CSAPR Remand Red Line Analysis

Gregory Stella
Alpine Geophysics, LLC

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Presentation Outline

- Introduction
- Court Opinion
- Example Calculation
- Findings and Other Considerations

Introduction

- The following presentation summarizes a potential technical approach regarding possible responses to the U.S. Court of Appeals' opinion on the Cross-State Air Pollution Rule
- The opinion confirmed that downwind States have primary responsibility for attaining NAAQS within their borders
- The opinion then turned to what obligation, if any, upwind States might have with respect to reducing their contribution to the air quality in downwind nonattainment areas under "good neighbor" provisions of the Clean Air Act

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Analysis Purpose

- To apply court red lines to an example data set in an attempt to illustrate how reduction requirements for upwind states on downwind monitors using EPA approved methods and models
- All data and results presented are for illustrative purposes and are not offered as a final solution
- Integrate latest 8hr ozone design values and recent available 2014/2018 CAIR modeling to demonstrate application options with EPA's attainment test software and 2010 OSAT modeling results
- Determine if other issues are encountered with attempting to solve the problem

CSAPR Remand

- The U.S. Court of Appeals for the District of Columbia Circuit Aug. 21 vacated EPA's Cross-State Air Pollution Rule (CSAPR) in the suit EME Homer City Generation L.P. v. EPA
- Court found that EPA exceeded its Clean Air Act authority in part when it required upwind states to reduce emissions by more than their own significant contributions to a downwind State's nonattainment
- Court opinion provides bases for several rules to be applied to determining how "good neighbor" provisions are to be applied

Basic rule

- Court opinion – EPA has authority to require upwind States to reduce only their own significant contributions to a downwind State's nonattainment (p.7)

- Implications – An upwind State's obligation is limited to its own significant contribution and it cannot be directed to reduce emissions to account for any other factors impacting a downwind State's nonattainment. Any residual contribution becomes the responsibility of the downwind State.

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Proportionality of Downwind State

- Court opinion – If the downwind State's contribution alone would push it above the NAAQS, then the entire above-NAAQS amount cannot be attributed only to upwind States (p.27). EPA must factor in how much of the above-NAAQS amount comes from the downwind State itself (p.38).

- Implications – A downwind State is responsible for that portion of the above-NAAQS amount that is not attributable to significant contributions from upwind States

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Proportionality of Upwind States

- Court opinion – The collective burden must be allocated among the upwind States in proportion to the size of their contributions to the downwind State nonattainment (pp. 25-26)

- Implications – The ratio of an individual upwind State contribution to the total contribution used as scalar to determine allocations

The Role of Costs

- Court opinion – EPA may lower an upwind State's obligation in order to prevent unreasonably high costs from being imposed, and EPA may do so in a way that benefits some upwind States more than others (p. 27). An upwind State need not terminate a subset of its contribution if the cost to do so is unreasonable (Michigan v. EPA)

- Implications – EPA may reduce some or all of the obligations of upwind States to prevent the imposition of unreasonable costs

Insignificance

- Court opinion – An upwind State may not be forced to reduce more than its own contribution to a downwind State minus the insignificance amount (p.24)

- Implications – Once allocations are made, a State is not required to reduce more than that contribution amount minus the significance threshold

NAAQS Attainment

- Court opinion – An upwind State's obligation to reduce its contribution ends at the point where the affected downwind State achieves attainment (p. 25)

- Implications – Once an area meets the NAAQS, no additional upwind reductions are required

Over-Control

- Court opinion – Even in a situation involving a single upwind State affecting multiple downwind States (where it may not be possible to accomplish the rollback in an entirely proportional manner) EPA must avoid using the good neighbor provisions to unnecessarily over-control in downwind States (p. 29)

- Implications – When multiple downwind areas are concerned, reductions associated with one downwind area should be reviewed in other areas to ensure unnecessary over control is not achieved

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Technical Approach

- Obtained and integrated into EPA's attainment test software the most currently available 8-hr ozone design value data by monitor
- These data then used with previously generated modeling results from a base year 2008 and future year 2014 and 2018 CAIR control simulations to derive modeled design values for current ozone NAAQS
- Results of this analysis convey monitors and areas where future year modeling results in modeled nonattainment within the previously simulated 12km domain

CAIR Results (2014 & 2018)

			8hr Ozone Design Value (ppb)	
Monitor	**State**	**County**	**2008 dv**	**2014 dv**
240251001	Maryland	Harford	89.30	81.10
361030009	New York	Suffolk	84.00	78.20
420170012	Pennsylvania	Bucks	83.70	76.40
421010024	Pennsylvania	Philadelphia	83.00	76.10
340150002	New Jersey	Gloucester	82.00	75.90
390171004	Ohio	Butler	82.00	75.70
390610006	Ohio	Hamilton	80.30	75.10
90011123	Connecticut	Fairfield	81.70	74.90
340250005	New Jersey	Monmouth	80.00	74.80
551170006	Wisconsin	Sheboygan	79.30	74.40

			8hr Ozone Design Value (ppb)	
Monitor	**State**	**County**	**2008 dv**	**2018 dv**
240251001	Maryland	Harford	89.30	77.60
361030009	New York	Suffolk	84.00	75.60
340150002	New Jersey	Gloucester	82.00	72.50
340250005	New Jersey	Monmouth	80.00	72.40
420170012	Pennsylvania	Bucks	83.70	72.30
390171004	Ohio	Butler	82.00	72.20
421010024	Pennsylvania	Philadelphia	83.00	72.20
551170006	Wisconsin	Sheboygan	79.30	71.80
390610006	Ohio	Hamilton	80.30	71.60
90011123	Connecticut	Fairfield	81.70	71.00

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Red Lines Analysis Steps

- Step 1: Determine scaled CAIR design value (DV)
- Step 2: Apply OSAT data to DV from Step 1 to determine contribution from upwind States, downwind State, background
- Step 3: Using contributions from Step 2, determine what portion of any amount over DV is attributable solely to upwind States
- Step 4: Allocate upwind States' collective amount (Step 3) to each upwind State in proportion to their contribution to downwind DV (Step 2)
- Step 5: Select from among state allocations in Step 4, those upwind States that have contributions to the DV that exceed the significance level
- Step 6: Make appropriate adjustments to the subset of an upwind State's contribution as necessary to eliminate the imposition of unreasonable costs

Harford, MD Example

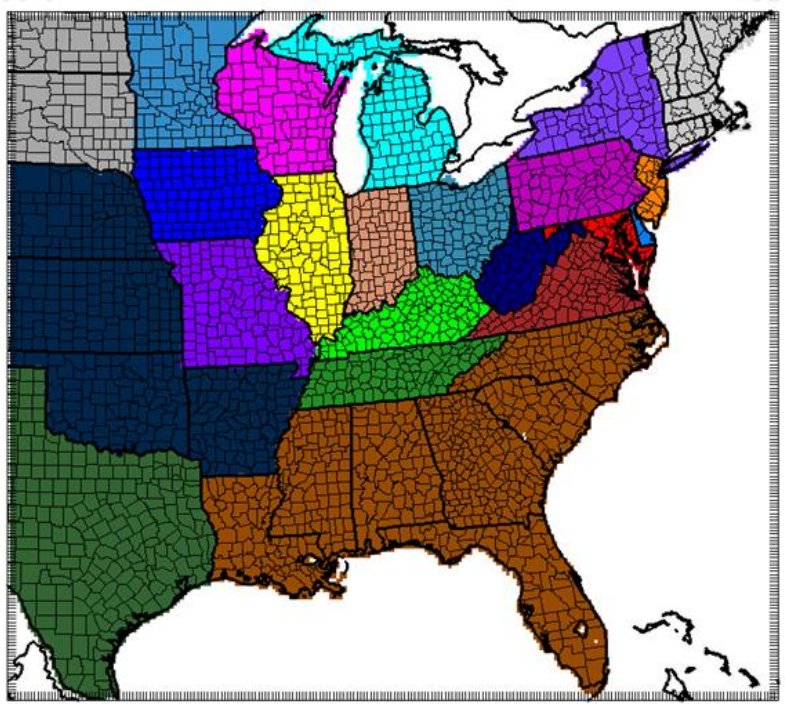
- 2018 CAIR projection of 77.6 ppb
- 8hr ozone NAAQS of 75 ppb
  - Attainment reached at 75.9 ppb
- Reduction to achieve NAAQS = 1.7 ppb

- Application: How do we assign required upwind area contribution reduction using CAIR DV and illustrative OSAT results?
  - Scale DV to modeled concentration and apply red lines to resulting contributions

OSAT Modeling

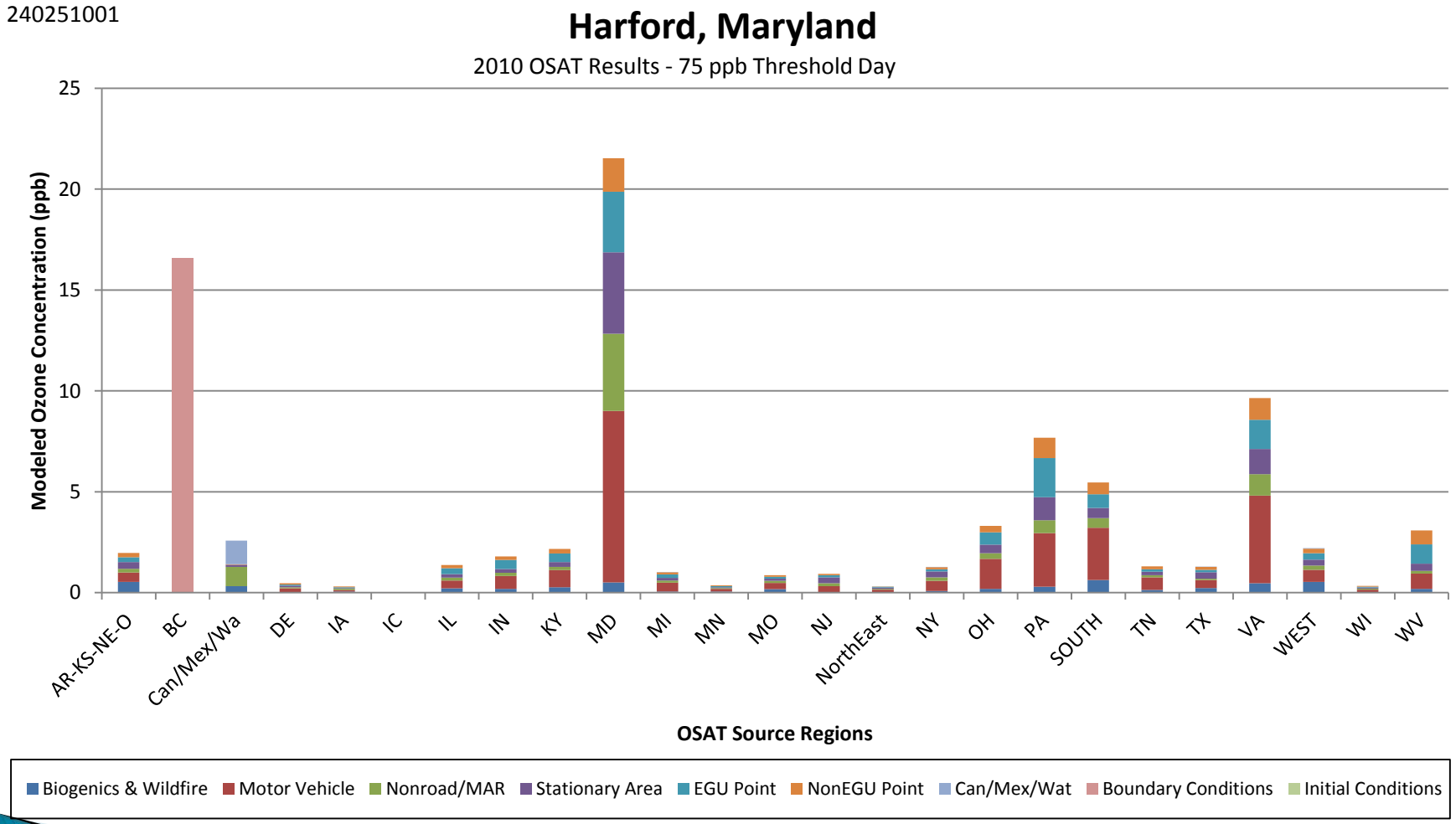
- Estimates the contributions of emissions from multiple source regions and categories to ozone concentrations at downwind receptors in a single model simulation

- 2010 base case simulation



OSAT Region/Source Contribution

240251001



Harford, MD OSAT Results

Monitor **240251001 Harford, Maryland**

	2010 Modeled Ozone Concentration Values (ppb)										OSAT Scaled	Anthro Scaled
Region	**Bio & Fire**	**MV**	**Nonroad**	**Area**	**EGU**	**Non-EGU**	**Can**	**BC**	**IC**	**Total**	**DV (ppb)**	**DV (ppb)**
AR-KS-NE-O	0.53	0.47	0.18	0.34	0.24	0.2	0	-	-	1.96	1.73	1.26
BC	0	0	0	0	0	0	0	16.58	-	16.58	14.65	14.65
Can/Mex/Wa	0.32	0	0.95	0.11	0	0.03	1.17	-	-	2.58	2.28	2.00
DE	0.01	0.2	0.06	0.08	0.05	0.07	0	-	-	0.47	0.42	0.41
IA	0.06	0.08	0.06	0.03	0.04	0.03	0	-	-	0.3	0.27	0.21
IC	0	0	0	0	0	0	0	-	0.01	0.01	0.01	0.01
IL	0.21	0.39	0.14	0.18	0.29	0.16	0	-	-	1.37	1.21	1.02
IN	0.19	0.63	0.17	0.18	0.45	0.18	0	-	-	1.8	1.59	1.42
KY	0.27	0.84	0.16	0.24	0.43	0.23	0	-	-	2.17	1.92	1.68
MD	0.5	8.51	3.82	4.04	3	1.67	0	-	-	21.54	19.03	18.59
MI	0.06	0.43	0.11	0.13	0.17	0.11	0.02	-	-	1.03	0.91	0.86
MN	0.05	0.13	0.05	0.04	0.05	0.04	0	-	-	0.36	0.32	0.27
MO	0.17	0.31	0.1	0.11	0.1	0.07	0	-	-	0.86	0.76	0.61
NJ	0.02	0.3	0.14	0.3	0.11	0.06	0	-	-	0.93	0.82	0.80
NorthEast	0.01	0.14	0.04	0.06	0.04	0.02	0	-	-	0.31	0.27	0.27
NY	0.08	0.5	0.18	0.29	0.11	0.1	0.02	-	-	1.28	1.13	1.06
OH	0.18	1.49	0.28	0.43	0.61	0.32	0	-	-	3.31	2.92	2.77
PA	0.29	2.66	0.64	1.14	1.94	1.01	0	-	-	7.68	6.79	6.53
SOUTH	0.63	2.59	0.48	0.5	0.68	0.58	0	-	-	5.46	4.82	4.27
TN	0.14	0.62	0.11	0.17	0.12	0.14	0	-	-	1.3	1.15	1.02
TX	0.23	0.39	0.07	0.32	0.12	0.14	0.01	-	-	1.28	1.13	0.93
VA	0.47	4.34	1.06	1.25	1.45	1.07	0	-	-	9.64	8.52	8.10
WEST	0.53	0.6	0.21	0.29	0.32	0.23	0.02	-	-	2.2	1.94	1.48
WI	0.03	0.12	0.05	0.05	0.04	0.04	0	-	-	0.33	0.29	0.27
WV	0.18	0.76	0.13	0.36	0.96	0.69	0	-	-	3.08	2.72	2.56
Grand Total	**5.16**	**26.5**	**9.19**	**10.64**	**11.32**	**7.19**	**1.24**	**16.58**	**0.01**	**87.83**	**77.60**	**73.04**

Red Highlighted values indicate >1% NAAQS significance level (0.75 ppb)

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Downwind State Responsibility

- Local Contribution
  - Maryland only
  - 18.59 ppb
- Background Contribution
  - IC/BC/Canada/Mexico/Water
  - 16.65 ppb
- Insignificant Contributors
  - Assume Western / Central States Included
  - 4.77 ppb
- Cost Excused Contributors
  - If any identified

Downwind State Responsibility (con't)

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- Does total of downwind state responsibility exceed NAAQS?
  - Background + local = 35.24 ppb
- If so, that entire above-NAAQS amount is sole responsibility of downwind state
- If not, the above-NAAQS amount is then subject to the following allocation /significance/cost analysis

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Proportionality of Contribution

- Determine the contribution from each State using ratio of individual State contribution to total contribution

- Contribution
  = Upwind + Downwind (incl. Background)
  = 73.04 ppb

Modeled Contribution

Monitor **240251001 Harford, Maryland**

Region	2010 Modeled Ozone Concentration Values (ppb) - Scaled									Anthro Scaled DV (ppb)	Percent Contribution to Concentration
	Bio & Fire	MV	Nonroad	Area	EGU	Non-EGU	Can	BC	IC		
MD	0.44	7.52	3.38	3.57	2.65	1.48	0.00	-	-	18.59	25.5%
Background											
BC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.65	-	14.65	20.1%
Can/Mex/Wa	0.28	0.00	0.84	0.10	0.00	0.03	1.03	-	-	2.00	2.7%
IC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.01	0.01	0.0%
Total										***16.65***	***22.8%***
Non-Significant											
AR-KS-NE-O	0.47	0.42	0.16	0.30	0.21	0.18	0.00	-	-	1.26	1.7%
DE	0.01	0.18	0.05	0.07	0.04	0.06	0.00	-	-	0.41	0.6%
IA	0.05	0.07	0.05	0.03	0.04	0.03	0.00	-	-	0.21	0.3%
MN	0.04	0.11	0.04	0.04	0.04	0.04	0.00	-	-	0.27	0.4%
MO	0.15	0.27	0.09	0.10	0.09	0.06	0.00	-	-	0.61	0.8%
NorthEast	0.01	0.12	0.04	0.05	0.04	0.02	0.00	-	-	0.27	0.4%
WEST	0.47	0.53	0.19	0.26	0.28	0.20	0.02	-	-	1.48	2.0%
WI	0.03	0.11	0.04	0.04	0.04	0.04	0.00	-	-	0.27	0.4%
Total										***4.77***	***6.5%***
Significant											
IL	0.19	0.34	0.12	0.16	0.26	0.14	0.00	-	-	1.02	1.4%
IN	0.17	0.56	0.15	0.16	0.40	0.16	0.00	-	-	1.42	1.9%
KY	0.24	0.74	0.14	0.21	0.38	0.20	0.00	-	-	1.68	2.3%
MI	0.05	0.38	0.10	0.11	0.15	0.10	0.02	-	-	0.86	1.2%
NJ	0.02	0.27	0.12	0.27	0.10	0.05	0.00	-	-	0.80	1.1%
NY	0.07	0.44	0.16	0.26	0.10	0.09	0.02	-	-	1.06	1.5%
OH	0.16	1.32	0.25	0.38	0.54	0.28	0.00	-	-	2.77	3.8%
PA	0.26	2.35	0.57	1.01	1.71	0.89	0.00	-	-	6.53	8.9%
SOUTH	0.56	2.29	0.42	0.44	0.60	0.51	0.00	-	-	4.27	5.8%
TN	0.12	0.55	0.10	0.15	0.11	0.12	0.00	-	-	1.02	1.4%
TX	0.20	0.34	0.06	0.28	0.11	0.12	0.01	-	-	0.93	1.3%
VA	0.42	3.83	0.94	1.10	1.28	0.95	0.00	-	-	8.10	11.1%
WV	0.16	0.67	0.11	0.32	0.85	0.61	0.00	-	-	2.56	3.5%
Total										***33.03***	***45.2%***
Grand Total	**5.16**	**26.5**	**9.19**	**10.64**	**11.32**	**7.19**	**1.24**	**16.58**	**0.01**	**73.04**	**100.0%**

Upwind Allocation

- After determining contributions, identify significantly contributing upwind States and their associated allocations
- State Contribution Allocation
  - = (Anthro State / Contribution) * NAAQS Exceedance
- Example: Ohio
  - = (2.77 ppb/ 73.04 ppb) * 1.7 ppb
  - = 0.06 ppb
- Adjust to eliminate unreasonable costs on some or all of upwind States contribution

Reduction of Significant Contribution

Monitor	240251001	Harford, Maryland	
		Percent	Reduction
	Anthro Scaled	Contribution	of Significant
Region	DV (ppb)	to Concentration	Contribution
AR-KS-NE-O	1.26	1.7%	0.00
BC	14.65	20.1%	0.00
Can/Mex/Wa	2.00	2.7%	0.00
DE	0.41	0.6%	0.00
IA	0.21	0.3%	0.00
IC	0.01	0.0%	0.00
IL	1.02	1.4%	0.02
IN	1.42	1.9%	0.03
KY	1.68	2.3%	0.04
MD	18.59	25.5%	0.43
MI	0.86	1.2%	0.02
MN	0.27	0.4%	0.00
MO	0.61	0.8%	0.00
NJ	0.80	1.1%	0.02
NorthEast	0.27	0.4%	0.00
NY	1.06	1.5%	0.02
OH	2.77	3.8%	0.06
PA	6.53	8.9%	0.15
SOUTH	4.27	5.8%	0.10
TN	1.02	1.4%	0.02
TX	0.93	1.3%	0.02
VA	8.10	11.1%	0.19
WEST	1.48	2.0%	0.00
WI	0.27	0.4%	0.00
WV	2.56	3.5%	0.06
Grand Total	**73.04**	**100.0%**	**1.20**

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Total Upwind Reduction

- Maximum required significant contributing upwind State reduction is equivalent to sum of individual significant contributing upwind State reduction based on Court opinion rules

- Total reduction requirement
  = 1.20 ppb (including local reduction)

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Multi-Area Application

- Red line approach requires an area only to control its share of the nonattainment contribution

- What happens if the allocation of a source state for one area is significantly higher than the allocation for another area?

Red Line Analysis – Multi-Area

	CAIR Modeling Ozone DVs Potential Reduction Requirement (ppb)			
	2014 CAIR			
Monitor	Harford, MD	Suffolk, NY	Bucks, PA	Philadelphia, PA
Ozone DV	81.1	78.2	76.4	76.1
Required Reduction	5.2	2.3	0.5	0.2
Region				
DE	0.00	0.03	0.01	0.00
IL	0.07	0.04	0.01	0.00
IN	0.10	0.04	0.01	0.00
KY	0.12	0.03	0.01	0.00
MD	**1.32**	0.07	0.03	0.01
MI	0.06	0.04	0.01	0.00
MO	0.00	0.00	0.01	0.00
NJ	0.06	0.29	0.04	0.01
NorthEast	0.00	0.10	0.01	0.00
NY	0.08	**0.37**	0.01	0.01
OH	0.20	0.07	0.02	0.01
PA	0.46	0.17	**0.10**	**0.04**
SOUTH	0.30	0.13	0.02	0.01
TN	0.07	0.02	0.01	0.00
TX	0.07	0.03	0.01	0.00
VA	0.58	0.12	0.02	0.01
WV	0.18	0.04	0.01	0.01
Grand Total	**3.67**	**1.58**	**0.35**	**0.14**
Residual Nonattainment	**1.53**	**0.72**	**0.15**	**0.06**

Max contribution by Region across all nonattaining monitors

Maximum contribution by Region for individual monitor

Local Source Impact

- If a downwind State with a monitor in nonattainment is required to achieve an upwind reduction for another monitor in nonattainment, there is likely a larger local impact that could help bring the local monitor into attainment

- Should a local area first be responsible for its own contribution to other downwind monitors before a solution to its own monitor is estimated?

- Example: NY impact on downwind monitors

Local Source Contribution

	CAIR Modeling Ozone DVs Potential Reduction Requirement (ppb)			
	2014 CAIR			
Monitor	Harford, MD	Suffolk, NY	Bucks, PA	Philadelphia, PA
Ozone DV	81.1	78.2	76.4	76.1
Required Reduction	5.2	2.3	0.5	0.2
Region				
DE	0.00	0.03	0.01	0.00
IL	0.07	0.04	0.01	0.00
IN	0.10	0.04	0.01	0.00
KY	0.12	0.03	0.01	0.00
MD	1.32	0.07	0.03	0.01
MI	0.06	0.04	0.01	0.00
MO	0.00	0.00	0.01	0.00
NJ	0.06	0.29	0.04	0.01
NorthEast	0.00	0.10	0.01	0.00
NY	0.08	0.37	0.01	0.01
OH	0.20	0.07	0.02	0.01
PA	0.46	0.17	0.10	0.04
SOUTH	0.30	0.13	0.02	0.01
TN	0.07	0.02	0.01	0.00
TX	0.07	0.03	0.01	0.00
VA	0.58	0.12	0.02	0.01
WV	0.18	0.04	0.01	0.01
Grand Total	**3.67**	**1.58**	**0.35**	**0.14**
Residual Nonattainment	**1.53**	**0.72**	**0.15**	**0.06**
Impact from other nonattaining monitor State				

Green highlighted cells indicate where other upwind monitor States contribute to downwind monitor nonattainment

Local Source Solution First?

- Don't we need to solve downwind local responsibility first, and if so, which area do we start with?

- Do we solve downwind to upwind? Low exceedance to high? Monitor with least number of contributing States or highest?

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Other Red Line Interpretations

- Add local requirement for control
  - Local sources are part of the solution regardless of contribution percentage
- Alternative significance threshold
  - What would be implication of establishment of alternative threshold?
- Cost considerations
  - How should upwind State obligations be reduced to avoid imposition of unreasonable costs?

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Observations for Discussion

- Non-linearity of emissions reduction to ozone concentration
  - Ex. – ton of NOx reduced from Illinois may not have same ppb reduction impact in MD and NY
- 2010 OSAT results do not reflect emission changes seen in 2014/2018 CAIR simulations
  - Relative contribution currently based on 2010 allocation and could change with future year emissions delta
- Relative contribution of source types within each source region
  - EGU vs. MV vs. Non-EGU vs. Nonroad vs. Area
  - Should cost/ppb play in determining strategy?

Additional Observations

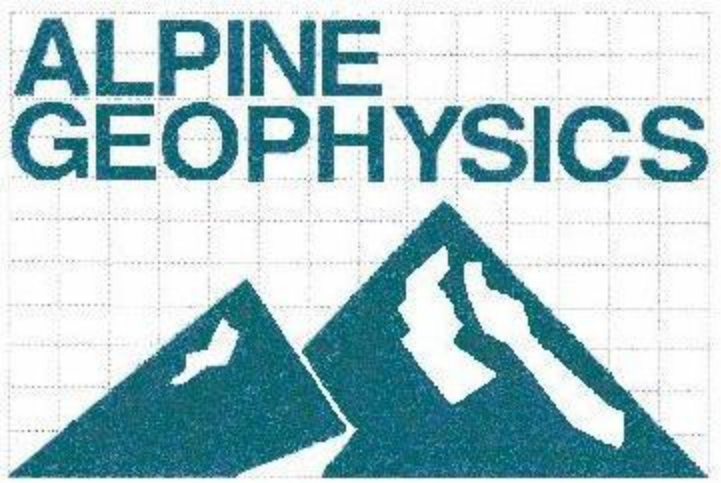
- Maintenance Plans
  - One time significant contribution analysis by upwind State at time of its SIP submittal
  - No additional analysis required by upwind States due to socio-economic changes in downwind State
- Impact of meteorological regime and uniqueness of high ozone days
  - Individual day exceedances may initiate from multiple geographies and conditions

Additional Observations (con't)

- Emission Controls
  - The development and implementation by the States of "good neighbor" SIPs is the proper place to address such questions as whether additional controls are needed on one or more units or whether it is necessary for units to be operated differently, or at different emission rates, than is provided by otherwise applicable regulatory requirements

Contact Information

Gregory Stella
Managing Partner
Alpine Geophysics, LLC
828-675-9045
gms@alpinegeophysics.com



Please follow this link for any updates that may have been made to this presentation:

http://midwestozonegroup.com/files/CSAPR_Remand_Red_Line_Analysis-2010_OSAT.pdf