

Good Neighbor SIP Discussion

October 24, 2014

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History

- Discussions began in December of 2013 with the petition for the addition of Illinois, Indiana, Kentucky, Michigan, North Carolina, Ohio, Tennessee, Virginia, and West Virginia to the Ozone Transport Region (176A)
- Further conversations in May of 2014 where Tad introduced the Good Neighbor SIP process to help with MD's ozone SIP due in June 2015
- Additional, regular conversations held regarding the modeling that has been conducted to support these two items

What Are We Trying To Resolve?

- MOG asked to conduct technical analyses to assist in the air quality assessment of an EGU optimization study
 - Run SCR/SNCR controls at optimized rates
 - Purpose to review controls to help MD reach attainment

Current Air Quality Observations

- We've now seen most recent 2014 ozone concentration data showing Harford, MD in attainment of the 75 ppb NAAQS
 - Many other northeastern monitors also attain 8hr ozone NAAQS

State	County	Site ID	4th Highest MDA8 (ppm)						8hr Ozone DV (ppm)	
			2009	2010	2011	2012	2013	2014*	2011-2013	2012-2014*
Maryland	Harford	240251001	0.083	0.096	0.098	0.086	0.072	0.067	0.085	0.075
Maryland	Harford	240259001	0.069	0.080	0.085	0.083	0.068	0.070	0.079	0.074

*Draft 4th high as of September 30, 2014

2014 Ozone Season Preview

- Look at preliminary (draft) 4th high 8hr ozone design value from AQS network
 - 122 eastern state monitors show nonattainment of 75ppb NAAQS with 2011-2013 DVs
 - 17 eastern state monitors (15 counties) remain in nonattainment with draft 2012-2014 DVs
 - No counties moved from attainment to nonattainment

Nonattainment Monitors with Draft 2012/2014 8hr Ozone DVs

State Name	County Name	AQS Site ID	2011-2013 Design Value (ppm)	2012-2014 Design Value* (ppm)
Connecticut	Fairfield	090013007	0.089	0.082
Michigan	Allegan	260050003	0.086	0.082
Connecticut	Fairfield	090010017	0.083	0.079
Indiana	LaPorte	180910005	0.083	0.079
Connecticut	Fairfield	090019003	0.087	0.079
Illinois	Lake	170971007	0.080	0.079
Michigan	Berrien	260210014	0.082	0.078
Ohio	Lake	390850003	0.080	0.078
Connecticut	New Haven	090099002	0.089	0.078
Connecticut	Middlesex	090070007	0.081	0.078
Michigan	Muskegon	261210039	0.081	0.078
Connecticut	Tolland	090131001	0.077	0.078
Maryland	Cecil	240150003	0.082	0.078
Connecticut	New London	090110124	0.084	0.077
Missouri	Saint Charles	291831002	0.082	0.076
Maryland	Prince George's	240338003	0.081	0.076
Illinois	Cook	170310032	0.080	0.076

*Using draft 4th highest ozone concentrations as of September 30, 2014

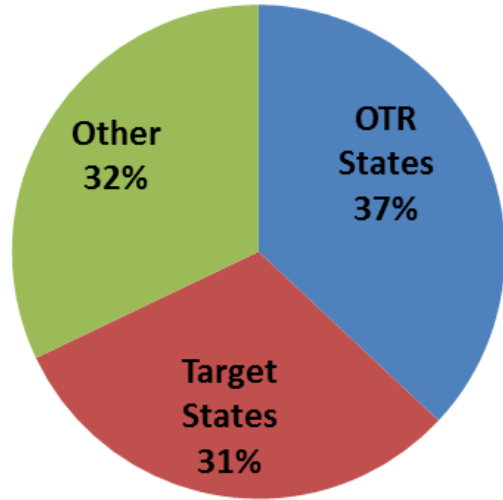
176A Petition State Monitors

Recent 8hr Ozone Design Values

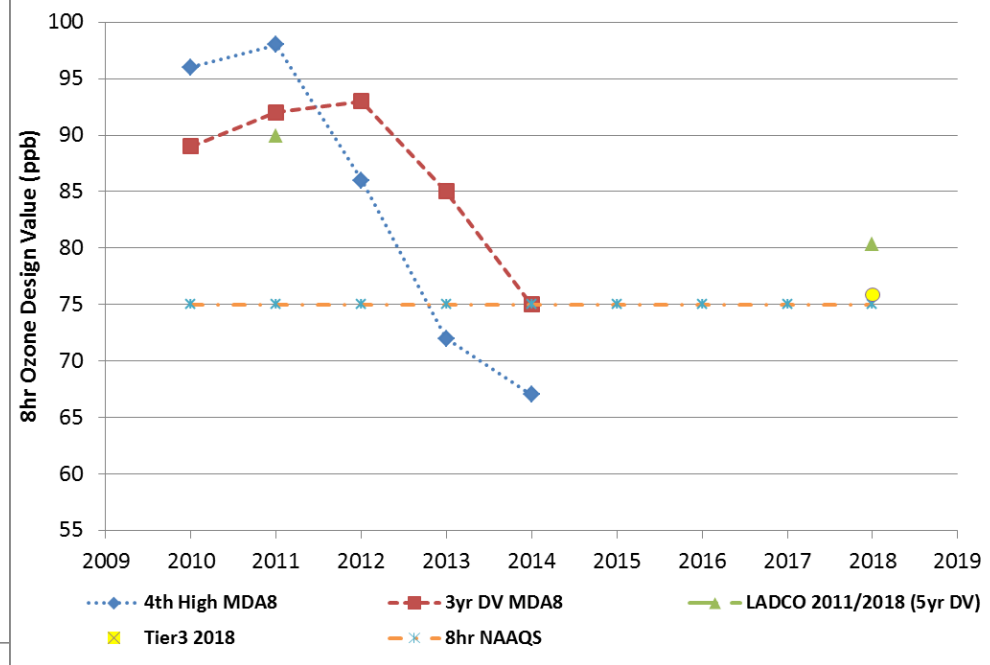
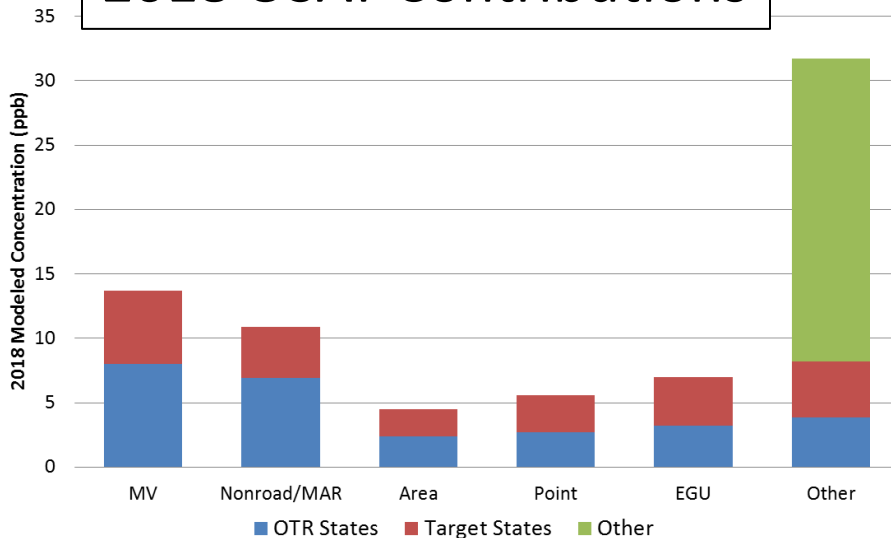
Monitor	County	4th Highest MDA8 (ppb)				3yr Design Value (ppb)			
		2011	2012	2013	2014*	2011	2012	2013	2014*
240251001	Harford, Maryland	98	86	72	67	92	93	85	75
361030002	Suffolk, New York	89	83	72	61	84	85	87	72
90019003	Fairfield, Connecticut	87	89	86	61	79	85	87	79
421010024	Philadelphia, Pennsylvania	89	85	68	66	83	87	80	73
340150002	Gloucester, New Jersey	92	87	73	66	82	87	84	75
250070001	Dukes, Massachusetts	78	82	65	58	76	80	75	68
440090007	Washington, Rhode Island	74	82	79	60	73	78	78	74
100031007	New Castle, Delaware	78	82	62	71	75	80	74	72
330074001	Coos, New Hampshire	68	71	69	65	69	70	87	68
500030004	Bennington, Vermont	59	67	62	50	65	64	62	60

* As of 30 Sept 2014

Ozone Metrics - Harford, MD

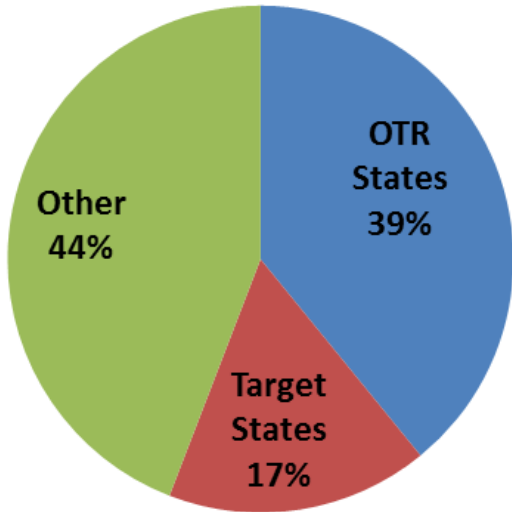


2018 OSAT Contributions

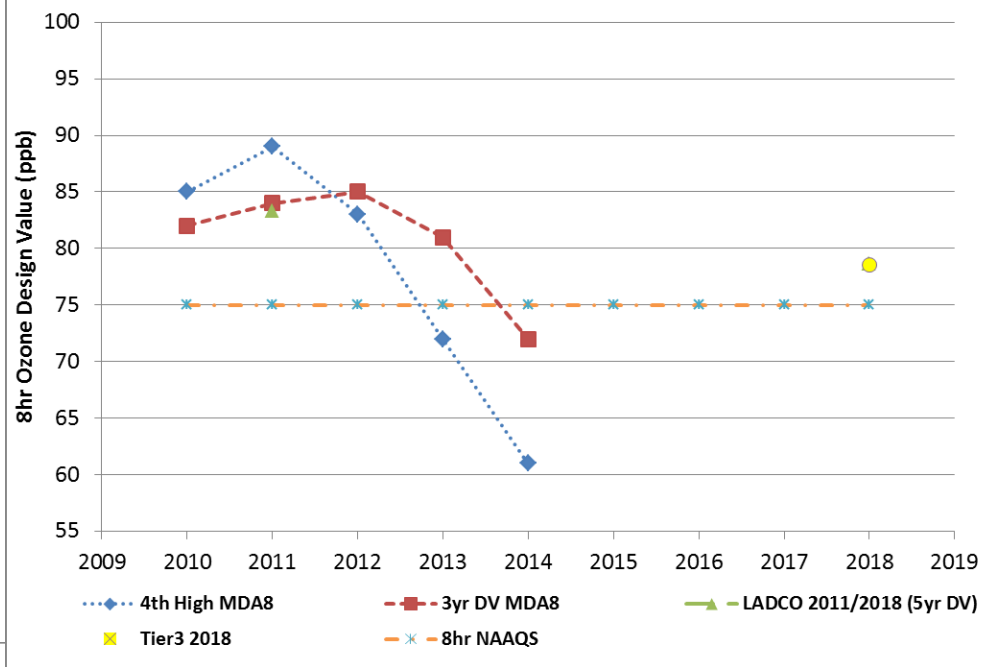
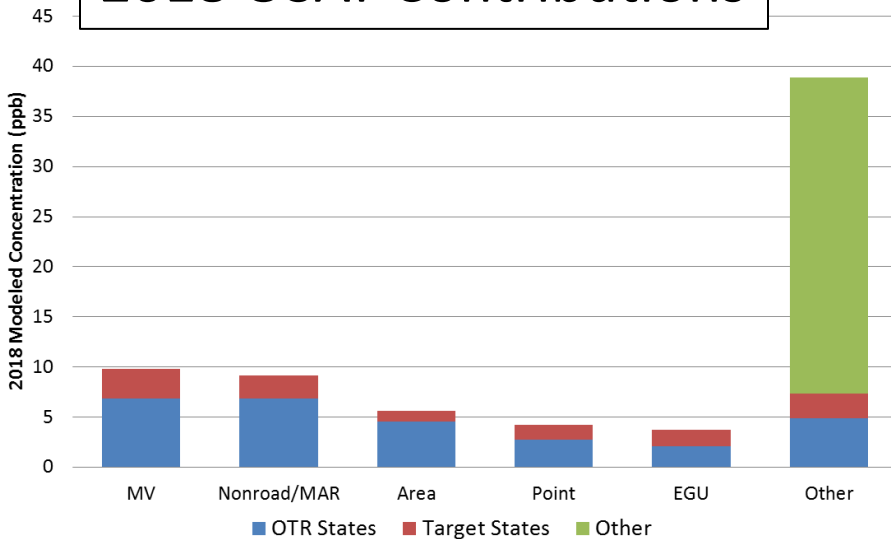


Results based on EPA published ozone 8-hr ozone design values and ozone source apportionment modeling from LADCO/IPM 2018 air quality simulations

Ozone Metrics – Suffolk, NY

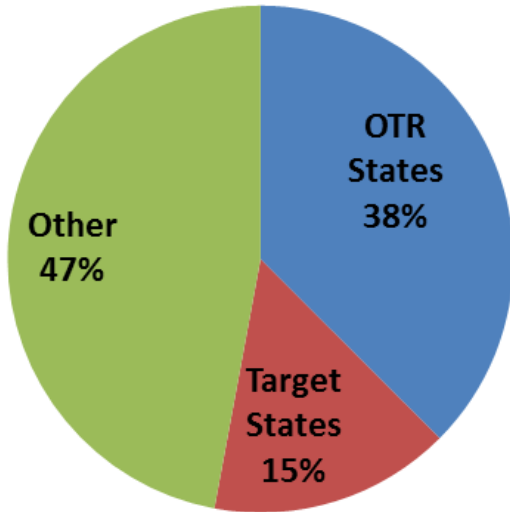


2018 OSAT Contributions

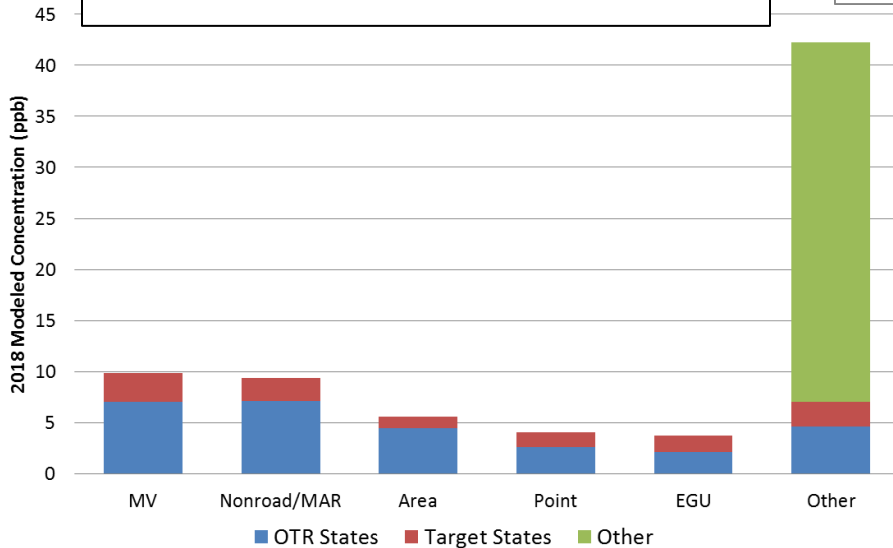
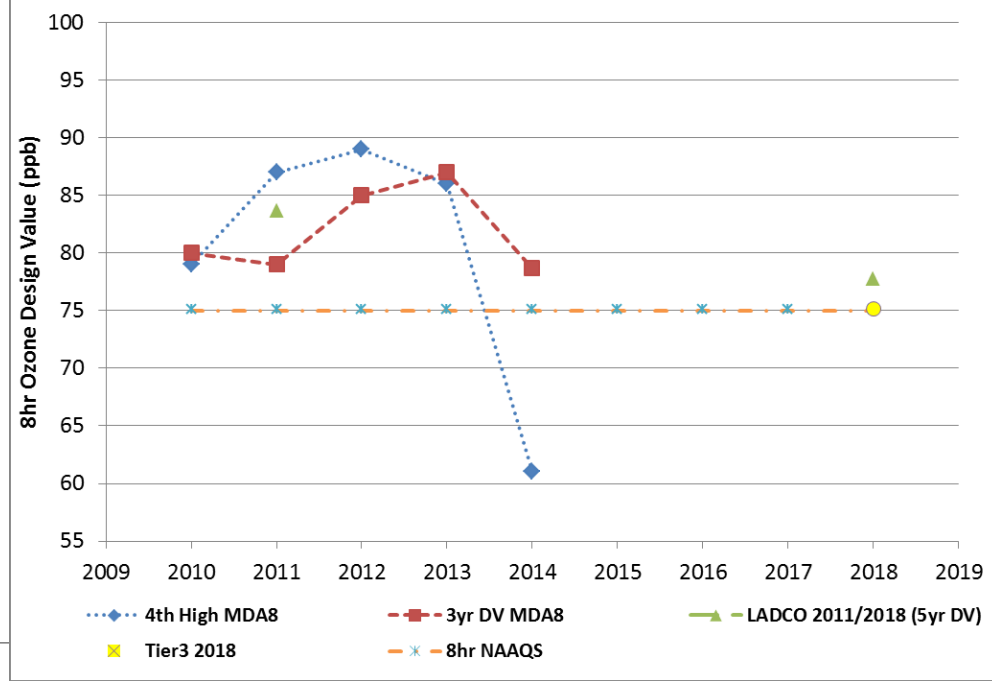


Results based on EPA published ozone 8-hr ozone design values and ozone source apportionment modeling from LADCO/IPM 2018 air quality simulations

Ozone Metrics – Fairfield, CT

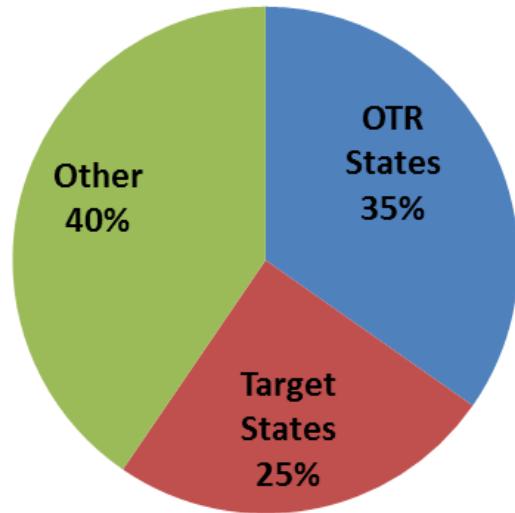


2018 OSAT Contributions

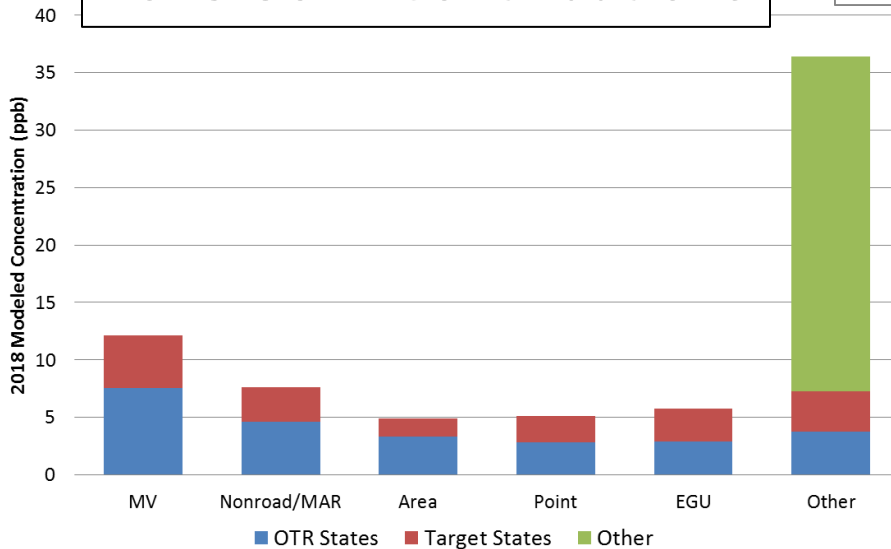
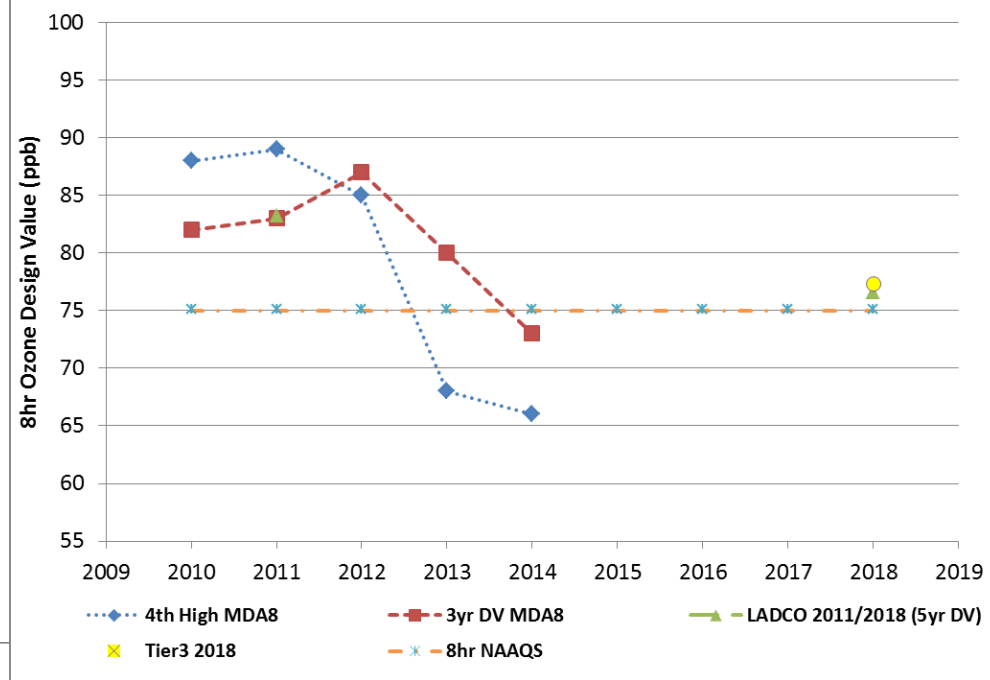


Results based on EPA published ozone 8-hr ozone design values and ozone source apportionment modeling from LADCO/IPM 2018 air quality simulations

Ozone Metrics – Philadelphia, PA

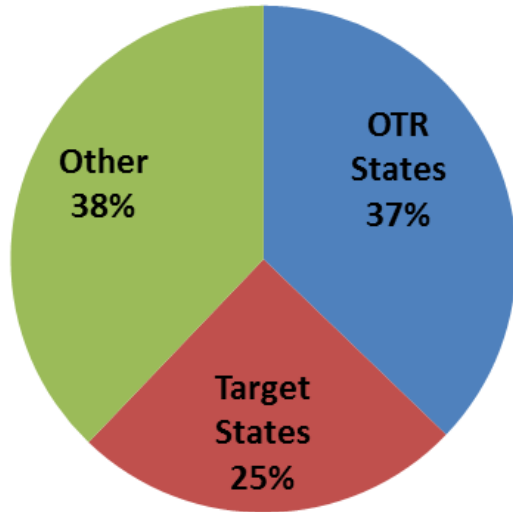


2018 OSAT Contributions

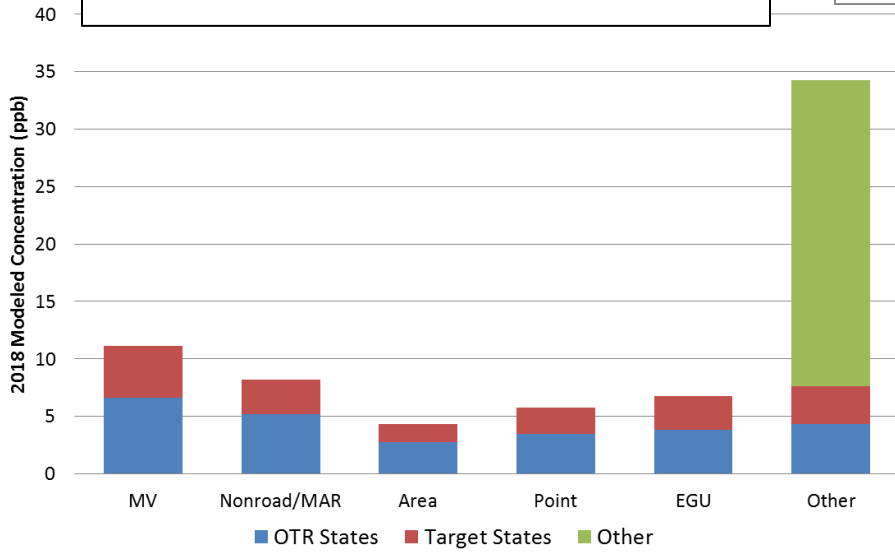
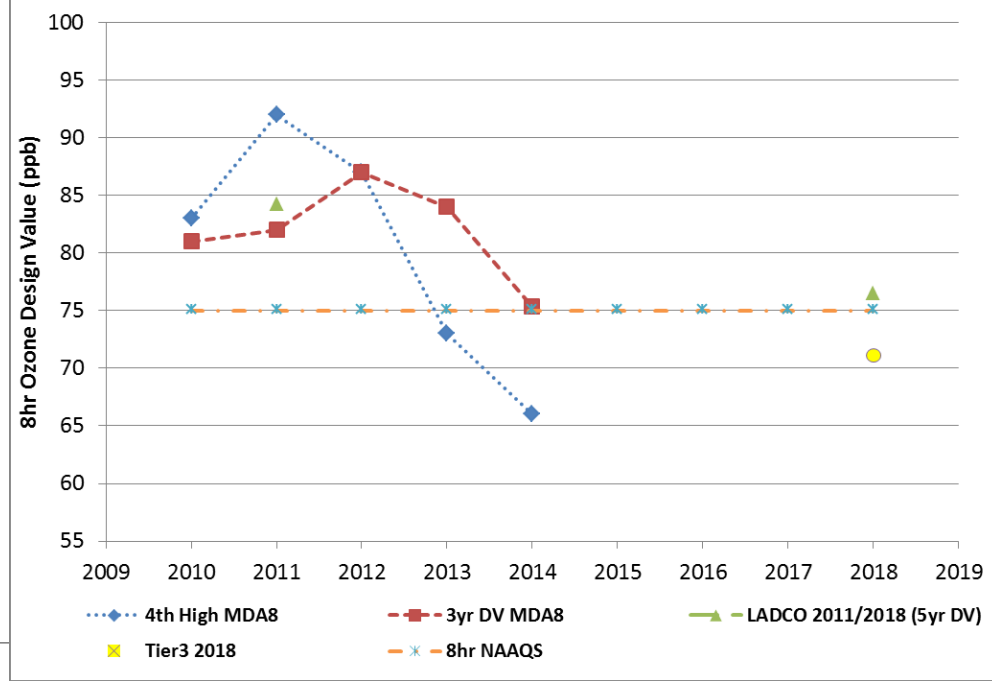


Results based on EPA published ozone 8-hr ozone design values and ozone source apportionment modeling from LADCO/IPM 2018 air quality simulations

Ozone Metrics – Gloucester, NJ



2018 OSAT Contributions



Results based on EPA published ozone 8-hr ozone design values and ozone source apportionment modeling from LADCO/IPM 2018 air quality simulations

MD's Good Neighbor Optimization

- MD picked 11 states
 - IL, IN, KY, MD, MI, NC, OH, PA, TN, VA, and WV
 - Optimized SCR/SNCR to lowest rate since 2005
 - MD predicts 0.9 ppb improvement in 2018 with lowest rate optimization across all states

3rd Lowest Rate Optimization

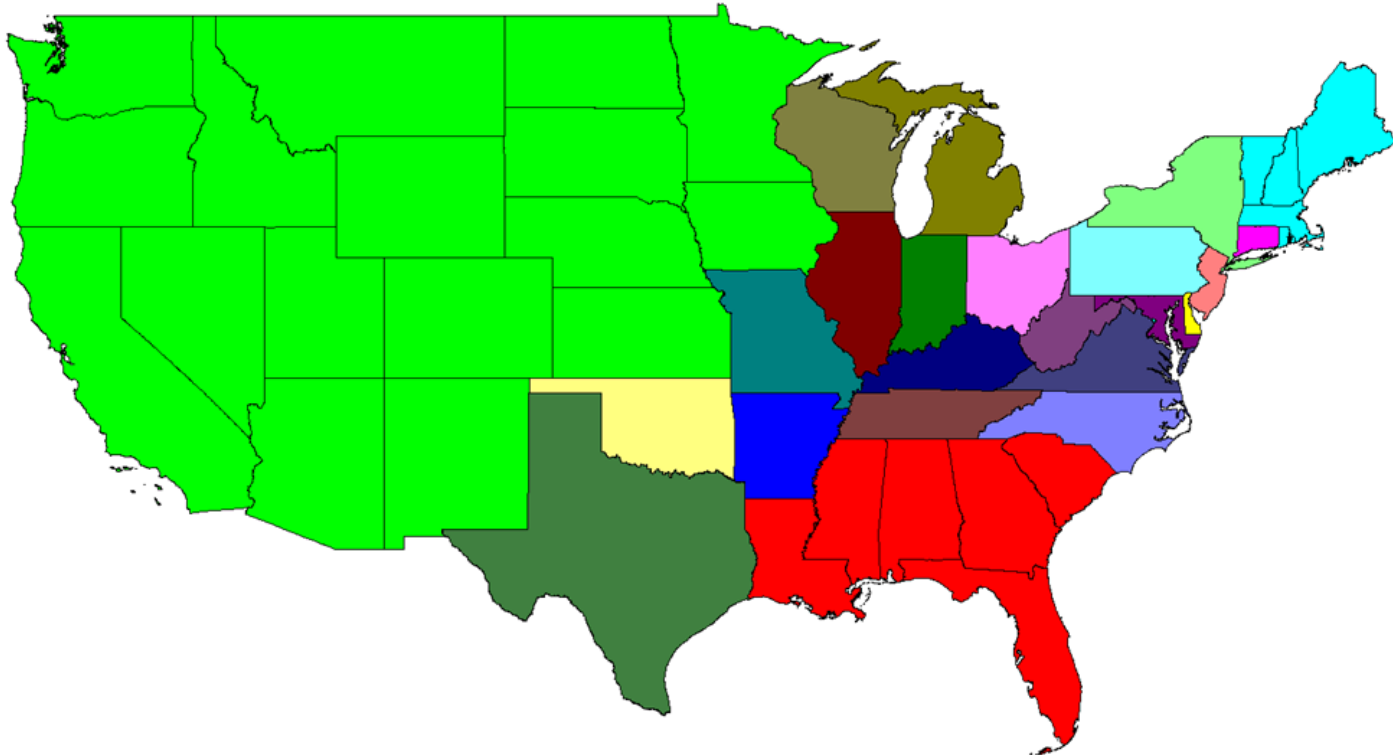
- Developed list of SCR/SNCR units based on CEM data reporting
- Looked at 3rd lowest rate for optimization
 - Both SCR/SNCR results
 - Presumption that lowest rate occurs immediately after installation
 - 3rd lowest rate allows for full year of operation after installation and company optimization of controls

Emission / Air Quality Relationships

- Ratio development calculation relating 2011 ozone season summer episode (June through August) NO_x emissions from EGU sources within each State to its ozone concentration air quality contribution at downwind monitors
- Designed to establish a NO_x emissions to ozone concentration ratio that will be used in later stages of the analysis

Base Year Source-Receptor Analyses

- Base year (2011) APCA/OSAT to develop ozone source-receptor relationship data from CAMx simulation



Concentration to Tons Ratio Calculation

Region	2011 NOx Tons	Design Value Adjusted (ppb)			ppb/ton Ratio
		EGU	Total	% of Total	
IL	19,436	0.33	1.67	1.86%	1.69E-05
IN	35,559	0.47	2.35	2.61%	1.34E-05
KY	25,905	0.32	1.59	1.77%	1.22E-05
MD	5,420	2.43	18.77	20.85%	4.48E-04
MI	22,130	0.26	1.99	2.21%	1.17E-05
NC	15,313	0.15	1.18	1.31%	9.60E-06
OH	29,847	0.66	5.38	5.98%	2.20E-05
PA	43,507	2.46	9.25	10.28%	5.66E-05
TN	8,342	0.08	0.76	0.84%	9.49E-06
VA/DC	11,014	0.69	6.38	7.08%	6.26E-05
WV	16,496	0.84	2.49	2.76%	5.07E-05
Grand Total		10.23	90.00	100.00%	

- Each ton of NOx from all EGUs in upwind State is calculated to have an impact on downwind monitor
- Assumption that each ton of NOx reduced from upwind state EGUs will reduce downwind monitor ozone concentration by this amount

Emission Inventory Assessment

- Match 2011 modeling platform of EGU emissions to CAMD reported metadata and identify which units have post-combustion NO_x control (SCR / SNCR) installed for operation
- Using other historical CAMD data (ozone season 2005-2013 emission and operating reports), we made a preliminary determination as to which units in 2011 were operating these post-combustion controls during the summer episode

SCR/SNCR - Top Reducing Units

				2011 Ozone Season		NOx Rate		NOx Reduction (Tons)	
				NOx Rate	NOx	(lbs/MMBtu)			
				(lbs/		3 rd			
State	Facility	ORIS	UNIT	MMBtu)	(Tons)	Lowest	Lowest	Lowest	3 rd Lowest
PA	Keystone	3136	2	0.364	5,044.3	0.043	0.045	-4,444.3	-4,415.2
PA	Keystone	3136	1	0.374	4,854.6	0.043	0.052	-4,294.7	-4,177.8
PA	Montour	3149	1	0.331	3,298.4	0.058	0.084	-2,720.1	-2,465.3
OH	W H Zimmer	6019	1	0.217	3,559.5	0.056	0.075	-2,638.4	-2,338.4
PA	Montour	3149	2	0.316	3,132.2	0.058	0.094	-2,559.4	-2,203.7
KY	Paradise	1378	3	0.332	2,431.2	0.100	0.108	-1,698.0	-1,640.2
IN	Gibson	6113	2	0.226	2,043.4	0.067	0.098	-1,437.0	-1,163.5
WV	Harrison Power Station	3944	3	0.214	1,834.2	0.066	0.072	-1,269.7	-1,213.9
IN	Gibson	6113	1	0.182	1,504.5	0.034	0.071	-1,221.1	-917.1
WV	Harrison Power Station	3944	2	0.201	1,774.7	0.066	0.080	-1,190.9	-1,072.7
WV	Harrison Power Station	3944	1	0.191	1,698.4	0.063	0.079	-1,134.2	-997.2
IL	Kincaid Station	876	2	0.204	1,566.7	0.060	0.062	-1,104.9	-1,086.4
PA	Hatfield's Ferry Station	3179	3	0.439	2,848.0	0.270	0.368	-1,098.9	-466.4
PA	Cheswick	8226	1	0.235	1,690.0	0.090	0.171	-1,043.4	-462.8

Emission/Air Quality Change Calculation

- Calculate the State-level difference in EGU NO_x emissions resulting from the application of post-combustion NO_x control compared to actual 2011 operations
 - in cases where post-combustion control was already in operation at lowest rates or units are not identified to have SNCR/SCR installed, this value will be zero
- Apply this value to each State-monitor where we have generated an emissions to air quality change ratio

SCR & SNCR Optimization

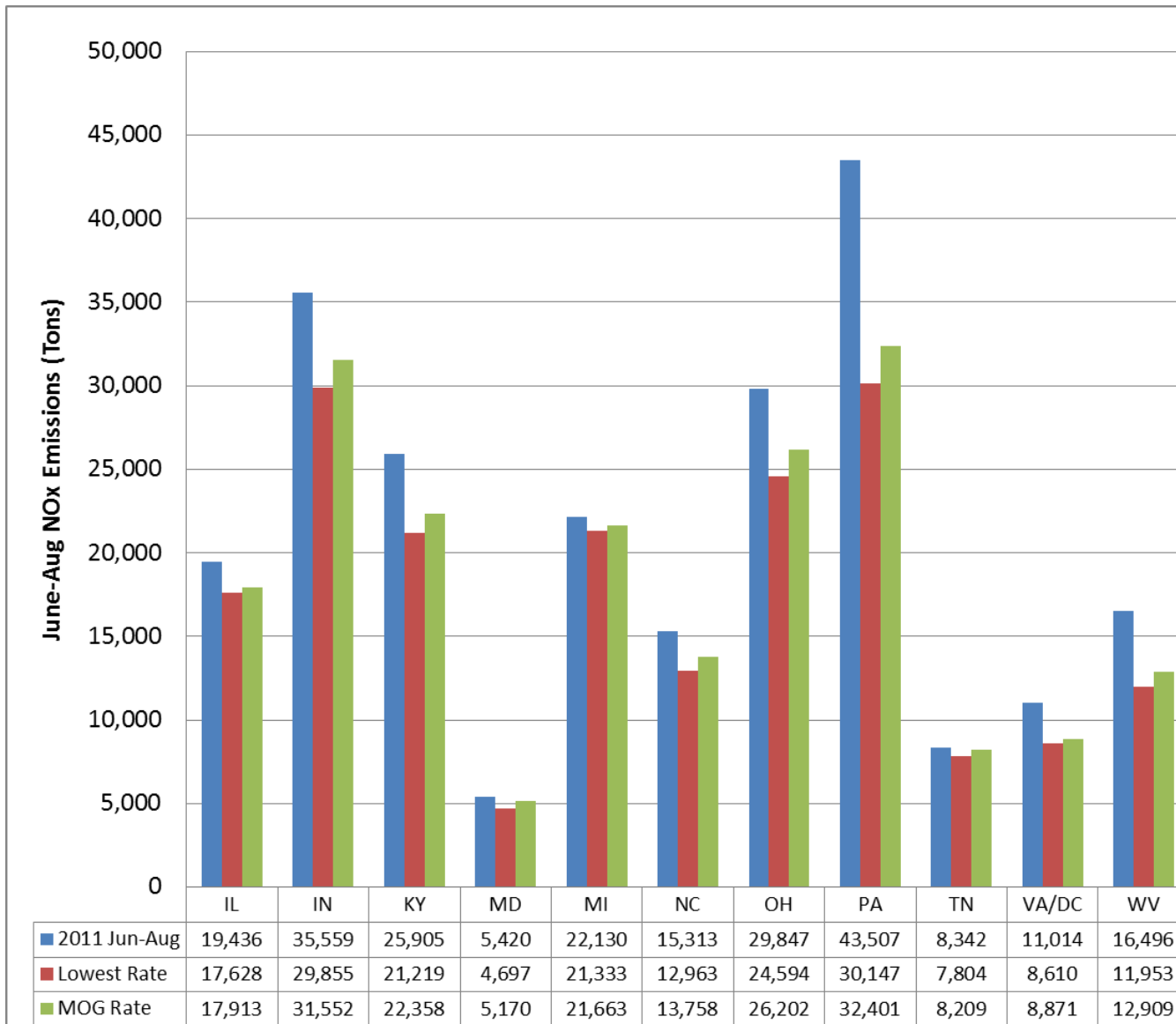
May-Sept Application

State	2011 Ozone Season		2005-2013		Lowest Rate	3rd Low Rate
	NOx Rate (lbs/MMBtu)	NOx Emissions (Tons)	Lowest NOx Rate	3rd Lowest Rate	NOx Tons Difference	NOx Tons Difference
PA Total	0.242	34,730.2	0.095	0.120	-21,095.2	-17,574.6
IN Total	0.160	20,225.2	0.086	0.108	-9,300.5	-6,522.1
OH Total	0.131	24,554.4	0.087	0.100	-8,178.3	-5,742.7
KY Total	0.119	15,866.3	0.068	0.082	-6,867.0	-5,001.8
WV Total	0.100	14,418.9	0.053	0.063	-6,789.0	-5,300.2
VA Total	0.235	9,660.9	0.130	0.141	-4,304.0	-3,867.2
NC Total	0.127	16,479.5	0.097	0.109	-3,880.5	-2,342.5
IL Total	0.097	7,592.7	0.058	0.064	-3,021.7	-2,569.0
MI Total	0.115	5,652.3	0.088	0.100	-1,292.0	-716.4
MD Total	0.154	7,353.2	0.129	0.144	-1,194.0	-481.1
TN Total	0.093	7,102.8	0.081	0.090	-886.0	-210.4
Grand Total	0.141	163,636.3	0.084	0.098	-66,808.1	-50,328.1

Optimization Application

- Calculation at each monitor was conducted for each upwind State with ozone contribution (significant or not)

June-August Optimization NOx All EGU Emissions



June – August Optimization Ozone Harford, MD Monitor

Region	Lowest Rate Strategy (ppb)					3rd Lowest Rate Strategy (ppb)				
	Tons Red	EGU	Delta	Total	% of Total	Tons Red	EGU	Delta	Total	% of Total
IL	-1,808	0.30	0.03	1.64	1.86%	-1,522	0.30	0.03	1.65	1.86%
IN	-5,704	0.40	0.08	2.28	2.58%	-4,007	0.42	0.05	2.30	2.59%
KY	-4,687	0.26	0.06	1.54	1.74%	-3,547	0.27	0.04	1.55	1.75%
MD	-723	2.11	0.32	18.44	20.90%	-249	2.32	0.11	18.65	21.03%
MI	-797	0.25	0.01	1.98	2.24%	-467	0.25	0.01	1.98	2.24%
NC	-2,349	0.12	0.02	1.15	1.31%	-1,554	0.13	0.01	1.16	1.31%
OH	-5,254	0.56	0.10	5.28	5.98%	-3,645	0.58	0.08	5.30	5.98%
PA	-13,360	1.71	0.76	8.49	9.62%	-11,107	1.84	0.63	8.62	9.71%
TN	-538	0.07	0.01	0.75	0.85%	-133	0.08	0.00	0.76	0.85%
VA/DC	-2,404	0.54	0.15	6.23	7.06%	-2,143	0.56	0.13	6.24	7.04%
WV	-4,543	0.61	0.23	2.26	2.56%	-3,587	0.65	0.18	2.31	2.60%
Grand Total	-42,166	8.47	1.76	88.24	100.00%	-31,962	8.95	1.28	88.72	100.00%

Air Quality Effectiveness Calculation

- Apply emission change to each State-monitor and generate an emissions to air quality change ratio
- From optimization results, developed EGU reduction effectiveness factor from 2011 modeling and OSAT results
 - Looks at effectiveness of ton reduced on downwind ozone concentration change
 - Calculated for each monitor

OSAT/ Reduction Efficiency (SCR/SNCR)

Jun-Aug 2011 Optimization

Harford, MD Monitor

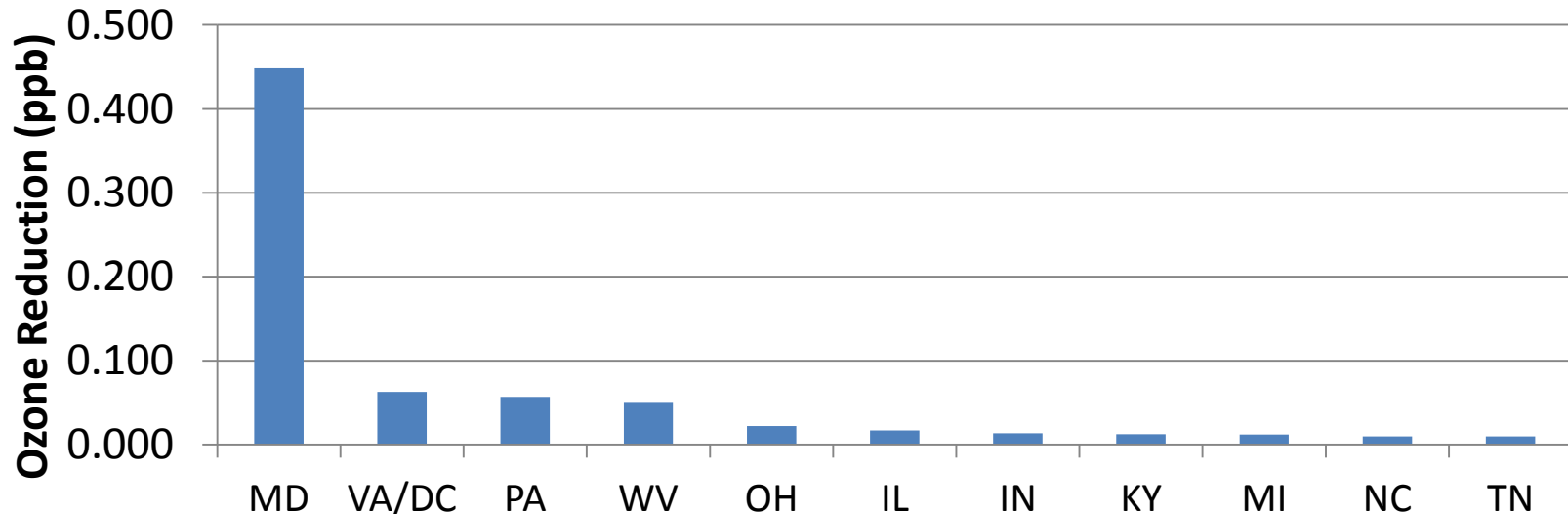
State	NOx Tons Reduced	Change in O3 (ppb)	Efficiency Factor ppb/ton red
PA	11,107	0.63	5.66E-05
WV	3,587	0.18	5.07E-05
VA/DC	2,143	0.13	6.26E-05
MD	249	0.11	4.48E-04
OH	3,645	0.08	2.20E-05
IN	4,007	0.05	1.34E-05
KY	3,547	0.04	1.22E-05
IL	1,522	0.03	1.69E-05
NC	1,554	0.01	9.60E-06
MI	467	0.01	1.17E-05
TN	133	0.00	9.49E-06
Total	31,962	1.28	

Compare total 2011 reduction of 1.28 ppb with MD estimate of 0.9 ppb in 2018.
 MD/PA comprise 58% (0.74 ppb) of ozone reduction under 3rd lowest rate strategy.

Efficiency Comparison

- Optimization of EGU controls in MD has almost an order of magnitude greater impact on Harford monitor than any other state

**Ozone ppb Decrease with
1,000 Ton EGU Reduction**



2018 Attainment Results

- Ran EPA attainment model (MATS) on LADCO 2018 modeling platform
 - Based on EPA EGU modeling with IPM
 - Includes results of onroad Tier3 NPRM
 - Compare to final Tier3 EPA dv modeling, MD scenario application, current draft 3yr dvs

2018 Ozone DVs

Eastern US Modeling Domain

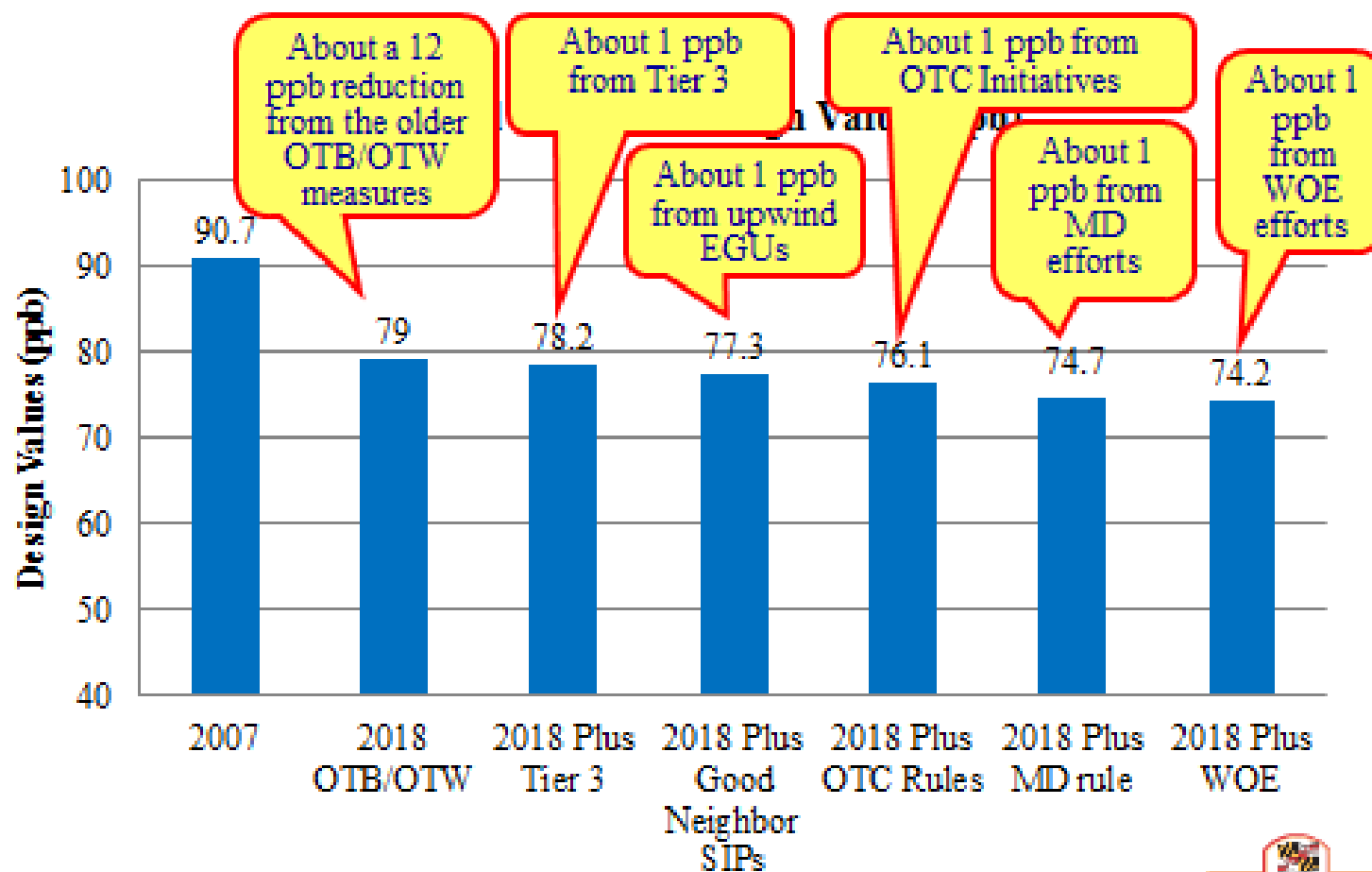
Location	LADCO Modeling DV (ppb)	Tier3	MD 3C	2012-14 3yr DV
	2011 DV	2018 DV	2018 DV	
Harford, Maryland	90.0	80.4	75.87	75
Suffolk, New York	83.3	78.7	78.52	
Fairfield, Connecticut	83.7	77.8	75.16	
New Haven, Connecticut	85.7	77.8	72.28	
Sheboygan, Wisconsin	84.3	77.0	71.57	
Philadelphia, Pennsylvania	83.3	76.6	77.32	
Gloucester, New Jersey	84.3	76.5	71.13	
Hamilton, Ohio	82.0	76.2	71.57	
Jefferson, Kentucky	82.0	76.0	69.25	
Wayne, Michigan	78.7	75.8	74.13	
Saint Charles, Missouri	82.3	75.6	72.56	
Allegan, Michigan	82.7	75.5	74.44	
Allegheny, Pennsylvania	80.7	74.9	72.91	
Franklin, Ohio	80.3	74.7	70.71	
Oldham, Kentucky	82.0	74.6	66.48	
Arlington, Virginia	81.7	74.0	69.43	
Fairfax, Virginia	82.3	74.0	69.25	
Cecil, Maryland	83.0	73.8	72.82	

MD 2018 results lower than LADCO or Tier3
Why?

MD's Path to Attainment



Where do the Benefits Come From

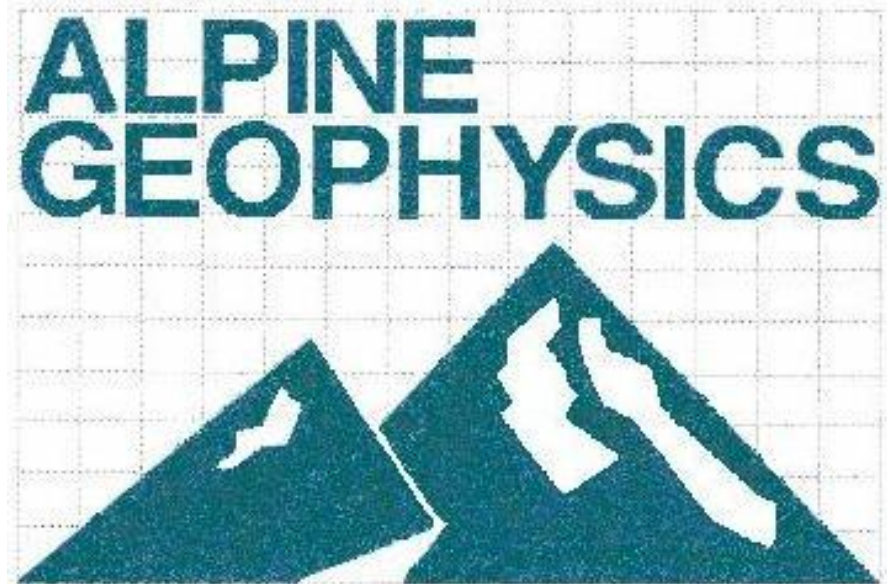


“The Bottom Line”

<u>Case / Strategy</u>	<u>Reduction</u>	<u>Ozone dv</u>	
<i>MD 2018 DV</i>		<i>79 ppb</i>	
Tier 3	~ 0.8 ppb	78.2	
Add'l OTR Measures	~ 1.2	77.0	
Add'l MD Only Controls	~ 1.4	75.6	<- Already Attainment
EGU Optimized (MD/PA)	~ 0.5	75.1	58% of Total Optimization
Attainment achieved without Upwind State Controls			
EGU Optimized (Upwind)	~ 0.4	74.7	
<i>MD 2018 Scenarios DV</i>		<i>74.7</i>	
WOE	~ 0.5		
MOVES2014/MEGAN	Lower (?)		
PA NOx RACT	Lower		
Unit Retirements	Lower		

Conclusions

- Current Harford monitoring data points to attainment of 75 ppb NAAQS
- 2018 modeling data projects Harford attainment without additional upwind controls
- Is there other justification for upwind control?



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