

Emission and Air Quality Trends Review 1999-2011



Iowa

July 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 utility coal 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

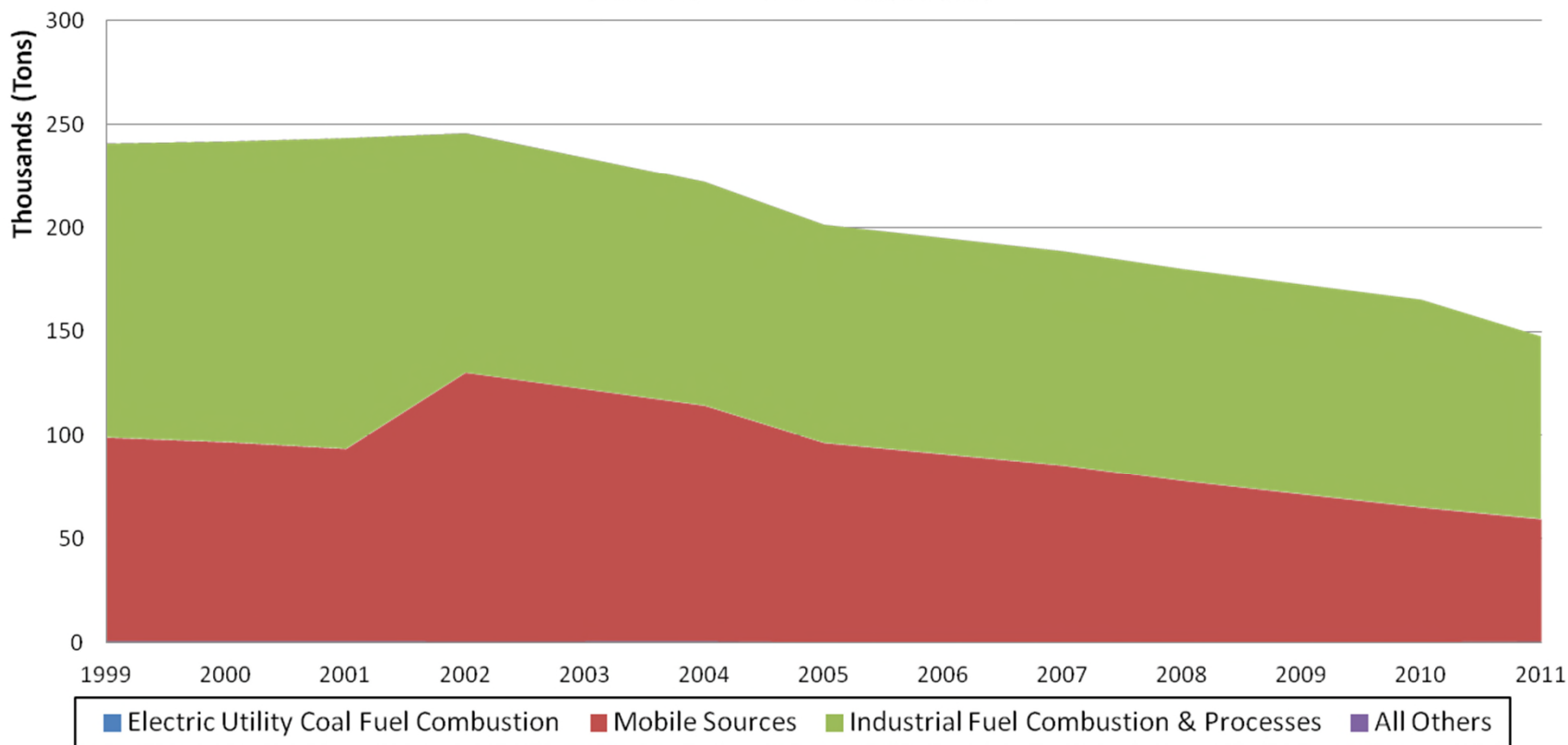
Iowa Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	641	667	597	298	298	303	381	335	352	568
Mobile Sources	98,385	92,913	121,676	96,114	90,645	85,175	77,464	70,999	64,534	58,706
Industrial Fuel Combustion & Processes	141,896	149,941	111,693	104,931	104,014	103,098	102,181	101,263	100,347	88,325
All Others	96	41	102	68	65	67	58	50	49	28
Total	241,018	243,562	234,069	201,411	195,022	188,643	180,084	172,648	165,283	147,627

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%	-54%	-53%	-53%	-41%	-48%	-45%	-11%
Mobile Sources	0%	-6%	24%	-2%	-8%	-13%	-21%	-28%	-34%	-40%
Industrial Fuel Combustion & Processes	0%	6%	-21%	-26%	-27%	-27%	-28%	-29%	-29%	-38%
All Others	0%	-57%	6%	-30%	-32%	-31%	-39%	-48%	-49%	-71%
Total	0%	1%	-3%	-16%	-19%	-22%	-25%	-28%	-31%	-39%

Iowa Emission Trends (VOC)

**Major Source Category Summary
Annual VOC Emissions**



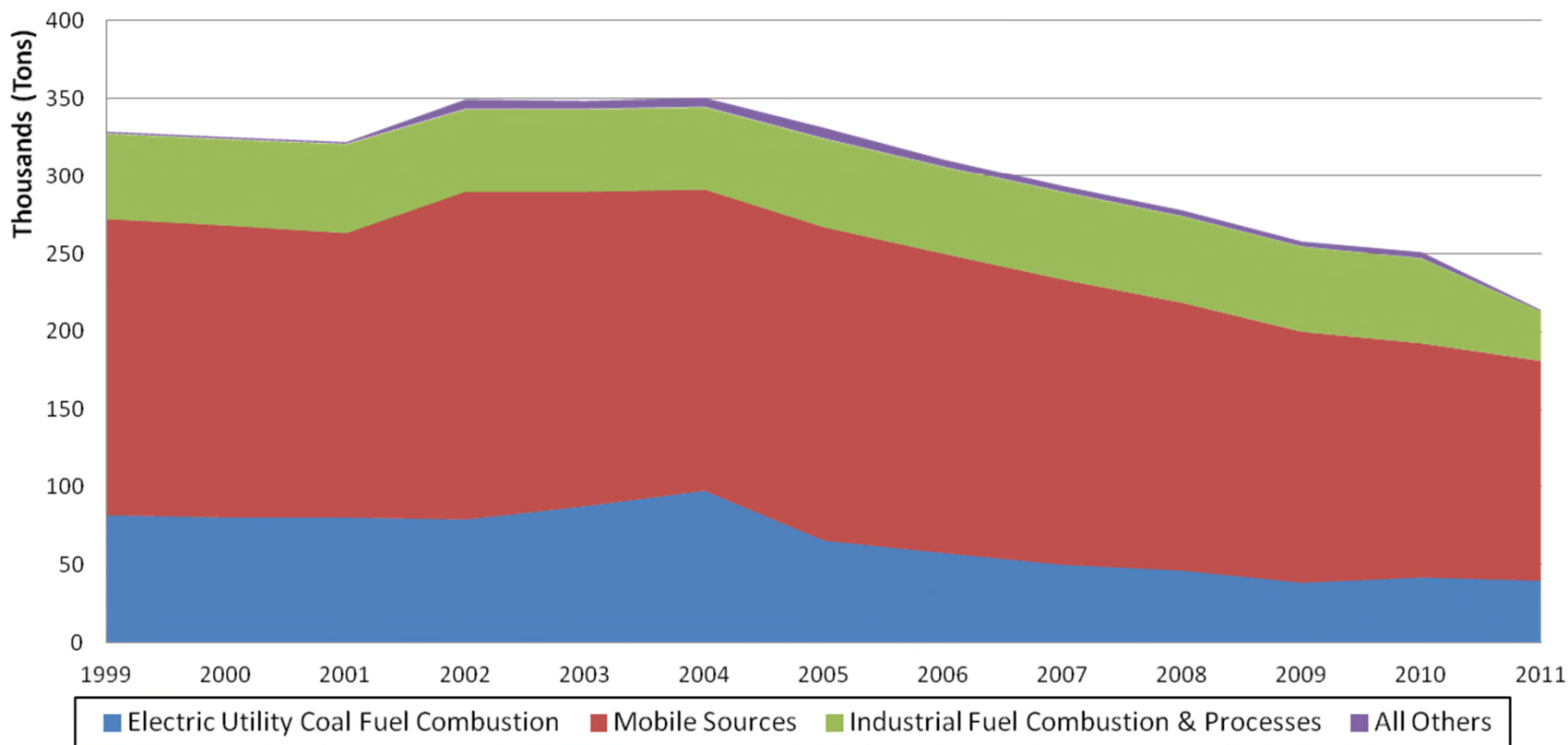
Iowa Emission Trends (NO_x)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	81,739	80,259	87,516	65,502	57,513	49,983	46,297	38,498	41,885	39,786
Mobile Sources	190,390	182,814	202,184	201,349	192,337	183,324	172,072	161,311	150,550	141,327
Industrial Fuel Combustion & Processes	55,458	57,819	53,640	57,496	56,336	56,153	55,529	54,646	54,520	31,868
All Others	1,024	985	5,094	6,778	4,480	3,737	3,630	3,141	3,837	792
Total	328,612	321,877	348,434	331,126	310,666	293,197	277,529	257,596	250,792	213,772

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-2%	7%	-20%	-30%	-39%	-43%	-53%	-49%	-51%
Mobile Sources	0%	-4%	6%	6%	1%	-4%	-10%	-15%	-21%	-26%
Industrial Fuel Combustion & Processes	0%	4%	-3%	4%	2%	1%	0%	-1%	-2%	-43%
All Others	0%	-4%	397%	562%	337%	265%	254%	207%	275%	-23%
Total	0%	-2%	6%	1%	-5%	-11%	-16%	-22%	-24%	-35%

Iowa Emission Trends (NO_x)

Major Source Category Summary
Annual NO_x Emissions



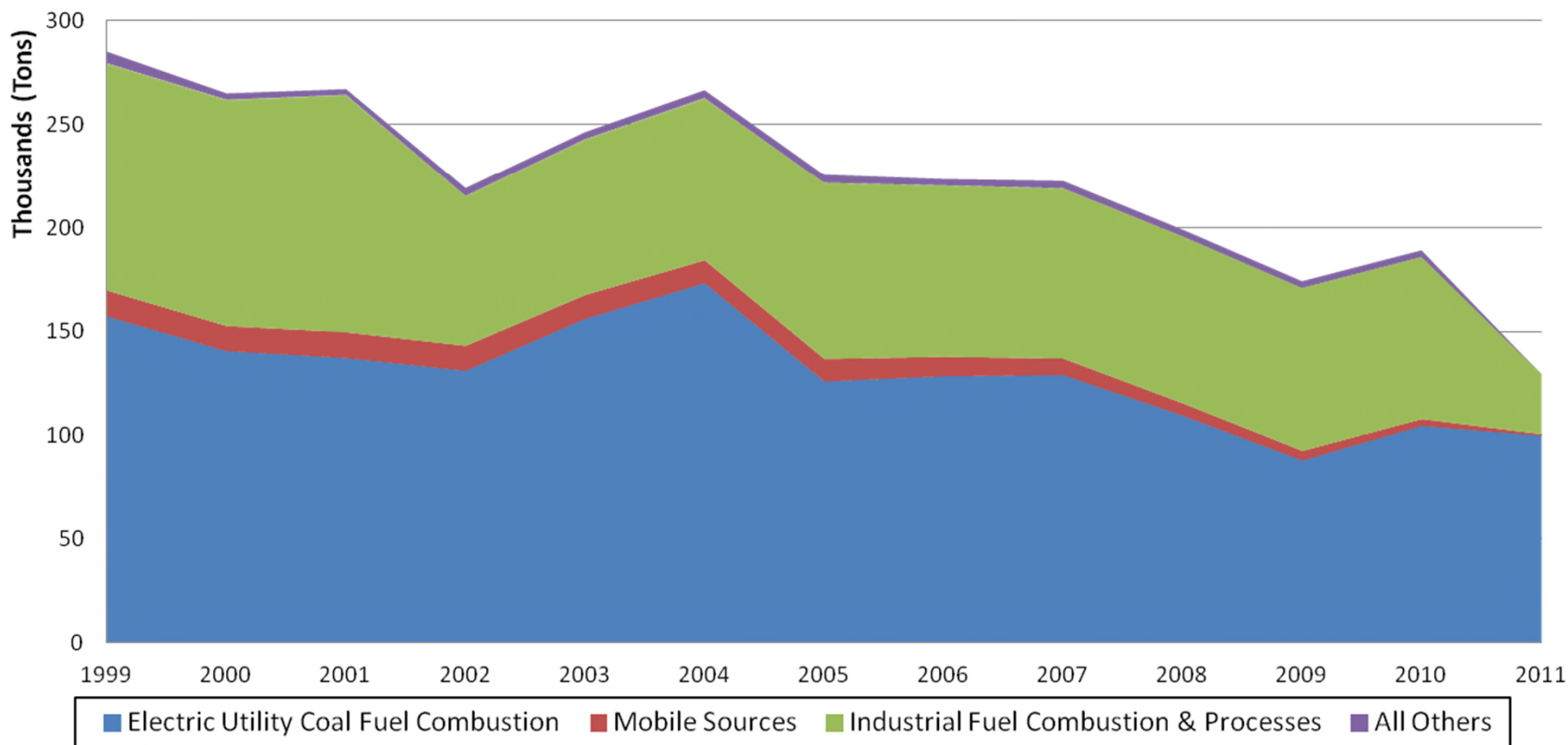
Iowa Emission Trends (SO₂)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	157,255	137,268	156,074	125,964	128,454	129,048	109,518	87,990	104,614	99,844
Mobile Sources	12,476	12,388	11,543	10,903	9,457	8,010	5,969	4,653	3,337	767
Industrial Fuel Combustion & Processes	109,756	114,647	75,244	84,770	82,451	81,873	80,352	78,368	77,981	29,130
All Others	5,512	2,709	3,398	3,918	3,051	3,606	3,244	3,244	3,186	23
Total	284,999	267,011	246,260	225,556	223,413	222,536	199,083	174,255	189,118	129,763

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-13%	-1%	-20%	-18%	-18%	-30%	-44%	-33%	-37%
Mobile Sources	0%	-1%	-7%	-13%	-24%	-36%	-52%	-63%	-73%	-94%
Industrial Fuel Combustion & Processes	0%	4%	-31%	-23%	-25%	-25%	-27%	-29%	-29%	-73%
All Others	0%	-51%	-38%	-29%	-45%	-35%	-41%	-41%	-42%	-100%
Total	0%	-6%	-14%	-21%	-22%	-22%	-30%	-39%	-34%	-54%

Iowa Emission Trends (SO₂)

Major Source Category Summary
Annual SO₂ Emissions



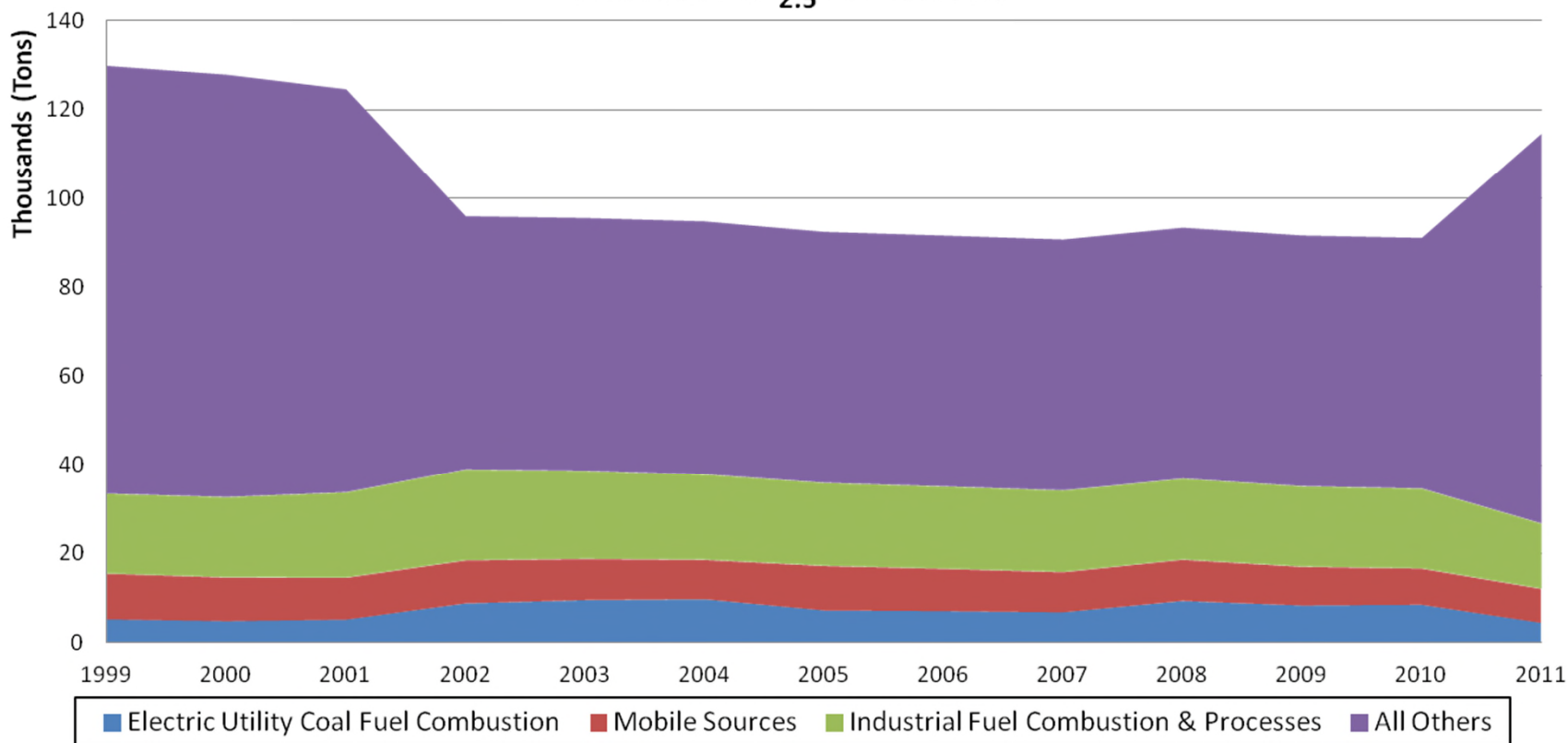
Iowa Emission Trends (PM_{2.5})

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	5,257	5,196	9,610	7,289	7,118	6,848	9,424	8,393	8,559	4,474
Mobile Sources	10,281	9,439	9,259	10,010	9,519	9,029	9,266	8,706	8,147	7,649
Industrial Fuel Combustion & Processes	17,923	19,129	19,812	18,613	18,462	18,326	18,186	18,039	17,903	14,608
All Others	96,390	90,814	56,781	56,415	56,404	56,410	56,397	56,378	56,380	87,795
Total	129,851	124,577	95,462	92,326	91,503	90,613	93,273	91,516	90,987	114,527

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-1%	83%	39%	35%	30%	79%	60%	63%	-15%
Mobile Sources	0%	-8%	-10%	-3%	-7%	-12%	-10%	-15%	-21%	-26%
Industrial Fuel Combustion & Processes	0%	7%	11%	4%	3%	2%	1%	1%	0%	-18%
All Others	0%	-6%	-41%	-41%	-41%	-41%	-41%	-42%	-42%	-9%
Total	0%	-4%	-26%	-29%	-30%	-30%	-28%	-30%	-30%	-12%

Iowa 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 Iowa
- NO_x and SO₂ from Electric Utility Fuel Combustion sources show decrease over time as a result of Acid Rain and NO_x Budget Trading Program 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

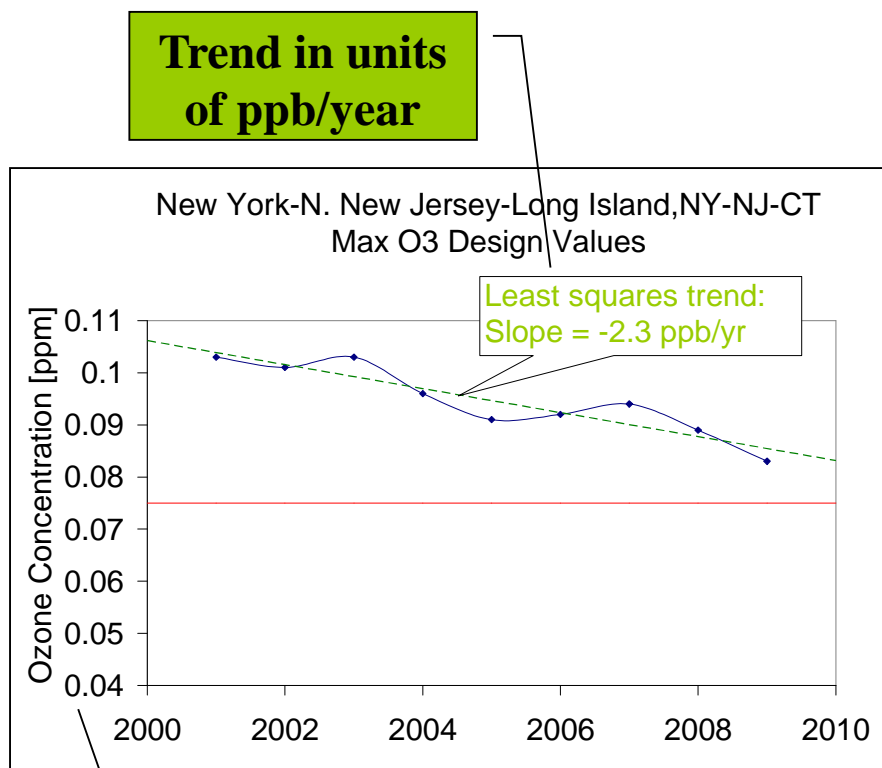
Data Handling Procedures

- 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

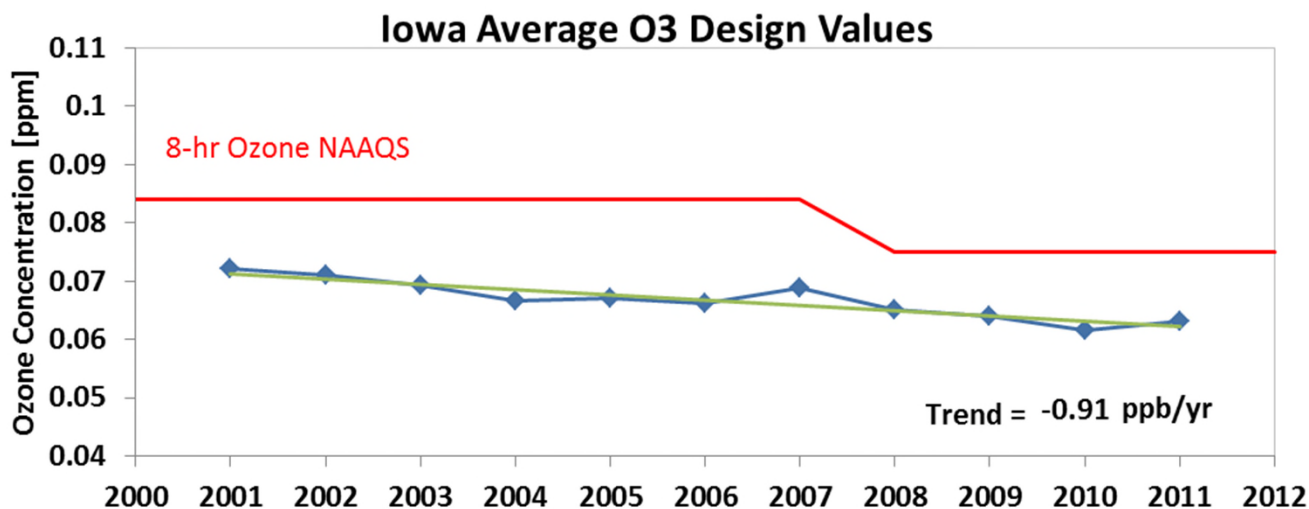
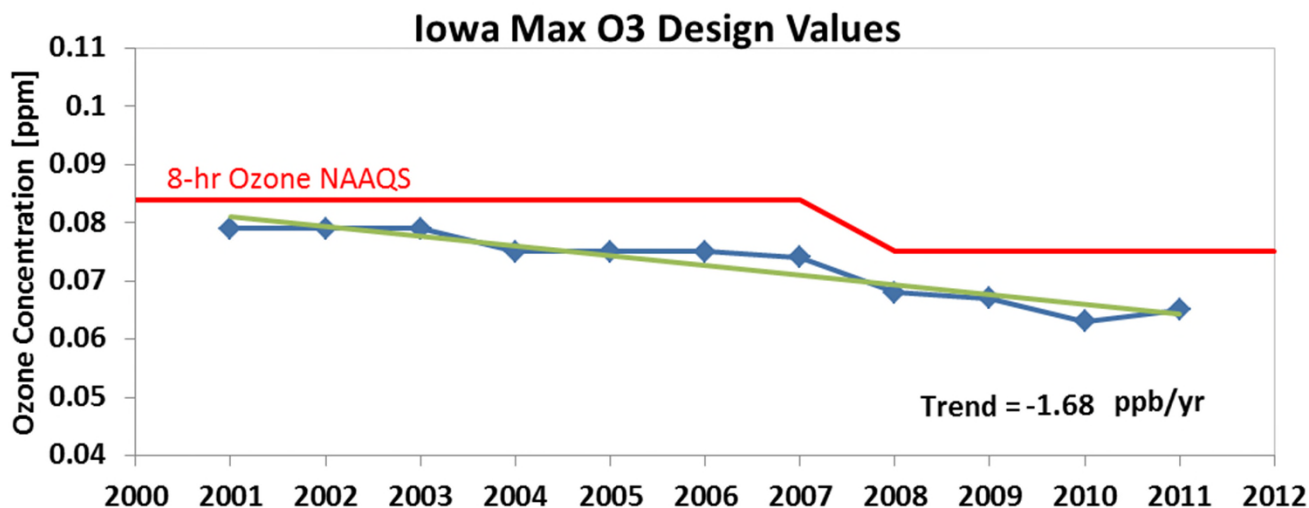
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculations based on EPA data handling conventions
 - Data extracted from monitors that have a non-regulatory monitoring type are omitted
 - Selection of trend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



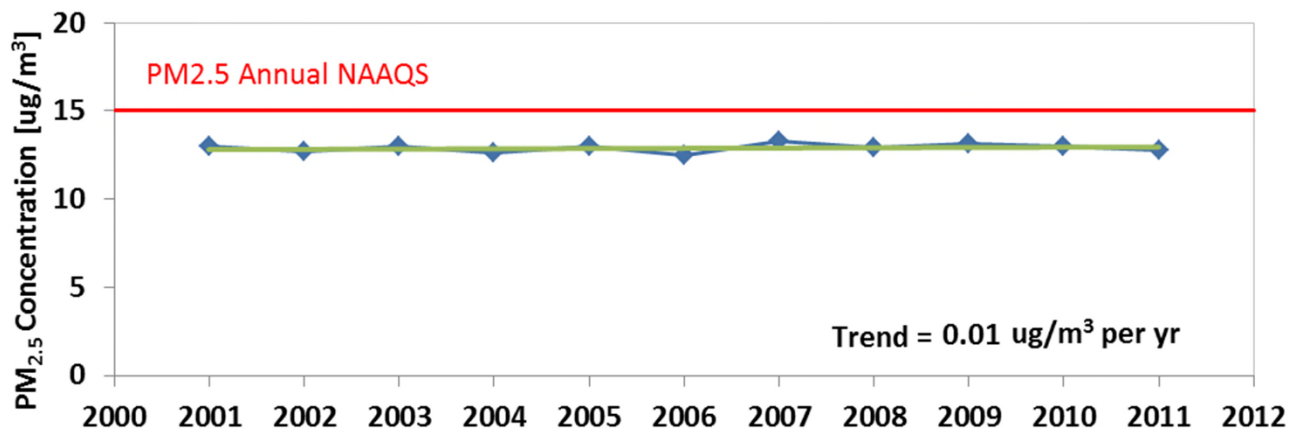
Ozone Trends by Site in Iowa

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
1901700114420101	Bremer, IA	0.063	-0.90
1904500214420101	Clinton, IA	0.064	-1.65
1908511014420101	Harrison, IA	0.065	-1.38
1911300284420101	Linn, IA	0.062	-0.62
1911300334420101	Linn, IA	0.063	-0.85
1914710024420101	Palo Alto, IA	0.065	-0.60
1916300144420101	Scott, IA	0.063	-1.89
1916900114420101	Story, IA	0.06	-0.25
1918100224420101	Warren, IA	0.062	-0.03

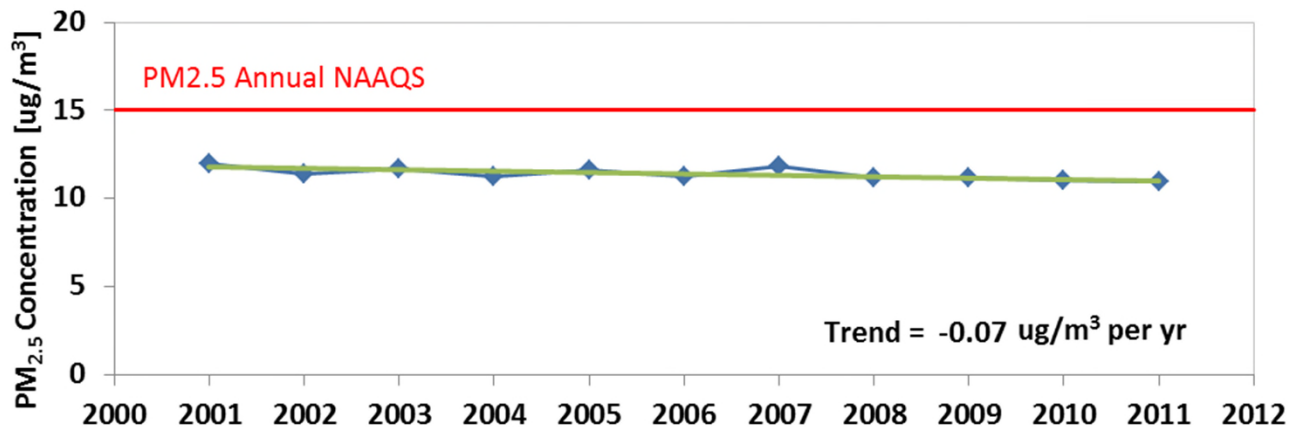
Note: Only monitoring sites meeting data completeness criteria listed

Max/Ave PM_{2.5} Annual DVs and Trend

Iowa Max PM_{2.5} Annual Design Values

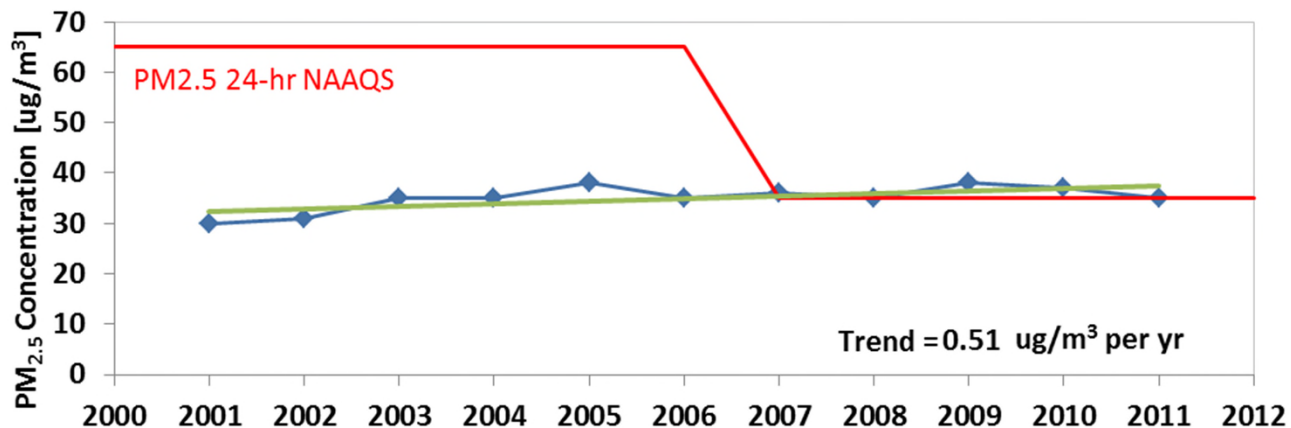


Iowa Average PM_{2.5} Annual Design Values

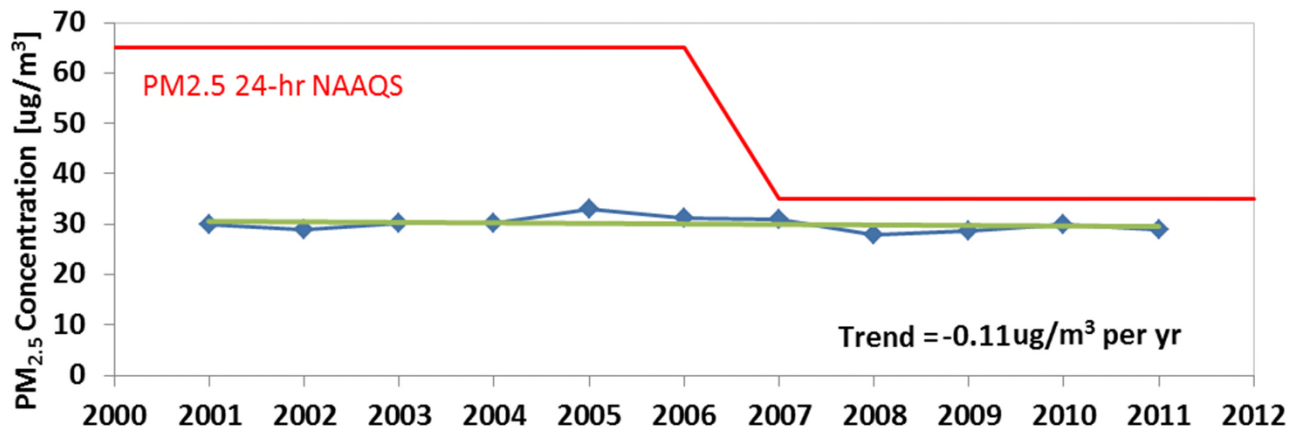


Max/Ave PM_{2.5} 24-Hour DVs and Trend

Iowa Max PM_{2.5} 24-Hour Design Values



Iowa Average PM_{2.5} 24-Hour Design Values



PM_{2.5} Trends by Site in Iowa

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
190130008	Black Hawk	10.6	29	-0.08	0.07
190450021	Clinton	11.1	29	-0.12	-0.47
191032001	Johnson	10.8	28	-0.06	-0.25
191130037	Linn	9.9	30	-0.13	-0.38
191390015	Muscatine	12.8	35	0.02	0.12
191532510	Polk	9.6	27	-0.08	-0.13
191550009	Pottawattamie	10.9	25	0.05	-0.13
191630015	Scott	11.4	29	-0.13	-0.36
191630018	Scott	11.5	29	-0.08	-0.20

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O₃ design values have decreased since 1999 in Iowa, and average PM_{2.5} design values have remained relatively steady since 1999 in Iowa.
- There are no currently designated O₃ or PM_{2.5} non-attainment areas in Iowa