May 10, 2010

Air Quality Analyses for Ozone and $PM_{2.5}$: Effect of Banked Emissions in Ohio (Attainment)

The purpose of this paper is to summarize air quality modeling conducted by the Lake Michigan Air Directors Consortium (LADCO) to support the State of Ohio's emissions banking rule. The modeling provides information on the air quality impact of banked emissions, including how these emissions affect the State's modeled attainment demonstration for ozone and fine particles ($PM_{2.5}$). The modeling was conducted in accordance with U.S. Environmental Protection Agency (EPA) guidance: "Guidelines on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze", EPA-454/B07-002, April 2007.

Based on the modeling analyses, the following general conclusions can be made:

- Additional (banked) emissions produce relatively small changes (increases) in ozone and PM2.5 concentrations at a few locations in Ohio and neighboring states.

- From an attainment standpoint, no new violations for ozone and PM2.5 are predicted in any county. It should be noted that the PM2.5 SIP modeling did predict an annual concentration slightly above the standard in Cuyahoga County, which the State addressed with "weight of evidence". This new modeling analysis (with the banked emissions) predicted **no change** at the peak concentration monitor in this county.

Overview of Air Quality Problems

This assessment focused on attainment and maintenance of the 1997 version of the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and ozone.

On July 18, 1997, EPA adopted new air quality standards for $PM_{2.5}$ and ozone. For the 1997 version of the $PM_{2.5}$ standard, EPA promulgated designations on December 17, 2004 (70 FR 944, January 5, 2005) based on air quality data for 2001 - 2003. The designations became effective on April 5, 2005[1]. As of January 2010, there are about 200 counties in the eastern U.S. still designated as nonattainment, including 27 counties in the State of Ohio. SIPs for $PM_{2.5}$ were due no later than three years from the effective date of the nonattainment designations (per section 172(b) of the Clean Air Act) (i.e., by April 2008). The applicable attainment date for $PM_{2.5}$ nonattainment areas is five years from the date of the nonattainment designation (i.e., by April 2010).

On September 21, 2006, EPA strengthened the 24-hour $PM_{2.5}$ standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$, and retained the current annual $PM_{2.5}$ standard at 15 $\mu g/m^3$. On December 22, 2008, EPA announced designations for 211 counties (or portions thereof) in 25 states, including Illinois, Indiana, Michigan, Ohio, and Wisconsin, as not meeting the NAAQS for $PM_{2.5}$ based on 2005 – 2007 data. Because air quality monitoring data for 2008 were

[1] The final designations reflected air quality data for 2002-2004.

expected to become available shortly after EPA's action, EPA indicated that it would evaluate the status of an area based on 2006-2008 air quality data. On November 13, 2009 (74 FR 58688), EPA published final area designations for the 24-hour standard based on 2006 – 2008 data. EPA designated 31 areas, including some or all of 120 counties, as nonattainment areas, including five areas in the LADCO region: Milwaukee, Detroit, Cleveland, Canton, and Steubenville. These areas will need to develop and implement plans to meet the 24-hour $PM_{2.5}$ standards within three years after the effective date of the designations. Nonattainment areas are required to meet the standards by 2014.

For the 1997 version of the ozone standard, EPA promulgated designations on April 15, 2004 (69 FR 23858, April 30, 2004) based on air quality data for 2001 - 2003. The designations became effective on June 15, 2004. As of January 2010, there are about 200 counties in the eastern U.S. still designated as nonattainment, including five counties in the State of Ohio (all in the Cincinnati area). SIPs for ozone were due no later than three years from the effective date of the nonattainment designations (i.e., by June 2007). The attainment date for ozone varies as a function of nonattainment classification. For the region, the attainment dates range from June 2007 (marginal nonattainment areas) to June 2010 (moderate nonattainment areas).

On March 12, 2008, EPA announced that it was strengthening the 8-hour primary (and secondary) ozone standard from the 1997 level of 0.08 parts per million (ppm) to 0.075 ppm. For the 2008 version of the ozone standard, EPA started the designation process by calling on states to submit their nonattainment recommendations by March 2009. Based on these recommendations and a review of the most recent air quality data, EPA ndicated its intent to promulgate designations by March 2010.

On January 6, 2010, EPA proposed to tighten the 8-hour primary ozone standard to a level within the range of 0.060-0.070 ppm, and to establish a cumulative, seasonal secondary standard at a level within the range of 7-15 ppm-hours. The form of the primary standard remains the same (i.e., compliance is based on the 3-year average of 4^{th} high 8-hour values). The form of the new proposed secondary standard is a "cumulative peak-weighted index," called W126. In conjunction with this action, EPA delayed the designations for the 2008 (0,075 ppm) standard from March 2010 to March 2011 in order to allow EPA to complete its reconsideration of the 2008 standard before determining whether designations are necessary. If, as a result of the reconsideration, EPA issues different ozone standards in 2010, then the new ozone standards would replace the 2008 ozone standards and implementation requirements associated with the 2008 ozone standards, including area designations, would no longer apply. Instead, EPA would begin a new process to designate areas for the 2010 ozone NAAQS on an accelerated schedule.

Base Scenario

The State's attainment demonstration is based on LADCO's Round 5.1 air quality modeling - see "Regional Air Quality Analyses for Ozone, PM2.5, and Regional Haze: Final Technical Support Document", April 25, 2008.

Key elements of the modeling are as follows:

> Model: CAMx (version 4.50) with CB05 gas phase chemistry, SOA chemistry updates, AERMOD dry deposition scheme, ISORROPIA inorganic chemistry, SOAP organic chemistry, RADM aqueous phase chemistry, and PPM horizontal transport

Base Year: 2005

Future Years of Interest: 2009, 2012, 2018

Domain/Grid Resolution: For $PM_{2.5}$ and haze, the large eastern U.S. grid at 36 km (see box on right side of Figure 1) was used. For ozone, the smaller grid at 12 km (see shaded portion of the box on the right side of Figure 1) was used.

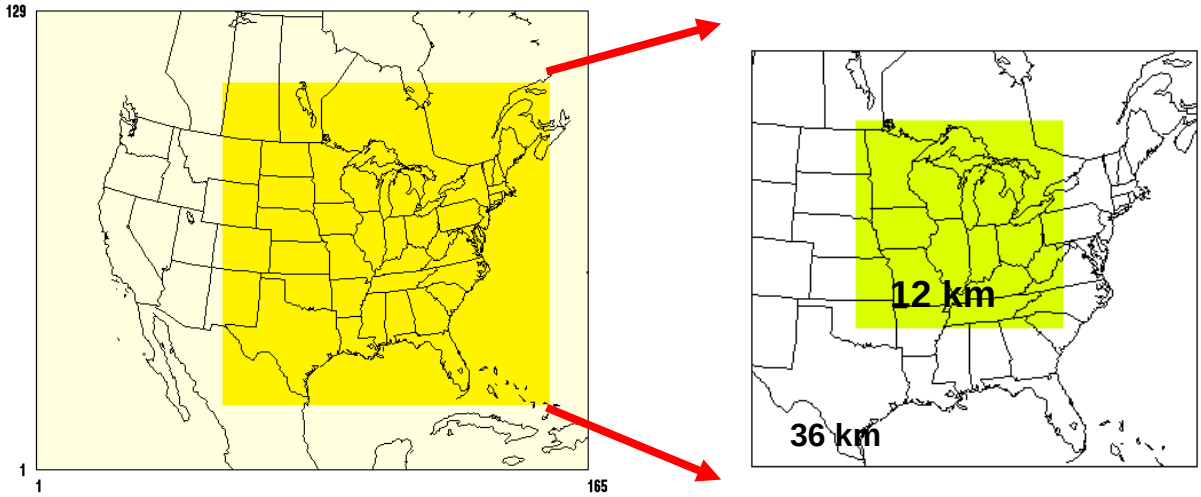


Figure 1. Modeling grids – RPO domain (left) and LADCO modeling domain (right)

Meteorology: Meteorological inputs for 2005 were derived using the Fifth-Generation NCAR/Penn State Meteorological Model (MM5), version 3.7. Model performance was assessed quantitatively for a number of parameters, including temperature, wind fields, mixing ratio, and precipitation. Overall, model performance was found to be reasonable, with the exception of large over-predictions of rainfall in the late spring and summer months, especially in the Southeast United States.

Emissions: Emission inventories for 2005 were prepared using models for on-road, nonroad, ammonia, and biogenic sources, and using data supplied by the States and other regions for point sources, area sources, and MAR (commercial marine, aircraft, and railroads). Complete emission inventories were developed for 2009 and 2018 (using models for on-road and nonroad sources, and application of growth and control factors for other sectors), while 2012 inventories were derived for most sectors by interpolation.

A brief summary of the inventory for each sector is provided below.

On-road Sources: Link-based emissions were developed for the LADCO States and Minnesota by a contractor for LADCO using the CONCEPT emissions model. CONCEPT was run with meteorological data for a July and January weekday, Saturday, and Sunday (July 15 – 17 and January 16 – 18). Emissions for other months were derived by interpolating between the January and July data.

Off-road Sources: NMIM2005 was run to produce emission estimates for most sectors. Separate calculations were made to account for commercial marine, aircraft, and railroads using local data developed by a contractor for LADCO.

Area Sources: Base year emissions data were supplied by the states. These data were processed by LADCO to produce weekday, Saturday, and Sunday emissions for each month. Ammonia and biogenic emissions were included as special low-level area source emissions.

Point Sources: Base year emissions data were supplied by the states. These data were processed by LADCO to produce weekday, Saturday, and Sunday emissions for each month.

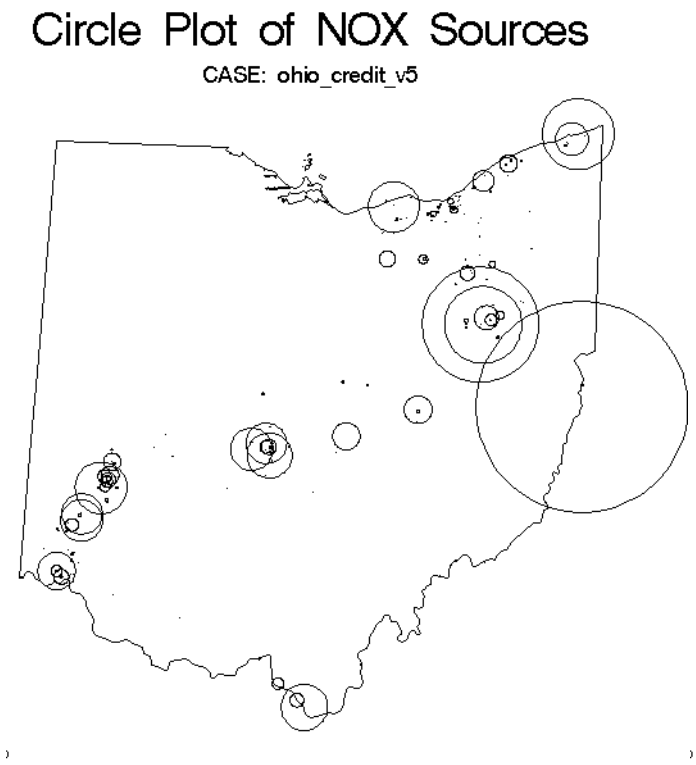
For power plants (electrical generating units – EGUs), LADCO's Round 5.1 modeling relied on future year emissions based on IPM3.0 emissions modeling by EPA, which assumed full implementation of the Clean Air Interstate Rule (CAIR). Table 1 provides a summary of the Round 5.1 (attainment demonstration) emissions for EGUs in Ohio.

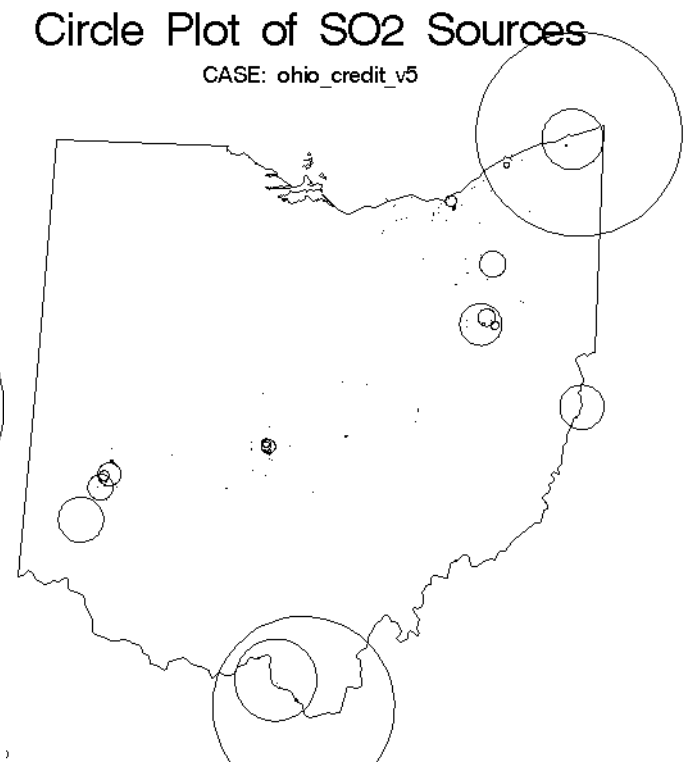
Table 1. Ohio EGU Emissions (tons per year)

	2009	2012	2018
NOx	94,400		96,103
SO2	427,500		316,883

Banked (point source) emissions for 266 facilities were supplied by the State of Ohio. Spatial plots of the SO2, NOx, VOC, and PM emissions (for all 266 sources) are provided in Figure 2. Larger circles represent larger emissions. The total emissions for all 266 sources are:

SO2 = 22,697.53 TPY NOx = 13,342.05 TPY
VOC = 7,306.42 TPY PM2.5 = 1,708.97 TPY





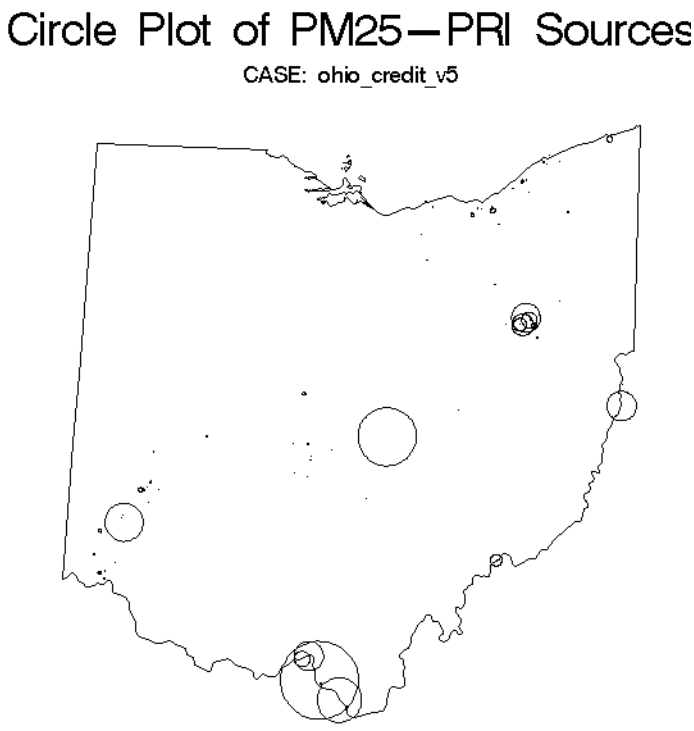


Figure 2. Spatial plot of banked emission sources in Ohio for NOx, SO2, and PM2.5

Modeling Results

Peak modeled concentrations for counties in Ohio and neighboring states for the two base scenarios (both without and with the banked emissions) are provided in Tables 1 – 3 for PM2.5-annual, PM2.5-daily, and ozone, respectively. Values above the air quality standards are highlighted.

For ozone, the SIP modeling predicted attainment of the standard at all monitors in the State. The new modeling for the base attainment scenario with banked emissions predicted no values above the standard Thus, the State's attainment demonstration is preserved even with inclusion of the banked emissions in the State's inventory.

For PM2.5, the SIP modeling predicted attainment of the annual standard at all monitors in the State, except for one monitor in Cuyahoga County, which the State addressed with "weight of evidence". For the base attainment scenario, the new modeling with banked emissions generally predicted no values above the standard. (For Cuyahoga County, the modeling predicted no change in the peak annual concentration.) Thus, the State's attainment demonstration is preserved even with inclusion of the banked emissions in the State's inventory.

Future analyses for the new, lower air quality standards (.075 ppm, 8-hour for ozone, and 35 ug/m3, 24-hour for PM2.5) will be conducted over the next few years in support of revised SIPs for these pollutants. These analyses will include the banked emissions in the State's inventory in demonstrating attainment.

ANNUAL								Round 5.1			Round 5.1 w/ bank			Difference		
Monitor	ST	County	3_05	04_06	05_07	BYDV		2009	2012	2018	2009	2012	2018	2009	2012	2018
3900900031	OH	Athens	12.3	12.2	12.7	12.4		10.3	10.0	9.8	10.3	10.0	9.8	0	0	0
3901700031	OH	Butler	16.2	15.7	16.2	16		13.5	13.2	12.8	13.5	13.3	12.9	0	0.1	0.1
3901700161	OH	Butler	16.1	15.5	15.6	15.7		13.1	12.9	12.5	13.1	12.9	12.5	0	0	0
3901700171	OH	Butler	15.4	15.7	17.2	16.1		13.6	13.3	12.9	13.7	13.4	13.0	0.1	0.1	0.1
3901710041	OH	Butler	15.1	14.6	15	14.9		12.6	12.3	11.9	12.6	12.4	12.0	0	0.1	0.1
3902300051	OH	Clark	14.7	14.4	14.8	14.6		12.5	12.2	11.7	12.5	12.3	11.8	0	0.1	0.1
3902500221	OH	Clermont	15.7	14.2	14.2	14.7		12.0	11.8	11.4	12.0	11.8	11.4	0	0	0
3903500271	OH	Cuyahoga	16.1	15.3	14.9	15.4		13.6	13.2	12.8	13.6	13.3	12.8	0	0.1	0
3903500341	OH	Cuyahoga	14.1	13.4	13.8	13.8		12.1	11.8	11.3	12.1	11.8	11.4	0	0	0.1
3903500381	OH	Cuyahoga	18.1	17.2	16.8	17.4		15.3	14.9	14.4	15.3	14.9	14.4	0	0	0
3903500451	OH	Cuyahoga	17	16.2	16.2	16.5		14.4	14.1	13.6	14.5	14.1	13.6	0.1	0	0
3903500601	OH	Cuyahoga	17.7	16.9	16.8	17.1		15.0	14.6	14.1	15.1	14.7	14.2	0.1	0.1	0.1
3903500651	OH	Cuyahoga	16.4	15.6	15.8	15.9		14.0	13.7	13.2	14.1	13.7	13.2	0.1	0	0
3903500661	OH	Cuyahoga	12.8	11.7	0	12.3		11.4	11.1	10.7	11.4	11.1	10.8	0	0	0.1
3903510021	OH	Cuyahoga	14.6	13.9	13.9	14.1		12.2	11.8	11.4	12.2	11.9	11.4	0	0.1	0
3904900241	OH	Franklin	16	15	14.9	15.3		13.0	12.6	12.1	13.0	12.7	12.2	0	0.1	0.1
3904900251	OH	Franklin	15.5	14.9	14.9	15.1		12.8	12.4	11.9	12.8	12.5	12.0	0	0.1	0.1
3904900811	OH	Franklin	14.3	13.7	13.5	13.8		11.7	11.5	11.0	11.8	11.5	11.1	0.1	0	0.1
3905700051	OH	Greene	12.4	13.2	13.6	13.1		11.5	11.2	10.8	11.5	11.3	10.9	0	0.1	0.1
3906100061	OH	Hamilton	16.6	14.9	14.8	15.4		12.8	12.6	12.2	12.8	12.6	12.2	0	0	0
3906100141	OH	Hamilton	17.5	17.1	17.3	17.3		14.5	14.2	13.8	14.5	14.3	13.8	0	0.1	0
3906100401	OH	Hamilton	15.9	15.2	15.4	15.5		12.8	12.6	12.2	12.8	12.6	12.2	0	0	0
3906100411	OH	Hamilton	15.2	15.2	15.8	15.4		12.9	12.7	12.3	12.9	12.7	12.3	0	0	0
3906100421	OH	Hamilton	17.3	16.7	16.6	16.9		14.0	13.8	13.3	14.0	13.8	13.4	0	0	0.1
3906100431	OH	Hamilton	15.8	15.4	15.4	15.5		12.9	12.7	12.3	12.9	12.7	12.3	0	0	0
3906170011	OH	Hamilton	16.6	16	15.9	16.2		13.4	13.2	12.7	13.4	13.2	12.8	0	0	0.1
3906180011	OH	Hamilton	17.9	17.4	17.3	17.5		14.6	14.4	13.9	14.7	14.4	14.0	0.1	0	0.1
3908100171	OH	Jefferson	15.8	15.4	15.5	15.6		12.8	12.5	12.7	12.8	12.5	12.8	0	0	0.1
3908110011	OH	Jefferson	17.2	16.3	16.1	16.5		13.5	13.2	13.4	13.5	13.2	13.5	0	0	0.1
3908510011	OH	Lake	13	12.6	13.1	12.9		11.9	11.6	11.2	12.0	11.7	11.3	0.1	0.1	0.1
3908530021	OH	Lake	0	11.5	12.7	12.1		10.6	10.3	10.0	10.6	10.4	10.1	0	0.1	0.1
3908700101	OH	Lawrence	15	15	15.4	15.1		12.5	12.2	12.0	12.5	12.2	12.0	0	0	0
3909300161	OH	Lorain	14.1	13.6	12.7	13.5		11.8	11.5	11.0	11.8	11.5	11.1	0	0	0.1
3909330021	OH	Lorain	12.8	12.6	13	12.8		11.1	10.8	10.4	11.1	10.8	10.4	0	0	0
3909500241	OH	Lucas	14.7	14.1	14.4	14.4		12.7	12.5	12.1	12.8	12.5	12.1	0.1	0	0
3909500251	OH	Lucas	14.4	13.6	13.9	14		12.3	12.1	11.6	12.3	12.1	11.6	0	0	0
3909500261	OH	Lucas	14.3	13.8	14.2	14.1		12.5	12.2	11.8	12.5	12.3	11.8	0	0.1	0
3909900051	OH	Mahoning	15	14.5	14.5	14.7		12.5	12.2	11.8	12.6	12.2	11.9	0.1	0	0.1
3909900141	OH	Mahoning	15.5	15	14.8	15.1		12.9	12.6	12.2	12.9	12.6	12.2	0	0	0
3910300031	OH	Medina	15.2	13.6	13.3	14		11.4	11.2	10.8	11.5	11.2	10.8	0.1	0	0
3911300311	OH	Montgomer	15	14.6	14.9	14.8		12.6	12.4	11.9	12.7	12.4	12.0	0.1	0	0.1
3911300321	OH	Montgomer	15.9	15.2	15.5	15.5		13.3	13.0	12.5	13.3	13.0	12.6	0	0	0.1
3913300021	OH	Portage	13.4	13.2	13.6	13.4		11.5	11.2	10.9	11.6	11.3	10.9	0.1	0.1	0
3913510011	OH	Preble	13.9	13.5	13.9	13.8		11.6	11.4	11.0	11.7	11.4	11.0	0.1	0	0
3914500131	OH	Scioto	14.6	14.5	14.8	14.6		12.0	11.8	11.5	12.1	11.8	11.6	0.1	0	0.1
3915100171	OH	Stark	16.7	16	16.1	16.3		14.0	13.7	13.3	14.1	13.7	13.4	0.1	0	0.1
3915100201	OH	Stark	15.2	14.2	14.3	14.6		12.6	12.3	11.9	12.7	12.4	12.0	0.1	0.1	0.1
3915300171	OH	Summit	15.6	15	14.8	15.1		13.1	12.8	12.3	13.1	12.8	12.4	0	0	0.1
3915300231	OH	Summit	14.6	14.1	14.1	14.3		12.3	12.0	11.6	12.4	12.1	11.7	0.1	0.1	0.1
3915500071	OH	Trumbull	14.7	14.4	14.5	14.5		12.5	12.2	12.0	12.6	12.3	12.0	0.1	0.1	0

ANNUAL								Round 5.1			Round 5.1 w/ bank			Difference		
Monitor	**ST**	**County**	**3_05**	**04_06**	**05_07**	**BYDV**		**2009**	**2012**	**2018**	**2009**	**2012**	**2018**	**2009**	**2012**	**2018**
2101900171	KY	Boyd	14.4	14.4	14.7	14.5		11.7	11.4	11.3	11.8	11.5	11.4	0.1	0.1	0.1
2103700031	KY	Campbell	13.7	13.1	13.2	13.3		11.6	11.4	11.0	11.6	11.4	11.0	0	0	0
2111700071	KY	Kenton	14.5	14.2	14.5	14.4		11.9	11.7	11.3	11.9	11.7	11.3	0	0	0
2118300321	KY	Ohio	14.9	13.8	14	14.2		11.9	11.7	11.4	11.9	11.8	11.4	0	0.1	0
5400900051	WV	Brooke	16.8	16.4	16.4	16.5		13.5	13.2	13.5	13.6	13.3	13.5	0.1	0.1	0
5401100061	WV	Cabell	16.3	16.1	16.6	16.3		13.4	13.1	13.0	13.5	13.1	13.0	0.1	0	0
5402900111	WV	Hancock	16.4	15.7	15.9	16		13.0	12.7	13.0	13.1	12.8	13.0	0.1	0.1	0
5402910041	WV	Hancock	16.6	15.4	15.2	15.7		12.8	12.5	12.7	12.9	12.6	12.8	0.1	0.1	0.1
5405110021	WV	Marshall	15.3	15	15.2	15.2		12.4	12.0	11.9	12.4	12.1	12.0	0	0.1	0.1
5406900081	WV	Ohio	14.6	14.1	0	14.4		11.6	11.3	11.2	11.6	11.3	11.2	0	0	0
5406900101	WV	Ohio	15.4	14.3	14.6	14.8		11.9	11.6	11.5	11.9	11.6	11.5	0	0	0
5410710021	WV	Wood	15.4	15.3	15.4	15.4		12.7	12.4	12.1	12.7	12.4	12.1	0	0	0
				# > 15 ug/m3				**1**	**0**	**0**	**2**	**0**	**0**			

DAILY								Round 5.1			Round 5.1 w/ bank			Difference		
Monitor	ST	County	3_05	04_06	05_07	BYDV		2009	2012	2018	2009	2012	2018	2009	2012	2018
3900900031	OH	Athens	32	32	33	32		21	21	20	21	21	20	0	0	0
3901700031	OH	Butler	41	38	38	39		28	28	28	28	28	28	0	0	0
3901700161	OH	Butler	37	37	38	37		28	28	28	28	28	28	0	0	0
3901700171	OH	Butler	38	40	45	41		29	29	29	29	29	29	0	0	0
3901710041	OH	Butler	37	37	38	37		26	26	26	27	27	26	1	1	0
3902300051	OH	Clark	35	35	36	35		27	27	26	27	27	27	0	0	1
3902500221	OH	Clermont	38	35	34	36		26	26	27	26	26	27	0	0	0
3903500271	OH	Cuyahoga	39	36	35	37		33	33	32	33	33	32	0	0	0
3903500341	OH	Cuyahoga	38	35	37	37		32	31	31	32	32	31	0	1	0
3903500381	OH	Cuyahoga	47	43	42	44		37	36	35	37	36	35	0	0	0
3903500451	OH	Cuyahoga	42	37	38	39		31	30	29	31	30	29	0	0	0
3903500601	OH	Cuyahoga	46	41	40	42		38	38	37	38	38	37	0	0	0
3903500651	OH	Cuyahoga	41	37	38	39		31	31	31	32	31	31	1	0	0
3903510021	OH	Cuyahoga	34	33	35	34		28	27	26	28	27	27	0	0	1
3904900241	OH	Franklin	40	38	38	39		32	32	32	32	32	32	0	0	0
3904900251	OH	Franklin	39	38	38	38		31	30	30	31	30	30	0	0	0
3904900811	OH	Franklin	34	33	33	34		24	23	23	24	23	23	0	0	0
3905700051	OH	Greene	29	31	33	31		24	24	24	24	24	24	0	0	0
3906100061	OH	Hamilton	45	39	38	41		28	28	28	28	28	28	0	0	0
3906100141	OH	Hamilton	39	39	37	38		25	25	24	26	25	24	1	0	0
3906100401	OH	Hamilton	36	36	38	37		25	24	24	25	24	24	0	0	0
3906100411	OH	Hamilton	35	35	37	36		29	29	29	29	29	29	0	0	0
3906100421	OH	Hamilton	37	37	38	37		28	28	28	28	28	28	0	0	0
3906100431	OH	Hamilton	36	35	36	36		28	28	28	28	28	28	0	0	0
3906170011	OH	Hamilton	40	39	38	39		30	30	29	30	30	29	0	0	0
3906180011	OH	Hamilton	40	40	41	41		31	31	31	31	31	31	0	0	0
3908100171	OH	Jefferson	42	40	40	41		29	28	29	29	28	29	0	0	0
3908110011	OH	Jefferson	46	43	38	42		31	31	32	32	31	32	1	0	0
3908510011	OH	Lake	37	31	31	33		26	26	25	26	26	26	0	0	1
3908700101	OH	Lawrence	33	34	35	34		23	22	22	23	22	22	0	0	0
3909300161	OH	Lorain	35	32	29	32		26	26	25	27	26	25	1	0	0
3909330021	OH	Lorain	32	31	32	32		25	25	24	25	25	24	0	0	0
3909500241	OH	Lucas	39	35	35	36		33	33	33	33	33	32	0	0	-1
3909500251	OH	Lucas	37	34	35	35		32	33	32	32	33	32	0	0	0
3909500261	OH	Lucas	37	34	34	35		31	31	31	31	31	31	0	0	0
3909900051	OH	Mahoning	36	35	35	35		27	27	26	27	27	26	0	0	0
3909900141	OH	Mahoning	38	37	36	37		30	30	30	30	30	30	0	0	0
3910300031	OH	Medina	39	34	32	35		23	23	23	23	23	23	0	0	0
3911300311	OH	Montgomer	37	34	36	36		29	28	29	29	29	29	0	1	0
3911300321	OH	Montgomer	40	36	37	38		30	30	30	31	30	30	1	0	0
3913300021	OH	Portage	34	34	35	34		27	27	26	27	27	26	0	0	0
3913510011	OH	Preble	34	32	34	33		27	26	26	27	27	27	0	1	1
3914500131	OH	Scioto	34	33	36	35		24	24	24	25	24	24	1	0	0
3915100171	OH	Stark	38	37	36	37		28	28	27	29	28	27	1	0	0
3915100201	OH	Stark	36	33	33	34		27	27	26	27	27	27	0	0	1
3915300171	OH	Summit	40	38	37	38		31	30	29	31	30	29	0	0	0
3915300231	OH	Summit	38	37	34	36		29	29	28	29	29	28	0	0	0
3915500071	OH	Trumbull	38	36	35	36		29	28	28	29	29	28	0	1	0
2101900171	KY	Boyd	33	32	32	32		22	21	21	22	21	21	0	0	0
2103700031	KY	Campbell	31	30	32	31		26	26	26	26	26	26	0	0	0
2111700071	KY	Kenton	34	35	36	35		24	25	24	24	25	24	0	0	0
2118300321	KY	Ohio	35	29	32	32		22	22	21	22	22	21	0	0	0

DAILY								Round 5.1			Round 5.1 w/ bank			Difference		
Monitor	**ST**	**County**	**3_05**	**04_06**	**05_07**	**BYDV**		**2009**	**2012**	**2018**	**2009**	**2012**	**2018**	**2009**	**2012**	**2018**
5400900051	WV	Brooke	42	40	37	39		29	29	29	29	29	29	0	0	0
5401100061	WV	Cabell	35	34	37	35		24	23	23	25	24	23	1	1	0
5402910041	WV	Hancock	41	40	41	41		28	27	28	28	27	28	0	0	0
5405110021	WV	Marshall	33	34	35	34		24	23	24	24	23	24	0	0	0
5406900101	WV	Ohio	31	29	32	31		23	23	24	23	23	23	0	0	-1
5410710021	WV	Wood	34	35	37	35		24	22	22	24	23	22	0	1	0
				# > 35 ug/m3				**2**	**2**	**1**	**2**	**2**	**1**			

OZONE													
			--------		Round 5.1			Round 5.1 w/ bank			Diffreence		
Monitor	ST	County	AVGDV		2009	2012	2018	2009	2012	2018	2009	2012	2018
3900300021	OH	Allen	78.7		74.9	71.9	66.3	75.0	72.4	66.5	**0.1**	**0.5**	**0.2**
3900710011	OH	Ashtabula	89		84.1	81.3	76.0	84.5	82.1	76.6	**0.4**	**0.8**	**0.6**
3901700041	OH	Butler	83.3		80.8	78.8	74.0	80.8	79.3	74.3	**0**	**0.5**	**0.3**
3901710043	OH	Butler	82.3		78.9	76.7	71.2	79.0	77.1	71.5	**0.1**	**0.4**	**0.3**
3902300011	OH	Clark	81		76.9	74.1	68.1	77.2	74.8	68.6	**0.3**	**0.7**	**0.5**
3902300031	OH	Clark	77		73.8	71.6	66.4	74.1	72.1	66.8	**0.3**	**0.5**	**0.4**
3902500221	OH	Clermont	81		78.6	76.6	72.0	78.7	77.0	72.2	**0.1**	**0.4**	**0.2**
3902710021	OH	Clinton	82.3		78.0	75.2	68.9	78.1	75.6	69.1	**0.1**	**0.4**	**0.2**
3903500341	OH	Cuyahoga	71		68.1	66.5	63.3	68.2	66.8	63.5	**0.1**	**0.3**	**0.2**
3903500641	OH	Cuyahoga	74		71.8	70.3	67.1	71.9	70.7	67.4	**0.1**	**0.4**	**0.3**
3903550021	OH	Cuyahoga	79.7		76.8	75.2	71.9	77.0	75.7	72.1	**0.2**	**0.5**	**0.2**
3904100021	OH	Delaware	78.3		74.0	71.4	64.9	74.3	71.9	65.4	**0.3**	**0.5**	**0.5**
3904900281	OH	Franklin	80.3		76.8	74.9	70.1	76.9	75.2	70.5	**0.1**	**0.3**	**0.4**
3904900291	OH	Franklin	86.3		82.8	80.5	74.6	83.0	81.1	75.0	**0.2**	**0.6**	**0.4**
3904900371	OH	Franklin	80.3		77.2	75.3	70.3	77.3	75.8	70.8	**0.1**	**0.5**	**0.5**
3904900811	OH	Franklin	79.7		76.5	74.5	69.1	76.6	75.0	69.5	**0.1**	**0.5**	**0.4**
3905500041	OH	Geauga	79.3		75.4	73.1	68.0	75.6	73.5	68.3	**0.2**	**0.4**	**0.3**
3905700061	OH	Greene	80.3		76.6	74.1	68.3	76.8	74.6	68.7	**0.2**	**0.5**	**0.4**
3906100061	OH	Hamilton	84.7		82.8	81.0	76.3	82.9	81.4	76.5	**0.1**	**0.4**	**0.2**
3906100101	OH	Hamilton	82		79.2	77.2	73.2	79.3	77.7	73.4	**0.1**	**0.5**	**0.2**
3906100401	OH	Hamilton	81.7		80.5	79.0	75.0	80.6	79.3	75.1	**0.1**	**0.3**	**0.1**
3908100161	OH	Jefferson	79		73.2	71.2	67.1	73.7	72.0	67.8	**0.5**	**0.8**	**0.7**
3908100171	OH	Jefferson	81.3		75.3	73.3	69.1	75.9	74.1	69.8	**0.6**	**0.8**	**0.7**
3908300021	OH	Knox	77.7		73.2	70.4	64.1	73.4	71.0	64.5	**0.2**	**0.6**	**0.4**
3908500031	OH	Lake	86.3		82.7	80.8	77.1	82.9	81.3	77.4	**0.2**	**0.5**	**0.3**
3908530021	OH	Lake	80.7		77.1	75.2	71.1	77.2	75.6	71.2	**0.1**	**0.4**	**0.1**
3908700061	OH	Lawrence	70.7		66.6	65.1	62.1	67.0	65.6	62.5	**0.4**	**0.5**	**0.4**
3908700111	OH	Lawrence	63.3		59.4	58.0	54.9	59.8	58.5	55.4	**0.4**	**0.5**	**0.5**
3908900051	OH	Licking	78		73.4	70.5	63.9	73.6	71.1	64.3	**0.2**	**0.6**	**0.4**
3909300171	OH	Lorain	76.5		73.0	70.9	66.9	73.1	71.4	67.1	**0.1**	**0.5**	**0.2**
3909300181	OH	Lorain	77.3		73.8	71.7	67.6	73.9	72.2	67.8	**0.1**	**0.5**	**0.2**
3909500241	OH	Lucas	76.3		72.1	69.8	65.7	72.2	70.3	65.9	**0.1**	**0.5**	**0.2**
3909500271	OH	Lucas	77.7		73.5	71.0	66.5	73.6	71.5	66.6	**0.1**	**0.5**	**0.1**
3909500341	OH	Lucas	81.3		77.2	74.7	70.4	77.3	75.2	70.6	**0.1**	**0.5**	**0.2**
3909500811	OH	Lucas	80.7		76.1	73.8	69.5	76.3	74.3	69.6	**0.2**	**0.5**	**0.1**
3909700071	OH	Madison	79.7		75.5	72.8	66.9	75.8	73.4	67.3	**0.3**	**0.6**	**0.4**
3909900131	OH	Mahoning	78.7		73.0	70.1	64.1	73.2	70.6	64.4	**0.2**	**0.5**	**0.3**
3910300031	OH	Medina	80.3		75.6	72.7	66.8	75.9	73.3	67.2	**0.3**	**0.6**	**0.4**
3910900051	OH	Miami	76.7		72.8	70.3	64.5	73.1	71.0	65.0	**0.3**	**0.7**	**0.5**
3911300191	OH	Montgomer	86		82.0	79.3	73.3	82.3	80.0	73.8	**0.3**	**0.7**	**0.5**
3911300331	OH	Montgomer	74		70.6	68.2	63.0	70.8	68.8	63.5	**0.2**	**0.6**	**0.5**
3913310011	OH	Portage	83.7		78.4	75.3	68.7	78.7	76.0	69.2	**0.3**	**0.7**	**0.5**
3913510011	OH	Preble	73		69.4	66.9	61.7	69.7	67.5	62.1	**0.3**	**0.6**	**0.4**
3915100161	OH	Stark	78		72.9	70.0	64.1	73.6	71.1	65.1	**0.7**	**1.1**	**1**
3915100211	OH	Stark	76.3		70.5	67.9	62.3	71.1	68.6	63.1	**0.6**	**0.7**	**0.8**
3915110091	OH	Stark	79		73.9	70.9	64.8	74.3	71.7	65.6	**0.4**	**0.8**	**0.8**
3915140051	OH	Stark	81		75.0	71.9	65.7	75.4	72.7	66.3	**0.4**	**0.8**	**0.6**
3915300201	OH	Summit	83.7		78.9	75.8	69.3	79.3	76.6	69.9	**0.4**	**0.8**	**0.6**
3915500091	OH	Trumbull	80		73.9	70.8	64.6	74.2	71.4	64.9	**0.3**	**0.6**	**0.3**

OZONE													
			--------		Round 5.1			Round 5.1 w/ bank			Diffreence		
Monitor	**ST**	**County**	**AVGDV**		**2009**	**2012**	**2018**	**2009**	**2012**	**2018**	**2009**	**2012**	**2018**
3915500111	OH	Trumbull	84.3		78.2	74.9	68.2	78.4	75.5	68.6	**0.2**	**0.6**	**0.4**
3916500071	OH	Warren	87.7		83.6	81.0	74.8	83.7	81.4	75.1	**0.1**	**0.4**	**0.3**
3916700041	OH	Washingto	82.7		77.8	75.9	71.7	77.9	76.1	71.8	**0.1**	**0.2**	**0.1**
3917300031	OH	Wood	80		75.0	72.2	66.9	75.2	72.6	67.0	**0.2**	**0.4**	**0.1**
2101500031	KY	Boone	75.3		72.5	69.9	65.2	72.5	70.2	65.3	**0**	**0.3**	**0.1**
2101900171	KY	Boyd	77.3		72.8	71.1	67.9	73.1	71.6	68.3	**0.3**	**0.5**	**0.4**
2103700031	KY	Campbell	85.3		84.3	82.7	78.6	84.2	82.9	78.7	**-0.1**	**0.2**	**0.1**
2111700071	KY	Kenton	78.3		76.2	74.6	71.2	76.2	74.9	71.3	**0**	**0.3**	**0.1**
2118300321	KY	Ohio	70.7		69.0	67.5	63.1	69.0	67.8	63.1	**0**	**0.3**	**0**
5401100061	WV	Cabell	78.7		73.9	72.2	68.8	74.2	72.6	69.1	**0.3**	**0.4**	**0.3**
5402910041	WV	Hancock	75.7		70.2	68.3	64.0	70.7	69.0	64.6	**0.5**	**0.7**	**0.6**
5406900071	WV	Ohio	76		69.2	67.6	64.1	69.5	68.1	64.4	**0.3**	**0.5**	**0.3**
5406900091	WV	Ohio	63		56.6	55.6	52.9	56.8	55.9	53.0	**0.2**	**0.3**	**0.1**
5406900101	WV	Ohio	85		77.3	75.7	71.7	77.7	76.2	72.1	**0.4**	**0.5**	**0.4**
5410710021	WV	Wood	79		74.2	72.4	68.3	74.3	72.6	68.3	**0.1**	**0.2**	**0**
			# > 85 PPB		**0**	**0**	**0**	**0**	**0**				**# > 85 PPB**
			# > 75 PPB		**28**	**12**	**4**	**28**	**16**				**# > 75 PPB**