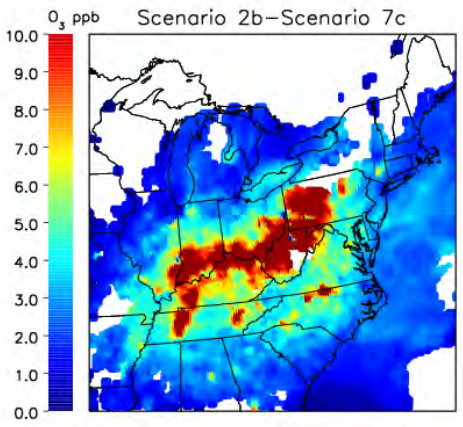
Modeling Update – February 2015

The Maryland Attainment Plan, Transport and Contribution Modeling and Analyses of Running Controls More Effectively at Coal Fired Power Plants



Tad Aburn, Air Director, MDE

MARAMA Board of Directors 2015 Annual Meeting – February 24th, 2015

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Topics

- Background
- The Maryland Attainment Plan
  - What does the modeling tell us about attainment?
- Transport Modeling
- Running controls more efficiently
- EPA's Guidance and Contribution Modeling
- Schedule and next steps

Background

Maryland's Attainment Problem

- Only state East of the Mississippi designated as a "Moderate" nonattainment area by EPA
- Baltimore is the only nonattainment area in the East required to submit an "Attainment" SIP in 2015
  - This SIP must be supported by photochemical modeling and an "Attainment Demonstration"
- We believe we have enough modeling completed to have a clear picture of what Maryland needs in it's plan to bring the State into attainment
  - This analysis also shows that most other areas in the East should also come close to attaining the 75 ppb standard

Background – Collaboration

- On August 6, 2013- Approximately 30 Air Directors participated in a call to begin a technical collaboration on ozone transport in the East
  - Preliminary modeling conducted by Maryland, LADCO, SESARM and OTC
    - Showed that a collaborative solution for the 75 ppb ozone standard may be possible
- In April 2014, preliminary discussions between Commissioners began
- As a result of these discussions, the "State Collaborative on Ozone Transport" (SCOOT) was established. First meeting in November 2014.
  - One of the goals of SCOOT is to explore the possibility of the states working together and submitting complementary Attainment and Good Neighbor SIPs
- The modeling conducted by Maryland and others has … and will continue to be … a major part of the SCOOT process

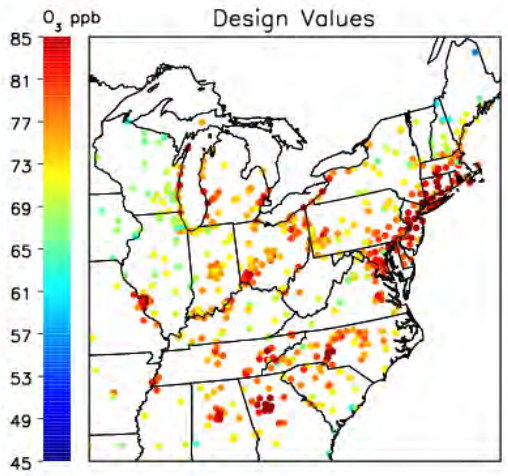
Background

EPA's Recent Transport Initiative

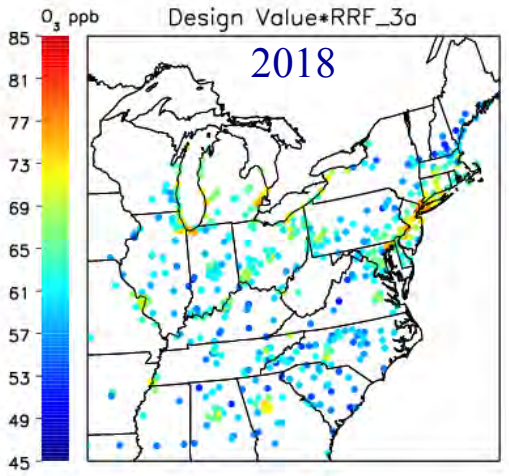
- On January 22, EPA issued a guidance memo to begin a process that will require states to submit Good Neighbor SIPs to address ozone transport in the East
- The guidance establishes a framework … and provides preliminary analyses … to identify which states are contributing significantly to downwind problem areas
- An April 8 meeting with states is to focus on what measures will need to be included in Good Neighbor SIPs
- The Maryland modeling will be very useful in the EPA process
  - It blends well with the process initiated by SCOOT and the process being set up by EPA

Building the Maryland Plan

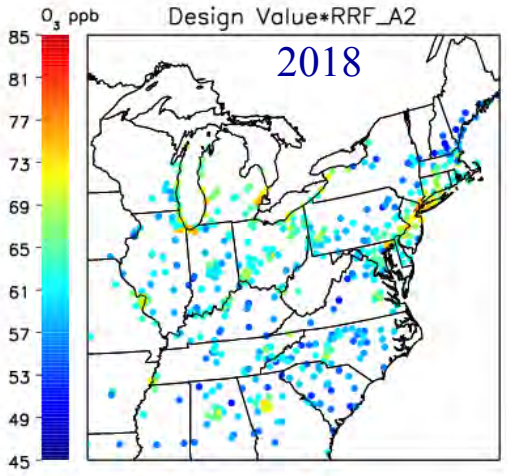
The 2007 or 2011 Base



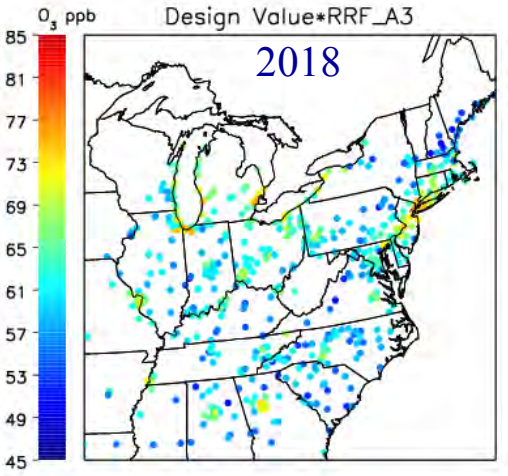
Add regional controls across the East
(OTB/OTW, Tier 3, regional EGU controls)



Add the "OTR" controls
along I-95 corridor



Add new controls just
in MD



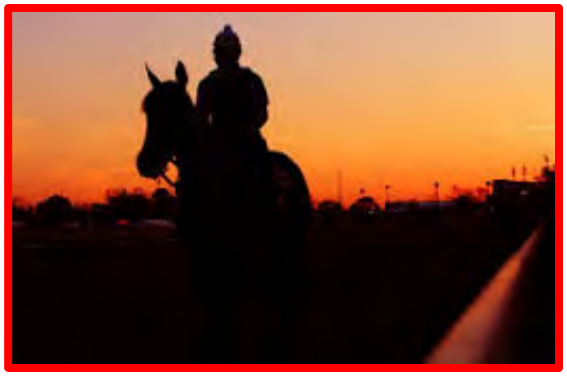
Modeling the Maryland Plan

- Maryland has conducted preliminary modeling of the Plan and believes it will allow MD to come very close to meeting the 75 ppb ozone standard
  - Started with the OTC CMAQ 2007 platform – 2018 future year
  - Have evolved to the 2011 platform and now running both CMAQ and CAMX
    - Focus still on 2018 as the future year
  - There is still a significant amount of work that needs to get done to improve the 2011 platform … but we have learned a lot

CMAQ = Community Multiscale Air Quality Model
CAMX = Comprehensive Air Quality Model with Extensions

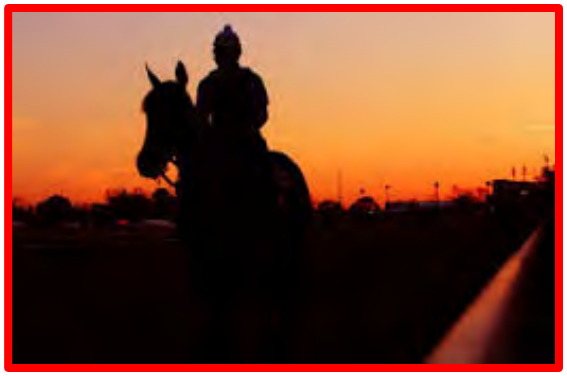
What We've Learned

- The 2011 Platform is giving us results consistent with the 2007 Platform
  - All model performance is good
- We will make significant progress because of existing control programs
- We appear to be close to having a plan to meet the 75 ppb standard
  - This plan also appears to bring most other areas in the East into attainment
- Running EGU controls optimally during bad ozone periods is important
- Additional reductions in MD and in "close-by" states are also important



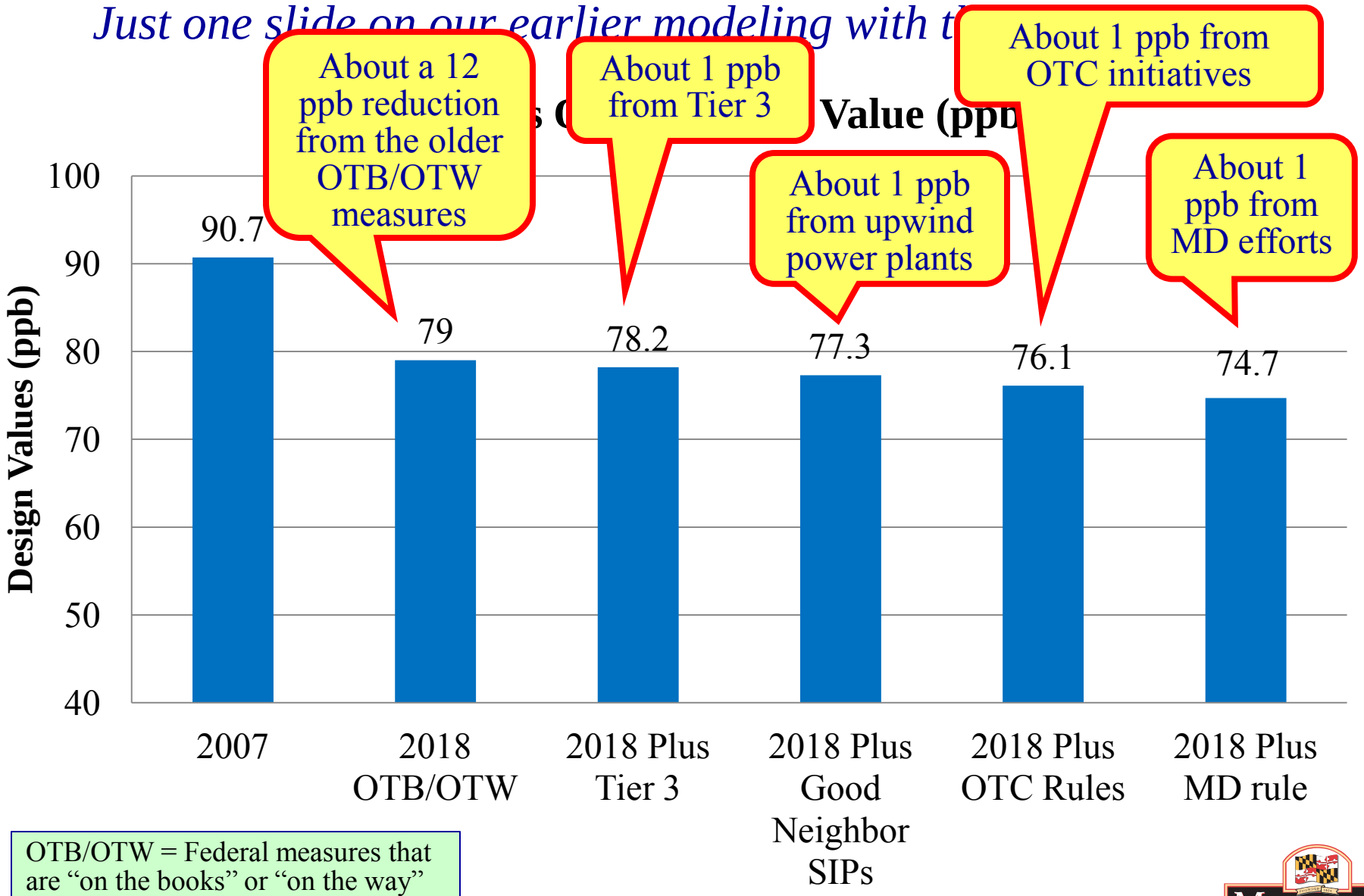
The Key Elements of Maryland's Plan

- Number 1 Need – The Tier 3 Mobile Source and Fuel Standards
  - The most important new program to reduce high ozone in Maryland
- Number 2 – Additional local reductions in Maryland
- Number 3 – Good Neighbor SIPs to address the contribution from more distant and close-by neighboring states
  - Analysis shows that if power plants in all upwind states simply run the controls that have already been purchased … during the ozone season … and planned retirements occur … and
  - New OTC model programs are implemented in the OTC states …
  - Then … transport into Maryland for the current ozone standard will be adequately addressed



Modeling the MD Plan in 2018 - 2007 Platform

Just one slide on our earlier modeling with t



OTB/OTW = Federal measures that are "on the books" or "on the way"

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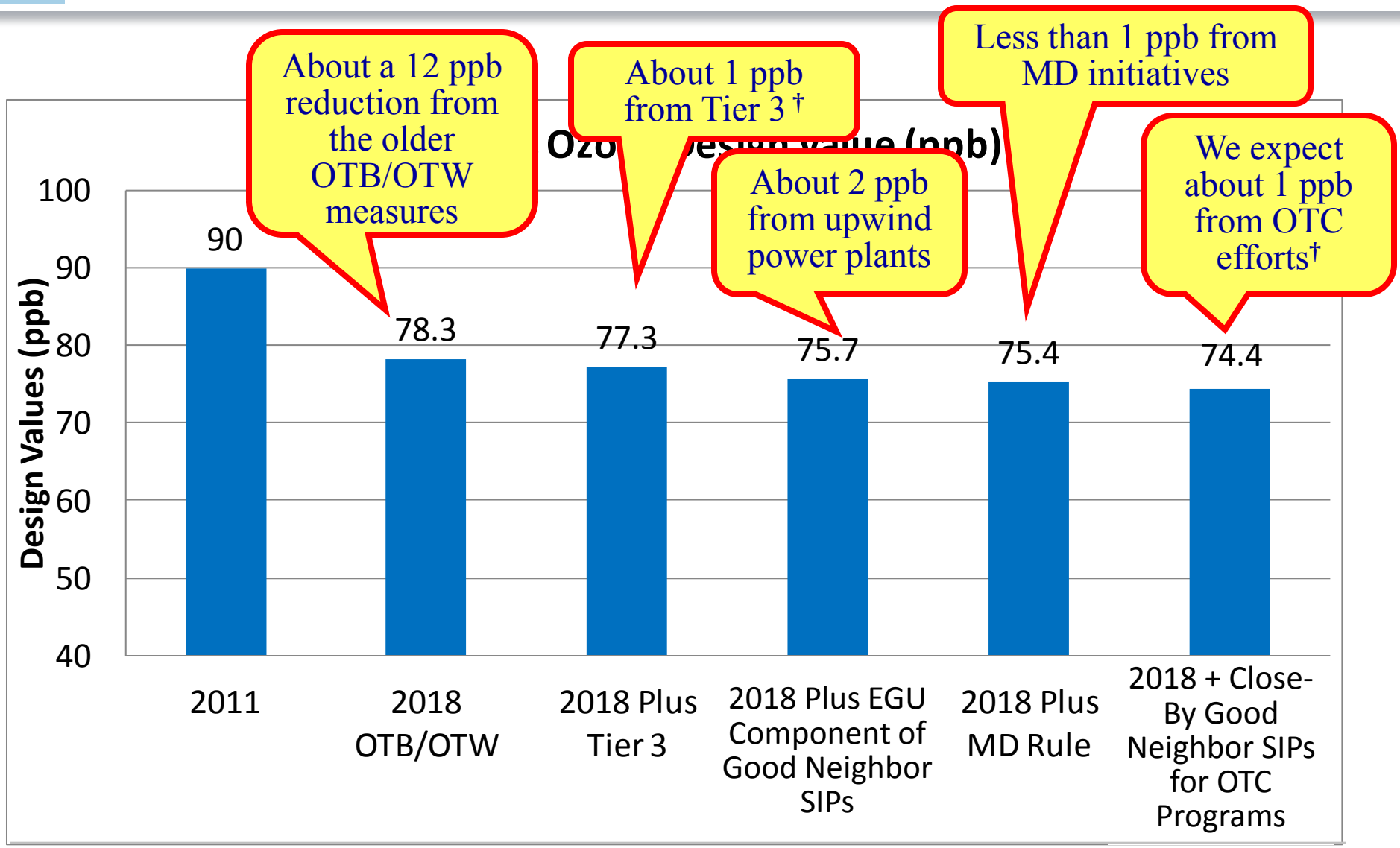
Modeling the MD Plan in 2018 - 2011 Platform

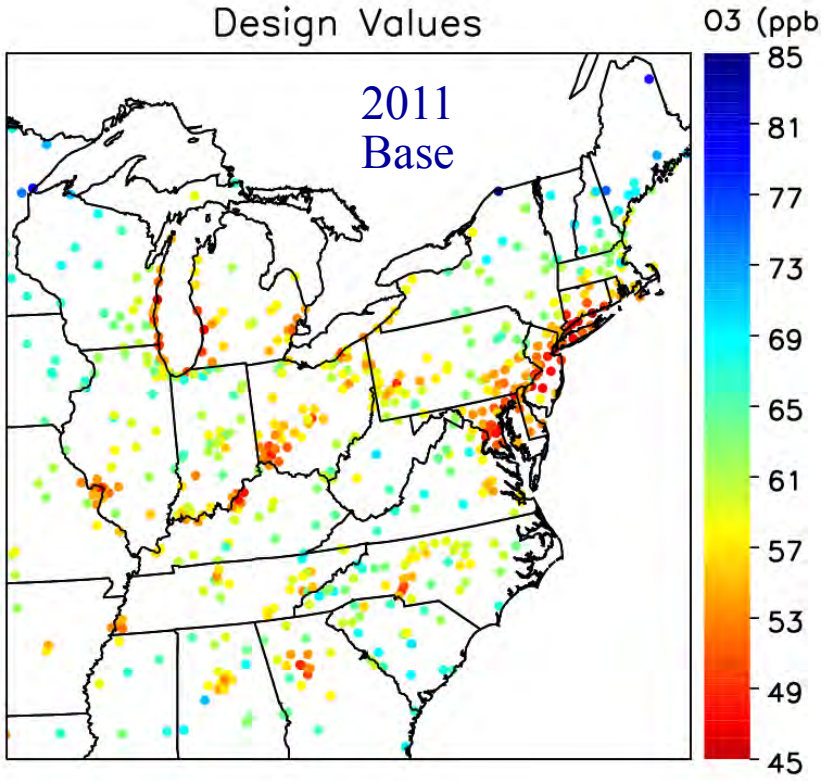


† This value is based on a very rough estimate from earlier modeling work.

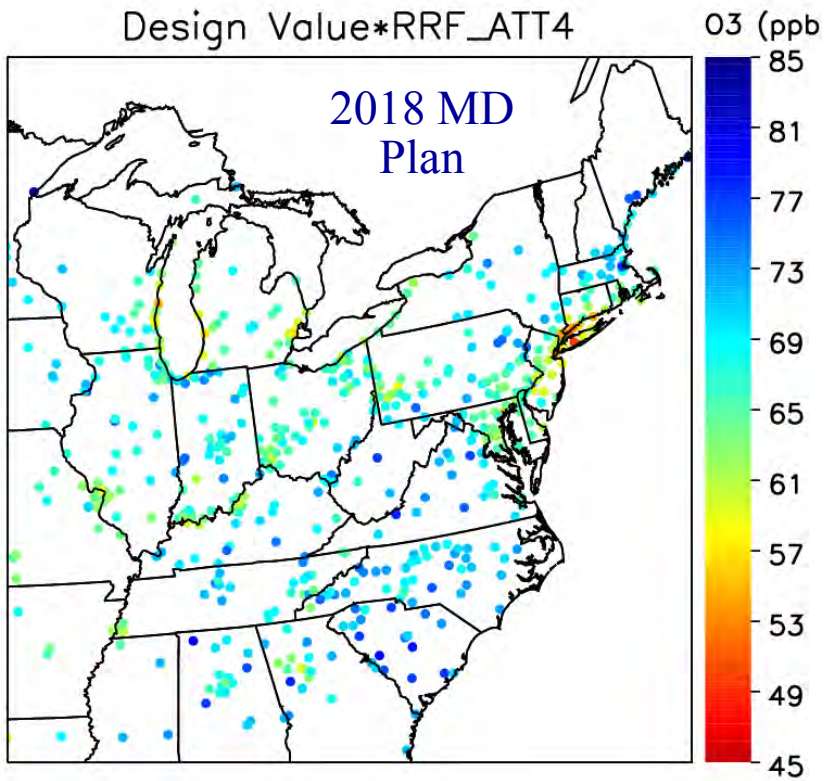
The Bottom Line

Before and After the Maryland Plan

Before the MD Plan

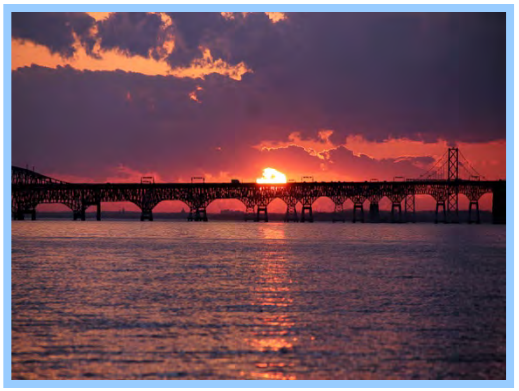


After the MD Plan



Where Do the OTB/OTW Reductions Come From?

- There are over 40 control programs in this piece of our modeling
  - Generally older control programs that continue to generate deeper reductions as they are phased in or as fleets turn over
- By far, the largest contributors to NOx reductions in the OTB/OTW category are mobile sources
  - Tier 2 Vehicle Standards
  - Federal fuel economy (CAFÉ) standards
  - Heavy Duty Diesel Standards
  - Marine Diesel Engine Standards
  - Emission Control Area (ECA) requirements
  - Many more …
- VOC reductions from the OTB/OTW category come from programs like
  - Federal consumer product and paint regulations
  - Tier 2 Vehicle Standards
  - VOC RACT … Many more …



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What Inside the OTR Measures are Included?

- Mobile Source Initiatives
  - Aftermarket Catalyst effort
  - ZEV/CALEV state programs
  - Onroad and offroad idling
  - Heavy Duty I&M
  - Smartways
- NOx and VOC reductions
- New potential initiatives like Ports are not included

- Stationary and Area Source Efforts
  - Third Generation OTC/SAS Initiatives
    - Consumer products
    - Architectural and Industrial Maintenance (AIM) Coatings
    - Auto coatings
    - Ultra Low NOx burners
- NOx and VOC reductions

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Reductions from OTC Measures

OTC Model Control Measures	Regional Reductions (tons per year)	Regional Reductions (tons per day)
Aftermarket Catalysts	14,983 (NOx) 3,390 (VOC)	41 (NOx) 9 (VOC)
On-Road Idling	19,716 (NOx) 4,067 (VOC)	54 (NOx) 11 (VOC)
Nonroad Idling	16,892 (NOx) 2,460 (VOC)	46 (NOx) 7 (VOC)
Heavy Duty I & M	9,326 (NOx)	25 (NOx)
Enhanced SMARTWAY	2.5%	
Ultra Low NOx Burners	3.669 (NOx)	10 (NOx)
Consumer Products	9,729 (VOC)	26 (VOC)
AIM	26,506 (VOC)	72 (VOC)
Auto Coatings	7,711 (VOC)	21 (VOC)

- Just in the OTC states
- Thanks to OTC SAS and Mobile Source Committees
- Thanks to Joseph Jakuta and Julie McDill
- These emission reduction estimates are being updated as we speak

What "Inside MD" Reductions are Included?

- New EGU regulation for NOx
  - Required for RACT and Attainment
- Maryland efforts on mobile sources
  - Electric vehicle initiatives
  - ZEV efforts
  - "Beyond Conformity" partnerships
- Primarily NOx reductions from EGU regulation

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New Reductions in Transport Included?

- Three significant new transport strategies are included
- The Federal Tier 3 Vehicle and Fuel Standards may be the most significant new transport strategy
- New OTC Regional Measures
- “Good Neighbor Partnerships” that address coal-fired power plants in 10 states upwind of MD are also included in the modeling
  - Focuses primarily on the large potential reductions from insuring that currently installed technologies are run well
    - Also includes significant reductions from units scheduled for retirement (or other major changes) by 2018
  - Already a discussion item at SCOOT
    - More later

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Maryland Monitors - 2011 Platform - CMAQ

County	DV 2011	2018 Future Baseline	2018 Future Baseline with Optimized EGUs	2018 Maryland Plan
Anne Arundel	83.0	70.2	69.1	67.7
Baltimore	79.0	68.4	67.0	65.7
Baltimore	80.7	70.4	69.4	68.1
Calvert	79.7	68.5	67.5	65.7
Carroll	76.3	67.2	65.6	64.3
Cecil	83.0	70.5	69.0	67.8
Charles	79.0	67.3	66.1	63.6
Frederick	76.3	66.9	65.3	63.8
Garrett	72.0	60.8	59.4	58.4
Harford	90.0	77.3	75.7	74.4
Harford	79.3	67.1	65.8	64.6
Kent	78.7	66.8	65.4	64.2
Montgomery	76.3	66.9	65.3	63.8
Prince George's	79.0	66.7	65.8	64.5
Prince George's	82.3	69.6	68.6	67.1
Washington	72.7	63.3	61.9	60.9

- All values in parts per billion (ppb)
- 2018 Future Baseline … OTB/OTW with Tier 3
- 2018 with Optimized EGUs … OTB/OTW, Tier 3 and EGUs running at best observed rates from the past
- 2018 MD Plan … OTB/OTW, Tier 3, Optimized EGU Controls, new OTC controls and new MD controls

The Baltimore Area - 2011 Platform - CMAQ

County	DV 2011	2018 Future Baseline	2018 Future Baseline with Optimized EGUs	2018 Maryland Plan
Anne Arundel	83.0	70.2	69.1	67.7
Baltimore	79.0	68.4	67.0	65.7
Baltimore	80.7	70.4	69.4	68.1
Carroll	76.3	67.2	65.6	64.3
Harford	90.0	77.3	**75.7**	74.4
Harford	79.3	67.1	65.8	64.6
Baltimore Area Average Exposure	81.3	70.1	68.8	67.5

- All values in parts per billion (ppb)
- 2018 Future Baseline … OTB/OTW with Tier 3
- 2018 with Optimized EGUs … OTB/OTW, Tier 3 and EGUs running at best observed rates from the past
- 2018 MD Plan … OTB/OTW, Tier 3, Optimized EGU Controls, new OTC controls and new MD controls

Monitors – Preliminary EPA Problem Areas

County, State	AQS #	DV 2011	2018 Future Baseline	2018 Future Baseline with Optimized EGUs	2018 Maryland Plan
Attainment Problems - 2018					
Harford, MD	240251001	90	77.3	75.7	74.4
Fairfield, CT	090013007	84.3	74.5	74.0	72.9
Fairfield, CT	090019003	83.7	77.2	76.8	75.7
Suffolk, NY	361030002	83.3	80.6	80.1	79.1
Maintenance Problems - 2018					
Fairfield, CT	090010017	80.3	78.1	77	76.7
New Haven, CT	090099002	85.7	75.4		74.1
Jefferson, KY	211110067	82.0			69.7
Allegan, MI	260050003	82.7			73.1
Saint Charles, MO	291831002	82.3			71.9
Camden, NJ	340071001	82.7			69.5
Gloucester, NJ	340150002	84.3			70.6
Richmond, NY	360850067	81.3	75.4	74.9	73.9
Philadelphia, PA	421010024	83.3	73.2	71.9	70.8
Sheboygan, WI	551170006	84.3	75.6	75.4	75.4

No new local or "clean hands" reductions have been included for the NJ/NY/CT NAA area. Maybe an extra ppb or 2?

Mid-Atlantic Problem Monitors – 2011 Platform

County, State	AQS #	DV 2011	2018 Future Baseline	2018 Future Baseline with Optimized EGUs	2018 MD Plan
Attainment Problems - 2018					
Harford, MD	240251001	90	77.3	75.7	74.4
Fairfield, CT	090013007	84.3	74.5	74.0	72.9
Fairfield, CT	090019003	83.7	77.2	76.8	75.7
Suffolk, NY	361030002	83.3	80.6	80.1	79.1
Maintenance Problems – 2018					
Fairfield, CT	090010017	80.3	78.1	77.7	76.7
New Haven, CT	090099002	85.7	75.4	75.1	74.1
Camden, NJ	340071001	82.7	71.5	70.5	69.5
Gloucester, NJ	340150002	84.3	73.0	71.7	70.6
Richmond, NY	360850067	81.3	75.4	74.9	73.9
Philadelphia, PA	421010024	83.3	73.2	71.9	70.8
Other Areas – 2018					
Prince Georges, MD	240338003	82.3	69.6	68.6	67.1
New Castle, DE	100031010	78	66.7	65.4	64.3
Bucks, PA	420170012	80.3	69.5	68.3	67.2
Fairfax, VA	510590030	82.3	70.4	69.9	68.3
Mecklenberg, NC	371191009	79.7	63.7	63.2	63.2

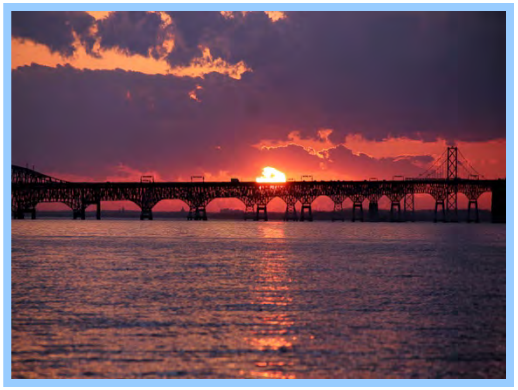
Toughest Monitors in the East

County, State	AQS #	DV 2011	2018 Future Baseline	2018 Future Baseline with Optimized EGUs	2018 Maryland Plan
Harford, MD	240251001	90	77.3	75.7	74.4
Fairfield, CT	090013007	84.3	74.5	74.0	72.9
Fairfield, CT	090019003	83.7	77.2	76.8	75.7
Suffolk, NY	361030002	83.3	80.6	80.1	79.1
Fairfield, CT	090010017	80.3	78.1	77.7	76.7
New Haven, CT	090099002	85.7	75.4	75.1	74.1
Jefferson, KY	211110067	82.0	71.1	69.7	69.7
Allegan, MI	260050003	82.7	73.3	73.1	73.1
Saint Charles, MO	291831002	82.3	72.2	71.9	71.9
Camden, NJ	340071001	82.7	71.5	70.5	69.5
Gloucester, NJ	340150002	84.3	73.0	71.7	70.6
Richmond, NY	360850067	81.3	75.4	74.9	73.9
Philadelphia, PA	421010024	83.3	73.2	71.9	70.8
Sheboygan, WI	551170006	84.3	75.6	75.4	75.4
Prince Georges, MD	240338003	82.3	69.6	68.6	67.1
New Castle, DE	100031010	78	66.7	65.4	64.3
Bucks, PA	420170012	80.3	69.5	68.3	67.2
Fairfax, VA	510590030	82.3	70.4	69.6	68.3
Wayne, MI	261630019	78.7	73.0	72.9	72.9
Mecklenberg, NC	371191009	79.7	63.7	63.2	63.2
Fulton, GA	131210055	81.0	70.4	70.3	70.3
Knox, TN	470931020	71.7	61.9	61.4	61.4
Hamilton, OH	390610006	82.0	71.1	69.3	69.3
Franklin, OH	390490029	80.3	70.0	69.6	69.6

- All values in parts per billion (ppb)
- 2018 Future Baseline … OTB/OTW with Tier 3
- 2018 with Optimized EGUs … OTB/OTW, Tier 3 and EGUs running at best observed rates from the past
- 2018 MD Plan … OTB/OTW, Tier 3, Optimized EGU Controls, new OTC controls and new MD controls

CAMX Modeling – 2011 Platform

- Maryland is now working to have both CMAQ and CAMX working in harmony … using the 2011 platform
- Still have a ways to go, but preliminary work is both promising and interesting
- Have also begun to use CAMX/OSAT to look at contribution by meteorological regime and time of day



CAMX/OSAT = CAMXs Ozone Source Apportionment Tool

Preliminary MD 2018 CAMX Analyses

Our preliminary CAMX work with the 2011 platform is still evolving but also very interesting. Appears that CAMX is "less optimistic" than CMAQ. CAMX modeling of MD Plan available soon.

Maryland Monitoring Location	Connecticut			2018 CAMx ATT-4 CB05 July Only (ppb)
	Monitoring Location	Weighted 2011 Design Value	2018 Design Value CAMx	
Davidsonville	Greenwich	80.3	76.7	70.2
Padonia	Danbury	81.3	71.8	69.6
Essex	Stratford	84.3	76.9	70.8
Calvert	Westport	83.7	78.0	67.6
South Carroll	East Hartford	73.7	65.6	65.7
Fair Hill	Cornwall	70.3	61.3	70.4
Southern Maryla	Middletown	79.3	69.7	66.3
Frederick Airport	New Haven	74.3	67.5	66.0
Piney Run	Madison	85.7	77.1	61.2
Edgewood	Groton	80.3	73.5	78.2
Aldino	Stafford	75.0	66.6	67.9
Millington				66.4
Rockville				66.9
HU-Beltsville				67.1
PG Equestrian Ce				69.4
Hagerstown				62.8
Furley				65.1

LADCO's CAMx simulation @ Edgewood:

2018 Design Value using CB05 (IPM): 81.5 ppb, (ERTAC): 82.7 ppb

What's different between LADCO and U. of Maryland?

Model domain … Time period … Boundary condition

Preliminary analyses – contact Dan Goldberg, UMD prior to use

New Reductions in Transport?

- The Plan includes three new … significant … common sense … transport strategies

1. The federal Tier 3 Vehicle and Fuel Standards may be the most significant new transport strategy
2. New OTC model rules and initiatives
3. "Good Neighbor Partnerships" that address coal-fired power plants in 10 states upwind of MD are also included
    - Focuses primarily on the large potential reductions from insuring that currently installed technologies are run well
    - Low cost … common sense … private sector interest in discussing potential solution

Running Power Plant Controls Effectively

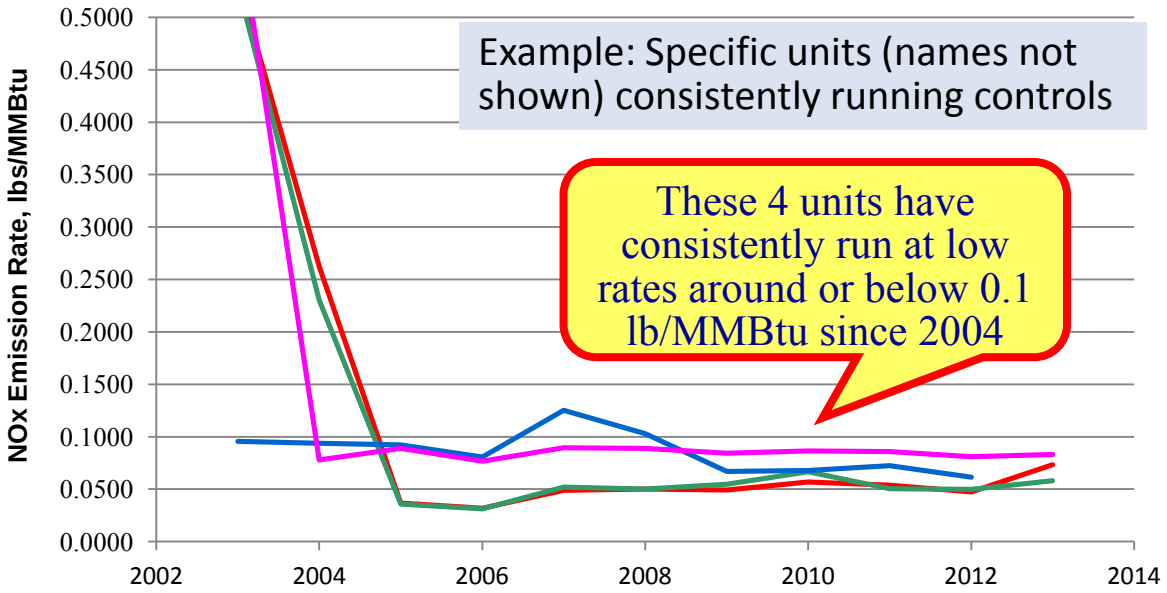
- OTC, LADCO, Maryland and other states have analyzed EGU emissions data to see how well existing pollution controls are being run
- Changes in the energy market, a regulatory system that is driven by ozone season tonnage caps and inexpensive NOx allowances have created an unexpected situation
  - EGU operators can meet ozone season tonnage caps without operating their control technologies efficiently on bad ozone days
  - Sometimes not running them at all

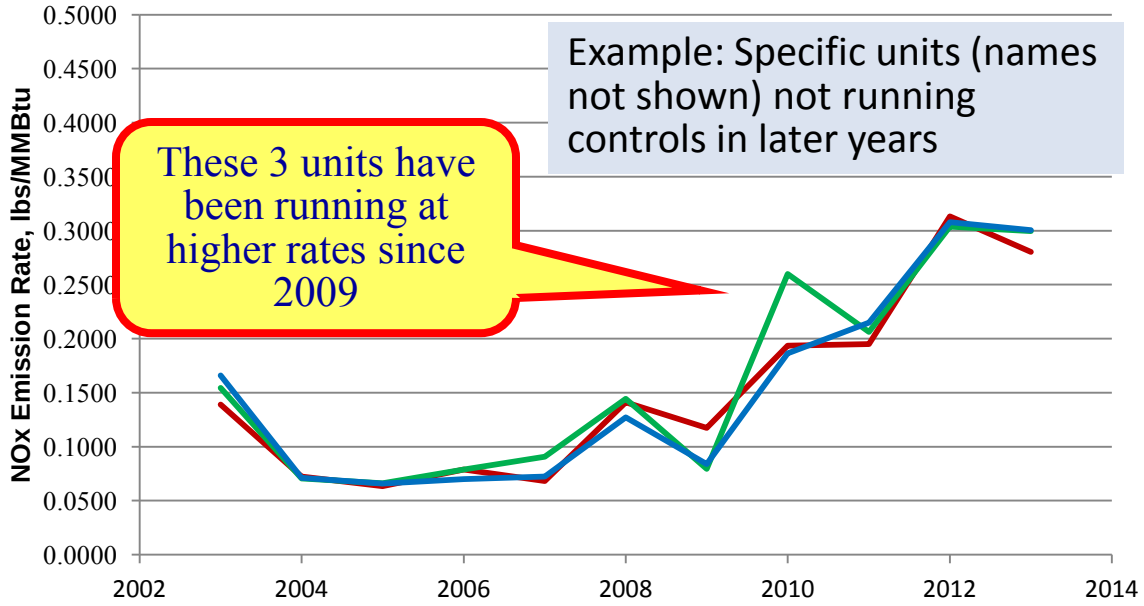
Running EGU Controls Well?

Average Ozone Season Emission Rates at Specific Units by Year

Many Sources Run Controls Well →

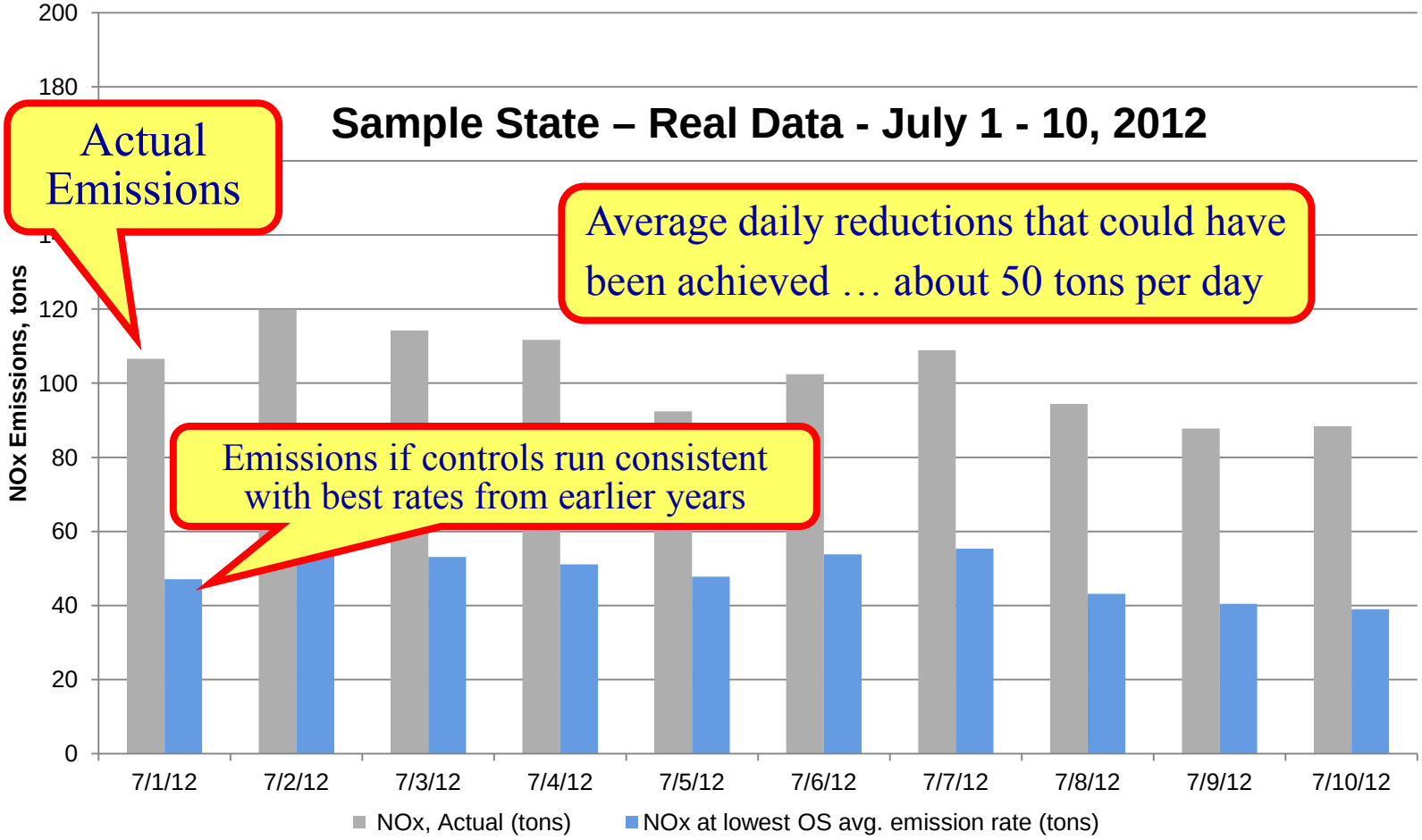
Some Units Are Not Running Controls as Well →



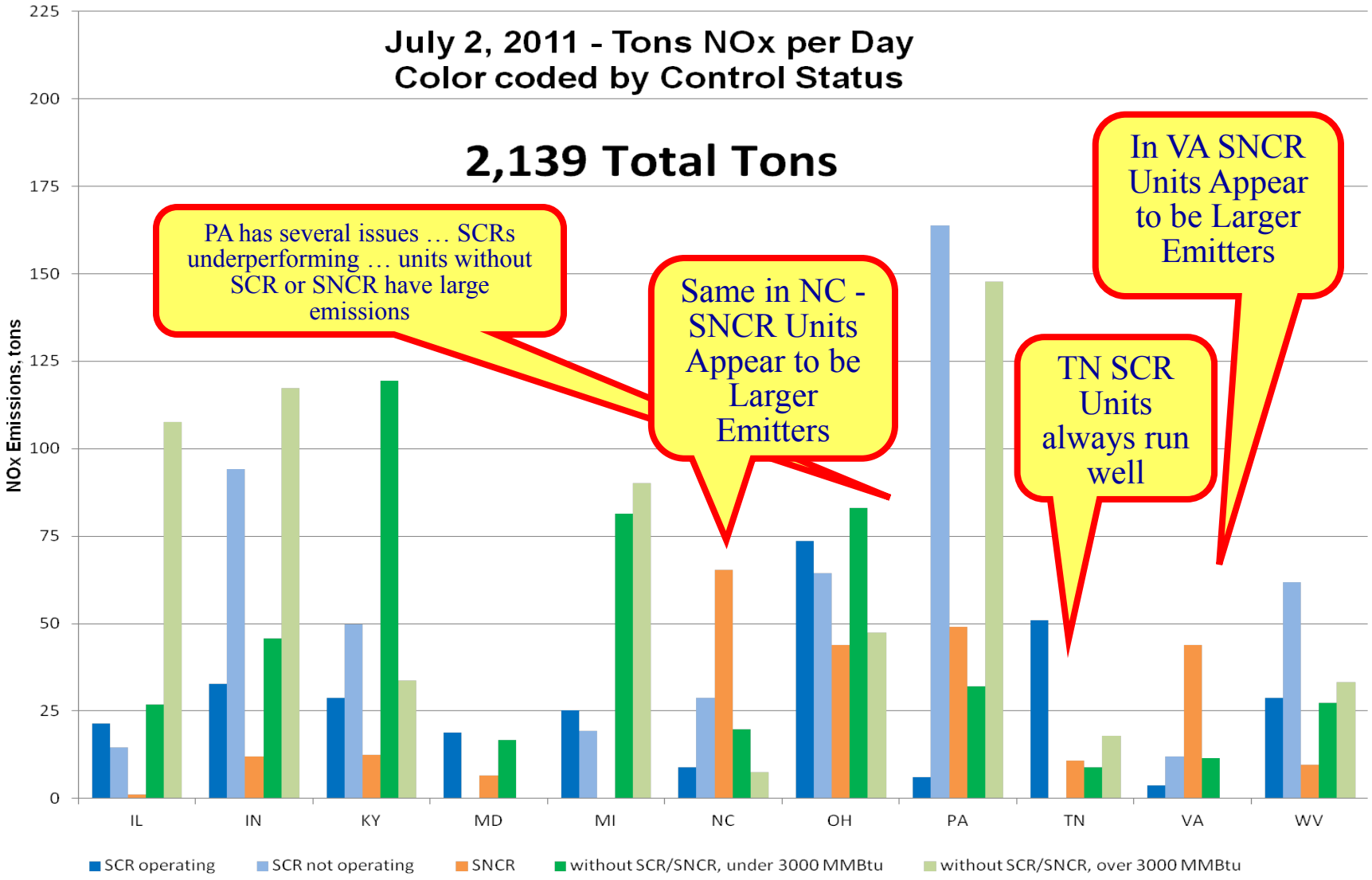


Emission Increases Can be Significant

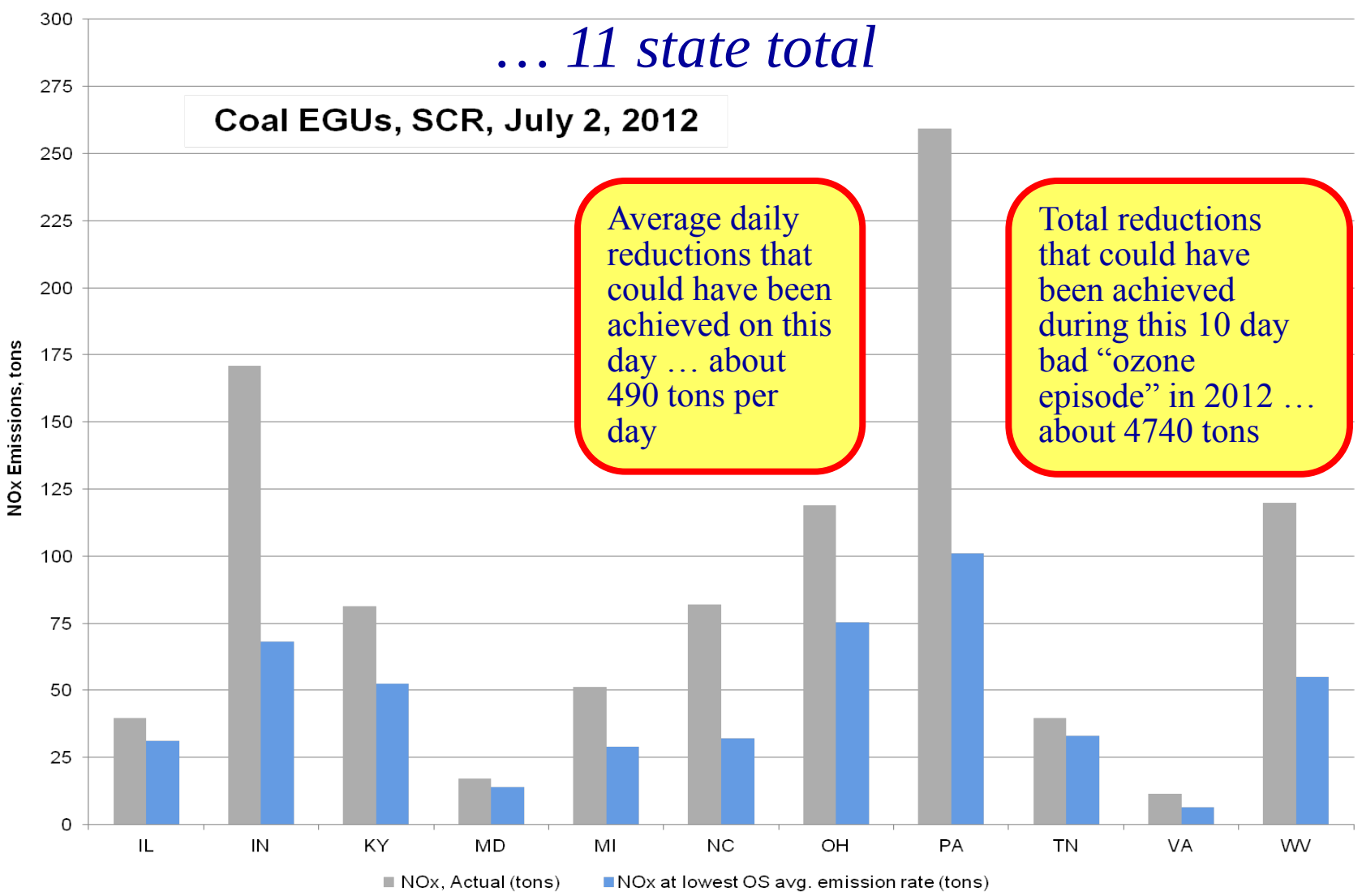
MDE conducted detailed analyses of the July 1 to 10 ozone episode in 2011 – Every coal unit in 11 states



This is Happening in Many States



Reductions Could be Very Large



Maryland just distributed a third update to this data analysis package for all 11 states.

We Modeled Lost Ozone Benefit

County, State	AQS #	Lost benefit using worst rates in CAMD data 2005 to 2012	Lost benefit using actual 2011 CAMD rates
Harford, MD	240251001	2.6	1.6
Fairfield, CT	090013007	0.8	0.5
Fairfield, CT	090019003	06	0.4
Suffolk, NY	361030002	0.7	0.4
Fairfield, CT	090010017	0.6	0.4
New Haven, CT	090099002	0.4	0.3
Jefferson, KY	211110067	2.5	1.6
Allegan, MI	260050003	0.8	0.2
Saint Charles, MO	291831002	0.7	0.4
Camden, NJ	340071001	1.8	1.3
Gloucester, NJ	340150002	2.4	1.7
Richmond, NY	360850067	0.9	0.5
Philadelphia, PA	421010024	2.6	1.8
Sheboygan, WI	551170006	0.5	0.3
Prince Georges, MD	240338003	2.0	1.2
New Castle, DE	100031010	2.5	1.7
Bucks, PA	420170012	2.2	1.6
Fairfax, VA	510590030	1.8	1.1
Wayne, MI	261630019	0.4	0.1
Mecklenberg, NC	371191009	1.7	1.0
Fulton, GA	131210055	0.4	0.2
Knox, TN	470931020	2.1	0.5
Hamilton, OH	390610006	2.9	1.9
Franklin, OH	390490029	0.9	0.5

- All values in parts per billion (ppb)
- Worst rates … Assumes all units run at worst rates seen between 2005 and 2012
- 2011 rates … Runs units at actual rates seen in 2011

New Nonattainment Areas?

- EPA will be designating areas as "nonattainment" under the new 65 to 70 ppb standard soon
- The data for 2015 and 2016 will clearly be important
  - EPA uses 3 years of data for designations
- Having power plants run their controls well may be very important to how areas are designated

Monitor	2014 Design Value*	Increased Ozone
Greene County, IN	71 ppb	5 to 7 ppb
Oldham County, KY	74 ppb	2 to 3 ppb
Garret County, MD	68 ppb	2 to 3 ppb
Person County, NC	66 ppb	3 to 11 ppb
Warren County, OH	72 ppb	1 to 2 ppb
Armstrong County, PA	74 ppb	3 to 6 ppb
Kanawa County, WV	69 ppb	2 to 5 ppb

SCRs on 2018 Uncontrolled Units

- Have just completed a new series of sensitivity runs to look at this issue
- Continued analyses of EGU Control Technology Optimization
- Have now added in uncontrolled units modeled as if they are controlled by an SCR

Summary – Upwind EGU Tests

Modeled Ozone Reductions in ppb

Monitor County, State	Optimized Existing Controls (Upper End)	Optimized Existing Controls (2011 Data)	SCR's on Post-2018 Uncontrolled Units
Edgewood, MD	2.6	1.6	0.3
Babylon, NY	0.7	0.5	0.1
Greenwich Point Park, CT	0.6	0.4	0.1

These reductions are based upon EGU projections from EPA using IPM. Updated analyses that are in the works … using ERTAC .. may show greater benefit

EPA's Recent Initiative on Transport

- On January 22 EPA issued a guidance memo that began to spell out how EPA will move forward to insure that ozone transport is addressed.
  - The guidance builds off of Supreme Court decisions
    - Both the Homer City and the CSAPR decisions
- In very simple terms, the guidance begins to identify who owes Good Neighbor SIPs
  - Future actions will define when Good Neighbor SIPs are due and how states are to determine what control measures need to be in the GN SIP
- This all blends well with the SCOOT process

Preliminary EPA Contribution Work

- EPA has performed preliminary CAMX OSAT Modeling to identify which states may owe Good Neighbor SIPs for selected problem areas
  - Future problems with **nonattainment** and future problems with **maintenance** both considered

Problem Monitors	DE	IL	IN	KY	MD	MI	MO	NJ	NY	OH	PA	TN	TX	VA	WV
Harford, MD			X	X		X				X	X		X	X	X
Suffolk, NY		X	X	X	X	X		X		X	X		X	X	X
Fairfield, CT					X	X		X	X	X	X			X	X
Camden, NJ	X	X	X	X		X	X		X	X	X		X		X
Gloucester, NJ	X	X	X	X	X	X			X	X	X		X	X	X
Richmond, NY	X		X	X	X			X		X	X			X	X
Philadelphia, PA	X	X	X	X	X			X		X		X	X	X	X

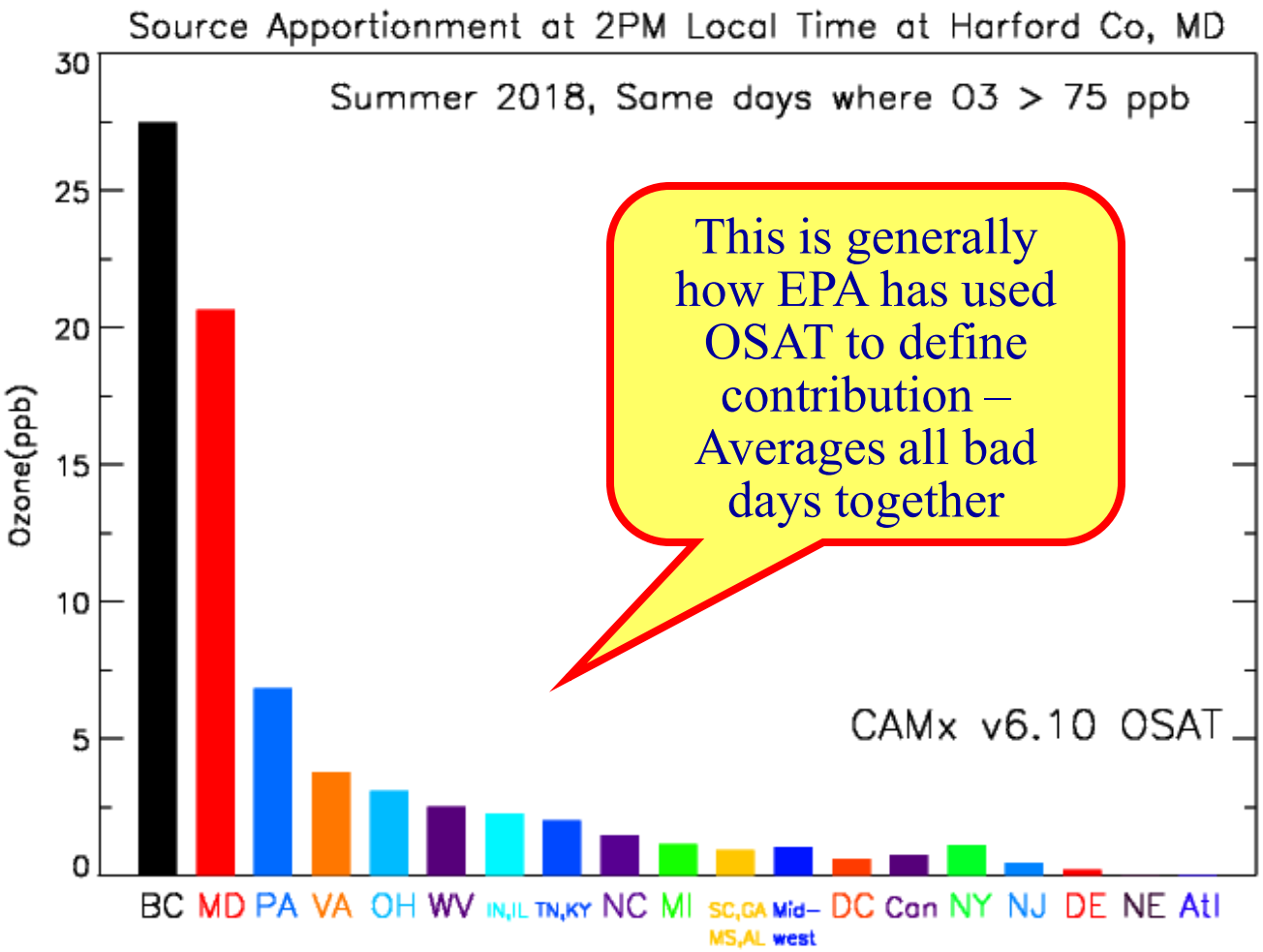
Good Neighbor SIPs …

… What does the MD modeling say about what control measures states will need to include in their Good Neighbor SIPs?

- Very preliminary - based upon current modeling effort
- Still does not bring NY/NJ/CT NAA into attainment - Also has no "clean hands" local control efforts in NY/NJ/CT NAA included

Control Programs Needed	CT	DE	IL	IN	KY	MD	MI	MO	NJ	NY	OH	PA	TN	TX	VA	WV
Optimized EGU controls	x	x	x	x	x	+	x	x	x	x	x	x	x	x	x	x
Aftermarket Catalyst	x	x				x			x	x		x			x	
On- and off-road idling	x	x				x			x	x		x			x	
OTC VOC initiatves	x	x				x			x	x		x			x	
Smartways	x	x				x			x	x		x			x	
Smaller Combustion	?					?			?	?		?			?	

2018 - Traditional OSAT – Harford, MD



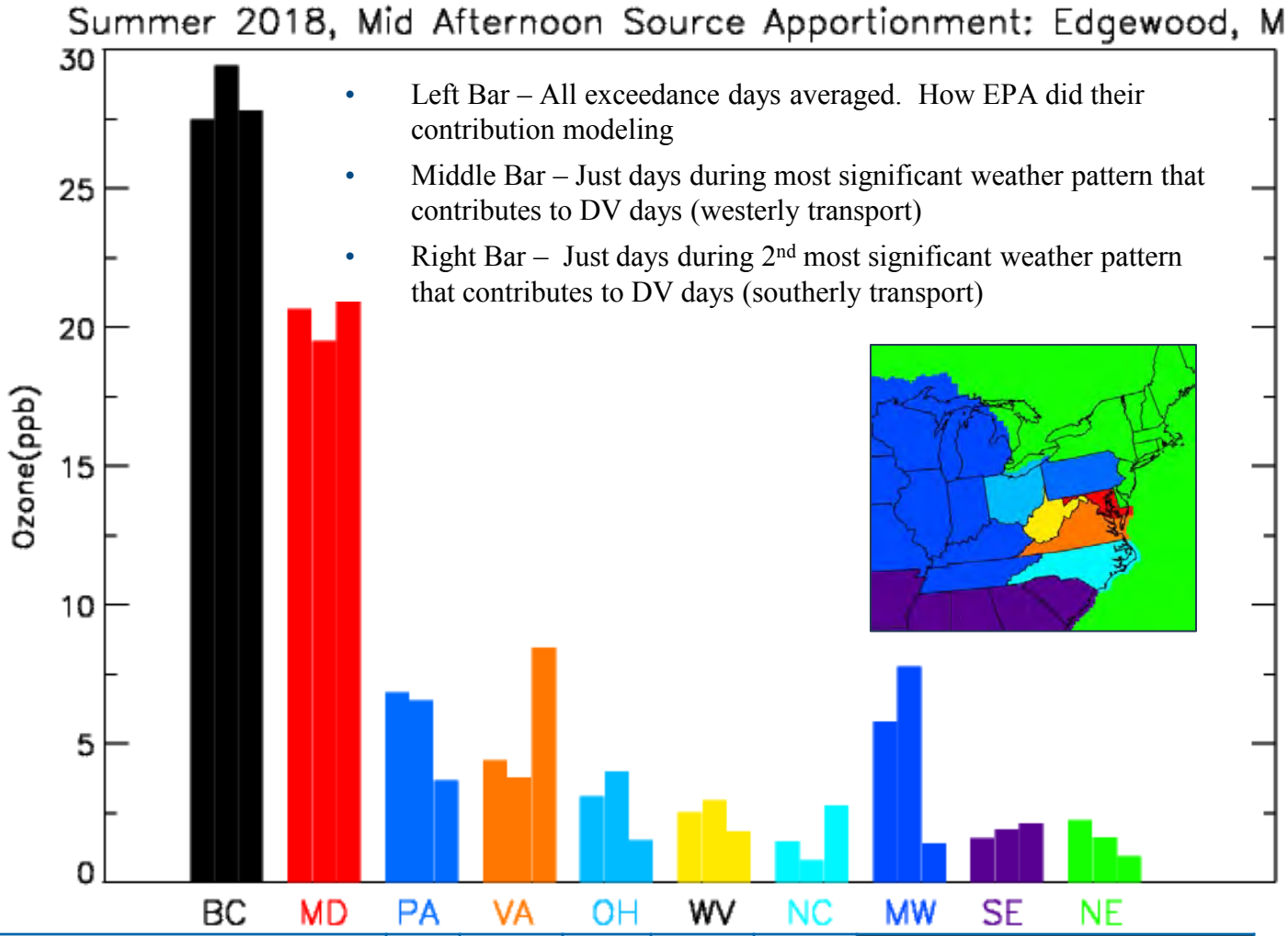
This is generally how EPA has used OSAT to define contribution – Averages all bad days together

Percent contribution to Harford monitor – EPA preliminary analysis	6.93	4.43	4.17	2.80		0.57	0.86		Not	Not	Not	

Preliminary analyses – contact Dan Goldberg, UMD prior to use

Shouldn't Contribution Focus on Days that Count?

Attainment is based upon the worst days (DV days) not average bad days

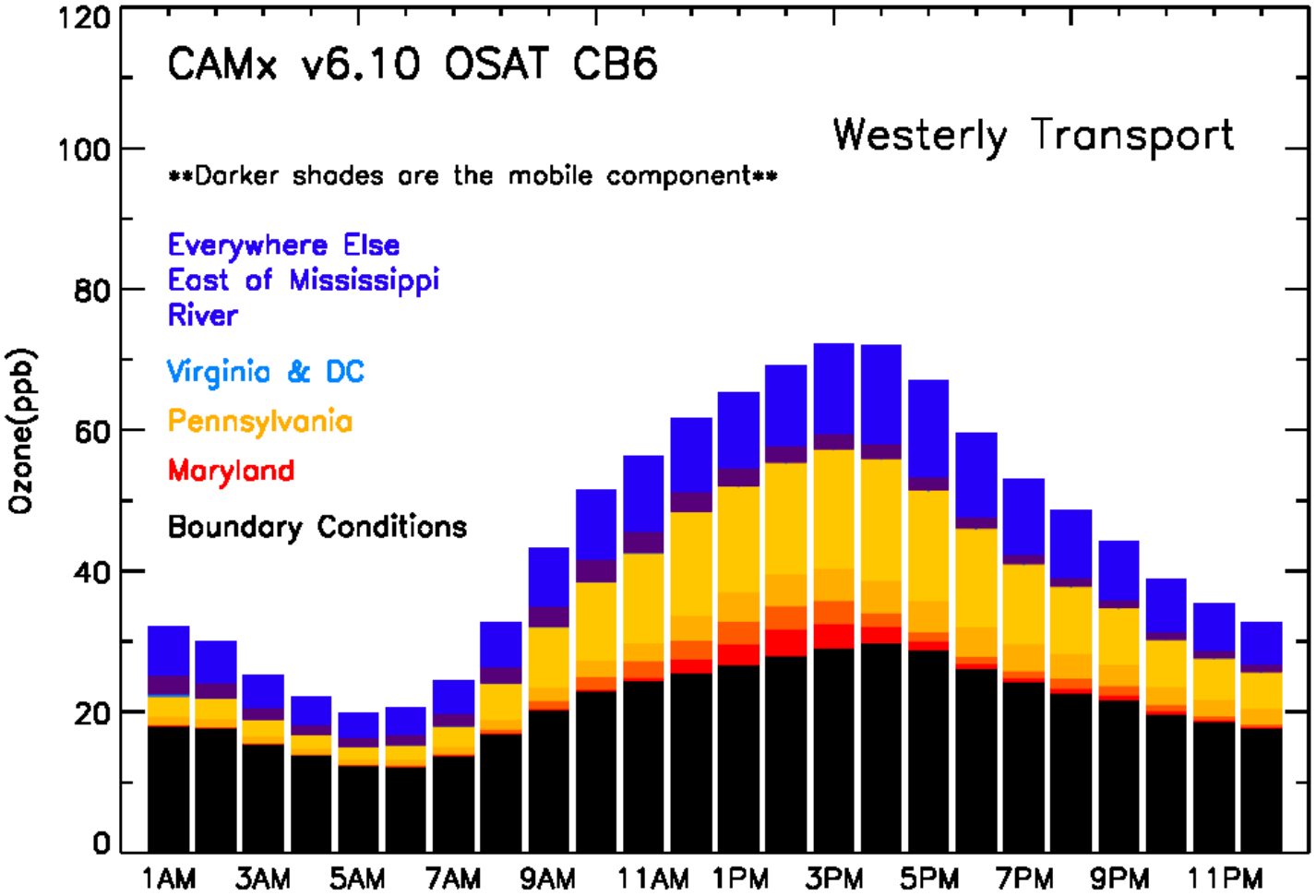


- Left Bar – All exceedance days averaged. How EPA did their contribution modeling
- Middle Bar – Just days during most significant weather pattern that contributes to DV days (westerly transport)
- Right Bar – Just days during 2nd most significant weather pattern that contributes to DV days (southerly transport)

Percent contribution to Harford monitor – EPA preliminary analysis	6.93	4.43	4.17	2.80	0.57	

Transport from the West

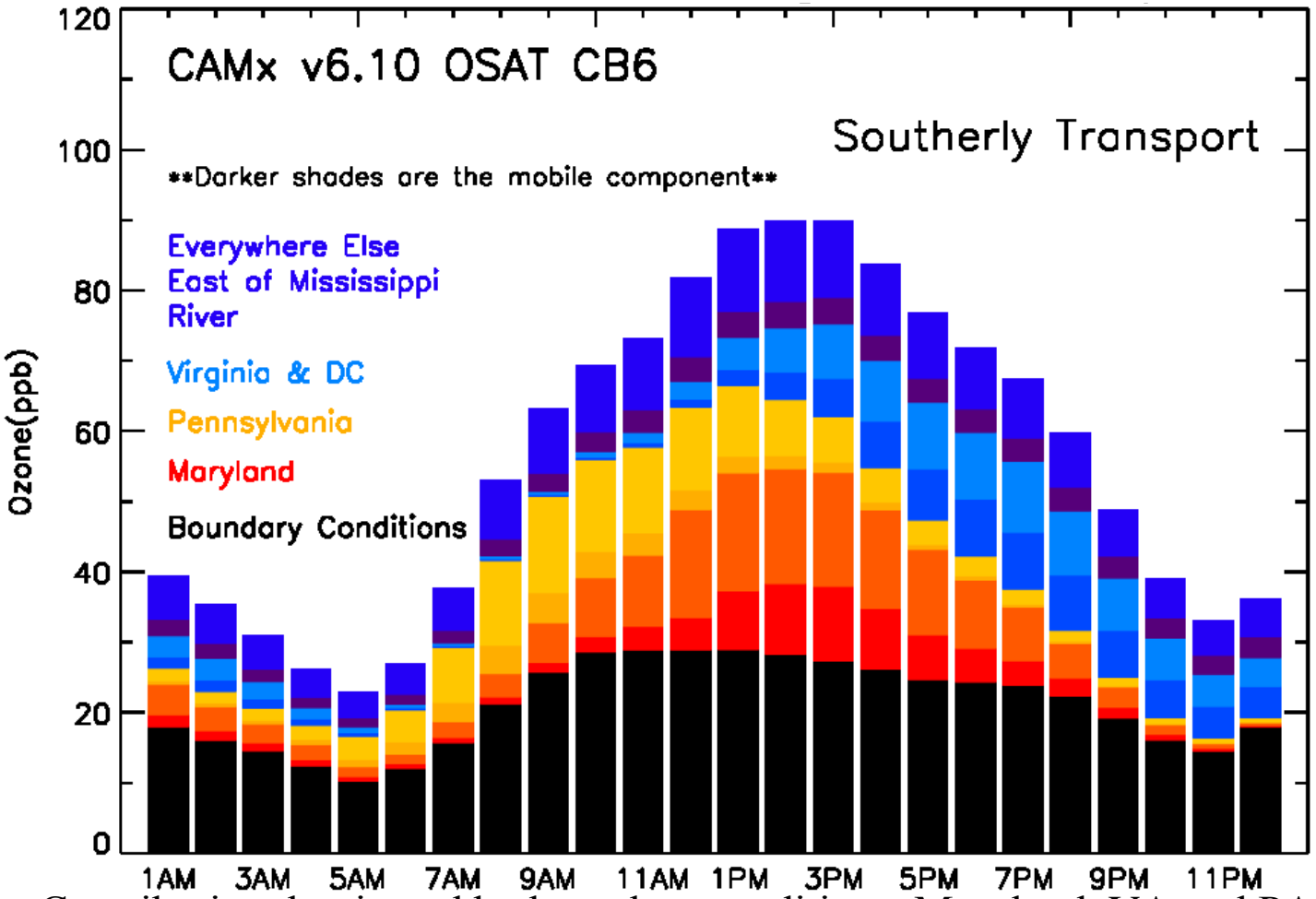
Contribution – Edgewood MD – July 4, 2011



Contribution dominated by boundary conditions, Pennsylvania and other areas. MD and VA contribution is smaller.

Transport from the South

Contribution – Edgewood MD – July 6, 2011

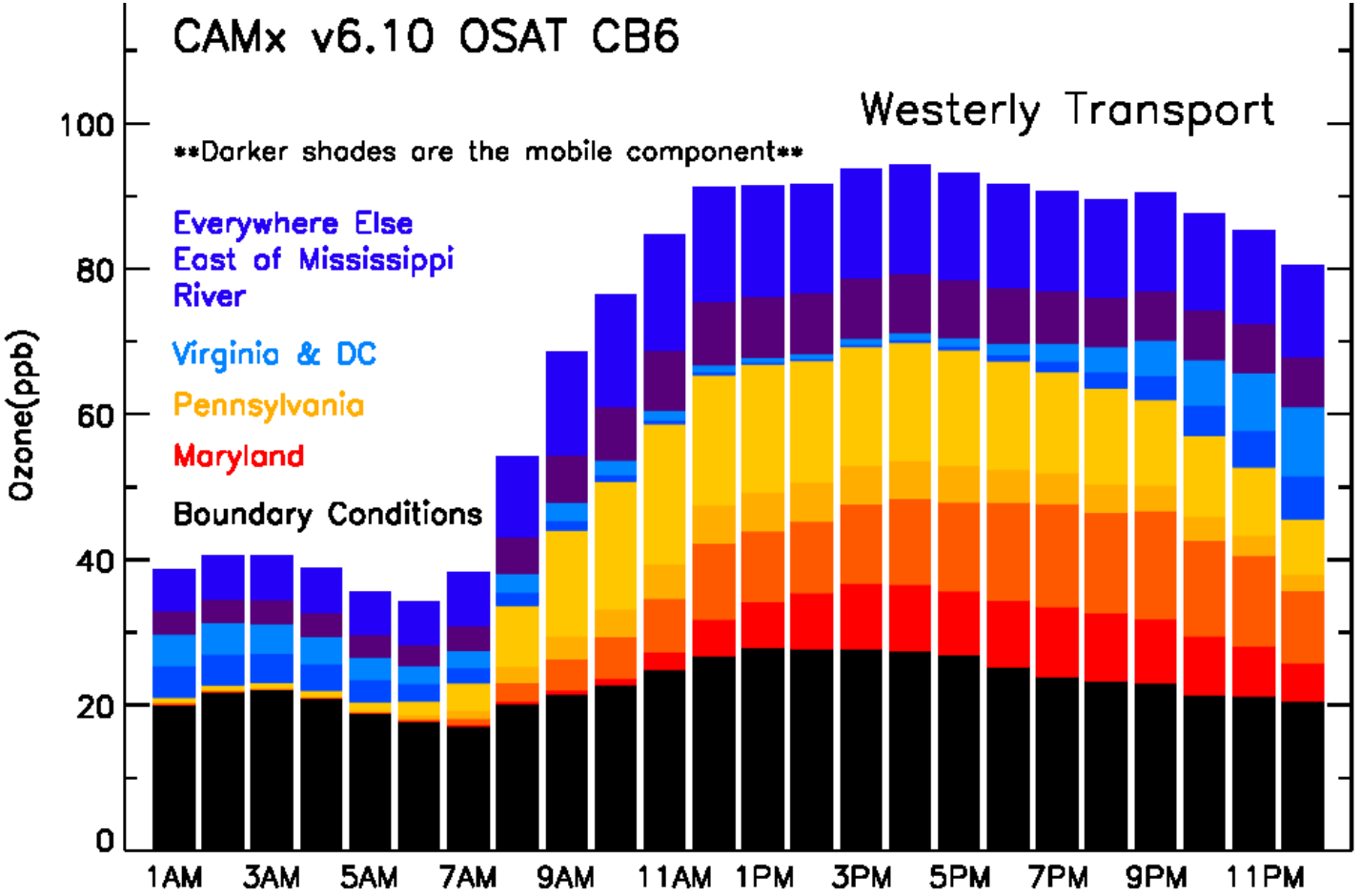


Contribution dominated by boundary conditions, Maryland, VA and PA.
Contribution from other areas is smaller.

Westerly with a Little Southerly Flow

… and maybe a nocturnal low level jet ?

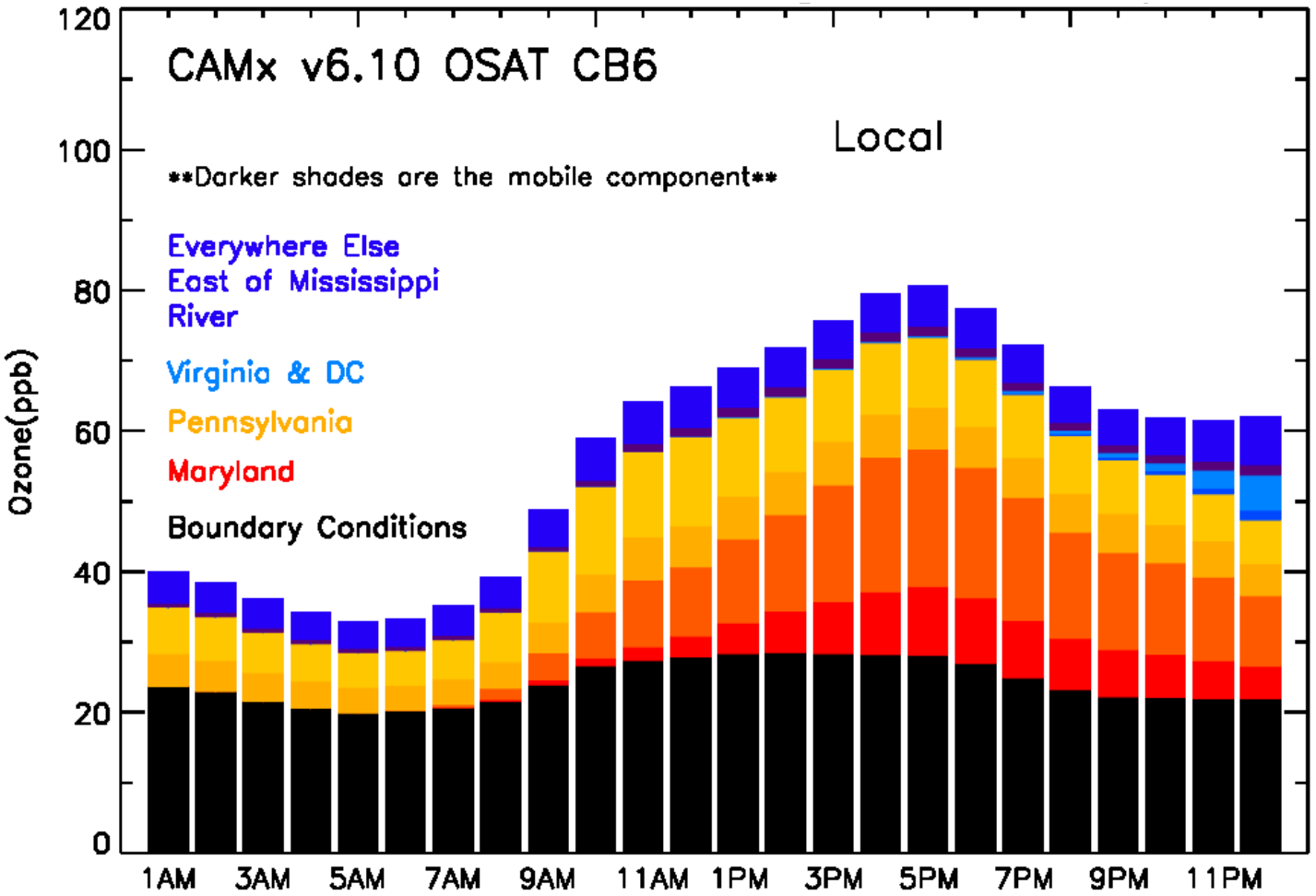
Contribution – Edgewood MD – July 7, 2011



Contribution spread between boundary conditions, MD, PA and other areas.
Note interesting VA contribution at night during a westerly flow event.

Contribution by Transport Pattern - Local

Contribution – Edgewood MD – July 2, 2011



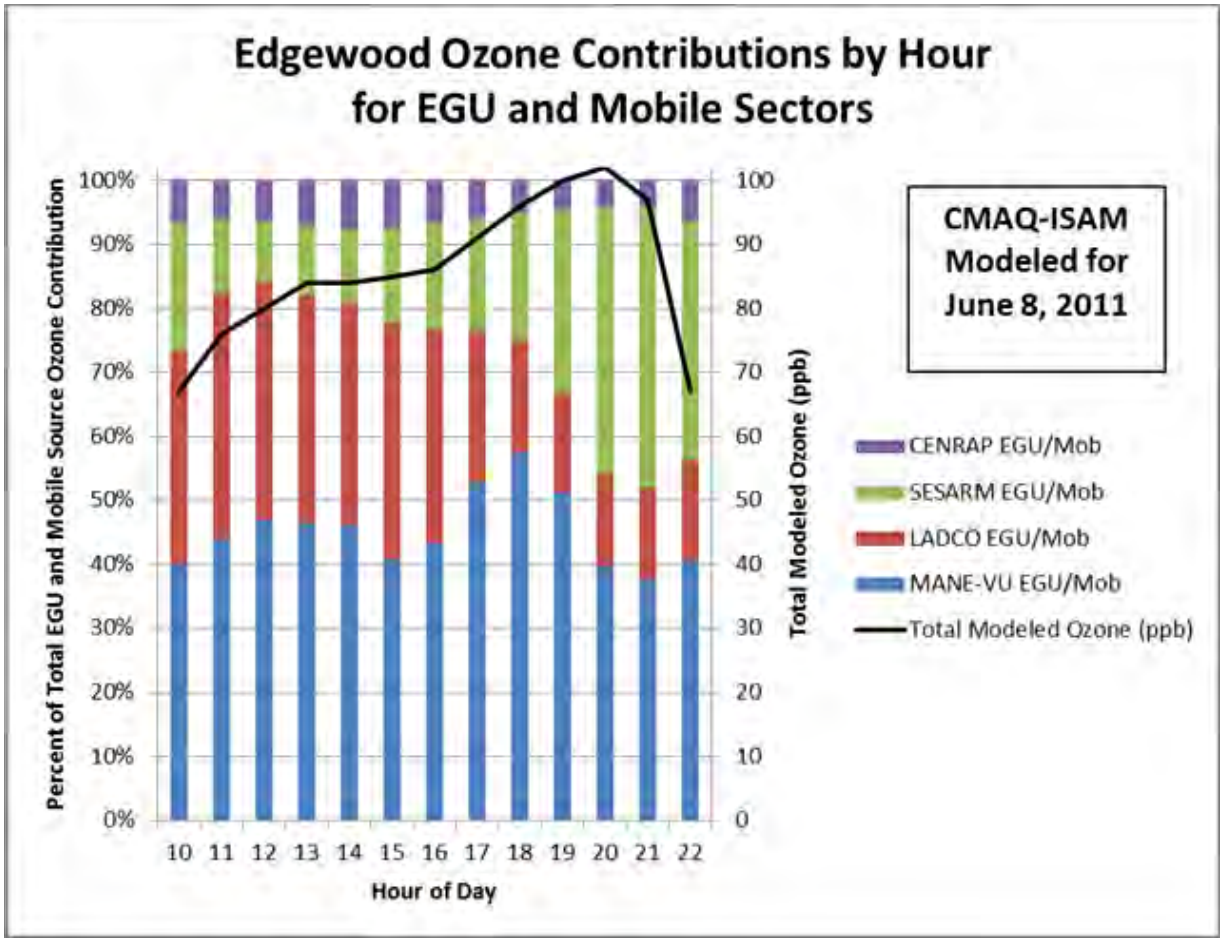
Contribution dominated by boundary conditions, Maryland and Pennsylvania. Contribution from other areas is smaller.

New York Contribution Modeling

- NYDEC actually originated the work looking at day specific and meteorologically driven contribution
- Using CMAQ's Integrated Source Apportionment Method (CMAQ-ISAM)
- Focused on ozone contribution from EGU/mobile by region
- A few samples of the preliminary NYDEC ISAM work

Weather and Time of Day Really Matter

… Hour by hour contribution on June 8, 2011 A "westerly transport" day



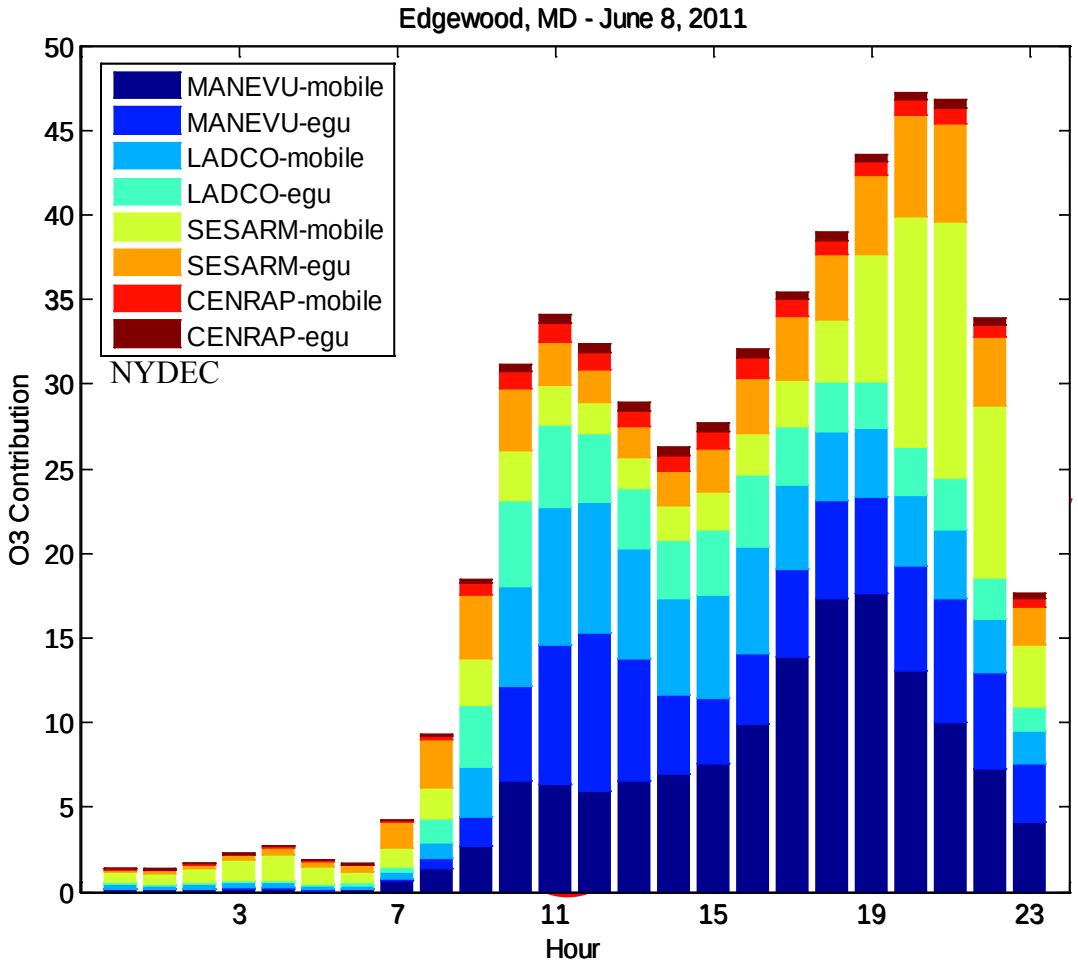
- Steady large contribution from OTC states all day
- Large contribution from Midwest states in the morning and middle of the day
- Large contribution from southeast states in the afternoon (believe to be mostly Northern VA)

NYDEC

Weather also Affects Sector Contribution

… Hour by hour contribution on June 8, 2011 from key sectors

(Does not include all source sectors that are part of the modeling)



- Contribution in the morning is from mobile and EGU sectors
  - More from OTC and LADCO states
  - Less from SESARM
- Contribution in the afternoon shifts to more mobile and more from SESARM states (believe mostly N. VA)
  - Less from LADCO
- There is simply no silver bullet

Timing and Next Steps

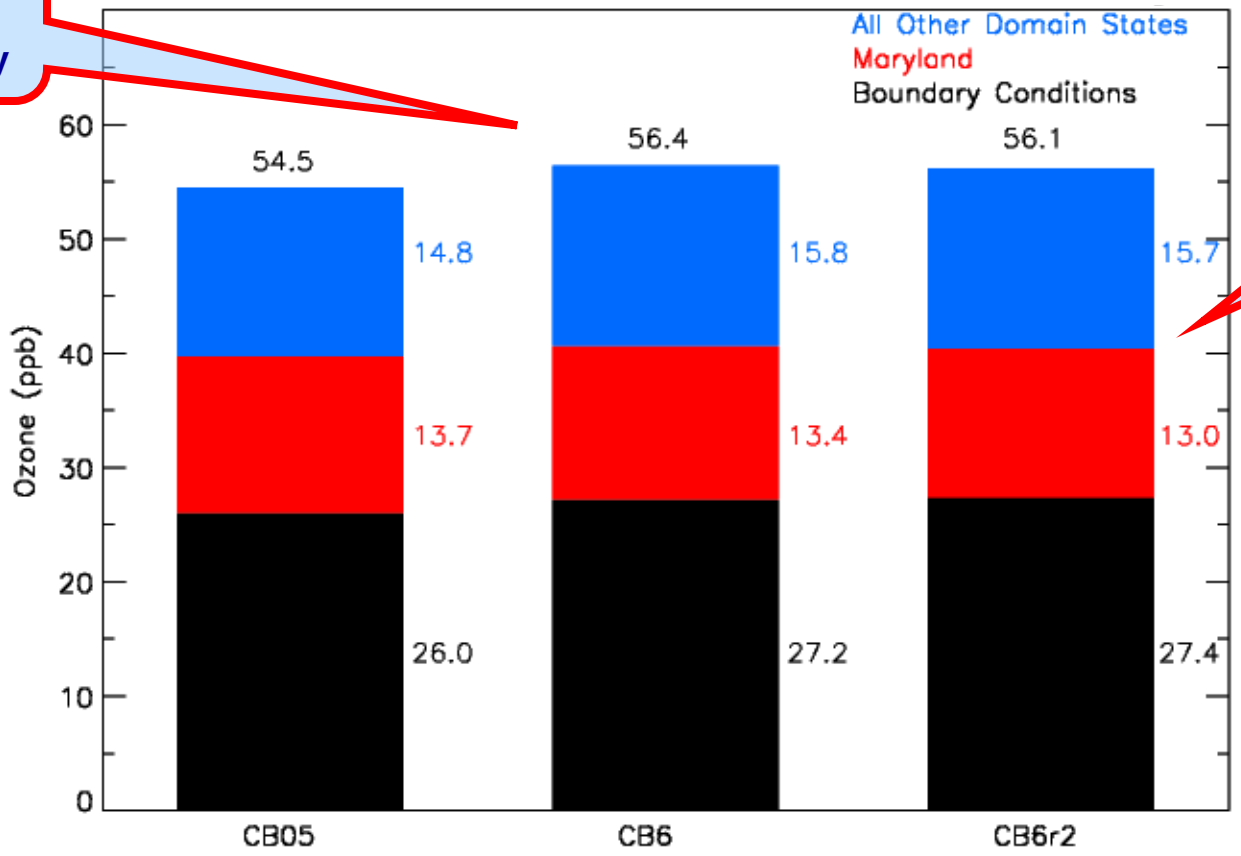
- Still working to submit Attainment SIP ASAP
  - Yes, data is clean … for now … but we do not believe the weather will always be so friendly
    - We take our responsibility to attain as expeditiously as possible very seriously
- MD effort is very much linked to SCOOT
  - Hope to have some general Good Neighbor agreements by summer 2015
- Several key areas we are working on to improve our modeling and technical analyses
  - New chemistry
  - New EPA guidance on calculating DVs
  - New research on the key role of NOx
  - New biogenics, ships… no extra slides

New Chemistry

EPA has just released new CB6 chemistry for CAMX.
U of M also doing "enhanced chemistry" sensitivity testing with CMAQ

Ozone levels appear to be higher with new chemistry

Surface Ozone Mid-afternoon in the Baltimore, MD region during the July 2011 Median: CB05, CB6 & CB6r2 gas-phase chemistry



Local contribution appears to go down and upwind contribution goes up

Larger contributions from upwind locations when using the new CB6r2 gas-phase chemistry

New EPA Guidance on DV Calculations

EPA has just released new "MATS" guidance on calculating DVs

CAMx v6.10 Design Values (2011 Platform) New RRF Calculation

Maryland Monitoring Location	County	2011 DV (ppb)	2018 CAMx Baseline (ppb)	2018 CAMx Baseline New RRF (ppb)
Davidsonville	Anne Arundel	83.0	72.1	70.7
Padonia	Baltimore	79.0	71.4	71.3
Essex	Baltimore	80.7	72.1	71.1
Calvert	Calvert	79.7	69.3	68.1
South Carroll	Carroll	76.3	66.8	66.8
Fair Hill	Cecil	83.0	72.2	70.9
Southern Maryland	Charles	79.0	68.3	67.6
Frederick Airport	Frederick	76.3	67.2	67.0
Piney Run	Garrett	72.0	62.2	61.8
Edgewood	Harford	90.0	79.7	79.0
Aldino	Harford	79.3	69.1	67.6
Millington	Kent	78.7	68.2	66.8
Rockville	Montgomery	76.3	67.8	66.9
HU-Beltsville	Prince George's	79.0	68.8	67.9
PG Equestrian Center	Prince George's	82.3	71.2	70.0
Hagerstown	Washington	72.7	64.0	63.9
Furley	Baltimore City	73.7	67.0	67.1

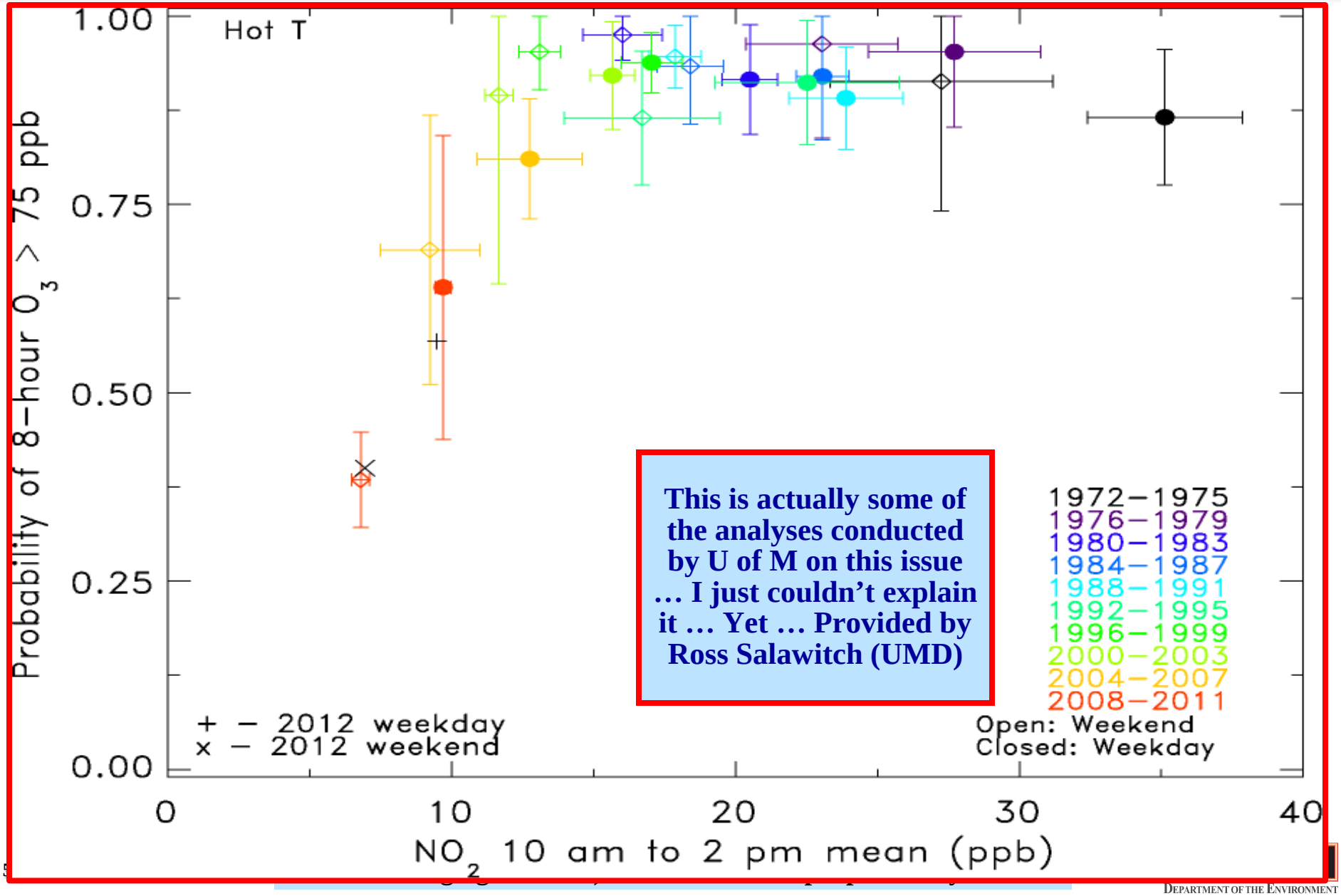
Sometimes no change at all

Usually a little lower

Sometimes a little higher

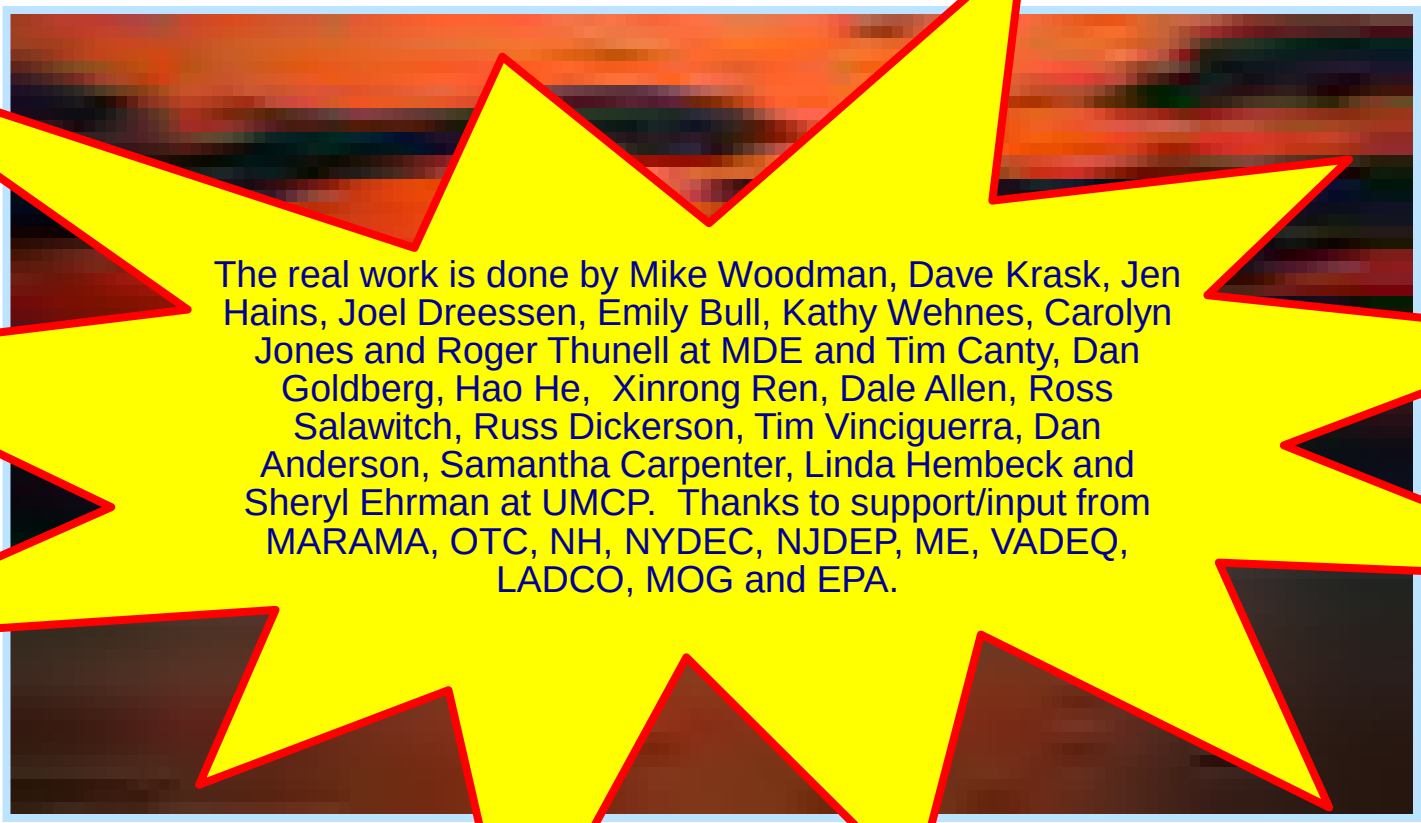
Very recent work with CMAQ shows the new DV calculations give us consistently lower ozone values – sometimes a ppb

Have We Reached a Tipping Point with NOx?



This is actually some of the analyses conducted by U of M on this issue … I just couldn't explain it … Yet … Provided by Ross Salawitch (UMD)

Thanks



The real work is done by Mike Woodman, Dave Krask, Jen Hains, Joel Dreessen, Emily Bull, Kathy Wehnes, Carolyn Jones and Roger Thunell at MDE and Tim Canty, Dan Goldberg, Hao He, Xinrong Ren, Dale Allen, Ross Salawitch, Russ Dickerson, Tim Vinciguerra, Dan Anderson, Samantha Carpenter, Linda Hembeck and Sheryl Ehrman at UMCP. Thanks to support/input from MARAMA, OTC, NH, NYDEC, NJDEP, ME, VADEQ, LADCO, MOG and EPA.