Addressing Maintenance Monitor Flexibilities Using the 2023 Cross-State Air Pollution Rule Closeout Modeling Platform

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INTRODUCTION

Alpine Geophysics, LLC was tasked by the Midwest Ozone Group (MOG) to review EPA's Considerations for Identifying Maintenance Receptors Memo[1] (EPA's memo) and to determine if MOG's recent updated 4km modeling[2] and observed ozone concentrations[3] meet conditions outlined in EPA's memo relative to identifying maintenance monitors under the CSAPR Closeout rule.

Under EPA's memo, a modeled demonstration would need to show that using an alternative base year period would lead to a projected future year design value at or below a concentration of 70.9 ppb which is necessary to demonstrate modeled attainment of the 2015 70 ppb ozone NAAQS. If that demonstration is successful, EPA would expect states to include with their SIP demonstration submission technical analyses showing that:

1. meteorological conditions in the area of the monitoring site were conducive to ozone formation during the period of clean data or during the alternative base period design value used for projections;
2. ozone concentrations have been trending downward at the site since 2011 (and ozone precursor emissions of nitrogen oxide (NOx) and volatile organic compounds (VOC) have also decreased); and
3. emissions are expected to continue to decline in the upwind states out to the attainment date of the receptor.

EPA has provided meteorological data[1] to support #1 above and elsewhere has also provided historical emission trends[4] and emission projections[5] that demonstrate continued decline of ozone precursors through 2023 to support #3. Modeled ozone concentration data from EPA's 12km and MOG's updated 4km modeling, as well as historical observed concentrations to support investigating the #2 condition are identified.

As presented in the following two tables, MOG's updated 4km modeling identified maintenance and nonattainment monitors for additional review. From this list we have separated our review into two bins, (1) monitors that are solely maintenance monitors based on the CSAPR monitor classification methodology and (2) monitors that are predicted as nonattainment monitors using this same methodology.

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1 https://www.epa.gov/airmarkets/considerations-identifying-maintenance-receptors-memo
2 "Air Quality Modeling Technical Support Document for Midwest Ozone Group's Updated 4km Modeling," prepared by Alpine Geophysics, LLC, Burnsville, NC. December 2018.
3 https://www.epa.gov/outdoor-air-quality-data
4 https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data
5 https://www.epa.gov/air-emissions-modeling/additional-updates-2011-and-2023-emissions-version-63-platform-technical

Alpine 4km Modeling-identified maintenance monitors in the 4km domains.

			Ozone Design Value (ppb)					
				EPA "No Water" 12km Modeling		Alpine 4km Modeling		
Monitor	State	County	DVb (2011)	DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	2015-2017 DV
90013007	CT	Fairfield	84.3	71.0	75.0	69.2	73.1	83
90019003	CT	Fairfield	83.7	73.0	75.9	68.3	71.0	83
90099002	CT	New Haven	85.7	69.9	72.6	68.9	71.5	82
240251001	MD	Harford	90.0	70.9	73.3	70.9	73.3	75
260050003	MI	Allegan	82.7	69.0	71.7	70.0	72.8	73
340150002	NJ	Gloucester	84.3	68.2	70.4	68.8	71.0	74
360850067	NY	Richmond	81.3	67.1	68.5	69.6	71.0	76
361030002	NY	Suffolk	83.3	74.0	75.5	70.6	72.0	76

Alpine 4km Modeling-identified nonattainment monitor in the 4km domains.

			Ozone Design Value (ppb)					
				EPA "No Water" 12km Modeling		Alpine 4km Modeling		
Monitor	State	County	DVb (2011)	DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	2015-2017 DV
551170006	WI	Sheboygan	84.3	72.8	75.1	71.5	73.8	80

Presented in the remainder of this document is an analysis of current data related to criteria established in EPA's memo for determining whether it is appropriate for a monitor to be classified as a maintenance monitor.

1. **Utilization of alternative base period design values results in a projection of clean data for all monitors.**

As a first step in demonstrating whether a monitor should be properly characterized as a maintenance receptor, 2023 ozone design values using alternate base year concentrations (from the three, three-year time periods between 2009 – 2013) for each monitor listed above are presented in the following table. These data demonstrate that each of the monitors has at least one alternate base year period design value that results in a 2023 projection equal to or lower than the 70.9 ppb threshold satisfying this condition.

Alternate Base Year Projections of 2023 ozone Design Values (ppb) from Alpine 4km Modeling for Key Monitors in the 4km Domains.

				2023 Ozone Design Value (ppb)				
Monitor	**State**	**County**	**DVb (2011)**	**DVf (Ave)**	**DVf (Max)**	**DVf (Max 2009/11)**	**DVf (Max 2010/12)**	**DVf (Max 2011/13)**
90013007	Connecticut	Fairfield	84.3	69.2	73.1	64.8	69.8	
90019003	Connecticut	Fairfield	83.7	68.3	71.0	64.5	69.4	
90099002	Connecticut	New Haven	85.7	68.9	71.5	65.1	69.9	
240251001	Maryland	Harford	90.0	70.9	73.3			67.0
260050003	Michigan	Allegan	82.7	70.0	72.8	66.1		
340150002	New Jersey	Gloucester	84.3	68.8	71.0	66.9		68.6
360850067	New York	Richmond	81.3	69.6	71.0			66.7
361030002	New York	Suffolk	83.3	70.6	72.0			68.7
551170006	Wisconsin	Sheboygan	84.3	71.5	73.8	68.7		

It is noted that the Sheboygan, WI monitor would be a candidate for the maintenance flexibility if EPA was to determine that, for other reasons, this monitor no longer qualified to be a nonattainment monitor.

2. **Meteorological conditions of the monitors were conducive to ozone formation.**

One of the criteria established in EPA's guidance memo[6] for approving an alternative demonstration of a monitor's maintenance status is that the "meteorological conditions in the area of the monitoring site were conducive to ozone formation during the period of clean data or during the alternative base period design value used for projections."

EPA goes on to offer the following general comment on meteorological conditions[7]:

> "In general, below average temperatures are on indication that meteorological conditions are unconducive for ozone formation, whereas above average temperatures are an indication that meteorology is conducive to ozone formation. Within a particular summer season, the degree that meteorology is conducive for ozone formation can vary from region to region and fluctuate with time within a particular region. For example, the temperature-related information presented below suggests that summer meteorology was generally conducive for ozone formation in 2010, 2011, 2012 and 2016 in most regions. In contrast, the summer of 2009 was generally unconducive for ozone formation, overall, in most regions. In addition, the summers of 2013 and 2014 were not particularly conducive for ozone formation in the Upper Midwest, Ohio Valley, South, Southeast."

6 https://www.epa.gov/airmarkets/considerations-identifying-maintenance-receptors-memo; see page 4.
7 *Id*. see page A-3.

Significantly, most alternative demonstrations set forth in this memorandum are based upon alternative base year periods involving the years 2010 through 2013. EPA has recognized that, with one limited exception relevant to this analysis (the summer of 2013 in the Upper Midwest), the meteorology in these years was conducive to ozone formation. Significantly, none of the monitors addressed during the years 2010 through 2013 are located in the Upper Midwest. Alternative demonstrations including the time period 2010 through 2013 have been applied to the following monitors:

Fairfield CT	90013007
Fairfield CT	90019003
New Haven CT	90099002
Harford MD	240251001
Gloucester NJ	34050002
Richmond NY	360850067
Suffolk NY	361030002

While EPA offers the caution that the summer of 2009 was generally not conducive for ozone formation, we have been careful to develop an alternative demonstration for the following monitors that do not rely on 2009 exclusively. Rather, the alternative base case period selected for the following monitors also includes the average of the years 2010 and 2011 which clearly are ozone conducive years:

Allegan MI	260050003
Sheboygan WI	551170006

By basing model projections for the attainment year of 2023 on alternative base period design values for ozone conducive year, these monitors meet the meteorological threshold of the memorandum.

3. **Ozone concentrations are trending downward.**

As an additional supporting case to the flexibility in identifying maintenance monitors, EPA guidance provides that a state would need to show that “ozone concentrations have been trending downward at the site since 2011”. The first table below presents 4th high ozone concentration data[8] measured at each noted receptor and a calculated slope between 2011 and the most recently EPA-approved 4th high concentrations from 2017. The second table below presents a count of the number of ozone exceedance days per monitor per year relative to the 2015 70 ppb ozone NAAQS. For all monitors listed, negative slope, indicating the necessary downward trends, are demonstrated for both of these metrics which satisfies the required condition of trending downward concentrations.

8 https://www.epa.gov/air-trends/air-quality-design-values

4th High Ozone Concentrations (ppb) and Slope Calculation for Key Monitors in the 4km Domains.

			4th High Ozone Concentration (ppb)							
Monitor	State	County	2011	2012	2013	2014	2015	2016	2017	Slope (2011-2017) (ppb/yr)
90013007	Connecticut	Fairfield	87	90	90	74	86	83	81	-1.29
90019003	Connecticut	Fairfield	87	89	86	81	87	87	81	-0.75
90099002	Connecticut	New Haven	92	90	85	69	81	80	86	-1.50
240251001	Maryland	Harford	98	86	72	67	74	79	76	-2.79
260050003	Michigan	Allegan	85	95	78	77	72	76	71	-3.07
340150002	New Jersey	Gloucester	92	87	73	70	76	76	73	-2.71
360850067	New York	Richmond	87	78	71	72	79	77	72	-1.39
361030002	New York	Suffolk	89	83	72	66	78	73	77	-1.79
551170006	Wisconsin	Sheboygan	84	93	78	72	81	85	75	-1.43

Daily Ozone Exceedance Counts and Slope Calculation for Key Monitors in the 4km Domains.

			Daily Ozone Exceedance Counts							
Monitor	State	County	2011	2012	2013	2014	2015	2016	2017	Slope (2011-2017
90013007	Connecticut	Fairfield	13	19	17	8	15	14	11	-0.64
90019003	Connecticut	Fairfield	14	19	15	9	16	15	9	-0.79
90099002	Connecticut	New Haven	10	17	11	2	14	10	12	-0.18
240251001	Maryland	Harford	22	17	5	3	5	9	6	-2.29
260050003	Michigan	Allegan	9	36	8	7	4	9	4	-2.61
340150002	New Jersey	Gloucester	17	21	4	3	6	7	6	-2.11
360850067	New York	Richmond	17	14	4	6	10	10	7	-1.14
361030002	New York	Suffolk	16	12	5	0	7	4	7	-1.46
551170006	Wisconsin	Sheboygan	13	35	10	4	11	11	13	-1.68

4. **Emissions of ozone precursors have been trending downwards since 2011 and are expected to continue to decline out to the attainment date of the receptor.**

NOx and VOC emissions across the CSAPR region have been dramaticaly reduced in recent years. These emission reductions will continue as the result of "on-the-books" regulatory programs already required by states on their own sources, "on-the-way" regulatory programs that have already been identified by state regulatory agencies as efforts that they must undertake as well as from the effectiveness of a variety of EPA programs including the CSAPR Update Rule.

Presented below are tables developed from EPA modeling platform summaries[9] illustrating the estimated total anthropogenic emission reduction emission reduction in the several eastern states.

As can be seen in the first table, total annual anthropogenic NOx emissions are predicted to decline by 29% between 2011 and 2017 over the CSAPR domain and by 43% (an additional 1.24 million tons) between 2011 and 2023.

Final CSAPR Update Modeling Platform Anthropogenic NOx Emissions (Annual Tons).

	Annual Anthropogenic NOx Emissions (Tons)			Emissions Delta (2017-2011)		Emissions Delta (2023-2011)	
State	**2011**	**2017**	**2023**	**Tons**	**%**	**Tons**	**%**
Alabama	359,797	220,260	184,429	139,537	-39%	175,368	-49%
Arkansas	232,185	168,909	132,148	63,276	-27%	100,037	-43%
Illinois	506,607	354,086	293,450	152,521	-30%	213,156	-42%
Indiana	444,421	317,558	243,954	126,863	-29%	200,467	-45%
Iowa	240,028	163,126	124,650	76,901	-32%	115,377	-48%
Kansas	341,575	270,171	172,954	71,404	-21%	168,621	-49%
Kentucky	327,403	224,098	171,194	103,305	-32%	156,209	-48%
Louisiana	535,339	410,036	373,849	125,303	-23%	161,490	-30%
Maryland	165,550	108,186	88,383	57,364	-35%	77,167	-47%
Michigan	443,936	296,009	228,242	147,927	-33%	215,694	-49%
Mississippi	205,800	128,510	105,941	77,290	-38%	99,859	-49%
Missouri	376,256	237,246	192,990	139,010	-37%	183,266	-49%
New Jersey	191,035	127,246	101,659	63,789	-33%	89,376	-47%
New York	388,350	264,653	230,001	123,696	-32%	158,349	-41%
Ohio	546,547	358,107	252,828	188,439	-34%	293,719	-54%
Oklahoma	427,278	308,622	255,341	118,656	-28%	171,937	-40%
Pennsylvania	562,366	405,312	293,048	157,054	-28%	269,318	-48%
Tennessee	322,578	209,873	160,166	112,705	-35%	162,411	-50%
Texas	1,277,432	1,042,256	869,949	235,176	-18%	407,482	-32%
Virginia	313,848	199,696	161,677	114,152	-36%	152,171	-48%
West Virginia	174,219	160,102	136,333	14,117	-8%	37,886	-22%
Wisconsin	268,715	178,927	140,827	89,788	-33%	127,888	-48%
CSAPR States	**8,651,264**	**6,152,990**	**4,914,012**	**2,498,274**	**-29%**	**3,737,252**	**-43%**

As can be seen in the second table, total annual anthropogenic VOC emissions are predicted to decline by 9% between 2011 and 2017 over the CSAPR domain and by 15% (an additional 1.43 million tons) between 2011 and 2023.

9 83 Fed. Reg. 7716 (February 22, 2018).

Final CSAPR Update Modeling Platform Anthropogenic VOC Emissions (Annual Tons).

	Annual Anthropogenic VOC Emissions (Tons)			Emissions Delta (2017-2011)		Emissions Delta (2023-2011)	
State	**2011**	**2017**	**2023**	**Tons**	**%**	**Tons**	**%**
Alabama	393,465	328,996	306,583	64,468	-16%	86,882	-22%
Arkansas	342,779	312,750	295,210	30,029	-9%	47,569	-14%
Illinois	372,137	320,543	294,087	51,594	-14%	78,049	-21%
Indiana	284,378	226,734	200,827	57,644	-20%	83,551	-29%
Iowa	191,201	158,520	144,326	32,681	-17%	46,875	-25%
Kansas	461,871	457,042	388,734	4,828	-1%	73,137	-16%
Kentucky	273,603	236,383	214,051	37,220	-14%	59,551	-22%
Louisiana	692,238	647,568	586,378	44,670	-6%	105,860	-15%
Maryland	125,468	105,316	95,511	20,152	-16%	29,957	-24%
Michigan	450,276	350,937	301,599	99,339	-22%	148,677	-33%
Mississippi	274,537	236,316	213,200	38,221	-14%	61,338	-22%
Missouri	377,268	331,054	307,386	46,214	-12%	69,882	-19%
New Jersey	183,091	152,805	141,113	30,286	-17%	41,978	-23%
New York	417,438	337,078	301,794	80,361	-19%	115,645	-28%
Ohio	391,315	306,215	303,144	85,101	-22%	88,172	-23%
Oklahoma	607,943	561,947	538,770	45,996	-8%	69,172	-11%
Pennsylvania	376,322	317,876	293,703	58,446	-16%	82,618	-22%
Tennessee	290,998	231,537	207,178	59,461	-20%	83,820	-29%
Texas	2,194,868	2,324,259	2,244,343	(129,391)	6%	(49,475)	2%
Virginia	295,360	254,049	235,605	41,311	-14%	59,755	-20%
West Virginia	139,516	173,841	172,511	(34,324)	25%	(32,995)	24%
Wisconsin	288,296	231,988	204,074	56,308	-20%	84,222	-29%
CSAPR States	**9,424,368**	**8,603,753**	**7,990,125**	**820,614**	**-9%**	**1,434,242**	**-15%**

CONCLUSION

EPA's October 19, 2018 guidance memo offers states the option of using an alternative method of identifying maintenance monitors to be addressed in their Good Neighbor SIPs related to the 2015 ozone NAAQS. The analysis presented in this paper illustrates that when current data is applied to the various criteria identified by EPA, states are provided with the basis for requesting EPA to determine that it is no longer necessary to consider any of the subject monitors as maintenance monitors for purposes related to the 2015 ozone NAAQS.

Appendix A

Projected Maintenance Monitors

Monitor 90013007 **Fairfield, Connecticut**

CSAPR Closeout Modeling Results (MDA8 ppb) / **Alternate Base Year Period DVf (ppb)**

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
84.3		71.0	75.0		69.2	73.1		64.8	69.8	73.1

MDA8 DV (3yr Ave ppb)

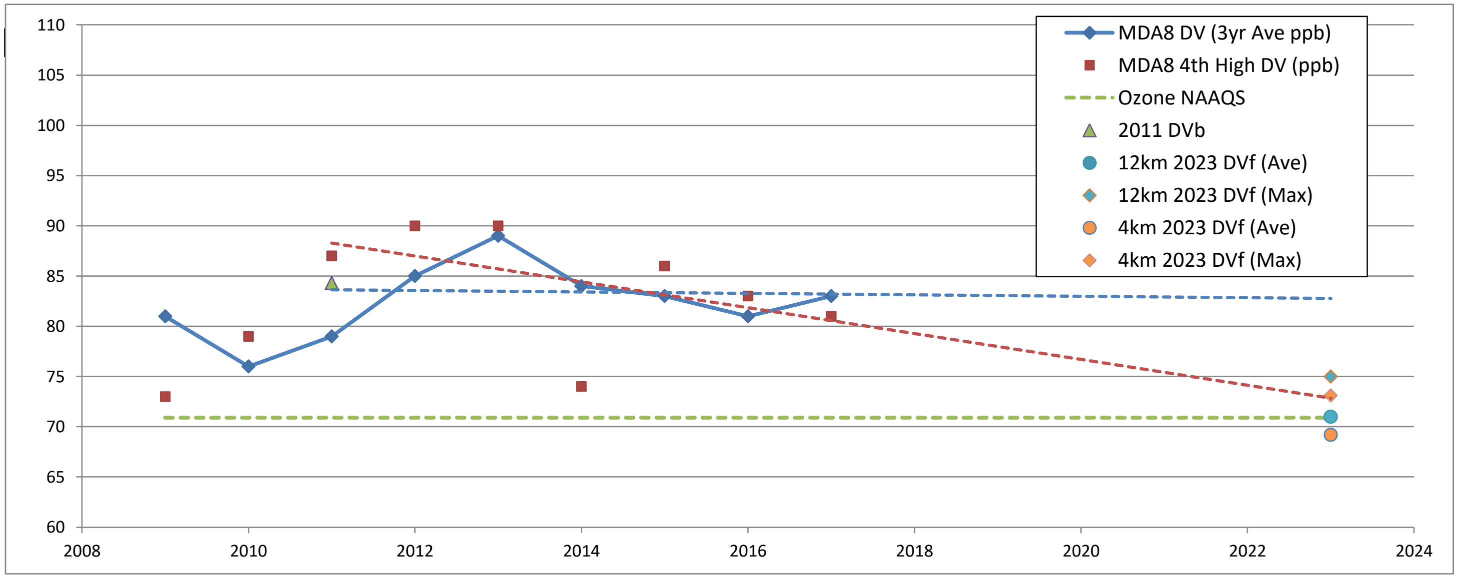
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
81	76	79	85	89	84	83	81	83

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
73	79	87	90	90	74	86	83	81	-1.29

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
13	19	17	8	15	14	11	-0.64



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.89	0.72	0.97	1.84	6.32	1.10	0.38
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	0.52	1.04	0.87	2.20	3.07	0.44	

Monitor	90019003	Fairfield, Connecticut

CSAPR Closeout Modeling Results (MDA8 ppb) / **Alternate Base Year Period DVf (ppb)**

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
83.7		73.0	75.9		68.3	71.0		64.5	69.4	71.0

MDA8 DV (3yr Ave ppb)

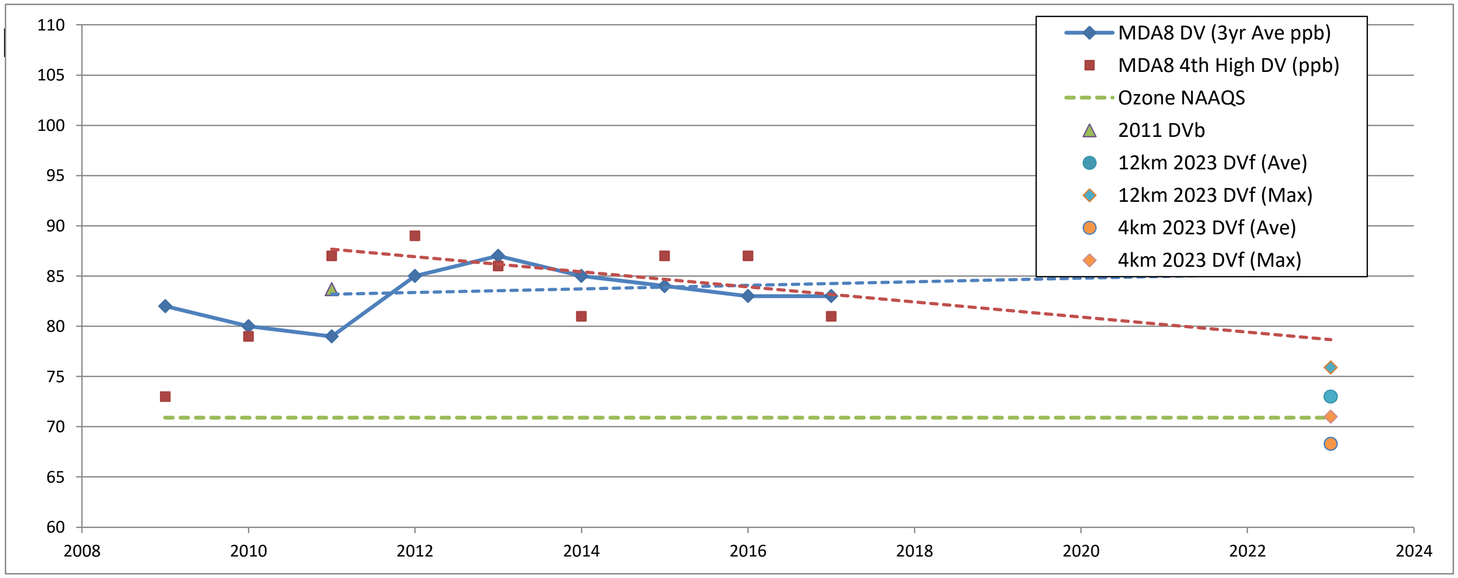
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
82	80	79	85	87	85	84	83	83

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
73	79	87	89	86	81	87	87	81	-0.75

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
14	19	15	9	16	15	9	-0.79



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.79	0.67	0.83	1.60	6.56	1.14	0.37
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	0.64	1.09	0.95	2.35	3.51	0.53	

Monitor 90099002 New Haven, Connecticut

CSAPR Closeout Modeling Results (MDA8 ppb) / **Alternate Base Year Period DVf (ppb)**

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
85.7		69.9	72.6		68.9	71.5		65.1	69.9	71.5

MDA8 DV (3yr Ave ppb)

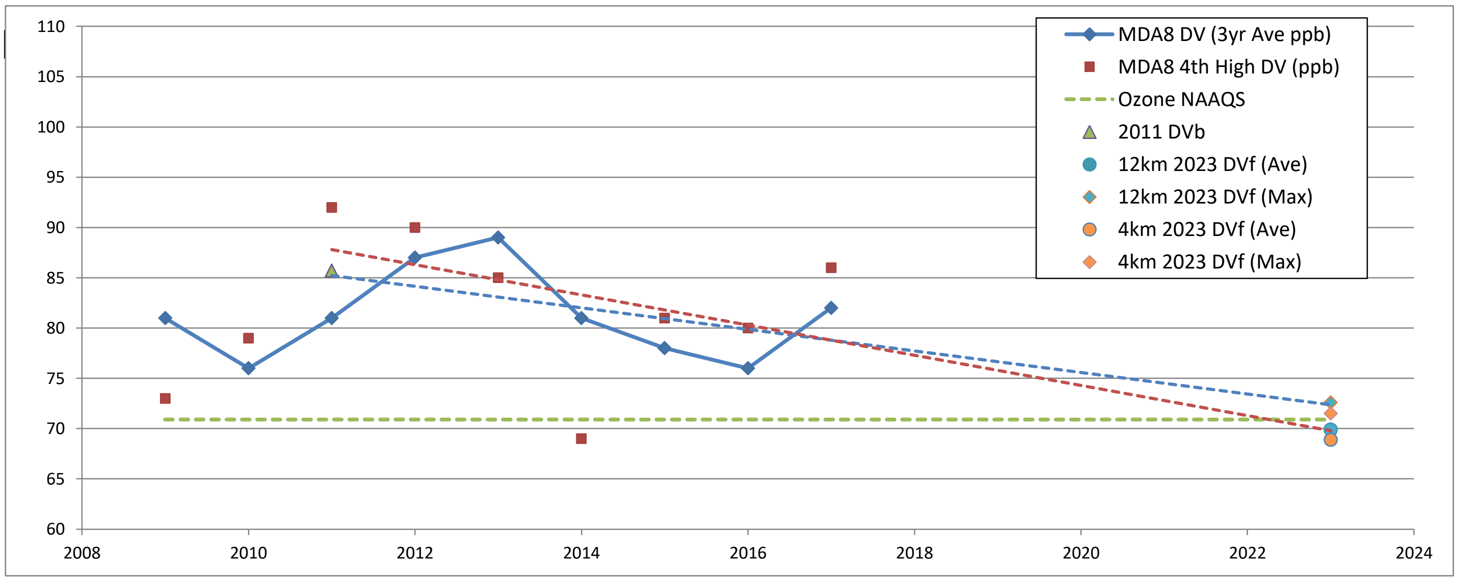
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
81	76	81	87	89	81	78	76	82

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
73	79	92	90	85	69	81	80	86	-1.50

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
10	17	11	2	14	10	12	-0.18



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.32	0.46	0.50	1.17	4.87	0.61	0.29
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	0.42	0.81	0.76	1.77	2.55	0.35	

Monitor 240251001 **Harford, Maryland**

CSAPR Closeout Modeling Results (MDA8 ppb) | **Alternate Base Year Period DVf (ppb)**

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
90		70.9	73.3		70.9	73.3		72.5	73.3	67.0

MDA8 DV (3yr Ave ppb)

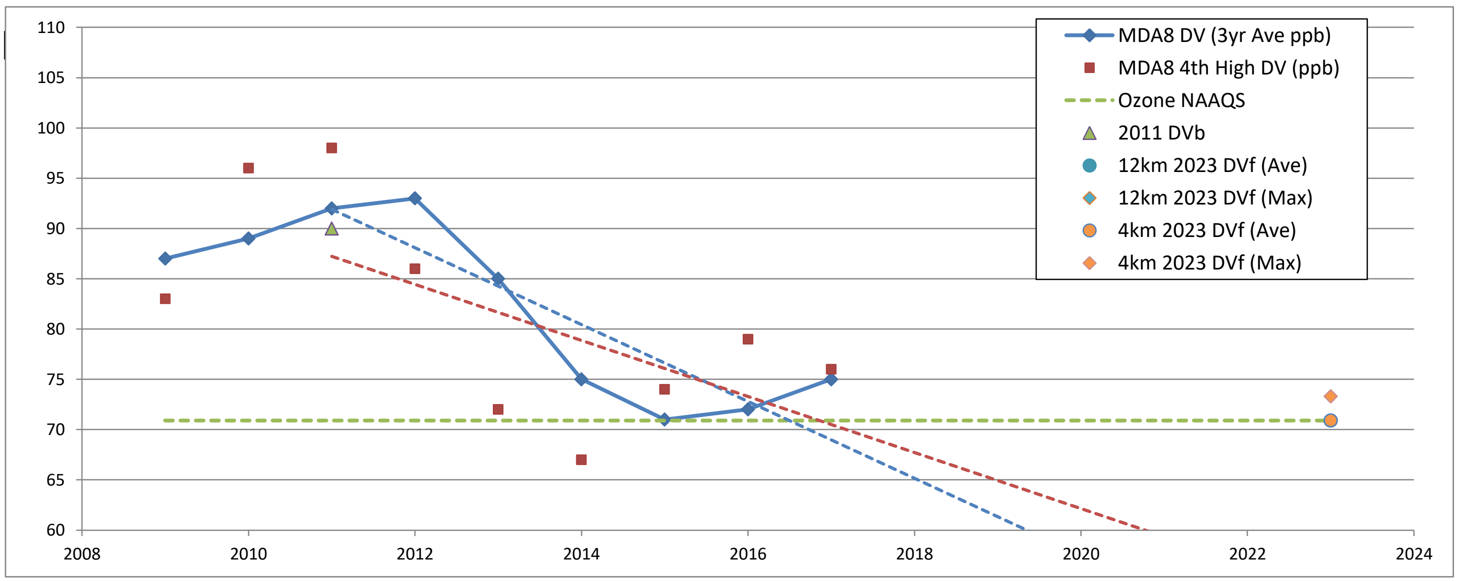
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
87	89	92	93	85	75	71	72	75

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
83	96	98	86	72	67	74	79	76	-2.79

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
22	17	5	3	5	9	6	-2.29



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	1.52	0.84	1.35	2.77	4.32	2.78	0.59
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	2.07	1.05	1.81	3.02	2.70	2.52	

Monitor	260050003	Allegan, Michigan

CSAPR Closeout Modeling Results (MDA8 ppb) — **Alternate Base Year Period DVf (ppb)**

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
82.7		69.0	71.7		70.0	72.8		66.1	71.1	72.8

MDA8 DV (3yr Ave ppb)

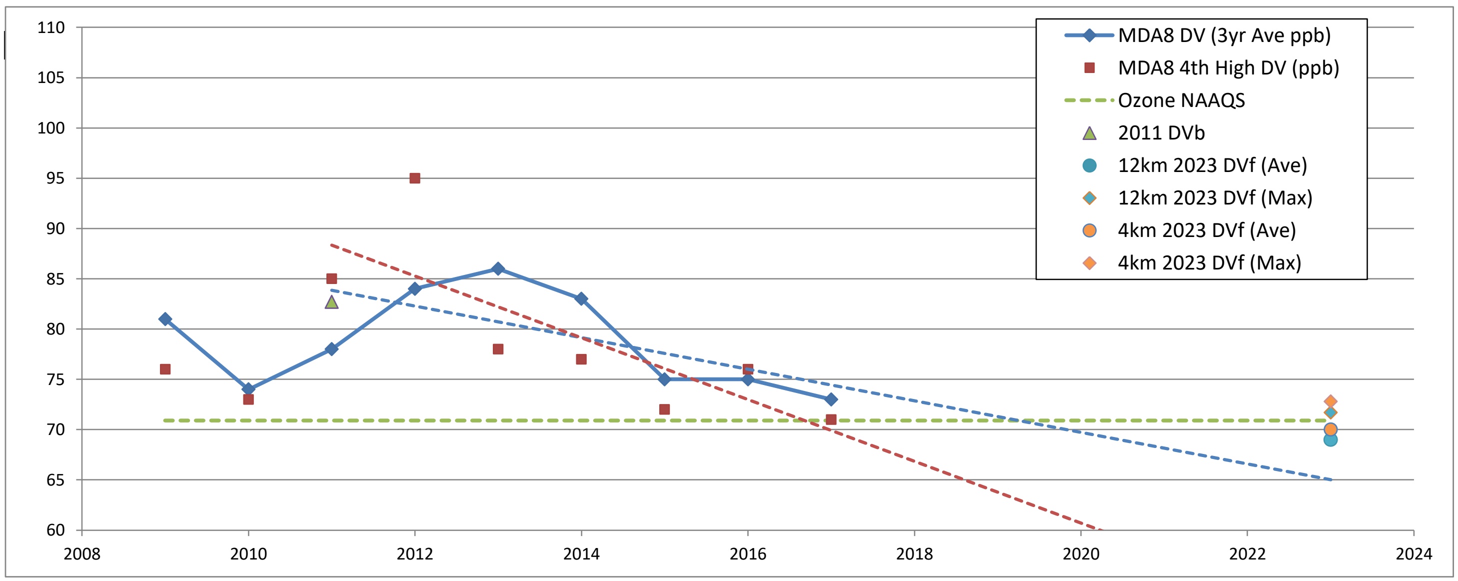
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
81	74	78	84	86	83	75	75	73

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
76	73	85	95	78	77	72	76	71	-3.07

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
9	36	8	7	4	9	4	-2.61



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.58	19.62	7.11	0.19	0.05	0.11	2.61
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	0.00	0.00	0.00	0.00	0.00	0.00	

Monitor	340150002	Gloucester, New Jersey

CSAPR Closeout Modeling Results (MDA8 ppb)

Alternate Base Year Period DVf (ppb)

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
84.3		68.2	70.4		68.8	71.0		66.9	71.0	68.6

MDA8 DV (3yr Ave ppb)

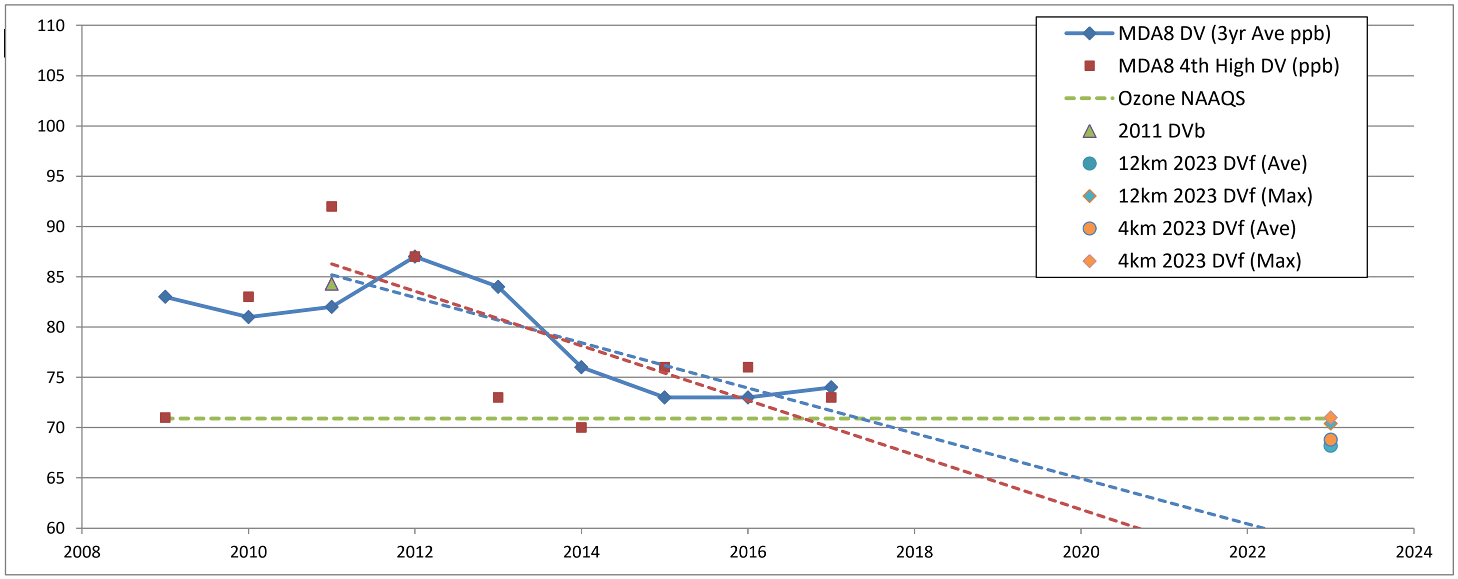
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
83	81	82	87	84	76	73	73	74

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
71	83	92	87	73	70	76	76	73	-2.71

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
17	21	4	3	6	7	6	-2.11



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.81	0.95	1.03	2.67	14.43	1.81	0.53
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	1.69	1.54	1.98	4.07	8.29	1.63	

Monitor	360850067	Richmond, New York

CSAPR Closeout Modeling Results (MDA8 ppb) / **Alternate Base Year Period DVf (ppb)**

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
81.3		67.1	68.5		69.6	71.0		71.0	71.0	66.7

MDA8 DV (3yr Ave ppb)

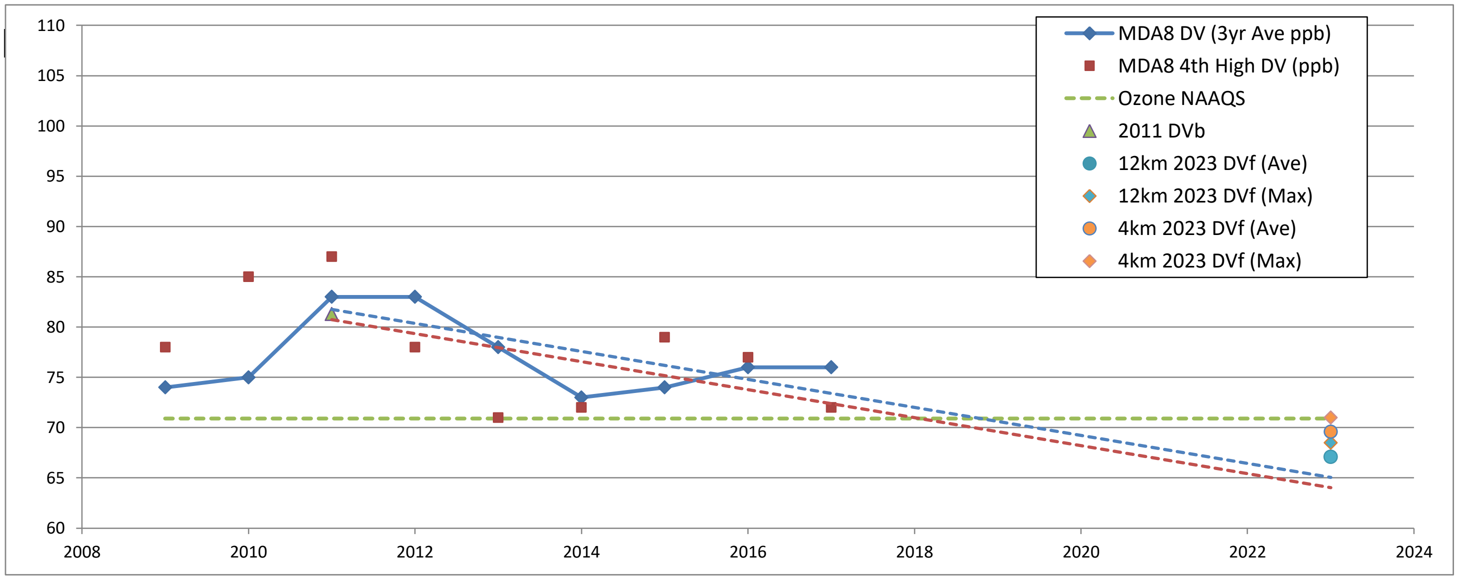
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
74	75	83	83	78	73	74	76	76

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
78	85	87	78	71	72	79	77	72	-1.39

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
17	14	4	6	10	10	7	-1.14



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.84	0.80	0.92	2.05	10.41	1.54	0.46
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	0.93	1.34	1.29	2.97	5.73	0.71	

Monitor	361030002	Suffolk, New York

CSAPR Closeout Modeling Results (MDA8 ppb)

Alternate Base Year Period DVf (ppb)

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
83.3		74.0	75.5		70.6	72.0		71.2	72.0	68.7

MDA8 DV (3yr Ave ppb)

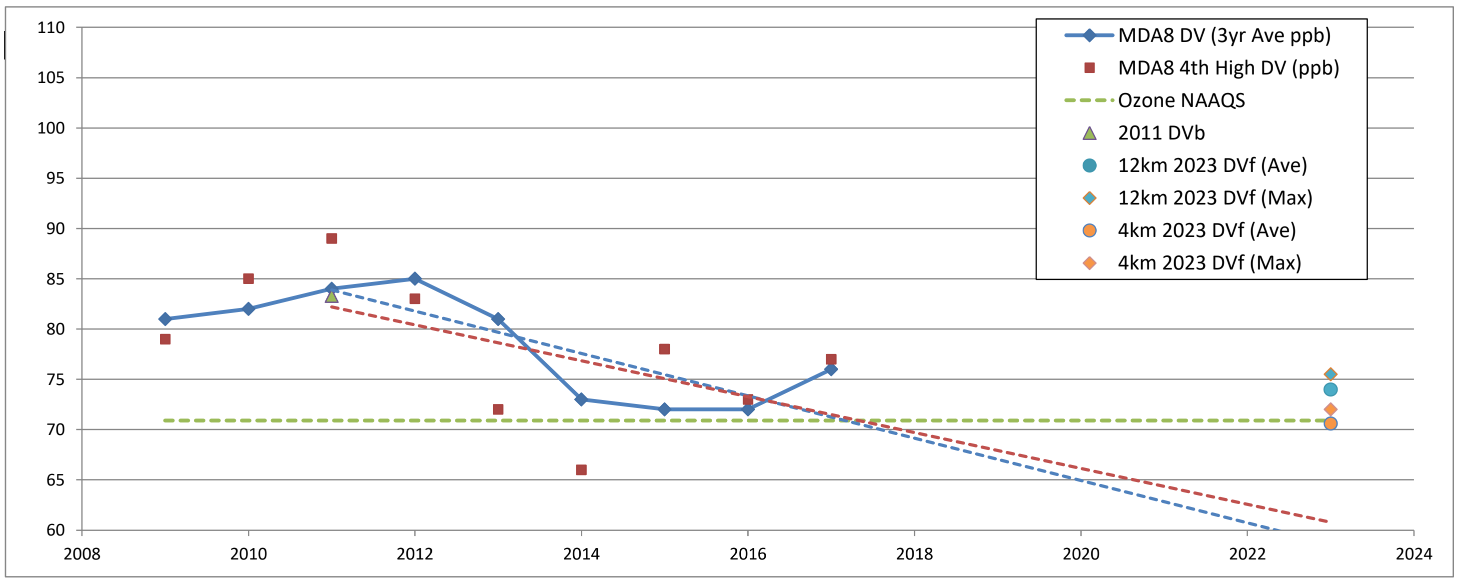
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
81	82	84	85	81	73	72	72	76

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
79	85	89	83	72	66	78	73	77	-1.79

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
16	12	5	0	7	4	7	-1.46



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.49	0.64	0.69	1.76	6.86	0.81	0.39
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	0.64	1.15	0.93	2.34	4.32	0.65	

Appendix B

Projected Nonattainment Monitors

Monitor 551170006 **Sheboygan, Wisconsin**

CSAPR Closeout Modeling Results (MDA8 ppb) | **Alternate Base Year Period DVf (ppb)**

2011 DVb		12km 2023 DVf (Ave)	12km 2023 DVf (Max)		4km 2023 DVf (Ave)	4km 2023 DVf (Max)		4km 2023 DVf (2009/11)	4km 2023 DVf (2010/12)	4km 2023 DVf (2011/13)
84.3		72.8	75.1		71.5	73.8		68.7	73.8	72.1

MDA8 DV (3yr Ave ppb)

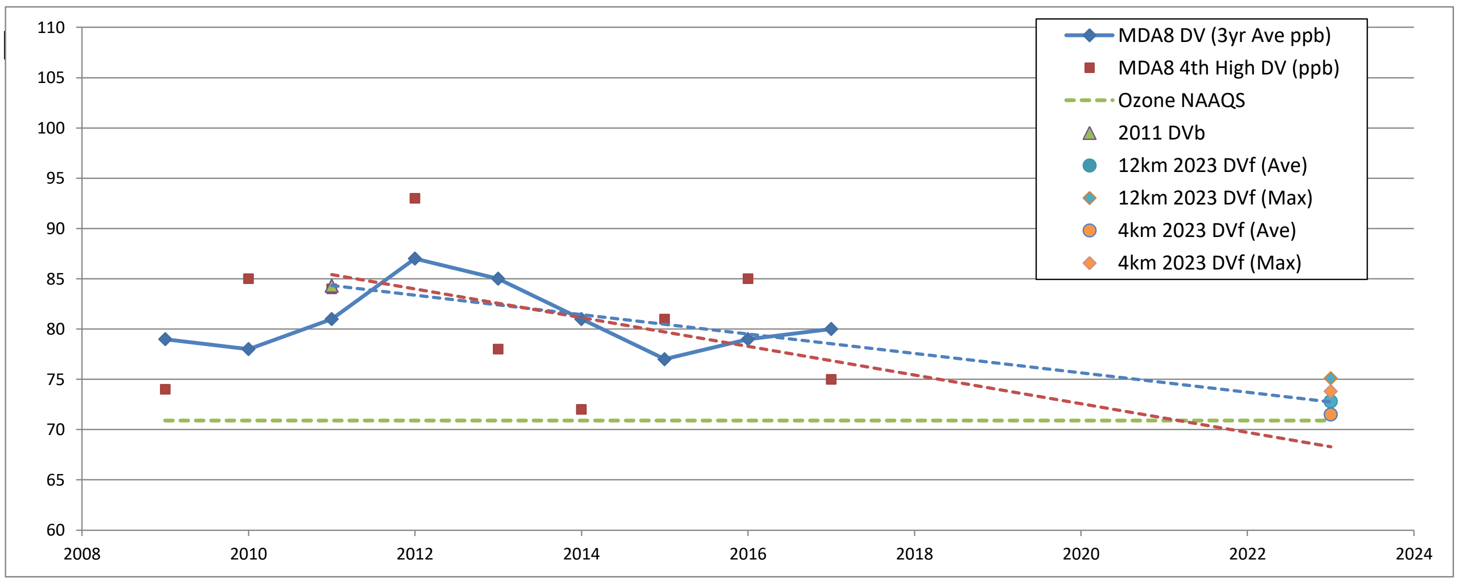
2007-09	2008-10	2009-11	2010-12	2011-13	2012-14	2013-15	2014-16	2015-17
79	78	81	87	85	81	77	79	80

MDA8 4th High DV (ppb)

2009	2010	2011	2012	2013	2014	2015	2016	2017	4th High DV Slope 2011-2017
74	85	84	93	78	72	81	85	75	-1.43

Number of Daily Exceedances of 70 ppb NAAQS

2011	2012	2013	2014	2015	2016	2017	# of Exceedances Slope 2011-2017
13	35	10	4	11	11	13	-1.68



Significant Contribution (ppb) from Key MOG States

Modeling Run	KY	IL	IN	OH	PA	WV	MO
12km APCA (EPA)	0.81	15.73	7.11	1.10	0.41	0.64	1.37
4km OSAT (MOG; 4km Flexi-Nest; NE Only)	0.00	0.00	0.00	0.00	0.00	0.00	