Appendix D: Sensitivity of Emissions Inventory

Synopsis

As described in Section 2.3.3 of the RIA, the approach for future-year emissions projections for non-EGU stationary sources was modified for this analysis. Emission projection methods for all other source categories (including mobile sources and electric generating units) remain essentially unchanged from recent analyses. The methodology used in this RIA to forecast non-EGU stationary source categories recognizes the disconnection between prior projection estimates and the historical record. The methodology is called an 'interim' emissions projection approach to acknowledge that we will work to develop improved and consistent emissions forecasting model(s) for future analyses. Due to the potential significance of this analytical assumption, the EPA sought consultation and advice from the Advisory Council on Clean Air Compliance Analysis and Air Quality Modeling Subcommittee (Council) of the Science Advisory Board on this interim emissions projection approach and requested recommendations on long-term methodological improvements that could be made in emissions forecasting for the non-EGU stationary source sectors. This appendix includes information presented to the Council, the Council's advice to the EPA, a discussion of the implication of recommendations by the Council for three sectors in 2020, and a sensitivity analysis of the emissions and air quality impacts of this interim emissions projection approach. The sensitivity analysis included in this appendix presents the impact of this analysis change on emissions and air quality predictions in 2015.

D.1 Consultation with the Council

On August 31, 2006, the EPA consulted with the Council by teleconference. In this consultation, the EPA requested advice and comments from the Council on its interim forecasting approach for emissions from stationary non-EGU sources used in this RIA. Specifically, the EPA requested recommendations on caveats and sensitivities that could be provided in the RIA in the discussion of this approach and suggestions or data that could be provided to help with a longer term approach to emission forecasting for these source categories. A background document was prepared for the Council's consideration and is attached to this appendix as Attachment 1.

On September 15, 2006, the Council issued a letter to Stephen L. Johnson, Administrator of EPA with the findings of its consultation. The Council's letter is available at http://www.epa.gov/sab/pdf/council-con-06-007.pdf. In its response the Council recommends an alternative to the 'interim' method used by the EPA. This alternative would capture the underlying technological change that the Council contends is likely driving the decline in emissions, i.e., the efficiency gains in production processes and improvements in air pollution control technologies that can be expected over time. The Council suggests using the National Emissions Inventory in the 1990s to estimate a declining "emissions intensity" as it relates to the level of output by sector. The Council recommends the first step in this process be to factor out any decline in emissions that could be attributable to the Clean Air Act. As a default, the EPA could assume the residual historical rate of decline (i.e., after removing declines attributable to the Clean Air Act) would continue to be constant in future years. The Council did recognize the limitations of a court-ordered schedule for the PM NAAQS in the EPA's ability to implement its recommendations into this RIA. Detailed recommendations of longer term approaches were also discussed and included in the meeting minutes. These minutes are available at http://www.epa.gov/sab/06minute.htm.

In response to the Council's recommendation, the EPA did endeavor to conduct a limited analysis using the Council's recommended approach for three important non-EGU stationary source sectors including Pulp and Paper Manufacturing, Petroleum Refining, and Chemicals and Allied Products for SO_2 emissions only. The court-ordered schedule for the PM NAAQS review does not allow for further investigation of the merits of this method for all relevant non-EGU stationary source categories or relevant pollutants. We found that the Council's suggested approach resulted in essentially a downward trend in future year SO_2 emissions for these source categories. Using an approach similar to the Counsel's suggested approach, emissions would decline significant from 2002 to 2020 for these industries. This is because historical emissions reductions used in this analysis could not be directly attributed to Clean Air Act mandated controls and therefore the entire declining emission trend for these three sectors was assumed to continue into the future. We recognize the limitations of this analysis since some historical emission reductions may have been due to Clean Air Act mandated controls (e.g., SIPs, NSPS) that are applied to individual facilities (rather than mandated controls that would be applicable to the entire sector), but given the limited time and quality of the control information in the emission inventory an accurate attribution of these historical emission reductions to the Clean Air Act was not possible.

This comparison suggests the interim approach used for this RIA by EPA is conservative with respect to the emissions projections (i.e., results in emission projections that are lower than those used in previous analyses but higher than those resulting from the Council's recommended approach) relative to the alternative suggested. The EPA does recognize the need to develop a long-term more robust and consistent method for forecasting emissions for the non-EGU stationary sources sectors. The EPA feels the Council's advice will be helpful to formulate a new and improved emissions forecasting methodology for the stationary non-EGU sources for future analyses.

In addition to the analysis conducted in response to the Council's recommendation, ongoing emission inventory analysis has been conducted for the second 812 Prospective Benefits and Costs of the Clean Air Act analysis.[1] The results of a historical inventory analysis for the 812 study suggest the complexity involved in developing a new and improved emissions projections methodology that recognizes key components of historical emissions changes. This study found that sector-specific research needs to be done to improve emissions projections. The study showed that even within a specific source category the bias in projection methods and historical data may differ across pollutants demonstrating the challenges involved in developing a new method of emissions forecasting. The EPA recognizes that significant effort will be required to design an improved emission forecasting method for the stationary non-EGU sources, and the EPA is committed to designing an improved approach in the future.

[1] Memorandum from Jim Neumann, IEc, Jim Wilson and Andy Bollman, EH Pechan and Associates to Jim DeMocker, EPA/OAR/OPAR. "Documentation of Analysis of 1990-2002 Emissions for Selected Non-EGU Stationary Point Sources," September 19, 2006.

D.2 Comparison of Sensitivity Analysis Emissions

For this sensitivity, we created two emissions cases for input to the CMAQ model. In Case 1 use the interim approach (i.e., removal of the economic growth term from the emissions projections equation) for projecting stationary non-EGU sources. Case 2 contains emission using our previous growth assumptions for these sources that was used for the Clean Air Interstate Rule (CAIR).

Both cases use *most* of our revised control assumptions that are described in Section 2.3.2 of the main body of the PM NAAQS RIA. Because the sensitivity was performed prior to the final version of the 2015 emissions used for the RIA modeling, there are some differences between the control assumptions in the 2015 inventories used for this sensitivity and those of the final 2015 emissions used for the RIA. These differences are relatively localized to a handful of plants affected by the changes, so we have concluded that the results of this sensitivity are sufficiently applicable for the purpose of characterizing the AQ modeling sensitivity to the revised growth approach.

In this section, we first describe the differences between Case 1 of the sensitivity and the final 2015 baseline emissions. Second, we describe how we created the Case 2 emissions and summarize the differences between Case 1 and Case 2.

D.1.1 Difference in 2015 Emissions Used in Sensitivity Comparison to Final Analysis 2015 Baseline Emissions

For both Case 1 and Case 2, there were two differences in the control assumptions used as compared to the final 2015 and 2020 emissions used for the PM NAAQS RIA. These were:

1. Included SO2 reductions in the non-EGU point sources for the “Industrial, Commercial, and Institutional Boilers and Process Heaters Rule”. These were ultimately determined to be invalid and therefore removed from the final analysis used for the RIA.
2. Used original EGU emissions including CAIR, CAMR, and CAVR (used for the Clear Skies analyses). These were ultimately revised as described in Section 2.3.3 and Table 2-8 of the main body of the RIA.

These changes resulted in emissions differences in selected counties. We compare Case 1 with the final RIA emissions in Table 1(a) for EGUs and Table 1(b) for non-EGU point sources.

Table D-1(a): EGU Sector Comparison of Case 1 Emissions with Final RIA Baseline Emissions*

	2015 NOX				2015 SO2				2015 PM2.5			
State	Case 1	RIA Baseline	Diff	%Diff	Case 1	RIA Baseline	Diff	%Diff	Case 1	RIA Baseline	Diff	%Diff
Alabama	49,144	48,501	-643	-1.3%	260,267	247,538	-12,729	-4.9%	15,853	15,993	140	0.9%
Arizona	65,858	65,840	-18	0.0%	60,347	60,321	-26	0.0%	10,012	10,010	-2	0.0%
Arkansas	31,908	31,925	17	0.1%	22,801	22,795	-6	0.0%	4,731	4,735	4	0.1%
California	21,968	21,964	-4	0.0%	5,068	5,066	-1	0.0%	4,835	4,833	-2	-0.1%
Colorado	60,440	60,437	-3	0.0%	57,467	57,452	-15	0.0%	3,942	3,943	1	0.0%
Connecticut	6,936	6,901	-34	-0.5%	3,902	3,901	-1	0.0%	676	668	-8	-1.2%
Delaware	9,551	8,198	-1,352	-14.2%	27,646	22,992	-4,653	-16.8%	4,623	3,962	-661	-14.3%
District of Columbia	53	54	0	0.6%	0	0	0	0.0%	7	7	0	3.3%
Florida	61,483	60,411	-1,072	-1.7%	167,199	163,704	-3,495	-2.1%	19,847	19,771	-76	-0.4%
Georgia	66,780	66,773	-7	0.0%	240,913	220,749	-20,164	-8.4%	21,102	20,235	-866	-4.1%
Idaho	587	587	0	0.0%	0	0	0	0.0%	69	69	0	0.0%
Illinois	65,352	65,728	376	0.6%	245,328	230,488	-14,840	-6.0%	13,786	14,271	484	3.5%
Indiana	81,795	80,329	-1,467	-1.8%	376,779	362,960	-13,819	-3.7%	32,326	31,181	-1,144	-3.5%
Iowa	51,741	52,456	715	1.4%	163,493	162,891	-602	-0.4%	8,228	8,100	-128	-1.6%
Kansas	39,816	39,799	-17	0.0%	58,540	58,525	-15	0.0%	6,219	6,217	-2	0.0%
Kentucky	76,860	79,310	2,450	3.2%	264,152	262,778	-1,374	-0.5%	24,202	24,195	-7	0.0%
Louisiana	32,486	32,475	-11	0.0%	62,050	62,034	-17	0.0%	3,536	3,535	-1	0.0%
Maine	1,797	1,816	19	1.1%	5,335	4,801	-533	-10.0%	231	238	6	2.8%
Maryland	12,843	12,815	-27	-0.2%	42,787	34,267	-8,520	-19.9%	4,867	4,867	0	0.0%
Massachusetts	19,111	19,179	68	0.4%	17,400	17,741	341	2.0%	2,869	2,874	5	0.2%
Michigan	92,411	92,275	-136	-0.1%	393,060	369,805	-23,255	-5.9%	22,347	21,622	-725	-3.2%
Minnesota	40,086	40,156	71	0.2%	84,742	84,979	237	0.3%	14,481	14,485	4	0.0%
Mississippi	7,878	7,893	15	0.2%	85,649	57,919	-27,730	-32.4%	4,009	3,584	-425	-10.6%
Missouri	69,950	69,921	-29	0.0%	266,422	266,369	-53	0.0%	26,508	26,499	-8	0.0%
Montana	38,431	38,420	-10	0.0%	22,480	22,474	-6	0.0%	4,831	4,830	-1	0.0%
Nebraska	42,854	42,842	-12	0.0%	36,760	36,750	-10	0.0%	2,905	2,904	-1	0.0%
Nevada	30,589	30,596	8	0.0%	27,394	27,424	30	0.1%	4,123	4,126	3	0.1%
New Hampshire	2,932	2,968	36	1.2%	7,423	7,426	3	0.0%	928	940	12	1.3%
New Jersey	13,244	12,732	-512	-3.9%	32,490	29,426	-3,065	-9.4%	5,978	5,870	-108	-1.8%
New Mexico	71,538	71,517	-21	0.0%	52,899	52,884	-14	0.0%	7,916	7,915	-2	0.0%
New York	23,405	23,616	212	0.9%	48,835	48,544	-290	-	8,703	8,652	-50	-0.6%

								0.6%				
North Carolina	50,814	50,855	41	0.1%	124,591	124,637	46	0.0%	18,966	19,001	35	0.2%
North Dakota	39,857	39,862	6	0.0%	85,061	85,050	-11	0.0%	6,132	6,132	1	0.0%
Ohio	93,344	90,204	-3,140	-3.4%	271,778	266,292	-5,486	-2.0%	33,425	32,821	-604	-1.8%
Oklahoma	57,929	57,815	-115	-0.2%	46,670	45,755	-915	-2.0%	13,354	13,349	-5	0.0%
Oregon	10,607	10,604	-2	0.0%	10,037	10,034	-3	0.0%	807	807	0	0.0%
Pennsylvania	74,277	74,813	536	0.7%	141,443	136,360	-5,084	-3.6%	23,956	23,718	-238	-1.0%
Rhode Island	481	475	-5	-1.1%	0	0	0	0.0%	111	110	-2	-1.6%
South Carolina	36,391	36,380	-11	0.0%	105,427	104,914	-512	-0.5%	14,487	14,453	-34	-0.2%
South Dakota	1,749	1,748	0	0.0%	4,149	4,148	-1	0.0%	372	372	0	0.0%
Tennessee	27,310	27,191	-119	-0.4%	191,511	173,081	-18,431	-9.6%	14,363	13,690	-674	-4.7%
Texas	158,008	158,413	405	0.3%	373,127	363,943	-9,183	-2.5%	28,995	29,603	608	2.1%
Utah	53,408	53,393	-14	0.0%	53,123	53,109	-14	0.0%	4,361	4,360	-1	0.0%
Vermont	35	41	7	19.6%	0	0	0	0.0%	7	9	2	32.0%
Virginia	39,960	39,739	-221	-0.6%	94,576	87,365	-7,212	-7.6%	10,296	10,043	-254	-2.5%
Washington	14,996	14,995	-1	0.0%	11,077	11,074	-3	0.0%	2,641	2,641	0	0.0%
West Virginia	39,545	39,534	-11	0.0%	111,001	111,953	952	0.9%	17,690	17,687	-3	0.0%
Wisconsin	40,843	42,412	1,569	3.8%	150,657	148,032	-2,625	-1.7%	8,942	8,727	-215	-2.4%
Wyoming	53,079	53,065	-14	0.0%	74,265	73,846	-420	-0.6%	7,246	7,244	-2	0.0%
	1,982,455	1,979,977	-2,479	-0.1%	4,988,121	4,804,595	-183,526	-3.7%	490,841	485,895	-4,946	-1.0%

* Differences of 5% are more are shaded. Differences in other pollutants exist, but not shown.

Table D-1(b): Non-EGU Comparison of Case 1 Emissions with Final RIA Baseline Emissions*

		2015 SO2		
State	**County**	**Case 1**	**RIA Baseline**	**Diff**
Illinois	Macon Co	25,164	29,605	4,441
Illinois	Peoria Co	2,890	9,763	6,873
Iowa	Clinton Co	3,778	18,879	15,101
Iowa	Muscatine Co	4,042	16,115	12,073
Iowa	Story Co	2,267	11,336	9,069
Maryland	Allegany Co	4,423	19,227	14,804
Ohio	Ross Co	6,597	30,735	24,138
Pennsylvania	Erie Co	2,286	10,210	7,924
Pennsylvania	York Co	6,161	12,363	6,202
Tennessee	Davidson Co	2,746	8,554	5,808
Tennessee	Sullivan Co	14,600	32,539	17,939
West Virginia	Marshall Co	15,159	24,799	9,640
Wisconsin	Brown Co	6,200	20,959	14,759

* Only counties with differences are shown

D.1.2. Difference in 2015 Emissions Due to Revised Growth Assumptions

To create the Case 2 emissions, we applied the growth factors used for CAIR to the non-EGU point, other area and fugitive dust sectors. These CAIR growth factors were applied with our revised control assumptions used for PM NAAQS, with the exception of those two revisions listed in Section 2.1. The origin of the CAIR growth data is described more fully in Section 4.1 of the CAIR Emission Inventory Technical Support Document, available at http://www.epa.gov/air/interstateairquality/pdfs/finaltech01.pdf. The emissions were the same between Case 1 and Case 2 for emissions from EGUs, on-road mobile sources, nonroad mobile sources, agricultural livestock and fertilizer application, and fires (wildfires, prescribed burning, agricultural burning, and open burning).

Table 2(a) provides state-total differences for non-EGU point and stationary area sources between the Case 1 and Case 2 for VOC, NO_x, SO_2, NH_3, and $PM_{2.5}$. Table 2(b) provides state-total differences for the entire state between the two cases for the same pollutants.

Table D-2(a): Case 1 Compared to Case 2 Emissions by State, Sectors that Changed and Pollutant

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Alabama	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	18,826	20,050	6%
	Nonpoint	152,290	196,383	29%	10,612	13,175	24%	44,895	31,436	-30%	1,370	1,635	19%	11,015	13,791	25%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	447	255	-43%
	Non-EGU Point	47,520	63,838	34%	89,158	112,327	26%	113,811	128,959	13%	494	589	19%	24,063	30,556	27%
Alabama Total		**199,810**	**260,220**	**30%**	**99,770**	**125,502**	**26%**	**158,706**	**160,395**	**1%**	**1,863**	**2,225**	**19%**	**54,352**	**64,652**	**19%**
Arizona	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	23,394	28,891	23%
	Nonpoint	91,612	130,416	42%	53,957	67,996	26%	3,457	3,504	1%	2,699	3,159	17%	5,025	7,000	39%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	327	413	26%
	Non-EGU Point	5,706	9,204	61%	29,725	39,710	34%	32,568	48,431	49%	41	78	91%	2,145	2,933	37%
Arizona Total		**97,318**	**139,620**	**43%**	**83,682**	**107,706**	**29%**	**36,025**	**51,935**	**44%**	**2,740**	**3,237**	**18%**	**30,891**	**39,236**	**27%**
Arkansas	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	36,892	37,149	1%
	Nonpoint	92,027	112,573	22%	35,729	42,949	20%	19,998	30,680	53%	1,069	1,377	29%	7,003	8,713	24%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	35	42	18%
	Non-EGU Point	26,495	35,455	34%	54,281	69,560	28%	26,849	33,652	25%	1,235	1,454	18%	17,776	23,912	35%
Arkansas Total		**118,522**	**148,028**	**25%**	**90,010**	**112,509**	**25%**	**46,846**	**64,332**	**37%**	**2,305**	**2,832**	**23%**	**61,707**	**69,815**	**13%**
California	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	63,469	71,821	13%
	Nonpoint	415,895	506,517	22%	145,151	167,149	15%	10,453	12,196	17%	1,936	2,254	16%	67,190	82,513	23%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	32	42	32%
	Non-EGU Point	45,589	62,985	38%	101,665	120,422	18%	37,134	44,628	20%	13,902	13,699	-1%	21,630	29,367	36%
California Total		**461,484**	**569,502**	**23%**	**246,816**	**287,570**	**17%**	**47,586**	**56,824**	**19%**	**15,837**	**15,953**	**1%**	**152,321**	**183,744**	**21%**
Colorado	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	25,524	26,380	3%
	Nonpoint	84,216	105,390	25%	11,237	15,622	39%	1,991	2,361	19%	72	97	35%	12,596	16,245	29%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	45	61	36%

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
	Non-EGU Point	33,869	47,126	39%	38,415	48,359	26%	9,191	11,137	21%	242	295	22%	11,457	15,169	32%
Colorado Total		**118,085**	**152,516**	**29%**	**49,651**	**63,981**	**29%**	**11,183**	**13,498**	**21%**	**314**	**392**	**25%**	**49,622**	**57,855**	**17%**
Connecticut	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	1,649	1,963	19%
	Nonpoint	118,202	127,272	8%	13,721	14,873	8%	12,121	12,148	0%	2,285	2,766	21%	10,263	12,289	20%
	Non-EGU Point	5,615	7,596	35%	3,293	4,266	30%	2,946	4,097	39%	39	52	34%	1,749	2,506	43%
Connecticut Total		**123,817**	**134,868**	**9%**	**17,014**	**19,139**	**12%**	**15,066**	**16,244**	**8%**	**2,324**	**2,818**	**21%**	**13,661**	**16,757**	**23%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Delaware	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	1,664	1,820	9%
	Nonpoint	14,820	18,917	28%	3,857	5,247	36%	10,594	16,086	52%	379	466	23%	2,292	3,141	37%
	Non-EGU Point	3,641	4,610	27%	8,550	10,363	21%	20,096	22,457	12%	671	762	14%	765	996	30%
Delaware Total		**18,461**	**23,527**	**27%**	**12,407**	**15,610**	**26%**	**30,690**	**38,543**	**26%**	**1,050**	**1,228**	**17%**	**4,721**	**5,957**	**26%**
District of Columbia	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	262	367	40%
	Nonpoint	9,561	10,898	14%	2,326	3,061	32%	5,938	7,448	25%	982	1,133	15%	728	969	33%
	Non-EGU Point	4	5	24%	477	547	15%	792	924	17%	9	12	38%	29	35	18%
District of Columbia Total		**9,565**	**10,903**	**14%**	**2,803**	**3,608**	**29%**	**6,730**	**8,371**	**24%**	**990**	**1,145**	**16%**	**1,019**	**1,371**	**34%**
Florida	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	22,270	25,783	16%
	Nonpoint	269,923	359,803	33%	30,248	35,731	18%	39,817	62,248	56%	3,389	4,548	34%	14,722	19,891	35%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	19	26	43%
	Non-EGU Point	40,347	52,998	31%	59,586	76,949	29%	87,311	105,004	20%	569	737	29%	29,238	38,988	33%
Florida Total		**310,270**	**412,800**	**33%**	**89,834**	**112,680**	**25%**	**127,128**	**167,252**	**32%**	**3,958**	**5,284**	**34%**	**66,249**	**84,688**	**28%**
Georgia	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	32,708	35,300	8%
	Nonpoint	167,804	215,134	28%	26,056	32,418	24%	4,407	5,934	35%	2,452	3,180	30%	16,968	23,029	36%
	Non-EGU Point	30,264	40,575	34%	77,356	95,851	24%	84,486	115,947	37%	4,778	6,247	31%	50,009	66,558	33%
Georgia Total		**198,068**	**255,710**	**29%**	**103,412**	**128,269**	**24%**	**88,893**	**121,881**	**37%**	**7,230**	**9,427**	**30%**	**99,686**	**124,886**	**25%**
Idaho	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	26,653	27,428	3%
	Nonpoint	169,139	261,550	55%	36,323	50,800	40%	1,652	2,040	23%	562	740	32%	13,682	19,934	46%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	3	4	42%
	Non-EGU Point	3,942	5,592	42%	11,298	14,393	27%	18,109	23,392	29%	984	1,292	31%	5,828	8,215	41%
Idaho Total		**173,080**	**267,142**	**54%**	**47,620**	**65,192**	**37%**	**19,762**	**25,432**	**29%**	**1,546**	**2,032**	**31%**	**46,166**	**55,581**	**20%**
Illinois	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	92,621	91,260	-1%
	Nonpoint	272,712	341,249	25%	39,045	46,306	19%	41,299	56,996	38%	9,979	12,273	23%	17,107	22,139	29%
	Point fugitive	0	0	0%	0	0	0%	0	0	0%	0	0	0%	215	260	21%

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
	dust															
	Non-EGU Point	82,756	113,170	37%	100,177	127,465	27%	174,790	194,627	11%	9,215	13,490	46%	30,695	42,176	37%
Illinois Total		**355,468**	**454,419**	**28%**	**139,221**	**173,771**	**25%**	**216,089**	**251,622**	**16%**	**19,194**	**25,763**	**34%**	**140,638**	**155,835**	**11%**
Indiana	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	54,764	55,930	2%
	Nonpoint	190,403	236,149	24%	43,924	46,630	6%	8,922	9,015	1%	2,948	3,754	27%	13,691	16,896	23%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	576	744	29%
	Non-EGU Point	63,344	88,865	40%	89,582	112,702	26%	168,608	194,805	16%	3,460	4,802	39%	46,199	58,815	27%
Indiana Total		**253,747**	**325,014**	**28%**	**133,506**	**159,331**	**19%**	**177,530**	**203,820**	**15%**	**6,409**	**8,556**	**34%**	**115,229**	**132,386**	**15%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Iowa	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	70,799	69,864	-1%
	Nonpoint	123,428	132,131	7%	29,622	34,596	17%	23,947	24,405	2%	7,234	7,583	5%	9,552	9,707	2%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
	Non-EGU Point	8,295	11,259	36%	28,043	32,049	14%	54,132	56,262	4%	4,145	5,382	30%	5,223	7,155	37%
Iowa Total		**131,723**	**143,389**	**9%**	**57,665**	**66,645**	**16%**	**78,079**	**80,667**	**3%**	**11,379**	**12,965**	**14%**	**85,574**	**86,725**	**1%**
Kansas	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	102,359	101,325	-1%
	Nonpoint	88,932	97,015	9%	14,362	16,382	14%	3,800	4,376	15%	1,637	1,895	16%	6,981	6,786	-3%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	213	286	34%
	Non-EGU Point	22,742	30,772	35%	85,488	108,635	27%	17,165	23,787	39%	858	1,116	30%	8,501	11,097	31%
Kansas Total		**111,674**	**127,787**	**14%**	**99,850**	**125,017**	**25%**	**20,965**	**28,163**	**34%**	**2,495**	**3,011**	**21%**	**118,053**	**119,493**	**1%**
Kentucky	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	18,216	20,012	10%
	Nonpoint	106,387	130,612	23%	73,937	84,608	14%	56,977	56,666	-1%	1,242	1,521	23%	14,301	19,028	33%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	298	325	9%
	Non-EGU Point	64,477	82,869	29%	35,240	41,784	19%	34,990	39,571	13%	575	664	15%	12,712	16,036	26%
Kentucky Total		**170,865**	**213,481**	**25%**	**109,177**	**126,392**	**16%**	**91,967**	**96,236**	**5%**	**1,817**	**2,185**	**20%**	**45,527**	**55,401**	**22%**
Louisiana	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	19,511	21,177	9%
	Nonpoint	93,605	110,099	18%	93,604	112,916	21%	90,933	135,352	49%	22,828	23,289	2%	9,262	11,070	20%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	3	4	20%
	Non-EGU Point	55,074	67,429	22%	234,799	282,924	20%	163,566	206,605	26%	8,507	10,777	27%	33,318	42,140	26%
Louisiana Total		**148,679**	**177,528**	**19%**	**328,402**	**395,840**	**21%**	**254,499**	**341,956**	**34%**	**31,334**	**34,067**	**9%**	**62,094**	**74,391**	**20%**
Maine	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	2,318	2,591	12%
	Nonpoint	90,770	115,111	27%	8,218	8,804	7%	15,722	16,897	7%	1,278	1,574	23%	14,317	17,429	22%
	Non-EGU Point	4,230	5,638	33%	18,897	25,403	34%	30,595	43,305	42%	123	170	39%	10,019	13,328	33%
Maine Total		**95,001**	**120,749**	**27%**	**27,115**	**34,208**	**26%**	**46,317**	**60,202**	**30%**	**1,401**	**1,744**	**24%**	**26,654**	**33,348**	**25%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Maryland	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	6,375	7,440	17%
	Nonpoint	80,866	113,550	40%	17,069	20,955	23%	41,581	54,861	32%	1,636	2,166	32%	15,145	20,191	33%
	Non-EGU Point	5,264	6,738	28%	18,529	23,637	28%	22,836	28,755	26%	372	511	37%	4,108	5,101	24%
Maryland Total		**86,130**	**120,287**	**40%**	**35,598**	**44,592**	**25%**	**64,416**	**83,615**	**30%**	**2,008**	**2,677**	**33%**	**25,628**	**32,732**	**28%**
Massachusetts	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	10,345	11,249	9%
	Nonpoint	146,756	178,720	22%	25,595	28,858	13%	68,235	85,836	26%	5,665	6,917	22%	18,086	21,941	21%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
	Non-EGU Point	9,078	12,524	38%	17,675	22,121	25%	17,904	24,535	37%	64	87	35%	2,343	3,208	37%
Massachusetts Total		**155,835**	**191,244**	**23%**	**43,271**	**50,978**	**18%**	**86,140**	**110,371**	**28%**	**5,729**	**7,004**	**22%**	**30,774**	**36,398**	**18%**
Michigan	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	37,834	39,983	6%
	Nonpoint	249,950	283,840	14%	48,563	55,971	15%	34,238	38,797	13%	5,489	6,912	26%	18,175	22,991	26%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	35	44	28%
	Non-EGU Point	43,667	60,547	39%	90,725	114,013	26%	76,286	91,921	20%	393	492	25%	12,928	17,251	33%
Michigan Total		**293,617**	**344,387**	**17%**	**139,287**	**169,983**	**22%**	**110,524**	**130,718**	**18%**	**5,883**	**7,404**	**26%**	**68,971**	**80,269**	**16%**
Minnesota	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	89,116	87,386	-2%
	Nonpoint	162,881	171,010	5%	21,747	24,126	11%	5,662	6,122	8%	3,776	4,237	12%	16,131	15,382	-5%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	343	413	20%
	Non-EGU Point	23,284	30,693	32%	55,734	67,831	22%	21,466	25,656	20%	990	1,106	12%	13,987	17,744	27%
Minnesota Total		**186,165**	**201,703**	**8%**	**77,481**	**91,958**	**19%**	**27,129**	**31,778**	**17%**	**4,766**	**5,343**	**12%**	**119,577**	**120,924**	**1%**
Mississippi	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	25,401	26,098	3%
	Nonpoint	114,534	141,358	23%	4,154	5,243	26%	492	480	-2%	798	1,022	28%	8,714	11,816	36%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	1	1	33%
	Non-EGU Point	49,184	72,732	48%	103,232	134,960	31%	69,285	81,194	17%	1,146	1,703	49%	21,575	28,569	32%
Mississippi Total		**163,718**	**214,090**	**31%**	**107,387**	**140,203**	**31%**	**69,777**	**81,673**	**17%**	**1,944**	**2,725**	**40%**	**55,691**	**66,484**	**19%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Missouri	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	84,991	87,148	3%
	Nonpoint	141,792	157,892	11%	35,170	37,137	6%	34,207	37,589	10%	3,806	4,153	9%	16,723	16,995	2%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	77	101	31%
	Non-EGU Point	28,479	37,598	32%	31,422	40,255	28%	114,680	142,441	24%	3,968	4,917	24%	10,093	12,664	25%
Missouri Total		**170,271**	**195,491**	**15%**	**66,593**	**77,391**	**16%**	**148,887**	**180,029**	**21%**	**7,774**	**9,070**	**17%**	**111,884**	**116,907**	**4%**
Montana	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	30,128	31,183	3%
	Nonpoint	41,974	45,221	8%	10,310	13,082	27%	1,233	1,248	1%	269	344	28%	3,990	5,457	37%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	125	176	41%
	Non-EGU Point	3,365	4,480	33%	15,350	18,919	23%	19,805	24,536	24%	407	473	16%	5,469	7,143	31%
Montana Total		**45,339**	**49,700**	**10%**	**25,661**	**32,001**	**25%**	**21,038**	**25,784**	**23%**	**676**	**816**	**21%**	**39,712**	**43,958**	**11%**
Nebraska	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	73,693	74,178	1%
	Nonpoint	70,366	73,827	5%	13,784	16,517	20%	9,850	13,536	37%	598	783	31%	3,769	3,940	5%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	56	74	33%
	Non-EGU Point	6,702	10,179	52%	11,537	15,194	32%	7,097	9,426	33%	14	18	24%	2,519	3,699	47%
Nebraska Total		**77,068**	**84,007**	**9%**	**25,321**	**31,712**	**25%**	**16,948**	**22,962**	**35%**	**612**	**801**	**31%**	**80,037**	**81,891**	**2%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Nevada	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	15,666	19,866	27%
	Nonpoint	33,547	50,610	51%	7,220	8,992	25%	3,452	3,463	0%	915	1,302	42%	2,289	3,036	33%
	Non-EGU Point	840	1,378	64%	4,693	6,460	38%	656	867	32%	14	21	42%	1,281	1,645	28%
Nevada Total		**34,387**	**51,988**	**51%**	**11,912**	**15,452**	**30%**	**4,108**	**4,330**	**5%**	**929**	**1,323**	**42%**	**19,236**	**24,546**	**28%**
New Hampshire	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	821	964	17%
	Nonpoint	53,387	67,255	26%	5,385	5,947	10%	10,185	11,121	9%	945	1,179	25%	9,446	11,572	22%
	Non-EGU Point	2,229	3,098	39%	2,743	3,648	33%	5,250	7,610	45%	47	69	48%	1,587	2,223	40%
New Hampshire Total		**55,617**	**70,353**	**26%**	**8,128**	**9,595**	**18%**	**15,435**	**18,731**	**21%**	**992**	**1,248**	**26%**	**11,854**	**14,759**	**24%**
New Jersey	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	5,320	6,323	19%
	Nonpoint	145,975	168,922	16%	37,797	41,146	9%	47,838	52,714	10%	4,051	4,809	19%	15,819	18,695	18%
	Non-EGU Point	19,237	25,132	31%	17,022	20,304	19%	6,553	7,451	14%	186	226	22%	1,727	2,090	21%
New Jersey Total		**165,212**	**194,054**	**17%**	**54,819**	**61,449**	**12%**	**54,391**	**60,166**	**11%**	**4,237**	**5,035**	**19%**	**22,866**	**27,109**	**19%**
New Mexico	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	71,683	74,356	4%
	Nonpoint	44,554	57,577	29%	25,426	31,398	23%	8,451	5,939	-30%	389	487	25%	3,922	5,026	28%
	Non-EGU Point	12,101	15,477	28%	79,394	100,801	27%	74,580	102,463	37%	42	51	22%	2,345	3,441	47%
New Mexico Total		**56,656**	**73,054**	**29%**	**104,820**	**132,199**	**26%**	**83,031**	**108,402**	**31%**	**430**	**538**	**25%**	**77,950**	**82,824**	**6%**
New York	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	24,246	26,938	11%
	Nonpoint	598,612	715,327	19%	65,289	67,254	3%	159,191	159,552	0%	13,437	16,040	19%	71,427	84,611	18%
	Non-EGU Point	5,465	7,385	35%	37,583	46,857	25%	71,006	79,401	12%	972	1,095	13%	3,855	4,679	21%
New York Total		**604,077**	**722,712**	**20%**	**102,873**	**114,111**	**11%**	**230,197**	**238,953**	**4%**	**14,409**	**17,135**	**19%**	**99,529**	**116,228**	**17%**
North Carolina	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	16,121	18,028	12%
	Nonpoint	207,535	260,171	25%	14,412	17,774	23%	31,822	33,669	6%	2,122	2,657	25%	23,618	31,877	35%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	50%
	Non-EGU Point	68,168	93,710	37%	46,995	58,432	24%	66,220	84,852	28%	1,876	2,468	32%	14,571	19,606	35%
North Carolina Total		**275,703**	**353,881**	**28%**	**61,407**	**76,206**	**24%**	**98,042**	**118,520**	**21%**	**3,998**	**5,125**	**28%**	**54,311**	**69,510**	**28%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
North Dakota	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	60,541	59,874	-1%
	Nonpoint	60,442	52,882	-13%	18,442	19,719	7%	56,231	52,831	-6%	202	243	21%	2,834	2,771	-2%
	Non-EGU Point	661	754	14%	10,627	11,688	10%	21,629	24,007	11%	12	14	16%	3,482	4,058	17%
North Dakota Total		**61,103**	**53,636**	**-12%**	**29,069**	**31,407**	**8%**	**77,860**	**76,838**	**-1%**	**214**	**258**	**20%**	**66,856**	**66,703**	**0%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Ohio	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	45,273	47,795	6%
	Nonpoint	259,823	319,076	23%	60,160	67,867	13%	67,415	75,340	12%	7,196	8,996	25%	22,232	26,832	21%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	695	909	31%
	Non-EGU Point	33,261	45,189	36%	69,407	80,740	16%	79,844	83,247	4%	2,505	3,070	23%	14,723	18,657	27%
Ohio Total		**293,084**	**364,265**	**24%**	**129,567**	**148,607**	**15%**	**147,259**	**158,587**	**8%**	**9,701**	**12,065**	**24%**	**82,922**	**94,192**	**14%**
Oklahoma	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	76,349	78,323	3%
	Nonpoint	122,510	150,164	23%	30,256	35,282	17%	5,277	6,735	28%	7,736	8,029	4%	6,711	8,114	21%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	13	19	45%
	Non-EGU Point	19,900	24,599	24%	98,984	116,193	17%	27,498	31,773	16%	3,490	4,268	22%	5,898	7,538	28%
Oklahoma Total		**142,410**	**174,764**	**23%**	**129,241**	**151,475**	**17%**	**32,774**	**38,508**	**17%**	**11,226**	**12,297**	**10%**	**88,971**	**93,994**	**6%**
Oregon	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	9,487	10,136	7%
	Nonpoint	252,174	305,486	21%	17,460	20,325	16%	22,142	24,124	9%	292	349	20%	40,518	48,832	21%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	4	6	37%
	Non-EGU Point	11,890	16,225	36%	15,988	19,685	23%	8,932	11,003	23%	67	75	12%	8,149	10,938	34%
Oregon Total		**264,064**	**321,710**	**22%**	**33,448**	**40,010**	**20%**	**31,074**	**35,126**	**13%**	**359**	**424**	**18%**	**58,158**	**69,911**	**20%**
Pennsylvania	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	21,181	23,574	11%
	Nonpoint	233,160	277,662	19%	53,241	60,281	13%	94,191	105,063	12%	6,050	7,261	20%	30,781	35,079	14%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	97	115	19%
	Non-EGU Point	38,255	51,239	34%	89,806	105,159	17%	82,718	91,483	11%	1,277	1,518	19%	15,182	18,379	21%
Pennsylvania Total		**271,415**	**328,901**	**21%**	**143,047**	**165,440**	**16%**	**176,909**	**196,546**	**11%**	**7,328**	**8,779**	**20%**	**67,241**	**77,148**	**15%**
Rhode Island	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	528	663	25%
	Nonpoint	30,425	44,695	47%	4,901	5,981	22%	5,263	5,711	9%	97	107	10%	1,232	1,387	13%
	Non-EGU Point	1,566	2,221	42%	1,650	2,212	34%	2,505	3,493	39%	3	4	47%	127	174	36%
Rhode Island Total		**31,991**	**46,916**	**47%**	**6,551**	**8,193**	**25%**	**7,768**	**9,204**	**18%**	**100**	**111**	**11%**	**1,888**	**2,224**	**18%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
South Carolina	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	13,723	14,553	6%
	Nonpoint	167,921	217,715	30%	18,945	22,279	18%	14,763	15,286	4%	1,005	1,268	26%	11,062	14,711	33%
	Non-EGU Point	25,434	36,526	44%	35,917	42,427	18%	52,420	61,982	18%	1,111	1,470	32%	7,580	9,405	24%
South Carolina Total		**193,355**	**254,241**	**31%**	**54,862**	**64,706**	**18%**	**67,183**	**77,268**	**15%**	**2,116**	**2,737**	**29%**	**32,365**	**38,669**	**19%**
South Dakota	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	45,372	46,022	1%
	Nonpoint	40,987	38,866	-5%	6,292	6,657	6%	20,387	20,634	1%	309	386	25%	3,266	3,266	0%
	Non-EGU Point	1,256	1,893	51%	4,503	5,965	32%	1,363	1,867	37%	1	1	54%	400	495	24%
South Dakota Total		**42,243**	**40,758**	**-4%**	**10,795**	**12,622**	**17%**	**21,750**	**22,502**	**3%**	**310**	**387**	**25%**	**49,038**	**49,783**	**2%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Tennessee	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	18,271	20,494	12%
	Nonpoint	178,994	233,527	30%	23,997	29,385	22%	41,818	46,434	11%	3,377	4,946	46%	15,068	20,307	35%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	2	3	55%
	Non-EGU Point	81,141	116,387	43%	62,850	75,238	20%	75,252	88,682	18%	2,246	2,950	31%	27,675	40,280	46%
Tennessee Total		**260,134**	**349,914**	**35%**	**86,846**	**104,623**	**20%**	**117,069**	**135,116**	**15%**	**5,624**	**7,897**	**40%**	**61,016**	**81,085**	**33%**
Texas	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	231,843	243,614	5%
	Nonpoint	528,746	636,524	20%	43,589	49,983	15%	7,113	8,982	26%	6,917	8,777	27%	27,008	32,678	21%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	88	115	32%
	Non-EGU Point	118,284	149,692	27%	423,216	495,841	17%	204,910	238,233	16%	0	0	0%	21,869	27,424	25%
Texas Total		**647,031**	**786,216**	**22%**	**466,804**	**545,824**	**17%**	**212,022**	**247,215**	**17%**	**6,917**	**8,777**	**27%**	**280,808**	**303,832**	**8%**
Utah	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	13,334	15,654	17%
	Nonpoint	47,699	64,544	35%	18,576	23,020	24%	10,560	9,720	-8%	632	871	38%	4,199	5,599	33%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	274	381	39%
	Non-EGU Point	6,751	9,163	36%	24,839	30,025	21%	9,391	11,641	24%	785	932	19%	3,873	5,040	30%
Utah Total		**54,450**	**73,707**	**35%**	**43,415**	**53,045**	**22%**	**19,951**	**21,361**	**7%**	**1,417**	**1,803**	**27%**	**21,680**	**26,674**	**23%**
Vermont	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	2,578	2,822	9%
	Nonpoint	22,491	25,441	13%	3,999	4,658	16%	6,988	8,426	21%	272	339	25%	5,200	5,763	11%
	Non-EGU Point	1,767	2,442	38%	877	1,432	63%	1,294	1,904	47%	1	1	53%	425	600	41%
Vermont Total		**24,257**	**27,883**	**15%**	**4,876**	**6,091**	**25%**	**8,283**	**10,331**	**25%**	**272**	**340**	**25%**	**8,204**	**9,185**	**12%**
Virginia	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	8,739	9,812	12%
	Nonpoint	168,516	216,083	28%	43,689	50,568	16%	15,237	18,193	19%	685	809	18%	18,707	25,165	35%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	3	4	21%
	Non-EGU Point	43,536	58,742	35%	68,155	80,635	18%	73,384	87,033	19%	727	788	8%	11,739	15,031	28%
Virginia Total		**212,052**	**274,825**	**30%**	**111,844**	**131,203**	**17%**	**88,622**	**105,226**	**19%**	**1,413**	**1,597**	**13%**	**39,187**	**50,012**	**28%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Washington	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	14,379	14,265	-1%
	Nonpoint	156,929	201,834	29%	17,915	21,626	21%	3,086	3,291	7%	3,715	4,650	25%	23,540	30,568	30%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	1	2	23%
	Non-EGU Point	12,290	16,945	38%	31,619	39,609	25%	36,290	44,551	23%	4,206	5,514	31%	10,184	13,445	32%
Washington Total		**169,219**	**218,779**	**29%**	**49,533**	**61,235**	**24%**	**39,376**	**47,843**	**22%**	**7,921**	**10,164**	**28%**	**48,105**	**58,280**	**21%**

		VOC			NO_X			SO_2			NH_3			$PM_{2.5}$		
State	**Sector**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
West Virginia	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	2,543	2,760	9%
	Nonpoint	47,466	55,715	17%	12,988	15,476	19%	13,003	14,599	12%	441	522	18%	7,114	8,621	21%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	108	127	18%
	Non-EGU Point	16,531	20,608	25%	44,318	52,440	18%	51,470	59,383	15%	514	587	14%	10,766	13,483	25%
West Virginia Total		**63,997**	**76,323**	**19%**	**57,306**	**67,916**	**19%**	**64,473**	**73,983**	**15%**	**955**	**1,109**	**16%**	**20,531**	**24,991**	**22%**
Wisconsin	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	23,550	25,417	8%
	Nonpoint	211,413	257,205	22%	29,434	32,713	11%	43,831	57,219	31%	2,596	3,325	28%	29,331	37,898	29%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	2	2	38%
	Non-EGU Point	31,347	44,210	41%	41,740	49,030	17%	56,804	58,937	4%	846	1,045	24%	7,383	9,989	35%
Wisconsin Total		**242,760**	**301,416**	**24%**	**71,175**	**81,743**	**15%**	**100,634**	**116,156**	**15%**	**3,442**	**4,370**	**27%**	**60,266**	**73,307**	**22%**
Wyoming	Nonpoint fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	34,434	35,814	4%
	Nonpoint	17,354	20,439	18%	60,241	74,895	24%	14,903	14,276	-4%	292	353	21%	2,524	3,211	27%
	Point fugitive dust	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
	Non-EGU Point	11,418	14,085	23%	36,495	42,874	17%	38,120	39,916	5%	654	752	15%	15,621	19,575	25%
Wyoming Total		**28,772**	**34,524**	**20%**	**96,735**	**117,769**	**22%**	**53,023**	**54,192**	**2%**	**946**	**1,105**	**17%**	**52,579**	**58,600**	**11%**
Grand Total		**8,467,766**	**10,532,928**	**24%**	**4,127,627**	**4,962,706**	**20%**	**3,770,157**	**4,429,407**	**17%**	**228,834**	**275,325**	**20%**	**3,031,998**	**3,455,245**	**14%**

Table D-2(b): Case 1 Compared to Case 2 Emissions by State and Pollutant (all anthropogenic emission sectors included)

	VOC			NOX			SO2			NH3			PM2.5		
State	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
Alabama	286,037	346,447	21%	255,044	280,775	10%	424,702	426,391	0%	85,199	85,561	0%	94,151	104,451	11%
Arizona	193,129	235,431	22%	263,284	287,307	9%	100,500	116,410	16%	45,348	45,845	1%	84,187	92,532	10%
Arkansas	170,115	199,621	17%	203,948	226,447	11%	74,130	91,616	24%	146,535	147,062	0%	83,121	91,229	10%
California	849,540	957,558	13%	825,242	865,997	5%	70,243	79,480	13%	324,066	324,181	0%	291,590	323,013	11%
Colorado	191,953	226,383	18%	205,042	219,372	7%	71,260	73,575	3%	78,299	78,377	0%	81,557	89,790	10%
Connecticut	160,769	171,820	7%	81,643	83,768	3%	20,352	21,529	6%	9,806	10,299	5%	18,290	21,386	17%
Delaware	30,215	35,281	17%	43,139	46,342	7%	59,755	67,608	13%	17,752	17,930	1%	10,769	12,005	11%
District of Columbia	12,939	14,277	10%	9,331	10,136	9%	6,780	8,422	24%	1,509	1,664	10%	1,241	1,592	28%
Florida	609,012	711,543	17%	432,336	455,182	5%	310,958	351,082	13%	73,489	74,815	2%	210,806	229,245	9%
Georgia	355,854	413,495	16%	350,655	375,512	7%	335,024	368,012	10%	124,332	126,529	2%	173,021	198,222	15%
Idaho	274,187	368,248	34%	98,419	115,991	18%	23,876	29,546	24%	81,136	81,621	1%	167,056	176,471	6%
Illinois	486,738	585,689	20%	444,125	478,674	8%	471,599	507,132	8%	111,111	117,680	6%	167,400	182,597	9%
Indiana	344,207	415,474	21%	371,901	397,726	7%	561,507	587,797	5%	100,650	102,797	2%	157,479	174,636	11%
Iowa	177,629	189,295	7%	201,599	210,579	4%	243,118	245,707	1%	241,350	242,935	1%	99,948	101,099	1%
Kansas	154,747	170,860	10%	227,556	252,723	11%	80,132	87,330	9%	151,498	152,014	0%	136,048	137,488	1%
Kentucky	234,191	276,806	18%	310,692	327,907	6%	368,433	372,702	1%	61,098	61,467	1%	83,664	93,537	12%
Louisiana	234,179	263,028	12%	613,661	681,099	11%	358,309	445,767	24%	66,430	69,162	4%	121,437	133,733	10%
Maine	126,724	152,472	20%	54,420	61,513	13%	52,086	65,971	27%	9,075	9,418	4%	32,013	38,706	21%
Maryland	152,199	186,357	22%	157,258	166,252	6%	110,597	129,796	17%	35,107	35,776	2%	41,051	48,155	17%
Massachusetts	220,112	255,522	16%	175,130	182,838	4%	105,995	130,226	23%	14,659	15,934	9%	40,897	46,522	14%
Michigan	473,221	523,990	11%	423,462	454,158	7%	513,080	533,273	4%	71,642	73,163	2%	107,199	118,497	11%
Minnesota	306,630	322,167	5%	270,278	284,755	5%	119,636	124,286	4%	163,719	164,297	0%	153,339	154,686	1%
Mississippi	222,793	273,165	23%	210,436	243,252	16%	165,720	177,617	7%	76,176	76,956	1%	89,271	100,064	12%
Missouri	259,237	284,456	10%	295,736	306,535	4%	422,967	454,109	7%	121,992	123,288	1%	151,542	156,566	3%
Montana	73,469	77,830	6%	127,553	133,893	5%	45,202	49,948	11%	47,456	47,596	0%	65,054	69,300	7%
Nebraska	104,123	111,061	7%	152,303	158,693	4%	54,225	60,239	11%	142,849	143,038	0%	88,400	90,254	2%
Nevada	76,173	93,774	23%	91,068	94,607	4%	33,406	33,628	1%	11,802	12,195	3%	44,741	50,051	12%
New Hampshire	80,159	94,895	18%	38,997	40,464	4%	23,356	26,652	14%	3,926	4,182	7%	16,545	19,449	18%
New Jersey	249,603	278,446	12%	197,426	204,056	3%	90,234	96,008	6%	18,307	19,105	4%	35,882	40,125	12%
New Mexico	116,160	132,559	14%	246,040	273,418	11%	139,821	165,191	18%	52,614	52,722	0%	137,636	142,510	4%
New York	787,657	906,292	15%	427,458	438,696	3%	290,825	299,581	3%	75,399	78,125	4%	128,333	145,032	13%

	VOC			NOX			SO2			NH3			PM2.5		
State	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**	**Case 1**	**Case 2**	**% Diff**
North Carolina	471,046	549,225	17%	267,441	282,240	6%	225,881	246,359	9%	198,260	199,387	1%	105,593	120,793	14%
North Dakota	76,760	69,292	-10%	117,103	119,441	2%	163,147	162,126	-1%	57,449	57,492	0%	76,935	76,782	0%
Ohio	436,266	507,447	16%	451,373	470,413	4%	431,072	442,399	3%	86,803	89,168	3%	132,126	143,396	9%
Oklahoma	201,035	233,388	16%	272,262	294,496	8%	80,694	86,427	7%	123,609	124,680	1%	113,620	118,643	4%
Oregon	365,104	422,750	16%	153,020	159,582	4%	50,840	54,892	8%	49,658	49,724	0%	134,968	146,721	9%
Pennsylvania	414,605	472,091	14%	462,695	485,087	5%	328,200	347,837	6%	92,757	94,208	2%	108,787	118,694	9%
Rhode Island	41,240	56,165	36%	23,122	24,764	7%	8,431	9,866	17%	1,705	1,716	1%	2,788	3,124	12%
South Carolina	261,951	322,836	23%	174,160	184,004	6%	175,256	185,341	6%	37,309	37,930	2%	64,706	71,009	10%
South Dakota	60,161	58,676	-2%	46,961	48,788	4%	26,552	27,303	3%	83,011	83,088	0%	58,785	59,530	1%
Tennessee	349,379	439,159	26%	250,355	268,131	7%	316,869	334,915	6%	54,005	56,278	4%	90,329	110,399	22%
Texas	951,427	1,090,613	15%	1,145,445	1,224,465	7%	620,673	655,866	6%	319,202	321,061	1%	377,140	400,164	6%
Utah	112,574	131,831	17%	153,361	162,991	6%	75,448	76,858	2%	31,154	31,540	1%	63,633	68,627	8%
Vermont	38,222	41,848	9%	20,185	21,399	6%	8,436	10,484	24%	9,867	9,935	1%	10,422	11,403	9%
Virginia	310,041	372,814	20%	319,590	338,950	6%	188,262	204,866	9%	59,252	59,436	0%	66,319	77,143	16%
Washington	252,421	301,981	20%	190,411	202,112	6%	57,377	65,843	15%	62,892	65,134	4%	65,546	75,720	16%
West Virginia	91,769	104,095	13%	160,080	170,690	7%	183,911	193,420	5%	14,041	14,195	1%	47,537	51,997	9%
Wisconsin	346,558	405,213	17%	223,676	234,244	5%	254,576	270,098	6%	86,221	87,150	1%	81,110	94,150	16%
Wyoming	51,472	57,223	11%	184,094	205,128	11%	128,540	129,709	1%	17,725	17,884	1%	77,144	83,165	8%
Grand Total	**12,845,731**	**14,910,893**	**16%**	**12,420,516**	**13,255,595**	**7%**	**9,071,990**	**9,731,241**	**7%**	**3,949,250**	**3,995,741**	**1%**	**4,791,155**	**5,214,402**	**9%**

D.3 Impact of Emissions Changes on Air Quality Model Prediction

The results of the growth sensitivity model runs (i.e., 2015 Case 1 and Case 2) are provided in Table 3. This table contains the county PM2.5 concentrations for those counties that are projected to be nonattainment of the current PM2.5 annual NAAQS in either of the two cases. The data in Table 3 indicate that all of these counties have higher PM2.5 in Case 2 compared to Case 1. The average increase between the two cases is 1.3 $\mu g/m^3$. In over 50 percent of the counties, the increase in PM2.5 is less than 1 $\mu g/m^3$. The largest differences, which are 3 $\mu g/m^3$ or more, are predicted for several counties in California. Between Case 1 and Case 2, the number of nonattainment counties increases from 20 to 29. Of the additional nonattainment counties, 3 are in the West and 6 are in the East.

Table D-3: Comparison of Projected Annual Average $PM_{2.5}$ Concentrations for 2015 Case 1 and Case 2.

State	County	2015 Case 1	2015 Case 2	Difference in PM2.5 (Case 2 - Case 1)
Alabama	Jefferson Co	16.1	17.4	1.2
California	Fresno Co	20.3	21.1	0.8
California	Imperial Co	14.8	15.2	0.4
California	Kern Co	21.6	22.6	0.9
California	Kings Co	17.4	18.0	0.6
California	Los Angeles Co	23.7	27.7	3.9
California	Merced Co	15.8	16.4	0.6
California	Orange Co	20.0	23.0	3.0
California	Riverside Co	27.8	30.8	3.0
California	San Bernardino Co	24.6	27.9	3.3
California	San Diego Co	15.8	16.5	0.7
California	San Joaquin Co	15.3	16.2	0.8
California	Stanislaus Co	16.5	17.3	0.8
California	Tulare Co	21.4	22.3	0.9
California	Ventura Co	14.1	15.3	1.2
Georgia	Bibb Co	13.9	15.1	1.2
Georgia	Clayton Co	14.2	15.3	1.1
Georgia	Floyd Co	14.4	16.2	1.8
Georgia	Fulton Co	15.9	16.7	0.8
Georgia	Wilkinson Co	13.8	15.2	1.4
Illinois	Cook Co	15.5	16.9	1.4
Illinois	Madison Co	15.3	16.6	1.3
Illinois	St. Clair Co	14.7	15.9	1.2
Michigan	Wayne Co	17.6	18.5	0.9
Montana	Lincoln Co	15.0	15.4	0.4
Ohio	Cuyahoga Co	15.6	16.4	0.8
Ohio	Hamilton Co	14.4	15.2	0.8
Ohio	Scioto Co	15.6	16.3	0.6
Pennsylvania	Allegheny Co	16.5	17.1	0.6

Maps of the increase in emissions associated with the comparison of sensitivity Case 2 that incorporates growth for the non-EGU stationary sources to the estimates for Case 1 are shown in Figure 2 for the eastern US and Figure 3 for the western states. Figures 4 and 5 present the distribution of increases for individual grid cells of this comparison for the east and west, respectively. This analysis shows that geographically the largest increases in $PM_{2.5}$ associated with the growth sensitivity case are predicted in the Southeast from Arkansas and Louisiana to Georgia and Tennessee, and western Kentucky northward into Illinois, Indiana and Ohio. Figure 2 and 4 indicate $PM_{2.5}$ is higher by more than a ug/m3 in Birmingham, St. Louis, Chicago and Atlanta, with Detroit at 0.9 ug/me higher in Case 2. The impact of the growth sensitivity scenario emissions is less in Cleveland and Pittsburgh, compared with other cities. In most of the gird cells in the East (over 70 percent) $PM_{2.5}$ is higher in Case 2 by 0.5 ug/m3 or less. Fewer than 5 percent of the grid cells are predicted to have increases in $PM_{2.5}$ at or above 0.75 ug/m3. The granularity of the patterns shown on the map suggests that many of the areas with the largest increases in PM may be affected by differential growth assumptions at non-EGU point sources. As shown on Figures 3 and 5 in the west, the largest increases are in the South Coast/LA and Central Valley of California. $PM_{2.5}$ is higher in the South Coast by over 3 ug/m3 in Case 2 compared to Case 1. In the Central Valley, $PM_{2.5}$ is higher by less than 1.5 ug/m3. Other areas with notably higher $PM_{2.5}$ in Case 2 include Salt Lake City, southwest Idaho, northern Idaho, and an isolated grid cell in western Oregon. Outside of the above areas the impacts of the Case 2 growth assumptions are on the order of 0.5 ug/m3 in urban areas and 0.25 ug/m3 or less in rural areas.

D.4 Discussion and Implication of results

The air quality modeling above illustrates the implications that assumptions regarding the projection of the emissions inventory can have for the “down-stream” emission control cost and monetized human health benefit analyses. To the extent that we over-estimate growth in future emissions, then we apply emission controls to reduce emissions beyond a level necessary to meet attainment. This “over-control” would then bias control costs high; it would also bias estimated benefits high, as we would monetize the human health benefits of achieving a larger increment of air quality change than necessary to reach attainment.

Conversely, if we under-estimate future emissions growth, then we fail to apply enough emission controls to attain fully. This “under-control” would then bias both estimated control cost low; it would also bias estimated benefits low, as we would monetize the human health benefits of achieving a smaller increment of air quality change than necessary to reach attainment.

As indicated in Chapter 2, EPA used the interim approach instead of the approach used in the past since it is in better alignment with historical data.

Figure D-2. Increase in PM2.5 Predicted for the Case 2 Growth Scenario vs Case 1 - East

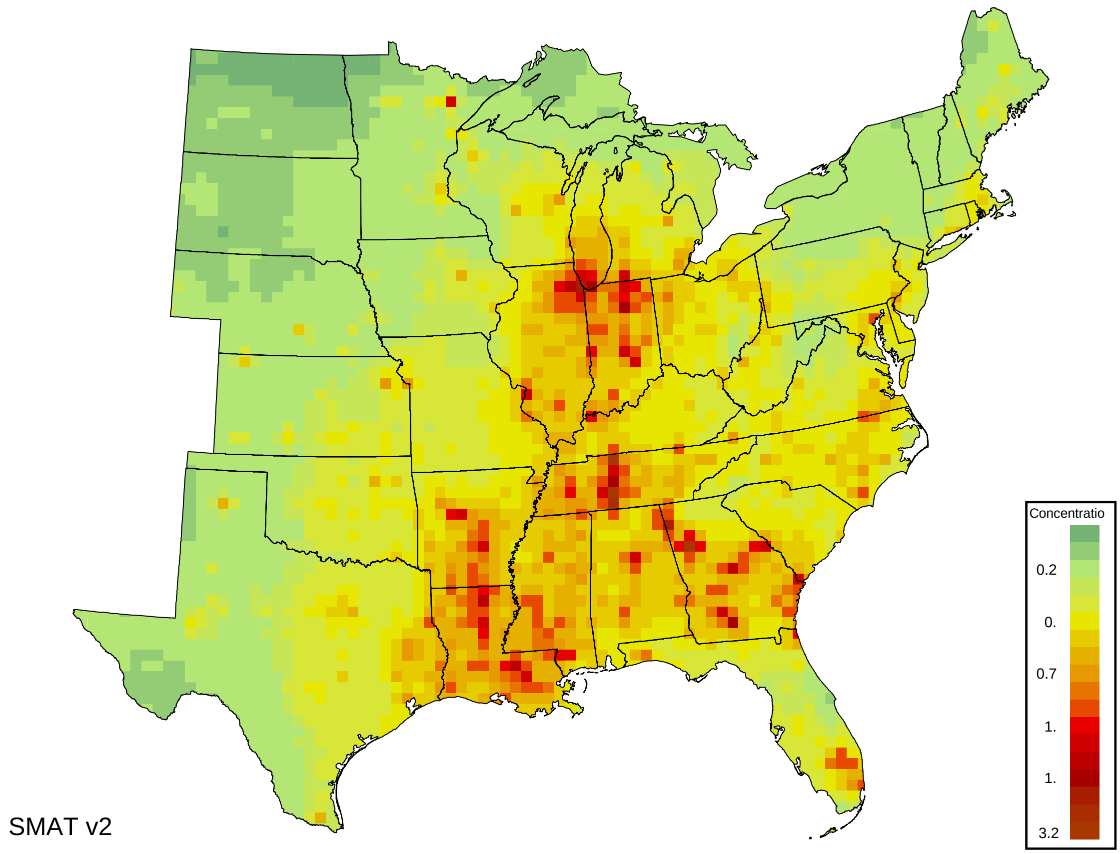


Figure D-3. Increase in PM2.5 Predicted for the Case 2 Growth Scenario vs Case 1 – West

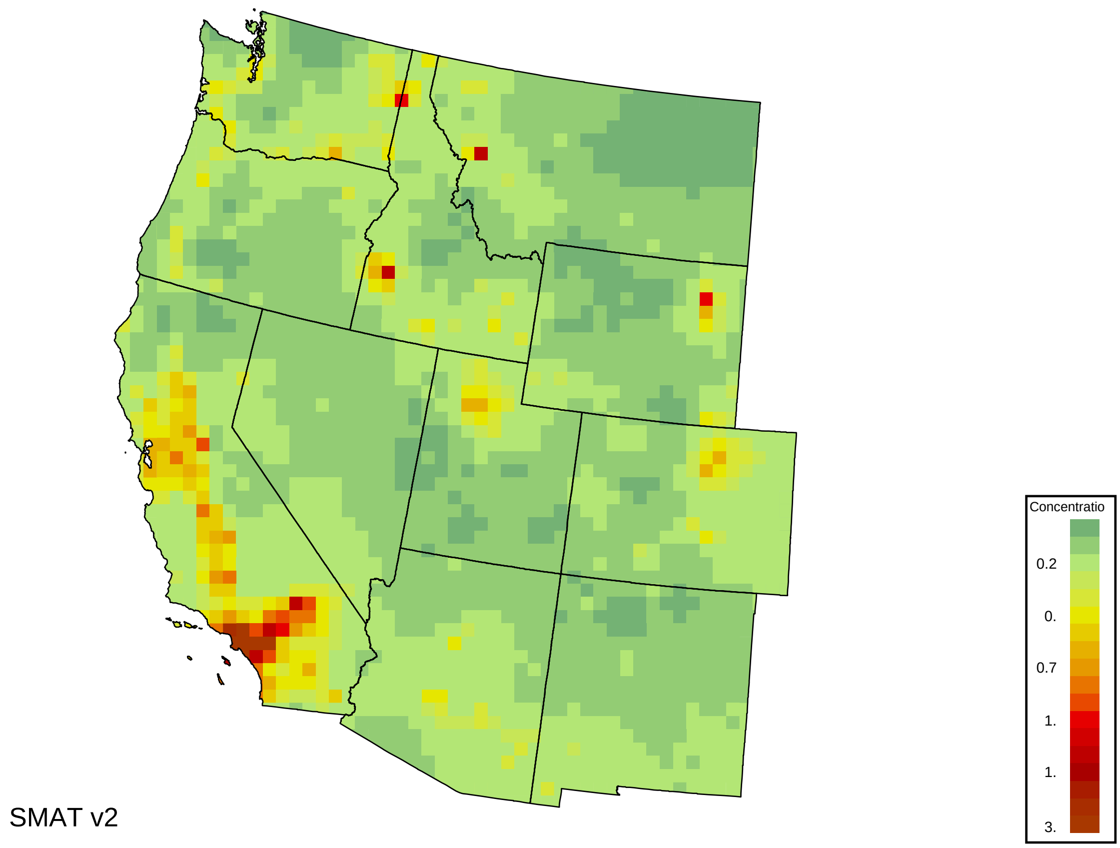


Figure D-4. Percent of Model Grids in the East with Higher PM2.5 in the Growth Sensitivity Case vs the Base Case

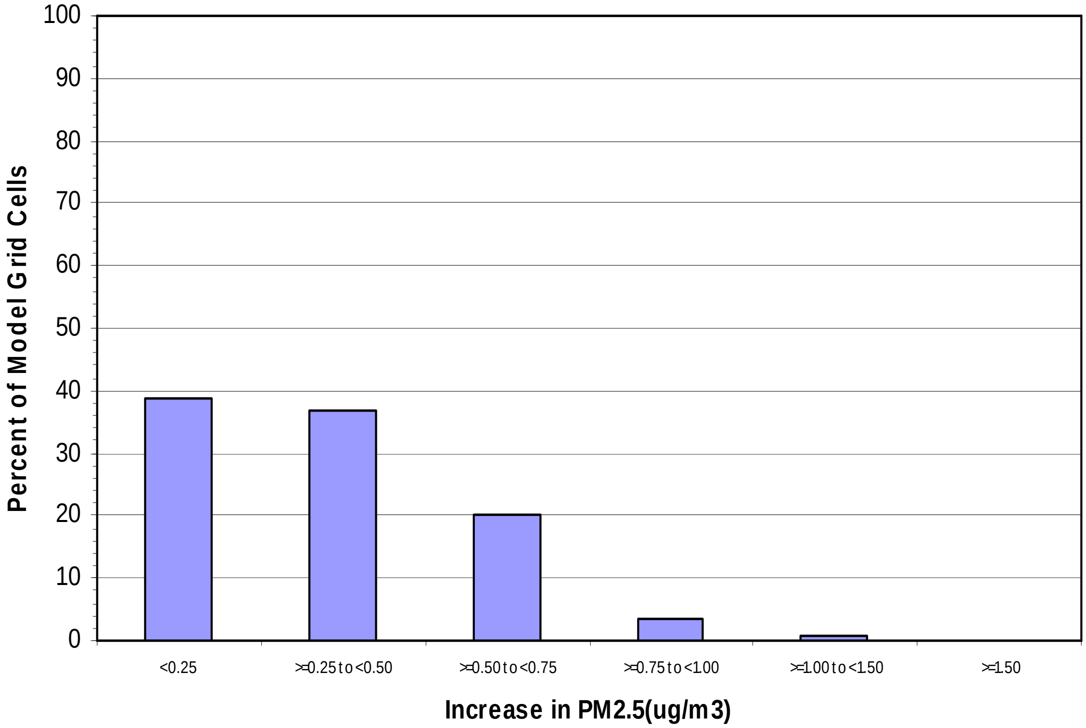
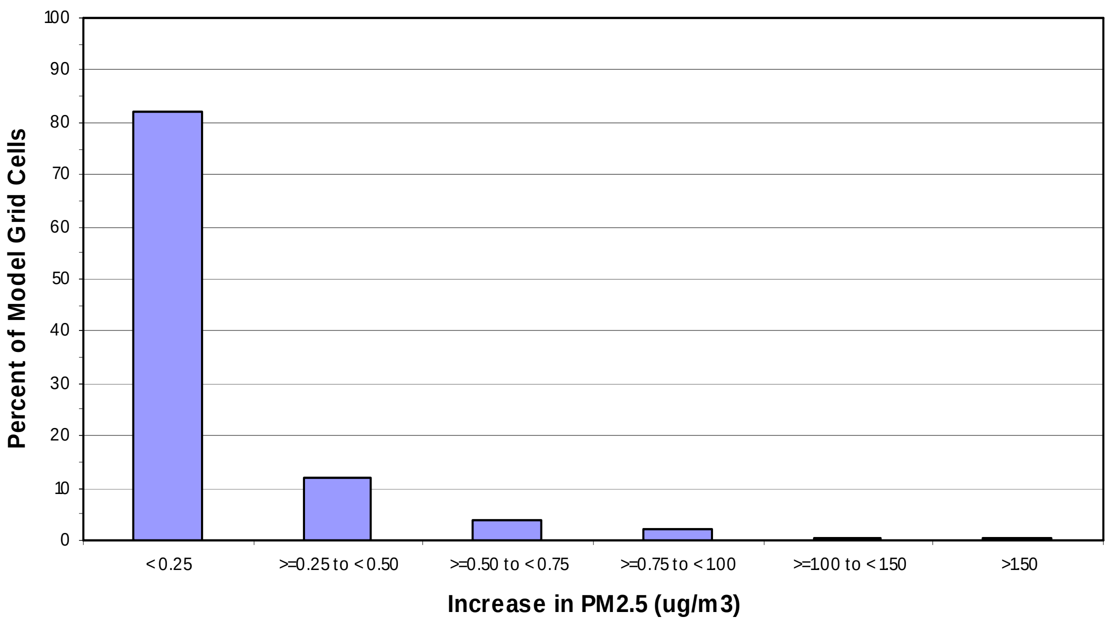


Figure D-5. Percent of Model Grids in the West with Higher PM2.5 in the Growth Sensitivity Case vs the Base Case



Attachment 1. Background Document Provided to the Council

Improving EPA Emissions Forecasting For Regulatory Impact Analyses

Summary of the Issue

The EPA conducts Regulatory Impact Analyses (RIAs) to assess the benefits and costs of air regulations. These RIAs require emissions forecasts for all relevant source categories. We continually improve these forecasts over time and significant advances have been made for major source categories including mobile sources and Electric Generating Units (EGUs). However, we have observed a disconnect between our emissions forecasts for certain stationary non-EGU source categories and the historical record. (For this document, stationary non-EGU or non-utility sources include large industrial combustion and process point sources (e.g., industrial boilers, petroleum refineries, chemical manufactures, etc.), as well as, small stationary commercial, institutional, and residential non-point sources.) This discrepancy appears to have led to significant over-prediction of emissions projections in longer-forecast periods required for the NAAQS and other programs. We have developed an interim approach for addressing this issue and intend to use it to develop a range of forecasts that will provide some understanding of the potential uncertainties implied by the past methodology and the historical record. This interim application will first be used for the RIA for the review of the PM NAAQS. We seek a consultation with the Council to provide advice on how to portray the interim approach and the uncertainties involved. We will continue to work to develop long-term improved approaches for addressing this issue.

Background

Overview of Emission Inventory Forecasts in RIAs

EPA has established a tradition of improving the emissions inventory and modeling platform for Regulatory Impact Analyses. As new and improved data, methods, and models become available, we incorporate this information into the emissions estimates and modeling platform at appropriate times. The drivers to the updates are the ever-evolving "state of knowledge" and comments received on previous analyses. We have placed highest priority on improving data/methods/and models for pollutants or sectors impacted by the policy (e.g., EGUs for the Clean Air Interstate Rule (CAIR); mobile sources for the Heavy Duty Diesel Engine and Fuel Rule and the Spark Ignition Nonroad Engine Rule).

For most Regulatory Impact Analyses, we use emissions from a historical year, or base year, (e.g., 2001) as the starting point for forecasting potential future-year emissions. In evaluating the potential impact of the subject regulation, we develop multiple future-year emission estimates based on a range of regulatory options. In general, EPA estimates the future-year emissions by forecasting changes in the various activities that generate emissions and using this forecasted activity to increase (or decrease) emissions.

We then reduce forecasted future-year emissions for the impact of mandated Clean Air Act (CAA) emission controls.

Methods Used to Forecast Emissions Inventories

Emissions in the future will differ from current emissions inventories due the following factors:

- Changes (typically growth) in economic activity that influence emissions,
- Changes in the mix of production activities both within and between economic sectors,
- Changes in vintages of capital equipment,
- Changes in population, energy use, land use, or motor vehicle miles traveled,
- Technological innovation or changes altering:
    - Production processes for emission sources,
    - Control technologies available,
    - Substitution of inputs to production (e.g., fuel switching), and
- Emission controls implemented to satisfy CAA regulations, voluntary programs and other initiatives expected to reduce air emissions.

For many source categories, EPA uses emission factors to relate air pollution to emission-generating activities (e.g., production activities of an industry). In previous analyses, the method used to project stationary non-utility emissions involves forecasting current emissions into the future by considering the following two factors:

- Changes in economic activity (generally we have assumed a linear relationship between economic activity changes and emission changes because, as stated above, many of the other factors that may influence changes in emissions are difficult to quantify) and
- Application of emission controls mandated by various parts of the CAA.

The typical formula for estimating projected inventories follows:

Projected Future Emissions = Current Emissions * Emission Growth Adjustment * Emission Control Adjustment

The emissions growth adjustment increases or decreases (typically increases) emissions in the future from current base year levels due to forecasted changes in economic or other activities that impact emission levels (e.g., population). The emission control adjustment decreases future-year emissions for expected emissions controls resulting from mandated CAA regulations. In the past, the economic growth adjustment for stationary non-EGU sources has been based upon the results of the Policy Insight® Model for Regional Economic Model, Inc (REMI) by state and Standard Industrial Classification (SIC) codes or fuel consumption forecasts by fuel type and energy sector (e.g., industrial, commercial, residential) from the US Department of Energy.

For non-EGU stationary source categories, many factors that influence future emissions (technology innovations, changes in vintages of capital equipment, energy use, etc.) listed above are difficult to quantify and are not adequately captured in current models. Our past forecasting approaches for these source categories do appear to model economic growth and the impacts of CAA emission controls relatively well, but do not address the many other factors affecting emissions (shown above) sufficiently. Forecasting emissions for these source categories is further complicated by the multitude of non-EGU stationary source categories involved (over 800 industry categories). In 2002, emissions from non-EGU stationary sources represented approximately 62 percent of total direct $PM_{2.5}$ emissions (excluding emissions from dust and fires) and approximately 18 percent and 25 percent of important PM precursors, NO_X and SO_2, respectively. While emissions from these sources are relatively small when compared to total emissions from all sources of SO_2 and NO_X, these sources represent the major contributors to direct $PM_{2.5}$ emissions and are major source categories considered in the current PM NAAQS RIA. Emission projections for the stationary non-EGU sources will be used to estimate the benefits and costs of the PM NAAQS in the RIA and EPA recognizes the immediate need for better future year emissions estimates for these categories.

Emissions projection methods are less of an issue for mobile sources and EGUs, and these sources are not subject to our interim approach. For these sources, EPA has developed improved models specific to mobile sources (MOBILE and NONROAD models) and EGUs (Integrated Planning Model). These models address many of the deficiencies in our current approach for stationary non-EGU sources previously discussed. The Integrated Planning Model is a market model of the electric utility industry that captures the impact of capital turnover and economically-motivated fuel switching on emissions. For EGUs, we also have better emissions source testing due to the installation of continuous emissions monitoring for these units. For mobile sources, our models directly address equipment turnover and the issue of fuel switching. More details may be obtained about these models at www.epa.gov/airmarkets/epa-ipm and http://www.epa.gov/OMSWWW/models.htm. In addition to EGUs and mobile sources, inventory projections for agricultural ammonia emissions are based on projected animal populations provided by US Department of Agriculture, and these sources are also not covered by our interim approach.

Problems with Past Projection Approaches

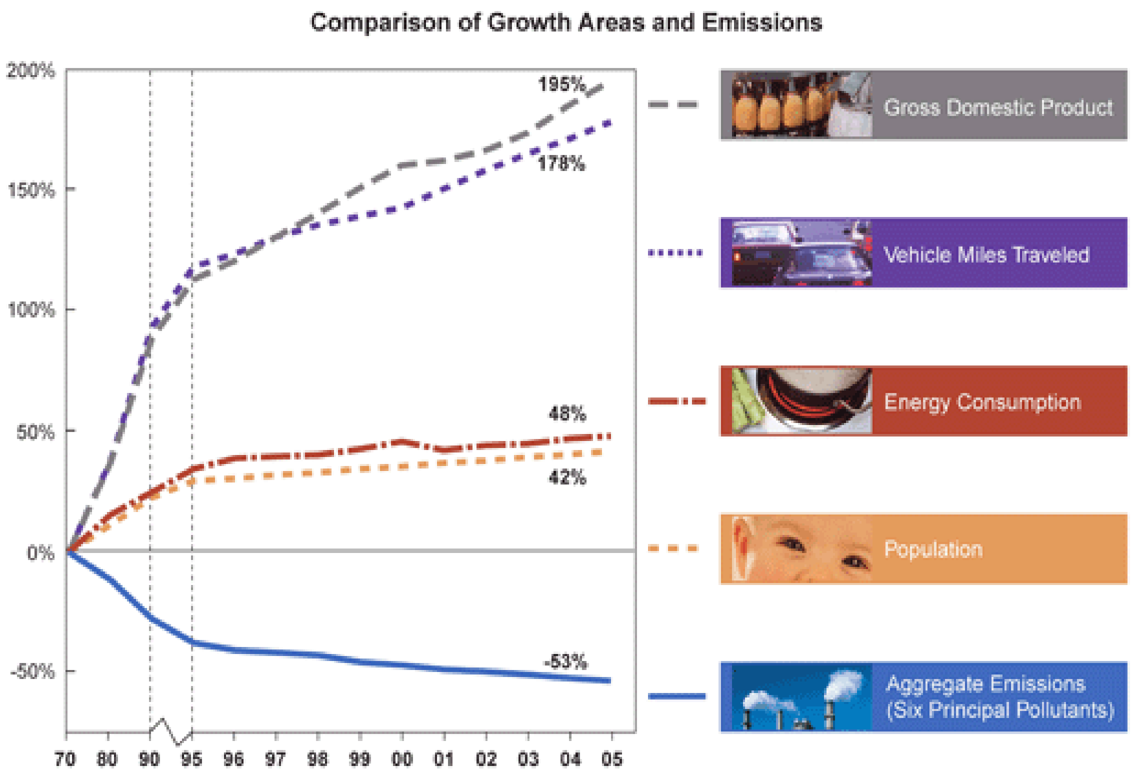
Using the approaches described above for stationary non-EGU sources, we logically forecast continuing emission increases relating to economic, population, and other sources of growth for any given analytical starting point. Such forecasts, however, are inconsistent with the relationships we see historically. Figure 1 compares activity variables that impact emissions (GDP, energy consumption, population, vehicle miles traveled) with historical air emissions from all sources (pollutants include SO_2, NO_x, VOC, PM_{10}, CO, and Pb). Since 1970, air emissions have been steadily declining while GDP, population, energy consumption, and vehicle miles traveled all have grown. The emissions shown in Figure 1 are dominated by mobile sources emissions. But the trend also exists when focusing on PM-related emissions from EGU or non-EGU stationary point and area sources, collectively as well as for key industry. The newly developed 2002 National Emissions Inventory provides more historical emissions data to corroborate the historical decline in emissions we are observing. Figure 2 shows decreasing trends in $PM_{2.5}$ and the primary PM precursors SO_2 and NO_x for non-EGU stationary source emissions from 1990 through 2002. The data source for the historical year emissions inventory is the National Emissions Inventory (NEI). The NEI provides historical emission estimates for 1990, 1996, 1999, and 2002 that represent measurements and estimates of actual emissions for the particular year. The primary data source for the NEI emissions are State emission inventories. These data are supplemented by emissions estimates developed by EPA to fill gaps in the data provided by the States. Both the State and EPA developed emissions are based on actual activity or actual activity surrogate data for the given year. Thus emissions estimates in the NEI for 1990, 1996, 1999, 2002 do not rely upon the application of growth factors to actual emissions from an older emissions inventory.

Historical emissions trends for key industrial sectors (chemical and allied products, petroleum refining and allied products, paper and allied products, and primary metals manufacturing) important to the PM NAAQS analysis are shown in Figure 3. We also see similar general downward trends in historical emissions across different regions of the country. Figure 4 compares historical trends for the stationary non-EGU source categories with the CAA baseline (includes control programs that would be implemented by 2010) emissions forecast made in the 1997 NAAQS RIA. This figure indicates the inconsistency between the forecasts and the trends thus far.

Our projection methods used to estimate growth for stationary non-EGU sources until now have focused on estimates of economic growth and emission reductions resulting from CAA mandates. We've assumed logically that the "growth" part of emission trends correlates linearly with economic or other emission generating activities. Our methods have attempted to forecast growth in the general economy and to match this growth to those industry sectors that generate air emissions. This approach assumes that the emission rate per unit of activity is the same in the base year and future years for the stationary non-EGU sources unless emission controls are applied (i.e., emission controls are the only factor that reduces emission rates.) Based upon historical data, we recognize this assumption is likely incomplete. It is now apparent that the focus exclusively on economic growth forecasts and consideration of CAA emission controls overlooks important factors that influence emission trends.

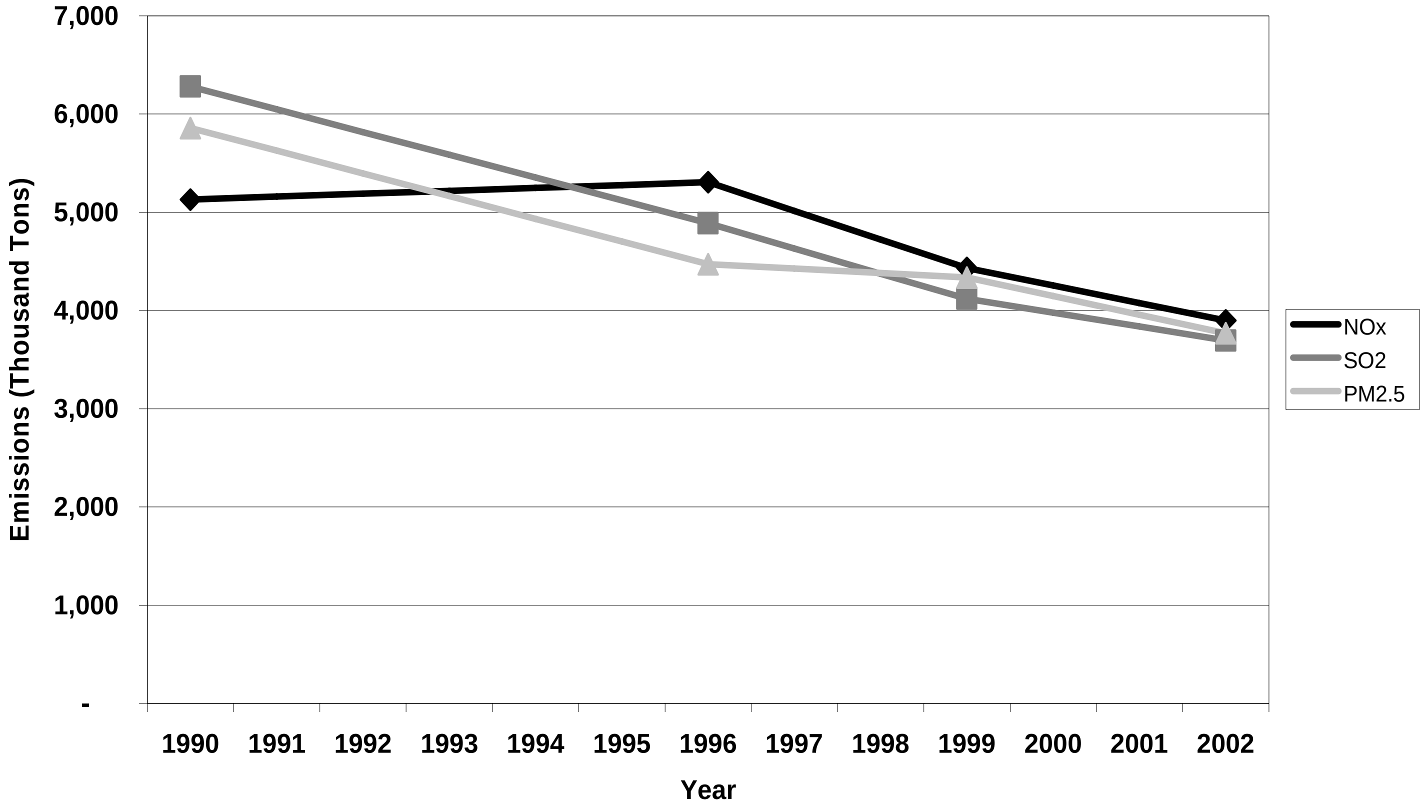
While information needed for a full understanding is lacking, we have several plausible explanations for the differences we observe in economic growth projections and emission trends and reasons to believe these trends may continue in the future. These explanations involve the replacement of older vintages of capital equipment and emission

Figure 1



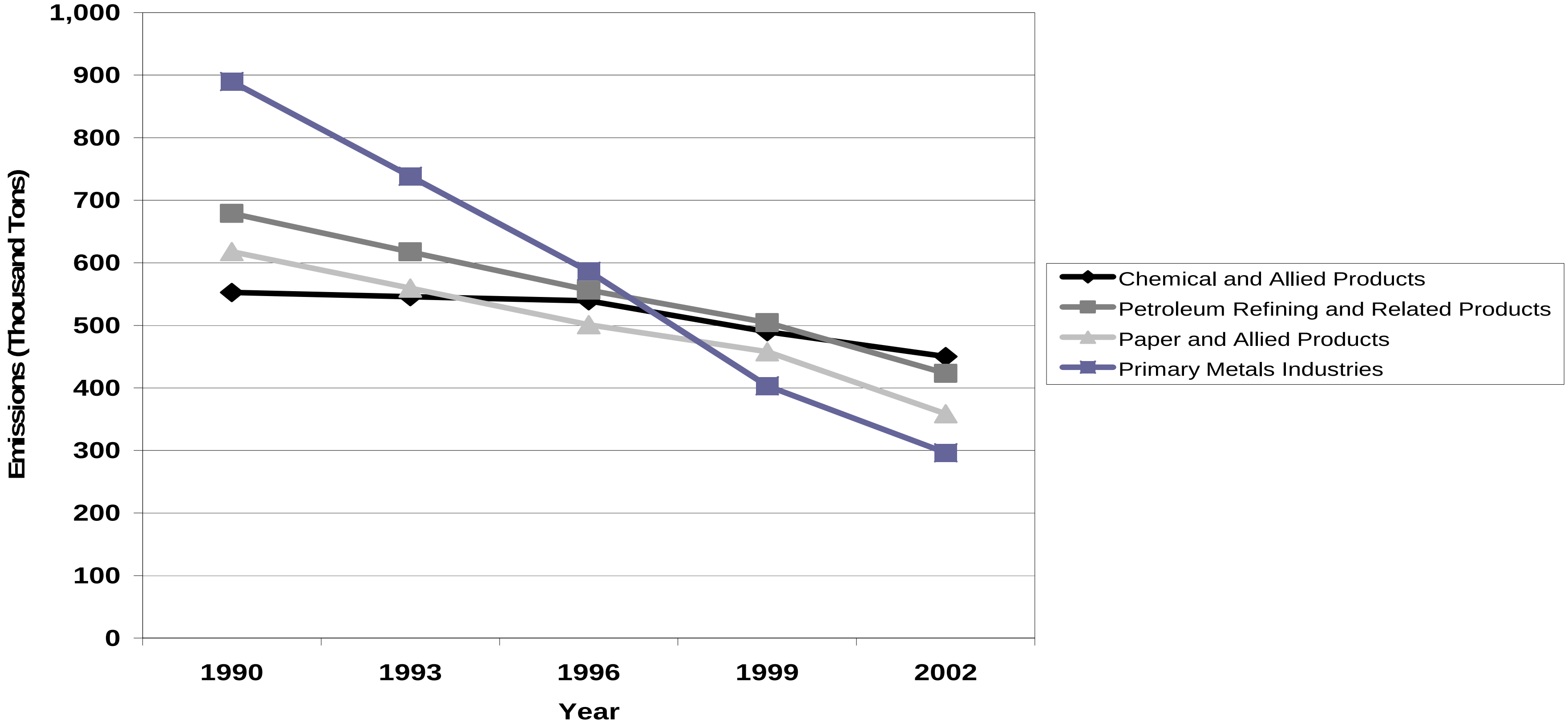
Data Sources: US Department of Commerce, Bureau of Economic Analysis, US Dept. of Transportation, Federal Highway Administration, US Census Bureau, and US Department of Energy.

Figure 2
1990 -2002 Emission Inventories
Non-EGU Stationary Sources Only[1]



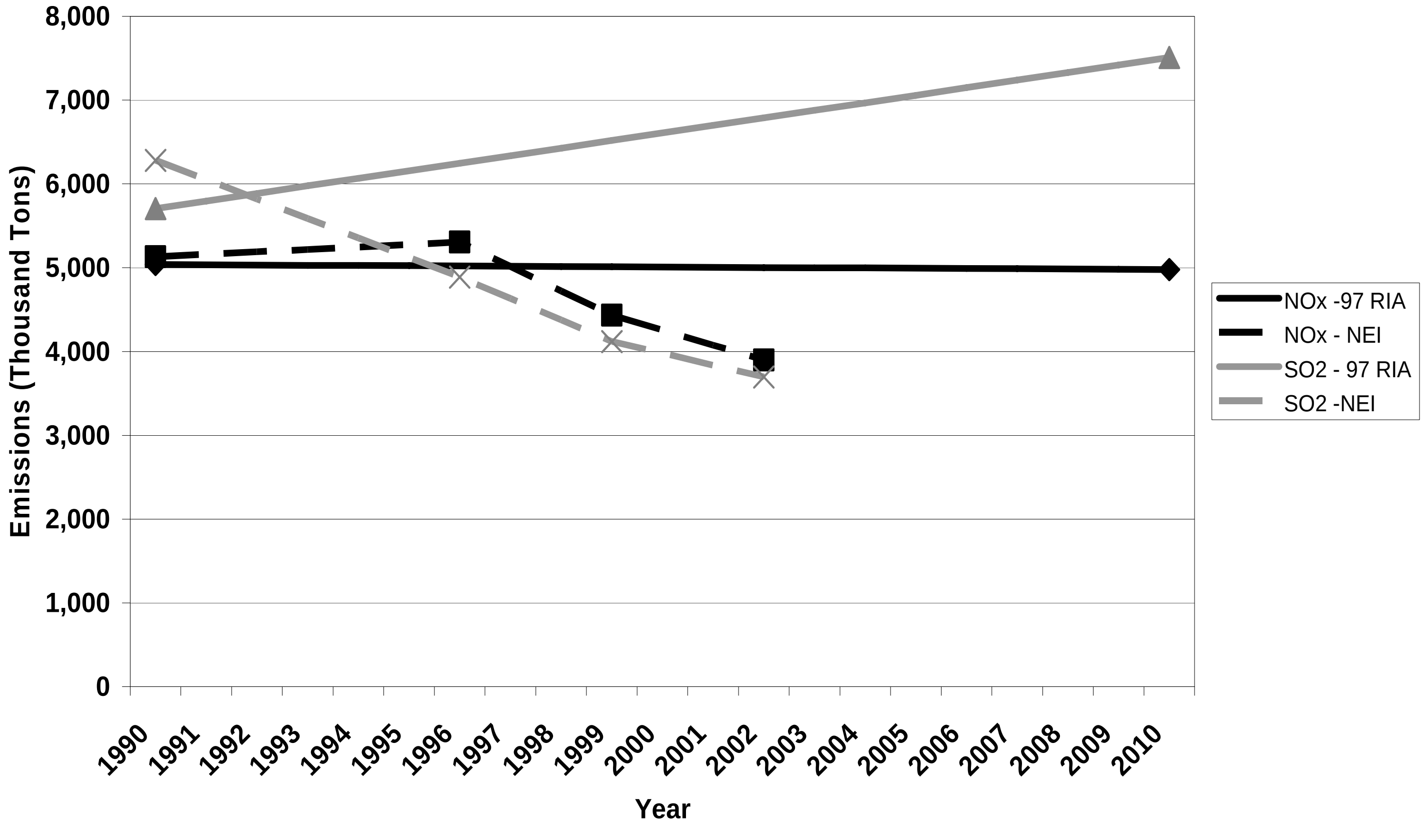
[1] Emissions shown reflect non-utility stationary point and non-point sources only, excluding fires. Source: National Emissions Inventory

Figure 3
Historical SO2 Emission Trends for Large Industrial Categories



[1] Emissions shown reflect 2 digit-SIC source categories. Source: National Emissions Inventory

Figure 4
Comparison of 1997 PM NAAQS RIA Forecasts and NEI Actual Emissions
Non-EGU Stationary Sources Only[1]



[1] Sources: National Emissions Inventory and Regulatory Impact Analysis for the Ozone and PM NAAQS, 1997.

rates. Firms replace emission generating equipment for multiple reasons including regulatory requirements, enhanced productivity, retirement of obsolete equipment, energy efficiency (e.g., fuel switching) and other reasons. Profit seeking firms will attempt to maximize profits for the firm with each capital investment. Thus, installation of new more efficient equipment may result in an increase in production of goods and services without the corollary per unit increase in emissions or in maintenance of current levels of production with lower levels of emissions. These outcomes are reasonably likely regardless of the rationale for the equipment replacement (i.e., enhanced productivity, regulatory requirements, obsolescence of existing equipment, or energy efficiency measures such as fuel switching) for firms seeking to maximize profits. Our current growth projection methods do not explicitly capture such a phenomenon, and there is a lag in our ability to recognize newly installed emission control equipment in our current emission inventory process. We have particular difficulty in accounting for potential emission reductions from regulatory actions such as CAA New Source Review and New Source Performance Standards. In addition, emission rates may not reflect current conditions. The emission rates are determined through source testing. Although we suspect that average emission rates are declining, we have not been able to verify this fact through updated sources testing due to budget constraints.

While it is not clear that all of the factors that have served to produce this historical decline will continue to operate in the future, it appears unreasonable to assume that we currently have arrived at an ‘inflection point’ past which the trend will stop or reverse itself. Indeed, because the available data show that a number of large sources in the sectors of interest have no or limited pollution controls, it is reasonable to expect emissions rates will be steady or decline. Continuing to ignore this factor in future-year emission projections may increasingly skew the predicted emissions increase, and the farther into the future the forecast the more dramatic the impact. The preceding and other explanations suggested that we need to reevaluate our emission forecasting approaches for stationary non-EGU sources to incorporate factors not adequately considered in past methodologies.

Interim Approach to Address this Issue

We are currently reviewing the PM NAAQS and completing an RIA that estimates the benefits and costs of the standard. The stationary non-EGU sectors are important sectors for this analysis and emission projections are more important for this analysis than they have been in some previous analyses. Over-predicting future emissions for these sectors will lead to an over-prediction of the benefits and costs of the PM NAAQS. We also believe that potential prediction errors will be greater in distant future years (e.g., 2020) due to compounding of growth. As recent and upcoming analyses are examining policies that will be implemented in 2020 or later, these over-prediction errors have become magnified. As a result, we explored alternative methods of addressing this problem. Due to a court-ordered schedule for this analysis, the time needed to complete a comprehensive revamp of our forecasting model for these source categories was not possible.

As we develop a more comprehensive approach, we are making an interim change in our analysis to better align our forecasts of future growth in the stationary non-EGU sectors with the historical record. As an interim approach, we will not apply economic growth to emissions for many stationary non-EGU sources. Table 1 shows the emission forecasting techniques planned for the PM NAAQS RIA. As shown, the interim approach affects stationary non-EGU point and non-point sources only. We recognize that this solution is a short term one at best, and needs to be improved for the future. Our RIA for the PM NAAQS will show a sensitivity analysis of the implications of the interim approach relative to our traditional approach. Figure 5 shows the forecasted emission trends for the non-utility stationary sources using the old methodology and the new interim approach. As depicted in Figure 5, the new interim approach will result in lower future-year emission projections for these sources that more closely match the observed historical trends. It is worthwhile to recognize that the emissions from these stationary non-EGU sectors are a subset of total emissions and the interim approach adjustment is minimal when looking at emissions from all source categories (see Figure 6).

In the long term, we recognize the need to improve our forecasting methods and models for these important source categories. The technical work needed for a more sophisticated and improved approach will take time to develop. In the interim, our approach has been implemented in the short time frame needed for our ongoing regulatory work. The interim approach minimizes the over-prediction error in future year emission estimates for stationary non-utility sources. This approach does not have an *a priori* bias in either direction, as it simply holds non-utility stationary source emissions to be consistent with the observed levels in 2001, accounting for known control programs to be implemented in future years. The interim approach does not apply the observed downward trend in emissions, and as such may still overstate future emissions levels if historical trends continue.

To develop an improved approach to emission projections, we are focusing first on sectors that are the largest contributors to precursors of ozone, PM, regional haze, and high risk toxics. Developing the appropriate emissions projection technique is a complex process that requires more analysis to first identify and understand the sources of change in historical emissions. As previously discussed, our past methods do appropriately reflect the impact of economic growth and emission control impacts on future-year emissions, but do not adequately reflect the impact of other factors such as technological innovation, capital turnover, fuel switching, and other activities that may have significant impacts on emissions. After gaining the necessary understanding of these trends, we will develop models that better reflect historical and anticipated future trends for key stationary non-EGU sectors. This focus on important sectors will provide the most benefit for the effort expended to improve emissions projections.

After gaining an understanding of historical trends, EPA will evaluate currently available forecasting models capable of estimating local, regional, and national economic trends. Key considerations will be the efficacy of these models to forecast growth for key stationary non-EGU industry sectors. In addition, EPA will consider techniques to model technological innovation and adoption for both productive processes and control equipment and models that consider new facility location decision-making. EPA's goal is to implement these improvements as a part of the new 2002 emissions based modeling platform. These changes may not be available for the initial version 2002 platform, but could be incorporated into the modeling platform along with other updates. When an improved approach is formulated, the EPA will consult with the Council to obtain feedback on the new methodology prior to its implementation.

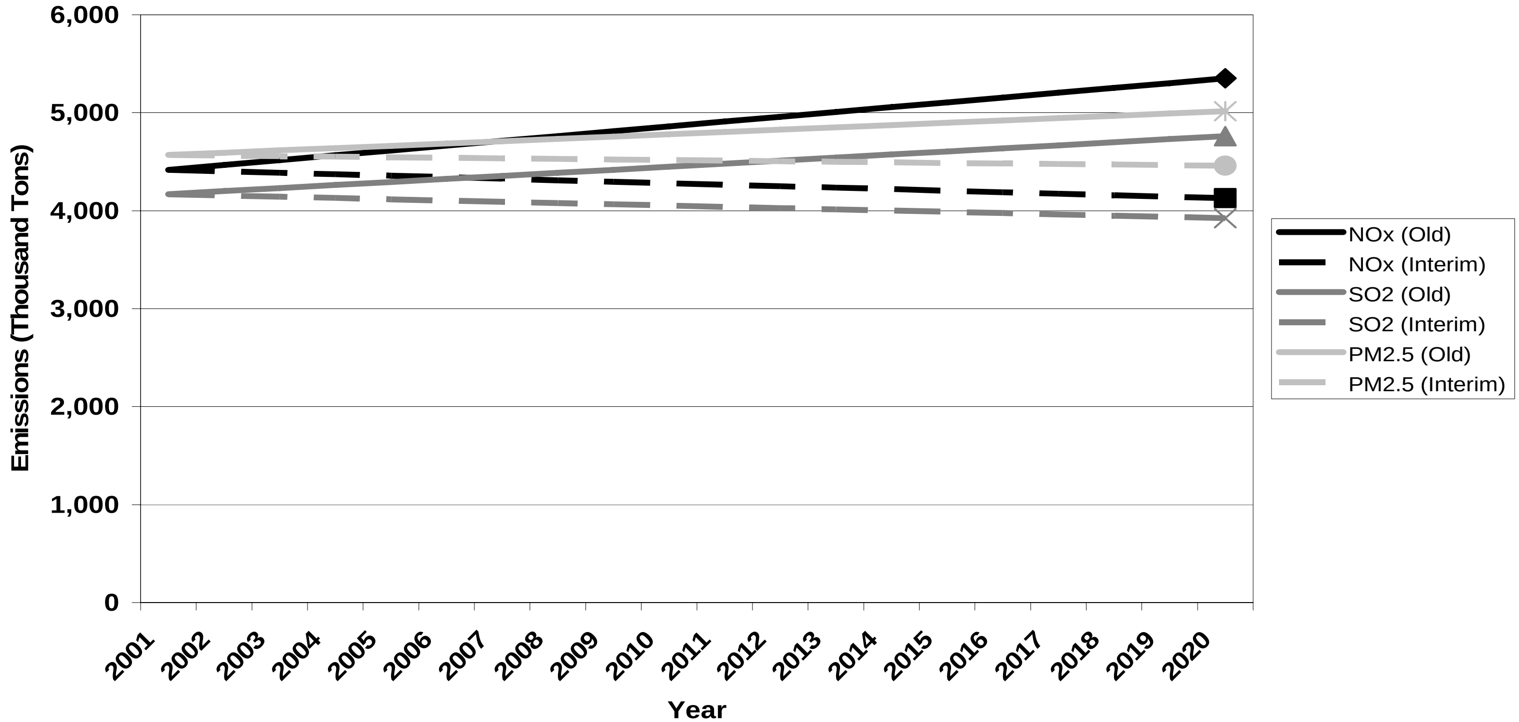
Question for the Council

Please provide your advice and comments on EPA's discussion and underlying development of the interim forecasting approach for stationary non-EGU sources described above. Are there caveats and sensitivities that should be provided in the discussion of this interim approach in our analyses? Are there additional suggestions or data you could provide to help with the development of a longer term approach?

Table 1. Emissions Sources and Basis for Current and Future-Year Inventories

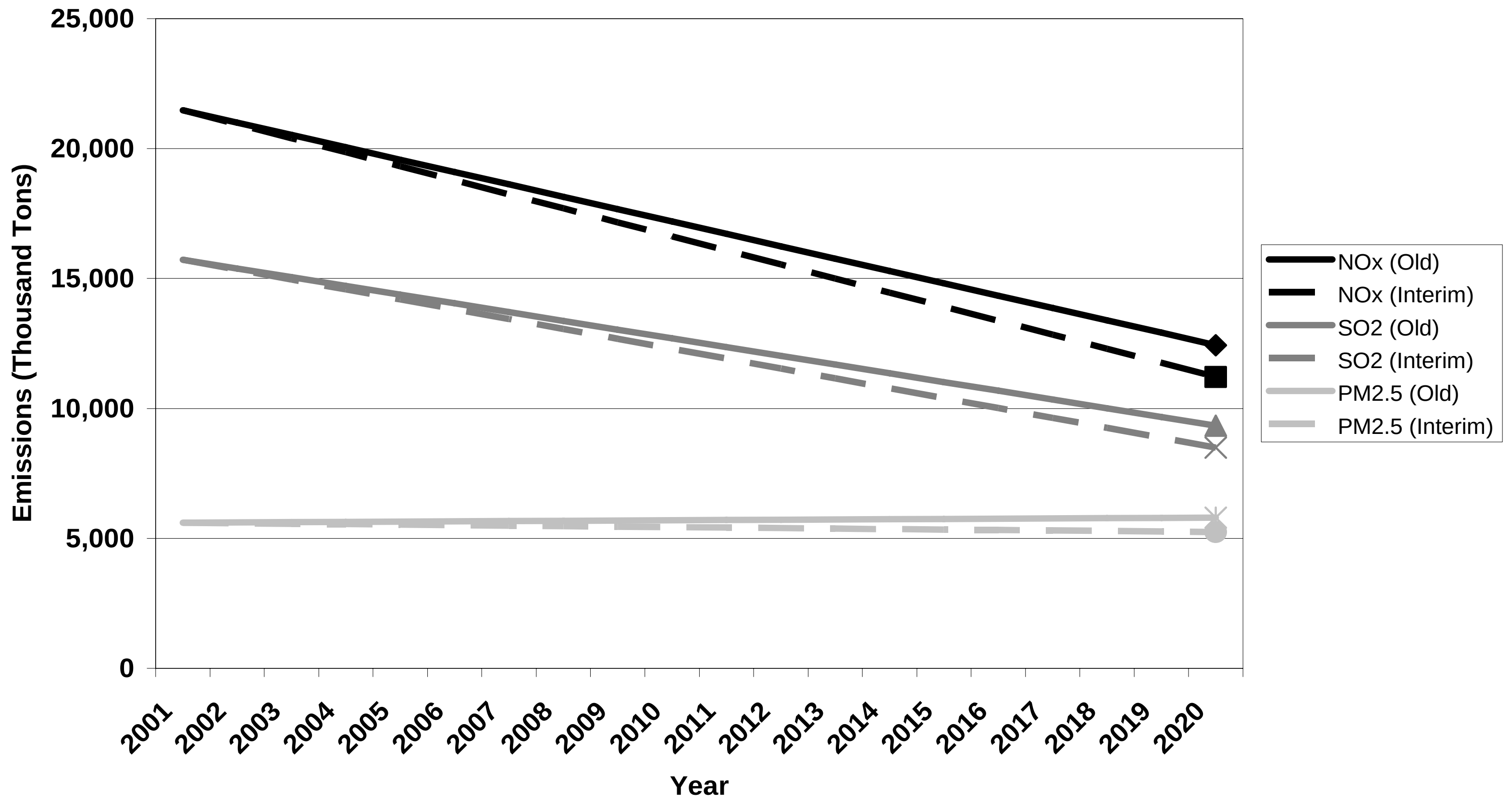
Sector	Interim Projection Method Applied	Future-Year Base Case Projections
EGU	No	Integrated Planning Model (IPM)
Non-EGU Point Sources	Yes	Apply CAA mandated controls to base year emissions to project future emissions. Projected changes in economic activity not applied to emission projection.
Other Stationary Non-point	Yes	Apply CAA mandated controls to base year emissions to project future emissions. Projected changes in economic activity not applied to emission projection.
Fires	No	Average fires from 1996 through 2002 (based on state-total acres burned), with the same emissions rates and county distributions of emissions as in the 2001 NEI
Ag -NH3	No	Livestock – USDA projections of future animal population Fertilizer – Held constant at 2001 level
On-road	No	Projected vehicle miles traveled (VMT) DOE Energy Outlook VMT projections, future-year emissions rates from MOBILE6.2 model via National Mobile Inventory Model (NMIM)
Nonroad	No	NONROAD 2004 model via NMIM

Figure 5
2020 Emission Forecasts - Old and Interim Methods
Non-EGU Stationary Sources Only[1]



Source: Analysis completed for the PM NAAQS RIA (forthcoming).

Figure 6
2020 Emission Forecasts - Old and Interim Methods
All Sources



Source: Analysis completed for the PM NAAQS RIA (forthcoming).

References

U.S. Census Bureau. 2005. Table 4. Population: 1790 to 1990 and Population Projections National Summary Table NP-T1. <http://www.census.gov/popest/national/>.

U.S. Department of Commerce, Bureau of Economic Analysis. (2005) Table 1.1.6 Real Gross Domestic Product, Chained Dollars. <http://www.bea.gov/bea/dn/home/gdp.htm>.

U.S. Department of the Energy. (2005) Table 2.1a. Energy Consumption by Sector, 1949-2004 and Table 1. Total Energy Supply and Disposition Summary, Reference Case Forecast, Annual 2002-2025.
< www.eia.doe.gov/oiaf/analysispaper/sacsa/pdf/appb_page.pdf - 2004-06-07>.

U.S. Department of Transportation, Federal Highway Administration. http://www.fhwa.dot.gov/environment/vmttext.htm.

US Environmental Protection Agency. National Emissions Inventory. http://www.epa.gov/ttn/chief/eiinformation.html

US Environmental Protection Agency. Regulatory Impact Analysis for the Ozone and PM NAAQS. 1997. <http.epa.gov./ttn/ecas/ria.html>.