



Regional Haze SIP Development: Lessons Learned, Key Questions, Next Steps

NESCAUM & MARAMA Regional Haze SIP Training
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Presentation by Susan Wierman, MARAMA

Main points

- Start with existing SIP and progress report
 - Update with current inventory, data analysis, and modeling as available
- Review potential additional controls for your largest SO₂ sources – costs, impacts
- Resources are limited for regional assistance
- Aim to submit by 2018

What we've learned about progress

- Progress in Regional Haze SIPs must be measured in 3 ways.
 1. Visibility improvements (5-year average)
 2. Adoption of measures to reduce emissions
 3. Emissions reductions achieved (annual)
- Take credit for what you've accomplished!

What we've learned about SIPs

- It takes time and resources. Start now.
- Read the rule. Read the guidance. Pay attention to the checklist.
- States & regional organizations both have work to do. Assign manageable tasks.
- Use your initial SIP, progress report, and other agencies' SIPs as examples. Keep in touch with peers. Share drafts. Ask questions.



Key questions to be addressed

- 1. Which states contributed to haze at MANE-VU Class I areas in 2011?**
 - These are the states the Class I states must consult with in setting RPGs.
- 2. Which sources were the most important contributors to regional haze at MANE-VU Class I areas in 2011?**
 - These sources should be analyzed with respect to reasonable controls.
- 3. What control measures for those sources are reasonable by 2028?**
 - These must be included in state SIPs.
- 4. What impacts on visibility will result from implementing reasonable controls by 2028?**
 - This will help define Reasonable Progress Goals.

Example: 2002 Top Ranked Sulfate Contributing States for Acadia

REMSAD	Q/d	CALPUFF (NWS)	CALPUFF (MM5)	Emissions x Residence Time %
MA	Canada	Canada	MA	Canada
Canada	PA	PA	Canada	PA
PA	OH	OH	OH	OH
ME	NY	MA	PA	NY
OH	IN	NY	NY	IL

Source: MANE-VU Contribution Assessment, p. 8-9

Example: 2002 Top Ranked Sulfate Contributing States for Brigantine

REMSAD	Q/d	CALPUFF (NWS)	CALPUFF (MM5)	Emissions x % Time Upwind
PA	PA	PA	PA	PA
Ohio	Ohio	Ohio	Ohio	Ohio
Canada	MD	VA	WV	WV
NY	Canada	NC	MD	Canada
MD	WV	WV	VA	NJ

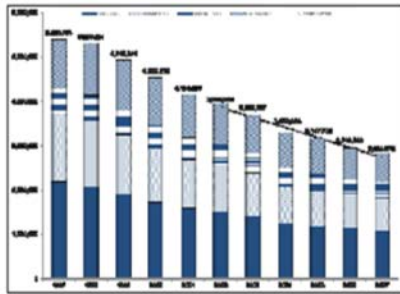
Source: MANE-VU Contribution Assessment, pp. 8-2 to 8-6

NESCAUM 2007 Contribution Update

Contributions to Regional Haze in
the Northeast and Mid-Atlantic
United States:
Preliminary Update Through 2007

Mid-Atlantic/Northeast Visibility Union
(MANE-VU) Updated Contribution Assessment

Prepared by Northeast States for Coordinated Air Use Management (NESCAUM)
for the Mid-Atlantic/Northeast Visibility Union (MANE-VU)



March 2012

- Enhanced Q/d approach by state
 - Each state's population-weighted distance
 - Weighting factor from 2002 Calpuff modeling
- Percent upwind probability based on trajectory analysis

States with largest impacts in 2007

- Acadia, Great Gulf, & Lye Brook
 - Pennsylvania
 - Ohio
 - Canada
 - New York
 - Indiana
 - Michigan
- Brigantine
 - Pennsylvania
 - Maryland
 - Ohio
 - Indiana
 - West Virginia
 - Virginia
 - North Carolina

This looks very much the same as the 2002 analysis.

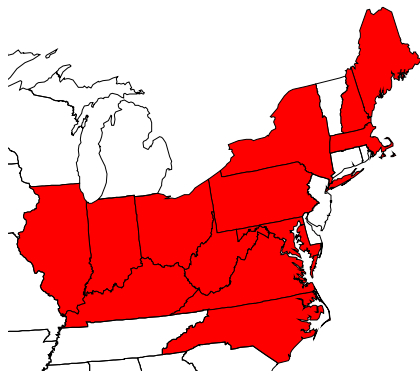
Another Example: 2002 Contribution Thresholds using REMSAD model – 3 methods

- **Method 1:** States/regions that contribute 0.1 ug/m³ sulfate or more on 20% worst visibility days
- **Method 2:** States/regions that contribute at least 2% of total sulfate observed on 20% worst visibility days
- **Method 3:** Top ten contributing states on 20% worst visibility days

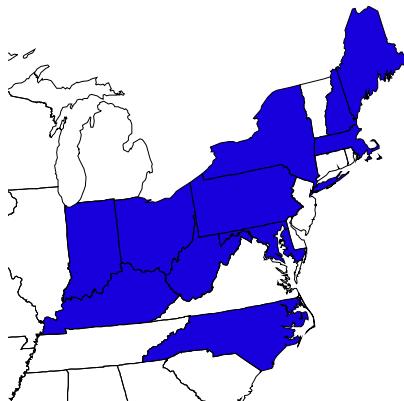
Acadia

20% Worst Days

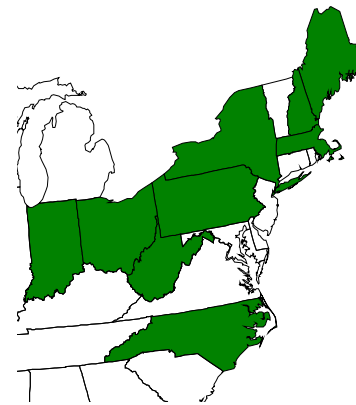
0.1 $\mu\text{g}/\text{m}^3$ Sulfate



2 % of Sulfate



Top 10 States

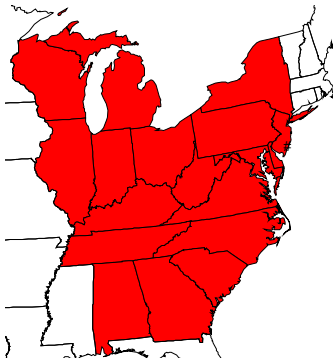


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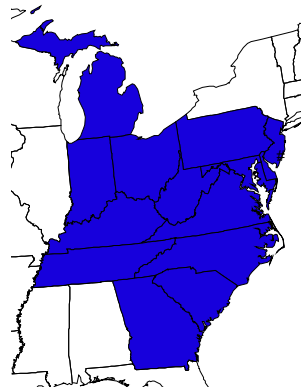
Brigantine

20% Worst Days

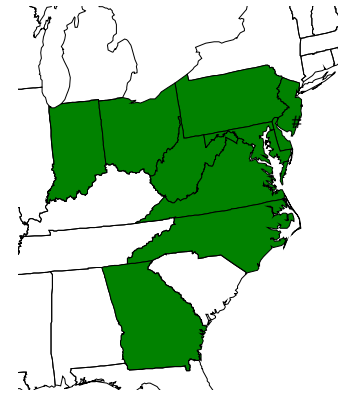
0.1 $\mu\text{g}/\text{m}^3$ Sulfate



2 % of Sulfate



Top 10 States

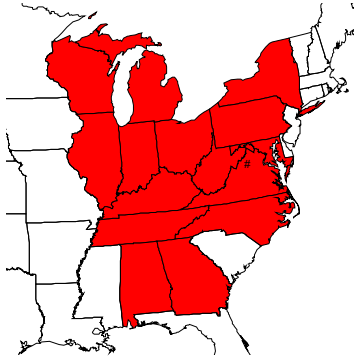


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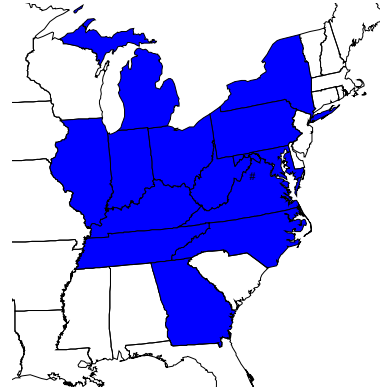
Shenandoah

20% Worst Days

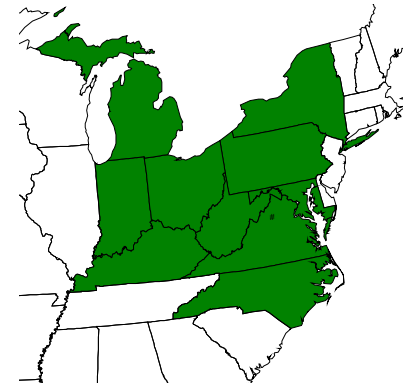
0.1 $\mu\text{g}/\text{m}^3$ Sulfate



2 % of Sulfate



Top 10 States

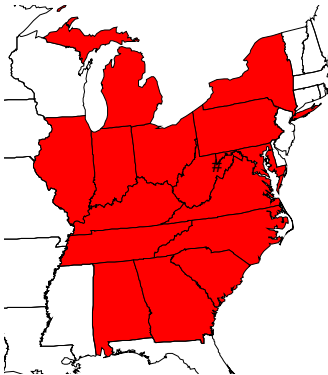


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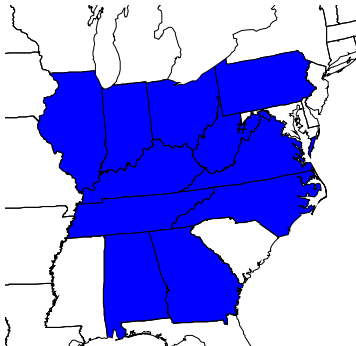
Dolly Sods

20% Worst Days

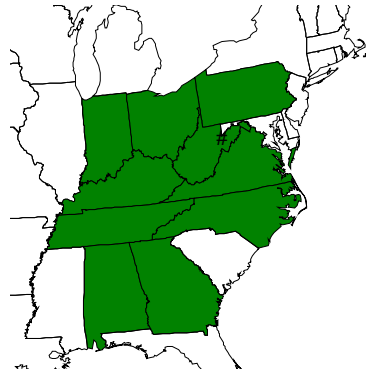
0.1 $\mu\text{g}/\text{m}^3$ Sulfate



2 % of Sulfate



Top 10 States



$\mu\text{g}/\text{m}^3$

What methods will be available to assess states' 2011 contributions?

- Multiple methods used with 2002 & 2007 data provided similar results.
- All areas are making progress.
- Keep it simple – less time and resources.
- May be able to update with regional Q/d and/or modeling – TBD.



SIP Tip: What states contribute?

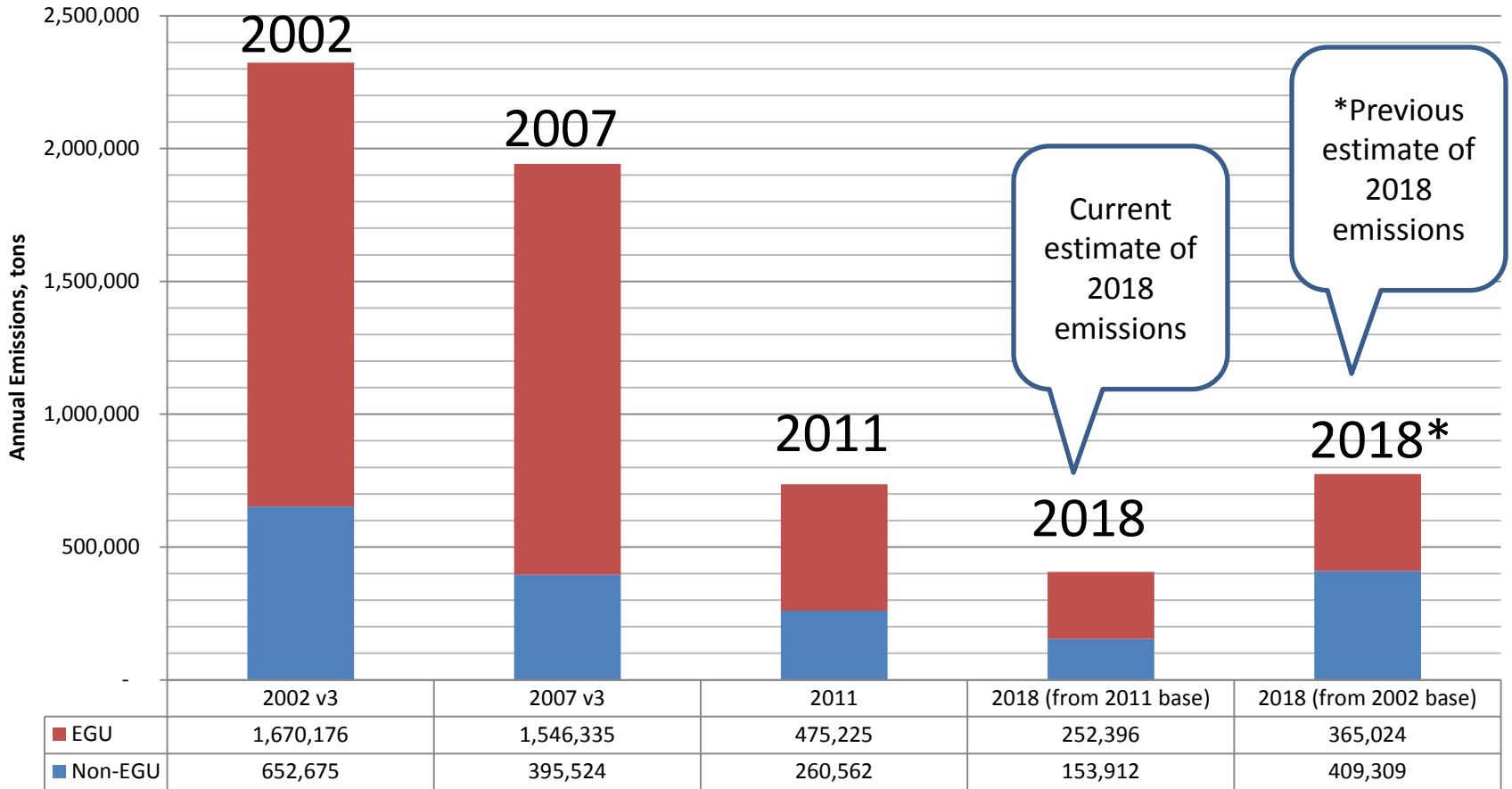
- To get started quickly, consider the following:
 - Assume your state contributes to the same Class I areas as last time and proceed. Incorporate information later as available concerning quantitative analysis.
 - Class I states will need to review more information in order to be sure they consult appropriately, but it's safe to assume the area of influence won't expand to more states than last time.



Key Questions

1. Which states contributed to haze at MANE-VU Class I areas in 2011?
 - These are the states the Class I states must consult with in setting RPGs.
2. **Which sources were the most important contributors to regional haze at MANE-VU Class I areas in 2011?**
 - These sources should be analyzed with respect to reasonable controls.
3. What control measures for those sources are reasonable by 2028?
 - These must be included in state SIPs.
4. What impacts on visibility will result from implementing reasonable controls by 2028?
 - This will help define Reasonable Progress Goals.

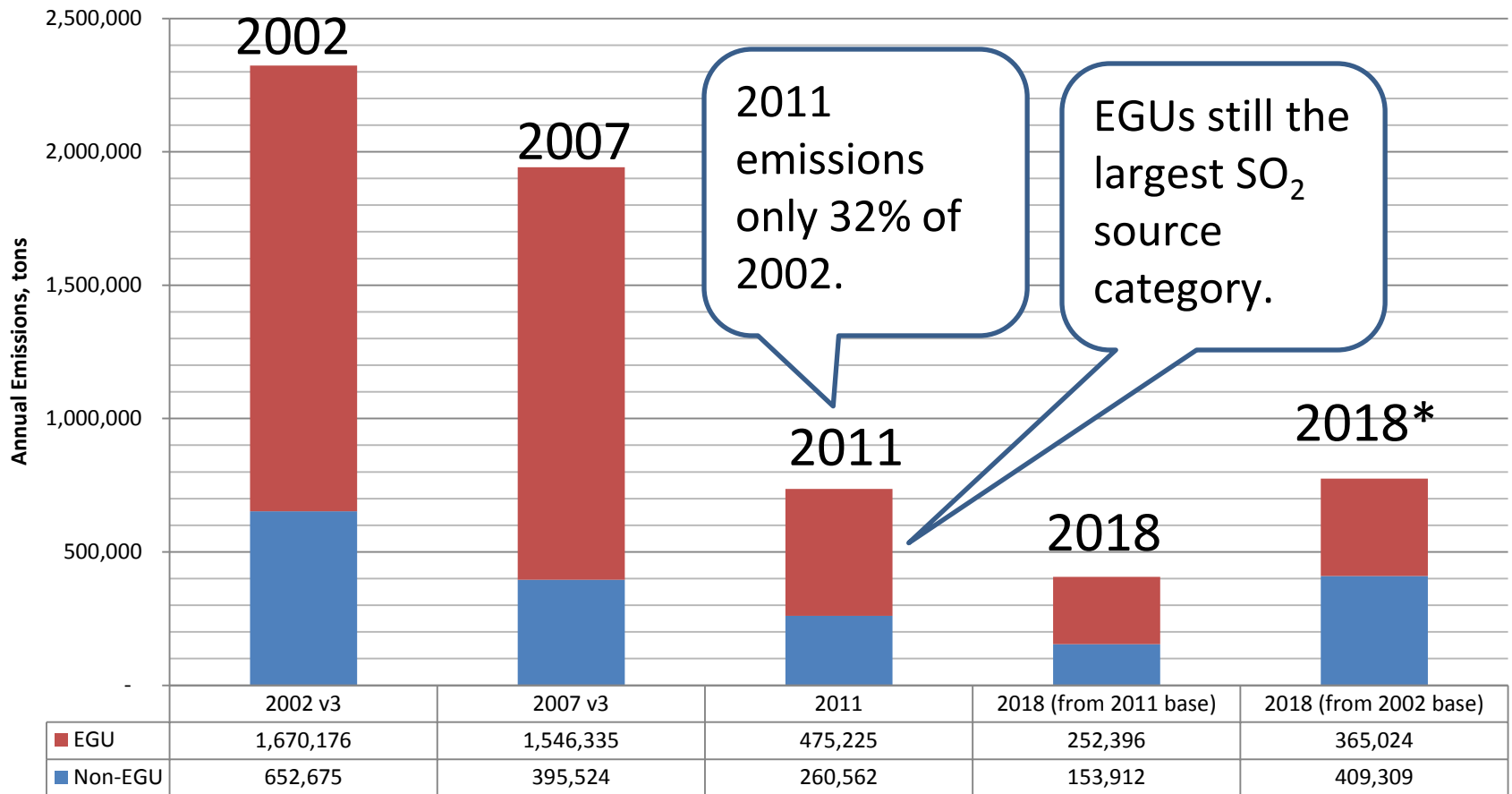
MANE-VU SO2 Emissions Decline



2002 v3, 2007 v3, and 2018 (from 2002 base) are from Mid-Atlantic Regional Air Management Association (MARAMA). *Regional Emissions Trends Analysis for MANE-VU States Technical Support Document Revision 4*. (January 30, 2014.)

2011 and 2018 (from 2011 base) are from the MARAMA Alpha Inventory, summarized using the Emissions Modeling Framework.

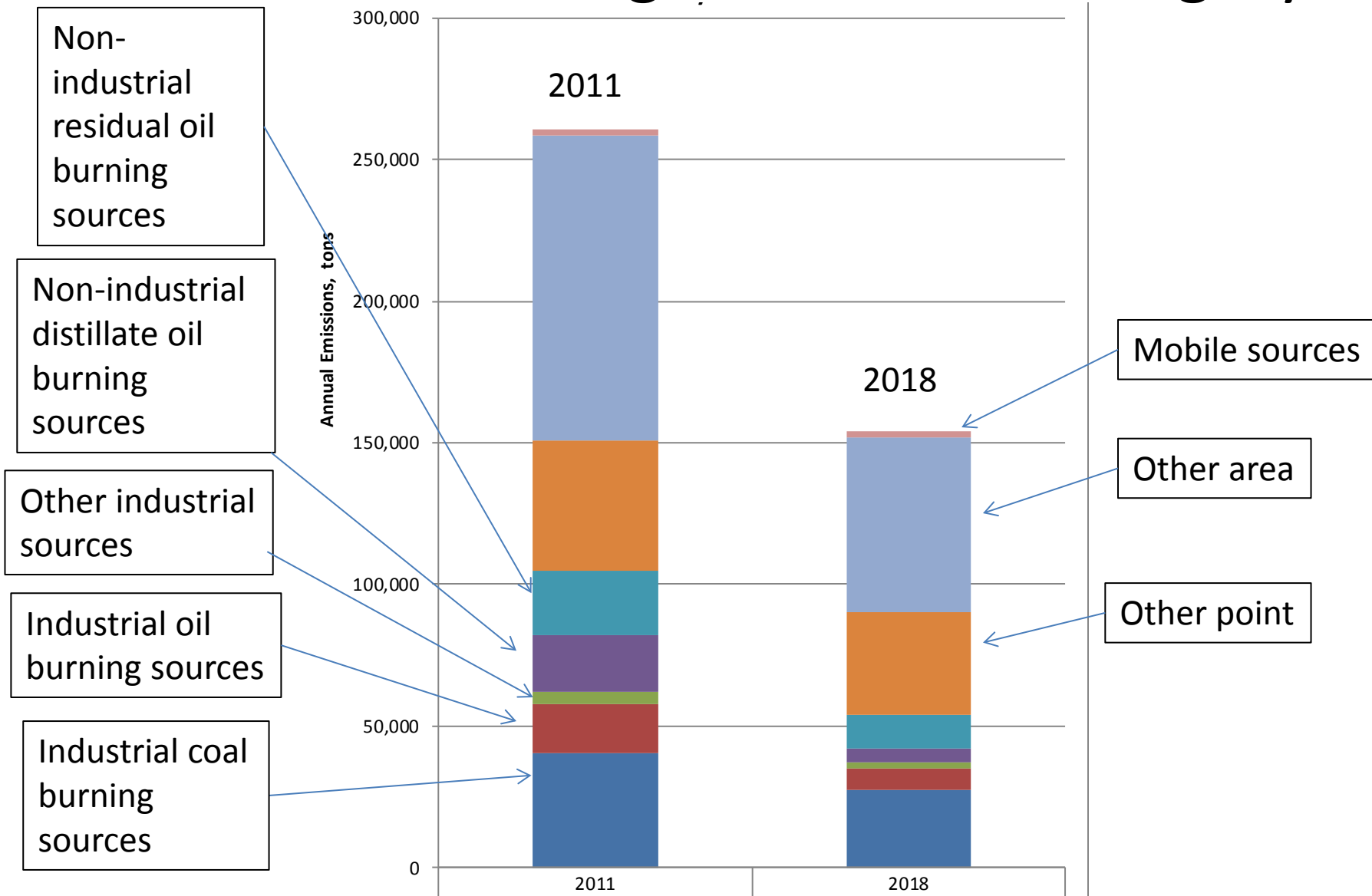
EGUs still dominate MANE-VU SO₂



2002 v3, 2007 v3, and 2018 (from 2002 base) are from Mid-Atlantic Regional Air Management Association (MARAMA). *Regional Emissions Trends Analysis for MANE-VU States Technical Support Document Revision 4.* (January 30, 2014.)

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Industrial Boilers largest non-EGU category



SO₂ Emissions Trends Analysis

- MANE-VU SO₂ emissions declined and are already less than projected for 2018
- EGUs remain the largest source category
- Coal-fired industrial boilers comprise the largest category of non-EGU SO₂ emissions
- Impossible to obtain the same amount of reductions in the future – 2011 SO₂ emissions only about 1/3 of 2002

Work is underway

- MARAMA completing 2011 inventory documentation
- MARAMA will project 2018 inventory
 - Need EPA assistance with mobile sources
- Tom Downs tabulated 2014 emissions from 167 EGUs – shows substantial reductions
- OTC 4-factor group identifying source categories for analysis
- MARAMA to hire contractor to assist with 4-factor analysis
- Consider Q/d analysis for large point sources
- Consider CAMx modeling to assess impacts of key source categories



SIP Tip: Contributing Sources

- To get started quickly, consider the following:
 - Do you have dispersion modeling for your major SO₂ sources for NAAQS assessment?
 - Does this work quantify sulfate impacts on Class I areas?
 - EGUs are still the largest source category of SO₂ emissions in MANE-VU.
 - Be sure your inputs to ERTAC EGU forecasting are up to date and consistent with SIP requirements.
 - Coal-fired boilers are the second largest source category.
 - List your major sources and applicable requirements



Key Questions

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 - These are the states the Class I states must consult with in setting RPGs.
2. Which sources were the most important contributors to regional haze at MANE-VU Class I areas in 2011?
 - These sources should be analyzed with respect to reasonable controls.
3. **What control measures for those key sources or source categories are reasonable by 2028?**
 - These must be included in state SIPs.
4. What impacts on visibility will result from implementing reasonable controls by 2028?
 - This will help define Reasonable Progress Goals.

Selecting Reasonable Control Measures

- Required to consider 4 factors (at least for point sources):
 - Costs of compliance
 - Time necessary for compliance
 - Remaining useful life of any existing source subject to such requirements
 - Energy and non-air quality environmental impacts of compliance

Controls Considered in First Round

- Beyond-CAIR EGU SO₂ reductions,
- Low-sulfur heating oil (residential and commercial), and
- Controls on industrial, commercial, and institutional (ICI) boilers (both coal and oil-fired), lime and cement kilns, residential wood combustion, and outdoor burning (including outdoor wood boilers).

Controls included in SIPs

- Delaware refinery source emissions control
- BART controls
- Either 90% controls on 167 specific EGUs or alternative emissions reductions
- Reductions in sulfur in fuel oil
- Others??

Other rules may affect visibility

- How will sources in your state comply with MATS? SO₂ NAAQS?
- What additional controls will your state adopt?
 - EGUs – are fuel switches/shutdowns permanent?
 - Industrial boilers
 - Distributed generation
 - Residential wood combustion
- How will implementation of climate strategies affect SO₂ emissions by 2028?

Implications of TX/OK Proposed FIP

- Proposed FIP (12/16/2014) intended nationally applicable
- Disapproved states' Reasonable Progress Goals and substituted tighter ones
- EPA directed states to consider 4-factor analysis of individual sources
- And include tighter controls on those sources in modeling to determine RPGs

EPA's recent analysis for TX & OK FIP

- Q/D analysis of over 1,600 Texas facilities narrowed the list to 38 facilities
- CAMx used to analyze impacts of each of the 38 facilities on the 20% worst days
- Reviewed cost analysis prepared by states during SIP development: controls were available below \$2,700 /ton threshold established by Texas

EPA considered impacts and costs

- Visibility impacts - not one of 4 factors but may consider.
- EPA noted that “some facilities can have large impacts on certain days and significant impacts on the 20% worst days, even [a facility located]...more than 800 km from [a class I area]...”
- Imperceptible visibility improvements (i.e., less than 1 dv) may still be determined to be significant.
- Modeling to set RPG should include final BART controls.

EPA: OK should have asked TX for more

- ...Oklahoma ...had (1) abundant information showing the impact of Texas sources on visibility at the Wichita Mountains, ...and (2) evidence that cost-effective controls on these sources were likely available.
- ...Oklahoma...should have requested that the TCEQ further investigate these sources or requested additional reductions from Texas sources...
- to ensure that all reasonable measures to improve visibility were included in Texas' [long term strategy] LTS and incorporated into Oklahoma's RPG for the Wichita Mountains."

Controls EPA Directed Added

- Require operation of scrubbers
- Don't assume source will be controlled just because IPM predicts it will: reasonable controls may "replace or complement" CSAPR
- "...upgrading an underperforming SO₂ scrubber is one of the most cost-effective pollution control upgrades a coal fired power plant can implement to improve the visibility at Class I areas."



SIP Tip: Evaluate controls

- To get started quickly, consider the following:
 - Do a quick review and update of construction management and smoke management sections and compose statement of adequacy or revision
 - Create a list of the largest SO₂ sources in your state,
 - List sources shut down since 2011.
 - Identify the applicable requirements, list compliance agreements and deadlines
 - Compile available cost and impact analyses, and evaluate whether sources are well controlled.



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Updating Goals

- Reasonable Progress Goals must be updated in SIPs due in 2018
- Goals must be set for each Class I Area for reasonable progress through 2028
- Goals are set by the state where the Class I area is located after consultation with other states whose emissions affect visibility there and with FLMs

Reasonable Controls

Translate to Reasonable Goals

- The expected change in deciviews is calculated by modeling the impact of control measures considered to be reasonable.
- The decision about which measures are reasonable leads to a conclusion about how much visibility improvement is reasonable by 2028

What's involved?

- Develop baseline emissions inventory
 - Identify key sources affecting Class I areas
- Project emissions for 2028
- Quantify emission reductions from reasonable measures to be implemented
 - Already on the books and any additional controls
- Model air quality impacts 2011 & 2025/8
- Convert air pollutant impacts to deciviews



SIP Tip: Setting Goals

- To get started quickly, consider the following:
 - Current progress in most areas may already satisfy the Uniform Rate of Progress for 2028
 - At a minimum, you must document and take credit for emissions reductions due to federal, state, and local programs that are on the books/on the way by 2028
 - Reasonable progress goals are not enforceable, but you must show you have done your part to achieve them, so pay attention to the process.
 - Work with OTC/MANE-VU to prepare regional modeling.

The bottom line

- You have much less time and MANE-VU has much less money than used to prepare the initial SIPs.
- It should be easy to demonstrate 2028 progress consistent with the uniform rate of progress.
- Preparing SIPs by 2018 will save time and money.
 - We have a 2011 base year inventory.
 - MANE-VU resources unknown after 2015, but we can help you this year.
- Be familiar with your current SIP and EPA rules and get started on what you can

Next Steps

- Complete outstanding 5-yr progress reports (states)
- Complete 2011 base year emissions and 2028 projections, documentation, and analysis (States, MARAMA, & OTC)
- Identify potential controls available by 2028 to reduce emissions of SO₂, NO_x, and VOC (4-factor work group & states)
- Conduct 4-factor analysis on selected controls (MARAMA + contractor)
- Assess need for SIP revisions to revise existing control measures already included in SIPs (states)

Information Links

- The MANE-VU website
 - www.otcair.org/mane-vu
- The NESCAUM regional haze website
 - www.nescaum.org/topics/regional-haze
- The MARAMA regional haze website
 - <http://www.marama.org/technical-center/regional-haze-planning>
- The EPA visibility website
 - <http://www.epa.gov/airquality/visibility/index.html>



Questions?

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Julie McDill: jmcdill@marama.org

Susan McCusker: smccusker@marama.org

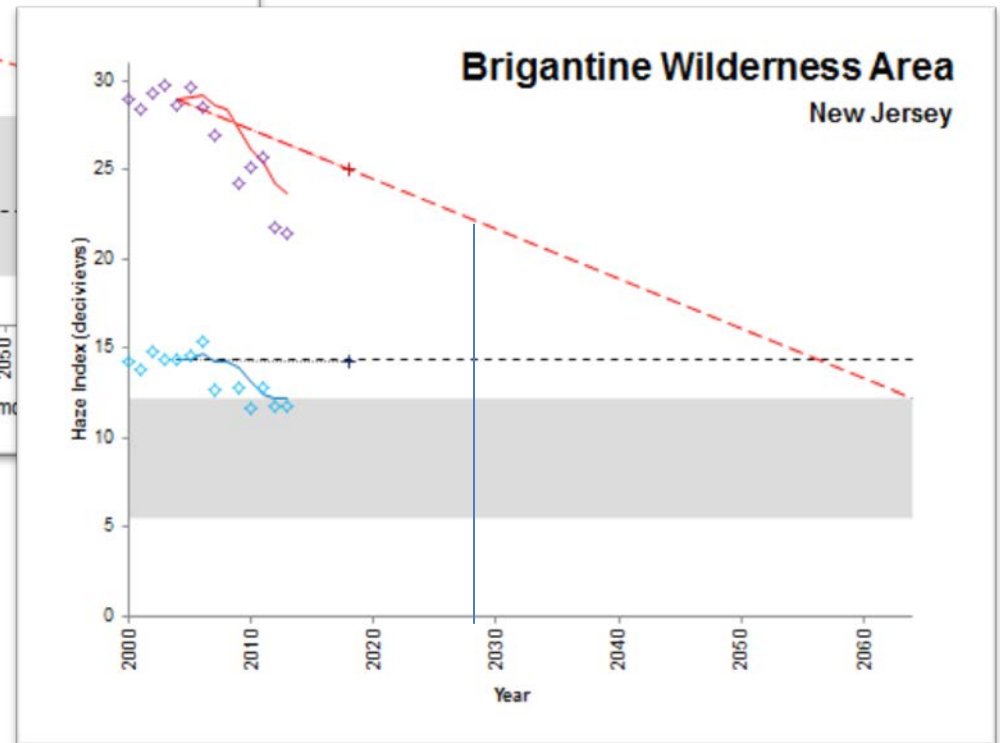
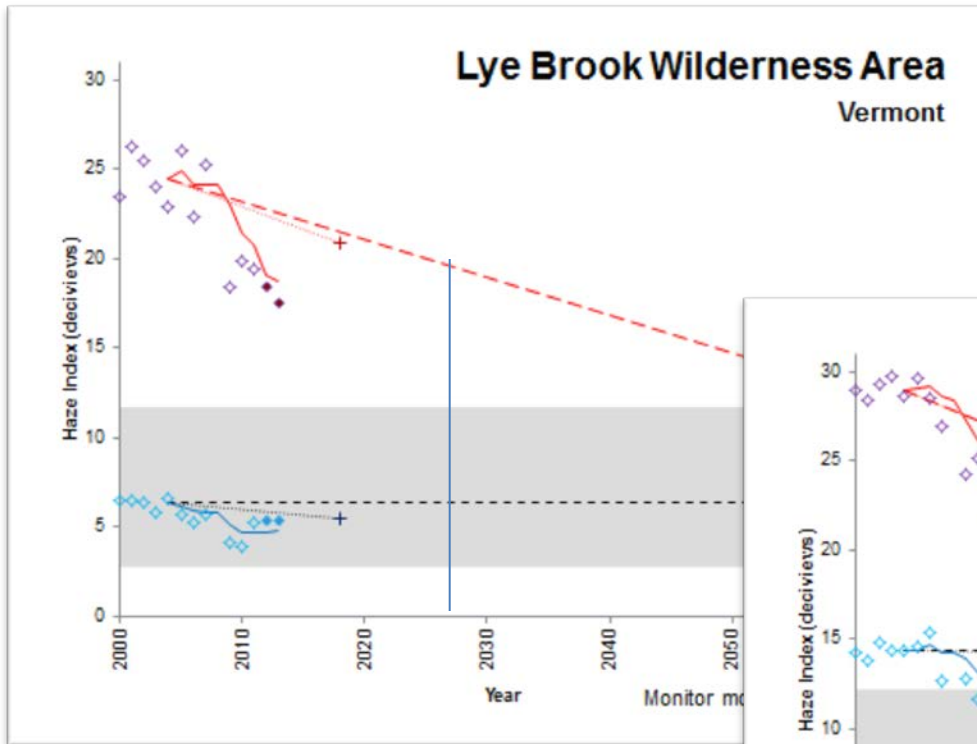
Phone: 443.901.1882

Extra slides

Most SIPs approved, 3 progress reports completed

Jurisdiction	Initial RH SIP Submittal Date	Status of Regional Haze SIP	Status of 5-year Progress Report
Connecticut	11/18/2009	Approved 7/10/2014	FLM consultation complete. Compiling comments.
Maine	12/9/2010	Approved 4/24/12	Working on draft
Massachusetts	12/30/2011	Approved 9/19/13	Working on draft
New Hampshire	1/29/2010	Approved 8/22/12	Submitted to EPA December 2014
Rhode Island	8/10/2009	Approved 5/22/12	Submitted to EPA 1/7/15
Vermont	8/31/2009	Approved 5/22/12	Working on draft
New Jersey	7/28/2009	Approved 1/3/12	Working on draft
New York	3/15/2010	Partial app'l and FIP 8/28/12. SIPs to replace FIPs public comment closes 4/3/15 & 5/1/15	Public comment period closes 4/3/15
Delaware	9/25/2008	Approved 7/19/11	Approved 5/5/2014 79 FR 25506
District of Columbia	10/27/2011	Approved 2/2/12	Working on draft
Maryland	2/13/2012	Approved 7/6/12	Working on draft
Pennsylvania	12/20/2010	Limited approvals 7/13/12, 8/13/12, & 4/30/14; Transport Rule BART FIP 6/2/12; Additional BART approvals 1/21/15 & 3/27/15.	Working on draft

Comparing 2028 to the Uniform Rate



Figures from Leiran Biton, NESCAUM

Long Term Strategy for 2028

- Each state's SIP must include reasonable measures necessary to achieve the 2028 reasonable progress goals set by the Class I States affected by your state.
 - Enforceable emissions limitations, compliance schedules, federal rules, etc.
- Your state must demonstrate it has included all measures needed to obtain its fair share of emission reductions
 - Basis: assumptions used in modeling to set the reasonable progress goals

7 Things Must be Considered in Long Term Strategy – first 4

1. Ongoing air pollution control programs
2. Projected changes in point, area, and mobile source emissions over the period addressed by the long term strategy
3. Source retirement and replacement schedules
4. Emissions limitations and schedules for compliance to achieve the RPG

7 Things Must be Considered in Long Term Strategy – next 3

5. Measures to mitigate impacts of construction activities
6. Smoke management techniques for agricultural and forestry management, including existing plans
7. Enforceability of emissions limits and controls

Helpful References

- MANE-VU overview documents
 - Mid-Atlantic /Northeast Visibility Union Second Interim Report (MARAMA)
 - SIP Template for 5 year progress reports (MARAMA)
- EPA rules and guidance
 - EPA regional haze regulatory actions:
<http://www.epa.gov/airquality/visibility/actions.html>
 - EPA guidance for setting reasonable progress goals:
http://www.epa.gov/ttn/oarpg/t1/memoranda/reasonable_progress_guid071307.pdf
 - Emissions inventory guidance (2014 draft):
<http://www.epa.gov/ttnchie1/publications.html>
 - Modeling guidance (2014 draft):
http://www.epa.gov/ttn/scram/guidance_sip.htm

References for haze analysis

- Visibility trends
 - Nature of Fine Particles and Regional Haze (NESCAUM)
 - Tracking Visibility Progress, 2004-2011 (NESCAUM)
- Contribution assessment
 - NESCAUM Contribution Assessment for initial SIPs
 - NESCAUM Updated Contribution Analysis for 2007
 - Contribution of Non-Sulfate Aerosol to Regional Haze in MANE-VU (NESCAUM)

MANE-VU Emissions References

- Emissions inventory
 - 2007/2017/2020 Modeling Emissions Inventory Version 2 Preliminary Trends Analysis (MARAMA)
 - Documentation of 2011 and future projections (MARAMA—under development)
 - Analysis of 2011 and 2018 emissions (draft MARAMA document)

Control Measure References

- Control measure analysis
 - Reasonable Progress Report prepared for initial SIPs (MARAMA)
 - Overview of State and Federal Actions relative to MANE-VU Ask (NESCAUM)
 - OTC white papers
 - Case-by-case BART determinations
 - Source specific SO₂ NAAQS compliance analyses
 - Report on the MANE-VU 2009 Science Meeting—Total Reactive Nitrogen: Regional Haze Impacts and Mitigation Options (MARAMA)
 - Forthcoming 4-factor analysis for MANE-VU (MARAMA)