



*State of Maryland 1-Hour Sulfur Dioxide (SO<sub>2</sub>)  
National Ambient Air Quality Standard (NAAQS)  
State Implementation Plan*

*for the*

*Anne Arundel County and Baltimore County, MD  
("Wagner") Nonattainment Area*

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**Prepared by:  
Maryland Department of the Environment**



**Maryland Department of the Environment  
Anne Arundel County and Baltimore County, MD  
2010 SO<sub>2</sub> NAAQS Nonattainment Area**

Maryland Department of the Environment  
Air and Radiation Administration  
1800 Washington Boulevard, Suite 730  
Baltimore, Maryland 21230  
Phone 410.537.3255 • Fax 410.537.4223

## ACRONYMS AND ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	microgram(s) per cubic meter
AERMAP	AERMOD terrain preprocessor
AERMET	AERMOD meteorological preprocessor
AERMOD	American Meteorological Society/EPA Regulatory Model
AQS	Air Quality System
BPIPRM	Building Profile Input Program (BPIP) for the Plume Rise Model Enhancements algorithm
CAA	Clean Air Act
CEV	Critical emission value
CFR	Code of Federal Regulations
COA	Consent Order and Agreement
CSAPR	Cross State Air Pollution Rule (CSAPR)
EGU	Electric Generating Unit
EMF	Emission Modeling Framework
EPA	U.S. Environmental Protection Agency
FGD	Flue gas desulfurization
FIP	Federal Implementation Plan
FR	Federal Register
g/s	gram(s) per second
LAER	Lowest Achievable Emission Rate
lb/hr	pound(s) per hour
MACT	Maximum Achievable Control Technology
MARAMA	Mid-Atlantic Regional Air Management Association
MATS	Mercury and Air Toxic Standards
MDE	Maryland Department of the Environment
NAAQS	National Ambient Air Quality Standard
NEI	National Emission Inventory
NESHAP	National Emission Standards for Hazardous Air Pollutants
NID	Novel integrated desulfurization
NOV	Notice of Violation
NOx	Nitrogen oxides
NSPS	New Source Performance Standards
NSR	New Source Review
ppb	parts per billion
ppm	parts per million
RACM	Reasonably Available Control Measure
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
SCC	Source Classification Code
SIP	State Implementation Plan
SO <sub>2</sub>	Sulfur dioxide
SO <sub>x</sub>	Sulfur oxides
TSD	Technical Support Document
TSP	Total Suspended Particles
TVOP	Title V Operating Permit

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SO<sub>2</sub> NONATTAINMENT AREA SIP

## EXECUTIVE SUMMARY

The Maryland Department of the Environment (MDE or Department) is proposing a revision to Maryland's State Implementation Plan (SIP) under the federal Clean Air Act (CAA), as amended in 1990. This SIP revision addresses the federal requirements for the sulfur dioxide (SO<sub>2</sub>) nonattainment area encompassing the portions of Anne Arundel County and Baltimore County, Maryland within 26.8 kilometers (16.7 miles) of Herbert A. Wagner Generating Station's Unit 3 stack. This SIP revision and supporting documentation describe the CAA-mandated air quality demonstration of attainment of the primary 2010, 1-hour National Ambient Air Quality Standard (NAAQS) for SO<sub>2</sub> in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area.

On July 12, 2016, the EPA designated this one area in Maryland as an SO<sub>2</sub> nonattainment area for the 2010 primary SO<sub>2</sub> NAAQS, based on available air quality modeling results (See 81 FR 45039). The designation for the Anne Arundel County and Baltimore County, Maryland Nonattainment Area went into effect on September 12, 2016. Section 192(a) of the CAA, 42 U.S.C. § 7514a(a), requires SO<sub>2</sub> nonattainment areas to attain the 2010 NAAQS as expeditiously as practicable, but no later than five years from the effective date of EPA's designations, which is September 12, 2021, for the 2016 designations.

Section 172(c) of the CAA (42 U.S.C. § 7502(c)), requires nonattainment plan provisions to address the following elements, which are included in this SIP revision: a base year inventory, provisions for reasonable further progress (RFP) toward attainment, provisions for implementation of reasonably available control measures/technology (RACM/RACT), a demonstration (using EPA-approved air dispersion modeling) that the area will attain the NAAQS by September 21, 2021, enforceable emissions limitations and other measures as necessary to provide for the area's attainment, an approved New Source Review (NSR) program for new and modified major stationary sources, and contingency measures.

This SIP revision demonstrates that the Anne Arundel and Baltimore County nonattainment area meets all requirements necessary for an approvable attainment demonstration SIP revision.

## 1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) published a revised primary (health-based) National Ambient Air Quality Standard (NAAQS) for SO<sub>2</sub> entitled “Primary National Ambient Air Quality Standard (NAAQS) for Sulfur Dioxide; Final Rule,” on June 22, 2010 (75 FR 35520). With this rule, the EPA established a new 1-hour primary (health-based) standard for SO<sub>2</sub> at a level of 75 parts per billion (ppb), which is met when the 3-year average of the annual 99<sup>th</sup> percentile of 1-hour daily maximum concentrations is less than or equal to 75 ppb. It included provisions for the revocation of the prior SO<sub>2</sub> primary standards.

The earlier SO<sub>2</sub> standards were first promulgated in 1971 and retained in 1996 after an EPA review, and they include a 24-hour standard and an annual standard.<sup>1,2</sup> In deciding to revoke these prior NAAQS one year or more after the effective date of initial SO<sub>2</sub> area designations, the EPA Administrator noted in the preamble to the final rule for the 2010 SO<sub>2</sub> NAAQS, “a 1-hour standard at a level of 75 ppb would have the effect of maintaining 24-hour and annual SO<sub>2</sub> concentrations generally well below the levels of the current 24-hour and annual NAAQS.”<sup>3</sup> Also, the Administrator “notes the lack of sufficient health evidence to support an annual standard to protect against health effects associated with long-term SO<sub>2</sub> exposure.”<sup>4</sup> The 1-hour SO<sub>2</sub> standard, as a primary standard, is defined in CAA Section 109(b)(1) as a standard “the attainment and maintenance of which in the judgment of the [EPA] Administrator, based on [the air quality] criteria and allowing an adequate margin of safety, are requisite to protect the public health.”<sup>5</sup> The primary SO<sub>2</sub> NAAQS must protect the health of populations who are particularly sensitive to air pollution, such as children, the elderly, and those with conditions such as asthma and emphysema.

EPA published the final rule for the second round of area designations for the 1-hour, 2010 SO<sub>2</sub> primary national ambient air quality standard (NAAQS) on July 12, 2016 (81 Fed. Reg. 45039), with an effective date of September 12, 2016. In that round of designations, EPA designated the “Anne Arundel County and Baltimore County, MD” area “nonattainment” for the 2010 SO<sub>2</sub> NAAQS. Based on air quality modeling that included local SO<sub>2</sub> emissions data from 2013-2015, EPA defined this nonattainment area as including “Portions of Anne Arundel County that are within 26.8 kilometers (16.7 miles) of Herbert A. Wagner’s Unit 3 stack, which is located at 76.52752 W. longitude, 39.17765 N. latitude (-76.52752, 39.17765), and portions of Baltimore County that are within 26.8 kilometers (16.7 miles) of Herbert A. Wagner’s Unit 3 stack,” at the same latitude and longitude. Baltimore City,

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<sup>1</sup> See, U.S. Environmental Protection Agency, “Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions”, Stephen D. Page, Director, EPA’s Office of Air Quality Planning and Standards, to Regional Air Division Directors Regions 1- 10, April 23, 2014, pp. 46-47, available at: [https://www.epa.gov/sites/production/files/2016-06/documents/20140423guidance\\_nonattainment\\_sip.pdf](https://www.epa.gov/sites/production/files/2016-06/documents/20140423guidance_nonattainment_sip.pdf), accessed October 10, 2017.

<sup>2</sup> This does not apply to Maryland, in part because Maryland did not have any areas designated “nonattainment” under the 24-hour or annual SO<sub>2</sub> NAAQS. See “Technical Support Document for Final Designation Maryland Area Designations for the 2010 SO<sub>2</sub> Primary National Ambient Air Quality Standard,” [https://www.epa.gov/sites/production/files/2016-06/documents/r3\\_md\\_final\\_designation\\_tsd\\_06302016.pdf](https://www.epa.gov/sites/production/files/2016-06/documents/r3_md_final_designation_tsd_06302016.pdf), accessed October 10, 2017.

<sup>3</sup> 75 FR 35550, June 22, 2010.

<sup>4</sup> Ibid.

<sup>5</sup> See 75 FR 35521, dated June 22, 2010.



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portions of which are located within a 26.8 kilometers (16.7 miles) radius of the Wagner Unit 3 stack, though, is not included in the nonattainment area.

In the EPA Technical Support Document (TSD) for Final Designation Maryland Area Designations for the 2010 SO<sub>2</sub> Primary National Ambient Air Quality Standard<sup>6</sup> (page 22) the 75 ppb NAAQS is referenced as equivalent to 196.5 µg/m<sup>3</sup>. In 82 Fed. Reg. 45242<sup>7</sup>, dated 9/28/17, concerning the SO<sub>2</sub> state implementation plan (SIP) for Central New Hampshire, EPA states, “Using a numerical conversion factor of 2.619 µg/m<sup>3</sup> per ppb, the 2010 SO<sub>2</sub> NAAQS of 75 ppb is equivalent to 196.4 µg/m<sup>3</sup>.” EPA rounds or truncates the calculated equivalent conversion value of 196.425 µg/m<sup>3</sup> (2.619 x 75) to one significant digit after the decimal point to arrive at the 196.4 µg/m<sup>3</sup> value and is on record that 196.4 µg/m<sup>3</sup> is a technically appropriate conversion of the 75 ppb standard to µg/m<sup>3</sup>. The one significant digit after the decimal point methodology coincides with EPA’s rounding convention in Part II of the final rule.<sup>8</sup> 40 CFR 50 Appendix T, Section 4, “Rounding Conventions for the 1-Hour Primary SO<sub>2</sub> NAAQS,” states:

- (a) Hourly SO<sub>2</sub> measurement data shall be reported to AQS in units of parts per billion (ppb), to at most one place after the decimal, with additional digits to the right being truncated with no further rounding.

Section 192(a) (42 U.S.C. 7514(a)) of the Clean Air Act requires nonattainment areas to attain the 2010 1-hour SO<sub>2</sub> NAAQS “as expeditiously as practicable but no later than 5 years from the date of the nonattainment designation”<sup>9</sup> which is September 12, 2021.

Sections 110 and 172 of the CAA (42 U.S.C. 7410 and 42 U.S.C. 7502) require states to develop revisions to their State Implementation Plan to demonstrate how each nonattainment area within the state will attain the NAAQS by the attainment date, in this case September 12, 2021. Accordingly, MDE is required to show that the Anne Arundel County and Baltimore County, MD nonattainment area is attaining the 2010, 1-hour SO<sub>2</sub> NAAQS, with a modeled “3 year design value of no greater than 75 ppb throughout the entire nonattainment area by the statutory attainment date, through the adoption and implementation, at a minimum, of emission control measures representing RACM/RACT.”<sup>10</sup> Given that EPA designated the area “nonattainment” based on air quality modeling, MDE is required to show via air quality modeling that the area is attaining the NAAQS. This SIP revision (referred to simply as a “SIP,” from here on) includes that air quality modeling and attainment demonstration.

As required in section 192 of the Clean Air Act (42 U.S.C. Sec. 7514a), this SIP was due on March 12, 2018, 18 months after the effective date of the 2010 SO<sub>2</sub> NAAQS nonattainment designation.<sup>11</sup>

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<sup>6</sup> [https://www.epa.gov/sites/production/files/2016-06/documents/r3\\_md\\_final\\_designation\\_tsd\\_06302016.pdf](https://www.epa.gov/sites/production/files/2016-06/documents/r3_md_final_designation_tsd_06302016.pdf)

<sup>7</sup> In 82 Fed. Reg. 45242, dated 9/28/17, concerning the SO<sub>2</sub> state implementation plan (SIP) for Central New Hampshire, EPA states, “Using a numerical conversion factor of 2.619 µg/m<sup>3</sup> per ppb, the 2010 SO<sub>2</sub> NAAQS of 75 ppb is equivalent to 196.4 µg/m<sup>3</sup>. See 82 FR 45242, 9/28/17.

<sup>8</sup> <https://www3.epa.gov/ttn/naaqs/standards/so2/fr/20100622.pdf> (page 78 of 85)

<sup>9</sup> See 42 U.S.C. Sec. 7514a(a), accessed at <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapl-partD-subpart5-sec7514a.htm>, October 10, 2017.

<sup>10</sup> U.S. Environmental Protection Agency, “Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions,” 2014, p. 10.

<sup>11</sup> See CAA Sec. 191(a), codified as 42 U.S.C. 7514(a).

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On September 9, 2019, EPA found that Maryland failed to submit a complete State Implementation Plans (SIP) showing how the Anne Arundel Baltimore County nonattainment area will meet the 2010 1-Hour Primary SO<sub>2</sub> NAAQS (effective date September 20, 2019).

## 1.1 Health and Environmental Effects of Sulfur Dioxide

Under the Clean Air Act, EPA is required to review the existing criteria air pollutant NAAQS, such as for SO<sub>2</sub>, every five years. In the review of the SO<sub>2</sub> NAAQS that resulted in the 2010 promulgation of the new, 1-hour, 75 ppb SO<sub>2</sub> NAAQS, EPA's Clean Air Scientific Advisory Committee (CASAC) reviewed many epidemiologic studies and controlled human exposure studies to assess the health impacts of human exposures to sulfur dioxide. EPA decided to set the SO<sub>2</sub> NAAQS to a level of 75 ppb, with an averaging time of 1 hour, and with the form of the standard (and compliance with the standard) measured as the three-year average of the annual 99th percentile of 1-hour daily maximum concentrations. EPA considered the health impacts of human exposure to SO<sub>2</sub> in making these decisions.

In particular, in deciding to set the level of the sulfur dioxide standard to 75 ppb, EPA focused on ensuring that the level of the standard protects against exposures that last anywhere from 5 minutes to 24 hours, short-term exposures to SO<sub>2</sub>, since short-term exposures are of concern. The new standard includes protection against 5-minute peak exposures to SO<sub>2</sub> among the most vulnerable populations, such as asthmatic children. The level of the standard affects the number of 5-minute daily maximum SO<sub>2</sub> concentrations that exceed the health exposure-related benchmarks of 400 ppb and 200 ppb. A 75 ppb 1-hour daily maximum standard is expected to “substantially limit asthmatics’ exposure to 5-10 minute SO<sub>2</sub> concentrations greater than or equal to 200 ppb.”<sup>12,13</sup>

Population-level studies found that short-term exposures to SO<sub>2</sub> were associated with emergency room visits and hospitalizations for respiratory illnesses, especially in people with asthma, children, and older adults. Health intervention studies found that decreases in SO<sub>2</sub> levels were linked to improvements in respiratory symptoms. Human clinical studies in exercising adults with asthma found respiratory symptoms and decreased lung function after 5 - 10 minutes of exposure to SO<sub>2</sub> at levels measured in ambient air.

Overall, populations that are vulnerable or potentially susceptible to health effects from exposure to SO<sub>2</sub> include people with asthma; children; older adults; people playing, working, or exercising outdoors; and people of a lower socioeconomic status/lower income. The respiratory effects from exposure to SO<sub>2</sub> can be particularly troublesome for people with asthma who are playing or exercising, or in other words, doing things that prompt faster breathing. SO<sub>2</sub> exacerbates asthma by triggering immediate tightening of the airways. People with asthma have underlying inflammation and are more sensitive to the effects of breathing SO<sub>2</sub>. Also, exercise causes breathing changes that can increase the impact of SO<sub>2</sub> exposure.

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<sup>12</sup> See the final NAAQS, 75 Fed. Reg. 35519-35603, at [http://www.epa.gov/ttn/naaqs/standards/so2/s\\_so2\\_cr\\_fr.html](http://www.epa.gov/ttn/naaqs/standards/so2/s_so2_cr_fr.html).

<sup>13</sup> EPA's final Risk and Exposure Assessment to Support the Review of the SO<sub>2</sub> Primary National Ambient Air Quality Standard, 2009, or “REA.” See [http://www.epa.gov/ttn/naaqs/standards/so2/s\\_so2\\_cr\\_rea.html](http://www.epa.gov/ttn/naaqs/standards/so2/s_so2_cr_rea.html), accessed 12/27/2013.

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As EPA explains in the final rule designating the Anne Arundel County and Baltimore County, MD area “nonattainment” for the 1-hour SO<sub>2</sub> NAAQS, the health impacts of short-term exposures to SO<sub>2</sub> can be significant. This includes consideration of SO<sub>2</sub> as the indicator for all of the forms of gaseous sulfur oxide (SO<sub>x</sub>) pollutants, such as SO<sub>3</sub>, as well as consideration of the impact of SO<sub>2</sub> as a precursor to the formation of fine particulate matter (see 81 FR 45041 (July 12, 2016)).

Current scientific evidence links short-term exposures to SO<sub>2</sub>, ranging from 5 minutes to 24 hours, with an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms. These effects are particularly important for asthmatics at elevated ventilation rates (e.g., while exercising or playing). Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly and asthmatics.

The EPA’s NAAQS for SO<sub>2</sub> is designed to protect against exposure to the entire group of sulfur oxides (SO<sub>x</sub>). SO<sub>2</sub> is the component of greatest concern and is used as the indicator for the larger group of gaseous SO<sub>x</sub>. Other gaseous SO<sub>x</sub> (e.g., SO<sub>3</sub>) are found in the atmosphere at concentrations much lower than SO<sub>2</sub>.

Emissions that lead to high concentrations of SO<sub>2</sub> generally also lead to the formation of other SO<sub>x</sub>. Control measures that reduce SO<sub>2</sub> can generally be expected to reduce people’s exposures to all gaseous SO<sub>x</sub>. This may also have the important co-benefit of reducing the formation of fine sulfate particles, which pose significant public health threats. SO<sub>x</sub> can react with other compounds in the atmosphere to form small particles. These particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. The EPA’s NAAQS for particulate matter are designed to provide protection against these health effects.

On April 3, 2012, the EPA took final action to retain the existing secondary (welfare-based) NAAQS for oxides of nitrogen and sulfur (77 FR 20218). This final rule took effect on June 4, 2012. EPA sets secondary standards to protect against environmental damage caused by certain air pollutants. In reviewing the existing science concerning ecological effects from sulfur oxides (SO<sub>x</sub>) and nitrogen oxide (NO<sub>x</sub>) exposure, EPA considered the effects of exposures to these pollutants in the gas phase (airborne) and also in the various gas, liquid, and solid forms that may be deposited from the air onto ecosystems on land and in water such as lakes and streams. Ecosystem effects of concern include, for example, stream acidification which can lead to reductions in the diversity of fish species and declines in fish populations’ health; damage such as foliar (leaf) injury and decreases in photosynthesis and growth of vegetation; and soil acidification leading to decreased growth and increased susceptibility to disease and injury among certain tree species such as sugar maple and red spruce.<sup>14</sup>

EPA decided to retain the existing secondary NAAQS as is, to protect against direct damage to vegetation by exposure to gas-phase oxides of nitrogen and sulfur, such as foliar injury, decreased photosynthesis, and decreased growth. They did not add any new standards to address deposition of

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<sup>14</sup> See, “Overview of Effects,” in “Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Sulfur; Final Rule,” 77 FR 20224-20226 (April 3, 2012), available at <https://www.gpo.gov/fdsys/pkg/FR-2012-04-03/pdf/2012-7679.pdf>, accessed October 19, 2017.

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oxides of sulfur and nitrogen onto sensitive ecosystems. They did, however, include in the rule a description of “a field pilot program being developed to enhance our understanding of the degree of protectiveness that would likely be afforded by a multi-pollutant standard to address deposition-related acidification of sensitive aquatic ecosystems.”<sup>15</sup>

The secondary standard for SO<sub>2</sub> is 0.5 ppm (or 500 ppb) averaged over three hours, not to be exceeded more than once per year.

## **1.2 Sulfur Dioxide in the Anne Arundel County and Baltimore County, MD Nonattainment Area**

The major sources of air emissions of SO<sub>2</sub> have historically been large industrial coal- and oil-burning facilities including power plants, smelters, steel producers, pulp paper manufacturers, fertilizer manufacturers, and mobile and non-road sources that burn high-sulfur fuels. The major industrial sources of SO<sub>2</sub> in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area are the following power plants, which together emitted over 14,600 tons per year of sulfur dioxide in 2014.

- Brandon Shores Generating Station (“Brandon Shores”), which includes two coal-fired electric generating units.
- Herbert A. Wagner Generating Station (“Wagner”), which includes two coal-fired electric generating units, one #6 fuel oil-fired unit and one dual fuel (natural gas and fuel oil) unit.
- Charles P. Crane Generating Station (“Crane”), which includes two coal-fired electric generating units.

In addition, the Wheelabrator Baltimore waste-to-energy incinerator emits sulfur dioxide at approximately 310 tons per year in 2014

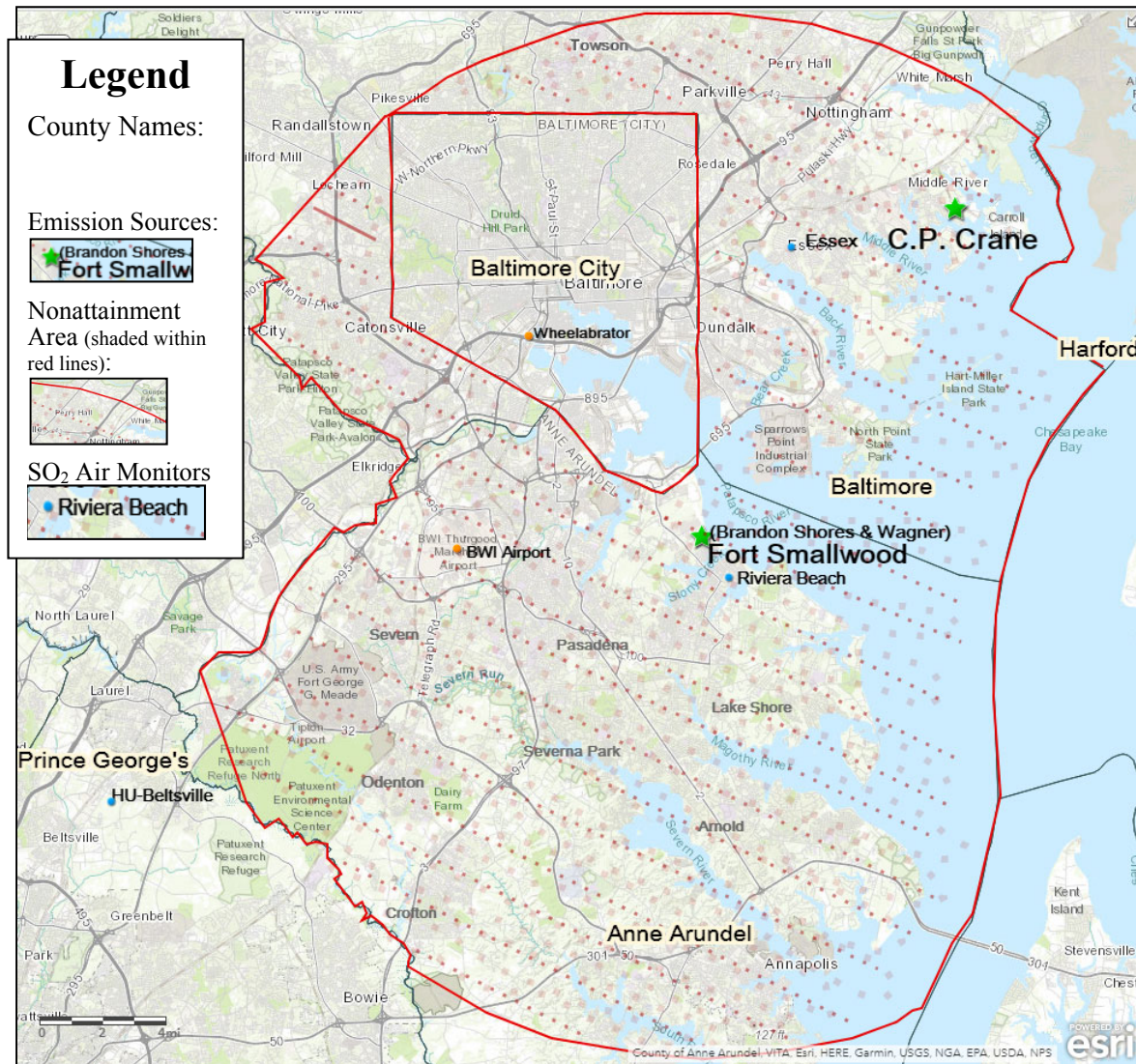
The location of these emission sources of SO<sub>2</sub> in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area is shown in Figure 1.

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<sup>15</sup> Ibid, 77 FR 20218 (April 3, 2012).

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Figure 1: Anne Arundel County and Baltimore County Nonattainment Area



The above map was created using <https://maryland.maps.arcgis.com> and is courtesy of Baltimore and Anne Arundel Counties, VITA, Esri, HERE, Garmin, Intermap, USGS, NGA, EPA, USDA, and NPS.

The nonattainment area includes the shaded area of the map within the red outline, which includes portions of Anne Arundel County and Baltimore County within 26.8 km (16.7 miles) of the Wagner Unit 3 stack. Baltimore City is not part of the nonattainment area, but is instead designated “unclassifiable/attainment.”<sup>16</sup>

The Brandon Shores Generating Station and Herbert A. Wagner Generating Station are located together on a 456-acre site at the Fort Smallwood Complex in Anne Arundel County. According to the Part 70 Operating Permit Fact Sheet for these sources, “The primary emission units at Brandon Shores are two (2) coal-fired generating units with a combined nominal generating capacity of approximately

<sup>16</sup> Air Quality Designations for the 2010 Sulfur Dioxide (SO<sub>2</sub>) Primary National Ambient Air Quality Standard—Round 2, U.S. Environmental Protection Agency (EPA), 81 Fed. Reg. 45039 (July 12, 2016) (to be codified at 40 CFR pt. 81).

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1,370 megawatts (MW). Each unit has a rated capacity of 7,128 million British thermal units per hour (MMBtu/hr).<sup>17</sup> Note that each unit is equipped with a flue gas desulfurization system (FGD or “scrubber”) for the removal of SO<sub>2</sub> from the flue gas.

For Wagner, the permit fact sheet says the following: “the primary emission units at Wagner are four steam-electric generating units with a combined nominal rating of approximately 1,040 MW.”

- Wagner Unit #1 is a “natural gas-fired (No. 6 fuel-oil backup) B&W [Babcock & Wilcox] dry bottom wall-fired boiler,” and is rated at 1,337 MMBtu/hr.
- “Unit #2 is a B&W dry bottom wall-fired (coal)-fired natural circulation steam boiler equipped with low NO<sub>x</sub> burners... and is also rated at 1,337 MMBtu/hr.”
- “Unit #3 is a B&W coal-fired, once-through supercritical steam boiler... rated at 2,740 MMBtu/hr.”
- “Unit #4 is a B&W dry bottom wall-fired No. 6 fuel oil-fired steam boiler,” and is rated at 4,200 MMBtu/hr.
- “All four units use natural gas for startup and main burner ignition.”<sup>18</sup>

Note that Wagner Unit #2 uses low-chlorine coal to comply with the federal Mercury and Air Toxics Standards (MATS) for hydrogen chloride (HCl), and this coal also happens to have significantly lower sulfur content, helping with reducing the unit’s SO<sub>2</sub> emissions. Wagner Unit #3 has a dry sorbent injection system for HCl control for compliance with the MATS. This system has a co-benefit of reducing SO<sub>2</sub> emissions slightly.

The Charles P. Crane Generating Station generates SO<sub>2</sub> emissions primarily from Crane Units #1 and #2, each of which consists of a “solid fossil fuel-fired cyclone steam boiler with natural gas used for start-up purposes,” according to the Part 70 Operating Permit for these sources.<sup>19</sup> Crane Unit #1 has a nominal generating capacity of 190 MW, and Unit #2 195 MW. The heat rated capacity for each unit is estimated at 2,500 MMBtu/hr. The Crane units generally burn low-sulfur coal, which reduces their SO<sub>2</sub> emissions, and they installed a dry sorbent injection system (DSI) to reduce HCl in compliance with the MATS rule. The DSI, in combination with the baghouses installed at Crane to control particulate emissions, also reduces SO<sub>2</sub> emissions.

### 1.3 SIP Requirements for Nonattainment Areas

The Clean Air Act requires that areas designated “nonattainment” for the sulfur dioxide NAAQS fulfill certain requirements. Firstly, these areas must meet the requirements found in Section 172 of the Clean Air Act, located in the U.S. Code at 42 U.S.C. Sec. 7502, “Nonattainment plan provisions in general.”<sup>20</sup> This section addresses the following issues: attainment dates for nonattainment areas; nonattainment plan provisions; plan revisions required in response to finding of plan inadequacy; and

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<sup>17</sup> Raven Power Fort Smallwood LLC, Brandon Shores and Wagner Generating Stations, 1005 Brandon Shores Road, Baltimore MD 21226, Permit No. 24-003-0468, Part 70 Operating Permit Fact Sheet, page 1.

<sup>18</sup> Ibid, page 2.

<sup>19</sup> C.P. Crane, LLC, 1001 Carroll Island Road, Chase, Maryland 21220, Part 70 Operating Permit No. 24-005-00079.

<sup>20</sup> 42 U.S.C. Section 7502, United States Code, 2013 edition, U.S. Government Publishing Office, available at <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapl-partD-subpart1-sec7502.htm>, accessed on October 31, 2017.

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future modification of standard, including relaxation of a national primary ambient air quality standard. Secondly, nonattainment areas for SO<sub>2</sub> must meet the requirements under Sections 191 and 192 of the Clean Air Act (42 U.S.C. Sec. 7514 and 7514a).<sup>21,22</sup> See the previous description of these sections of the Clean Air Act, on page 8 of this document.

Beyond the Clean Air Act, the EPA has issued guidance to assist with implementation of the 1-hour SO<sub>2</sub> NAAQS, particularly the development of this nonattainment area SIP revision. The latest guidance, from 2014, is “Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions.”<sup>23</sup> In the 2014 guidance, EPA also cites the following: the General Preamble published in the Federal Register on April 16, 1992 (see 57 FR 13498, at 13545)<sup>24</sup> and the SO<sub>2</sub> Guideline Document, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, EPA-452/R-94-008, February 1994.<sup>25</sup> EPA notes that where the 2014 guidance has not altered the earlier guidance, then the earlier guidance is still in effect.

## 1.4 SIP Process

The Clean Air Act requires states to develop and implement SO<sub>2</sub> emission reduction strategies in the form of a SIP revision. The SIP is the state's "master plan" for attaining and maintaining the SO<sub>2</sub> and other pollutants' NAAQS.

Once the administrator of the EPA approves a state implementation plan revision, the revision becomes part of the plan and is enforceable as federal law under Section 113 of the Clean Air Act (see 42 U.S.C. Sec. 7413).<sup>26</sup> If EPA finds the SIP inadequate to attain the NAAQS in all or any regions of the state, and if the state fails to make the requisite amendments to address the deficiency, the EPA administrator may issue a Federal Implementation Plan (FIP) under CAA Section 110(c)(1).<sup>27</sup>

EPA is required to impose sanctions on the states under three circumstances:

- (1) The state fails to submit a SIP revision;
  - (2) EPA makes a finding of the inadequacy of the SIP to meet prescribed air quality requirements;
- and

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<sup>21</sup> 42 U.S.C. Section 7514, United States Code, 2013 edition, “Plan Submission Deadlines,” U.S. Government Publishing Office, available at <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchap1-partD-subpart5-sec7514.htm>, accessed November 1, 2017.

<sup>22</sup> 42 U.S.C. Section 7514a, United States Code, 2013 edition, “Attainment Dates,” U.S. Government Publishing Office, available at <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchap1-partD-subpart5-sec7514a.htm>, accessed November 1, 2017.

<sup>23</sup> See U.S. Environmental Protection Agency (EPA), Memorandum from Stephen D. Page, Director, to Regional Air Division Directors, Regions 1-10, April 23, 2014, [https://www.epa.gov/sites/production/files/2016-06/documents/20140423guidance\\_nonattainment\\_sip.pdf](https://www.epa.gov/sites/production/files/2016-06/documents/20140423guidance_nonattainment_sip.pdf), accessed November 1, 2017.

<sup>24</sup> See U.S. Government Publishing Office, <https://www.gpo.gov/fdsys/pkg/FR-1992-04-16/pdf/FR-1992-04-16.pdf#page=242>, page 13545.

<sup>25</sup> See the U.S. Environmental Protection Agency, National Service Center for Environmental Publications (NSCEP), <https://www.epa.gov/nscep>, for a copy of the 1994 guidelines document, EPA-452/R-94-008.

<sup>26</sup> 42 U.S.C. Section 7413, United States Code, 2013 edition, “Federal Enforcement,” U.S. Government Publishing Office, available at <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchap1-partA-sec7413.htm>, accessed November 2, 2017.

<sup>27</sup> 42 U.S.C. Section 7410; see referenced sections of the Clean Air Act are available at <https://www.epa.gov/clean-air-act-overview/clean-air-act-title-i-air-pollution-prevention-and-control-parts-through-d#ia>, accessed November 2, 2017.

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(3) The state fails to enforce the control strategies that are contained in the SIP. Sanctions include more stringent New Source Review offset requirements (2:1) and the withholding of federal funds for highway projects, other than those for safety, mass transit, or transportation improvement projects related to air quality improvement or maintenance. The New Source Review sanction would begin 18 months after an EPA disapproval of the SIP and the withholding of federal funds for highway projects sanction would begin 24 months after an EPA disapproval. In addition, no federal agency or department will be able to award a transportation grant or fund, license, or permit any other transportation project that does not conform to the most recently approved SIP.<sup>28</sup>

## 1.5 State Commitment/Implementation Assurances

The measures in the SIP must be supported by any necessary legislative authority, and these measures must be adopted by the applicable governmental body responsible for their implementation. The Maryland General Assembly provides legislative authority to MDE and other state agencies responsible for the SIP's implementation. In turn, MDE and other agencies, as needed, adopt the measures in the SIP such as through promulgating state regulations and establishing legally binding agreements with SO<sub>2</sub> emissions sources.

In order to provide states with guidance on developing effective control strategies, EPA has identified four fundamental principles that SIP control strategies must adhere to in order to achieve the desired emissions reductions. These four fundamental principles are outlined in the General Preamble to Title I of the Clean Air Act at 57 Federal Register 13498, at 13567, April 16, 1992.<sup>29</sup> The four fundamental principles are:

- a) Quantification: Emissions reductions ascribed to the control measure must be quantifiable and measurable;
- b) Enforceability: The control measures must be enforceable, in that the state must show that they have adopted legal means for ensuring that sources are in compliance with the control measure;
- c) Replicability: Measures are replicable, including having procedures that are sufficiently specific and non-subjective, so that different parties would interpret and enforce them the same way; and
- d) Accountability: The control strategy is accountable; for example, source-specific emission limits are permanent and consistent with the SIP attainment demonstrations, and the SIP contains methods, such as permits, to track emissions changes at sources and make modifications if emissions reductions are not achieved as planned.

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<sup>28</sup> See Section 179 of the Clean Air Act, 42 U.S.C. 7509, "Sanctions and Consequences of Failure to Attain," <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchap1-partD-subpart1-sec7509.htm>, accessed November 2, 2017.

<sup>29</sup> See U.S. Government Publishing Office, <https://www.gpo.gov/fdsys/pkg/FR-1992-04-16/pdf/FR-1992-04-16.pdf#page=242>, page 13567, accessed November 6, 2017.



## 1.6 Public Participation

Requirements for a public participation process, including a public comment period and public hearing, are set forth in Section 110(a)(2) of the CAA and in 40 CFR § 51.102.<sup>30,31</sup>

## 1.7 Submittal of the Plans

These state implementation plans are developed through a public process and then they are formally adopted by the State and submitted by the Maryland Governor's designee to EPA's Region III office. The Clean Air Act requires EPA to review each SIP and to approve the plan if it meets all of the relevant applicable requirements within the Clean Air Act. CAA Section 110(k) (42 U.S.C. 7410) gives EPA six months to review the state's SIP submittal and to determine if it meets the minimum criteria (is "complete"), and 12 months from the completeness assessment deadline to determine if that complete SIP can be partially or fully approved.

## 1.8 Failure to Submit

The EPA Administrator is required under Section 179(a) of the CAA, 42 U.S.C. § 7509(a), to impose sanctions based on four types of actions:

- (1) A finding that a state has failed, for an area designated nonattainment under section 7407(d) of the CAA, to submit a SIP or a SIP element, or a finding that it has submitted a SIP or SIP element that does not satisfy the completeness criteria under CAA Sec. 7410(k);
- (2) EPA disapproval of a SIP in whole or in part under section 7410(k) of the CAA, for an area designated nonattainment under section 7407;
- (3) A determination that the state has not made any other required submission, has made an inadequate submission (as required by the CAA), or that EPA disapproves the submission; or
- (4) A finding that a requirement of an approved SIP is not being implemented.

Section 179 of the CAA (42 U.S.C. 7509)<sup>32</sup> and 40 C.F.R. § 52.31<sup>33</sup> explain that if the State fails to correct any SIP deficiency within 18 months from the Administrator's finding, determination or disapproval, EPA may impose limitations on certain federal highway transportation funding or impose

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<sup>30</sup> See Section 110 of the Clean Air Act, 42 U.S.C. 7410, "State implementation plans for national primary and secondary ambient air quality standards," <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partA-sec7410.htm>, accessed November 6, 2017.

<sup>31</sup> See 40 CFR Part 51.102, U.S. Government Publishing Office (GPO), <https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol2/pdf/CFR-2017-title40-vol2-part51.pdf>, pages 185-186, accessed November 6, 2017.

<sup>32</sup> See 42 U.S.C. 7509, "Sanctions and Consequences of Failure to Attain," <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart1-sec7509.htm>, accessed November 2, 2017.

<sup>33</sup> See 40 CFR 52.31, "Selection of sequence of mandatory sanctions for findings made pursuant to section 179 of the Clean Air Act," U.S. Environmental Protection Agency (EPA), Government Publishing Office, <https://www.gpo.gov/fdsys/pkg/CFR-2016-title40-vol3/pdf/CFR-2016-title40-vol3-sec52-31.pdf>, accessed November 6, 2017.

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“offset” limitations on new developments in affected areas such that each new or modified stationary emission source of SO<sub>2</sub> must reduce emissions by double the amount of increased emissions from the new source. If the State fails to correct the deficiency within another 6 months, though, limitations on certain federal highway transportation funding and the requirement for increased offsets both must be imposed.

In addition, Section 110(c) of the Clean Air Act indicates the criteria under which EPA can issue a Federal Implementation Plan (FIP) for a nonattainment area. Overall, the EPA can issue a FIP anytime within two years of making a finding that a State has not submitted a required SIP, or has submitted one but it does not meet the completeness criteria. Also, EPA can issue a FIP within the two-year window if EPA has disapproved a State’s SIP in part or in full. If, however, a State issues a correction to address EPA’s finding, and EPA approves this correction before promulgating a FIP, then the FIP can be averted.

On September 20, 2019, the EPA found that Maryland failed to submit a complete SIP showing how areas in each state will address nonattainment of the 2010 1-Hour Primary SO<sub>2</sub> NAAQS (84 FR 49462).

In accordance with Section 179 of the CAA, the finding triggered a mandatory 18-month sanction “clock” that began on Oct 21, 2019, the effective date of EPA’s publication of the findings in the Federal Register. Similarly, these findings establish a statutory deadline of no more than 24 months by which the EPA must either approve a complete SIP submittal or finalize a Federal Implementation Plan (FIP) that addresses the outstanding nonattainment area SIP requirements to ensure attainment by the attainment date.

Maryland is submitting this attainment demonstration to the EPA for approval as a revision to Maryland’s SIP. An EPA determination that Maryland has submitted a “complete” SIP revision will stop the sanctions “clock” and EPA approval of the SIP revision will stop the FIP “clock.” 40 C.F.R. § 52.31.

## 2.0 EMISSION INVENTORIES

States are required under Section 172(c)(3) of the CAA to develop comprehensive, accurate and current emission inventories of all sources of the relevant pollutant in the nonattainment area. In general, point sources are expected to be the primary contributors to violations of the 2010 1-hour SO<sub>2</sub> NAAQS. These sources report emissions annually to the Department in accordance with the provisions of the Code of Maryland Regulations (COMAR) (relating to reporting of sources).

For the base year inventory (2014), actual emissions from the sources of SO<sub>2</sub> in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area are included. Projected emissions are included for the 2021 attainment year inventory. The inventory includes emissions as described for each of the following segments:

- **Point sources** are those sources for which the Department collects individual emissions-related information and then submits the inventory to EPA through the Emission Inventory System (EIS). Generally, they represent major stationary sources for which permits are issued but may also include smaller point sources as well.
- **Nonpoint/Area sources** of SO<sub>2</sub> include:
  - Nonpoint/Area sources are the industrial, commercial, and residential sources too small or too numerous to be handled individually. Where stationary point sources and stationary area sources overlap, the nonpoint/area source values are adjusted to remove any double counting.
- **Quasi-Point sources** are facilities that due to size and/or function are considered point sources. These establishments contain a wide variety of air emission sources, including traditional point sources, on-road mobile sources, off-road mobile sources and area sources. For each particular establishment, the emissions from these sources are totaled under a single point source and summary documents include these “quasi-point” sources as point sources. Quasi-Point sources of SO<sub>2</sub> include:
  - Baltimore/Washington International Airport (BWI).
- **Nonroad Mobile Model sources** of SO<sub>2</sub> include:
  - Nonroad sources, which can encompass a diverse collection of engines.
- **Nonroad Mobile Marine-Air-Rail (M-A-R) sources** of SO<sub>2</sub> include:
  - Nonroad M-A-R sources encompass a diverse collection of engines from marine vessels, airports (other than BWI) and railroads.
- **Onroad Mobile sources** of SO<sub>2</sub> include:

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- On road sources, which include highway vehicles (cars, light-duty trucks, heavy-duty trucks and buses).

MDE used emissions inventory data extracted from various databases for the base year inventory (2014) including in-house database systems, the Mid-Atlantic Regional Air Management Association (MARAMA) Emissions Modeling Framework (EMF) system, and the EPA National Emissions Inventory (NEI), which was compiled mainly based on EIS data from state, local and tribal input to provide the data necessary for inventory projection and air quality modeling to be used in addressing SIP requirements.

See Appendix A-1 for the Emission Inventory Methodology Documentation from MDE’s full inventory analysis.

## 2.1 2014 Base Year Emission Inventory

An emission inventory was developed for SO<sub>2</sub> in accordance with EPA’s 2014 SO<sub>2</sub> SIP Guidance.<sup>34</sup> This 2014 base year emission inventory is intended to satisfy the requirement of Section 172(c)(3) of the CAA, 42 U.S.C. § 7502(c)(3). The values in all the tables of this inventory section have been rounded to two decimal places.

**Table 1: Base Year 2014 Sulfur Dioxide Emission Inventory**

Anne Arundel County and Baltimore County, MD SO <sub>2</sub> Nonattainment Area Emission Source Category	SO <sub>2</sub> Annual Emissions (tpy)
Stationary Point Sources	14,675.76
Quasi-Point Sources	121.70
Area Sources	960.59
Non-road MOVES Model Sources	11.42
Marine-Air-Rail Sources	227.29
On-road Highway Sources	96.55
<b>TOTAL</b>	<b>16,093.31</b>

### 2.1.1 Point Source Emissions

As shown in Table 1 above, SO<sub>2</sub> emissions from point sources account for over 91% of all SO<sub>2</sub> emissions tabulated in the nonattainment area. In 2014, 51 facilities reported SO<sub>2</sub> emissions as point sources in the Anne Arundel County and Baltimore County, MD SO<sub>2</sub> nonattainment area.

<sup>34</sup> See, footnote 1, above, for full citation to this EPA guidance.

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Table 2 displays the emissions of each point source facility in the nonattainment area that reported 2014 emissions of greater than six tons SO<sub>2</sub>. Emissions from all point sources reporting six tons or less SO<sub>2</sub> were a combined 28.579 tons SO<sub>2</sub>, as shown on Table 2. Note that, in addition to the SO<sub>2</sub> emissions from the main electric generating units (EGU) at Brandon Shores, Wagner and C.P. Crane, Table 2 also lists a smaller emission amount for the ancillary sources at those power stations. The 2014 SO<sub>2</sub> emissions from the EGU facilities account for over 99% of the annual SO<sub>2</sub> emissions from all point sources within the nonattainment area.

See Appendix A-3 for the detailed point source emissions extracted from MDEs TEMPO database system and accounted for in this SIP revision.

**Table 2: Point Source 2014 Actual Sulfur Dioxide Emission Inventory**

<b>Facility</b>	<b>2014 SO<sub>2</sub> Annual Emissions (tpy)</b>
Brandon Shores	3,145.09
Wagner	9,610.26
C.P. Crane	1,887.16
All Other Point Sources Combined	33.26
<b>TOTAL</b>	<b>14,675.76</b>

### 2.1.2 Quasi-Point Source Emissions

Compared to the point source emissions discussed above, the emissions of SO<sub>2</sub> from quasi-point sources are relatively small. MDE identified only one source, BWI International Airport, as a quasi-point source within the nonattainment area.

The complete tables of the Quasi-Point source emissions by Source Classification Code (SCC) for the nonattainment area can be found in Appendix A-4.

### 2.1.3 Area/Nonpoint Source Emissions

Compared to the point source emissions discussed above, the emissions of SO<sub>2</sub> from area/nonpoint source category are relatively small. The area/nonpoint source emissions are calculated on a county-level basis.

The Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area bisects zip codes and cities such as Towson, Pikesville, White Marsh, and Lochearn-Milford Mill-Randallstown, making the proportioning of the county-level emission estimates to the finer resolution of the nonattainment area unfeasible. Since the SO<sub>2</sub> emissions from this source category are relatively small when compared to point source emissions, and proportioning the county-level emissions from this source category would

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only decrease their relative importance, MDE decided to include all of the county-level emissions from this source category.

Complete tables of the Area/Nonpoint source emissions by Source Classification Code (SCC) for the nonattainment area can be found in Appendix A-5.

#### **2.1.4 NONROAD MOVES Model Source Emissions**

Compared to the point source emissions discussed above, the emissions of SO<sub>2</sub> from the NONROAD MOVES Model source category are relatively small. The NONROAD MOVES Model source emissions are calculated on a county-level basis.

As noted above for the area/nonpoint source emissions, the Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area bisects zip codes and cities such as Towson, Pikesville, White Marsh, and Lochearn-Milford Mill-Randallstown, making the proportioning of the county-level emission estimates to the finer resolution of the nonattainment area unfeasible. Since the SO<sub>2</sub> emissions from this source category are relatively small when compared to point source emissions and proportioning the county-level emissions from this source category would only decrease their relative importance, MDE decided to include all of the county-level emissions from this source category.

Complete tables of the NONROAD MOVES Model source emissions by Source Classification Code (SCC) for the nonattainment area can be found in Appendix A-6.

#### **2.1.5 Marine-Air-Rail Source Emissions**

Compared to the point source emissions discussed above, the emissions of SO<sub>2</sub> from Nonroad Marine-Air-Rail (M-A-R) source category are relatively small. The M-A-R source emissions are calculated on a fuel consumption basis and allocated to geographical locations based on shape files.

As noted above, the Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area bisects zip codes and cities such as Towson, Pikesville, White Marsh, and Lochearn-Milford Mill-Randallstown, making the proportioning of the county-level emission estimates to the finer resolution of the nonattainment area unfeasible. Since the SO<sub>2</sub> emissions from this source category are relatively small when compared to point source emissions and proportioning the county-level emissions from this source category would only decrease their relative importance, MDE decided to include all of the county-level emissions from this source category.

Complete tables of the M-A-R source emissions by Source Classification Code (SCC) for the nonattainment area can be found in Appendix A-7.

### 2.1.6 Onroad Source Emissions

Compared to the point source emissions discussed above, the emissions of SO<sub>2</sub> from ONROAD MOVES Model source category are relatively small. The ONROAD MOVES Model<sup>35</sup> source emissions are calculated on a county-level basis.

As noted above, the Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area bisects zip codes and cities such as Towson, Pikesville, White Marsh, and Locheam-Milford Mill-Randallstown, making the proportioning of the county-level emission estimates to the finer resolution of the nonattainment area unfeasible. Since the SO<sub>2</sub> emissions from this source category are relatively small when compared to point source emissions and proportioning the county-level emissions from this source category would only decrease their relative importance, MDE decided to include all of the county-level emissions from this source category.

Complete tables of the ONROAD MOVES Model source emissions by County summed at a Source Classification Code (SCC) level for the two counties can be found in Appendix A-8.

## 2.2 2021 Projected Attainment Inventories

### 2.2.1 Summary of 2021 Estimated Emissions

Table 3 summarizes the SO<sub>2</sub> emissions projected in the Anne Arundel County and Baltimore County Maryland nonattainment area in 2021. These emissions take activity and emissions growth and/or controls into account where available. The SO<sub>2</sub> emission reductions from stationary point sources are derived solely from the coal-fired electric generating units identified as the main contributors to the SO<sub>2</sub> nonattainment designation. SO<sub>2</sub> emissions are expected to decrease by approximately 4,790 tons or 30% from 2014 to 2021.

The table is based on data from the MDE’s emissions inventory but has been manually adjusted to account for projected operational strategies and conditions and applicable emission limits. See Appendix A for the detailed breakdown of the point, quasi-point, area, nonroad and on-road mobile 2021 emission projection tables.

**Table 3: Projection Year 2021 Sulfur Dioxide Emission Inventory**

Anne Arundel County and Baltimore County, MD SO <sub>2</sub> Nonattainment Area Emission Source Category	SO <sub>2</sub> Annual Emissions (tpy)
Stationary Point Sources	9,683.98
Quasi-Point Sources	149.42
Area Sources	983.48

<sup>35</sup> MOVES Model v2014a PPSuites Process with all 2014 updates

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Non-road MOVES Model Sources	5.81
Marine-Air-Rail Sources	261.56
On-road Highway Sources	48.00
<b>TOTAL</b>	<b>11,132.25</b>

Table 4 depicts the detailed breakdown of the projected stationary point sources for the attainment year (2021) that includes the permanent and enforceable control measures in the form of emission limits for the specific EGU facilities.



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**Table 4: Point Source 2021 Projected Sulfur Dioxide Emission Inventory**

Facility	2014 Actual SO <sub>2</sub> Emissions (tpy)	2021 Projected SO <sub>2</sub> Emissions (tpy)
Brandon Shores Unit 1	1,669.90	1,669.90
Brandon Shores Unit 2	1,475.19	1,475.19
H.A. Wagner Unit 3	7,276.12	4,626.72
H.A. Wagner Unit 1	72.62	58.91
H.A. Wagner Unit 2	1,938.99	10.00
H.A. Wagner Unit 4	322.53	242.84
C.P. Crane Unit 1	573.38	1,566.49
C.P. Crane Unit 2	1,313.78	
All Other Point	33.26	33.92
<b>Total</b>	<b>14,675.76</b>	<b>9,683.98</b>

### 2.2.2 Growth Projection Methodologies

MDE used a variety of growth surrogates to project the base year emissions. The projection inventory therefore reflects the operational conditions of the base year. Appropriate growth surrogates, including population, housing, employment and vehicles miles traveled, were applied to each source category to produce the emission projections for 2021. The detailed methodology for the projection emissions inventory is explained in Appendix A-2.

The electric generating units that are the focus of this SIP were adjusted to account for the projected operational strategies, conditions and emission limits reflected in the consent agreements for the units, which are incorporated by reference in the attainment plan. A detailed analysis of the methodology for calculating the reductions is explained in Appendix A-9.

### 3.0 CONTROL STRATEGIES

#### 3.1 Permanent and Enforceable Control Measures

This section describes the federal and state measures that have provided emissions reductions both prior to and since the 2014 base year, leading to the attainment and maintenance of the 2010 1-hour SO<sub>2</sub> NAAQS.

##### 3.1.1 National Rules

Facility specific compliance strategies to meet New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), the Acid Rain trading program and the federal Cross-State Air Pollution Rule (CSAPR) may result in SO<sub>2</sub> reductions. If included in federally enforceable permits, these compliance strategies provide permanent and enforceable emission reductions of SO<sub>2</sub>. In addition, EPA along with the International Maritime Organization (IMO) has instituted global standards related to air pollution.

Section 112(d) of the CAA, 42 U.S.C. § 7412(d), requires EPA to regulate hazardous air pollutants from major stationary sources based on the performance of Maximum Achievable Control Technology (MACT) standards. EPA established final emission standards for industrial, commercial, and institutional boilers and process heaters at major sources to meet the NESHAP at 40 C.F.R. Part 63 Subpart DDDDD, also known as the Boiler MACT. This MACT was finalized on March 21, 2011 (76 FR 15608). EPA promulgated final amendments to the Boiler MACT on January 31, 2013 (78 FR 7138). On November 20, 2015 (80 FR 72790), EPA took final action on the reconsideration of outstanding issues pertaining to the 2013 Boiler MACT amendments. The Boiler MACT specifically regulates mercury, hydrogen chloride, carbon monoxide and particulate matter; however, compliance with these standards may also significantly reduce SO<sub>2</sub> emissions.

EPA established National Emission Standards for Hazardous Air Pollutants (NESHAP) for Coal and Oil-Fired Electric Utility Steam Generating Units,” 40 CFR Part 63, Subpart UUUUU,<sup>36</sup> also known as the Mercury and Air Toxics Rule (MATS). The MATS rule, which was published on February 16, 2012 (77 FR 9304), applies to certain boilers and incinerators. The rule does not directly require that sources reduce SO<sub>2</sub>; however, control measures to comply with the rule namely, scrubbers, also reduce SO<sub>2</sub>. Alternatively, facilities can choose to meet an SO<sub>2</sub> emission limit as a way to limit their hydrochloric acid and hydrofluoric acid emissions.

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<sup>36</sup> See U.S. Government Publishing Office (GPO), <https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol16/pdf/CFR-2017-title40-vol16-part63-subpartUUUUU.pdf>, accessed November 28, 2017. The original publication of the rule is here: The U.S. Environmental Protection Agency (EPA), “National Emission Standards for Hazardous Air Pollutants From Coal and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units,” Final Rule, 77 FR 9304, February 16, 2012, available at <https://www.gpo.gov/fdsys/pkg/FR-2012-02-16/pdf/2012-806.pdf#page=2>, accessed November 28, 2017.

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*NEW SOURCE PERFORMANCE STANDARDS (NSPS)*

Fossil fuel-fired steam generators subject to NSPS have facility-specific strategies in place to meet New Source Performance Standards. In particular, fossil fuel-fired steam generators must limit their sulfur oxide emissions to comply with federally enforceable Clean Air Act Title V permit requirements for New Source Performance Standards (NSPS)-Standards of Performance for Fossil-Fuel-Fired Steam Generators,<sup>37</sup>

**40 CFR Part 60 Subpart D**—Standards of Performance for Fossil-Fuel-Fired Steam Generators (NSPS)

**§60.43** - Standard for sulfur dioxide (SO<sub>2</sub>).

(a) Except as provided under paragraph (d) of this section, on and after the date on which the performance test required to be conducted by §60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases that contain SO<sub>2</sub> in excess of:

(1) 340 ng/J heat input (0.80 lb/MMBtu) derived from liquid fossil fuel or liquid fossil fuel and wood residue.

(2) 520 ng/J heat input (1.2 lb/MMBtu) derived from solid fossil fuel or solid fossil fuel and wood residue, except as provided in paragraph (e) of this section.”

(c) Compliance shall be based on the total heat input from all fossil fuels burned, including gaseous fuels.

The Fort Smallwood complex and C.P. Crane facilities have facility-specific strategies in place to meet the 40 CFR subpart D New Source Performance Standards. For example, Brandon Shores Unit 1 and Unit 2 must limit their sulfur oxide emissions to comply with federally enforceable Clean Air Act Title V permit requirements for New Source Performance Standards (NSPS)-Standards of Performance for Fossil-Fuel-Fired Steam Generators,<sup>38</sup>

*ACID RAIN PROGRAM / CROSS-STATE AIR POLLUTION RULE*

The Acid Rain Program (ARP)<sup>39</sup> established under [Title IV of the 1990 Clean Air Act \(CAA\) Amendments](#) requires major emission reductions of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>), the primary precursors of acid rain, from the power sector. The ARP sets a permanent cap on the total amount of SO<sub>2</sub> that may be emitted by electric generating units (EGUs) in the contiguous United States. The program was phased in, with the final 2010 SO<sub>2</sub> cap set at 8.95 million tons.

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<sup>37</sup> See Clean Air Act Section 111, “Standards of performance for new stationary sources,” 42 U.S.C. 7411, and Clean Air Act Section 129, “Solid waste combustion,” 42 U.S.C. 7429. See <https://www.epa.gov/clean-air-act-overview/clean-air-act-title-i-air-pollution-prevention-and-control-parts-through-d#ia>, accessed November 15, 2017. Also see 40 CFR Part 60.43, “Standard for sulfur dioxide (SO<sub>2</sub>)” U.S. Government Publishing Office (GPO), <https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol7/pdf/CFR-2017-title40-vol7-sec60-43.pdf>, 40 CFR Ch. 1 (7-1-17 Edition), accessed November 16, 2017.

<sup>38</sup> See Clean Air Act Section 111, “Standards of performance for new stationary sources,” 42 U.S.C. 7411, and Clean Air Act Section 129, “Solid waste combustion,” 42 U.S.C. 7429. See <https://www.epa.gov/clean-air-act-overview/clean-air-act-title-i-air-pollution-prevention-and-control-parts-through-d#ia>, accessed November 15, 2017. Also see 40 CFR Part 60.43, “Standard for sulfur dioxide (SO<sub>2</sub>)” U.S. Government Publishing Office (GPO), <https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol7/pdf/CFR-2017-title40-vol7-sec60-43.pdf>, 40 CFR Ch. 1 (7-1-17 Edition), accessed November 16, 2017.

<sup>39</sup> See Title IV – Acid Deposition Control, of the Clean Air Act Amendments of 1990, now contained in 40 CFR Parts 72 through 78, available at <https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol18/pdf/CFR-2017-title40-vol18-chap1-subchapC.pdf>, accessed November 28, 2017.

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The Cross-State Air Pollution Rule (CSAPR)<sup>40</sup> was adopted on July 6, 2011 to address air pollution from upwind states that crosses state lines and affects air quality in downwind states. The CSAPR requires fossil fuel-fired electric generating units at coal-, gas-, and oil-fired facilities in 27 states (of which Maryland is one) to reduce emissions to help downwind areas attain fine particle and/or ozone NAAQS. This rule requires certain states in the eastern half of the U.S. to improve air quality by reducing power plant emissions of sulfur dioxide (SO<sub>2</sub>) and oxides of nitrogen (NO<sub>x</sub>) that cross state lines and contribute to smog and soot pollution in downwind states.

The Fort Smallwood and C.P. Crane facilities comply with the Acid Rain Program and the Cross-State Air Pollution Rule.

*MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY (MACT)*

As described above, EPA established National Emission Standards for Hazardous Air Pollutants for Coal and Oil-Fired Electric Utility Steam Generating Units,” 40 CFR Part 63, Subpart UUUUU, known as the Mercury and Air Toxics Standard (MATS). Brandon Shores Units 1 and 2, Wagner Units 2 and 3, and Crane Units 1 and 2 comply with federally enforceable Clean Air Act Title V permit requirements for the MATS rule, in particular, the standard for hydrogen chloride. Compliance with this rule results in some secondary benefits for SO<sub>2</sub> emission reductions at these units.

*EMISSION CONTROL AREA*

EPA participates on the U.S. delegation to the International Maritime Organization (IMO), which is part of the United Nations. The Marine Environment Protection Committee (MEPC) is a group of member states within IMO that works on maritime safety and security and the prevention of marine pollution. The resulting global standards are embodied in the International Convention on the Prevention of Pollution from ships, a treaty called "MARPOL." In particular, MARPOL Annex VI defines engine and vessel requirements related to air pollution. On March 26, 2010, the IMO officially designated waters off of North American coasts as an area in which stringent international emission standards will apply to ships. The first-phase sulfur in fuel standard began in 2012, the second phase began in 2015, and stringent NO<sub>x</sub> engine standards began in 2016.

Vessels operating in Emission Control Areas (ECA) must meet the following requirements:

- Fuel-sulfur concentrations may not exceed 0.10 weight percent, or vessels may use an approved equivalent method (such as SO<sub>x</sub> scrubbers, also known as “exhaust gas cleaning systems”).
- Engines above 130 kW installed on vessels built (or modified) since 2000 must be certified to meet appropriate emission standards corresponding to the vessel's build date (or modification date). As of January 1, 2016, engines installed on new and modified vessels are subject to the Annex VI Tier III NO<sub>x</sub> standards while those engines are operating in the ECA.

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<sup>40</sup> See 76 FR 48208, August 8, 2011. See <https://www.gpo.gov/fdsys/pkg/FR-2011-08-08/pdf/2011-17600.pdf#page=2>, accessed November 15, 2017.

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The international standards apply to both U.S. vessels and to foreign vessels. Engines installed on U.S. vessels are also subject to fuel standards and engine emission standards that EPA has adopted under the Clean Air Act.

The Port of Baltimore is located within the Baltimore City limits and as such is not part of the Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area; however, significant SO<sub>2</sub> reductions may be achievable through the global standards.

### 3.1.2 State Rules

#### *SULFUR CONTENT LIMITATIONS FOR FUEL*

The Fort Smallwood Complex electric generating units are required to comply with COMAR 26.11.09.07, “Control of Sulfur Oxides from Fuel Burning Equipment.” The units are located in the Baltimore Metropolitan Area, known as “Area III” of Maryland; accordingly, they are required to meet the following requirements:<sup>41</sup>

“COMAR 26.11.09.07A. Sulfur Content Limitations for Fuel. A person may not burn, sell, or make available for sale any fuel with a sulfur content by weight in excess of or which otherwise exceeds the following limitations:

- “(2) In Areas III and IV:
  - (a) All solid fuels, 1.0 percent;
  - (b) Distillate fuel oils, 0.3 percent;
  - (c) Residual fuel oils, 1.0 percent”<sup>42</sup>

C.P. Crane Units 1 and 2 are required to comply with limits on the content of sulfur in the fuel they burn, as indicated in the federally enforceable portion of their Clean Air Act Title V permit. Specifically, the units are required to comply with COMAR 26.11.09.07B(4), “Control of Sulfur Oxides from Fuel Burning Equipment.” The units are located in the Baltimore Metropolitan Area, known as “Area III” of Maryland; accordingly, they are required to meet the following requirements:<sup>43</sup>

For any existing fuel-burning equipment of the cyclone type in excess of 1000 million Btu (1055 gigajoules) actual heat input per hour, the emission standard for solid fuel is 3.5 pounds oxides of sulfur

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<sup>41</sup> Code of Maryland Regulations (COMAR) 26.11.09.07, “.07 Control of Sulfur Oxides From Fuel Burning Equipment,” available at <http://www.dsd.state.md.us/comar/comarhtml/26/26.11.09.07.htm>, accessed November 28, 2017.

<sup>42</sup> Note: COMAR 26.11.09.07A(2)(c), regarding residual fuel oils, applies to Wagner Units 1 and 4. Unit 1 occasionally burns Number 6 fuel oil, otherwise burning natural gas. Unit 4 typically burns Number 6 fuel oil. COMAR 26.11.09.07A(2)(a), regarding solid fuels, applies to Wagner Units 2 and 3. The only permissible fuels for Wagner Unit 2 and Wagner Unit 3 are solid fossil fuels including bituminous coal, subbituminous coal, and a blend of bituminous and subbituminous coals, except that natural gas may be used during startups. COMAR 26.11.09.07A(2)(a), regarding solid fuels, also generally applies to Units 1 and 2 at Brandon Shores, but COMAR 26.11.09.07A(2)(b) applies to the two Brandon units as far as their use of Number 2 fuel oil on start-up.

<sup>43</sup> Code of Maryland Regulations (COMAR) 26.11.09.07, “.07 Control of Sulfur Oxides From Fuel Burning Equipment,” available at <http://www.dsd.state.md.us/comar/comarhtml/26/26.11.09.07.htm>, accessed November 28, 2017.

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per million Btu (1.6 kilograms per gigajoule) actual heat input. Compliance is determined on a block 24 hour basis.<sup>44</sup>

Healthy Air Act (2010-2013)

Brandon Units 1 and 2, H.A. Wagner Units 2 and 3, and C.P. Crane Units 1 and 2 are required, in the federally enforceable portion of their Title V permit, to comply with the Maryland Healthy Air Act, COMAR 26.11.27.03C “SO<sub>2</sub> Emission Limitations,” and COMAR 26.11.27.03E, “System-Wide Compliance Determinations.”<sup>45</sup>

COMAR 26.11.27.03C. SO<sub>2</sub> Emission Limitations.

(1) Except as provided in §E of this regulation, annual SO<sub>2</sub> emissions from each affected electric generating unit may not exceed the number of tons in §C(2) of this regulation.

(2) Annual Tonnage Limitations.

Affected Unit	Annual SO <sub>2</sub> Tonnage Limitations Beginning January 1, 2013
Brandon Shores Unit 1	5,392 tons
Brandon Shores Unit 2	5,627 tons
H.A Wagner Unit 2	1,239 tons
H.A Wagner Unit 3	2,490 tons
C.P. Crane Unit 1	1,532 tons
C.P. Crane Unit 2	1,646 tons

COMAR 26.11.27.03E. System-Wide Compliance Determinations.<sup>46</sup>

(1) Compliance with the emission limitations in §§B and C of this regulation may be achieved by demonstrating that the total number of tons emitted from all electric generating units in a system does not exceed the sum of the tonnage limitations for all electric generating units in that system.

(2) A system-wide compliance determination shall be based only upon emissions from units in Maryland that are subject to the emission limitations in §§B and C of this regulation.

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<sup>44</sup> Note: EPA, in a September 4, 1981, Federal Register notice (46 FR 44448) approved a revision to the Maryland State Implementation Plan, establishing an emission standard for sulfur oxides from existing solid fuel-fired, cyclone type fuel-burning equipment having an actual heat input in excess of 1,000 million BTU per hour. The Federal Register notice clarified that, at Crane, “Maryland will enforce the SO<sub>2</sub> emission limitation on a 24-hour basis.” See <https://www.gpo.gov/fdsys/pkg/FR-1981-09-04/pdf/FR-1981-09-04.pdf>, accessed December 28, 2017.

<sup>45</sup> COMAR 26.11.27.03, “General Requirements,” available at <http://www.dsd.state.md.us/comar/comarhtml/26/26.11.27.03.htm>, accessed November 28, 2017.

<sup>46</sup> “System” means two or more electric generating units owned, operated, or controlled by the same person.

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- (4) If a unit that is part of a system is transferred to a different person that does not own, operate, lease, or control an affected unit subject to this chapter, the transferred unit shall meet the limitations in §§B and C of this regulation applicable to that electric generating unit.

*C.P. CRANE SETTLEMENT AGREEMENT (2018)*

On June 15, 2018 MDE submitted a settlement agreement to EPA (signed May 23, 2018) between C.P. Crane LLC and the Maryland Department of the Environment that required the C.P. Crane facility to permanently cease the burning of coal in CPC Units 1 and 2 by no later than June 15, 2018. C.P. Crane LLC complied with the settlement agreement by the compliance date and subsequently disabled CPC Units 1 and 2. In or around July/August of 2019, EPA stated that the disabling of the units and the permanent ban on the burning of coal were insufficient to meet the SIP requirements of the SO<sub>2</sub> NAAQS. EPA recommended that the most straight forward approach to adopting the modeled SO<sub>2</sub> emission limits for C.P. Crane into the SIP, is through development of a consent order, unilateral order or permit which can ultimately be submitted into the SIP. The additional permit restrictions on the disabled units are presented in Section 3.1.3.

*MOBILE SOURCES*

The requirement for the use of low sulfur fuel has helped reduce SO<sub>2</sub> emissions in Maryland, including in the Anne Arundel County and Baltimore County, MD Nonattainment Area. All highway diesel fuel is required to be Ultra Low Sulfur Diesel (ULSD) with a 5 ppm sulfur content limit.

Maryland adopted more stringent sulfur standards for #1 and #2 grade fuel oil in COMAR 03.03.05.04 – Specifications for No. 1 and No. 2 Fuel Oil (ASTM D-396), which were effective on October 13, 2014. Statewide reduction in the sulfur content of fuel oil is required. “On and after July 1, 2016, the percent by mass of sulfur in No. 1 and No. 2 fuel oil “shall not exceed” 0.05 percent.<sup>47</sup>

### **3.1.3 New Facility-Specific Requirements**

Sulfur dioxide emission rates and operational constraints for Brandon Shores, H.A. Wagner and C.P. Crane that provide for attainment and maintenance of the 2010 1-hour SO<sub>2</sub> NAAQS were developed through air dispersion modeling conducted by AECOM for Talen Energy, which has as a subsidiary, Raven Power, and for C.P. Crane LLC. The air dispersion modeling, which followed EPA’s modeling guidance, is described in greater detail in Section 4 of this document, and the modeling report and supporting technical information are included as Appendix C. The air quality dispersion modeling completed demonstrates that the following combination of emission limits and operational constraints at these three facilities is sufficient for the Anne Arundel County and Baltimore County, MD Nonattainment Area’s compliance with the 2010 1-hour SO<sub>2</sub> NAAQS:

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<sup>47</sup> Code of Maryland Regulations (COMAR) 03.03.05.04, “Specifications for No. 1 and No. 2 Fuel Oil (ASTM D-396), available at <http://www.dsd.state.md.us/comar/comarhtml/03/03.03.05.04.htm>, accessed November 28, 2017.

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***Main Limitations Relied Upon to Meet the NAAQS***

- C.P. Crane Units 1 & 2
  - Effective October 9, 2019, Units 1 & 2 combined are limited to 2,900 lb SO<sub>2</sub>/hr (1-hour averaging time);
  
- Brandon Shore Units 1 & 2 (BS1 & BS2) and Wagner Unit 3 (W3)
  - Beginning January 1, 2021, at all times when Unit BS1 and/or BS2 at the Brandon Shores generating station (whether operating individually or in tandem) and Unit W3 at the H.A. Wagner generating station are simultaneously operating, the following SO<sub>2</sub> emissions limits shall apply:
    - Units BS1, BS2, and W3 shall not exceed a cumulative SO<sub>2</sub> emissions limit of 3,860 pounds per hour, as measured on a 30-day rolling average, including only those hours when the applicable units are operating; and
    - Units BS1 and BS2 (operating either individually or in tandem) shall not exceed a cumulative total of 435 hours per calendar year when the applicable units are operating at a combined SO<sub>2</sub> emissions rate greater than 2,851 pounds per hour.
  
- Wagner Unit 3
  - Beginning January 1, 2021, at all times when operating, Unit W3 at the H.A. Wagner generating station shall not exceed an SO<sub>2</sub> emissions limit of 1,904 pounds per hour, as measured on a 30-day rolling average.
  - Beginning January 1, 2021, at all times when operating, Unit W3 at the H.A. Wagner generating station shall not exceed a maximum rate of 3,289 pounds SO<sub>2</sub> per hour, as measured on a one-hour average.
  - Beginning January 1, 2021, at all times when operating, Unit W3 at the H.A. Wagner generating station shall not exceed a cumulative total of 336 hours per calendar year when the Unit's SO<sub>2</sub> emissions rate is greater than 2,299 pounds per hour, as measured on a one-hour average.
  
- Brandon Shore Units 1 & 2
  - Beginning January 1, 2021, at all times when operating, Unit BS1 and BS2 at the Brandon Shores generating station (whether operating individually or in tandem) shall not exceed a combined SO<sub>2</sub> emissions limit of 3,860 pounds per hour, as measured on a 30-day rolling average.
  - Beginning January 1, 2021, at all times when Unit W3 at the H.A. Wagner generating station is not operating, Unit BS1 and BS2 at the Brandon Shores generating station (whether operating individually or in tandem) shall not exceed a combined SO<sub>2</sub> emissions limit of 5,150 pounds per hour, as measured on a 1-hour average, on more than three hours per calendar year.
  
- Wagner Unit 2 (W2)
  - No later than July 1, 2020, Unit W2 at the H.A. Wagner generating station shall permanently cease burning coal and shall only burn natural gas.



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***Supplemental Limitations Providing Additional Assurances to Comply with the NAAQS***

- Wagner Unit 1 (W1)
  - Beginning January 1, 2021, at all times when operating, Unit W1 at the H.A. Wagner generating station shall not exceed an SO<sub>2</sub> emissions limit of 480 pounds per hour, as measured on a one-hour average.
  - Beginning January 1, 2021, at all times when operating, Unit W1 at the H.A. Wagner generating station shall not exceed 438 hours of operation per calendar year when burning fuel oil. (The unit can operate additional hours on natural gas.)
  
- Brandon Shore Units 1 & 2
  - Beginning January 1, 2021, at all times when operating, Unit BS1 and BS2 at the Brandon Shores generating station (whether operating individually or in tandem) shall not exceed a combined SO<sub>2</sub> emissions limit of 9,980 pounds per hour, as measured on a rolling three-hour average.
  
- Wagner Unit 4 (W4)
  - Beginning January 1, 2021, at all times when operating, Unit W4 at the H.A. Wagner generating station shall not exceed an SO<sub>2</sub> emissions limit of 1,350 pounds per hour, as measured on a one-hour average.
  - Beginning January 1, 2021, at all times when operating, Unit W4 at the H.A. Wagner generating station shall not exceed 438 hours of operation per calendar year when burning fuel oil.

These SO<sub>2</sub> emission limits and operational constraints are contained and further defined in the consent agreements with the facilities and included in Appendix B within this SIP document. The emission limits and operational constraints will also be included in the facility Title V permits. The Department will execute the consent agreements after considering any public comments received and prior to submitting to EPA, for approval, the final SIP revision for the Anne Arundel County and Baltimore County, MD Nonattainment Area for the 2010, 1-hour SO<sub>2</sub> NAAQS. The Department requests that the consent agreements be incorporated by reference into the Maryland SIP. The entire SIP, including the consent agreements, will be federally enforceable upon EPA's approval.

### **3.2 Reasonably Available Control Measures Analysis**

Section 172(c)(1) of the Clean Air Act, 42 U.S.C. § 7502(c)(1), requires states to “provide for implementation of all reasonably available control measures [RACM] as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at minimum, of reasonably available control technology [RACT] and shall provide for attainment of the national primary ambient air quality standards.” States are required to consider permanent and enforceable control measures in nonattainment area SIP revisions. The EPA anticipates that the implementation of national and regional control programs will ease the process of planning for attainment of the 2010 1-hour SO<sub>2</sub> NAAQS<sup>48</sup> through permanent enforceable and creditable control measures.

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<sup>48</sup> EPA Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions (April 2014), p. 14.

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The Anne Arundel County and Baltimore County, Maryland Nonattainment Area is required to attain the 2010 1-hour SO<sub>2</sub> NAAQS by September 12, 2021. As discussed in Section 1 of this SIP revision, the most significant sources of SO<sub>2</sub> emissions impacting the Anne Arundel County and Baltimore County, Maryland Nonattainment Area are the Brandon Shores, H.A. Wagner and C.P. Crane electric generation stations.

MDE has analyzed RACM/RACT for the coal-fired electric generating units identified in Table 5 (see Section 4.2 below) that emit over 91% of the nonattainment area's SO<sub>2</sub> emissions. MDE has determined that no additional RACM/RACT requirements are needed beyond those already established in COMAR 26.11.27 (Healthy Air Act); those required under federal measures such as the MATS or MACT that provide for equivalent or better control than RACM/RACT; or those reductions that will be required as a part of Maryland's attainment/control strategy discussed under Section 3.1.3 of this SIP. These measures and limits are equivalent to or more stringent than RACM/RACT. Below is a discussion relevant to the coal-fired emission units and control equipment in place at each of the facilities within the nonattainment area.

### **3.2.1 Brandon Shores**

The primary emission units at Brandon Shores are two (2) coal-fired generating units with a combined nominal generating capacity of approximately 1,370 megawatts (MW).

- Each unit has a rated capacity of 7,128 million British thermal units per hour (MMBtu/hr). Unit #1 (MDE Registration #3-0015) was placed in commercial service in 1984, and Unit #2 (MDE Registration #3-0016) was placed in commercial service in 1991.
- Both units are Babcock and Wilcox (B&W) solid fossil fuel-fired (coal), dry bottom boilers with circular wall burners. No. 2 fuel oil is used for start-up and main burner ignition. Coal is transferred to the plant storage bunker via conveyor belts, after which the coal is pulverized and blown into the furnace.
- Unit #1 is equipped with overfire air and low nitrogen oxide (NO<sub>x</sub>) burners. Unit #2 is equipped with low NO<sub>x</sub> burners and with burners out of service (BOOS). Currently for each unit, the flue gas is passed through hot-side electrostatic precipitators (ESPs) and selective catalytic reduction (SCR) to reduce NO<sub>x</sub> emissions. The gas is then treated with a dry sorbent injection system for the control of sulfuric acid mist and powdered activated carbon (PAC) injection system for the control of mercury (Hg). It is passed through fabric filter baghouses to collect the particulate matter (PM) emissions, followed by a flue gas desulfurization (FGD) system for the removal of sulfur dioxide (SO<sub>2</sub>). Ash is collected from the ESP hoppers and conveyed pneumatically to storage silos from where it is loaded into trucks for final disposition.
- Both units are equipped with continuous emissions monitoring systems (CEMS) for NO<sub>x</sub>, SO<sub>2</sub>, carbon dioxide (CO<sub>2</sub>), Hg and PM.

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Existing permit limits on the main coal-fired units include:

- Sulfur content by weight not to exceed 1% on all solid fuels
- Sulfur content by weight not to exceed 0.3% for distillate fuel oils, with No.2 fuel oil mandated for start up
- Sulfur content by weight not to exceed 1.0% for residual fuel oils
- Annual SO<sub>2</sub> Tonnage Limit under COMAR 26.11.27.03C (Healthy Air Act) of
  - 5,392 tons – Brandon Shores Unit 1
  - 5,627 tons – Brandon Shores Unit 2

Brandon Shores Units 1 & 2 are also required by this SIP submission to meet the emission limitations presented in Section 3.1.3 and the Appendices. No additional RACM/RACT requirements are needed to meet the RACT/RACM requirements for the SO<sub>2</sub> NAAQS.

### **3.2.2 H.A. Wagner**

The primary emission units at Wagner are four (4) steam-electric generating units with a combined nominal rating of approximately 1,040 MW:

- Unit #1 (MDE Registration #5-0489) is a natural gas-fired (No. 6 fuel-oil backup) B&W dry bottom wall-fired boiler, which began operation in 1956. Unit #1 is rated at 1,337 MMBtu/hr and is controlled by a cold-side ESP. Unit #1 is equipped with a CEMS for NO<sub>x</sub> and CO<sub>2</sub> and a Continuous Opacity Monitor (COMS) for opacity.
- Unit #2 (MDE Registration #3-0017) is a B&W dry bottom wall-fired coal-fired natural circulation steam boiler equipped with low NO<sub>x</sub> burners. Unit 2 began operation in 1959. Unit #2 is rated at 1,337 MMBtu/hr and is controlled using a PAC injection system for Hg control, a cold-side ESP for PM control, and selective non-catalytic reduction (SNCR) for NO<sub>x</sub> control. Unit #2 is equipped with CEMS for NO<sub>x</sub>, CO<sub>2</sub>, SO<sub>2</sub> and Hg and COMS for opacity.
- Unit #3 (MDE Registration #3-0003) is a B&W coal-fired, once-through supercritical steam boiler, which began operation in 1966. Unit #3 is rated at 2,740 MMBtu/hr and is controlled by an SCR for NO<sub>x</sub> control, PAC injection for Hg control, and a cold-side ESP for PM control. Unit #3 is equipped with CEMS for NO<sub>x</sub>, CO<sub>2</sub>, SO<sub>2</sub> and Hg and COMS for opacity.
- Unit #4 (MDE Registration #4-0017) is a B&W dry bottom wall-fired No. 6 fuel oil-fired steam boiler, which began operation in 1972. Unit #4 is rated at 4,200 MMBtu/hr and is controlled by a multiple cyclone for the control of PM. Unit #4 is equipped with CEMS for NO<sub>x</sub>, SO<sub>2</sub>, and CO<sub>2</sub> and COMS for opacity. All four units use natural gas for startup and main burner ignition. Ash from the coal boilers is collected from the ESP hoppers and conveyed pneumatically to storage silos from where it is loaded into trucks for final disposition.

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Existing permit limits on Units 1 (5-0489) & 4 (4-0017) include:

- Sulfur content by weight not to exceed 1% on all solid fuels
- Sulfur content by weight not to exceed 0.3% for distillate fuel oils
- Sulfur content by weight not to exceed 1.0% for residual fuel oils

New operational constraints in the consent order and SO<sub>2</sub> SIP for Wagner Units 1 & 4:

The units are limited to less than 500 hours of operation during any 12-consecutive month period each. The operation restrictions on these sources limit the potential to emit SO<sub>2</sub> to levels where additional SO<sub>2</sub> controls are not feasible. Therefore, the operational restrictions on the boilers and the fuel sulfur content limit are considered to meet RACT/RACM requirements.

Existing permit limits on Units 2 (3-0017) & 3 (3-0003) include:

- Sulfur content by weight not to exceed 1% on all solid fuels
- Sulfur content by weight not to exceed 0.3% for distillate fuel oils
- Sulfur content by weight not to exceed 1.0% for residual fuel oils
- Annual SO<sub>2</sub> Tonnage Limit under COMAR 26.11.27.03C (Healthy Air Act) of
  - 1,239 tons – H.A. Wagner Unit 2
  - 2,490 tons – H.A. Wagner Unit 3

New SO<sub>2</sub> Measures in the consent order and SO<sub>2</sub> SIP for Wagner Units 2 & 3:

- Unit 2 Shut down or convert to Natural Gas - Sulfur emissions will approach zero
- Unit 3 Dry Sorbent Injection (DSI) estimated to reduce sulfur emissions by 30%

The operation restrictions, DSI control technology and sulfur content limitations on these sources limit the potential to emit SO<sub>2</sub> to levels where additional SO<sub>2</sub> controls are not feasible. Therefore, the operational restrictions and sulfur content limitation on the boilers are considered to meet RACT/RACM requirements.

### **3.2.3 C.P. Crane**

The major components of the facility consist of two (2) solid fossil fuel-fired cyclone burner steam boilers, one (1) oil fired combustion turbine, two (2) auxiliary boilers, and solid fossil fuel, limestone, and ash handling operations.

- Each of the two (2) utility boilers (Units 1 and 2) are fired by four (4) cyclone burners with two (2) cyclones located on the front and two (2) located directly opposite on the rear side of the boiler (opposite fired). A General Electric turbine rated at 200 gross megawatts is powered by Unit 1, while Unit 2 powers a Westinghouse turbine rated at 205 gross megawatts. Each turbine loses approximately 9-10 megawatts in order to magnetize the generator and power the fans, conveyors, pumps etc.
- In 1999, the boilers were retrofitted with natural gas reburn (NGR) systems to reduce NO<sub>x</sub> generation. Subsequently, an over-fire air system (OFA) was installed and is currently being used to reduce NO<sub>x</sub> emissions rather than the NGR system. The units start up on natural gas

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and switch over to solid fossil fuel-firing for normal operation. Each unit is controlled by an individual baghouse and equipped with selective non-catalytic reduction (SNCR) for NO<sub>x</sub> control, activated carbon injection for mercury control and dry sorbent injection (DSI) systems. Units 1 and 2 are also equipped with continuous opacity and gas monitors as well as four heat sensing flow monitors. Gas probes are located on the stacks and monitor NO<sub>x</sub>, SO<sub>2</sub>, CO<sub>2</sub> and mercury.

- Each of the two (2) auxiliary boilers is used for supplying steam to C.P. Crane Generating Station. Auxiliary Boiler # 2 is fired with No. 2 fuel oil with a maximum rating of 25 million Btu per hour heat input. Raven Power was granted approval in 2015 to convert Auxiliary Boiler #3 to burn natural gas as the primary fuel with No. 2 fuel as backup. Boiler # 3 is rated at 62.5 million Btu per hour heat input.
- Under the Healthy Air Act (HAA), the Crane units were required to reduce emission of nitrogen oxide (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), and mercury (Hg). To meet the HAA requirements, Crane installed a Selective Non-Catalytic Reduction (SNCR) system to reduce NO<sub>x</sub> emissions, installed an Activated Carbon Injection (ACI) system to reduce Hg emissions and switched to sub-bituminous coal to reduce SO<sub>2</sub> emissions. SNCR was installed in November of 2008.
- To comply with MACT requirements, Crane installed a Dry Sorbent Injection (DSI) system to reduce emissions of Hydrogen Chloride (HCl). This DSI system was operational by January 2016.

Existing permit limits on Units 1 (3-0108) & 2 (3-0109) include:

- For any existing fuel-burning equipment of the cyclone type in excess of 1000 million Btu (1055 gigajoules) actual heat input per hour, the emission standard for solid fuel is 3.5 pounds of oxides of sulfur per million Btu (1.6 kilograms per gigajoule) actual heat input.
- Annual SO<sub>2</sub> Tonnage Limit under COMAR 26.11.27.03C (Healthy Air Act) of
  - 1,532 tons – C.P. Crane Unit 1
  - 1,646 tons – C.P. Crane Unit 2

New SO<sub>2</sub> Measures in the consent order and SO<sub>2</sub> SIP for Crane Units 1 & 2:

- Unit 1 and Unit 2 combined are limited to 2,900 lb SO<sub>2</sub>/hr.

The operational restrictions and sulfur content limitations on these sources limit the potential to emit SO<sub>2</sub> to levels where additional SO<sub>2</sub> controls are not feasible. Therefore, the operational restrictions and sulfur content limitation on the boilers are considered to meet RACT/RACM requirements.

### 3.2.4 Conclusion

EPA has interpreted section 172(1)(c) of the CAA to mean that states must consider all potentially available measures to determine whether they are reasonably available for implementation in the area, and whether they would advance the area's attainment date.<sup>49</sup> RACT requirements are specifically intended to impose emission controls for purposes of attainment and maintenance of the NAAQS within a specific nonattainment area.<sup>50</sup> Therefore, the control plan in place for the Anne Arundel County and Baltimore County, Maryland Nonattainment Area, which has been demonstrated to attain and maintain the 2010 1-hour SO<sub>2</sub> NAAQS, also meets RACT, which is defined in 40 C.F.R. § 51.100(o) in relevant part as "...devices, systems, process modifications, or other apparatus or techniques that are reasonably available taking into account:

- (1) The necessity of imposing such controls in order to attain and maintain a national ambient air quality standard;
- (2) The social, environmental, and economic impact of such controls; ..."

Therefore, the combination of permanent and enforceable emission reductions from operation of the control equipment installed and the emission restrictions and conditions in the new consent agreement (provide date) for Fort Smallwood and C.P. Crane satisfy the RACT/RACM requirement. The combined emission reductions from these emission restrictions and conditions have demonstrated through modeling to provide for attainment of the 2010 1-hour SO<sub>2</sub> NAAQS throughout the Anne Arundel County and Baltimore County, Maryland Nonattainment Area, as discussed in detail in Section 4, below.

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<sup>49</sup> See, Approval and Promulgation of Air Quality Implementation Plans; District of Columbia, Maryland, Virginia; Post 1996 Rate-of-Progress Plans, One-Hour Ozone Attainment Demonstrations and Attainment Date Extension for the Metropolitan Washington D.C. Ozone Nonattainment Area; Final Rule, 66 FR 586 at 596, 607 (January 3, 2001), available at: <https://www.federalregister.gov/documents/2001/01/03/01-61/approval-and-promulgation-of-air-quality-implementation-plans-district-of-columbia-maryland-virginia>.

<sup>50</sup> See, 79 FR 32894 (June 9, 2014); see Also, NRDC v. EPA, 571 F. 3d 1245, 1252-53 (D.C. Cir. 2009).

#### 4.0 AIR DISPERSION MODELING ANALYSIS

Air dispersion modeling served as the basis for developing SO<sub>2</sub> emission limits that would be permanent and enforceable so that the Anne Arundel County and Baltimore County, Maryland Nonattainment Area will attain the 2010 1-hour SO<sub>2</sub> NAAQS by September 12, 2021.

Talen Energy, parent company to Raven Power, currently owns and/or operates the Brandon Shores and H.A. Wagner facilities within the Anne Arundel and Baltimore County nonattainment area. CP Crane LLC currently owns and/or operates the C.P. Crane facility within the Anne Arundel and Baltimore County nonattainment area. Talen Energy and CP Crane LLC contracted with AECOM to conduct the 1-hour SO<sub>2</sub> air dispersion modeling.

The air dispersion modeling was conducted consistent with the EPA's relevant air dispersion modeling policy and guidance, including Appendix A of the EPA's 1-hour SO<sub>2</sub> nonattainment area SIP guidance<sup>51</sup> and the EPA's revised "Guideline on Air Quality Models."<sup>52</sup> In the SO<sub>2</sub> NAAQS Designations Modeling Technical Assistance Document,<sup>53</sup> EPA states:

"States are expected to submit a modeling and analysis protocol that details the methodology and model inputs before commencement of the modeling exercise."

In accordance with the guidance, AECOM prepared and MDE submitted a 1-hour SO<sub>2</sub> modeling protocol to EPA Region 3 prior to commencing the modeling process. Before undertaking the hundreds of model runs required to establish longer-term average emission limits, AECOM, MDE, Talen Energy and CP Crane LLC asked EPA to review and provide comments on the modeling protocol to determine consistency with EPA modeling guidance. Due to the complexity of the proposed modeling, which included the development of randomly reassigned emissions (RRE) and the unique nature of the SO<sub>2</sub> standard, the modeling protocol review process took some time. In the end EPA stated via email that:

Based on the information provided and reviewed to date, it appears that MDE's modeling protocols, modeling files, and modeling report are consistent with EPA guidance.

EPA notes that the technical discussion of modeling protocol and determinations of consistency with EPA guidance prior to submittal of a SIP revision does not constitute EPA approval of any SIP elements under 110(k). Maryland's inclusion of EPA's review and determination that the modeling protocol is consistent with EPA guidance is not meant to be an approval of a SIP or SIP element, rather it is meant to illustrate EPA's role in the process.

The Talen Energy and CP Crane LLC air dispersion modeling report and report appendices are included as Appendix C-1 and Appendix C-2, respectively. All data associated with the air dispersion

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<sup>51</sup> Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions, EPA memorandum, April 23, 2014, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

<sup>52</sup> Federal Register, 82 FR 5182, Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter; Final Rule, January 17, 2017.

<sup>53</sup> SO<sub>2</sub> NAAQS Designations Modeling Technical Assistance Document, USEPA, August 2016 Page 33

modeling are also included in Appendix C-3. The air dispersion modeling protocol is included as Appendix C-6. The following subsections provide a brief summary and the results of AECOM’s 1-hour SO<sub>2</sub> air dispersion modeling.

#### 4.1 Air Dispersion Modeling Summary

The air dispersion modeling utilized the American Meteorological Society / EPA Regulatory Model (AERMOD) version 16216r and its associated preprocessors, including (1) the AERMOD meteorological preprocessor (AERMET) version 16216, (2) the AERMOD terrain preprocessor (AERMAP) version 11103, (3) the AERMET pre-processor (AERMINUTE) to incorporate 1-minute automated surface observation system (ASOS) wind data, (4) the AERMET surface characteristics processor (AERSURFACE), and (5) the building downwash preprocessor (BPIPFRM) version 04274. The EPA requires AERMOD as the near-field air dispersion model for a wide range of regulatory applications in all types of terrain and for aerodynamic building downwash. AERMOD was executed with regulatory default options.

A single merged stack is used for Brandon Shores Units 1 and 2. A single representative stack may be used to represent several sources that are identified as “similar”. “Similar” stacks are those that are located less than 100 m apart, emit the same pollutants, and have stack heights and gas exit velocities differing by less than 20 percent. Brandon Shores Units 1 and 2 exhaust to *two flues in one shell* with height and internal exit diameter values as reported in Table 5 below. For the modeling demonstration, a single merged stack is appropriate for use for Units 1 and 2. To account for this merged stack in the modeling, the average velocity, weighted average temperature, and equivalent stack diameter were used in AERMOD, consistent with EPA Model Clearinghouse Memo 91-II-01.

**Table 5: Stack Parameters for Input to AERMOD**

Stack	Full-Load Stack Parameters			
	Stack Height (m)	Exit Diameter (m)	Exit Temperature (K)	Exit Velocity (m/s)
Crane Unit 1	107.59	3.328	435.93	30.48
Crane Unit 2	107.59	3.330	438.77	30.48
Brandon Shores Unit 1	121.92	9.53	324.817	15.073
Brandon Shores Unit 2	121.92	9.53	324.817	14.895
Brandon Shores Merged Stack	121.92	13.470	324.817	14.984
Wagner Unit 3	105.46	4.215	422.220	32.059
Wagner Unit 1	87.48	3.099	419.261	48.804
Wagner Unit 4	104.24	6.706	577.594	21.729
Wheelabrator	96.01	2.130	485.93	22.55



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The Brandon Shores facility's SO<sub>2</sub> emission sources include two coal-fired boilers (Unit 1 and Unit 2) that emit to the atmosphere through separate flues within a common stack. Each of Brandon Shores' boilers is equipped with a flue gas desulfurization (FGD) pollution control device. The H.A. Wagner facility's SO<sub>2</sub> emission sources include two coal-fired boilers (Unit 2 and Unit 3); one natural gas and #6 fuel oil dual-fired boiler (Unit 1) and one #6 fuel oil-fired boiler (Unit 4) that emit to the atmosphere through separate stacks. H.A. Wagner Unit 2 is retiring or converting to natural gas. H.A. Wagner Unit 1 operates infrequently and primarily on natural gas. H.A. Wagner Unit 4 operates infrequently. As a result, consistent with EPA's 2011 guidance<sup>54</sup>, H.A. Wagner Units 1 and 4 are considered to be intermittent sources and consequently were not included in the 1-hour critical emission value (CEV) modeling runs. However, they were included in the longer-term randomly reassigned emissions (RRE) modeling runs. H.A. Wagner Unit 3 is equipped with a dry sorbent injection system. The C.P. Crane facility's SO<sub>2</sub> emission sources include two coal-fired boilers (Unit 1 and Unit 2) that emit to the atmosphere through separate stacks. Each aforementioned stack was characterized in AERMOD as a point source.

The 1-hour SO<sub>2</sub> emission rate for the C.P. Crane facility was determined by the air dispersion modeling to be equal to the CEV. The CEV refers to the hourly emission rate that the model predicts would result in the 5-year average of the annual 99th percentile of daily maximum hourly SO<sub>2</sub> concentrations being at or below the level of the 1-hour SO<sub>2</sub> NAAQS.

For H.A. Wagner and Brandon Shores, attainment of the 1-hour SO<sub>2</sub> NAAQS in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area can be assured via compliance with the use of the 30-day rolling average emission limits (as discussed below) and supplemental shorter term emission limits and operational constraints.

EPA's April 23, 2014 guidance for SO<sub>2</sub> nonattainment area SIP submissions notes:

...it may be possible in specific cases for states to develop control strategies that account for variability in 1-hour emissions rates through emission limits with averaging times that are longer than 1 hour, using averaging times as long as 30-days, but still provide for attainment of the 2010 1-hour SO<sub>2</sub> NAAQS.

EPA's general expectation is the following, for infrequent periods of hourly emissions above the critical emission value:

...these periods would be unlikely to have a significant impact on air quality, insofar as they would be very unlikely to occur repeatedly at the times when the meteorology is conducive for high ambient concentrations of SO<sub>2</sub>.

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<sup>54</sup> U.S. Environmental Protection Agency, March 1, 2011 memorandum from Tyler Fox to Regional Air Division Directors, "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO<sub>2</sub> National Ambient Air Quality Standard," [http://www3.epa.gov/scram001/guidance/clarification/Additional\\_Clarifications\\_AppendixW\\_Hourly-NO2-NAAQS\\_FINAL\\_03-01-2011.pdf](http://www3.epa.gov/scram001/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf), accessed November 14, 2019.

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EPA considers this option to be:

...an appropriate balance between providing a strong assurance that the NAAQS will be attained and maintained, while still acknowledging the necessary variability in source operations and the impairment to source operations that would occur under what could be in some cases an unnecessarily restrictive approach to constraining that variability.

Brandon Shores and Wagner Unit 3 are equipped with and operate with SO<sub>2</sub> emissions control devices. For such sources seeking alternate or longer-term emission limits, EPA's guidance notes this:

Sources with emission control equipment may be especially prone to periodic occurrences of high emissions, arising on occasions when the control equipment is not operating or operating at reduced efficiency. Therefore, the EPA finds it advisable that longer-term average limits for sources that meet these limits through the use of emission control equipment be subject to supplemental limits that serve to constrain the frequency and/or magnitude of occasions of elevated emissions. Establishment of such supplemental limits as part of a longer-term averaging approach is especially important in cases with significant potential for frequent and/or high magnitude occasions of elevated emissions, including, but not limited to, sources using emissions control equipment.

For the purposes of calculating a 30-day average SO<sub>2</sub> emission limit for Brandon Shores Units 1 and 2 and Wagner Unit 3, Talen Energy has elected to follow the procedure set forth in Appendix B of EPA's nonattainment guidance document. In general, EPA expects that any emission limit with an averaging time longer than 1 hour would need a downward adjustment to compensate for the loss of stringency inherent in applying a longer-term average limit. Discussions of the proposed SO<sub>2</sub> emission limits for each stack are presented in the Sections 6.1 through 6.6 of the "SO<sub>2</sub> NAAQS Compliance Modeling Report for the Anne Arundel and Baltimore Counties, MD Non-Attainment Area – Rev 1" (see Appendix C-1).

Building downwash parameters for each stack were calculated by using BPIP and used as input to AERMOD. For the Anne Arundel County and Baltimore County, Maryland Nonattainment Area, SO<sub>2</sub> emissions from all three facilities were used in AERMOD.

The Howard University (HU)-Beltsville, MD monitor (Site #24-033-0030), which is located in Prince George's County about 33 kilometers (20.5 miles) to the southwest of the Brandon Shores and H.A. Wagner (Fort Smallwood Complex) facilities and 52 km (32.3 miles) southwest of C.P. Crane, was used to determine the uniform regional background 1-hour SO<sub>2</sub> pollutant concentrations for the NAAQS SO<sub>2</sub> modeling. The HU-Beltsville 1-hour SO<sub>2</sub> monitoring data is sufficiently complete and is acceptable to use in the modeling. EPA's March 2011 clarification memo regarding 1-hour NO<sub>2</sub> modeling and which EPA also applies to 1-hour SO<sub>2</sub> NAAQS modeling,<sup>55</sup> allows for an approach

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<sup>55</sup> U.S. Environmental Protection Agency, Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO<sub>2</sub>, National Ambient Air Quality Standard, Memorandum from Tyler Fox, Leader, Air Quality Modeling Group, to Regional Air Division Directors, March 1, 2011, available at [https://www3.epa.gov/ttn/scram/guidance/clarification/Additional\\_Clarifications\\_AppendixW\\_Hourly-NO2-NAAQS\\_FINAL\\_03-01-2011.pdf](https://www3.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf), accessed May 21, 2018, and cross-referenced in U.S. Environmental Protection Agency,

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using the 99<sup>th</sup> percentile monitored values whereby the background values vary by season and by hour of the day. AECOM applied this approach to its modeling, using data from the 3-year period of 2014-2016.

Receptors were placed in nested Cartesian grids centered on the Fort Smallwood Complex and C.P. Crane with the following spacing:

- Every 25 meters along the ambient boundary,
- Every 100 meters out to a distance of 15 km, and
- Every 500 meters between 15 and 25 km.

The meteorological data required for input to AERMOD was created with the latest version of AERMET (16216) using the adjusted u\* option from a 5-year meteorological dataset from 2012 through 2016. This option is now a default option per the recently promulgated Appendix W.<sup>56</sup> Hourly surface observations from Baltimore-Washington International Airport, MD along with concurrent upper air data from Sterling, VA were used as inputs to AERMET with both 1-minute and 5-minute wind speed and direction data incorporated in AERMET Stage 2. The surface data (wind direction, wind speed, temperature, sky cover, and relative humidity) are measured 10 meters above ground level.<sup>57</sup>

## 4.2 Summary of Critical Emissions Values

The emission rates used in the 1-hour critical emission rate model runs that demonstrated compliance with the 1-hour SO<sub>2</sub> NAAQS are presented in Table 6 and Table 7. For a full discussion of the modeling results see the modeling report in Appendix C.

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“Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions”, April 23, 2014, page A-8, “The March 1, 2011 NO<sub>2</sub> memorandum (U.S. EPA, 2011a) also offers recommendations for determining nearby sources, and those recommendations are relevant for SO<sub>2</sub> as well.”

<sup>56</sup> See EPA’s Guideline on Air Quality Models (“Appendix W” to 40 CFR Part 51).

<sup>57</sup> Anemometer height obtained from National Weather Service ASOS Implementation site. <http://www.nws.noaa.gov/ops2/Surface/asosimplementation.htm>

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**Table 6: Emission Rates Used for Critical Value SO<sub>2</sub> NAAQS Compliance Modeling with Continuous Operation of Brandon Shores and Wagner Unit 3 (Case 1)**

Facility	Source Description	CEV - SO <sub>2</sub> Emission Rate Modeled in Compliance Run	
		Lb/hr	g/s
C.P. Crane	Unit 1	2,900	368.5
	Unit 2		
H.A. Wagner	Unit 1	0	0
	Unit 2	N/A	N/A
	Unit 3	2,299	289.7
	Unit 4	0	0
Brandon Shores	Unit 1	2,851	359.2
	Unit 2		

Note: Total emissions from Brandon Shores and Wagner 3 is 5,150 lb/hr

**Table 7: Emission Rates Used for Critical Value SO<sub>2</sub> NAAQS Compliance Modeling with Continuous Operation of Brandon Shores Only (Case 2)**

Facility	Source Description	CEV - SO <sub>2</sub> Emission Rate Modeled in Compliance Run	
		Lb/hr	g/s
C.P. Crane	Unit 1	2,900	368.5
	Unit 2		
H.A. Wagner	Unit 1	0	0
	Unit 2	N/A	N/A
	Unit 3	0	0
	Unit 4	0	0
Brandon Shores	Unit 1	5,150	648.9
	Unit 2		

### 4.3 Summary of Randomly Reassigned Emission Modeling Results<sup>58</sup>

AERMOD simulations were run using randomly reassigned 1-hour emission rates for Brandon Shores (merged stack) and H.A. Wagner Units 1, 3, and 4, along with constant CEV 1-hour emission rates for C.P. Crane and Wheelabrator, plus regional background. The 100 modeling runs, with 5-year running averages of the 99th percentile peak daily 1-hour maximum at each receptor, all resulted in modeled design value 1-hour SO<sub>2</sub> concentrations that demonstrate compliance with the NAAQS.

The highest 5-year average 99th percentile daily maximum 1-hour SO<sub>2</sub> concentration of the 100 model simulations, for Case 1, was 194.92 µg/m<sup>3</sup> (occurred in simulation run 87) and is in compliance with the NAAQS. Table 8 and Table 9 present the source culpability at the peak receptor near each plant for the controlling concentrations of RRE simulation run 87. The total concentration at the receptor is presented in the first row, while the remaining rows present the source contributions as concentrations in µg/m<sup>3</sup> and also as percentages of the total.

Appendix C-2, with the modeling report appendices A-H; in particular, Appendix G, provides a table of the highest 5-year average 99th percentile daily maximum SO<sub>2</sub> concentrations for each simulation run for Case 1.

Table 10 provides a comparison of the model concentrations at the peak receptor location for the Case 1 CEV run and the Case 1 RRE simulation run 87. EPA Region 3 provided the following assessment based on the results from this table:

<sup>58</sup> See Section 6.6 of the Air Dispersion Modeling Report in Appendix C-1 to this document.

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“The peak receptor locations and yearly distributions of 4th high concentrations are remarkably similar given that the bulk of the RRE Case 87 hours had combined Fort Smallwood emissions below the CEV-1 limit (5,150 lbs/hr). This appears to support the RRE methodology in regards to establishing the proposed emission rates that will meet the 1-hour SO<sub>2</sub> NAAQS.”

Because of the voluminous amount of data used in support of these calculations, these data are not included in this report, but are rather included with the modeling files provided in Appendix C-3.

**Table 8: Source Contributions for Peak Impact near Fort Smallwood Complex for Controlling Case 1 RRE Simulation Run 87**

Source	Concentration (µg/m <sup>3</sup> )	Percent Contribution
Crane Unit 1 & 2	1.57	0.8%
Brandon Shores Merged Stack	83.68	42.9%
Wagner Unit 1	4.02	2.1%
Wagner Unit 3	93.97	48.2%
Wagner Unit 4	5.18	2.7%
Wheelabrator	0.5	0.3%
Ambient Background	5.99	3.1%
Peak Impact (Total)	194.92	100%

**Table 9: Source Contributions for Peak Impact near C.P. Crane for Controlling Case 1 RRE Simulation Run 87**

Source	Concentration (µg/m <sup>3</sup> )	Percent Contribution
Crane Unit 1 & 2	185.94	95.6%
Brandon Shores Merged Stack	0.44	0.2%
Wagner Unit 1	0.0	0.0%
Wagner Unit 3	0.52	0.3%
Wagner Unit 4	0.0	0.0%
Wheelabrator	0.14	0.1%
Ambient Background	7.41	3.8%
Peak Impact (Total)	194.45	100%

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**Table 10: Comparison of Peak Model Receptor Design Concentrations from Case 1 CEV and Controlling RRE Simulation Run 87**

Run	Easting	Northing	5-Year Avg.	2012 Max	2013 Max	2014 Max	2015 Max	2016 Max
<b>CEV-1</b>	363053.8	4339693	196.40	217.85	217.76	207.92	178.14	160.34
<b>RRE 87</b>	363253.8	4339193	194.92	206.24	219.99	230.67	164.07	153.60

## 5.0 EMISSION LIMITS

Sulfur dioxide emission rates for C.P. Crane and Fort Smallwood that provide for attainment and maintenance of the 2010 1-hour SO<sub>2</sub> NAAQS were developed through air dispersion modeling that AECOM conducted for Talen Energy and C.P. Crane. The air dispersion modeling is described in greater detail in Section 4.0 of this document. The development of these emission limits is described in the air dispersion modeling report and report appendices that are included in Appendices C-1 and C-2, respectively. All data associated with the development of the emission limits are included with the air dispersion modeling data in Appendix C-3.

As demonstrated by the modeling, the following combination of emission limits at these facilities is sufficient for compliance with the 2010 1-hour SO<sub>2</sub> NAAQS within the Anne Arundel County and Baltimore County, MD Nonattainment Area.

The following subsections provide a brief summary of the development and establishment of the SO<sub>2</sub> emission limits.

### 5.1 Development of Critical Emission Value SO<sub>2</sub> Permit Limits

EPA guidance uses the term "critical emission value," or CEV, to refer to the hourly emission rate that the model predicts would result in the 5-year average of the annual 99th percentile of daily maximum hourly SO<sub>2</sub> concentrations at the level of the 1-hour NAAQS, given representative meteorological data for the area. Establishing 1-hour limits at the CEV is a conservative approach to developing a control strategy that ensures that NAAQS violations do not occur, and is an approach that the EPA recommended in the 2014 SO<sub>2</sub> guidance and considers as an acceptable approach to demonstrate compliance with the 1-hour SO<sub>2</sub> NAAQS.

C.P. Crane selected to use the model-derived CEV as the 1-hour maximum permitted SO<sub>2</sub> level for the facility. MDE agreed with the selection. The CEV emission limit for the C.P. Crane facility was developed consistent with EPA's SO<sub>2</sub> SIP guidance.

The Department's consent agreement with C.P. Crane LLC includes all necessary operational constraints and emission limitations applicable to the facility for the Anne Arundel County and Baltimore County, MD Nonattainment Area to attain the 1-hour SO<sub>2</sub> NAAQS as required under the Clean Air Act. The consent agreement is included in Appendix B-2.

Facility	Source Description	Source ID	Combined SO <sub>2</sub> Emission Limit (lb/hr)	Averaging Period
C.P. Crane	Unit 1	Disabled	2,900	1-hour
	Unit 2	Disabled		



## 5.2 Development of Longer-Term Average SO<sub>2</sub> Emission Limits

Talen Energy developed longer-term average SO<sub>2</sub> emission limits for the Fort Smallwood Generating Station that consists of the Brandon Shores and H.A. Wagner facilities. The emission limits for the Fort Smallwood facility were developed consistently with EPA's 2014 SO<sub>2</sub> SIP guidance.

Talen Energy developed proposed SO<sub>2</sub> emission limits for the Brandon Shores and H.A. Wagner Generating Stations using the Randomly Reassigned Emissions (RRE) approach described in Appendix B of the EPA 2014 SO<sub>2</sub> guidance document.

EPA Region 3 reviewed the modeling approach and methodology (see Appendix C-4) used in the development of the longer-term SO<sub>2</sub> emission limits and, based on the information provided and reviewed, determined that they were consistent with EPA guidance as noted below (emphasis added).

EPA has reviewed MDE's modeling protocols, modeling files, and modeling report for the Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area, and understands that MDE will develop consent orders with the facilities to *adopt the emission and operational limits that modeled attainment* to meet the 2010 1-hour National Ambient Air Quality Standard (NAAQS).<sup>59</sup>

MDE also concluded that the emission limits and operational constraints conform to EPA's modeling guidance for SO<sub>2</sub>. The development of the emission limits and operational constraints are described in the AECOM air dispersion modeling report and report appendices that are included in Appendices C-1 and C-2. All data associated with the development of the emission limits and operational constraints are included with the air dispersion modeling data in Appendix C-3.

The Department's consent agreement with Talen Energy includes all necessary operational constraints and emission limitations applicable to the facility for the nonattainment area to attain the 1-hour SO<sub>2</sub> NAAQS as required under the Clean Air Act. The consent agreement is included in Appendix B-1.

## 5.3 Established SO<sub>2</sub> Emission Limits

The SO<sub>2</sub> limits in the signed consent orders in Appendix B demonstrate compliance with the 2010 1-hour SO<sub>2</sub> NAAQS within the Anne Arundel County and Baltimore County, Maryland Nonattainment Area by the mandatory attainment date of September 12, 2021. These limits are summarized below. Note that unless otherwise stated, the limits and operational constraints will take effect on January 1, 2021.

- C.P. Crane Emission Limit – Unit 1 & Unit 2 combined SO<sub>2</sub> limit of 2,900 lbs/hr; effective October 9, 2019
- Brandon Shores Units 1 and 2 combined (whether operating individually or in tandem):

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<sup>59</sup> Technical discussion of modeling protocols and determinations of consistency with EPA guidance prior to submittal of a SIP revision does not constitute EPA approval of any SIP elements under 110(k).

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- Are limited to 3,860 lb SO<sub>2</sub>/hr limit (30-day rolling average)
- Cannot emit more than 9,980 lb SO<sub>2</sub>/hr (3-hour rolling average time)
- Are limited to 3 hours per calendar year of combined emissions greater than 5,150 lb SO<sub>2</sub>/hour (1-hour average) when Wagner 3 is not operating
- Are limited to 435 hours per calendar year of combined emissions greater than 2,851 lb SO<sub>2</sub>/hr when Wagner 3 is also operating
  
- Brandon Shores Units 1 and 2 and Wagner Unit 3 operating together:
  - Are limited to 3,860 lb SO<sub>2</sub>/hr limit (30-day rolling average) when Brandon Unit 1 and/or Brandon Unit 2 (operating individually or together), and Wagner 3 are *simultaneously* operating
  
- Wagner Unit 3 alone:
  - Cannot emit more than 3,289 lb SO<sub>2</sub>/hr (1-hour averaging time);
  - Is limited to emitting 1,904 lb SO<sub>2</sub>/hr (30-day rolling average);
  - Is limited to 336 hours per calendar year having emissions greater than 2,299 lb SO<sub>2</sub>/hr (1-hour averaging time)
  
- Wagner 1 alone:
  - Cannot emit more than 480 lb SO<sub>2</sub>/hr (1-hour averaging time)
  - Is limited to operating 438 hours per calendar year using fuel oil; note that the unit can operate additional hours on natural gas
  
- Wagner 2 alone:
  - Cease operation or convert from burning coal to burning natural gas.<sup>60</sup>
  
- Wagner 4 alone:
  - Cannot emit more than 1,350 lb SO<sub>2</sub>/hr (1-hour averaging time)
  - Is limited to operating 438 hours per calendar year using fuel oil; note that the unit can operate additional hours on natural gas

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<sup>60</sup> Note: Raven Power Fort Smallwood has agreed that no later than July 1, 2020 H.A. Wagner Unit 2 will cease burning coal and will only burn natural gas.

## 5.4 Summary of Emission Reductions from Control Measures

### Brandon Shores

Brandon Shores Units 1 & 2 are equipped with state-of-the-art flue gas desulfurization (FGD or “scrubber”) control technology for the removal of SO<sub>2</sub> from the flue gas. No additional reductions are expected from these units.

### H.A. Wagner Unit 1

H.A. Wagner Unit 1 is a dual-fired unit (natural gas and fuel oil). The unit is restricted to burning low sulfur fuel oil and an operational constraint of 438 hours annually when burning fuel oil. The sulfur in fuel oil is restricted by 70% to 0.3%. Because of the units’ infrequent use, MDE conservatively did not estimate any emission reductions from the unit.

### H.A. Wagner Unit 2

H.A. Wagner Unit 2 is a coal-fired unit. The unit will either be shut down or converted to natural gas. In either case SO<sub>2</sub> emissions will be greatly reduced zero, thus all of the emissions are credited as reductions.

### H.A. Wagner Unit 3

H.A. Wagner Unit 3 is a coal-fired unit. The unit has installed a dry sorbent injection system and will use a specialized sorbent that is expected to reduce SO<sub>2</sub> emissions by 30% (on a rolling 30-day basis). MDE conservatively estimated SO<sub>2</sub> emission reductions by assuming that when the unit operated it emitted at the maximum 30-day rolling average permitted (1,904 lbs/hr). MDE summed the permitted hourly values and subtracted the sum from the 2014 actual annual emissions emitted from the unit. The SO<sub>2</sub> emission reductions reflect the operational activity represented in the 2014 base year.

### H.A. Wagner Unit 4

H.A. Wagner Unit 4 is a fuel oil-fired unit. The unit is restricted to burning low sulfur fuel oil and an operational constraint of 438 hours annually. The sulfur in fuel oil is restricted by 70% to 0.3%. Because of the units’ infrequent use, MDE conservatively did not estimate any emission reductions from the unit.

### C.P. Crane Units 1 & 2

C.P. Crane Units 1 & 2 are coal-fired units. The units are restricted to the combined critical emission value of 2,900 lbs/hr. MDE conservatively estimated emission reductions from the two units by summing emissions on an hourly basis. Hourly emissions in excess of 2,900 pounds were considered reductions.

Table 11 provides a summary of the anticipated emission reductions from control measures at the larger SO<sub>2</sub> point sources in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area. Over the 2014 through 2021 timeframe, SO<sub>2</sub> emission reductions from these point sources are expected to be reduced by approximately 4,800 tons per year. The SO<sub>2</sub> emission reductions reflect the operational activity represented in the 2014 base year.

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**Table 11: Change in Emissions from 2014 to 2021 with Control Measures**

Facility	2014 Actual SO <sub>2</sub> Emissions (tpy)	2021 Projected SO <sub>2</sub> Emissions (tpy)	SO <sub>2</sub> Emissions Reductions (2014 - 2021) (tpy)
Brandon Shores Unit 1	1,669.90	1,669.90	0.00
Brandon Shores Unit 2	1,475.19	1,475.19	0.00
Wagner Unit 3	7,276.12	4,626.72	2,649.40
Wagner Unit 1	72.62	58.91	13.71
Wagner Unit 2	1,938.99	10.00	1,928.99
Wagner Unit 4	322.53	242.84	79.68
C.P. Crane Unit 1	573.38	1,566.49	320.67
C.P. Crane Unit 2	1,313.78		
<b>Total</b>	<b>14,642.50</b>	<b>9,650.05</b>	<b>4,992.45</b>

### 5.5 EPA Review of Modeled SO<sub>2</sub> Emission Limits

The EPA believes that dispersion modeling is an appropriate tool to indicate violations of the SO<sub>2</sub> NAAQS. According to EPA, “An area may also be demonstrated in attainment if appropriate modeling analysis [*sic*] indicates no violations of the 2010 SO<sub>2</sub> NAAQS.”<sup>61</sup>

In accordance with EPA’s guidance, longer-term (30-day rolling average) SO<sub>2</sub> limits with supplemental short-term limits were proposed for Brandon Shores Units 1 and 2 and Herbert A. Wagner Unit 3 to comply with the 1-hour SO<sub>2</sub> NAAQS. In demonstrating compliance with the longer-term average limits, a question arose as to whether hours without operations/emissions could be included in the average. The question was submitted to EPA for review. The review took over a year to conclude that the inclusion of non-operating hours in the calculations for determining compliance with the limit is inconsistent with EPA’s guidance (see Appendix C-5).

The model results and emission limits were presented to EPA for review. Prior to developing consent orders with the facilities, MDE asked EPA to state that the modeled results were sufficient to meet the NAAQS. After months of deliberation, EPA stated the following:

EPA has reviewed MDE’s modeling protocols, modeling files, and modeling report for the Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area, and understands that MDE will develop consent orders with the facilities to ***adopt the emission and operational limits that modeled attainment*** to meet the 2010 1-hour National Ambient Air Quality Standard (NAAQS).<sup>62</sup>

<sup>61</sup> <https://www.epa.gov/sites/production/files/2016-06/documents/20150320so2designations.pdf>

<sup>62</sup> Technical discussion of modeling protocols and determinations of consistency with EPA guidance prior to submittal of a SIP revision does not constitute EPA approval of any SIP elements under 110(k).

## 6.0 REASONABLE FURTHER PROGRESS

Section 172(c)(2) of the CAA requires that the SIP revision for a nonattainment area include RFP; particularly, “such annual incremental reductions in emissions of the relevant air pollutant as are required by this part [part D] or may reasonably be required by the Administrator, for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date.”<sup>63</sup> The EPA’s 1994 SO<sub>2</sub> Guideline Document<sup>64</sup> on pages 6-39 and the 2014 SO<sub>2</sub> SIP Guidance on page 40 explain that the RFP definition is less applicable to SO<sub>2</sub> because a limited number of sources affect the nonattainment area, as compared with pollutants such as ozone and particulate matter, and controlling the emissions from these few sources would yield significant and immediate air quality improvements. Furthermore, EPA explains in the General Preamble that RFP is best construed as “adherence to an ambitious compliance schedule.”<sup>65</sup> Maryland must ensure that the affected sources implement appropriate control measures as expeditiously as practicable in order to ensure attainment of the standard by the applicable attainment date.<sup>66</sup>

As evidenced in Figure 2 below, the monitored levels of SO<sub>2</sub> indicate that the Anne Arundel County and Baltimore County SO<sub>2</sub> nonattainment area is currently meeting the standard and that the RFP requirement for an ambitious compliance schedule is already underway. The source emission reductions described in the next section provide further evidence that the nonattainment area is meeting the RFP requirement of “as expeditiously as practicable.”

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<sup>63</sup>42 U.S.C. Section 7502(c)(2), available at <https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchap1-partD-subpart1-sec7502.htm>, accessed September 4, 2018.

<sup>64</sup> See, SO<sub>2</sub> Guideline Document, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, EPA-452/R-94-008, Feb. 1994, 6-39, available at: [https://www3.epa.gov/ttn/naaqs/aqmguidance/collection/cp2/19940201\\_oaqs\\_epa-452\\_r-94-008\\_so2\\_guideline.pdf](https://www3.epa.gov/ttn/naaqs/aqmguidance/collection/cp2/19940201_oaqs_epa-452_r-94-008_so2_guideline.pdf).

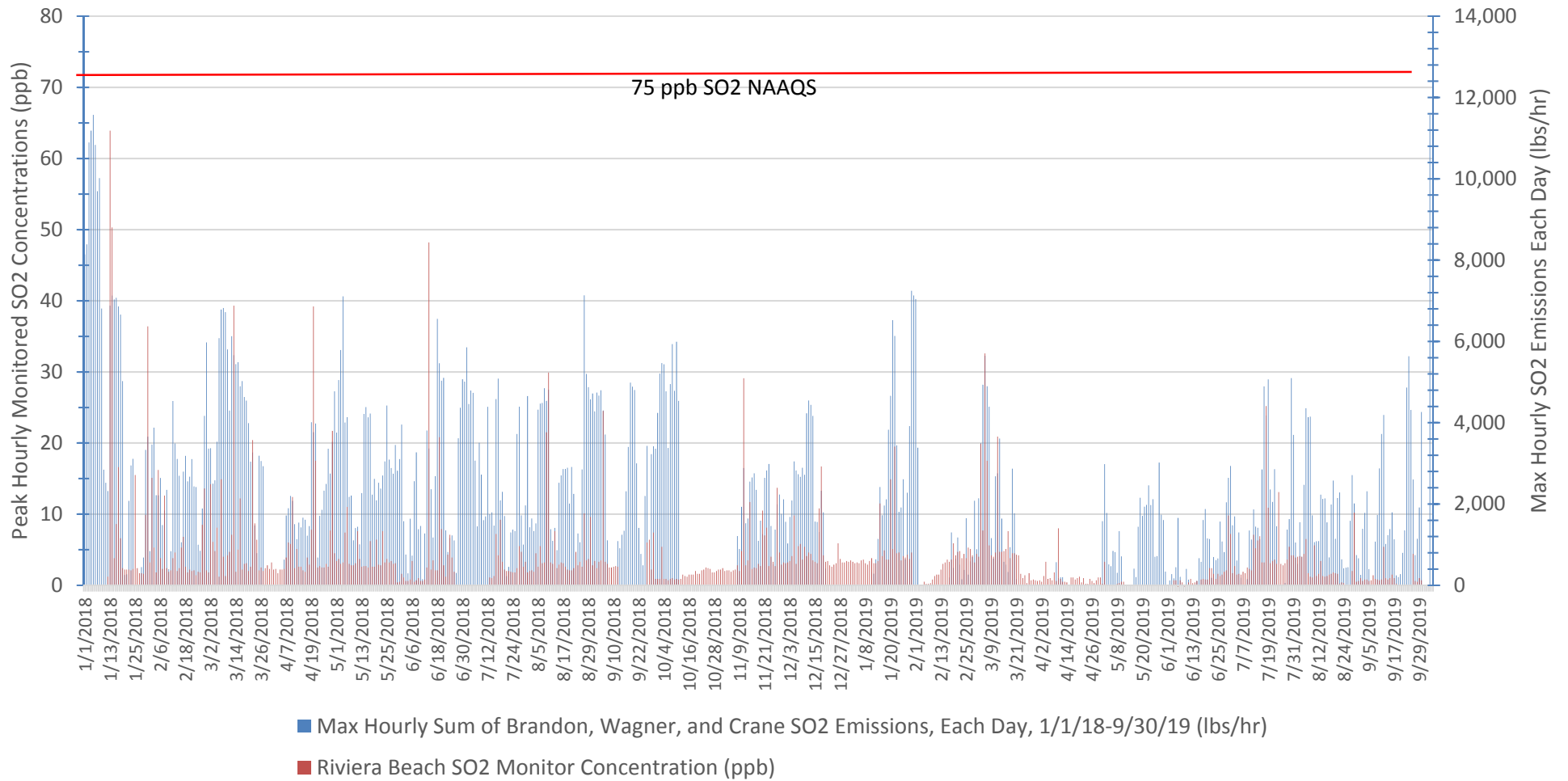
<sup>65</sup> See, 74 FR 13547 (April 16, 1992).

<sup>66</sup> See, EPA Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions (April 2014) at p. 40.

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Figure 2: Chart of SO<sub>2</sub> Emissions & Air Monitoring Concentrations

Peak Daily Riviera Beach Monitor SO<sub>2</sub> Concentrations &  
Maximum Hourly Sum of Brandon, Wagner, & Crane SO<sub>2</sub> Emissions  
Each Day, 1/1/18-9/30/19



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## 6.1 Source Reductions

The largest sources of SO<sub>2</sub> emissions in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area are the Brandon Shores, H.A. Wagner and C.P. Crane steam-boiler power plants.

As discussed in detail in Section 3.2 (relating to Reasonably Available Control Measures) above, the main units at each of these facilities are equipped with a variety of control devices to reduce SO<sub>2</sub> emissions. Operation of the sources and control equipment at these facilities, in accordance with emission restrictions and conditions in the Maryland Healthy Air Act, has greatly decreased SO<sub>2</sub> emissions in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area. Table 12 summarizes the control technology in place on the main units at Brandon Shores, H.A. Wagner and C.P. Crane. Note that controls implemented under the Maryland Healthy Air Act and other state and federal programs prior to 2014 were included in the base year and were not used to calculate reasonable further progress emission reductions.

**Table 12: EGU SO<sub>2</sub> Control Technology**

Facility	Unit	Fuel	SO <sub>2</sub> Control	Control Installation Date
Brandon Shores	Boiler 1	Coal	Flue Gas Desulfurization	2010
Brandon Shores	Boiler 2	Coal	Flue Gas Desulfurization	2010
H.A. Wagner	Boiler 1	Natural Gas /Fuel Oil	Operational Constraints	2021
H.A. Wagner	Boiler 2	Coal	Deactivation or Natural Gas Conversion	2020
H.A. Wagner	Boiler 3	Coal	Dry Sorbent Injection	2017-2018
H.A. Wagner	Boiler 4	#6 Fuel Oil	Operational Constraints	2021
C.P. Crane	Boiler 1	Coal	None	N/A
C.P. Crane	Boiler 2	Coal	None	N/A

As shown in Table 12, some of the control equipment at each of these facilities was installed before January 2017. Controls at Brandon Shores pre-date the 2014 to 2016 timeframe of the nonattainment designations but continue to provide significant emission reductions in the area. The operation of the FGDs at Brandon Shores Units 1 & 2 in 2010 corresponded with the reduction requirements mandated by the Maryland Healthy Air Act. These are included in the base year and were not included in the calculation of RFP. The control at H.A. Wagner Unit 3 was operational in 2017, providing additional emission reductions in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area to meet the RFP requirement.

### **6.1.1 Analysis of SO<sub>2</sub> NAAQS Limitations**

The emissions reductions directly attributable to the SO<sub>2</sub> NAAQS permit limitations and operational constraints on the Brandon Shore, Wagner and C.P Crane facilities are summarized in Section 5.4 (Summary of Emission Reductions from Control Measures) and Table 11, above. A conservatively estimated overall SO<sub>2</sub> reduction percent of 34% is expected from the measures adopted via consent order.

## **6.2 Air Quality Monitoring Network and Equipment**

The Department establishes, operates, and maintains a network of ambient air monitors throughout Maryland.

### **6.2.1 Samplers**

The Maryland SO<sub>2</sub> monitoring network consists only of SO<sub>2</sub> monitors that have been designated by the EPA as either Federal Reference Method or Federal Equivalent Method monitors. All ambient air monitors are subjected to the Federal Quality Assurance requirements of 40 C.F.R. Part 58, Appendix A. In addition, all samplers are located at sites that have met the minimum siting requirements of Part 58, Appendix E.

Sulfur dioxide is measured with an ultraviolet fluorescence analyzer. Air is drawn through a sample cell where it is then subjected to high intensity ultraviolet light. This causes the SO<sub>2</sub> molecules in the air to fluoresce and release light. The fluorescence is detected with a photomultiplier tube and converted to an electrical signal proportional to the SO<sub>2</sub> concentration.

### **6.2.2 Network Design**

Under 40 C.F.R. § 58.10, an annual network design plan is required to be submitted to the EPA Regional Administrator by July 1 of each year for concurrence with any proposed monitoring changes. The network design document informs both the EPA and the public of any planned changes to the sampling network for the next year. The annual network design plan provides a description of the current monitoring network, a reason for each change, and any other information relevant to any change. In addition, the Department provides EPA Region III with prior notification of any planned changes to the network between formal network design submissions. As needed, details of these changes are communicated to and approved by the EPA. The Department published the 2018 Annual Ambient Air Monitoring Network Plan<sup>67</sup> on June 20, 2017, and posted the plan on its website.

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<sup>67</sup> <http://mde.maryland.gov/programs/Air/AirQualityMonitoring/Documents/MDNetworkPlanCY2018.pdf>



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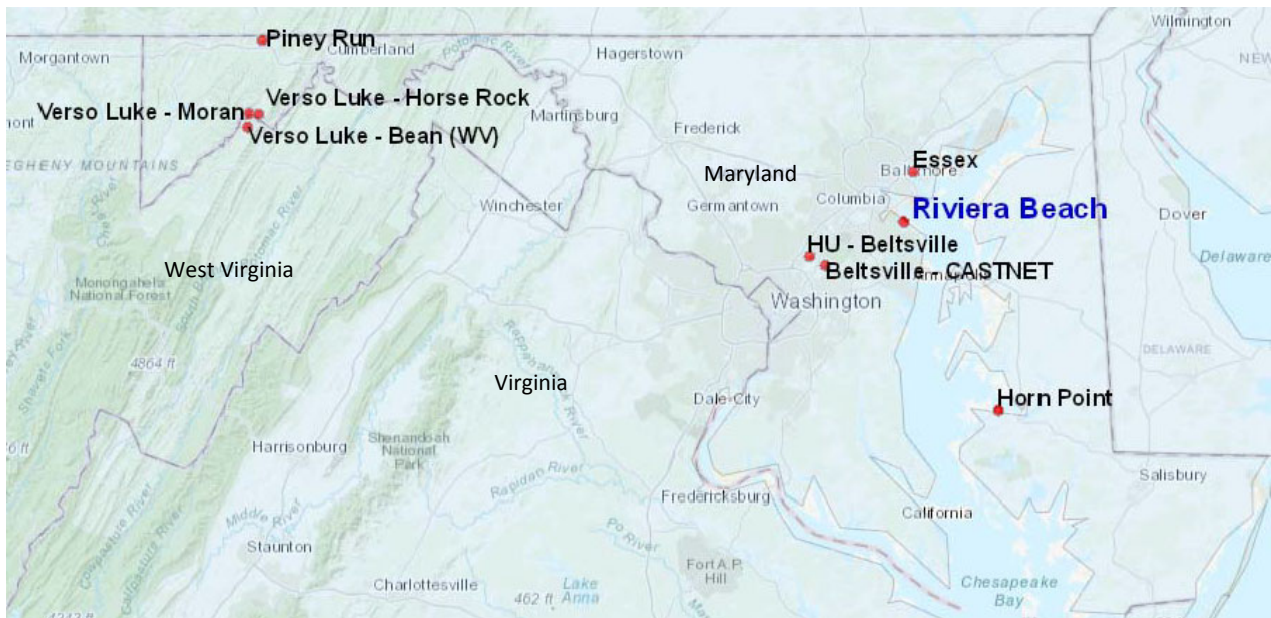
### 6.2.3 Reporting to the EPA

The Department collects and reports to the EPA all ambient air quality data for SO<sub>2</sub>, carbon monoxide, ozone, nitrogen dioxide, lead, and particulate matter. The reports comply with the federal requirements of 40 C.F.R. § 58.16 (relating to data submittal and archiving requirements). The submitted data is reviewed, edited, validated, and entered into the EPA Air Quality System (AQS) for updating pursuant to prescribed AQS procedures. The EPA AQS receives each report within 90 days after the end of the quarterly reporting period. Each year's data is certified by May 1 of the following year.

### 6.3 Air Quality Monitoring in the Nonattainment Area

The Department operates a source-oriented SO<sub>2</sub> monitor in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area, at Riviera Beach Elementary School, Anne Arundel County (AQS 24-003-2002). The monitor, which was established as a Special Purpose Monitor (SPM) on January 12, 2018, has been showing SO<sub>2</sub> monitoring values below the 2010 1-hour SO<sub>2</sub> NAAQS. Figure 3 shows the location of the monitor.

**Figure 3: Maryland SO<sub>2</sub> Monitors**



Map Service: US EPA Office of Air and Radiation, Office of Air Quality Planning and Standards (OAR, OAQPS). Data: Various state, local, and tribal air pollution agencies using procedures specified by the US EPA. | Esri, HERE, Garmin, FAO, USGS, EPA, NPS

## 7.0 CONTINGENCY MEASURES

Section 172(c)(9) of the CAA requires a SIP revision for a nonattainment area to provide “specific measures to be undertaken if the area fails to make reasonable further progress, or to attain the national primary ambient air quality standard by the attainment date....” The measures shall take effect without further action by the state or the Administrator. The 2014 SO<sub>2</sub> SIP Guidance states that contingency measures are other available control measures for the area that are not already included in the control strategy for the attainment demonstration of the SIP.<sup>68</sup>

### 7.1 SO<sub>2</sub> Interpretation

The EPA explained on pages 6-40 and 6-41 of its 1994 SO<sub>2</sub> Guideline Document, “SO<sub>2</sub> control measures are by definition based upon what is directly quantifiably necessary to attain the SO<sub>2</sub> NAAQS, it would be unlikely for an area to implement the necessary emissions control yet fail to attain the NAAQS.”<sup>69</sup> The 1994 Guideline, cited on p. 41 of the 2014 SO<sub>2</sub> SIP Guidance, explains that contingency measures for SO<sub>2</sub> can mean that the “air agency has a comprehensive program to identify sources of violations of the SO<sub>2</sub> NAAQS and to undertake an ‘aggressive’ follow-up for compliance and enforcement, including expedited procedures for establishing enforcement consent agreements pending the adoption of the revised SIP.”<sup>70</sup>

### 7.2 Facility-Initiated Contingency Measures

The consent agreements are included in Appendix B. The Department will execute the consent agreements after considering public comments received, if any, on the consent agreements and SIP and prior to submitting to EPA for approval the final SIP revision for the Anne Arundel County and Baltimore County, Maryland Nonattainment Area for the 2010 1-hour SO<sub>2</sub> NAAQS. The Department requests that the final consent orders be incorporated by reference into the Maryland SIP. Those portions will be federally enforceable upon EPA’s approval.

The draft consent orders contain the measures below that are designed to keep the area from triggering an exceedance or violation of the 1-hour SO<sub>2</sub> standard.

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<sup>68</sup> EPA Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions (April 2014), p. 41.

<sup>69</sup> SO<sub>2</sub> Guideline Document, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, EPA-452/R-94-008, Feb. 1994, pp. 6-40, 6-41, available at: [https://www3.epa.gov/ttn/naaqs/aqmguid/collection/cp2/19940201\\_oaqps\\_epa-452\\_r-94-008\\_so2\\_guideline.pdf](https://www3.epa.gov/ttn/naaqs/aqmguid/collection/cp2/19940201_oaqps_epa-452_r-94-008_so2_guideline.pdf).

<sup>70</sup> SO<sub>2</sub> Guideline Document (Feb. 1994), as cited in EPA Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions (April 2014), pp. 40-41.

### 7.2.1 Fort Smallwood (Brandon Shores and H.A. Wagner) Contingency Measures

1. Emissions exceedance audit report:

At any time that emissions from BS1, BS2, and/or W3<sup>71</sup> at the Fort Smallwood Complex exceed one or more of the SO<sub>2</sub> emissions limits or fuel oil operations limits identified in Paragraphs 1 through 12 of this Consent Order, Raven Power shall, with 48 hours of such exceedance, undertake a full-system audit of Units BS1, BS2, W1, W2, W3, and W4 (cumulatively) at the Fort Smallwood Complex and shall submit a telephone report on the next business day and a written report to the Department within 10 days of the exceedance. At any time that emissions from Units W1, W2, and/or W4 at the Fort Smallwood Complex exceed one or more of the SO<sub>2</sub> emissions limits or fuel oil operations limits identified in Paragraphs 1 through 12 of this Consent Order, Raven Power shall, within 48 hours of knowledge of fuel test results, undertake a full-system audit of Units BS1, BS2, W1, W2, W3, and W4 (cumulatively) at the Fort Smallwood Complex and shall submit a telephone report on the next business day and a written report to the Department within 10 days of the exceedance. The telephone report shall be submitted pursuant to COMAR 26.11.01.07C. A written report to satisfy this requirement shall include both (1) the results of the full-system audit, and (2) a report of excess emissions prepared pursuant to COMAR 26.11.01.07D and Section 3.4 of the Operating Permit. The full-system audit shall consist of a review of the parameters routinely monitored by the continuous emissions monitoring systems and the digital data acquisition systems installed on the SO<sub>2</sub> generating units and their control devices and programs to determine whether or not the units and their controls were operating in accordance with good engineering practices.

- a. If the units or their controls were not operating in accordance with good engineering practices, then Raven Power shall implement corrective actions to ensure that the limits of this Consent Order are not exceeded.
- b. If the units and controls were operating in accordance with good engineering practice, then Raven Power shall inform the Department as to the reasons for their exceedance of one or more of their SO<sub>2</sub> emissions limits and implement corrective actions to ensure that the limits of this Consent Order are not exceeded.
- c. In any case of an exceedance of an SO<sub>2</sub> emission limit or of a fuel oil operations limit, Raven Power shall document and notify the Department of the corrective actions that they have taken.
- d. The audit, report of excess emissions, documentation of corrective actions taken, and associated records shall be maintained on site for five years.

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<sup>71</sup> The abbreviations are defined as follows: BS1 and BS2 are Brandon Shores Units 1 & 2. W1, W2, W3, and W4 are H.A. Wagner Units 1, 2, 3, and 4.

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2. Daily exceedance report:

This is detailed in the consent order as quoted here:

If the Essex, Maryland monitor (AIRS ID 24-005-3001) or any other Department-approved air quality SO<sub>2</sub> monitor located within the SO<sub>2</sub> Nonattainment Area, measures a 1-hour SO<sub>2</sub> concentration exceeding 75 parts per billion (i.e. an exceedance of the 1-hour SO<sub>2</sub> NAAQS), then the Department will notify Raven Power within 5 business days both verbally and in writing. If, however, Raven Power first notifies the Department both verbally and in writing of the monitored exceedance, then the Department will not also notify Raven Power. In either case, whether it is the Department or Raven Power who first notifies the other party of the monitor's exceedance of the 75 parts per billion SO<sub>2</sub> limit, within 2 business days of that first notification, Raven Power shall notify the Department whether Units BS1, BS2, W1, W2, W3, and W4 were running at the time of the exceedance or within 24 hours preceding the exceedance. If any of those Units were running during that timeframe, Raven Power shall analyze the meteorological data on the day the 1-hour exceedance occurred to determine the extent the Fort Smallwood SO<sub>2</sub> emissions contributed to the 1-hour exceedance. The meteorological data analysis shall include: (1) trajectories run at three different heights (one at stack height; and two more within the boundary layer) by the National Oceanic and Atmospheric Administration's Hysplit program or an equivalent program; and (2) an analysis of meteorological data including the Baltimore-Washington International Airport's meteorological data and modeled upper air data using the National Weather Service's Bufkit or an equivalent program. Raven Power shall submit its meteorological data analysis, and its findings therefrom, to the Department within 30 days of written notification of the exceedance of the 1-hour SO<sub>2</sub> NAAQS.

### **7.2.2 C.P. Crane Contingency Measures**

To quote the consent order, C.P. Crane LLC has disabled the units and C.P. Crane LLC agreed to permanently cease the burning of coal in the Units under a previous Consent Order executed with the Department. As such, C.P. Crane LLC will notify the Department (1) upon implementation of any plan to restart coal burning operations at either Unit 1 or Unit 2 and (2) of any change in the inoperable status of the units within 48 hours of the change.

### **7.3 Department-Initiated Contingency Measures**

A violation of the 2010 1-hour SO<sub>2</sub> NAAQS occurs when, based on data collected and quality-assured by MDE, the SO<sub>2</sub> design value (the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations) at an ambient air quality monitoring site exceeds 75 ppb. Data is quality-assured and submitted to the EPA's AQS on a quarterly basis. Contingency measures are

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required to be implemented, as appropriate, if an RFP milestone is missed, or if there is a violation of the 2010 1-hour SO<sub>2</sub> NAAQS.

MDE has a comprehensive compliance and enforcement program to identify sources of violations of the 2010 1-hour SO<sub>2</sub> NAAQS and can undertake aggressive follow-up for compliance and enforcement including the ability to enact a consent order in a timely manner. The Department is choosing to implement the above contingency measures proactively to identify and correct any problem before it would result in a violation of the NAAQS. The investigation contingency measure described below would be implemented if an SO<sub>2</sub> monitor in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area registers a 1-hour daily maximum concentration exceeding 75 ppb. (This does not necessarily constitute a violation of the NAAQS.) The Department would proceed with an investigation and enforcement as appropriate.

### **7.3.1 Investigation**

If the MDE Air and Radiation Administration (ARA), monitoring division staff identify a 1-hour daily maximum SO<sub>2</sub> concentration exceeding 75 ppb when submitting the quarterly SO<sub>2</sub> monitoring data at an MDE-operated SO<sub>2</sub> monitor in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area, the following step will be taken:

Within 5 business days, MDE ARA staff will contact Fort Smallwood and C.P. Crane in writing to trigger the implementation of their “daily exceedance report” contingency measure.<sup>72</sup>

### **7.3.2 Enforcement**

The Department is authorized by the Annotated Code of Maryland Section 2-609 to take action that it deems necessary or proper for the effective enforcement of the consent order and the rules and regulations promulgated under the Act. This includes, as needed, revising permitted emissions limits in the consent agreements with Talen Energy and/or CP Crane LLC and submitting these revisions to EPA for approval into the SIP. It also includes enforcement actions that may result in the assessment of civil penalties.

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<sup>72</sup> For a description of the “daily exceedance report,” see Sections 7.2.1(b) and 7.2.2(b) above.

## 8.0 NONATTAINMENT NEW SOURCE REVIEW AND PREVENTION OF SIGNIFICANT DETERIORATION

Section 172(c)(5) of the CAA, 42 U.S.C. § 7502(c)(5), prescribes that an attainment SIP requires permits for the construction and operation of new or modified major stationary sources in the nonattainment area in accordance with Section 173 of the CAA, 42 U.S.C. § 7503. Section 7503 details the conditions under which permits to construct and operate may be issued by the permitting agency.

Maryland has a fully implemented Nonattainment New Source Review (NNSR) program under COMAR 26.11.17, “Nonattainment Provisions for Major New Sources and Major Modifications,” addressing the criteria pollutants. EPA has approved this chapter into the Maryland SIP, most recently at 77 FR 45949, August 2, 2012, and 80 FR 39969, July 13, 2015.

Maryland’s NNSR program meets the SO<sub>2</sub>-applicable requirements of 42 U.S.C. Sec 7503, as detailed below:

The SIP-approved chapter, COMAR 26.11.17, applies to any new major stationary source or major modification of a major stationary source that is “major” for a pollutant for which the area has been designated “nonattainment” under the Clean Air Act [42 U.S.C. Sec. 7407(d)(1)(A)(i)].<sup>73</sup> This includes the Anne Arundel County and Baltimore County, MD SO<sub>2</sub> nonattainment area. The approved SIP includes SO<sub>2</sub> as a “Regulated NSR pollutant.” COMAR 26.11.17.01B(24) states the following (emphasis added):

(24) "Regulated NSR pollutant" means **any pollutant for which a national ambient air quality standard has been promulgated** and any pollutant that is a constituent or precursor of the pollutant for which there is an ambient air quality standard, provided that the constituent or precursor may only be regulated under this chapter as part of regulation of the pollutant.”

In the SIP-approved copy of COMAR 26.11.17, “major stationary source” is defined as “any stationary source of air pollution which emits or has the potential to emit 100 tons or more of any regulated NSR pollutant,” which by definition includes SO<sub>2</sub>.<sup>74</sup> A “significant” net increase in SO<sub>2</sub> emissions is defined as 40 tons per year. “Best Available Control Technology” is defined as an emissions limitation “based on the maximum degree of [emissions] reduction for each regulated NSR pollutant which would be emitted from any proposed major stationary source or major modification.

COMAR 26.11.17.03 “General Conditions,” fulfills several requirements under 42 U.S.C. 7503. This regulation states that all permits and approvals required under this subtitle [COMAR 26.11] must be obtained before construction or modification of “an emissions unit subject to this chapter

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<sup>73</sup> See COMAR 26.11.17.02A(3)

<sup>74</sup> See COMAR 26.11.17.01B(17)

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[COMAR 26.11.17]”.<sup>75</sup> Below are the details of the provisions of this regulation that fulfill 42 U.S.C. 7503, organized by the section of 42 U.S.C. 7503 that they fulfill:

- **42 U.S.C. 7503(a)(2)**  
COMAR 26.11.17.03B(2) states, “The proposed new major stationary source or major modification will meet an emission limitation which specifies the lowest achievable emissions rate.”
- **42 U.S.C. 7503(a)(3)**  
COMAR 26.11.17.03B(1) states that the permit or approval applicant, “certifies that all existing major stationary sources owned or operated by the applicant, or any entity controlling, controlled by, or under common control with the applicant, in the State are in compliance with all applicable emission limitations or are in compliance with an approved federally enforceable plan for compliance.”
- **42 U.S.C. 7503(a)(5)**  
COMAR 26.11.17.03B(6) states, “An analysis of alternative sites, sizes, production processes, and environmental control techniques for a proposed source demonstrates that benefits of the proposed source significantly outweigh the environmental and social costs imposed as a result of its location, construction, or modification...”

In COMAR 26.11.02.12F, Maryland requires that applicants for approval of prevention of significant Deterioration (PSD) sources, new source review (NSR) sources, and certain permits to construct publish a notice of the opportunity to submit public comments and to request a public hearing.

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<sup>75</sup> COMAR 26.11.17.03A

## 9.0 CONFORMITY

General conformity as well as transportation conformity are required under CAA Section 176(c), 42 U.S.C. § 7506(c), to ensure that federal actions, including federally-funded highway and transit project activities, do not cause or worsen air quality violations or delay timely attainment of the relevant NAAQS. The 2014 SO<sub>2</sub> SIP Guidance document states, “With respect to the 2010 NAAQS, federal agencies are expected to continue to estimate emissions for conformity analyses in the same manner as they estimated emissions for conformity analyses under the previous NAAQS for SO<sub>2</sub>.”<sup>76</sup>

Also the 2014 SO<sub>2</sub> SIP Guidance states the following:<sup>77</sup>

Due to the relatively small, and decreasing, amounts of sulfur in gasoline and on-road diesel fuel, the EPA’s transportation conformity rules provide that they do not apply to SO<sub>2</sub> unless either the EPA Regional Administrator or the director of the state air agency has found that transportation-related emissions of SO<sub>2</sub> as a precursor are a significant contributor to a PM<sub>2.5</sub> nonattainment problem...

There have been no findings of significance for any of the precursors (including SO<sub>2</sub>) to PM<sub>2.5</sub>. Because transportation-related emissions are not significant, transportation conformity does not apply in the Anne Arundel County and Baltimore County, Maryland Nonattainment Area.

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<sup>76</sup> See, EPA Guidance for 1-Hour SO<sub>2</sub> Nonattainment Area SIP Submissions (April 2014), p. 45.

<sup>77</sup> Ibid. 2014 SO<sub>2</sub> SIP Guidance, p. 45-46.



## **APPENDICES**

### **Appendix A – Emission Inventory**

- Appendix A-1: Emission Inventory Methodology Documentation
- Appendix A-2: Projection Inventory Methodology Documentation
- Appendix A-3: Point Source Inventory
- Appendix A-4: Quasi-Point Source Inventory
- Appendix A-5: Area/Nonpoint Source Inventory
- Appendix A-6a: Nonroad MOVES Model Inventory (2014)
- Appendix A-6b: Nonroad MOVES Model Inventory (2021)
- Appendix A-7: Nonroad M-A-R Inventory
- Appendix A-8a: Onroad Source Inventory
- Appendix A-8b: Onroad Mobile SO<sub>2</sub> Modeling Files 2014-2021
- Appendix A-9: EGU Emission Reduction Documentation
- Appendix A-10: Hourly EGU Emissions

### **Appendix B – Consent Orders, Permits and Plan Approvals**

- Appendix B-1: Consent Order – Brandon Shores and Wagner Generating Stations
- Appendix B-2: Consent Order – C.P. Crane Generating Station

### **Appendix C – Air Dispersion Modeling Support**

- Appendix C-1: Air Dispersion Modeling Report
- Appendix C-2a: Air Dispersion Modeling Report Appendices A-H
- Appendix C-2b: Air Dispersion Modeling Report Appendices B-F Time Series Plots
- Appendix C-3: Air Dispersion Modeling Data
- Appendix C-4: EPA Findings Regarding the Air Dispersion Modeling and Methods
- Appendix C-5: EPA Determination That Averaging Non-Operating Hours Inconsistent with EPA's Guidance
- Appendix C-6: Air Dispersion Modeling Protocol
- Appendix C-7: Weight of Evidence – Supplemental Information on Air Dispersion Modeling

### **Appendix D – U.S. EPA SO<sub>2</sub> Data Requirements Rule**

### **Appendix E – Public Hearing Notices, Comments, and Responses**