Emission and Air Quality Trends Review

Utah

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

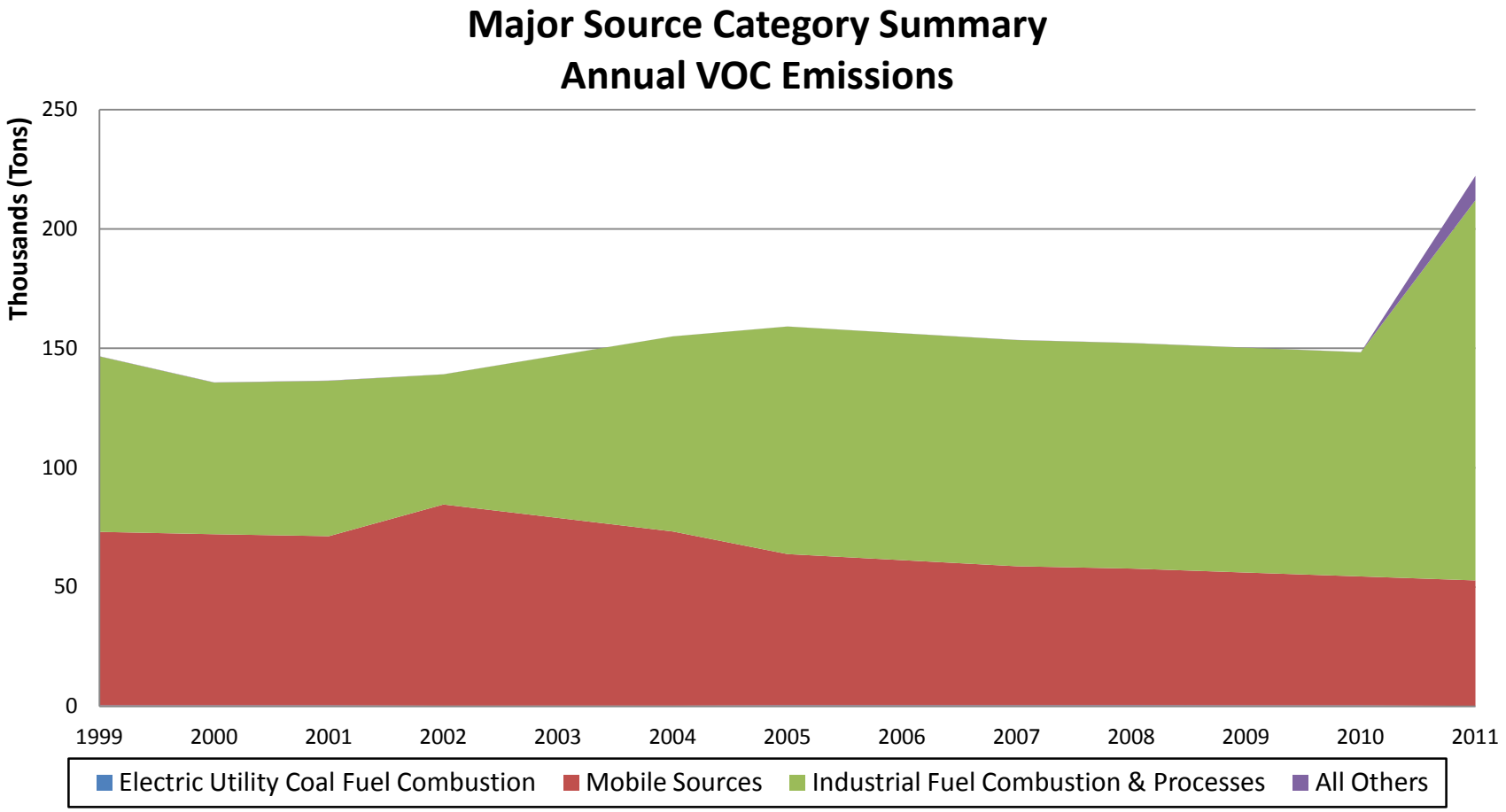
- Negative values indicate decrease in emissions, positive values indicate an increase

Utah Emission Trends (VOC)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	454	447	347	479	484	474	490	445	432	232
Mobile Sources	72,653	70,859	78,594	63,325	60,778	58,232	57,242	55,625	54,007	52,543
Industrial Fuel Combustion & Processes	73,496	65,092	68,128	95,331	95,047	94,763	94,478	94,194	93,910	159,276
All Others	79	102	31	30	44	63	66	58	53	10,231
Total	**146,683**	**136,500**	**147,099**	**159,165**	**156,353**	**153,532**	**152,276**	**150,322**	**148,402**	**222,281**

	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%	-24%	6%	7%	4%	8%	-2%	-5%	-49%
Mobile Sources	0%	-2%	8%	-13%	-16%	-20%	-21%	-23%	-26%	-28%
Industrial Fuel Combustion & Processes	0%	-11%	-7%	30%	29%	29%	29%	28%	28%	117%
All Others	0%	29%	-62%	-62%	-44%	-21%	-17%	-27%	-33%	12797%
Total	**0%**	**-7%**	**0%**	**9%**	**7%**	**5%**	**4%**	**2%**	**1%**	**52%**

Utah Emission Trends (VOC)

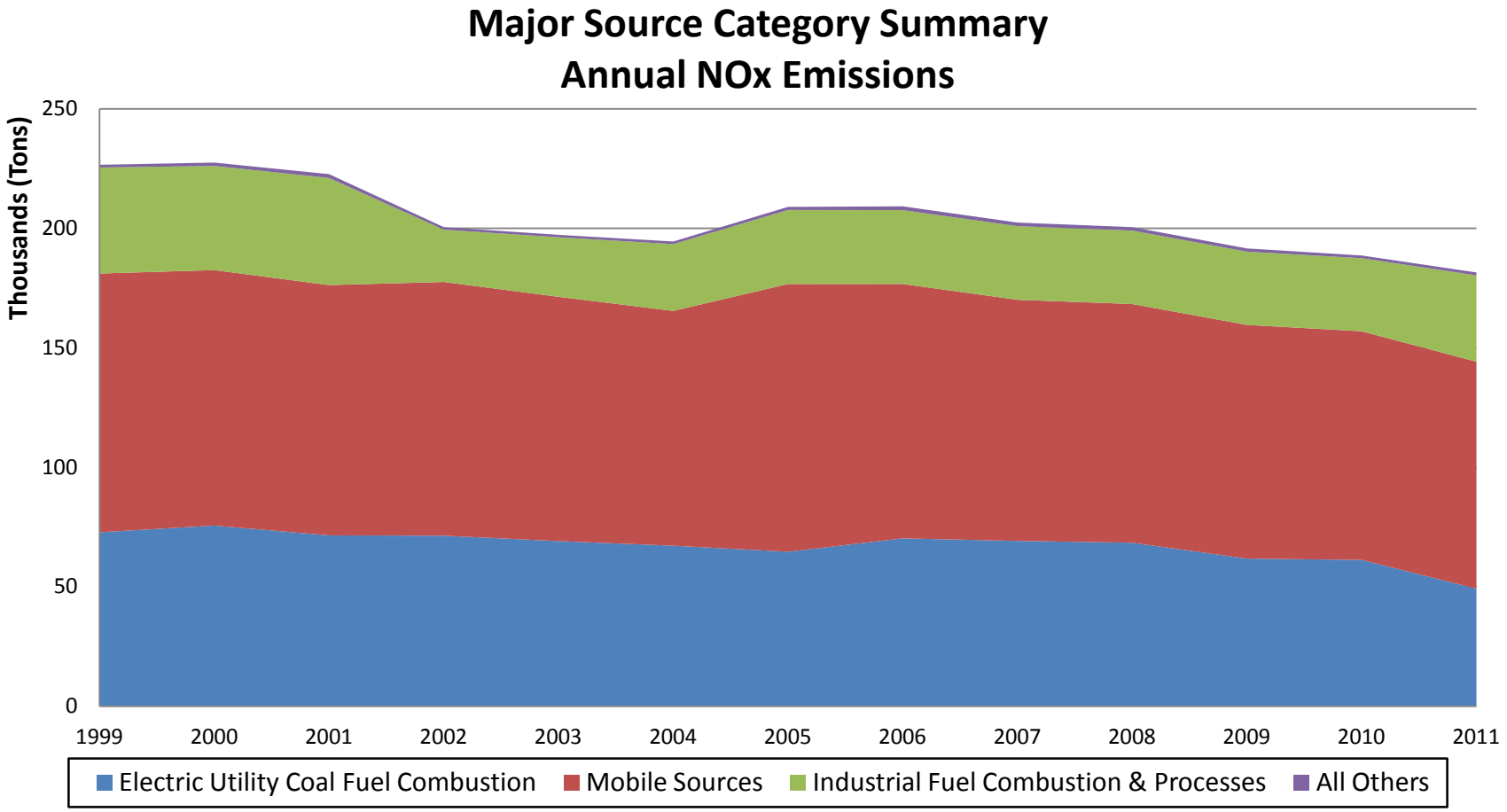


Utah Emission Trends (NOx)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	72,815	71,514	69,121	64,668	70,253	69,193	68,446	61,803	61,242	49,207
Mobile Sources	108,286	104,748	102,229	112,047	106,479	100,912	99,889	97,792	95,695	94,975
Industrial Fuel Combustion & Processes	44,360	44,830	24,915	30,980	30,898	30,816	30,734	30,652	30,570	36,141
All Others	1,139	1,593	1,021	1,290	1,587	1,499	1,439	1,353	1,140	1,226
Total	**226,600**	**222,685**	**197,285**	**208,985**	**209,218**	**202,420**	**200,509**	**191,601**	**188,648**	**181,549**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	-2%	-5%	-11%	-4%	-5%	-6%	-15%	-16%	-32%
Mobile Sources	0%	-3%	-6%	3%	-2%	-7%	-8%	-10%	-12%	-12%
Industrial Fuel Combustion & Processes	0%	1%	-44%	-30%	-30%	-31%	-31%	-31%	-31%	-19%
All Others	0%	40%	-10%	13%	39%	32%	26%	19%	0%	8%
Total	**0%**	**-2%**	**-13%**	**-8%**	**-8%**	**-11%**	**-12%**	**-15%**	**-17%**	**-20%**

Utah Emission Trends (NOx)

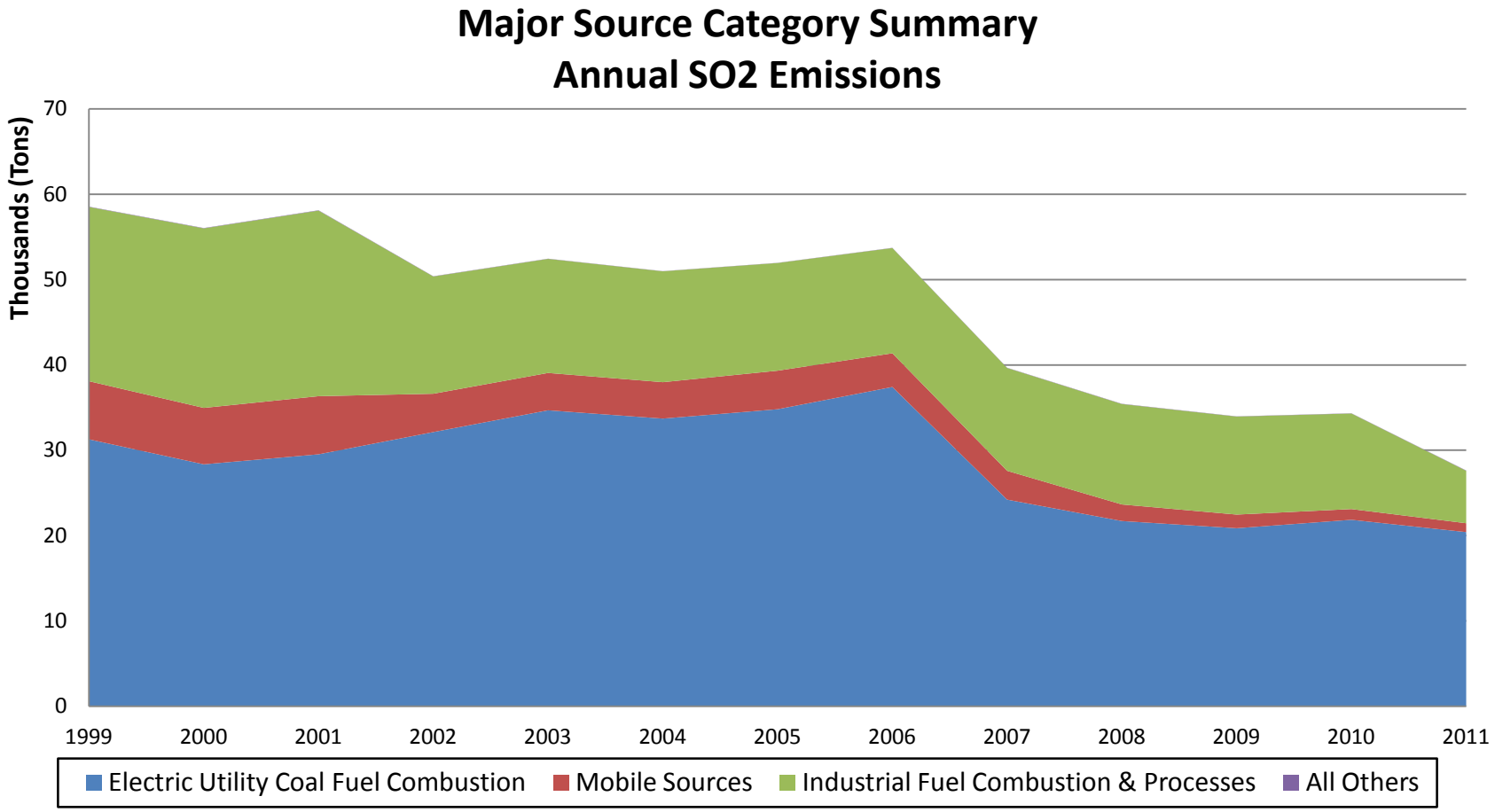


Utah Emission Trends (SO_2)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	31,277	29,524	34,680	34,804	37,413	24,213	21,705	20,862	21,851	20,407
Mobile Sources	6,811	6,810	4,378	4,519	3,948	3,377	1,942	1,599	1,257	1,042
Industrial Fuel Combustion & Processes	20,420	21,749	13,366	12,620	12,336	12,052	11,768	11,484	11,200	6,144
All Others	36	38	23	19	23	28	29	26	25	35
Total	**58,544**	**58,121**	**52,448**	**51,961**	**53,719**	**39,670**	**35,444**	**33,971**	**34,333**	**27,628**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	-6%	11%	11%	20%	-23%	-31%	-33%	-30%	-35%
Mobile Sources	0%	0%	-36%	-34%	-42%	-50%	-71%	-77%	-82%	-85%
Industrial Fuel Combustion & Processes	0%	7%	-35%	-38%	-40%	-41%	-42%	-44%	-45%	-70%
All Others	0%	5%	-36%	-49%	-38%	-24%	-20%	-29%	-33%	-3%
Total	**0%**	**-1%**	**-10%**	**-11%**	**-8%**	**-32%**	**-39%**	**-42%**	**-41%**	**-53%**

Utah Emission Trends (SO_2)

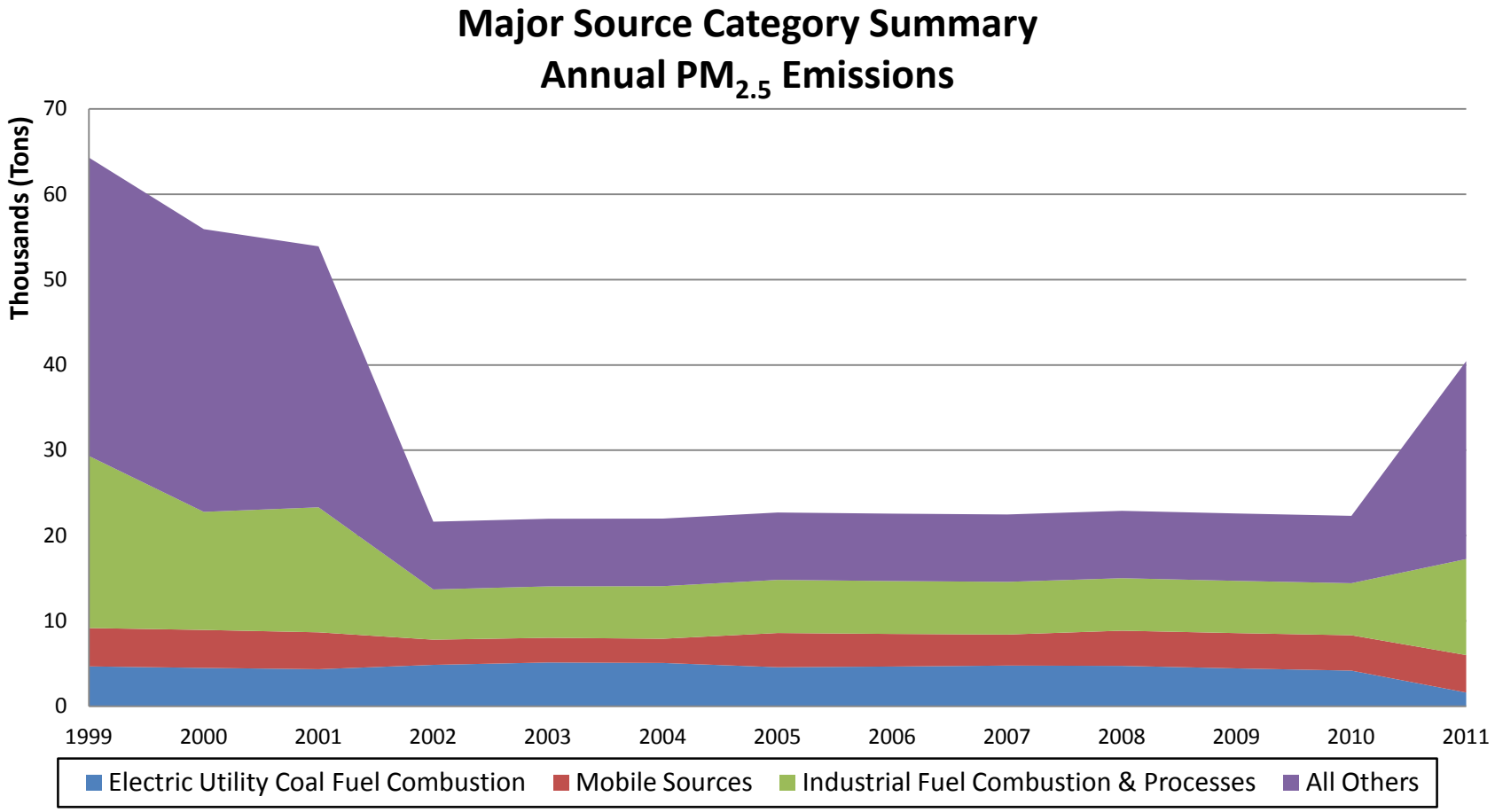


Utah Emission Trends ($PM_{2.5}$)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	4,671	4,342	5,129	4,577	4,654	4,769	4,733	4,439	4,177	1,610
Mobile Sources	4,494	4,322	2,895	4,007	3,821	3,634	4,123	4,134	4,144	4,387
Industrial Fuel Combustion & Processes	20,157	14,649	6,023	6,225	6,200	6,174	6,149	6,124	6,099	11,253
All Others	34,960	30,581	7,924	7,896	7,896	7,896	7,895	7,894	7,893	23,190
Total	**64,283**	**53,895**	**21,970**	**22,704**	**22,570**	**22,473**	**22,901**	**22,590**	**22,313**	**40,441**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	-7%	10%	-2%	0%	2%	1%	-5%	-11%	-66%
Mobile Sources	0%	-4%	-36%	-11%	-15%	-19%	-8%	-8%	-8%	-2%
Industrial Fuel Combustion & Processes	0%	-27%	-70%	-69%	-69%	-69%	-69%	-70%	-70%	-44%
All Others	0%	-13%	-77%	-77%	-77%	-77%	-77%	-77%	-77%	-34%
Total	**0%**	**-16%**	**-66%**	**-65%**	**-65%**	**-65%**	**-64%**	**-65%**	**-65%**	**-37%**

Utah Emission Trends ($PM_{2.5}$)



Emission Trends Summary

- All pollutants with the exception of VOC have decreased since 1999 in aggregate across Utah
  - VOC increases largely due to Industrial Processes
- 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

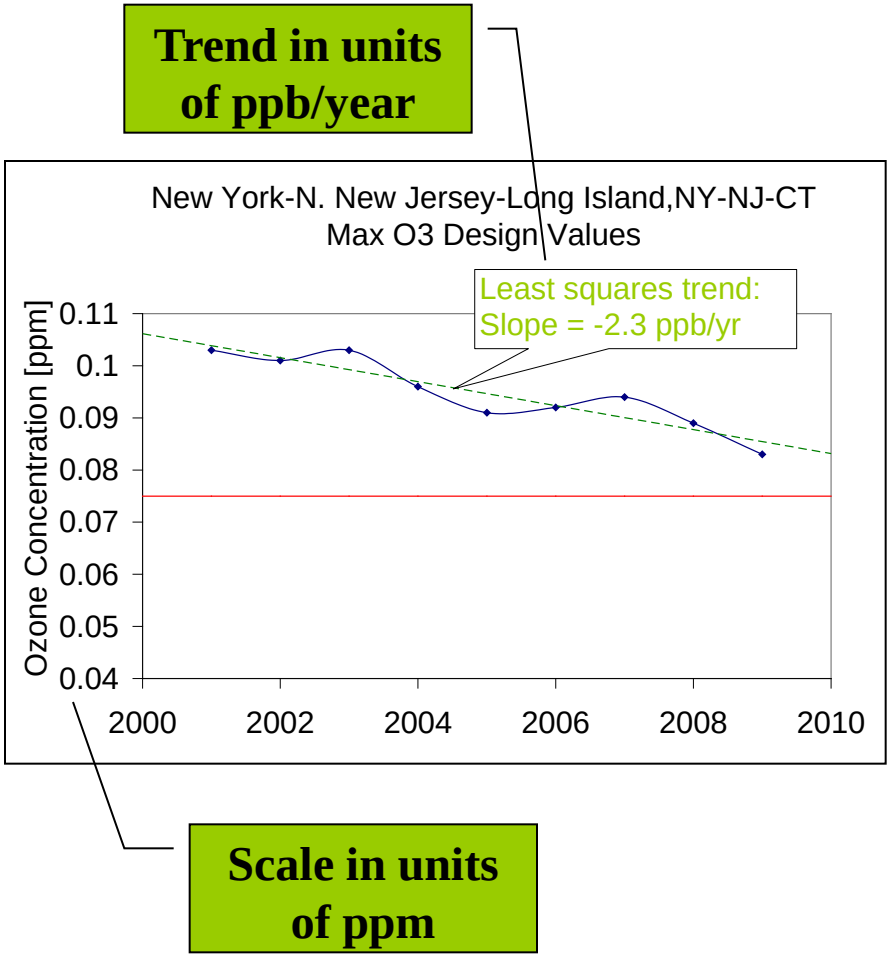
Data Handling Procedures

- 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

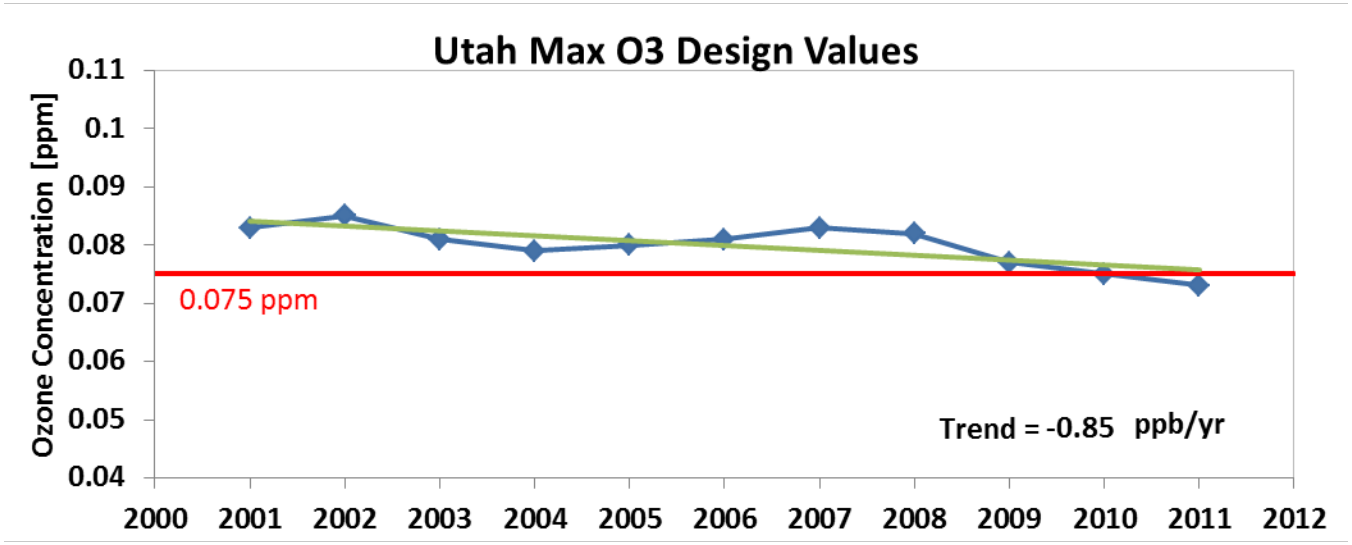
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculations based on EPA data handling conventions
  - Data extracted from monitors that have a non-regulatory monitoring type are omitted
  - Selection of trend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

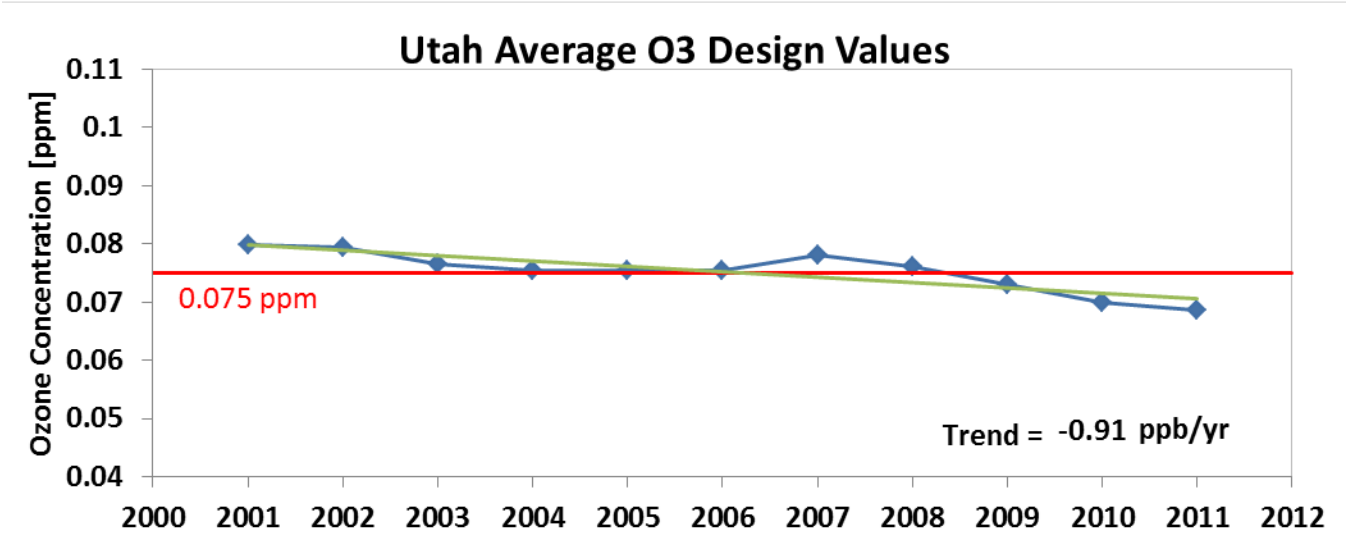
Trend Calculation



- 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



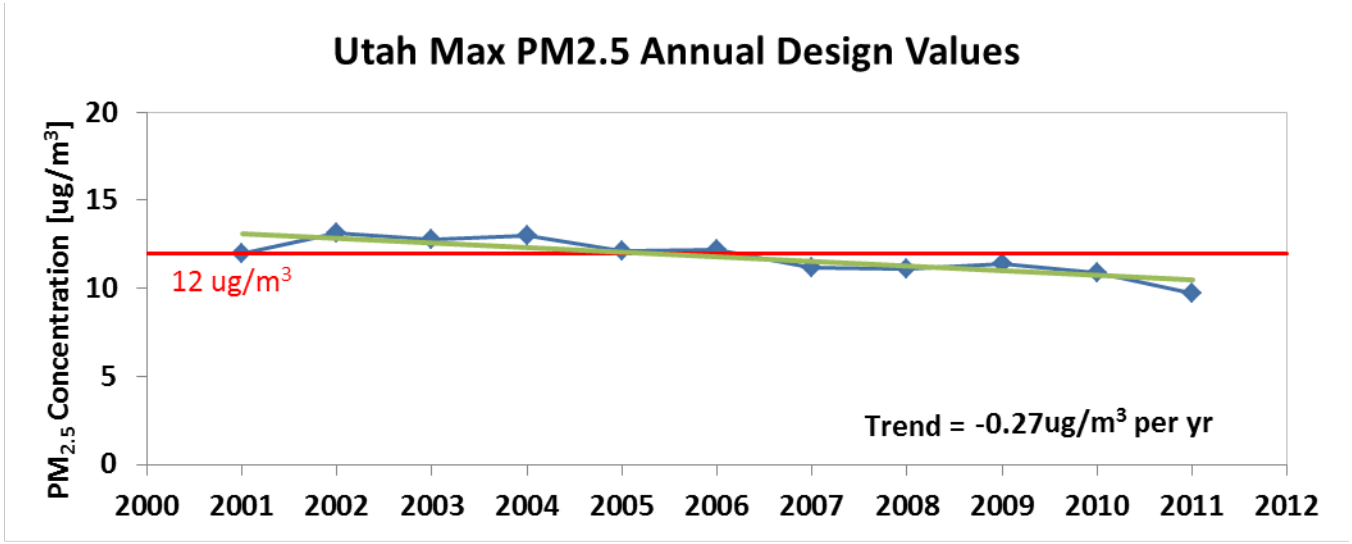


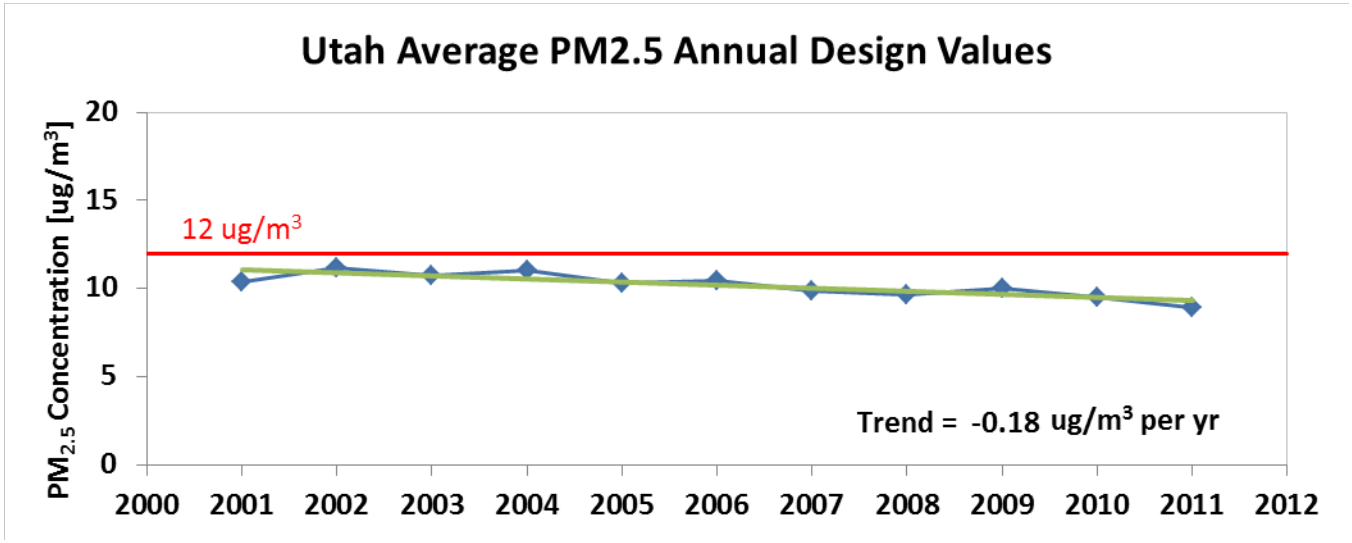
Ozone Trends by Site in Utah

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
490050004442010 1	Cache, UT	0.061	-0.81
490350003442010 1	Salt Lake, UT	0.073	-0.62
490352004442010 1	Salt Lake, UT	0.072	-1.03
490353006442010 1	Salt Lake, UT	N/A	-0.45
490370101442010 1	San Juan, UT	0.068	-0.30
490490002442010 2	Utah, UT	0.067	-0.55
490495008442010 1	Utah, UT	N/A	-1.07
490495010442010 1	Utah, UT	0.068	-0.94
490571003442010 1	Weber, UT	0.071	-1.18

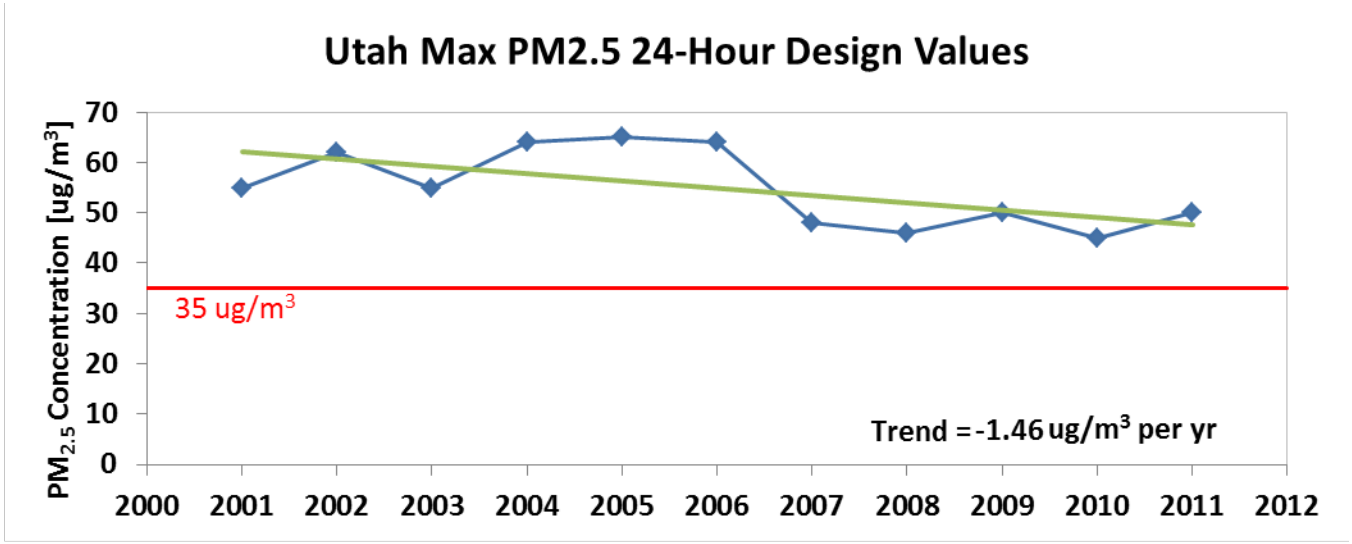
Note: Only monitoring sites meeting data completeness criteria listed

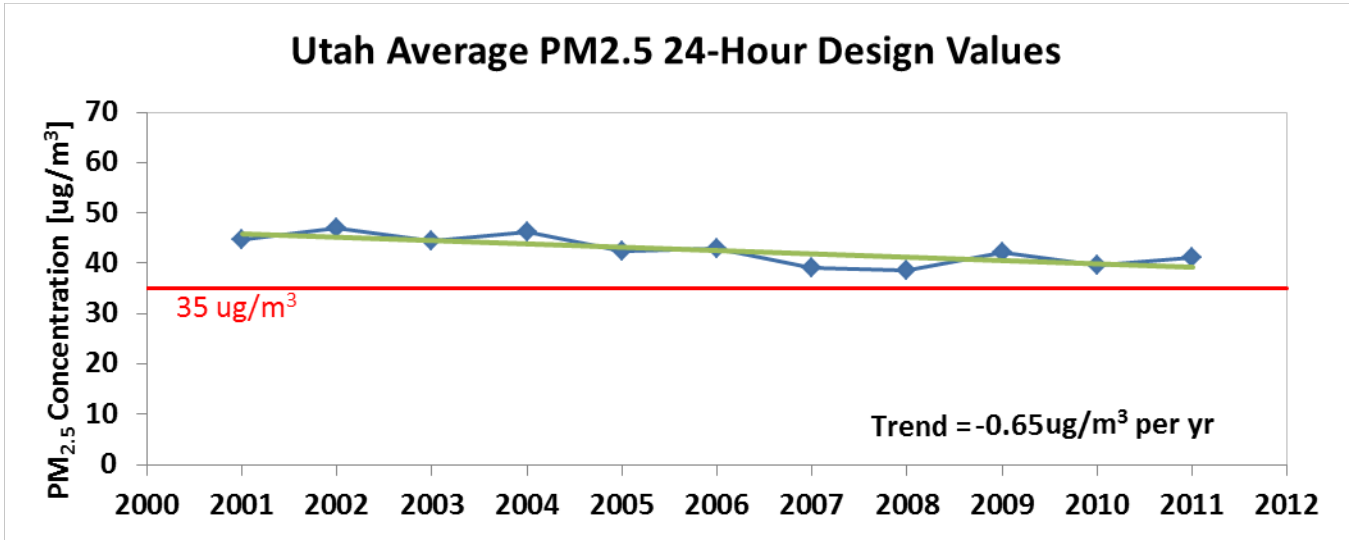
Max/Ave $PM_{2.5}$ Annual DVs and Trend





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





$PM_{2.5}$ Trends by Site in Utah

		2009-2011 DV [ug/m³]		Trend [ug/m³ per year]	
Monitoring Site	County	Annual	24-Hr	Annual DV	24-Hr DV
490030003	Box Elder	8.2	40	-0.11	-0.30
490050004	Cache	9.7	42	-0.47	-2.56
490350003	Salt Lake	N/A	50	-0.21	-1.15
490353006	Salt Lake	9.7	45	-0.18	-1.15
490490002	Utah	8.7	35	-0.17	-0.26
490494001	Utah	9.1	41	-0.09	-0.14
490495008	Utah	N/A	38	N/A	-0.13
490495010	Utah	8.5	42	0.03	0.84
490570002	Weber	N/A	41	N/A	-1.38
490571003	Weber	8.3	37	-0.22	-0.77

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O_3 and $PM_{2.5}$ design values have decreased since 1999 in Utah.

- There are no currently designated O_3 non-attainment areas in Utah; 24-hr $PM_{2.5}$ design values have decreased since 1999 at Logan, UT and Salt Lake City, UT non-attainment areas but have remained steady at Provo, UT non-attainment area