

Emission and Air Quality Trends Review

Illinois

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

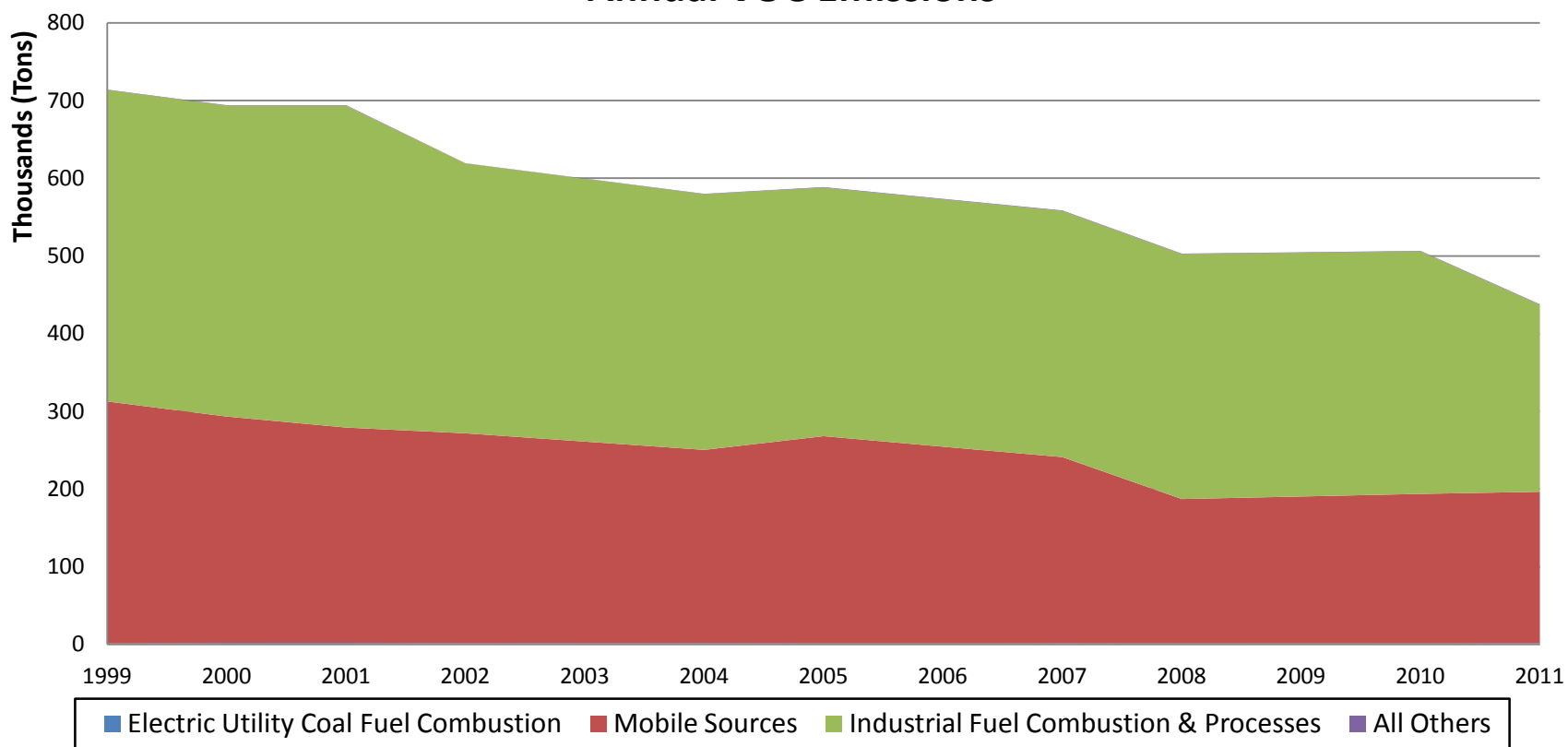
Illinois Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	1,146	1,819	1,476	1,282	1,244	1,351	1,293	1,231	1,276	1,430
Mobile Sources	311,520	277,282	259,546	266,706	253,212	239,719	185,791	189,098	192,405	194,995
Industrial Fuel Combustion & Processes	400,957	414,332	338,231	319,940	318,391	316,842	315,293	313,746	312,195	240,711
All Others	528	676	411	743	690	728	663	654	674	660
Total	714,150	694,109	599,665	588,671	573,537	558,639	503,040	504,729	506,549	437,795

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	59%	29%	12%	9%	18%	13%	7%	11%	25%
Mobile Sources	0%	-11%	-17%	-14%	-19%	-23%	-40%	-39%	-38%	-37%
Industrial Fuel Combustion & Processes	0%	3%	-16%	-20%	-21%	-21%	-21%	-22%	-22%	-40%
All Others	0%	28%	-22%	41%	31%	38%	26%	24%	28%	25%
Total	0%	-3%	-16%	-18%	-20%	-22%	-30%	-29%	-29%	-39%

Illinois Emission Trends (VOC)

**Major Source Category Summary
Annual VOC Emissions**



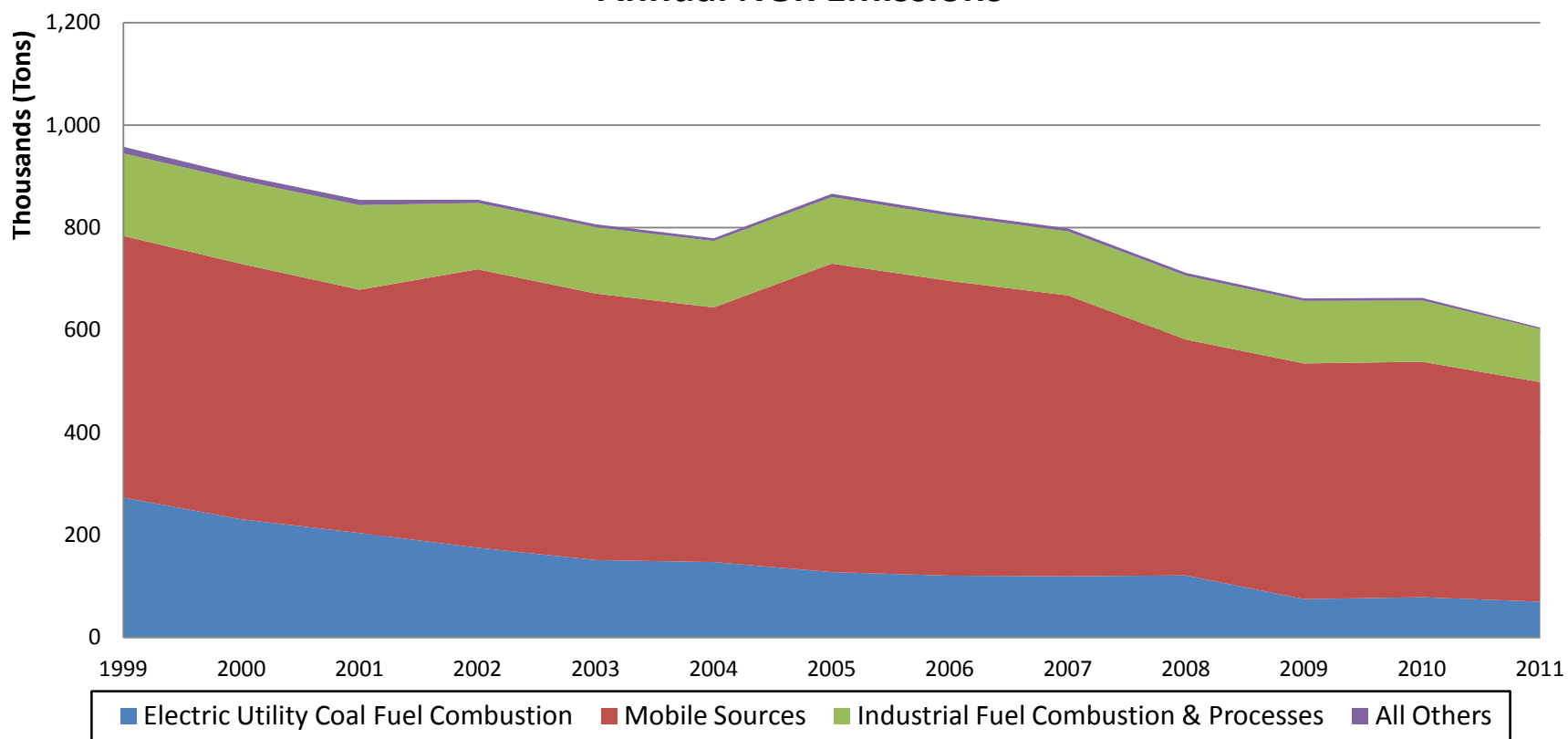
Illinois Emission Trends (NO_x)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	273,025	203,911	151,077	127,568	120,626	119,462	121,130	74,854	78,542	69,818
Mobile Sources	510,646	474,838	520,202	602,187	575,168	548,149	460,314	459,967	459,619	428,648
Industrial Fuel Combustion & Processes	161,068	165,103	129,514	129,831	127,382	124,933	124,587	121,963	119,505	103,453
All Others	13,009	10,275	5,654	6,482	5,745	6,005	5,613	4,990	5,175	2,821
Total	957,747	854,126	806,447	866,067	828,921	798,550	711,645	661,774	662,842	604,741

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-25%	-45%	-53%	-56%	-56%	-56%	-73%	-71%	-74%
Mobile Sources	0%	-7%	2%	18%	13%	7%	-10%	-10%	-10%	-16%
Industrial Fuel Combustion & Processes	0%	3%	-20%	-19%	-21%	-22%	-23%	-24%	-26%	-36%
All Others	0%	-21%	-57%	-50%	-56%	-54%	-57%	-62%	-60%	-78%
Total	0%	-11%	-16%	-10%	-13%	-17%	-26%	-31%	-31%	-37%

Illinois Emission Trends (NO_x)

**Major Source Category Summary
Annual NO_x Emissions**



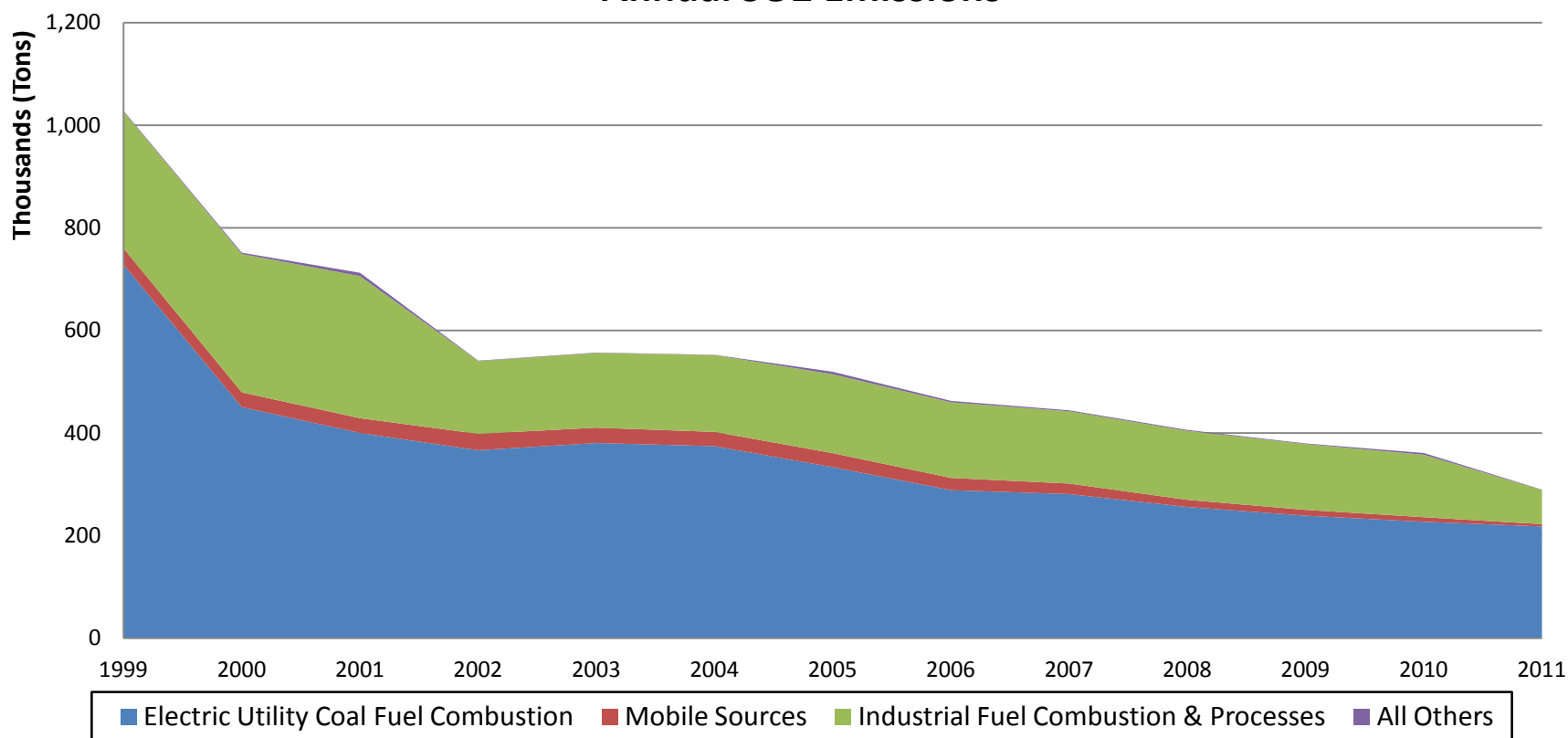
Illinois Emission Trends (SO₂)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	727,899	400,085	380,480	333,465	288,601	280,950	255,833	238,793	226,936	217,840
Mobile Sources	31,991	28,815	29,946	27,266	23,881	20,496	13,857	11,407	8,957	4,496
Industrial Fuel Combustion & Processes	266,471	276,929	145,758	153,744	147,354	140,963	134,575	128,207	121,797	66,665
All Others	1,633	6,578	715	4,922	2,833	1,885	1,785	1,267	3,367	639
Total	1,027,994	712,406	556,900	519,398	462,669	444,294	406,050	379,674	361,056	289,641

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-45%	-48%	-54%	-60%	-61%	-65%	-67%	-69%	-70%
Mobile Sources	0%	-10%	-6%	-15%	-25%	-36%	-57%	-64%	-72%	-86%
Industrial Fuel Combustion & Processes	0%	4%	-45%	-42%	-45%	-47%	-49%	-52%	-54%	-75%
All Others	0%	303%	-56%	201%	74%	15%	9%	-22%	106%	-61%
Total	0%	-31%	-46%	-49%	-55%	-57%	-61%	-63%	-65%	-72%

Illinois Emission Trends (SO₂)

**Major Source Category Summary
Annual SO₂ Emissions**



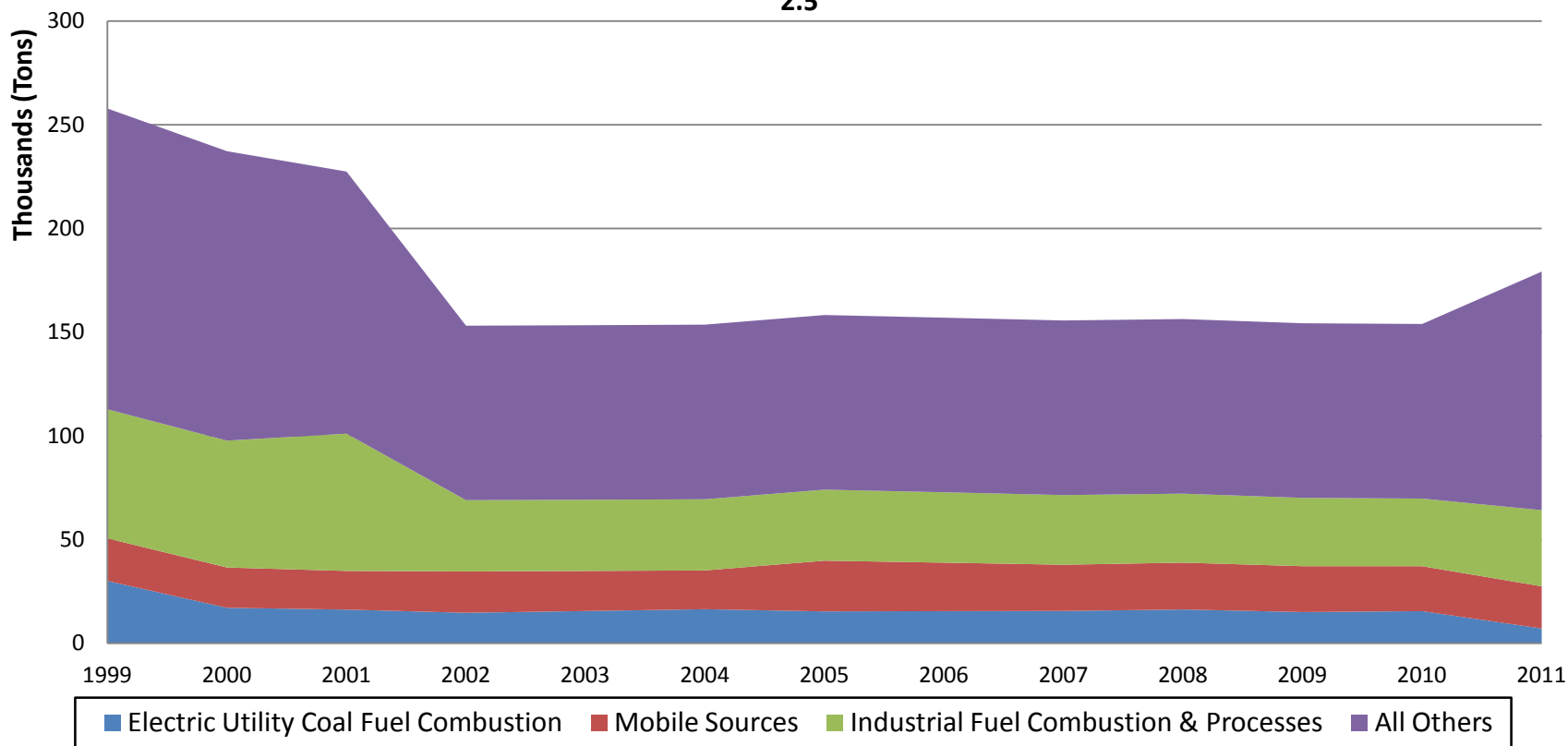
Illinois Emission Trends (PM_{2.5})

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	30,049	16,228	15,537	15,356	15,495	15,567	16,283	15,039	15,484	7,135
Mobile Sources	20,513	18,646	19,322	24,463	23,380	22,298	22,591	22,134	21,677	20,324
Industrial Fuel Combustion & Processes	62,247	66,186	34,337	34,247	33,918	33,588	33,260	32,934	32,602	36,724
All Others	145,020	126,383	84,153	84,199	84,188	84,189	84,192	84,189	84,190	115,020
Total	257,829	227,442	153,349	158,265	156,981	155,642	156,326	154,295	153,952	179,203

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-46%	-48%	-49%	-48%	-48%	-46%	-50%	-48%	-76%
Mobile Sources	0%	-9%	-6%	19%	14%	9%	10%	8%	6%	-1%
Industrial Fuel Combustion & Processes	0%	6%	-45%	-45%	-46%	-46%	-47%	-47%	-48%	-41%
All Others	0%	-13%	-42%	-42%	-42%	-42%	-42%	-42%	-42%	-21%
Total	0%	-12%	-41%	-39%	-39%	-40%	-39%	-40%	-40%	-30%

Illinois 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 Illinois
- 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

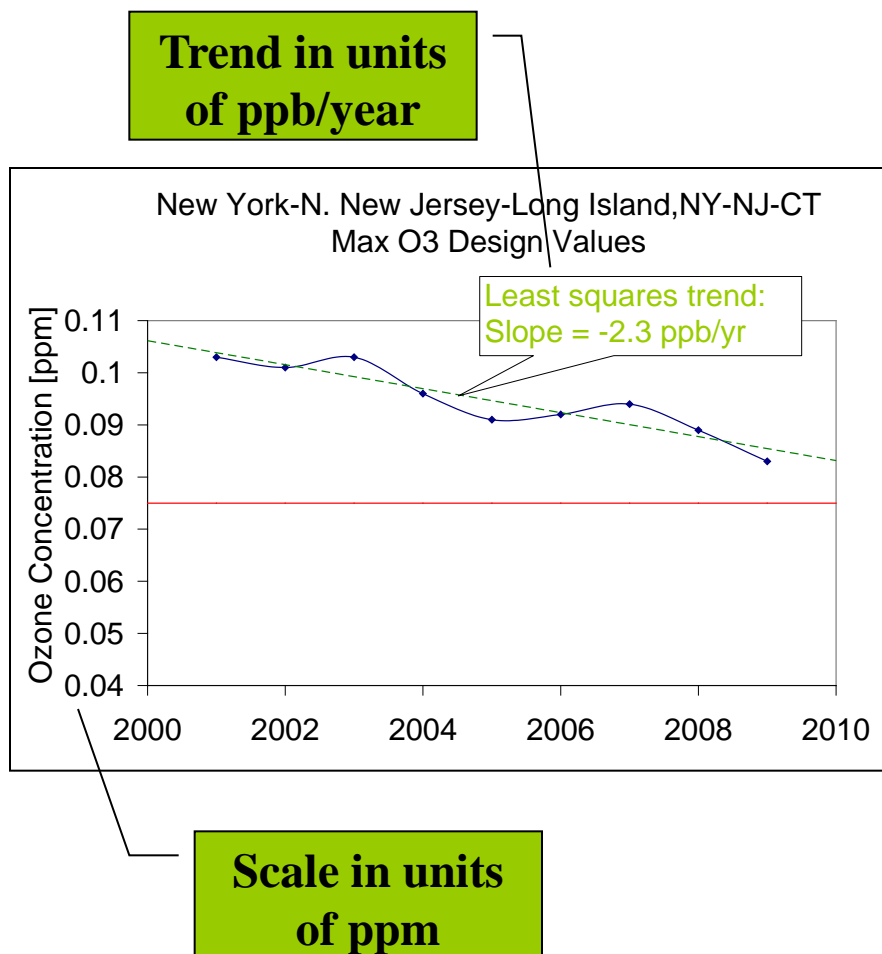
Data Handling Procedures

- 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

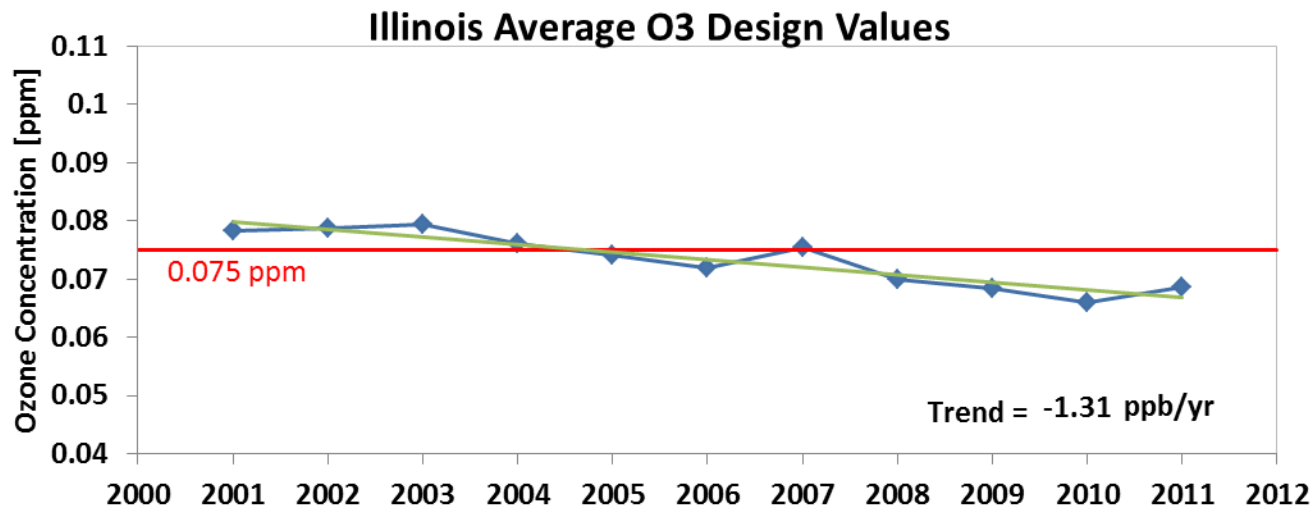
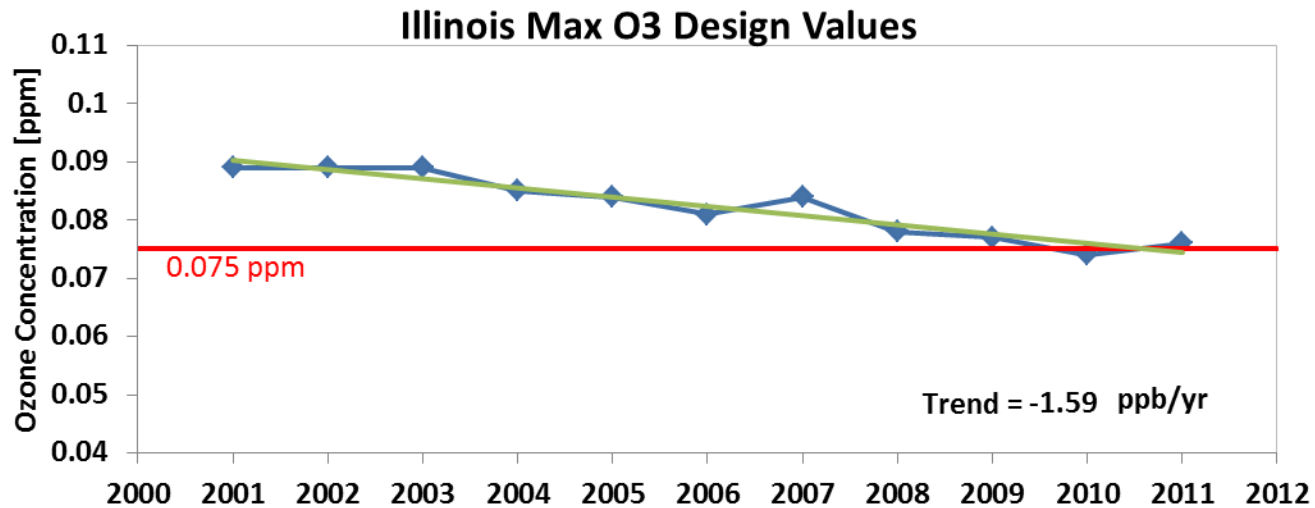
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculations based on EPA data handling conventions
 - Data extracted from monitors that have a non-regulatory monitoring type are omitted
 - Selection of trend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

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1701900044420101	Champaign, IL	N/A	-1.90
1703100014420101	Cook, IL	0.071	-0.72
1703100324420101	Cook, IL	0.072	-1.99
1703100644420101	Cook, IL	0.068	-0.81
1703100724420101	Cook, IL	N/A	-1.55
1703110034420102	Cook, IL	0.067	-1.16
1703116014420101	Cook, IL	0.069	-0.20
1703140024420101	Cook, IL	0.069	-0.53
1703142014420101	Cook, IL	0.072	-1.33
1703170024420101	Cook, IL	0.069	-2.11
1704360014420101	DuPage, IL	0.063	-1.06

Note: Only monitoring sites meeting data completeness criteria listed

Ozone Trends by Site in Illinois

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1704910014420102	Effingham, IL	0.068	-1.15
1708310014420101	Jersey, IL	0.072	-2.25
1708900054420101	Kane, IL	0.069	-1.25
1709710024420101	Lake, IL	N/A	-1.73
1709710074420101	Lake, IL	0.076	-1.05
1711100014420101	McHenry, IL	0.067	-2.13
1711320034420101	McLean, IL	0.068	-1.03
1711500134420101	Macon, IL	0.07	-0.86
1711700024420101	Macoupin, IL	0.07	-1.35
1711900084420101	Madison, IL	0.074	-1.49
1711910094420101	Madison, IL	0.076	-0.67

Note: Only monitoring sites meeting data completeness criteria listed

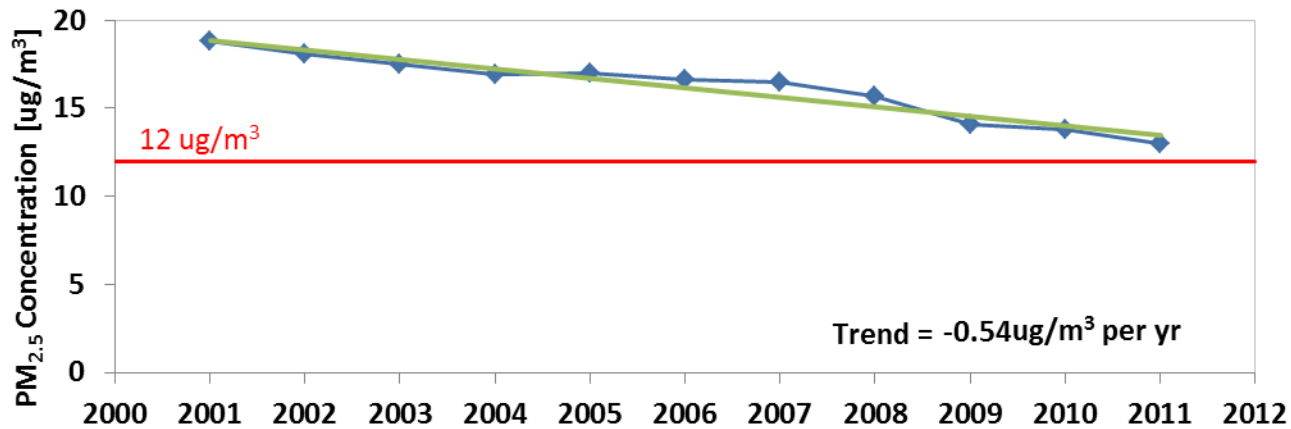
Ozone Trends by Site in Illinois

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1711930074420101	Madison, IL	0.072	-1.11
1714300244420101	Peoria, IL	0.059	-1.51
1714310014420101	Peoria, IL	0.069	-1.05
1715700014420101	Randolph, IL	0.063	-1.61
1716130024420101	Rock Island, IL	0.056	-1.48
1716300104420102	St. Clair, IL	0.072	-1.59
1716700104420101	Sangamon, IL	N/A	-1.58
1719710114420101	Will, IL	0.063	-1.97
1720120014420101	Winnebago, IL	0.066	-1.06

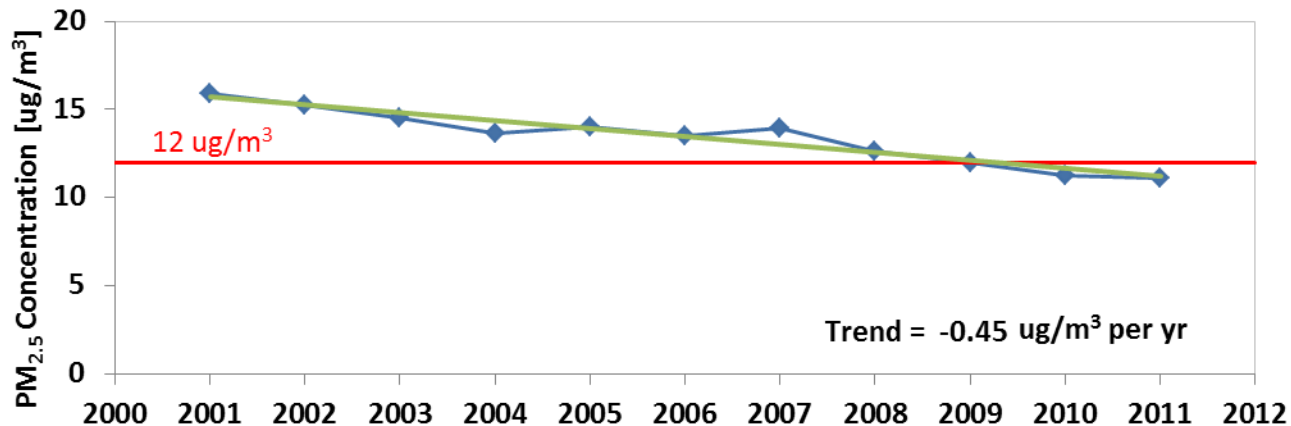
Note: Only monitoring sites meeting data completeness criteria listed

Max/Ave PM_{2.5} Annual DVs and Trend

Illinois Max PM_{2.5} Annual Design Values

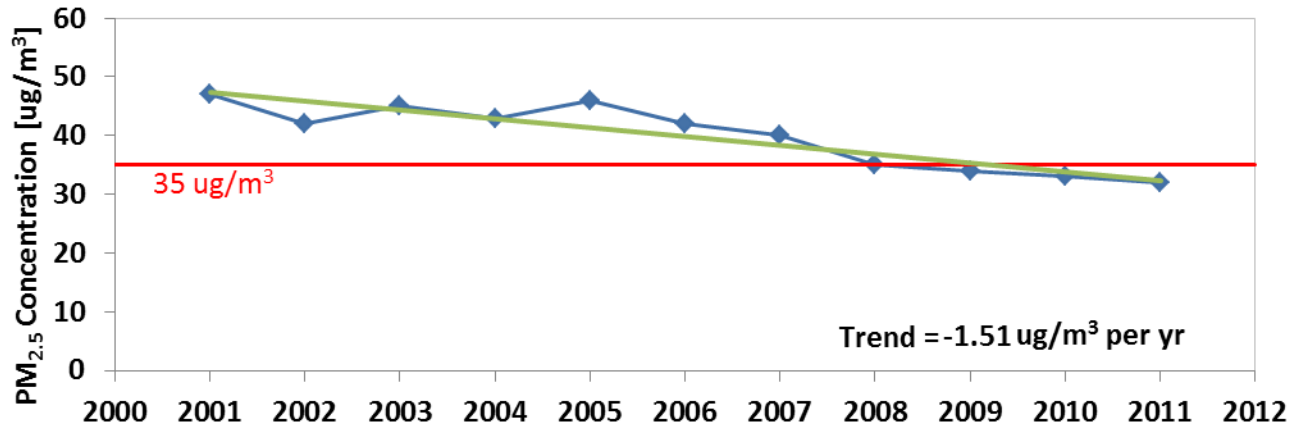


Illinois Average PM_{2.5} Annual Design Values

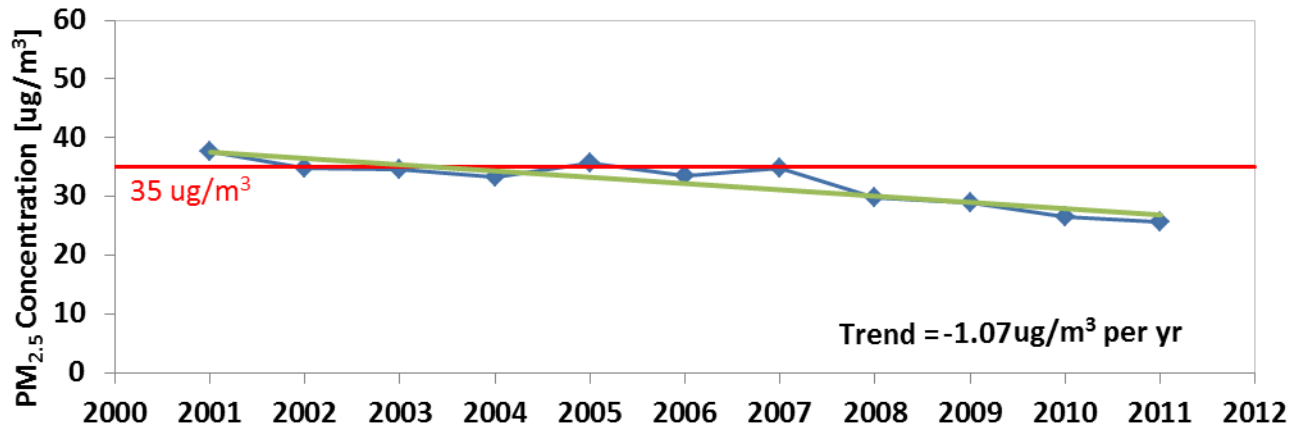


Max/Ave PM_{2.5} 24-Hour DVs and Trend

Illinois Max PM_{2.5} 24-Hour Design Values



Illinois Average PM_{2.5} 24-Hour Design Values



PM_{2.5} Trends by Site in Illinois

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
170191001	Champaign	10.4	22	-0.26	-0.53
170310022	Cook	12.7	29	-0.47	-1.12
170310050	Cook	N/A	N/A	-0.59	-1.45
170310052	Cook	12.4	32	-0.63	-1.28
170310057	Cook	N/A	N/A	-0.49	-0.70
170310076	Cook	11.5	28	-0.54	-0.98
170311016	Cook	N/A	32	N/A	-1.51
170312001	Cook	11.6	26	-0.52	-1.25
170313301	Cook	11.6	30	-0.54	-0.92
170314007	Cook	10.7	27	-0.40	-1.15

Note: Only monitoring sites meeting data completeness criteria listed

PM_{2.5} Trends by Site in Illinois

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
170314201	Cook	9.6	26	-0.47	-1.12
170434002	DuPage	10.7	25	-0.46	-0.80
170890003	Kane	10.2	27	-0.48	-0.64
170971007	Lake	N/A	N/A	-0.43	-0.82
170990007	LaSalle	N/A	N/A	N/A	-0.68
171110001	McHenry	10.0	26	-0.38	-0.92
171150013	Macon	11.6	23	-0.33	-1.17
171191007	Madison	13.0	27	-0.45	-1.38
171192009	Madison	11.7	22	-0.35	-1.42
171193007	Madison	11.8	24	-0.37	-1.12

Note: Only monitoring sites meeting data completeness criteria listed

PM_{2.5} Trends by Site in Illinois

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
171430037	Peoria	11.3	26	-0.37	-0.97
171570001	Randolph	9.8	20	-0.31	-0.96
171613002	Rock Island	9.8	22	-0.33	-0.93
171630010	St. Clair	12.5	23	-0.49	-1.55
171634001	St. Clair	N/A	N/A	N/A	-1.32
171670012	Sangamon	10.9	25	-0.30	-1.00
171971002	Will	10.8	25	-0.46	-0.90
171971011	Will	9.7	23	-0.41	-0.64

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