Emission and Air Quality Trends Review

Oregon

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

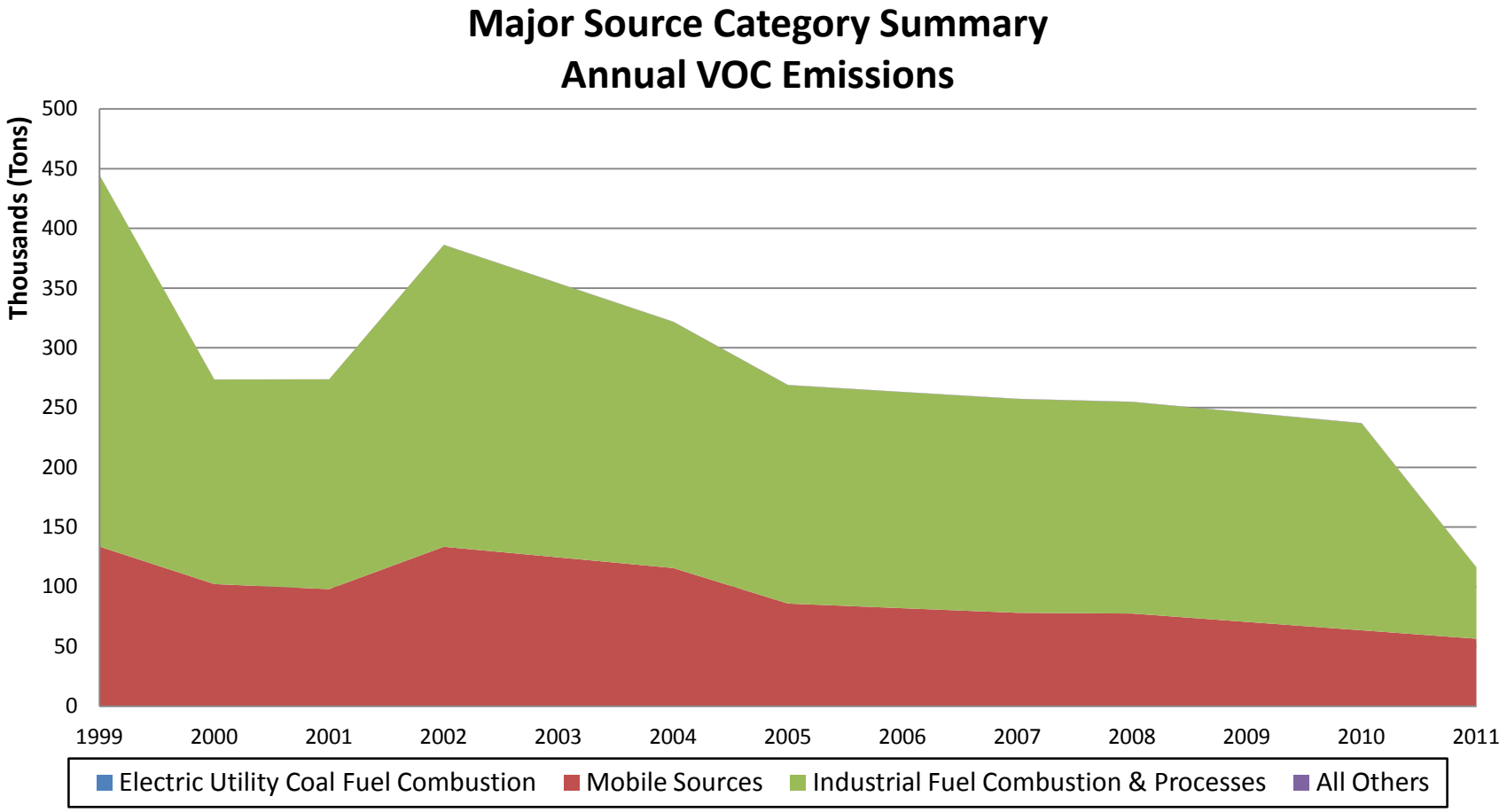
- Negative values indicate decrease in emissions, positive values indicate an increase

Oregon Emission Trends (VOC)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	64	74	74	63	43	76	66	51	67	60
Mobile Sources	133,546	97,966	124,527	85,892	82,015	78,138	77,534	70,528	63,522	56,458
Industrial Fuel Combustion & Processes	310,842	175,565	229,363	182,817	180,907	178,997	177,087	175,177	173,267	59,694
All Others	78	82	148	191	173	185	215	203	202	165
Total	**444,529**	**273,686**	**354,112**	**268,963**	**263,139**	**257,396**	**254,901**	**245,959**	**237,057**	**116,377**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	17%	17%	-1%	-32%	20%	3%	-20%	5%	-6%
Mobile Sources	0%	-27%	-7%	-36%	-39%	-41%	-42%	-47%	-52%	-58%
Industrial Fuel Combustion & Processes	0%	-44%	-26%	-41%	-42%	-42%	-43%	-44%	-44%	-81%
All Others	0%	5%	91%	146%	123%	139%	176%	162%	160%	113%
Total	**0%**	**-38%**	**-20%**	**-39%**	**-41%**	**-42%**	**-43%**	**-45%**	**-47%**	**-74%**

Oregon Emission Trends (VOC)

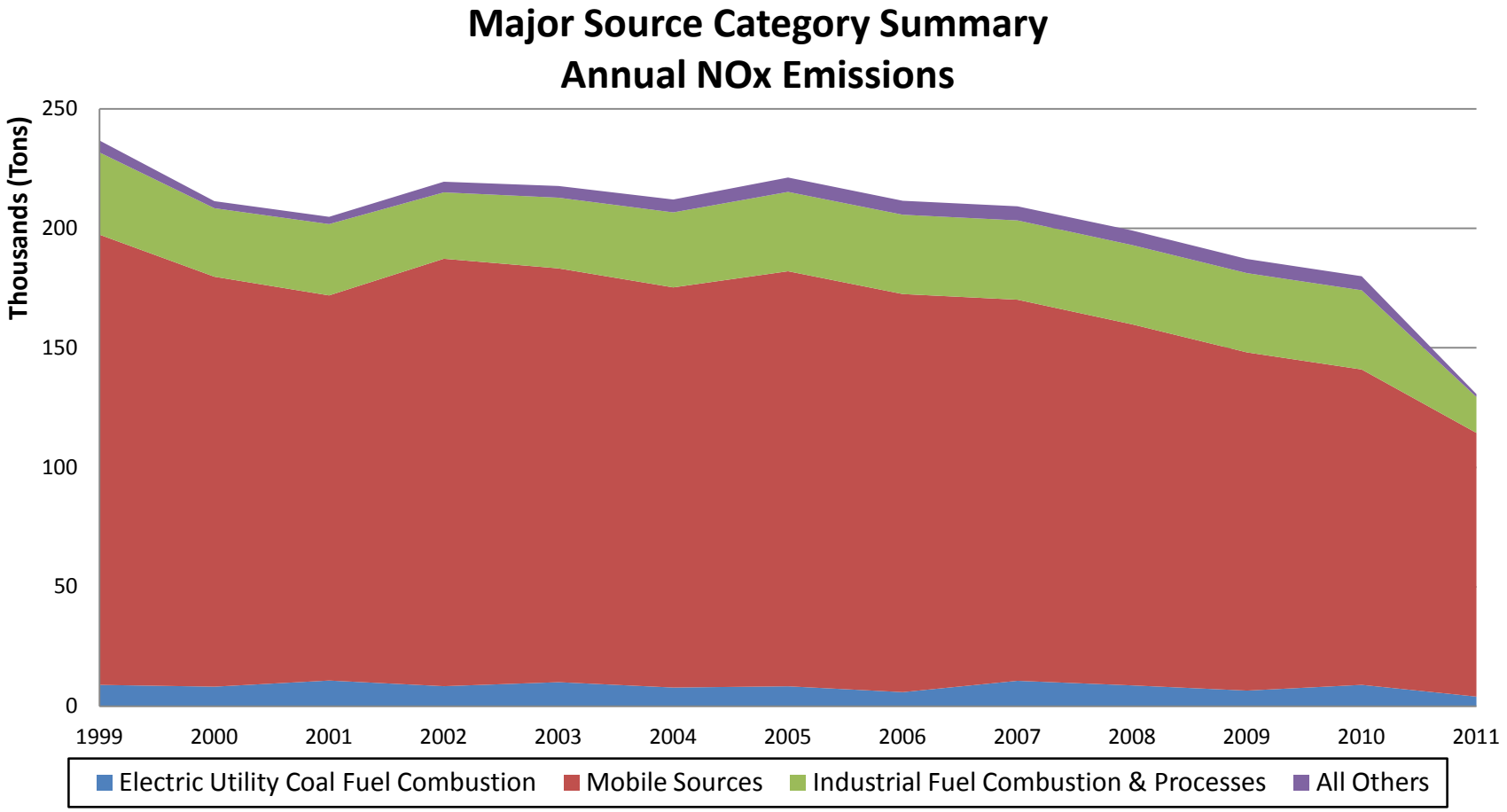


Oregon Emission Trends (NOx)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	8,944	10,768	10,080	8,354	5,918	10,657	8,734	6,561	8,956	4,048
Mobile Sources	188,391	161,166	173,166	173,698	166,591	159,484	151,094	141,538	131,982	110,345
Industrial Fuel Combustion & Processes	34,418	29,846	29,588	33,205	33,195	33,185	33,175	33,164	33,154	15,037
All Others	4,985	3,043	4,890	6,017	5,840	5,899	6,100	5,921	5,866	1,204
Total	**236,737**	**204,824**	**217,725**	**221,274**	**211,544**	**209,224**	**199,102**	**187,184**	**179,958**	**130,635**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	20%	13%	-7%	-34%	19%	-2%	-27%	0%	-55%
Mobile Sources	0%	-14%	-8%	-8%	-12%	-15%	-20%	-25%	-30%	-41%
Industrial Fuel Combustion & Processes	0%	-13%	-14%	-4%	-4%	-4%	-4%	-4%	-4%	-56%
All Others	0%	-39%	-2%	21%	17%	18%	22%	19%	18%	-76%
Total	**0%**	**-13%**	**-8%**	**-7%**	**-11%**	**-12%**	**-16%**	**-21%**	**-24%**	**-45%**

Oregon Emission Trends (NOx)

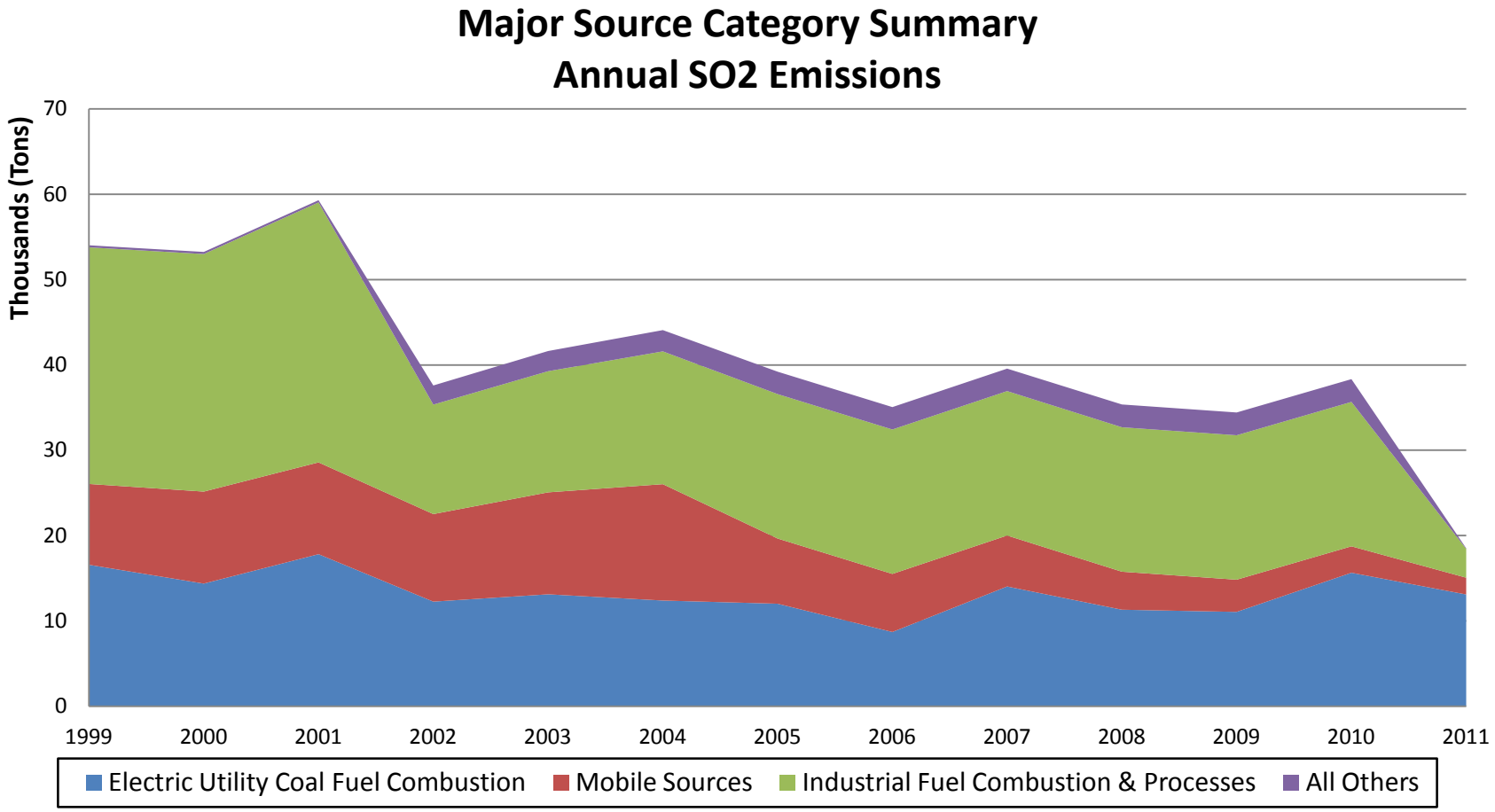


Oregon Emission Trends (SO_2)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	16,577	17,821	13,119	12,017	8,703	14,037	11,315	11,057	15,647	13,100
Mobile Sources	9,473	10,756	11,947	7,640	6,805	5,971	4,455	3,775	3,096	1,966
Industrial Fuel Combustion & Processes	27,724	30,465	14,193	16,925	16,924	16,924	16,923	16,923	16,922	3,380
All Others	241	257	2,366	2,624	2,623	2,632	2,671	2,670	2,668	69
Total	**54,015**	**59,298**	**41,625**	**39,205**	**35,056**	**39,564**	**35,364**	**34,425**	**38,332**	**18,514**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	8%	-21%	-28%	-47%	-15%	-32%	-33%	-6%	-21%
Mobile Sources	0%	14%	26%	-19%	-28%	-37%	-53%	-60%	-67%	-79%
Industrial Fuel Combustion & Processes	0%	10%	-49%	-39%	-39%	-39%	-39%	-39%	-39%	-88%
All Others	0%	6%	882%	989%	989%	992%	1009%	1008%	1007%	-72%
Total	**0%**	**10%**	**-23%**	**-27%**	**-35%**	**-27%**	**-35%**	**-36%**	**-29%**	**-66%**

Oregon Emission Trends (SO_2)

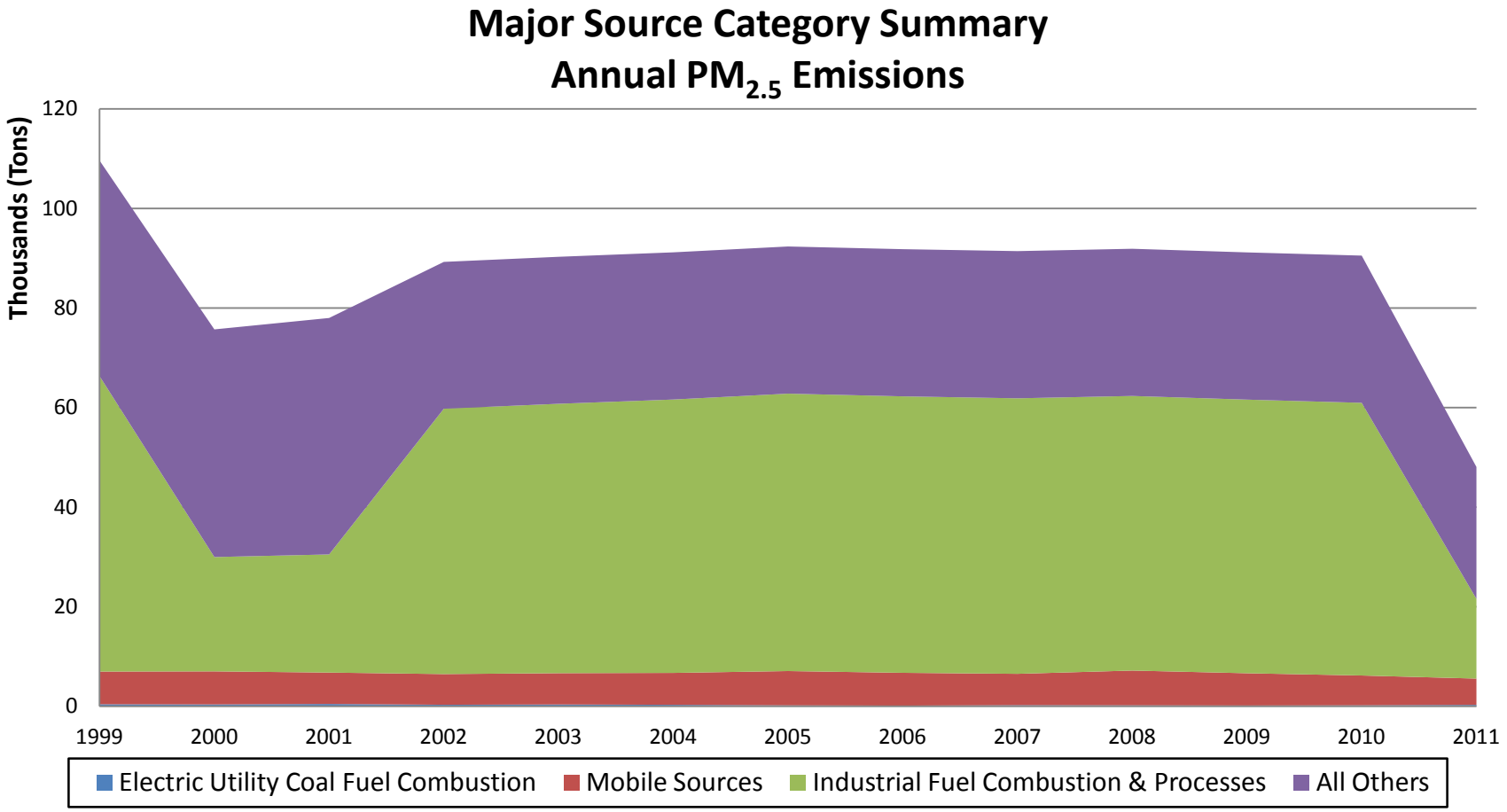


Oregon Emission Trends ($PM_{2.5}$)

	Annual Emissions (Tons)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	404	464	361	182	124	219	189	147	192	284
Mobile Sources	6,567	6,305	6,287	6,893	6,596	6,299	6,987	6,487	5,987	5,275
Industrial Fuel Combustion & Processes	59,328	23,727	54,112	55,722	55,533	55,343	55,154	54,964	54,775	16,010
All Others	43,301	47,500	29,527	29,563	29,564	29,566	29,569	29,570	29,572	26,503
Total	**109,601**	**77,996**	**90,287**	**92,359**	**91,817**	**91,427**	**91,899**	**91,169**	**90,526**	**48,072**

	Annual Emissions Change (Percent since 1999)									
Source Category	**1999**	**2001**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Electric Utility Coal Fuel Combustion	0%	15%	-11%	-55%	-69%	-46%	-53%	-64%	-52%	-30%
Mobile Sources	0%	-4%	-4%	5%	0%	-4%	6%	-1%	-9%	-20%
Industrial Fuel Combustion & Processes	0%	-60%	-9%	-6%	-6%	-7%	-7%	-7%	-8%	-73%
All Others	0%	10%	-32%	-32%	-32%	-32%	-32%	-32%	-32%	-39%
Total	**0%**	**-29%**	**-18%**	**-16%**	**-16%**	**-17%**	**-16%**	**-17%**	**-17%**	**-56%**

Oregon Emission Trends ($PM_{2.5}$)



Emission Trends Summary

- All pollutants have decreased since 1999 in aggregate across Oregon
- 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

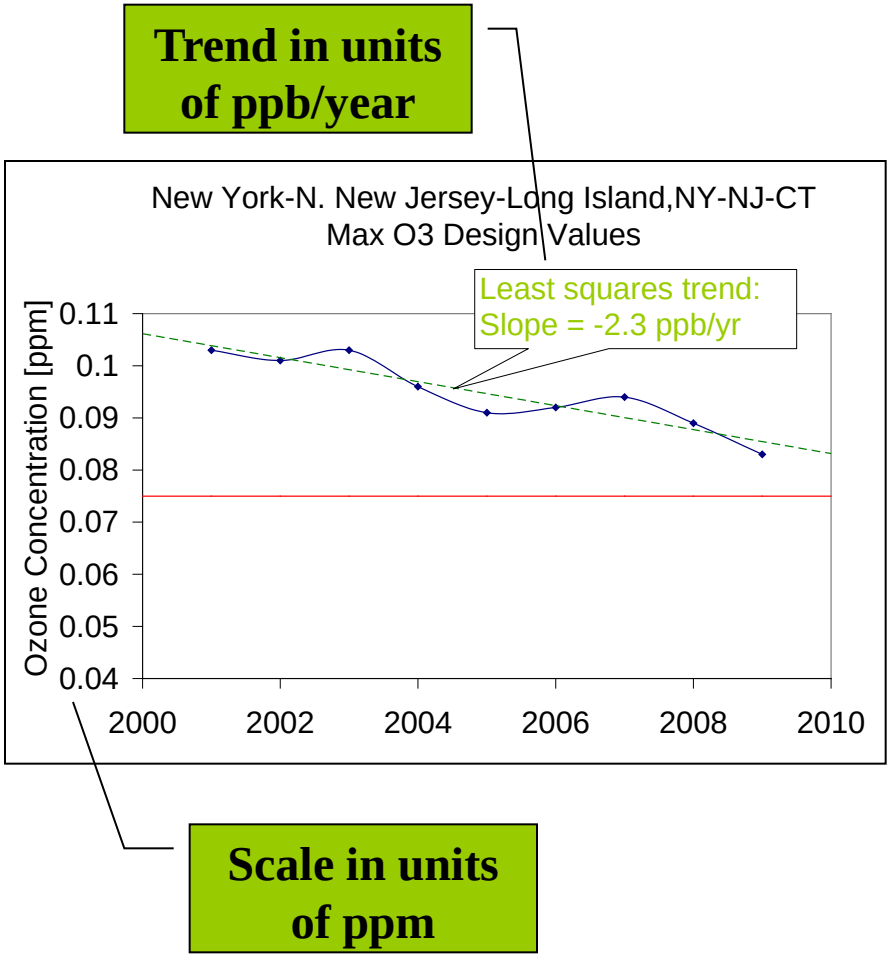
Data Handling Procedures

- 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

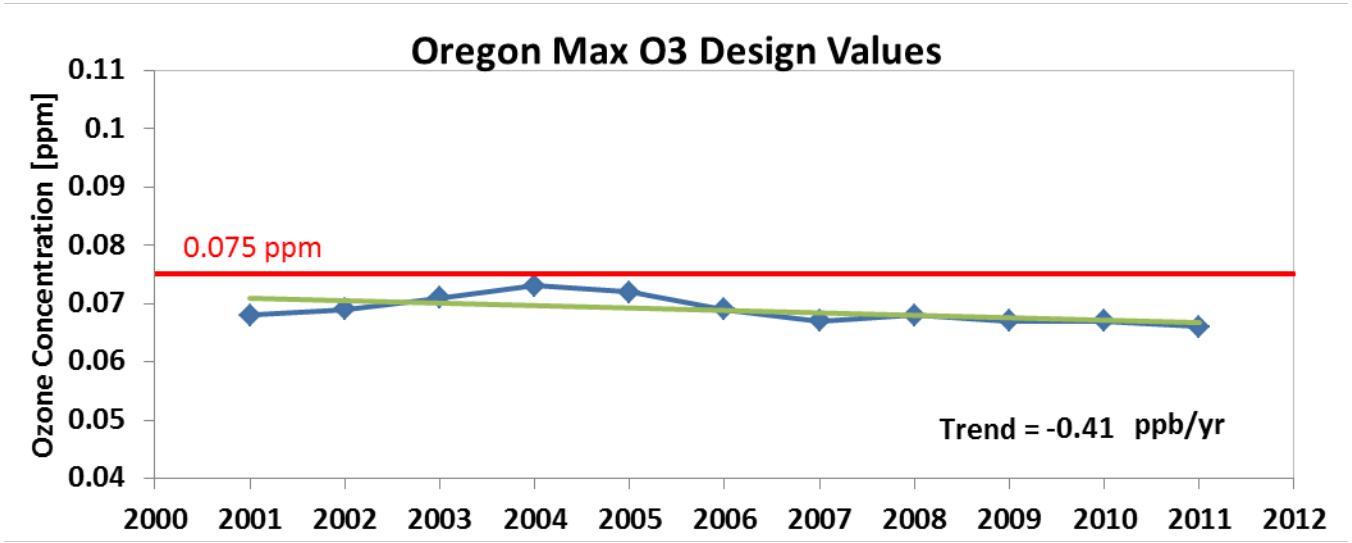
- Annual $PM_{2.5}$ DV and 24-hr $PM_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculations based on EPA data handling conventions
  - Data extracted from monitors that have a non-regulatory monitoring type are omitted
  - Selection of trend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

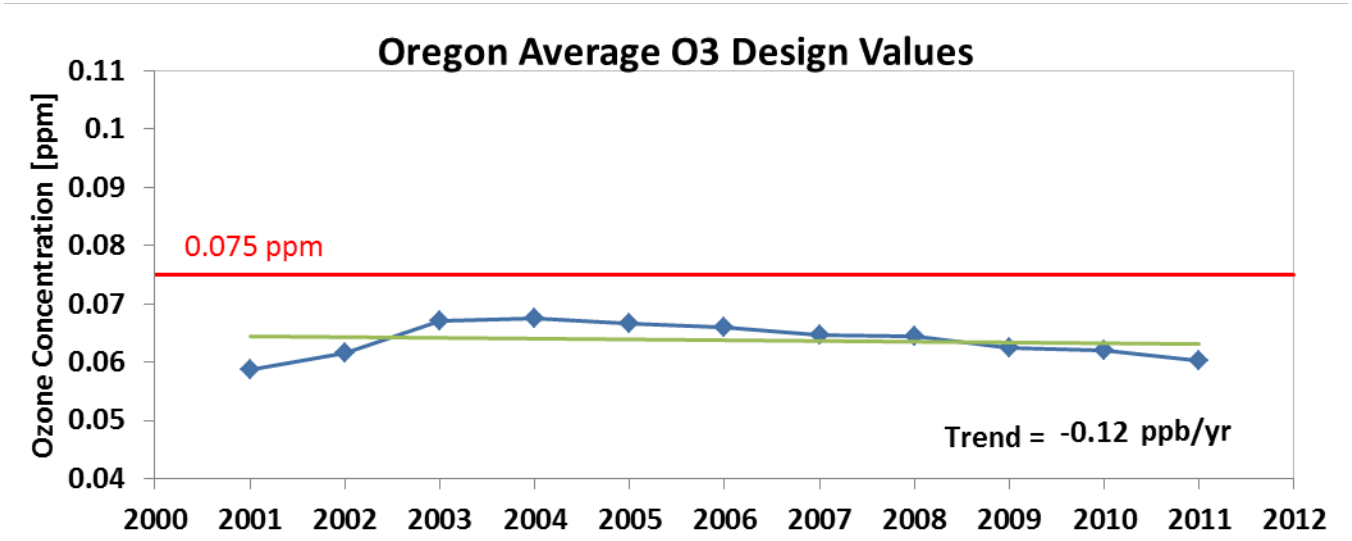
Trend Calculation



- 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



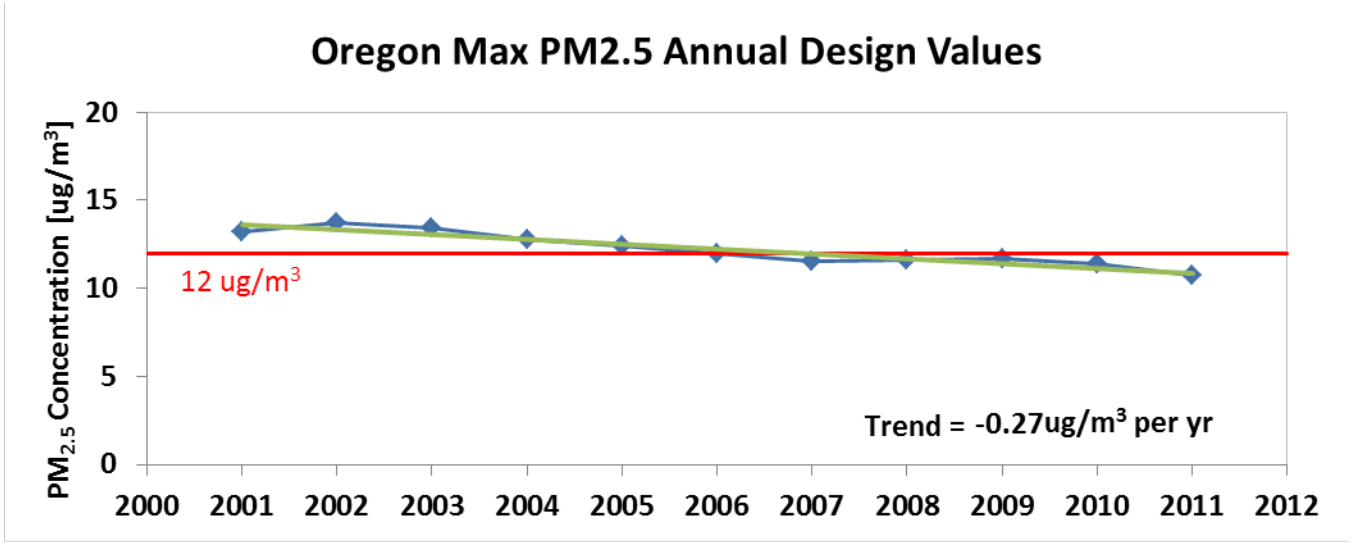


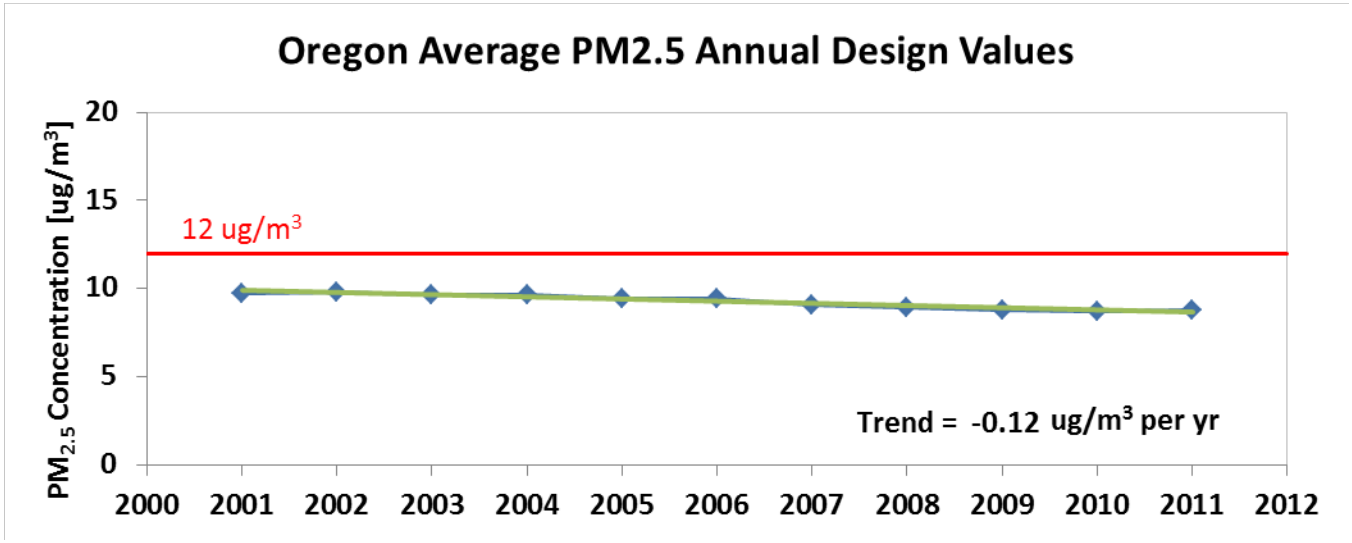
Ozone Trends by Site in Oregon

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
4100500044420101	Clackamas, OR	0.066	-0.25
4100900044420101	Columbia, OR	0.053	-0.22
4102902014420101	Jackson, OR	0.061	-0.90
4103900604420101	Lane, OR	0.059	0.05
4103910074420101	Lane, OR	0.061	-1.52
4104700044420101	Marion, OR	0.061	0.30

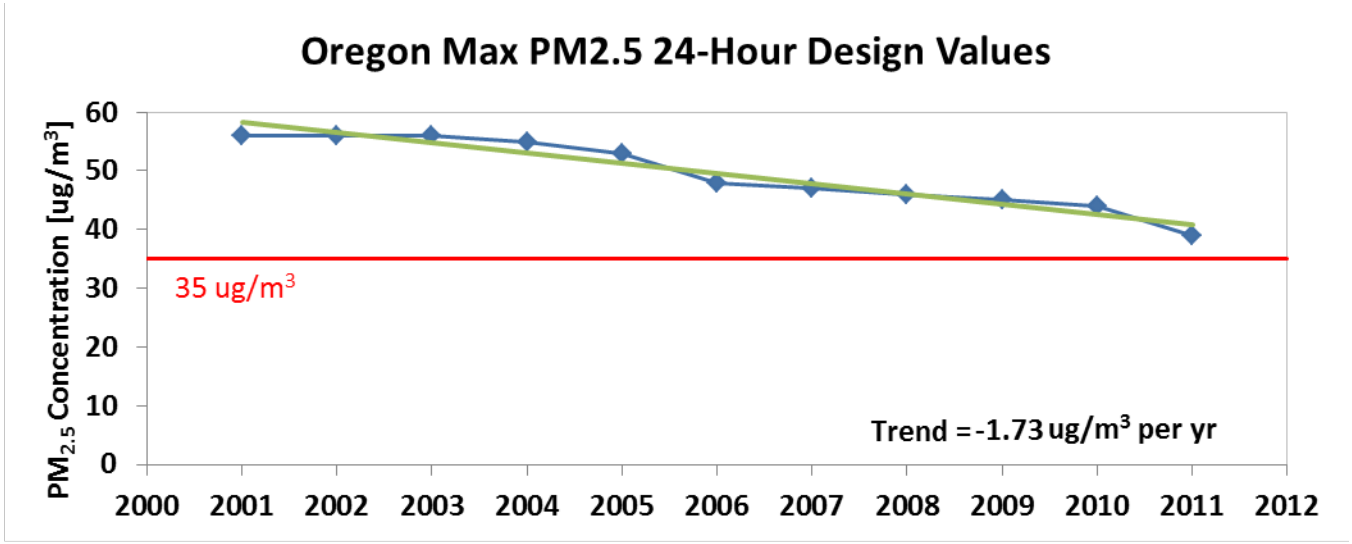
Note: Only monitoring sites meeting data completeness criteria listed

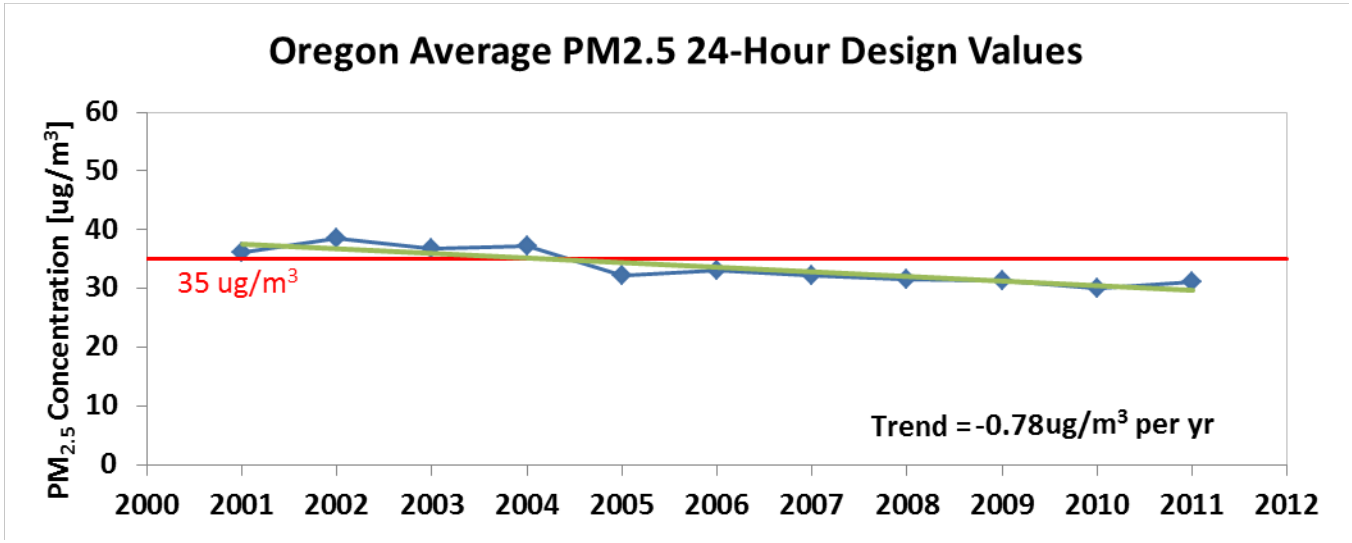
Max/Ave $PM_{2.5}$ Annual DVs and Trend





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





$PM_{2.5}$ Trends by Site in Oregon

		2009-2011 DV [ug/m³]		Trend [ug/m³ per year]	
Monitoring Site	County	Annual	24-Hr	Annual DV	24-Hr DV
410290133	Jackson	8.8	28	-0.27	-1.09
410291001	Jackson	N/A	N/A	-0.06	-1.03
410350004	Klamath	10.7	39	0.13	-0.75
410390060	Lane	7.0	25	-0.25	-1.12
410392013	Lane	10.0	39	-0.37	-2.11
410510080	Multnomah	7.4	25	-0.14	-0.15
410510246	Multnomah	N/A	N/A	-0.24	-0.65

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O_3 design values have remained steady between 1999 and 2011 in Oregon (but decreased since 2004). Average annual and 24-hr $PM_{2.5}$ design values have decreased slightly since 1999 in Oregon.

- There are no currently designated O_3 non-attainment areas in Oregon. $PM_{2.5}$ design values have decreased in Oakridge, OR and Klamath Falls, OR, the only two currently designated 24-hour $PM_{2.5}$ non-attainment areas in Oregon.