

# Emission and Air Quality Trends Review 1999-2011

---

## Arkansas

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<sub>x</sub>, SO<sub>2</sub>, and PM<sub>2.5</sub>
- 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

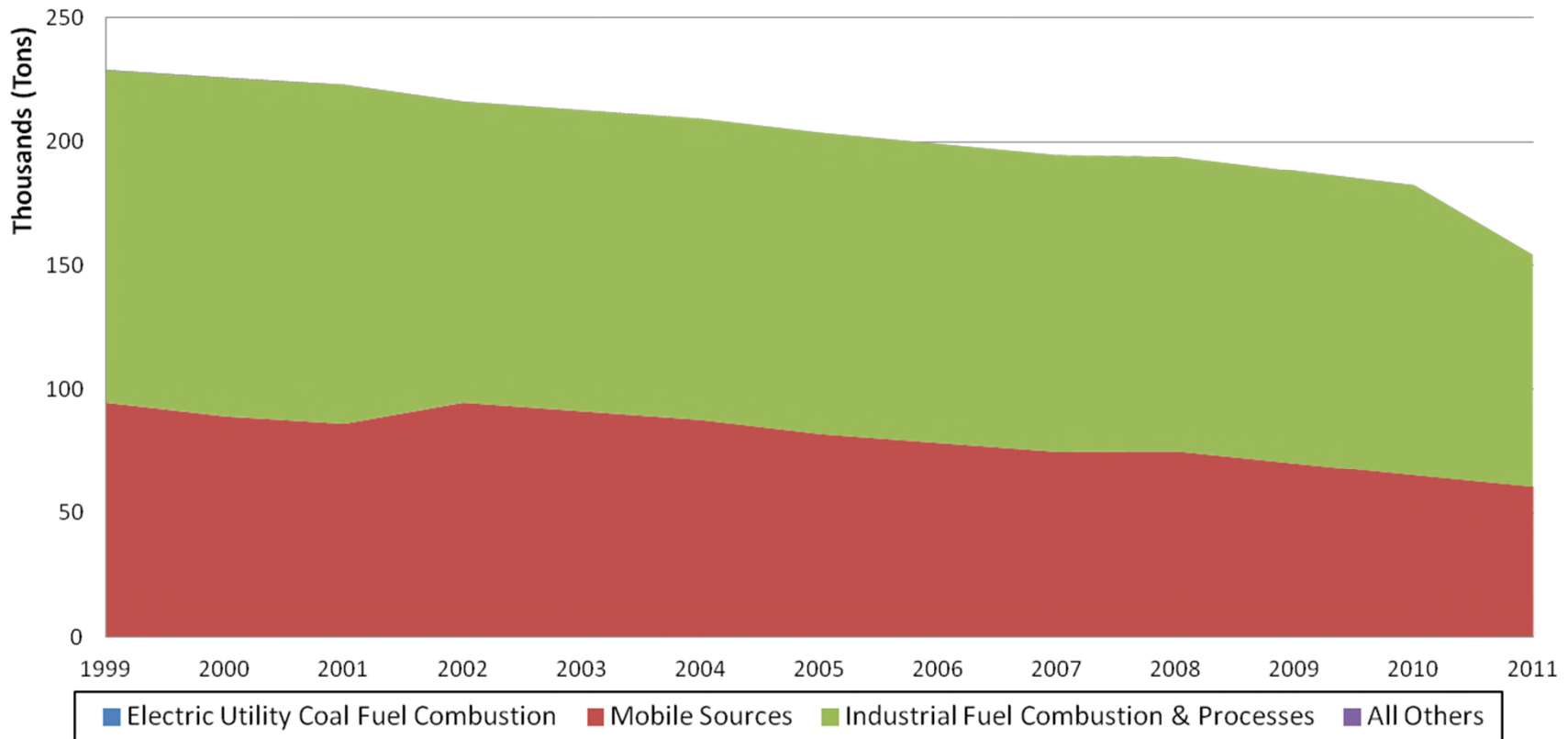
# Arkansas Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	451	458	439	420	438	464	450	421	444	363
Mobile Sources	94,412	85,893	90,939	81,819	78,199	74,579	74,811	69,899	64,987	60,356
Industrial Fuel Combustion & Processes	134,060	136,660	121,379	121,461	120,515	119,571	118,623	117,679	116,736	93,490
All Others	191	131	99	84	92	84	86	97	104	77
<b>Total</b>	<b>229,113</b>	<b>223,142</b>	<b>212,856</b>	<b>203,784</b>	<b>199,244</b>	<b>194,698</b>	<b>193,970</b>	<b>188,096</b>	<b>182,271</b>	<b>154,287</b>

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%	-3%	-7%	-3%	3%	0%	-7%	-1%	-19%
Mobile Sources	0%	-9%	-4%	-13%	-17%	-21%	-21%	-26%	-31%	-36%
Industrial Fuel Combustion & Processes	0%	2%	-9%	-9%	-10%	-11%	-12%	-12%	-13%	-30%
All Others	0%	-31%	-48%	-56%	-52%	-56%	-55%	-49%	-45%	-59%
<b>Total</b>	<b>0%</b>	<b>-3%</b>	<b>-7%</b>	<b>-11%</b>	<b>-13%</b>	<b>-15%</b>	<b>-15%</b>	<b>-18%</b>	<b>-20%</b>	<b>-33%</b>

# Arkansas Emission Trends (VOC)

**Major Source Category Summary  
Annual VOC Emissions**



# Arkansas Emission Trends (NO<sub>x</sub>)

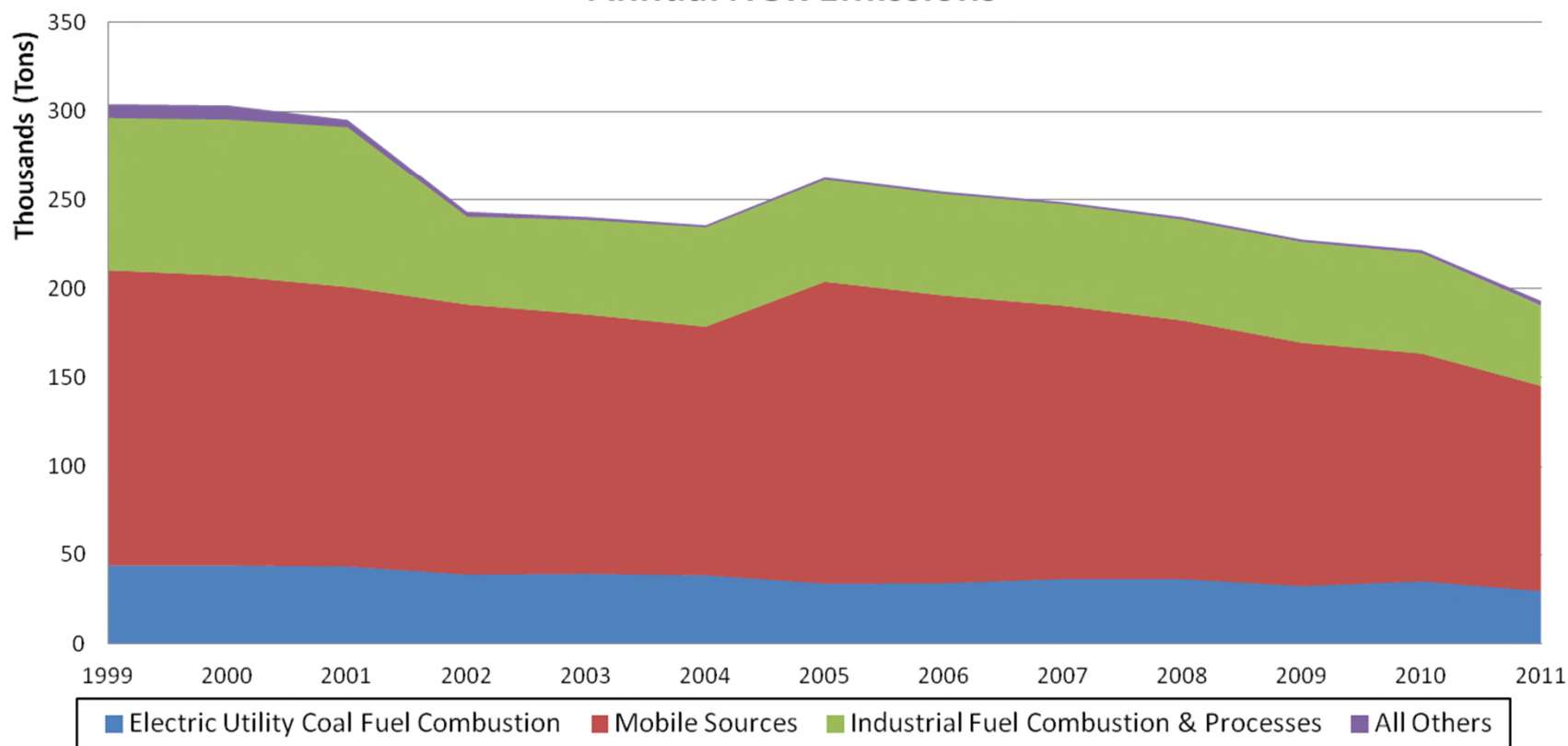
Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	44,147	43,623	39,515	34,062	34,279	36,598	36,514	32,644	35,305	29,840
Mobile Sources	166,123	157,283	146,005	169,815	161,813	153,810	145,615	136,990	128,366	115,706
Industrial Fuel Combustion & Processes	86,234	90,431	53,097	57,518	57,196	57,081	56,620	56,592	56,264	44,957
All Others	7,768	4,157	1,660	1,287	1,245	1,172	1,428	1,356	1,672	2,623
<b>Total</b>	<b>304,271</b>	<b>295,494</b>	<b>240,277</b>	<b>262,682</b>	<b>254,532</b>	<b>248,660</b>	<b>240,177</b>	<b>227,582</b>	<b>221,607</b>	<b>193,126</b>

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%	-10%	-23%	-22%	-17%	-17%	-26%	-20%	-32%
Mobile Sources	0%	-5%	-12%	2%	-3%	-7%	-12%	-18%	-23%	-30%
Industrial Fuel Combustion & Processes	0%	5%	-38%	-33%	-34%	-34%	-34%	-34%	-35%	-48%
All Others	0%	-46%	-79%	-83%	-84%	-85%	-82%	-83%	-78%	-66%
<b>Total</b>	<b>0%</b>	<b>-3%</b>	<b>-21%</b>	<b>-14%</b>	<b>-16%</b>	<b>-18%</b>	<b>-21%</b>	<b>-25%</b>	<b>-27%</b>	<b>-37%</b>



# Arkansas Emission Trends (NO<sub>x</sub>)

Major Source Category Summary  
Annual NO<sub>x</sub> Emissions



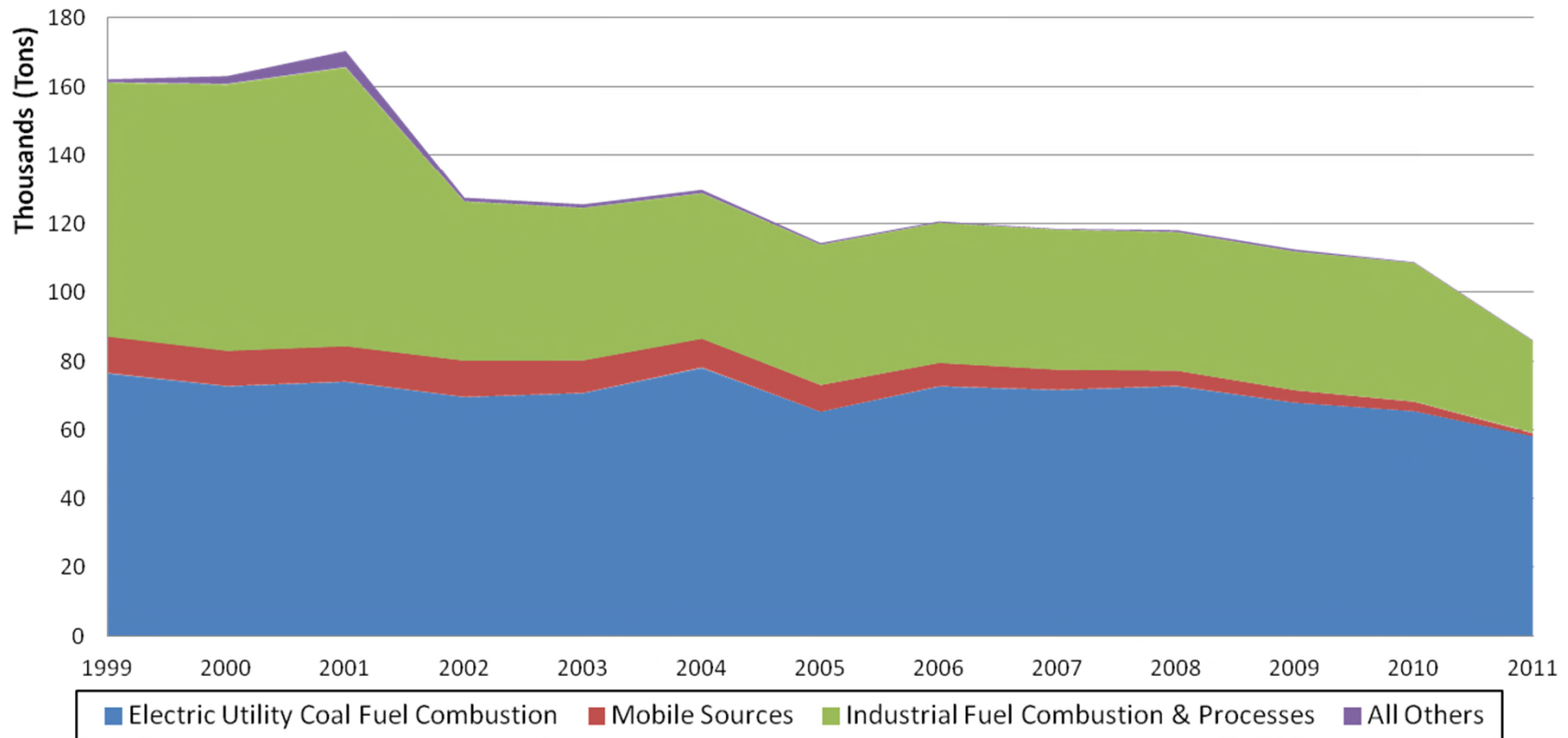
# Arkansas Emission Trends (SO<sub>2</sub>)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	76,592	74,134	70,873	65,480	72,821	71,777	72,889	68,069	65,645	58,439
Mobile Sources	10,591	10,279	9,437	7,700	6,759	5,819	4,438	3,584	2,730	875
Industrial Fuel Combustion & Processes	74,144	81,329	44,305	40,758	40,731	40,716	40,276	40,269	40,262	26,710
All Others	851	4,643	974	442	338	177	513	552	188	188
<b>Total</b>	<b>162,177</b>	<b>170,384</b>	<b>125,588</b>	<b>114,380</b>	<b>120,649</b>	<b>118,489</b>	<b>118,116</b>	<b>112,474</b>	<b>108,826</b>	<b>86,212</b>

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-3%	-7%	-15%	-5%	-6%	-5%	-11%	-14%	-24%
Mobile Sources	0%	-3%	-11%	-27%	-36%	-45%	-58%	-66%	-74%	-92%
Industrial Fuel Combustion & Processes	0%	10%	-40%	-45%	-45%	-45%	-46%	-46%	-46%	-64%
All Others	0%	445%	14%	-48%	-60%	-79%	-40%	-35%	-78%	-78%
<b>Total</b>	<b>0%</b>	<b>5%</b>	<b>-23%</b>	<b>-29%</b>	<b>-26%</b>	<b>-27%</b>	<b>-27%</b>	<b>-31%</b>	<b>-33%</b>	<b>-47%</b>

# Arkansas Emission Trends (SO<sub>2</sub>)

Major Source Category Summary  
Annual SO<sub>2</sub> Emissions



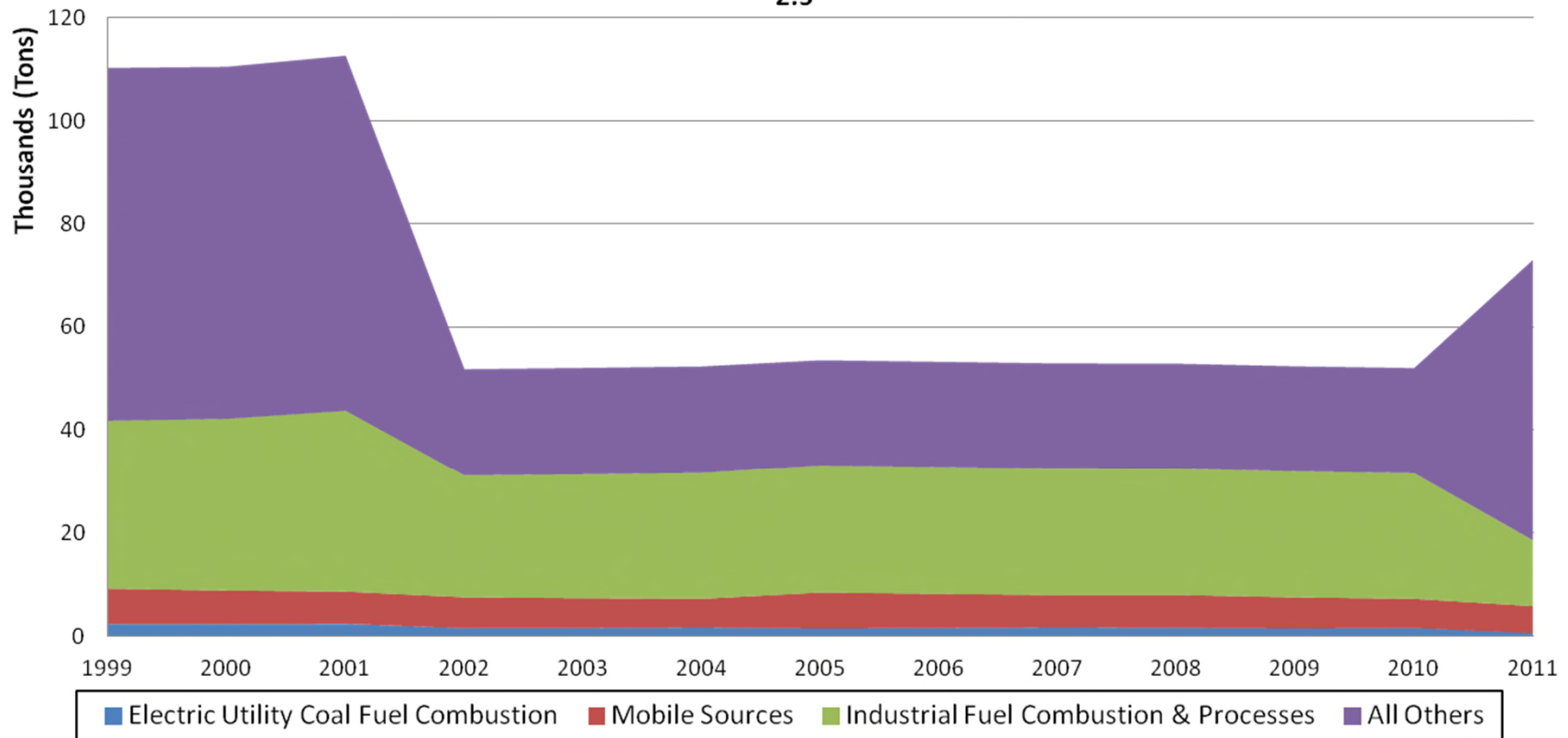
# Arkansas Emission Trends (PM<sub>2.5</sub>)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	2,463	2,490	1,675	1,605	1,677	1,771	1,718	1,608	1,694	668
Mobile Sources	6,773	6,177	5,737	6,884	6,561	6,236	6,318	5,957	5,596	5,200
Industrial Fuel Combustion & Processes	32,642	35,139	24,006	24,724	24,646	24,562	24,495	24,421	24,344	12,740
All Others	68,386	68,824	20,658	20,349	20,384	20,374	20,375	20,401	20,416	54,330
<b>Total</b>	<b>110,264</b>	<b>112,630</b>	<b>52,076</b>	<b>53,562</b>	<b>53,267</b>	<b>52,944</b>	<b>52,906</b>	<b>52,388</b>	<b>52,050</b>	<b>72,938</b>

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%	-32%	-35%	-32%	-28%	-30%	-35%	-31%	-73%
Mobile Sources	0%	-9%	-15%	2%	-3%	-8%	-7%	-12%	-17%	-23%
Industrial Fuel Combustion & Processes	0%	8%	-26%	-24%	-24%	-25%	-25%	-25%	-25%	-61%
All Others	0%	1%	-70%	-70%	-70%	-70%	-70%	-70%	-70%	-21%
<b>Total</b>	<b>0%</b>	<b>2%</b>	<b>-53%</b>	<b>-51%</b>	<b>-52%</b>	<b>-52%</b>	<b>-52%</b>	<b>-52%</b>	<b>-53%</b>	<b>-34%</b>

# Arkansas Emission Trends (PM<sub>2.5</sub>)

**Major Source Category Summary**  
**Annual PM<sub>2.5</sub> Emissions**



# Emission Trends Summary

---

- All pollutants have decreased since 1999 in aggregate across Arkansas
- NO<sub>x</sub> from Electric Utility Fuel Combustion sources show decrease over time as a result of CAIR control implementation
- All pollutants from the Highway and Off-highway Vehicles categories show decrease over time as a result of various mobile source fuel and fleet rulemakings, including the Tier 2/Gasoline Sulfur rule and Heavy Duty Engine/Vehicle and Highway Diesel Fuel rules

# Air Quality Design Values

---

## □ Ozone

- Annual 4<sup>th</sup> highest daily maximum 8-hour average averaged over three consecutive years
- Current standard = 0.075 ppm

## □ PM<sub>2.5</sub> Annual

- Annual arithmetic mean of quarterly means averaged over three consecutive years
- Current standard = 12 ug/m<sup>3</sup>

## □ PM<sub>2.5</sub> 24-Hour

- Annual 98<sup>th</sup> percentile of daily averages averaged over three consecutive years
- Current standard = 35 ug/m<sup>3</sup>

# 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

---

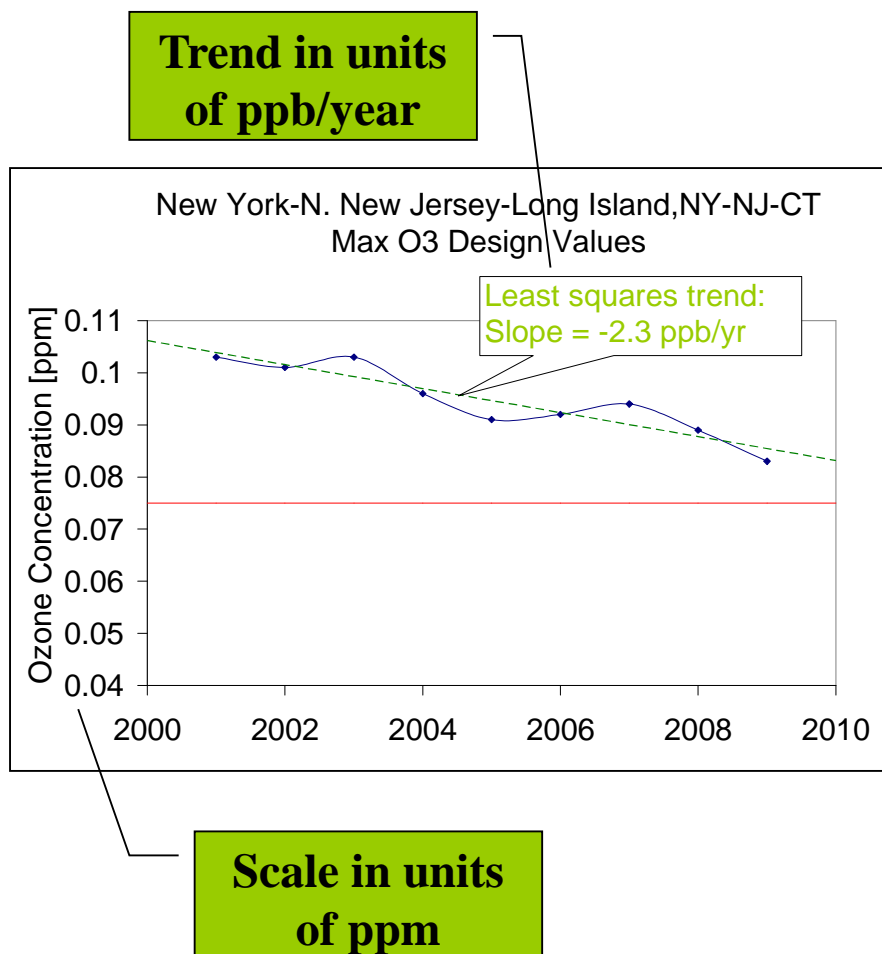
- O<sub>3</sub> design value (DV) for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculated using annual 4<sup>th</sup> highest daily max 8-hr averages and percent of valid observations, based on EPA data handling conventions
  - Data associated with exceptional 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

---

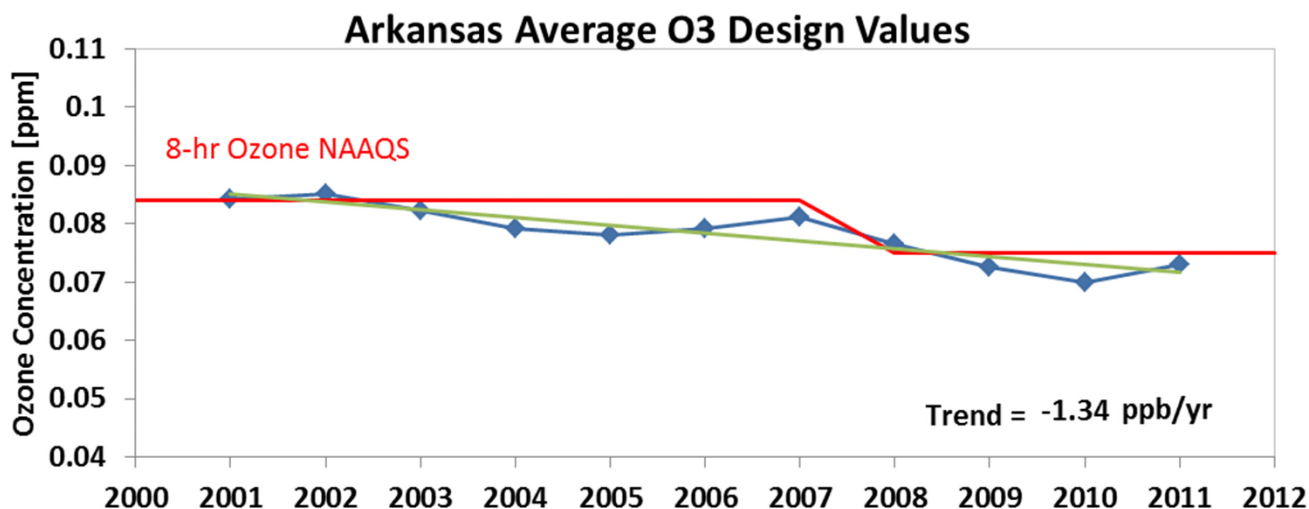
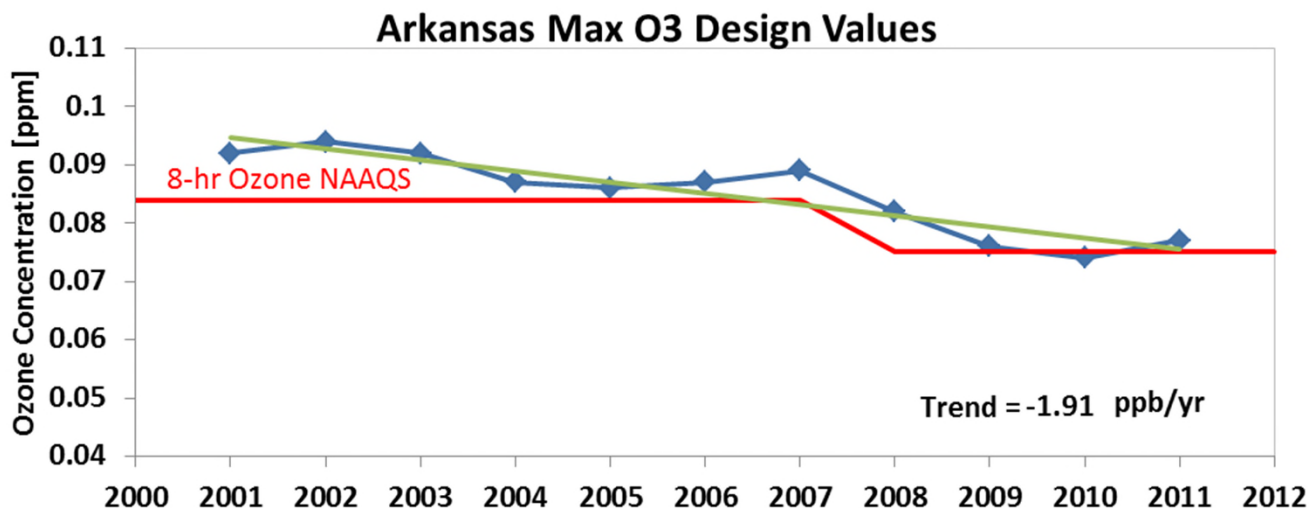
- Annual PM<sub>2.5</sub> DV and 24-hr PM<sub>2.5</sub> DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculations based on EPA data handling conventions
  - Data extracted from monitors that have a non-regulatory monitoring type are omitted
  - Selection 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<sub>3</sub> DVs and Trend



# Ozone Trends by Site in Arkansas

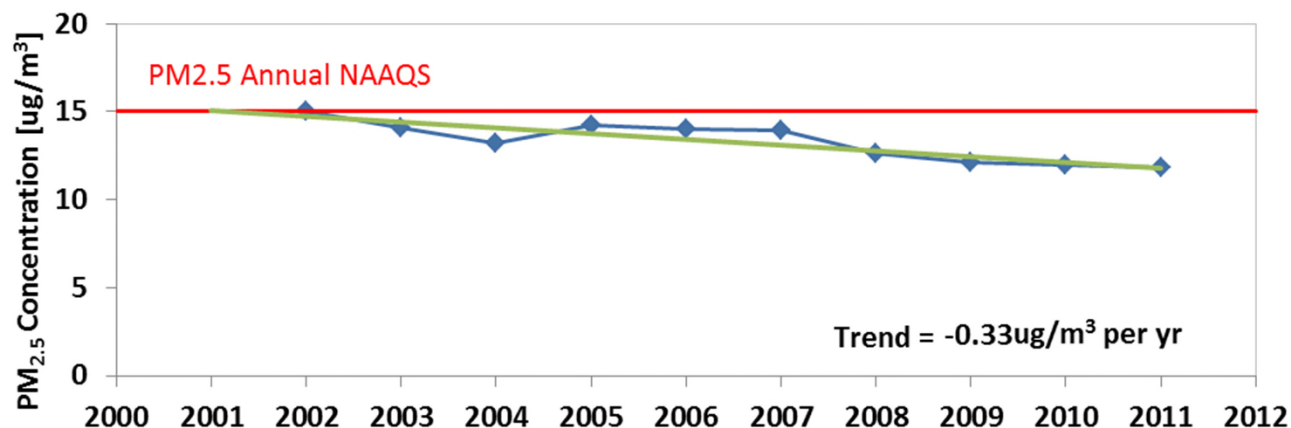
---

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
0503500054420101	Crittenden, AR	0.077	-1.91
0510100024420101	Newton, AR	0.068	-1.27
0511900074420101	Pulaski, AR	0.073	-0.90
0511910024420101	Pulaski, AR	0.074	-1.29

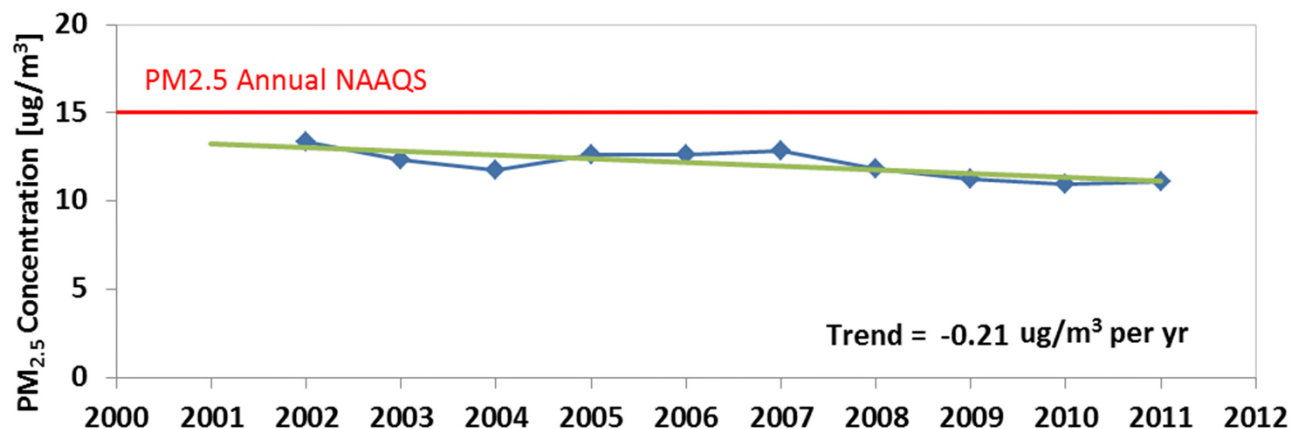
Note: Only monitoring sites meeting data completeness criteria listed

# Max/Ave PM<sub>2.5</sub> Annual DVs and Trend

## Arkansas Max PM2.5 Annual Design Values

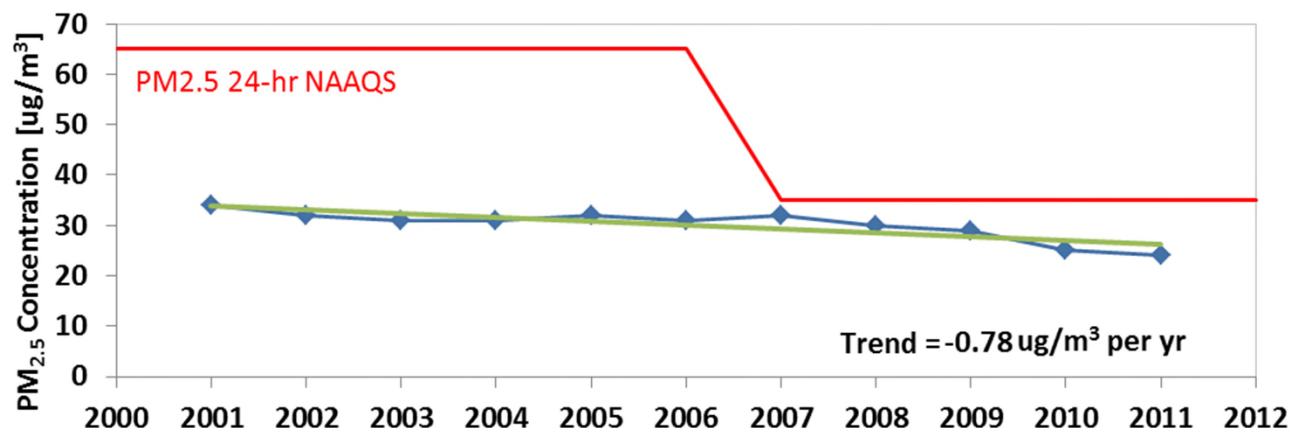


## Arkansas Average PM2.5 Annual Design Values

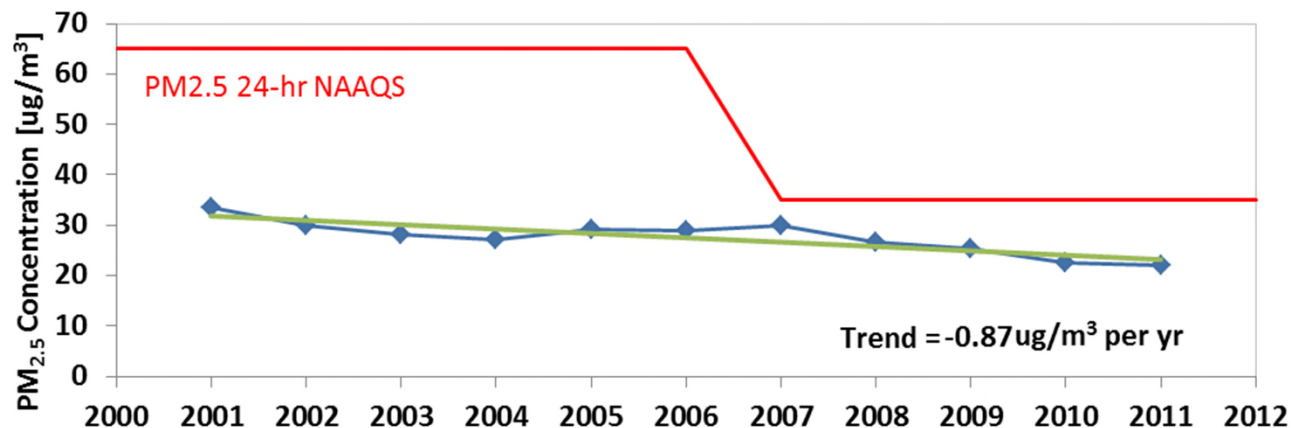


# Max/Ave PM<sub>2.5</sub> 24-Hour DVs and Trend

## Arkansas Max PM<sub>2.5</sub> 24-Hour Design Values



## Arkansas Average PM<sub>2.5</sub> 24-Hour Design Values



# PM<sub>2.5</sub> Trends by Site in Arkansas

Monitoring Site	County	2009-2011 DV [ug/m <sup>3</sup> ]		Trend [ug/m <sup>3</sup> per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
050010011	Arkansas	10.7	22	-0.18	-0.67
050030005	Ashley	10.6	22	-0.23	-0.78
050450002	Faulkner	10.8	20	-0.27	-1.25
051070001	Phillips	10.7	21	-0.20	-1.00
051130002	Polk	10.8	21	-0.07	-0.56
051150003	Pope	11.3	23	-0.14	-0.54
051190007	Pulaski	11.7	23	-0.29	-0.94
051191004	Pulaski	11.8	24	-0.33	-0.74
051450001	White	11.3	22	-0.16	-0.52

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 Arkansas; average annual  $PM_{2.5}$  design values have decreased since 2000 (incomplete data in 1999)
- $O_3$  design values have decreased since 1999 in Memphis, TN-MS-AR, the only currently designated  $O_3$  non-attainment area in Arkansas. There are no currently designated  $PM_{2.5}$  non-attainment areas in Arkansas