Technical Support Document:

Chapter 36
Proposed Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for Puerto Rico

1. Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (the EPA, we, or us) must designate areas as either "nonattainment," "attainment," or "unclassifiable" for the 2010 1-hour sulfur dioxide (SO_2) primary national ambient air quality standard (NAAQS) (2010 SO_2 NAAQS). The CAA defines a nonattainment area as an area that does not meet the NAAQS or that contributes to a nearby area that does not meet the NAAQS. An attainment area is defined by the CAA as any area that meets the NAAQS and does not contribute to a nearby area that does not meet the NAAQS. Unclassifiable areas are defined by the CAA as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. In this action, EPA has defined a nonattainment area as an area that the EPA has determined violates the 2010 SO_2 NAAQS or contributes to a violation in a nearby area, based on the most recent 3 years of air quality monitoring data, appropriate dispersion modeling analysis, and any other relevant information. An unclassifiable/attainment area is defined by EPA as an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS[1]. An unclassifiable area is defined by EPA as an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

This technical support document (TSD) addresses designations for nearly all remaining undesignated areas in the Commonwealth of Puerto Rico for the 2010 SO_2 NAAQS. Section

[1] The term "attainment area" is not used in this document because the EPA uses that term only to refer to a previous nonattainment area that has been redesignated to attainment as a result of the EPA's approval of a state-submitted maintenance plan.

302(d) of the CAA includes the Commonwealth of Puerto Rico in the definition of the term "State" and herein throughout this document is regarded as a state and interchangeably referred to as "the Commonwealth" or "the State." In previous final actions, the EPA has issued designations for the 2010 SO_2 NAAQS for selected areas of the country.[2] The EPA is under a December 31, 2017, deadline to designate the areas addressed in this TSD as required by the U.S. District Court for the Northern District of California.[3] We are referring to the set of designations being finalized by the December 31, 2017 deadline as "Round 3" of the designations process for the 2010 SO_2 NAAQS. After the Round 3 designations are completed, the only remaining undesignated areas will be those where a state has installed and begun timely operating a new SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 Data Requirements Rule (DRR) (80 FR 51052). The EPA is required to designate those remaining undesignated areas by December 31, 2020.

Puerto Rico submitted its first recommendation regarding designations for the 2010 1-hour SO_2 NAAQS on June 3, 2011. The state submitted updated recommendations on March 26, 2012[4]. The state submitted further updates on December 19, 2016[5], March 3[6], 2017 March 28, 2017[7], and May 30, 2017[8]. In our intended designations, we have considered all the submissions from the state, except where a recommendation in a later submission regarding a particular area indicates that it replaces an earlier recommendation for that area we have considered the recommendation in the later submission.

For the areas in Puerto Rico that are part of the Round 3 designations process, Table 1 identifies EPA's intended designations and the counties or portions of counties to which they would apply. It also lists Puerto Rico's current recommendations. The EPA's final designation for these areas will be based on an assessment and characterization of air quality through ambient air quality data, air dispersion modeling, other evidence and supporting information, or a combination of the above.

[2] A total of 94 areas throughout the U.S. were previously designated in actions published on August 5, 2013 (78 FR 47191), July 12, 2016 (81 FR 45039), and December 13, 2016 (81 FR 89870).
[3] *Sierra Club v. McCarthy*, No. 3-13-cv-3953 (SI) (N.D. Cal. Mar. 2, 2015).
[4] Puerto Rico's March 26, 2012 submittal retracted its previous recommendations in its letter dated June 3, 2011, and recommended an "unclassifiable" recommendation for all areas of Puerto Rico. The basis for Puerto Rico's recommendation was "the emission inventory may not reflect the more recent and available information"
[5] Puerto Rico's December 19, 2016 submittal addressed designation recommendations and modeling for all areas of Puerto Rico.
[6] Puerto Rico's March 3, 2017 submittal consisted of revised modeling to address some errors found in the modeling assessment submitted on December 19, 2016.
[7] Puerto Rico's March 28, 2017 submittal consisted of updated modeling for PREPA Costa Sur in the Guayanilla area
[8] Puerto Rico's May 30, 2017 submittal substituted "Gobernador Pinero Ward" for the wards previously identified as Caparra Heights and Puerto Nuevo" in the March 2017 submittals.

Table 1. Summary of the EPA's Intended Designations and the Designation Recommendations by Puerto Rico

Area	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
San Juan Area	Within the Cataño Municipality: Palmas and Barrio Pueblo Wards	Nonattainment	Within Cataño Municipality: Palmas and Barrio Pueblo Wards	Nonattainment
	Within the Toa Baja Municipality: Palo Seco Ward and Sabana Seca Ward (partial)[9]	Nonattainment	Within the Toa Baja Municipality: Palo Seco and Sabana Seca Wards	Nonattainment
			Remaining Wards in the Tao Baja Municipality[10]	Unclassifiable
	Within the San Juan Municipality: San Jan Antiguo, Santurce, Hato Rey Norte, Hato Rey Sur, Hato Rey, El Cinco, Monacillo Urbano, and Gobernador Pinero[11] Wards	Nonattainment	Within the San Juan Municipality: San Jan Antiguo, Santurce, Hato Rey Norte, and Gobernador Pinero	Nonattainment
			Remaining Wards in the San Juan Municipality[12]	Unclassifiable
	Within the Guaynabo Municipality: Pueblo Viejo and Frailes Wards	Nonattainment	Within the Guaynabo Municipality: Pueblo Viejo Ward	Nonattainment
			Remaining Wards in the Guaynabo Municipality[13]	Unclassifiable
	Within the Bayamón Municipality: Juan Sánchez Ward	Nonattainment	Within the Bayamón Municipality: Juan Sánchez Ward	Nonattainment

[9] Puerto Rico recommended the northeast portion of the Sana Seca Ward, near Palo Seco, be designated as nonattainment using the intersection between 866 and 165 as a landmark.

[10] The remaining Wards in the Tao Baja Municipality to be designated as unclassifiable include: Toa Baja Pueblo, Media Luna, and Candelaria.

[11] Puerto Rico previously referred to the Gobernador Pinero Ward as the Caparra Heights and Puerto Nuevo Wards. In a May 30, 2017 submission to EPA, Puerto Rico updated their submission to refer to Caparra Heights and Puerto Nuevo Wards as the Gobernador Pinero Ward.

[12] The remaining wards in the San Juan Municipality to be designated as unclassifiable include: Hato Rey Central, Hato Rey Sur, Oriente, Sabana Llana Norte, Sabana Lllana Sur, Rio Piedras, Universidad, El Cinco, Monacillo Urbano, Monacillo, Cupey, Caimito, Tortugo, and Quebrada Arenas.

[13] The remaining wards in the Guaynabo Municipality to be designated as unclassifiable include: Frailes, Ciudad de Guaynabo, Santa Rosa, Camarones, Rio, Mamey, Guaraguao, Sonadora, and Hato Nuevo.

			Remaining Wards in the Bayamón Municipality[14]	Unclassifiable
			Dorado Municipality	Unclassifiable
			Toa Alta Municipality	Unclassifiable
			Within the Carolina Municipality: Cangrejo Arriba and Sabana Abajo Wards	Unclassifiable
Guayama-Salinas Area	Within the Guayama Municipality: Jobos, Ponzo, and Hono Wards	Nonattainment	Guayama Municipality	Unclassifiable
	Within the Salinas Municipality: Aguirre Ward and Lapa Ward (partial)[15]	Nonattainment	Within the Salinas Municipality: Aguirre and Lapa Wards	Nonattainment
			Santa Isabel, Coama, Aibonito, and Cayey Municipalities	Unclassifiable
			Remaining areas in Salinas[16]	Unclassifiable
Guayanilla Area	Guayanilla and Peñuelas Municipalities	Unclassifiable/ Attainment	Guayanilla and Peñuelas Municipalities	Unclassifiable/ Attainment
Rest of State*	Not Specified	Unclassifiable/ Attainment	Rest of State	Unclassifiable/ Attainment

* EPA intends to designate the remaining undesignated municipalities (or portions of municipalities) in Puerto Rico as "unclassifiable/attainment" as these areas were not required to be characterized by the state and cannot be classified on the basis of available information as meeting or not meeting the NAAQS. These areas that we intend to designate as unclassifiable/attainment (those to which this row of this table is applicable) are identified more specifically in section 6 of this TSD.

For states that elected to install and begin operation of a new, approved SO_2 monitoring network, the EPA is required to designate those areas pursuant to a court ordered schedule, by December 31, 2020. Puerto Rico did not elect to install a new SO_2 monitoring network.

[14] The remaining wards in the Bayamón Municipality include: Buena Vista, Cerro Gordo, Dajaos, Guaraguao Abajo, Guaraguao Arriba, Hato Tejas, Minillas, Nuevo, Pájaros, Barrio Pueblo, and Santa Olaya.
[15] Puerto Rico recommended a portion of Lapa Ward be designated as nonattainment, specifically east and south of Highway 52, using as landmark the intersection between Highway 52 with Street 1 of Hacienda Hucar.
[16] The remaining areas in Salinas to be designated as unclassifiable include: Palmas, Quebrada Yeguas, Rio Jueyes, and Salinas Pueblo.

2. General Approach and Schedule

Updated designations guidance documents were issued by the EPA through a July 22, 2016, memorandum and a March 20, 2015, memorandum from Stephen D. Page, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Air Division Directors, U.S. EPA Regions I-X. These memoranda supersede earlier designation guidance for the 2010 SO_2 NAAQS, issued on March 24, 2011, and identify factors that the EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The documents also contain the factors that the EPA intends to evaluate in determining the boundaries for designated areas. These factors include: 1) air quality characterization via ambient monitoring or dispersion modeling results; 2) emissions-related data; 3) meteorology; 4) geography and topography; and 5) jurisdictional boundaries.

To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, the EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in August 2016.[17]

Readers of this chapter of this TSD should refer to the additional general information for the EPA's Round 3 area designations in Chapter 1 (Background and History of the Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard) and Chapter 2 (Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for States with Sources Not Required to be Characterized).

As specified by the March 2, 2015, court order, the EPA is required to designate by December 31, 2017, all "remaining undesignated areas in which, by January 1, 2017, states have not installed and begun operating a new SO_2 monitoring network meeting EPA specifications referenced in EPA's" SO_2 DRR (80 FR 51052). The EPA will therefore designate by December 31, 2017, areas of the country that are not, pursuant to the DRR, timely operating EPA-approved and valid monitoring networks. The areas to be designated by December 31, 2017, include the areas associated with four sources in Puerto Rico meeting DRR emissions criteria, and other areas not specifically required to be characterized by the state under the DRR.

Because many of the intended designations have been informed by available modeling analyses, this preliminary TSD is structured based on the availability of such modeling information. There is a section for each municipality, where there is modeling information available. The remaining to-be-designated municipalities are then addressed together in Section 6.

The EPA does not plan to revise this TSD after consideration of state and public comment on our intended designation. A separate TSD will be prepared as necessary to document how we have addressed such comments in the final designations.

[5] https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf. In addition to this TAD on modeling, the EPA also has released a technical assistance document addressing SO_2 monitoring network design, to advise states that have elected to install and begin operation of a new SO_2 monitoring network. See Draft SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, February 2016, https://www.epa.gov/sites/production/files/2016-06/documents/so2monitoringtad.pdf.

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

1) 2010 SO_2 NAAQS – The primary NAAQS for SO_2 promulgated in 2010. This NAAQS is 75 ppb, based on the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations. See 40 CFR 50.17.
2) Design Value - a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the NAAQS.
3) Designated nonattainment area – an area that, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, EPA has determined either: (1) does not meet the 2010 SO_2 NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS.
4) Designated unclassifiable/attainment area – an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.[18]
5) Designated unclassifiable area – an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.
6) Modeled violation – a violation of the SO_2 NAAQS demonstrated by air dispersion modeling.
7) Recommended attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as attainment.
8) Recommended nonattainment area – an area that a state, territory, or tribe has recommended that the EPA designate as nonattainment.
9) Recommended unclassifiable area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable.
10) Recommended unclassifiable/attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable/attainment.
11) Violating monitor – an ambient air monitor meeting 40 CFR parts 50, 53, and 58 requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.
12) We, our, and us – these refer to the EPA.

[18] The term "attainment area" is not used in this document because the EPA uses that term only to refer to a previous nonattainment area that has been redesignated to attainment as a result of the EPA's approval of a state-submitted maintenance plan.

3. Technical Analysis for the San Juan Area

3.1. Introduction

This is the technical analysis for the Toa Baja, Cataño, Bayamon, Guaynabo, San Juan, Dorado, Toa Alta, and Carolina (e.g., Cangrejo Arriba and Sabana Abajo wards only) municipalities in Puerto Rico (San Juan area).

The EPA must designate the San Juan, PR, area by December 31, 2017, because the area has not been previously designated and Puerto Rico has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR for any sources of SO_2 emissions in San Juan.

3.2. Air Quality Monitoring Data for the San Juan Area

This factor considers the SO_2 air quality data in the San Juan area. Puerto Rico initially submitted air quality monitoring data in the June 3, 2011, submission to EPA for two monitors, one operating in Cataño (AQS ID 72-033-0004) and the other in Bayamon (AQS ID 72-021-0006). The values submitted were 3-year (2007-2009) averages of the 99th percentile of the annual daily 1-hour average concentrations. The reported values are not comparable to the NAAQS, since the level of the 1-hour NAAQS for sulfur dioxide is calculated as the 3-year average of the 99th percentile of the daily maximum 1-hour average concentrations.

Puerto Rico did not factor the earlier submitted monitoring data in their designation recommendations to EPA in December 2016 and later, which was based exclusively on modeling conducted for the DRR sources in the area, and further discussed in the next section.
Puerto Rico did not draw any significant conclusions from the data submitted in June 2011, and noted in 2011 that the monitors may need to be adjusted to meet SO_2 network design requirements.

Puerto Rico has not provided any updated air monitoring data submissions for the area in the later submittals, with the exception of monitoring data from the Guayama SO_2 monitor (AQS ID 72-057-0009) used for determining background SO_2 concentrations for the modeling, which is further discussed in the next section.

Table 2. SO_2 Monitor Design Values[19] – San Juan Area

Municipality	Air Quality System (AQS) Monitor ID	Distance from PREPA Palo Seco (km)	Direction from PREPA Palo Seco	Distance from PREPA San Juan (km)	Direction from PREPA San Juan	2011-2013 SO_2 Design Value (ppb)	2012-2014 SO_2 Design Value (ppb)	2013-2015 SO2 Design Value (ppb)	2014-2016 SO_2 Design Value (ppb)
Cataño	72-033-0004	2.5	SE	4	W	46	Not valid (NV)	NV	NV
Bayamón	72-021-0006	4	S	5	SW	NV	NV	NV	NV

- The Cataño monitor (AQS ID 72-033-0004) listed above is the only SO_2 Air Quality System monitor that operated in the San Juan area through 2016. This monitor is located at 11 Final St. Las Vegas in the Cataño municipality. The monitor is approximately 2.5 kilometers (km) southeast of the PREPA Palo Seco facility, and 4 km west of the PREPA San Juan facility. Data collected at this monitor indicates recent invalid design values due to incomplete data collection. . The design value is a 3-year average; the 2014-2016 DV would have averaged 2014, 2015, and 2016 calendar years. The Cataño monitor only had complete data for three of four quarters in all three years. The most recent valid design value (for 2011-2013) was 46 ppb.
- The Bayamón monitor (AQS ID 72-21-0006) is located at the Regional Jail of Bayamón. The monitor is approximately 4 kilometers (km) south of the PREPA Palo Seco facility, and 5 km southwest of the PREPA San Juan facility. For the 2014-2016 design value, the monitor had only one complete quarter in the three-year period (i.e., in calendar year 2014). The most recent valid design value (for 2008-2010) was 18 ppb.

The Cataño and Bayamón monitors are in close proximity to PREPA Palo Seco and PREPA San Juan. However, Puerto Rico has not provided, nor is EPA aware of information that the monitors are located in the area of maximum impact. The air quality modeling presented in the next section appears to show that the monitors would be located outside the area of maximum impact for both PREPA Palo Seco and PREPA San Juan.

EPA believes that data from the Cataño and Bayamón monitors do not provide information that can be used to support the designation recommendation for the area since they have not collected enough data for comparison to the NAAQS in recent years, and because the EPA does not have information that they are located in the area of maximum impact. Therefore, EPA has accepted air quality modeling from Puerto Rico to assess air quality for the area.

[19] SO_2 Design values are defined as the 3-year average of the 99th percentile of the daily maximum 1-hour SO_2 concentrations.

3.3. Air Quality Modeling Analysis for the San Juan Area Addressing PREPA San Juan and PREPA Palo Seco

3.3.1. Introduction

This section presents all the available air quality modeling information for a portion of San Juan that includes PREPA San Juan, which is located in the San Juan municipality, and PREPA Palo Seco, which is located in the Toa Baja municipality (this portion of San Juan will often be referred to as "the San Juan area" within this section).

This area contains the following SO_2 sources around which Puerto Rico is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

- The PREPA San Juan facility emits 2,000 tons or more annually. Specifically, PREPA San Juan emitted 5,135 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Puerto Rico has chosen to characterize it via modeling.

- The PREPA Palo Seco facility emits 2,000 tons or more annually. Specifically, PREPA Palo Seco emitted 3,128 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Puerto Rico has chosen to characterize it via modeling.

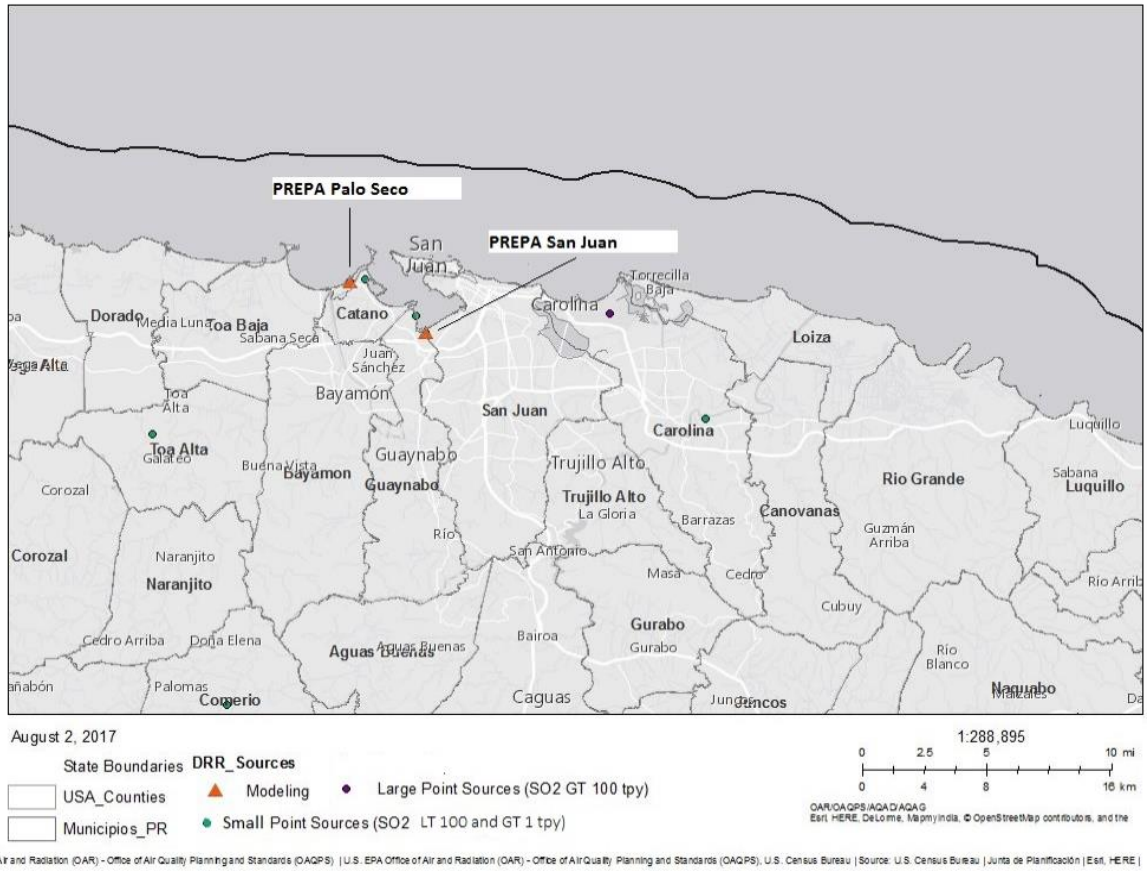
Each of the two facilities listed above were modeled separately. In its submission, Puerto Rico recommended that an area that includes the areas surrounding the PREPA San Juan and PREPA Palo Seco facilities, specifically portions of the Cataño, Toa Baja, San Juan, Guaynabo, and Bayamón municipalities, be designated as nonattainment based in part on an assessment and characterization of air quality impacts from each of the facilities. The assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, the EPA agrees with the Commonwealth's recommendation for the area (with EPA adjusted boundaries as described later in this TSD), and intends to designate the area as nonattainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Puerto Rico has assessed via air quality modeling is located in San Juan, Puerto Rico, area in the north area of the island. As seen in Figure 1 below, the PREPA San Juan and PREPA Palo Seco facilities are located in San Juan, PR, area near the island coastline on the northern part of the island. PREPA San Juan is located in the northwest section of the San Juan municipality; PREPA Palo Seco is located approximately 5.5 km northwest of PREPA San Juan, in the Toa Baja municipality. PREPA San Juan is located near Primary Road (PR) 28, southeast of the town of Cataño, next to the Bay of Newport (Bahia de Puerto Nuevo). PREPA Palo Seco is located near PR 165 and the Palo Seco neighborhood, near the Bay of San Juan (Bahia De San Juan).

As shown in Figure 1 below, there are several other point sources in the San Juan area that are near both PREPA Palo Seco and PREPA San Juan. There are four small point sources (emitting 35 tons less of SO_2 annually) that are within 20 km of both facilities. The closest point sources to the two PREPA facilities are Bacardi (located less than 1 km east of PREPA Palo Seco emitting less than 35 tpy), and Edelcar, Inc. (located 1 km northwest of PREPA San Juan emitting approximately 2 tpy). A moderately sized source, Luis Munoz Marin International Airport, emitted 586 tons in 2014, is located in the northern portion of the Carolina Municipality. The airport is located approximately 11 km east of PREPA San Juan and 15 km east of PREPA Palo Seco.

Also included in Figure 1 is the area the state recommends as nonattainment for the designation, i.e., portions of the Cataño, Toa Baja, San Juan, Guaynabo, and Bayamón municipalities. The specific designation boundaries as recommended by Puerto Rico are shown below in the modeling discussion in Figures 7 and Figure 9. The designation boundaries, as determined by EPA, are shown in Figure 10 in the section below that summarizes our intended designation.

Figure 1. Map of the San Juan, PR Area Addressing PREPA San Juan and PREPA Palo Seco



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered the modeling assessments for each of the two PREPA facilities (i.e., PREPA San Juan and PREPA Palo Seco) that were submitted by the Puerto Rico Environmental Quality Board (PREQB).

Table 2 – Modeling Assessments for the San Juan Area

Assessment Submitted by	Date of the Assessment	Identifier Used in this TSD	Distinguishing or Otherwise Key Features
PREQB	2013-2015	PREPA San Juan	Met data 2007-2009
PREQB	2013-2015	PREPA Palo Seco	Met data 2007-2009

3.3.2. Modeling Analysis Provided by the State

3.3.2.1. Differences Between and Relevance of the Modeling Assessments Submitted by the State

Puerto Rico's original modeling assessment submitted on December 19, 2016, contained a variety of modeling flaws, including incorrect emissions and inaccurate averaging of the model results to assess the final modeled facility impact. Upon consultation with EPA, Puerto Rico conducted the modeling analysis again and resubmitted the corrected model results on March 3, 2017. In the new model runs, Puerto Rico used the actual hourly emission rates instead of a single annual value used earlier. Previously, they had conducted the modeling runs for each of the three years individually and averaged the 4th highest modeled concentration for each year, regardless of whether the corresponding receptor was the same through the years, to attain the facility impact. In the new modeling, all three years were run together and the averaging was corrected to match the form of the 1-hour SO_2 NAAQS and the measured ambient design value. Additionally, Puerto Rico updated the model from version 15181 to the most recent version, AERMOD 16216r. Only regulatory default options were used in both versions. The adjusted u* (friction velocity) option for low winds was not used in either version. The results from the March 3, 2017, modeling will be used for the intended designation and are discussed in the following sections.

3.3.2.2. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

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

Puerto Rico used AERMOD version 16216r. A discussion of the Commonwealth's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

3.3.2.3. Modeling Parameter: Rural or Urban Dispersion

For the purpose of performing the modeling for the area of analysis, Puerto Rico determined that it was most appropriate to run the model in urban mode since the PREPA San Juan and PREPA Palo Seco are located in an urban environment. A population of 434,374 was used to determine that the San Juan area is urban. In addition, land use data confirms that the area surrounding PREPA San Juan and PREPA Palo Seco are urban. This is based on Auer technique and population density as specified in the Guideline of Air Quality Models.

3.3.2.4. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The source of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the San Juan area, Puerto Rico included two modeling analyses. One around the PREPA San Juan area, and the other one around the PREPA Palo Seco area. There are no other sources that emit over 2,000 tons per year (tpy) of SO_2 within 50 km of these sources. The Commonwealth determined that this was the appropriate distance to adequately characterize air quality through modeling in order to determine the potential extent of any SO_2 NAAQS violations. Contributions from other smaller or distance sources were taken into account by adding a background concentration to the modeled impacts. No other sources beyond the San Juan area were determined by the Commonwealth to have the potential to cause a concentration gradient within the area of analysis that should be explicitly modeled. As mentioned previously there are several point sources in the San Juan area. However, the background sources would have been accounted for in the background monitoring concentration.

Regarding PREPA San Juan and PREPA Palo Seco's analyses, the grid receptor spacing for the area of analysis chosen by Puerto Rico is as follows: the first was a coarse receptor grid with a 250 meter (m) spacing to determine the distance out to which the facility could potentially cause or contribute to a modeled violation of the NAAQS. A second more refined grid was then super imposed with a 50 m spacing in order to find locations of maximum impacts within the modeled domain. Discrete receptors were placed on each of the PREPA fence lines.

The receptor network for PREPA San Juan contained 3,565 receptors, and the network covered primarily an area to the west of the facility since the predominant trade wind in the Caribbean is from the easterly direction as indicated by the wind rose in Figure 4. The grid extended approximately 8.5 km to the west, 2 km to the south, 5.5 km to the north, and 3.7 km to the east

of the facility. The receptor network for PREPA Palo Seco contained 1,535 receptors, and the network covered primarily an area to the south of the facility. The grid extended approximately 3.5 km to the west, 3 km to the south, 0.1 km to the north, and 3 km to the east of the facility.

Figure 2 and Figure 3, both generated by EPA, show Puerto Rico's chosen area of analysis surrounding the facilities, as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, Puerto Rico placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property. The Commonwealth also placed receptors in other locations that it considered to be ambient air relative to each modeled facility. Puerto Rico included receptors over water even though it would not be feasible to place monitor there. Receptors were only removed from their own respective property in each modeling run. Discrete receptors across the facility fenceline were included in each run. An existing fence precluded public access.

Figure 2: Area of Analysis and Receptor Grid for the sources in San Juan Area: PREPA San Juan Facility

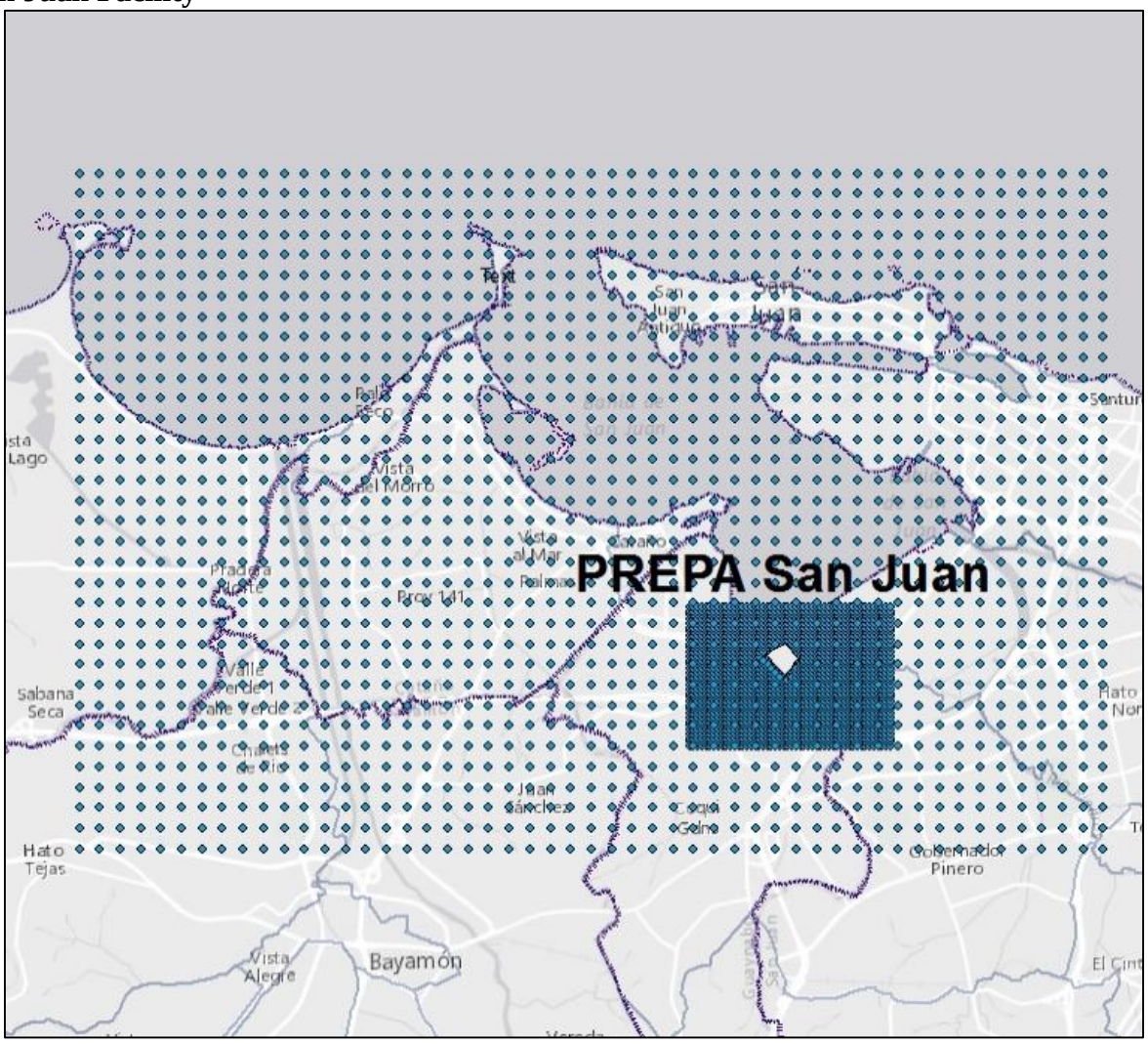
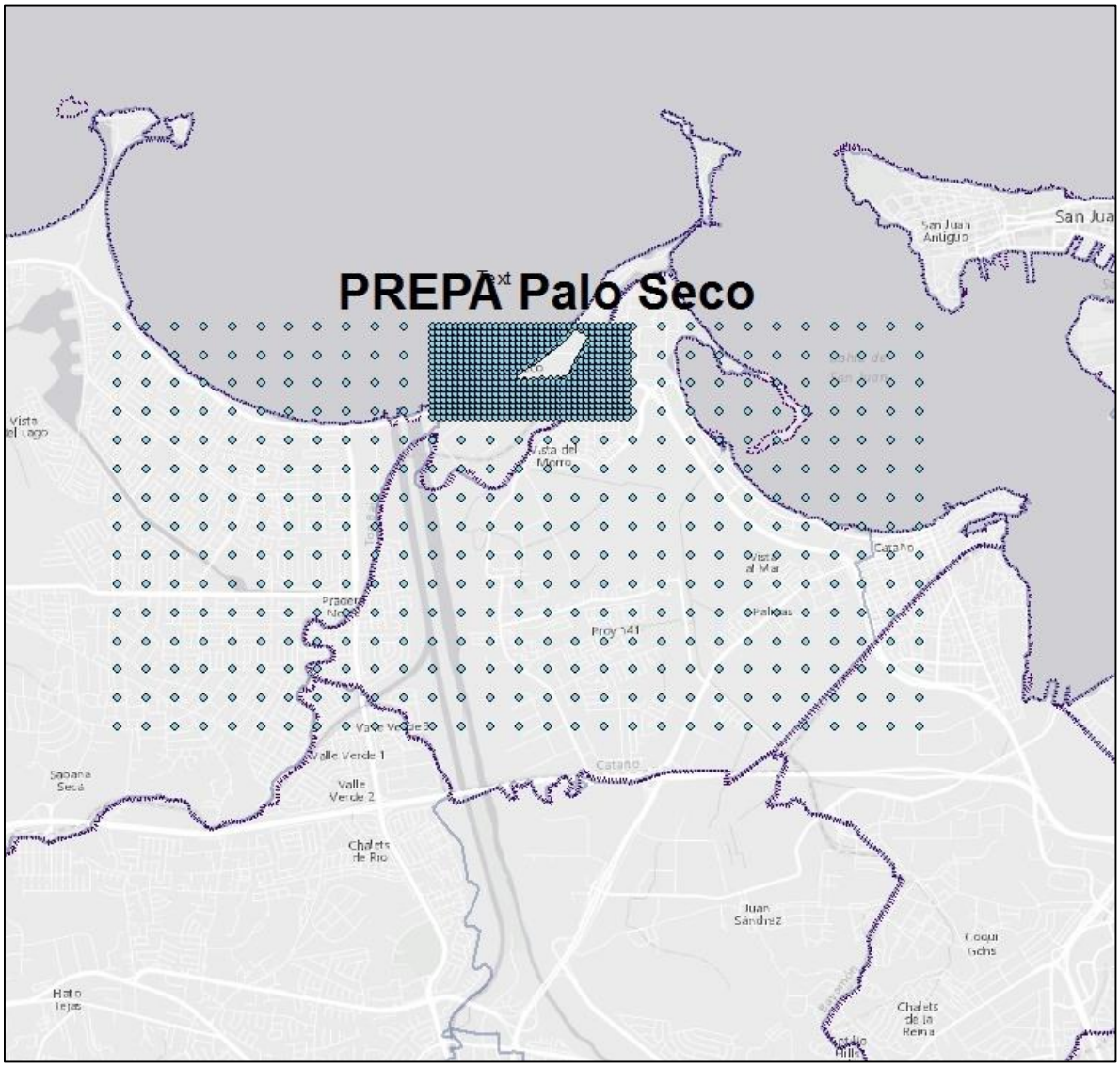


Figure 3: Area of Analysis and Receptor Grid for the sources in San Juan Area: PREPA Palo Seco Facility



The receptor grid in the PREPA San Juan modeling analysis extended onto the PREPA Palo Seco property since this is ambient air with respect to PREPA San Juan. Receptors were not placed on PREPA San Juan's property in its own analysis on the basis that this is not considered ambient air to its own property. This means that the impacts of the emissions from PREPA San Juan were assessed on PREPA Palo Seco property but not on its own property. An extensive coarse and refined Cartesian receptor grid covering the maximum area of impact was included in the modeling. However, the receptor grid may not have encompassed all areas where there is the potential for PREPA San Juan and PREPA Palo Seco to cause or contribute to an exceedance of the NAAQS.

3.3.2.5. Modeling Parameter: Source Characterization

PREPA San Juan and PREPA Palo Seco were explicitly included in the modeling of the San Juan area since their individual annual SO_2 emissions exceed the threshold of 2,000 tons of SO_2 per year.

Puerto Rico characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the Commonwealth used actual stack heights in conjunction with actual emissions. The Commonwealth also adequately characterized the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Since the Puerto Rico Environmental Quality Board (EQB) does not have complete building information to include the effect of downwash in AERMOD for the area, building downwash was not included in the model run.

Downwash would likely increase the concentrations near the source. The concentrations further downwind and outside the wake area would be the same with or without downwash. However, since the area already violated the NAAQS even without downwash, the area would be considered nonattainment regardless of the additional contributions due to downwash. Therefore, EPA finds that not using downwash in the modeling of PREPA San Juan or PREPA Palo Seco did not affect the outcome of the modeling in the area for purposes of this action. EPA would have preferred that the two sources be modeled together due to their proximity to each other. However, both sources individually showed modeled violations. Therefore, a combination of both would increase the magnitude of the violation, but the designation would remain nonattainment.

3.3.2.6. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

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

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for

designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included PREPA San Juan and PREPA Palo Seco in the area of this analysis. Puerto Rico has chosen to model these facilities using actual emissions. The facilities in the state's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For PREPA San Juan and PREPA Palo Seco, Puerto Rico provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 3. A description of how the Commonwealth obtained hourly emission rates is given below this table.

Table 3. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the San Juan Area

	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
PREPA San Juan	5,307	5,135	6,063
PREPA Palo Seco	5,700	3,128	2,979

PREPA San Juan and PREPA Palo Seco do not have CEMs on their stacks. For PREPA San Juan and PREPA Palo Seco, the actual emissions data were obtained from the EQB Rule 410, "Maximum Sulfur Content in Fuels" of the Puerto Rico Regulations of the Control of Atmospheric Pollution (RCAP) reports and the SO_2 actual emission data submitted and certified by PREPA. PREPA submits the actual emissions reports annually to EQB and these are reviewed by the Inspection and Compliance Division of the Air Quality Area. This report presents the annual SO_2 actual emissions for the emissions units in the PREPA facility. Rule 410 includes the monthly fuel usage and days of operation for the PREPA emission units during a year. The information for this report is submitted by the PREPA as a permit requirement and is reviewed by the Air Monitoring, Validation, and Data Management Division of Puerto Rico EQB.

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3.3.2.7. Modeling Parameter: Meteorology and Surface Characteristics

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

For the area of analysis for the San Juan area, Puerto Rico used three years of NWS meteorological data. The three years of meteorological data are not concurrent with the three years of SO_2 actual emissions data. For San Juan analyses, the meteorology is from 2007-2009. The title of the three-year data period was manually changed (change of the year on AERMET output file) as if it were from 2013 to 2015. The Commonwealth used surface meteorology from the San Juan NWS meteorological tower located in the Luis Muñoz Marin International Airport, and coincident upper air observations from the same location as best representative of meteorological conditions within the area of analysis.

The inputs to AERMET for surface characteristics (surface roughness length, albedo and Bowen ratio) were determined by the land use/cover classification that surrounds the San Juan NWS meteorological tower site (International Airport). Albedo is the fraction of solar energy reflected from the earth back into space, the Bowen ratio is the method generally used to calculate heat lost or heat gained in a substance, and the surface roughness is sometimes referred to as "z_o." The 1992 land cover data needed to run the AERSURFACE utility surface characteristics processor is not available in Puerto Rico. However, the equations in AERSURFACE were manually calculated. These equivalent equations are documented in the Alaska Department of Environmental Conservation (*ADEC Guidance AERMET Geometric Means, How to calculate the Geometric Mean, Bowen ratio and the Inverse-Distance Weighted Geometric Mean Surface Roughness length in Alaska*, 2009).

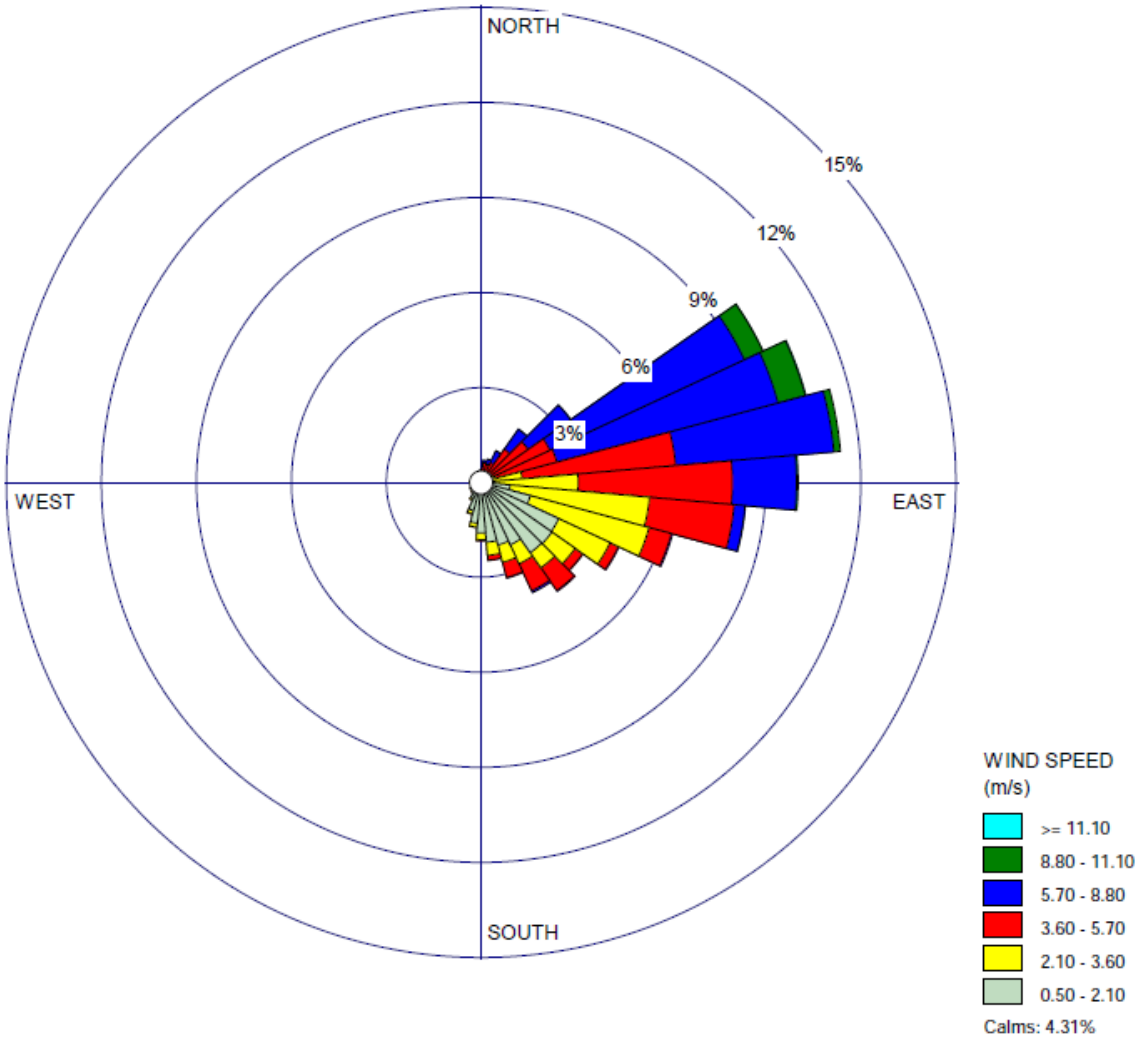
The land cover categories values were obtained by tables given in USEPA *AERSURFACE User Guide* (2008), together with fractions of the total area of interest. The area fractions of land cover classifications were calculated based on satellite maps, available aerial photographs, and observational visits to the area. All land cover classification system values were extracted as mid-summer seasonal values for the surface characteristics and year round average moisture conditions typical in the tropics. For this analysis, the 1-km radius circular area centered at the meteorological station site was divided into 3 sectors for the surface roughness.

In the figure below, generated by the EPA the location of this NWS station is shown relative to the area of analysis.

Figure 3: Area of Analysis and the NWS station in the San Juan, PR Area

EPA generated the 3-year surface wind rose for the San Juan NWS meteorological tower located at the Luis Muñoz Marin International Airport using the surface files provided by Puerto Rico. In Figure 4, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The predominant trade wind direction is from the east with calms occurring 4.31% of the time.

Figure 4: San Juan, PR Cumulative Annual Wind Rose for Years 2007 – 2009



Meteorological data from the above surface and upper air NWS stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. Puerto Rico followed the methodology and settings presented in the SO_2 NAAQS Designations Modeling Technical Assistance Document in the processing of the raw meteorological data into an AERMOD-ready format, and used the methodology described above to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from the NWS station mentioned above, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute wind data.

EPA agrees that even though the meteorological data is not from the same years as the modeled emission data years, the data is appropriate in this case since it is temporally representative of the area. The meteorology over the years is very persistent in Puerto Rico and hence even though Puerto Rico used older meteorological data, it is still applicable for the area. EPA also agrees that the data was appropriately preprocessed using AERMINUTE and AERMET. Since the 1992 National Land Cover data needed to run the AERSURFACE utility is not available in Puerto Rico, the equivalent methodology to determine surface characteristics was used.

3.3.2.8. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as almost completely flat. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the 7.5 minute USGS Digital Elevation Model data. EPA agrees the AERMAP preprocessor was appropriately applied by Puerto Rico in this case to simulate the surrounding terrain.

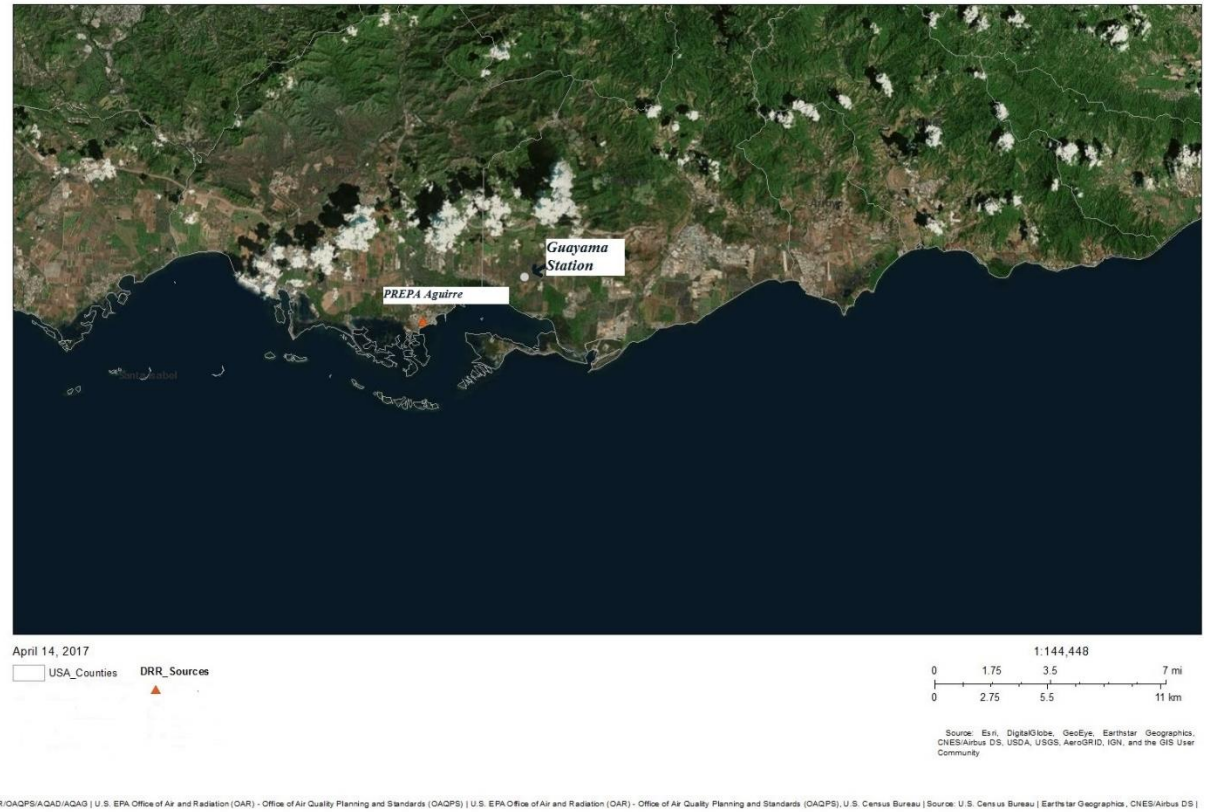
3.3.2.9. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, Puerto Rico chose the "tier 1" approach. Puerto Rico has SO_2 air quality monitors in the vicinity of the San Juan area but they are 5 km or less from PREPA Palo Seco and PREPA San Juan. Utilizing the Cataño (AQS ID 72-033-0004) or Bayamon (AQS ID 72-021-0006) monitors as background would likely result in double-counting of emissions from the PREPA facilities. Therefore, they are not representative of the regional background, including other nearby point source impacts. A regional site monitor that is impacted by similar natural and distant man-made sources was used by PREQB, in particular, the Guayama SO_2 monitor (AQS 72-057-0009) from the years 2010-2012. The single design value of the background concentration for this area of analysis was determined by the Commonwealth to be 58 micrograms per cubic meter (μg/m3), equivalent to 22 parts per billion (ppb) when expressed in two significant figures, and that value was added to the final AERMOD results that were submitted by PREQB to EPA.

EPA believes that it would be more appropriate to utilize the design value from the same monitor at Guayama from the years 2009-2011, which would increase the background to 60 $\mu g/m^3$; equivalent to 23 ppb. EPA notes that data collected from 2010-2012 was incomplete due to data not reported in 2012 to EPA's AQS database. 2012 had three complete quarters of data, instead of four. Data collected from 2009-2011 is complete, and valid. AQS data is posted at https://www.epa.gov/air-trends/air-quality-design-values.

Since the monitor at Guayama is the most representative background monitor in the San Juan area, EPA agrees with Puerto Rico's approach for using the identified monitor for background concentration. Due to data completeness issues, EPA believes it would be more appropriate to use an earlier design value (2009-2011) to represent background. EPA's notes that the earlier design value is only slightly higher at 23 ppb, rather than 22 ppb. In addition, the 2010 design value is also 23 ppb, which further validates that this is a representative background concentration. EPA substituted the Puerto Rico provided design value with the more appropriate 2009-2011 design value, which EPA added to the final modeled concentration submitted by PREQB. EPA did not remodel the primary sources impact.

Figure 5: Air Quality Monitoring Station at Guayama



3.3.2.10. PREPA San Juan - Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the San Juan area of analysis are summarized below in Table 4.

Table 4. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for PREPA San Juan in the San Juan Area

Input Parameter	Value
AERMOD Version	16216r (regulatory options)
Dispersion Characteristics	Urban
Modeled Sources	1
Modeled Stacks	5
Modeled Structures	0
Modeled Fencelines	1
Total receptors	3,565
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2007-2009
NWS Station for Surface Meteorology	Luis Muñoz Marin International Airport
NWS Station Upper Air Meteorology	Luis Muñoz Marin International Airport
NWS Station for Calculating Surface Characteristics	Luis Muñoz Marin International Airport
Methodology for Calculating Background SO_2 Concentration	Guayama SO_2 monitor (AQS 72-057-0009), Tier 1 based on 2009-2011 design value
Calculated Background SO_2 Concentration	23 ppb or 60 $\mu g/m^3$

The results presented below in Table 5 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

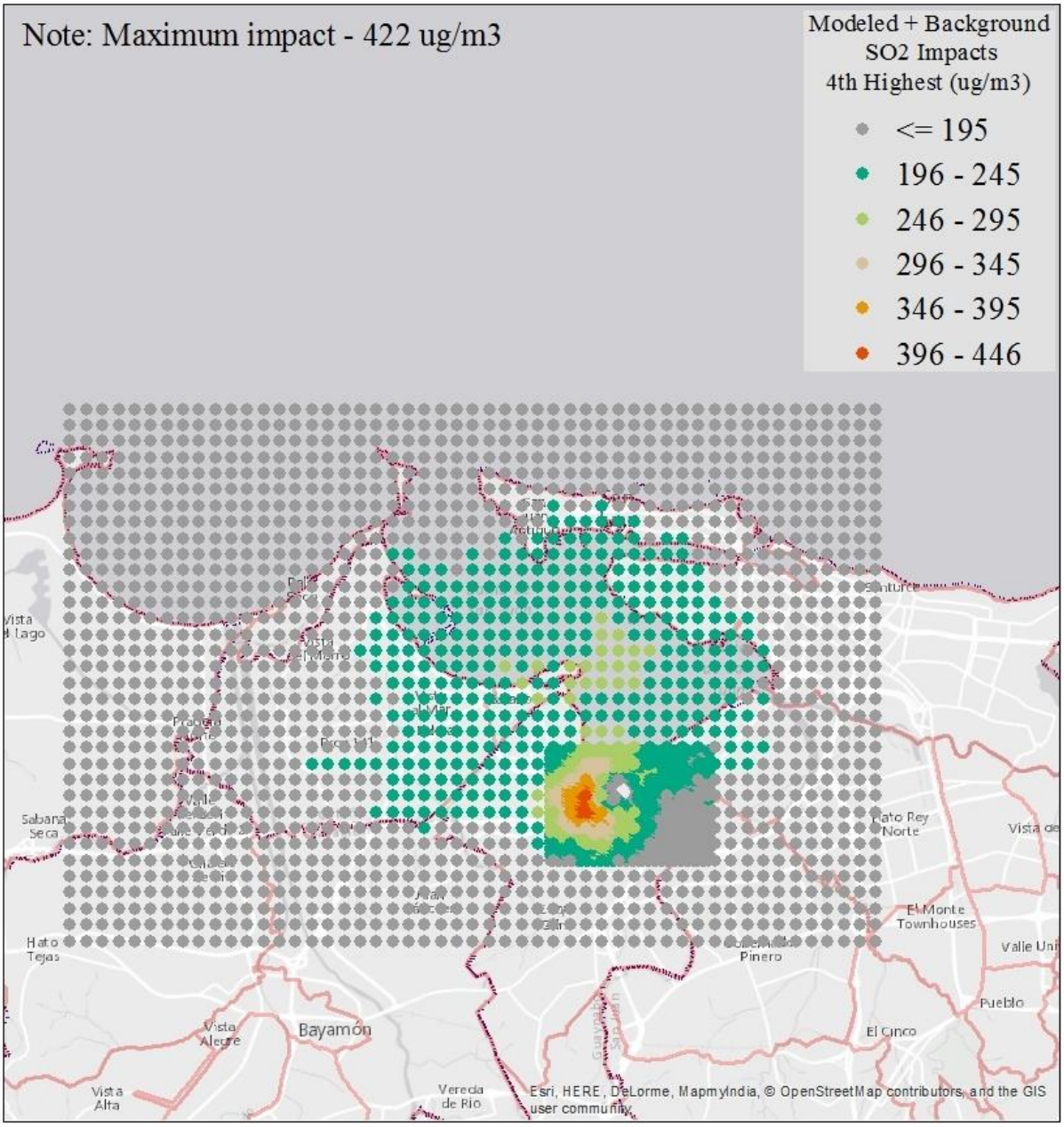
Table 5. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for PREPA San Juan in the San Juan Area

Averaging Period	Data Period	Receptor Location [UTM zone 19N]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-2015	805350	2039622	422	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

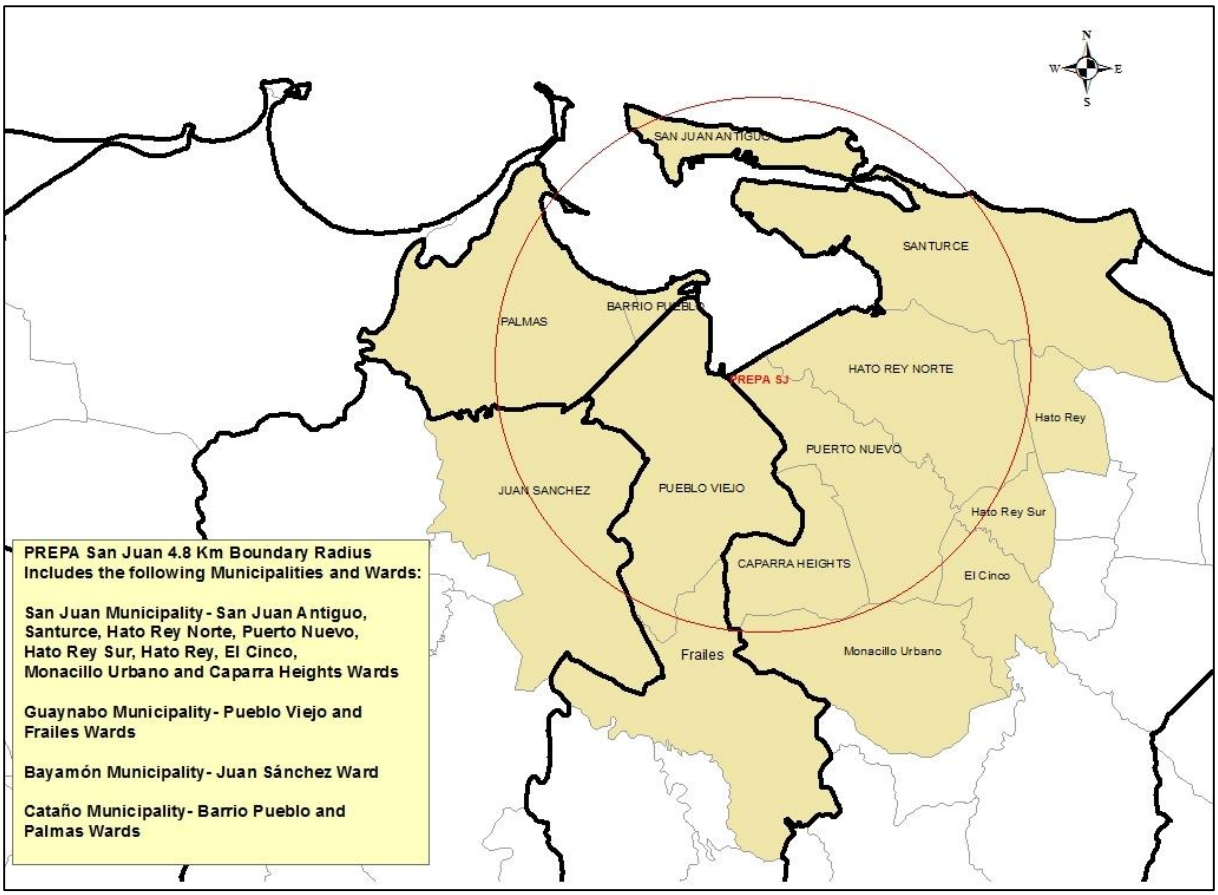
EPA determined that the 2010-2012 design value for background concentration provided by Puerto Rico was based on incomplete data, as described earlier. Hence, EPA determined a more appropriate value for the background concentration and added it the modeled concentrations submitted by Puerto Rico. Puerto Rico's modeling with EPA's corrected background of 60 $\mu g/m^3$ indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 422 $\mu g/m^3$, equivalent to 161 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facility/facilities. Figure 6 below (as adjusted for EPA's corrected background) was included as part of the Commonwealth's recommendation, and indicates that the predicted value occurred slightly to the southwest of the facility. The Commonwealth's receptor grid is also shown in the figure.

Figure 6: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for PREPA San Juan in the San Juan Area



The modeling submitted by Puerto Rico indicates that the 1-hour SO_2 NAAQS is violated at the receptors with the highest modeled design concentration. The modeling results also include the area in which NAAQS violations were modeled, information that is relevant to the selection of the boundaries of the area that will be designated. The PREPA San Juan model results are over the 1-hour SO_2 NAAQS with a maximum radius of 4.8 km. The boundary impact radius is defined by municipalities and wards. Figure 7 shows a map with the portions (i.e. identified wards) of the San Juan, Guaynabo, Bayamon, and Cataño municipalities recommended by Puerto Rico for boundary impact radius of PREPA San Juan. It should be noted that the radius provided reflects the background concentration of 58 $\mu g/m^3$, while EPA finds a background value of 60 $\mu g/m^3$ is more appropriate, which would slightly increase the radius. Puerto Rico's recommendation includes all wards that are included in the circular boundary impact radius, which is the radius based on the outermost violating receptor.

Figure 7: PREPA San Juan 1-Hour SO_2 Modeling Results Boundary Impact Radius, Years 2013-2015



3.3.2.11. PREPA Palo Seco - Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the San Juan area of analysis are summarized below in Table 6.

Table 6: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for PREPA Palo Seco in the San Juan Area

Input Parameter	Value
AERMOD Version	16216r (regulatory options)
Dispersion Characteristics	Urban
Modeled Sources	1
Modeled Stacks	7
Modeled Structures	0
Modeled Fencelines	1
Total receptors	1,535
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2007-2009
NWS Station for Surface Meteorology	Luis Muñoz Marin International Airport
NWS Station Upper Air Meteorology	Luis Muñoz Marin International Airport
NWS Station for Calculating Surface Characteristics	Luis Muñoz Marin International Airport
Methodology for Calculating Background SO_2 Concentration	Guayama SO_2 monitor (AQS 72-057-0009), Tier 1 based on 2009-2011 design value
Calculated Background SO_2 Concentration	23 ppb or 60 $\mu g/m^3$

The results presented below in Table 7 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

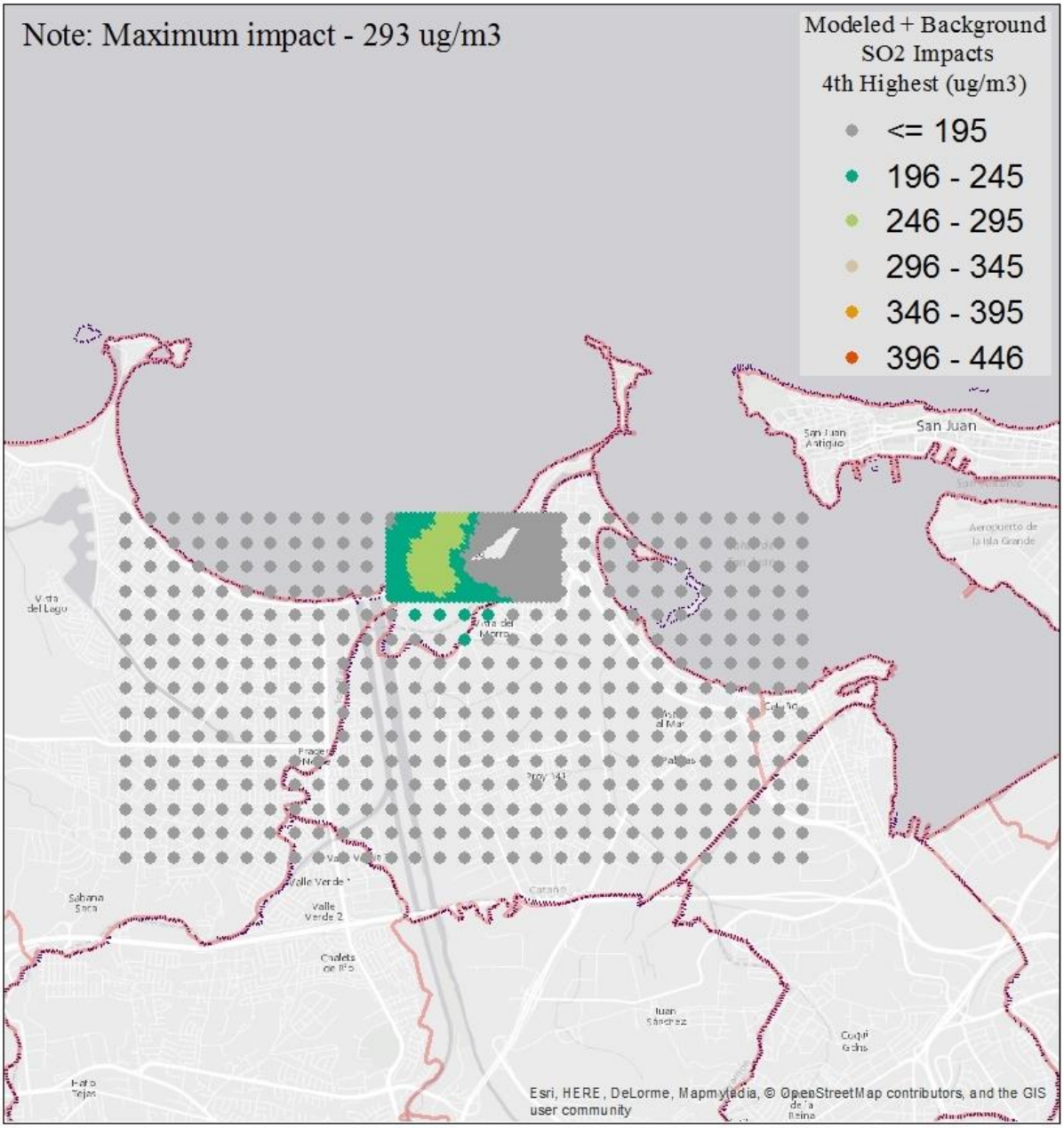
Table 7. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for PREPA Palo Seco in the San Juan Area

		Receptor Location [UTM zone 19N]		99^{th} percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	**Data Period**	**UTM Easting**	**UTM Northing**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2013-2015	800650	2043072	293	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

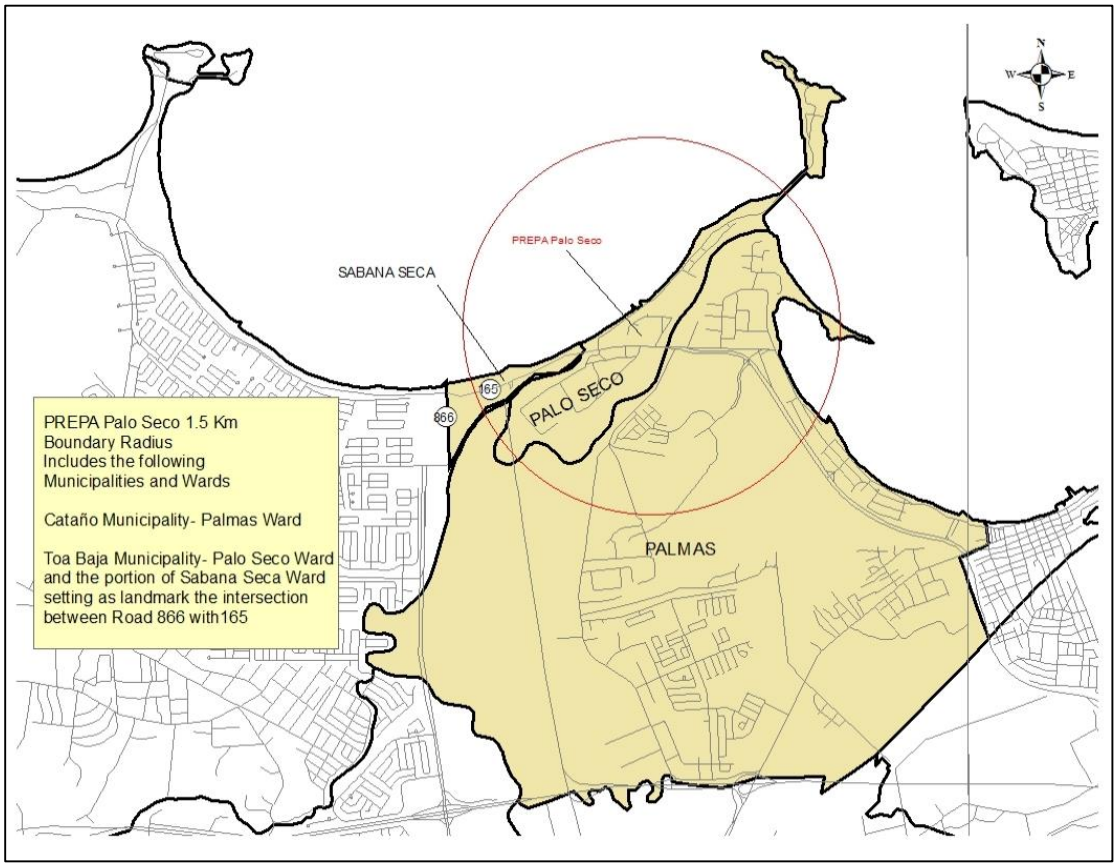
EPA determined that the 2010-2012 design value for background concentration provided by Puerto Rico was based on incomplete data, as described earlier. Hence, EPA determined a more appropriate value for the background concentration and added it the modeled concentrations submitted by Puerto Rico. Puerto Rico's modeling with EPA's corrected background of 60 $\mu g/m^3$ indicates that the highest predicted 99^{th} percentile daily maximum 1-hour concentration within the chosen modeling domain is 293 $\mu g/m^3$, equivalent to 111.9 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facility/facilities. Figure 8 below (as adjusted for EPA's corrected background) was included as part of the state's recommendation, and indicates that the predicted value occurred slightly to the southwest of the facility. The Commonwealth's receptor grid is also shown in the figure.

Figure 8: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for PREPA Palo Seco in the San Juan Area



The modeling submitted by Puerto Rico indicates that the 1-hour SO_2 NAAQS is violated at the receptors with the highest modeled concentration. The modeling results also include the area in which NAAQS violations were modeled, information that is relevant to the selection of the boundaries of the area that will be designated. The PREPA Palo Seco model results are over the 1-hour SO_2 NAAQS with a maximum radius of 1.5 km. The boundary impact radius is defined by municipalities and wards. Figure 9 shows a map with the municipalities and wards recommended by Puerto Rico for boundary impact radius of PREPA San Juan. These include the municipalities of Toa Baja and Cataño. In Cataño municipality, Puerto Rico recommends the jurisdictional limit for Palmas ward and the Palo Seco ward jurisdictional limit in Toa Baja municipality. In the case of the Sabana ward in Toa Baja, the Puerto Rico recommendation is the northeast portion of the ward near Palo Seco, using as landmark the intersection between Road 866 and Road 165. The other part of the ward would be excluded from the boundary radius. It should be noted that the radius provided reflects the background concentration of 58 $\mu g/m^3$, while EPA is recommending a more appropriate background value of 60 $\mu g/m^3$, which would slightly increase the radius. Puerto Rico's recommendation includes all wards or portions of wards that are included in the circular boundary radius, which is the radius based on the outermost violating receptor.

Figure 9: PREPA Palo Seco 1-Hour SO_2 Modeling Results Boundary Impact Radius, Years 2013-2015



3.3.2.12. The EPA's Assessment of the Modeling Information Provided by the State

Based on the information provided by Puerto Rico and summarized in Section 3.3, EPA concluded that the Commonwealth adequately examined and characterized sources within the area of analysis and appropriately placed receptors in the modeling domain; appropriately initialized and accounted for modeled emission sources; correctly selected meteorological sites and properly processed the data; adequately estimated surface characteristics. EPA found a more appropriate background design value and added it to the modeled concentrations. Based on this assessment, we conclude the modeling provided by the Commonwealth accurately characterizes air quality in the area of analysis. However, the use of a smaller modeling domain and not considering the two sources in the same modeling run make it difficult to conclude that the violations do not also occur further beyond the receptor grid used by Puerto Rico.

3.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the San Juan Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

3.5. Jurisdictional Boundaries in the San Juan Area

The EPA's goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable. Puerto Rico recommended that EPA designate the following established wards within the municipalities listed below as nonattainment:

- Cataño municipality: Palmas ward, Barrio Pueblo ward
- Toa Baja municipality: Palo Seco ward
- San Juan Municipality: San Juan Antiguo ward, Santurce ward, Hato Rey Norte ward, , Hato Rey Sur ward, Hato Rey ward, El Cinco ward, Monacillo Urbano ward, Governador Pinero ward
- Guaynabo Municipality: Pueblo Viejo ward, Frailes ward
- Bayamón Municipality: Juan Sánchez ward

In addition to recommending the entire Palo Seco ward in the Toa Baja municipality as nonattainment as noted above, Puerto Rico also recommended adding a portion of the Sabana Seca ward in the Toa Baja municipality as nonattainment. Only a small portion of the Sabana ward was within the maximum impact radius of 1.5 km predicted by Puerto Rico's modeling. Instead of the full ward, Puerto Rico used roadways to define the extent of the area; i.e., portion of the Sabana ward using as a landmark the intersection between Road 866 with 165.

3.6. Other Information Relevant to the Designations for the San Juan Area

The EPA has received no third party modeling for the area. The EPA does not have any other relevant information.

3.7. The EPA's Assessment of the Available Information for the San Juan Area

The modeling analysis submitted by Puerto Rico to characterize air quality in the area surrounding PREPA San Juan and PREPA Palo Seco showed overlapping modeled violations. The boundary radius from the PREPA San Juan modeling is approximately 4.8 km. The boundary radius from the PREPA Palo Seco modeling is approximately 1.5 km. Considering both boundary radii in the area, which only cover a limited portion of the San Juan area, a smaller nonattainment area is supported.

As mentioned earlier in the TSD, the boundary impact radius as determined by Puerto Rico is based on a circular area where the radius extends to the outermost violating receptor. This circular area included receptors (for example, to the east of the facility) that do not violate. Puerto Rico proposed the whole circular area as the nonattainment area. This may be overly conservative as it would include areas that do not contain violating receptors. The predicted SO_2 impacts shown in Figure 6 and Figure 8 in the previous section of this TSD, do not show violating receptors in the Frailes ward in the Guaynabo municipality; as well as Hato Rey Sur, Hato Rey, El Cinco, and Monacillo Urbano wards in the San Juan Municipality.

Other than PREPA San Juan and PREPA Palo Seco, there are only two small SO_2 point sources in the area; i.e. Bacardi (34 tons per year) in Cataño, and Edelcar (2 tons per year) point sources in Guaynabo. Both sources were included in the boundaries of the recommended nonattainment area by Puerto Rico.

There is a moderately sized source, Luis Munoz Marin Airport, which emitted 586 tons in 2014, which is less than 3 km east of the San Juan municipality, in the Carolina municipality. Any contributions to the impacts from the airport would be accounted for in the background.

EPA does not believe the partial ward of Sabana Seca is clearly defined, and would not be a suitable basis for defining the nonattainment area.

Puerto Rico did not consider the cumulative impact in its modeling of PREPA San Juan and PREPA Palo Seco, which makes the exact boundaries more uncertain. EPA believes that a larger nonattainment area encompassing the full wards downwind to the west, especially Sabana Seca ward to the west of the two PREPA facilities, as listed below provide an appropriate margin of safety to ensure that areas exceeding the NAAQS are included in the nonattainment area. In addition, EPA notes that the 2012 background design value concentration of 58 $\mu g/m^3$ (22 ppb) as determined by Puerto Rico was incomplete and not valid. EPA found the 2011 design value of 60 $\mu g/m^3$ (23 ppb) for the background monitor to be complete and more appropriate. Furthermore, the 2010 design value at the same monitor was also 23 ppb, which reinforces that 23 ppb is an appropriate background concentration.

EPA believes that a nonattainment area consisting of the Palmas ward, and the Barrio Pueblo wards within the Cataño municipality; the Palo Seco ward, and the entire Sabana Seca ward within the Toa Baja municipality; the San Juan Antiguo ward, Santurce ward, Hato Rey Norte

ward, Gobernador Pinero ward within the San Juan municipality; the Pueblo Viejo ward within the Guaynabo municipality; and the Juan Sánchez ward within the Bayamón municipality will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended nonattainment area. EPA does not believe that the Frailes ward within the Guaynabo municipality; as well as Hato Rey Sur, Hato Rey, El Cinco, and Monacillo Urbano wards in the San Juan municipality should be included in the intended nonattainment area since they do not contain any violating receptors based on the modeling, and they are unlikely to contribute to modeled nonattainment (e.g., there are no SO_2 point sources greater than 1 ton per year).

The use of a relatively small modeling domain and not considering the two nearby sources in the same modeling run make it difficult to conclude that the violations do not occur further beyond the receptor grid used by Puerto Rico. Based on this uncertainty, EPA intends to designate the area surrounding the nonattainment, i.e. the remainder of the San Juan area, with one exception as noted below, as unclassifiable.

EPA intends to designate as unclassifiable the remainder of the Toa Baja, Cataño, Bayamon, Guaynabo, and San Juan municipalities. EPA also intends on designating two additional municipalities to the west (Dorado and Toa Alta) due to the predominant wind direction from the east. EPA is designating the northwestern portion of the Carolina municipality, (i.e., Cangrejo Arriba ward, and Sabana Abajo ward), which are upwind, as unclassifiable.
.

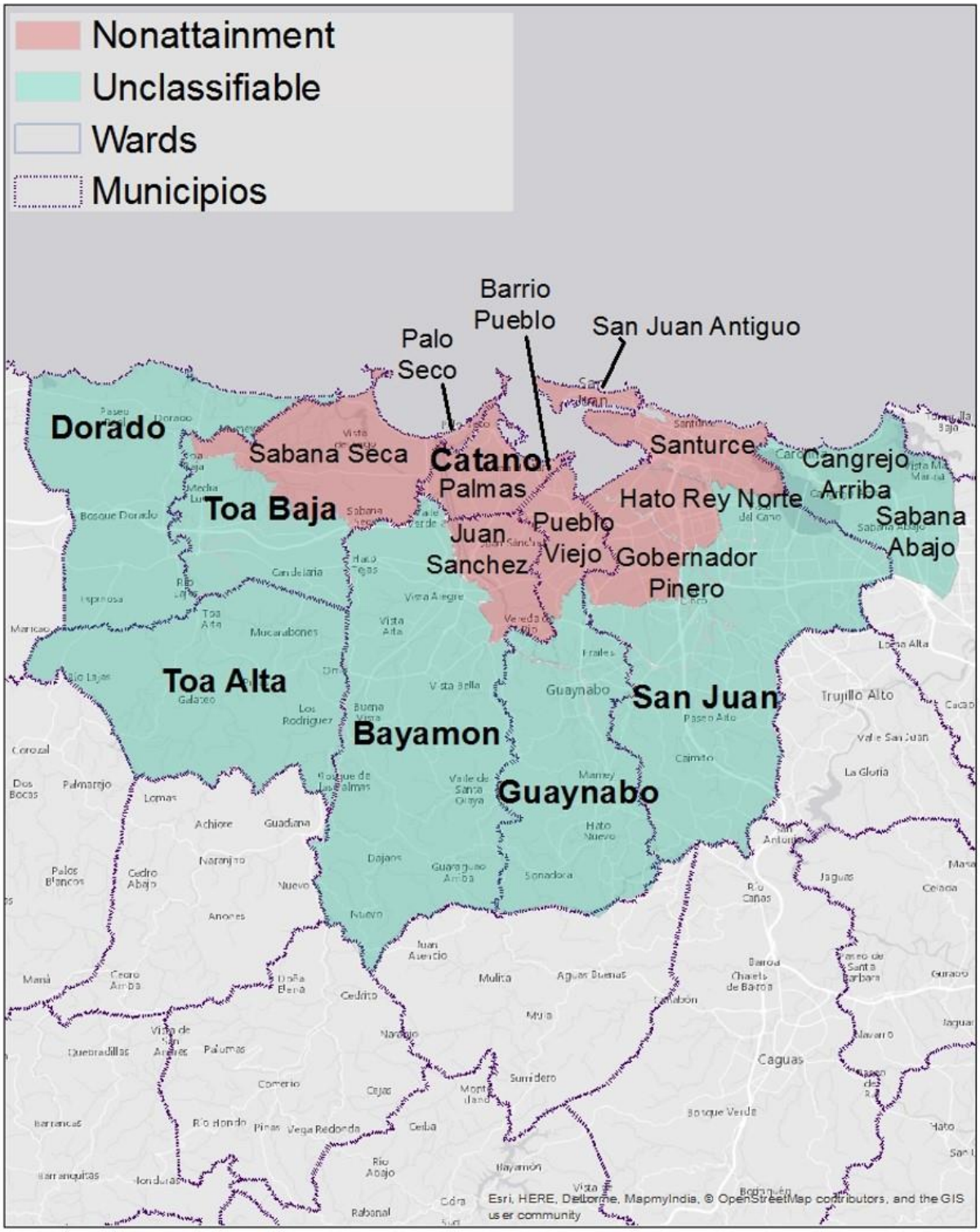
3.8. Summary of Our Intended Designation for the San Juan Area

After careful evaluation of the Puerto Rico's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the portion of the San Juan Area consisting of the Palmas ward, and the Barrio Pueblo wards within the Cataño municipality; the Palo Seco ward, and the Sabana Seca ward within the Toa Baja municipality; the San Juan Antiguo ward, Santurce ward, Hato Rey Norte ward, PGovernador Pinero ward within the San Juan municipality; the Pueblo Viejo ward within the Guaynabo municipality; and the Juan Sánchez ward within the Bayamón municipality as nonattainment for the 2010 SO_2 NAAQS. The EPA is designating these areas as "nonattainment" since EPA has determined, based on available information including appropriate modeling analyses, that they either: (1) do not meet the 2010 SO_2 NAAQS, or (2) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

Specifically, the boundaries are comprised of borders of the following wards: Palmas, Barrio Pueblo, Palo Seco, Sabana Seca, San Juan Antiguo, Santurce, Hato Rey Norte, Governador Pinero, Pueblo Viejo, and Juan Sánchez. Further, EPA intends to designate the remaining portions of the Toa Baja, San Juan, Guaynabo, and the Bayamón municipalities as unclassifiable. EPA also intends on designating the Cangrejo Arriba and Sabana Abajo Wards in the Carolina municipality as unclassifiable along with the Dorado and Toa Alta Municipalities as unclassifiable. The EPA is designating these areas as "unclassifiable" because we do not have

adequate information for these areas that would allow the EPA to make the determinations that would be required for a designation of "nonattainment" or "unclassifiable/attainment." A designation of "unclassifiable" indicates that the EPA cannot determine based on all available information whether the area is meeting or not meeting the NAAQS or where the EPA cannot determine whether the area contributes to a violation in a nearby area. Figure 10 shows the boundary of these intended designated nonattainment and unclassifiable/attainment areas.

Figure 10. Boundary of the Intended San Juan Area Nonattainment and Unclassifiable Areas



4. Technical Analysis for the Guayama-Salinas Area

This is the technical analysis for the Guayama, Salinas, Santa Isabel, Coamo, Aibonito, and Cayey municipalities in Puerto Rico.

4.1. Introduction

The EPA must designate the Guayama-Salinas, PR area by December 31, 2017, because the area has not been previously designated and Puerto Rico has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR for any sources of SO2 emissions in Guayama-Salinas.

Regarding the intended boundary of the area, the EPA must designate as nonattainment any area that violates the NAAQS and any nearby area that contributes to the violation in the violating area. The air monitor in the Salinas municipality shows a violation of the 2010 SO_2 NAAQS based on data collected between 2014 and 2016, therefore at least some area around the violating monitor must be designated nonattainment.

Puerto Rico has also performed and submitted to EPA air quality modeling for the portion of the Guayama-Salinas area to characterize SO_2 air quality around the nearby PREPA Aguirre facility in Salinas. PREPA Aguirre is only 3 km away from the air monitor in the Salinas municipality. The air quality modeling submitted by Puerto Rico also shows a violation of the NAAQS.

In the following sections, we consider the appropriate extent of the nonattainment area. This assessment focuses on the potential for other nearby parts of Guayama-Salinas area to be either violating the 2010 SO_2 NAAQS or contributing to violation of the NAAQS. The EPA has evaluated neighboring municipalities based on an assessment of the air quality modeling performed for the Guayama-Salinas area and other relevant information to determine if sources or emissions activity originating from the adjacent municipalities contribute to the recorded violation of the NAAQS in Salinas.

4.2. Air Quality Monitoring Data for the Guayama-Salinas Area

This factor considers the SO_2 air quality monitoring data in the Guayama-Salinas area. The EPA is evaluating this factor for its impact to the intended designation of the Guayama, and Salinas, Santa Isabel, Coamo, Aibonito, and Cayey municipalities.

Puerto Rico initially submitted to the EPA air quality monitoring data in the June 3, 2011, for two monitors, one operating in Salinas (AQS ID 72-123-0002) and the other in Guayama (AQS ID 72-057-0009). The values submitted were 3-year (2007-2009) averages of the 99th percentile of the annual daily 1-hour average concentrations. The reported values are not comparable to the

NAAQS, because the level of the 1-hour NAAQS for sulfur dioxide is calculated as the 3-year average of the 99th percentile of the daily maximum 1-hour average concentrations.

Puerto Rico designation recommendations to EPA in December 2016 and later, were based exclusively on modeling conducted for the DRR source in the area, i.e., PREPA Aguirre. The Commonwealth did not factor any significant conclusions from the monitoring data previously submitted in June 2011. Previous design values were below the NAAQS, but trending upward.

Table 8. SO_2 Monitor Design Values for the Guayama-Salinas Area

Municipality	AQS ID	Distance from PREPA Aguirre (km)	Direction from PREPA Aguirre	2011-2013 Design Value (ppb)	2012-2014 Design Value (ppb)	2013-2015 Design Value (ppb)	2014-2016 Design Value (ppb)
Salinas	72-123-0002	3	W	19	23	30**	32**
Guayama	72-057-0009	5	NE	NV*	NV	NV	NV

* Not Valid
** Design value is not certified because Puerto Rico deleted monitoring data from AQS.

- The Salinas monitor (AQS ID 72-123-0002) listed above is the only SO_2 Air Quality System monitor that operated in the Guayama-Salinas area through 2016. This monitor is located at the in Salinas Municipality at Road 2 Final, Las Mareas, approximately 3 km west of the PREPA Aguirre facility. The monitor's 2014-2016 design value and 2013-2015 design value shown in Table 8 are subject to change. EPA notes that some previously entered data in EPA's Air Quality System (AQS) database, from 2014 through 2016, were invalidated and removed by Puerto Rico after EPA had already concurred on the data's validity. EPA and Puerto Rico are currently working to determine whether some or all of the data are valid and should be re-entered into AQS. The 2014-2016, and 2013-2015 design values could change based on the final determination by EPA.

- The Guayama monitor (AQS ID 72-057-0009) is located in the City of Guayama at the Guayama police station parking lot. The monitor is approximately 5 kilometers (km) east of the PREPA Aguirre facility. The most recent and valid design value was 23 ppb from 2009-2011. The Guayama monitor was used by Puerto Rico for determining background SO_2 concentrations for the modeling, which is further discussed in the next section, and Puerto Rico used a 2010-2012 design value for the Guayama SO_2 monitor. EPA notes that the 2012 design value is considered invalid as a result of incomplete data collection for calendar year 2012. EPA notes that the Guayama monitor has not had a valid design value since 2009-2011

Both the Salinas and Guayama monitors are in close proximity to PREPA Aguirre. The Salinas monitor is 3 km downwind (west) of PREPA Aguirre, while the Guayama monitor is 5 km upwind (northeast). Puerto Rico has not provided information that either of the monitors are sited in the area of maximum concentration necessary to characterize the maximum 1-hour SO_2

concentrations near the PREPA Aguirre facility. The Guayama monitor is outside the modeled violating receptor area as demonstrated by the modeling. The maximum modeled concentrations are likely higher than the monitored concentrations for both the Salinas and Guayama areas. EPA does not believe that the Salinas or Guayama monitors provide information that can be used to support the designation recommendation for the area. Additionally, EPA and Puerto Rico are currently working to determine whether some or all of the monitoring data are valid and should be re-entered into AQS. For the Guayama monitor, there has not been enough data collected in recent years for the data to be compared to the NAAQS, nor is there information that that the monitor is located in the area of maximum impact. Therefore, EPA has accepted air quality modeling from Puerto Rico to assess air quality for the area.

4.3. Air Quality Modeling Analysis for the Guayama-Salinas Area Addressing PREPA Aguirre

4.3.1. Introduction

This section presents all the available air quality modeling information for a portion of Guayama-Salinas that includes PREPA Aguirre. (This portion of Guayama-Salinas will often be referred to as "the Guayama-Salinas area" within this section.) This area contains the following SO_2 source around which Puerto Rico is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

- The PREPA Aguirre facility emits 2,000 tons or more annually. Specifically, PREPA Aguirre emitted 9,261 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Puerto Rico has chosen to characterize it via modeling.

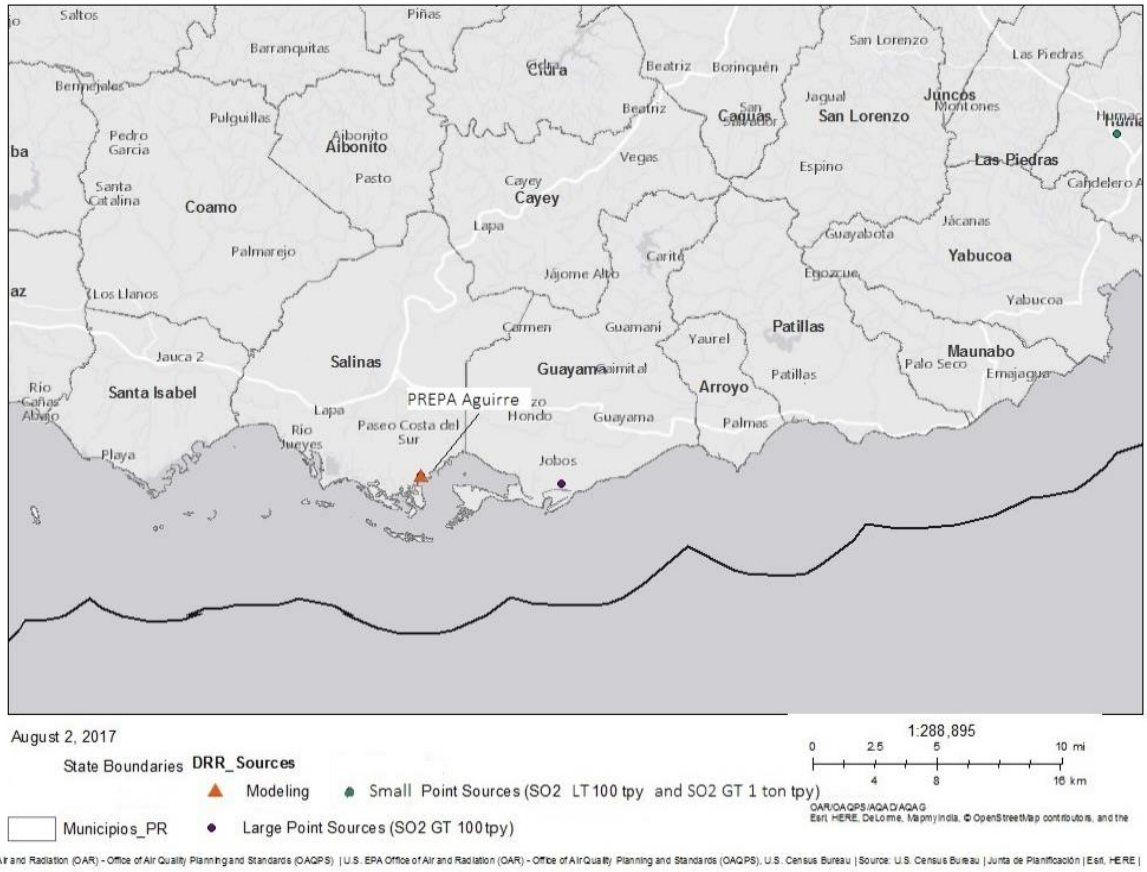
In its submission, Puerto Rico recommended that an area that includes the area surrounding the PREPA Aguirre, specifically portions of the Guyama and Salinas municipalities, be designated as nonattainment based in part on an assessment and characterization of air quality impacts from this facility. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, the EPA agrees with the Commonwealth's recommendation for the area (with EPA adjusted boundaries as described later in this TSD), and intends to designate the area as nonattainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Puerto Rico has assessed via air quality modeling is located in Guayama-Salinas, Puerto Rico, in the south area of the island.

As seen in Figure 11 below, the PREPA Aguirre facility is located in in Guayama-Salinas, PR, near the southern island coastline. PREPA Aguirre is located near PR 705, the Jobos Bay National Estuarine Research Reserve, and Jobos Bay (Bahia de Jobos) in Salinas. Also in Figure 11, there is a moderately sized point source, (i.e., AES Cogen, approximately 8.5 km east of PREPA Aguirre in Guayama. The facility emitted 245 tons of SO_2 in 2014.

Also included in the figure is the area Puerto Rico recommends as nonattainment for the designation, i.e., portions of the Guayama, and Salinas municipalities. The designation boundaries are shown in the figure in the section below that summarizes our intended designation.

Figure 11. Map of the Guayama-Salinas, PR Area Addressing PREPA Aguirre



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered the modeling assessment from Puerto Rico. The EPA has not received modeling of this area from any other parties.

4.3.2. Modeling Analysis Provided by the State

4.3.2.1.Differences Between and Relevance of the Modeling Assessments Submitted by the State

Puerto Rico's original modeling assessment submitted on December 19, 2016, contained a variety of modeling flaws, including incorrect emissions and inaccurate averaging of the model results to attain the final modeled facility impact. Upon consultation with EPA, Puerto Rico

conducted the modeling analysis again and resubmitted the corrected model results on March 3, 2017. In the new model runs, Puerto Rico used the hourly emission rates instead of a single annual value used earlier. Previously, they had conducted the modeling runs for each of the three years individually and averaged the 4th highest modeled concentration for each year, regardless of whether the corresponding receptor was the same through the years, to attain the facility impact. In the new modeling, all three years were run together and the averaging was corrected to match the form of the 1-hour SO_2 NAAQS and the measured ambient design value. Additionally, Puerto Rico updated the model to use the most recent AERMOD 16216r version. The results from the modeling submitted on March 3, 2017, will be used for the intended designation and are discussed in the following sections.

4.3.2.2. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

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

Puerto Rico used AERMOD version 16216r. A discussion of the Commonwealth's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

4.3.2.3. Modeling Parameter: Rural or Urban Dispersion

For the purpose of performing the modeling for the area of analysis, Puerto Rico determined that it was most appropriate to run the model in rural mode. Based on land use information, the area surrounding PREPA Aguirre is rural. This is based on Auer technique as specified in the Guideline of Air Quality Models.

4.3.2.4. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

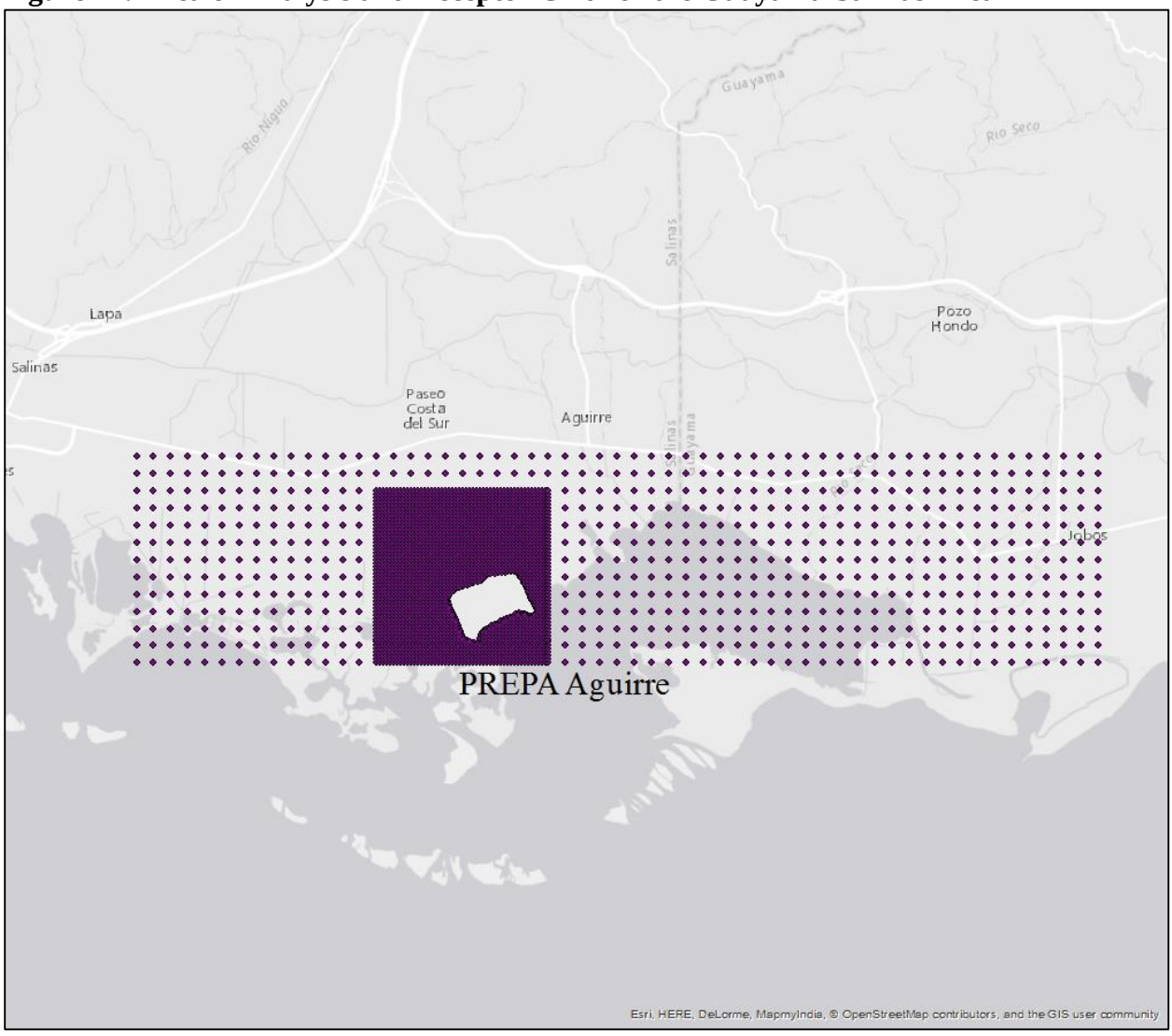
The source of SO_2 emissions subject to the DRR in this area is described in the introduction to this section. For the Guayama-Salinas area, Puerto Rico has included no other emitters of SO_2 within 50 km of PREPA Aguirre in any direction. The Commonwealth determined that this was

the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS violations in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond 50 km were determined by the Commonwealth to have the potential to cause concentration gradient impacts within the area of analysis. However, a background concentration was added to the modeled impacts in order to account for the contribution of other smaller and distance sources.
The grid receptor spacing for the area of analysis chosen by Puerto Rico is as follows: the first was a coarse receptor grid with a 250 m spacing to determine the distance out to which the facility could potentially cause or contribute to a modeled violation of the NAAQS. A second more refined grid was then super imposed with a 50 m spacing in order to find locations of maximum impacts within the modeled domain. Discrete receptors were placed at the PREPA Aguirre fenceline.

The receptor network contained 3,111 receptors, and the network covered primarily an area to the north of the facility. The grid extended approximately 4.5 km to the west, 0.3 km to the south, 1.7 km to the north, and 8 km to the east of the facility. Figure 12, generated by the EPA, shows Puerto Rico's chosen area of analysis surrounding the facility, as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, Puerto Rico placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property. The Commonwealth also placed receptors in other locations that it considered to be ambient air relative to each modeled facility. Puerto Rico included receptors over water even though it would not be feasible to place monitor there. Receptors were only removed from the modeled facility's property. Discrete receptors across the facility fenceline were included in each run. An existing fence precluded public access.

Figure 12: Area of Analysis and Receptor Grid for the Guayama-Salinas Area



An extensive coarse and refined Cartesian receptor grid covering the maximum area of impact was included in the modeling. The receptor grid may not have encompassed all areas where there is the potential for PREPA Aguirre to cause or contribute to an exceedance of the NAAQS.

4.3.2.5. Modeling Parameter: Source Characterization

PREPA Aguirre was explicitly included in the modeling of the Guayama-Salinas area since its annual SO_2 emissions exceed the threshold of 2,000 tons of SO_2 per year.

Puerto Rico characterized this sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the Commonwealth used actual stack heights in conjunction with actual emissions. The Commonwealth also adequately characterized the source's stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Since Puerto Rico Environmental Quality Board (EQB) does not have complete building information

to include the effects of downwash in AERMOD for the area, building downwash was not included in the model run.

Downwash would likely increase the concentrations near the source. The concentrations further downwind and outside the wake area would be the same with or without downwash. However, since the area already violated the NAAQS even without downwash, the area would be considered nonattainment regardless of the additional contributions due to downwash. Therefore, EPA finds that not using downwash in the modeling of PREPA Aguirre did not affect the modeling being representative of air quality in the area for purposes of this action.

4.3.2.6. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent three years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

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

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, Puerto Rico included PREPA Aguirre in the area of analysis. The Commonwealth has chosen to model this facility using actual emissions. The facility in the Commonwealth's modeling analysis and its associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For PREPA Aguirre, Puerto Rico provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 10. A description of how the Commonwealth obtained hourly emission rates is given below this table.

Table 10. Actual SO_2 Emissions Between 2013 – 2015 from Facility in the Guayama-Salinas Area

	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
PREPA Aguirre	9,640	9,261	9,585

PREPA Aguirre does not have CEMs on its stacks. For PREPA Aguirre, the actual emissions data were obtained from the EQB RCAP Rule 410 reports and the SO_2 actual emission data submitted and certified by PREPA. PREPA submits the actual emissions reports annually to EQB and these are reviewed by the Inspection and Compliance Division of the Air Quality Area. This report presents the annual SO_2 actual emissions for the emissions units in the PREPA facility. The Rule 410 of the RCAP includes the monthly fuel usage and days of operation for the PREPA emission units during a year. The information for this report is submitted by the PREPA as a permit requirement and is reviewed by the Air Monitoring, Validation, and Data Management Division of Puerto Rico EQB.

4.3.2.7. Modeling Parameter: Meteorology and Surface Characteristics

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

For the area of analysis for the Guayama-Salinas area, Puerto Rico used three years of site-specific meteorological data. The three years of meteorological data are not concurrent with the three years of SO_2 actual emissions data. For Guayama-Salinas, the meteorology is from 2001-2003. The three-year data period was manually changed (change of the year on AERMET output file) as if it were from 2013 to 2015. The Commonwealth used surface meteorology from Jobos Bay National Estuarine Research Reserve (NERR) station located in the municipality of Guayama, and coincident upper air observations from the San Juan NWS meteorological station located in the Luis Muñoz Marin International Airport in San Juan, PR, as best representative of meteorological conditions within the area of analysis.

The meteorological data was obtained online courtesy of the Estuarine Reserve Division, Office of Ocean and Coastal Resource Management (NOAA) and by the Jobos Bay National Estuarine Research Reserve's principal investigator Luis A. Encarnación. The Jobos Bay NERR's data was previously verified (quality assurance and quality control checked) by an automated weather data management program used by the NERR's principal investigator and described in his metadata documents. The QA and QC checks were done by using simple criteria applied to the measurements obtained from the sensors. The data collections at 15-minutes average and 60-minutes and 24-hour averages were from instantaneous samples and 5-second samples, respectively. However, for dispersion modeling purposes the 15-minutes average data was chosen over the rest. The error and anomalous data that resulted from the automated criteria checks in the metadata were again verified for this air dispersion modeling. Therefore, according to Puerto Rico, this station has a good procedural standard.

The meteorological data was generated by a meteorological tower located in front of Jobos NERR Visitor's Center near latitude 17° 57' 23.34" North and longitude 66° 13' 22.56" West in the community of Aguirre. The Jobos Bay NERR meteorological data obtained included wind speed and direction at 10-meter height and temperature at 2.7-meter height, among other variables measured during that period. However, for this SO_2 modeling case, the parameters that will be used are wind speed, direction and temperature. According to the sensor heights, this station is good by exposure standards.

The percent data capture for hourly averaged wind speed, wind direction, and temperature during the period is 100%, 75% and 98%, respectively. No substitutions in temperature or wind speed were made for all missing wind speeds, directions, and temperatures. Certain changes in wind direction and speeds were done by definition of calms and corrections due to the magnetic and true earth's north (see below).

Comparing the Jobos metadata documentation, the EPA's recommended instrument specifications for an on-site meteorological monitoring program were met or closely met by the Jobos NERR meteorological sensor specifications. For example, the NERR's wind direction and temperature accuracies are ±3° and ±0.2°C, respectively comparing with the guidance accuracies specification of ±5° and ±0.5°C. The NERR's wind speed accuracy specification is close to guidance accuracy specification of ±0.3 meters per second compared to ±0.2 meters per second, respectively. Therefore, according to Puerto Rico, the meteorological data can be trusted by its performance specification standards. This station is not good in calibration standards since the calibrations conducted at the station were infrequent. However, the frequent quality assurance checks and the chosen data period close to its installation date reduces the errors due to drift.

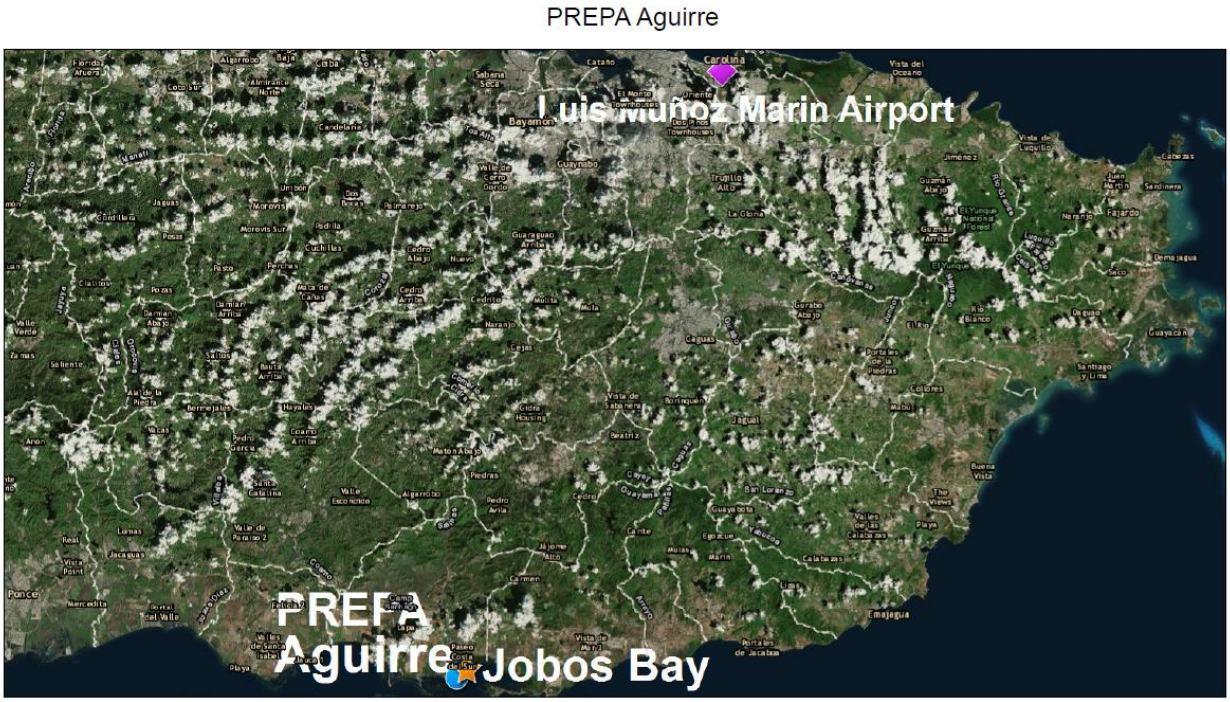
According to NERR's metadata document, the wind direction sensor was directed toward the Earths' magnetic north until April 1th, 2008. In order to correct this error, Puerto Rico looked at the magnetic declination at the time of the station installation on 1999. The magnetic declination at that time was near 12°; therefore, the magnetic declination was subtracted from the original wind direction data reported to get the true north wind direction from years 2001 to 2003.
The NERR's original wind speed and direction data suffered minor corrections due to the sensor threshold value, to the definition of calms and the distinction between the 360° and 0° wind directions. The wind sensor manufacturers' manual established wind speed threshold of 0.5 meters per second. Therefore, the original wind speeds reported lower than or equal to 0.4 were defined as calms (wind speeds set at 0.0 meters per second and wind direction set as 0°) in the actual data. In the same way, for the distinction between the 360° and the 0° wind directions, the original wind directions reported as 0° but with wind speeds greater than or equal to 0.5 meters per second were set as 360° in the actual data. Similarly, the original wind direction reported as 360° but with wind speed lower than or equal to 0.4 meters per second were set as 0° in the actual data.

The inputs to AERMET for surface characteristics (surface roughness length, albedo and Bowen ratio) were determined by the land use/cover classification that surrounds the Guayama's NERR meteorological site. Albedo is the fraction of solar energy reflected from the earth back into space, the Bowen ratio is the method generally used to calculate heat lost or heat gained in a substance, and the surface roughness is sometimes referred to as "$z_{o.}$" The surface characteristics surrounding the San Juan International Airport were also incorporated as part of the AERMET data substitution technique when processing onsite data. The 1992 land cover data needed to run the AERSURFACE utility surface characteristics processor is not available in Puerto Rico. However, the equations in AERSURFACE were manually calculated. These equivalent equations are documented in the Alaska Department of Environmental Conservation (*ADEC Guidance AERMET Geometric Means, How to calculate the Geometric Mean, Bowen ratio and the Inverse-Distance Weighted Geometric Mean Surface Roughness length in Alaska,* 2009).

The land cover categories values were obtained by tables given in USEPA *AERSURFACE User Guide* (2008), together with fractions of the total area of interest. The area fractions of land cover classifications were calculated based on observations of satellite maps. All land cover classification system values were extracted as mid-summer seasonal values for the surface characteristics and year round average moisture conditions typical in the tropics. The same computational equation and procedure was applied to the San Juan surface station as a secondary surface characteristics site in AERMET. For this analysis, the 1-km radius circular area centered at the meteorological station site was divided into 5 sectors for the surface roughness.

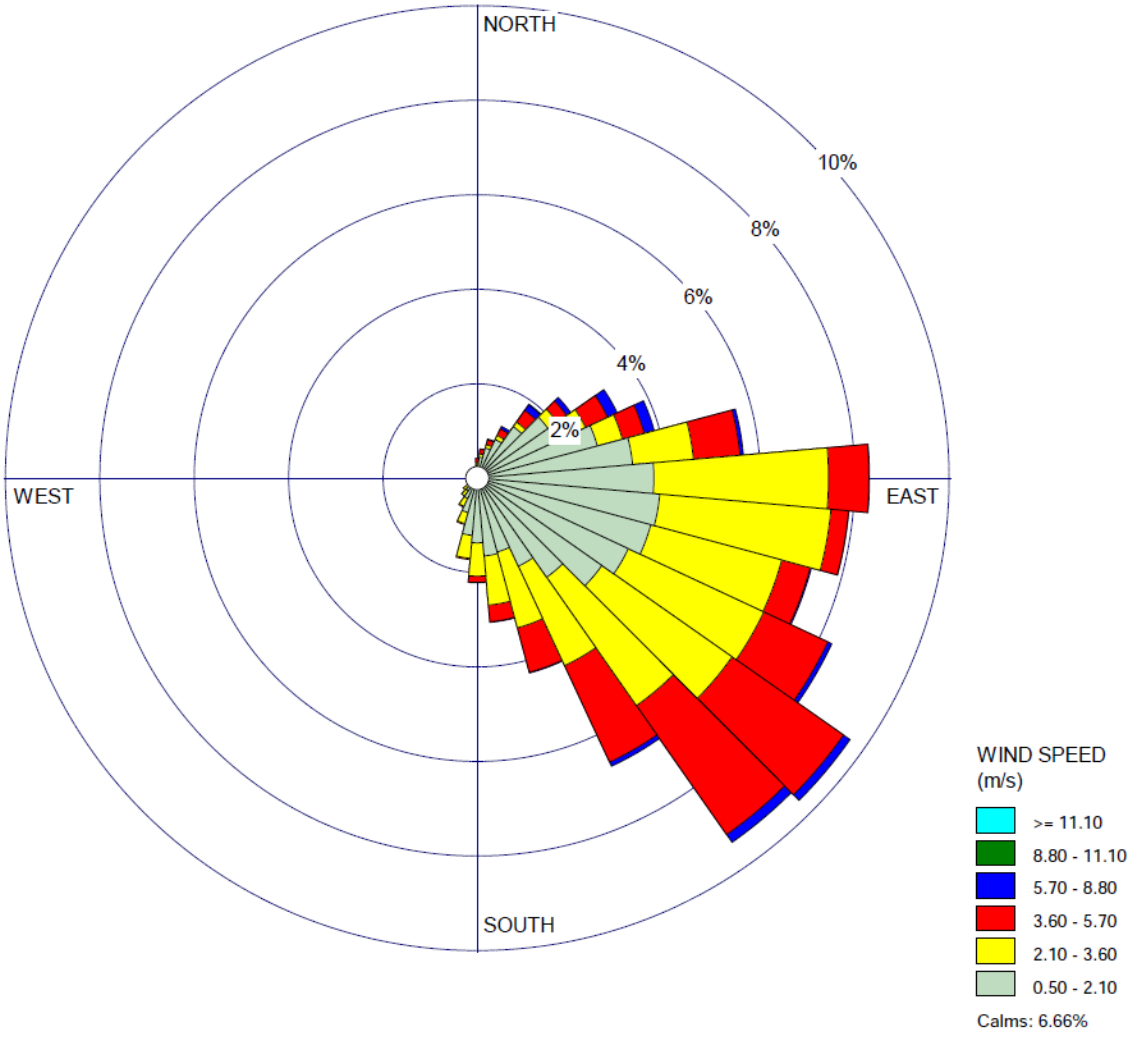
In the figure below, generated by the EPA, the locations of these NWS stations are shown relative to the area of analysis.

Figure 13. Area of Analysis and the NWS stations in the Guayama-Salinas, PR Area



EPA generated the 3-year surface wind rose for the Jobos Bay National Estuarine Research Reserve (NERR) station located in the municipality of Guayama using the surface files provided by Puerto Rico. In Figure 14, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The predominant trade wind direction is from the east-southeast with calms occurring 6.66% of the time

Figure 14: Guayama-Salinas, PR Cumulative Annual Wind Rose for Years 2001 – 2003



Meteorological data from the above surface and upper air NWS stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The state followed the methodology and settings presented in the SO_2 NAAQS Designations Modeling Technical Assistance Document (SO2TAD) in the processing of the raw meteorological data into an AERMOD-ready format, and used the methodology described above to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 15-minute duration was provided from the Jobos Bay station mentioned above, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute wind data.

EPA agrees that even though the meteorological data is not from the same years as the modeled emission years, the data is appropriate in this case since it is spatially and temporally representative of the area during the time of the emissions. Even though there is newer data available from the San Juan NWS station, the meteorology in the northern part of the island where the NWS station is located is not representative of the conditions on the southern part of the island where PREPA Aguirre is located. Since there was more representative data in the south it was used in this case. The data was site specific so it is spatially representative of the area. The Guideline of Air Quality Models (GAQM) recommends that site specific data is preferred. The GAQM also allows for older data provided it is temporally representative of current conditions (GAQM section 8.4.1(b)). It should be noted that meteorological conditions in the Caribbean are very persistent with very little daily or annual variability. Therefore, while the data is older, the data remains representative of the area and is acceptable to use for the purpose of determining the SO_2 designations of the area surrounding the facilities. EPA also agrees that the data was appropriately preprocessed using AERMINUTE and AERMET. The manual calculation of the surface characteristics is acceptable practice by EPA. The AERSURFACE tool is not available for use in this case since it requires the 1992 USGS land cover information which is not collected in Puerto Rico. However, the AERSURFACE categories were used to determine the surface characteristics. It is worth noting that AERSURFACE is not part of the AERMOD modeling system. It is only a tool to assist the calculations surface characteristics that would otherwise need to be calculated manually is the case in Puerto Rico. EPA finds the selection of meteorological data and surface characteristics to be representative and acceptable in this case.

4.3.2.8. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as flat near the coastline and mountainous to the north. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the 7.5 minute USGS Digital Elevation Model data.

EPA agrees the AERMAP preprocessor was appropriately applied by Puerto Rico in this case to simulate the surrounding terrain.

4.3.2.9. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, Puerto Rico chose the first approach. As mentioned previously in the monitoring section, PREQB used the nearby Guayama SO_2 monitor (AQS 72-057-0009) as the background monitor to represent nearby source impacts. The Guayama monitor, which is 5 km northeast of PREPA Aguirre, is 4.5 km downwind of the AES Puerto Rico Cogeneration plant. The single design value from the years 2010-2012 of the background concentration for this area of analysis was determined by the state to be 58 micrograms per cubic meter (μg/m3), equivalent to 22 ppb when expressed in 2 significant figures, and that value was conservatively added to the final AERMOD results.

EPA believes that it would be more appropriate to utilize the design value from the same monitor at Guayama from the years 2009-2011, which would increase the background to 60 (μg/m3); equivalent to 23 ppb. EPA notes that data collected from 2010-2012 was incomplete due to data not reported in 2012 to EPA's AQS database. 2012 had three complete quarters of data, instead of four. Data collected from 2009-2011 is complete, and valid. AQS data is posted at https://www.epa.gov/air-trends/air-quality-design-values.

Since the monitor at Guayama is the most representative background monitor in the Guayama-Salinas area, EPA agrees with Puerto Rico's approach for the using the identified monitor for background concentration. Due to data completeness issues, EPA believes it would be more appropriate to use an earlier design value (2009-2011) to represent background. EPA notes that the earlier design value is only slightly higher at 23 ppb, rather than 22 ppb. In addition, the 2010 design value is also 23 ppb, which further validates that this is a representative background concentration. EPA substituted the Puerto Rico provided design value with the 2009-2011 design value, which EPA added to the final modeled concentration submitted by PREQB. EPA did not remodel the primary sources impact.

4.3.2.10. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Guayama-Salinas area of analysis are summarized below in Table 11.

Table 11: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Guayama-Salinas Area

Input Parameter	Value
AERMOD Version	16216r (regulatory options)
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	5
Modeled Structures	0
Modeled Fencelines	1
Total receptors	3,111
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2001-2003
NWS Station for Surface Meteorology	Jobos Bay National Estuarine Research Reserve (NERR) station
NWS Station Upper Air Meteorology	Luis Muñoz Marin International Airport
NWS Station for Calculating Surface Characteristics	Jobos Bay National Estuarine Research Reserve (NERR) station
Methodology for Calculating Background SO_2 Concentration	Guayama SO_2 monitor (AQS 72-057-0009), Tier 1 based on 2009-2011 design value
Calculated Background SO_2 Concentration	23 ppb or 60 $\mu g/m^3$

The results presented below in Table 12 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

Table 12. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Guayama-Salinas Area

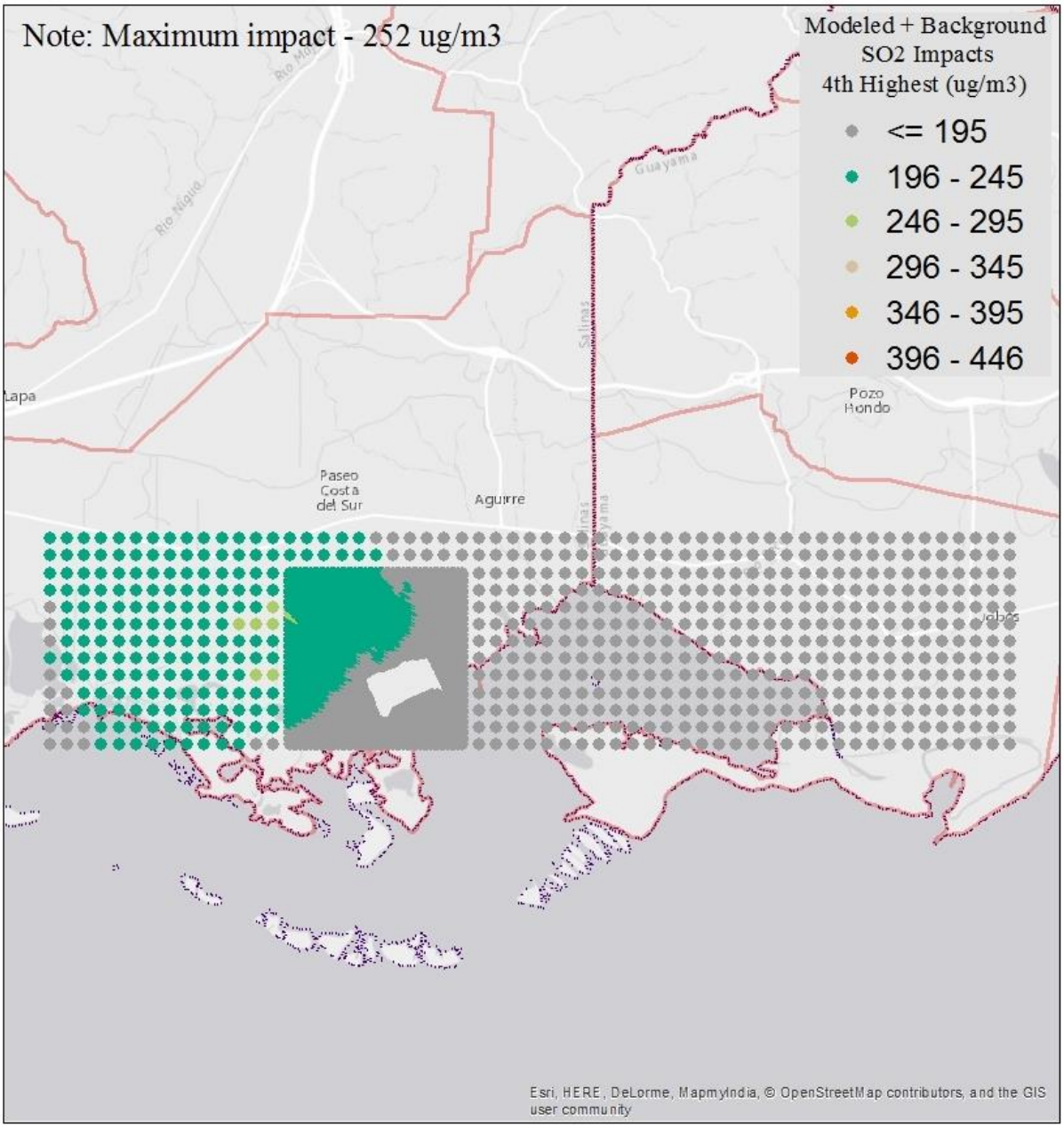
Averaging Period	Data Period	Receptor Location [UTM zone 19N]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-2015	791000	1987750	252	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

EPA determined that the 2010-2012 design value for background concentration provided by Puerto Rico was based on incomplete data, as described earlier. Hence, EPA determined a more appropriate value for the background concentration and added it the modeled concentrations submitted by Puerto Rico. Puerto Rico's modeling with EPA's corrected background of 60 $\mu g/m^3$ indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 252 $\mu g/m^3$, equivalent to 96 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facility. Figure 15 below (as adjusted for EPA's corrected background) was included as part of the Commonwealth's recommendation, and indicates that the predicted value occurred slightly to the northwest of the facility. The Commonwealth's receptor grid is also shown in the figure.

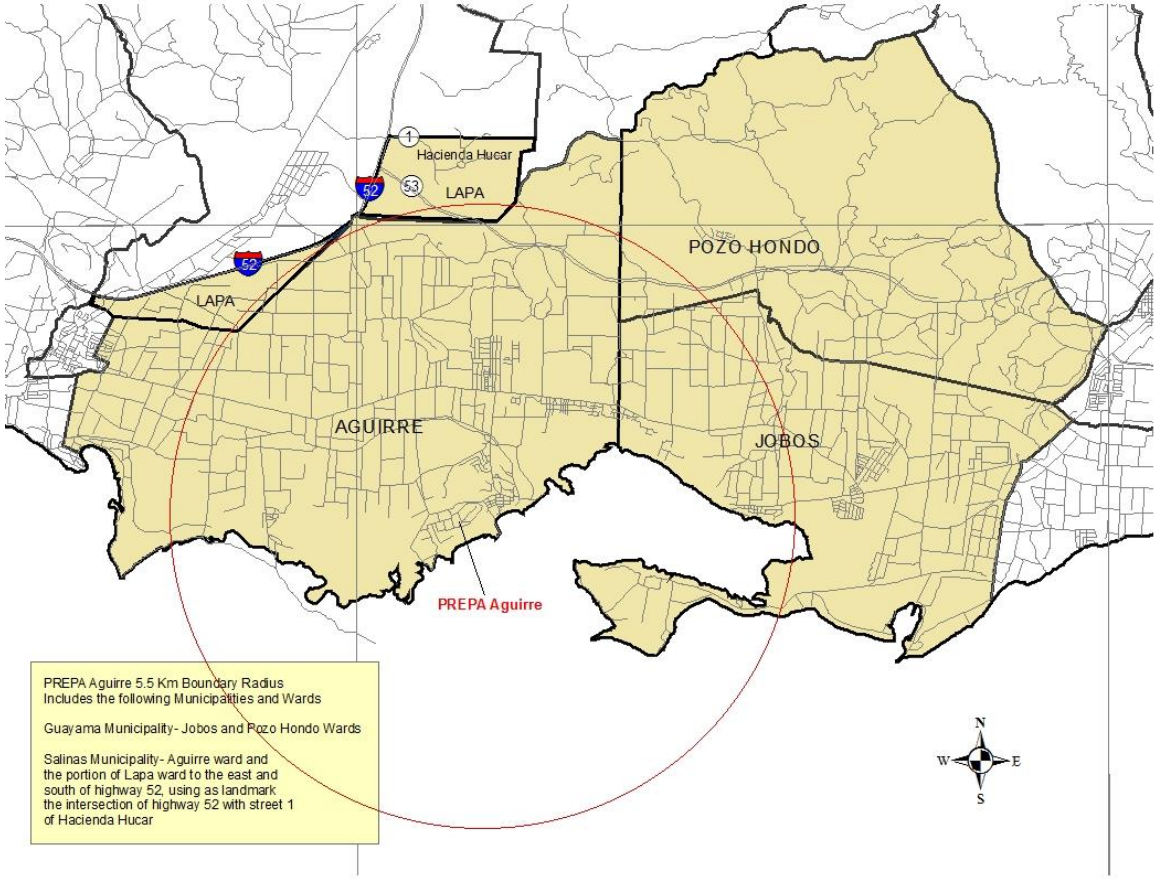
EPA notes that there are violating receptors on the northern, southern and western boundaries of the receptor grid as shown in figure 15, and had Puerto Rico used a larger grid additional violating receptors further north, south, and west may have been shown.

Figure 15: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Guayama-Salinas Area



The modeling submitted by Puerto Rico indicates that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration. The modeling results also include the area in which a NAAQS violation was modeled, information that is relevant to the selection of the boundaries of the area that will be designated. The PREPA Aguirre model results are over the 1-hour SO_2 NAAQS with a maximum impact radius of 5.5 km. The boundary impact radius is defined by municipalities and wards. Figure 16 shows a map with the municipalities and wards recommended by Puerto Rico for boundary impact radius of PREPA Aguirre. These include the municipalities of Guayama and Salinas. Puerto Rico recommends the jurisdictional limit for Jobos and Pozo Hondo wards in Guayama and for Aguirre ward in Salinas. Puerto Rico's recommendation for Lapa ward in Salinas is the portion of the ward to the east and south of Highway 52 near Aguirre ward, using as landmark the intersection between Highway 52 and Street 1 of Hacienda Húcar, as shown in the figure. It should be noted that the radius provided reflects the background concentration of 58 $\mu g/m^3$, while EPA is recommending a more appropriate background value of 60 $\mu g/m^3$, which would slightly increase the radius. Puerto Rico's recommendation includes all wards or portions of wards that are included in the circular boundary impact radius, which is the radius based on the outermost violating receptor.

Figure 16: PREPA Aguirre 1-Hour SO_2 Modeling Results Boundary Impact Radius, Years 2013-2015



4.3.2.11. The EPA's Assessment of the Modeling Information Provided by the State

Based on the information provided by Puerto Rico and summarized in Section 4.3, EPA concluded that the Commonwealth adequately examined and characterized sources within the area of analysis and placed limited receptors in the modeling domain, which resulted in violating receptors on the northern, southern and western boundaries of the receptor grid; appropriately initialized and accounted for modeled emission sources; correctly selected meteorological sites and properly processed the data; adequately estimated surface characteristics. EPA found a more appropriate background design value and added it to the modeled concentrations. Based on this assessment, we conclude the modeling provided by the Commonwealth accurately characterizes air quality in the area of analysis. However, the use of a smaller modeling domain makes it difficult to conclude that the violations do not also occur further beyond the receptor grid used by Puerto Rico.

4.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Guayama-Salinas, PR Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

4.5. Jurisdictional Boundaries in the Guayama-Salinas, PR Area

The EPA's goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable. Puerto Rico recommended that EPA designate Jobos and Pozo Hono wards in the Guyama municipality and the Aguirre Ward in the Salinas municipality as nonattainment. The boundaries of wards are well established and well known so that they provide a good basis for defining the area being designated.

Puerto Rico recommended only a portion of the Lapa ward in the Salinas municipality as nonattainment. Only a small portion of the Lapa ward was within the maximum impact radius of 5.5 km predicted by Puerto Rico's modeling. Instead of the full ward, Puerto Rico used roadways to define the extent of the area; i.e., portion of the Lapa ward to the east and south of Highway 52, using as a landmark Highway 52 with Street 1.

4.6. Other Information Relevant to the Designations for the Guayama-Salinas Area

The EPA has received no third party modeling for the area. The EPA does not have any other relevant information.

4.7. The EPA's Assessment of the Available Information for the Guayama-Salinas, PR Area

The modeling analysis submitted by Puerto Rico to characterize air quality in the area surrounding PREPA Aguirre located in the Salinas municipality, showed a modeled violation. The boundary impact radius from the modeling is approximately 5.5 km from PREPA Aguirre. Considering that the impact radius covers only a limited portion of the Guayama and Salinas municipalities area rather than the entire area, a smaller nonattainment area is supported.

As mentioned earlier in the TSD, the boundary impact radius as determined by Puerto Rico is based on the outermost violating receptor. Basing the size of the nonattainment area on the boundary impact radius may be overly conservative as it would include areas that do not contain violating receptors. The predicted SO_2 impacts shown in figure 15 does not show violating receptors in the Guayama municipality, including Jobos and Pozo Hondo ward, or in the Lapa ward in the Salinas municipality.

EPA notes that the 2012 background design value concentration of 58 $\mu g/m^3$ (22 ppb) as determined by Puerto Rico was incomplete and not valid. EPA found the 2011 design value of 60 $\mu g/m^3$ (23 ppb) for the background monitor to be complete and more appropriate. Furthermore, the 2010 design value at the same monitor was also 23 ppb, which reinforces that 23 ppb is an appropriate background concentration.

EPA believes that a partial designation of nonattainment of the Guayama-Salinas area is appropriate. Other than PREPA Aguirre, the only other point source is the AES Puerto Rico Cogeneration Plant located in Jobos ward, Guayama, which is a relatively small source (e.g., emitted 245 tons of SO_2 in 2014). The facility is upwind of the Guayama monitor (within 5 km) that was used by Puerto Rico in its modeling for PREPA Aguirre to represent background. The facility is approximately 8.5 km east of the area violating the NAAQS. There are no other point sources in any of the neighboring municipalities.

EPA does not believe the partial ward of Lapa is clearly defined by Highway 52 and Street 1 and would not be a suitable basis for defining the nonattainment area.

As previously mentioned, Puerto Rico's receptor grid showed violating receptors on the northern, southern, and western boundaries. Since the extent of the violation is unknown, EPA cannot determine based on available information whether the western portion of the Salinas municipality (i.e., Río Jueyes ward, and Salinas ward) is meeting or not meeting the NAAQS and should be designated nonattainment. Instead, EPA believes there is sufficient information to make a determination that the Lapa ward should be included in the nonattainment area based on

the predominant wind direction from the southeast and the large number of violating receptors on the northern boundary of the receptor grid.

EPA believes that a nonattainment area consisting of the Aguirre and Lapa wards in the Salinas municipality will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended nonattainment area. EPA does not believe that Jobos and Pozo Hondo wards in Guayama should be included in the intended nonattainment area since they do not contain any violating receptors based on the modeling. With the exception of the AES Cogeneration Plant in Jobos, there are no SO_2 point sources above 1 ton per year in either ward. EPA does not believe that the AES plant in Jobos, which emitted 245 tons of SO_2 in 2014, is of sufficient size or in close enough proximity (at approximately 8.5 km) to change the boundary of the violating area. As previously mentioned PREPA Aguirre emitted 9,261 tons of SO_2 in 2014. In addition, any contribution from AES would be accounted for in the background concentration that was added to the model.

EPA cannot determine based on available information the full extent of the nonattainment area due to the use of a relatively small modeling grid by Puerto Rico in its modeling, and the presence of violating receptors on the northern, southern, and western boundaries of the domain. Based on this uncertainty, EPA intends to designate adjacent areas to the north, south, and west as unclassifiable, including the entirety of the Santa Isabel, Coamo, Aibonito, and Cayey municipalities. EPA also intends to designate Guayama as unclassifiable because there is uncertainty regarding contribution from the AES Plant in Jobos. Consequently, EPA intends on designating the remainder of the Salinas municipality as unclassifiable.

4.8. Summary of Our Intended Designation for the Guayama-Salinas, PR Area

After careful evaluation of the Puerto Rico's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the portion of the Guayama-Salinas Area consisting of the Aguirre and Lapa wards in the Salinas municipality as nonattainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of borders of the Aguirre, and Lapa wards. The EPA is designating the Aguirre and Lapa wards as "nonattainment" since EPA has determined, based on available information including appropriate modeling analyses, that they either: (1) do not meet the 2010 SO_2 NAAQS, or (2) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

EPA intends on designating as unclassifiable the remainder of the Salinas municipality as well as Santa Isabel, Coamo, Aibonito, Cayey, and Guayama municipalities as unclassifiable. The EPA is designating these areas as "unclassifiable" because we do not have adequate information for these areas that would allow the EPA to make the determinations that would be required for a designation of "nonattainment" or "unclassifiable/attainment." A designation of "unclassifiable" indicates that the EPA cannot determine based on all available information whether the area is meeting or not meeting the NAAQS or where the EPA cannot determine whether the area contributes to a violation in a nearby area. Figure 17 shows the boundary of these intended designated Nonattainment and Unclassifiable areas.

Figure 17. Boundary of the Intended Guayama-Salinas Nonattainment and Unclassifiable Areas

5. Technical Analysis for the Guayanilla Area

5.1. Introduction

This is the technical analysis for the Guayanilla and Peñuelas municipalities in Puerto Rico (Guayanilla area). The EPA must designate the Guayanilla, PR, area by December 31, 2017, because the area has not been previously designated and Puerto Rico has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR for any sources of SO_2 emissions in Guayanilla.

5.2. Air Quality Monitoring Data for the Guayanilla Area

Puerto Rico did not submit any monitoring data for the Guayanilla area.

Puerto Rico submitted monitoring data from the Guayama SO_2 monitor (AQS ID 72-057-0009) used for determining background SO_2 concentrations for the modeling, which is further discussed in the next section. The background monitor is located in the Guayama municipality.

EPA notes that an air monitor previously operated in the Guayanilla area (AQS ID 72-059-0017). However, the air monitor, which was approximately 3 km northwest of the PREPA Costa Sur facility, has been discontinued and is no longer part of Puerto Rico's SO_2 monitoring network. The monitor was located at BO. MAGAS ARRIBA 382 in the Guayanilla municipality. The most recent valid design value (for 2007-2009) was 23 ppb.

Puerto Rico has not provided, nor is EPA aware of information to confirm if the monitor is sited to characterize the maximum 1-hour SO_2 concentrations near the PREPA Costa Sur facility. The predominant wind direction is from the northeast as noted in the modeling analysis section below.

EPA believes that data from the Guayanilla monitor does not provide information that can be used to support the designation recommendation for the area since the monitor has not collected enough data for comparison to the NAAQS in recent years, and because the EPA does not have information that the monitor was located in the area of maximum impact. Therefore, EPA has accepted air quality modeling from Puerto Rico to assess air quality for the area.

EPA believes that data from the monitor that previously operated in the Guayanilla area does not provide information that can be used to support the designation recommendation for the area since the monitor has not collected enough data for comparison to the NAAQS in recent years.

5.3. Air Quality Modeling Analysis for the Guayanilla Area Addressing PREPA Costa Sur

5.3.1. Introduction

This section presents all the available air quality modeling information for a portion of Guayanilla that includes PREPA Costa Sur. (This portion of Guayanilla will often be referred to

as "the Guayanilla area" within this section.) This area contains the following SO_2 source around which Puerto Rico is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

- The PREPA Costa Sur facility emits 2,000 tons or more annually. Specifically, PREPA Costa Sur emitted 8,336 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Puerto Rico has chosen to characterize it via modeling.

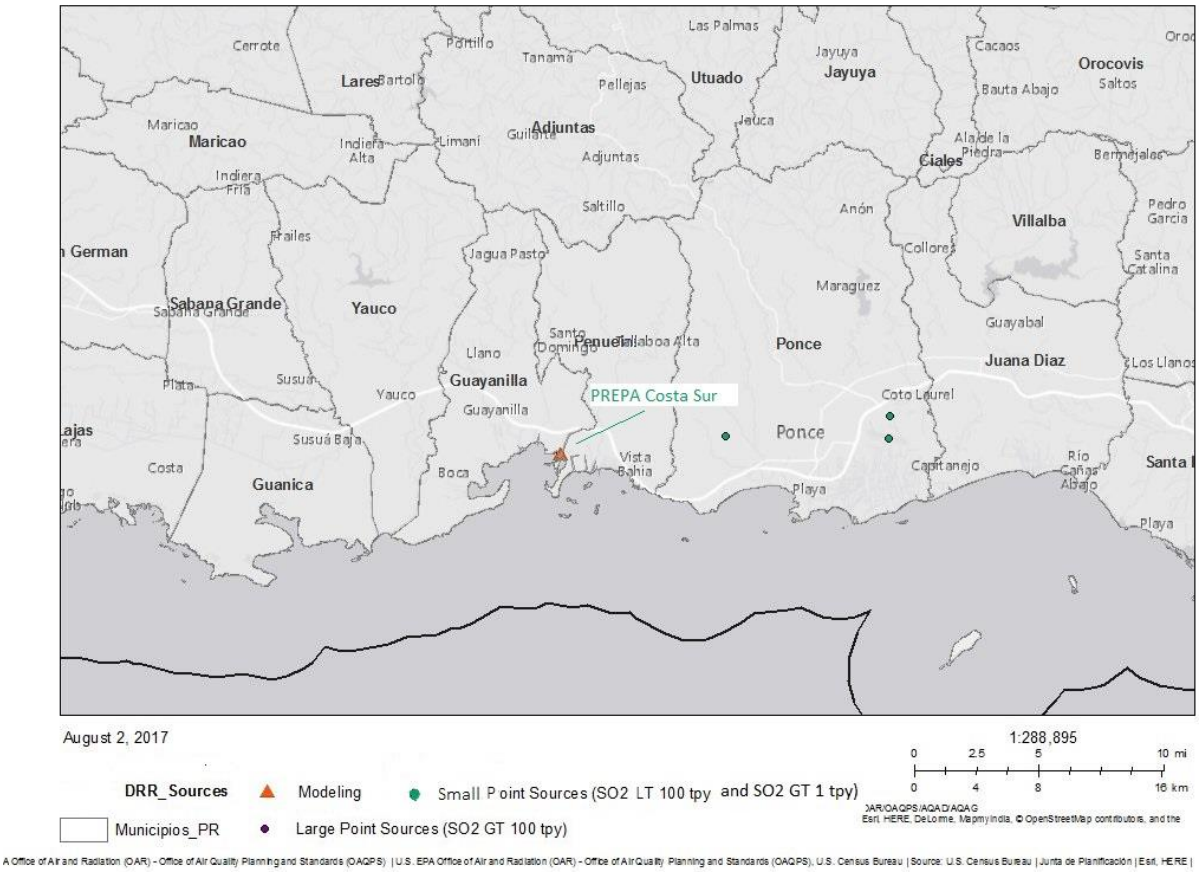
In its submission, Puerto Rico recommended that an area that includes the area surrounding the facility, specifically the entirety of Guayanilla and Peñuelas municipalities, be designated as unclassifiable/attainment based in part on an assessment and characterization of air quality impacts from this facility. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, the EPA agrees with the Commonwealth's recommendation for the area, and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Puerto Rico has assessed via air quality modeling is located in Guayanilla, Puerto Rico, in the south area of the island. The PREPA Costa Sur facility is located in Guayanilla, PR near the southern island coastline. There is high terrain to the north of the facility. As shown in Figure 18 below there are several other point sources in the Guayanilla, PR area that are near PREPA Costa Sur. There are three small point sources (emitting 100 tons or less of SO_2 annually) that are within 20 km of the facility. The closest point source to PREPA Costa Sur is BFI Ponce, which is 10 km east of PREPA Costa Sur and emitted approximately 2 tons of SO_2 in 2014.

Also included in the figure is Puerto Rico's recommended[20] area for the unclassifiable/attainment designation. The EPA's intended unclassifiable/attainment designation boundary for the Guayanilla area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

[20] Specific boundaries are not identified in Figure 18 as Puerto Rico is also recommending the neighboring municipalities shown as unclassifiable/attainment.

Figure 18. Map of the Guayanilla, PR Area Addressing PREPA Costa Sur



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered the modeling assessment from Puerto Rico. The EPA has not received modeling of this area from any other parties.

5.3.2. Modeling Analysis Provided by the State

5.3.2.1. Differences Between and Relevance of the Modeling Assessments Submitted by the State

Puerto Rico's original modeling assessment submitted on December 19, 2016 contained a variety of modeling flaws, including incorrect emissions and inaccurate averaging of the model results to attain the final modeled facility impact. Upon consultation with EPA, Puerto Rico conducted the modeling analysis again and resubmitted the model results on March 3, 2017. In the new model runs, Puerto Rico used the hourly emission rates based on monthly fuel usage instead of a single annual value used earlier. Previously, they had conducted the modeling runs for each of the three years individually and averaged the 4th highest modeled concentration for each year, regardless

of whether the corresponding receptor was the same through the years, to attain the facility impact. In the March 3, 2017 modeling, all three years were run together and the averaging was corrected to match the form of the 1-hour SO_2 NAAQS and the measured ambient design value. This form follows the monitored SO_2 design value calculation methodology. Additionally, Puerto Rico updated the model to use the most recent AERMOD 16216r version. For PREPA Costa Sur, the ADJ_u* option was included in the modeling. These modeling results showed no violations of the SO_2 NAAQS.

In the December 19, 2016, modeling, this area had shown high exceedances of the NAAQS. The reason the concentrations decreased was due to several units not operating; therefore, emissions for many hours was zero. Puerto Rico EQB believes that this is normal source operation and expect these emissions to be representative of actual emissions even though monthly emission values were used.

Since it showed attainment in the March 3, 2017, modeling (i.e., 173 $\mu g/m^3$) EPA could not conclude that the area was showing attainment unless the additional impacts due to building downwash was accounted for in the model. The March 3rd modeling results were close to the NAAQS, and the inclusion of downwash potentially could cause a NAAQS violation. EPA recommended that PREQB redo the modeling again with the use of building downwash. PREQB could not account for this since they did not have information regarding building dimensions. EPA used publically available software (SketchUp) to estimate these values and provided the necessary dimensions to PREQB. On March 28, 2017, Puerto Rico submitted the third and final round of modeling results. While, the concentrations due to downwash increased, the concentrations remained less than the NAAQS. The results from the March 28, 2017, modeling will be used for the intended designation and are discussed in the following sections.

5.3.2.2. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

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

Puerto Rico used AERMOD version 16216r. A discussion of the Commonwealth's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

5.3.2.3. Modeling Parameter: Rural or Urban Dispersion

For the purpose of performing the modeling for the area of analysis, Puerto Rico determined that it was most appropriate to run the model in rural mode. Based on land use information, the area

surrounding PREPA Costa Sur is rural. This is based on Auer technique as specified in the Guideline of Air Quality Models.

5.3.2.4. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

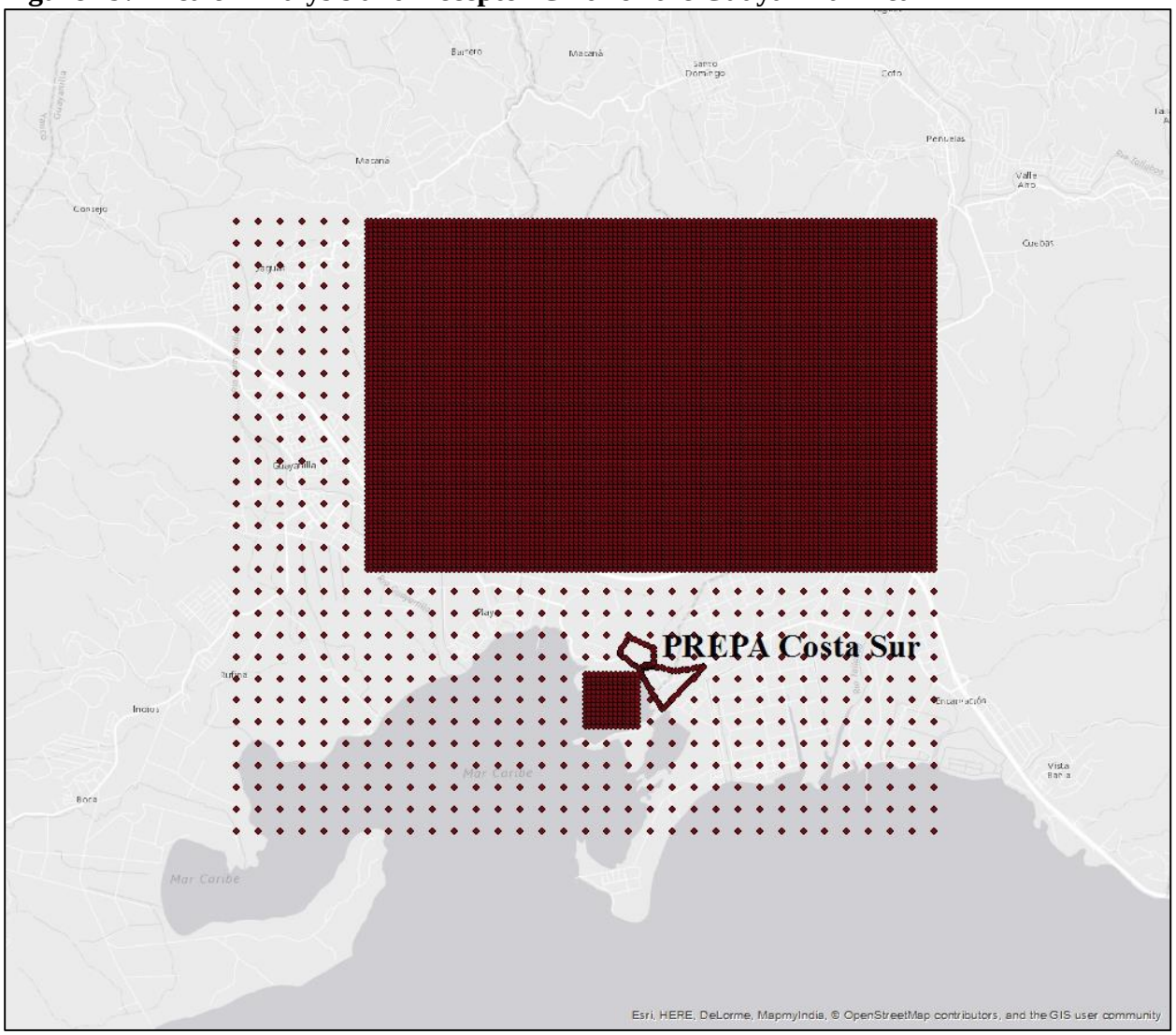
The source of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Guayanilla area, Puerto Rico has included no other emitters of SO_2 within 50 km of PREPA Costa Sur in any direction. The Commonwealth determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS violations in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond 50 km were determined by the Commonwealth to have the potential to cause concentration gradient impacts within the area of analysis. As mentioned previously, there are several small point sources in the Guayanilla area, the nearest of which emits 2 tons of SO_2 annually and is approximately 10 km upwind. These background sources, however, would have been accounted for in the modeling.

The grid receptor spacing for the area of analysis chosen by Puerto Rico is as follows: the first was a coarse receptor grid with a 250 m spacing to determine the distance out to which the facility could potentially cause or contribute to a modeled exceedance of the NAAQS. Two refined grids at 50 m spacing were then super imposed with a 50 m spacing in order to find locations of maximum impacts within the modeled domain. Discrete receptors were placed at the PREPA Costa Sur fenceline.

The receptor network contained 12,316 receptors, and the network covered primarily an area to the north of the facility. The grid extended approximately 4.4 km to the west, 1.4 km to the south, 4.7 km to the north, and 2.6 km to the east of the facility. Figure 19, generated by the EPA, shows Puerto Rico's chosen area of analysis surrounding the facility, as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, Puerto Rico placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property. The Commonwealth also placed receptors in other locations that it considered to be ambient air relative to each modeled facility. Puerto Rico included receptors over water even though it would not be feasible to place monitor there. Receptors were only removed from the modeled facility's property. Discrete receptors across the facility fenceline were included in each run. An existing fence precludes public access.

Figure 19: Area of Analysis and Receptor Grid for the Guayanilla Area



An extensive coarse and refined Cartesian receptor grid covering the maximum area of impact was included in the modeling, and hence is acceptable by the EPA.

5.3.2.5. Modeling Parameter: Source Characterization

PREPA Costa Sur was explicitly included in the modeling of the Guayanilla area since its annual SO_2 emissions exceed the threshold of 2,000 tons of SO_2 per year.

Puerto Rico characterized this/these source(s) within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the Commonwealth used actual stack heights in conjunction with actual emissions. The Commonwealth also adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. The AERMOD component BPIPPRM was used to assist in addressing building downwash.

The March 3, 2017 modeling showed attainment. However, EPA could not conclude that it was truly attainment since this modeling did not account for the additional impacts due to downwash. With assistance from EPA scientists, data for building dimensions in the facility was provided to Puerto Rico to include building downwash. The state remodeled with the building information. An additional modeling analysis was submitted on March 28, 2017, with downwash. The impacts increased to 193 ug/m^3.

5.3.2.6. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent three years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

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

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

As previously noted, Puerto Rico included PREPA Costa Sur in the area of analysis. The Commonwealth has chosen to model this facility using actual emissions. The facility in the Commonwealth's modeling analysis and its associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For PREPA Costa Sur, Puerto Rico provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 13. A description of how the Commonwealth obtained hourly emission rates is given below this table.

Table 13. Actual SO_2 Emissions Between 2013 – 2015 from Facility in the Guayanilla Area

Facility Name	SO_2 Emissions (tpy)		
	2013	2014	2015
PREPA Costa Sur	6,975	8,336	9,323

PREPA Costa Sur does not have CEMs on its stacks. For PREPA Costa Sur, the actual emissions data were obtained from the EQB RCAP Rule 410 reports and the SO_2 actual emission data submitted and certified by PREPA. PREPA submits the actual emissions reports annually to EQB and these are reviewed by the Inspection and Compliance Division of the Air Quality Area. This report presents the annual SO_2 actual emissions for the emissions units in the PREPA facility. The Rule 410 of the RCAP includes the monthly fuel usage and days of operation for the PREPA emission units during a year. The information for this report is submitted by the PREPA as a permit requirement and is reviewed by the Air Monitoring, Validation, and Data Management Division of the Puerto Rico EQB.

5.3.2.7. Modeling Parameter: Meteorology and Surface Characteristics

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

For the area of analysis for the Guayanilla area, Puerto Rico used three years of site-specific meteorological data. The three years of meteorological data are not concurrent with the three years of SO_2 actual emissions data. For Guayanilla, the meteorology is from 1991-1993. The three-year data period was manually changed (change of the year on AERMET output file) as if it were from 2013 to 2015. The Commonwealth used surface meteorology from a PREPA Tallaboa Meteorological station located in the municipality of Guayanilla, and coincident upper air observations from San Juan NWS meteorological station located in the Luis Muñoz Marin International Airport in San Juan, PR as best representative of meteorological conditions within the area of analysis.

Meteorological data from a PREPA Meteorological station located in the municipality of Guayanilla was used for the suggested TAD SO2 modeling. The meteorological data collected is from 1991 to 1993 and it was obtained by the Prevention of Significant Deterioration (PSD) Permit application for the Ecoelectrica Terminal and Cogeneration Project submitted in May 23, 1995. The source of the raw meteorological data for the PSD permit was generated by a PREPA Tallaboa Meteorological Tower located approximately 2.3 miles to the northeast of the Ecoelectrica Plant site in the Northern portion of Tallaboa Poniente region (Guayanilla). The Tallaboa meteorological data submitted included wind speed and direction at 10 and 76 meter heights, temperature at 10-meter height, stability (sigma-theta), and mixing heights. However, for this SO2 modeling case in AERMOD, the parameters that will be used are wind speed, direction and temperature at 10-meters. Sigma theta was not used since the ADJ_u* option was used.

The percent data capture reported in the permit for the 10-meter level of the years 1991, 1992 and 1993 is 81.2, 88.0 and 95%, respectively. Comparing with the 76 meter level, a higher percent data capture for the same period was observed. In order to increase the percent of capture for the 10-meter level, the missing data at 10-meter level wind direction, speed and sometimes ambient temperature were substituted by the data at 76-meter level based on meteorological sounded trends. No substitutions in temperature or wind speed were made at the 10-meter from the 76-meter data if the data departed too much of the trends observed during that period at 10 meters. Therefore, not all missing wind speeds and temperatures at 10-meter were substituted.

According to the PSD Ecoelectrica Project Site documentation, the EPA's recommended instrument specifications for an on-site meteorological monitoring program were met by the PREPA Tallaboa meteorological instrumentation. Therefore, according to Puerto Rico, this station has a good procedural, exposure, performance and calibration standards.

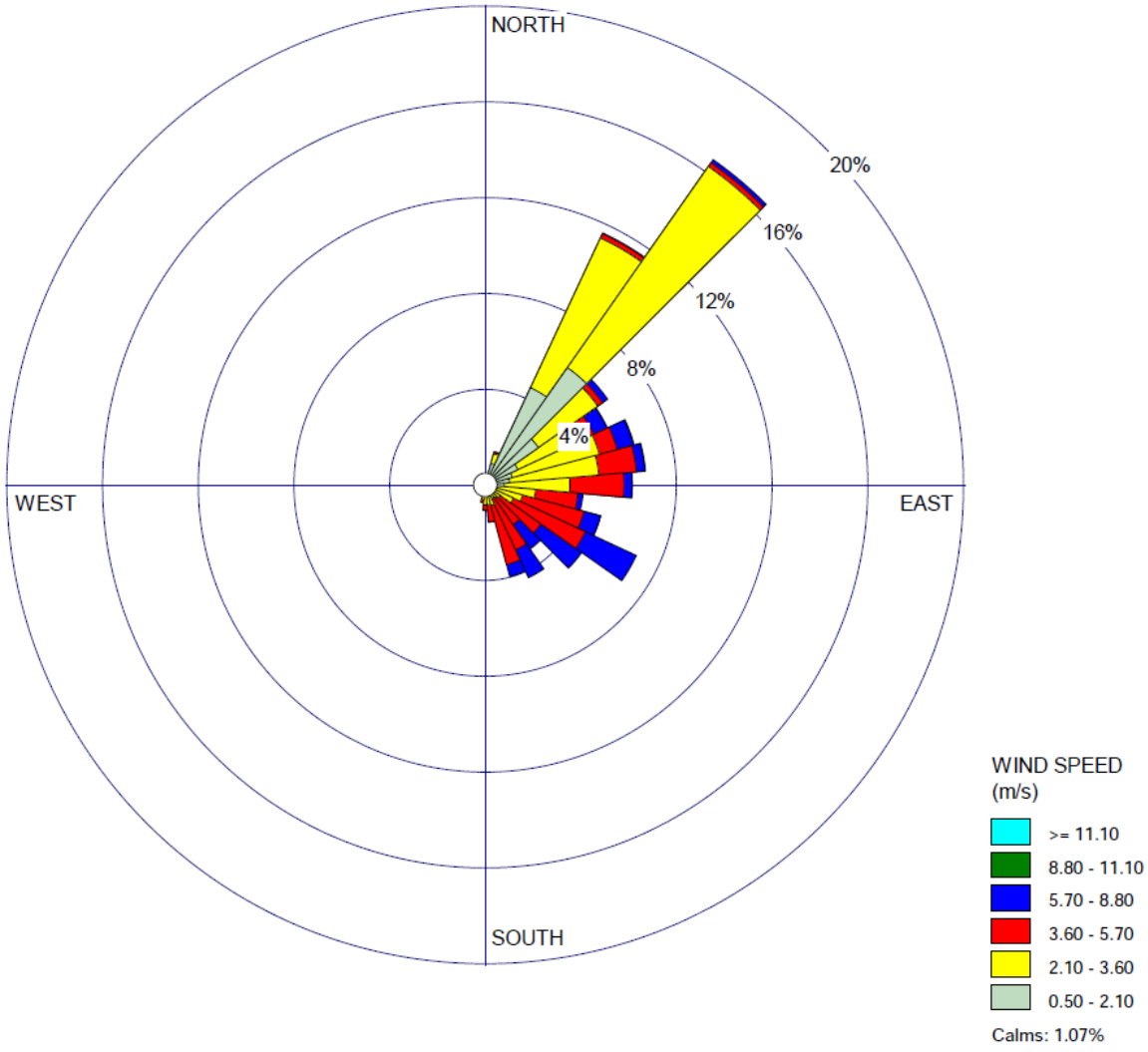
The inputs to AERSURFACE for surface characteristics (albedo, Bowen ratio, and surface roughness [z_o]) of the area of analysis. Albedo is the fraction of solar energy reflected from the earth back into space, the Bowen ratio is the method generally used to calculate heat lost or heat gained in a substance, and the surface roughness is sometimes referred to as "z_o" were determined by the land use/cover classification that surrounds the Tallaboa meteorological site. The surface characteristics surrounding the San Juan International Airport were also incorporated as part of the AERMET data substitution technique when processing onsite data. The 1992 land cover data needed to run the AERSURFACE utility surface characteristics processor is not available in Puerto Rico. However, the equations in AERSURFACE were manually calculated. These equivalent equations are documented in the Alaska Department of Environmental Conservation (*ADEC Guidance AERMET Geometric Means, How to calculate the Geometric Mean, Bowen ratio and the Inverse-Distance Weighted Geometric Mean Surface Roughness length in Alaska*, 2009).

The land cover categories values were obtained by tables given in USEPA *AERSURFACE User Guide* (2008), together with fractions of the total area of interest. The area fractions of land cover classifications were calculated based on satellite maps and observational visits to the area. All land cover classification system values were extracted as mid-summer seasonal values for the surface characteristics and year round average moisture conditions typical in the tropics. The same computational equation and procedure was applied to the San Juan surface station as a secondary surface characteristics site required in AERMET. For this analysis, the 1-km radius circular area centered at the meteorological station site was divided into 3 sectors for the surface roughness. In the figure below, generated by the EPA, the locations of these NWS stations are shown relative to the area of analysis.

Figure 20. Area of Analysis and the NWS stations in the Guayanilla, PR Area

EPA generated the 3-year surface wind rose for the PREPA Tallaboa Meteorological station located in the municipality of Guayanilla using the surface files provided by Puerto Rico. In Figure 21, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The winds are mostly from the east with the predominant trade wind direction being the northeast with calms occurring 1.07% of the time

Figure 21: Guayanilla, PR Cumulative Annual Wind Rose for Years 1991 – 1993



Meteorological data from the above surface and upper air NWS stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The state followed the methodology and settings presented in the SO_2 NAAQS Designations Modeling Technical Assistance Document in the processing of the raw meteorological data into an AERMOD-ready format, and used the methodology described above to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from the Tallaboa meteorological station mentioned above. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute wind data.

EPA agrees that even though the meteorological data is not from the same years as the model years, the data is appropriate in this case since it is spatially and temporally representative of the area. Even though there is newer data available from the San Juan NWS station, the meteorology in the northern part of the island where the NWS station is located is not representative of the conditions on the southern part of the island where PREPA Costa Sur is located. Therefore, the more representative data in the south was used in this case. The data was site specific so it is spatially representative of the area. The Guideline of Air Quality Models (GAQM) recommends that site specific data is preferred. The GAQM also allows for older data provided it is temporally representative of current conditions (GAQM section 8.4.1(b)). It should be noted that meteorological conditions in the Caribbean are very persistent with very little daily or annual variability. While the data is older, the data remains representative of the area and is acceptable to use for the purpose of determining the SO_2 designations of the area surrounding the facilities. EPA also agrees that the data was appropriately preprocessed using AERMET. The manual calculation of the surface characteristics is acceptable practice by EPA. The AERSURFACE tool is not available for use in this case since it requires the 1992 USGS land cover information which is not collected in Puerto Rico. However, the AERSURFACE categories were used to determine the surface characteristics. It is worth noting that AERSURFACE is not part of the AERMOD modeling system. It is only a tool to assist the calculations surface characteristics that would otherwise need to be calculated manually is the case in Puerto Rico. EPA finds the selection of meteorological data and surface characteristics to be representative and acceptable in this case.

5.3.2.8. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as flat near the coastline and mountainous to the north. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the 7.5 minute USGS Digital Elevation Model data.

EPA agrees the AERMAP preprocessor was appropriately applied by Puerto Rico in this case to simulate the surrounding terrain.

5.3.2.9. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, Puerto Rico chose the first approach. Puerto Rico has SO_2 air quality monitors in the vicinity of the San Juan area but they are source oriented; therefore, they are not representative of the nearby source impacts. A regional site monitor that is impacted by similar natural and distant man-made sources was used by PREQB, in particular, the Guayama SO_2 monitor (AQS 72-057-0009) from the years 2010-2012. The single design value of the background concentration for this area of analysis was determined by the Commonwealth to be 58 micrograms per cubic meter ($\mu g/m^3$), equivalent to 22 ppb when expressed in 2 significant figures, and that value was conservatively added to the final AERMOD results.

EPA believes that it would be more appropriate to utilize the design value from the same monitor at Guayama from the years 2009-2011, which would increase the background to 60 ($\mu g/m^3$); equivalent to 23 ppb. EPA notes that data collected from 2010-2012 was incomplete due to data not reported in 2012 to EPA's AQS database. 2012 had three complete quarters of data, instead of four. Data collected from 2009-2011 is complete, and valid. AQS data is posted at https://www.epa.gov/air-trends/air-quality-design-values.

Since the monitor at Guayama is the most representative background monitor in the Guayanilla area, EPA agrees with Puerto Rico's approach for the using the identified monitor for background concentration. Due to data completeness issues, EPA believes it would be more appropriate to use an earlier design value (2009-2011) to represent background. EPA's notes that the earlier design value is only slightly higher at 23 ppb, rather than 22 ppb. In addition, the 2010 design value is also 23 ppb, which further validates that this is a representative background concentration. EPA substituted the Puerto Rico provided design value with the more appropriate 2009-2011 design value, which EPA added to the final modeled concentration submitted by PREEQB. EPA did not remodel the primary sources impact.

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5.3.2.10. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Guayanilla area of analysis are summarized below in Table 14.

Table 14. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Guayanilla Area

Input Parameter	Value
AERMOD Version	16216r (with ADJ_U*)
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	5
Modeled Structures	0
Modeled Fencelines	1
Total receptors	12,316
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	1991-1993
NWS Station for Surface Meteorology	PREPA Tallaboa Meteorological station
NWS Station Upper Air Meteorology	Luis Muñoz Marin International Airport
NWS Station for Calculating Surface Characteristics	PREPA Tallaboa Meteorological station
Methodology for Calculating Background SO_2 Concentration	Guayama SO_2 monitor (AQS 72-057-0009), Tier 1 based on 2009-2011 design value
Calculated Background SO_2 Concentration	23 ppb or 60 $\mu g/m^3$

The results presented below in Table 15 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

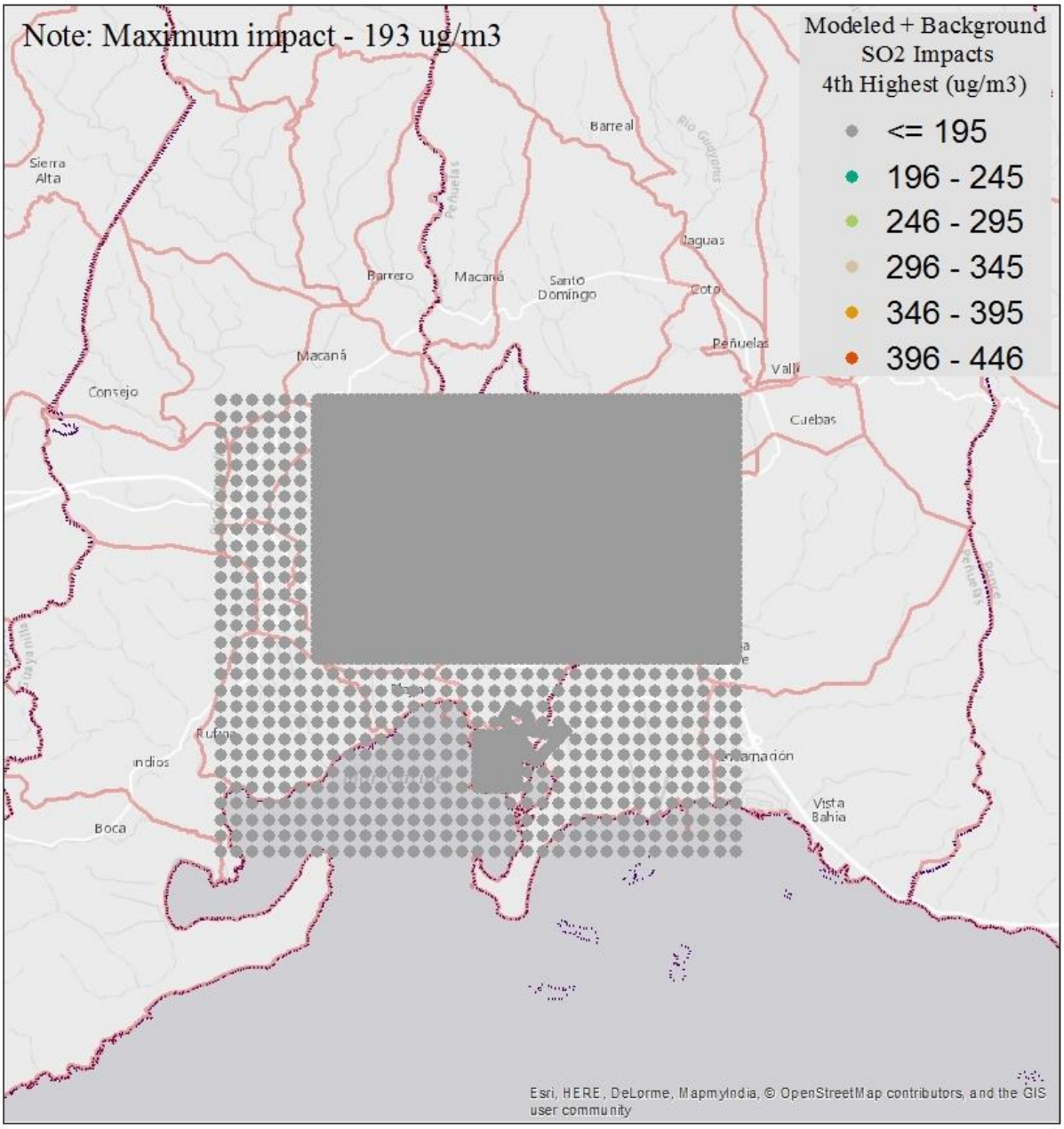
Table 15. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Guayanilla Area

Averaging Period	Data Period	Receptor Location [UTM zone 19N]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-2015	737450	1991200	193	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

EPA determined that the 2010-2012 design value for background concentration provided by Puerto Rico was based on incomplete data, as described earlier. Hence, EPA determined a more appropriate value for the background concentration and added it the modeled concentrations submitted by Puerto Rico. Puerto Rico's modeling with EPA's corrected background of 60 $\mu g/m^3$ indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 193 $\mu g/m^3$, equivalent to 73 ppb. This modeled concentration included the background concentration of SO_2 determined by EPA, and is based on actual emissions from the facility/facilities. Figure 22 below (as adjusted for EPA's corrected background) was included as part of the Commonwealth's recommendation, and indicates that the predicted value occurred slightly to the southwest of the facility. The Commonwealth's receptor grid is also shown in the figure.

Figure 22: Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Guayanilla Area



The modeling submitted by Puerto Rico does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration.

5.3.2.11. The EPA's Assessment of the Modeling Information Provided by the State

Based on the information provided by Puerto Rico and summarized in Section 5.3, EPA concluded that the Commonwealth adequately examined and characterized sources within the area of analysis and appropriately placed receptors in the modeling domain; appropriately initialized and accounted for modeled emission sources and building downwash; correctly selected meteorological sites and properly processed the data; adequately estimated surface characteristics. EPA found a more appropriate background design value and added it to the modeled concentrations. Based on this assessment, we conclude the modeling provided by the Commonwealth accurately characterizes air quality in the area of analysis.

5.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Guayanilla, PR Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

5.5. Jurisdictional Boundaries in the Guayanilla, PR Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for Guayanilla, PR Area. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

Puerto Rico recommended the Guayanilla municipality and the Peñuelas municipality as unclassifiable/attainment. The boundaries of municipalities are well established and well known so that they provide a good basis for defining the area being designated.

5.6. Other Information Relevant to the Designations for the Guayanilla Area

The EPA has received no third party modeling for the area. The EPA does not have any other relevant information.

5.7. The EPA's Assessment of the Available Information for the Guayanilla, PR Area

The modeling analysis submitted by Puerto Rico to characterize air quality in the area of Costa Sur, located in the Guayanilla area, indicates no violations of the 2010 SO_2 NAAQS. As discussed above, we conclude the modeling provided by the Commonwealth accurately characterizes air quality in the area of analysis, and indicates that the area meets the NAAQS and does not contribute to a nearby area that does not meet the NAAQS.

For the Guayanilla area, EPA believes a designation of unclassifiable/attainment for the Guayanilla area, to include the full municipalities of Guayanilla and Peñuelas municipalities is appropriate. The model results were below the NAAQS up to 6 km from PREPA Costa Sur, which included both municipalities.

There are no point sources above 1 ton per year in either Guayanilla or Peñuelas municipalities. There are several small point sources in the neighboring Ponce municipality, which borders Peñuelas to the east. The closest of the Ponce point sources to the area, BFI of Ponce, is located 3 km east of the Peñuelas eastern border. BFI emitted only approximately 2 tons of SO_2 in 2014. EPA does not believe BFI, or the other small sources further away (over 13 km) in Ponce would cause or contribute to a violation of the 2010 SO_2 NAAQS in the Peñuelas municipality especially since the PREPA Costa Sur, which was modeled with emissions several thousand tons per year greater, did not show violation of the NAAQS.

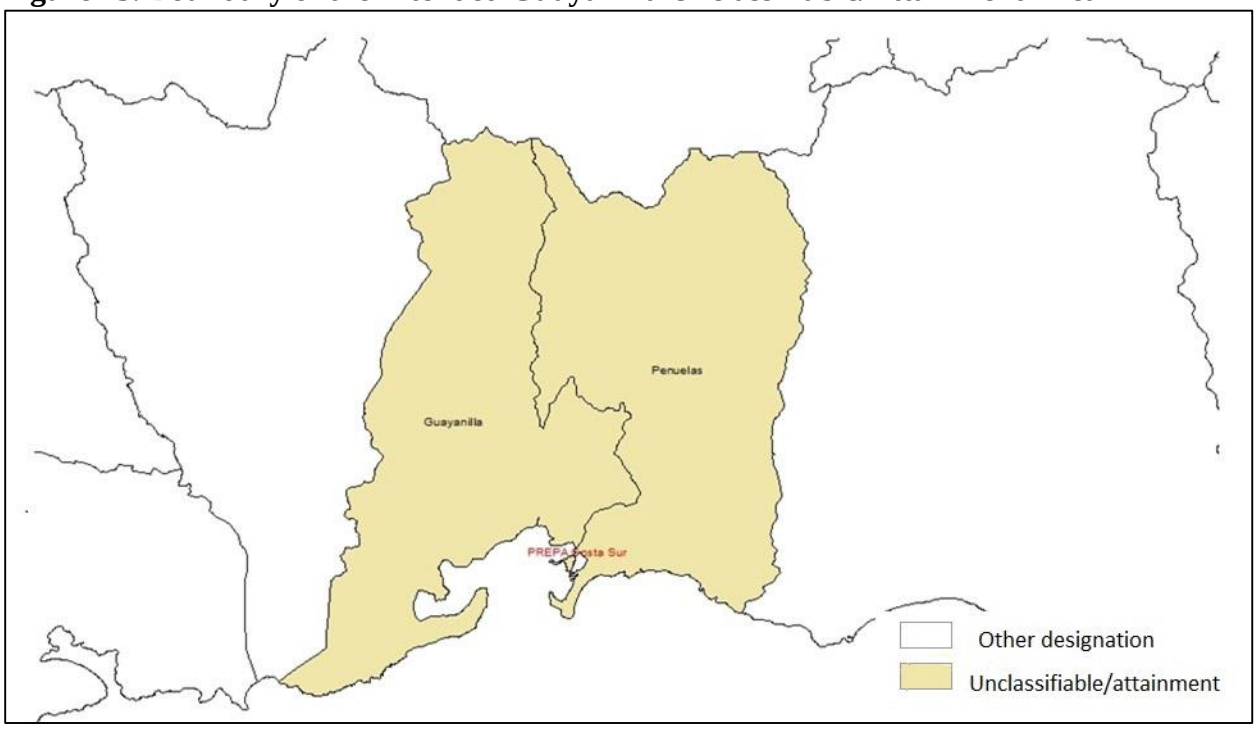
In addition, EPA notes that the 2012 background design value concentration of 58 $\mu g/m^3$ (22 ppb) as determined by Puerto Rico was incomplete and not valid. EPA found the 2011 design value of 60 $\mu g/m^3$ (23 ppb) for the background monitor to be complete and more appropriate. Furthermore, the 2010 design value at the same monitor was also 23 ppb, which reinforces that 23 ppb is an appropriate background concentration.

EPA believes that our intended unclassifiable/attainment area bounded by the borders of Guayanilla and Peñuelas municipalities will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/ attainment area.

5.8. Summary of Our Intended Designation for the Guayanilla, PR Area

After careful evaluation of Puerto Rico's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the Guayanilla area unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of borders of the Guayanilla and Peñuelas municipalities. The EPA is designating the Guayanilla and Peñuelas municipalities in the Commonwealth of Puerto Rico as "unclassifiable /attainment" because, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, EPA has determined that the area (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS. Figure 23 shows the boundary of this intended designated area.

Figure 23. Boundary of the Intended Guayanilla Unclassifiable/Attainment Area



6. Technical Analysis for the Remainder of Puerto Rico

6.1. Introduction

Puerto Rico has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR for any sources of SO_2 emissions in the municipalities identified in Table 16. Accordingly, the EPA must designate these counties by December 31, 2017. At this time, there are no air quality modeling results available to the EPA for these counties. In addition, there is no air quality monitoring data that indicate any violation of the 1-hour SO_2 NAAQS. The EPA is designating the municipalities in Table 16 in the Commonwealth of Puerto Rico as "unclassifiable/attainment" since these municipalities were not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

Table 16 also summarizes Puerto Rico's recommendations for these areas. Specifically, the Commonwealth recommended that entire State outside of the San Juan and Guayama-Salinas areas, be designated as unclassifiable/attainment based on the modeling results Puerto Rico submitted for PREPA Aguirre, PREPA Costa Sur, PREPA San Juan, and PREPA Palo Seco. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, the EPA agrees with the Commonwealth's recommendation for these areas and intends to designate the remaining areas as unclassifiable/attainment. Figure 24 shows the locations of these areas within Puerto Rico.

Table 16. Municipalities that the EPA Intends to Designate Unclassifiable/Attainment

Municipality	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Adjuntas	Entire State[21]	Unclassifiable/Attainment	Adjuntas	Unclassifiable/Attainment
Aguada	Entire State	Unclassifiable/Attainment	Aguada	Unclassifiable/Attainment
Aguadilla	Entire State	Unclassifiable/Attainment	Aguadilla	Unclassifiable/Attainment
Aguas Buenas	Entire State	Unclassifiable/Attainment	Aguas Buenas	Unclassifiable/Attainment
Añasco	Entire State	Unclassifiable/Attainment	Añasco	Unclassifiable/Attainment
Arecibo	Entire State	Unclassifiable/Attainment	Arecibo	Unclassifiable/Attainment
Arroyo	Entire State	Unclassifiable/Attainment	Arroyo	Unclassifiable/Attainment

[21] Puerto Rico recommended the remainder of the state outside the San Juan and Guayama-Salinas areas as unclassifiable/attainment.

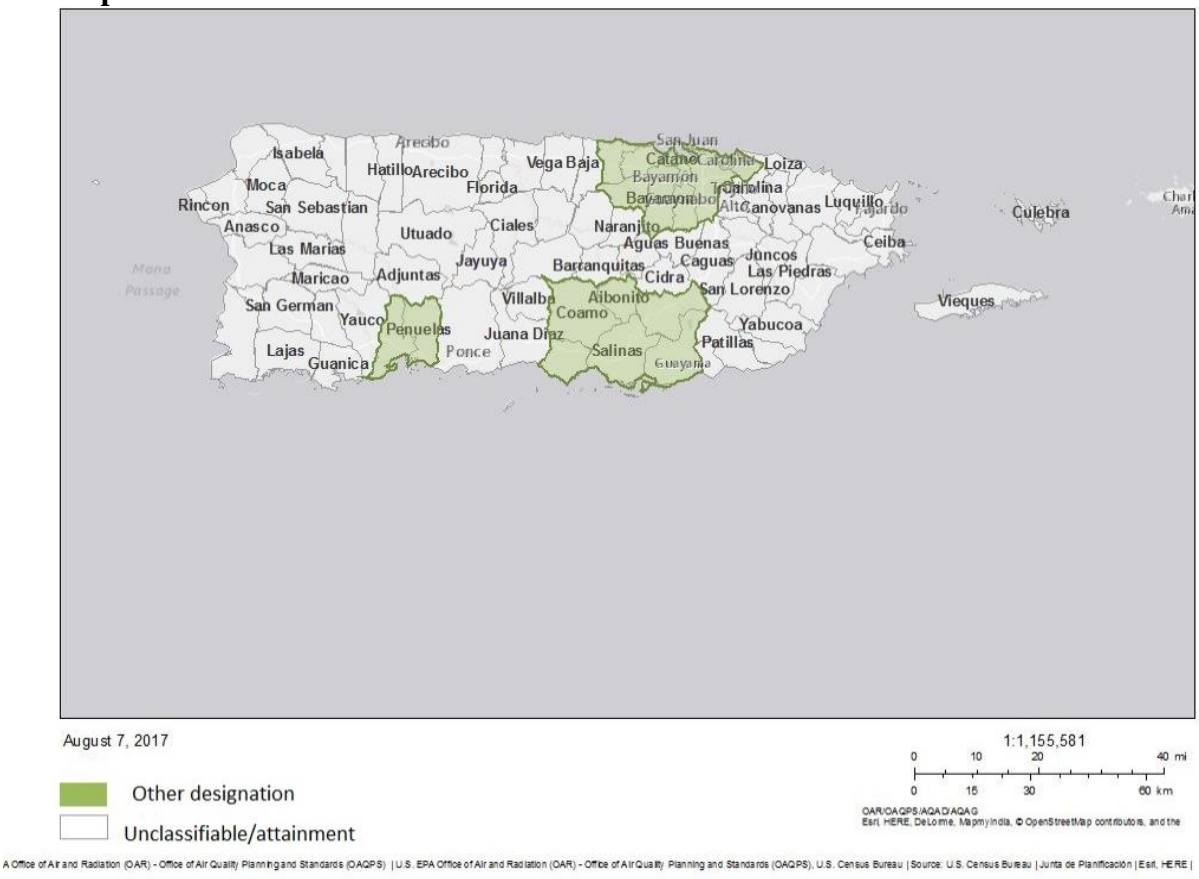
Municipality	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Barceloneta	Entire State	Unclassifiable/Attainment	Barceloneta	Unclassifiable/Attainment
Barranquitas	Entire State	Unclassifiable/Attainment	Barranquitas	Unclassifiable/Attainment
Cabo Rojo	Entire State	Unclassifiable/Attainment	Cabo Rojo	Unclassifiable/Attainment
Caguas	Entire State	Unclassifiable/Attainment	Caguas	Unclassifiable/Attainment
Camuy	Entire State	Unclassifiable/Attainment	Camuy	Unclassifiable/Attainment
Canóvanas	Entire State	Unclassifiable/Attainment	Canóvanas	Unclassifiable/Attainment
Carolina	Entire State	Unclassifiable/Attainment	Carolina (partial)[22]	Unclassifiable/Attainment
Cayey	Entire State	Unclassifiable/Attainment	Cayey	Unclassifiable/Attainment
Ceiba	Entire State	Unclassifiable/Attainment	Ceiba	Unclassifiable/Attainment
Ciales	Entire State	Unclassifiable/Attainment	Ciales	Unclassifiable/Attainment
Cidra	Entire State	Unclassifiable/Attainment	Cidra	Unclassifiable/Attainment
Comerío	Entire State	Unclassifiable/Attainment	Comerío	Unclassifiable/Attainment
Corozal	Entire State	Unclassifiable/Attainment	Corozal	Unclassifiable/Attainment
Culebra	Entire State	Unclassifiable/Attainment	Culebra	Unclassifiable/Attainment
Fajardo	Entire State	Unclassifiable/Attainment	Fajardo	Unclassifiable/Attainment
Florida	Entire State	Unclassifiable/Attainment	Florida	Unclassifiable/Attainment
Guánica	Entire State	Unclassifiable/Attainment	Guánica	Unclassifiable/Attainment
Gurabo	Entire State	Unclassifiable/Attainment	Gurabo	Unclassifiable/Attainment
Hatillo	Entire State	Unclassifiable/Attainment	Hatillo	Unclassifiable/Attainment
Hormigueros	Entire State	Unclassifiable/Attainment	Hormigueros	Unclassifiable/Attainment
Humacao	Entire State	Unclassifiable/Attainment	Humacao	Unclassifiable/Attainment
Isabela	Entire State	Unclassifiable/Attainment	Isabela	Unclassifiable/Attainment
Jayuya	Entire State	Unclassifiable/Attainment	Jayuya	Unclassifiable/Attainment
Juana Díaz	Entire State	Unclassifiable/Attainment	Juana Díaz	Unclassifiable/Attainment

[22] All remaining wards. EPA intends to designate the Cangrejo Arriba and Sabana Abajo wards in Carolina, which were evaluated in the technical analysis for the San Juan area, as "unclassifiable".

Municipality	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Juncos	Entire State	Unclassifiable/Attainment	Juncos	Unclassifiable/Attainment
Lajas	Entire State	Unclassifiable/Attainment	Lajas	Unclassifiable/Attainment
Lares	Entire State	Unclassifiable/Attainment	Lares	Unclassifiable/Attainment
Las Marías	Entire State	Unclassifiable/Attainment	Las Marías	Unclassifiable/Attainment
Las Piedras	Entire State	Unclassifiable/Attainment	Las Piedras	Unclassifiable/Attainment
Loíza	Entire State	Unclassifiable/Attainment	Loíza	Unclassifiable/Attainment
Luquillo	Entire State	Unclassifiable/Attainment	Luquillo	Unclassifiable/Attainment
Manatí	Entire State	Unclassifiable/Attainment	Manatí	Unclassifiable/Attainment
Maricao	Entire State	Unclassifiable/Attainment	Maricao	Unclassifiable/Attainment
Maunabo	Entire State	Unclassifiable/Attainment	Maunabo	Unclassifiable/Attainment
Mayagüez	Entire State	Unclassifiable/Attainment	Mayagüez	Unclassifiable/Attainment
Moca	Entire State	Unclassifiable/Attainment	Moca	Unclassifiable/Attainment
Morovis	Entire State	Unclassifiable/Attainment	Morovis	Unclassifiable/Attainment
Naguabo	Entire State	Unclassifiable/Attainment	Naguabo	Unclassifiable/Attainment
Naranjito	Entire State	Unclassifiable/Attainment	Naranjito	Unclassifiable/Attainment
Orocovis	Entire State	Unclassifiable/Attainment	Orocovis	Unclassifiable/Attainment
Patillas	Entire State	Unclassifiable/Attainment	Patillas	Unclassifiable/Attainment
Ponce	Entire State	Unclassifiable/Attainment	Ponce	Unclassifiable/Attainment
Quebradillas	Entire State	Unclassifiable/Attainment	Quebradillas	Unclassifiable/Attainment
Rincón	Entire State	Unclassifiable/Attainment	Rincón	Unclassifiable/Attainment
Río Grande	Entire State	Unclassifiable/Attainment	Río Grande	Unclassifiable/Attainment
Sabana Grande	Entire State	Unclassifiable/Attainment	Sabana Grande	Unclassifiable/Attainment
San Germán	Entire State	Unclassifiable/Attainment	San Germán	Unclassifiable/Attainment
San Lorenzo	Entire State	Unclassifiable/Attainment	San Lorenzo	Unclassifiable/Attainment
San Sebastián	Entire State	Unclassifiable/Attainment	San Sebastián	Unclassifiable/Attainment
Trujillo Alto	Entire State	Unclassifiable/Attainment	Trujillo Alto	Unclassifiable/Attainment

Municipality	Puerto Rico's Recommended Area Definition	Puerto Rico's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Utuado	Entire State	Unclassifiable/Attainment	Utuado	Unclassifiable/Attainment
Vega Alta	Entire State	Unclassifiable/Attainment	Vega Alta	Unclassifiable/Attainment
Vega Baja	Entire State	Unclassifiable/Attainment	Vega Baja	Unclassifiable/Attainment
Vieques	Entire State	Unclassifiable/Attainment	Vieques	Unclassifiable/Attainment
Villalba	Entire State	Unclassifiable/Attainment	Villalba	Unclassifiable/Attainment
Yabucoa	Entire State	Unclassifiable/Attainment	Yabucoa	Unclassifiable/Attainment
Yauco	Entire State	Unclassifiable/Attainment	Yauco	Unclassifiable/Attainment

Figure 24. The EPA's Intended Unclassifiable/Attainment Designations for Remaining Municipalities in Puerto Rico



6.2. Air Quality Monitoring Data for the Remainder of Puerto Rico

There are no valid design SO_2 design values between 2014-2016, or earlier periods, for any of the municipalities listed in Table 16.

6.3. Jurisdictional Boundaries for the Remainder of Puerto Rico

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for the remainder of Puerto Rico. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable. Puerto Rico recommended that EPA designate the "remainder of the geographical areas of Puerto Rico" as unclassifiable/attainment, and did not name specific boundaries.

6.4. The EPA's Assessment of the Available Information for the Remainder of Puerto Rico

These municipalities were not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS. These counties therefore meet the definition of an "unclassifiable/attainment" area.

Our intended unclassifiable/attainment areas, generally bounded by municipality boundaries, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area.

6.5. Summary of Our Intended Designation for the for the Remainder of Puerto Rico

After careful evaluation of Puerto Rico's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate each remaining municipality or portion thereof in of Puerto Rico as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the borders of the municipalities listed in Table 16, above. Following the completion of these Round 3 designations, there will be no remaining undesignated areas in Puerto Rico that will be addressed in Round 4. Figure 25 shows the boundary of the intended unclassifiable/attainment area for the remainder of the State.

Figure 25. Boundary of the Intended Unclassifiable/Attainment Areas for the Remainder of the State

August 7, 2017

1:1,155,581

0 10 20 40 mi

0 15 30 60 km

Other designation

Unclassifiable/attainment

OAR/OAQPS/AQAD/AQAG
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the

A Office of Air and Radiation (OAR) - Office of Air Quality Planning and Standards (OAQPS) | U.S. EPA Office of Air and Radiation (OAR) - Office of Air Quality Planning and Standards (OAQPS), U.S. Census Bureau | Source: U.S. Census Bureau | Junta de Planificación | Esri, HERE |