

Status of the Top 167 Electric  
Generating Units (EGUs) that  
Contributed to  
Visibility Impairment at  
MANE-VU Class I Areas during the  
2008 Regional Haze Planning  
Period

Mid-Atlantic/Northeast Visibility Union  
(MANE-VU)

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The Mid-Atlantic/Northeast Visibility Union (MANE-VU) identified 167 Electric Generating Units (EGUs) as sources that most affected visibility in the MANE-VU Class I areas during the 2008 planning period. In establishing the reasonable progress goal for regional haze, MANE-VU Class I areas relied in part on implementation of emission reductions at the 167 EGU sources by 2018. These 167 EGU sources are located both within and outside MANE-VU.

The MANE-VU “Ask” requested a 90% or greater reduction in SO<sub>2</sub> emissions from 2002 levels at each of the 167 stacks identified by MANE-VU as contributing to visibility impairment at the MANE-VU Class I areas. If it is infeasible to achieve this level of reduction from a unit, the state could obtain the requested reduction from other units in the State.

The attached worksheets provide a summary of the status of controls at the 167 EGU units. New Jersey worked off of a previous analysis carried out by Maine to update the status of the controls at the units. Steps taken to update the worksheets are described as follows:

### **Step 1**

The worksheet was updated with EGU control status from the National Electric Energy Data System (NEEDS) v5.14, and later NEEDS v5.15<sup>1</sup>. The worksheet previously had control status information from NEEDS v4.10. The worksheet was also updated with Environmental Protection Agency’s (EPA) 2011 and 2015 Clean Air Markets Division (CAMD) Air Markets Program Data (AMPD),<sup>2</sup> updates from States (Georgia, Indiana, Massachusetts, Maryland, Maine, Michigan, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, and Virginia) and information from state SIPS (Ohio Regional Haze 5-Year Progress Report (January 2016)). “0” was assigned to units that had no values for SO<sub>2</sub> emissions in 2015 CAMD AMPD. Data from the Eastern Regional Technical Advisory Committee (ERTAC) was also reviewed to ensure consistency and accuracy.

Units with SO<sub>2</sub> permit rates greater than 0.4lbs/mmBtu are highlighted in grey in the tables throughout the analysis. Note that some of the SO<sub>2</sub> permit rates could be the permit rates at the units before controls were installed. For some of the units with SO<sub>2</sub> permit rates greater than 0.4lbs/mmBtu, the actual amounts of SO<sub>2</sub> emitted were less than 0.4lb/mmBtu. It is recommended that units with actual SO<sub>2</sub> emissions greater than 0.4lbs/mmBtu be revisited in the future as resources allow.

Based on the information from the sources mentioned above, 46 out of the 167 units have been shut down, retired or decommissioned. The units eliminated are highlighted in grey in the tab “Retired\_Shutdown\_Decommissioned” in the spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X. These 46 units were eliminated in this step leaving 121 units.

Shawville is temporarily shut down to install equipment for burning natural gas. SO<sub>2</sub> emissions are expected to be well below the 90% reduction expected at the Shawville units when they start burning natural gas. Shawville has retained its rights to burn coal, however, a federal regulation

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<sup>1</sup> <http://www.epa.gov/airmarkets/power-sector-modeling-platform-v515> (Accessed February 22, 2016)

<sup>2</sup> <http://ampd.epa.gov/ampd/> (Accessed February 25, 2016)

requires the installation of scrubbers before they can burn coal. The enforceability of the controls on these units should be investigated in the future as resources allow.

The 46 units that were eliminated in this step are listed in Table 1.

**Table 1: Shut Down, Retired or Decommissioned Units (46 Units)**

STATE	ORIS ID	PLANT NAME	UNIT ID
DELAWARE	594	INDIAN RIVER	1
			2
			3
GEORGIA	709	HARLLEE BRANCH	3,4
INDIANA	988	TANNER'S CREEK	U1,U2,U3
			4*
	1010	WABASH RIVER	2*,3*,4*,5*,6*
MASSACHUSETTS	1606	MOUNT TOM	1
	1613	SOMERSET	8
	1626	SALEM HARBOR	1
			3
		4	
NEW JERSEY	2378	B L ENGLAND	1
NEW YORK	2526	GOUDEY	11,12,13
	2527	GREENIDGE	6
	2549	C R HUNTLEY	67*,68*
			63,64,65,66
	2554	DUNKIRK	3,4
	2594	OSWEGO	5
2642	ROCHESTER 7	3,4	
NORTH CAROLINA	2709	LEE	3
	2713	L V SUTTON	3
OHIO	2830	WALTER C BECKJORD	6
	2832	MIAMI FORT	5-1,5-2,6
	2837	EASTLAKE	5
	2840	CONESVILLE	1,2
	2864	R E BURGER	5 THRU 8
	2872	MUSKINGUM RIVER	1,2,3,4
			5*
7253	RICHARD GORSUCH	1,2,3,4	
PENNSYLVANIA	3113	PORTLAND	1
			2
	3148	MARTINS CREEK	1,2
	3178	ARMSTRONG	2
	2179	HATFIELD'S FERRY	1,2
3131	SHAWVILLE	3,4	

STATE	ORIS ID	PLANT NAME	UNIT ID
SOUTH CAROLINA	3319	JEFFERIES	3
			4
TENNESSEE	3405	JOHN SEVIER	3,4
VIRGINIA	3803	CHESAPEAKE	3
			4
WEST VIRGINIA	3936	KANAWHA RIVER	1,2
	3938	PHILIP SPORN	51
			11,21,31,41
	3942	ALBRIGHT	3
3947	KAMMER	1,2,3	

Note: Units with SO<sub>2</sub> permit rate greater than 0.4lbs/mmBtu are highlighted.

\* Units with actual amount of SO<sub>2</sub> emitted greater than 0.4lbs/mmBtu.

## **Step 2**

The remaining 121 units were reviewed for units that have 90% or greater SO<sub>2</sub> emission reductions from 2002 total SO<sub>2</sub> stack level emissions. The emission reduction was based on emissions reported as 2015 CAMD AMPD SO<sub>2</sub> stack level data. These units met the MANE-VU Ask at the stack level for a 90% or greater reduction. 83 units met this criterion, and were eliminated, leaving 38 units. The units eliminated are highlighted in light green in the tab “90%+Reduction” in the spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X. The 83 units that were eliminated are listed in Table 2.

**Table 2: Units with 90% or Greater SO<sub>2</sub> Emission Reductions (2002-2015) (83 Units)**

STATE	ORIS ID	PLANT NAME	UNIT ID
DELAWARE	593	EDGE MOOR	5
	594	INDIAN RIVER	4
GEORGIA	703	BOWEN	1BLR
			2BLR
			3BLR
			4BLR
ILLINOIS	861	COFFEEN	1,2
INDIANA	990	ELMER W STOUT	70
	1001	CAYUGA	1
			2
	1008	R GALLAGHER	1,2*
			3,4*
	6113	GIBSON	1,2
6705	WARRICK	1,2	
		4	
KENTUCKY	1355	E W BROWN	2,3
	1378	PARADISE	3
	1384	COOPER	1,2*
	6041	H L SPURLOCK	1

STATE	ORIS ID	PLANT NAME	UNIT ID
			2
MARYLAND	602	BRANDON SHORES	1
			2
	1552	C P CRANE	1
			2
	1571	CHALK POINT	1,2*
	1572	DICKERSON	1,2,3
	1573	MORGANTOWN	1
2			
MASSACHUSETTS	1599	CANAL	1
			2
	1619	BRAYTON POINT	1
			2
			3
MICHIGAN	1702	DAN E KARN	3*,4*
	1733	MONROE	1,2
			3,4
NEW HAMPSHIRE	2364	MERRIMACK	1
			2
	8002	NEWINGTON	1
NEW JERSEY	2403	HUDSON	2
	2408	MERCER	1
			2
NEW YORK	2480	DANSKAMMER	4
	2516	NORTHPORT	3
	8006	ROSETON	1
NORTH CAROLINA	2712	ROXBORO	3A*,3B*
	2721	CLIFFSIDE	5
	2727	MARSHALL	3
			4
	6250	MAYO	1A,1B
	8042	BELEWS CREEK	1
2			
OHIO	2828	CARDINAL	3
	2832	MIAMI FORT	7
	2840	CONESVILLE	4
	2850	J M STUART	1
			2
			3
			4
	2866	W H SAMMIS	1*,2*
			3,4
5			

STATE	ORIS ID	PLANT NAME	UNIT ID
			6
			7
	2876	KYGER CREEK	1*,2*,3*,4*,5*
PENNSYLVANIA	3149	MONTOUR	1
	8226	CHESWICK	1
SOUTH CAROLINA	3297	WATEREE	WAT1
			WAT2
	3298	WILLIAMS	WIL1
	6249	WINYAH	1
TENNESSEE	3407	KINGSTON	1,2,3,4*,5
			6,7,8,9
VIRGINIA	3775	CLINCH RIVER	1,2
	3797	CHESTERFIELD	4
			5
			6
WEST VIRGINIA	3935	JOHN E AMOS	1*,2*
			3
	3943	FORT MARTIN	1
			2
	3948	MITCHELL	1,2
	6264	MOUNTAINEER	1

Note: Units with SO<sub>2</sub> permit rate greater than 0.4lbs/mmBtu are highlighted.

\* Units with actual amount of SO<sub>2</sub> emitted greater than 0.4lbs/mmBtu.

### **Step 3**

The remaining 38 units were further reviewed for units that have scrubbers with at least 90% scrubber control efficiency. This was done on a case by case basis. SO<sub>2</sub> emission reductions at these units were between 85 and 89% in 2015 compared to 2002 levels. Some of these units had over 90% SO<sub>2</sub> emission reductions in 2014 but could have differed because of variations in amount of the unit's operation between later years and the 2002 base year. Units with wet scrubbers that were installed prior to 2002 were also eliminated even though some of them have emission reductions less than 85% when the wet scrubbers reported scrubber control efficiency of well over 90%. This could be as a result of how the scrubber was used; scrubber shut downs or inactivity, or emission reductions that may have already taken place before 2002. It could also be due to meteorological changes. In this step, 13 Units were eliminated, leaving 25. The units eliminated are highlighted in purple in the tab "Scrubber90%+" in the spreadsheet "167 EGU Stacks that Impact MANE-VU Class I Areas" in Appendix X. The 13 units that were eliminated are listed in Table 3.

**Table 3: Units with Scrubbers with 90% or Higher Scrubber Efficiency  
SO<sub>2</sub> Emission Reductions: 85%-89% (2002-2015) (13 Units)**

STATE	ORIS ID	PLANT NAME	UNIT ID
INDIANA	983	CLIFTY CREEK	1*,2*,3*
			4*,5,6*
	6113	GIBSON	3,4
KENTUCKY	1364	MILL CREEK	4
	6018	EAST BEND	2
NORTH CAROLINA	2712	ROXBORO	1
			2
			4A*,4B*
OHIO	2828	CARDINAL	1
PENNSYLVANIA	3136	KEYSTONE	1*
	3140	BRUNNER ISLAND	1*,2*
			3
	3149	MONTOUR	2

Note: Units with SO<sub>2</sub> permit rate greater than 0.4lbs/mmBtu are highlighted.

\* Units with actual amount of SO<sub>2</sub> emitted greater than 0.4lbs/mmBtu.

#### **Step 4**

In this step, the remaining 25 units were reviewed for units that have scrubbers (both wet and dry) installed. Dry scrubbers are believed to be less efficient than wet ones (generally below 80% emission reduction), but according to a USEPA Air Pollution Control Technology fact sheet,<sup>3</sup> newer dry scrubbers are capable of higher control efficiencies, on the order of 90%. Some of the units that were eliminated in this step had scrubbers with 90% or higher efficiency but SO<sub>2</sub> emission reductions at these units in 2015 were less than 85% compared with 2002 levels. 14 units were eliminated in this step, leaving 11. 11 of these 14 units had wet scrubbers, while 3 had dry scrubbers. The units eliminated are highlighted in blue (wet scrubbers) and light blue (dry scrubbers) in the tab “Scrubbers” in the spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X. The 14 units that were eliminated are listed in Table 4.

**Table 4: Units with Scrubbers (Wet and Dry)  
SO<sub>2</sub> Emission Reductions: < 85% (2002-2015) (14 Units)**

<u>Units with Wet Scrubbers</u>			
STATE	ORIS ID	PLANT NAME	UNIT ID
KENTUCKY	1356	GHENT	3,4
	1378	PARADISE	2
OHIO	2828	CARDINAL	2
	6019	W H ZIMMER	1
	6031	KILLEN STATION	2
	8102	GEN J M GAVIN	1

<sup>3</sup> <http://www3.epa.gov/ttnecat1/dir1/ffdg.pdf> (Accessed March 3, 2016)

<u>Units with Wet Scrubbers</u>			
STATE	ORIS ID	PLANT NAME	UNIT ID
			2
PENNSYLVANIA	3136	KEYSTONE	2*
WEST VIRGINIA	3954	MT STORM	1,2
	6004	PLEASANTS	1
			2
<u>Units with Dry Scrubbers</u>			
STATE	ORIS ID	PLANT NAME	UNIT ID*
PENNSYLVANIA	3122	HOMER CITY	1*
			2*
TENNESSEE	3403	GALLATIN	3*,4*

Note: Units with SO<sub>2</sub> permit rate greater than 0.4lbs/mmBtu are highlighted.

\* Units with actual amount of SO<sub>2</sub> emitted greater than 0.4lbs/mmBtu.

It is recommended that the units in Table 4 be revisited to determine why their emissions are lower than expected.

### **Step 5**

Units that have plans to retire or install newer controls by 2018 were eliminated in this step. Determinations were made based on updates from states and information from NEEDS v5.15. Six out of the remaining 11 units were eliminated, leaving 5 that will not meet the MANE-VU “Ask” by 2018. It is recommended that these units are reviewed again in the future to ensure that they either retired or installed controls. The units that were eliminated are highlighted in orange in the tab “Plans to Retire\_Control” in the spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X. The 6 units that were eliminated in this step are listed in Table 5.

**Table 5: Units with Plans to Retire or Install Newer Controls by 2018 (6 Units)**

STATE	ORIS ID	PLANT NAME	UNIT ID
INDIANA	6166	ROCKPORT	MB1*,MB2*
KENTUCKY	1353	BIG SANDY	BSU1*, BSU2*
MAINE	1507	WILLIAM F WYMAN	4*
OHIO	2836	AVON LAKE	12*
TENNESSEE	3406	JOHNSONVILLE	1 THRU 10. 1*,2*,3*,4*
VIRGINIA	3809	YORKTOWN	1*,2

Note: Units with SO<sub>2</sub> permit rate greater than 0.4lbs/mmBtu are highlighted.

\* Units with actual amount of SO<sub>2</sub> emitted greater than 0.4lbs/mmBtu.

### **Step 6**

The remaining 5 units were further reviewed for the quantity of SO<sub>2</sub> in pounds (lbs.) burned per Heat Input in MMBtu. This analysis was done using 2015 CAMD AMPD data. 0.1 – 0.4 was chosen as the acceptable rate. 1 unit was eliminated, leaving 4 units having higher SO<sub>2</sub> emissions than others. The unit that was eliminated is highlighted in brown in the tab “Heat Input” in the



spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X. The unit that was eliminated is listed in Table 6.

**Table 6: Units with SO<sub>2</sub> (lbs) Burned per Heat Input (MMBtu) Between 0.1-0.4 (1 Unit)**

STATE	ORIS ID	PLANT NAME	UNIT ID
NEW YORK	8006	ROSETON	2

Note: Units with SO<sub>2</sub> permit rate greater than 0.4lbs/mmBtu are highlighted.

**Step 7**

The remaining 4 units were ranked from highest to lowest based on total stack level SO<sub>2</sub> emissions using 2015 CAMD AMPD. These units do not seem to have sufficient SO<sub>2</sub> controls installed. These 7 units are listed in the tab “Rank” in the spreadsheet “167 EGU Stacks that Impact MANE-VU Class I Areas” in Appendix X, and are also listed in Table 7.

**Table 7: Units with Insufficient SO<sub>2</sub> Controls (4 Units)**

Plant	State	UNIT ID	ORIS ID	2015 CAMD SO <sub>2</sub> (tpy)	2002 CAMD SO <sub>2</sub> (tpy)	% Change 2002-2015
Trenton Channel	MI	9A*	1745	11,656	19,237	-39%
St. Clair	MI	7*	1743	8,938	15,980	-44%
Herbert A Wagner	MD	3*	1554	8,751	10,096	-13%
Yorktown	VA	3*	3809	2,070	10,567	-80%

Note: Units with SO<sub>2</sub> permit rate greater than 0.4lbs/mmBtu are highlighted.

\* Units with actual amount of SO<sub>2</sub> emitted greater than 0.4lbs/mmBtu.

SO<sub>2</sub> emissions at Yorktown, Unit 3 has reduced in the past few years because utilization of the unit was reduced a lot. In addition, the unit falls under the Mercury and Air Toxics Standard (MATS) rule and is utilizing the annual capacity factor threshold in the MATS rule to comply. Yorktown, unit 3 does not have any scrubbers.

A map showing the locations of the 167 EGU units and their status is shown in Figure 1.

**Figure 1: Status of Controls at Top 167 EGUs:  
Contribution to Visibility Impairment  
at MANE-VU Class I Areas**

