Draft Technical Support Document

Maryland
Area Designations for the 2010 SO_2 Primary National Ambient Air Quality Standard

Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA) must designate areas as either “unclassifiable,” “attainment,” or “nonattainment” for the 2010 1-hour sulfur dioxide (SO_2) primary national ambient air quality standard (NAAQS). The CAA defines a nonattainment area as one that does not meet the NAAQS or that contributes to a violation in a nearby area. An attainment area is defined as any area other than a nonattainment area that meets the NAAQS. Unclassifiable areas are defined as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

Maryland submitted a designation recommendation on April 19, 2011 and updated its designation recommendation with a letter dated November 20, 2015. EPA is now subject to a court-ordered July 2, 2016 deadline to designate certain areas established by the U.S. District Court for the Northern District of California. One area in Anne Arundel County, Maryland must be designated by EPA by this deadline, due to its having a SO_2 source with emissions over certain thresholds identified in the court order. This deadline is the first of three deadlines established by the court for EPA to complete area designations for the 2010 SO_2 NAAQS. Table 1 below lists Maryland’s 2015 recommendation for the area around Wagner, Maryland’s 2011 recommendation for Baltimore City, and identifies the portions of counties in Maryland that EPA intends to designate by July 2, 2016 based on an assessment and characterization of air quality through ambient air quality data, air dispersion modeling, other evidence and supporting information, or a combination of the above.

Table 1: Maryland’s Recommended and EPA’s Intended Designations

Area	Maryland’s Recommended Area Definition	Maryland’s Recommended Designation	EPA’s Intended Area Definition	EPA’s Intended Designation
Anne Arundel County and Baltimore County	Area boundary not provided	Attainment	Portions of Anne Arundel and Baltimore Counties that are within 35.5 kilometers of Herbert Wagner’s Unit 3 stack, which is located at 39.17765N latitude, 76.52752W longitude	Nonattainment

Baltimore City	Baltimore City	Unclassifiable	Same as State's Recommendation	Unclassifiable/Attainment

Background

On June 3, 2010, EPA revised the primary (health-based) SO_2 NAAQS by establishing a new 1-hour standard at a level of 75 parts per billion (ppb) which is attained when the 3-year average of the 99th percentile of 1-hour daily maximum concentrations does not exceed 75 ppb. This NAAQS was published in the Federal Register on June 22, 2010 (75 FR 35520) and is codified at 40 CFR 50.17. EPA determined this is the level necessary to protect public health with an adequate margin of safety, especially for children, the elderly and those with asthma. These groups are particularly susceptible to the health effects associated with breathing SO_2. The two prior primary standards of 140 ppb evaluated over 24 hours, and 30 ppb evaluated over an entire year, codified at 40 CFR 50.4, remain applicable.[1] However, EPA is not currently designating areas on the basis of either of these two primary standards. Similarly, the secondary standard for SO_2, set at 500 ppb evaluated over three hours has not been revised, and EPA is also not currently designating areas on the basis of the secondary standard.

General Approach and Schedule

Section 107(d) of the Clean Air Act requires that not later than one year after promulgation of a new or revised NAAQS, state governors must submit their recommendations for designations and boundaries to EPA. Section 107(d) also requires EPA to provide notification to states no less than 120 days prior to promulgating an area designation that is a modification of a state's recommendation. If a state does not submit designation recommendations, EPA will promulgate the designations that it deems appropriate. If a state or tribe disagrees with EPA's intended designations, they are given an opportunity within the 120-day period to demonstrate why any proposed modification is inappropriate.

On August 5, 2013, EPA published a final rule establishing air quality designations for 29 areas in the United States for the 2010 SO_2 NAAQS, based on recorded air quality monitoring data from 2009 - 2011 showing violations of the NAAQS (78 FR 47191). In that rulemaking, EPA committed to address, in separate future actions, the designations for all other areas for which the Agency was not yet prepared to issue designations.

Following the initial August 5, 2013 designations, three lawsuits were filed against EPA in different U.S. District Courts, alleging the Agency had failed to perform a nondiscretionary duty

[1] 40 CFR 50.4(e) provides that the two prior primary NAAQS will no longer apply to an area one year after its designation under the 2010 NAAQS, except that for areas designated nonattainment under the prior NAAQS as of August 22, 2010, and areas not meeting the requirements of a SIP Call under the prior NAAQS, the prior NAAQS will apply until that area submits and EPA approves a SIP providing for attainment of the 2010 NAAQS.

under the CAA by not designating all portions of the country by the June 2013 deadline. In an effort intended to resolve the litigation in one of those cases, plaintiffs Sierra Club and the Natural Resources Defense Council and EPA filed a proposed consent decree with the U.S. District Court for the Northern District of California. On March 2, 2015, the court entered the consent decree and issued an enforceable order for EPA to complete the area designations according to the consent decree schedule.

According to the consent decree and court order, EPA must complete the remaining designations on a schedule that contains three specific deadlines. By no later than July 2, 2016 (16 months from the court's order), EPA must designate two groups of areas: (1) areas that have newly monitored violations of the 2010 SO_2 NAAQS, and (2) areas that contain any stationary sources that had not been announced as of March 2, 2015 for retirement and that according to EPA's Air Markets Database emitted in 2012 either (i) more than 16,000 tons of SO_2 or (ii) more than 2,600 tons of SO_2 with an annual average emission rate of at least 0.45 pounds of SO_2 per one million British thermal units (lbs SO_2/mmBTU). Specifically, a stationary source with a coal-fired unit that as of January 1, 2010 had a capacity of over 5 megawatts and otherwise meets the emissions criteria, is excluded from the July 2, 2016 deadline if it had announced through a company public announcement, public utilities commission filing, consent decree, public legal settlement, final state or federal permit filing, or other similar means of communication, by March 2, 2015, that it will cease burning coal at that unit.

The last two deadlines for completing remaining designations are December 31, 2017, and December 31, 2020. EPA has separately promulgated requirements for states and other air agencies to provide additional monitoring or modeling information on a timetable consistent with these designation deadlines. We expect this information to become available in time to help inform these subsequent designations. These requirements were promulgated on August 21, 2015 (80 FR 51052), in a rule known as the SO_2 Data Requirements Rule (DRR).

Updated designations guidance was issued by EPA through a March 20, 2015 memorandum from Stephen D. Page, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Air Division Directors, U.S. EPA Regions I-X. This memorandum supersedes earlier designation guidance for the 2010 SO_2 NAAQS, issued on March 24, 2011, and it identifies factors that EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The guidance also contains the factors EPA intends to evaluate in determining the boundaries for all remaining areas in the country, consistent with the court's order and schedule. These factors include: 1) Air quality characterization via ambient monitoring or dispersion modeling results; 2) Emissions-related data; 3) Meteorology; 4) Geography and topography; and 5) Jurisdictional boundaries. This guidance was supplemented by two technical assistance documents intended to assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling or ambient air quality monitoring for sources that emit SO_2. Notably, EPA released its most recent versions of documents titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) and "SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document" (Monitoring TAD) in December 2013.

Based on ambient air quality data collected between 2012 and 2014, no violations of the 2010 SO_2 NAAQS have been recorded in any undesignated part of Maryland.[2] However, there is one source in the state meeting the emissions criteria of the consent decree and court order for which EPA must complete designations by July 2, 2016. In this draft technical support document, EPA discusses its review and technical analysis of the area that we must designate pursuant to the consent decree and court order. EPA also discusses any intended modifications from the State's recommendation based on all available data before us.

The following are definitions of important terms used in this document:

1) 2010 SO_2 NAAQS – The primary NAAQS for SO_2 promulgated in 2010. This NAAQS is 75 ppb, based on the three-year average of the 99th percentile of the annual distribution of daily maximum one-hour average concentrations. *See* 40 CFR 50.17.
2) Design Value - a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the NAAQS.
3) Designated nonattainment area – an area which EPA has determined has violated the 2010 SO_2 NAAQS or contributed to a violation in a nearby area. A nonattainment designation would reflect considerations of state recommendations and all of the information discussed in this document. EPA's decision would be based on all available information including the most recent three years of air quality monitoring data, available modeling analysis, and any other relevant information.
4) Designated unclassifiable area – an area which EPA cannot determine based on all available information whether it meets the 2010 SO_2 NAAQS.
5) Designated unclassifiable/attainment area – an area which EPA has determined to have sufficient evidence to find either is attaining or is likely to be attaining the NAAQS. EPA's decision would be based on all available information including the most recent three years of air quality monitoring data, available modeling analysis, and any other relevant information.
6) Modeled violation – a violation based on air dispersion modeling.
7) Recommended attainment area – an area a state or tribe has recommended that EPA designate as attainment.
8) Recommended nonattainment area – an area a state or tribe has recommended that EPA designate as nonattainment.
9) Recommended unclassifiable area – an area a state or tribe has recommended that EPA designate as unclassifiable.

[2] For designations based on ambient air quality monitoring data that violates the 2010 SO_2 NAAQS, the consent decree directs EPA to evaluate data collected between 2013 and 2015. Absent complete, quality-assured and certified data for 2015, the analyses of applicable areas for EPA's intended designations will be informed by data collected between 2012 and 2014. States with monitors that have recorded a violation of the 2010 SO_2 NAAQS during these years have the option of submitting complete, quality-assured and certified data for calendar year 2015 by April 19, 2016 to EPA for evaluation. If after our review, the ambient air quality data for the area indicates that no violation of the NAAQS occurred between 2013 and 2015, the consent decree does not obligate EPA to complete the designation. Instead, EPA may designate the area and all other previously undesignated areas in the state on a schedule consistent with the prescribed timing of the consent decree, i.e., by December 31, 2017, or December 31, 2020.

10) Recommended unclassifiable/attainment area – an area a state or tribe has recommended that EPA designate as unclassifiable/attainment.
11) Violating monitor – an ambient air monitor meeting all methods, quality assurance and siting criteria and requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.

Technical Analysis for the Anne Arundel County and Baltimore County, Maryland Area and Baltimore City, Maryland Area

Introduction

The Anne Arundel County and Baltimore County area contains one stationary source that according to EPA's Air Markets Database emitted in 2012 either (a) more than 16,000 tons of SO_2 or (b) more than 2,600 tons of SO_2 and had an annual average emission rate of at least 0.45 lbs SO_2/mmBTU. As of March 2, 2015, this stationary source, Herbert A. Wagner Generating Station (Wagner, or the Facility), had not met the specific requirements for being "announced for retirement."[3] Specifically, in 2012, Wagner emitted 7,514 tons of SO_2, and had an emissions rate of 1.105 lbs SO_2/mmBTU. Pursuant to the March 2, 2015 consent decree and court order, EPA must designate the area surrounding the facility by July 2, 2016.

In its April 19, 2011 submission to EPA for the initial designations for the 2010 SO_2 NAAQS, Maryland recommended that the area which includes Wagner, specifically the entirety of Anne Arundel County, be designated as unclassifiable. Likewise, Maryland's 2011 submission recommended that Baltimore City be designated as unclassifiable. The 2011 submission, however, did not include any supporting analyses. Subsequently, in its November 20, 2015 updated designation recommendation submission to EPA, Maryland recommended that the area surrounding Wagner be designated as attainment. Maryland, however, did not recommend any particular boundary for the area in its November 20, 2015 submission. Maryland stated that no monitors in Maryland violated the 1-hour SO_2 NAAQS, and EPA has confirmed this. On January 15, 2016, Maryland submitted a supplement to its 2015 recommendation which included a modeling analysis for the area around Wagner. Additionally, this supplement included comments on air dispersion modeling dated January 4, 2016, performed by Sierra Club and submitted to EPA, asserting that violations of the NAAQS are present in the area around Wagner. Maryland did not update its recommendation for Baltimore City in its 2015 updated recommendation. After careful review of the State's 2015 recommendation and all submitted available data including air quality characterization, emissions data, meteorology, geography, topography, and modeling analyses for the area around Wagner, EPA disagrees with the State's recommendations, and intends to designate the area surrounding Wagner (portions of Anne Arundel County and Baltimore County) as nonattainment, and Baltimore City as unclassifiable/attainment.

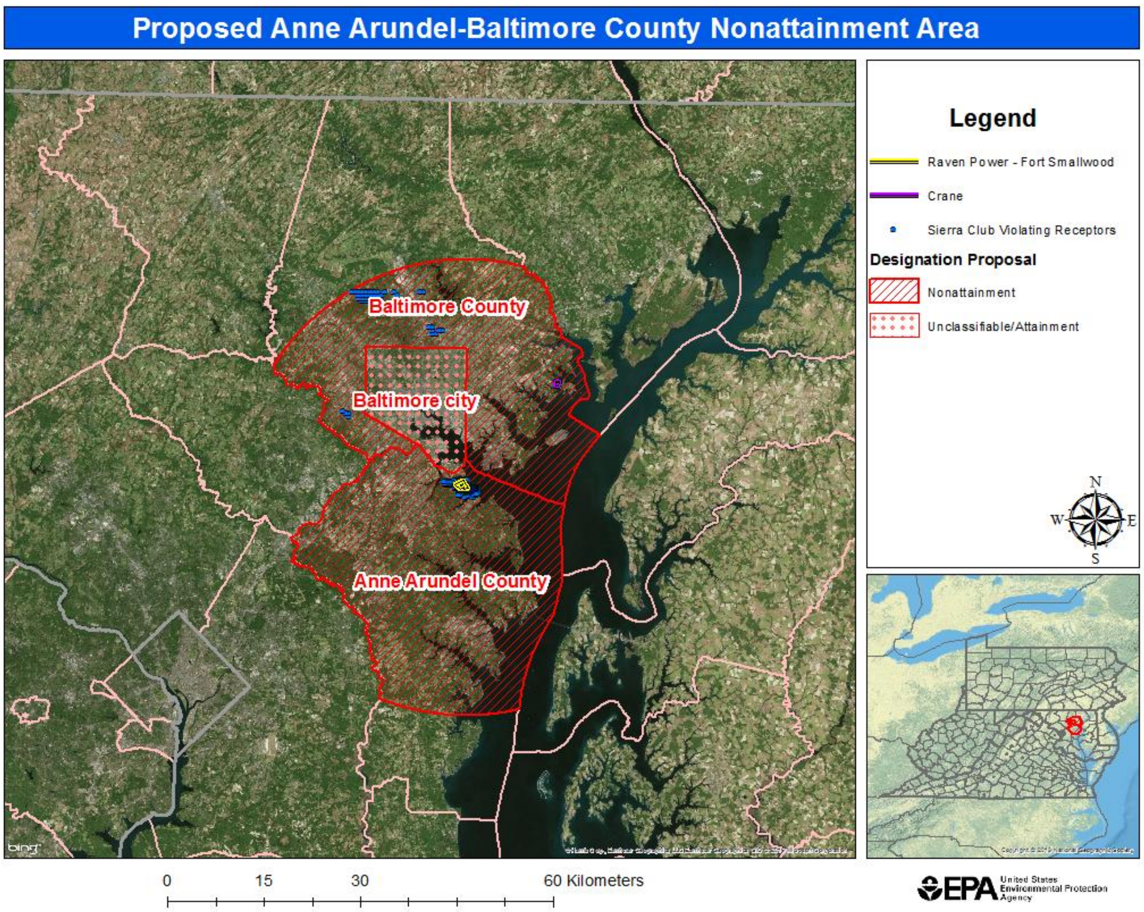
Wagner is located in eastern Maryland in the northern portion of Anne Arundel County. As seen in Figure 1, the facility[4] is located approximately two (2) kilometers south of the City of

[3] However, Wagner Unit 2 is on PJM Interconnection LLC's (PJM) current list for projected deactivation by June 1, 2020. *See* PJM's projected deactivation list, dated November 25, 2015, available at http://www.pjm.com/~/media/planning/gen-retire/pending-deactivation-requests.ashxhttp://www.pjm.com/~/media/planning/gen-retire/pending-deactivation-requests.ashx. PJM is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states, including Maryland, and the District of Columbia.

[4] EPA notes that the Wagner facility is considered one stationary source for purposes of Title V of the CAA and for CAA New Source Review (NSR) purposes with the Brandon Shores Generating Station (Brandon Shores) also

Baltimore along the Chesapeake Bay. Also included in the figure is EPA's intended nonattainment designation for the area. Specifically, the boundaries for our intended nonattainment area are comprised of the portions of Anne Arundel and Baltimore Counties that are within 35.5 kilometers of Herbert Wagner's Unit 3 stack, which is located at 39.17765N latitude, 76.52752W longitude.

Figure 1: EPA's Intended Designation for Anne Arundel County and Baltimore County Area



The discussion and analysis that follows below will reference the factors for evaluation contained in EPA's March 20, 2015 guidance, as appropriate.

Detailed Assessment for Anne Arundel County and Baltimore County Area

Air Quality Data

This factor considers the SO_2 air quality monitoring data in the area surrounding Wagner. The Facility is located in Anne Arundel County; however, there are no ambient air quality monitors located in this county. There is an ambient air quality monitor geographically near Anne

owned and operated by the same entity which owns and operates Wagner. Collectively, the facilities are known as "Fort Smallwood" and are subject to one Title V CAA permit issued by Maryland.

Arundel in Baltimore County. Maryland's updated 2015 designation recommendation included design values and the maximum 1-hour SO_2 concentrations from 2007-2014 for the Essex monitor (Air Quality Systems (AQS) ID 24-005-3001), located in Baltimore County (*see* Table 2). The State notes that the design value has decreased since the implementation of Maryland's Healthy Air Act. This monitor, however, is not located near Wagner and is instead located in neighboring Baltimore County, approximately 15 kilometers northeast of Wagner. As a result of this distance, EPA does not believe that the Essex monitor adequately characterizes air quality as a result of emissions from Wagner.

Table 2: Maryland's SO_2 Emissions and Air Monitoring Concentrations in the Vicinity of Wagner (in Maryland's November 20, 2015 submission)

Year	SO_2 Emissions (Tons/Year)				SO_2 Concentrations at Essex	
	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 three years. The 1-hour SO_2 standard is 75 parts per billion (ppb), calculated the same way.

Nonetheless, EPA has reviewed the most recent three years of monitoring data, i.e., 2012 – 2014, for the Essex monitor since there are no monitors in Anne Arundel County and the Essex monitor is the closest monitor to Wagner. Table 3 below shows the data from the Essex monitor which were confirmed through EPA's 2014 design value report for SO_2.[5]

Table 3: Available Air Quality Data Near Wagner

County	Air Quality Systems (AQS) Monitor ID	Monitor Name	Distance to Wagner (km)	2012 – 2014 SO_2 Design Value in ppb
Baltimore	24-005-3001	Essex	15	22

EPA's more detailed examination of daily peak 1-hour SO_2 concentrations and the 99th percentile daily 1-hour maximum SO_2 concentrations is also presented to gauge how high concentrations are in the vicinity of Wagner. The 99th percentile daily peak 1-hour concentrations are shown in Table 4 for the 2012-14 time period along with the 99th percentile for the Essex monitor. The Essex monitor's daily peak 1-hour SO_2 concentrations exceeded 50 percent of the NAAQS on one (1) day during the 2012-14 time period.

[5] The design value report for SO_2, as well as each of the other NAAQS, can be found at this link: http://www3.epa.gov/airtrends/values.html.

Table 4: Additional Monitoring Data for the Essex Monitor (24-005-3001)

Day's Peak 1-Hour > 37.5 ppb	Total Valid Days 2012-14	%Valid Days 2012-14	99th percentile 2012	99th percentile 2013	99th percentile 2014
1	1,084	98.9%	19	39	26

In addition, EPA's evaluation of the monitoring data indicates that 1-hour SO_2 concentrations at the Beltsville monitor (AQS ID 24-033-0030) in neighboring Prince George's County are less than half of those observed at Essex. This monitor is approximately 33 km west southwest of Wagner. Beltsville, unfortunately, does not meet the completeness criteria required to generate a valid design value though nearly 96 percent of the days were "complete." There were no days during the 2012-14 time period that exceeded 50 percent of the NAAQS at Beltsville.

Based on available ambient air quality data collected between 2012 and 2014, Anne Arundel's neighboring county, Baltimore County, does not show a violation of the 2010 SO_2 NAAQS at its monitor. Over the last two years there was only one (1) day in which 1-hour SO_2 concentrations exceeded 50 percent of the NAAQS.[6] However, the absence of a violating monitor when considering the distance from the Facility is not a sufficient technical justification to rule out that an exceedance of the 2010 SO_2 NAAQS may occur in the immediate vicinity of the Facility.

Additionally, Maryland's November 20, 2015 recommendation references a 2013 two-month monitoring study of SO_2 concentrations conducted around Raven Power's Wagner, Brandon Shores, and C.P. Crane facilities, and Maryland states that peak daily 1-hour maximum monitored SO_2 values were generally below 75 ppb, even though one site had a daily peak (101.7 ppb) that exceeded the 1-hour SO_2 NAAQS. The limited duration of this study does not allow EPA to make a determination of how frequently the NAAQS is exceeded, but given the occurrence of a maximum 1-hour SO_2 concentration of 101.7 ppb at the monitor closest to the Facility during the summer months, which is far in excess of the 75 ppb standard, an extrapolation would indicate that at least one exceedance of the NAAQS occurs quarterly. It must be noted, however, that EPA was not provided with any detailed information to permit EPA to evaluate the study, critically analyze the study's data, nor draw any conclusions from the study at this time. For instance, EPA has no information on how this study was conducted, who maintained the monitors in the study, what quality control checks were done on the monitors, nor any other critical information such as under what conditions this monitoring study was conducted. Given this information, there is a lack of supporting evidence to support an attainment designation for the area surrounding Wagner.

Emissions and Emissions-Related Data

Evidence of SO_2 emissions from the Facility meeting the emissions criteria of the March 2, 2015 consent decree and the court order is an important factor for determining whether the immediate area is experiencing elevated levels of SO_2 concentrations. Other considerations for this factor include county level SO_2 emissions data, and data for sources located within 50 km.

[6] *See* Maryland's November 20, 2015 designation recommendation, attachment 3, Table 2.

Maryland's updated 2015 designation recommendation included annual emissions data for sources in Anne Arundel County (i.e. Wagner and Brandon Shores), as well as annual emissions data from sources in neighboring Baltimore County (i.e. Crane). Maryland notes that implementation of Maryland's Healthy Air Act in 2010 resulted in a decrease of SO_2 emissions from Wagner, Brandon Shores, and Crane. Maryland's recommendation included the data provided in Table 2 above.

EPA confirms that emissions had decreased significantly from 2007 to 2010; however, they have not decreased since then, and have in fact increased slightly in 2014 from the 2010 level. Additionally, Wagner had been identified in 2015 as meeting the emission criteria outlined in the court order, and Wagner's emissions have not decreased further since 2010 with its SO_2 emissions remaining between 9,000 and 10,000 tons per year, As a result, EPA believes that this emissions data alone does not support the attainment designation recommended by Maryland. Wagner's emissions also have not decreased as significantly as Brandon Shore's and Crane's, which may reflect an absence or under-use of SO_2 controls.

To evaluate what emission controls are installed for Wagner and neighboring sources, EPA reviewed its Air Markets Programs (AMP) database. According to the AMP database, Brandon Shores has wet lime flue gas desulfurization (FGD) on Unit 1 and wet limestone SO_2 control for Unit 2. No SO_2 controls are listed in the EPA database for Wagner or C.P. Crane. Table 5 summarizes unit level controls and fuel types for the eight (8) primary combustion units at Wagner, Brandon Shores and C.P. Crane from the AMP database. With the lack of SO_2 emissions controls at Wagner and the present level of emissions at the plant, EPA lacks sufficient supporting evidence to support an attainment designation for the area around Wagner as Maryland has recommended.

Table 5: Air Markets Program Information for Brandon Shores, Wagner and C.P. Crane

Facility Name	Unit	Fuel Type (Primary)	Fuel Type (Secondary)	SO_2 Control(s)	Particulate Matter (PM) Control(s)	Mercury (Hg) Control(s)
Brandon Shores	1	Coal	-	Wet Lime FGD	Cyclone Baghouse	-
Brandon Shores	2	Coal	-	Wet Limestone	Cyclone Baghouse	-
Herbert A Wagner	1	Other Oil	Pipeline Natural Gas	-	Electrostatic Precipitator	-
Herbert A Wagner	2	Coal	-	-	Electrostatic Precipitator	Halogenated PAC Sorbent Injection
Herbert A Wagner	3	Coal	-	-	Electrostatic Precipitator	-
Herbert A Wagner	4	Other Oil	Pipeline Natural Gas	-	Electrostatic Precipitator	-
C P Crane	1	Coal	-	-	Baghouse	-
C P Crane	2	Coal	-	-	Baghouse	-

Further, EPA reviewed the emissions data provided by Maryland and confirmed the data by evaluating data obtained from the 2011 and 2013 National Emissions Inventory (NEI).[7] The annual SO_2 emissions data for point sources emitting at or above 100 tons per year (tpy) in Anne Arundel and neighboring Baltimore County and Baltimore City are summarized in Table 6 below. Figure 2 shows the locations of the emissions sources listed in Table 6. One source labeled in Figure 2, Sparrows Point, LLC, however, is not included in Table 6 because it has been permanently shut down and demolished.[8]

Table 6: 2011 and 2013 NEI SO_2 Emissions from Wagner and Other Local Sources

County	Owner and Operator	Facility Complex Name	Facility Name	Facility Subject to the Emissions Criteria of the March 2, 2015 consent decree?	Distance to Facility that Meets the Consent Decree Criteria in km	2011 Facility Total SO_2 Emissions (tpy)	2013 Facility Total SO_2 Emissions (tpy)
Anne Arundel	Raven Power Holdings, LLC	Fort Smallwood[9]	Wagner	Yes	0	11,943[10]	13,049[9]
Anne Arundel	Raven Power Holdings, LLC	Fort Smallwood	Brandon Shores	No	0	11,943[9]	13,049[9]
Baltimore	Raven Power Holdings, LLC	N/A	C.P. Crane LLC	No	22	5,684	2,973
Baltimore City	Wheelabrator Technologies	N/A	Wheelab-rator Baltimore, L.P.	No	12.9	261	321

EPA has also reviewed emissions data from EPA's AMP database. For 2014, Wagner's SO_2 emissions were 9,610 tpy and Brandon Shores were 3,145 tpy. Figure 3 shows annual SO_2 emissions for each unit from EPA's AMP. Of the eight (8) units reviewed, Wagner's unit 3

[7] Detailed information for the 2011 NEI can be found at this link: http://www3.epa.gov/ttnchie1/net/2011inventory.html. For more information on the 2013 NEI, contact the Region III office.

[8] The facility's Title V permit has expired.

[9] As discussed above, Brandon Shores and Wagner are treated as a single stationary source for Title V and NSR purposes due to common ownership by Raven Power Holdings, LLC, contiguous location, and same singular major industrial grouping.

[10] In both the 2011 and 2013 NEI, emissions from Wagner and Brandon Shores are combined and reported together as Wagner and Brandon Shores are treated as a single stationary source. Emissions from each facility, however, are reported individually in EPA's Air Markets Database as 9,610 tpy for Wagner in 2014 and 3,145 tpy for Brandon Shores in 2014.

emitted the largest amount of SO_2 during the 2012-14 time period. It should be noted that unit 3 does not have any SO_2 emission control devices installed.

Figure 2: 2013 NEI Annual SO_2 Emissions in tons per year

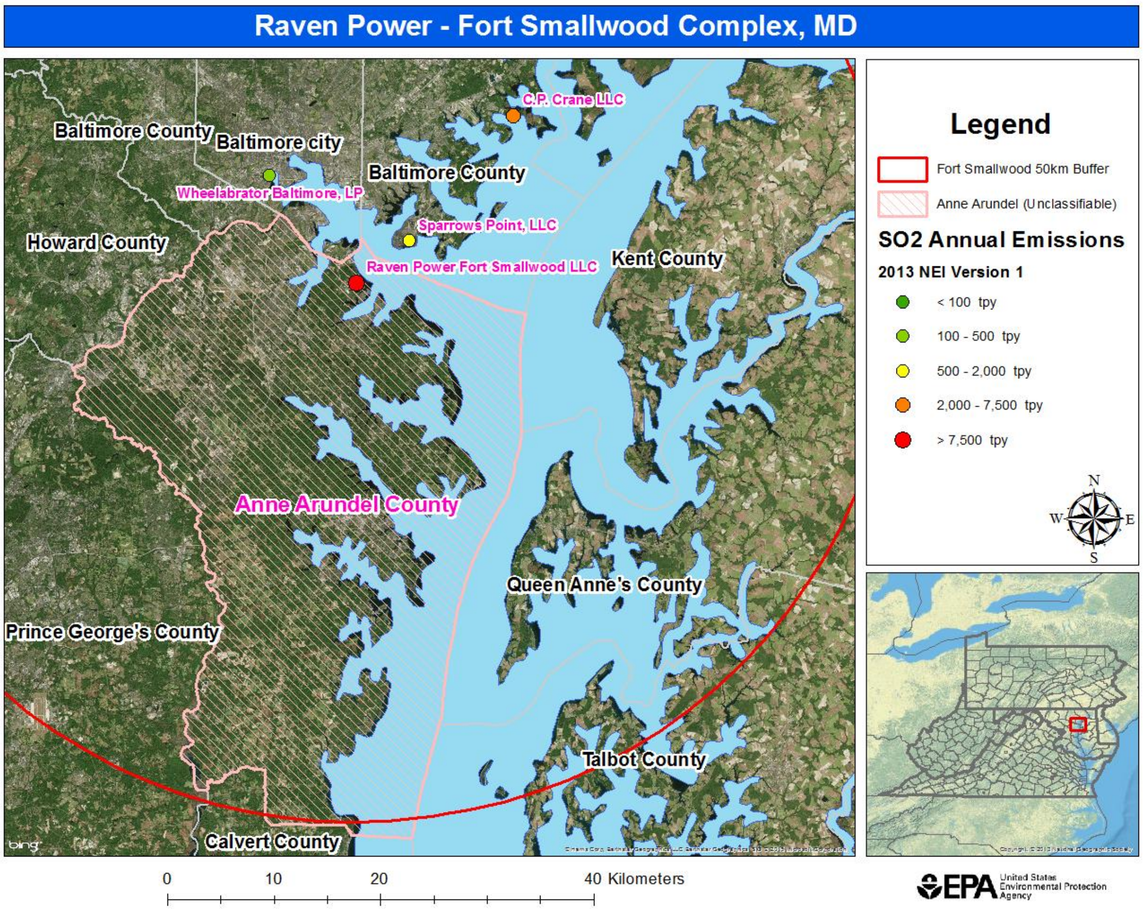
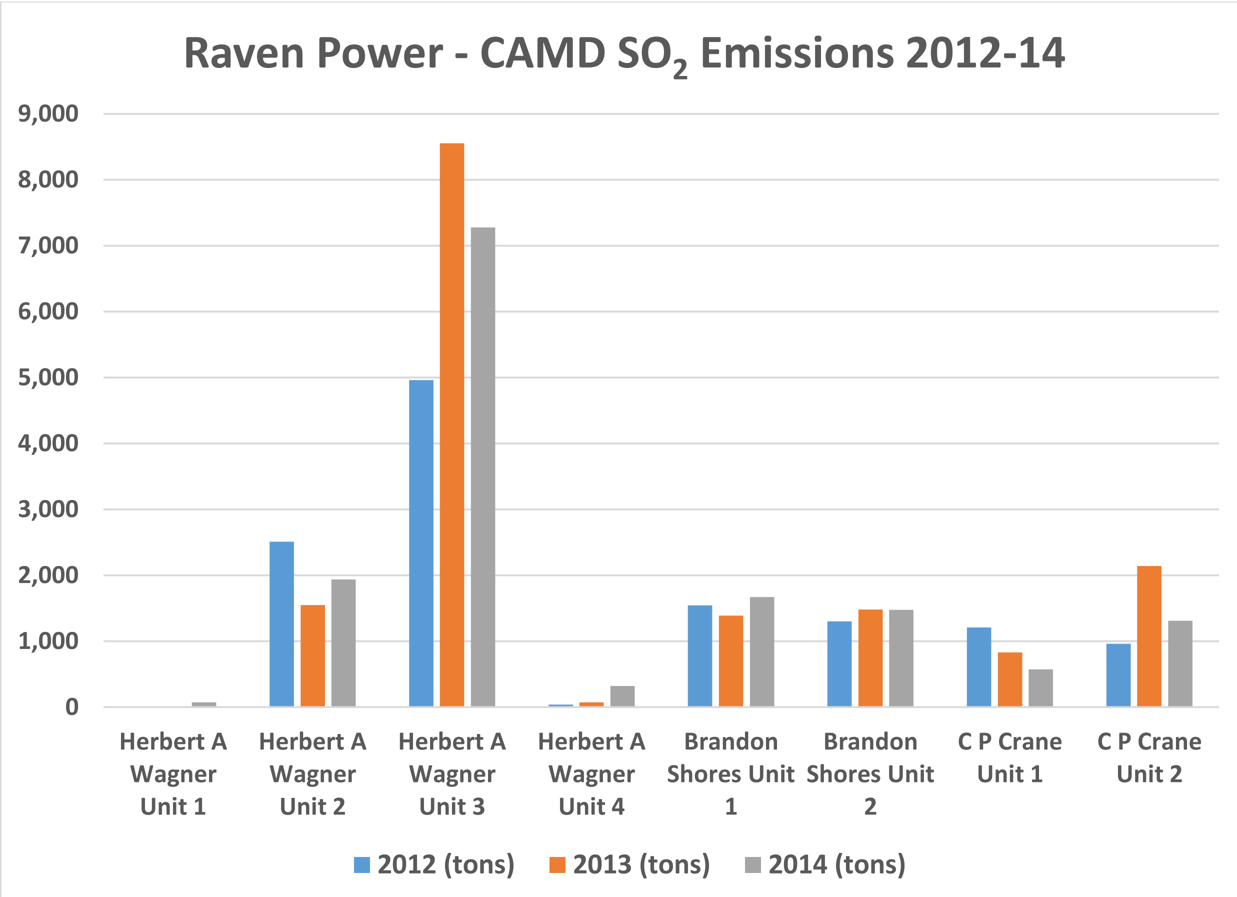


Figure 3: 2012-14 Annual Unit SO_2 Emissions in tpy from Wagner, Brandon Shores and Crane



The lack of SO_2 emissions controls at Wagner, lack of declining emissions trend from Wagner, and the present level of emissions at the plant indicates that there could be impacts from this plant on SO_2 concentrations in the area. EPA lacks sufficient supporting evidence to support an attainment designation for the area around Wagner as Maryland has recommended. Based on EPA's review of available emissions data, as well as air dispersion modeling information for the area surrounding Wagner discussed later in this draft technical support document, EPA believes a designation of nonattainment is appropriate for the area impacted by Wagner.

Emissions Controls

Maryland's updated 2015 designation recommendation mentions that in mid-April 2015, the owners of the Wagner facility, Raven Power, began to use a low sulfur coal at Wagner's unit 2 as a method of compliance with the federal Mercury and Air Toxics Standard (MATS). However, EPA has insufficient information on the percent sulfur coal and whether any restrictions on fuel sulfur coal are in a permanent, federally enforceable document such as a permit or SIP approved requirement. Maryland also mentions that in early 2016, Raven Power will be adding a dry sorbent injection (DSI) system to Wagner's unit 3 to comply with MATS to help reduce SO_2 emissions. Again, EPA has no further information at this time regarding the specifications of the DSI system, its control efficiency, and operational requirements and no information on whether DSI controls are federally enforceable via permits or SIP requirements. In addition, review of Wagner's unit-by-unit emissions reveals that emissions of SO_2 from Wagner's unit 3 are far greater than that of unit 2 and hence EPA believes controls and effectiveness of controls at unit 3 at reducing SO_2 are more important to any analysis of impacts from the plant. At this time, there are no federally enforceable controls in place at the plant to reduce SO_2, and Wagner's obligations to comply with the federal MATs requirements is not sufficient to allow EPA to fully evaluate future likely impacts from Wagner on the NAAQS, and are not relevant for evaluating whether actual emissions from 2012-2014 caused violations of the NAAQS during that period. Maryland has not presented any analysis or information to support that MATS compliance plans will reduce SO_2 emissions from Wagner to such an extent that the SO_2 NAAQS are met. Present information from Maryland regarding potential control options at the plant and fuel switching options without federally enforceable controls and limits is insufficient to support Maryland's recommendation of attainment for the area. Furthermore, based on EPA's review of emissions control information in conjunction with available air dispersion modeling discussed later in this draft technical support document, EPA believes a designation of nonattainment is appropriate for the area around Wagner.

Meteorology (Weather & Transport Patterns)

Maryland's updated 2015 designation recommendation did not address meteorology. Maryland did not provide a discussion of the meteorology, nor any analysis or impacts of this factor on the area around Wagner.

Evidence of source-receptor relationships between specific emissions sources and high SO_2 concentrations in the surrounding area is an important factor in determining the appropriate extent of EPA's intended nonattainment area. The closest hourly reporting meteorological monitoring station to Wagner is the Baltimore-Washington International Airport (BWI). BWI is located approximately twelve (12) kilometers west of Wagner. A wind rose for the 2012-14 time period (Figure 4) shows predominantly westerly winds in the area.

Figure 4: BWI 2012-14 Wind Rose

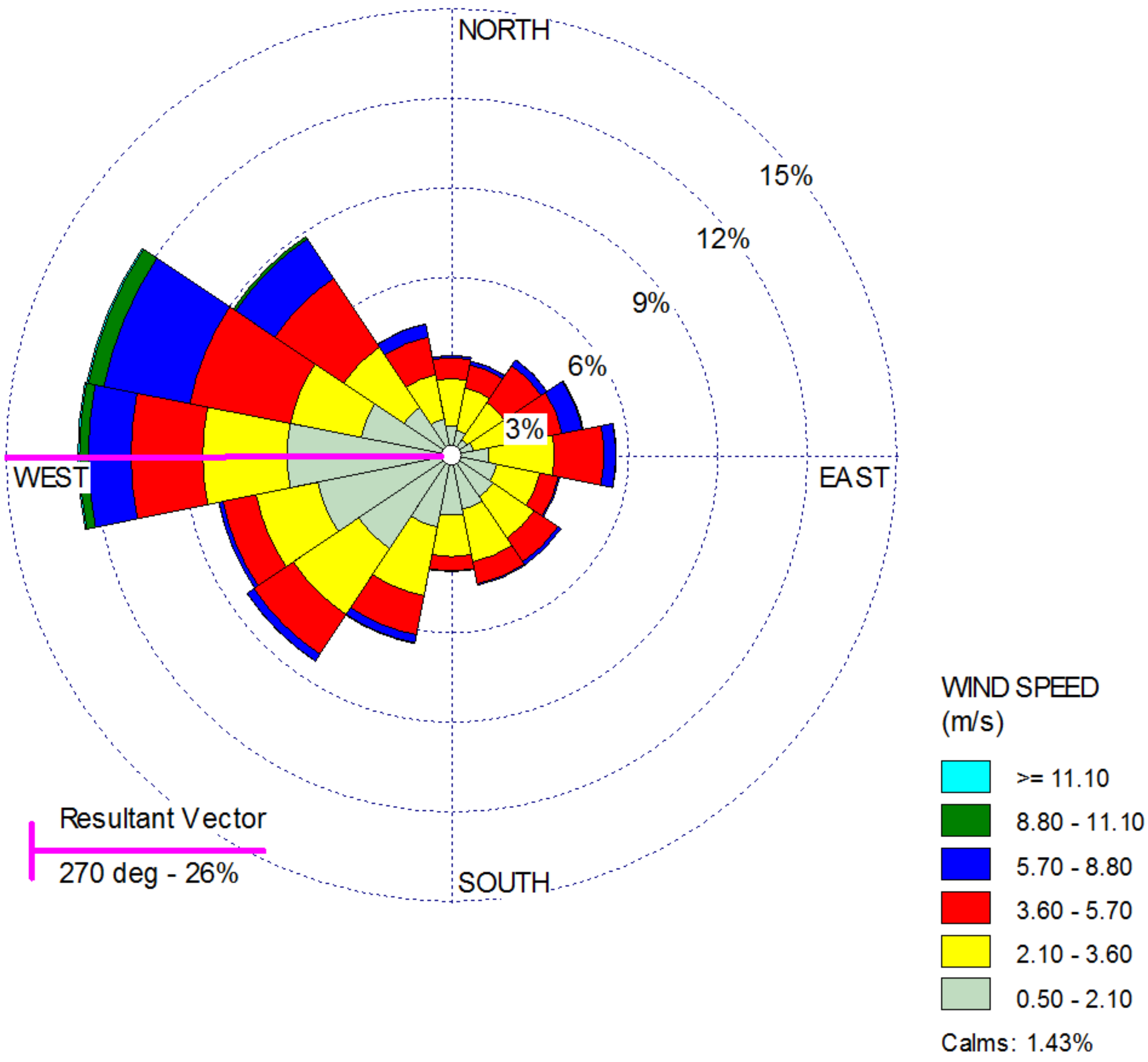
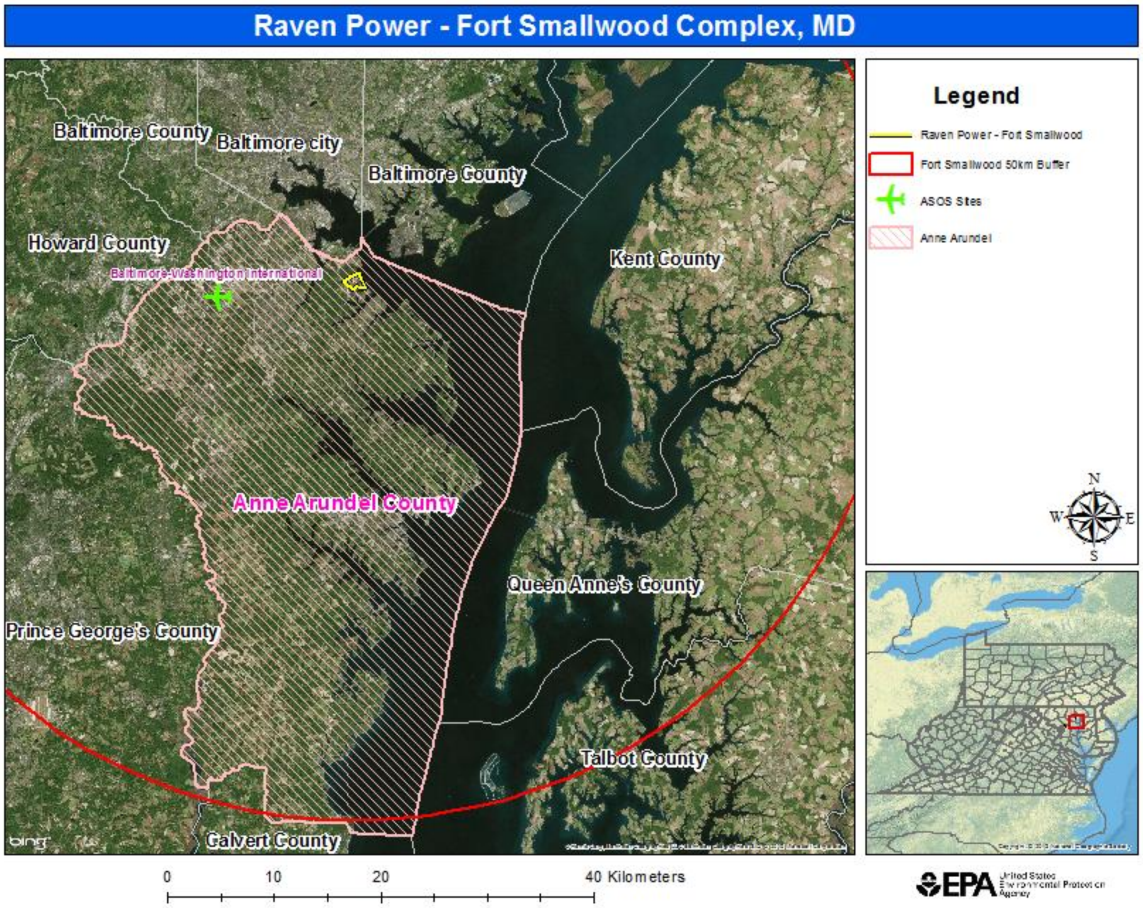


Figure 5: Location of BWI Monitoring Location



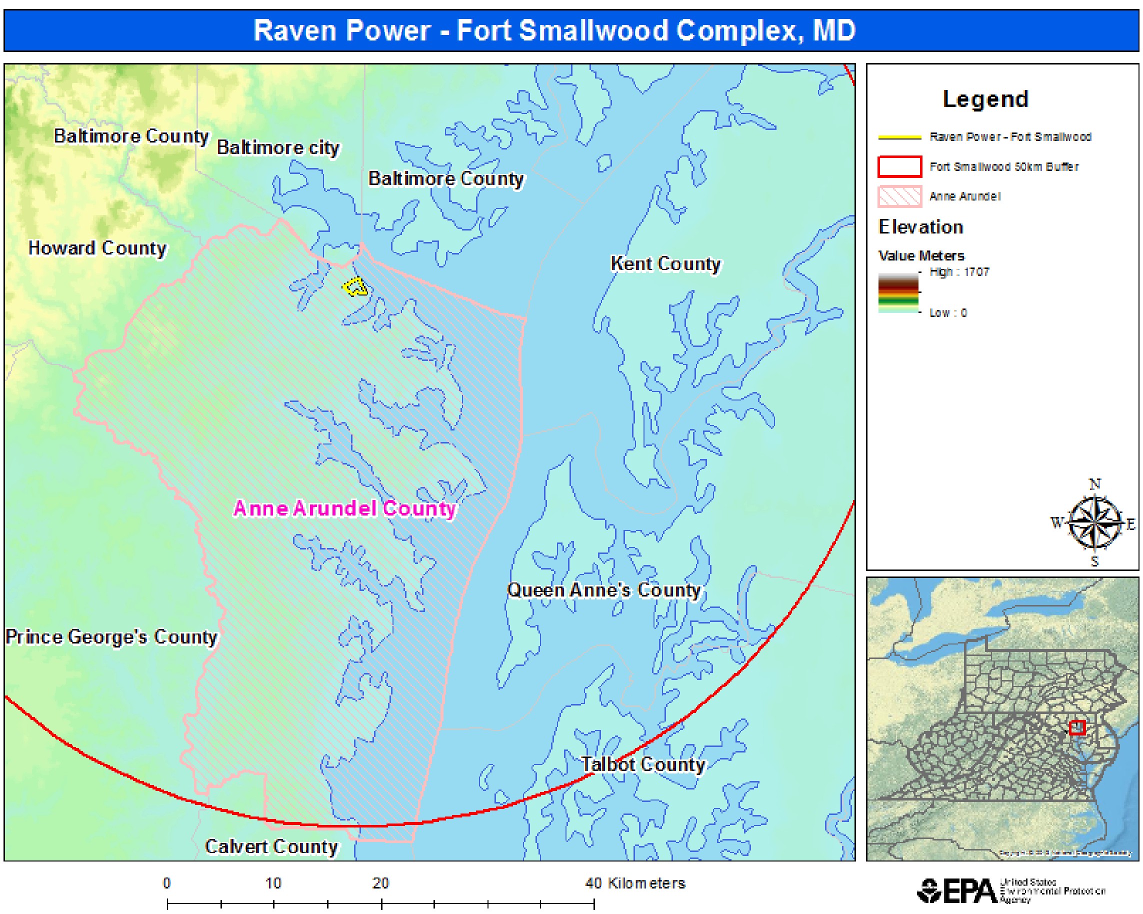
Geography and Topography (Mountain Ranges or Other Air Basin Boundaries)

Maryland's updated 2015 designation recommendation did not explicitly address this factor. Maryland did provide two topographical maps showing monitoring locations, but did not provide a discussion of the geography or topography, nor any analysis or impacts of this factor on the area around Wagner.

EPA has reviewed both the geography and topography of the area surrounding Wagner. Wagner and Anne Arundel County lie within the Atlantic Coastal Plain just west of the Chesapeake Bay (Figure 5). Elevations at the Facility are slightly above sea level. Stack heights at the Facility exceed 80 meters. This means that nearly all of the terrain in Anne Arundel County lies below the stack tops preventing potential plumes from directly impacting any nearby terrain features. The nearest terrain features lie over seventeen (17) kilometers northwest of Wagner.

As noted in EPA's Modeling TAD, , in areas of flat terrain, such as the area surrounding Wagner, the distance to maximum concentration is generally expected to fall within a distance of ten (10) stack heights or approximately 1 kilometer from Wagner. Given the lack of terrain, and using general modeling principals from EPA's Modeling TAD we expect maximum concentrations to occur within a kilometer or so from Wagner. The expected localized impact from Wagner is supported in information from the Summer 2013 Monitoring Study submitted by Maryland. Monitoring data from this study showed the Cianbro Site, located approximately three (3) kilometers west of Wagner, exceeded the 1-hr SO_2 NAAQS on one occasion. Although this information supports expected maximum concentrations to occur within a kilometer or so from Wagner, based on general westerly/northwesterly wind patterns and the lack of terrain, it is reasonable to conclude that transport may play some role in dispersing SO_2 downwind, and thereby causing additional violations of the SO_2 NAAQS farther than a kilometer from the facility. Based on EPA's review of this information, EPA believes there is insufficient evidence to support an attainment designation for the area surrounding Wagner. Furthermore, based EPA's review of available air dispersion modeling discussed later in this technical support document, EPA believes a designation of nonattainment is appropriate for the area impacted by Wagner.

Figure 6: Elevation/Topography of Anne Arundel and Surrounding Counties



Air Dispersion Modeling

Detailed Assessment of Maryland's Modeling

In its November 20, 2015 recommendation, Maryland included a narrative describing preliminary modeling analyses that were being conducted by the State. The State notes that the modeling uses 2012-2014 actual emissions data, including the reductions in 2015 being seen from the use of low-sulfur coal for compliance with MATS at Wagner's unit 2. EPA, however, is not aware of any federally enforceable restrictions on the Wagner plant regarding fuel sulfur limits or any SO_2 controls. The State furthermore notes that the preliminary modeling includes emission units of Wagner, Brandon Shores, Crane, Wheelabrator and Energy Answers, and that background concentrations were based on a season and hour-of-day approach delineated in EPA guidance. On January 15, 2016, Maryland submitted a set of modeling files and a final modeling report as a supplement to its 2015 recommendation. Additionally, Maryland also included comments on the modeling analysis submitted by Sierra Club on January 4. 2016, which can be found in the docket.

Model Selection and Modeling Components

EPA's draft Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

In June of 2015 the Maryland Department of the Environment (MDE) provided a modeling analysis to Raven Power, the owner of Wagner, Brandon Shore (collectively known as Fort Smallwood) and Crane generating stations. Raven Power then contacted AECOM to review and update MDE's modeling analysis.

Modeling components used by AECOM are summarized in Table 7. The modeling appears to have been completed in January 2016. AECOM included building downwash for the Wagner, Brandon Shores and Crane generating stations. No building downwash was determined for Wheelabrator Baltimore and Energy Answers, though this information was included in Energy Answers' PSD/NSR application modeling.

Table 7: Model Versions Summary

AERMOD Component	AECOM Version	Current Version
AERMOD	15181	15181
AERSURFACE	13016	13016
AERMAP	-	11103
AERMET	15181	15181
AERMINUTE	14337	15272
BPIPPRIME	04274	04274

Modeling Parameter: Rural or Urban Dispersion

EPA's recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment with 3 km of the facility. According to EPA's modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50% of the area within a 3 km radius of the facility is classified as rural. Conversely, if more than 50% of the area is urban, urban dispersion coefficients should be used in the modeling analysis. AECOM's modeling analysis utilized rural dispersion coefficients in its AERMOD runs. This conclusion was based on a visual inspection of 2011 Land Use Land Cover (LULC) information within three (3) kilometers of Fort Smallwood. When performing the modeling for the area of analysis, AECOM determined that it was most appropriate to run the model in rural mode. No analysis was done to determine if effective stack height exceeded any urban mixed layer that could be occurring over the City of Baltimore (*see* section 5.1 of EPA's *AERMOD Implementation Guide*). The estimated urban boundary layer is 298.8 meters (*see* equation (1) in previous noted section of EPA guidance).

Modeling Parameter: Area of Analysis (Receptor Grid)

EPA believes that a reasonable first step towards characterization of air quality in the area surrounding the Herbert A. Wagner Generating Station is to determine the extent of the area of analysis, i.e., receptor grid. Considerations presented in the draft Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations. For the Wagner area, AECOM has included a total of ten (10) SO_2 sources within twenty (20) kilometers (km) of the Herbert A. Wagner Generating Station. This generally follows guidance outlined in EPA's March 1, 2011 Clarification Memo entitled *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2, National Ambient Air Quality*[11]. Standard AECOM included sources controlled by Raven Power (Wagner, Brandon Shores and Crane) along with the Baltimore Incinerator (Wheelabrator Baltimore) and the proposed Energy Answers municipal waste incinerator.

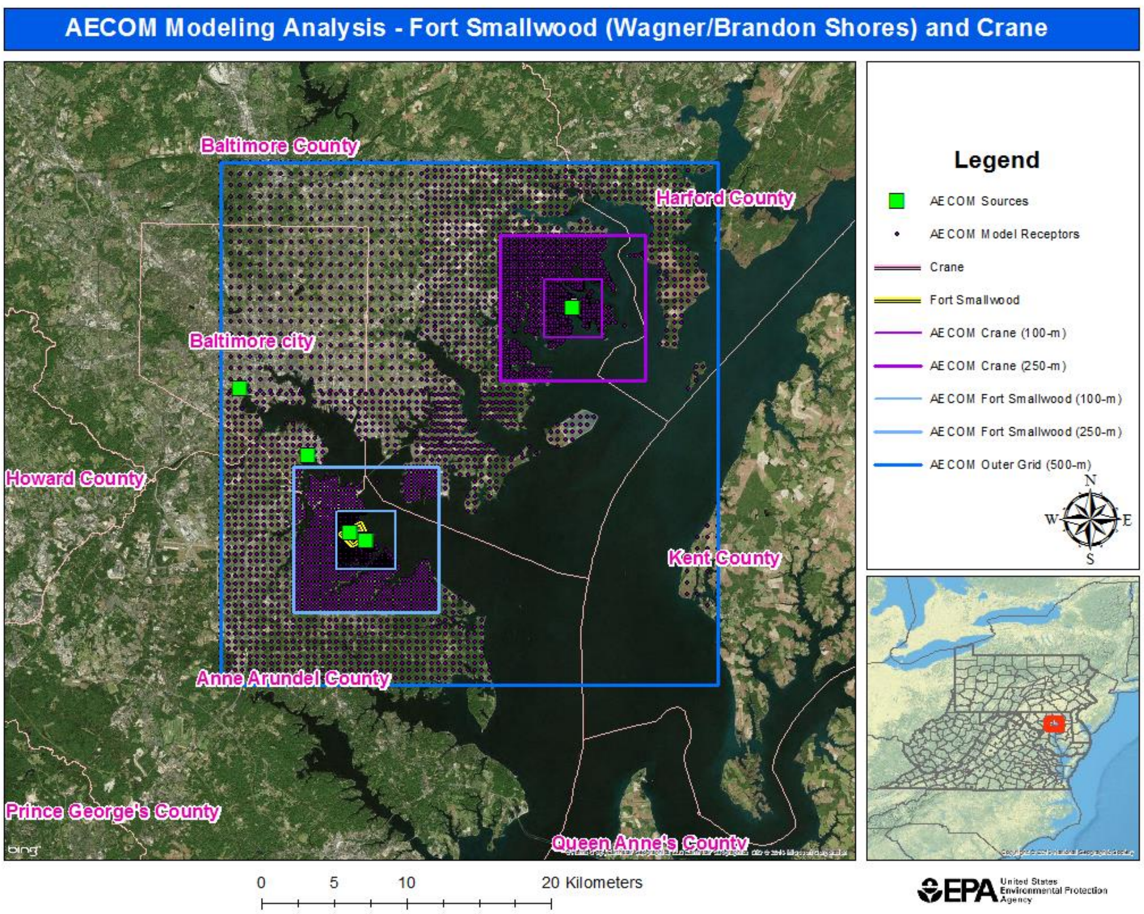
Imbedded Cartesian receptor grids were developed by AECOM surrounding the Fort Smallwood complex (Brandon Shores and Wagner) and Crane. The receptor grids were developed as follows:

[11] Top paragraph page 16

- 25 meter spacing along both facility's property boundary
- 100 meter spacing out to two (2) km
- 250 meter spacing between two (2) and five (5) km
- 500 meter spacing between five (5) and ten (10) km

The model receptor network contained a total of 6,181 receptors. Model receptors were placed in Anne Arundel and Baltimore counties and Baltimore City. AECOM followed EPA's Modeling TAD and attempted to remove receptors that were located over open water and other sites where it would not be feasible to site an actual monitor and record ambient impacts. Figure 7 shows AECOM's chosen area of analysis surrounding the Herbert A. Wagner Generating Station, as well as receptor grid for the area of analysis.

Figure 7: AECOM's Model Receptor Grid for the Wagner Area of Analysis



Modeling Parameter: Source Characterization

AECOM characterized ten (10) sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. All sources were modeled as point sources with no horizontal or obstructed stacks. These included all the major SO_2 sources operated by Raven Power along with two (2) other sources. All coal-fired units were included in the modeling analysis along with two (2) large oil-fired units at Wagner that make up the Fort Smallwood complex. Smaller ancillary emission sources and start-up/shut-down emissions were not included in AECOM's modeling analysis.

Additional stack information is summarized in Table 8. This includes information on emission rates, hourly varying stack parameters and how well sources using actual hourly emission rates compare to those rates pulled from EPA's Clear Air Markets website[12]. In general, Raven Power's modeled hourly emissions matched those extracted from the Clean Air Market's website.

Table 8: Summary of Stack Information for Facilities in the Wagner Area of Analysis

AECOM Source	Model Emission Rate	Hourly Emission Matches CAMD	Variable Stack Temp	Variable Stack Velocity
Crane 1	Actual, Hourly	Nearly Identical	No	No
Crane 2	Actual, Hourly	Nearly Identical	No	No
Brandon Shores 1	Actual, Hourly	Nearly Identical	Yes	Yes
Brandon Shores 2	Actual, Hourly	Nearly Identical	Yes	Yes
Wagner 1	Actual, Hourly	Nearly Identical	No	No
Wagner 2	Adjusted Actual, Hourly	Adjusted to 1.0 lb/MMBtu	Yes	Yes
Wagner 3	Actual, Hourly	Nearly Identical	Yes	Yes
Wagner 4	Actual, Hourly	Nearly Identical	No	No
Wheelabrator Baltimore	Allowable	NA	No	No
Energy Answers	Allowable	NA	No	No

Stack parameters pulled from EPA's 2011 National Emissions Inventory (NEI) are listed for comparison to AECOM's. Additionally, stack parameters for Energy Answers were pulled from its PSD/NSR application. The physical stack parameters (stack heights and stack diameters) from both data sets generally match. There is a slight discrepancy in Wheelabrator Baltimore's stack diameter. An equivalent stack diameter was taken based on the 2011 NEI since Wheelabrator's stack appears to have three flues contained in one stack (each 2.13 m in diameter). AECOM's stack parameters for Energy Answers are identical to those contained in its PSD/NSR application modeling analysis accept for the stack diameter, which was significantly larger in the application. There were also slight differences, i.e., a few meters, in the stack base elevations for Wheelabrator Baltimore and Energy Answers.

AECOM used a merged stack technique when Brandon Shore Units 1 & 2 operated simultaneously. This is in accordance with EPA Clearing House Memorandum 91-II-01 and is an appropriate modeling technique since both units share a common stack (dual-flue stack). Merging the stacks will slightly enhance the stack velocity and final plume rise. Again, this only occurs when both Brandon Shore units are operating.

[12] http://ampd.epa.gov/ampd/

Table 9: AECOM Stack Parameters

Facility	Unit	Stack Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
Fort Smallwood	Brandon Unit 1	121.92	324.817	15.073	9.5
Fort Smallwood	Brandon Unit 2	121.92	324.817	14.895	9.5
Fort Smallwood	Wagner Unit 1	87.478	330	30.48	3.099
Fort Smallwood	Wagner Unit 2	87.48	422.039	30.48	3.1
Fort Smallwood	Wagner Unit 3	105.46	416.48	33.817	4.215
Fort Smallwood	Wagner Unit 4	104.242	610.928	35.3568	5.334
C.P. Crane	Crane Stack 1	107.594	435.93	30.48	3.328
C.P. Crane	Crane Stack 2	107.59	438.71	30.48	3.33
Wheelabrator Baltimore		96.01	485.93	22.55	2.13
Energy Answers		89.92	439.26	25.94	1.2984

Table 10: EPA 2011 (Version 1) NEI Stack Parameters

Facility	Unit	Stack Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
Fort Smallwood	Brandon Unit 1	121.9	325.4	17.0	9.60
Fort Smallwood	Brandon Unit 2	121.9	325.4	17.0	9.60
Fort Smallwood	Wagner Unit 1	87.5	438.7	30.5	3.11
Fort Smallwood	Wagner Unit 2	87.5	438.7	30.3	3.11
Fort Smallwood	Wagner Unit 3	105.5	430.4	32.4	4.11
Fort Smallwood	Wagner Unit 4	104.2	610.9	35.4	5.33
C.P. Crane	Crane Stack 1	107.6	438.7	30.3	3.32
C.P. Crane	Crane Stack 2	107.6	433.2	30.3	3.32
Wheelabrator Baltimore		96.0	485.9	22.6	3.70

Table 11: Energy Answers Application (100% Load Run)

Facility	Unit	Stack Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
Energy Answers		89.92	439.26	25.94	4.26

Modeling Parameter: Emissions

EPA's Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent three years of actual emissions data and concurrent meteorological data. However, the Modeling TAD does provide for the flexibility of using allowable emissions in the form of the most recently permitted, (referred to as PTE or allowable) emissions rate.

EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information when it is available, and that these data are available for many electric generating units. In the absence of CEMS data, EPA's draft Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, EPA believes that detailed throughput, operating schedules, and emissions information from the impacted source(s) should be used.

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. Specifically, a facility may have recently adopted a new federally enforceable emissions limit, been subject to a federally enforceable consent decree, or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD. In these cases, the Modeling TAD notes that the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations should contain the necessary emissions information for designations-related modeling. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, AECOM included ten (10) sources in its SO_2 modeling analysis. AECOM selected and refined these sources based on earlier modeling conducted by MDE. These sources should adequately represent the area where maximum concentrations of SO_2 are expected to occur and adequately includes the sources which might contribute to those concentrations. There are no other larges sources of SO_2 that have the potential to cause significant concentration gradients within the area of analysis. For this area of analysis, AECOM used a hybrid approach, where emissions from most of the sources are expressed as actual emissions, two (2) sources used non-federally enforceable emission rates and one (1) source adjusted its historic actual emission rates to account for a fuel switch that has recently reduced the unit's actual SO_2 emissions. Tables 12-14 summarize the total emissions included in the modeling analysis. Source totals represent a mix of actual, non-federally enforceable and adjusted emission rates.

Table 12: Actual Emissions

Company ID	Facility Name	Unit	SO_2 Emissions (tons per year)		
			2012	2013	2014
Raven Power	Brandon Shores	1	1,546.9	1,389.0	1,669.9
Raven Power	Brandon Shores	2	1,301.3	1,481.3	1,475.2
Raven Power	Wagner	1	0.2	0.2	72.6
Raven Power	Wagner	2	2,512.8	1,551.3	1,939.0
Raven Power	Wagner	3	4,960.2	8,553.5	7,276.1
Raven Power	Wagner	4	41.2	72.7	322.5
Raven Power	Crane	1	1,212.0	831.3	573.4
Raven Power	Crane	2	961.2	2,140.3	1,313.8
	Total Emissions	All Facilities	12,535.8	16,019.6	14,642.5

Table 13: Adjusted Emissions Rate Sources

Company ID	Adjusted emissions rates (tons per year)	2011 NEI v1 (tons per year)
Wheelabrator Baltimore	439.2	261.3
Energy Answers	479.6	

Table 14: Adjusted Wagner Unit 2 Emissions

Unit	Emission Rate	SO_2 Emissions (tons per year)		
		2012	2013	2014
Wagner Unit 2	Actual	2,512.8	1,551.3	1,939.0
Wagner Unit 2	Adjusted (1.0 lbs/MMBtu)	2,219.5	1,139.2	1,421.7

Modeling Parameter: Meteorology and Surface Characteristics

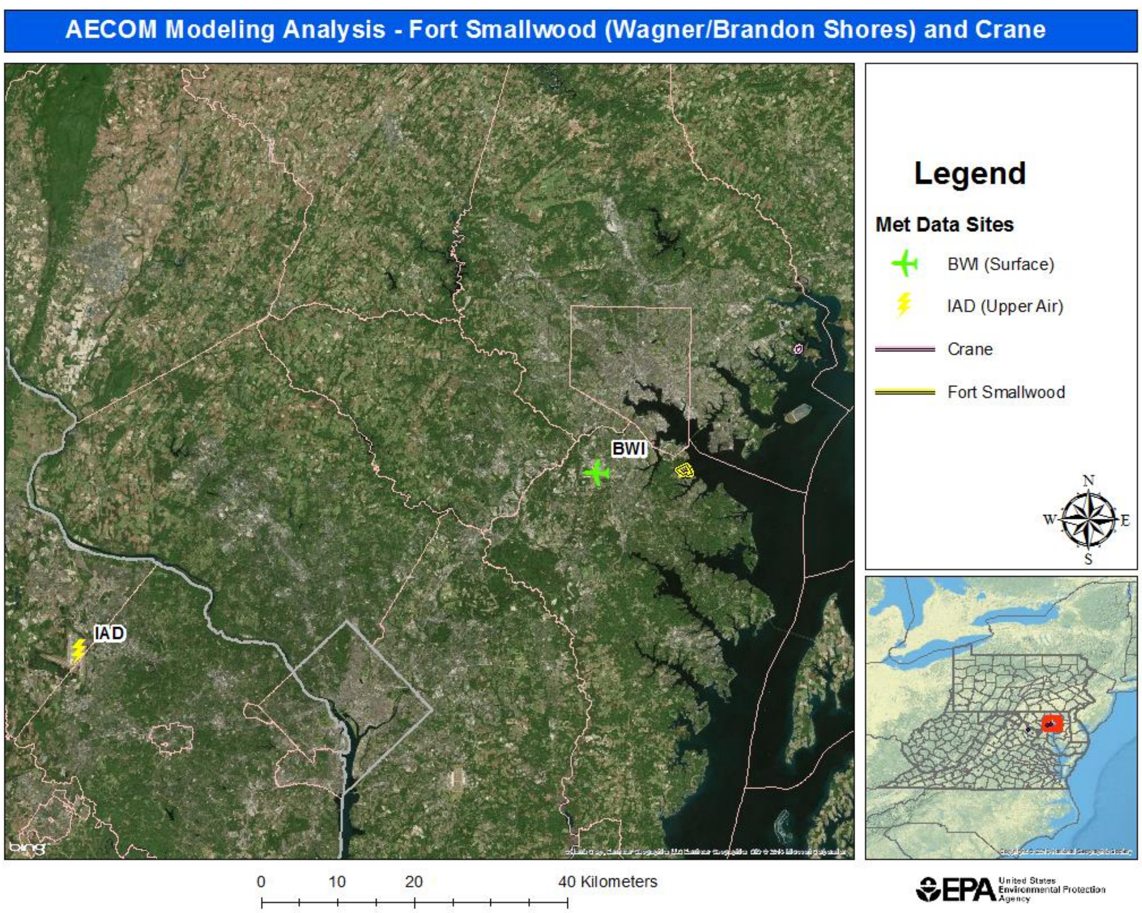
The most recent three (3) years of meteorological data (concurrent with the most recent three years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

For the Wagner area of analysis, AECOM used surface meteorology from Baltimore-Washington International Airport (BWI). Meteorological data was concurrent with the hourly emission date used in the modeling analysis (2012-14). AECOM's AERMOD file specified BWI's station elevation as 4.4 meters; the station's actual elevation is 45 meters. AECOM did not provide any documentation to determine if the meteorological data is representative of the Wagner area. BWI is the closest ASOS first order station and is located a little over 10 kilometers west of Fort Smallwood (*see* Figure 9). Upper Air data used in AERMET was taken from Sterling, VA, which is part of Dulles Airport (IAD) and is located approximately 82 kilometers west-southwest of Fort Smallwood. AECOM processed the data using AERMET's Adjust U* non-default option. This process adjusts the surface friction velocity for periods of low wind speeds.

EPA notes that the use of beta options, such as ADJ_U* and LOWWIND3, in AERMOD for any regulatory applications requires adherence with Appendix W, Section 3.2.2. This is further explained in EPA's December 10, 2015 Memorandum titled, "Clarification on the Approval Process for Regulatory Application of the AERMOD Modeling System Beta Options." Among other conditions, the use of beta options requires consultation with the appropriate EPA Regional Offices. Upon concurrence by EPA's Modeling Clearinghouse, EPA Regional Offices may approve the use of these beta options for regulatory applications as an alternative model. However, Maryland's air dispersion modeling, performed by AECOM, intended to characterize air quality as a result of SO_2 emissions from Wagner without prior consultation with and approval from EPA's Region 3's Office, and therefore has not met the applicable regulatory requirements contained in Appendix W, Section 3.2.2. As a result, EPA does not believe that the air quality modeling results obtained from the use of these beta options can be used as a reliable indicator of attainment status in the area around Wagner until appropriate alternative model approval is granted or these beta options are promulgated as regulatory options in AERMOD through EPA rulemaking.

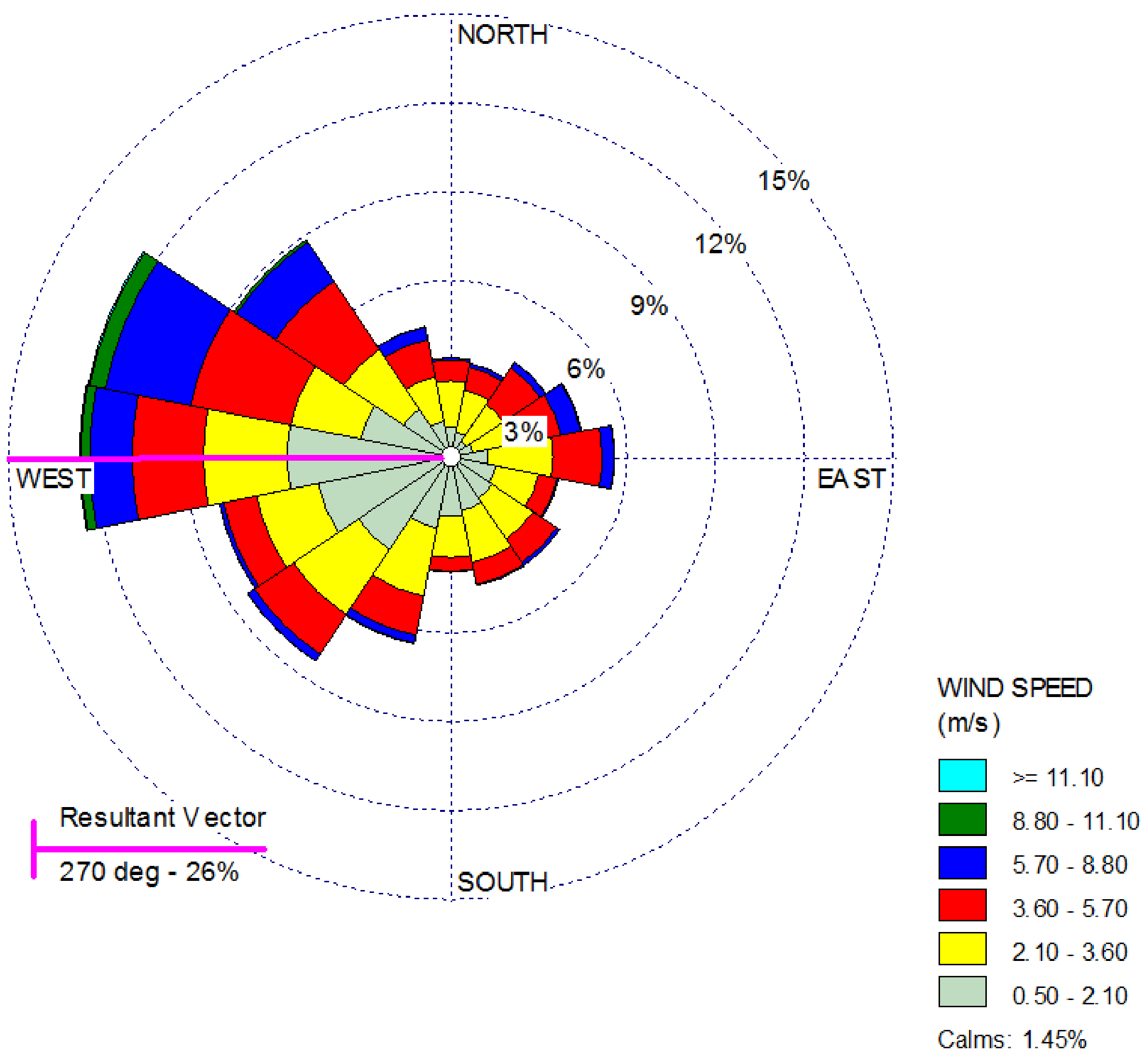
AECOM used AERSURFACE using the location of BWI to estimate the surface characteristics of the Wagner area of analysis. Estimated values for surface roughness used twelve (12) spatial sectors out to 1 km at a monthly temporal resolution for dry, wet, average conditions based on BWI's 30-year precipitation averages. AECOM also estimated values for albedo (the fraction of solar energy reflected from the earth back into space) and the Bowen ratio (the method generally used to calculate heat lost or heat gained in a substance. No months contained continuous snow cover though there may have been continuous snow cover at BWI in January and February of 2014.

Figure 9: Met Data Sites used in the Wagner Area of Analysis



The three-year (2012-14) surface wind rose for Baltimore-Washington Airport (BWI) based on the processed surface file is depicted in Figure 10. In this figure, the frequency and magnitude of wind speed and direction are defined in terms of where the wind is blowing from. The resultant vector shows the dominant direction or mean direction of the wind vectors. Winds were predominantly out of the west to northwest.

Figure 10: Surface Met File Cumulative Wind Rose for Years 2012-14



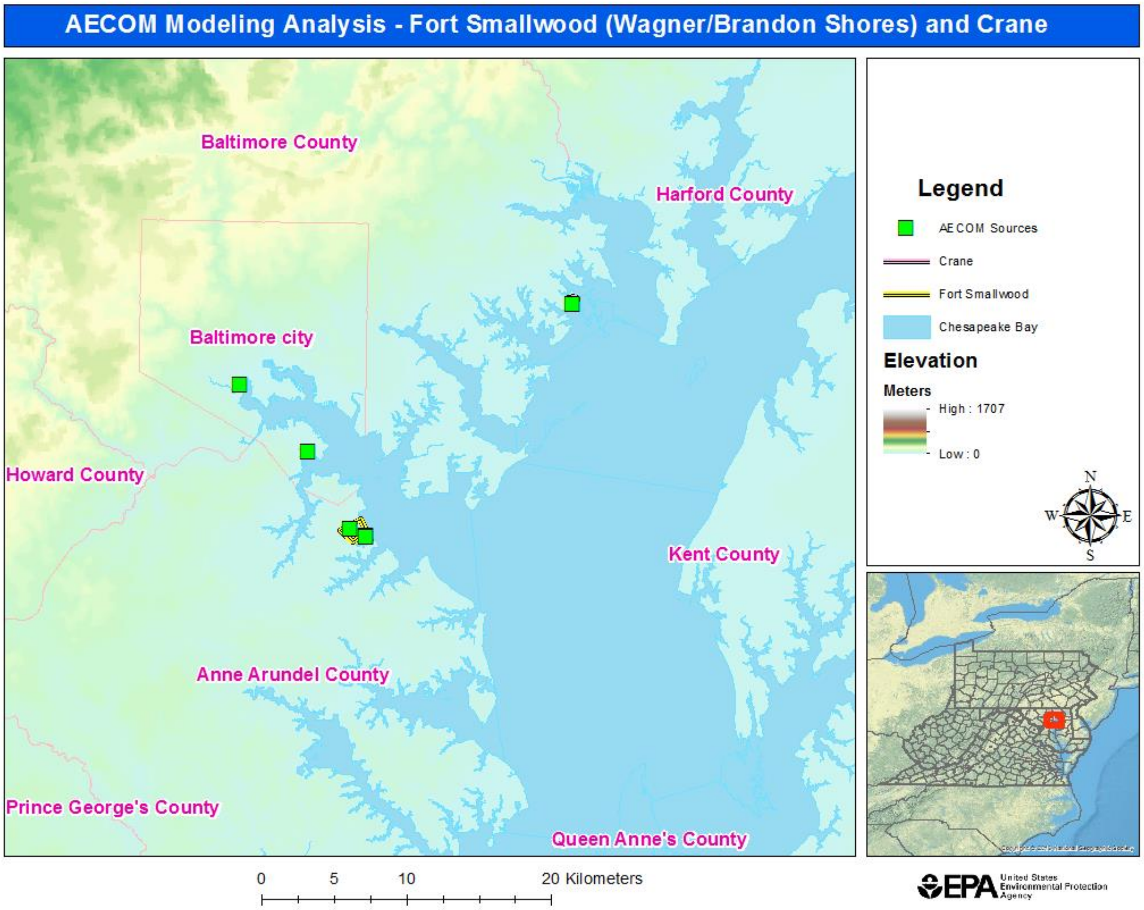
Meteorological data from the surface (BWI) and upper air stations (IAD) were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. AECOM appears to have generally followed the methodology and settings presented in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. There were differences in the AERMOD ready surface and profile files included in AECOM's documentation; the files included in the AERMOD directory do not match those included in the AERMET_V15181 directory. Notably, the reference measurement heights in the AERMET_V15181 do not match anemometer heights at BWI.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of one minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the one minute wind data.

Modeling Parameter: Geography and Terrain

Fort Smallwood, Crane, Wheelabrator Baltimore and the proposed Energy Answers facilities are all located along the western shoreline of the Chesapeake Bay. This area is generally characterized as part of the Atlantic Coastal Plain physiographic region. Terrain is generally flat in the vicinity of the modeled sources but rises steeply approximately 17 kilometers to the northwest of the Fort Smallwood Complex as the Atlantic Coastal Plain gives way to the Piedmont (*see* Figure 11).

Figure 11: Elevations in the AECOM modeling domain



Elevation information for stack-base elevations and model receptors was obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files using EPA's AERMAP processor.

Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "first tier" approach, based on monitored design values, or 2) a temporally varying approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For the Wagner area of analysis, AECOM chose to use an hour of day seasonal varying background concentrations. The background concentration for this area of analysis was determined by AECOM based on hourly monitored concentrations from the Beltsville, MD monitoring site. AECOM substituted a constant background concentration of 3.9 µg/m^3 whenever wind directions ranged from 70 to 130 degrees (easterly). This was done to account for a lack of SO_2 sources directly to the east of the Wagner area of analysis; 3.9 μg/m^3 was chosen to represent a true pristine background concentration.

Summary of Modeling Results

The AERMOD modeling parameters for the Wagner area of analysis are summarized below in Table 15. Note that AECOM used several non-default options in their AERMOD analysis. This included using Adjust U* in its AERMET processing and using the non-default Low Wind 3 option in AERMOD. These options were used in tandem and are not currently considered part of the regulatory default options in AERMOD. Moreover, Maryland did not seek and has not obtained EPA Regional approval for their use in this case. As a result, EPA does not believe that the air quality modeling results obtained from the use of these beta options can be used as a reliable indicator of attainment status in the area around Wagner until appropriate alternative model approval is granted or these beta options are promulgated as regulatory options in AERMOD through EPA rulemaking.

Table 15: AERMOD Modeling Parameters for the Wagner Area of Analysis

Wagner Area of Analysis	
AERMOD Version	15181
Dispersion Characteristics	Rural
Modeled Sources	4
Modeled Stacks	10
Modeled Structures	Multiple, Raven Power Sources Only
Modeled Fencelines	2
Total receptors	6,181
Emissions Type	Actual, PTE, Adjusted Actual
Emissions Years	Hourly 2012-2014, Current PTE, Retro Adjusted Hourly
Meteorology Years	2012-2014
Surface Meteorology Station	Baltimore-Washington International Airport, MD
Upper Air Meteorology Station	Dulles Airport, Sterling, VA
Methodology for Calculating Background SO_2 Concentration	Hour to Hour, Seasonally Varying, Easterly Winds changed to "background"
Non-Default AERMOD Options	Adjust U*, Low Wind 3
Calculated Background SO_2 Concentration	10.3 μg/m^3

The results presented below in Table 16 show the magnitude and geographic location of the highest predicted modeled concentration based on emissions compiled by AECOM.

Table 16: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration in the Wagner Area of Analysis Based on AECOM's Emission Profile

Averaging Period	Data Period	Receptor Location		SO_2 Concentration (μg/m³)	
		UTM/Latitude	UTM/Longitude	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2012-2014	369375	4336940	186.0	196.2*

*Equivalent to the 2010 SO_2 NAAQS set at 75 ppb

AECOM's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 186.0 μg/m³, or ~71 ppb. This modeled concentration included the background concentration of SO_2, and is based on AECOM's source emission profile. This predicted value occurred approximately 1.1 kilometers east-southeast of the Fort Smallwood Complex and is graphically represented along with all the other receptors below in Figures 12-13.

Figure 12: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations in the Wagner Area of Analysis Based on AECOM Emission Profile (Close-Up)

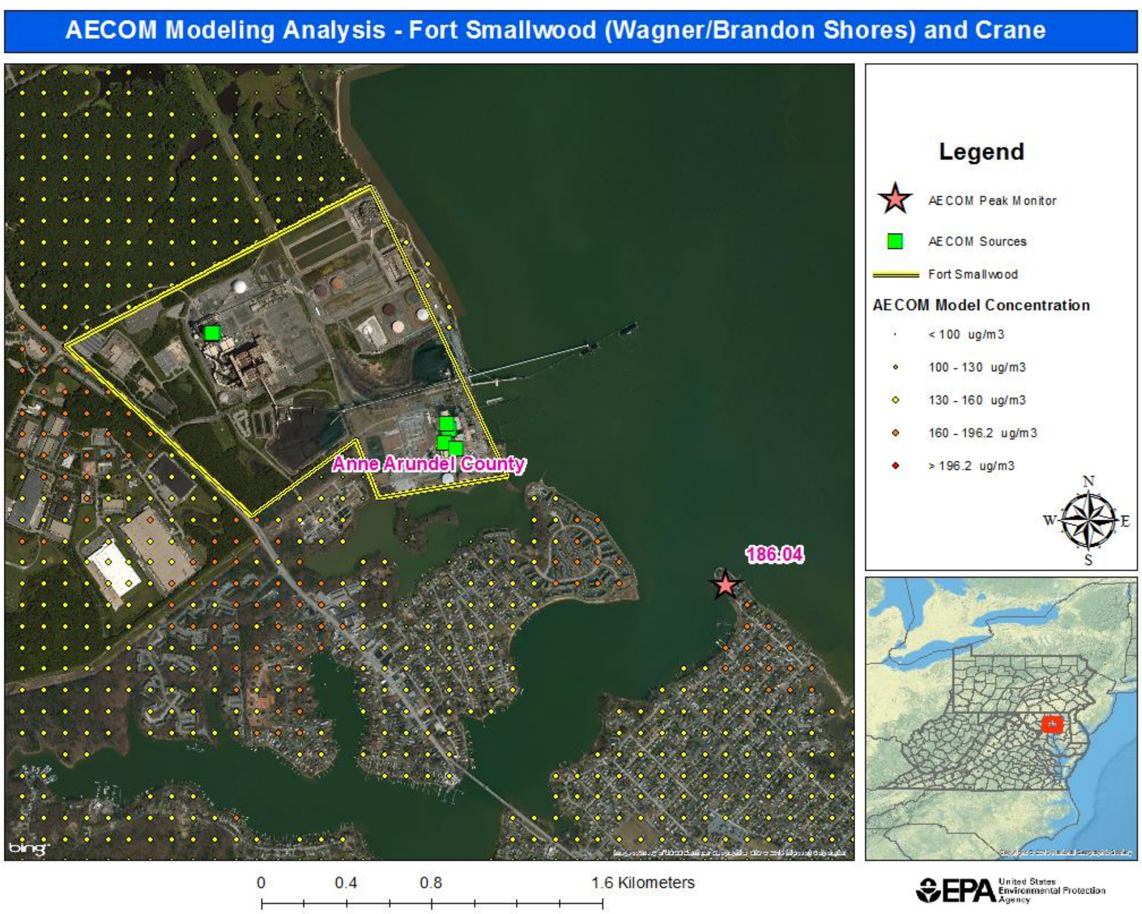
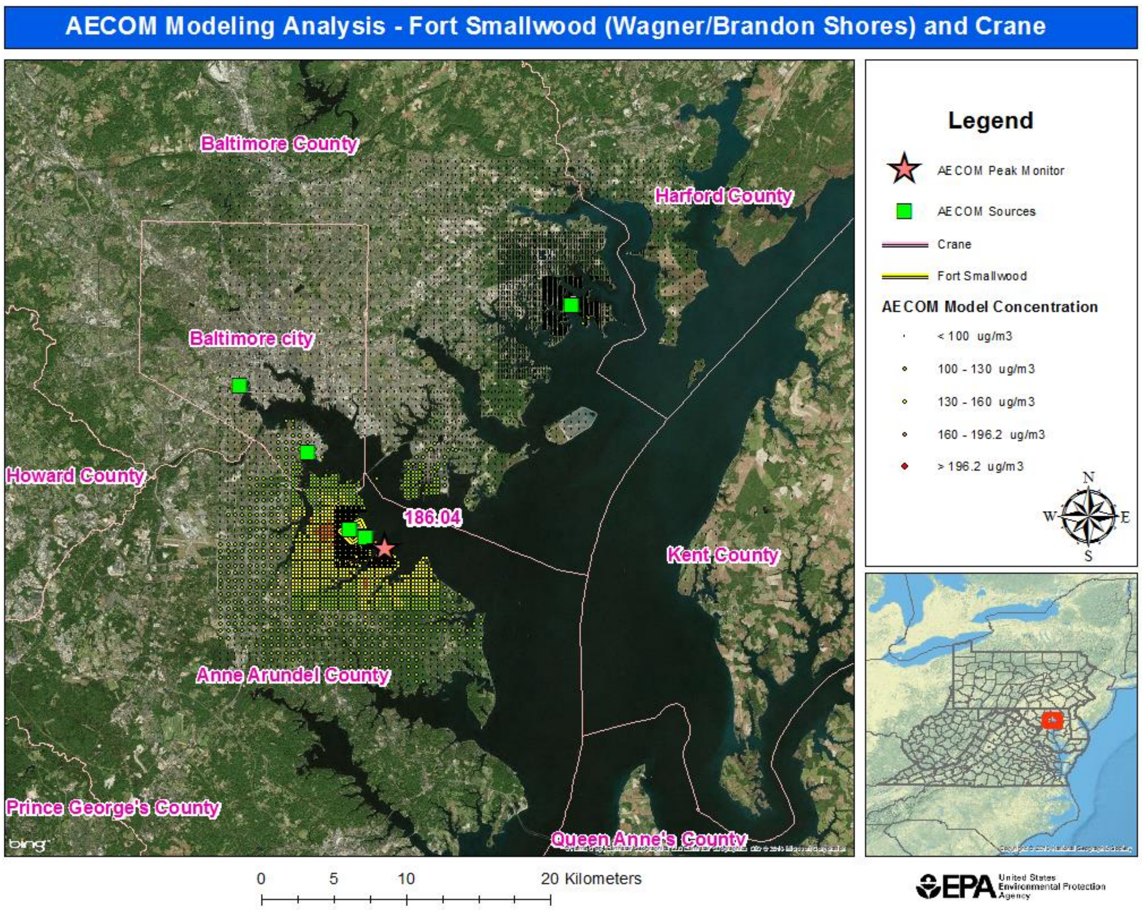


Figure 13: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations in the Wagner Area of Analysis Based on AECOM Emission Profile (Regional)



<u>Detailed Assessment of May 2015 Sierra Club Modeling for Wagner/Brandon Shores/Crane</u>

On January 4, 2016, Sierra Club submitted to EPA an air dispersion modeling analysis of SO_2 from Wagner, Brandon Shores, and Crane. The discussion and analysis that follows below will reference Sierra Club's use of the Modeling TAD, EPA's assessment of Sierra Club's modeling in accordance with the Modeling TAD, and the factors for evaluation contained in EPA's March 20, 2015 guidance, as appropriate

Model Selection and Modeling Components

EPA's draft Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD

- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

Modeling components used by Sierra Club are summarized in Table 17. This modeling analysis was completed in May of 2015 so some of the AERMOD components were run using older versions that were the latest available at the time. However, EPA does not believe that the use of the most recent versions of AERMOD and its components would alter the modeled results in a manner that would change our intended designation. Sierra Club used AERMOD version 14134, and a discussion of the individual components will be referenced in the corresponding discussion that follows as appropriate. While the version of AERMOD used in Sierra Club's modeling is not the latest version of the model available, EPA does not believe that updating the model version and rerunning with the same model inputs and options would result in significantly different modeled impacts or change our intended designation for the area of analysis. EPA conducts tests cases for newly released versions of AERMOD to document the differences in several "standard" test case scenarios to compare results with previous releases of the model.[13] Review of version 15181 test case results and comparison with version 14134 shows that the updated model version impacts modeled results for only a small subset of the test scenarios (capped and horizontal stacks and multiple urban areas), which are not applicable to Wagner. Therefore, we do not anticipate that rerunning the model with the later model version would significantly impact the modeled concentrations.

No buildings were included in this modeling analysis thus building downwash, which would tend to increase impacts, was not evaluated. AERMOD was run in regulatory default mode.

Table 17: Model Versions Summary

AERMOD Component	Sierra Club Version	Current Version
AERMOD	14134	15181
AERSURFACE	13016	13016
AERMAP	11103	11103
AERMET	14134	15181
AERMINUTE	14237	15272

Modeling Parameter: Rural or Urban Dispersion

EPA's recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment within 3 km of the facility. According to EPA's modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50% of the area within a 3 km radius of the facility is classified as rural. Conversely, if more than 50% of the area is urban, urban dispersion coefficients should be used in the

[13] AERMOD test case information available at the following website: http://www3.epa.gov/ttn/scram/dispersion_prefrec.htm.

modeling analysis. The Sierra Club modeling analysis used rural dispersion coefficients in AERMOD. This was determined by examining the percentage of land use categories within three (3) kilometers of the modeled sources. Land use land cover (LULC) information from 1992 was processed using AERSURFACE. Rural categorization was supported based on there being less than 50% of the LULC categories with urban uses surrounding the modeled sources.

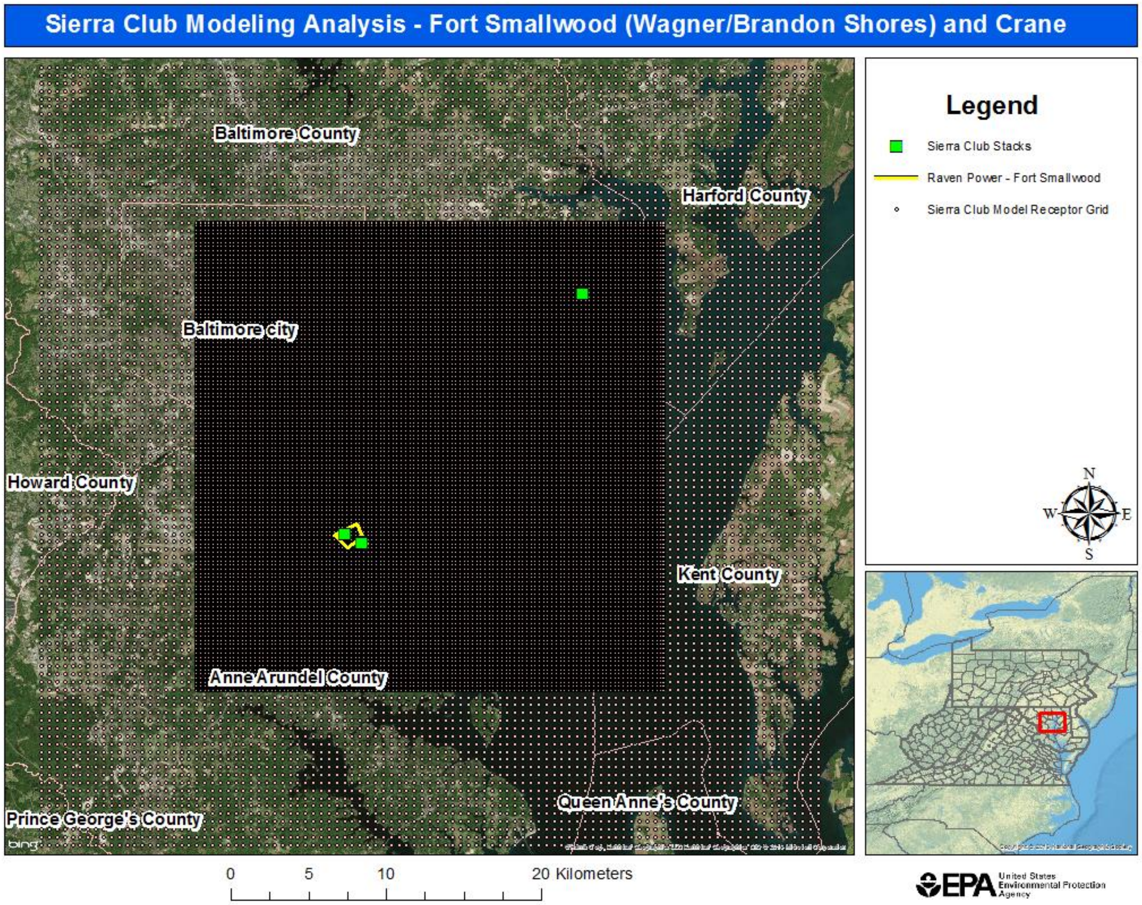
Modeling Parameter: Area of Analysis (Receptor Grid)

EPA believes that a reasonable first step towards characterization of air quality in the Wagner area is to determine the extent of the area of analysis, i.e., receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

Sierra Club used an extensive model receptor grid that included a total of 97,081 individual receptor grids. A 100-m spaced Cartesian grid was centered around the Fort Smallwood (Wagner and Brandon Shores generating units) and the Crane facilities. These facilities are roughly 20 kilometers distant from each other. The model receptor grid spacing was increased to 500 m and extended an additional 10 kilometers from the 100-m grid. Model receptors extended over the open waters of the Chesapeake Bay and adjacent rivers and also extended over the property boundaries of Fort Smallwood and Crane (these areas would not qualify as ambient air). Sierra Club also used flagpole receptors extending 1.5 m above the surface. EPA generally recommends receptors be located at ground level though this difference in receptor heights should have little impact on final model concentrations.

Figure 14 shows the Sierra Club's model receptor grid and the locations of the model sources. The approximate property/ambient air boundary of the Fort Smallwood complex, which includes the Wagner and Brandon Shores generating units, is also shown. Crane is located approximately 20 kilometers northeast of Fort Smallwood.

Figure 14: Sierra Club Model Receptor Grid



Modeling Parameter: Source Characterization

Sierra Club only modeled the coal units for Wagner, Brandon Shores and Crane. A total of six (6) sources were modeled. In addition to the two (2) coal units, Wagner also has two (2) oil fired units, which were not included in the modeling analysis. Table 18 lists the largest SO_2 sources from these facilities in EPA's Clean Air Markets Program[14] database.

Table 18: Source Listing for Wagner, Brandon Shores (collectively known as Fort Smallwood) and Crane

Facility	Unit	Fuel	SO_2 Control	Modeled
H.A. Wagner	Unit #1	Oil	-	No
H.A. Wagner	Unit #2	Coal	-	Yes
H.A. Wagner	Unit #3	Coal	-	Yes
H.A. Wagner	Unit #4	Oil	-	No

[14] http://ampd.epa.gov/ampd/

Brandon Shores	Unit #1	Coal	FGD	Yes
Brandon Shores	Unit #2	Coal	FGD	Yes
C. P. Crane	Unit #1	Coal	-	Yes
C. P. Crane	Unit #2	Coal	-	Yes

Modeling Parameter: Emissions

EPA's Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent three years of actual emissions data and concurrent meteorological data. However, the TAD does provide for the flexibility of using allowable emissions in the form of the most recently permitted, (referred to as PTE or allowable) emissions rate.

EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information when it is available, and that these data are available for many electric generating units. In the absence of CEMS data, EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, EPA believes that detailed throughput, operating schedules, and emissions information from the impacted source(s) should be used.

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. Specifically, a facility may have recently adopted a new federally enforceable emissions limit, been subject to a federally enforceable consent decree, or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD. In these cases, the Modeling TAD notes that the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations should contain the necessary emissions information for designations-related modeling. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

The Sierra Club modeling analysis included three (3) emissions scenarios, 1) permitted/maximum allowable emissions, 2) 99^{th} percentile actual hourly emissions, and 3) actual hourly emissions. Only the simulation that used actual emissions from the coal-fired units at Fort Smallwood (Wagner and Brandon Shores) and Crane are included in our review since these runs were done in accordance with EPA's Modeling TAD.

As noted previously, the modeling analysis did not include SO_2 emissions from two (2) oil-fired units that are part of Wagner. The coal-fired units included in the modeling analysis are the largest SO_2 emissions sources in the Baltimore, Maryland area. Other sources in the area are generally below 250 tpy with most well under 100 tpy. The facilities in the area of analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized in Table 19.

Table 19: 2012-14 Actual SO_2 Emissions Sources in the Sierra Club's Modeling Analysis

Facility Name	Unit Designation	SO_2 Emissions (tpy)		
		2012	2013	2014
H.A. Wagner	Unit #2	2,512.8	1,551.3	1,939.0
H.A. Wagner	Unit #3	4,960.2	8,553.5	7,276.1
Brandon Shores	Unit #1	1,546.9	1,389.0	1,669.9
Brandon Shores	Unit #2	1,301.3	1,481.3	1,475.2
C. P. Crane	Unit #1	1,212.0	831.3	573.4
C. P. Crane	Unit #2	961.2	2,140.3	1,313.8
	Total Emissions	15,194.4	15,946.7	14,247.2

For each of the six (6) coal units included in the modeling analysis, Sierra Club used actual hourly emissions from 2012-14. Sierra Club's hourly emission file was compared to hourly emissions from the Clean Air Markets website and found to be nearly identical. Physical stack parameters including stack heights and stack diameters were checked with information contained in the 2011 (Version 1) NEI. Modeled stack heights and diameters nearly matched those contained in the 2011 NEI. Stack temperatures and velocities for the modeled sources were taken from recent stack tests according Sierra Club's documentation. These values were kept constant throughout Sierra Club's modeling analysis. In reality, both stack temperatures and velocities will vary according to a unit's load. This information, however, is not readily available from EPA's Clean Air Market's website. The stack temperature and velocity information in the modeling analysis appears to be reasonable and is similar to values contained in the 2011 NEI. Sierra Club's modeled stack parameters and those taken from the 2011 NEI are summarized in Tables 20 and 21.

Table 20: Sierra Club Modeling Stack Parameters

Facility	Unit	Stack Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
Fort Smallwood	Brandon Unit 1	121.9	326.5	13.0	9.51
Fort Smallwood	Brandon Unit 2	121.9	326.5	12.0	9.51
Fort Smallwood	Wagner Unit 2	87.5	409.8	22.7	3.11
Fort Smallwood	Wagner Unit 3	105.5	418.7	28.7	4.21
C.P. Crane	Crane Stack 1	107.6	427.6	29.9	3.32
C.P. Crane	Crane Stack 2	107.6	427.6	29.1	3.32

Table 21: EPA 2011 (Version 1) NEI Stack Parameters

Facility	Unit	Stack Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
Fort Smallwood	Brandon Unit 1	121.9	325.4	17.0	9.60
Fort Smallwood	Brandon Unit 2	121.9	325.4	17.0	9.60
Fort Smallwood	Wagner Unit 2	87.5	438.7	30.3	3.11
Fort Smallwood	Wagner Unit 3	105.5	430.4	32.4	4.11
C.P. Crane	Crane Stack 1	107.6	438.7	30.3	3.32
C.P. Crane	Crane Stack 2	107.6	433.2	30.3	3.32

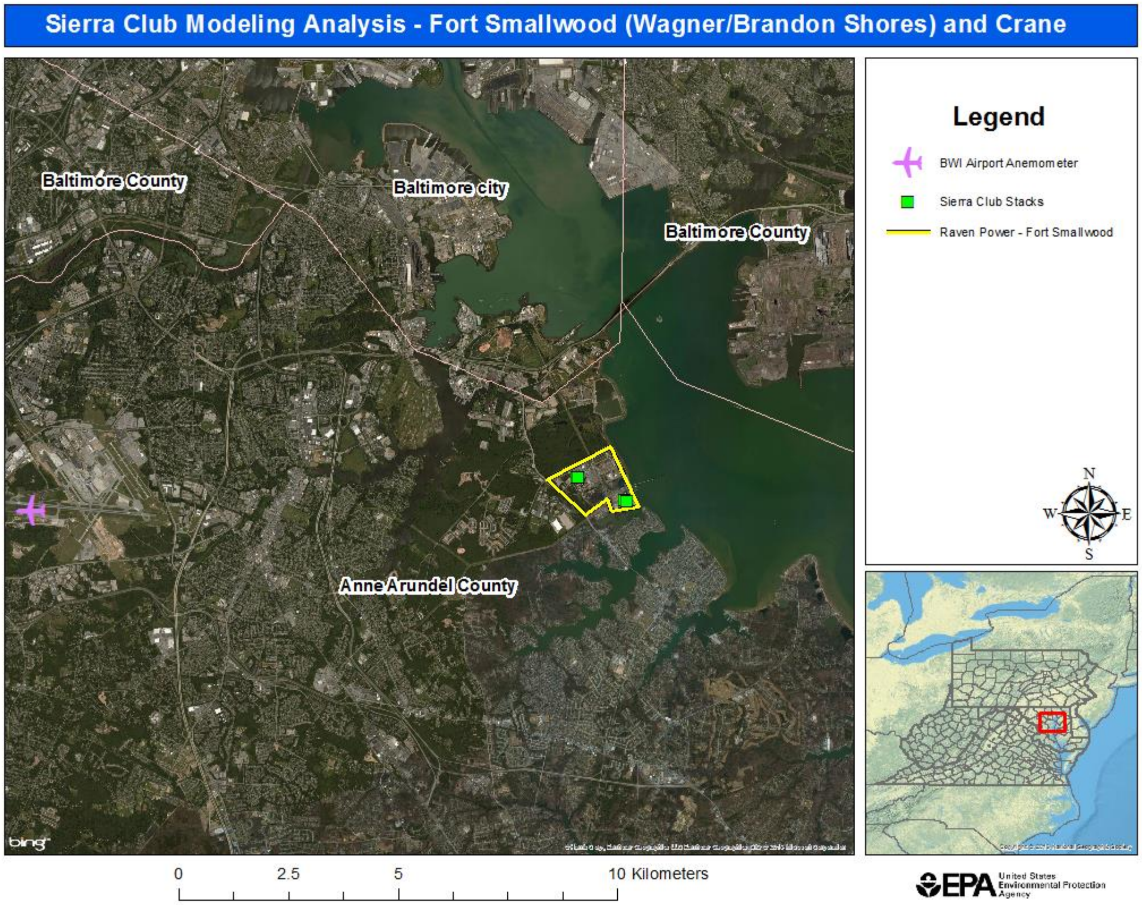
Modeling Parameter: Meteorology and Surface Characteristics

The most recent three years of meteorological data (concurrent with the most recent three years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

Sierra Club used hourly meteorological data from the Baltimore-Washington International Airport (BWI). Meteorological data was concurrent with the hourly emission date used in the modeling analysis (2012-14). Hourly wind measurements were supplemented with 1-minute data using EPA's AERMINUTE processor. Sierra Club did not provide any documentation to determine if the meteorological data is representative of the area surrounding Wagner. BWI is the closest ASOS first order station and is located a little over 10 kilometers west of Fort Smallwood (*see* Figure 15).

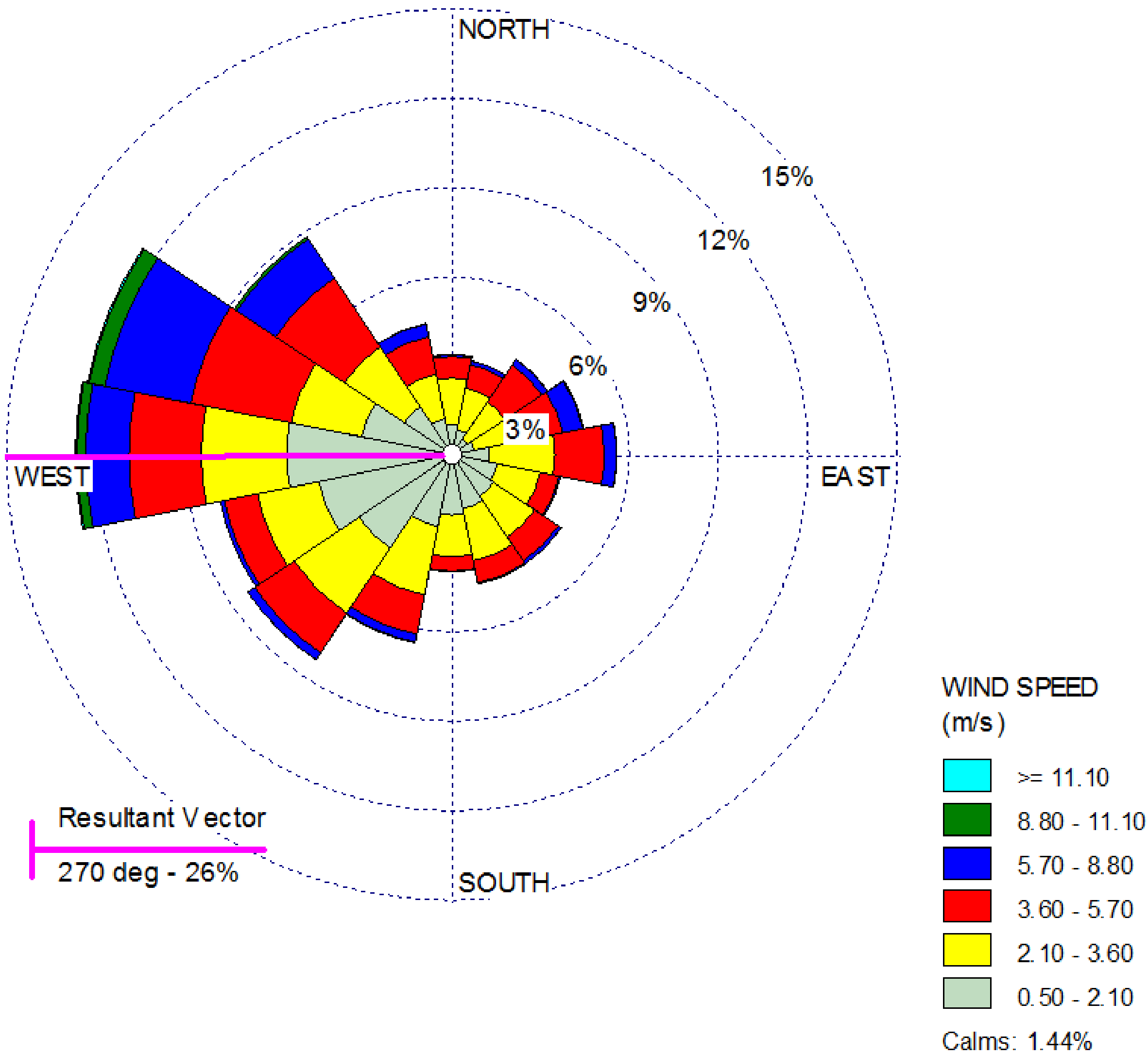
In addition to meteorological variables, AERMET needs surface characteristics to process the meteorological information into the format needed to run in AERMOD. Sierra Club used AERSURFACE to generate surface characteristics based on the location of the BWI anemometer site. The modeled anemometer height (10 meters) was confirmed with available information. Surface characteristics were based on twelve 30º sectors in AERSURFACE and developed on a seasonal basis. Continuous snow cover during the winter season and average moisture conditions were assumed for the entire simulation period. A quick check of snow cover information and monthly precipitation values at BWI showed snow cover was only continuous over the 2014-15 winter season and seasonal soil moisture conditions varied from average to wet to dry in accordance with Section 2.2 of the AERSURFACE user's guide.

Figure 15: Locations of BWI anemometer and Fort Smallwood



The three-year surface wind rose for the Baltimore-Washington Airport is depicted in Figure 16. Winds, based on the AERMET processed data, are predominantly from the west. The resultant vector shows the dominant direction or mean direction of the wind vectors.

Figure 16: Baltimore-Washington Airport Wind Rose for Years 2012 – 2014

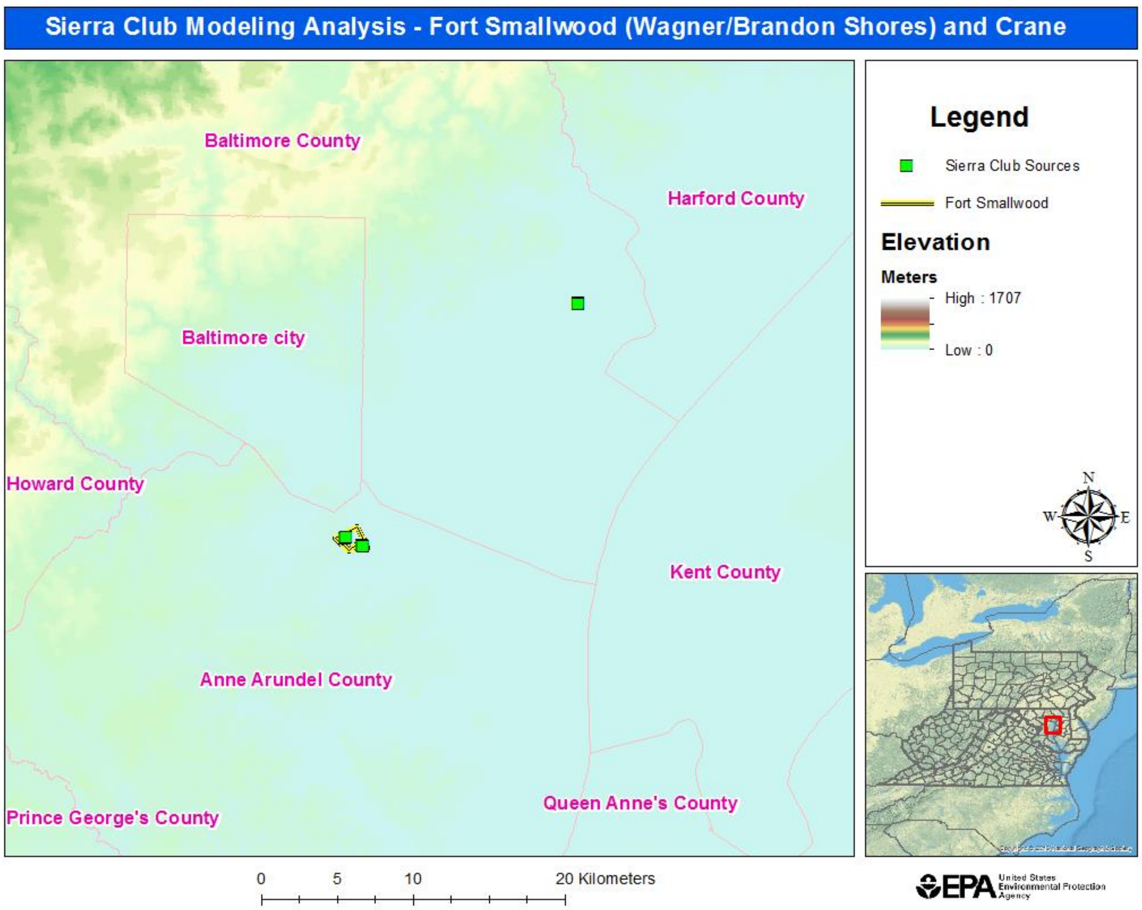


Meteorological data from the Baltimore-Washington Airport, MD and Sterling, VA were used in generating AERMOD-ready files with the AERMET processor. Output processing files provided by Sierra Club indicate the meteorological data is more than 90% complete using 1-minute data to supplement the hourly surface wind measurements. Minimum wind speed thresholds were set to 0.5 m/s as recommended. This approach is consistent with a March 2013 EPA memo titled, "Use of ASOS meteorological data in AERMOD dispersion Modeling."

Modeling Parameter: Geography and Terrain

Fort Smallwood and Crane are both located along the western shoreline of the Chesapeake Bay. This area is generally characterized as part of the Atlantic Coastal Plain physiographic region. Terrain is generally flat in the vicinity of the modeled sources but rises steeply approximately 17 kilometers to the northwest as the Atlantic Coastal Plain gives way to the Piedmont (*see* Figure 17).

Figure 17: Elevations in the Sierra Club modeling domain



Elevation information for stack-base elevations and model receptors was obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files using EPA's AERMAP processor.

Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing SO_2 background concentrations that are ultimately added to the modeled design values: 1) a "first tier" approach, based on monitored design values, or 2) a temporally varying approach, based on the 99th percentile monitored concentrations by hour of day and season or month. Sierra Club chose the first option and used the Prince George County's Beltsville monitor's 2011-13 design value, which had the lowest design value of the three (3) monitors in Maryland. Beltsville is located northeast of Washington DC and is over 30 km southwest of Fort Smallwood. The background concentration for the modeling analysis was 26.2 micrograms per cubic meter (μg/m^3), or 10 ppb.[15] This background value was added to the final AERMOD results.

Summary of Modeling Results

Sierra Club's AERMOD modeling summary for the area surrounding Wagner is summarized below in Table 22.

Table 22: AERMOD Modeling Parameters for the Wagner Area Modeling Analysis

Sierra Club's Wagner Area of Analysis	
AERMOD Version	14134
Dispersion Characteristics	Rural
Modeled Sources	2
Modeled Stacks	6
Modeled Structures	None
Modeled Fencelines	None
Total receptors	97,081
Emissions Type	Actual Hourly Varying
Emissions Years	2012-2014
Meteorology Years	2012-2014
Surface Meteorology Station	Baltimore-Washington Airport, MD
Upper Air Meteorology Station	Sterling, VA
Methodology for Calculating Background SO_2 Concentration	2011-13 Design Value
Calculated Background SO_2 Concentration	26.2 μg/m^3

The results presented below in Table 23 and Figure 18 show the magnitude and geographic location of the highest predicted modeled concentration based on actual (hourly) emissions.

Table 23: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration in the Wagner Area of Analysis Based on Actual (Hourly) Emissions

Averaging Period	Data Period	Receptor Location		SO_2 Concentration (μg/m^3)	
		UTM/Latitude	UTM/Longitude	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2012-2014	368,753.75	4,337,092.5	293.9	196.2 [16]

[15] The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1ppb = approximately 2.62μg/m^3.
[16] Equivalent to the 2010 SO_2 NAAQS set at 75 ppb.

Sierra Club's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 293.9 μg/m³, or approximately 112.3 ppb. This modeled concentration included a background concentration of SO_2, and is based on actual (hourly) emissions from six (6) modeled stacks at Fort Smallwood (Wagner and Brandon Shores) and Crane. The peak model concentration occurred approximately 500 meters east-southeast of Fort Smallwood.

Figure 18: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations in the Wagner Area of Analysis Based on Actual (Hourly) Emissions

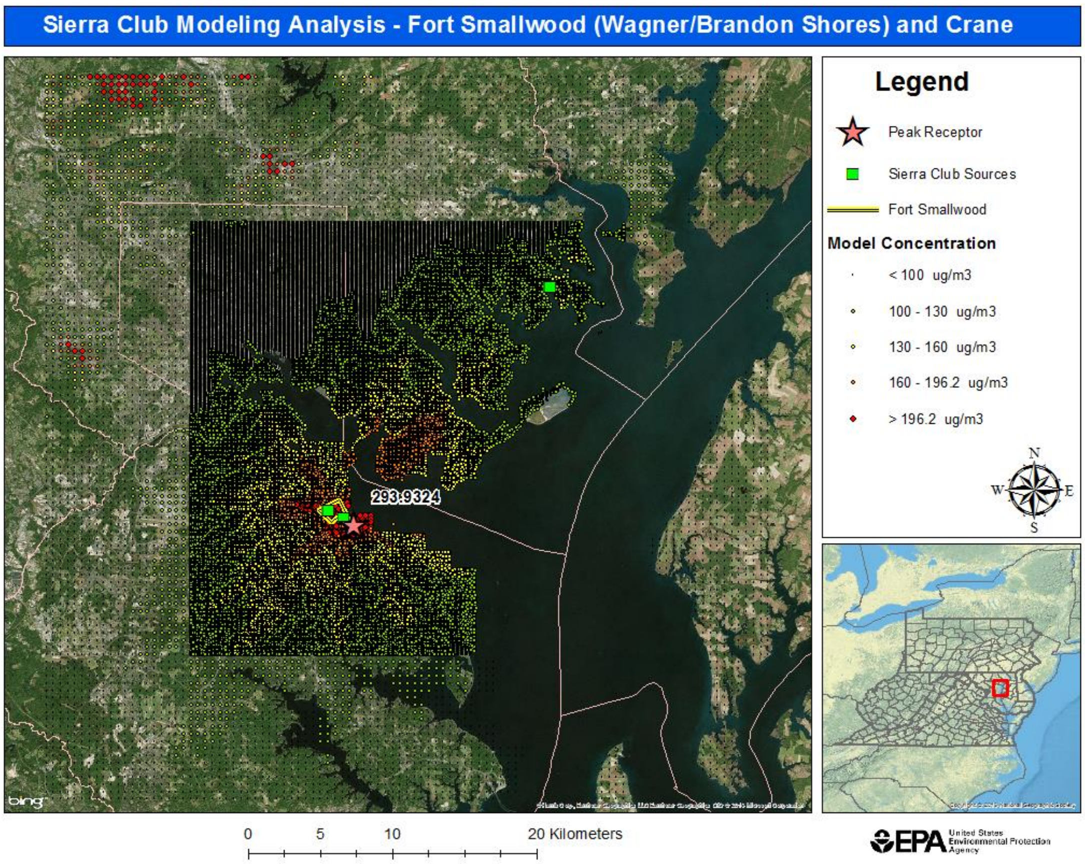
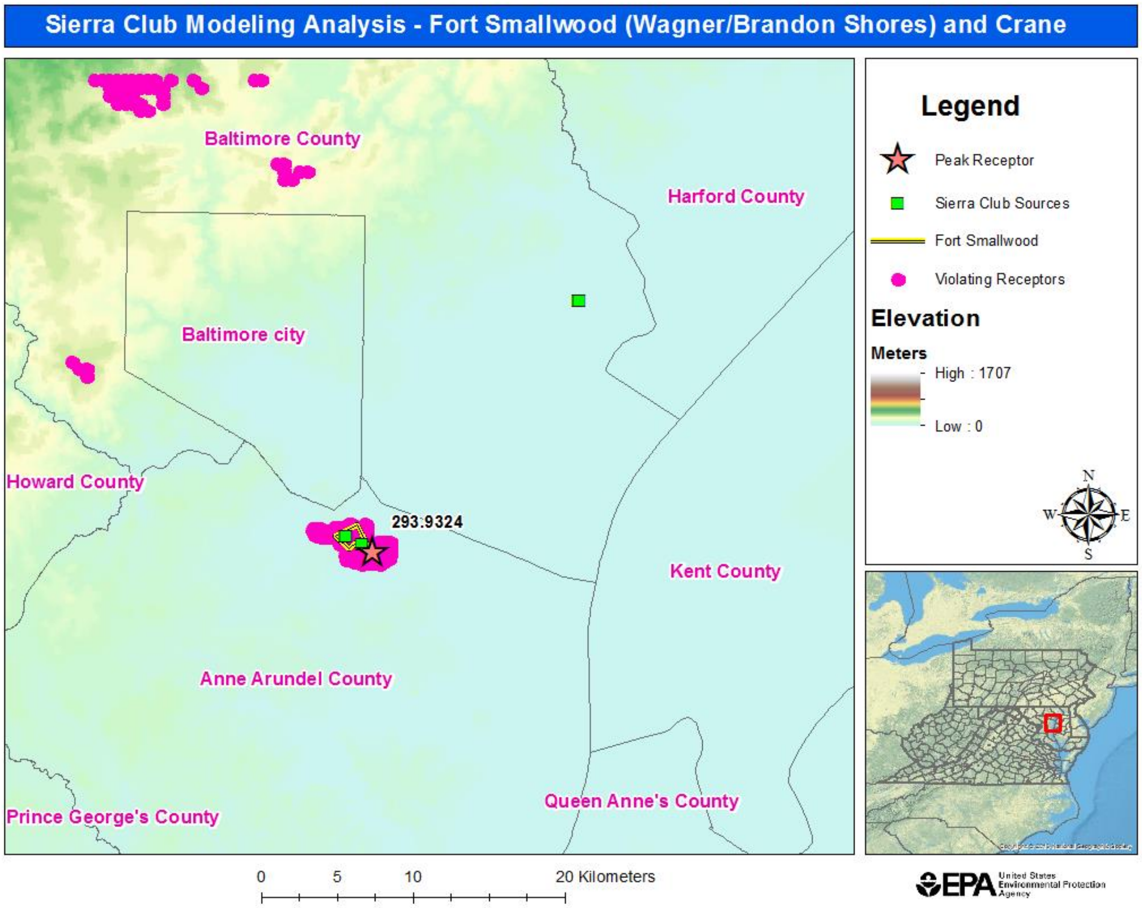


Figure 19 shows the locations of all of the model receptors that exceeded the 1-hour SO_2 NAAQS and elevation information. Violating model receptors are most concentrated within three (3) km of the Fort Smallwood facility. There are three other areas in the northwestern portion of the model receptor grid that had model receptors that exceeded the NAAQS. These areas are located over 30 km from Fort Smallwood and generally have elevations in the 140 to 190 meter range. Violating model receptors are located in Anne Arundel and Baltimore counties. Sierra Club did not use the MAXDCONT option in their AERMOD analysis so there was no information regarding individual stack contributions to the individual model receptor violations.

Figure 19: Violating Model Receptors and Model Domain Elevations



Modeling Analyses: Summary and Conclusion

Modeling Analysis Summary

EPA received two (2) modeling analyses that included emissions from the Wagner Generating Station in Anne Arundel County, Maryland. This facility is part of Raven Power's Fort Smallwood complex, which in addition to Wagner includes the Brandon Shores generating facility. The modeling analyses also included emissions from another Raven Power facility, the Crane Generating Station located approximately twenty (20) kilometers northeast of Fort Smallwood in Baltimore County, Maryland.

The first modeling analysis was submitted to EPA by Sierra Club in correspondence dated January 4, 2016. This included a modeling summary that was submitted to the Maryland Department of the Environment in June of 2015; the modeling report included in this submittal was dated May 4, 2015.

Sierra Club modeled SO_2 emissions from coal-fired units at Brandon Shores, Wagner and Crane using EPA's AERMOD dispersion model. Three (3) emissions scenarios were modeled including each unit's maximum allowable (permitted) emission rate, the 99th percentile hourly emission rate reported to EPA's Clean Air Market website between 2012 and 2014, and the actual hourly emission rates reported to EPA's Clean Air Market website again for 2012-14. Only the model simulations using the actual hourly emission rates were considered for attainment designation purposes.

Sierra Club's modeling analysis utilized an extensive model receptor grid centered on Fort Smallwood and Crane that extended nearly 50 km. This represents the approximate limit of steady-state Gaussian dispersion models such as AERMOD, as noted in section 6.2.3 (a) of EPA's Guideline on Air Quality Models (Guideline). While compliant with the Guideline, this receptor grid extends well beyond the recommended area of focus discussed in EPA's March 1, 2011 clarification memo.[17] In accordance with EPA's Modeling TAD, model receptor concentrations should be parsed to exclude any that occurred over open water or in areas otherwise not suitable for siting a physical monitor. Sierra Club's modeling included receptor points over open water, which were not considered in our analysis. While Sierra Club's modeling analysis included flagpole receptors instead of ground receptors, the minimal height of these flagpole receptors (1.5 meters) was not expected to significantly impact final model concentrations. Background concentrations based on the Beltsville, Maryland monitor's 2011-13 design value were added to final modeled concentrations.

Based on the actual hourly emissions, Sierra Club's maximum modeled 1-hour SO_2 concentration (in the form of the NAAQS) was 293. 9 $\mu g/m^3$, well above the health-based standard of 196.2 $\mu g/m^3$. While there may be some minor differences in final modeled concentrations based on Sierra Club's use of older versions of the AERMOD modeling components, some minor aberrations in meteorological processing steps and minor differences in stack parameters, these factors should not significantly change the final model concentrations.

EPA received a second modeling analysis from Maryland as a supplement to its 2015 designation recommendation on January 15, 2016. AECOM performed the modeling analysis. AECOM was asked by Raven Power to review a previous modeling analysis completed by the Maryland Department of the Environment. AECOM's modeling analysis also utilized EPA's AERMOD modeling system to estimate 1-hour SO_2 concentrations in the vicinities of Fort Smallwood (Brandon Shores and Wagner) along with Crane. This modeling analysis included additional sources that were not part of Sierra Club's modeling analysis; two (2) oil-fired units at Wagner along with Wheelabrator Baltimore and the proposed Energy Answers facilities. AECOM used a hybrid approach compiling the emission inventory used in their modeling analysis. Hourly emissions over 2012-14 were used for the majority of Raven Power's sources included in AECOM's modeling analysis. Non-federally enforceable emission rates were used for Wheelabrator Baltimore and the proposed Energy Answers facilities. Actual emissions for Wagner's coal-fired Unit 2 were retroactively reduced to 1.0 lbs/MMBtu to reflect a recent fuel switch (April 2015). Mixing emission rates is not in accordance with EPA's Modeling TAD.

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[17] *See* Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard and note that while the memo references the 1-hour NO_2 NAAQS it is equally applicable to the 1-hour SO_2 standard.

AECOM's modeling analysis utilizes an imbedded Cartesian modeling receptor grid on the order of 35 by 35 kilometers centered on the Fort Smallwood and Crane facilities. The number of receptors was much smaller than Sierra Club's and focused on areas approximately 10 kilometers from Raven Power's sources.

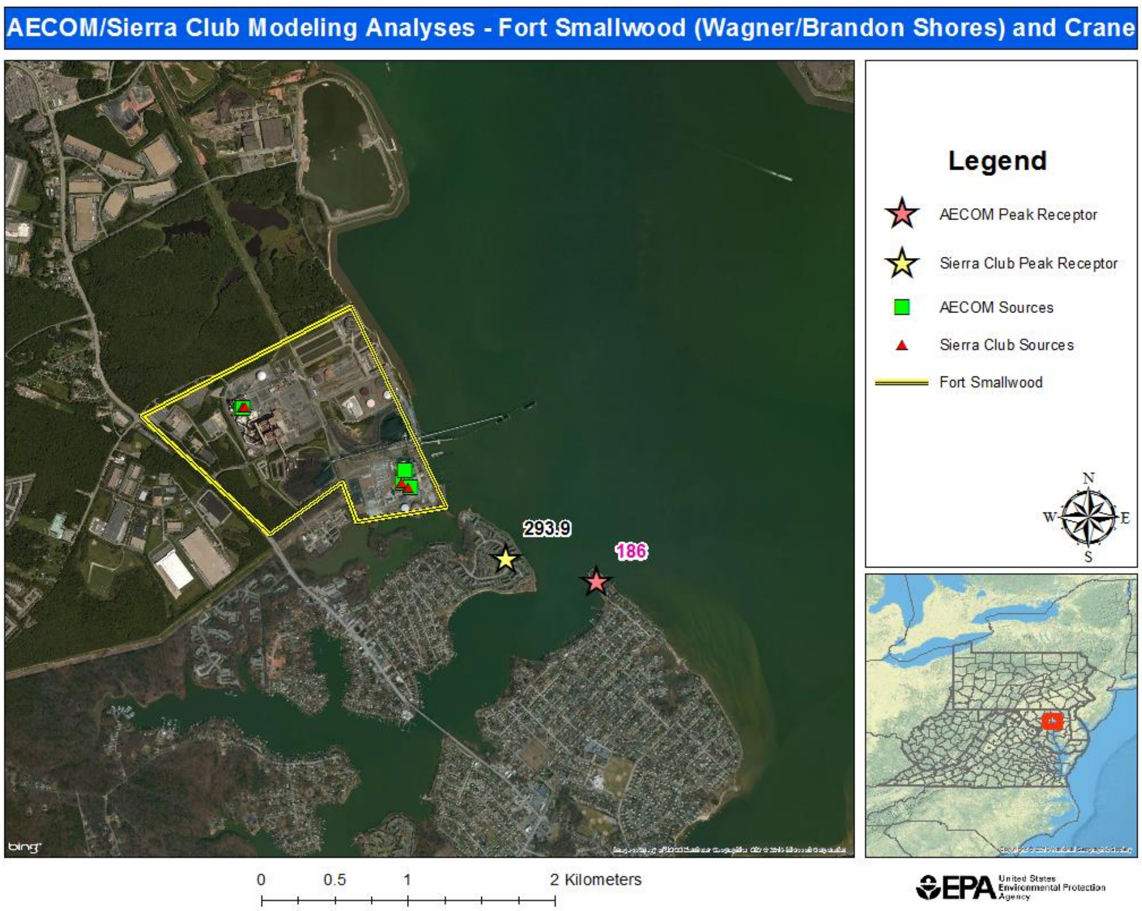
AERMOD processing largely followed standard EPA guidance with two (2) exceptions; AECOM used non-default options when it processed its meteorological data via AERMET's adjust U* option and utilized the Low Wind 3 processing option in AERMOD itself. EPA does not believe that the air quality modeling results obtained from the use of these beta options can be used as a reliable indicator of attainment status in the area around Wagner until appropriate alternative model approval is granted or these beta options are promulgated as regulatory options in AERMOD through EPA rulemaking. The modeling report submitted by AECOM includes a published paper that summarizes an evaluation of low-wind modeling approaches for tall-stack sources. While seasonally varying hour-by-hour background concentrations were added to the final model concentration, AECOM substituted a much lower background concentration (Beltsville, MD) when winds were from an easterly direction.

Final modeled concentrations from AECOM's modeling analysis were below the 1-hour SO_2 NAAQS. The peak model concentration was 186.0 $\mu g/m^3$ (standard is 196.2 $\mu g/m^3$).

Modeling Analysis Conclusion to Support Designation

EPA has reviewed the modeling analyses submitted by Sierra Club and AECOM. Both analyses used AEMOD to determine model concentrations near the Wagner generating station in northern Anne Arundel County, MD. Sierra Club's modeling analysis indicates 1-hour SO_2 concentrations near Wagner exceed the NAAQS. Model violations also occur in portions of Baltimore County. Model receptor violations in Baltimore County are over 10 km from Wagner and are generally beyond the area EPA recommends 1-hour modeling analyses as the area of focus (*see* EPA March 1, 2011 Clarification Memo). Peak modeled concentrations from AECOM's modeling analysis are significantly lower than Sierra Club's and are also under the 1-hour SO_2 NAAQS. Peak model concentrations for Sierra Club and AECOM both occur in the same general area, approximately 1 kilometer east southeast of Wagner (Fort Smallwood) and are shown in Figure 20.

Figure 20: Peak Model Concentrations from AECOM and Sierra Club Modeling Analyses



Based on analysis of both modeling studies, EPA believes that Sierra Club's modeling analysis most closely follows the guidance outlined in EPA's modeling TAD and is more representative of actual air quality conditions for the modeled period. While AECOM's analysis may suggest lower concentrations due to more recent emission reductions at Wagner's coal-fired Unit 2, substituting PTE or non-federally enforceable lower hourly emission rates retroactively to modify actual emissions does not follow EPA's modeling TAD, which suggests either using actual emissions from impacting sources or using PTE emission rates (either/or). AECOM's use of beta options within the AERMOD system may have also contributed to lower model concentrations. As noted earlier, upon concurrence by EPA's Modeling Clearinghouse, EPA Regional Offices may approve the use of these beta options for regulatory applications as an alternative model. However, Maryland's air dispersion modeling, performed by AECOM, intended to characterize air quality as a result of SO_2 emissions from Wagner without prior consultation with and approval from EPA's Region 3's Office, and therefore has not met the applicable regulatory requirements contained in Appendix W, Section 3.2.2. As a result, EPA does not believe that the air quality modeling results obtained from the use of these beta options can be used as a reliable indicator of attainment status in the area around Wagner until appropriate alternative model approval is granted or these beta options are promulgated as regulatory options in AERMOD through EPA rulemaking.

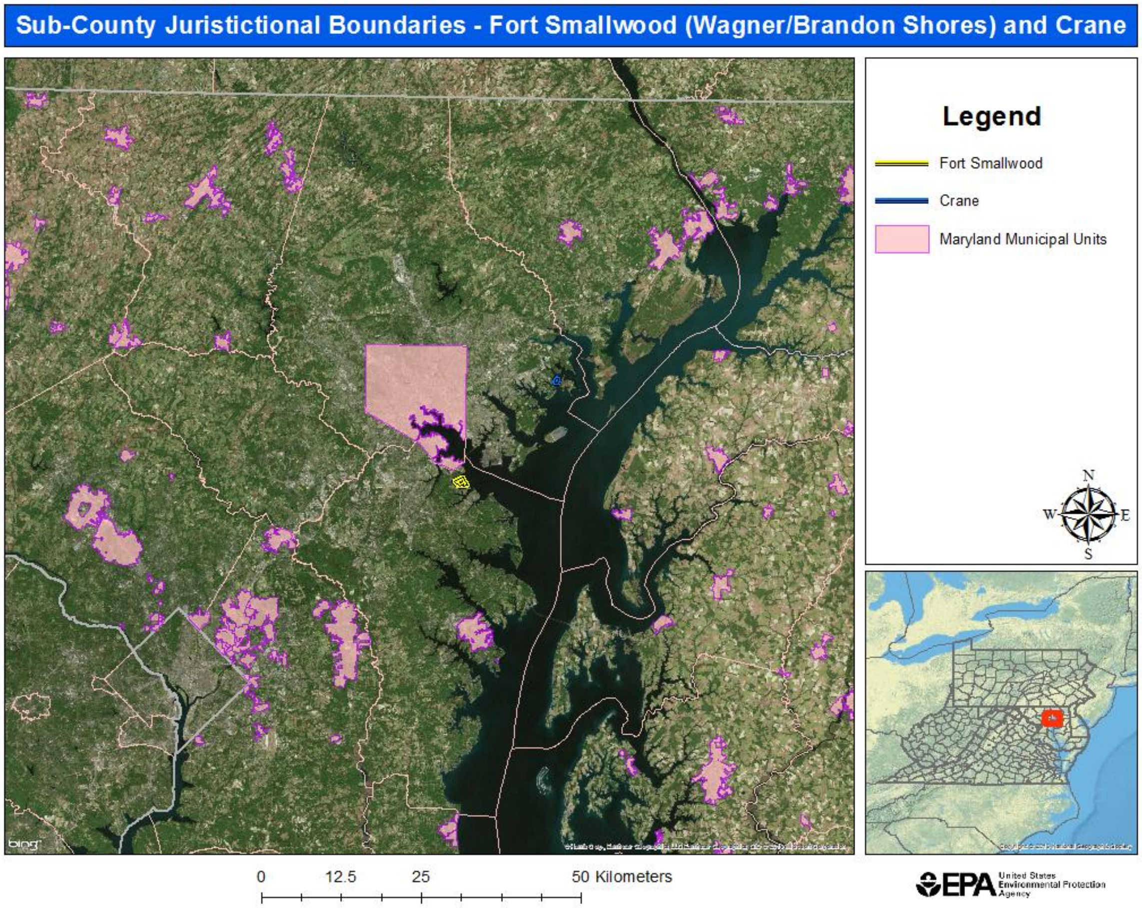
Given this information, EPA believes the Sierra Club air dispersion modeling provides persuasive evidence that SO_2 NAAQS violations are occurring within Baltimore County and Anne Arundel County, with the maximum concentration in the immediate vicinity of Wagner. In addition, EPA does not believe that AECOM's modeling provides persuasive evidence that the area is meeting the NAAQS based on actual emissions for the period analyzed.

Jurisdictional Boundaries

Maryland's original 2011 designation recommendation recommended that the entirety of Anne Arundel County be designated as unclassifiable. The State did not provide additional explanation nor analysis and chose to recommend the default county boundary at that time. Maryland's updated 2015 designation recommendation did not address this factor, and Maryland did not provide a recommended boundary for its recommended attainment designation for the Wagner area. Existing jurisdictional boundaries are considered for the purpose of informing our intended designation, specifically with respect to a clearly defined legal boundary once the geographic area associated with the immediate area surrounding Wagner, other nearby sources, and background concentration is determined.

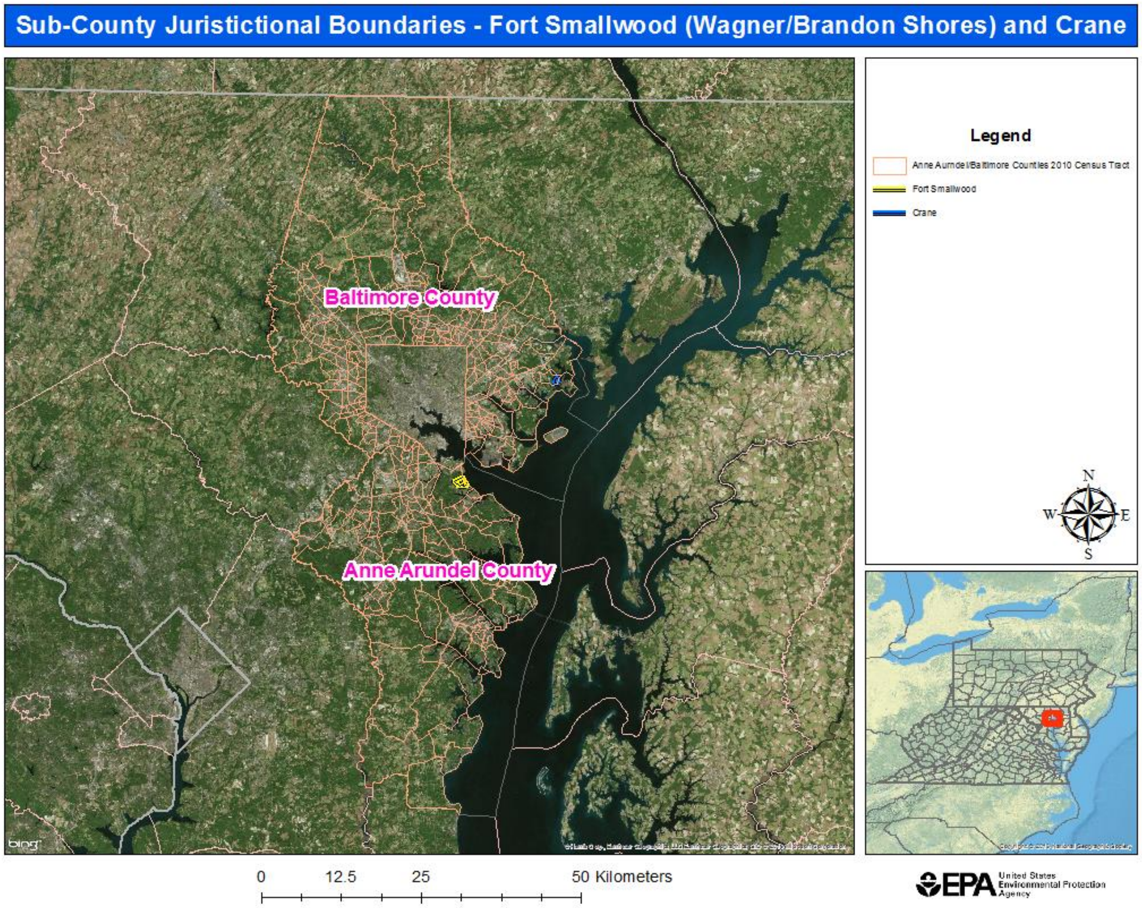
There are a limited number of sub-county jurisdictional boundaries to use if one would want to define attainment boundaries below the county scales. The State of Maryland has 156 municipal corporations otherwise known as municipalities. Figure 21 shows the municipal units in the Wagner area of analysis. These units, unfortunately, do not create a contiguous entity inside the county boundaries, and therefore, do not provide a method for delineating sub-county nonattainment boundaries in the Wagner area. There are a total of two (2) municipalities in Anne Arundel County and no municipalities that reside totally inside Baltimore County; one municipality in a neighboring county does extend into Baltimore County.

Figure 21: Maryland Municipalities in the Wagner Area



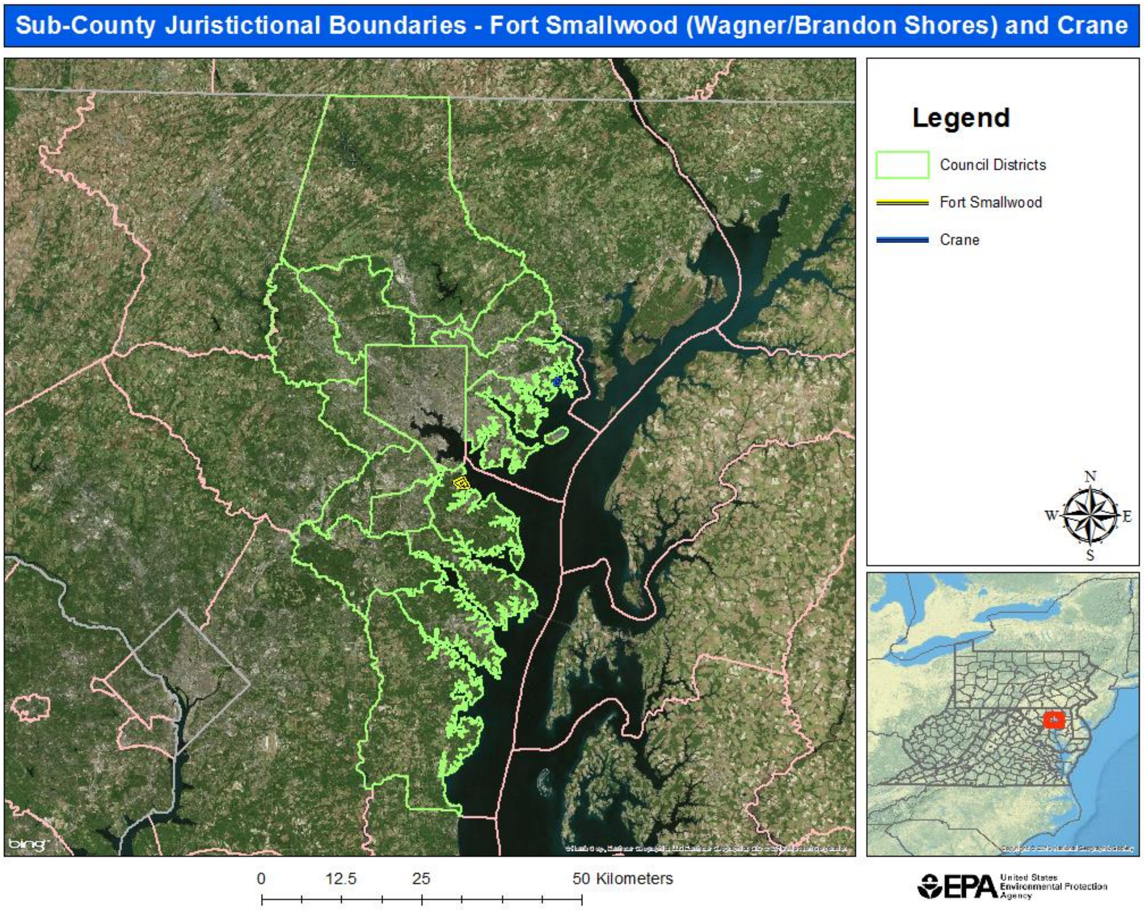
There are several other possibilities for defining boundaries below the county level in Maryland: US zip codes, US Census tracts, and council districts. Zip codes were created by the US Postal Service in the 1960s. Zip Codes, unfortunately, are not true linear features but groups of addresses assigned to a single code. Boundaries between individual zip codes are somewhat arbitrary and can be as small as a single mailing address. The US Census defines Census Tracts to help organize Census information. While these boundaries are sub-county, they can be quite small. There are a total of 411 Census tracts in Anne Arundel and Baltimore counties (*see* Figure 22). The number of Census tracts and their relative limited use may make these units difficult to use to delineate a nonattainment area that would have sub-county borders.

Figure 22: 2010 Census Tracts within Anne Arundel and Baltimore Counties in Maryland



A county council is a legislative body of the county that performs all local governmental functions within its jurisdiction. Both Baltimore and Anne Arundel Counties are divided into seven (7) council districts (Figure 23). The use of council districts for defining the nonattainment area around Wagner would be difficult in that the violations are spread across numerous districts, forming a non-contiguous area. Furthermore, because of where the modeled violations are located across Baltimore County in relation to Baltimore County's council district boundaries, large areas spanning northward towards Pennsylvania would be included that are likely not being impacted by Wagner's SO_2 emissions.

Figure 23: Council Districts within Anne Arundel and Baltimore Counties in Maryland



Given that existing jurisdictional boundaries do not appear suitable for defining the nonattainment area surrounding Wagner, EPA believes that another alternative to using jurisdictional boundaries is to draw a circle around the source and all modeled violating receptors. Such a circle would be drawn with Wagner's Unit 3 stack as the center (located at 39.17765N latitude, 76.52752W longitude) with a radius extending out 35.5 kilometers in order to capture all the violating receptors both within Anne Arundel and Baltimore Counties. Those portions of Anne Arundel and Baltimore Counties residing within this circle would encompass the nonattainment area. Furthermore, in the absence of information from Maryland concerning jurisdictional boundaries, EPA believes that our intended nonattainment area, consisting of portions of Anne Arundel County and Baltimore County, is comprised of a clearly defined legal boundary, and we find this boundary to be a suitably clear basis for defining our intended nonattainment area. There are no previously designated nonattainment areas in the nearby vicinity of Wagner whose boundaries could have been considered in this case. The area around Wagner would be nonattainment based on available modeling information regarding elevated SO_2 levels within Anne Arundel and Baltimore Counties, emissions data, emission control information, as well as wind patterns and terrain. See the "Air Dispersion Modeling" section for the assessment of air dispersion modeling provided by Sierra Club. In contrast, this information also shows that the jurisdictional area of Baltimore City does not have elevated SO_2 levels.

Other Relevant Information

On January 13, 2016, Sierra Club submitted a follow-up to their January 4, 2016 modeling submission. In that submission, Sierra Club notes that Maryland's 2015 designation recommendation includes ambient air monitoring data from a two-month study that shows the occurrence of a maximum 1-hour SO_2 concentration of 101.7 ppb at a monitor closest to Wagner, which far exceeds the SO_2 NAAQS. Additionally, Sierra Club's submission included a presentation Maryland gave to stakeholders in February 2014, in which Maryland summarizes the results of its own and Sierra Club's prior modeling and explains the unit-specific emission rates necessary to ensure compliance with the 1-hour SO_2 NAAQS. Sierra Club also included a draft SO_2 regulation Maryland had previously released to stakeholders that included proposed emission rates for sources. Sierra Club explains that the monitoring data provided by the State is not supportive of an attainment designation, and also urges EPA to carefully review any newly proposed emission limits from Maryland that may differ from those previously identified by Maryland in the draft SO_2 regulation. Under the "Air Quality Data" section in this draft technical support document, EPA acknowledges that the monitoring data from the two-month study Maryland submitted is not supportive of an attainment designation. EPA is unable to comment on any previously proposed SO_2 emission limits released in a draft regulation by Maryland as that would have been a work-in-progress and based on modeling that would have been done prior to EPA's Modeling TAD being released.

On January 20, 2016, Sierra Club submitted further information with regards to Maryland's January 15, 2016 recommendation supplement. Their submission notes that Maryland's January 15, 2016 modeling analysis neither utilized actual historical emission data, nor maximum SO_2 emissions, and inappropriately utilized options not formally approved under Appendix W, and assert that this analysis fails to support an attainment or unclassifiable designation. EPA's analysis of Maryland's modeling analysis is discussed in detail under the section entitled "Air Dispersion Modeling" in this draft technical support document.

Detailed Assessment for Baltimore City Area

Air Dispersion Modeling

Available air dispersion modeling shows persuasive evidence that violations of the SO_2 NAAQS are not occurring within Baltimore City. See the "Air Dispersion Modeling" section for EPA's detailed review of the analyses.

Air Quality Data

This factor considers the SO_2 air quality monitoring data; however, there are no ambient air quality monitors located in Baltimore City, and Maryland's 2011 designation recommendation did not address this factor. The closest ambient air quality monitor to Baltimore City is located east of Baltimore City in neighboring Baltimore County. The monitor's 2012-2014 design value is 22 ppb (*see* Tables 2 and 3), well below the SO_2 standard.

Emissions and Emissions-Related Data

Maryland's 2011 designation recommendation did not address this factor. EPA's review of emissions information shows that there are no large SO_2-emitting sources located within Baltimore City that could be contributing to elevated levels of SO_2 concentrations. The largest source in Baltimore City is Wheelabrator Baltimore L.P. with 2013 NEI SO_2 emissions of 321 tpy and 2011 NEI SO_2 emissions of 261 tpy (*see* Table 6); this facility is located approximately 3 km from the city border.

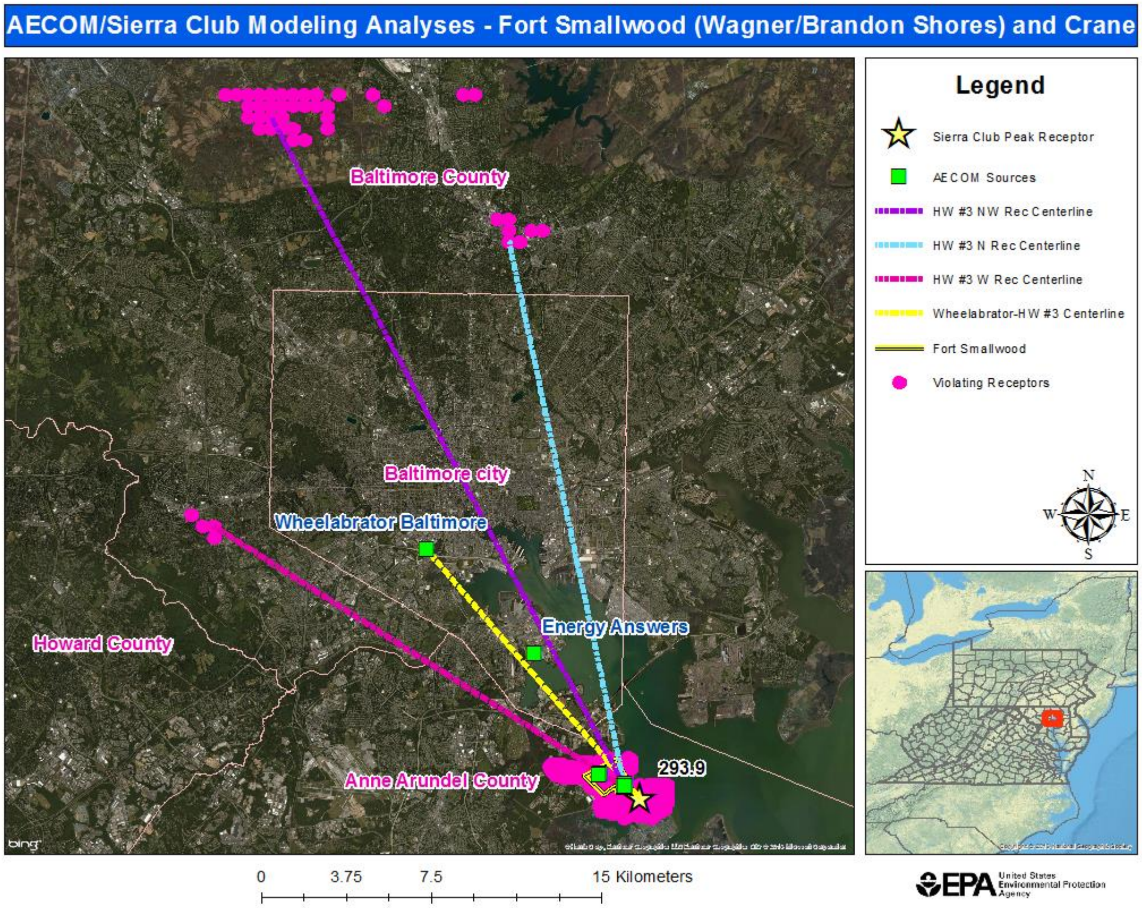
Traditionally, a source's modeled impact would be compared to the Significant Impact Level (SIL) to gauge if it is significantly impacting a modeled violation. This information, unfortunately, is not readily available from either Sierra Club's or AECOM's modeling analyses. Sierra Club did not include sources inside Baltimore City in its analysis, nor did it provide a culpability analysis of its modeled violations using the MAXDCONT function in AERMOD. While AECOM did include sources inside Baltimore City (Wheelabrator Baltimore and the proposed Energy Answers facility) they did not run MAXDCONT since there were no modeled violations in its analysis (MAXDCONT only works for receptors over the NAAQS).

In light of these deficiencies, EPA attempted to gauge Wheelabrator Baltimore's impact on Sierra Club's violating receptors using AECOM's modeling for its peak receptor and SCREEN3 modeling to determine if modeled concentrations would exceed the interim 1-hr SO_2 SIL (7.8 $\mu g/m^3$).

Table 4-3 in AECOM's modeling report lists the contributions from each source towards its peak modeled concentration. For all other sources, excluding Brandon Shores, Wagner and Crane, the total other sources category model concentration (Wheelabrator Baltimore and Energy Answers) was 1.4 $\mu g/m^3$, approximately 0.7% of the NAAQS. This indicates impacts from Wheelabrator Baltimore are below the 1-hr SO_2 SIL for receptors immediately downwind of Wagner. Based on this information, Wheelabrator Baltimore is not significantly contributing to (Sierra Club's) modeled violations surrounding Wagner.

Sierra Club modeling also had violating receptors in several other areas of Baltimore County. EPA ran SCREEN3 to gauge if emissions from Wheelabrator Baltimore could significantly contribute to these modeled violations. Figure 24 shows the locations of the violating receptors, significant emission sources in the Baltimore area and the approximate centerlines between Wagner Unit 3 and three (3) groups of violating receptors in Baltimore County and the Sierra Club peak receptor. Centerlines are lines drawn from an emission point to the receptor. A straight-line dispersion model calculates the maximum concentration along this centerline. Model concentrations will "fall off" laterally along the normal line drawn to the centerline following some type of Gaussian distribution. Based on the figure, Wheelabrator Baltimore generally falls off of the centerline from Wagner Unit 3 (except for the centerline drawn for the Sierra Club peak receptor).

Figure 24: Centerlines for various sources and modeled violating receptors



EPA ran SCREEN3 using emissions from Wheelabrator Baltimore for different receptors representing downwind receptors from Wagner (including Sierra Club's peak receptor) along with roughly three (3) groups of violating receptors based on the Sierra Club modeling. Model results are available as an appendix.

An emission rate of 1.0 grams/second (g/s) was used in SCREEN3. Concentrations can then be scaled according to Wheelabrator Baltimore's 2012-14 actual emissions; Energy Answers was omitted from the analysis since it had no actual emissions between 2012-14. Table 25 summarizes SCREEN3 results.

Table 24: Wheelabrator Baltimore 2012-14 Actual Emissions

Year	tpy	g/s
2012	194	5.56548
2013	321	9.23409
2014 (Preliminary)	310	8.91766

Table 25: Wheelabrator Baltimore Emissions and SCREEN3 Model Results

Receptor	Terrain Type	1-hr Model ($\mu g/m^3$/1.0 g/s)	24-hr Model ($\mu g/m^3$/1.0 g/s)[18]	Adjusted 2012 ($\mu g/m^3$)	Adjusted 2013 ($\mu g/m^3$)	Adjusted 2014 ($\mu g/m^3$)
Fort Smallwood Peak	Simple	0.481	-	2.68	4.44	4.29
Sierra Club Peak	Simple	0.4793	-	2.67	4.43	4.27
West Violating Receptors	Complex	-	0.3646	8.12	13.47	13.01
North Violating Receptors	Complex	-	0.2123	4.73	7.84	7.57
NW Violating Receptors	Complex	-	0.1518	3.38	5.61	5.41

SCREEN3 results indicate the only receptors where Wheelabrator Baltimore's contributions could potentially exceed the 1-hr SO_2 SIL is the group of receptors in western Baltimore County (due west of Wheelabrator Baltimore). SCREEN3 values for the West Receptors are approximately 7% of the NAAQS, which is over the interim 1-hr SO_2 4% SIL. It should be noted that the SCREEN3 result is the maximum concentration for the centerline extending between this group of receptors and Wheelabrator Baltimore and not the centerline drawn between Wagner Unit 3 and the West Receptors. In fact, only the edge of Wheelabrator Baltimore's plume based on the Wagner Unit 3-West Receptor centerline would impact these receptors, thus yielding a lower concentration than SCREEN3 would predict. Given that the violating receptors' peak 99th percentile concentrations are occurring during stable overnight hours, the lateral spread along the centerline for Wheelabrator Baltimore is probably not large enough to extend over these receptors; Wheelabrator Baltimore's plume would have to laterally spread nearly 5 km from the Wagner Unit 3-West Receptor centerline to impact these receptors. Further evidence of SCREEN3 overestimation is seen in the Sierra Club peak receptor concentrations. Based on AECOM's analysis, Wheelabrator Baltimore's modeled impact is less than 1% of the NAAQS at its peak model receptor. Since both the Sierra Club and AECOM peak receptors are nearly in the same place, AECOM's results indicate SCREEN3 is overestimating Wheelabrator Baltimore's model impacts by nearly a factor of three (3); 1.4 $\mu g/m^3$ versus 4.43 $\mu g/m^3$. Using this adjustment, Wheelabrator Baltimore's model contribution to the West Receptors is most likely under the interim 1-hr SO_2 SIL.

Due to its low emissions, and based on all available information, EPA finds it unlikely that any sources within Baltimore City have the potential to cause or contribute to a violation of the NAAQS within the city. Furthermore, available modeling analyses further provide evidence that large SO_2 sources located outside of Baltimore City are likewise not impacting SO_2 levels within Baltimore City.

[18] 24-hr concentration based on Valley model. Concentrations divided by 0.25 to get 1-hr concentrations in accordance with section 3.8 of SCREEN3 User's Guide.

Meteorology (Weather & Transport Patterns)

Maryland's 2011 designation recommendation did not address meteorology. EPA's review of meteorology shows that the closest hourly reporting meteorological monitoring station to Baltimore City is the Baltimore-Washington International Airport, located southwest of Baltimore City. A wind rose for the 2012-14 time period (*see* Figure 4) shows predominantly westerly winds in the area. Available modeling analyses provide evidence that westerly winds do not contribute to elevated levels of SO_2 within Baltimore City from large SO_2 sources located outside of Baltimore City. Likewise, based on SCREEN3 results and our analysis and comparison to AECOM's and Sierra Club's analyses discussed under the "Emissions and Emissions-Related" section, EPA believes there is persuasive evidence indicating that emissions from within Baltimore City are not impacting SO_2 levels in areas outside of Baltimore City that are not meeting the NAAQS.

Geography and Topography (Mountain Ranges or Other Air Basin Boundaries)

Maryland's 2011 designation recommendation did not address this factor. EPA has reviewed both the geography and topography of Baltimore City. Baltimore City lies west of the Chesapeake Bay with the southern half lying within the coastal plain and the north/northwest corner within the Piedmont plateau (*see* Figure 6). Given that there is limited terrain in this area, topography would likely not contribute to elevated concentrations of SO_2 in Baltimore City. Available modeling analyses provide evidence that the terrain located in the north/northwest of the city does not impact SO_2 concentrations within Baltimore City.

Jurisdictional Boundaries

Maryland's 2011 designation recommendation recommended that the entirety of Baltimore City be designated as unclassifiable. The State did not provide additional explanation nor analysis and chose to recommend the default city boundary at that time. Existing jurisdictional boundaries are considered for the purpose of informing our intended designation, specifically with respect to a clearly defined legal boundary. EPA's review of available air dispersion modeling shows persuasive evidence that elevated SO_2 levels are not occurring within Baltimore City. Therefore, EPA believes that our intended unclassifiable/attainment designation for Baltimore City is comprised of an appropriate and clearly defined legal boundary.

Conclusion for the Anne Arundel County and Baltimore County and Baltimore City Areas

After careful evaluation of the State's 2011 and 2015 updated recommendations and additional information including SO_2 emissions, air quality monitoring, air dispersion modeling results, meteorology, geography and topography, EPA intends to designate the area around the Herbert A. Wagner Generating Station as nonattainment for the 2010 SO_2 NAAQS. Specifically, EPA intends to include portions of Anne Arundel County and Baltimore County in the nonattainment area that are within 35.5 kilometers of Herbert A. Wagner's Unit 3 stack, which is located at 39.17765N latitude, 76.52752W longitude. Sierra Club's January 4, 2016 air dispersion modeling, which included actual SO_2 emissions data from Wagner, provides persuasive evidence that SO_2 NAAQS violations are occurring within Baltimore County and Anne Arundel County, with the maximum concentration in the immediate vicinity of Wagner. The modeling also shows that violations may be occurring in several locations northwest and west of the Facility in neighboring Baltimore County over 30 kilometers away from the Facility. In contrast, Maryland's submitted January 2016 modeling analysis is problematic, not in accordance with EPA's Modeling TAD or Appendix W, and does not support an attainment designation given that the Sierra Club modeling demonstrates violations. Given these air dispersion modeling results, emissions data, lack of federally enforceable SO_2 emission controls at Wagner and Crane, as well as general wind patterns and topography, EPA finds it reasonable that the area surrounding Wagner be designated as nonattainment, and as such intends to designate portions of Anne Arundel County and Baltimore County as nonattainment for the 2010 SO_2 NAAQS. Specifically, those portions of Anne Arundel and Baltimore Counties that are within 35.5 kilometers of Wagner's Unit 3 stack, which is located at 39.17765N latitude, 76.52752W longitude, would be designated as nonattainment.

Additionally, Sierra Club's air dispersion modeling shows persuasive evidence that violations are not occurring in Baltimore City. Given these modeling results and that there are no large SO_2 emissions sources located within Baltimore City that could be impacting areas outside of Baltimore City, as well as no violating monitors in the area and limited terrain, EPA believes there is persuasive evidence to support a conclusion that Baltimore City is meeting the NAAQS and that a designation of unclassifiable/attainment is appropriate. Therefore, EPA intends to designate Baltimore City as unclassifiable/attainment for the 2010 SO_2 NAAQS.

At this time, our intended designation for the state only applies to the area presented in this technical support document. Consistent with the conditions in the March 2, 2015 consent decree and the court order, EPA will evaluate and designate all remaining undesignated areas in Maryland by either December 31, 2017 or December 31, 2020.

APPENDIX: SCREEN3 MODEL RESULTS

02/08/16

12:00:14

*** SCREEN3 MODEL RUN ***

*** VERSION DATED 13043 ***

WheelabratorMD_Screen3

COMPLEX TERRAIN INPUTS:

SOURCE TYPE = POINT

EMISSION RATE (G/S) = 1.000000

STACK HT (M) = 96.0100

STACK DIAMETER (M) = 2.1300

STACK VELOCITY (M/S) = 22.5500

STACK GAS TEMP (K) = 485.9300

AMBIENT AIR TEMP (K) = 287.8000

RECEPTOR HEIGHT (M) = 0.0000

URBAN/RURAL OPTION = RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.

THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 102.264 M**4/S**3; MOM. FLUX = 341.593 M**4/S**2.

FINAL STABLE PLUME HEIGHT (M) = 180.5

DISTANCE TO FINAL RISE (M) = 150.0

VALLEY 24-HR CALCS **SIMPLE TERRAIN 24-HR CALCS**

TERR		MAX 24-HR		PLUME HT		PLUME HT			
HT	DIST	CONC	CONC	ABOVE STK	CONC	ABOVE STK		U10M	USTK
(M)	(M)	(UG/M**3)	(UG/M**3)	BASE (M)	(UG/M**3)	HGT (M)	SC		(M/S)
-----	-------	----------	----------	------	----------	------	--	----	----
154.	9460.	0.9060	0.3646	180.5	0.9060	75.7	6	1.0	3.5
148.	14040.	0.7316	0.2123	180.5	0.7316	75.7	6	1.0	3.5
195.	20290.	0.1518	0.1518	180.5	0.000	0.0	0	0.0	0.0

02/08/16

12:00:14

*** SCREEN3 MODEL RUN ***

*** VERSION DATED 13043 ***

WheelabratorMD_Screen3

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT

EMISSION RATE (G/S) = 1.000000

STACK HEIGHT (M) = 96.0100

STK INSIDE DIAM (M) = 2.1300

STK EXIT VELOCITY (M/S)= 22.5500

STK GAS EXIT TEMP (K) = 485.9300

AMBIENT AIR TEMP (K) = 287.8000

RECEPTOR HEIGHT (M) = 0.0000

URBAN/RURAL OPTION = RURAL

BUILDING HEIGHT (M) = 0.0000

MIN HORIZ BLDG DIM (M) = 0.0000

MAX HORIZ BLDG DIM (M) = 0.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.

THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 102.264 M**4/S**3; MOM. FLUX = 341.593 M**4/S**2.

*** FULL METEOROLOGY ***

****

*** SCREEN DISCRETE DISTANCES ***

****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
13980.	0.4810	3	1.0	1.3	592.9	591.94	1113.08	697.00	NO
14040.	0.4793	3	1.0	1.3	592.9	591.94	1117.24	699.63	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)

DWASH=NO MEANS NO BUILDING DOWNWASH USED

DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED

DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED

DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****

*** SUMMARY OF SCREEN MODEL RESULTS ***

****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	0.4810	13980.	0.
COMPLEX TERRAIN	0.9060	9460.	154. (24-HR CONC)

****

** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **

****