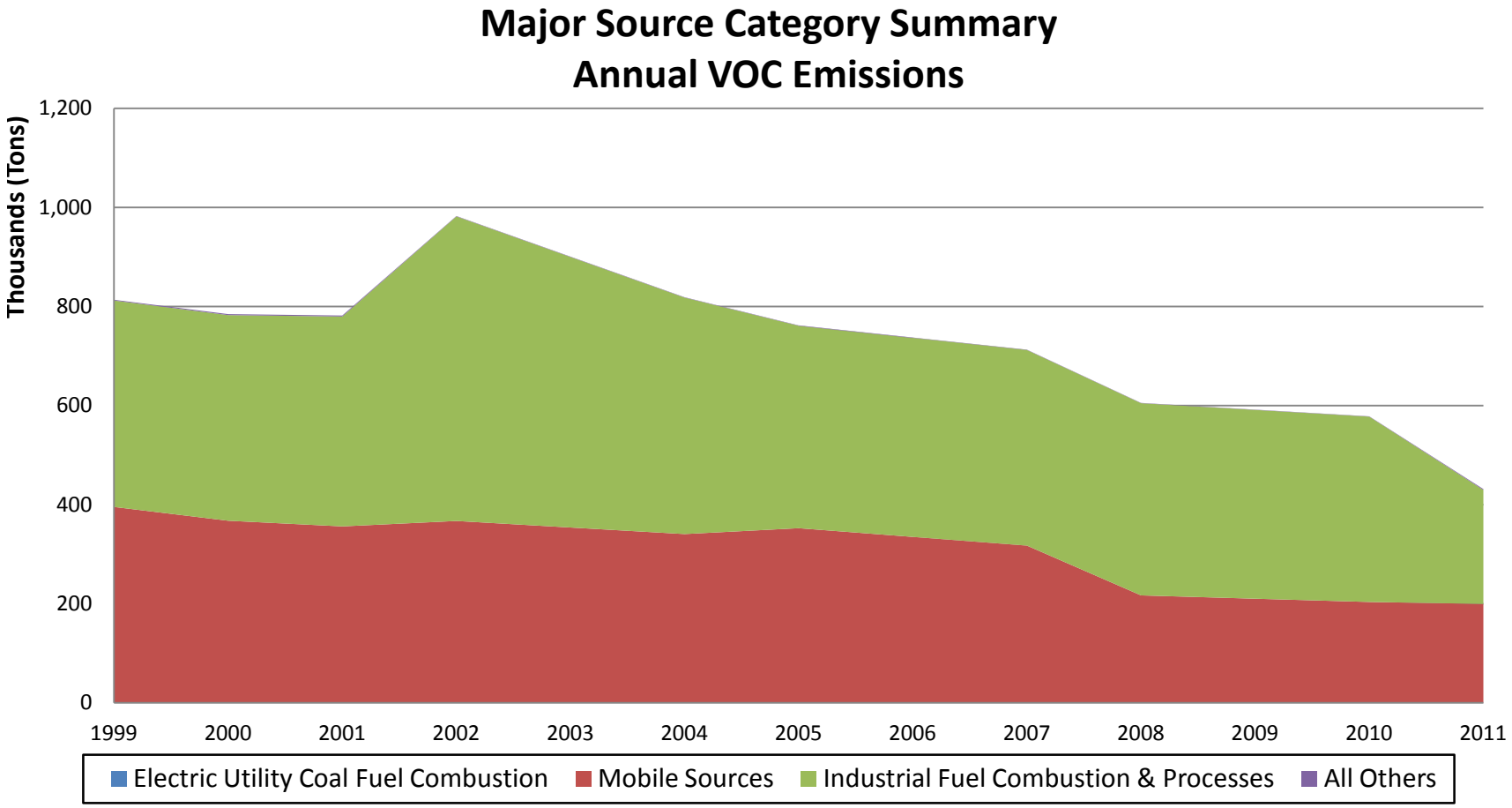
- Negative values indicate decrease in emissions, positive values indicate an increase

New York Emission Trends (VOC)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	259	263	310	221	218	215	216	155	168	171
Mobile Sources	395,076	355,812	353,514	352,228	334,659	317,090	216,589	209,965	203,341	199,385
Industrial Fuel Combustion & Processes	416,728	423,728	546,115	408,661	401,755	394,848	387,990	381,087	374,173	230,202
All Others	1,465	1,972	739	732	643	656	587	567	608	1,710
Total	**813,528**	**781,774**	**900,678**	**761,843**	**737,274**	**712,809**	**605,381**	**591,774**	**578,291**	**431,467**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	1%	20%	-14%	-16%	-17%	-17%	-40%	-35%	-34%
Mobile Sources	0%	-10%	-11%	-11%	-15%	-20%	-45%	-47%	-49%	-50%
Industrial Fuel Combustion & Processes	0%	2%	31%	-2%	-4%	-5%	-7%	-9%	-10%	-45%
All Others	0%	35%	-50%	-50%	-56%	-55%	-60%	-61%	-58%	17%
Total	**0%**	**-4%**	**11%**	**-6%**	**-9%**	**-12%**	**-26%**	**-27%**	**-29%**	**-47%**

New York Emission Trends (VOC)

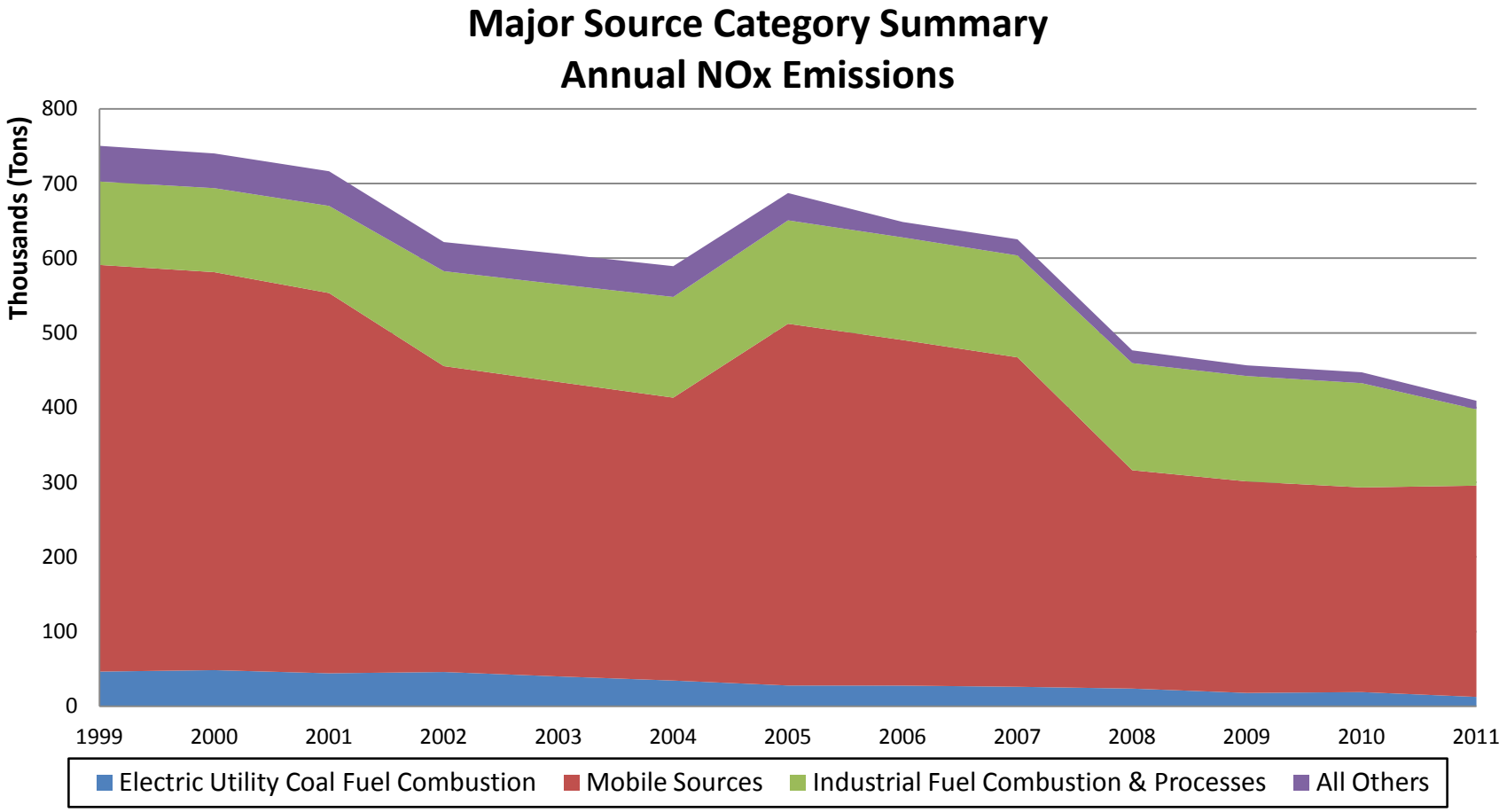


New York Emission Trends (NOx)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	46,470	44,173	39,961	27,808	27,648	26,081	23,678	17,851	18,976	12,548
Mobile Sources	544,529	509,193	394,254	484,443	462,803	441,163	292,432	283,256	274,080	282,906
Industrial Fuel Combustion & Processes	111,667	116,687	130,922	138,458	137,407	136,450	143,395	141,113	139,645	102,199
All Others	47,809	46,410	40,838	36,567	20,673	21,621	17,132	14,321	14,549	11,483
Total	**750,474**	**716,463**	**605,974**	**687,275**	**648,530**	**625,315**	**476,637**	**456,541**	**447,250**	**409,136**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	-5%	-14%	-40%	-41%	-44%	-49%	-62%	-59%	-73%
Mobile Sources	0%	-6%	-28%	-11%	-15%	-19%	-46%	-48%	-50%	-48%
Industrial Fuel Combustion & Processes	0%	4%	17%	24%	23%	22%	28%	26%	25%	-8%
All Others	0%	-3%	-15%	-24%	-57%	-55%	-64%	-70%	-70%	-76%
Total	**0%**	**-5%**	**-19%**	**-8%**	**-14%**	**-17%**	**-36%**	**-39%**	**-40%**	**-45%**

New York Emission Trends (NOx)

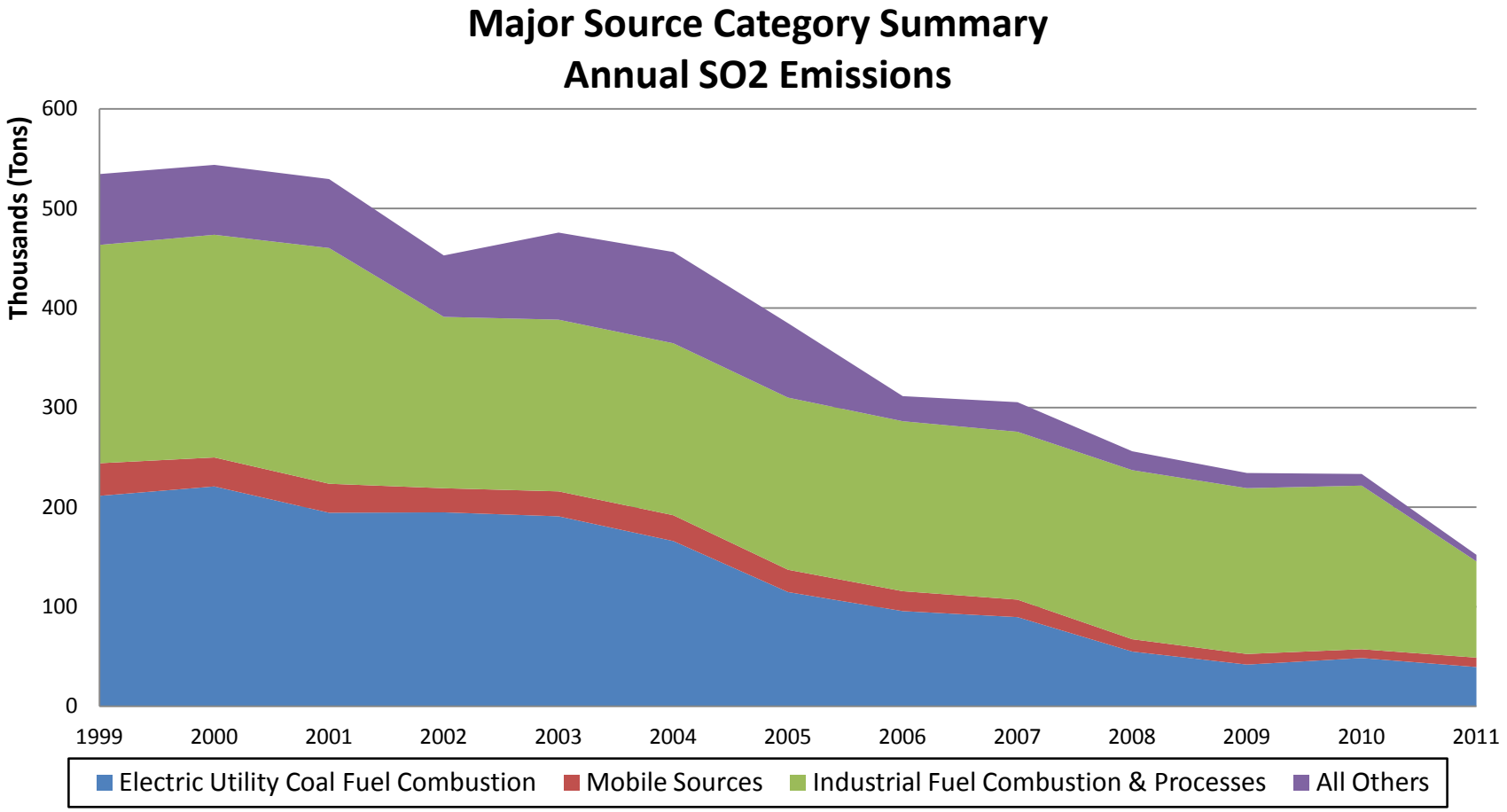


New York Emission Trends (SO_2)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	211,357	194,358	190,768	114,683	95,569	89,542	54,944	41,871	48,415	39,399
Mobile Sources	32,737	29,137	25,084	22,429	19,993	17,557	12,409	10,651	8,892	9,440
Industrial Fuel Combustion & Processes	219,298	236,758	172,425	172,876	170,740	168,613	169,800	166,525	164,318	96,646
All Others	71,147	69,244	87,470	74,754	25,175	29,686	18,958	15,247	11,682	6,630
Total	**534,539**	**529,498**	**475,746**	**384,742**	**311,477**	**305,398**	**256,111**	**234,295**	**233,307**	**152,115**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	-8%	-10%	-46%	-55%	-58%	-74%	-80%	-77%	-81%
Mobile Sources	0%	-11%	-23%	-31%	-39%	-46%	-62%	-67%	-73%	-71%
Industrial Fuel Combustion & Processes	0%	8%	-21%	-21%	-22%	-23%	-23%	-24%	-25%	-56%
All Others	0%	-3%	23%	5%	-65%	-58%	-73%	-79%	-84%	-91%
Total	**0%**	**-1%**	**-11%**	**-28%**	**-42%**	**-43%**	**-52%**	**-56%**	**-56%**	**-72%**

New York Emission Trends (SO_2)

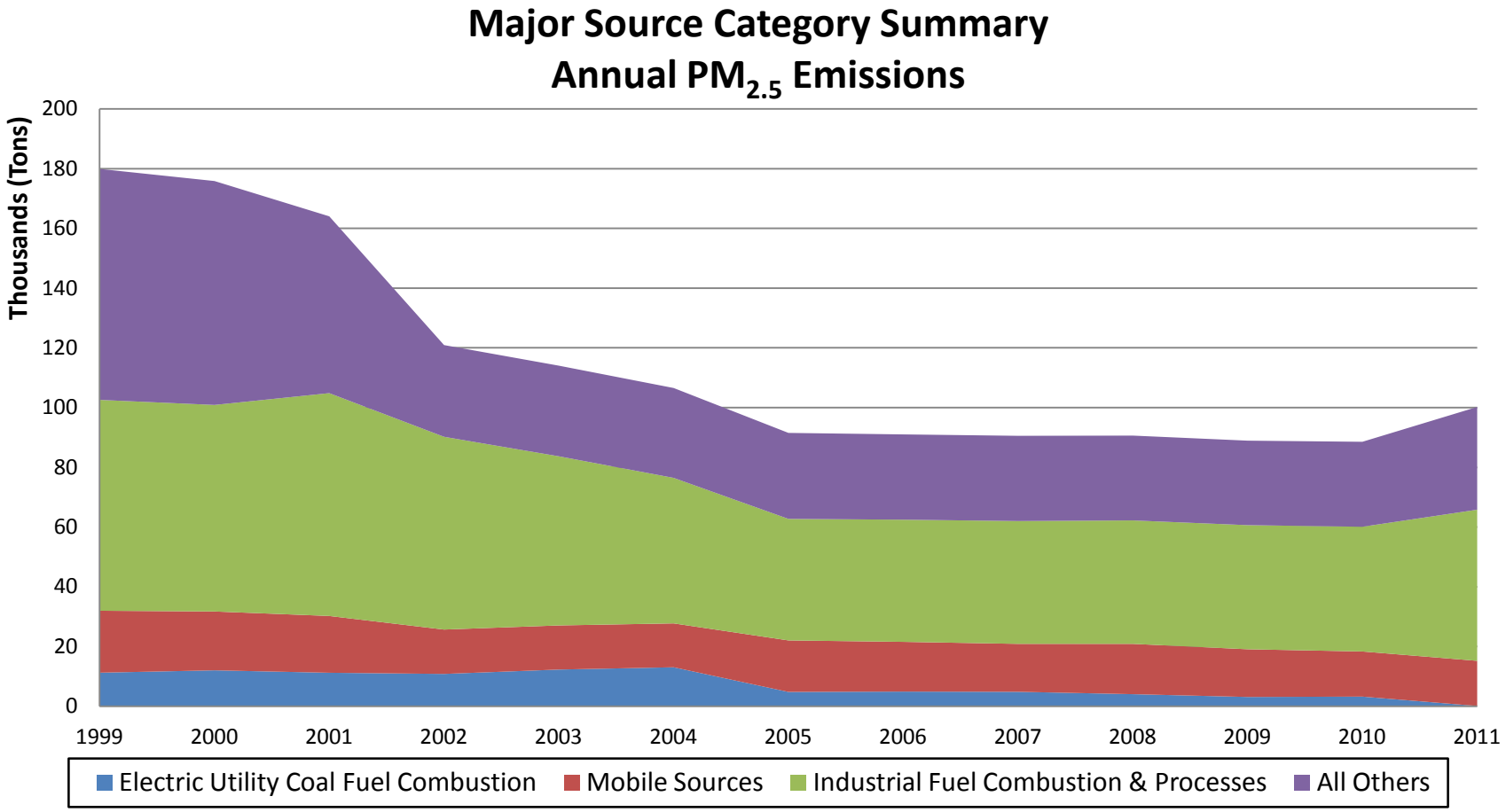


New York Emission Trends ($PM_{2.5}$)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	11,240	11,218	12,294	4,802	4,916	4,840	4,049	3,114	3,236	106
Mobile Sources	20,740	19,014	14,771	17,246	16,649	16,052	16,841	15,974	15,106	15,108
Industrial Fuel Combustion & Processes	70,593	74,601	56,624	40,684	40,899	41,113	41,331	41,545	41,760	50,597
All Others	77,324	59,195	30,338	28,784	28,552	28,538	28,396	28,288	28,442	34,389
Total	**179,897**	**164,027**	**114,027**	**91,517**	**91,015**	**90,544**	**90,618**	**88,921**	**88,544**	**100,201**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	0%	9%	-57%	-56%	-57%	-64%	-72%	-71%	-99%
Mobile Sources	0%	-8%	-29%	-17%	-20%	-23%	-19%	-23%	-27%	-27%
Industrial Fuel Combustion & Processes	0%	6%	-20%	-42%	-42%	-42%	-41%	-41%	-41%	-28%
All Others	0%	-23%	-61%	-63%	-63%	-63%	-63%	-63%	-63%	-56%
Total	**0%**	**-9%**	**-37%**	**-49%**	**-49%**	**-50%**	**-50%**	**-51%**	**-51%**	**-44%**

New York Emission Trends ($PM_{2.5}$)



Emission Trends Summary

- All pollutants have decreased since 1999 in aggregate across New York
- 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

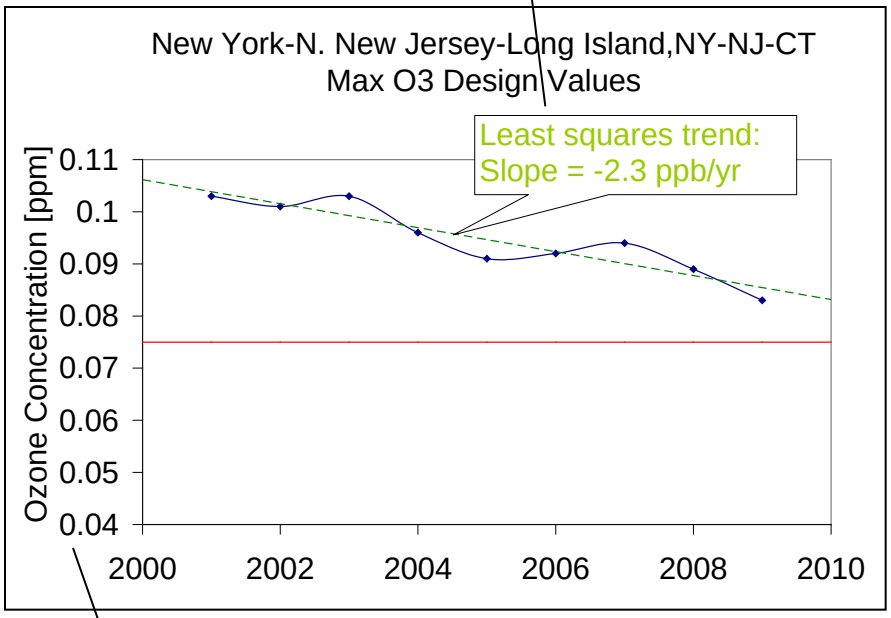
Data Handling Procedures

- 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

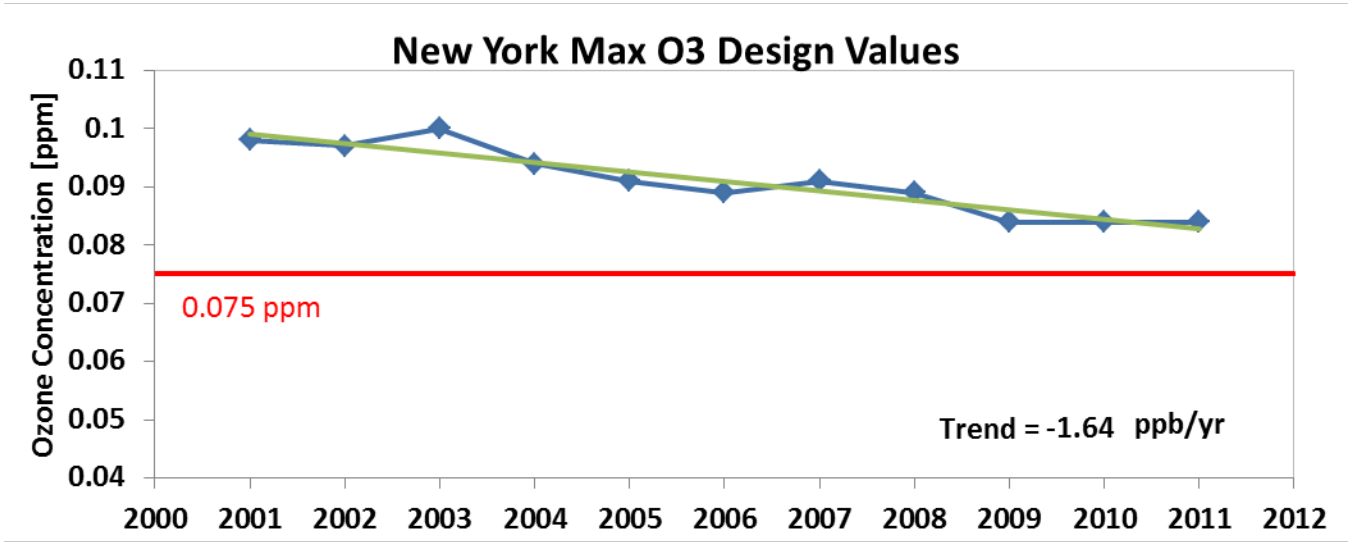
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculations based on EPA data handling conventions
  - Data extracted from monitors that have a non-regulatory monitoring type are omitted
  - Selection of trend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

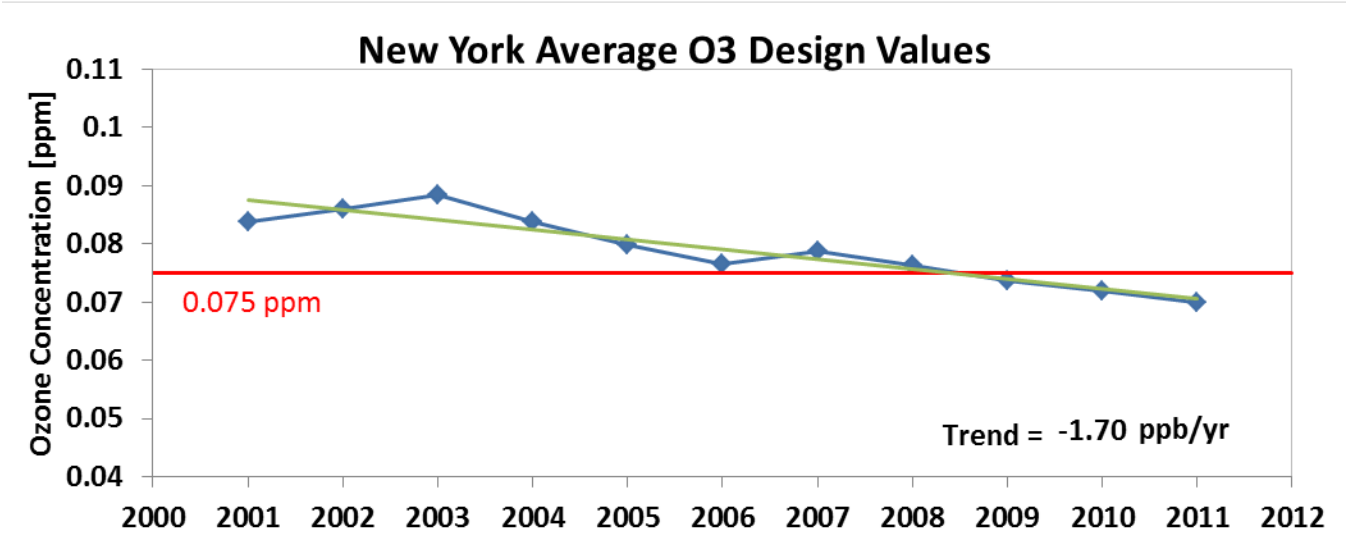
Trend Calculation



- 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 New York

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
3600100124420101	Albany, NY	0.067	-1.58
3601300064420101	Chautauqua, NY	0.072	-1.92
3601300114420101	Chautauqua, NY	0.072	-1.72
3601500034420101	Chemung, NY	0.066	-1.64
3602700074420101	Dutchess, NY	0.072	-2.17
3602900024420101	Erie, NY	0.069	-2.80
3603100034420101	Essex, NY	0.067	-1.65
3604100054420101	Hamilton, NY	0.066	-1.32
3604300054420101	Herkimer, NY	0.063	-0.85

Note: Only monitoring sites meeting data completeness criteria listed

Ozone Trends by Site in New York

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
3604500024420101	Jefferson, NY	0.071	-2.25
3605300064420101	Madison, NY	0.067	-1.29
3606310064420101	Niagara, NY	0.069	-2.49
3606500044420102	Oneida, NY	0.059	-2.15
3606710154420101	Onondaga, NY	0.067	-1.66
3607150014420101	Orange, NY	0.069	-1.59
3607900054420101	Putnam, NY	0.071	-2.05
3608101244420101	Queens, NY	0.075	-1.28
3608500674420101	Richmond, NY	0.083	-2.15

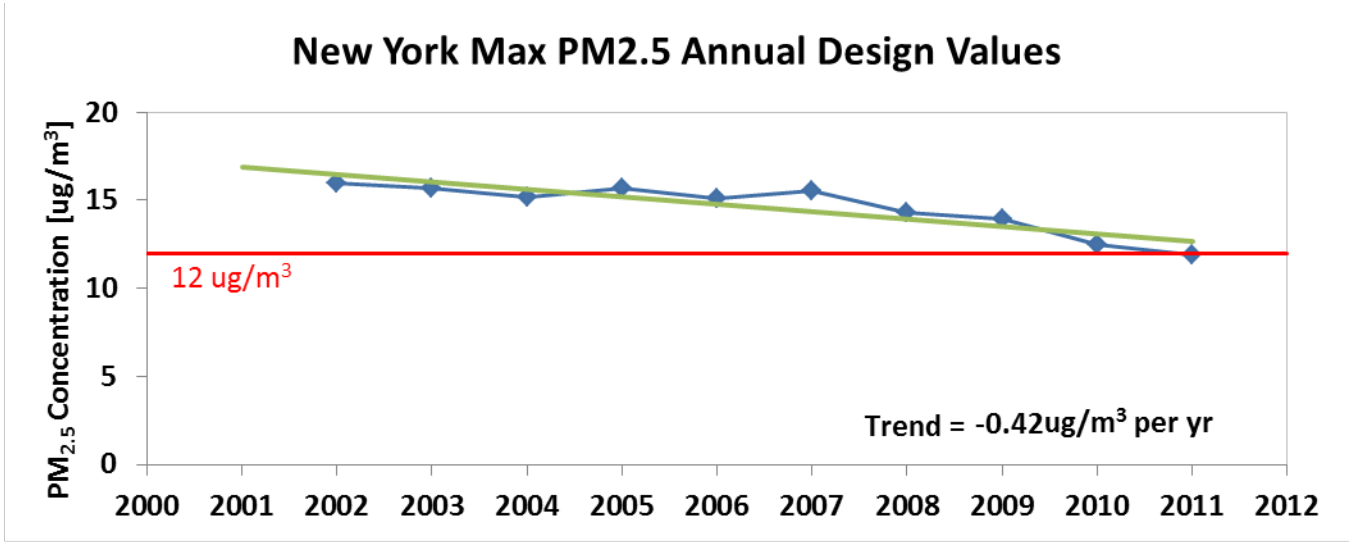
Note: Only monitoring sites meeting data completeness criteria listed

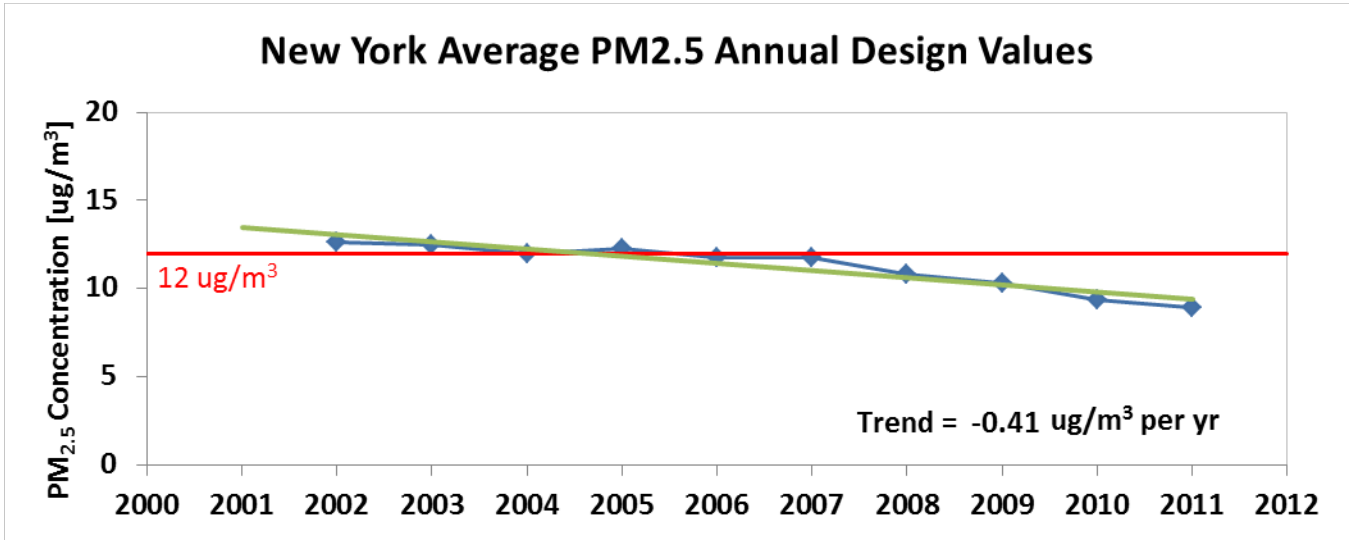
Ozone Trends by Site in New York

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
360910004442010 1	Saratoga, NY	0.068	-1.61
360930003442010 1	Schenectady, NY	N/A	-1.40
361030002442010 1	Suffolk, NY	0.084	-1.05
361030004442010 1	Suffolk, NY	0.075	-0.93
361030009442010 2	Suffolk, NY	N/A	-1.83
361111005442010 1	Ulster, NY	0.069	-1.57
361173001442010 1	Wayne, NY	0.063	-2.05
361192004442010 1	Westchester, NY	0.075	-1.60

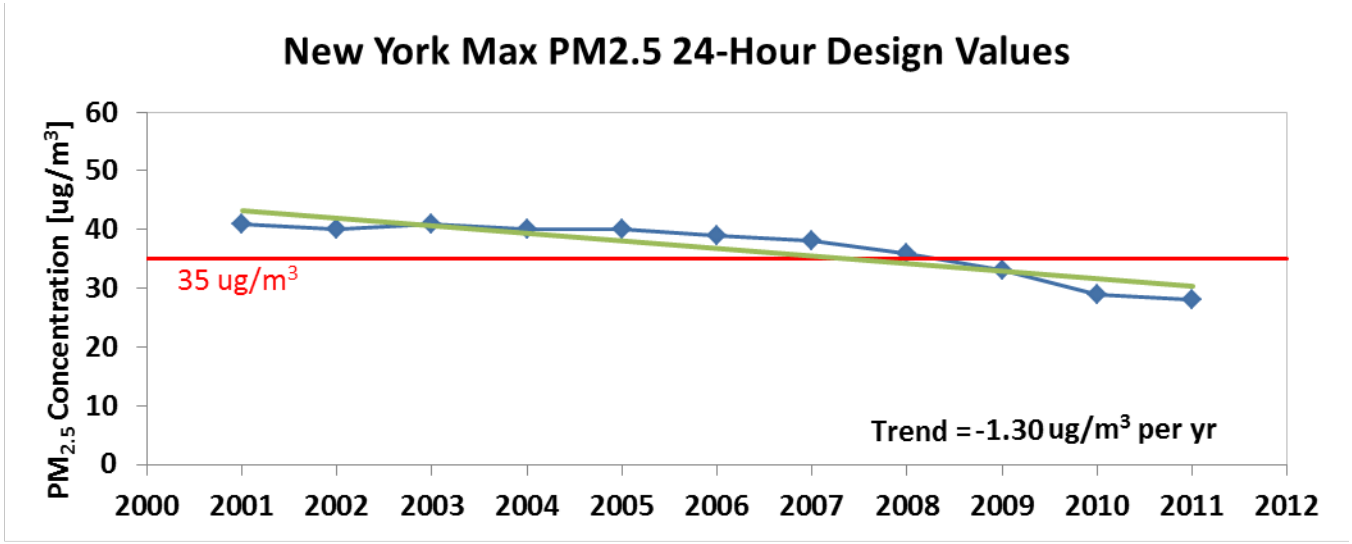
Note: Only monitoring sites meeting data completeness criteria listed

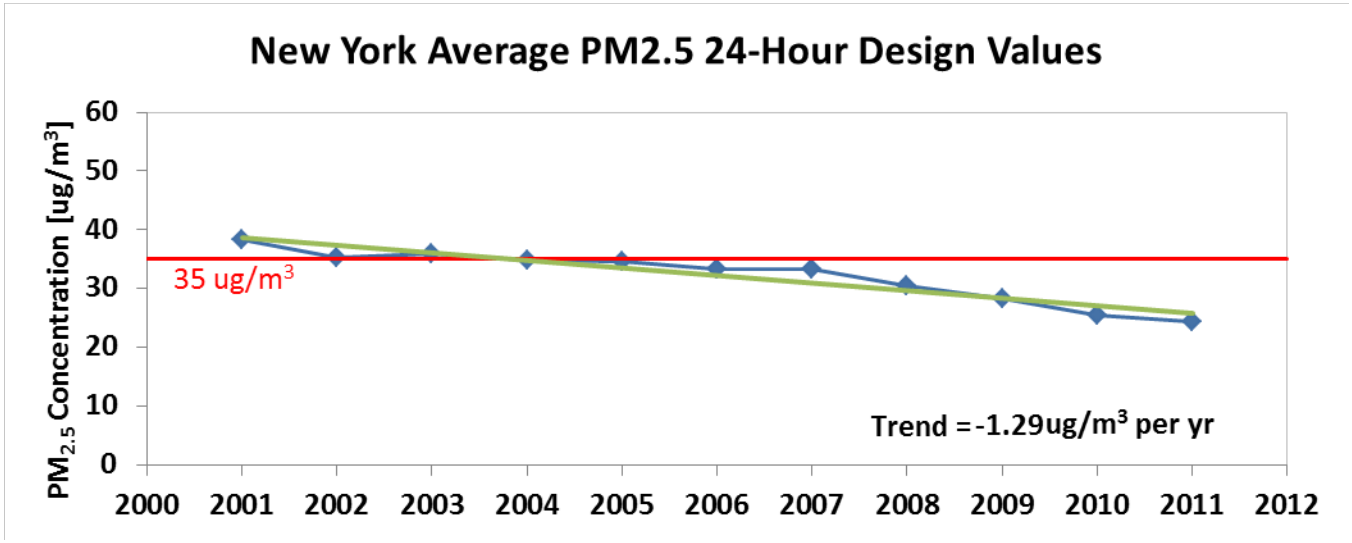
Max/Ave $PM_{2.5}$ Annual DVs and Trend





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





$PM_{2.5}$ Trends by Site in New York

		2009-2011 DV [ug/m³]		Trend [ug/m³ per year]	
Monitoring Site	County	Annual	24-Hr	Annual DV	24-Hr DV
360050080	Bronx	11.9	28	-0.42	-1.20
360050110	Bronx	N/A	N/A	N/A	-0.87
360130011	Chautauqua	7.4	21	-0.42	-1.44
360290005	Erie	N/A	26	N/A	-1.55
360291007	Erie	N/A	N/A	-0.58	-1.50
360470122	Kings	10.3	25	-0.56	-1.67
360590008	Nassau	8.9	23	-0.35	-1.16
360610079	New York	10.2	26	-0.50	-1.42

Note: Only monitoring sites meeting data completeness criteria listed

$PM_{2.5}$ Trends by Site in New York

		2009-2011 DV [ug/m³]		Trend [ug/m³ per year]	
Monitoring Site	County	Annual	24-Hr	Annual DV	24-Hr DV
360632008	Niagara	N/A	N/A	-0.40	-1.32
360671015	Onondaga	7.7	23	-0.36	-1.16
360710002	Orange	8.2	23	-0.39	-0.77
360850055	Richmond	N/A	24	N/A	-1.68
360850067	Richmond	8.5	23	-0.39	-0.92
361010003	Steuben	7.1	N/A	-0.34	N/A
361191002	Westchester	9.1	25	-0.37	-1.10

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O_3 and 24-hr $PM_{2.5}$ design values have decreased since 1999 in New York; average annual $PM_{2.5}$ design values have decreased since 2000 (incomplete data in 1999)

- O_3 and $PM_{2.5}$ design values have decreased since 1999 in all currently designated O_3 and $PM_{2.5}$ non-attainment areas in New York