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NC
Air Quality
ENVIRONMENTAL QUALITY

February 16, 2018

David Foerter
Ozone Transport Commission
444 N Capitol St NW Ste 322
Washington DC 20001-1529

Re: MANE-VU Regional Haze Consultation

Dear Mr. Foerter:

As you know, the Mid-Atlantic/Northeast Visibility Union (MANE-VU) identified North Carolina as one of 14 upwind states that may reasonably contribute to visibility impairment at MANE-VU Federal Class I areas located in Maine, New Hampshire, New Jersey, and Vermont (hereafter referred to as the "Inter-Regional Planning Organization (Inter-RPO) Ask or Ask).[1] At your invitation, the North Carolina Division of Air Quality (DAQ) has participated in each of the consultation calls MANE-VU held with the states identified in the Inter-RPO Ask.[2] These consultation calls have been helpful for understanding the technical analyses MANE-VU completed to identify states that may reasonably contribute to visibility impairment at MANE-VU Class I areas. The DAQ has also reviewed the technical documentation supporting the Ask. In the spirit of the consultation process, the DAQ is submitting this letter to share information, and express North Carolina's concerns with MANE-VU's analytical approach and conclusions as well as the timing for regional haze state implementation plan (SIP) submittals.

I. KapStone Kraft Paper Corporation (Facility ID 8048011 (3708300007), Unit ID ST-1,2 (ES-11-CU-001) - No. 1 Power Boiler)

The power boiler at Kapstone was identified in the MANE-VU Ask as having the potential for a 6.0 inverse megameter (Mm^{-1}) light extinction impact on MANE-VU Class I areas based on CALPUFF modeling of the facility's 2011 sulfur dioxide (SO_2) and nitrogen oxide (NOx) emissions. The DAQ reviewed the modeling documentation and found that the maximum potential light extinction impact modeled for the power boiler was 0.28 Mm^{-1} for MANE-VU Class I areas and 0.47 Mm^{-1} for Class I areas near the MANE-VU region (see Table 1). On January 31, 2018, the DAQ confirmed with Mr. David Healy, New Hampshire Department of Environmental Services, that the 6.0 Mm^{-1} extinction value shown in the Inter-RPO Ask for Kapstone Unit ST-1,2 is wrong. Mr. Healy confirmed that the extinction values shown in Table 1 below are correct for the power boiler and that the unit should not be included in the Ask. Therefore, we request that MANE-VU remove Kapstone from the Inter-RPO Ask.

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[1] Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) States Concerning a Course of Action in Contributing States Located Upwind of MANE-VU Toward Assuring Reasonable Progress for the Second Regional Haze Implementation Period (2018-2028), August 25, 2017.
[2] Letter from Foerter, Dave, Executive Director, MANE-VU/OTC to Regan, Michael, Secretary, NCDEQ, October 16, 2017.

Table 1. Summary of Potential Visibility Impacts on MANE-VU and Nearby Federal Class I Areas Modeled for the KapStone Kraft Paper Corporation Power Boiler[1]

Region	Class I Area	Estimated Extinction (Mm⁻¹)			
		Maximum Potential Visibility Impact	Met Year 2002	Met Year 2011	Met Year 2015
MANE-VU	Acadia National Park, ME	0.08	0.076	0.07	0.07
	Brigantine Wilderness Area, NJ	0.28	0.22	0.24	0.28
	Great Gulf Wilderness Area, NH	0.07	0.05	0.04	0.07
	Lye Brook Wilderness Area, VT	0.12	0.05	0.08	0.12
	Moosehorn Wilderness Area, ME	0.07	0.07	0.06	0.06
	Presidential Range Dry River Wilderness Area, NH	0.08	0.058	0.05	0.08
	Roosevelt Campobello International Park, ME/NB, Canada	0.06	0.06	0.06	0.05
Near MANE-VU	Dolly Sods Wilderness Area, WV	0.15	0.1	0.15	0.11
	James River Face Wilderness Area, VA	0.47	0.47	0.26	0.3
	Otter Creek Wilderness Area, WV	0.12	0.12	0.11	0.1
	Shenandoah National Park, VA	0.32	0.25	0.32	0.23

[1] Reference: 2016 MANE-VU Source Contribution Modeling Report, CALPUFF Modeling of Large Electrical Generating Units and Industrial Sources, Appendix F, April 4, 2017. CALPUFF modeling was performed using meteorological data for 2002, 2011, and 2015 and the highest light extinction impact was used as the maximum potential visibility impact.

In addition, the Kapstone facility has significantly reduced its SO_2 and NOx emissions since 2011. This would result in extinction values much lower than the modeling showed based on 2011 emissions.

- From 2011 to 2016, total facility SO_2 emissions have decreased by 94% (from 881 tons in 2011 to 55 tons in 2016) primarily due to SO_2 reductions from the No. 1 power boiler. The No. 1 power boiler accounted for 91% (803 tons) of total facility SO_2 emissions in 2011, and 68% (37 tons) in 2016.

- From 2011 to 2016, total facility NOx emissions have decreased by 13% (from 1,413 tons in 2011 to 1,232 tons in 2016). The No. 1 power boiler accounted for 71% (1,005 tons) of total facility NOx emissions in 2011, and 67% (820 tons) in 2016.

The DAQ will submit the latest 2016 emissions data for this facility to MANE-VU to support future modeling updates.

II. Statewide Contribution Assessment

The DAQ reviewed the following two documents in an effort to understand MANE-VU's statewide contribution assessment:

1. Selection of States for MANE-VU Regional Haze Consultation (2018), MANE-VU Technical Support Committee, Sept. 5, 2017.

2. MANE-VU Updated Q/d*C Contribution Assessment, MANE-VU Technical Support Committee, April 6, 2016.

As noted in these documents, MANE-VU considered the results of a weight-of-evidence approach based on emissions (tons per year) divided by distance (kilometers) (Q/d) calculations, CALPUFF modeling, and HYSPLIT back trajectories to determine which upwind states may reasonably contribute to visibility impairment at a MANE-VU Class I area. States that contributed 2 percent or more of the visibility impairment to a Class I area, and had an average mass impact of over 1 percent (0.01 microgram per cubic meter ($\mu g/m^3$)), were identified for consultation, and, therefore, included in the Inter-RPO Ask. Sulfur dioxide and NOx emissions for 2015 for all anthropogenic sources were considered in the assessment. The results for North Carolina are provided in Tables 2 and 3.

Table 2. Percent Mass-Weighted Sulfate and Nitrate Contributions from North Carolina to MANE-VU Class I Areas in 2015

Maximum	Acadia	Brigantine	Great Gulf	Lye Brook	Moosehorn	Mass Factor
2.7%	2.7%	2.7%	2.1%	2.3%	2.2%	0.34

Table 3. Percentage of Trajectories from North Carolina in 2015 on 20% Most Impaired Visibility Days[1]

Acadia	Brigantine	Great Gulf	Lye Brook	Moosehorn
0.55%	2.00%	0.00%	1.84%	1.22%

[1] 500 meter (m) trajectories were modeled using the HYSPLIT model, and 72-hour back trajectories were created 4 times per day at 3AM & PM and 9AM & PM. 2015 trajectories used the Eta Data Assimilation System (EDAS) 40-kilometer (km) meteorology. Trajectory points were mapped and counted within 25 x 25 mile grid cells.

Based on these results, MANE-VU concluded that, *"Modeling and trajectory analyses appear to support Alabama, North Carolina and Tennessee as being 2% contribution states. Each has sufficient emissions to cause some degree of visibility impact in the MANE-VU area and the trajectories suggest a connection on 20% most impaired visibility days, even if they are not as frequent as other states."*

Although the DAQ was unable to fully understand the methodologies that MANE-VU applied due to a lack of documentation in the two references reviewed, the following identifies serious technical limitations with the information presented.

Q/d Screening Tool

The Q/d screening methodology yields conservatively high estimates of potential impacts for the following reasons:

1. Q/d does not account for the formation of secondary particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) through chemical reactions as a function of distance. Consequently, Q/d assumes 100 percent conversion of SO_2 and NOx to ammonium sulfate (($NH_4)_2SO_4$ and ammonium nitrate (($NH_4)NO_3$)), respectively, which is overly conservative and yields unrealistic estimates.[3]

2. Q/d does not account for wind direction or residence time (i.e., the amount of time a pollutant impacts a given area). MANE-VU attempted to correct for this limitation, in part, by developing wind-

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[3] US EPA, Interagency Work Group on Air Quality Modeling Phase 3 Summary Report: Near-Field Single Source Secondary Impacts. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/P-15-002, July 2015, pages 23-24.

direction-specific constants for each IMPROVE monitor (based on prior CALPUFF modeling for point sources) to "scale" Q/d results. However, the details of this methodology is not documented in the references we reviewed; consequently, the DAQ cannot determine if this is a reasonable approach for screening purposes. The Brigantine Wilderness Area in New Jersey, which is the closest MANE-VU Class I area to North Carolina, is located about 507 km (315 miles) from the centroid of the closest point to North Carolina, and 635 km (394 miles) from the centroid of North Carolina. The DAQ does not believe that the MANE-VU screening methodology is robust enough to determine visibility impairment attribution at these long distances.

3. For the stationary non-point and mobile source sectors, MANE-VU did not provide documentation of how it prepared 2015 year emissions. The DAQ requests that MANE-VU provide this documentation for review and comment by the upwind states. Furthermore, MANE-VU cited several references justifying the use of Q/d as a screening tool for assessing potential visibility impacts of these sources on Class I areas. The DAQ reviewed these references and found that they all focus on using Q/d as a screening tool for large point sources only; not surface emissions from stationary non-point and mobile sources.[3,4,5,6] The DAQ believes that Q/d applied to the sum of total statewide annual emissions for stationary non-point and mobile sources at the state centroid results in significantly high impacts especially since Q/d does not account for atmospheric dispersion or residence time of pollutants impacting a Class I area.

Back-Trajectory Analysis

MANE-VU modeled back trajectories for the 20 percent most impaired visibility days during 2002, 2011 and 2015 at each of the MANE-VU Class I areas. MANE-VU used the back-trajectory results to qualitatively cross-check with the screening results to justify including states in MANE-VU Inter-RPO Ask. If an upwind state was determined to have a 2 percent or more impact on a MANE-VU Class I area and it had at least one trajectory originating from the upwind state, MANE-VU included the state in the Ask. The MANE-VU documentation does not identify the days during which or the number of trajectories originating from North Carolina. Given the low percentage of trajectories originating from North Carolina in 2015 (see Table 3), the DAQ believes that the back-trajectory analysis shows that North Carolina should not be considered as reasonably attributing to visibility impairment in any of MANE-VU's Class I areas, particularly when the screening analysis overestimates potential impacts. For distant-source regions, the trajectory threshold should be much higher to definitively assign culpability.

The DAQ further questions why MANE-VU used the course Eta Data Assimilation System (EDAS) 40-km meteorology for its 2011 and 2015 analysis, and EDAS 89-km meteorology for its 2002 analysis, instead of using the North American Mesoscale Forecast System (NAM) model with a 12-km grid for HYSPLIT trajectory modeling. The NAM model has become the model of choice not just for DAQ but also for EPA and other air quality agencies and RPOs for HYSPLIT trajectory modeling. Furthermore, the DAQ questions MANE-VU's selective use of meteorological years 2002, 2011 and 2015, instead of across consecutive years (e.g., 2011-2015). The DAQ believes that use of more current year emissions and meteorology would significantly improve the contribution assessment for MANE-VU Class I areas.

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[4] National Association of Clean Air Agencies, *PM2.5 Modeling Implementation for Projects Subject to National Ambient Air Quality Demonstration Requirements Pursuant to New Source Review*, Report from NACAA PM2.5 Modeling Implementation Workgroup, January 7, 2011, page 2-4 and Appendix E.

[5] Baker, K. R. and Foley, K. M., "A Nonlinear Regression Model Estimating Single Source Concentrations of Primary and Secondarily Formed PM2.5," July 2011.

[6] Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report—Revised (2010) Natural Resource Report NPS/NRPC/NRR—2010/232, US Forest Service, National Park Service, and U.S. Fish and Wildlife Service, October 2010.

Basis for Determining Reasonable Attribution

The documentation the DAQ reviewed did not explain the technical basis for the visibility impairing thresholds that MANE-VU used to include states in the Inter-RPO Ask. This is important for states such as North Carolina to understand and to have the opportunity to address since MANE-VU is claiming that North Carolina is reasonably attributing to visibility impairment in one or more of MANE-VU's Class I areas. Given the significant uncertainty associated with the Q/d screening tool, the weakness of the back-trajectory analysis, and lack of documentation explaining how MANE-VU arrived at the contribution results shown in Table 2, the DAQ believes it is inappropriate for MANE-VU to use these results to draw any conclusions regarding North Carolina's contribution to visibility impairment in any of the MANE-VU Class I areas. The DAQ requests that MANE-VU provide additional documentation explaining the basis for the thresholds.

IV. Timing of SIP Submittals

We request that MANE-VU states seriously consider delaying submittal of their regional haze state implementation plans (SIPs) from July 2018 to July 2021. As EPA noted in its final regional haze rule,[7] extension of the SIP submittal date to July 2021 "…will allow states to coordinate regional haze planning with other regulatory programs, including but not limited to the Mercury and Air Toxics Standards,[8] the 2010 1-hour SO_2 NAAQS,[9] the 2012 annual $PM_{2.5}$ NAAQS[10] and the Clean Power Plan,[11] with the further expectation that this cross-program coordination would lead to better overall policies and enhanced environmental protection." In addition, EPA has yet to release its final regional haze guidance document which, when released, may contain significant revisions to the draft guidance document released on June 30, 2016 that would affect the process for identifying state(s) as reasonably attributing to visibility impairment in downwind state Class I areas.[12] It is for these reasons that North Carolina is working with the nine other Visibility Improvement - State and Tribal Association of the Southeast (VISTAS) states to complete our regional haze modeling analysis in mid-2019 and regional haze SIP by July 2021. The differing schedules have resulted in seven VISTAS states being asked to assess the MANE-VU analysis without the benefit of the forthcoming VISTAS technical work. Accounting for the emission reduction benefits associated with the federal programs EPA cited in its rule and following the final regional haze guidance issued by EPA will help to ensure that upwind states such as North Carolina are not falsely implicated as contributing to visibility impairment at MANE-VU Class I areas.

In addition, on January 18, 2018, EPA announced its decision to revisit aspects of the 2017 regional haze rule.[13] While the extent of the review is uncertain, the potential exists that EPA could modify certain regional haze provisions prior to the July 2021 SIP submittal deadline that may affect state obligations under the rule. The MANE-VU states should allow time for EPA to complete its revisit to the rule and for the VISTAS analysis to be completed and shared before submitting SIPs incorporating any new emission control presumptions directed at the VISTAS states.

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[7] 82 FR 3116-3118, January 10, 2017.
[8] 77 FR 9304, February 16, 2012.
[9] 75 FR 35520, June 22, 2010.
[10] 78 FR 3086, January 15, 2013.
[11] 80 FR 64662, October 23, 2015. The Clean Power Plan was stayed by the Supreme Court for the duration of litigation. Order in Pending Case, West Virginia v. EPA, No. 15A773 (February 9, 2016). As a result, states have no compliance obligations with respect to the Clean Power Plan at this time.
[12] Draft Guidance on Progress Tracking Metrics, Long-term Strategies, Reasonable Progress Goals and Other Requirements for Regional Haze State Implementation Plans for the Second Implementation Period, June 30, 2016.
[13] EPA's Decision to Revisit Aspects of the 2017 Regional Haze Rule Revisions, https://www.epa.gov/visibility/epas-decision-revisit-aspects-2017-regional-haze-rule-revisions.

In our SIP, North Carolina will rely on VISTAS II regional-scale modeling for 2028 using the Comprehensive Air Quality Model with Extensions (CAMx) model with the Particulate Matter Source Apportionment Technology (PSAT) source apportionment method for assessing source contributions to Class I areas. This work will also be used to determine if North Carolina has a significant anthropogenic emissions source contribution to visibility impairment in each of MANE-VU's Class I areas. By delaying submittal of MANE-VU state regional haze SIPs until July 2021, North Carolina will be able to share more current emissions and modeling data with the MANE-VU states to determine if North Carolina emissions reasonably contribute to visibility impairment in any of the MANE-VU Class I areas.

IV. Summary and Conclusions

In closing, the DAQ welcomes the opportunity to consult with MANE-VU on the quality of data and analytical techniques used to determine reasonable attribution in MANE-VU Class I areas. As previously noted, the DAQ has serious concerns with the information included in the Inter-RPO Ask for North Carolina. First, I request that MANE-VU revise the Inter-RPO Ask to exclude the power boiler at Kraft Paper Corporation that was incorrectly included in the Ask.

Second, the statewide contribution assessment contains significant uncertainty associated with the Q/d screening tool (especially applied to stationary non-point and mobile source emissions) and back-trajectory analysis, and the technical documentation lacks clarity on how MANE-VU arrived at the contribution results shown in Table 2. For these reasons, the DAQ believes it is inappropriate for MANE-VU to use these results to draw any conclusions regarding North Carolina's contribution to visibility impairment in any of the MANE-VU Class I areas. In addition, the DAQ believes that MANE-VU has not demonstrated the need for North Carolina to pursue adoption and implementation of the emissions management measures MANE-VU included in its Inter-RPO Ask.

Finally, North Carolina recommends that MANE-VU take the additional time allowed by EPA to conduct CAMx and PSAT modeling such as VISTAS II is doing to determine if North Carolina reasonably attributes to visibility impairment in MANE-VU's Class I areas. Meanwhile, North Carolina is working with the VISTAS states to complete its CAMx and PSAT modeling and will rely on this modeling to assess its visibility impact on in-state and downwind state Class I areas. North Carolina will share this information with MANE-VU when it becomes available in 2019.

Thank you for the opportunity to comment on the Inter-RPO Ask. I hope that these comments are helpful and I look forward to continuing to work with you and the MANE-VU states to develop reasonable regional haze SIPs.

Sincerely,

Michael Abraczinskas, Director
Division of Air Quality, NCDEQ

MAA/rps

cc: Michael Pjetraj, DAQ
Sushma Masemore, DAQ
Randy Strait, DAQ