

Emission and Air Quality Trends Review 1999-2011

Nebraska

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

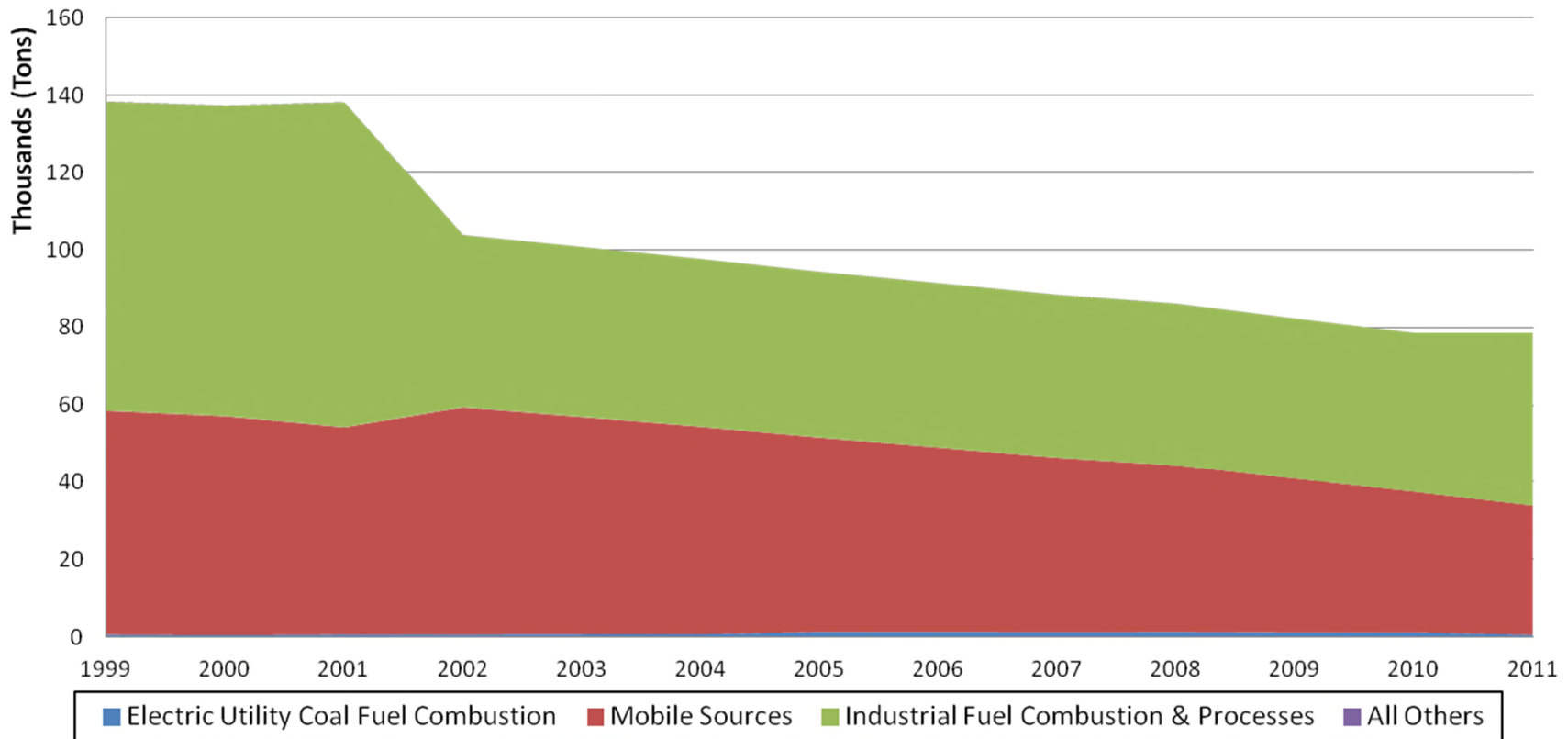
Nebraska Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	556	578	637	1,247	1,246	1,174	1,233	1,123	1,131	495
Mobile Sources	58,019	53,709	56,326	50,394	47,804	45,214	43,184	39,784	36,384	33,400
Industrial Fuel Combustion & Processes	79,733	83,874	43,692	42,600	42,284	41,967	41,650	41,334	41,017	44,623
All Others	51	59	36	37	35	39	32	28	27	60
Total	138,359	138,220	100,692	94,278	91,369	88,394	86,100	82,269	78,559	78,579

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%	15%	124%	124%	111%	122%	102%	104%	-11%
Mobile Sources	0%	-7%	-3%	-13%	-18%	-22%	-26%	-31%	-37%	-42%
Industrial Fuel Combustion & Processes	0%	5%	-45%	-47%	-47%	-47%	-48%	-48%	-49%	-44%
All Others	0%	16%	-29%	-28%	-31%	-23%	-37%	-45%	-47%	19%
Total	0%	0%	-27%	-32%	-34%	-36%	-38%	-41%	-43%	-43%

Nebraska Emission Trends (VOC)

**Major Source Category Summary
Annual VOC Emissions**



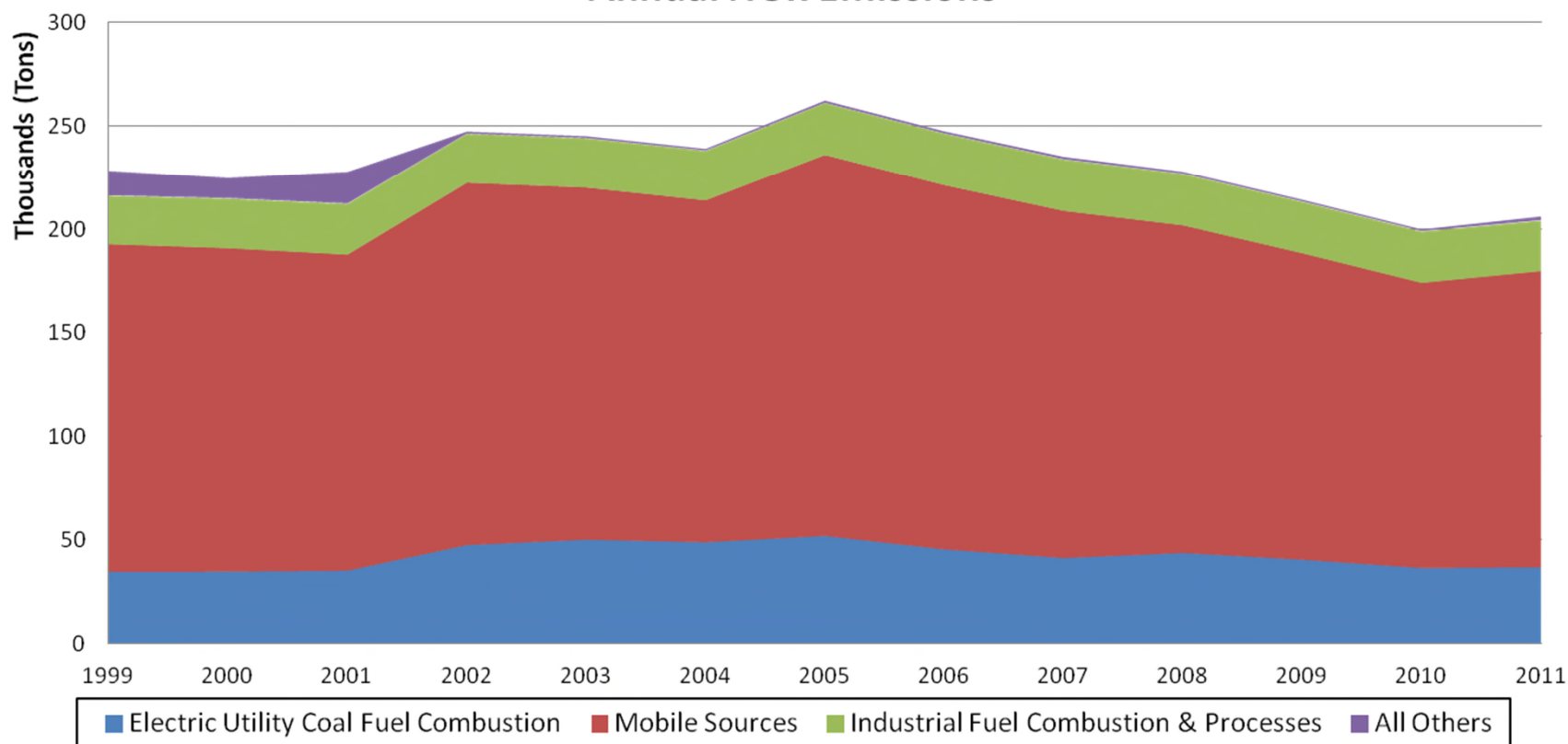
Nebraska Emission Trends (NO_x)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	34,567	35,196	50,140	51,953	45,459	41,277	43,744	40,492	36,455	36,844
Mobile Sources	158,363	152,692	170,090	184,175	175,947	167,720	158,281	148,073	137,866	143,135
Industrial Fuel Combustion & Processes	23,339	24,427	23,958	25,109	25,032	24,955	24,879	24,802	24,725	24,342
All Others	11,884	15,363	811	969	912	1,048	821	725	721	1,678
Total	228,153	227,677	244,999	262,206	247,350	235,000	227,725	214,092	199,767	206,000

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%	45%	50%	32%	19%	27%	17%	5%	7%
Mobile Sources	0%	-4%	7%	16%	11%	6%	0%	-6%	-13%	-10%
Industrial Fuel Combustion & Processes	0%	5%	3%	8%	7%	7%	7%	6%	6%	4%
All Others	0%	29%	-93%	-92%	-92%	-91%	-93%	-94%	-94%	-86%
Total	0%	0%	7%	15%	8%	3%	0%	-6%	-12%	-10%

Nebraska Emission Trends (NO_x)

Major Source Category Summary
Annual NO_x Emissions



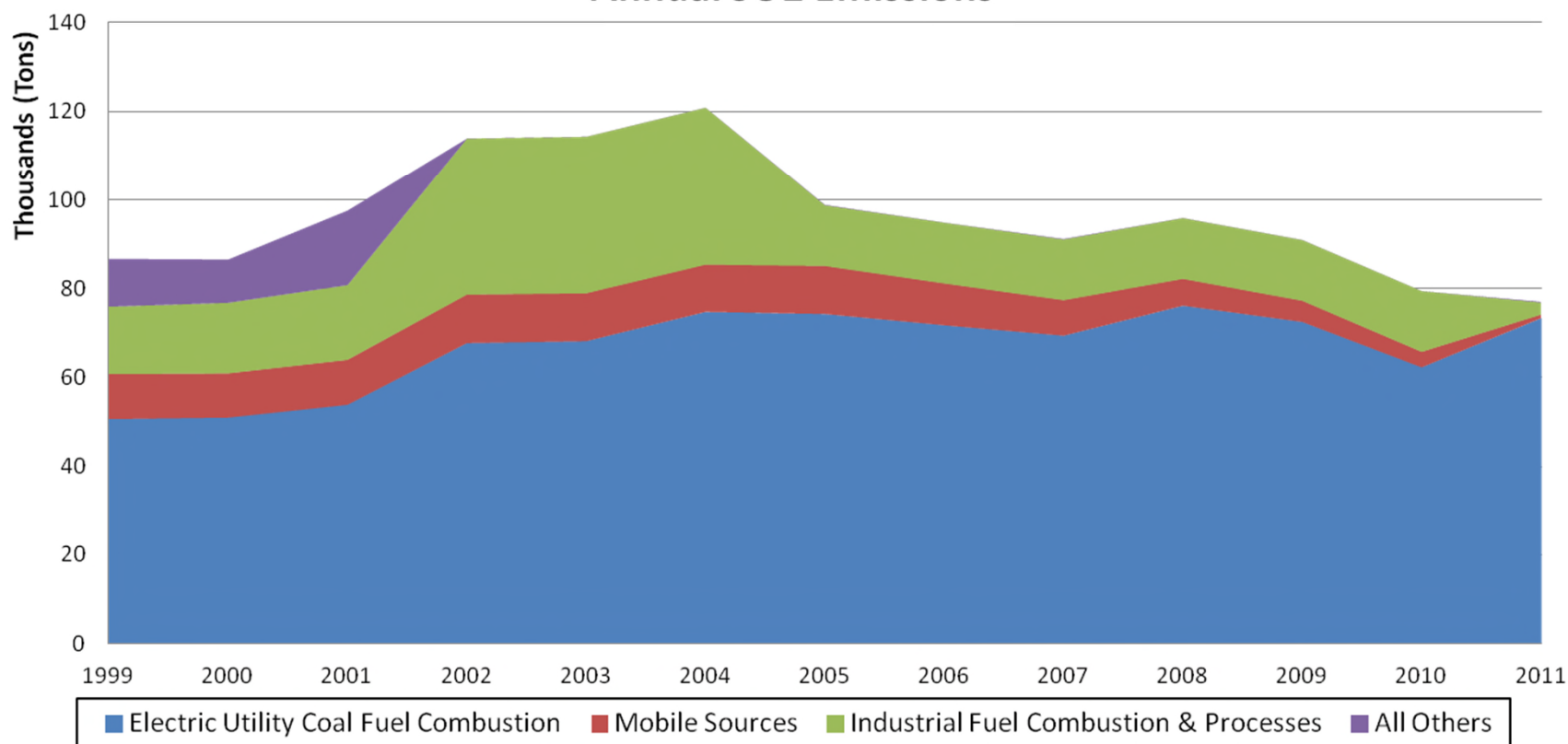
Nebraska Emission Trends (SO₂)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	50,704	53,902	68,122	74,203	71,688	69,343	76,066	72,430	62,278	73,271
Mobile Sources	10,123	10,123	10,820	10,862	9,455	8,048	6,105	4,817	3,529	874
Industrial Fuel Combustion & Processes	15,157	16,794	35,309	13,661	13,659	13,657	13,655	13,654	13,652	2,768
All Others	10,744	16,734	34	120	52	128	49	43	40	169
Total	86,728	97,553	114,285	98,846	94,854	91,176	95,876	90,944	79,499	77,081

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	6%	34%	46%	41%	37%	50%	43%	23%	45%
Mobile Sources	0%	0%	7%	7%	-7%	-20%	-40%	-52%	-65%	-91%
Industrial Fuel Combustion & Processes	0%	11%	133%	-10%	-10%	-10%	-10%	-10%	-10%	-82%
All Others	0%	56%	-100%	-99%	-100%	-99%	-100%	-100%	-100%	-98%
Total	0%	12%	32%	14%	9%	5%	11%	5%	-8%	-11%

Nebraska Emission Trends (SO₂)

**Major Source Category Summary
Annual SO₂ Emissions**



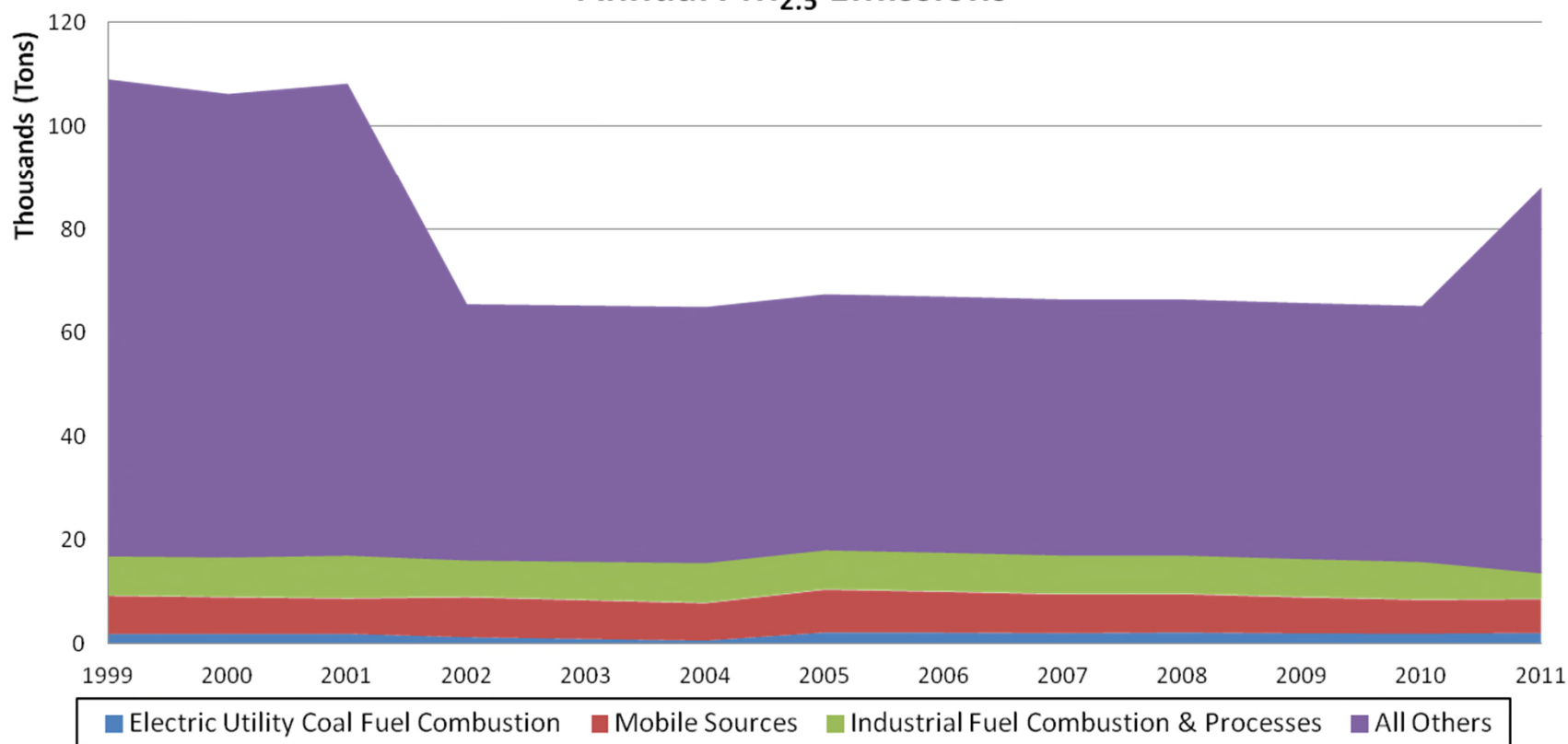
Nebraska Emission Trends (PM_{2.5})

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	1,818	1,837	846	2,093	2,072	1,966	2,097	1,928	1,869	2,009
Mobile Sources	7,379	6,823	7,493	8,294	7,903	7,513	7,432	6,978	6,524	6,537
Industrial Fuel Combustion & Processes	7,662	8,335	7,471	7,631	7,582	7,532	7,482	7,432	7,382	5,033
All Others	92,255	91,309	49,528	49,508	49,507	49,510	49,505	49,499	49,498	74,540
Total	109,114	108,303	65,338	67,526	67,063	66,520	66,516	65,837	65,273	88,119

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%	-53%	15%	14%	8%	15%	6%	3%	10%
Mobile Sources	0%	-8%	2%	12%	7%	2%	1%	-5%	-12%	-11%
Industrial Fuel Combustion & Processes	0%	9%	-2%	0%	-1%	-2%	-2%	-3%	-4%	-34%
All Others	0%	-1%	-46%	-46%	-46%	-46%	-46%	-46%	-46%	-19%
Total	0%	-1%	-40%	-38%	-39%	-39%	-39%	-40%	-40%	-19%

Nebraska 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 Nebraska
- 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

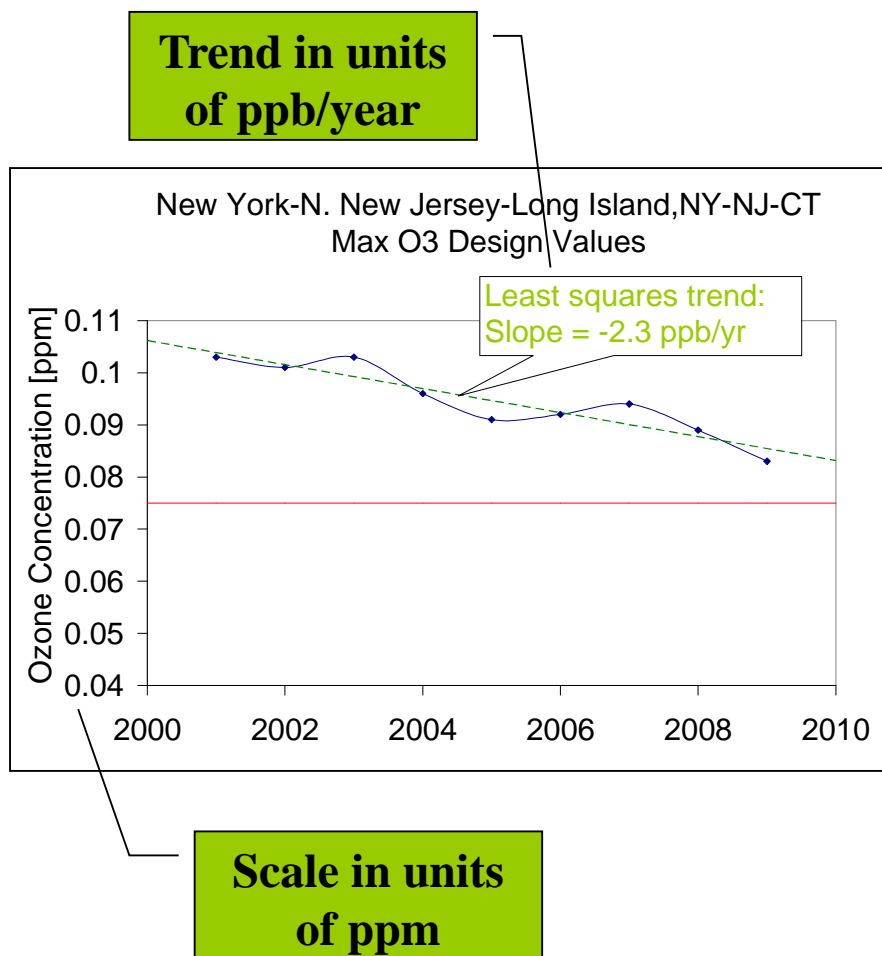
Data Handling Procedures

- 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

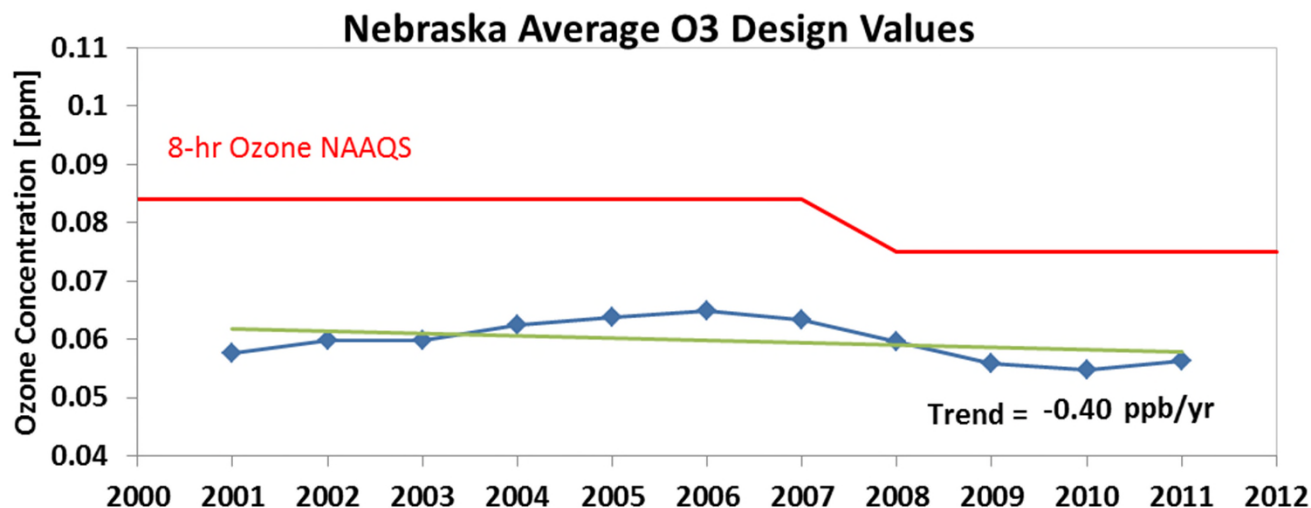
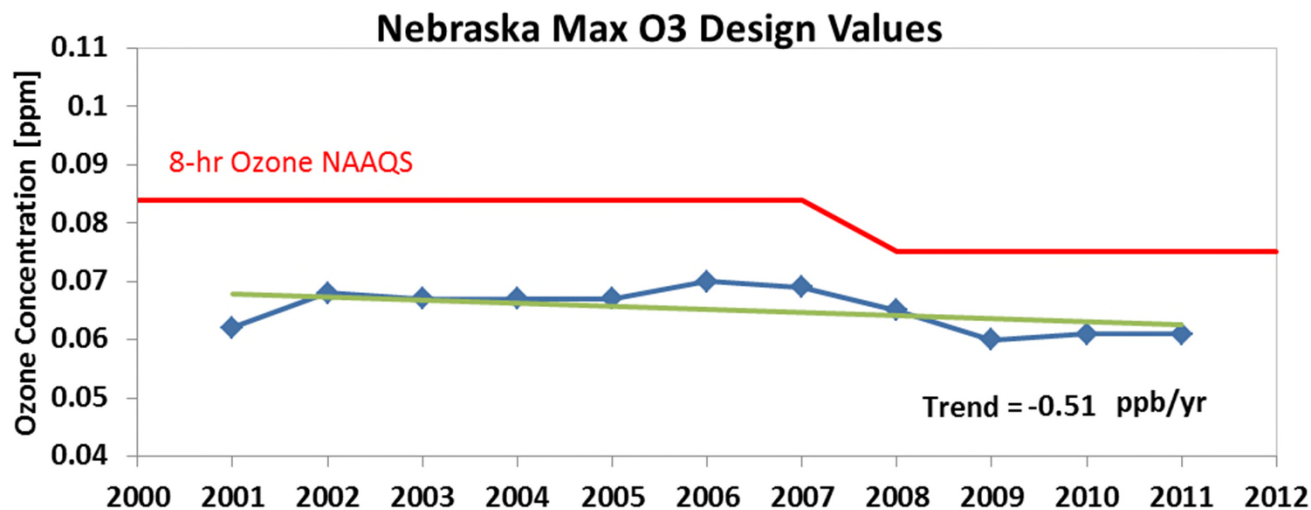
- Annual $\text{PM}_{2.5}$ DV and 24-hr $\text{PM}_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculations based on EPA data handling conventions
 - Data extracted from monitors that have a non-regulatory monitoring type are omitted
 - Selection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



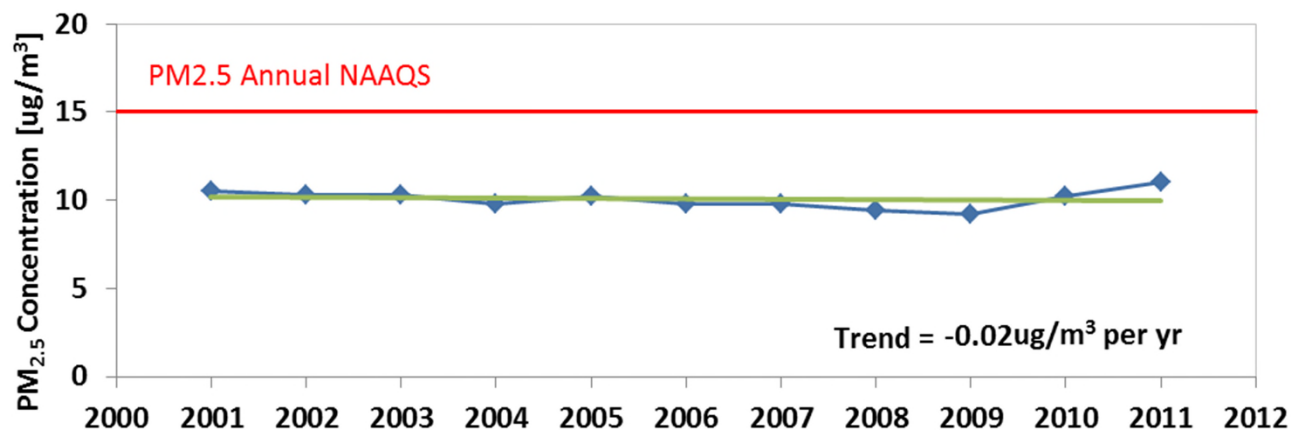
Ozone Trends by Site in Nebraska

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
3105500284420101	Douglas, NE	0.056	-0.65
3105500324420101	Douglas, NE	N/A	-2.23
3105500354420101	Douglas, NE	0.061	0.61
3110900164420101	Lancaster, NE	0.052	-0.31

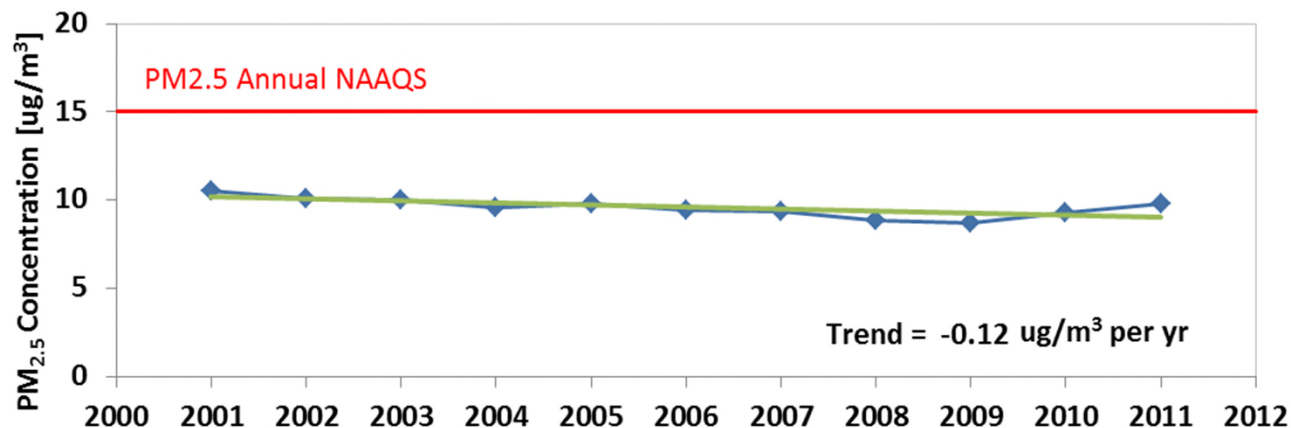
Note: Only monitoring sites meeting data completeness criteria listed

Max/Ave PM_{2.5} Annual DVs and Trend

Nebraska Max PM2.5 Annual Design Values

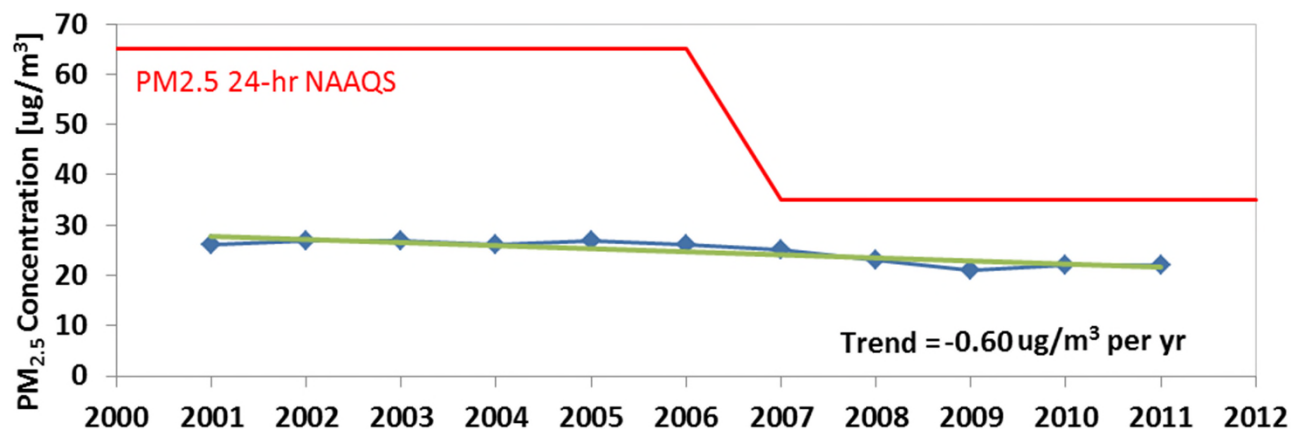


Nebraska Average PM2.5 Annual Design Values

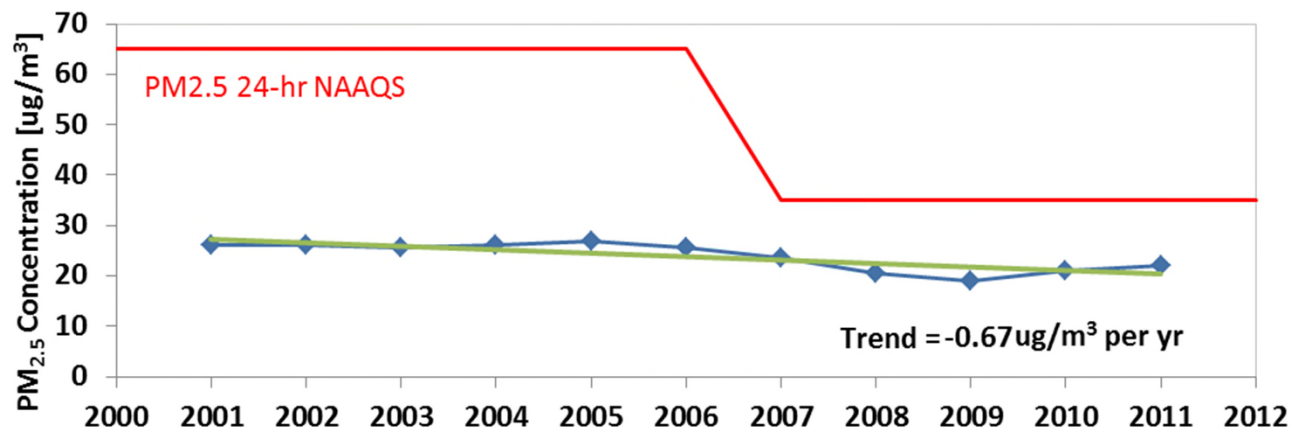


Max/Ave PM_{2.5} 24-Hour DVs and Trend

Nebraska Max PM_{2.5} 24-Hour Design Values



Nebraska Average PM_{2.5} 24-Hour Design Values



PM_{2.5} Trends by Site in Nebraska

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
310550052	Douglas	9.8	22	-0.12	-0.71
311090022	Lancaster	8.5	22	-0.21	-0.75
311530007	Sarpy	11.0	N/A	0.04	N/A

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O_3 and annual $PM_{2.5}$ design values have remained steady since 1999 in Nebraska. Average 24-hour $PM_{2.5}$ design values have decreased since 1999 in Nebraska based on data from two monitor stations.
- There are no currently designated O_3 or $PM_{2.5}$ non-attainment areas in Nebraska.