Base M Strategy Modeling: Emissions (Revised)

The purpose of this document is to summarize the emission estimates prepared for LADCO's latest (Base M) 2005 base year and 2008, 2009, 2012, 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. Additional emission reports are available on the LADCO website: http://www.ladco.org/tech/emis/r5/round5_reports.htm.

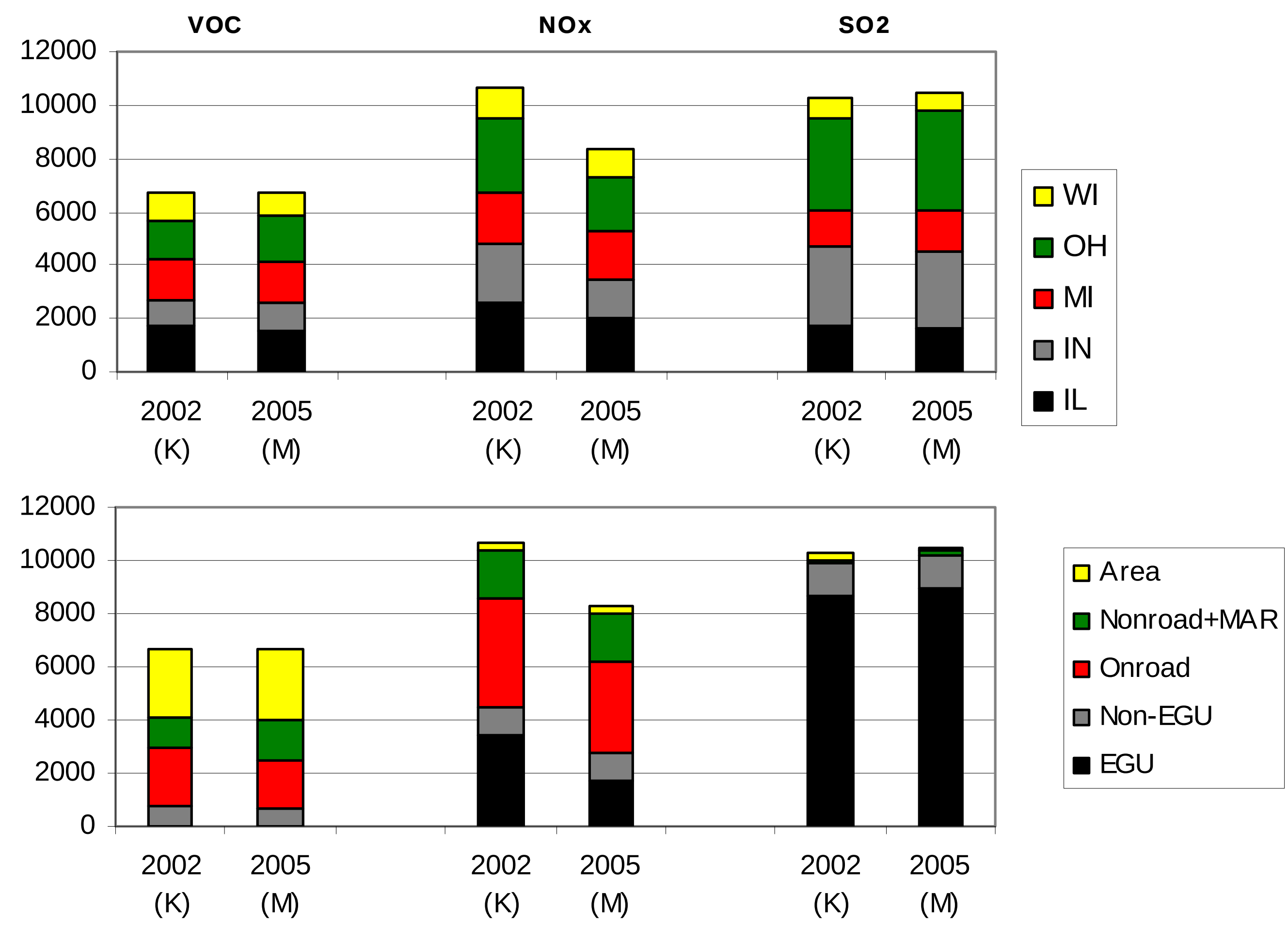


Figure 1. Base K and Base M Emissions for 5-State LADCO Region: VOC, NOx, and SO2 (TPD, July weekday)

Base Year Emissions

In mid-2006, LADCO completed modeling analyses for a 2002 base year and several future year control strategies (LADCO, 2006a and LADCO, 2006b). Following those analyses, a decision was made to conduct additional modeling using a more current base year (2005). Examination of multiple base years provides for a more complete technical assessment. All modeling was conducted in accordance with USEPA modeling guidelines (USEPA, 2007).

For on-road, ammonia, and biogenic sources, 2005 emissions were estimated by emission models. For other sectors in the LADCO States, 2005 emissions were either supplied by a contractor (railroads and commercial marine) or by the States (point sources, area sources, and aircraft). For other sectors in non-LADCO States, a contractor obtained the latest base (2002) and future year emission files (2009, 2018) from the other Regional Planning Organizations (RPOs) (Alpine, 2007a). Specifically, the following versions of these emissions files were used: MANE-VU: Version 3.1, WRAP: Pre2002d, CENRAP: Base F, and VISTAS: Base F. The 2005 emissions were then estimated by linearly interpolating between the 2002 and 2009 emissions.

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

On-Road: CONCEPT was run by a contractor using transportation data (e.g., VMT and vehicle speeds) for 24 networks supplied by the state and local planning agencies in the LADCO States and Minnesota (Environ, 2008). These data were first processed with T3 (Travel Demand Modeling [TDM] Transformation Tool) to provide input files for CONCEPT. For some networks, the VMT outputs from T3 were adjusted to match 2005 HPMS data. CONCEPT was then run with meteorological data for a July and January weekday, Saturday, and Sunday (July 15 – 17 and January 16 – 18) to produce link-specific, hourly emission estimates. A spatial plots of emissions for July 15 are provided in Figure 2.

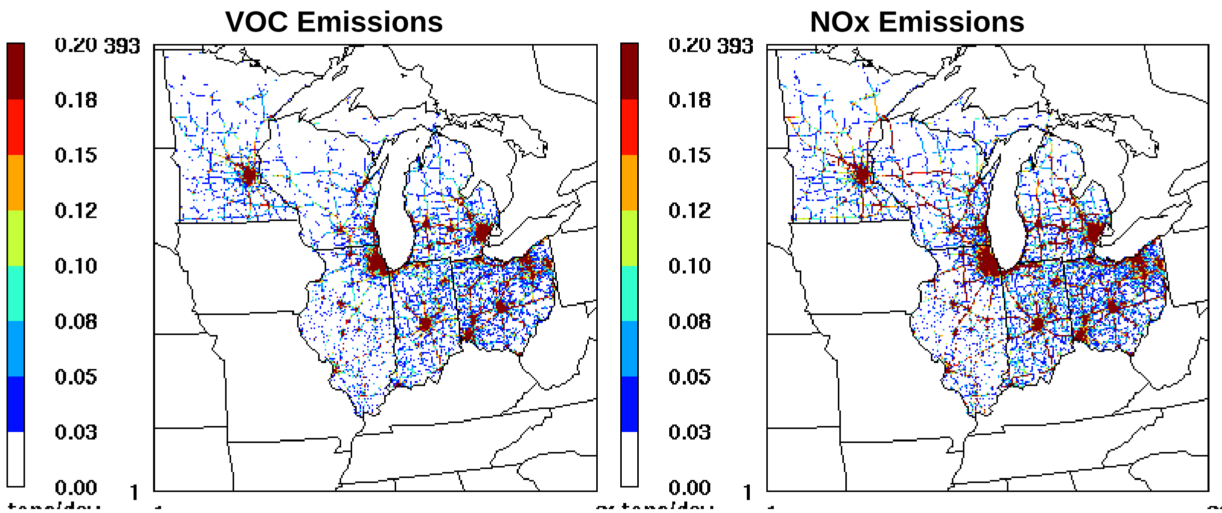


Figure 2. July 15, 2005 motor vehicle emissions for VOC (left) and NOx (right)

For the non-LADCO States, CONCEPT was run by a contractor using RPO-based HPMS county-level data (2002 and 2009) and MOBILE6 inputs (2002) compiled by another contractor (Environ, 2008). 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). Meteorological data for a July and January weekday, Saturday, and Sunday (July 15 – 17 and January 16 – 18) were used.

For other months (for both LADCO and non-LADCO States), weekday, Saturday, and Sunday emissions were linearly interpolated based on the January and July emissions.

Off-Road: NMIM2005 was run by Grant Hetherington (Wisconsin DNR) to produce emissions for most off-road sectors for the LADCO States plus Minnesota, Iowa, and Missouri. Improved model inputs included local data for construction and agricultural equipment prepared by a contractor were incorporated (E.H. Pechan, 2004), and 2005 gasoline parameters. (Note, model updates prepared by AIR to address evaporative emissions were not included.)

EMS was run by LADCO using Grant Hetherington's NMIM2005 data and, for the non-LADCO States, using emission files supplied by Alpine based on data from the other RPOs to produce weekday, Saturday, and Sunday emissions for each month.

Additional off-road sectors (i.e., commercial marine, aircraft, and railroads [MAR]) were handled separately. Aircraft emissions were supplied by the LADCO States. Updated information for railroads and commercial marine for the LADCO States was prepared by a contractor (Environ, 2007a and Environ 2007b). 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.

EMS was run by LADCO using the contractor and state data and, for the non-LADCO States, using emission files supplied by Alpine based on data from the other RPOs to produce weekday, Saturday, and Sunday emissions for each month.

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		----	----

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 RPOs 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) USEPA 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)." (USEPA, 2007b) Consequently, this category was omitted from the 2005 regional emissions inventory.

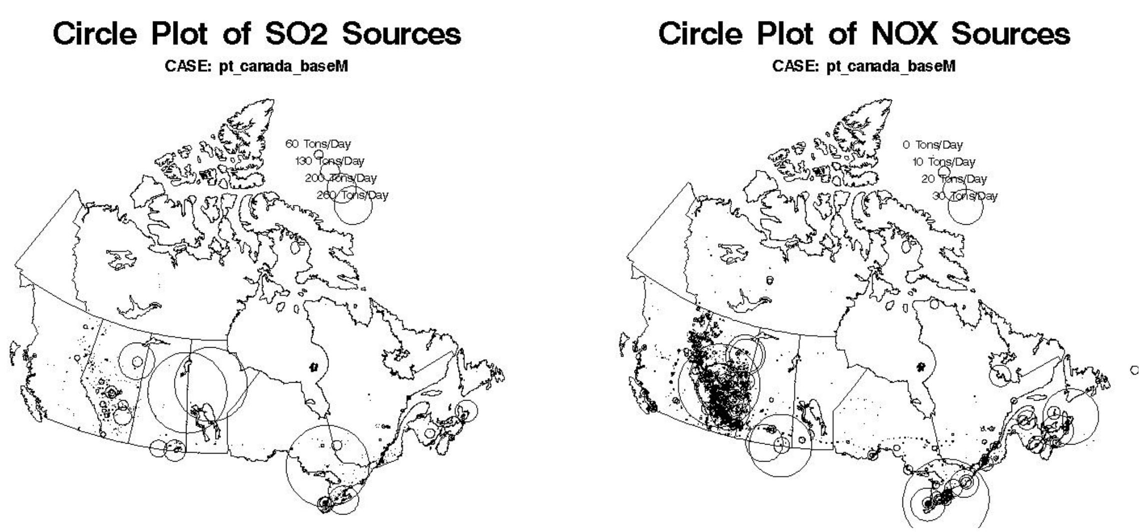
Outdoor Wood Boilers: Over the past several years, the installation and operation of outdoor wood boilers for residential use has increased dramatically in many northern states. Relying on an emission estimation methodology prepared by Bart Sponseller (WDNR, 2006), emissions were calculated by the other states for this category.

EGU Point: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 RPOs to produce weekday, Saturday, and Sunday emissions for each month. 2005 EGU emissions were temporalized for modeling purposes using profiles prepared by Scott Edick (Michigan DEQ) based on CEM data for the period 2004-2006. Profiles were generated for monthly weekday/Saturday/Sunday based on the median hourly emissions for that month, day, and hour of the day for the three years. Over 90% of NOX and SO2 emissions from EGUs in the LADCO states were assigned profiles. In non-Ladco states, the annual EGUs emissions were replaced with the 2005 sum of hourly emissions for all 365 days.

Non-EGU Point: 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 RPOs to produce weekday, Saturday, and Sunday emissions for each month. EGUs were removed from this 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 – see http://www.ec.gc.ca/pdb/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.



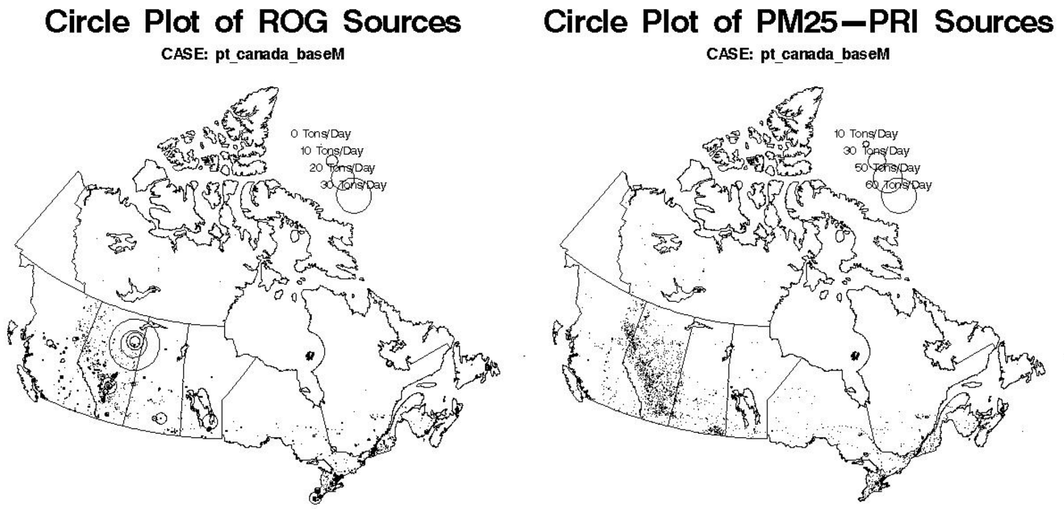


Figure 3. Base year emission plots for Canada

Biogenic Emissions: A contractor provided an updated version of the CONCEPT/MEGAN (Model of Emissions of Gases and Aerosols from Nature – see http://bai.acd.ucar.edu/Megan/) biogenics model, which was used to produce base year biogenic emission estimates (Alpine, 2007b). MEGAN includes functions for soil moisture plant stress, a more complete canopy model, full plant growth cycle emissions calculations, and state of the science emission rates.

Subsequent to deliver of the updated CONCEPT/MEGAN code, it was found that more recent data sets and model formulations were available. For the purposes of the Round 5 modeling, LADCO simply scaled the emission estimates from the updated code to reflect these newer data. This resulted in lower emissions for several organic aerosol species and NOx

Compared to the EMS/BIOME emissions used for Base K, there is more regional isoprene with MEGAN (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 precursors of secondary $PM_{2.5}$ organic carbon mass.

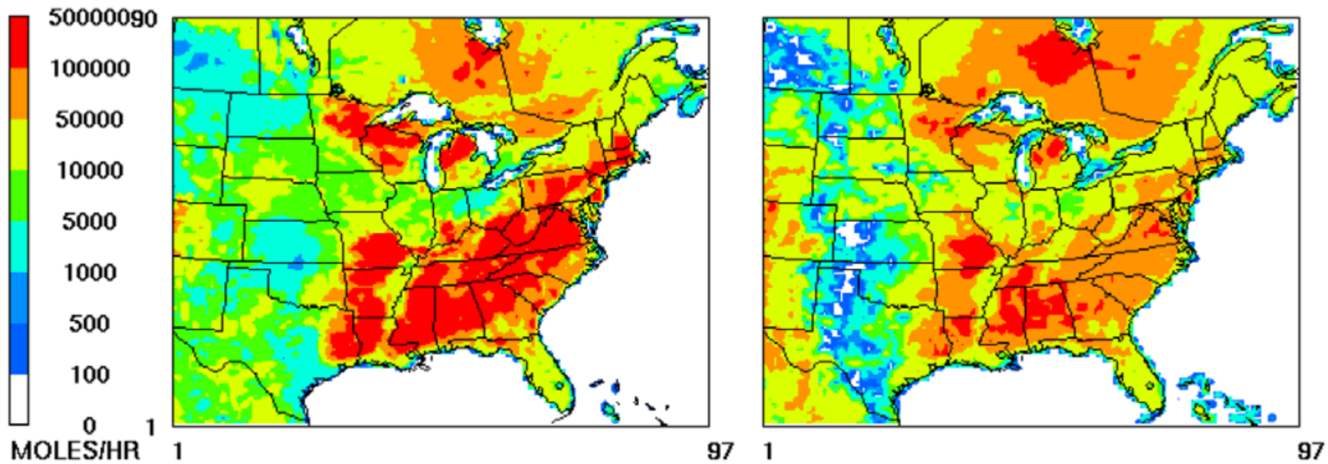


Figure 4. Isoprene emissions for Base M (left) v. Base K (right)

Ammonia Emissions: The CMU-based 2002 (Base K) annual ammonia emissions were projected to 2005 using growth factors from the Round 4 emissions modeling. These annual emissions were then adjusted by applying monthly temporal factors based on the process-based ammonia emissions model (http://www.conceptmodel.org/nh3/nh3_index.html). The model was run for the following list of model farms using 2002 meteorological data: Dairy (California, Wisconsin), Swine (Iowa, Wisconsin), and Beef (Texas, Washington, Wisconsin). Because the model was not complete for the poultry housing model, swine was use in its place given that both use confined operations.

Each model farms' emissions were used to generate monthly average day emissions and a monthly profile. The profiles were applied to geographies most associated with that farm type (e.g., all LADCO states used the Wisconsin farm results). The following figure shows the daily variation in emissions for the model farms.

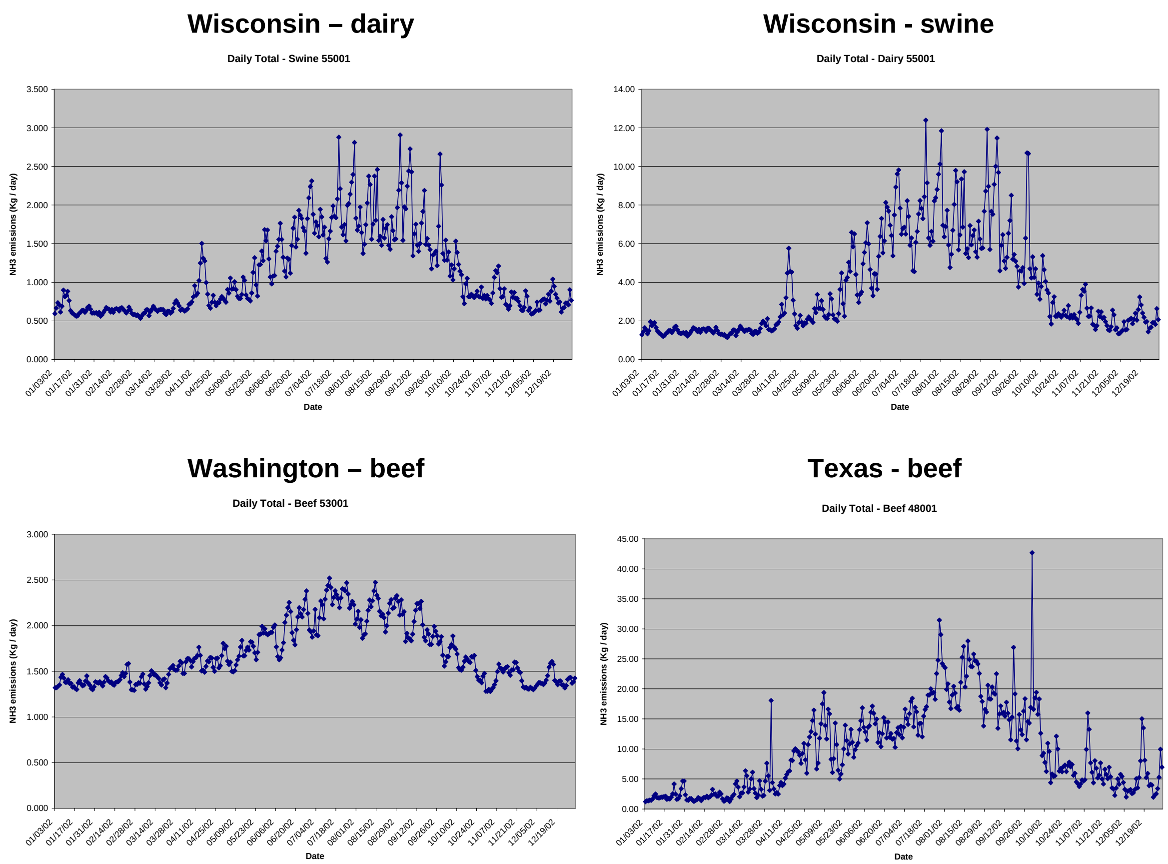


Figure 5. Daily emissions for 2002 for various model farms

A plot of the resulting average daily emissions by state and month is provided in Figure 6.

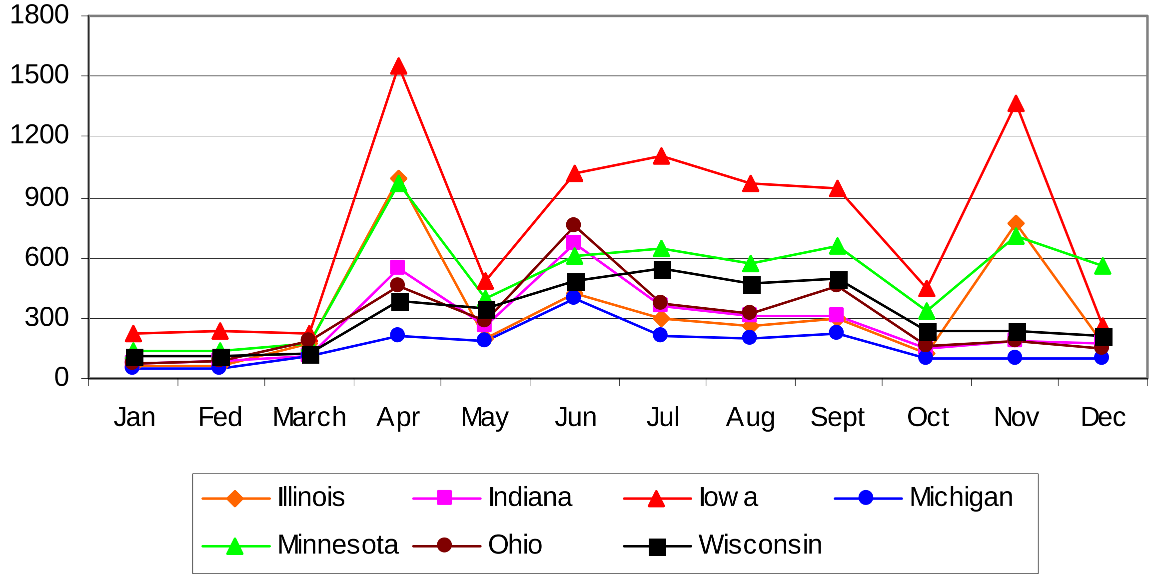


Figure 6. Average daily ammonia emissions for Midwest States by month for 2005

Fires: For Base K, a contractor (EC/R, 2004) developed a 2001, 2002, and 2003 fire emissions inventory for eight Midwest States (five LADCO states plus Iowa, Minnesota, and Missouri), including emissions from wild fires, prescribed fires, and agricultural burns. Projected emissions were also developed for 2010 and 2018 assuming “no smoke management” and “optimal smoke management” scenarios. An early model sensitivity run showed very little difference in modeled $PM_{2.5}$ concentrations. Consequently, the fire emissions were not included in subsequent modeling runs (i.e., they were not in the Base K or Base M modeling inventories).

Future Year Emissions
Complete emission inventories were developed for two future years: 2009 and 2018[1]. Source sector emission summaries for the base years (2002 – Base K and 2005 – Base M) and future years are shown in Figure 7. A more detailed state and source sector summary is provided in Attachment 1. Additional emission reports are available on the LADCO website (http://64.27.125.175/tech/emis/r5/round5_reports.htm.

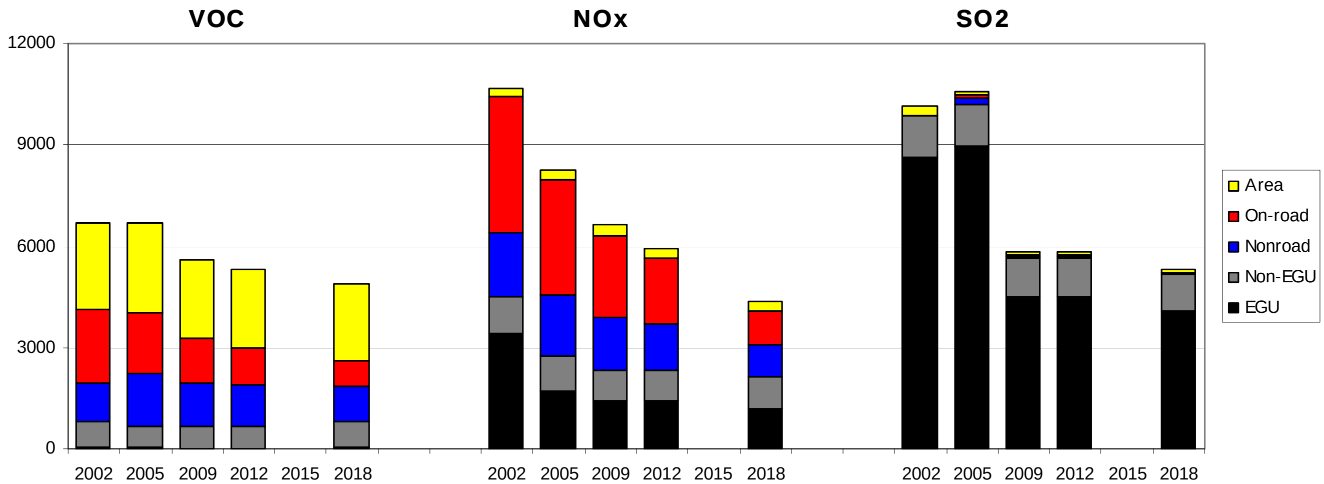


Figure 7. Base year and future year emissions for 5-State LADCO Region (TPD, July weekday)

[1] A 2008 proxy inventory was 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

A 2012 proxy inventory was prepared to support a preliminary 2012 modeling analysis to assess the effect of further emission reductions from existing controls. This inventory was derived by interpolating between 2009 and 2018 emissions for all sectors, except point sources (for which, the 2009 emissions were used).

For on-road, off-road, 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, 2007). Growth factors were based initially on EGAS (version 5.0), and were subsequently modified (for select, priority categories) by examining emissions activity data. For the non-LADCO States, future year emission files were supplied by Alpine based on data from the other RPOs. Due to a lack of information on future year conditions, the biogenic VOC and NOx emissions, and all Canadian emissions were assumed to remain constant between the base year and future years.

A "base" control scenario was prepared for each future year based on the following "on the books" controls (E.H. Pechan, 2007):

On-Highway Mobile Sources
- Federal motor vehicle emission control program, low sulfur gasoline, and ultra-low sulfur diesel 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
- Portable fuel containers

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[2]
- Combustion turbine MACT
- Consent decrees (refineries, ethanol plants, and ALCOA)[3]

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[2] E.H. Pechan's original control file included EPA-default control factor information. Alternative control factors were developed by Wisconsin for a few MACT categories, and were also applied to the other four LADCO States.

- Other (Illinois and Ohio NOx RACT[4], and BART in IN and WI)

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 (Environ, 2008). CONCEPT was only run with meteorological data for a July weekday (July 15). The emissions for Saturday and Sunday were derived by using scaling factors based on the 2005 emissions. The state-level emissions for the five LADCO States plus Minnesota are summarized in Table 2[5].

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.) Meteorological data for a July weekday (July 15) were used. The emissions for Saturday and Sunday were derived by using scaling factors based on the 2005 emissions.

For other months (for both LADCO and non-LADCO States), January weekday, Saturday, and Sunday emissions were derived based on the July:January ratios for 2005, and then the weekday, Saturday, and Sunday emissions for other months were linearly interpolated based on the January and July emissions.

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[3] E.H. Pechan's original control file included control factors for three sources in Wayne County, MI. These control factors were not applied in the regional-scale modeling to avoid double-counting with the State's local-scale analysis for PM2.5.

[4] WI believes that NOx RACT for their sources is already included in the 2005 basecase and EGU "will do" scenario, and IN provided NOx RACT information for inclusion as a no-EGU "may do" scenario.

[5] For northeastern IL (CATS region), 2009 and 2018 emissions were increases by 9% and 8%, respectively, to reflect newer transportation modeling by CATS.

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

Year	State	CO-tpd	TOG-tpd	NOx-tpd	PM2.5-tpd	SO2-tpd	NH3-tpd	Sum of VMT
2005	IL	3,684.3	341.5	748.2	12.9	9.6	35.9	344,087,819.6
	IN	3,384.9	282.0	541.1	8.9	11.1	25.7	245,537,231.9
	MI	4,210.3	351.9	722.0	12.4	13.9	35.3	340,834,025.9
	MN	2,569.1	218.7	380.5	6.3	7.6	17.7	170,024,599.7
	OH	6,113.4	679.8	933.6	16.2	18.8	36.5	360,521,068.6
	WI	2,206.0	175.1	457.5	7.8	9.2	19.7	189,123,964.3
Total		22,168.0	2,049.0	3,782.9	64.5	70.2	170.8	1,650,128,709.9
2009	IL	2,824.4	268.0	527.8	10.1	4.2	38.9	372,132,591.1
	IN	2,839.5	234.9	401.9	6.7	2.8	26.1	249,817,026.3
	MI	3,172.0	269.2	500.9	9.2	4.0	37.1	356,347,010.5
	MN	2,256.8	206.3	307.5	5.1	2.3	21.5	204,443,017.8
	OH	4,619.2	423.7	693.5	11.8	4.7	39.5	387,428,127.2
	WI	1,673.4	119.4	322.1	5.7	2.3	20.6	197,729,964.9
Total		17,385.3	1,521.5	2,753.6	48.7	20.3	183.6	1,767,897,737.8
2018	IL	2,084.7	151.5	200.7	6.3	3.7	43.1	413,887,887.3
	IN	2,217.3	138.4	173.0	4.4	2.6	30.2	288,042,232.1
	MI	2,434.3	163.5	204.1	5.9	3.6	40.5	388,128,431.8
	MN	1,799.6	123.1	137.1	3.6	2.2	24.9	237,022,213.7
	OH	3,361.5	242.5	274.1	6.8	4.0	43.1	421,694,093.4
	WI	1,255.5	68.4	138.5	3.9	2.0	22.2	218,277,167.5
Total		13,152.9	887.5	1,127.5	30.8	18.1	203.9	1,967,052,025.8

EGU Point: Future year emissions were based on EPA's IPM3.0 modeling[6]. 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).[7]
>
> 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 NOx emissions for the three scenarios. The individual facilities affected by the "will do" and "may do" adjustments are identified in Attachment 2. The net effect of these adjustments is a small increase in regional SO2 and NOx emissions.

Based on initial discussions with USEPA, a decision was made to use the 2010 IPM emissions in the 2009 modeling. USEPA subsequently insisted that 2009 modeling must represent 2009 conditions. Because 2009 and 2010 EGU NOx emissions are expected to be similar (note: CAIR Phase I compliance date for NOx is 2009), the Round 5.1 ozone modeling was not redone.

USEPA believes that 2009 and 2010 EGU SO2 emissions may be significantly different (note: CAIR Phase I compliance date for SO2 is 2010). In particular, USEPA noted that information on projected scrubber installations identifies several facilities are not expected to be completed until 2010. A model sensitivity run was conducted with adjusted (higher) EGU SO2 emissions.

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[6] 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

[7] Scenario 5b and 5c also reflect changes in Minnesota, Missouri, and North Dakota.

Table 4 provides information from USEPAs Clean Air Markets Division (CAMD) on scrubber installation dates. This information is based on various sources, including company announcements, consent decrees, vendors, and organizations that track scrubber installations. While there may be uncertainty in any projection of control installations, USEPA considers these adequate projections for SIP planning purposes.

USEPA identified six plants which: (1) are projected in IPM3.0 to have scrubbers in place by 2010 (or 2011), but will not be completed by 2009, and (2) are most likely to impact $PM_{2.5}$ air quality in the upper Midwest (see highlighting in Table 4). To reflect uncontrolled (2009) emissions for those facilities (and units), LADCO substituted actual 2005 emissions for the IPM3.0 projected 2010 emissions. The revised (2009) SO2 emissions for the six facilities (see Attachment 2) represent a 5-6% increase in domainwide SO2 emissions.

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	1033	1318	1318		1036	1194	1194
MI	667	667	667		725	725	725
OH	1326	1410	1410		983	1127	1127
WI	460	460	421		435	499	235
	4444	4736	4697		4048	3978	3714
MN	162	148	148		187	167	157
NOx	**5a**	**5b**	**5c**		**5a**	**5b**	**5c**
IL	275	247	247		224	195	195
IN	370	372	372		255	266	266
MI	242	242	242		243	243	243
OH	281	305	305		285	310	310
WI	165	164	155		176	172	145
	1333	1330	1321		1183	1186	1159
MN	116	142	142		132	157	125

Table 4. Facilities Anticipating SO2 Controls in 2009 and 2010

State Name	Plant Name	UniqueID_Final	ORIS Code	Unit ID	Capacity MW	Scrubber OnlineYear	Scrubber OnlineMonth
Alabama	Barry	3_B_5	3	5	768	2010	
Alabama	E C Gaston	26_B_5	26	5	861	2010	
Arizona	Cholla	113_B_3	113	3	271	2009	
Florida	Crystal River	628_B_4	628	4	720	2010	
Florida	Crist	641_B_6	641	6	302	2010	
Florida	Crist	641_B_7	641	7	477	2010	
Florida	Crystal River	628_B_5	628	5	717	2009	5
Florida	Deerhaven Generating Station	663_B_B2	663	B2	228	2009	5
Georgia	Bowen	703_B_1BLR	703	1BLR	713	2010	
Georgia	Wansley	6052_B_2	6052	2	892	2009	5
Georgia	Bowen	703_B_2BLR	703	2BLR	718	2009	4
Indiana	Clifty Creek	983_B_1	983	1	217	2010	
Indiana	Clifty Creek	983_B_2	983	2	217	2010	
Indiana	Clifty Creek	983_B_3	983	3	217	2010	
Indiana	Clifty Creek	983_B_4	983	4	217	2010	
Indiana	Clifty Creek	983_B_5	983	5	217	2010	
Indiana	Clifty Creek	983_B_6	983	6	217	2010	
Indiana	Warrick	6705_B_4	6705	4	300	2010	
Kentucky	Big Sandy	1353_B_BSU2	1353	BSU2	800	2009	11
Kentucky	E W Brown	1355_B_1	1355	1	94	2009	1
Kentucky	E W Brown	1355_B_2	1355	2	160	2009	1
Kentucky	E W Brown	1355_B_3	1355	3	422	2009	1
Kentucky	H L Spurlock	6041_B_1	6041	1	315	2009	
Maryland	Brandon Shores	602_B_1	602	1	643	2010	
Maryland	Brandon Shores	602_B_2	602	2	643	2010	
Maryland	Chalk Point LLC	1571_B_1	1571	1	341	2010	
Maryland	Chalk Point LLC	1571_B_2	1571	2	342	2010	
Maryland	Dickerson	1572_B_1	1572	1	182	2010	
Maryland	Dickerson	1572_B_2	1572	2	182	2010	
Maryland	Dickerson	1572_B_3	1572	3	182	2010	
Maryland	Morgantown Generating Plant	1573_B_1	1573	1	624	2009	
Maryland	Morgantown Generating Plant	1573_B_2	1573	2	620	2009	
Michigan	Monroe	1733_B_4	1733	4	775	2009 (2010?)	
Missouri	Sioux	2107_B_1	2107	1	497	2010	
Missouri	Sioux	2107_B_2	2107	2	497	2010	
New Jersey	PSEG Mercer Gen. Station	2408_B_1	2408	1	315.3	2010	
New Jersey	PSEG Mercer Gen. Station	2408_B_2	2408	2	309.9	2010	
New York	AES Westover	2526_B_11	2526	11	21.85	2010	
New York	AES Westover	2526_B_12	2526	12	21.85	2010	
New York	AES Westover	2526_B_13	2526	13	84	2010	
New York	AES Greenidge LLC	2527_B_4	2527	4	26.5	2010	
New York	AES Greenidge LLC	2527_B_5	2527	5	26.5	2010	
NorthCarolina	Cliffside	2721_B_1	2721	1	38	2010	

NorthCarolina	Cliffside	2721_B_2	2721	2	38	2010	
NorthCarolina	Cliffside	2721_B_3	2721	3	61	2010	
NorthCarolina	Cliffside	2721_B_4	2721	4	61	2010	
NorthCarolina	Cliffside	2721_B_5	2721	5	550	2010	
NorthCarolina	G G Allen	2718_B_1	2718	1	161.73	2009	5
NorthCarolina	Roxboro	2712_B_1	2712	1	369	2009	
NorthCarolina	G G Allen	2718_B_2	2718	2	161.73	2009	
NorthCarolina	G G Allen	2718_B_3	2718	3	259.77	2009	
NorthCarolina	G G Allen	2718_B_4	2718	4	274.77	2009	
NorthCarolina	G G Allen	2718_B_5	2718	5	265	2009	
NorthCarolina	Mayo	6250_B_1A	6250	1A	361.5	2009	
NorthCarolina	Mayo	6250_B_1B	6250	1B	361.5	2009	
Ohio	W H Sammis	2866_B_6	2866	6	630	2011	
Ohio	W H Sammis	2866_B_7	2866	7	630	2011	
Ohio	R E Burger	2864_B_7	2864	7	156	2010	
Ohio	R E Burger	2864_B_8	2864	8	156	2010	
Ohio	Kyger Creek	2876_B_1	2876	1	217	2010	
Ohio	Kyger Creek	2876_B_2	2876	2	217	2010	
Ohio	Kyger Creek	2876_B_3	2876	3	217	2010	
Ohio	Kyger Creek	2876_B_4	2876	4	217	2010	
Ohio	Kyger Creek	2876_B_5	2876	5	217	2010	
Ohio	Conesville	2840_B_4	2840	4	780	2009	4
Ohio	Bay Shore	2878_B_4	2878	4	215	2009	
Pennsylvania	Cheswick Power Plant	8226_B_1	8226	1	580	2010	
Pennsylvania	Hatfields Ferry Power Station	3179_B_1	3179	1	530	2009	1
Pennsylvania	Hatfields Ferry Power Station	3179_B_2	3179	2	530	2009	1
Pennsylvania	Hatfields Ferry Power Station	3179_B_3	3179	3	530	2009	1
Pennsylvania	Keystone	3136_B_1	3136	1	850	2009	
Pennsylvania	Keystone	3136_B_2	3136	2	850	2009	
Pennsylvania	PPL Brunner Island	3140_B_1	3140	1	321	2009	
Pennsylvania	PPL Brunner Island	3140_B_2	3140	2	378	2009	
Tennessee	Kingston	3407_B_1	3407	1	135	2010	
Tennessee	Kingston	3407_B_2	3407	2	135	2010	
Tennessee	Kingston	3407_B_3	3407	3	135	2010	
Tennessee	Kingston	3407_B_4	3407	4	135	2010	
Tennessee	Kingston	3407_B_5	3407	5	177	2010	
Tennessee	Kingston	3407_B_6	3407	6	177	2010	
Tennessee	Kingston	3407_B_7	3407	7	177	2010	
Tennessee	Kingston	3407_B_8	3407	8	177	2010	
Tennessee	Kingston	3407_B_9	3407	9	178	2010	
Tennessee	Bull Run	3396_B_1	3396	1	881	2009	1
Texas	Fayette Power Project	6179_B_1	6179	1	598	2009	
Texas	Fayette Power Project	6179_B_2	6179	2	598	2009	
Virginia	Chesterfield	3797_B_5	3797	5	310	2010	
Virginia	Yorktown	3809_B_1	3809	1	159	2010	

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ATTACHMENT 1

Emissions Summaries

February 27, 2008

ATTACHMENT 2

"Will Do", "May Do", and EGU Sensitivity - Facility Emissions

2009 – Difference between base (5a) and "will do" (5b) scenarios

The SAS System 11:10 Monday, March 3, 2008 1

-- polid=NOX --

Obs	cntryid	stid	cyid	fcid	name	polid	aceebase	aceenew	diff
1	US	17	97	097190AAC	MIDWEST GENERAT	NOX	12.19	6.90	-5.290
2	US	17	197	197810AAK	MIDWEST GENERAT	NOX	33.29	10.89	-22.400
3	US	18	73	00008	NIPSCO - R.M. S	NOX	26.50	24.81	-1.691
4	US	18	77	00001	IKEC - CLIFTY C	NOX	11.58	16.42	4.836
5	US	18	89	00117	NIPSCO - DEAN H	NOX	20.51	19.13	-1.384
6	US	27	37	2703700003	NSP dba Xcel En	NOX	8.39	27.73	19.339
7	US	27	61	2706100004	Minnesota Power	NOX	17.26	20.79	3.524
8	US	27	163	2716300005	Xcel Energy - A	NOX	5.40	7.60	2.204
9	US	29	183	0001	AMERENUE-SIOUX	NOX	32.89	14.80	-18.090
10	US	38	55	126	Coal Creek Stat	NOX	30.49	30.36	-0.132
11	US	38	57	12	Leland Olds Sta	NOX	11.32	36.67	25.348
12	US	38	57	125	Stanton Station	NOX	6.11	6.11	0.002
13	US	38	57	13	Antelope Valley	NOX	33.00	36.39	3.385
14	US	38	57	289	Coyote	NOX	35.12	36.95	1.839
15	US	38	59	172	RM Heskett Stat	NOX	5.45	4.72	-0.727
16	US	38	65	165	M R Young Stati	NOX	6.02	71.10	65.081
17	US	39	93	0247030013	AVON LAKE POWER	NOX	3.98	24.59	20.614
18	US	39	129	0165000006		NOX	.	3.51	.
19	US	55	11	606034110	DAIRYLAND POWER	NOX	21.10	20.70	-0.407
20	US	55	21	111003090	Alliant Energy-	NOX	14.89	17.97	3.080
21	US	55	43	122014530	Alliant Energy-	NOX	8.27	8.45	0.180
22	US	55	59	230006260	WIS ELECTRIC PO	NOX	7.84	14.89	7.050
23	US	55	71	436035930	MANITOWOC PUBLI	NOX	2.22	1.96	-0.259
24	US	55	79	241007690	WIS ELECTRIC PO	NOX	16.10	16.29	0.184
25	US	55	79	241007800	WIS ELECTRIC PO	NOX	8.87	6.84	-2.029
26	US	55	117	460033090	WP & L Alliant	NOX	19.18	11.99	-7.188
27	US	55	123	663020930	DAIRYLAND POWER	NOX	12.50	10.17	-2.335
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polid							410.47	508.72	94.735

-- polid=SO2 ---

Obs	cntryid	stid	cyid	fcid	name	polid	aceebase	aceenew	diff
28	US	17	97	097190AAC	MIDWEST GENERAT	SO2	56.96	34.89	-22.068
29	US	17	197	197810AAK	MIDWEST GENERAT	SO2	127.61	72.02	-55.599
30	US	18	29	00002	AMERICAN ELECTR	SO2	66.34	102.72	36.389
31	US	18	43	00004	PSI ENERGY - GA	SO2	25.53	66.01	40.488
32	US	18	73	00008	NIPSCO - R.M. S	SO2	82.52	63.71	-18.817
33	US	18	147	00020	INDIANA MICHIGA	SO2	71.67	198.71	127.042
34	US	18	167	00021	PSI ENERGY - WA	SO2	76.09	175.87	99.786
35	US	27	31	2703100001	Minnesota Power	SO2	12.23	5.74	-6.489
36	US	27	61	2706100004	Minnesota Power	SO2	30.90	20.91	-9.992
37	US	27	163	2716300005	Xcel Energy - A	SO2	7.31	9.75	2.438
38	US	29	183	0001	AMERENUE-SIOUX	SO2	27.81	10.43	-17.382
39	US	38	55	126	Coal Creek Stat	SO2	27.45	75.37	47.926
40	US	38	57	12	Leland Olds Sta	SO2	108.15	126.06	17.906
41	US	38	57	125	Stanton Station	SO2	25.29	12.37	-12.922
42	US	38	57	13	Antelope Valley	SO2	26.60	43.72	17.128
43	US	38	57	289	Coyote	SO2	19.26	53.19	33.932
44	US	38	59	172	RM Heskett Stat	SO2	9.23	30.11	20.872
45	US	38	65	165	M R Young Stati	SO2	27.98	82.23	54.249
46	US	39	81	0641160017	W. H. SAMMIS PL	SO2	147.97	55.61	-92.363
47	US	39	93	0247030013	AVON LAKE POWER	SO2	7.62	150.79	143.165
48	US	39	129	0165000006		SO2	.	32.45	.
49	US	55	21	111003090	Alliant Energy-	SO2	65.27	78.77	13.504
50	US	55	43	122014530	Alliant Energy-	SO2	12.19	45.19	33.002
51	US	55	59	230006260	WIS ELECTRIC PO	SO2	7.84	13.09	5.252
52	US	55	71	436035930	MANITOWOC PUBLI	SO2	6.56	11.01	4.456
53	US	55	79	241007690	WIS ELECTRIC PO	SO2	63.92	44.08	-19.837
54	US	55	79	241007800	WIS ELECTRIC PO	SO2	40.94	22.48	-18.454
55	US	55	123	663020930	DAIRYLAND POWER	SO2	22.33	4.32	-18.008
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polid							1203.57	1641.62	405.603
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2009 – Difference between "will do" (5b) and "may do" (5c) scenarios

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--- polid=NOX ---

Obs	cntryid	stid	cyid	fcid	name	polid	aceebase	aceenew	diff
1	US	19	139	70-01-011	MUSCATINE POWER	NOX	6.201	4.279	-1.9221
2	US	55	9	405031990	WI PUBLIC SERVI	NOX	9.101	7.700	-1.4014
3	US	55	11	606034110	DAIRYLAND POWER	NOX	20.696	20.735	0.0398
4	US	55	21	111003090	Alliant Energy-	NOX	17.970	17.968	-0.0015
5	US	55	25	113004430	MADISON GAS & E	NOX	5.764	3.895	-1.8696
6	US	55	43	122014530	Alliant Energy-	NOX	8.446	8.436	-0.0099
7	US	55	59	230006260	WIS ELECTRIC PO	NOX	14.892	10.427	-4.4643
8	US	55	71	436035930	MANITOWOC PUBLI	NOX	1.965	0.439	-1.5258
9	US	55	79	241007690	WIS ELECTRIC PO	NOX	16.288	16.311	0.0234
10	US	55	79	241007800	WIS ELECTRIC PO	NOX	6.837	6.841	0.0042
11	US	55	117	460033090	WP & L Alliant	NOX	11.991	12.036	0.0449
12	US	55	123	663020930	DAIRYLAND POWER	NOX	10.169	10.128	-0.0410
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polid							130.320	119.197	-11.1234

--- polid=SO2 ---

Obs	cntryid	stid	cyid	fcid	name	polid	aceebase	aceenew	diff
13	US	19	139	70-01-011	MUSCATINE POWER	SO2	6.925	13.184	6.2591
14	US	55	9	405031990	WI PUBLIC SERVI	SO2	20.331	16.795	-3.5366
15	US	55	21	111003090	Alliant Energy-	SO2	78.772	78.974	0.2026
16	US	55	25	113004430	MADISON GAS & E	SO2	25.853	0.096	-25.7571
17	US	55	43	122014530	Alliant Energy-	SO2	45.194	45.232	0.0384
18	US	55	59	230006260	WIS ELECTRIC PO	SO2	13.090	10.451	-2.6386
19	US	55	71	436035930	MANITOWOC PUBLI	SO2	11.012	3.001	-8.0102
20	US	55	79	241007690	WIS ELECTRIC PO	SO2	44.083	44.105	0.0221
21	US	55	79	241007800	WIS ELECTRIC PO	SO2	22.482	22.558	0.0764
22	US	55	123	663020930	DAIRYLAND POWER	SO2	4.322	4.243	-0.0792
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polid							272.063	238.640	-33.4231
							========	=======	========

2009 – Difference between EGU sensitivity (5s) and base (5a) scenarios

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-- polid=SO2 --

Obs	cntryid	stid	cyid	fcid	name	polid	aceebase	aceenew	diff
1	US	18	77	00001	IKEC - CLIFTY C	SO2	41.409	225.31	183.897
2	US	29	183	0001	AMERENUE-SIOUX	SO2	27.812	177.38	149.571
3	US	39	53	0627000003	OHIO VALLEY ELE	SO2	21.634	198.62	176.986
4	US	39	81	0641160017	W. H. SAMMIS PL	SO2	147.971	305.86	157.885
5	US	42	3	4200300157	ORION POWER MID	SO2	20.056	180.86	160.805
6	US	47	145	0013	TVA KINGSTON FO	SO2	45.050	169.89	124.835
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polid							303.931	1257.91	953.978
							========	=======	=======
							303.931	1257.91	953.978