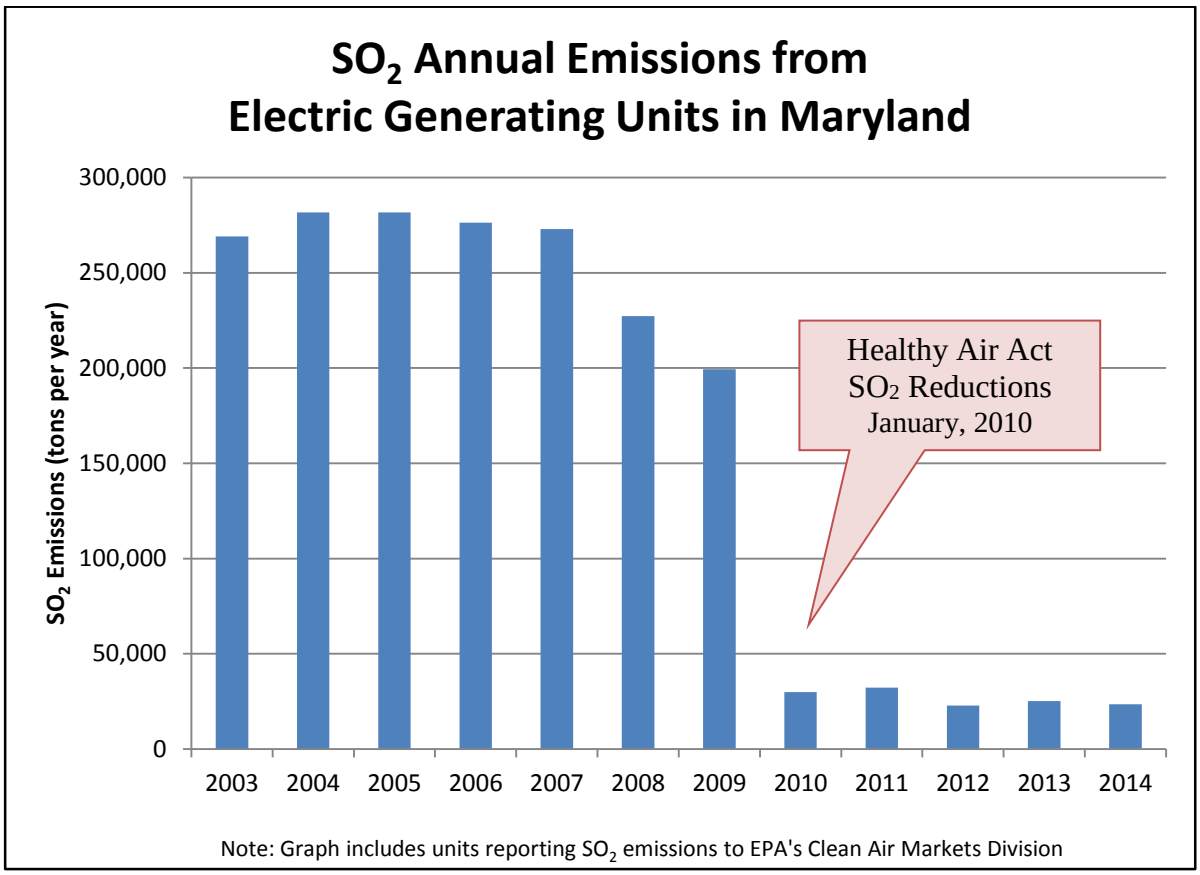
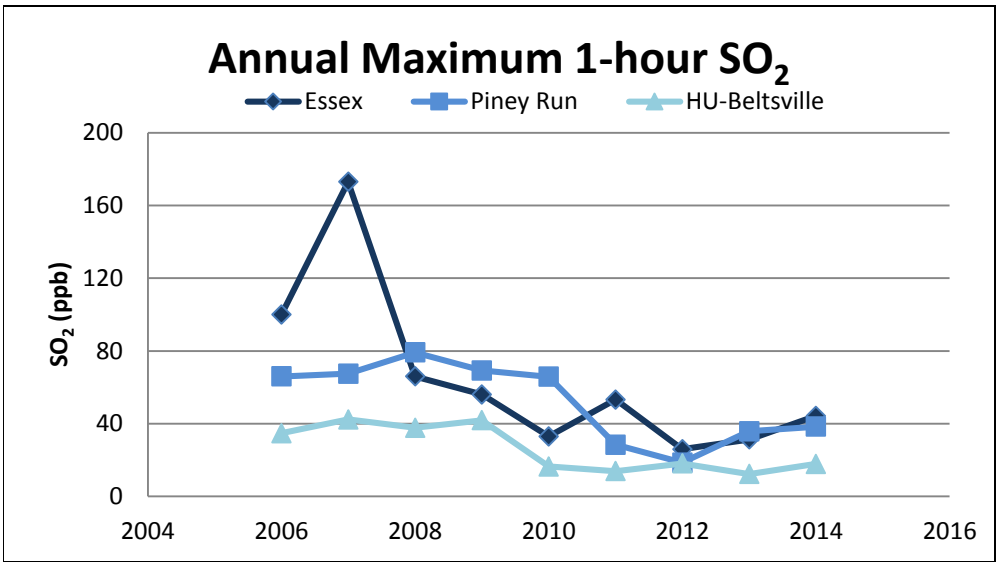
Attachment 1

Annual Reductions in Sulfur Dioxide (SO_2) from the Healthy Air Act



Attachment 2

One-Hour SO_2 trends, after the Healthy Air Act
(Note: the 1-hour SO_2 standard is 75 ppb)



Phase 1 SO_2 controls under the Healthy Air Act in 2010

SO_2 Emissions and Air Monitoring Concentrations in the Wagner Area, 2007-2014

	SO_2 Emissions (Tons/Year)				SO_2 Concentrations at Essex (ppb)	
Year	Total	Brandon Shores	Wagner	Crane	Design Value*	Max 1-hour
2007	92,931	42,041	20,259	30,631	**99**	173
2008	79,282	39,924	15,006	24,352	**86**	66
2009	60,391	32,821	15,093	12,477	**80**	56
2010	15,877	1,260	9,028	5,589	**43**	33
2011	17,518	2,829	9,007	5,682	**34**	53
2012	12,494	2,848	7,473	2,173	**22**	26
2013	16,020	2,870	10,178	2,972	**22**	31
2014	14,643	3,145	9,610	1,887	**22**	44

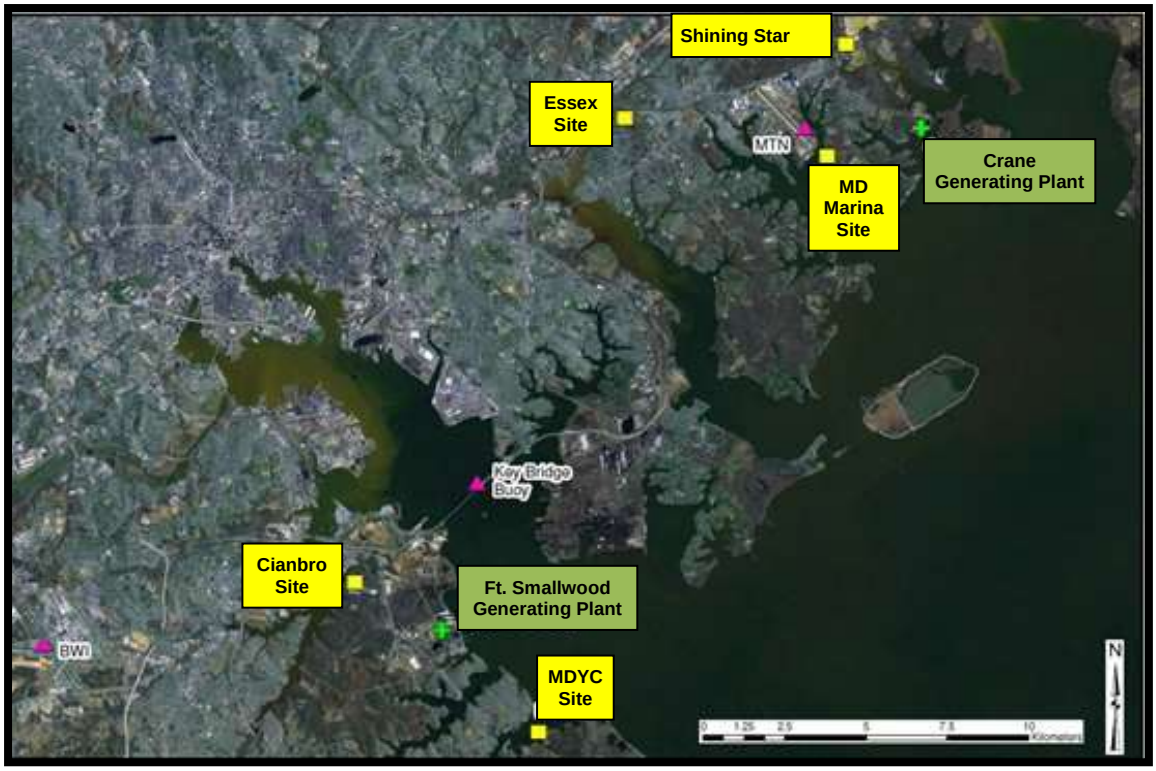
*The design value for the 1-hour SO_2 standard is the 99th percentile of the 1-hour daily maximum concentrations, averaged over 3 years. The 1-hour SO_2 standard is 75 parts per billion (ppb), calculated the same way.

Attachment 3

Summer 2013 Air Monitoring Study Results

A 2013 two-month monitoring study of SO_2 concentrations was conducted around Raven Power's Brandon Shores, Herbert A. Wagner, and C.P. Crane Generating Plants. Peak daily 1-hour maximum monitored SO_2 values were typically well below the 75 ppb 1-hour SO_2 NAAQS.

Monitoring Sites Used in the 2013 Study



Note: Monitoring sites are in yellow on the map; the generating stations are in green.

Monitored Values

Table 1. Top Five Monitored 1-Hour SO_2 Values during the 2013 Study

Peak Daily 1-Hour Maximum Monitored Value (ppb) Note: the 1-hour SO_2 standard is 75 ppb.					
Rank	Cianbro	MDYC	Shining Star	MD Marina	Essex
1	101.7	53.2	34.6	13.1	31.3
2	42.2	37.8	28.7	10.5	24.5
3	34.4	37.3	26.8	10.3	24.0
4	31.5	29.6	23.6	10.1	20.7
5	23.9	20.7	21.4	9.5	17.4

Table 2. All 1-Hour Daily Maximum SO_2 Data during the 2013 Study

Date	1-hour SO_2 Daily Maximum Concentration (ppb) Note: 1-hour SO_2 standard is 75 ppb. The blank cells were dates before a monitor started running, due to delays in obtaining a lease agreement to place the monitor.										
	In vicinity of Brandon & Wagner Plants		In vicinity of C.P. Crane Plant				In vicinity of Brandon & Wagner Plants		In vicinity of C.P. Crane Plant		
	Cianbro	MDYC	Shining Star	MD Marina	Essex	Date	Cianbro	MDYC	Shining Star	MD Marina	Essex
7/25/2013	0.7				0.4	8/25/2013	22.3	2.0	0.7	8.7	10.5
7/26/2013	22.0				4.7	8/26/2013	1.1	1.4	5.3	4.6	1.9
7/27/2013	0.5				9.2	8/27/2013	8.6	29.6	2.4	1.2	2.1
7/28/2013	21.9				10.5	8/28/2013	0.5	1.6	1.1	0.0	1.0
7/29/2013	1.7				1.5	8/29/2013	2.0	2.4	0.6	0.0	1.9
7/30/2013	1.2				1.4	8/30/2013	0.6	1.8	1.1	0.5	8.7
7/31/2013	1.6				13.4	8/31/2013	0.9	2.4	7.7	4.5	7.6
8/1/2013	0.5	0.0			4.0	9/1/2013	13.4	1.6	6.3	3.2	9.3
8/2/2013	2.2	7.2	0.0		2.9	9/2/2013	2.9	7.1	6.7	10.1	4.4
8/3/2013	1.0	1.5	0.0		1.3	9/3/2013	2.8	37.3	1.5	0.3	2.4
8/4/2013	2.0	3.8	0.0		1.7	9/4/2013	15.9	13.0	5.8	3.8	3.0
8/5/2013	17.0	0.3	0.6		2.7	9/5/2013	4.3	20.7	2.3	1.3	2.4
8/6/2013	0.7	0.0	0.2		1.5	9/6/2013	23.9	11.1	19.5	0.3	8.4
8/7/2013	0.6	2.1	0.4		1.3	9/7/2013	101.7	2.4	21.7	10.5	5.2
8/8/2013	1.0	3.1	7.4		11.8	9/8/2013	2.3	7.4	3.8	1.9	2.3
8/9/2013	0.7	4.0	0.7		3.7	9/9/2013	42.2	4.9	32.7	13.1	5.9
8/10/2013	34.4	11.9	0.4		2.5	9/10/2013	1.3	2.6	6.0	1.9	5.5
8/11/2013	20.4	4.0	26.8		13.0	9/11/2013	21.3	17.6	10.1	5.5	31.3
8/12/2013	6.2	6.3	0.0		1.6	9/12/2013	1.8	5.0	4.0	3.0	5.5
8/13/2013	1.4	14.3	2.6	3.4	2.1	9/13/2013	1.9	53.2	1.4	0.0	1.6
8/14/2013	2.9	6.4	1.4	3.0	2.7	9/14/2013	1.5	8.8	1.4	0.0	0.8
8/15/2013	8.5	3.3	1.3	2.2	0.9	9/15/2013	7.6	1.8	5.2	3.1	2.0
8/16/2013	2.4	3.1	1.2	3.2	1.4	9/16/2013	1.3	4.1	3.9	4.7	1.6
8/17/2013	2.0	1.9	1.8	2.5	2.9	9/17/2013	1.7	5.3	1.5	2.2	2.0
8/18/2013	0.6	1.3	0.7	1.9	0.5	9/18/2013	19.9	1.4	17.6	0.0	1.0
8/19/2013	0.6	2.1	1.6	2.5	2.0	9/19/2013	5.7	1.8	5.2	3.8	2.6
8/20/2013	31.5	19.9	24.9	9.5	6.2	9/20/2013	1.6	2.5	10.9	10.3	20.7
8/21/2013	0.8	3.2	2.0	2.8	8.7	9/21/2013	0.7	2.7	1.5	0.0	3.4
8/22/2013	1.8	6.4	5.5	6.2	2.2	9/22/2013	1.6	13.7	1.6	0.0	1.2
8/23/2013	1.1	14.4	0.6	2.4	1.7	9/23/2013	1.1	2.4	1.6	0.0	1.4
8/24/2013	1.2	1.4	0.9	0.0	0.7						

The hourly SO_2 levels were typically well below the 1-hour SO_2 NAAQS. Peak daily 1-hour maximum monitored SO_2 values ranged from 9.5 to 53.2 ppb except on one day during the 2-month study when the Cianbro monitor reached a level of 101.7 ppb. Overall, the study suggests that the Wagner area can attain the 1-hour SO_2 NAAQS.

Attachment 4

Preliminary MDE Modeling Analyses

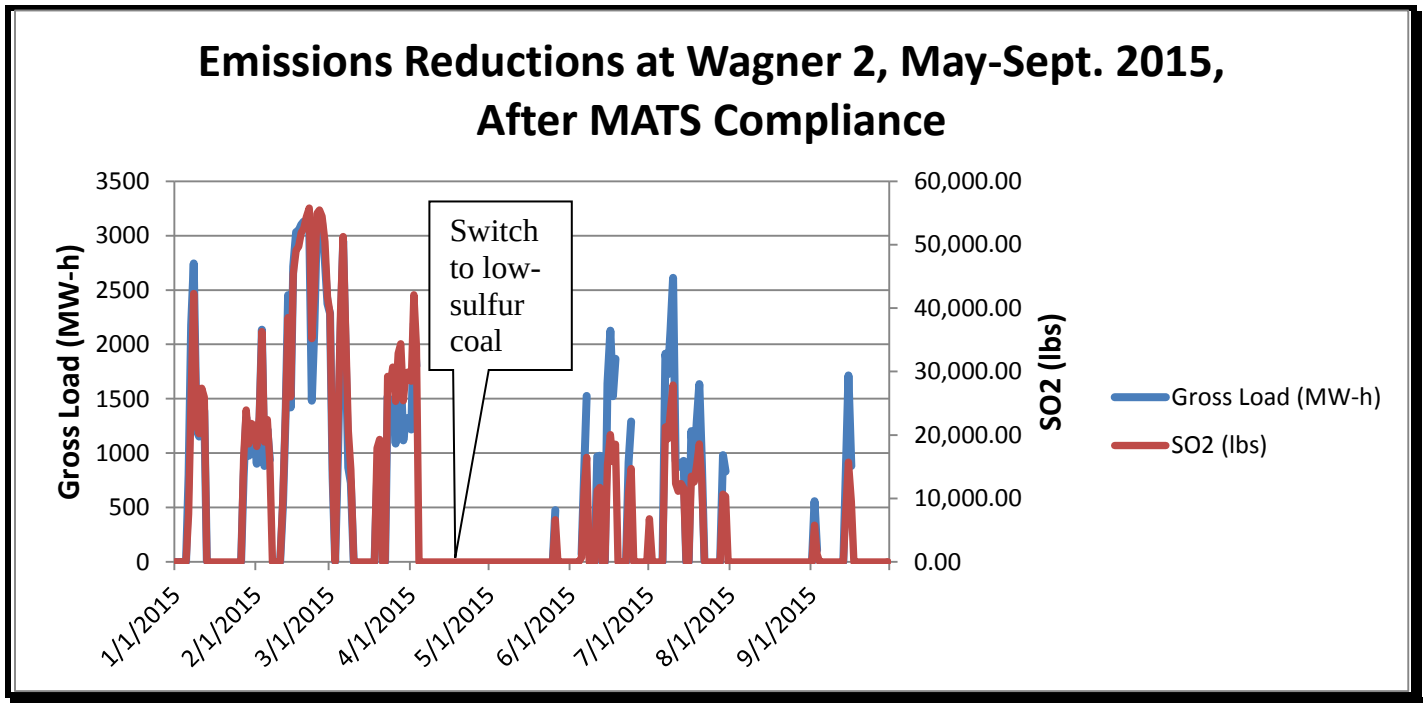
Preliminary AERMOD (Version 15181) dispersion modeling shows that the Wagner area is attaining the 2010 1-hour SO_2 standard. The modeling uses 2012 - 2014 actual emissions data, including the reductions presently being seen from the use of low-sulfur coal for compliance with the Mercury and Air Toxics Standards (MATS) at Wagner's unit 2 (see graph below). MDE modeling includes all of the emission units of Raven Power/Talen Energy (Wagner, Brandon Shores, and Crane Plants), and other nearby sources (Wheelabrator and Energy Answers). The background concentration calculation was based on season and hour-of-day approach included in EPA guidance. MDE is working with EPA to finalize this modeling. Attachment 5 provides a summary of how the modeling is being conducted.

Predicted Hourly SO_2 Levels*

(Note: The 1-hour SO_2 standard is 75 ppb, or 196.20 µg/m^3)

	4th Highest Concentration (µg/m^3), Without Background	Percentage Contribution (% contribution to total)	Total with Background (µg/m^3)
Wagner Unit 1	0.009	Negligible	**193.47**
Wagner Unit 2	26.47	15	
Wagner Unit 3	95.26	53	
Wagner Unit 4	21.53	11	
All other nearby sources**	37.61	21	

* Additional reductions are expected in 2016 as new controls required by MATS at Wagner 3 become operational.
**Brandon Shores, Crane, Wheelabrator and Energy Answers



Attachment 5

MDE Modeling

MDE is working with EPA Region III, the facility and other interested parties to finalize sophisticated SO_2 modeling by early 2016. MDE's modeling considers methodologies used by the Sierra Club and Raven Power in their independent modeling of SO_2 levels in the Wagner area:

Preliminary MDE modeling used the following inputs:

- AERMOD Version 15181
- Actual 1-hour SO_2 emissions data for 2012-2014
- Background 1-hour SO_2 concentrations from the MDE Howard University (HU) -Beltsville air monitoring station
- Building heights based on Google Earth
- Meteorological data, including Baltimore Washington International Airport (BWI) surface data, and Sterling, Virginia upper air data
- The seasonal and hour-of-day approach consistent with the methodology found in section 8, "Background Concentrations," of the "Draft SO_2 NAAQS Designations Modeling Technical Assistance Document" (EPA, December 2013)

Ongoing modeling includes consideration of the following potential refinements:

- The use the non-regulatory "LOWWIND3" option (BETA option) in AERMOD to address issues with model over-prediction under low wind speed conditions.
- Merged plumes/one stack for Brandon Shores when both units were running simultaneously, following EPA guidance
- The use of enhanced tools to evaluate plume rise. Work performed by AECOM, has assessed the effects of plume rise adjustments in the AERMOD modeling system by applying the concepts of moisture in plume modeling versus dry plume modeling. AERMOD treats the final plume rise based on the assumption of a "dry" plume, where the chimney plume is far from being saturated and carries no liquid water load. However, the "dry" plume rise in AERMOD might be affecting the final plume rise height in the model. AECOM has developed a moist plume rise model (IBJpluris) to estimate plume rise by modifying and adjusting the standard Briggs (1975) plume rise formula used in AERMOD. AECOM has implemented IBJpluris Ver. 2.7 in the AERMOIST pre-processor. The AERMOIST pre-processor uses a set of temperature and RH ranges to automatically build a stack-specific wet plume rise model based on the IBJpluris prediction.
- The use of LIDAR to more accurately estimate the building dimensions to be used as the inputs in the Building Profile Interface Program (BPIP) model of the AERMOD modeling system. Correct building dimensions are very important to estimate the effects of building downwash on the pollutant concentration at the facility. This LIDAR technique can be used to accurately measure the building length, width, and height, and stack height, for modeling purposes. The modeling may also use this technique in estimating the elevation of ground level for input in AERMAP, the terrain pre processor in the AERMOD model. The LIDAR technique is also helpful in plume mapping that depicts the plume rise and spread in the real time analyses.
- MDE is also looking at other potential surface meteorological data sites as input into AERMOD, in addition to surface data currently being used from the Baltimore-Washington International (BWI) airport.

Attachment 6

SO_2 Attainment Designation Timeline

- 2015: Maryland submits its designation recommendation letter for the Wagner area to EPA Region III.

- 2015 – Early 2016: MDE Secretary Ben Grumbles submits to EPA further emissions and modeling analyses and information to support the attainment designation or an updated designation recommendation.

- 2015 - 2018: Monthly calls between MDE and EPA to coordinate on the status of activities related to the designation of the Wagner area.

- January 15, 2016: MDE identifies federally enforceable emissions limits or permit conditions that may be needed to support the attainment designation, and MDE forwards this information to EPA. EPA's 120-day letters, in which EPA notifies states concerning any intended modifications to their designation recommendations, are expected on or about January 22, 2016.

- January 2018: Maryland's target date for providing documentation that the Wagner area is attaining the 1-hour SO_2 NAAQS including any federally enforceable emission limits or permit conditions that may be required to insure attainment. Note: If Maryland were to submit a nonattainment area state implementation plan (SIP) to EPA to comply with the 1-hour SO_2 NAAQS for the Wagner area, then January 2018 would be the date by which sources would be required to come to agreement, with states, to implement controls in time for a 1-hour SO_2 nonattainment area to attain the SO_2 NAAQS. This is ahead of that schedule.