

APPENDIX J

Base M3/Round 5 Modeling Emissions Summary

Base M Strategy Modeling: Emissions

The purpose of this document is to summarize the emission estimates prepared for LADCO's latest (Base M) 2005 base year and 2009 and 2018 future year modeling. Base year emissions by state and source sector for Base K (2002) and Base M (2005) are compared in Figure 1. A more detailed state and source sector summary is provided in Attachment 1.

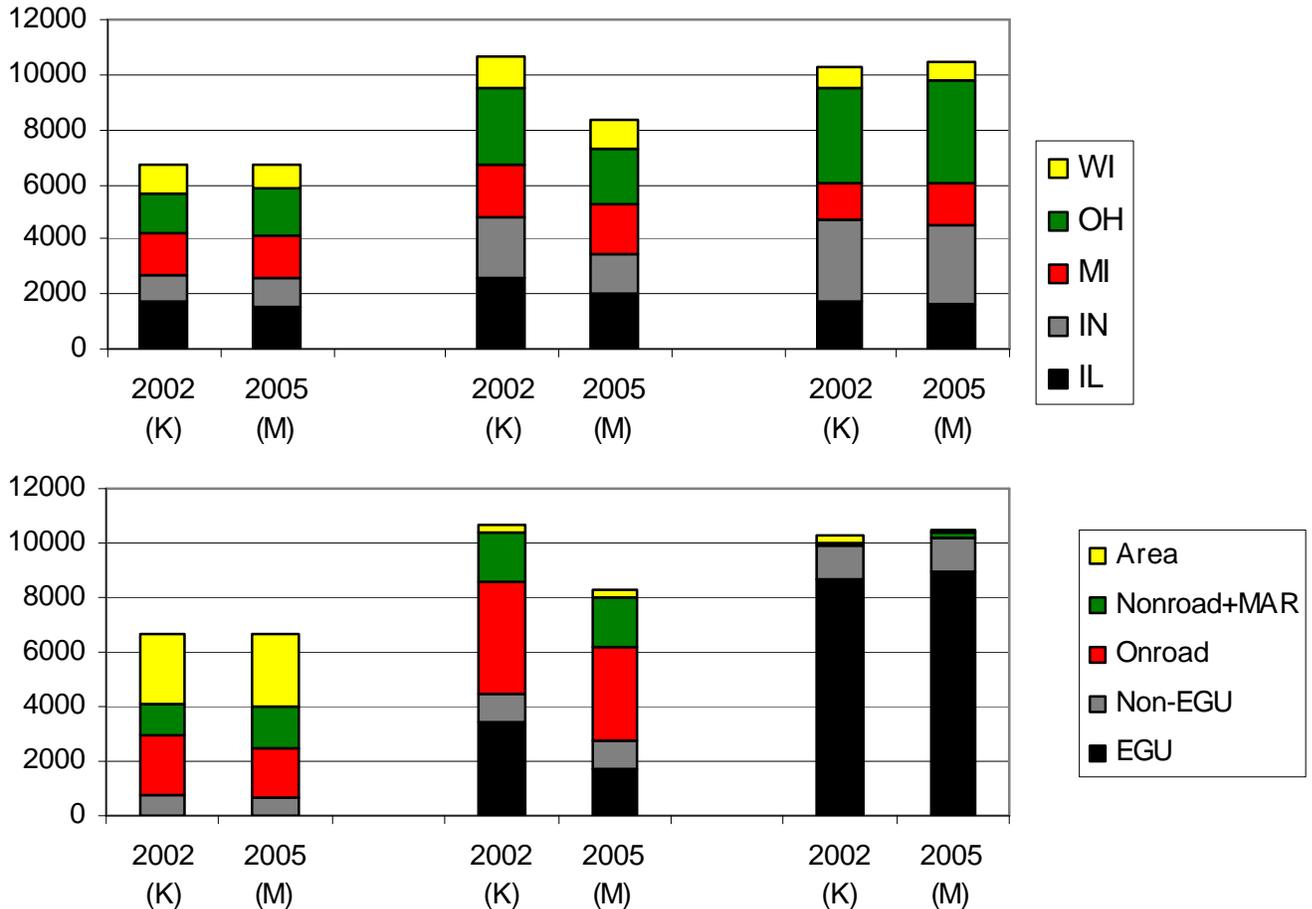


Figure 1. Base K and Base M Emissions for 5-State LADCO Region (TPD, July weekday)

Base Year Emissions

In mid-2006, LADCO completed modeling analyses for a 2002 base year and several future year control strategies (see “Base K/Round 4 Modeling: Emissions”, May 16, 2006 and “Base K/Round 4 Modeling: Summary”, August 31, 2006). Following those analyses, a decision was made to conduct additional modeling using a more current base year (2005). The plans for this modeling are reviewed in “Protocol Document: Technical Analyses to Support SIP Development for Ozone, PM2.5, and Regional Haze (Revised)”, October 13, 2006.

For on-road, nonroad, ammonia, and biogenic sources, the 2005 emissions were estimated by models. For the other sectors (point sources, area sources, and MAR [commercial marine, aircraft, and railroads]), the 2005 emissions were prepared using data supplied by the LADCO States and, for non-LADCO States, data developed by other Regional Planning Organizations. In particular, for the non-LADCO States, a contractor (Alpine, with assistance from MACTEC)

obtained the latest base (2002) and future year emission files (2009, 2018) from the other Regional Planning Organizations. Specifically, the following versions of these emissions files were used here:

MANE-VU: Version 3.1
CENRAP: Base F

WRAP: Pre2002d
VISTAS: Base F

2005 emissions were then estimated by linearly interpolating between the 2002 and 2009 emissions.¹

Further discussion of the development of the 2005 base year emissions is provided below:

On-road: CONCEPT was run by a contractor (Environ) using transportation data (e.g., VMT and vehicle speeds) supplied by the state and local planning agencies in the LADCO States and Minnesota for 24 networks. These data were first processed with T3 (Travel Demand Modeling [TDM] Transformation Tool) to provide input files for CONCEPT to calculate link-specific, hourly emission estimates. CONCEPT was run with meteorological data for a July and January weekday, Saturday, and Sunday (July 15 – 17 and January 16 – 18). A spatial plots of emissions for July 15 are provided in Figure 2.

For the non-LADCO States, CONCEPT was run by Environ using RPO-based HPMS county-level data (2002 and 2009) and MOBILE6 inputs (2002) compiled by another contractor for VISTAS. HPMS VMT for 2005 were generated by linearly interpolating between the 2002 and 2009 data. The 2002 MOBILE6 inputs were used for the 2005 modeling, with a few adjustments (e.g., fuel sulfur content was set to 30 ppm, as required by the Tier 2/low sulfur regulations).

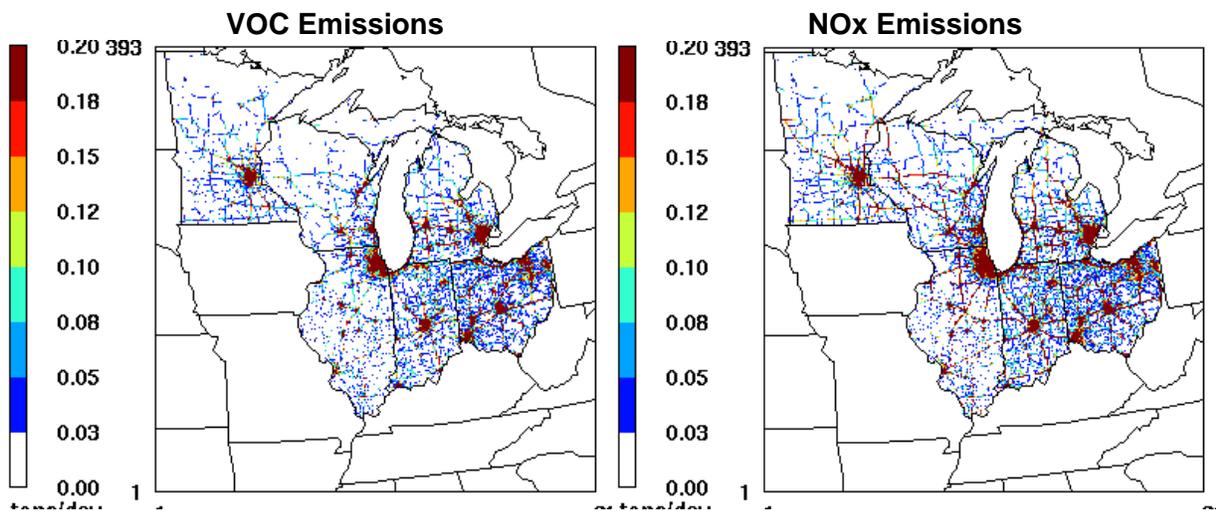


Figure 2. July 15, 2005 motor vehicle emissions for VOC (left) and NOx (right)

¹ Emissions Inventory Assistance: 2005 Base Year Biogenic and Other (non-LADCO) State Emissions”, March 12, 2007

Off-road: NMIM2005 was run by Grant Hetherington (Wisconsin DNR):

Phase 1: Run NMIM2005 for the LADCO states plus Minnesota plus Iowa and Missouri agriculture with Pechan's modifications only². The Pechan modifications that were not incorporated in the default NMIM2005 inputs and need to be incorporated are BSFC emission factor data, Michigan population data, Missouri seasonality data and revised countyfile, countyyear, countyyearmonth, datasource and gasoline NCD tables that assimilate fuel changes and file references.

Phase 2: Run NMIM2005 for the LADCO states plus Minnesota plus Iowa and Missouri agriculture with Pechan's modifications, revised 2005 LADCO gasoline parameters and a modified SCC table containing PM2.5 corrections for diesel equipment.

Phase 3: Run NMIM2005 for the LADCO states plus Minnesota plus Iowa and Missouri agriculture with Pechan's modifications, revised 2005 LADCO gasoline parameters, a modified SCC table containing PM2.5 corrections for diesel equipment and AIR's NONROAD.EXE. (Note: it is not clear if Phase 3 was used.)

Additional off-road sectors (i.e., commercial marine, aircraft, and railroads [MAR]) were handled separately. Aircraft emissions were supplied by the States. Updated information for railroads and commercial marine was prepared by a contractor (Environ).³ Table 1 compares the new 2005 emissions with the previous 2002 emission estimates. The new 2005 emissions reflect substantially lower commercial marine emissions and lower locomotive NOx emissions.

Table 1. Locomotive and Commercial Marine Emissions for 2002 and 2005 Base Year

	Railroads (TPY)			Commercial Marine (TPY)	
	2002	2005		2002	2005
VOC	7,890	7,625		1,562	828
CO	20,121	20,017		8,823	6,727
NOx	182,226	145,132		64,441	42,336
PM	5,049	4,845		3,113	1,413
SO2	12,274	12,173		25,929	8,637
NH3	86	85		----	----

For the non-LADCO States, Alpine developed appropriate emissions files based on data from the other Regional Planning Organizations, as noted above.

² "LADCO Nonroad Emissions Inventory Project – Development of Local Data for Construction and Agricultural Equipment", Final Report, September 10, 2004

³ "LADCO 2005 Locomotive Emissions", Environ, February 2007, and "LADCO 2005 Commercial Marine Emissions", Environ, March 2, 2007

Area: EMS was run by LADCO using 2005 data supplied by the LADCO States and, for the non-LADCO States, using emission files supplied by Alpine based on data from the other Regional Planning Organizations to produce weekday, Saturday, and Sunday emissions for each month. Special attention was given to two source categories: industrial adhesive and sealant solvent emissions and outdoor wood boilers.

Industrial Adhesives and Sealants: The NEI shows this to be a large VOC emissions category in the LADCO States (i.e., 50,000 TPY) EPA subsequently determined that “(f)or the Region V states, we no longer believe that there are any activities in the Industrial Adhesives and Sealants category (SCC 2440020000) that have not been inventoried either in the point source Industrial Adhesives and Sealants category or under the Consumer and Commercial Adhesives and Sealants nonpoint category (SCC 2460600000 - all adhesives and sealants).” Consequently, this category was omitted from the 2005 regional emissions inventory.

Outdoor Wood Boilers: Over the past several years, the installation and operation of outdoor wood boilers for residential use has increased dramatically in many northern states. Relying on an emission estimation methodology prepared by Bart Sponseller (Wisconsin DNR), emissions were calculated by the other states for this category.

For the non-LADCO States, a contractor (Alpine, with assistance from MACTEC) estimated 2005 emissions by linearly interpolating between the 2002 and 2009 emissions developed by the other RPOs.

Point-EGU: EMS was run by LADCO using 2005 data supplied by the LADCO States and, for the non-LADCO States, using emission files supplied by Alpine based on data from the other Regional Planning Organizations to produce weekday, Saturday, and Sunday emissions for each month.

The annual and summer season EGU emissions were temporalized for modeling purposes using profiles prepared by Scott Edick (Michigan DEQ) based on CEM data for the period 2002 – 2005.

Point-Non-EGU: EMS was run by LADCO using 2005 data supplied by the LADCO States (and, for the non-LADCO States, using emission files supplied by Alpine based on data from the other Regional Planning Organizations) to produce weekday, Saturday, and Sunday emissions for each month. EGUs were removed from the point source file.

Other improvements to the base year inventory included:

Canadian Emissions: Previous modeling inventories for Canadian sources were flawed due to problems with emissions (e.g., LADCO inventories omitted ammonia emissions) or stack parameters (e.g., VISTAS inventories failed to include proper stack parameters, resulting in emissions getting dumped in the surface layer of the model). For Base M, Scott Edick (Michigan DEQ) processed the 2005 Canadian National Pollutant Release Inventory (NPRI). Specifically, a subset of the NPRI data which are relevant to the air quality modeling were reformatted. A number of emission reports are available on the LADCO website (<http://www.ladco.org/tech/emis/basem/canada/index.htm>). Circle plot of point source emissions are presented in Figure 3.

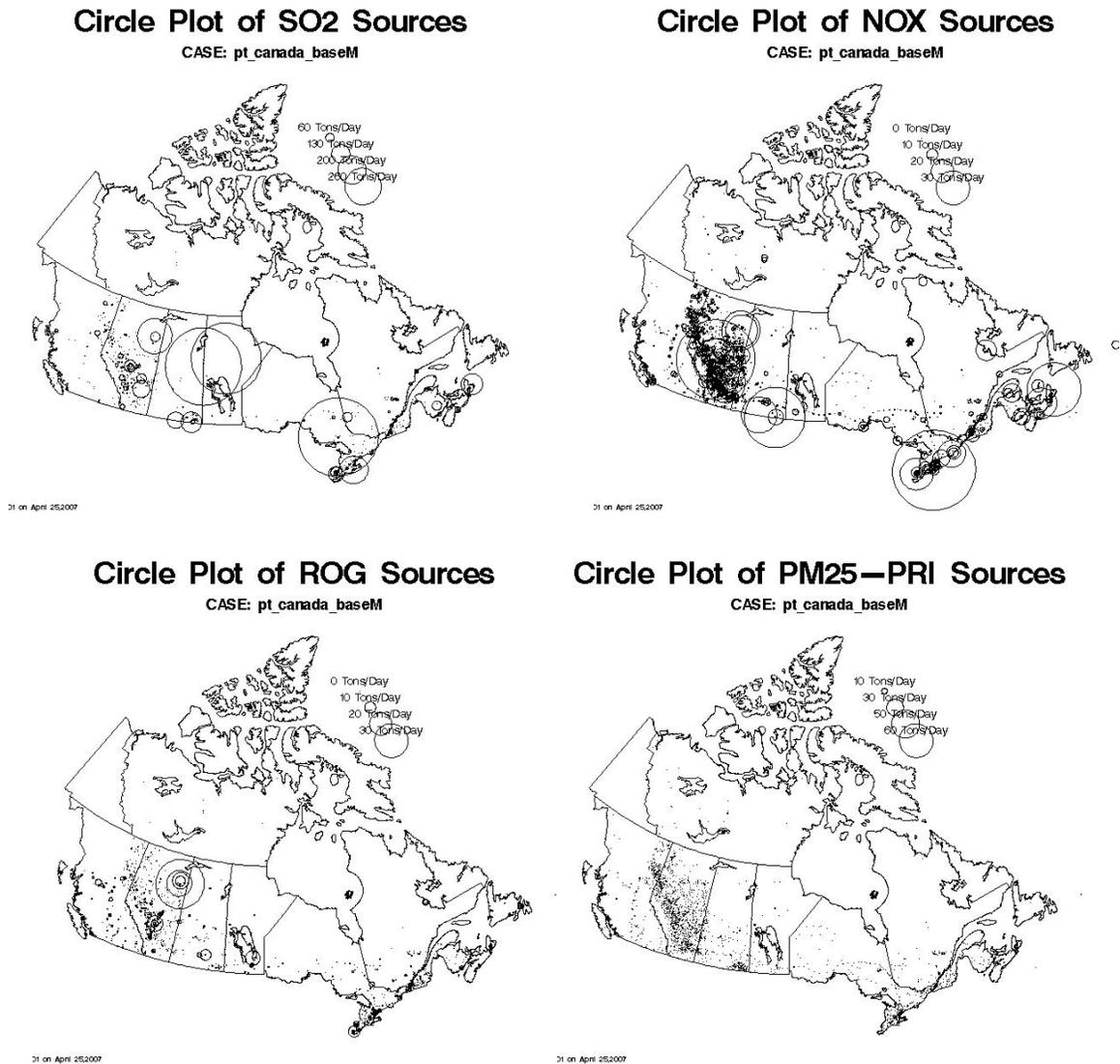


Figure 3. Base year emission plots for Canada

Biogenic Emissions: A contractor (Alpine) provided an updated version of the CONCEPT/MEGAN⁴ (Model of Emissions of Gases and Aerosols from Nature) biogenics model, which was used to produce base year biogenic emission estimates. Model improvements included: (a) reduced model run times, (b) improved ability to run successive days, and (c) enhanced meteorological input processing⁵.

Compared to the previous (EMS/BIOME) emissions, there is more regional isoprene using MEGAN compared to the BIOME estimates used for Base K (see Figure 4). Also, with the secondary organic aerosol updates to the CAMx air quality model, Base M includes emissions for monoterpenes and sesquiterpenes, which are pre-cursors of secondary PM2.5 organic carbon mass

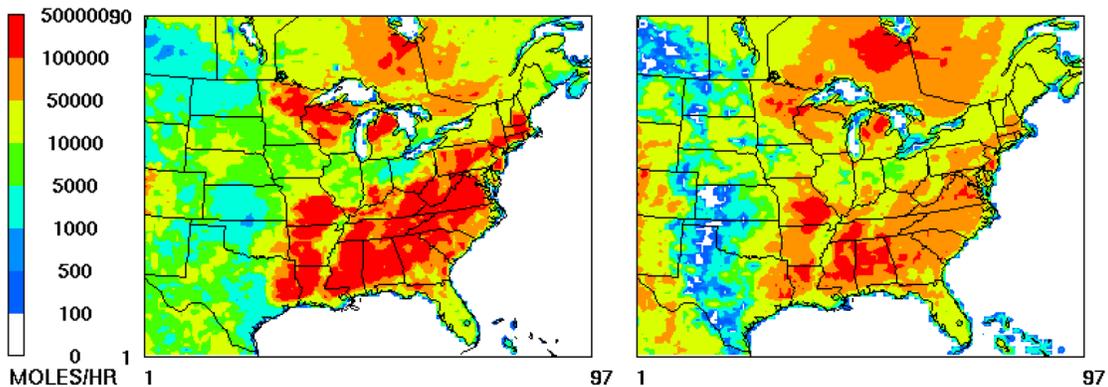


Figure 4. Isoprene emissions for Base M (left) v. Base K (right)

Ammonia Emissions: The CMU-based 2002 (Base K) ammonia emissions were projected to 2005 using growth factors from the Round 4 emissions modeling. These emissions were then adjusted by applying temporal factors by month based on the process-based ammonia emissions model. A plot of the average daily emissions by state and month is provided in Figure 5.

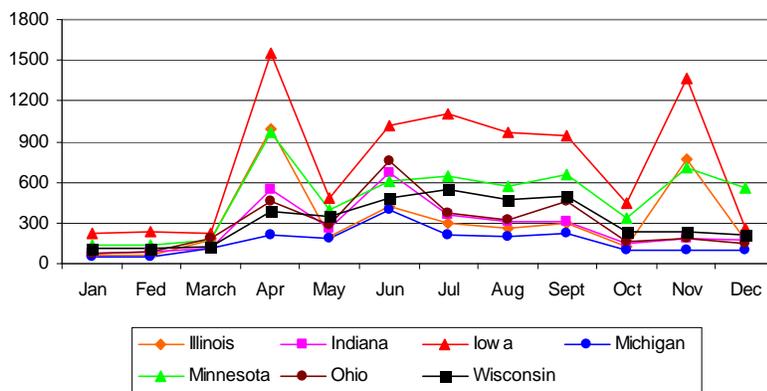


Figure 5. Average daily ammonia emissions for Midwest States by month (2005)

⁴ See <http://bai.acd.ucar.edu/Megan/>

⁵ Subsequent to deliver of the updated CONCEPT/MEGAN model, it was found that more recent data sets and model formulations were available. Consequently, additional model improvements were undertaken. Compared to the initial updated model, the revised model reflects lower emissions for several organic aerosol species and NOx.

Future Year Emissions

Emission inventories were developed for two future years: 2009 and 2018⁶. For on-road, nonroad, and EGU sources, the future year emissions were estimated by models (i.e., CONCEPT, NMIM2005, and IPM, respectively) and then processed by LADCO with EMS.

For other sectors (area, MAR, and non-EGU point sources) the future year emissions for the LADCO States were derived by applying growth and control factors to the base year inventory. These factors were developed by a contractor (E.H. Pechan).⁷ For the non-LADCO States, future year emission files were supplied by Alpine based on data from the other Regional Planning Organizations.

Growth factors were based initially on EGAS (version 5.0), and were subsequently modified (for select, priority categories) by examining emissions activity data. The categories which show the largest resulting growth factors include:

Category	2005-2009	2005-2018
Industrial residual oil	-49.4%	-49.6%
Industrial coal	-19.5%	-25.8%
Comm/consumer solvents	-10.5%	-15.6%
Architectural coatings	- 9.9%	- 9.3%
Auto refinishing	-12.9%	-38.9%
Ag – dairy cattle (NH3)	-10.2%	-39.0%
Outdoor wood boilers	+78.0%	+84.5%

⁶ A 2008 proxy inventory was also prepared to support a preliminary 2008 modeling analysis to assess attainment for the basic nonattainment areas (i.e, for areas with a 2009 attainment date, the appropriate panning year is 2008). This inventory reflects the following assumptions:

On-road: scale 2005 base year emissions using the Base K 2002 – 2009 trend (except for the Cincinnati-Dayton area, where 2008 emissions were generated using CONCEPT and 2008 data supplied by the local planning agency)

Off-road and area: scale 2005 base year emissions using the Base K 2002-2009 trend

Point – EGU: use 2005 base year emissions, with slight adjustment (-10%)

Point – Non-EGU: use 2005 base year emissions (note: Base K 2002-2009 trend suggests little change)

Biogenics: use new 2005 base year emissions

⁷ “Development of 2005 Base Year Growth and Control Factors for Lake Michigan Air Directors Consortium”, Draft Report, June 30, 2007

Control factors were prepared for the following area, MAR, and non-EGU point source existing (“on the books”) controls⁸:

Area/MAR

- VOC solvent categories (consumer solvents, AIM, and aerosol coatings)
- Portable fuel containers
- Woodstoves
- Stage II
- Locomotives and marine vessels (proposed rule)

Non-EGU Point

- NOx SIP call (IL RICE only)
- MACT
- Consent decrees (refineries, ethanol plants, and ALCOA)
- Other (Ohio NOx RACT and BART in IN and WI)

⁸ The complete set of “on the books” control measures consists of the following:

On-Highway Mobile Sources

- Tier II/Low sulfur fuel
- Inspection/Maintenance programs (nonattainment areas)
- Reformulated gasoline (nonattainment areas)

Off-Highway Mobile Sources

- Federal control programs incorporated into NONROAD model (e.g., nonroad diesel rule), plus the evaporative Large Spark Ignition and Recreational Vehicle standards
- Heavy-duty diesel (2007) engine standard/Low sulfur fuel
- Federal railroad/locomotive standards
- Federal commercial marine vessel engine standards

Area Sources

- Consumer solvents
- AIM coatings
- Aerosol coatings

Power Plants

- Title IV (Phases I and II)
- NOx SIP Call
- Clean Air Interstate Rule
- Clean Air Mercury Rule

Other Point Sources

- VOC 2-, 4-, 7-, and 10-year MACT standards
- Combustion turbine MACT
- Industrial boiler/process heater/RICE MACT

Further discussion of the development of the future year emissions is provided below:

On-road: Similar to the base year modeling, CONCEPT was run using transportation data (e.g., VMT and vehicle speeds) supplied by the state and local planning agencies for 2009 and 2018. CONCEPT was only run with meteorological data for the July weekday. The emissions for Saturday and Sunday were derived by using scaling factors based on the 2005 emissions. The state-level emissions for the six states are summarized in Table 2.

For the non-LADCO States, CONCEPT was run by Environ using HPMS county-level data and MOBILE6 inputs compiled by another contractor for VISTAS. Note, the emissions modeling for IA, MO, and OK was redone for 2009 to reflect the state-developed registration distribution data. (The initial modeling for 2009 used national default values for registration distribution assumed by VISTAS' contractor. CENRAP's contractor developed emissions inventories for 2002 and 2018 using the state-developed data. For consistency, Environ's remodeling for these three states for 2009 also used the state-developed data.)

Table 2. Summary of On-road Emissions (TPD – July 15, 2005)

Year	State	CO	TOG	NOx	PMC	PM2.5	SO2	NH3	Sum of VMT
2005	IL	3,684.3	341.5	748.2	6.2	12.9	9.6	35.9	344,087,820
	IN	3,384.9	282.0	541.1	4.4	8.9	11.1	25.7	245,537,232
	MI	4,210.3	351.9	722.0	6.1	12.4	13.9	35.3	340,834,026
	MN	2,569.1	218.7	380.5	3.1	6.3	7.6	17.7	170,024,600
	OH	6,113.4	679.8	933.6	6.8	16.2	18.8	36.5	360,521,069
	WI	2,206.0	175.1	457.5	3.5	7.8	9.2	19.7	189,123,964
2005 Total		22,168.0	2,049.0	3,782.9	30.1	64.5	70.2	170.8	1,650,128,710
2009	IL	2,724.4	259.5	508.3	6.1	9.7	4.1	37.2	356,044,263
	IN	2,839.5	234.9	401.9	4.3	6.7	2.8	26.1	249,817,026
	MI	3,172.0	269.2	500.9	6.1	9.2	4.0	37.1	356,347,010
	MN	2,256.8	206.3	307.5	3.5	5.1	2.3	21.5	204,443,018
	OH	4,619.2	423.7	693.5	6.9	11.8	4.7	39.5	387,428,127
	WI	1,673.4	119.4	322.1	3.5	5.7	2.3	20.6	197,729,965
2009 Total		17,285.3	1,513.1	2,734.2	30.4	48.3	20.2	181.9	1,751,809,409
2018	IL	2,022.9	147.5	194.9	6.4	6.1	3.6	41.5	396,450,836
	IN	2,217.3	138.4	173.0	4.7	4.4	2.6	30.2	288,042,232
	MI	2,434.3	163.5	204.1	6.3	5.9	3.6	40.5	388,128,432
	MN	1,799.6	123.1	137.1	3.8	3.6	2.2	24.9	237,022,214
	OH	3,361.5	242.5	274.1	6.9	6.8	4.0	43.1	421,694,093
	WI	1,255.5	68.4	138.5	3.7	3.9	2.0	22.2	218,277,167
2018 Total		13,091.0	883.5	1,121.7	31.7	30.6	17.9	202.3	1,949,614,975

Off-road: Similar to the base year inventory, NMIM2005 was run by Grant Hetherington (Wisconsin DNR) to produce the future year inventories, with updated growth factors by E.H. Pechan.

Point-EGU: Future year emissions were based on EPA's IPM3.0 modeling⁹. Three CAIR scenarios were addressed:

- 5a: EPA's IPM3.0 was assumed as the future year base for EGUs.
- 5b: EPA's IPM3.0, with several "will do" adjustments identified by the States. These adjustments should reflect a legally binding commitment (e.g., signed contract, consent decree, or operating permit).
- 5c: EPA's IPM3.0, with several "may do" adjustments identified by the States. These adjustments reflect less rigorous criteria, but should still be some type of public reality (e.g., BART determination or press announcement).

Table 3 summarizes the SO₂ and NO_x emissions for the three scenarios. The net effect is a small change (increase) in regional SO₂ and NO_x emissions.

⁹ The second set of new IPM runs by EPA were used. These runs were performed at the request of the RPOs and reflect the addition of run years 2012 and 2018, and the use of four load segments for 2032 to decrease model size (instead of six segments). Comparing the results in this run with EPA's initial v3.0, showed small differences. Below is a quick summary of the run year differences.

EPA Base Case for IPM v.3.0

2010: 2009-2012
2015: 2013-2017
2020: 2018-2022
2025: 2023-2027
2032: 2028-2035

Base Case RPO Run for IPM v3.0 (added 2012 and 2018 run years, 2020 run year merged with the 2025 run year, and four load segments used for the 2032 run year)

2010: 2009-2011
2012: 2012-2012
2015: 2013-2017
2018: 2018-2019
2025: 2020-2028
2032: 2029-2035

Table 3. Comparison of EGU Emissions for Base (5a), Will Do (5b), and Will Do (5c) Scenarios

	2010				2018		
SO2	5a	5b	5c		5a	5b	5c
IL	958	881	881		869	433	433
IN	1068	1949	1929		1075	1900	1880
MI	667	667	667		725	725	725
OH	1345	1505	1505		995	995	995
WI	460	460	421		435	499	235
	4498	5462	5403		4099	4552	4268
MN	162	148	148		187	167	157
NOx	5a	5b	5c		5a	5b	5c
IL	275	247	247		224	195	195
IN	384	478	476		264	358	356
MI	242	242	242		243	243	243
OH	285	309	309		290	290	290
WI	165	164	155		176	172	145
	1351	1440	1429		1197	1258	1229
MN	116	142	142		132	157	125

ATTACHMENT 1

Emissions Summaries

	VOC	Base M	BaseK	Base M	BaseK	Base M	NOx	Base M	BaseK	Base M	BaseK	Base M	SOX	Base M	BaseK	Base M	BaseK	Base M	PM2.5	Base M	BaseK	Base M	BaseK	Base M	
July	2002	2005	2009	2009	2012	2018	2002	2005	2009	2009	2012	2018	2002	2005	2009	2009	2012	2018	2002	2005	2009	2009	2012	2018	
Nonroad																									
IL	224	321	164	257	149	130	324	333	263	275	224	154	31	33	5	5	0.6	0.4		30		24			14
IN	125	195	94	160	95	72	178	191	142	158	141	141	17	19	3	3	3	0.3	0.2		17		13		7
MI	348	414	307	350	276	222	205	239	159	197	133	93	19	22	3	3	0.5	0.3	0.3		22		18		12
OH	222	356	161	294	145	126	253	304	195	246	162	109	23	29	4	5	0.5	0.3	0.3		27		22		11
WI	214	238	194	203	175	140	145	157	114	129	97	69	13	15	2	2	0.3	0.2	0.2		14		12		9
5-State Total	1133	1524	920	1264	840	713	1105	1224	873	1005	757	566	103	118	17	18	4.9	1.5	1.4		110		89		53
U.S. Total	8463	9815	5442	8448		5244	6041	9060	6057	8120		5832	505	654	117	153		104	13		573		750		484
MAR																									
IL	10	11	10	10	10	6	277	246	201	228	195	186	0	22	0	19	0	0	17		7		6		4
IN	5	5	5	5	5	3	123	93	89	87	87	84	0.2	8	0.2	7	0.2	0.2	6		2		2		2
MI	7	7	7	7	7	8	114	87	112	82	111	110	0.6	21	0.7	14	0.7	0.8	8		3		3		2
OH	8	7	8	7	8	5	177	134	128	126	126	122	0.4	14	0.3	12	0.3	0.3	10		4		4		2
WI	4	4	4	4	4	3	79	58	59	54	59	57	12.7	8	9.5	6	9.5	8.7	5		2		2		1
5-State Total	34	34	34	33	34	35	770	618	589	577	578	559	13.9	73	10.7	58	10.7	10	46		18		17		11
U.S. Total	307	317	321	157	329	346	4968	4515	4002	1813	3964	3919	620	512	509	122	509	503	290		147		57		165
OtherArea																									
IL	679	675	688	594	700	738	62	48	68	48	70	73	11	11	12	16	12	13	16		40		64		69
IN	354	391	365	358	373	398	62	56	65	58	67	69	158	32	150	32	151	153	32		2		2		2
MI	518	652	516	562	520	541	49	49	52	50	53	54	71	29	68	29	68	68	28		111		114		120
OH	546	604	550	506	558	593	50	93	59	108	60	62	22	6	34	15	35	35	14		19		35		34
WI	458	315	467	290	474	506	32	37	34	37	34	35	9	17	9	13	10	10	13		11		12		12
5-State Total	2555	2637	2586	2310	2625	2776	255	283	278	301	284	293	271	95	273	105	276	279	103		183		227		237
U.S. Total	17876	21093	18638	18683		20512	24300	3856	4899	4100	4220	4418	5357	2075	2947	2062	2559		2189	2709		2735		2621	2570
On-Road																									
IL	446	341	314	259	260	197	890	748	578	508	474	300		9		4		3		13		10			6
IN	405	282	237	235	193	150	703	541	425	402	313	187		11		3		2		9		7			2
MI	522	351	335	269	303	217	926	722	680	501	619	385		14		4		3		12		9			3
OH	574	680	365	424	340	238	1035	934	609	693	512	270		18		4		4		16		12			4
WI	238	175	144	119	117	88	481	457	303	322	226	118		9		2		2		8		6			2
5-State Total	2185	1829	1395	1306	1213	890	4035	3402	2595	2426	2144	1260		61		17		14		58		44			17
U.S. Total	14263				7825		23499				13170														
EGU																									
IL	9	7	8	6	8	9	712	305	227	275	244	231	1310	1158	944	958	789	810	868		13		34		77
IN	6	6	6	6	7	6	830	393	406	384	424	283	2499	2614	1267	1068	1263	1048	1075		16		73		74
MI	12	6	11	4	11	12	448	393	218	242	219	247	1103	1251	1022	667	1031	1058	725		15		25		29
OH	5	4	6	5	7	7	1139	408	330	285	322	271	3131	3405	1463	1345	994	701	995		28		94		80
WI	3	5	3	2	4	4	293	213	146	165	139	147	602	545	512	460	492	500	435		0		22		25
5-State Total	35	28	34	23	37	38	3422	1712	1327	1351	1348	1179	8645	8973	5208	4498	4569	4117	4098		72		248		285
U.S. Total	214	140	195	124	197	215	14371	10316	7746	7292	7721	7007	6105	31839	34545	20163	16956	17629	14727	14169		685		1131	1571
Non-EGU																									
IL	313	221	286	230	305	350	356	330	334	310	338	343	373	423	251	407	257	249	417		16		17		19
IN	150	130	160	138	170	199	238	179	212	181	216	225	292	218	270	218	274	290	232		35		36		44
MI	123	116	115	121	122	139	216	240	208	242	214	229	162	158	166	148	171	185	163		20		21		25
OH	77	84	75	88	79	90	177	175	157	174	160	167	240	289	231	290	210	216	295		27		28		33
WI	88	84	97	89	104	120	98	97	91	93	92	94	163	156	154	152	155	156	152		0		0.1		0.1
5-State Total	751	635	733	666	780	898	1085	1021	1002	1000	1020	1058	1083	1230	1244	1072	1215	1067	1259		98		102		121
U.S. Total	4087	3877	4409		4700	5378	6446	6730	6129		6435	6952	5759	5630	6093		6340	6970					1444		1777
IL	1681	1576	1470	1356	1432	1434	2621	2010	1671	1644	1545	1287	1725	1656	1212	1409	1059	1072	1321		119		155		189
IN	1045	1009	867	902	843	853	2134	1453	1339	1270	1248	989	2966	2902	1690	1331	1691	1492	1347		81		133		131
MI	1530	1546	1291	1313	1239	1139	1958	1730	1429	1314	1349	1118	927	1356	1495	1260	865	1271	1312	927		183		190	191
OH	1432	1735	1165	1324	1137	1062	2831	2048	1478	1632	1342	1001	1060	3416	3761	1732	1671	1240	953	1318		121		195	164
WI	1005	821	909	707	878	862	1128	1019	747	800	647	520	800	750	687	635	667	675	607		35		54.1		49.1
5-State Total	6693	6687	5702	5602	5529	5350	10672	8260	6664	6660	6131	4915	4505	10263	10564	6581	5911	5928	5504	5521		539		727.1	724.1