Solving the Ozone Transport Problem

A Proposal for a Collaborative Solution

Technical and Policy Framework for Resolving the Issue Through Complementary “Good Neighbor” and “Attainment” SIPs

Tad Aburn, Air Director, MDE
LADCO Air Directors – May 1, 2014

Martin O’Malley, Governor  |  Anthony G. Brown, Lt. Governor  |  Robert M. Summers, Ph.D., Secretary
Topics

- Background
- Scenario 7 and 7B Modeling
  - Just a peak at 7B
  - What Do They Tell Us?
- Mobile Sources, Power Plants and Transport
  - Some science, some data and some common sense next steps
  - Addressing mobile sources along the I-95 Corridor
  - Some power plant issues we should discuss
- A “State Initiated Solution” to the ozone transport problem
  - A proposal from Maryland
Background – Ozone Transport

• Many, many balls in the air
  • Supreme Court deliberations
  • “Expand the OTR” Petition under Section 176A of the Clean Air Act (CAA)
  • Challenges to EPA over large nonattainment areas (CAA Section 107)
  • Challenges to EPA over “Good Neighbor” SIPs (CAA Section 110A2D)
  • EPA’s Transport Rule Process
  • A collaborative effort between upwind and downwind states to address the ozone transport issue

• Remainder of this presentation will focus on the collaborative effort
On August 6, 2013- Approximately 30 Air Directors participated in a call to begin a technical collaboration on ozone transport in the East.

There was discussion … and general agreement … on beginning technical analyses of a scenario (called “Phase 1”) that would try and capture the progress that could be achieved if:

- The EPA Tier 3 and Low Sulfur Fuel program is effectively implemented.
- The potential changes in the EGU sector from shutdowns and fuel switching driven by MATS, low cost natural gas and other factors were included.
- The potential changes in the ICI Boiler sector driven by Boiler MACT and low cost natural gas were also included.
- There was also general agreement that, at some point, Commissioner level discussions may take place.

In early April 2014, preliminary discussions between Commissioners began.

- A Commissioner level Collaborative is being discussed.
OTC Scenario 7 and 7B

• Preliminary sensitivity runs to try and get a general feel for how the “Phase 1” collaborative strategy will help reduce ozone

• Built from the OTC 2007 Platform

• Will be updated … in many ways … as new data becomes available
  • 2011/2018 EPA information
  • Updated ERTAC projections
  • More

• Basic new controls included in Scenario 7 and 7B
  • Mobile
  • EGU
  • ICI Boiler
Reductions from Mobile Sources

• Adds additional mobile source NOx reductions in the 2018 time frame from EPA’s proposed Tier 3 and Low Sulfur Fuel Rule

• Builds off of fairly significant NOx reductions from current mobile source measures including:
  • EPA Tier 2 standards
  • Reformulated gasoline and other fuels
  • I & M Programs
  • More

• Programs like Tier 2 continue to generate more reductions through 2018 as the fleet turns over
Reductions from EGUs

• Based on overwhelming input from many states on the need to try and capture all of the changes in the EGU sector

• Significant changes:
  • Shutdowns
  • MATS compliance
  • Fuel conversions resulting from low cost natural gas

• What’s included in Scenario 7 and 7B?
  • PJM and other announced shutdowns
  • Other changes built into regional ERTAC projections like natural gas conversions
  • Assumptions about loss of capacity being replaced by natural gas and coal generation
## Reductions from ICI Boilers

- Preliminary estimates generated working with the Council of Industrial Boiler Owners (CIBO)
- Driven primarily by Boiler MACT and low cost natural gas
- Preliminary estimates may underestimate reductions according to recent discussions with CIBO

<table>
<thead>
<tr>
<th></th>
<th>ICI Boiler Emission Reductions in the East</th>
<th>Change in Total Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>52%</td>
<td>2.3%</td>
</tr>
<tr>
<td>SO2</td>
<td>76%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Direct PM</td>
<td>82%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
Model Set-Up and Performance

- No detail in this presentation
- Available, but not really that critical
- Scenario 7 and 7B ... again are preliminary sensitivity runs
- Basics
  - Built from OTC 2007 CMAQ Platform
  - Model performance is generally acceptable
  - Do include some recent ERTAC EGU projection work
Concentrations – Before and After

Before Scenario 7

After Scenario 7
Modeled Design Values

Before Scenario 7

After Scenario 7

2007 Base

2018 Scenario 7
## Maryland Design Values

... Before and after Scenario 7

<table>
<thead>
<tr>
<th>County</th>
<th>Design Value 2007</th>
<th>After Scenario 7 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne Arundel</td>
<td>85.7</td>
<td>68</td>
</tr>
<tr>
<td>Baltimore</td>
<td>77.3</td>
<td>65</td>
</tr>
<tr>
<td>Baltimore</td>
<td>83.3</td>
<td>71</td>
</tr>
<tr>
<td>Calvert</td>
<td>78</td>
<td>61</td>
</tr>
<tr>
<td>Carroll</td>
<td>82.3</td>
<td>66</td>
</tr>
<tr>
<td>Cecil</td>
<td>89</td>
<td>74</td>
</tr>
<tr>
<td>Charles</td>
<td>80.7</td>
<td>62</td>
</tr>
<tr>
<td>Frederick</td>
<td>80.3</td>
<td>65</td>
</tr>
<tr>
<td>Garrett</td>
<td>73.3</td>
<td>63</td>
</tr>
<tr>
<td>Harford</td>
<td>90.7</td>
<td>76</td>
</tr>
<tr>
<td>Harford</td>
<td>87.3</td>
<td>74</td>
</tr>
<tr>
<td>Kent</td>
<td>81.3</td>
<td>66</td>
</tr>
<tr>
<td>Montgomery</td>
<td>82.7</td>
<td>68</td>
</tr>
<tr>
<td>Prince George's</td>
<td>82</td>
<td>67</td>
</tr>
<tr>
<td>Prince George's</td>
<td>85.3</td>
<td>68</td>
</tr>
<tr>
<td>Washington</td>
<td>76.7</td>
<td>62</td>
</tr>
<tr>
<td>Baltimore (City)</td>
<td>67</td>
<td>57</td>
</tr>
</tbody>
</table>
Updated CMAQ Chemistry?

- For years, Maryland and the University of Maryland have been analyzing model performance aloft, where most transport takes place
  - Not always great
- In 2011, the Discover AQ field study in the Mid-Atlantic provided new unique data aloft
- U of M has analyzed aloft chemistry and found some problems with nitrogen chemistry
  - Fails to carry NOx reduction benefits downwind
- Working with ORD on new aloft chemistry concepts
  - Will show small, but important additional benefits from regional scale NOx strategies
  - Maybe an extra 2 ppb benefit in Maryland
### Scenario 7 Screening Modeling Results

#### High Values - OTR State

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Scenario 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>76</td>
</tr>
<tr>
<td>DE</td>
<td>69</td>
</tr>
<tr>
<td>DC</td>
<td>70</td>
</tr>
<tr>
<td>ME</td>
<td>65</td>
</tr>
<tr>
<td>MD</td>
<td>76</td>
</tr>
<tr>
<td>MA</td>
<td>72</td>
</tr>
<tr>
<td>NH</td>
<td>62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Scenario 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJ</td>
<td>78*</td>
</tr>
<tr>
<td>NY</td>
<td>77</td>
</tr>
<tr>
<td>PA</td>
<td>79</td>
</tr>
<tr>
<td>RI</td>
<td>66</td>
</tr>
<tr>
<td>VT</td>
<td>57</td>
</tr>
<tr>
<td>VA (OTR)</td>
<td>70</td>
</tr>
</tbody>
</table>

* NJ’s highest monitor (85 ppb) is being evaluated for performance*
## Scenario 7 Screening Modeling Results
### High Values – Other States

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Scenario 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>73</td>
</tr>
<tr>
<td>Cook County</td>
<td></td>
</tr>
<tr>
<td>Kentucky</td>
<td>68</td>
</tr>
<tr>
<td>Jefferson County</td>
<td></td>
</tr>
<tr>
<td>North Carolina</td>
<td>72</td>
</tr>
<tr>
<td>Mecklenburg County</td>
<td></td>
</tr>
<tr>
<td>Georgia</td>
<td>77</td>
</tr>
<tr>
<td>DeKalb County</td>
<td></td>
</tr>
<tr>
<td>Indiana</td>
<td>75</td>
</tr>
<tr>
<td>Lake County</td>
<td></td>
</tr>
</tbody>
</table>
Scenario 7B

- An update to Scenario 7
  - Still based on 2007 base year
  - Better ERTAC data
  - Other improvements
  - Lost generation … now also moves to coal … not just natural gas
- Still being reviewed … but
  - Results will be very similar to Scenario 7
- For Maryland, with enhanced chemistry, new local controls that have not yet been included, Tier 3 Vehicle and Fuel Standards and a few fixes to the regional power plant piece of the puzzle (more in a minute)
  - … I believe we will model attainment
- Hope to have modeling with 2011/2018 base year/platform soon
  - Believe the updated platform may actually show greater ozone benefit
Maryland’s Ozone Research Effort

- MDE works in partnership with local universities (UMD at College Park, UMBC, Penn State and Howard University) to study Maryland’s air pollution problems
  - Airplanes
  - Balloons
  - Lidar
  - Profilers
  - Satellites
  - Special monitors
  - Modeling
  - More
Understanding Ozone Transport

• It’s complicated … but not that complicated … some key concepts
• An “elevated reservoir” of ozone
  • A transport cloud
  • An elevated ocean of ozone
  • The residual layer
• Three different types of transport
  • Westerly Transport – Power plants are a contributor
  • Night-time, Southerly Transport – Vehicles, power plants, more
  • City to City – Washington to Baltimore … NY to CT, etc. – mostly vehicles
What is This Reservoir?

*A balloon launch at 2:30 am south of Baltimore ... north of Washington*

---

**Ground level ozone is low ... about 40 ppb**

**We measure a cloud of high ozone aloft ... 2000 feet above ground level ... 100ppb**

**We see this before almost every bad ozone day**
The Elevated Ozone Reservoir

- Every bad ozone day, in the morning hours, a large reservoir of ozone sits above Maryland and the Mid-Atlantic waiting to mix down
  - Ozone levels in the reservoir can routinely reach 60 to 100 ppb
  - In the morning, ozone levels at the surface are very low
- Around 10:00 or 11:00 … the “nocturnal inversion” breaks down … and
  - Ozone in the elevated reservoir mixes down to the surface and degrades air quality
The Elevated Reservoir – The 90’s

Aloft Ozone Reservoir (July 15, 1995)

1. Elevated Reservoir Before Inversion Break
2. Inversion Breaks The Regional Signal
3. Local and Regional Pollution Combined

Hourly Ozone Concentration (ppb)

Source: Maryland Department of the Environment

Line: Average Profile of Maryland Monitors (Near Sea-Level)
Shaded: Variations of Near Sea-Level Monitors
Same Signal – New York 2011

Aloft Ozone Reservoir (June 8, 2011)

1. Elevated Reservoir Before Inversion Break
2. Inversion Breaks The Regional Signal
3. Local and Regional Pollution Combined

Source: Maryland Department of the Environment
This is a good way to look at the regional part of our problem in Maryland. Regional mobile sources, power plants and other sources all contribute to the “reservoir”. You see this “regional” component …. pretty much … all summer long.

This is a good way to look at the “local” part of our problem in Maryland. Mobile sources generally dominate this piece of our problem, but other sources and more “close by” power plants also contribute. Local does not mean just Baltimore. For Baltimore, “local” also clearly includes the huge emission contribution from mobile sources around Washington DC.
Reducing Regional Ozone – A Case Study

- The 2003/2004 NOx SIP Call as a case study. Significant NOx reductions from Federal Tier 2 Vehicle Standards occurring in the same time frame
  - A classic ozone transport success story
  - Incoming ozone levels collect in an elevated reservoir over night
  - Real world programs like the NOx SIP call and Tier 2 Vehicle Standards show that:
    - Adding regional controls …
    - Results in regional NOx emission reductions …
    - Which leads to reduced ozone in the elevated reservoir …
    - Which lead to lower ozone at ground level and public health protection!

Ground Level Ozone Drops Dramatically in the Same Time Frame

- [Chart showing Maryland's 8-Hour Ozone Design Value per Year]
So … Where Does This Take Us?

- We understand the science of ozone better than ever
- We’ve implemented programs that have worked in the real world
- Maryland needs a two-part strategy to continue making progress
  - Local controls are still critical
    - We need to be pushing the envelope on mobile sources
  - National/super-regional controls are also essential
    - EPA’s Tier 3 Vehicle and Fuels Standard is the most important new measure needed by Maryland
    - There has been significant progress in reducing NOx from regional power plants
      - But there are a few issues that need to be resolved
Pushing Local Controls

- Mobile sources
  - Older efforts
    - California car state
    - Enhanced I & M
    - Many other programs
  - New efforts
    - Governor’s ZEV MOU
    - Aftermarket catalysts
    - Ports
    - Many diesel initiatives
    - Older vehicle and “legacy fleet” initiatives
    - “Beyond Conformity” (VMT reduction) efforts

- Other sectors
  - Many “Copied from CA” VOC regulations
  - NOx reductions from small and large non-EGU stationary source
  - Diesel generators that participate in demand response programs
  - More
Conducted Analyses of EGU data in 11 states

Why West Virginia?
A Good Story
Have 99% of what is needed to submit an appropriate “Good Neighbor” SIP
Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- We are trying to make sure we capture all of the changes that have occurred in upwind power plants and have put together this small sample package of data and analyses to begin a dialogue with upwind states to make sure we have the best data available.
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their controls during the ozone season because of the recent changes in the energy market, reduced coal capacity and inexpensive allowances. This, in many states … like Maryland and many other states … who drive their controls with an “ozone season tonnage cap”, is perfectly legal.
  - This is a critical issue that we would also like to begin a dialogue on with you. There appears to be an interest from the EGU sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE is also doing the peak day emissions analyses for two additional, large, regional scale, ozone episodes: July 1-7, 2011 and July 1-10, 2012.
- More detailed data and analyses and spreadsheets are available upon request.
WV Coal Capacity Breakout

- Total Capacity Coal = 15,849 MW
  - 15 units with SCR = 11,755 MW = 74%
  - 4 with SNCR = 496 MW = 3%
  - 19 without SCR/SNCR = 3597 MW = 23%

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
We began looking at Maryland sources in 2011 and 2012. We have a comprehensive stakeholder process for our updated EGU requirements. Material on the Maryland regulation development process are on the MDE “stakeholder” page.
Running Controls

Average Ozone Season Emission Rates at Specific Units by Year

West Virginia Coal Fired EGUs, SCR

Example: Specific units (names not shown) consistently running controls

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
Average Ozone Season Emission Rates at Specific Units by Year

Not Running Controls Well

Example: Specific units (names not shown) not running controls in later years.

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
Changes That Are In The Works

West Virginia Coal EGUs, July 2, 2011

- Shutdown by 2017
  - Per ERTAC-EGU Version 2.0
  - Unit Availability File (updated 8/16/2013)

- Controls/Fuel Switches by 2019
  - Per ERTAC-EGU Version 2.0
  - Controls File (updated 8/16/2013)

- Optimistic Shutdown by 2018
  - Per a variety of media sources

- Optimistic Controls/Fuel Switches by 2016
  - Per a variety of media sources

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
Emissions During Ozone Episodes

Primary Issue to Discuss
Can we find a common sense way to insure controls are run in the core ozone season?

Second Issue to Discuss
It appears that there are many changes taking place with these units. How can we make sure that states like Maryland have the best available data on these units?
Scenario 7 and 7B tell us that the 2018 Scenario … we all thought would show major progress … will do just that.

EPA’s process is ongoing, but the collaborative modeling could provide a higher quality solution to the issue than the EPA modeling.

- EPA’s effort is likely to be challenged.

In 2015 … Areas like Baltimore owe attainment SIPs and modeling.

- All states owe “Good Neighbor” SIPs.
  - … at some point.

A state partnership proposal by Maryland …
How Do We Move Forward?

- Clearly continue the technical collaboration
  - Commissioner level discussions appear to be supporting the states working together to find a solution
- How do we capture what Scenario 7 and 7B appear to be telling us?
  - Would love to hear thoughts from others
- One idea from Maryland …
  - Upwind and downwind states submit a package of complementary SIPs in 2015
    - Attainment SIPs from states like Maryland
      - We are the only state in the East that owes an attainment SIP in 2015
    - Good Neighbor SIPs from others
    - Supported by collaborative modeling and Maryland’s SIP quality modeling
      - This is actually what the Clean Air Act requires
  - Could “trump” the EPA Transport Rule and alter the 176A Petition
Timing

- **Maryland Straw Proposal**
  - January to December 2014
    - Technical collaboration and stakeholder discussions continue
  - Mid-2014
    - Commissioner level discussions
  - End of 2014
    - Technical work to support “Complementary Package of SIPs” complete

- Spring 2015 - States submit SIPs

- This timing works for MD’s SIP, but may also be critical if the “State Solution” is to trump the EPA transport rule and alter the 176A Petition
Thanks
Solving the Ozone Transport Problem

A Proposal for a Collaborative Solution

Technical and Policy Framework for Resolving the Issue Through Complementary “Good Neighbor” and “Attainment” SIPs

Tad Aburn, Air Director, MDE
Midwest Ozone Group Meeting – May 9, 2014

Martin O’Malley, Governor   |   Anthony G. Brown, Lt. Governor   |   Robert M. Summers, Ph.D., Secretary
My Dilemma

EPA Tad

Just submit the SIP!! …
I don’t care what you think - the law says you can clean the air by 2015

But that’s scientifically impossible … man
Baltimore – Worst Ozone in the East

Emissions in Tough Nonattainment Areas

Baltimore ... the bad boy of eastern ozone is actually an emissions wimp
> Half the emissions of Washington
> A third of the emissions in Philly
> 25% of NY emissions
Topics

• Background
• Scenario 7 and 7B Modeling
  • Just a peak at 7B
  • What Do They Tell Us?
• Mobile Sources, Power Plants and Transport
  • Some science, some data and some common sense next steps
  • Addressing mobile sources along the I-95 Corridor
  • Some power plant issues we should discuss
• A “State Initiated Solution” to the ozone transport problem
  • A proposal from Maryland
Background – Ozone Transport

• Many, many balls in the air
  • Supreme Court has recently acted
    • Not real clear on what happens next
  • “Expand the OTR” Petition under Section 176A of the Clean Air Act (CAA)
• Challenges to EPA over large nonattainment areas (CAA Section 107)
• Challenges to EPA over “Good Neighbor” SIPs (CAA Section 110A2D)
• EPA’s Transport Rule Process
  • A collaborative effort between upwind and downwind states to address the ozone transport issue
• Remainder of this presentation will focus on the collaborative effort
• On August 6, 2013- Approximately 30 Air Directors participated in a call to begin a technical collaboration on ozone transport in the East

• There was discussion … and general agreement … on beginning technical analyses of a scenario (called “Phase 1”) that would try and capture the progress that could be achieved if:
  • The EPA Tier 3 and Low Sulfur Fuel program is effectively implemented
  • The potential changes in the EGU sector from shutdowns and fuel switching driven by MATS, low cost natural gas and other factors were included
  • The potential changes in the ICI Boiler sector driven by Boiler MACT and low cost natural gas were also included
  • There was also general agreement that, at some point, Commissioner level discussions may take place

• In early April 2014, preliminary discussions between Commissioners began
  • A Commissioner level Collaborative is being discussed
OTC Scenario 7 and 7B

• Preliminary sensitivity runs to try and get a general feel for how the “Phase 1” collaborative strategy will help reduce ozone

• Built from the OTC 2007 Platform

• Will be updated … in many ways … as new data becomes available
  • 2011/2018 EPA information
  • Updated EGU (ERTAC*) projections
  • More

• Basic new controls included in Scenario 7 and 7B
  • Mobile
  • EGU
  • ICI Boiler

* ERTAC = Eastern Regional Technical Advisory Committee – State lead group working on state-of-the-art EGU emissions projections and other inventory issues
Reductions from Mobile Sources

• Adds additional mobile source NOx reductions in the 2018 time frame from EPA’s proposed Tier 3 and Low Sulfur Fuel Rule

• Builds off of fairly significant NOx reductions from current mobile source measures including:
  • EPA Tier 2 standards
  • Reformulated gasoline and other fuels
  • I & M Programs
  • More

• Programs like Tier 2 continue to generate more reductions through 2018 as the fleet turns over
Reductions from EGUs

- Based on overwhelming input from many states on the need to try and capture all of the changes in the EGU sector

- Significant changes:
  - Shutdowns
  - MATS compliance
  - Fuel conversions resulting from low cost natural gas

- What’s included in Scenario 7 and 7B?
  - PJM and other announced shutdowns
  - Other changes built into regional ERTAC projections like natural gas conversions
  - Assumptions about loss of capacity being replaced by natural gas and coal generation
Reductions from ICI Boilers

- Preliminary estimates generated working with the Council of Industrial Boiler Owners (CIBO)
- Driven primarily by Boiler MACT and low cost natural gas
- Preliminary estimates may underestimate reductions according to recent discussions with CIBO

<table>
<thead>
<tr>
<th></th>
<th>ICI Boiler Emission Reductions in the East</th>
<th>Change in Total Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>52%</td>
<td>2.3%</td>
</tr>
<tr>
<td>SO2</td>
<td>76%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Direct PM</td>
<td>82%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
Model Set-Up and Performance

- No detail in this presentation
- Available, but not really that critical
- Scenario 7 and 7B … again are preliminary sensitivity runs
- Basics
  - Built from OTC 2007 CMAQ Platform
  - Model performance is generally acceptable
  - Do include some recent ERTAC EGU projection work
Concentrations – Before and After

Before Scenario 7

After Scenario 7
Modeled Design Values

Before Scenario 7

After Scenario 7

2007 Base

2018 Scenario 7
## Maryland Design Values

... Before and after Scenario 7

<table>
<thead>
<tr>
<th>County</th>
<th>Design Value 2007</th>
<th>After Scenario 7 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne Arundel</td>
<td>85.7</td>
<td>68</td>
</tr>
<tr>
<td>Baltimore</td>
<td>77.3</td>
<td>65</td>
</tr>
<tr>
<td>Baltimore</td>
<td>83.3</td>
<td>71</td>
</tr>
<tr>
<td>Calvert</td>
<td>78</td>
<td>61</td>
</tr>
<tr>
<td>Carroll</td>
<td>82.3</td>
<td>66</td>
</tr>
<tr>
<td>Cecil</td>
<td>89</td>
<td>74</td>
</tr>
<tr>
<td>Charles</td>
<td>80.7</td>
<td>62</td>
</tr>
<tr>
<td>Frederick</td>
<td>80.3</td>
<td>65</td>
</tr>
<tr>
<td>Garrett</td>
<td>73.3</td>
<td>63</td>
</tr>
<tr>
<td>Harford</td>
<td>90.7</td>
<td>76</td>
</tr>
<tr>
<td>Harford</td>
<td>87.3</td>
<td>74</td>
</tr>
<tr>
<td>Kent</td>
<td>81.3</td>
<td>66</td>
</tr>
<tr>
<td>Montgomery</td>
<td>82.7</td>
<td>68</td>
</tr>
<tr>
<td>Prince George's</td>
<td>82</td>
<td>67</td>
</tr>
<tr>
<td>Prince George's</td>
<td>85.3</td>
<td>68</td>
</tr>
<tr>
<td>Washington</td>
<td>76.7</td>
<td>62</td>
</tr>
<tr>
<td>Baltimore (City)</td>
<td>67</td>
<td>57</td>
</tr>
</tbody>
</table>
Updated CMAQ Chemistry?

- For years, Maryland and the University of Maryland have been analyzing model performance aloft, where most transport takes place
  - Not always great
- In 2011, the Discover AQ field study in the Mid-Atlantic provided new unique data aloft
- U of M has analyzed aloft chemistry and found some problems with nitrogen chemistry
  - Fails to carry NOx reduction benefits downwind
- Working with ORD on new aloft chemistry concepts
  - Will show small, but important additional benefits from regional scale NOx strategies
  - Maybe an extra 2 ppb benefit in Maryland
### Scenario 7 Screening Modeling Results

**High Values - OTR State**

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Scenario 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>76</td>
</tr>
<tr>
<td>DE</td>
<td>69</td>
</tr>
<tr>
<td>DC</td>
<td>70</td>
</tr>
<tr>
<td>ME</td>
<td>65</td>
</tr>
<tr>
<td>MD</td>
<td>76</td>
</tr>
<tr>
<td>MA</td>
<td>72</td>
</tr>
<tr>
<td>NH</td>
<td>62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Scenario 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJ</td>
<td>78*</td>
</tr>
<tr>
<td>NY</td>
<td>77</td>
</tr>
<tr>
<td>PA</td>
<td>79</td>
</tr>
<tr>
<td>RI</td>
<td>66</td>
</tr>
<tr>
<td>VT</td>
<td>57</td>
</tr>
<tr>
<td>VA (OTR)</td>
<td>70</td>
</tr>
</tbody>
</table>

* NJ’s highest monitor (85 ppb) is being evaluated for performance*
### Scenario 7 Screening Modeling Results

**High Values – Other States**

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Scenario 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois Cook County</td>
<td>73</td>
</tr>
<tr>
<td>Kentucky Jefferson County</td>
<td>68</td>
</tr>
<tr>
<td>North Carolina Mecklenburg County</td>
<td>72</td>
</tr>
<tr>
<td>Georgia DeKalb County</td>
<td>77</td>
</tr>
<tr>
<td>Indiana Lake County</td>
<td>75</td>
</tr>
</tbody>
</table>
Scenario 7B

- An update to Scenario 7
  - Still based on 2007 base year
  - Better ERTAC data
  - Other improvements
  - Lost generation … now also moves to coal … not just natural gas
- Still being reviewed … but
  - Results will be very similar to Scenario 7
- For Maryland, with enhanced chemistry, new local controls that have not yet been included, Tier 3 Vehicle and Fuel Standards and a few fixes to the regional power plant piece of the puzzle (more in a minute)
  - … I believe we will model attainment
- Hope to have modeling with 2011/2018 base year/platform soon
  - Believe the updated platform may actually show greater ozone benefit
Maryland’s Ozone Research Effort

- MDE works in partnership with local universities (UMD at College Park, UMBC, Penn State and Howard University) to study Maryland’s air pollution problems
  - Airplanes
  - Balloons
  - Lidar
  - Profilers
  - Satellites
  - Special monitors
  - Modeling
  - More
Understanding Ozone Transport

- It’s complicated … but not that complicated … some key concepts
- An “elevated reservoir” of ozone
  - A transport cloud
  - An elevated ocean of ozone
  - The residual layer
- Three different types of transport
  - Westerly Transport – Power plants are a contributor
  - Night-time, Southerly Transport – Vehicles, power plants, more
  - City to City – Washington to Baltimore … NY to CT, etc. – mostly vehicles
- Much more on thumb drive
What is This Reservoir?

A balloon launch at 2:30 am south of Baltimore ... north of Washington

Ground level ozone is low ... about 40 ppb

We measure a cloud of high ozone aloft ... 2000 feet above ground level ... 100ppb

We see this before almost every bad ozone day
The Elevated Ozone Reservoir

- Every bad ozone day, in the morning hours, a large reservoir of ozone sits above Maryland and the Mid-Atlantic waiting to mix down
  - Ozone levels in the reservoir can routinely reach 60 to 100 ppb
  - In the morning, ozone levels at the surface are very low
- Around 10:00 or 11:00 … the “nocturnal inversion” breaks down … and
  - Ozone in the elevated reservoir mixes down to the surface and degrades air quality
The Elevated Reservoir – The 90’s

- The colored line – Aloft monitors … now supplemented with balloons
- The gray line – MD ground level ozone monitors
- Noon

Source: Maryland Department of the Environment
Same Signal – Tennessee 2011

Aloft Ozone Reservoir (June 8, 2011)

1. Elevated Reservoir Before Inversion Break
2. Inversion Breaks The Regional Signal
3. Local and Regional Pollution Combined

Source: Maryland Department of the Environment
Same Signal – New York 2011

Aloft Ozone Reservoir (June 8, 2011)

1. Elevated Reservoir Before Inversion Break
2. Inversion Breaks The Regional Signal
3. Local and Regional Pollution Combined

Source: Maryland Department of the Environment
This is a good way to look at the regional part of our problem in Maryland. Regional mobile sources, power plants and other sources all contribute to the “reservoir”. You see this “regional” component …. pretty much … all summer long.

This is a good way to look at the “local” part of our problem in Maryland. Mobile sources generally dominate this piece of our problem, but other sources and more “close by” power plants also contribute. Local does not mean just Baltimore. For Baltimore, “local” also clearly includes the huge emission contribution from mobile sources around Washington DC.
Reducing Regional Ozone – A Case Study

Ground Level Ozone Drops Dramatically in the Same Time Frame

- The 2003/2004 NOx SIP Call as a case study. Significant NOx reductions from Federal Tier 2 Vehicle Standards occurring in the same time frame
  - A classic ozone transport success story
  - Incoming ozone levels collect in an elevated reservoir over night
  - Real world programs like the NOx SIP call and Tier 2 Vehicle Standards show that:
    - Adding regional controls …
    - Results in regional NOx emission reductions …
    - Which leads to reduced ozone in the elevated reservoir …
    - Which lead to lower ozone at ground level and public health protection!
So … Where Does This Take Us?

• We understand the science of ozone better than ever
• We’ve implemented programs that have worked in the real world
• Maryland needs a two-part strategy to continue making progress
  • Local controls are still critical
    • We need to be pushing the envelope on mobile sources
  • National/super-regional controls are also essential
    • EPA’s Tier 3 Vehicle and Fuels Standard is the most important new measure needed by Maryland
    • There has been significant progress in reducing NOx from regional power plants
      • But there are a few issues that need to be resolved
Pushing Local Controls

• Mobile sources
  • Older efforts
    • California car state
    • Enhanced I & M
    • Many other programs
  • New efforts
    • Governor’s ZEV MOU
    • Electric vehicle initiatives
    • Aftermarket catalysts
    • Ports
    • Many diesel initiatives
    • Older vehicle and “legacy fleet” initiatives
    • “Beyond Conformity” (VMT reduction) efforts

• Other sectors
  • Many “Copied from CA” VOC regulations
  • NOx reductions from small and large non-EGU stationary source
  • Diesel generators that participate in demand response programs
  • More
Conducted Analyses of EGU data in 11 states

Why West Virginia?

A Good Story … Have 99% of what is needed to submit an appropriate “Good Neighbor” SIP

April 21, 2014
Purpose

- Maryland is the only Moderate nonattainment area in the East for the 75 ppb ozone standard.
  - This means that Maryland is the only state required to submit an attainment SIP
  - Only state required to perform attainment modeling.
- We are now beginning to build our “SIP Quality” modeling platform.
- We are trying to make sure we capture all of the changes that have occurred in upwind power plants and have put together this small sample package of data and analyses to begin a dialogue with upwind states to make sure we have the best data available.
- We have used readily available data, like the CAMD and ERTAC data, but we recognize that these data sources can be out of date, or not include recent changes.
  - We hope you can help us with making sure we have the best possible data.
- One major issue that our data analyses have uncovered is that many EGU units appear to not be running their controls during the ozone season because of the recent changes in the energy market, reduced coal capacity and inexpensive allowances. This, in many states ... like Maryland and many other states ... who drive their controls with an "ozone season tonnage cap", is perfectly legal.
  - This is a critical issue that we would also like to begin a dialogue on with you. There appears to be an interest from the EGU sector to discuss this issue and see if a common sense fix can be designed. Maryland believes this fix would be relatively cost-effective compared to the capital cost of the control technologies.
- MDE is also doing the peak day emissions analyses for two additional, large, regional scale, ozone episodes: July 1-7, 2011 and July 1-10, 2012.
  - More detailed data and analyses and spreadsheets are available upon request.
Current Controls?

WV Coal Capacity Breakout

- Total Capacity Coal = 15,849 MW
  - 15 units with SCR = 11,755 MW = 74%
  - 4 with SNCR = 496 MW = 3%
  - 19 without SCR/SNCR = 3597 MW = 23%

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
We began looking at Maryland sources in 2011 and 2012. We have a comprehensive stakeholder process for our updated EGU requirements. Material on the Maryland regulation development process are on the thumb drive.
Running Controls

Average Ozone Season Emission Rates at Specific Units by Year

West Virginia Coal Fired EGUs, SCR

Example: Specific units (names not shown) consistently running controls

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
Average Ozone Season Emission Rates at Specific Units by Year

West Virginia Coal Fired EGUs, SCR

Example: Specific units (names not shown) not running controls in later years.

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
Emissions During Ozone Episodes

WV - Tons Per Day NOx By Control Status

West Virginia, Peak Days in July 2011, Coal EGUs

- SCR operating
- SCR not operating
- SNCR
- without SCR/SNCR, under 3000 MMBtu
- without SCR/SNCR, over 3000 MMBtu

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
A Snapshot – Other Areas

July 2, 2011 - Tons NOx per Day by Control Status

- SCR operating
- SCR not operating
- SNCR
- without SCR/SNCR, under 3000 MMBtu
- without SCR/SNCR, over 3000 MMBtu

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
Changes That Are In The Works

West Virginia Coal EGUs, July 2, 2011

- **Shutdown by 2017**: Per ERTAC-EGU Version 2.0
  - Unit Availability File (updated 8/16/2013)

- **Optimistic Shutdown by 2018**: Per a variety of media sources

- **Optimistic Controls/Fuel Switches by 2016**: Per a variety of media sources

- **Controls/Fuel Switches by 2019**: Per ERTAC-EGU Version 2.0
  - Controls File (updated 8/16/2013)

**NOx Emissions, tons**

- **UNIT 01**
- **UNIT 02**
- **UNIT 03**
- **UNIT 04**
- **UNIT 05**
- **UNIT 06**
- **UNIT 07**
- **UNIT 08**
- **UNIT 09**
- **UNIT 10**
- **UNIT 11**
- **UNIT 12**
- **UNIT 13**
- **UNIT 14**
- **UNIT 15**
- **UNIT 16**
- **UNIT 17**
- **UNIT 18**
- **UNIT 19**
- **UNIT 20**
- **UNIT 21**
- **UNIT 22**
- **UNIT 23**
- **UNIT 24**
- **UNIT 25**
- **UNIT 26**
- **UNIT 27**
- **UNIT 28**
- **UNIT 29**
- **UNIT 30**
- **UNIT 31**
- **UNIT 32**
- **UNIT 33**
- **UNIT 34**
- **UNIT 35**
- **UNIT 36**
- **UNIT 37**

DRAFT – April 2, 2014 – Requesting QA of data. For discussion purposes only.
Two Issues to Discuss

Primary Issue to Discuss
Can we find a common sense way to insure controls are run in the core ozone season?

Second Issue to Discuss
It appears that there are many changes taking place with these units. How can we make sure that states like Maryland have the best available data on these units?
A State Driven Solution?

- Scenario 7 and 7B tell us that the 2018 Scenario … we all thought would show major progress … will do just that
- EPA’s process is likely to change and slow down
  - The collaborative modeling could provide a higher quality solution to the issue than the EPA modeling
  - EPA efforts are often challenged
- In 2015 … Areas like Baltimore owe attainment SIPs and modeling
- All states owe “Good Neighbor” SIPs
  - … at some point
- A state partnership proposal by Maryland …
How Do We Move Forward?

• Clearly continue the technical collaboration
  • Commissioner level discussions appear to be supporting the states working together to find a solution

• How do we capture what Scenario 7 and 7B appear to be telling us?
  • Would love to hear thoughts from others

• One idea from Maryland …
  • Upwind and downwind states submit a package of complementary SIPs in 2015
    • Attainment SIPs from states like Maryland
      • We are the only state in the East that owes an attainment SIP in 2015
    • Good Neighbor SIPs from others
    • Supported by collaborative modeling and Maryland’s SIP quality modeling
      • This is actually what the Clean Air Act requires
  • Could “trump” an EPA Transport Rule, alter the 176A Petition and influence any “CSAPR 2” initiative
Timing

• Maryland Straw Proposal
  • January to December 2014
    • Technical collaboration and stakeholder discussions continue
  • Mid-2014
    • Commissioner level discussions
  • End of 2014
    • Technical work to support “Complementary Package of SIPs” complete
  • Spring 2015 - States submit SIPs
    • This timing works for MD’s SIP, but may also be critical if the “State Solution” is to influence an EPA transport rule, the 176A Petition or CSAPR 2
Thanks